

# **APPENDIX A**

## **ACRONYMS**



## APPENDIX A

### Acronyms and Abbreviations (Acronyms for Tinian and FDM included in Appendix D)

°F	Degrees Fahrenheit
36 CES/CEV	36th Civil Engineering Squadron Environmental Flight
36 LG	36th Logistics Group
36 MDG	36th Medical Group
36 MSG	36th Mission Support Group
36 OSS	36th Operation Support Squadron
36 WG	36th Wing
AFB	Air Force Base
AFI	Air Force Instruction
AFPMB	Armed Forces Pest Management Board
AGL	Above Ground Level
AMT	Adaptive Management Team
APHIS	Animal and Plant Health Inspection Service
ATFP	Anti-Terrorism/Force Protection
ATSDR	Agency for Toxic Substances and Disease Registry
BAM	Bird Avoidance Model
BASH	Bird/Wildlife Aircraft Strike Hazard
BMP	Best Management Practice
BMUS	Bottomfish Management Unit Species
BO	Biological Opinion
BRD	Biological Resources Division
BSO	Budget Submitting Office
CATM	Combat Arms and Training Maintenance
CBD	Center for Biological Diversity
CBM	Coordinated Bird Monitoring
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH	Critical Habitat
cm	Centimeter
CNIC	Commander, Navy Installations Command
CNMI DLNR	Commonwealth of the Northern Marianas Department of Lands and Natural Resources
CNO	Chief of Naval Operations
CO	Commanding Officer
CRB	Coconut Rhinoceros Beetle
CRMO	Coastal Resources Management Office
CWA	Clean Water Act

CZMA	Coastal Zone Management Act
dBA	A-weighted decibel
DEQ	Division of Environmental Quality
DOD	Department of Defense
DoN	Department of the Navy
DUSD(IandE)	Deputy Under Secretary of Defense (Installations and Environment)
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ENSO	El Nino Southern Oscillations
EO	Executive Order
EOD	Explosive Ordnance Disposal
EQR	Environmental Quality Report
ERA	Ecological Reserve Area
ERL	Environmental Readiness Level
ESA	Endangered Species Act
ESQD	Explosive Safety Quantity Distance
FDM	Farallon de Medinilla
FMC	Fishery Management Council
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	Fiscal Year
FYDP	Future Year Defense Plan
GDAWR	Guam Department of Agricultural, Division of Aquatic Wildlife Resources
GDPR	Guam Department of Parks and Recreation
GEPA	Guam Environmental Protection Agency
GIS	Geographic Information System
GNWR	Guam National Wildlife Refuge
GovGuam	Government of Guam
HAPC	Habitat Areas of Particular Concern
HERA	Haputo Ecological Resource Area
HMU	Habitat Management Unit
III MEF	U.S. Marine Corps' III Marine Expeditionary Force
INRMP	Integrated Natural Resources Management Plan
IPM	Integrated Pest Management
IPMP	Integrated Pest Management Plan
IRP	Installation Restoration Program
ISR	Intelligence, Surveillance, Reconnaissance
ITCZ	Inter-tropical Convergence Zone

JGPO	Joint Guam Program Office
JRM	Joint Region Marianas
km/h	kilometers per hour
LEED	Leadership in Energy and Environmental Design
LID	Low Impact Development
MAPS	Monitoring Avian Productivity and Survivorship
MBTA	Migratory Bird Treaty Act
MCL	Maximum Contaminant Level
MGD	Million Gallons per Day
MILCON	Military Construction
MIRC	Mariana Islands Range Complex
MISTCS	Mariana Islands Sea Turtle and Cetacean Survey
MLA	Military Lease Area
MLD	Million Liters per Day
mm	Millimeter
MMPA	Marine Mammal Protection Act
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MOUT	Military Operations in Urbanized Terrain
mph	Miles per Hour
MRP	Marine Resources Preserve
MSA	Munitions Storage Area
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
msl	Mean Sea Level
MUNS	Munitions Squadron
Mw	Moment Magnitudes
MWR	Morale, Welfare and Recreation
NAVFAC	Naval Facilities Engineering Command
NAVFACMAR	Naval Facilities Engineering Command Marianas
NBG	Naval Base Guam
NEPA	National Environmental Policy Act
NGLA	Northern Guam Lens Aquifer
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
O&M	Operations and Maintenance
O&MN	Operations and Maintenance, Navy
OPAREA	Operating Area

OPERA	Orote Peninsula Ecological Reserve Area
OPNAVINST	Office of the Chief of Naval Operations Instruction
OSD	Office of the Secretary of Defense
P.L.	Public Law
PARC	Partners in Amphibian and Reptile Conservation
PIF	Partners in Flight
PMUS	Pelagic Management Unit Species
POM	Program Objectives Memorandum
PPBES	Planning, Programming, Budget, and Execution System
QRP	Qualified Recycling Program
RF	Radio Frequency
RPM	Real Property Maintenance
SAIA	Sikes Act Improvement Act
SCA	Student Conservation Association
SeaBees	Naval Mobile Construction Battalions
SECNAVINST	Secretary of the Navy Instruction
SERDP	Strategic Environmental Research and Development Program
SLMP	Submerged Land Management Plan
SOGCN	Species of Greatest Conservation Need
SOP	Standard Operating Procedure
SPCC	Spill Prevention Control and Countermeasures
SVL	snout-to-vent length
TES	Threatened, Endangered, and Species of Concern
TNC	The Nature Conservancy
TS	Telecommunications Site
U.S.C.	United States Code
UIC	Underground Injection Control
UOG	University of Guam
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USDA-NWRC	U.S. Department of Agriculture-National Wildlife Research Center
USDA-WS	U.S. Department of Agriculture-Wildlife Services
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VCO	Volunteer Conservation Officer
VCOP	Volunteer Conservation Officer Program
VOC	Volatile Organic Compounds
WPRFMC	Western Pacific Region Fishery Management Council

## **APPENDIX B**

**RELEVANT ENVIRONMENTAL LAWS, REGULATIONS, POLICIES, GUIDANCE,  
INSTRUCTIONS, AND ORDERS**



## APPENDIX B

### List of Relevant Environmental Laws, Regulations, Policies, and Guidance (Relevant legal information for Tinian and FDM included in Appendix D)

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#### FEDERAL LAWS, REGULATIONS, AND EXECUTIVE ORDERS FOR NATURAL RESOURCES

- Animal Damage Control Act (7 U.S.C. 426 et seq.)
- Anti-Deficiency Act (31 U.S.C. 1341 et seq.)
- Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.)
- Base Closure and Realignment Act (Part A of title XXIX of P.L. 101-510; 10 U.S.C. 2687)
- Clean Air Act, as amended (42 U.S.C. 7401 et seq.)
- Clean Water Act, Sections 401 and 404 (33 U.S.C. 1311)
- Coastal Barrier Resources Act of 1982 (16 U.S.C. 1451 et seq.)
- Coastal Zone Management Act (16 U.S.C. 1451–1456)
- Comprehensive Employment and Training Act Amendments of 1978 (P.L. 95-524)
- Comprehensive Environmental Response, Compensation and Liability Act (Superfund) of 1980, (42 U.S.C. 9601 et seq.)
- Conservation and Rehabilitation Program on Military and Public Lands, as amended (16 U.S.C. 670 et seq.)
- Coral Reef Conservation Act of 2000 (16 U.S.C. 6401 et seq.)
- Council on Environmental Quality Regulations on Implementing NEPA Procedures (40 CFR 1500–1508)
- Defense Environmental Restoration Program (10 U.S.C. 2701)
- Department of Defense Appropriation Act of 1991 (P.L. 102-393)
- Dredge and Fill Nationwide Permit Program (33 CFR 330)
- Endangered and Threatened Wildlife and Plants (50 CFR 17)
- Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)
- Entering Military, Naval, or Coast Guard Property (18 U.S.C. 1382)
- Environmental Effects in the United States of Department of Defense Strategies (32 CFR 188)
- Erosion Protection Act (33 U.S.C. 426)
- Estuary Protection Act (16 U.S.C. 1221)
- Executive Order 11514, Protection and Enhancement of Environmental Quality
- Executive Order 11644, Use of Off-Road Vehicles on the Public Lands
- Executive Order 11987, Exotic Organisms

- Executive Order 11988, Floodplain Management
- Executive Order 11990, Protection of Wetlands
- Executive Order 12902, Energy Efficiency and Water Conservation at Federal Facilities
- Executive Order 12962, Recreational Fisheries
- Executive Order 13089, Coral Reef Protection
- Executive Order 13112, Invasive Species
- Executive Order 13158, Marine Protected Areas
- Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds
- Executive Order 13352, Cooperative Conservation
- Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management
- Farmland Protection Act (7 U.S.C. 4201 et seq.)
- Federal Agency Recycling and the Council on Federal Recycling and Procurement Policy (Executive Order 12780)
- Federal Aid in Wildlife Restoration Act of 1937 (16 U.S.C. 669–669I); also known as the “Pittman-Roberts Act.”
- Federal Compliance with Pollution Control Standards (42 U.S.C. 4321)
- Federal Consistency with Approved Coastal Management Programs under CZMA (15 CFR 930)
- Federal Environmental Pesticide Control Act of 1972 (7 U.S.C. 2809)
- Federal Facilities Compliance Act of 1992 (42 U.S.C. 6961)
- Federal Insecticide, Fungicide, and Rodenticide Act, as amended (7 U.S.C. 136 et seq.)
- Federal Land Policy and Management Act (43 U.S.C. 1701)
- Federal Noxious Weed Act (7 U.S.C. 2801 et seq.)
- Federal Plant Pest Act (7 U.S.C. 150aa et seq.)
- Federal Water Pollution Control Act (Clean Water Act) (33 U.S.C. 1251 et seq.)
- Federal Water Pollution Control Act, as Amended by the Clean Water Act of 1977 (P.L. 92-500)
- Fish and Wildlife Conservation Act (16 U.S.C. 2901 et seq.)
- Fish and Wildlife Conservation and Natural Resources Management Programs on Military Reservations (P.L. 96-561)
- Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.)
- Fish and Wildlife Improvement Act of 1978 (16 U.S.C. 7421)
- Fish and Wildlife Service List of Endangered and Threatened Wildlife (50 CFR 17)
- Fishery Conservation and Management Act of 1976 as amended, (16 U.S.C. 1801 et seq.)
- Forest Resources Conservation and Shortage Relief Act (16 U.S.C. 620 et seq.)

- Hunting and Fishing on Federal Lands (10 U.S.C. 2671 et seq.)
- Implementation of Section 311 of the Federal Water Pollution Control Act of October 18, 1972, as amended,
- Interagency Cooperation Endangered Species Act of 1973 (50 CFR 402)
- Lacey Act of 1900 (16 U.S.C. 701), and Lacey Act Amendments of 1981 (16 U.S.C. 3371– 3378)
- Land and Water Conservation Act of 1965 (16 U.S.C. 4601 et seq.)
- Legacy Resource Protection Program Act (P.L. 101-511)
- Magnuson Stevens Fishery Conservation and Management Act of 1976 (16 U.S.C. 1801)
- Marine Mammal Protection Act of 1972 (P.L. 92-522)
- Marine Protection, and Sanctuaries Act of 1972, as amended (16 U.S.C. 1361 et seq.)
- Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. 1401 et seq.)
- Migratory Bird Conservation Act (16 U.S.C. 715 parts 25–28)
- Migratory Bird Treaty Act of 1918 (16 U.S.C. 703–711)
- Military Construction Authorization Act of 1956 - Leases; non-excess property (10 U.S.C. 2667)
- Military Construction Authorization Act of 1956 - Sale of Certain Interests in Lands; Logs (10 U.S.C. 2665)
- Military Construction Authorization Act of 1975 (10 U.S.C. 2665)
- Military Reservation and Facilities: Hunting, Fishing and Trapping (10 U.S.C. 2671)
- Multiple-Use Sustained Yield Act (16 U.S.C. 528)
- National Defense Authorization Act for Fiscal Year 1999 (P.L. 105-261)
- National Defense Authorization Act for Fiscal Year 2003 (P.L. 107-314)
- National Defense Authorization Act for Fiscal Year 2004 (P.L. 108-136)
- National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 et seq.)
- National Oceanic and Atmospheric Administration Coastal Zone Management Program Development and Approval Regulation (15 CFR 923)
- National Trails System Act of 1968 (16 U.S.C. 1271)
- National Wildlife Refuge System Administration Act of 1996 (16 U.S.C. 668dd–668ee)
- Natural Resources Management Program (32 CFR 190)
- Neotropical Migratory Bird Conservation Act (16 U.S.C. 6101 et seq.)
- Nonindigenous Aquatic Nuisance Prevention and Control Act, as amended (16 U.S.C. 4701 et seq.)
- North American Wetlands Conservation Act (16 U.S.C. 4401 et seq.)
- Noxious Plant Control Act (43 U.S.C. 1241)
- Ocean Dumping Regulations and Criteria (40 CFR 220, 227)

- Off-Road Vehicles Use on Public Lands (Executive Order 11989)
- Oil Pollution Control Act of 1990 (33 U.S.C. 2701 et seq.)
- Outdoor Recreation - Federal/State Program Act (16 U.S.C. 4601 et seq.)
- Outer Continental Shelf Air Regulations (40 CFR 55)
- Partners for Fish and Wildlife Act (16 U.S.C. 3771 et seq.)
- Plant Quarantine Act (7 U.S.C. 151–167)
- Pollution Prevention Act (42 U.S.C. 13101 et seq.)
- President’s Directive on Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds.
- Protection and Enhancement of Environmental Quality (Executive Order 11514, as amended by Executive Orders 11541 and 11991)
- Regulations Concerning Marine Mammals (50 CFR 18, 216, 228)
- Resource Conservation and Recovery Act (42 U.S.C. 6901 et seq.)
- Responsibilities of Federal Agencies to Protect Migratory Birds (Executive Order 13186)
- Rivers and Harbors Act of 1889 (33 U.S.C. 403 et seq.)
- Safe Drinking Water Act (42 U.S.C. 300(f) et seq.)
- Sales of Forest Products on Federal Lands (10 U.S.C. 2665 et seq.)
- Sikes Act Improvement Act of 1997 (16 U.S.C. 670a et seq.)
- Soil and Water Conservation Act (16 U.S.C. 2001 et seq.)
- Soil Conservation Act (16 U.S.C. 5901)
- Water Pollution Prevention and Control (33 U.S.C. 1251 et seq.)
- Wetland Resources (16 U.S.C. 3901)
- Wild and Scenic River Act (16 U.S.C. 1274)

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**FEDERAL GUIDELINES FOR NATURAL RESOURCES**

- Cooperative Agreement between the Department of Defense and The Nature Conservancy for Assistance in Natural Resources Inventory.
  - Memorandum of Agreement for Federal Neotropical Migratory Bird Conservation Program and Addendum (Partners in Flight-Aves De Las Americas) among the Department of Defense, through Each of the Military Services, and Over 110 Other Federal and State Agencies and Nongovernmental Organizations
  - Memorandum of Agreement for Professional and Technical Assistance Conducting Biological Surveys, Research and Related Activities between the Department Of Defense and the National Biological Service of the Department of the Interior
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- Memorandum of Understanding between Department of Defense, U.S. Fish and Wildlife Service, and the International Association of Fish and Wildlife Agencies for a Cooperative Integrated Natural Resources Management Program on Military Installations
- Memorandum of Understanding between the Environmental Protection Agency and the Department of Defense with Respect to Integrated Pest Management
- Memorandum of Understanding for Watchable Wildlife Programs
- USACE 1987 Wetland Delineation Manual.
- Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)

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**DEPARTMENT OF DEFENSE DIRECTIVES, REGULATIONS AND POLICIES FOR NATURAL RESOURCES**

- Concurrent Jurisdiction Act, (48 U.S.C. 1704)
- Criminal Procedure Code, 8 GCA 5.55.
- Deputy Under Secretary of Defense Memorandum, Integrated Natural Resources Management Plan Template
- DOD Directive 3200.15, Sustainment of Ranges and Operating Areas
- DOD Directive 4140.1, Material Management Policy
- DOD Directive 4700.4, Natural Resources Management Program
- DOD Directive 4705.1, Management of Land-Based Water Resources in Support of Joint Contingency Operations
- DOD Directive 4710.1, Archaeological and Historic Resources Management
- DOD Directive 4715.01, Environmental Security
- DOD Directive 5030.41, Oil and Hazardous Substance Pollution Prevention and Contingency Program
- DOD Directive 6050.1, Environmental Effects in the U.S. of DOD Strategies
- DOD Directive 6050.15, Prevention of Oil Pollution from Ships Owned or Operated by the Department of Defense
- DOD Directive 6050.2 (as amended), Use of Off-Road Vehicles on DOD Lands
- DOD Directive 6050.4, Marine Sanitation Devices for Vessels Owned or Operated by DOD
- DOD INRMP Handbook, Resources for INRMP Implementation
- DOD Instruction 4001.01, Installation Support
- DOD Instruction 4150.07, DOD Pest Management Program
- DOD Instruction 4165.57, Air Installations Compatible Use Zones
- DOD Instruction 4165.59, DOD Implementation of the Coastal Zone Management Act
- DOD Instruction 4700.2, Secretary of Defense Award for Natural Resources and Environmental Management

- DOD Instruction 4715.03, Natural Resources Conservation Program
- DOD Instruction 4715.4, Pollution Prevention
- DOD Instruction 4715.6, Environmental Compliance
- DOD Instruction 4715.7, Environmental Restoration Program
- DOD Instruction 4715.9, Environmental Planning and Analysis
- DOD Instruction 5000.13, Natural Resources - The Secretary of Defense Natural Resource Conservation Award
- DOD Instruction 6050.05, DOD Hazard Communication Program
- DOD Instruction 6055.6, DOD Fire and Emergency Services Program
- DOD Memorandum on Implementation of Ecosystem Management in DOD
- DOD Urban Forestry Manual
- Memorandum of Understanding to Foster the Ecosystem Approach (15 December 1995)

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**DEPARTMENT OF NAVY DIRECTIVES, REGULATIONS, AND POLICIES FOR NATURAL RESOURCES**

- CINCPACFLTINST 5090.1B Pacific Fleet Environmental Protection Program.
  - COMNAVMARIANAS Fire Prevention Program Instruction (COMNAVMARIANAS Instruction 11320.1)
  - Department of Navy Procedures for Implementing NEPA (32 CFR 775)
  - Management and Recreation of Natural and Cultural Resources on U.S. Naval Activities, Guam (OPNAVINST 5090.6)
  - NAVFAC P-73, Real Estate Manual P-73
  - NAVFACINST 11010.45, Regional Shore Infrastructure Planning
  - NAVFACINST 11012.111A, Land Use Conservation Planning
  - NAVFACINST 6250.3H, Applied Biology Program Services and Training
  - NCTAMS WESTPAC Guam Instruction 11011.1C (currently undergoing revision as COMNAVMARIANAS instructions)
  - OPNAVINST 11000.17, National Preservation Act Consultations Related to Base Realignment and Closure Strategies
  - OPNAVINST 11010.20F, Facilities Projects Manual
  - OPNAVINST 5090.1D, Environmental Readiness Program Manual
  - OPNAVINST 5750.13, Historical Properties of the Navy
  - OPNAVINST 6250.4B, Pest Management Program
  - OPNAVINST 8000.16, Environmental Security Management
  - OPNAVINST 8026.2A, Navy Munitions Disposition Policy
  - SECNAVINST 4000.35, Department of the Navy Cultural Resources Program
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- SECNAVINST 5090.8, Policy for Environmental Protection, Natural Resources, Cultural Resources Program
- SECNAVINST 5100.13E, Navy and Marine Corps Tobacco Policy
- SECNAVINST 6240.6E, Implementation of DOD Directives under DOD Instruction 4700.4

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**DEPARTMENT OF AIR FORCE DIRECTIVES, REGULATIONS, AND POLICIES FOR NATURAL RESOURCES**

- AFI 32-7064, Integrated Natural Resources Management
- AFI 32-1053, Pest Management Program
- AFI 32-7060, Interagency and Intergovernmental Coordination for Environmental Planning
- AFI 32-7081, Forest Management Manual
- Policy Memo for Implementation of Sikes Act Improvement Amendments, USAF Environmental Office (HQ USAF/ILEV) on January 29, 1999
- AFPD 32-70, Environmental Quality
- AFI 32-7061, Environmental Impact Analysis Process (EIAP)
- 32 CFR Part 989, as amended, EIAP
- 36 Wing Instruction (WGI) 32-7003

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**COOPERATIVE AGREEMENTS BETWEEN DEPARTMENT OF DEFENSE AND GUAM FOR NATURAL RESOURCES**

- Cooperative Agreement for the Establishment of the Guam Overlay National 5542 Wildlife Overlay Refuge Unit (10 December 1993)
- Cooperative Agreement for the Protection, Development and Management of Fish and Wildlife Resources at U.S. Naval Communication Area Master Station, WESTPAC (14 March 1988), 8 pp.
- Cooperative Agreement for the Protection, Development and Management of Fish and Wildlife Resources at U.S. Naval Magazine, Guam (7 March 1988) 6 pp.
- Cooperative Agreement for the Protection, Development and Management of Fish and Wildlife Resources at U.S. Naval Station, Guam (12 April 1988) 8 pp.
- Cooperative Agreement for the Protection, Development and Management of Fish and Wildlife Resources at U.S. Navy Public Works Center (11 April 1988) Guam, 8 pp.
- Cooperative Agreement for the Protection, Development and Management of Fish and Wildlife Resources at U.S. Naval Supply Depot, Guam 29 February 1988), 8 pp.
- Memorandum of Agreement for Cooperative Law Enforcement between the U.S. Fish and Wildlife Service and Division of Aquatic and Wildlife Resources Department of Agriculture, Territory of Guam, 5 pp. (9 July 1990)
- Memorandum of Understanding among the Government of Guam and the U.S. Air Force and the U.S. Navy and the U.S. Fish and Wildlife Service (14 December 1993), 6 pp. with 3 pp. of signatures.

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**GOVERNMENT OF GUAM LAWS, REGULATIONS, AND POLICIES FOR NATURAL RESOURCES**

- Endangered Species Act of Guam: (5 GCA 63208, Public Law 6-85)
- Game, Forestry and Conservation (5 GCA, Chapter 63, Public Law 6-85)
- Government Code of Guam (Section 47104)
- Guam Water Pollution Control Act (10 GCA)
- Government Code of Guam (1 GCA 4002 (a) as amended by P.L. 20-185)
- Importation: Harboring (5 GCA 63124)
- Organic Act of Guam of 1950, as amended (48 U.S.C. 1421, et seq., 64 Stat. 384)
- Protection of Wild Animals (5 GCA 63121)
- Protection of Wild Birds (5 GCA 63120)
- Brown Tree Snake Control and Eradication Act of 2004 (??)
- Memorandum of Agreement for Cooperative Law Enforcement.
- Guam Invasive Species Council (5 GCA, 70101 et seq.)

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**FEDERAL LAWS, REGULATIONS, AND EXECUTIVE ORDERS FOR CULTURAL RESOURCES**

- American Indian, Religious Freedom Act of 1978 (42 U.S.C. 1996)
- Antiquities Act of 1906 (16 U.S.C. 431et seq.)
- Archaeological and Historic Preservation Act of 1974 (Moss-Bennet Act), (16 U.S.C. 469 et seq.)
- Archaeological Resources Protection Act of 1979 (16 U.S.C. 470 et seq.)
- Executive Order 11593, Protection and Enhancement of the Cultural Environment
- Historic Resources Inventories and Protection on Federal Lands (Executive Order 11593)
- Historic Sites Act of 1935 (16 U.S.C. 461 et seq.)
- National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 et seq.)
- Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001–3013)

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**DEPARTMENT OF DEFENSE DIRECTIVES, REGULATIONS, AND POLICIES FOR CULTURAL RESOURCES**

- Archaeological and Historical Resources on Military Lands (DOD Directive 4710.1, Environmental Security)
- Memorandum of Agreement - Concurrent Jurisdiction (for law enforcement) 5 pp. (1 September 1988)
- Memorandum of Understanding between the Department of Defense and the U.S. Fish and Wildlife Service for the Ecosystem-based Management of Fish, Wildlife and Plant Resources on Military Lands, 17 May 1999.

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**DEPARTMENT OF NAVY DIRECTIVES, REGULATIONS, AND POLICIES FOR CULTURAL RESOURCES**

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- Management and Recreation of Natural and Cultural Resources on U.S. Naval Activities, Guam (OPNAVINST 5090.6)

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**DEPARTMENT OF AIR FORCE DIRECTIVES, REGULATIONS, AND POLICIES FOR CULTURAL RESOURCES**

- AFI 32-7065, Cultural Resources Management

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## **APPENDIX C**

### **INRMP PROJECTS, SCHEDULES, AND IMPLEMENTATION TABLE**



## APPENDIX C

### INRMP Projects, Schedules, and Implementation Table

**Table C-1** contains natural resources projects proposed for JRM facilities, and projects to meet sustainability objectives. The projects contained within **Table C-1** may be revised over time and new projects may be added as new natural resources management priorities or needs arise. The table includes the INRMP subject area and issue number, EPR project number, a project description, the ERL priority number, the corresponding law or regulation, proposed frequency and fiscal years for implementing each recommendation, and the initiatives in the Natural Resources Metrics Builder that the project meets based on Chief of Naval Operations guidance for preparing, implementing, and revising INRMPs in April 2006.

The Natural Resources Metrics were developed to support the annual Natural Resources Program reviews between the Navy and its Sikes Act partners, the USFWS and State Fish and Wildlife agencies, by gathering and reporting essential information required by Congress, Executive Orders, existing U.S. laws, and the Department of Defense. This document summarizes the Natural Resources Metrics by Focus Area, including questions and associated explanations. The seven Focus Areas to be evaluated during the annual review of the Natural Resources Program/INRMP are as follows:

1. Ecosystem Integrity
2. Listed Species and Critical Habitat
3. Fish and Wildlife Management for Public Use
4. Partnership Effectiveness
5. Team Adequacy
6. INRMP Project Implementation
7. INRMP Impact on the Installation Mission

The projects presented in **Table C-1** strive to enhance natural resources on JRM, without impacting other installation plans and activities. Achieving these recommendations will require development to be conducted in an environmentally sensitive way (i.e., smart growth) and requires cooperation between the installation garrison, environmental offices, facilities and maintenance, and operations. Any future changes in mission, training activity, or technology should be analyzed to assess their impact on natural resources. As new installation plans and DoN guidance and regulations are developed, they should be integrated with the goals and management actions resulting from this INRMP.

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**Table C-1. Joint Region Marianas INRMP Projects and Implementation Table**

**Andersen Air Force Base**

INRMP Section	EPR Project Number	Title	Project Description	ERL Priority	Legal Driver <sup>1</sup>	Implementation		Natural Resources Metrics Builder	BO requirement
						Frequency	Fiscal Year		
TE-1	M5240CN041	Andersen AFB-Fruit Bat Monitoring for ISR/Strike	Annual monitoring for Mariana fruit bats, Andersen AFB	4	ESA, SAIA, DODI 4715.03	Annually	All	1, 2, 4, and 7	ISR/Strike 2006 MIRC 2010
TE-1 TE-2	M5240NR046	Andersen AFB - Mitigation, Establish Five Forage Plots for ISR/Strike	Establish 10 foraging plots containing native tree species for Mariana crow and fruit bats	4	ESA	Alternate Years	FY12, FY13 and FY15	1, 2, 4, and 7	ISR/Strike 2006
TE-5 TE-7	M5240NR155	Threatened and endangered species monitoring	Surveys of federally listed species, migratory birds	4	ESA, SAIA, MTBA	Quarterly	All	1, 2, 4 and 7	
TE-9 SLM-2	M524010012	Andersen AFB-Marine Survey	Surveys of the Marine Preserve.	4	ESA, SAIA, OPNAVINST 5090.1D	Once	FY14	1, 2, 4, and 7	
TE-10	M5240CN039	Andersen AFB-Serianthes Recovery	<i>Serianthes nelsonii</i> recovery efforts, propagating, outplanting, and protecting existing individuals	4	ESA	Annually	All	1, 2, 4, and 7	
TE-11	M5240CN018	Andersen AFB-Starling Nests Boxes	Construct and install bird nest boxes on Andersen AFB for the Micronesian starling	4	ESA, MBTA, EO 13186	Once	FY15, FY16, FY17 and FY18	1, 2, 4, and 7	
FWM-1	M5240NR059	Operations and Management of the HMU, Andersen AFB	Ensure that annual maintenance of the HMU and fenceline occur at Andersen AFB.	4	ESA	Annual Continuing	All	1 - 7	ISR/Strike 2006

**Andersen Air Force Base**

INRMP Section	EPR Project Number	Title	Project Description	ERL Priority	Legal Driver <sup>1</sup>	Implementation		Natural Resources Metrics Builder	BO requirement
						Frequency	Fiscal Year		
ISM-1	M524010005	Andersen AFB-Mitigation, Non-native Plant Removal and Control	Monitor, remove or control invasive plant species on Andersen AFB.	4	NEPA, ESA, PPA 7701	Twice	FY14 and FY16	1, 5, 6 and 7	ISR/Strike 2006
ISM-1	M524010013	Andersen AFB-Invasive Plant Species Survey and Control	Survey Andersen AFB for invasive plant species, implement controls for top ranked	4	PPA 7701, EO 13112, ESA	Once	FY16	1, 5, 6 and 7	
ISM-2	M5240NR063 emergent	Coconut Rhinoceros Beetle (CRB) Management	Monitoring and control of CRB infestations	4	NISA, EO 1311	Once	FY12	1, 5, 6 and 7	
ISM-3	M5240NR061	Andersen AFB-Cycas Micronesia Management for Conservation	Management and protection endemic Cycas Micronesia plants	4	SAIA, DODI 4715.03, OPNAVINST 5090.1D	Once	FY12	1, 5, 6 and 7	
ISM-4	M5240CN030	Develop Ungulate Management Database	Vegetation database development for ungulate eradication and control projects	4	ESA, NEPA, OPNAVINST 5090.1D	Once	FY12	1, 5, 6 and 7	
ISM-5	M5240CN022	Andersen AFB-Mitigation, Construction of a 254 hectare Ungulate Exclosure	Construction of ungulate exclosure at Ritidain Point	4	ESA, NEPA, SAIA	Once	FY12	1, 5, 6 and 7	NSW Field Beddown 2006 ISR/Strike 2006
ISM-7	M5240CN020	Andersen AFB-Mitigation HMU and Fenceline Maintenance	Maintenance of BTS barrier around the HMU	4	ESA, NEPA, SAIA	Annually Continuing	All	1, 5, 6 and 7	NSW Field Beddown 2006 ISR/Strike 2006
ISM-7	M5240NR055	BTS Trapping MSA	Brown treesnake trapping in the MSA1	4	EO 13112	Annually Continuing	All	1, 5, 6 and 7	

**Andersen Air Force Base**

INRMP Section	EPR Project Number	Title	Project Description	ERL Priority	Legal Driver <sup>1</sup>	Implementation		Natural Resources Metrics Builder	BO requirement
						Frequency	Fiscal Year		
OR-4	M5240CN005	Conservation Outreach	Awareness training, printing of educational materials	4	NEPA	Annually Continuing	All	1 - 7	NSW Field Beddown 2006 ISR/Strike 2006 MIRC 2010

**Key Legal Driver:**

CRCA = Coral Reef Conservation Act  
 CWA = Federal Clean Water Act  
 EO = Executive Order  
 ESA = Federal Endangered Species Act  
 GESA = Guam Endangered Species Act  
 MBCA = Migratory Bird Conservation Act  
 MBTA = Federal Migratory Bird **Treaty** Act

**Key Metrics Builder:**

1. INRMP Implementation
2. Partnerships/Cooperation and Effectiveness
3. Team Adequacy
4. Status of Federally Listed Species and Critical Habitat

**Table C-2. Joint Region Marianas INRMP Projects and Implementation Table**

**Naval Base Guam**

INRMP Section	EPR Project Number	Title	Project Description	ERL Priority	Legal Driver <sup>1</sup>	Implementation		Natural Resources Metrics Builder	BO Requirement
						Frequency	Fiscal Year		
3.4.1	61755NR167	Sustainable land use management of natural resources	Management of front gate wetland at NBG	4	ESA, SAIA	Once	FY12	1 – 7	
3.4.1	61755NR829	Region INRMP	Annually review and update the JRM INRMP	4	SAIA, ESA, DOD Instruction 4715.03	Annually	All	1 – 7	
TE-5	61755NR812	NBG Mariana swiftlet diet study	Mariana swiftlet diet study	4	ESA, SAIA, DOD Inst 4715.3	2 Years	FY16 and FY17	1, 2, 4, and 7	
TE-6	61755NR166	NBG: Habitat rehabilitation for threatened and endangered species Mariana common moorhen Hagoi wetland Tinian	Enhance habitat for the Mariana common moorhen. Hagoi wetland, Tinian	4	ESA, SAIA, DOD Instruction 4715.03	Multiple Years	FY12, FY13 and FY16	1, 2, 4, and 7	
TE-6	61755NR008	NBG Mariana common moorhen wetland use and population survey	Survey wetlands on NBG for Mariana common moorhen.	4	ESA, CWA, SAIA	Biennial	FY14, FY16, FY18	1, 2, 4, and 7	
TE-6	61755NR847	NBG Mariana common moorhen: multiscale assessment of watershed integrity of Fena Reservoir	Assess the habitat status and condition for Mariana common moorhen.	4	SAIA, SWCA 590A, ESA	Once	FY18	1, 2, 4, and 7	

Naval Base Guam

INRMP Section	EPR Project Number	Title	Project Description	ERL Priority	Legal Driver <sup>1</sup>	Implementation		Natural Resources Metrics Builder	BO Requirement
						Frequency	Fiscal Year		
TE-7	61755NR839	NBG Micronesian megapode and Mariana fruit bat native forest enhancement - Tinian	Improve up to 30 acres of habitat per year by planting native forest tree species	4	ESA, SAIA, DOD Instruction 4715.03	Annually Continuing	All	1, 2, 4, and 7	
TE-7	61755NR831	NBG Megapode habitat use study	Population parameters and habitat use of Micronesian megapodes on FDM.	4	ESA, DOD Instruction 4715.03, OPNAVINST 5090.1D	Once	FY17	1, 2, 4, and 7	
TE-9	61755NR177	NBG: Sea Turtle Nest Activity Verification	Sea turtle nest verification entails excavation of nest chamber post incubation and emergence period to determine hatch success	4	SAIA, ESA, OPNAVINST 5090.1D	Once	FY12	1, 2, 4, and 7	
TE-9	61755NR808	NBG Sea turtle nesting habitat: invasive plant control	Survey, map and remove invasive plants within sea turtle nesting habitat NBG	4	ESA, SAIA, EO 13112	Annually	FY 14, FY15, FY16, FY17, FY18	1, 2, 4, and 7	
TE-9	61755NR815	NBG Sea turtle distribution and habitat use	Habitat use and movements of threatened and endangered sea turtles on Navy submerged lands around Guam.	4	ESA, OPNAVINST 5090.1D, SAIA	3 Years	FY12 FY14, FY15 and FY16	1, 2, 4, and 7	
TE-11	61755NR830	NBG – Bumphead parrot fish	Identify the presence, distribution, and abundance the bumphead parrotfish Navy submerged lands	4	ESA, MSFCM, EO 13089	Twice	FY14 and FY18	1, 2, 4, and 7	

**Naval Base Guam**

INRMP Section	EPR Project Number	Title	Project Description	ERL Priority	Legal Driver <sup>1</sup>	Implementation		Natural Resources Metrics Builder	BO Requirement
						Frequency	Fiscal Year		
TE-13	61755NR818	NBG Benthic habitat mapping - T&E and candidate species habitat	Classify and delineate benthic habitats and map the distribution of target species (i.e. candidate corals, forage for listed species).	4	ESA, MSFCM, EO 13089	3 Years	FY16, FY17 and FY18	1, 2, 4, and 7	
TE-13	61755NR804	NBG Sea Grass Survey	Conduct a sea grass survey in subtidal areas at Dadi Beach	4	ESA, MSFCM, EO 13089	Biennial	FY14, FY16 and FY18	1, 2, 4, and 7	
TE-13	61755NR172	NBG Native Plant Propagation	Rehabilitate threatened and endangered species habitat, and reduce soil erosion	4	ESA, SWCA 590A, EO 13089	Multiple Years	FY12, FY13, and FY18	1, 2, 4, and 7	
WT-2	61755NR842	Restoration - Fena waterline replacement	Revegetate 1 acre of land used during construction of water line	4	ESA, SWCA 590A, OPNAVINST 5090.1D	Once	FY12		Sect 7 Consultation
FWM-1	61755NR142	Endangered Species Surveys: Population Trends	Surveys to document population trends and distribution of federally listed birds, fruit bats, migratory birds and sea turtles.	4	ESA, MTBA, SAIA	Annually	All	1, 2, 5, 6, and 7	
FWM-1	61755NR165	Biological survey of Fena reservoir and contributing tributaries	Survey Fena Reservoir and tributaries for long-term trend analysis of lake ecosystem	4	ESA, CWA, SAIA	Once	FY12	1, 2, 5, 6, and 7	
FWM-2	61755NR813	NBG Migratory bird habitat use and land use planning	Conduct a study to determine habitats used by migratory birds on NBG.	3	MTBA, DOD Instruction 4715.03, OPNAVINST 5090.1D	2 Years	FY14 and FY15	1, 2, 5, 6, and 7	
FWM-2	61755NR821	NBG Migratory bird study of FDM	Estimate population parameters of nesting seabirds on FDM.	3	MBTA, OPNAVINST 5090.1D	Once	FY17	1, 2, 5, 6 and 7	

Naval Base Guam

INRMP Section	EPR Project Number	Title	Project Description	ERL Priority	Legal Driver <sup>1</sup>	Implementation		Natural Resources Metrics Builder	BO Requirement
						Frequency	Fiscal Year		
VHM-1	61755NR837 61128NR115	NBG Habitat monitoring, long-term vegetation surveys for recovery of T&E species	Resurvey vegetation identified within existing inventory plots on the overlay lands of the Guam National Wildlife Refuge.	4	ESA, MBTA, SAIA	Every 5 Years	FY12 FY17	1 - 7	
VHM-1	61755NR175	NBG Protection of ecological reserve areas	Improved management, conservation, protection, restoration and enhancement of Navy's Ecological Reserve Areas	4	SAIA, ESA, OPNAVINST 5090.1D	Annually Continuing	All	1 - 7	
VHM-1	61755NR810 61755NR840	NBG Vegetation classification and delineation	Develop vegetation maps for Navy lands on Guam that can be used to map habitat for threatened and endangered species.	4	SAIA	2 Years	FY14 and FY15	1 - 7	
SLM-1	61755NR814	NBG Assessment of artificial reef techniques	Evaluate the effectiveness of different techniques for establishing artificial reefs in Apra Harbor and other Navy submerged lands	3	MSFCM, CRCA, EO 13089	3 Years	FY14, FY15 and FY16	1, 2, 5, 6 and 7	
SLM-1	61755NR849	NBG-Coral protection mooring buoys	Maintain 15 mooring buoys installed on Navy submerged lands	4	SAIA, EO 13089, CRPA, OPNAVINST 5090.1D	3 Years	FY12 – FY 16	1, 2, 5, 6 and 7	
SLM-2	61755NR168	NBG Monitor marine ecosystems: coral reef indicators	Coral Reef Habitat Survey to monitor key coral reef indicator species	4	SAIA, CRCA, EO 13089	Annually Continuing	All	1, 2, 4, 5, 6 and 7	
ISM-4	61755NR807	NBG Ungulate management population control	Implement NBG Ungulate Management Plan	4	SAIA, ESA, DODI 4715.03	Annually	FY14 on	1, 5, 6 and 7	JGPO 2010
ISM-6	61755NR185	NBG Feral dog and cat control	Management and removal of feral dogs and cats	4	EO13112, SAIA, ESA	Once	FY12	1, 5, 6 and 7	

**Naval Base Guam**

INRMP Section	EPR Project Number	Title	Project Description	ERL Priority	Legal Driver <sup>1</sup>	Implementation		Natural Resources Metrics Builder	BO Requirement
						Frequency	Fiscal Year		
ISM-7	61755NR834	NBG Swiftlet population protection: brown treesnake trapping	Trapping of brown treesnakes around three swiftlet caves on NBG	4	SAIA, ESA, OPNAVINST 5090.1D	Annually Continuing	All	1, 5, 6 and 7	MIRC BO 2010
WP-1	61755NR832	NBG Soil and water conservation	Implement critical soil and water conservation measures	4	SWCA 5090A, CWA, ESA	Annually Continuing	All	1 and 5	
WFM-1	61755NR827	NBG Wildland fire management plan	Updates to the update to the Wildland Fire Management Plan for Navy Lands	4	SAIA, ESA, DOD Instruction 4715.03	Twice	FY12 FY17	1 and 5	
OR-3	61755NR809	Recreational use assessment of natural resources	Assessment of recreational use at public areas on NBG, not including the ERAs.	4	SAIA	3 Years	FY 14, FY15 and FY16	1 – 7	
GIS-1	61755NR820	NBG GIS database management	Maintain database of threatened and endangered species information, surveys, wetlands, and GIS spatial analysis	4	SAIA, ESA	Annually	All	1 - 7	

Note:

1. This is not a comprehensive list of applicable regulations; other regulations, policies, or guidance could apply. Please review **Appendix B** for a comprehensive list of laws, policies, and guidance for management of natural resources.

**Key Legal Driver:**

CRCA = Coral Reef Conservation Act  
 CWA = Federal Clean Water Act  
 EO = Executive Order  
 ESA = Federal Endangered Species Act  
 GESA = Guam Endangered Species Act  
 MBCA = Migratory Bird Conservation Act  
 MBTA = Federal Migratory Bird Treaty Act

MMPA = Marine Mammal Protection Act  
 MSFCMA = Magnuson-Stevens Fishery Conservation and Management Act  
 NEPA = National Environmental Policy Act  
 NHPA = National Historic Preservation Act  
 NISA = National Invasive Species Act  
 OPNAVINST = Chief of Naval Operational Instruction 5090.1D  
 SAIA = Sikes Act Improvement Act  
 SWCA = Soil and Water Conservation Act

**Key Metrics Builder:**

**Naval Base Guam**

INRMP Section	EPR Project Number	Title	Project Description	ERL Priority	Legal Driver <sup>1</sup>	Implementation		Natural Resources Metrics Builder	BO Requirement
						Frequency	Fiscal Year		

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>1. INRMP Implementation</li> <li>2. Partnerships/Cooperation and Effectiveness</li> <li>3. Team Adequacy</li> <li>4. Status of Federally Listed Species and Critical Habitat</li> </ul> | <ul style="list-style-type: none"> <li>5. Ecosystem Integrity</li> <li>6. Fish and Wildlife Management and Public Use</li> <li>7. INRMP Impact on the Installation Mission</li> </ul> |
|--|---|

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## **APPENDIX D**

**UPDATE OF THE INTEGRATED NATURAL RESOURCES MANAGEMENT PLANS FOR  
U.S. NAVY LEASED LANDS ON TINIAN AND FARALLON DE MEDINILLA**



# 2010

**UPDATE OF INTEGRATED NATURAL  
RESOURCES MANAGEMENT PLANS FOR NAVY  
LEASED LANDS ON TINIAN AND FARALLON  
DE MEDINILLA**

**Plan Years 2010 - 2015**



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5/29/2010

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**UPDATE OF INTEGRATED NATURAL RESOURCES MANAGEMENT PLANS FOR  
U.S. NAVY LEASED LANDS ON TINIAN AND FARALLON DE MEDINILLA**

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## ACRONYMS AND KEY TERMS

AAFB	Andersen Air Force Base
ac	acre
AVV	Amphibious Assault Vehicle
BA	Biological Assessment
BASH	Bird/Animal Aircraft Strike Hazard
Biodiversity	The variety and abundance of life forms, processes, functions, and structures of plants, animals, and other living organisms, including the relative complexity of species, communities, gene pools, and ecosystems at spatial scales that range from local through regional to global. Also, an index of richness in a community ecosystem, or landscape and the relative abundance of these species
BO	Biological Opinion. A document that states the U.S. Fish and Wildlife Service or the National Marine Fisheries Service's opinion as to whether or not the Federal action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat. It includes a summary of the information on which the opinion is based and a detailed discussion of the effects of the action on listed species or designated critical habitat [50 CFR §402.02, 50 CFR402.14]
BOMBEX	Bombing Exercise
BTS	Brown treesnake
CAD	Cartridge Actuated Device
CEQ	Council on Environmental Quality
CITES	Convention of International Trade in Endangered Species
CFR	Code of Federal Regulations
CNO	Chief of Naval Operations
CO	Commanding Officer
COMNAVMARIANAS	Commander, U.S. Naval Forces Marianas
Conservation Area	Area in MLA classified in 2004 INRMP as "No Wildlife Disturbance Zone". Referred to for the purpose of this updated INRMP as Conservation Area due to the disturbance restriction pertaining to the prohibited use of military aircraft

Critical Habitat	1) Specific areas within the geographic area occupied by a federally listed species on which physical and biological features are found that are essential to the conservation of the species and that may require special management or protection; 2) The specific areas outside the geographic area that are occupied by a listed species that are determined to be essential for the conservation of species
CRMO	CNMI Coastal Resources Management Office
CZM	Coastal Zone Management
CZMA	National Coastal Zone Management Act of 1972 (16 USC 1451 et seq.)
CNMI-DFW	CNMI Department of Land and Natural Resources, Division of Fish and Wildlife
DAA	Defense Authorization Act
DEIS	Draft Environmental Impact Statement
DNLR	CNMI Department of Lands and Natural Resources
DoD	Department of Defense
DPW	CNMI Department of Public Works
Ecosystem	A spatially explicit, relatively homogenous unit of the earth that includes all interacting organisms and components of the abiotic environment within its boundaries
Ecosystem diversity	Encompasses the variety of habitats that occur within a region, or the mosaic of patches found within a landscape: grasslands, wetlands, and forests.
Endangered species	Any species of plant or animal defined by the Endangered Species Act of 1973 as being in danger of extinction throughout all or a significant portion of its range, and published in the Federal Register.
Endemic	Native to and found only in a designated place
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMUA	Exclusive Military Use Area
EO	Executive Order of the Office of the President of the United States
ERL	Environmental Readiness Level
ESA	Endangered Species Act of 1973, as amended, 16 USC 1531 et seq

ESI	Environmental Sensitivity Index
EV BLC	Environmental Business Line Core
Extirpation	1) Local extinction of a species from an area; 2) Loss of some; however, not all populations of a species.
FDM	Farallon de Medinilla
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
ft	feet
FY	Fiscal Year
FYDP	Future Year Defense Plan
GIS	Geographic Information System
Gpd	gallons per day
GUNEX	Gunner Exercise
ha	hectare
Habitat	1) A unit area of environment, 2) The place, natural or otherwise (including climate, food, cover, and water) where an animal, plant, or population naturally or normally lives and develops
HACCP	Hazard Analysis and Critical Control Points
Halophyte	A plant that is more or less restricted to saline soil or to sites that are influenced by salt water
IBB	International Broadcasting Bureau
in	inch
Indigenous	Native to a specified area or region, not introduced
Inert ordnance	Physical equipment pertaining to a weapon that is inactive
INRMP	Integrated Natural Resources Management Plan
ISSG	Invasive Species Specialist Group
IUCN	International Union for Conservation of Nature
JGPO	Joint Guam Program Office

kg	kilograms
km	kilometer (1000 m or 3280 ft)
km <sup>2</sup>	square kilometer
kph	kilometer per hour
LBA	Lease Back Area
LCAC	Air Cushioned Landing Craft
Listed	Protected under the Endangered Species Act of 1973, as amended and described as threatened or endangered
lpd	liters per day
m	meter (3.2808 ft)
m <sup>2</sup>	square meters
M-SFCMA	The Magnuson Fishery Conservation and Management Act of 1976, renamed the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) when amended on October 11, 1996
Marianas	Mariana Islands
MBTA	Bird Treaty Act of 1918 [16 USC §§ 703-712]
Mesic	Sites or habitats characterized by intermediate moisture conditions, i.e., neither wet or dry
MDC	Micronesian Development Corporation
mi	mile
mi <sup>2</sup>	square miles
MISSILEX	Missile Exercise
MLA	Military Lease Area – Lands within the Commonwealth of the Northern Mariana Islands legally leased to the United States under the Leaseback and Disposal Agreement between the Commonwealth of the Northern Mariana Islands and the United States of America made pursuant to the Covenant to Establish a Commonwealth of the Northern Mariana Islands in Political Union with the United States of America
MMPA	Marine Mammal Protection Act of 1972, as amended [16 USC 1361-1421]
MOU	Memorandum of Understanding

MOUT	Military Operations in an Urban Environment Training
MPLA	Marianas Public Land Authority
MSL	Mean Sea Level
NANPCA	Nonindigenous Aquatic Nuisance Prevention and Control Act
NAVFACMAR	Naval Facilities Marianas
NBG	Naval Base Guam
NEPA	National Environmental Policy Act (42 U.S. Code [USC] §4321-4347)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	USDA Natural Resources Conservation Service
NSWU-1	Navy SEAL Training Unit 1
OEBGD	Oversees Environmental Baseline Guidance Document
OI	Operating Instruction
OIA	Office of Insular Affairs
OPNAVINST	Chief of Naval Operations Instruction
OSD	Office of the Secretary of Defense
POM	Program Objectives Memorandum
PPBS	Planning, Programming and Budgeting System (The DoD budget process)
Protected	Species listed by the United States federal government as threatened or endangered under the Endangered Species Act, listed as protected under the Migratory Bird Act, or listed as locally protected in the Mariana Islands
Rare	Low number of individuals of a species
SAIA	Sikes Act Improvement Act of 1997, Public Law 105-85, Div. B. Title 29, Nov1997; and codified at 16 USC §670a et seq. (1998) amending the Sikes Act of 1960
SCS	Soil Conservation Service
SCUBA	Self-contained Underwater Breathing Apparatus

SDZ	Surface Danger Zone
Sikes Act	Sikes Act of 1960, 16 USC §670a et seq. (1996)
SOP	Standard Operating Procedures
Species diversity	The variety and abundance of different types of organisms
spp.	species
Take	Under the Endangered Species Act of 1973, a taking or take is to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect an animal or to attempt to engage in any such conduct "Harm", is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering
Threatened	Defined under the Endangered Species Act as species that are likely to become endangered within the foreseeable future throughout all or a significant part of their range
TMAPS	Tropical Monitoring of Avian Productivity and Survivorship
U.S.	United States of America
USC	U.S. Code
USCOMPAC	U.S. Commander of the Pacific
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UXO	unexploded ordnance

## EXECUTIVE SUMMARY

Natural resource management on military lands is mandated by the Sikes Act of 1960 (Section 101 [16 U.S.C. 670]), which states that the Secretary of Defense is responsible for preparing and implementing an Integrated Natural Resource Management Plan (INRMP) for each military installation belonging to the United States. Specifically, an INRMP is a management document composed under military supervision for the express purpose of developing a program for the conservation and rehabilitation of natural resources on military property. While establishing a program of conservation, an INRMP is to be formulated with the objectives of imposing “no net loss” to the military mission of the installation while maintaining the natural integrity of the lands surrounding the installation.

The goals of environmental conservation and military readiness are not mutually exclusive. It is generally understood within the INRMP planning process that a healthy environment is of value to the installation. The goal of “no net loss” is best achieved through the protection and preservation of U.S. Navy lands and by conserving the biodiversity within these lands. The Department of Defense (DoD) has asserted this awareness through policy such as the DoD Directive 4715.3, Environmental Conservation Program, and OPNAVINST 5090.1C, Natural Resources Management, both which are aimed at protecting the natural environment of military land.

Each INRMP is an adaptive document that undergoes a review process every five years. The Tinian and Farallon de Medinilla (FDM) INRMP is an updated version of the 2004 Tinian and FDM INRMP. This document will serve as a practical guide for the management and stewardship of natural resources on the islands of Tinian and FDM, while ensuring the successful accomplishment of the military mission. Specifically, it serves as the basis for Joint Region Marianas (JRM) and Naval Base Guam (NBG) natural resources programs, planning documents, budget allocation, and project implementation. It will also serve as a guide for interagency coordination and public outreach. This INRMP will be reviewed and updated annually to reflect new information and policy.

Tinian and FDM are part of the Commonwealth of the Northern Mariana Islands (CNMI). Although the CNMI is self-governed, it is legally bound by the same legislation and is warranted the same protection status as lands that have been granted full statehood. Any proposed alteration to the landscape of either island involving a federal action is subject to compliance with the National Environmental Policy Act (NEPA). Governmental protection also extends to threatened and endangered flora and fauna, which are safeguarded under the Endangered Species Act (ESA).

Both Tinian and FDM are used for training exercises that support the readiness of U.S. and allied troops; nevertheless each island is unique and serves its own purpose as valuable land leased by NBG. Tinian lends itself to realistic on the ground strategies in a natural jungle setting and FDM is the only aerial bombing range in the Pacific. Consequently, the document is partially grouped according to location in the following seven chapters:

- Chapter 1. Introduction and Planning Approach
- Chapter 2. Environmental Management Strategy and Mission Sustainability
- Chapter 3. Current Conditions and Use - Tinian
- Chapter 4. Program Elements - Tinian
- Chapter 5. Current Conditions and Use - FDM
- Chapter 6. Program Elements - FDM
- Chapter 7. Implementation and Compliance

Information provided in this INRMP will enable effective management of Tinian and FDM military leased lands. A review of the history and current status of these islands, including human and biological aspects are included as are conservation strategies aimed at addressing federally protected species. Other strategies included focus on biological studies aimed at better understanding the natural requirements of protected species including sea turtle movements and habitat use by the Micronesian megapode. Plans for the management of species and valuable island resources include the cessation of fishing in the waters surrounding FDM and the development of a marine mammal management strategy for Tinian.

An interdisciplinary approach was employed in the development of this INRMP. The information used in the construction of each section of this document was gathered from multiple sources. Guidance was also solicited from federal and local agencies. Information acquired during this process has resulted in an accurate representation of the status and management needs of local ecosystems, balanced against the requirement of the installation to accomplish its missions at the highest level of efficiency.

Joint Region Marianas (JRM) and Naval Base Guam (NBG) are responsible for developing appropriate agreements between federal and local government agencies to ensure an ecosystem-based approach is followed in managing and protecting the natural resources on Tinian and FDM. Cooperation with U.S. Fish and Wildlife Service will help ensure that fish and wildlife are protected to the maximum extent practicable. Where feasible, habitat rehabilitation measures will be factored into remedial actions to enhance fish and wildlife resources on Navy land.

## **1.0 INTRODUCTION TO INRMP AND PLANNING APPROACH**

### **1.1 Overview**

An Integrated Natural Resources Management Plan (INRMP) functions as a planning document for Department of Defense (DoD). It provides guidance on the management of natural resources that will allow multipurpose uses without compromising the military's mission. This INRMP is specific to the United States Navy (U.S. Navy) lease lands on the islands of Tinian and Farallon de Medinilla (FDM), in the Commonwealth of the Northern Mariana Islands (CNMI). The document can be used as a principal information source for preparing DoD related Environmental Assessments (EA), Environmental Impact Statements (EIS), and Environmental Master Plans. The INRMP also provides the basis for formulating the natural resource budget. Overall, the outcome of the INRMP is a vision for long-term natural resource protection and management through the implementation of short-term management actions. The summation of these management actions is a dynamic planning tool that can be modified as conditions and priorities change.

The INRMP was developed using an interdisciplinary approach in which information was gathered from a variety of organizations and sources. Guidance was solicited from federal, state, and local agencies and groups. These varying perspectives allowed for an accurate portrayal of the status and management needs of local ecosystems, balanced against the requirement for the U.S. Navy to accomplish its missions at the highest possible level of efficiency.

### **1.2 GENERAL LOCATION**

Tinian and FDM are located in the Marianas archipelago (Figure 1). The Marianas are comprised of 15 volcanic islands in the western Pacific Ocean approximately 3,226 mi (8,355 km) west of Hawaii, 1,272 mi (3,294 km) south of Tokyo, Japan, 1,438 mi (3,724 km) east of Manila, Philippines, and 2,951 mi (7,643 km) north of Sydney, Australia. The archipelago spans nearly 675 mi (1086 km) from Guam, the southernmost island, to Farallon de Pajaros (Uracas) in the north. Guam is a U.S. unincorporated Territory, politically distinct from the CNMI. As a result, Guam is not considered a part of the CNMI (Berger et al. 2005). The islands of the CNMI extend between the latitudes 14°N and 21°N and longitudes 145°E to 146°E. The total land area of CNMI is approximately 118,610 ac (48,000 ha) with Saipan, Tinian and Rota the largest in terms of land mass and population. Other inhabited CNMI islands include Pagan, Alamagan and Agrihan (Berger et al. 2005). Specific Tinian and FDM information are outlined in Sections 3.1 and 5.1 respectively.

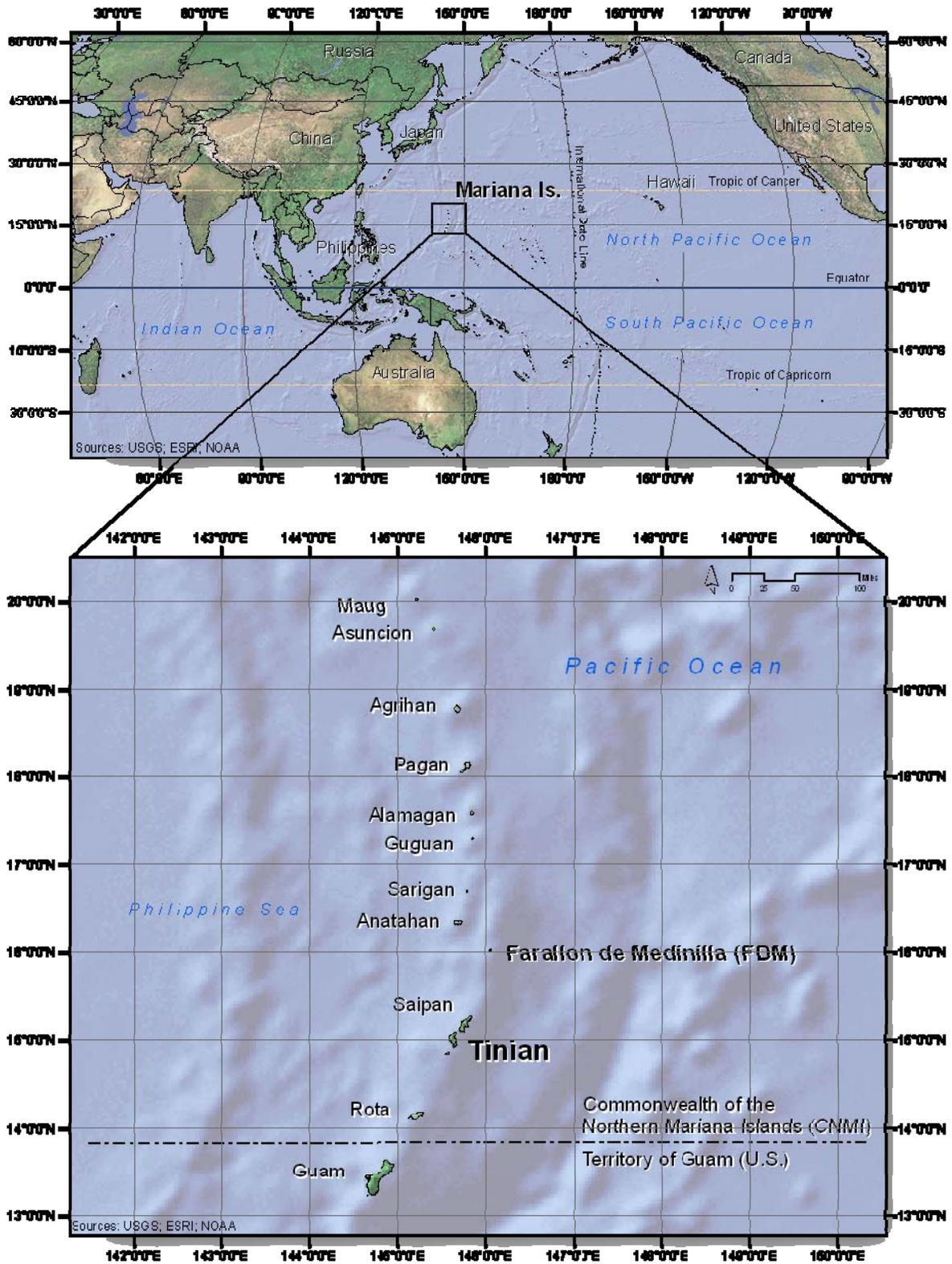


Figure 1. Map showing location of Tinian and Farallon de Medinilla (FDM) in the Marianas archipelago

### 1.3 Purpose and Scope

The U.S. Navy policy, in the public's best interest, is to act responsibly to restore, improve, preserve and properly utilize natural resources on U.S. Navy-administered lands. The U.S. Navy is charged with complying with federal laws, regulations and policies, and showing a conscientious and active concern for the inherent value of natural resources in all U.S. Navy plans, actions and programs. Proposals for new and continuing actions that affect natural resources are coordinated with managers of those resources. Recommendations to minimize impacts are incorporated to the extent they are financially and reasonably practical. The principal of good stewardship is also applied to those natural resources potentially affected by U.S. Navy operations and protected by other agency administrations such as marine mammals and coral reefs. Pursuant to the U.S. Navy Commanders' Guide to Environmental Compliance, the U.S. Navy environmental strategy is to lead in protecting the environment and conserving natural resources for present and future generations (U.S. Navy 1995). This is achieved under three main programmatic areas; compliance, conservation and pollution prevention.

*Compliance:* The U.S. Navy must ensure that their operations meet federal and appropriate state, local and host nation environmental requirements. Areas of operation affected include wastewater discharge, sewage treatment, noise abatement, endangered species and wetlands management, air quality attainment, historic properties management, and solid and hazardous waste management. U.S. Navy guidance is contained in Chief of Naval Operations Instruction (OPNAVINST) 5090.1C, 24-1 "Natural Resources Management" dated October 30, 2007.

*Conservation:* Through natural and cultural resources management, the U.S. Navy strives to protect and enhance the life-sustaining quality of the land and waterways under their protection. The U.S. Navy manages, conserves and restores the land and renewable natural resources (e.g., marine and freshwater vertebrates, invertebrates and ecosystems, wildlife habitat and vegetative communities) as well as protects historic and archaeological resources. Information pertinent to U.S. Navy conservation policy and regulation can be found within the OPNAVINST 5090.1C, NAVFACINST 11010.70.

*Pollution Prevention:* The U.S. Navy strives to eliminate pollution by reducing pollution at its source and reducing or eliminating the creation of pollutants through efficient use of raw materials, energy, water, or other resources. Examples of pollution prevention techniques include: improved hazardous materials management, input substitution, product reformulation, process redesign or modification, improved operation and maintenance, and integrated recycling. Through careful pre-planning, the U.S. Navy considers the possible environmental and occupational, safety and health impacts of future operations and activities. These considerations are documented and methods to avoid or reduce as many adverse effects as possible are developed. Pollution prevention and control is mandated under the National Environmental Policy Act (NEPA), OPNAVINST 5090.1B, OPNAVINST 4110.2, and OPNAVINST 5100.23D.

Each DoD installation controls its development and typically restricts public access for safety or security reasons. Because of these factors, installations often become “islands of biodiversity” and constitute refuges for endangered species. However, heightened environmental protection may lead to greater restrictions on military training activities through the designation of critical habitats and other constraints. Therefore, the major responsibility of the INRMP is to advance technological superiority and combat readiness of U.S. armed forces while conserving the natural resources that will sustain current and future multipurpose uses of military lease lands.

## **1.4 Goals and Objectives**

Implementation of the INRMP will serve to protect natural resources located on the military leased lands of Tinian and FDM. Successful management of DoD natural resources will promote long-term resource sustainability, the ability of military lands to effectively cause “no net loss”, and support the overall mission.

Since Tinian and FDM have unique natural resources assemblages and DoD missions, goals and objectives will be presented for each island separately.

### **1.4.1 Tinian**

#### **1.4.1.1 Fish and Wildlife Resources**

*Overall Goal:* By December 2017, current numbers of threatened and endangered species on Tinian will be maintained or potentially increased and the listing of candidate species of concern will be prevented. Fish and wildlife resources will be better documented through adaptive management and monitoring programs.

*Objective 1:* Conduct monitoring surveys of Tinian avifauna, targeting endangered species such as the Micronesian megapode and Mariana common moorhen.

*Strategy* - Utilize U.S. Navy biologist or qualified contracted biologist to conduct surveys, record data and form cooperative agreements with other Federal agencies as deemed necessary. Surveys for megapodes and forest avifauna will occur monthly. Mariana common moorhen surveys will be conducted monthly. Produce annual report.

*Objective 2:* Complete five years of the Tropical Monitoring of Avian Productivity and Survivorship (TMAPS) project by 2017.

*Strategy* –This project is a cooperative project between U.S. Navy, USGS, USDA, CNMI DFW, and USFWS. Forest surveys of birds will be conducted by a USFWS biologist.

*Objective 3:* Develop Tinian forest bird management plan.

*Strategy* - Utilize U.S. Navy or qualified contracted biologist and form cooperative agreements with other Federal agencies as deemed necessary by the project.

*Objective 4:* Initiate a study to verify presence of the Mariana Islands tree snail (*Partula gibba*) or other tree snails on Tinian by 2012.

*Strategy* - Employ U.S. Navy or qualified contracted biologist to search for tree snails in select targeted habitats within the MLA. Report findings.

*Objective 5:* Initiate and fund sea turtle migration or movement (primarily green sea turtles) monitoring for the Marianas by 2012.

*Strategy* - Fund the study as a two-year Master's project in cooperation with a recognized university.

*Objective 6:* Develop marine mammal management strategy by 2013.

*Strategy* - Produce a marine mammal management plan through U.S. Navy environmental staff or qualified contractor in cooperation with NOAA and CNMI DFW.

#### 1.4.1.2 Wildlife Habitat

*Overall Goal:* Military training will result in no net loss to Tinian habitat for threatened and indigenous fauna of concern through December 2017.

*Objective 1:* Conduct on-going monthly vegetation monitoring.

*Strategy* - Utilize U.S. Navy biologist or contract biologist to conduct surveys and record data. Produce annual reports.

*Objective 2:* Enhance Tinian forested areas with native tree species by planting 30 ac (12 ha) in the MLA each year from 2012 to 2017 (total 150 ac (61 ha)).

*Strategy* - Conduct under-planting of desired native species in accordance with planting techniques deemed successful in the 2002 U.S. Navy project, Tinian reforestation/enhancement. Planting will be carried out by a qualified contractor under the supervision of DoD environmental staff.

*Objective 3:* Conduct long-term habitat monitoring and vegetation surveys.

*Strategy* - Utilize U.S. Navy biologist or qualified contracted biologist to conduct surveys and record data. Reports will be generated at the completion of each periodic cycle.

*Objective 4:* Conduct on-going quarterly monitoring of cycads planted as a result of U.S. Navy relocation project to safe harbor cycads from Guam.

*Strategy* - Utilize U.S. Navy biologist or qualified contract biologist to monitor cycad health. Remove any potentially threatening weeds/vegetation or infestations from the vicinity. Produce annual reports.

*Objective 5:* Increase the Conservation Area in the MLA to minimize disturbance by 2012.

*Strategy* - Implement the updated Conservation Area into DoD training regulations.

*Objective 6:* Develop and implement a Tinian Wildfire Management Plan.

*Strategy:* Develop a wildfire plan specifically for military activities on the MLA. This plan will be developed by U.S. Navy or qualified contract biologist. Plan will be implemented by 2013.

*Objective 7:* Assess the effects of rat exclusion in various habitat types by 2017.

*Strategy* – Utilize U.S. Navy or qualified contract biologist to conduct a study on the effects of removing rats and preventing rat immigration to various habitats such as the Hagoi wetland or native limestone forest.

#### 1.4.1.3 Wetlands

*Overall Goal:* All Tinian wetlands to be mapped by 2012 with a corresponding management program implemented for conservation before 2017.

*Objective 1:* Implement Hagoi wetland management plan.

*Strategy* – Plan to be implemented under guidance of NAVFAC PAC.

*Objective 2:* Enhance endangered Mariana common moorhen habitat at the Hagoi wetland by enhancing and maintaining areas of open water.

*Strategy* – Annual removal, preferably by hand, the successional sedge (*Schoenoplectus littoralis*) from open water habitat to inhibit the growth of the wetland dependant plant *Phragmites karka*. *P. karka* will be removed from Hagoi as deemed necessary. Utilize contractor to undertake and implement vegetation modification under supervision of a wetland specialist.

#### 1.4.1.4 Coastal Resources

*Overall Goal:* Prevent the destruction or detrimental modification of Tinian coastal and near-shore habitat through to 2017, thus protecting federally listed and native species that utilize these areas.

*Objective 1:* Conduct on-going, semi-annual, in-water surveys off the MLA beaches of Unai Chulu and Unai Babui to measure ecosystem health.

*Strategy* - Utilize U.S. Navy or qualified contract biologist to conduct surveys and record data. Produce annual reports.

*Objective 2:* Conduct on-going monthly inspections of MLA sandy beaches for the presence of nesting sea turtles.

*Strategy* - Utilize U.S. Navy or qualified contract biologist to conduct surveys and record data. Produce annual reports.

*Objective 3:* Remove debris from nesting sea turtle habitat at Unai D'angkolo and develop monitoring plan for trash accumulation through to 2017.

*Strategy:* Utilize U.S. Navy or qualified contract biologist. Develop plan for proper waste/trash removal.

## **1.4.2 FDM**

### **1.4.2.1 Fish and Wildlife Resources**

*Overall Goal:* By December 2017, current numbers of endangered and indigenous species on FDM will be maintained or potentially increase. Fish and wildlife resources will be better documented through adaptive management and monitoring programs.

*Objective 1:* Conduct on-going monitoring of FDM avifauna.

*Strategy* - Utilize U.S. Navy or qualified contract biologist to conduct quarterly surveys via helicopter and record data. Form cooperative agreement with other government agencies if deemed necessary. Produce annual reports.

*Objective 2:* Conduct on-going sea turtle monitoring surveys.

*Strategy* - Utilize U.S. Navy or qualified contract biologist to conduct quarterly surveys via helicopter and record data. Produce annual report.

*Objective 3:* Develop management plan for rat eradication and exterminate rats by method/s determined in plan.

*Strategy* - Management plan to be developed by U.S. Navy or qualified contract staff by December 2013 with the cooperation of government agencies where beneficial. Following completion of management plan, implement rat eradication as specified in plan. Monitor success of eradication and control to determine the need for continuance. Rat eradication to be conducted by the U.S. Navy and/or contracted experts with the cooperation of any needed additional government agencies. Prior to rat eradication, determine which

species of rat are present on the island. Initial eradication complete by December 2017.

*Objective 4:* Complete megapode life-history study on Saipan and Sarigan (these island megapode colonies are mitigation for FDM DoD activities).

*Strategy* - Fund a Masters or Doctoral student to carry out project and complete by December 2017. Publish thesis.

*Objective 5:* Implement and conduct Micronesian megapode distribution and abundance studies at five-year intervals.

*Strategy* - Utilize U.S. Navy or qualified contracted biologist to conduct surveys and record data. Surveys will be conducted every five years and coordinated with range clearance/closure. First survey to be conducted in 2012, the second in 2017. Produce reports following each survey.

*Objective 6:* Conduct two-year satellite telemetry seabird study.

*Strategy* - Utilize U.S. Navy or qualified contract biologist to conduct surveys for two years. Cooperative agreements may be established with other government agencies if determined necessary.

*Objective 7:* Determine megapode survivorship, territoriality, and habitat use on FDM by December 2017.

*Strategy* - Utilize U.S. Navy or qualified contract biologist to conduct surveys and record data. Utilize periods when range is closed for annual clearing to conduct surveys. Produce annual reports.

*Objective 8:* Consolidate count and observational data from all previous FDM bird surveys.

*Strategy* - Utilize U.S. Navy or qualified contract biologist to combine and analyze data to determine population trends. A report will be produced by 2017.

#### 1.4.2.2 Wildlife Habitat

*Overall Goal:* Military training will result in no net habitat loss for indigenous FDM fauna through December 2017.

*Objective 1:* Instigate and complete the installation of constructed red-footed booby nesting platforms.

*Strategy* - To be conducted by the U.S. Navy or qualified contract biologist with the cooperation of government agencies where beneficial. Nesting platforms will be constructed and deployed to suitable areas by December 2017.

*Objective 2:* Complete comprehensive mapping of FDM seabird nesting areas

*Strategy* – Utilize U.S. Navy or qualified contact biologist to conduct surveys of bird species nesting locations. Surveys will use over-flight imagery and ground truthing and project completed by 2015. Produce report.

*Objective 3:* Complete comprehensive FDM vegetation study with mapping.

*Strategy* - Utilize U.S. Navy or qualified contract biologist to conduct surveys and map vegetation using ground-truthed over-flight imagery. Project will be completed by 2015. Produce report.

#### 1.4.2.3 Coastal Resources

*Overall Goal:* Minimize the destruction of FDM coastal and near-shore habitat and protect federally listed species utilizing that habitat through 2017.

*Objective 1:* Conduct on-going annual in-water marine monitoring surveys of substrate, corals and other marine life.

*Strategy* - Utilize U.S. Navy or qualified contract biologist to conduct surveys and record data. Produce annual report.

*Objective 2:* Establish marine preserve around FDM by 2012.

*Strategy* – Implement a total ban on fishing that extends two (2) nautical miles from the shores of FDM.

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## **2.0 ENVIRONMENTAL MANAGEMENT STRATEGY AND MISSION SUSTAINABILITY**

Both Tinian and FDM are strategic military training grounds. Tinian provides a natural jungle setting for on-the-ground training. FDM is the only live-fire training range available in the Pacific. This INRMP strives to support their use while providing for, and protecting, the natural environment and resident native species.

Section 2.0 outlines the INRMP process as it pertains to Tinian and FDM and reviews the defining and regulating legislation pertinent to natural resource conservation on these Military Leased Lands.

### **2.1 Management Systems**

The Sikes Act, passed 15 September 1960, functions as a driver to promote effectual planning, development, maintenance, and coordination of wildlife, fish, and game conservation and rehabilitation on military lands. Pursuant to Section 101 (16 USC 670a), the Act stipulates that the "Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of natural resources on military installations". As a means of providing protection to natural resources occurring on military land, an INRMP must be prepared and implemented for each military installation.

#### **2.1.1 Cooperative Management**

Section 101.2 (16 USC 670a) of the Sikes Act necessitates that an INRMP be prepared in cooperation with the Secretary of the Interior, by way of "acting through the Director of the United States Fish and Wildlife Service (USFWS), and the head of each appropriate State fish and wildlife agency for the State in which the military installation is located". The INRMP should represent a mutual agreement between these federal agencies.

Since Tinian and FDM belong to the CNMI, the resulting governmental cooperation occurs between the U.S. DoD and the representative CNMI Fish and Wildlife Agencies for each island. Adaptive management and mitigation projects occur with the knowledge and approval of the appropriate CNMI government agencies.

#### **2.1.2 Adaptive Management**

Each INRMP is subject to regular review processes that serve to ensure management goals are obtained and continually met. In the event that changes are made to regulating legislation or unknown pressures on the conservation efforts become known, the INRMP can be updated to meet the current natural resource needs.

In accordance with section 101(f) of the Sikes Act, "Not later than March 1 of each year, the Secretary of Defense shall review the extent to which integrated natural resources

management plans were prepared or were in effect and implemented in accordance with this title in the preceding year, and submit a report on the findings of the review to the committees.”

Section 101(b)(2) stipulates that at a minimum of every 5 years, a formal review process to determine whether or not the INRMP is meeting the requirements of the Sikes Act is undertaken. An INRMP that is not meeting the requirements of the Sikes Act will be subject to formal revision.

An INRMP implemented with a functional adaptive management plan is critical to meet the changing needs of military missions and the installation’s natural resources. Adaptive management is accomplished with the assistance of regular monitoring of critical and important species and ecosystems. Current information pertaining to habitat status and endangered species population demographics provides an indication whether the lands are being managed with a positive, negative or neutral affect on conservation targets.

Since 1998, the NBG has conducted an on-going monthly monitoring program for the Mariana common moorhen, the Micronesian megapode, forest birds, and sea turtles for the island of Tinian. For the island of FDM, NBG has monitored colony size of resident bird species and sea turtles each month, and marine life annually.

### **2.1.3 Ecosystem Management**

Management plans that focus on ecosystems rather than specific species are important because of the interconnectivity of the land and resident wildlife. For example, FDM mitigation conducted on the island of Sarigan to remove feral ungulates from forest ecosystems has effectively prevented or limited further soil erosion, the loss of native plants, and has promoted viable habitat for the endangered Micronesian megapode (Kessler 2004).

Ecosystem projects on Tinian focus on native forest enhancement and protection and wetland habitat preservation for protection of the Mariana common moorhen. The Hagoi wetland, situated on military land, is the only habitat on Tinian capable of supporting large numbers of the endangered moorhen. The NBG currently enforces training regulations to protect this habitat and has deemed it a Conservation Area. FDM supports breeding colonies of indigenous birds protected under the MBTA. The Northern end of FDM has been designated a No Fly, No Live-fire Zone (see section 5.2 discussion) to preserve this habitat and allow resident birds to reproduce with minimized interference.

The continual threat of invasion by non-native species remains a significant conservation issue for all the islands in the Marianas. Current management strategies for Tinian and FDM incorporate interdiction, as well as minimizing and mitigating the detrimental affects invasive species have on novel island ecosystems (See sections 4.7 and 6.7).

## **2.2 Prevention of Loss**

An INRMP specifies that conservation goals regulating land use and natural resource decisions result in no net loss in the capability of the military installation to support the military mission. The objective of this updated INRMP is to provide for the sustainability of Tinian and FDM natural resources while facilitating the military mission.

## **2.3 Sustainability of the Military Mission and Natural Environment**

The primary INRMP objective is to support the military mission by developing a natural resource management strategy that will maintain DoD activities on military leased land. It is outside the scope of the INRMP to suggest changes to the military mission.

### **2.3.1 Military Mission and Sustainable Land Use**

The principal use of U.S. Navy leased lands in the CNMI is to ensure command preparedness. Military leased lands of Tinian and FDM are used for training, which is a critical component of national defense. Neither island has permanently stationed bases, either DoD personnel or infrastructure, to support a continued troop presence. The Joint Guam Program Operation (JGPO) is in effect and joint basing occurred on 1 October 2009. Joint basing will ultimately result in increases to training missions in the region. No changes in lease conditions are anticipated.

Tinian and FDM provide unique field training opportunities for national defense because:

- Tinian is sparsely populated and provides a jungle environment that allows for realistic field training scenarios; and
- FDM is the only aerial firing range in the western Pacific.

Damage to the environment is counterproductive to the continued use of Tinian and FDM. Specific to Tinian, sustaining the realistic quality of field training is conducive to both military and natural resource goals.

### **2.3.2 Impact to the Mission**

This INRMP is likely to marginally increase impact on the DoD mission for Tinian and result in little impact for FDM. These potential impacts are discussed further in Sections 3.0 and 4.0 (Tinian), and Sections 5.0 and 6.0 (FDM).

### **2.3.3 Relationship to Operational Area Plans**

The Marianas archipelago is a strategic location for the U.S. DoD. The southern-most island of Guam is a U.S. Territory and the location of two permanent U.S. military bases, Naval

Base Guam (NBG) and Andersen Air Force Base (AAFB). Currently, a relocation effort overseen by the JGPO is underway to transfer a Marine Expeditionary Force from Okinawa, Japan to Guam. As a result, DoD assets on Guam are slated for significant expansion in the near future. Tinian and FDM are a key component of this growth. Both islands are located in close proximity to Guam. With the relocation of the Marine Expeditionary Force, training activities at both locations are expected to increase considerably.

The following supporting documents are currently in place for the environmental aspects of the DoD activities and increases in military movement.

- 1.) A Biological Assessment (BA) for the Mariana Islands Range Complex has been drafted for terrestrial species (U.S. Navy 2009). This document is expected to be finalized in 2010 (A. Brooke 2010, NAVFACMAR, in litteris). Increased use of the Mariana Islands for DoD purposes is expected to create some associated impacts requiring mitigation. The Biological Assessment (BA) identifies and discusses where and how these impacts are likely to occur.
- 2.) A draft Environmental Impact Statement (EIS) of the Guam and CNMI military relocation was completed in September 2009 (JGPO 2009); the final EIS is pending. The document states that training activities are to increase and are likely to occur monthly on Tinian. The purpose and need for Tinian as a strategic training location are documented as:
  - positioning U.S. forces to defend the homeland, including the U.S. Pacific territories;
  - maintaining regional stability, peace and security;
  - maintaining flexibility to respond to regional threats;
  - providing powerful U.S. presence in the Pacific region;
  - increasing aircraft carrier presence in the Western Pacific;
  - defending U.S., Japan, and other allies' interests;
  - providing capabilities that enhance global mobility to meet contingencies around the world; and
  - encompassing a strong local command and control structure.

This INRMP will support the operational plans discussed in these abovementioned documents. The scope of this INRMP does not include any additional impacts of Tinian or FDM utilization by DoD for training purposes. Mitigation identified in the BA and DEIS considered necessary for Tinian and FDM will be included as detailed projects aimed to enhance, support, and monitor the natural ecosystems of these islands while providing sustained integrity of the mission.

## 2.4 Natural Resources Consultation Requirements

The Sikes Act Improvement Act of 1997 (SAIA) requires that INRMPs be developed in cooperation with the USFWS and State Fish and Wildlife agencies. Both the USFWS and CNMI Department of Land and Natural Resources, Division of Fish and Wildlife (CNMI-DFW) were involved in the development of the 2004 Tinian and FDM INRMP by participating in scoping meetings, suggesting natural resources management projects and commenting on drafts of the INRMP.

Tinian and FDM provide habitat for the endangered Micronesian megapode, hawksbill sea turtle, and the threatened Marianna fruit bat, and green sea turtle. Tinian also supports a population of the endangered Mariana common moorhen. Indigenous people inhabit Tinian and the island has historical importance because of existing WWII sites. Both Tinian and FDM have coastal ecosystems that warrant protection and are subject to coastal zoning. The relevant legislation pertaining to consultation with private or non-DoD government agencies in regards to these resources are listed below.

- Section 7 of the Endangered Species Act (ESA) (16 USC §1531) states that all Federal agencies will operate under the jurisdiction of the Act to utilize consultation to carry out programs supporting endangered and threatened species. Consultation will be conducted for the assurance that any action funded or carried out by the agency will not jeopardize the continuation of any endangered or threatened species, any listed species that may be present in an area affected by a project, and in the event a project will adversely affect designated critical habitat.
- Section 106 consultation under the National Historic Preservation Act (NHPA) of 1966 (16 USC §470) requires Federal agencies to take into account the effects of their undertakings on historic properties, and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings.
- Consistency determination under the Coastal Zone Management Act (CZMA) (16 USC §1451 to 1465) encourages States to manage and conserve coastal areas as unique, irreplaceable resources. The CZMA states that land subject solely to the discretion of the Federal government, such as federally owned or leased property, is excluded from the CNMI coastal zone. However, Federal activities that directly affect the coastal zone are to be conducted in a manner consistent with the CNMI CZM program. The U.S. Navy conducted an effects test to determine whether the action would affect any coastal use or resource in the coastal zone.
- OPNAVINST 5090.1C states that proposed activities “that may adversely affect threatened or endangered species, or the designated or proposed critical habitat of an endangered species” will warrant a need for a BA and consultation under the ESA. Additionally, environmental review and consultation requirements need to be identified so that “lead and cooperating agencies may prepare required analyses and studies concurrently with, and integrated with, the EIS as mandated by the NEPA.

## 2.5 NEPA Compliance

The function of the National Environmental Policy Act (NEPA) is to “declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality (CEQ).”

In pursuit of this goal, the NEPA mandates that for proposals significantly affecting the quality of the human environment, a detailed statement by the responsible office is required. The statement must include:

- The environmental impact of the proposed action;
- any adverse environmental effects which cannot be avoided should the proposal be implemented;
- alternatives to the proposed action;
- the relationship between local, short-term uses of the environment;
- the maintenance and enhancement of long-term productivity; and
- any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented.

An Environmental Assessment (EA) was prepared with a “Finding of No significant Impact” for the islands of Tinian and FDM prior to the implementation of the 2004 INRMP planning document (Appendix 1).

### 2.5.1 Coordination, Planning, and Maintenance

In accordance to 32CFR775.1 (Chapter 6 Department of the Navy, part 775 Procedures for Implementing the National Environmental Policy Act), the U.S. Navy is to use a “systematic, interdisciplinary approach to ensure the integrated use of natural and social sciences and environmental considerations in planning and decision making where there may be an impact on man's environment” and to “use ecological information in planning and developing resource-oriented projects”.

The Chief of Navy Operations and the Commandant of the Marine Corps are responsible for directing subordinates to ensure the required documentation is procured for environmental planning. They are also charged with assuring that analysis on environmental effects from proposed actions are conducted in accordance with DoD regulations, CEQ regulations (40 CFR parts 1500-1508), and other applicable regulations. Environmental impacts will be evaluated at the initial project planning stages and at each appropriate decision step throughout the development of a project or program.

Early in the planning stages of a proposed action, the appropriate level of documentation under NEPA will be determined based on the following questions:

1. Is the action a major federal action significantly affecting the human environment requiring an EIS?
2. Is the action one for which the impacts are not known or which may not be significant and, therefore, an EA is appropriate?
3. Is the action one that has no potential for significant impacts and can be categorically excluded from further NEPA documentation?

Additionally, CEQ regulations (40 CFR 1508.18(a)) define major federal actions subject to evaluation under NEPA to include a clause for "new and continuing activities". The term "new" encompasses all future activities not in effect at the time of the proposal, where as "continuing activities" addresses unforeseen issues such as unexpected habitat degradation.

### **2.5.2 Mitigation Planning**

Any environmental mitigation required as a result of proposed project actions will be determined during the investigation process into the scope of potential environmental impacts, which is required for NEPA compliance. A Biological Opinion (BO) was conducted for the 2004 INRMP document covering proposed military activities. Needed mitigation measures will be incorporated into this INRMP as projects for implementation.

## **2.6 Beneficial Partnerships and Collaborative Resource Planning**

All environmental planning is to be conducted with the cooperation of agencies and organizations that have a vested interest in the affected lands. Due to the interconnectivity of ecosystems, the formation of partnerships is a necessary management tool. OPNAVINST 5090.1C, Ch.24 Natural Resources Management, encourages installations to work with other organizations, agencies, and individuals throughout the planning process. The coordination of INRMP preparations with the installation personnel responsible for military operations is considered especially critical.

Collaborative partnerships beneficial to the development of the Tinian and FDM INRMP are listed below.

#### *United States Federal Government*

- Environmental Protection Agency (EPA, Region 9, San Francisco)
- United States Fish and Wildlife Service (USFWS, Division of Ecological Services, Honolulu)
- United States Geological Service (USGS)
- United States Department of Commerce
  - National Oceanic and Atmospheric Administration (NOAA)
  - National Marine Fisheries Service (NMFS)

- United States Department of Agriculture/Forest Service (USDA-FS)
- United States Department of Agriculture/Natural Resources Conservation Service (USDA-NRCS)

*Commonwealth of the Northern Mariana Islands - CNMI*

- Mariana Public Land Authority (MPLA)
- Executive Branch CNMI
  - Coastal Resources Management Office (CRMO)
- Department of Public Health and Environmental Services (PHES)
- Department of Lands and Natural Resources (DLNR)
  - Division of Fish and Wildlife (CNMI-DFW)
- University of Guam Marine Lab (UOG-ML)

## **2.7 Public Access and Outreach**

Section 2905 of the Sikes Act requires the Secretary of the appropriate military department to provide the public an opportunity to review and comment on newly developed INRMPs. However, the Sikes Act does not stipulate that the public be provided an opportunity to comment on limited revisions to an existing INRMP or the continuation of an existing INRMP without revision. If substantial revisions to the INRMP resulting in biophysical consequences different from those outlined in the initial INRMP are to occur, a new NEPA analysis should be prepared and the public provided an opportunity to comment on the document.

None of the projects or provisions in this document significantly alters the biophysical scope and intention of the original INRMP document. FDM is strictly a military use island with no public access. Tinian's military training activities largely occur within the military exclusion zone, which will not change in area or extent in terms of current public availability. Therefore, no period of public review occurred for this updated INRMP.

## **2.8 Encroachment Partnering**

OPNAVINST 1101.40 specifically addresses encroachment partnering and defines an encroachment pressure as "private development adjacent to an installation, range, or air and water operating areas, certain environmental restrictions, or growing competition for resources such as waterfront, airspace, and frequency spectrum".

Encroachment pressures due to factors such as private development or environmental restrictions can constrain DoD activities by limiting low-altitude flight, beach operations, night and all-weather training, and live-fire training. To address these issues, U.S. Navy has created the Encroachment Management Program, which facilitates the resolution of

encroachment issues. The program encourages interaction between DoD, local, State, other Federal agencies, and community leaders to “prevent encroachment impacts and promote compatible development of lands” in the vicinity of U.S. Navy operations.

Tinian has a small resident population located primarily in the south. As a result, encroachment is minor and does not impede upon DoD lands or interests. FDM has no resident population and public access is prohibited. Therefore FDM does not experience encroachment from public or private parties. Fishing is allowed in the waters surrounding FDM but is prohibited during military training exercises. However, it is possible that conflict can arise in situations where fishermen do not avoid FDM waters during training exercises.

Encroachment concerns related to Tinian and FDM are primarily environmental in nature. The endangered Mariana common moorhen is a resident of Tinian, and the endangered megapode and threatened Mariana fruit bat are known from both Tinian and FDM. Endangered hawksbill sea turtles and threatened green sea turtles are also found in the waters surrounding Tinian and FDM. Two fish species of federal concern with a range that includes the Mariana archipelago are the humphead wrasse (*Cheilinus undulates*) and the bumphead parrotfish (*Bolbometopon muricatum*) (NOAA 2004). The bumphead parrotfish was recently proposed for protection under the ESA (NOAA 2010). The presence of federally protected species on and around these islands carries legal restrictions which may limit certain military activities. Environmental restrictions and their associated issues are addressed in this INRMP to ensure natural resource responsibility is considered while effectively resulting in no net loss to the mission.

## **2.9 Data Management and Dissemination of Information**

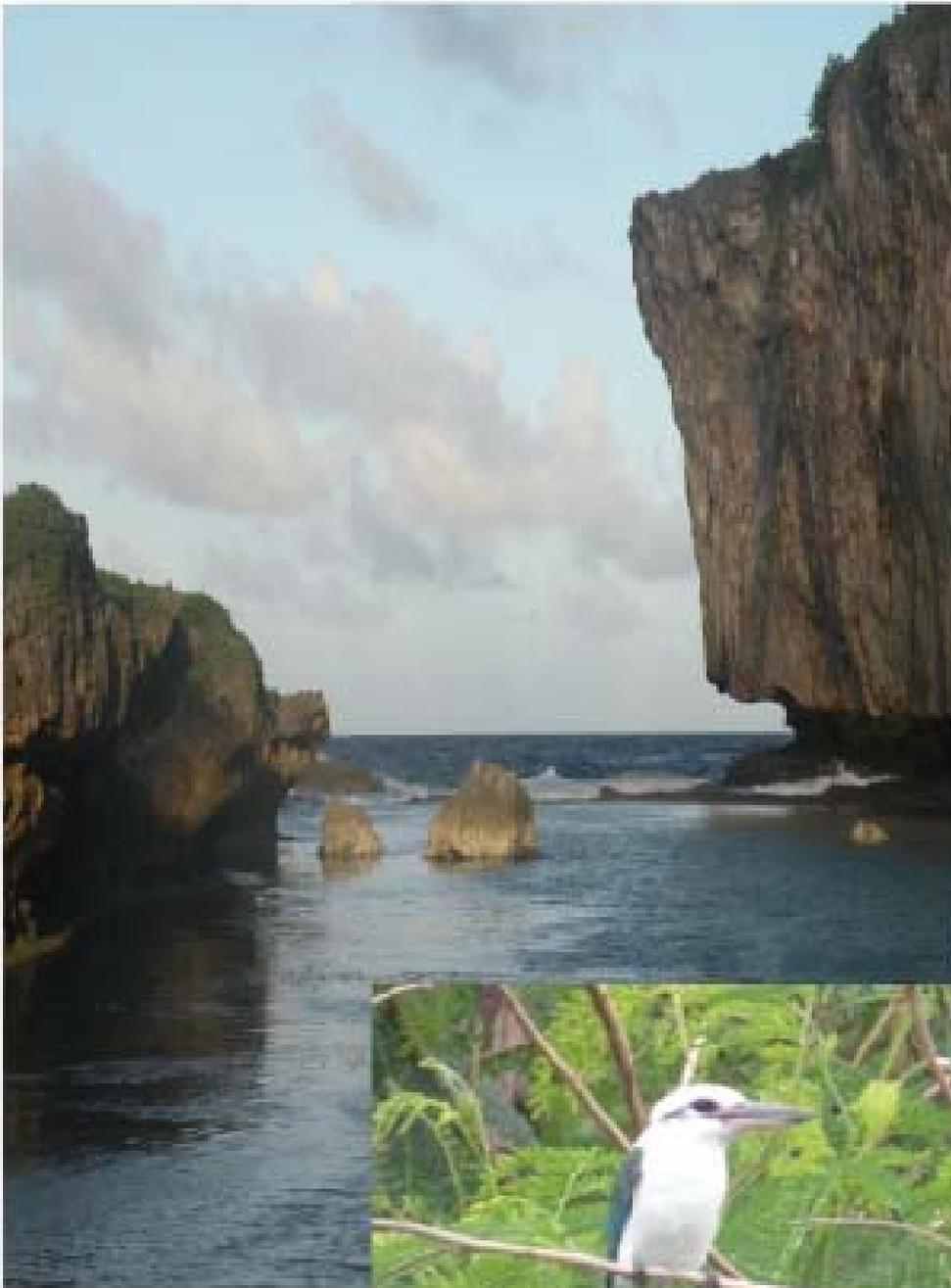
The Joint Region Marianas (JRM) Environmental Business Line Core (EV BLC) is tasked with all administrative and programmatic duties of the Commanding Officer (CO) for natural resources stewardship and management programs. The EV BLC also has responsibility for ensuring that the CO is informed of all natural resources issues and conditions, objectives of INRMP plans, and potential or actual conflicts between mission requirements and natural resource management. Other requirements for coordination, public notice, documentation, and additional programmatic duties are detailed in OPNAVINST 5090.1C.

## **2.10 Natural Resource Personnel Training**

Natural resource personnel duties extend to the monitoring of migratory birds and sea turtles on FDM and Micronesian megapodes, native forest birds, fruit bats, and turtle nesting beaches on Tinian. Biologist duties can also include the oversight of termed conservation projects occurring on the islands. Training for these responsibilities is accomplished through repeated visits as an observer overlapping with visits by experienced biologists. Trainees are accompanied by an experienced biologist to ensure consistency of methods and results between observers. Mentoring new staff with knowledgeable U.S. Navy biologists, as a means of training, is carried out for all projects occurring on Tinian and FDM.

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# Tinian



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### 3.0 TINIAN CURRENT CONDITIONS AND USE

#### 3.1 Location

Tinian is the fourth island, south to north, in the Marianas archipelago (Figure 2). It is located at approximately 15°N and 145° 38' E (Berger et al. 2005), about 5 mi (8 km) south of Saipan (Mueller-Dombois and Fosberg 1998). Tinian is roughly 12.4 mi (20 km) long and 5 mi (8 km) wide with a total land area of 39.3 mi<sup>2</sup> (101.8 km<sup>2</sup>) (Berger et al. 2005).

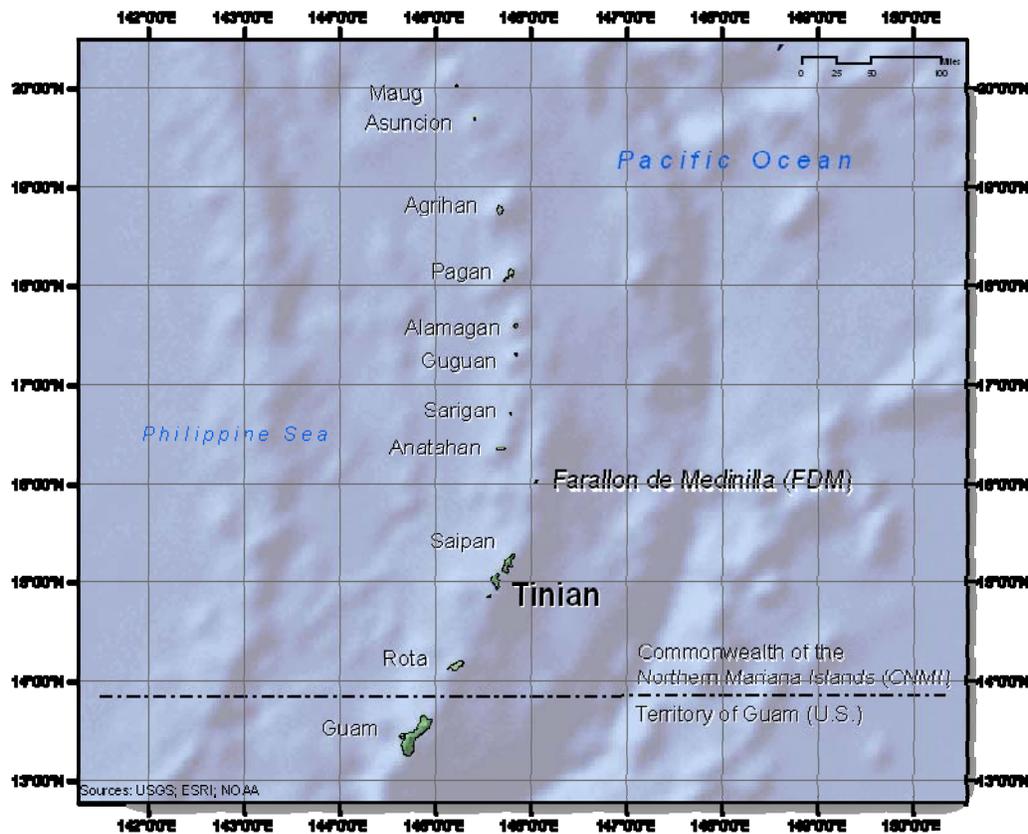


Figure 2. Map showing Tinian’s location in the Marianas archipelago

#### 3.2 Current Military Land Use Practices

The DoD leases approximately 15,347 contiguous ac (6,211 ha) of northern Tinian for field training. The Tinian Military Lease Areas (MLA) comprises areas north of the Tinian International Airport (also known as West Field) to the northern-most point of the island, Puntan Tahgong (Figure 3). The MLA is divided into the Exclusive Military Use Area (EMUA), approximately 7,577 ac (3,066 ha), located in the north, and the Lease Back Area (LBA),

approximately 7,770 ac (3,145 ha), centrally located on the island. A key characteristic of the MLA is it provides the largest maneuver area for field training in the Marianas. Primarily forested areas in the MLA serve as a realistic combat environment for jungle maneuvers and amphibious landings (Table 1). The EMUA is the primary training area, and civilian access is prohibited during exercises, except Voice of America relay station staff. The LBA is used primarily for agriculture. Boundaries between the land use areas are not secured, except around the Voice of America.

### **3.2.1 Exclusive Military Use Area (EMUA)**

The EMUA is the primary military training area on Tinian (Figure 3). The area is not secured from the public and day use access is not regulated, except when military exercises are in progress. Within the EMUA cattle ranching and resident human occupation is not permitted (A. Brooke 2009, NAVFACMAR, personal communication). Unai Chulu and Unai Dãngkolo are two sandy beaches located in the EMUA. These beaches can support Landing Air Craft Cushion (LCAC) training (Table 1). To date, Unai Chulu is the only beach that has been utilized for LCAC training. Due to storm damage to Unai Chulu, beach repairs are required prior to further training activities (U.S. Navy 2009). Unai Babui is a rocky beach that, with some improvements, could support Amphibious Assault Vehicle (AAV) landings (U.S. Navy 2009). There are no live-fire ranges in the EMUA, with the exception of small arms fire into bullet traps associated with WWII structures located in North Field (U.S. Navy 2009). Historic runways built in 1945 occupy much of North Field on which bivouac training occurs (U.S. Navy 2009). Two of four runways have been abandoned and are overgrown. One of the remaining is used for fixed wing and helicopter activities, the other for parachute drops and helicopter training activities (JGPO 2009).

### **3.2.2 Lease Back Area (LBA)**

The LBA can be used for on-the-ground instruction associated with Military Operations in an Urban Environment Training (MOUT), bivouac, vehicle and land navigation, and other field activities (Table 1). No live-fire ranges exist on the LBA. However, live and blank firing in an abandoned Japanese headquarters building associated with MOUT training occurs (Section 106 National Historic Preservation Act consultation with the CNMI Division of Historic Preservation has been completed). Expended rounds from small arms are contained in bullet traps (U.S. Navy 2009). Open flames in vegetative areas are prohibited as a part of bivouac training and are only permissible for training activities occurring on hard-top surfaces such as runways at West Field. No vegetation clearing occurs as a result of training (U.S. Navy 2009).

Within the LBA, the Federal Aviation Administration (FAA) Mitigation Area was established as a result of an agreement between the Commonwealth Ports Authority (CPA), FAA, U.S. Navy, and USFWS. It was designed to create an area of habitat protection as mitigation for past expansions of the Tinian Airport (West Field) (Figure 3). The terms of the agreement allow the U.S. military to use the FAA Mitigation Area for low impact, non habitat destructive training (JGPO 2009).



Figure 3. Tinian land use map showing the Military Lease Area (MLA) comprised of the Exclusive Military Use Area (EMU) and Lease Back Area (LBA)

Table 1. Existing and proposed training activities in the Exclusive Military Use Area (EMUA) and Lease Back Area (LBA) of Tinian. Source: U.S. Navy (2009).

	<b>Exercise</b>	<b>Location</b>
<i>Strike Warfare</i>	Combat search and rescue (CSAR)	Tinian North Field
<i>Amphibious Warfare</i>	Amphibious Assault Marine Air Ground Task Force (MAGTF)	Tinian MLA (Unai Chulu, Dångkolo, and Babui; and Tinian Harbor; North Field)
	Amphibious Raid Special Purpose (MAGTF)	Tinian MLA (Unai Chulu, Dångkolo, and Babui; and Tinian Harbor; North Field)
<i>Expeditionary Warfare</i>	Military Operations in Theatre Training (MOUT)	Tinian
<i>Special/Expeditionary Warfare</i>	Land Demolitions (IED Discovery Disposal)	Tinian MLA
	Seize Airfield	Tinian North Field
	Airfield Expeditionary	Tinian North Airfield
	Intelligence, Surveillance, Reconnaissance (ISR)	Tinian
	Field Training Exercise (FTX)	Tinian North Field
	Non-Combatant Evacuation Operation (NEO)	Tinian MLA (Unai Chulu, Dångkolo, and Babui; and Tinian harbor; North Field)
	Maneuver (Convoy; Land Navigation)	Tinian MLA
	Humanitarian Assistance/Disaster Relief Operation (HADR)	Tinian
	Force Protection	Tinian North Field
<i>Force Protection/Anti-Terrorism</i>	Force Protection	Tinian North Field

### 3.2.3 Training Operations on Tinian

DoD training is conducted in five general mission areas on Tinian; Air Warfare, Sea Warfare, Undersea Warfare, Land Warfare, and Amphibious Warfare. Training conducted in these mission areas occurs to ensure the readiness of the U.S. Navy, U.S. Marine Corps, and Air Force units; Guam Army National Guard (GUARNG), Guam Air National Guard (GUANG); Army Reserves Marianas (AR-Marianas); U.S. Coast Guard, and other commands based and deployed in the Western Pacific. Terrestrial training exercises can be categorized as one of six major training activities; Strike Warfare, Amphibious Warfare, Expeditionary Warfare, Special Warfare, Special Expeditionary Warfare, and Force Protection/Antiterrorism (U.S. Navy 2009). Table 1 provides a list of the DoD training activities that may occur on Tinian and their location. Figure 4 shows all areas where training opportunities and restrictions exist on Tinian.

Large-scale maneuvers occur periodically on Tinian. Operation Tandem Thrust, for example, tests USCOMPAC joint capability and involves U.S. Navy, Marines, Army and Air Force units. Exercises were held in 1993, 1995, 1999 and 2003. Also occurring on Tinian is the Joint Airborne/Air Transportability Training. Strategic personnel airlift and drop/recovery using fixed-wing aircraft is the primary goal of the exercise. North Field is used for MC-130 shortened field training using C-130 aircraft with night vision equipment, close quarter battle, and rapid runway repair training. Amphibious assault training occurs at designated beach landing sites (Unai Babui, Unai Chulu, and Unai Dångkolo). Over-the-beach training is conducted at Unai Chulu beach and urban environment and in-extremis hostage rescue exercises are permitted in the Japanese WW II structures (Belt Collins 1998).

DoD services are permitted to use areas outside of the MLA, including Tinian Harbor, West Tinian Airport and a staging area near San Jose for logistical support.

### 3.3 History and Pre-Military Land Use

At least three large village complexes historically existed on Tinian; Taga, Tachogna and Dångkolo, with smaller sites at Unai Chulu, Makpo, Unai Masalog and Carolinas Ridge. First European contact occurred in 1521. The Spanish took formal possession of Tinian in 1565. At this time, the native population is estimated at 7,000 people. In 1684, the entire Spanish garrison was destroyed during conflicts with the Chamorro people who rebelled against pressure to convert to Catholicism. The garrison was rebuilt in 1690. The Tinian Chamorros were defeated by the Spanish in 1695 and the survivors transported to Guam.

In 1899, the Spanish lost control of their possessions in the Marianas to Germany. In 1902, approximately 36 Chamorros and 59 Carolinians resided on Tinian. Tinian came under control of imperial Japan in 1914 and a civil administration was established in 1922. Large-scale sugar production was established on 80 to 90 percent of the island's tillable soil, which resulted in the destruction of forests and archaeological sites. During this time, the island population grew was about 14,000.

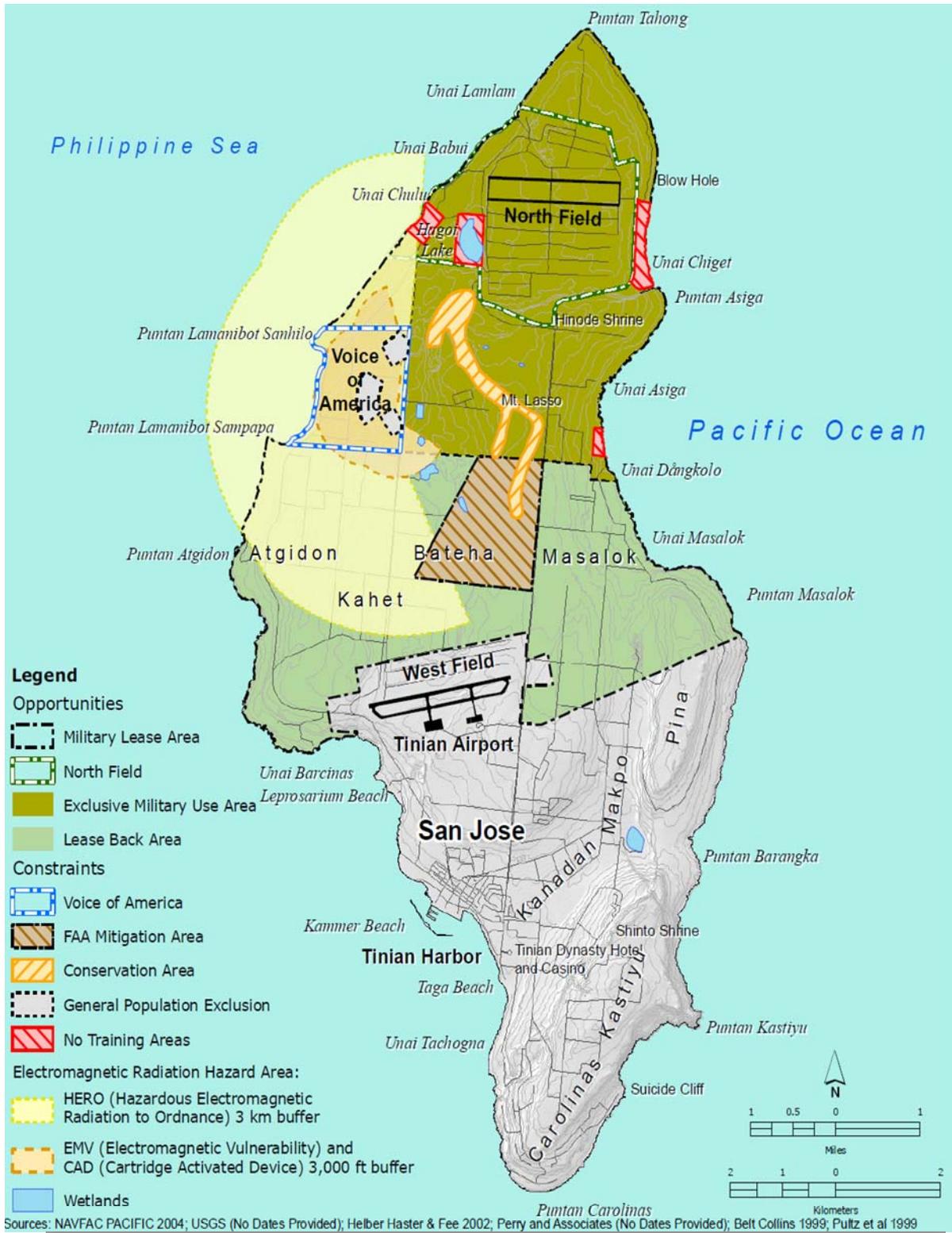


Figure 4. Military training constraints and opportunities on Tinian

In 1936, most Tinian Chamorro residents were relocated by the Japanese to Rota and Saipan. Subsequently, 1,200 Japanese convicts were brought to Tinian to build airfields and other military facilities. Systematic bombing of Tinian and Saipan by American forces began in 1944. As a result, Tinian is littered with unexploded ordnance (Figure 5). Subsequent to taking the island, the U.S. military transformed Tinian into the largest B-29 base in the Pacific, and the largest operational base in the world. North Field was expanded and West Field was developed to accommodate two 8,500-foot (2.6-km) B-29 runways. Among the purposes of the Marianas operation (code named FORAGER), was the provision of a base to initiate the B-29 bombings of Japanese home islands. These included the infamous B-29 flights of the Enola Gay and Bock's Car, which dropped atomic bombs on Hiroshima and Nagasaki, respectively. The U.S. military population on Tinian grew to 250,000 and by the end of the war, 29,000 missions had been flown from the island.



Figure 5. Unexploded ordnance (UXO) at Babui. Photo: SWCA

In 1945, a major typhoon destroyed many of Tinian's buildings. In 1962, the island reverted to civilian control and approximately 400 Chamorros returned to the island. The northern Tinian was leased to the U.S. in the 1970s for military training. In 1978, Tinian became a member of the CNMI.

### **3.4 Regional Land Uses**

Public land uses on Tinian include tourism, agriculture, commerce, recreation, and communication. The Marianas Public Land Authority (MPLA) prepared a Public Land Use Plan for the CNMI in 1989 but it was never formally adopted. Although the Coastal Resources Management Office (CRMO) has designated areas of particular concern and is responsible for regulating the use of these areas, there is currently no CNMI land use zoning regulations. Land uses overlap to some extent. For example, civilian recreational use is

permitted within the MLA. Land use constraints are dictated by lease agreements, designated natural and cultural conservation areas, and health and safety considerations.

### **3.4.1 Agriculture**

Forty-six percent of farmland soils in CNMI are located on Tinian and are concentrated in the southern Carolinas Plateau and between the Tinian International Airport and North Field. Thirty one farms, totaling 2,071 ac (838 ha), were reported in a 2007 agricultural census (USDA-NASS 2007). Nine of these exist on private land and represent only 139 ac (56 ha) of the total farmland area. Ninety three percent of farms are located on public property. Twenty two leased farms occupy 1,933 ac (782 ha). Only 70 ac (28 ha) is used as cropland, the remainder for grazing (USDA-NASS 2007). Commercial farming is small-scale, and fruit and vegetable cultivation exists only for local and Saipan consumption. Smaller ranches and individual families raise cattle and pigs for personal consumption (Figure 6).

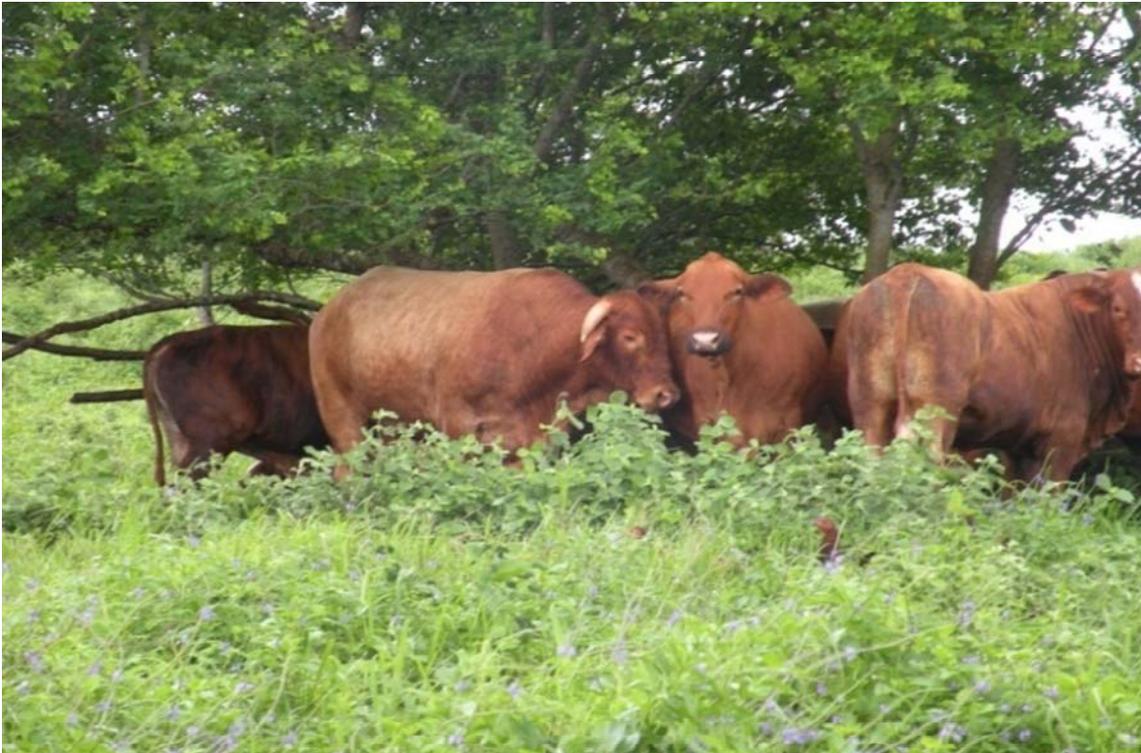


Figure 6. Cattle ranching is popular on Lease Back Area (LBA) of Tinian. Photo: SWCA

The Micronesian Development Corporation (MDC) has historically been the largest agricultural business operator in Tinian. In 1960, the company leased approximately 9,900 ac (4,000 ha) and by 1974 maintained approximately 2,000 head of cattle. The 1990s saw a transition to smaller agricultural leases. By 1995, cattle-grazing was reduced to approximately 1,000 head on land leased from MDC by Bar K Ranch who runs a slaughterhouse and cold storage facility. In 2007, there were 21 cattle farms with 669 head

of cattle, 11 pig farms (201 pigs or hogs) and two poultry farms (180 chickens) on Tinian (USDA-NASS 2007).

### 3.4.2 Tourism

The Casino Gaming Control Act of 1989 authorized five casino licenses within the municipality. To date, the only casino built and operating is the Tinian Dynasty Hotel and Casino constructed by Hong Kong Entertainment International. The Tinian Dynasty Hotel and Casino is a 409-room facility with 70,000 ft<sup>2</sup> (6503 m<sup>2</sup>) of gaming space is located in southern Tinian (Figure 4). Tourism peaked in 2000, with 93,679 annual overnight visitors, all attributed to the casino (CNMI/DCL 2001). To support this increase in tourism, a new airport runway was built, capable of accommodating wide-bodied aircraft used in direct flights from China and other Asian locations.

Other tourist activities include visiting WWII historic sites and viewing natural scenery (Figure 7). The majority of historic sites are located within the EMUA. Access to these and wildlife areas are free, unless booked through a tour or dive company.

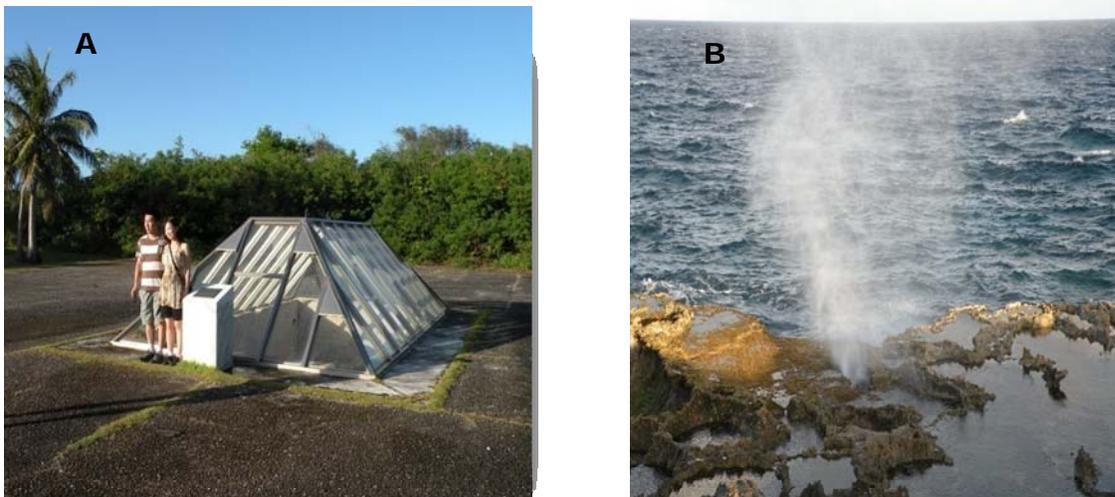


Figure 7. A) Tourists pose in front of the infamous atomic bomb pits on Tinian. B) Areas such as the blowhole located in the north-east coast of the EMUA are popular tourist spots. Photo: SWCA

### 3.4.3 Voice of America

The Voice of America, part of the International Broadcasting Bureau (IBB), operates from the Mariana Relay station on the coast of northwestern Tinian (Figure 8). The 800 ac (324 ha) site is within the EMUA and is subject to EMUA land use constraints. The station supplements broadcasts from the Philippines, Sri Lanka, and Thailand, and improves listening coverage in China, Southeast Asia, Indonesia and other areas of the western

Pacific (U.S. Information Agency 1995). Voice of America is operated under contract to Boeing (Trip 2002).



Figure 8. Voice of America is situated on the north-west coast of Tinian and is a relay station to improve listening coverage in the region. Photo: SWCA

### **3.5 General Physical Environment**

#### **3.5.1 Climate**

Tinian's climate is tropical marine with a relatively uniform mean temperature of 83° F (28° C). Average humidity is between 79 and 86 percent each month, the highest generally between July and November.

Annual rainfall averages 93.3 in (237 cm) per year. Average monthly rainfall ranges between 2.5 and 13.6 in (6.4-34.6 cm). Typically, 58 percent of rain falls between July and November and 14 percent in the dry season from January to April. Tinian is located within the northeast trade wind belt and is frequently affected by typhoons (Falanruw et al. 1989).

#### **3.5.2 Topography and Geology**

Tinian consists of a series of five elevated limestone plateaus at various elevations, separated by escarpments and steeply sloping areas. All four primary ecosystems (coastal

waters, lowlands, wetlands, and cliff-line) occur within the EMUA. Tinian’s ecosystems are defined and discussed in section 3.6.1.

### 3.5.3 Soil

The USDA Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service (SCS), has identified ten General Soil Map Units on Tinian, including two lowland soil units, two upland soil units, and six limestone plateau soil map units (Table 2 and Figure 9). General Soil Map Units are a mapping convention used to represent a general population of soils on a landscape segment. There is considerable variation within the General Soil Map Units. The percent coverage for lowland, upland and limestone plateau soils is 3, 5, and 85 percent, respectively.

Table 2. Tinian general soil map units. Source: USDA/SCS (1989).

Map Units	% Cover	Characteristics	General Distribution
Mesei Variant	<1	Moderately deep, very poorly drained, level soils; in depressional areas	85% Mesei soils, 10% Inarajan soils, minor areas of Laolao soils, Chinen soils, Shioya soils
Shioya	2	Very deep, excessively drained, level to nearly level soils; on coastal strands	85% Shioya soils, small areas of Urban land, Chinen soils, Takpochao soils
<b><i>Upland</i></b>			
Laolau-Akina	1	Moderately deep, well-drained, strongly sloping to steep soils; on volcanic uplands	Almost entirely Laolao soils
Takpochao-Chinen-Rock	4	Shallow, well-drained, strongly sloping to extremely steep soils, and Rock outcrop; on limestone escarpments and plateaus	40% Takpochao soils, 30% Chinen soils, 25% Rock outcrop, and 5% Saipan soils
Chinen-Takpochao	14	Very shallow and shallow, well drained, nearly level to strongly sloping soils; on limestone plateaus and side slopes	75% Chinen soils, 20% Takpochao soils, small areas of Saipan soils
Chinen-Urban	10	Shallow, well-drained, nearly level soils, and Urban land; on limestone plateaus	50% Chinen soils, 25% Urban land, 15% Chinen soils, 10% Dandan soils, small areas of Takpochao soils
Dandan-Chinen	51	Shallow and moderately deep, well-drained, nearly level to strongly sloping soils; on limestone plateaus	45% Dandan soils, 40% Chinen soils, small areas of Takpochao and Saipan soils
Banaderu-Rock Outcrop	2	Shallow, well-drained, nearly level to moderately steep soils, and Rock outcrop; on limestone plateaus	90% Banaderu soils, <5% Rock outcrops, small areas of Saipan soils and Takpochao soils
Kagman-Saipan	3	Deep and very deep, well-drained, nearly level to strongly sloping soils; on limestone plateaus	70% Kagman soils, 20% Saipan soils, 10% Chinen soils

Saipan-Dandan	5	Moderately deep and very deep, well-drained, nearly level to gently sloping soils; on limestone plateaus	55% Saipan soils, 30% Dandan soils, 10% Chinen soils, 5% Takpochao
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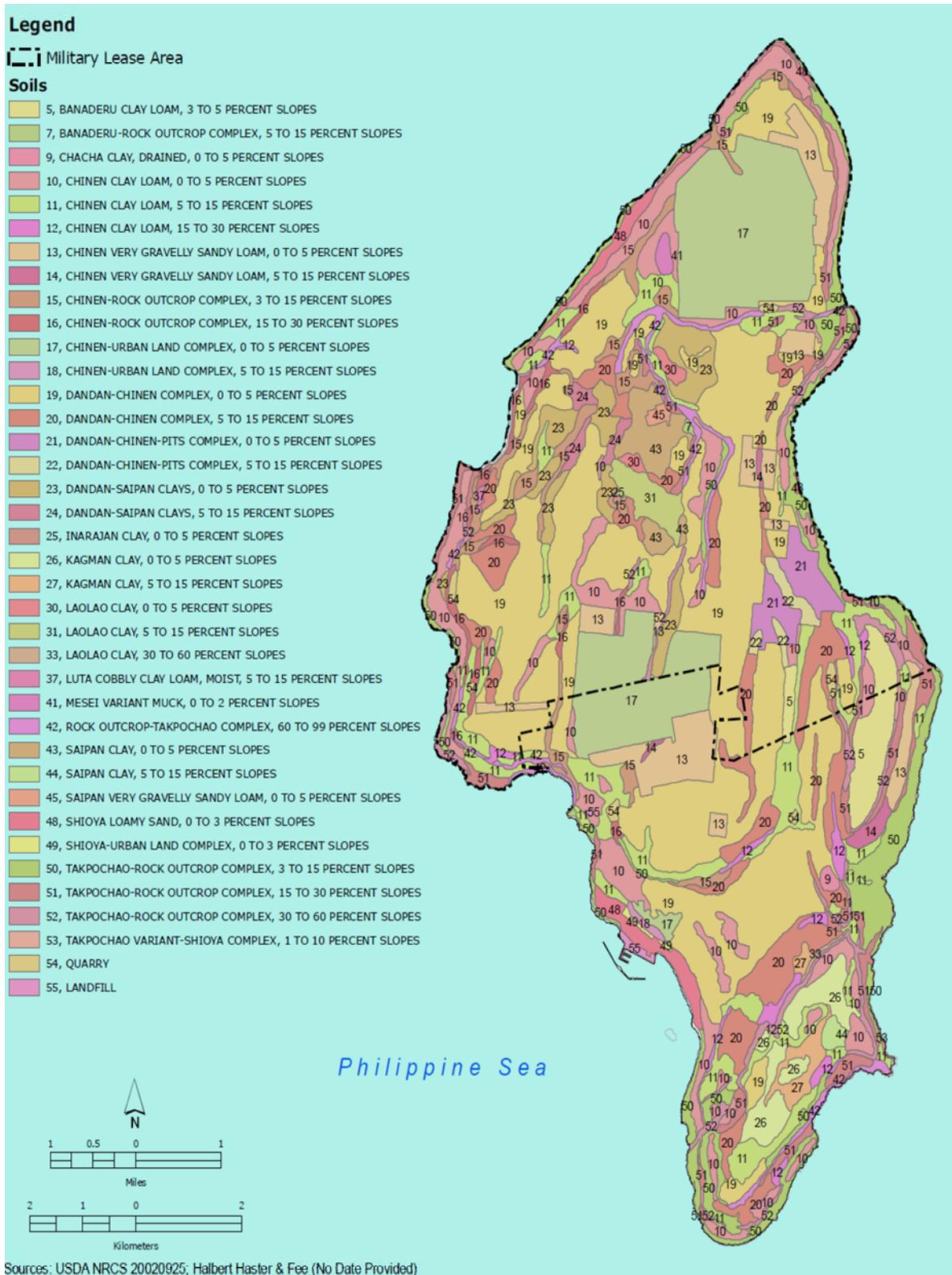


Figure 9. Soil types on Tinian

### **3.5.4 Hydrology and Ground Water Resources**

Tinian is composed of permeable limestone that overlays a relatively impermeable volcanic foundation. Surface runoff is practically non-existent due to rapid percolation through the soils. There are no springs or perennial streams. Most of Tinian's groundwater supply is located within the Takpochao Limestone and the Ghyben-Herzberg lens areas. The basal fresh water lens extends from 2 to 4 ft (0.6 to 1.2 m) mean sea level (MSL) to about 80 to 160 ft (24 to 49 m) below sea level at its deepest point (NOAA et al. 1980).

Existing resources may be capable of supplying up to 7 million gallons/day (gpd) (27 million liters/day (lpd)) of potable fresh water, which can support a population of 70,000 people at an average supply rate of 100 gpd/person (379 lpd/person). Recent assessments are more conservative and estimate 30,000 people can be supported by Tinian's water resources (Ramon Camacho 2010, NAVFACMAR, in litteris). In 1992, water usage was estimated at 650 gpd/person (2,460 lpd/person) compared to the U.S. average of 150 gpd/person (568 lpd/person). This difference in water consumption is attributed to leaking infrastructure and poor conservation practices on Tinian (USDA/SCS 1994). The majority of households utilize municipal water, although approximately 10 percent are totally dependent on rainwater catchment (USDA/SCS 1994).

Historically, groundwater resources supported over 150,000 military personnel during WWII. Peak usage during WWII is estimated at 2.3 million gpd (8.7 million lpd). To fulfill these water requirements, approximately 40 wells were drilled at an average depth of 300 ft (70 m). Following the end of the war, most wells were abandoned (USDA/SCS 1994).

### **3.5.5 Surface Water**

#### 3.5.5.1 Wetlands

Tinian wetland ecosystems existing within MLA boundaries are Mahalang (1.3 ac (0.5 ha)), Bateha (1.5 ac (0.6 ha)), and Hagoi (38.4 ac (15.5 ha)). Hagoi, Tinian's largest wetland (Figure 4 and 10) is an important habitat for the endangered Mariana common moorhen (Wil Chee-Planning Inc. and AECOS Inc. 2008).

#### 3.5.5.2 Watersheds

The USDA/SCS identified five sub-watershed areas on Tinian in a 1994 study of island resources (Figure 10). The watershed area designations were based on Steering Committee concern areas, topography and principal land use (Table 3).

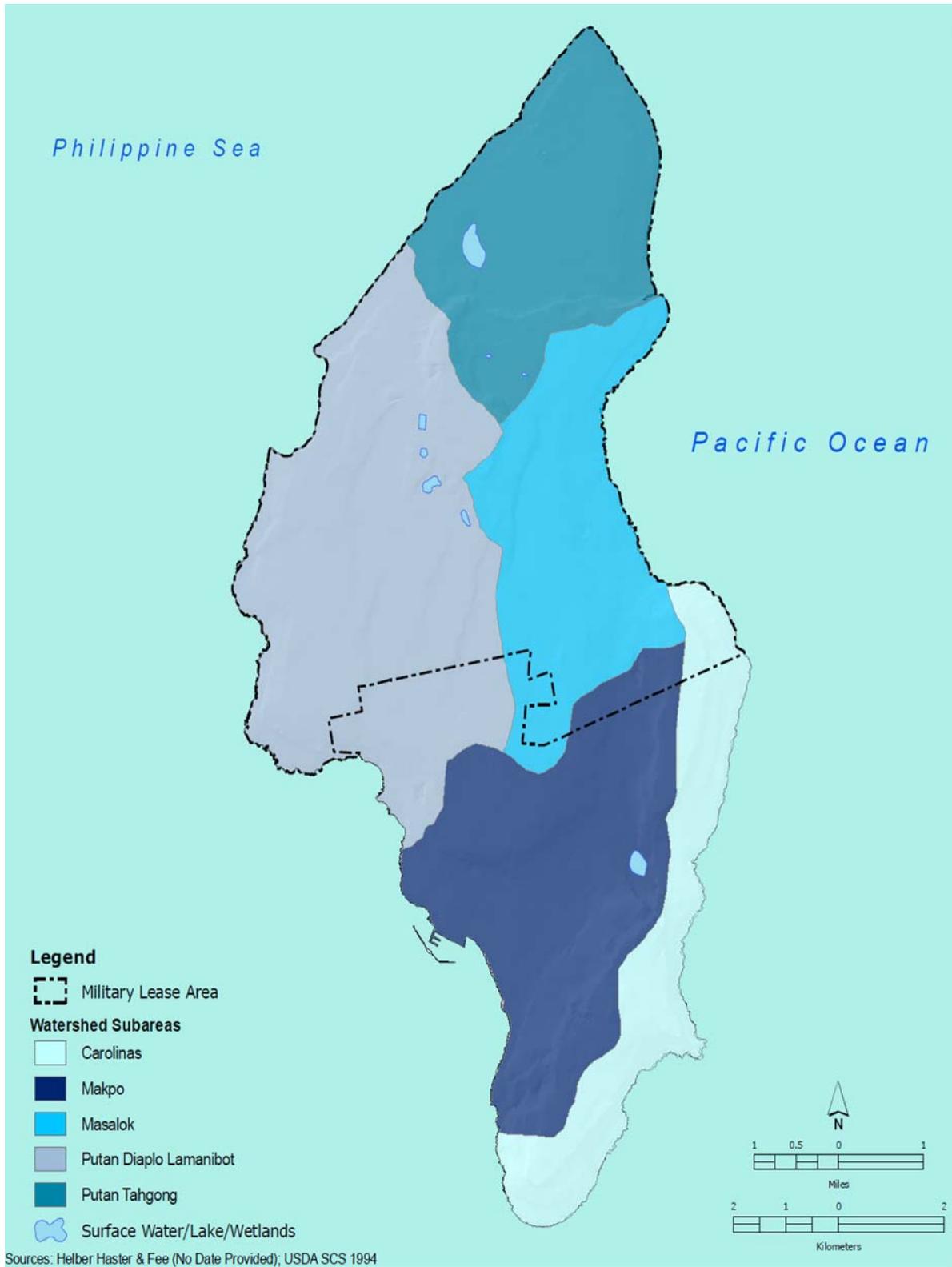


Figure 10. Location of the five sub-watershed areas on Tinian



Table 3. Location, ecosystem type and size of watersheds on Tinian. Source: USDA/SCS (1994).

<b>Watershed</b>	<b>Predominant INRMP Ecosystem</b>	<b>Acres (hectares)</b>	<b>Principal Uses</b>	<b>Attributes</b>	<b>Issues</b>
Makpo Valley	Wetland, Lowland	59,80 (2,420)	Tinian government, commerce, crop production	Supplies all potable and agricultural water, Makpo wetland	No sewer system, no grading erosion controls
Putan Diaplo-Lamanibot	Lowland	7,734 (3,130)	Agriculture, conservation	Farming and ranching, secondary forest	Open dump is potential for groundwater contamination
Carolinas	Cliff-line	2,669 (1,080)	All public land, most leased to MDC for grazing	Limestone forest	No land clearing erosion controls, no water wells
Masalok	Lowland	4,053 (1,640)	Livestock grazing, forest, MLA	Unexploited groundwater, potable water storage tank	UXO, overgrazing, no groundwater wells
Putan Tahgong	Lowland, Wetland	4,300 (1,740)	MLA	Hagoi wetland	Most disturbed watershed, groundwater highly vulnerable to surface contaminants



### **3.5.6 Infrastructure**

Tinian has approximately 68 mi (110 km) of roads that are administered by CNMI's Department of Public Works (DPW). Eighth Avenue and Broadway are the key north-south roadways. The majority of roads were graded and paved prior to and during WWII. The road system successfully supported heavy military truck traffic during the war. Current traffic is extremely light and roads have not been maintained. Consequently, they have deteriorated over time.

Two runways operate on Tinian; Runway Able at North Field and the Tinian International Airport. Runway Able is within the EMUA and Tinian International Airport is on public land. The Tinian International Airport was recently upgraded to accommodate increased air traffic. Runway Able at North Field may be used for vertical and short field landings (U.S. Navy 2009).

Tinian Harbor, located in San Jose, is the sole harbor on the island. The harbor is protected by a deteriorating sheet pile breakwater constructed during WWII, consisting of a concrete wharf and two finger piers with slips parallel to the main wharf. A small marina pier has low-draft berths along a quay with stern-to moorings. The quay is used to moor commercial barges. One stevedore company services the commercial shipping traffic for the island.

## **3.6 Biotic Environment**

### **3.6.1 Ecosystems**

Tinian consists of a series of five limestone plateaus at various elevations, separated by escarpments and steeply sloping areas. The four primary ecosystems identified on Tinian is coastal, lowland, wetland, cliff-line and marine (Figures 11 and 12).

#### 3.6.1.1 Coastal

The coastal ecosystem supports valued marine and halophytic species such as sea turtles and sea grass. Some small sand beaches are present, most in northern Tinian (Figure 13). Several coral communities are located in the near-shore waters of the MLA. The coral reef systems of Tinian are categorized as fringing, patch and barrier. Fringing reefs are found along most of Tinian's coastline in water depths of 6 in to 6 ft (0.1 - 1.8 m) depending on the tide and can be as broad as 400 ft (122 m). Patch reefs are small reef areas located in shallow and deep water and are not always found close to the coastline. Barrier reefs occur beyond the MLA coastal ecosystem in deep water and can extend for miles from the coastline.

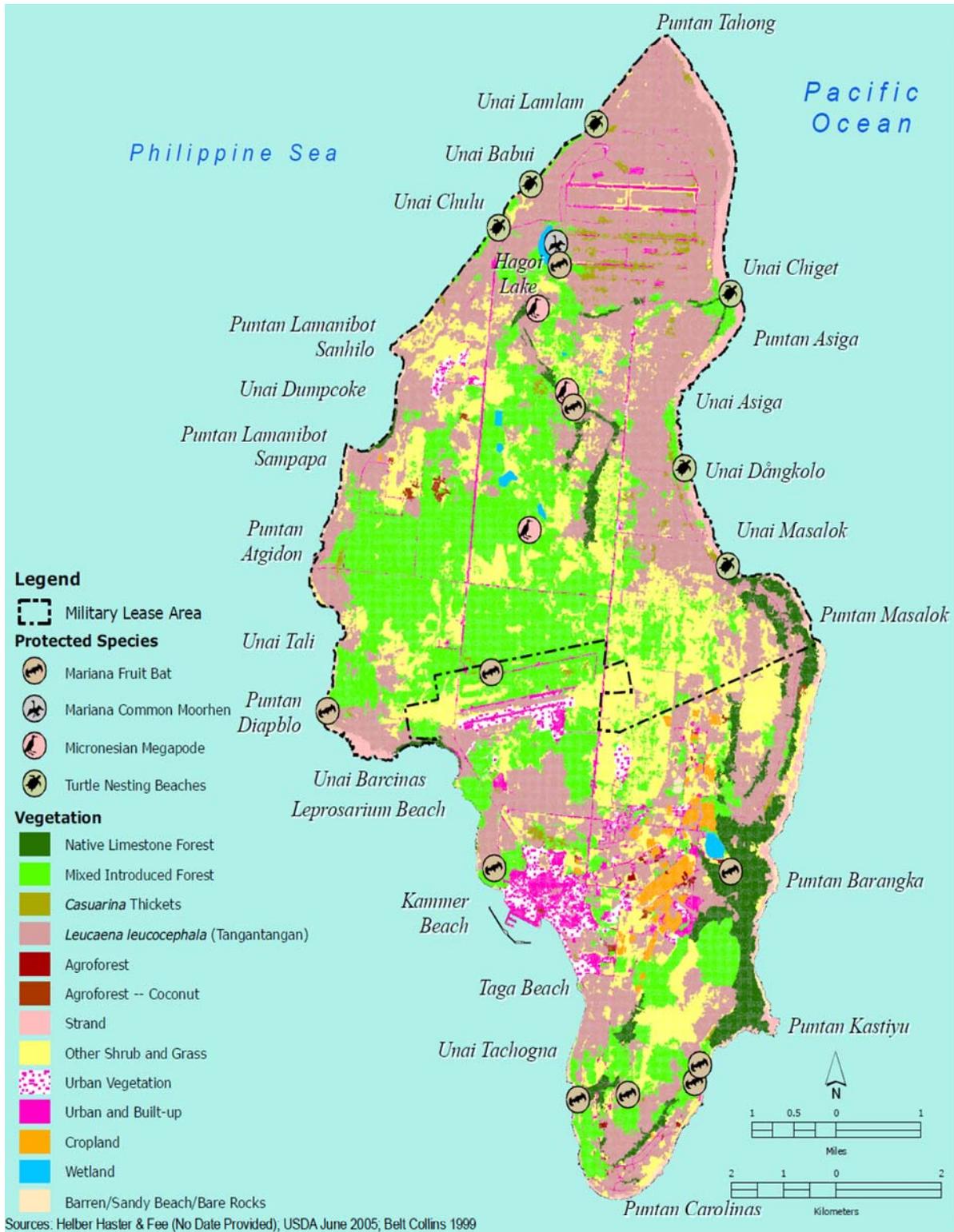


Figure 11. Tinian’s terrestrial biotic environment including vegetation and federally protected fauna

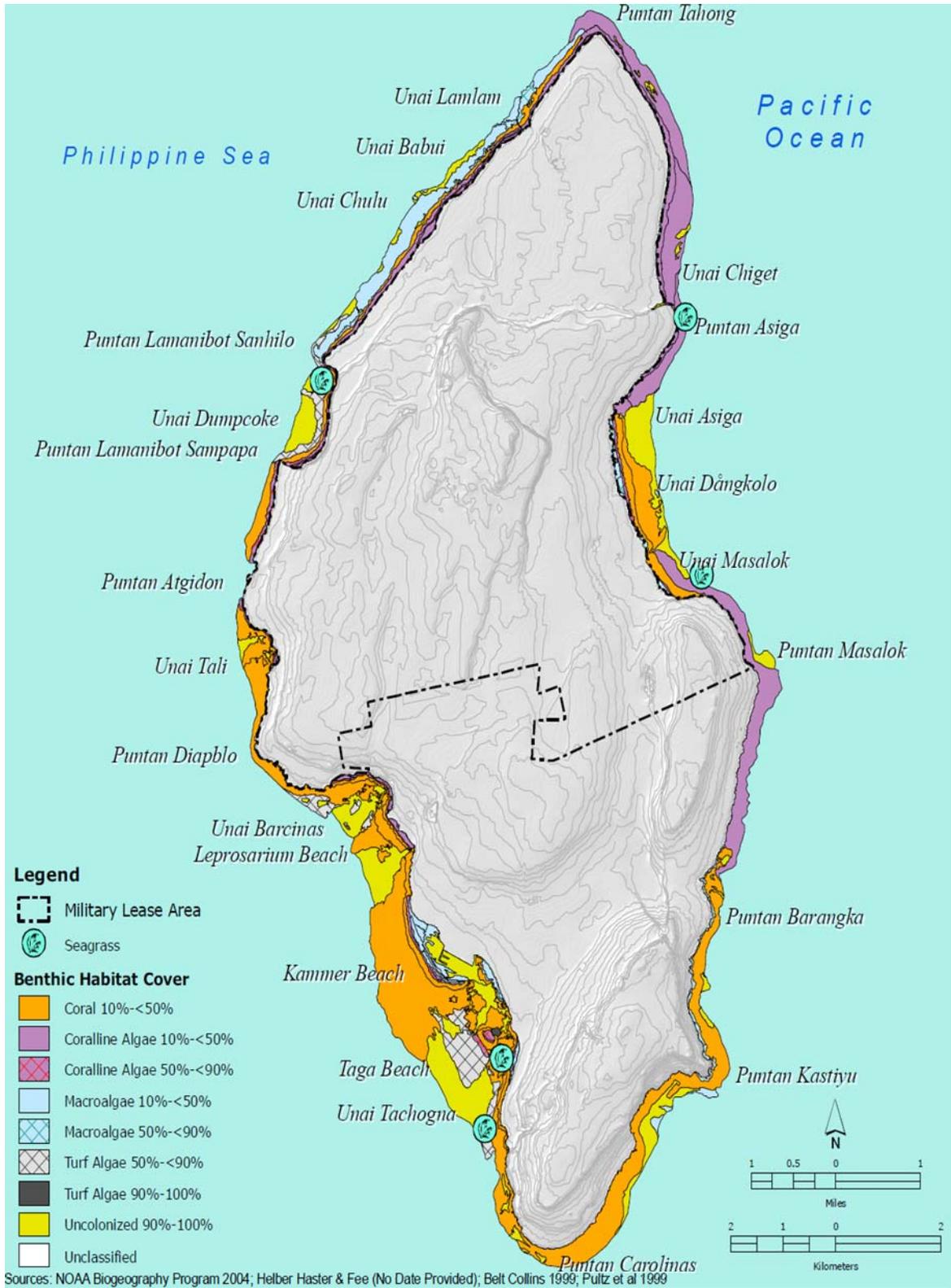


Figure 12. Tinian’s marine biotic environment



Figure 13. Unai Dångkolo is an example of a strand sandy beach on Tinian. Photo: SWCA

#### 3.6.1.2 Lowland

Lowlands, the largest ecosystem on Tinian, comprise approximately half the total land area and extend between the coastal forests and the island's interior limestone cliffs. The lowlands have been heavily disturbed by historical land uses and violent typhoon weather systems that frequent the Marianas. Lowlands are characterized by secondary forests predominantly tangantangan (*Leucaena leucocephala*), crop and grazing lands, and urban development (Figure 14).



Figure 14. Cattle grazing is common in the lowland ecosystem on Tinian. Photo: SWCA

### 3.6.1.3 Cliff-line

The cliff-line ecosystem consists of isolated areas of native limestone and mixed forest that follow ridgelines (Figure 15). Forested areas located at the top of Mt. Lasso and around the north escarpment of Maga contain native trees, such as *Pisonia grandis*, *Ficus* spp., *Cynometra ramiflora*, *Guamia mariannae*, *Pandanus tectorius*, *Cerbera dilata*, and *Ochrosia mariannensis*. These species support Mariana fruit bats and Micronesian megapodes. Cliff-line habitat is also used by the Tinian monarch. Historically, some areas of cliff-line forest (e.g., Mt. Lasso and Maga) were used for cattle grazing. However, the presence of some native species such as *Cynometra ramiflora* is not conducive to cattle grazing, resulting in limited use of the area (A. Brooke 2010, NAVFACMAR, personal communication).



Figure 15. Example of cliff-line forest in Mt. Lasso area. Photo: SWCA

### 3.6.1.4 Wetland

There are no officially delineated wetlands on Tinian; however, wetland/marsh ecosystems exist on Tinian. These wetland habitats are discrete areas of impermeable clay that impound rainwater. At least one wetland, Hagoi (Figure 11 and 16), is considered jurisdictional and qualifies for official description to Army Corps of Engineers (ACOE) standards (Wil Chee-Planning Inc. and AECOS Inc. 2008). None are designated or actively managed as protected areas.

The Hagoi wetland is a fringing marsh with a total area of about 38.4 ac (15.5 ha). Roughly 3.1 ac (1.25 ha) is open water to a depth of 3 ft (1 m) (USFWS 1996). Hagoi is dependent entirely on precipitation and thus water levels fluctuate considerably (S. Vogt 2010, NAVFACPAC, in litteris). During the dry season, the water levels at established depth gauges are insufficient to measure and open water is reduced to small areas of ponding water (USFWS 1996). In the wet season however, open water can extend up to 0.5 mi (0.8 km) (Gingerich and Yeats 2000). Although farming adjacent to Hagoi has historically occurred, the interior has not been disturbed.



Figure 16. Hagoi wetland is a fringing forested swamp that sustains a population of Mariana common moorhen. Photo: SWCA

Hagoi is classified under the Cowardin System (Cowardin et al. 1979) as follows:

<i>System:</i>	Palustrine
<i>Class:</i>	Emergent wetland
<i>Subclass:</i>	Persistent
<i>Water Regime:</i>	Intermittently exposed
<i>Water Chemistry:</i>	Mixohaline
<i>Dominant plants:</i>	Herbaceous emergents

The soil at Hagoi is Messei Variant muck, characterized as deep and poorly drained soil that undergoes frequent flooding. Messei Variant is comprised of black muck 7.9 in (20 cm) deep over gray gravelly mucky clay loam and gray gravelly sandy loam that extends for more than 39.3 in (100 cm) (Young 1988). Hagoi is situated on a limestone terrace over either an impervious layer or a perched water table. The basin is gradually filling with sediment, caused by runoff or peat deposits. Without intervention, the open water will eventually become marsh with an almost complete covering of emergent vegetation (Moore et al. 1977).

Other Tinian wetlands are ephemeral because they are rainfall dependent. Two are within the MLA; Mahalang (size = 1.3 ac (0.5 ha)) and Bateha (size = 1.5 ac (0.6 ha)). Both are assumed man-made (Wil Chee-Planning Inc. and AECOS Inc. 2008). Makpo Swamp is outside the MLA and once supported open water, but municipal groundwater pumping has significantly altered the water level (Belt Collins 1999).

Mahalang is located close to Hagoi, but at a higher elevation (Gingerich and Yeats 2000). It is comprised of a cluster of 10 ephemeral ponds, with the two largest about 1.2 ac (0.5 ha) (USFWS 1996). In 1994, all ponds were shallow, open water with some emergent vegetation. Six months after initial inspection all but one area was dry (USFWS 1996). Inspection of the Mahalang area in 2007 yielded only a sink hole that could possibly represent some of the wetlands reported by USFWS (1996). The area was previously, but no longer, inhabited by cattle and located in a field of tall elephant grass (Wil Chee-Planning Inc. and AECOS Inc. 2008).

Bateha is located within the LBA near the center of Tinian. Ten ponds have been reported in the area. Of these, only one was considered a wetland during the 1996 survey conducted by USFWS (Wil Chee-Planning Inc. and AECOS Inc. 2008). According to the USFWS (1996) survey, the open water area expanded after Typhoon Wilda in 1994, but shrank and disappeared by March 1995. A 2007 survey reported an area in the Bateha vicinity capable of accumulating water during the wet season. However, water accumulation at this site is not considered capable of lasting very long due to outflow by ground seepage (Wil Chee-Planning Inc. and AECOS Inc. 2008).

#### 3.6.1.5 Coral Reefs

In 2008, Tinian coral reefs were surveyed in a combined effort between USFWS, NOAA, UOG-ML and the CNMI government. These surveys included the reefs of Unai Babui, Unai Chulu, and Unai Dãngkolo, the three major beaches located within the EMUA (Minton et al. 2009).

Unai Babui is situated on the west coast of Tinian (Figure 12), characterized by high cliffs and little reef. The beach of Unai Babui is a small “pocket” beach with a narrow reef flat, 164 ft (<50 m) wide, that forms highly rugose spur and groove formations. Spur and groove formation is a coral classification for an assemblage that normally supports high coral density, species richness, and coral size (Figure 17a). The depth of the reef flat ranges from 0 to 6.6 ft (0-2 m). The reef community was separated out by reef flat and reef subsiding on slope due to differences in species richness and composition. Twenty-eight coral genera were identified. Mean coral density was estimated at  $0.014 \pm 0.014$  colonies/ft<sup>2</sup> ( $0.15 \pm 0.15$  colonies/m<sup>2</sup>) for the reef flat and  $2.61 \pm 0.52$  colonies/ft<sup>2</sup> ( $28.13 \pm 5.59$  colonies/m<sup>2</sup>) for the reef slope. Only one species was identified on the reef flat, the hump coral (*Porites lutea*). The slope was dominated by the genera of knob coral (*Favia* spp.) and brain coral (*Goniastrea* spp.).

The most predominate genera of algae were green alga (*Caulerpa cupressoides* and *Baculogypsina sphaerulata*), brown alga (*Turbinaria ornate*), red coralline alga (*Lithophyllum pygmaeum*), and turf algae. The cone snail (*Conus flavidus*) dominates on the reef flat, while echinoderms (e.g., starfish, sea urchins, sea cucumbers), polychaetes (bristle worms), and mollusks (e.g., snails, clams, octopus) were most common on the slope. However, only one crown of thorns star fish (*Acanthaster planci*) was seen off of Babui during the survey. The most prevalent fish on the reef were damselfish (Pomacentridae), chubs (Kyphosidae), and silversides (Atherinidae). A few large surgeonfish (Acanthuridae) were seen. However, no sharks or rays were observed.

Unai Chulu is also located on Tinian's west coast (Figure 17b) and is structurally similar to Unai Babui with the exception that it possesses a shallow reef crest and a deep channel cut. Twenty-four coral genera were identified. Mean coral densities were  $0.33 \pm 0.11$  colonies/ft<sup>2</sup> ( $3.55 \pm 1.14$  colonies/m<sup>2</sup>) on the reef flat and  $3.77 \pm 0.95$  colonies/ft<sup>2</sup> ( $40.58 \pm 10.21$  colonies/m<sup>2</sup>) on the reef slope. *Porites lutea* and *Goniastrea retiformis* dominated the reef flat and *Acropora verweyi* and *Leptastrea purpurea* were most common on the slope. The most common algae species were the red crustose coralline alga (*Hydrolithon onkodes*) and the green alga (*Halimeda gracilis*). The echinoderms *Holothuria atra*, *Echinometra mathaei*, and *Echinostrephus aciculatus*, along with tube worms were the prevailing invertebrates. Only one crown-of-thorns star fish (*Acanthaster planci*) was recorded for Chulu during the survey. Damselfish (Pomacentridae), wrasses (Labridae), and silversides (Atherinidae) were the most frequently identified fish families. Common large fish were surgeonfish (Acanthuridae) and parrotfish (Scaridae). A white tipped reef shark (*Triaenodon obesus*) was also observed.

Unai Dångkolo, also known as Long Beach, is Tinian's largest beach. Unai Dångkolo is located on the northeastern coast (Figure 18) and is characterized by a wide fringing reef flat and a shallow shelf, extending about 1.2 mi (2 km) offshore. It is comprised of mixed sand and other hard substrates. Reef depth varies between 0-6.6 ft (0-2 m). Twenty-five genera of coral were identified. Mean coral densities were  $0.43 \pm 0.17$  colonies/ft<sup>2</sup> ( $4.65 \pm 1.87$  colonies/m<sup>2</sup>) for the reef flat and  $2.81 \pm 0.28$  colonies/ft<sup>2</sup> ( $30.24 \pm 2.98$  colonies/m<sup>2</sup>) on the reef slope. Dominate coral species found were *Favia matthai* (complex) and *Goniastrea retiformis*. Algae species were dominated by coralline algae (*Pneophyllum conicum* and *Hydrolithon onkodes*), *Baculogypsina sphaerulata*, and turf algae. *Echinothrix diadema* and *Holothuria atra* were the dominant invertebrate species. Sponges (Porifera) and Bryozoa were rare or absent in the community. Damselfish (Pomacentridae), wrasses (Labridae), silversides (Atherinidae), and parrotfish (Scaridae) were the most abundant fish. No sharks or rays were observed.

All surveyed reefs were subjected to heavy fishing pressure, demonstrated by low fish densities, biomass, and individual size. Popular fishery species and those of commercial value were rare or absent from all study sites. Conclusions on the abundance and diversity of invertebrates were less clear due to the nocturnal and secretive nature of many species that could influence detection (Minton et al. 2009).

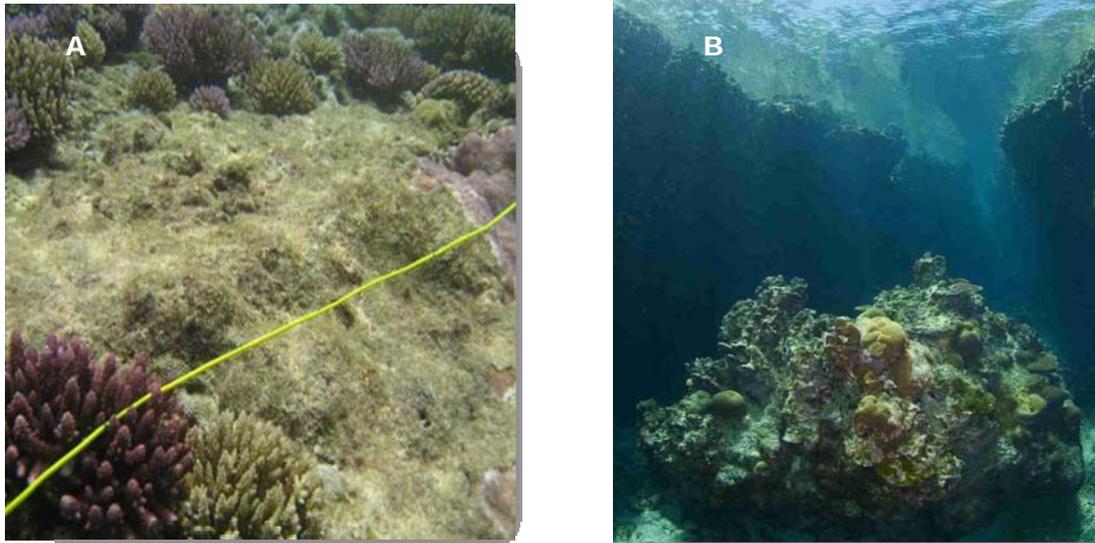


Figure 17. A) Coral near the reef crest at Unai Babui. Photo: S. Kolinski, NOAA. Source: Minton et al. (2009). B) Coral at Unai Chulu. Photo: T. Schils, University of Guam. Source: (Minton et al. 2009)



Figure 18. Unai Dangkolo fringing reef. Photo: R. Wescom, NAVFACMAR

### 3.6.2 Fauna

Tinian's native terrestrial fauna includes forest birds, waterbirds, seabirds, one fruit bat, eight reptiles, two land crustaceans, and one tree snail (Table 4). Additional fauna, such as insects and arachnids are not included.

Table 4. Native terrestrial fauna known from Tinian. Sources: Reichel and Glass (1991), Vogt and Williams (2004), Brooke (2008b), Rodda et al. (2008), Smith et al. (2008), Vogt (2008a,b).

	<b>Common name</b>	<b>Genus</b>	<b>Species</b>	<b>Local Name</b>
<i>Birds</i>	Rufous fantail	<i>Rhipidura</i>	<i>rufifrons</i>	Na'abak
	Micronesian starling	<i>Aplonis</i>	<i>opaca</i>	Sali
	Tinian monarch	<i>Monarcha</i>	<i>takatsukasae</i>	Chichirikan Tinian
	Micronesian honeyeater	<i>Myzomela</i>	<i>rubratra</i>	Egigi
	Bridled white-eye	<i>Zosterops</i>	<i>conspicillatus</i>	Nosa
	Mariana fruit-dove	<i>Ptilinopus</i>	<i>roseicapilla</i>	Tottot
	White-throated ground-dove	<i>Gallicolumba</i>	<i>xanthonura</i>	Paluman apaka
	Collared kingfisher	<i>Todiramphus</i>	<i>chloris</i>	Sihek
	Micronesian megapode	<i>Megapodius</i>	<i>laperouse laperouse</i>	Sasangat
	Mariana common moorhen	<i>Gallinula</i>	<i>chloropus guami</i>	Pulatatt
	Brown booby	<i>Sula</i>	<i>leucogaster</i>	Lu'ao
	Black noddy	<i>Anous</i>	<i>minutus</i>	Fahang dikiki
	Brown noddy	<i>Anous</i>	<i>stolidus</i>	Fahang
	Pacific reef-heron	<i>Egretta</i>	<i>sacra</i>	Chuchuko atilong
	White tern	<i>Gygis</i>	<i>alba</i>	Chunge'
	Yellow bittern	<i>Ixobrychus</i>	<i>sinensis</i>	Kakkak
	<i>Mammal</i>	Mariana fruit bat	<i>Pteropus</i>	<i>mariannus mariannus</i>
<i>Reptiles</i>	Micronesian gecko	<i>Perochirus</i>	<i>ateles</i>	Guali'ek
	Oceanic snake-eyed skink	<i>Cryptoblepharus</i>	<i>poecilopleurus</i>	Guali'ek halom tano'
	Littoral skink	<i>Emoia</i>	<i>atrocostata</i>	Guali'ek halom tano'
	Mariana skink	<i>Emoia</i>	<i>slevini</i>	Halom tano
	Mutilating gecko	<i>Gehyra</i>	<i>mutilata</i>	Guali'ek
	Mourning gecko	<i>Lepidodactylus</i>	<i>lugubris</i>	Guali'ek
	Pacific blue-tailed skink	<i>Emoia</i>	<i>caeruleocauda</i>	Guali'ek halom tano'
Brahminy blindsnake	<i>Ramphotyphlops</i>	<i>braminus</i>		
<i>Crustaceans</i>	Coconut crab	<i>Birgus</i>	<i>latro</i>	Ayuyu
	Hermit crab	<i>Coenobita</i>	<i>spp.</i>	Umang
<i>Snail</i>	Mariana Islands tree snail	<i>Partula</i>	<i>gibba</i>	Akaleha

### 3.6.3 Threatened and Endangered Species

#### 3.6.3.1 Birds

Tinian has two federally endangered bird species; Mariana common moorhen and Micronesian megapode. The Mariana swiftlet, also federally endangered, has been documented on Tinian, but has not been recorded since 1976 and is presumed extirpated from the island. Furthermore, the federally endangered Mariana mallard (*Anas oustaleti*) was known from Tinian but is now considered extinct and was removed from the Federal List of Endangered and Threatened Wildlife and Plants in 2004 (USFWS 2004a). A full listing of Tinian avifauna identified during a 1985 study can be found in Appendix 5.

##### *Mariana Common Moorhen (Gallinula chloropus guami), Pulatatt*

The Mariana common moorhen (Figure 19) was federally listed as endangered in 1984 (USFWS 1984). The species relies on wetland habitat for breeding, foraging, and shelter. It is a dark to sooty gray waterbird, about 13 in (33 cm) long, with a red bill with a yellow tip, red frontal shield, and yellow legs (Baker 1951, Pratt et al. 1987). The *guami* subspecies is limited to the Mariana archipelago and is presently found on Guam, Saipan, Rota, and Tinian. Though presently extirpated, data indicate that historical populations also occurred on Pagan (USFWS 1991b). In 2001, the combined archipelago adult population was estimated at 287 of which 41 (14 percent) birds were present at Hagoi Wetland on Tinian (Takano and Haig 2004). Monthly counts of moorhen at Hagoi Wetland between 2002 and 2007 resulted in annual means of between 10 and 17 birds, the highest being 23 recorded in October 2006 (Vogt 2009c). Moorhen numbers have declined as a result of habitat loss (vegetation encroachment), historical poaching, and predation by rats and monitor lizards (Takano and Haig 2004). Critical habitat has not been designated for this species. The recovery plan for the moorhen outlines criteria necessary for down listing which includes a stable resident population on Tinian of 75 adult birds for five consecutive years (USFWS 1991b).



Figure 19. Common moorhen. Photo: S. Vogt, NAVFACPAC

*Micronesian Megapode (Megapodius laperouse laperouse), Sasangat*

The Micronesian megapode (Figure 20), federally listed as endangered in 1970 (USFWS 1970), is rarely observed on Tinian. Megapodes have been recorded in upland cliff-line forest in areas least disturbed by storms and anthropogenic forces. The species was first collected on Tinian in 1820 (Baker 1951). During World War II and throughout the 1970s and early 1980s, most ornithological surveys and inventories failed to locate megapodes on the island (Gleize 1945, Downs 1946, Marshall 1949, Pratt et al. 1979, Engbring et al. 1986). However, there were unverified reports of two megapodes in 1974 (Owen 1974) and a single sighting in the limestone forest north of Maga in 1985 (Wiles et al. 1987). In 1995, three separate individuals were observed in the Maga, Bateha, and Mt. Lasso regions (O'Daniel and Krueger 1999). One megapode was heard at Mt. Lasso in February 2000 (Cruz et al. 2000b). The Maga region was a common area for megapode detections in 2001, 2004, and 2005 (Wittelman 2001, Vogt 2008a). The 2001 detections ( $n = 7$ ) were believed to represent two individual birds (Wittelman 2001). Megapodes were not detected during surveys on Tinian in 2006, 2007, and 2008 (Vogt 2008a, Camp et al. 2009a). However, one megapode was heard by an employee of Tinian's DLNR near the Seabees Monument in 2009 (P. Radley 2010, CNMI-DFW, in litteris).

Whether megapode on Tinian are resident, introduced, or transient (dispersal could occur from nearby Saipan (3.5 mi, 5.6 km away) or Aguiguan (5.5 mi, 8.9 km away)) is unclear. O'Daniel and Krueger (1999) hypothesized that megapodes transit after the breeding season on Saipan or Aguiguan. Saipan megapode estimate was 40 in 1982 (Engbring et al. 1986). However, island-wide survey detections in 1996 ( $n = 1$ ) and 2007 ( $n = 0$ ) were so low that it was not possible to determine the number of birds present (Camp et al. 2009b). Eleven megapodes were estimated on Aguiguan (Engbring et al. 1986), but like Saipan, detections from surveys in 2000 ( $n = 12$ ), 2006 ( $n = 2$ ), and 2008 ( $n = 15$ ) were too low to estimate (Cruz et al. 2000a, Vogt 2008a, Camp et al. 2009a). Critical habitat has not been designated for this species.



Figure 20. Micronesian megapode. Photo: N. Johnson

*Mariana Swiftlet (Aerodramus bartschi), Yayaguak*

The Mariana swiftlet (Figure 21) was federally listed as endangered in 1984 (USFWS 1984) and is presently found only on Saipan, Aguiguan, and Guam (Cruz et al. 2008). Despite more than 88 caves on the island (Stafford 2003), there are no swiftlet breeding records on Tinian (Reichel and Glass 1988). Prehistoric evidence of swiftlets was discovered at one rockshelter and one cave on the island in 1994 (Steadman 1999). Swiftlets are considered itinerant on Tinian, most likely moving from Saipan or Aguiguan (USFWS 1991a). Observations of swiftlets on Tinian were first reported in 1945 by Marshall (1949) and Gleize (1945). Swiftlets were noted in “fair numbers” on the island in 1976 (Pratt et al. 1979). These are believed to be the last swiftlet sightings on Tinian; they are considered extirpated from the island (Reichel and Glass 1991).



Figure 21. Mariana swiftlet. Photo: C. Kessler, USFWS

3.6.3.2 Mammals

*Mariana Fruit Bat (Pteropus mariannus mariannus), Fanihi*

The Mariana fruit bat (Figure 22) is a medium-sized colonial flying fox. It was federally listed as endangered on Guam by USFWS in 1984 (USFWS 1984). However, in 2005, the USFWS determined that movement of fruit bats between all islands in the Mariana archipelago occurs, resulting in exchange of genetic material. Consequently, Mariana fruit bats on Guam and throughout the CNMI comprise one subspecies and are now listed as federally threatened throughout their entire range (USFWS 2005c). In the Mariana Islands, the Mariana fruit bat is known to occur on all islands extending northward from Guam to Maug (Wiles et al. 1989b, Johnson 2001, Vogt 2009b).



Figure 22. Mariana fruit bat. Photo: N. Johnson

No permanent Mariana fruit bat colony is currently known on Tinian. Although rare, sightings have been reported on the island. Sightings of two and as many as four fruit bats in the Kastiyu forest occurred in 1979 and 1983-1984, respectively (Wheeler 1980, Wiles et al. 1989b). In 1994, a single bat was observed flying at the southern end of the island and in 1995 another fruit bat was noted near San Jose Village (Krueger and O'Daniel 1999). Fruit bats were not observed during surveys in 2000, 2001, and 2008 (Cruz et al. 2000b, Johnson 2001, Brooke 2008b). The highest number of recent sightings from Tinian was in 2005; approximately five individuals were detected in cliff-line forest in the Maga region (Brooke 2008b). Observations may be fruit bats moving from nearby Saipan or Aguiguan (Brooke 2008b). Aguiguan has a small colony of fruit bats, with an estimated 40 to 60 individuals in 2002 and 2008 respectively (Esselstyn et al. 2003, Brooke 2008b). Sightings of fruit bats on Saipan are rare, but do occur (Johnson 2001).

Over-harvesting is a major threat to fruit bats in the Marianas. When bat abundance severely declined due to hunting 1960s and 1970s, bats were legally imported to Guam. Between 1975 and 1981, 1,366 harvested bats from brought to Guam from Tinian for human consumption (Wiles 1992). The Government of Guam passed its own Endangered Species Act in 1982 (Guam Endangered Species Act, 5 GCA 63208, PL – 15-36), banning the importation of Mariana fruit bats from other islands in the archipelago. This, coupled with the inclusion Mariana fruit bats in the Convention of International Trade in Endangered Species (CITES) in 1989, ceased all legal exportation of the species (Wiles 1992). Hunting restrictions and education on Tinian have increased public awareness; however the Mariana fruit bat is considered a delicacy and still hunted.

### 3.6.3.3 Reptiles

Two species of sea turtle recorded in Tinian’s waters are federally listed by the USFWS and the NMFS: the green sea turtle (threatened) and hawksbill turtle (endangered). Enforcement of the ESA for sea turtles is shared between the USFWS and the NMFS. USFWS’s jurisdiction applies when listed sea turtles temporarily utilize beaches for nesting purposes and NMFS retains jurisdiction when listed sea turtles are present in the marine environment. There are no terrestrial reptiles federally listed as threatened or endangered on Tinian.

#### *Hawksbill Turtle (Eretmochelys imbricata), Haggan karai*

Hawksbill turtles are known to occur in the waters surrounding Tinian. No sightings were recorded during a 13-month survey in 1994-1995 or in 2001 (Pultz et al. 1999, Kolinski et al. 2004). One hawksbill was observed during in-water surveys near Saipan in 2005 (Berger et al. 2005). Hawksbill turtles are rare around the southern islands of the CNMI (Kolinski et al. 2004, Berger et al. 2005).

#### *Green Sea Turtle (Chelonia mydas), Haggan*

The green sea turtle (Figure 23) has been observed in Tinian’s near-shore environments. The total number of turtles inhabiting this region in 2001 was estimated at 800 individuals (Kolinski et al. 2004). Favored feeding habitats for sea turtles are seagrass beds.

Twenty-four green sea turtle nests were documented at six beaches on Tinian in 1995: Leprosarium, Barcinas, Chulu, Lamlam, Dångkolo, and Masalok (Pultz et al. 1999). Four additional beaches supported green sea turtle nesting prior to 1995 (Babui, Chiget, Tachogna, and Kammer) (Pultz et al. 1999). Six of the 10 known nesting beaches (Chulu, Lamlam Dångkolo, Babui, Chiget, and Masalok) are located within the MLA (Figure 11).

In 2009, 16 nests were found on six beaches; eight at Unai Dångkolo. No evidence of nest predation or human disturbance was noted (Wenninger 2010b). A permitted excavation of a nest located in Unai Chulu showed 10 percent egg infertility (Wenninger 2010b). No new turtle activity was seen in 2009 between July and December. In September 2009, all the beaches were swept clean by a typhoon (Wenninger 2010b).



Figure 23. Green sea turtle. Photo: SWCA

### 3.6.4 Species of Interest

#### 3.6.4.1 Forest Birds

##### *Tinian Monarch (Monarcha takatsukasae), Chichirikan Tinian*

The Tinian monarch (Figure 24) is a species of interest as its range is limited to the island of Tinian. This species was listed as federally endangered by the USFWS in 1970 (USFWS 1970), and subsequently down listed to threatened in 1987 (USFWS 1987). The Tinian monarch was removed from the Federal List of Endangered and Threatened Wildlife and Plants in 2004 (USFWS 2004b). The CNMI government identifies the monarch as threatened and endangered and includes it on their local list (DLNR 2000).



Figure 24. Tinian monarch. Photo: S. Vogt, NAVFACPAC

The 1970 federal endangered listing was believed to be based primarily on an estimate of 40-50 monarchs in 1945 (Gleize 1945). However, it is unclear whether Gleize's estimate was the entire population or the number of monarchs he observed. Most likely it was the latter as the Tinian monarch was considered abundant between December 1944 and December 1945 (Marshall 1949). Subsequent visits and surveys on Tinian also recorded the monarch to be ubiquitous (Owen 1974, Pratt et al. 1979, Cruz et al. 2000b). Comprehensive island-wide surveys conducted in 1982 and 1996 resulted in population estimates of  $39,338 \pm 2,131$  SE and  $55,721 \pm 3,846$  SE individuals, respectively (Engbring et al. 1986, Lusk et al. 2000a).

Surveys conducted in 2008 estimated the population at approximately 38,449 monarchs, a decline from 1996 (Camp et al. 2009a). USFWS (2005a) mentioned that limestone forest, tangantangan thicket, and secondary forest are quality habitats for the Tinian monarch. During the 2008 survey, monarch densities declined considerably from densities reported by USFWS in all quality habitats; 79 percent in limestone forest, 27 percent in tangantangan thicket and 24 percent in secondary forest (Camp et al. 2009a). Threats to the population of this single island endemic include habitat degradation, encroachment, accidental introduction of the brown treesnake, and stochastic processes (Lusk et al. 2000a, Berger et al. 2005, Camp et al. 2009a).

3.6.4.2 Migratory Birds

Tinian serves as an important stopover location for migratory bird, including a number of shorebirds, waterfowl, waterbirds, and seabirds. These birds use Tinian to rest and forage during their respective non-breeding seasons. Of the 64 migratory bird species known in the CNMI, 28 have been identified from Tinian (Table 5). For shorebirds such as common sandpipers, Pacific golden-plovers, ruddy turnstones, and whimbrels, exposed coral reef and open field habitats are likely common observation locations on Tinian. Waterfowl, such as Eurasian wigeons and tufted ducks, and waterbirds, such as black-crowned night-herons and Swinhoe’s snipe are typically associated with standing water sources (e.g., Lake Hagoi). Seabirds (e.g., gray-backed terns, sooty terns, white-winged terns) likely use Hagoi Wetland as well as Tinian’s near-shore waters. In 2008, a black-winged stilt was seen at Hagoi by NAVFAC biologists (A. Brooke 2010, NAVFACMAR, personal communication).

Table 5. Migratory birds recorded on Tinian. Sources: Reichel and Glass (1991), Wiles (2005), National Audubon Society (2009).

Common Name	Genus	Species
Barn swallow	<i>Hirundo</i>	<i>rustica</i>
Black kite	<i>Milvus</i>	<i>migrans</i>
Black-bellied plover	<i>Pluvialis</i>	<i>squatarola</i>
Black-crowned night-heron	<i>Nycticorax</i>	<i>nycticorax</i>
Black-winged stilt	<i>Himantopus</i>	<i>himantopus</i>
Cattle egret	<i>Bubulcus</i>	<i>ibis</i>
Common sandpiper	<i>Actitis</i>	<i>hypoleucos</i>
Eurasian coot	<i>Fulica</i>	<i>atra</i>
Eurasian wigeon	<i>Anas</i>	<i>penelope</i>
Gadwall	<i>Anas</i>	<i>strepera</i>
Garganey	<i>Anas</i>	<i>querquedula</i>
Gray-backed tern	<i>Sterna</i>	<i>lunata</i>
Gray-tailed tattler	<i>Heteroscelus</i>	<i>brevipes</i>
Green-winged teal	<i>Anas</i>	<i>crecca</i>
Intermediate egret	<i>Egretta</i>	<i>intermedia</i>
Lesser sand-plover	<i>Charadrius</i>	<i>mongolus</i>
Marsh sandpiper	<i>Tringa</i>	<i>stagnatilis</i>
Northern pintail	<i>Anas</i>	<i>acuta</i>
Northern shoveler	<i>Anas</i>	<i>clypeata</i>
Pacific golden-plover	<i>Pluvialis</i>	<i>fulva</i>
Pectoral sandpiper	<i>Calidris</i>	<i>milanotos</i>
Ruddy turnstone	<i>Arenaria</i>	<i>interpres</i>
Sooty tern	<i>Sterna</i>	<i>fuscata</i>
Swinhoe’s snipe	<i>Gallinago</i>	<i>megala</i>
Tufted duck	<i>Aythya</i>	<i>fuligula</i>
Wandering tattler	<i>Heteroscelus</i>	<i>incanus</i>
Whimbrel	<i>Numenius</i>	<i>phaeopus</i>
White-winged tern	<i>Chlidonias</i>	<i>leucopterus</i>
Wood sandpiper	<i>Tringa</i>	<i>glareola</i>

### 3.6.4.3 Reptiles

#### Micronesian Gecko (*Perochirus ateles*), Guali'ek

The Micronesian gecko (Figure 25) is listed as threatened and endangered by the CNMI government and is the only terrestrial reptile protected in the CNMI (DLNR 2000). However, it is not federally protected under ESA. This gecko has never been abundant on Tinian. Two specimens have been collected from Mt. Lasso, one in 1946 by H. Townes (Wiles et al. 1989a), the other from one of two plots located in limestone forest in 2008 (Rodda et al. 2008). One specimen was collected in southern Tinian in August 2003 (Rodda et al. 2008). An individual was observed but not captured in close proximity to Mt. Lasso in February 2007 (Rodda et al. 2008).



Figure 25. Micronesian gecko. Photo: S. Vogt, NAVFACPAC

### 3.6.4.4 Invertebrates

#### *Coconut Crab (Birgus latro), Ayuyu*

The coconut crab (Figure 26) is the largest land invertebrate in the world and occurs on every island in the Mariana archipelago (Berger et al. 2005). This crab can attain large sizes with a leg span of approximately 3 ft (90 cm) and weight over 10 lbs (5 kg) (Vogt and Williams 2004). Due to its large size and edible flesh, the coconut crab is a valued food item for indigenous people of the Marianas (Vogt 2008b). The crab is an omnivorous scavenger, consuming invertebrates, carrion, fruit, and decaying vegetation (Berger et al. 2005). The coconut crab is not listed as threatened or endangered by the USFWS or CNMI government. It is considered a CNMI game species and may be legally hunted during the official hunting season (15 September and 15 November). Individual hunters are permitted a bag limit of five and a season limit of 10 crabs, with all crabs less than three inches across the back and all females carrying eggs prohibited (DLNR 2000).

A study in 2007 indicated that coconut crabs on U.S. Navy leased lands are extremely over-harvested, with just over six percent of captured crabs at legal size ( $\geq 3$  in carapace width) (Vogt 2008b). The average thoracic length and weight for 79 crabs on Tinian (males and females combined) was only 1.1 in (29 mm) and 7.4 oz (209 g), respectively. Comparable measurements from a non-harvested population on Diego Garcia in 2003-2004 were 1.8 in (46 mm) and 29.8 oz (844 g). In the same study, population densities on Tinian were found

to be quite low compared to the non-harvested population on Diego Garcia. On Tinian, coconut crab densities were 2 crabs/ac (4.9 crabs/ha) in native forest and 0.7 crabs/ac (1.8 crabs/ha) in tangantangan forest. The coconut crab density estimate for the Diego Garcia was 94 crabs/ac (233 crabs/ha), about 47 times greater than Tinian.



Figure 26. Coconut crab. Photo: SWCA

*Mariana Islands Tree Snail (Partula gibba), Denden*

The Mariana Islands tree snail (0.55 – 0.71 in, 14 – 18 mm long; 0.39 – 0.55 in, 10 – 14 mm wide) is listed as critically endangered by IUCN (Mollusc Specialist Group 1996) and is a federal candidate for listing under the Endangered Species Act (USFWS 2005b). It is not listed as threatened and endangered by the CNMI government.

This tree snail (Figure 27) is endemic to the Mariana Islands and the most widely distributed tree snail in the archipelago. It is known from nine islands; Guam, Rota, Aguiguan, Tinian, Saipan, Anatahan, Sarigan, Alamagan, and Pagan (Kondo 1970, Smith et al. 2008). Abundance on the island is currently unknown. Tinian surveys for partulid snails were conducted with the support of USFWS in 2008. Results from this investigation are currently unavailable (A. Brooke 2010, NAVFACMAR, personal communication). However, Mariana Islands tree snail shells were collected on the ground in 2008 along two permanent transects established for forest bird surveys located in the vicinity of the Mt. Lasso within the EMUA (A. Brooke 2010, NAVFACMAR, personal communication). Due to the abundance and presence of the predatory Manokwar flatworm (*Platydemus manokwari*), agricultural clearing by Japanese and post WWII cattle pastures that included limestone forested cliff-line areas, there is concern regarding the partulid's ability to persist on Tinian (Smith 1995). The predatory flatworm, known to feed on juvenile partulid tree snails in the wild on Guam and Pacific tree snails (*P. radiolata*) in captivity, is believed to be the main threat to the continued existence of tree snails in the region (Hopper and Smith 1992). Hopper and Smith (1992) reported that on Guam where flatworm abundance was high, partulid tree snail populations were rapidly declining. Other potential predators of Mariana Islands tree snail are the giant African snail (*Achatina fulica*), the wolf snail (*Euglandina rosea*), rats and

shrews. The giant African snail was recently observed around the Dynasty Hotel and wolf snail shells have been observed on Tinian (A. Brooke 2010, NAVFACMAR, personal communication).



Figure 27. Mariana Islands tree snail. Photo: B. Smith, University of Guam

#### 3.6.4.5 Fishes

During transect surveys in 2008, the most abundant fish families recorded in the coral reef communities (Figure 28) adjacent to Unai Babui, Unai Chulu, and Unai Dångkolo (all in the EMUA) were damselfish (Pomacentridae), chubs (Kyphosidae), silversides (Atherinidae), wrasses (Labridae), and parrotfish (Scaridae) (Minton et al. 2009).

Commercial and recreational fishing occurs within and beyond the Tinian MLA coastal ecosystem boundary. The fish typically caught in near-shore waters are surgeonfish (Acanthuridae), wrasses (Labridae), snappers (Lutjanidae), and groupers (Epinephelinae). Pelagic take includes mahimahi (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri*), and tuna (Scrombridae).



Figure 28. Tinian reef community. Photo: J. Starmer, CNMI CRMO. Source: Minton et al. (2009)

**3.6.5 Introduced Species**

Introduced terrestrial species that can negatively impact Tinian’s native wildlife and vegetation include at least four birds, seven mammals, seven reptiles, and one amphibian (Table 6). Additional introduced fauna, such as insects and arachnids are not addressed.

Table 6. Introduced fauna species present on Tinian. Sources: Wiles (1990), Reichel and Glass (1991), Rodda et al. (2008), Vogt (2008a), Camp et al. (2009a), Wiewel et al. (2009).

	<b>Common Name</b>	<b>Genus</b>	<b>Species</b>	<b>Local Name</b>
<i>Birds</i>	Rock pigeon	<i>Columba</i>	<i>livia</i>	
	Red junglefowl	<i>Gallus</i>	<i>gallus</i>	
	Eurasian tree sparrow	<i>Passer</i>	<i>montanus</i>	Gaga pale
	Island collared-dove	<i>Streptopelia</i>	<i>bitorquata</i>	Paluman senesa
<i>Mammals</i>	Feral cat	<i>Felis</i>	<i>catus</i>	
	Feral dog	<i>Canis</i>	<i>familiaris</i>	
	Feral goat	<i>Capra</i>	<i>hircus</i>	
	Philippine deer	<i>Cervus</i>	<i>mariannus</i>	
	Cattle	<i>Bos</i>	<i>taurus</i>	
	Pacific rat	<i>Rattus</i>	<i>exulans</i>	
	Norway rat	<i>Rattus</i>	<i>norvegicus</i>	
	Malayan black rat	<i>Rattus</i>	<i>diardii</i>	
	House shrew	<i>Suncus</i>	<i>murinus</i>	Cha'ka
	House mouse	<i>Mus</i>	<i>musculus</i>	
<i>Reptiles</i>	Green anole	<i>Anolis</i>	<i>carolinensis</i>	Guali'ek

	Curious skink	<i>Carlia</i>	<i>ailanpalai</i>	Guali'ek halom tano'
	Mutilating gecko	<i>Gehyra</i>	<i>mutilata</i>	Guali'ek
	Oceanic gecko	<i>Gehyra</i>	<i>oceanica</i>	Achiak
	Indo-Pacific house	<i>Hemidactylus</i>	<i>frenatus</i>	Guali'ek
	Emerald skink	<i>Lamprolepis</i>	<i>smaragdina</i>	
	Mangrove monitor	<i>Varanus</i>	<i>indicus</i>	Hilitai
<i>Amphibian</i>	Marine toad	<i>Rhinella</i>	<i>marina</i>	Kairo'

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### 3.6.5.1 Birds

Four introduced birds occur on Tinian (rock pigeon, red junglefowl, Eurasian tree sparrow, and the island collared-dove; Table 6). Marshall (1949) reported one rock pigeon in natural forest in April 1945. In 1982, all rock pigeons observed were either caged or in close proximity to human habitation; there was no evidence of a feral population (Engbring et al. 1986). Rock pigeons can now be found in the LBA and appear to have taken on feral status (P. Wenninger 2010, NAVFACMAR, in litteris). Pigeons can also be found at the Dynasty Hotel where they are released in association with ceremonies for tourists (A. Brooke 2010, NAVFACMAR, personal communication). Red junglefowl were observed in 1944-1945 (Marshall 1949), and an estimated 120 individuals inhabited the island in 1982 (Engbring et al. 1986). These are believed to be associated with domestic flocks. Today junglefowl are found throughout the island and no longer exclusively associated with humans (P. Wenninger 2010, NAVFACMAR, in litteris). The Eurasian tree sparrow was first documented on Tinian in 1974, observed in San Jose village (Owen 1974). In 1982, Engbring (1986) estimated about 276 sparrows on Tinian, most in the vicinity of San Jose village. The island collared-dove was introduced to the southern Mariana Islands by the Spanish from the Philippines in the 1700s (Baker 1951). Island collared-doves are considered common to abundant on Tinian since World War II (Gleize 1945, Downs 1946, Marshall 1949, Baker 1951, Owen 1974, Pratt et al. 1979). In 1982, 929 individuals were estimated on Tinian (Engbring et al. 1986). Surveys in 2008 indicated that the number was increasing, with an estimated 2,198 individuals on the island (Camp et al. 2009a).

### 3.6.5.2 Mammals

Introduced mammals on Tinian include feral cats, goats, Philippine deer, cattle, rats, house mice, and house shrews (Table 6). Feral cats are extremely common on Tinian and have been observed hunting in native forest at night (Vogt 2008a). Approximately 500 feral goats inhabited the southeastern coast in the early 1900's before the population was either killed or captured for sale on Saipan (Wiles 1990). Apart from some domesticated goats on farms, it is unclear whether a feral herd still exists on the island. Philippine deer were introduced from Saipan and Rota to Tinian in the 1960s, and their numbers increased to approximately 100-200 individuals by 1974 (Owen 1974). The deer population on Tinian, after intense hunting and predation by dogs were extirpated from the island by the early 1980s (Wiles 1990). However deer were recently intentionally re-introduced by local government into Tinian's conservation area (A. Brooke 2010, NAVFACMAR, personal communication). Domestic cattle were relatively common on Tinian in 1982, estimated at 6,000 to 7,000

(Lusk et al. 2000a). Numbers declined to 4,000 in 1993, then 2,000 in 1996, following drought (Lusk et al. 2000a). Trampling, browsing, and heavy grazing by cattle on Tinian likely have most likely reduced the abundance of native plants, increased the dispersal of introduced plants, and enhanced soil compaction and erosion throughout the island (Wiles 1990).

Rodents, particularly rats, have been implicated in 40 to 60 percent of recorded bird and reptile extinctions world-wide (Wanless et al. 2007). Rodents are predators of nesting birds, land invertebrates, and plants, as well as a reservoir of disease and disperser of invasive plant seeds (Amori and Clout 2003). They also contribute to the decline of native vegetation by consuming native seeds or seedlings (DeMattia et al. 2004). There are at least three breeding species in the CNMI; Pacific rat (*Rattus exulans*), Norway rat (*R. norvegicus*), and Asian house rat (*R. tanezumi*) (Wiles 2005).

On Tinian, the Pacific rat is rare and the Norway rat uncommon (Stinson 1994). The Pacific rat was apparently introduced by the Chamorro people and has been present in the Mariana Islands for at least 3,500 years (Wiles 1990). The Norway rat is a relatively recent arrival to the Mariana Islands. Specimens of this rat were collected on Saipan after World War II and the first record from Guam in 1962 (Eldredge 1988).

Although the black rat (*Rattus rattus*) is broadly reported throughout Micronesia, practically all populations have been subsequently identified as the Asian house rat (Marshall 1962, Flannery 1995 cited in Wiles 2005). However, during a 2005-2007 small mammal study in the southern Mariana Islands, genetic material collected from *Rattus* specimens believed to be either black rat or Asian house rat (two morphologically similar species) indicated all were related to the *Rattus rattus diardii* (Malayan black rat) group (Wiewel et al. 2009). Regardless of taxonomic identity, this rat species is known from Tinian, where mean densities in 2005-2007 were 29.6 animals/ac (73 animals/ha) (Wiewel et al. 2009).

The house shrew is common on Tinian (Stinson 1994). It was first observed on Saipan in 1962 and Rota in 1966 (Barbehenn 1974), and likely arrived in Tinian around the same time (Wiles 1990). Wiewel et al. (2009) reported the mean density of house shrews on Tinian between 2005 and 2007 was 15.6 animals/ac (38.5 animals/ha).

The origin of the house mouse in the Mariana archipelago is unclear. House mice are uncommon on Tinian (Stinson 1994). Mean densities of mice on the island in 2005-2007 found were 1 animal/ac (2.6 animals/ha) (Wiewel et al. 2009).

### 3.6.5.3 Reptiles

Introduced reptiles on Tinian include the green anole, curious skink, mutilating gecko, oceanic gecko, Indo-Pacific house gecko, emerald skink, and monitor lizard (Table 6). The monitor is classified as non-native as a result of a 1995 paleontological study on the islands of Rota, Aguiguan, and Tinian that found the monitor lizard at only two sites in strata of historic age (Pregill 1998). However, this non-native status was questionable in a recent study of Guam that placed the monitor into prehistoric strata (Pregill and Steadman 2009).

In 2008, a study that assessed the status of introduced and native reptiles was carried out in three habitat types (tangantangan forest, mixed forest, and limestone forest) (Rodda et al. 2008). Green anole distribution was patchy, yet still expanding. Anoles were numerous along 8<sup>th</sup> Avenue near the Voice of America facility and along the road leading to Mt. Lasso's summit. Total removal plots found mean densities of curious skinks at 324/ac (800/ha) in tangantangan forest, 223/ac (550/ha) in mixed forest and 25.5/ac (63/ha) in limestone forest. In the same habitats, mean densities of mutilating geckos were estimated to be 81/ac (200/ha), 324/ac (800/ha), and 328/ac (813/ha), respectively. Oceanic geckos and emerald skinks were observed in all three habitat types. Monitor lizards were detected in the limestone forest. Monitor lizards are also known from Lake Hagoi, where they are suspected predators of Mariana common moorhen eggs (Vogt 2009c).

There have been five credible sightings of the brown treesnake since 1982. None of these sightings resulted in the capture of the snake (Campbell 2004). However, evidence does not support an established brown treesnake population on Tinian.

#### 3.6.5.4 Amphibians

The marine toad is the only known introduced amphibian on Tinian (Table 6) and is believed to have been introduced in 1944 when approximately 4,000 individuals were observed in lily ponds and cisterns (Stohler and Cooling 1945 cited in Eldredge 1988). By 1974, the toad was common throughout the island (Owen 1974). In 2008, the marine toad was observed crossing roads throughout Tinian, and recorded in total removal plots located in mixed and limestone forest habitats (Rodda et al. 2008). This toad is a prolific breeder, laying up to 70,000 eggs per year. Marine toads have substantially impacted ecosystems via direct and indirect mechanisms (Crossland 2000) and are possibly a threat to the native herpetofauna on Tinian. This toad possesses large parotid glands that excrete poison and kill potential predators (Crossland 2000).

#### **3.6.6 Flora**

Early reports of plant species on Tinian dating from the 1700s describe the island as predominately limestone forest supporting trees locally referred to as *Pisonia grandis*, *Cerbera dilatata*, and *Guamia mariannae*. Tinian's native vegetation composition has been largely impacted by continued agricultural and military use of the island, which began in the early 1800s. In the 1920s, large sections of land were cleared by the Japanese to support sugar cane production. These fields were abandoned in the 1940s during World War II (Mueller-Dombois and Fosberg 1998). During that time, military activities relating to the war effort became primarily responsible for continued vegetation loss. Native limestone forests that once dominated the vegetation structure of the island have been reduced to 5 percent of the total vegetation cover (Wescom 2005). Despite severe historical habitat alterations, there are currently no federally or CNMI threatened or endangered plants on Tinian and no critical habitat has been designated. Remnant pockets of native forest do still

persist on Tinian and are of value for their ability to support species that are threatened, endangered, or of concern. Although not comprehensive, Table 7 depicts some common native trees and shrubs present on Tinian. A full listing of vascular plants found on Tinian during a 1985 study can be found in Appendix 6.

### **3.6.7 Threatened and Endangered Species**

There are currently no federally listed plant species on Tinian.

Table 7. Common native trees and shrubs on Tinian. Sources: Cruz et al. (2000b), Vogt and Williams (2004), Raulerson (2006).

Family	Genus	Species	Common name	Local name	Description
Annonaceae	<i>Guamia</i>	<i>mariannae</i>		Paipai	Small tree
Araliaceae	<i>Polyscias</i>	<i>grandifolia</i>		Pepega	Small tree
Apocyanaceae	<i>Cerbera</i>	<i>dilatata</i>		Chiute	Medium tree
	<i>Neisosperma</i>	<i>oppositifolia</i>		Fagot	Medium tree
	<i>Ochrosia</i>	<i>mariannensis</i>	Lipstick tree	Langiti	Medium tree
Boraginaceae	<i>Cordia</i>	<i>subcordata</i>		Niyoron	Small to medium tree
	<i>Tournefortia</i>	<i>argentea</i>	Velvet leaf	Hunik	Medium tree
Caesalpiaceae	<i>Cynometra</i>	<i>ramiflora</i>		Gulos	Medium tree
	<i>Intsia</i>	<i>bijuga</i>		Ifit	Medium to large tree
Casuarinaceae	<i>Casuarina</i>	<i>equisetifolia</i>	Ironwood	Gagu	Large tree
Celastraceae	<i>Maytenus</i>	<i>thompsonii</i>		Lulujut	Small tree
Combretaceae	<i>Terminalia</i>	<i>catappa</i>	Pacific tropical almond	Talisai	Large tree
Euphorbiaceae	<i>Drypetes</i>	<i>dolichocarpa</i>		Mwelel	Small tree
	<i>Melanolepis</i>	<i>multiglandulosa</i>		Alum	Medium tree
Fabaceae	<i>Erythrina</i>	<i>variegata</i>	Tiger claw	Gaogao	Large tree
Goodeniaceae	<i>Scaevola</i>	<i>taccada</i>	Half-flower	Nanaso	Shrub
Hernandiaceae	<i>Hernandia</i>	<i>sonora</i>	Lantern tree	Nonak	Large tree
Lecythidaceae	<i>Barringtonia</i>	<i>asiatica</i>	Fishkill	Puting	Large tree
Malvaceae	<i>Hibiscus</i>	<i>tiliaceus</i>	Beach hibiscus	Pago	Medium tree
	<i>Thespesia</i>	<i>populnea</i>	Rosewood	Banalo	Medium tree
Meliaceae	<i>Aglaia</i>	<i>mariannensis</i>		Mapunyao	Medium to large tree
Moraceae	<i>Artocarpus</i>	<i>mariannensis</i>	Seeded breadfruit	Dukduk	Large tree
	<i>Ficus</i>	<i>prolixa</i>	Strangler fig	Nunu	Large tree
	<i>Ficus</i>	<i>tinctoria</i>	Dyer's fig	Hodda	Large tree
Myrtaceae	<i>Eugenia</i>	<i>palumbis</i>		Agatelang	Small tree or shrub
Nyctaginaceae	<i>Pisonia</i>	<i>grandis</i>		Umumu	Large tree
Pandanaeae	<i>Pandanus</i>	<i>dubius</i>		Pahong	Medium tree
	<i>Pandanus</i>	<i>tectorius</i>	Screw pine	Kafu	Medium tree
Rubiaceae	<i>Aidia</i>	<i>cochinchinensis</i>		Sumak	Medium tree
	<i>Bikkia</i>	<i>tetrandra</i>	Torchwood	Gausali	Shrub
	<i>Guettarda</i>	<i>speciosa</i>	Zebrawood	Panao	Medium tree
	<i>Morinda</i>	<i>citrifolia</i>	Indian mulberry	Lada	Medium tree
	<i>Psychotria</i>	<i>mariana</i>		Aploghating	Medium tree
Urticaceae	<i>Dendrocnide</i>	<i>latifolia</i>	Chew		Medium tree
	<i>Pipturus</i>	<i>argenteus</i>	Silvery pipturus	Amahadyan	Small to medium tree
Verbenaceae	<i>Premna</i>	<i>obtusifolia</i>	False elder	Ahgao	Medium tree



### 3.6.8 Other Botanical Species of Interest

The cycad (*Cycas micronesica*; Figure 29) is listed as endangered by IUCN (Marler et al. 2006). Cycads from Guam were planted on Tinian in 2009 as part of a safe harbor project to create a viable population in the absence of the invasive and destructive cycad scale (*Aulacaspis yasumatsui*).



Figure 29. The cycad (*Cycas micronesica*) is listed as endangered by IUCN. Photo: SWCA

### 3.6.9 Vegetation Communities on Tinian

#### 3.6.9.1 Limestone Forest

Limestone forest fall into three types: mixed forest, coastal forest, and halophytic-xerophytic shrub. Mixed forest is classified as a cliff-line ecosystem. These forests occur on the peak of Mt. Lasso and the areas surrounding the north escarpment of Maga (Figure 30). The coastal and halophytic-xerophytic forests occur in near-shore ecosystems.

Limestone forests occurring in cliff-line ecosystems are referred to as “typhoon forests” due to adaptations in the vegetation promoting forest regeneration in the presence of typhoon damage. Some plant species will reproduce by generating new shoots from fallen branches and by flowering in exposed areas cleared by wind damage. Vegetation that occurs in typhoon forests includes *Pisonia grandis*, *Cynometra ramiflora*, *Ficus* spp., and *Guamia mariannae*.



Figure 30. Native limestone forest on Tinian. Photo: SWCA

Coastal limestone forest occurs on slopes above the ocean. Plants found in this vegetative community include *Cerbera dilatata*, *Ochrosia mariannensis*, *Guamia mariannae*, and *Pandanus tectorius*. Coastal limestone forests can be found at Unai Masalok. Halophytic-xerophytic scrub vegetation occurs in near ocean habitat on limestone rocks. The dominant plant species in a halophytic-xerophytic scrub habitat is *Pemphis acidula* (Hawaiian Agronomics Inc. 1985).

Limestone forest is valued for supporting foraging and roosting activities carried out by Mariana fruit bats, as well as native forest birds including Micronesian megapodes and Tinian monarchs.

#### 3.6.9.2 Secondary Growth Forest

Secondary growth forests (Figure 31) contain a mixture of native and introduced trees, shrubs, and dense understory plants. These forests comprise parts of the lowland ecosystem. Dominant trees include *Leucaena leucocephala*, *Acacia confusa*, *Pithecellobium dulce*, and *Casuarina equisetifolia*. Dense stands of *Bambusa vulgaris* can also be found in secondary forests.



Figure 31. Secondary growth forest on Tinian. Photo: SWCA

#### 3.6.9.3 Tangantangan Forest

Tangantangan (*Leucaena leucocephala*) forest (Figure 32) dominates mainly the level to moderately sloping areas at the north end of the island (Figure 11), and serves as foraging and roosting habitat for some native bird species. Tangantangan is also included in secondary growth forest and is a part of the lowland ecosystem. However, on Tinian there

are extensive homogeneous stands of this species. Often the stands are interspersed with *Panicum maximum*, which grows to 6 ft (1.9 m) tall (Hawaiian Agronomics Inc. 1985).



Figure 32. Tangantangan forest. Photo: SWCA

#### 3.6.9.4 Open Field

Open field habitat is characterized by grass and other ground-covering vegetation with small thickets of native and introduced vegetation (Figure 33). Open field habitat is also included as a component of the lowland ecosystem. Generally, these fields occur in areas of historical cattle grazing. Introduced species such as *Lantana camara*, *Operculina ventricosa*, *Mikania scandens*, and *Mimosa invisa* are present in open fields as well as small groves of trees including *Spathodea campanulata*.



Figure 33. Open field habitat on Tinian. Photo: SWCA

### 3.6.9.5 Wetland

Vegetation present near open water area is typically dominated by *Schoenoplectus litoralis* var. *capensis*, with patches of *Acrostichum aureum* and *Paspalum orbiculare* (Figure 34). This band of mixed vegetation is surrounded by a band of *Phragmites karka*, an obligate wetland species (Wil Chee-Planning Inc. and AECOS Inc. 2008). Crop plants have been planted in areas, and these disturbed areas contain *Casuarina equisetifolia*, vines, and weedy herbs.

*Phragmites karka* surrounding Hagoi Wetland is approximately 57 ac (23 ha) in area. The wetland submergent plant-like algae, *Chara* spp., is abundant in some of the open water areas within sedge vegetation. Green algae (Chlorophyta) are also present and increase during the dry season. During the dry season, >50 percent of the open water areas was found to be covered with algae (USFWS 1996).

Table 8 provides a list of vegetation identified during a 2008 investigation of Tinian’s wetlands (Wil Chee-Planning Inc. and AECOS Inc. 2008).



Figure 34. Wetland vegetation near the entrance to Lake Hagoi. Photo: SWCA

Table 8. Vegetation recorded within or in close proximity to wetland habitat on Tinian in 2007. N = Native, I = Introduced, E = Endemic. Source: Wil Chee-Planning Inc. and AECOS Inc. (2008).

Family	Genus	Species	Common Name	Local Name	Status
<b><i>Pteridophyta</i></b>					
Polypodiaceae	<i>Acrostichum</i>	<i>aureum</i>	Swamp fern	Langayao	N
	<i>Phymatosorus</i>	<i>grossus</i>		Kahlao	N
Nephrolepidaceae	<i>Nephrolepis</i>	<i>biserrata</i>			N
	<i>Nephrolepis</i>	<i>hirsutula</i>		Amaru	N
Thelypteridaceae	<i>Thelypteris</i>	spp.			N
<b><i>Dicotyledonae</i></b>					
Acanthaceae	<i>Blechnum</i>	<i>pyramidatum</i>			I
Asteraceae	<i>Bidens</i>	<i>alba</i>			I
	<i>Chromolaena</i>	<i>odorata</i>	Siam weed		I
	<i>Mikania</i>	<i>scandens</i>	Mile-a-minute		I
Bombacaceae	<i>Ceiba</i>	<i>pentandra</i>	Kapok tree		I
Boraginaceae	<i>Heliotropium</i>	<i>indicum</i>			N
Casuarinaceae	<i>Casuarina</i>	<i>equisetifolia</i>	Ironwood	Gagu	N
Convolvulaceae	<i>Ipomoea</i>	<i>aquatica</i>		Cancon	I
	<i>Ipomoea</i>	<i>obscura</i>			I
	<i>Operculina</i>	<i>ventricosa</i>		Alalag	I
Caricaceae	<i>Carica</i>	<i>papaya</i>			I
Cucurbitaceae	<i>Momordica</i>	<i>charantia</i>		Admagoso	I
Euphorbiaceae	<i>Melanolepis</i>	<i>multiglandulosa</i>		Alum	N
Fabaceae	<i>Albizia</i>	<i>lebeck</i>		Kalaskas	I
	<i>Cassia</i>	<i>alata</i>			I
	<i>Centrosema</i>	<i>pubescens</i>			I
	<i>Crotalaria</i>	<i>pallida</i>			I
	<i>Desmanthus</i>	<i>virgatus</i>			I
	<i>Leucaena</i>	<i>leucocephala</i>		Tangantangan	I
	<i>Mimosa</i>	<i>pudica</i>	Sensitive plant		I
	<i>Mucuna</i>	<i>gigantea</i>			N
	<i>Pithecellobium</i>	<i>dulce</i>		Kamachile	I
	<i>Senna</i>	<i>occidentalis</i>			I
Goodinaceae	<i>Scaevola</i>	<i>taccada</i>		Nanaso	N
Malvaceae	<i>Abutilon</i>	<i>indicum</i>			N
	<i>Hibiscus</i>	<i>tiliaceus</i>		Pago	N
Oleaceae	<i>Jasminum</i>	<i>marianum</i>			E
Rhamnaceae	<i>Colubrina</i>	<i>asiatica</i>			N
Solanaceae	<i>Capsicum</i>	<i>frutescens</i>			I
	<i>Physalis</i>	<i>angulata</i>		Doni-sali	I
	<i>Solanum</i>	<i>torvum</i>			I
Verbinaceae	<i>Stachytarpheta</i>	<i>australis</i>			I
	<i>Stachytarpheta</i>	<i>jamaicensis</i>	Jamaican vervain		I
<b><i>Monocotyledonae</i></b>					
Araceae	<i>Colocasia</i>	<i>esculenta</i>			I
	<i>Cyrtosperma</i>	<i>chamissonis</i>			I
Arecaceae	<i>Cocos</i>	<i>nucifera</i>	Coconut palm	Niyog	I
Commelinaceae	<i>Schoenoplectus</i>	<i>littoralis</i> var. <i>capensis</i>	Day flower		N

Family	Genus	Species	Common Name	Local Name	Status
Pandanaceae	<i>Pandanus</i>	<i>tectorius</i>		Kafu	N
Poaceae	<i>Bambusa</i>	<i>vulgaris</i>		Piao-payo	I
	<i>Paspalum</i>	<i>orbiculare</i>	Rice grass		I
	<i>Pennistum</i>	<i>polystachyon</i>	Mission grass		I
	<i>Pennisetum</i>	<i>purpureum</i>	Elephant grass		I
	<i>Phragmites</i>	<i>karka</i>		Karriso	N
	<i>Saccharum</i>	<i>spontaneum</i>		Wild cane	I
	<i>Urochloa</i>	<i>maxima</i>		Guinea grass	I
	<i>Urochloa</i>	<i>mutica</i>		Para grass	I

### 3.6.9.6 Strand

Strand vegetation occurs on sandy beaches, and is often mixed with halophytic-xerophytic species (Figure 35). This vegetation type is a component of the coastal ecosystem. Tinian beaches consisting of strand vegetation are Unai Chulu, Unai Babui, Unai Chiget, and Unai Dångkolo (Hawaiian Agronomics Inc. 1985). Vegetation in strand habitat includes *Tournefortia argentea*, *Bidens alba*, *Stachytarpheta jamaicensis*, *Lantana camara*, *Thespesia populnea*, and *Ipomoea pes-caprae*.



Figure 35. Strand vegetation at Unai Chulu. Photo: SWCA

*Euphorbia sparrmannii* var. *tinianensis*, is a semi-succulent herb endemic to Tinian and occurs only at Unai Masalok. Lamanibot Bay and other headland communities are valued as healthy xerophytic-halophytic scrub and can contain *Heritiera longipetiolata* (Hawaiian Agronomics Inc. 1985). *Heliotropium anomalum* can be found near the cliff slope rim terrace pools created by the Unai Chiget blow hole and is not reported elsewhere on Tinian. The Unai Chiget region also includes a forest of *Hernandia sonora*. Dense areas of this tree are not common in its range and this particular stand is unique on Tinian.

#### 3.6.9.7 Marine Vegetation

Seagrass beds, considered a coastal ecosystem, are located at Puntan Lamanibot, Unai Chiget, Tachogna Beach, and Unai Masalok (Figure 12). These beds are used as feeding grounds for sea turtles. *Enhalus acoroides* is a large seagrass thriving at Unai Chiget. However, this seagrass is common on Guam and other Pacific reefs and is not considered to be rare or endangered.

#### **3.6.10 Introduced Species**

The majority of Tinian's flora is introduced, with approximately 75 percent of the monocots and 66 percent of the dicots non-native (Hawaiian Agronomics Inc. 1985). In many areas, plants introduced during the Spanish occupation have claimed previously cleared land that is no longer in use, creating secondary forests comprised mainly of tangantangan, but also consisting of *Triphasia trifolia*, *Jatropha gossypifolia*, *Pithecellobium dulce*, and *Muntingia calabura* (Mueller-Dombois and Fosberg 1998). *Acacia confusa* is an introduced tree that was noted to exist in dense stands on the island by the early 1950s (Mueller-Dombois and Fosberg 1998). Additional introduced plants on Tinian include *Lantana camara*, *Chromolaena odorata*, and *Coccinia grandis*.

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## 4.0 TINIAN PROGRAM ELEMENTS

### 4.1 Current and Completed Projects for Tinian supported by the U.S. Navy

The U.S. Navy has a history of supporting Tinian environmental projects as a part of their island management strategy. Many of these projects are long-term and have been on-going since 1999 as way to assess the health of the island's ecosystems and species. Other projects that have been undertaken include habitat restoration, the safe harboring of flora native to the Marianas, and a forest indicator study.

#### 4.1.1 Long-term Projects for Island Health and Species Protection

##### 4.1.1.1 Tinian Forest Enhancement

Native tree planting contracts were awarded for Tinian in 2001, 2002, and 2007. These contracts provided for the planting of native seedlings on 10 ac (4.1 ha) in 2001 and an additional 12 ac (4.9 ha) in habitat adjacent to native cliff-line limestone forest within the MLA in 2002. The contract specified *Cynometra ramiflora*, *Ficus tinctoria*, *Neisosperma oppositifolia*, *Pandanus tectorius* (Figure 36), *Psychotria mariana*, and *Morinda citrifolia* be planted. After demonstrating success by planting native species in existing tangantangan forest to provide shade for seedlings (Wescom 2005), forest enhancement continued with 8 ac (3 ha) of native forest planted in 2007 (A. Brooke 2010, NAVFACMAR, personal communication). Plans to continue planting are slated to continue over the next 5 years.



Figure 36. *Pandanus tectorius* planted as a part of forest mitigation project. Photo: SWCA

#### 4.1.1.2 Micronesian Megapode and Forest Bird Surveys

Monthly monitoring for the Micronesian megapode began in 1999. The incorporation of data collection for other native forest birds followed in 2004. Bird counts are conducted along seven established limestone forest transects located within the EMUA. The location of these transects are based on past records of the megapode on Tinian. Reports on survey findings are published each year. No megapodes have been sighted in recent years during these surveys. Overall detection of forest birds has increased annually between the years of 2004-2007 (Vogt 2009c).

#### 4.1.1.3 Sea Turtle Monitoring

Eighteen sandy beaches are inspected each month for the presence of sea turtles and their nests (Wenninger 2010b). Annual fluctuations in nesting activity have been observed. Nesting can oscillate between a year of no nesting activity and one or two years of crawls and nests (Vogt 2009c). In 2009, sixteen nests were found on six beaches, with the most nests recorded on Unai Dångkolo. No human nests predation was detected. One nest excavated with a permit had 90 percent hatch success (Wenninger 2010b).

#### 4.1.1.4 Moorhen Monitoring at Hagoi

A U.S. Navy biologist visits the Hagoi wetland monthly to record the number of moorhen present at the Hagoi wetland and their reproductive status. Detection of birds is established by visual and audible identification. Overall individual moorhen numbers appear stable, but egg production has decreased since the surveys began in 1999. Egg predation by the monitor lizard is considered a factor (Vogt 2009c). Between 11 and 17 moorhen were detected in 2009. Two nests were identified, one empty and one containing two eggs (Wenninger 2010a).

#### 4.1.1.5 Marine Resource Surveys

Semi-annual in-water surveys are conducted off of the EMUA beaches if Unai Babui, Unai Chulu, and Unai Dångkolo. These surveys target the reef communities and record the coral, fish, marine mammals, and invertebrates observed. The abundance of these animal classes and their overall health is also reported. The results of these surveys are discussed in this INRMP under section 3.6.1.5.

### **4.1.2 Completed projects**

#### 4.1.2.1 Coconut Crab Indicator Study

The coconut crab is an indigenous crustacean with a slow growth and low reproductive rate. They are locally valued in the Marianas as a food source and are subject to intense hunting by residents (Figure 37). Coconut crabs were sampled in February, April, and May of 2007 in multiple habitat types on Tinian. Treating the coconut crab as an indicator species, the study sought to establish crab densities and demographics on the island. The results

showed that only six percent of the 79 crabs captured for the study were of the legal harvest size. Information on crab weight was compared to data collected from a separate Diego Garcia study revealing that the Tinian population has average weights four times lower than those on Diego Garcia. Crab take under the legal harvest size was observed on Tinian (Vogt 2008b). The results of this study indicate a severe over harvesting of crabs on Tinian.



Figure 37. Coconut crab trap on Unai Lam Lam. Photo: SWCA

#### 4.1.2.2 Cycad Relocation from Guam to Tinian

The invasive Asian scale was accidentally introduced to the island of Guam in 2003. The result has been a devastating deterioration in cycad health and an increase in cycad mortality (Marler and Muniappan 2006). Three years after its introduction, 90 percent of the cycads on Guam had been lost. The scale has since made its way to Rota where it is having a similar affect. The islands of Saipan and Tinian historically supported introduced cycads, based on sediment core pollen analysis; however the plant was removed by humans before World War II. As a means of safe-harboring the species, the U.S. Navy has funded a project to establish 1,000 cycad seedlings on Tinian in the native limestone forests of the EMUA (Brooke 2009). These seedlings are currently thriving (Figure 38) and are regularly inspected by a U.S. Navy biologist and maintained by a qualified contractor. Cycad maintenance includes a visual search for disease or parasites and the physical removal of encroaching vines. Reports have stated that the cycads are healthy and survivorship is high.



Figure 38. Young cycad planted on Tinian. Photo: SWCA

#### 4.1.2.3 Satellite Transmitter Attachment to Green Sea Turtles

Seven green sea turtles were fitted with satellite transmitters in 2002 (Figure 39). Fitting transmitters to sea turtles is a technique useful to monitor turtle movements and migration patterns. This was a cooperative project between CNMI-DFW, GDAWR, the U.S. Navy, and USFWS. Two techniques were attempted for turtle capture; waiting at potential nest sites and capture by free-diving personnel (Kessler and Vogt 2002). Free diving was the most effective method of capture.



Figure 39. Tinian conservation officer Elvin Masaga and U.S. Navy Biologist Scott Vogt recording data on a female green sea turtle. Source: Kessler and Vogt (2002)

#### 4.1.2.4 Candidate Butterfly Survey

A collaborative survey between the U.S. Navy and USFWS to determine the presence of two butterfly candidate species on Tinian occurred in 2008 (Hawley and Castro 2008). These species were the Marianas rusty and forest flicker. No life stages of these species were observed during the survey.

#### 4.1.2.5 Tinian and Aguiguan General Insect Surveys

In August 2008, a general entomological survey was conducted on Tinian and Aguiguan in collaboration between the U.S. Navy and USFWS (USFWS 2009). Specimens from the survey were sent to the Bishop Museum, Hawaii, for identification and permanent curation. Authors of the report speculated the presence of the carnivorous tropical paper wasp (locally known as the boonie bee) at high densities could be preventing the candidate butterflies from inhabiting Tinian or Aguiguan.

#### 4.1.2.6 Land Reptiles and Amphibians of Tinian

An effort to catalogue Tinian's terrestrial reptile and amphibian species in 2008 was undertaken by USGS in a U.S. Navy, USFWS, and OIA funded project (Rodda et al. 2008). Reptiles and amphibians were detected using glue board traps, night visual searches, and six total removal plots. Each total removal plot was a 33 x 33 ft (10 x 10 m) fenced area

from which all vegetation was checked for herpetofauna and removed from the plot. The study found four skink, five gecko, and one anole species. Most notable was the discovery of a Micronesian gecko, an endemic of Micronesia. The Micronesian gecko has been reported from Tinian twice prior to this study (in 1946 and 2003) (Rodda et al. 2008).

#### 4.1.2.7 Mariana Fruit Bat Surveys on Tinian and Aguiguan

Occasionally, Mariana fruit bats are sighted on Tinian. A small number of bats are reported from Aguiguan, Tinian's neighboring island. The Mariana fruit bat is a federally listed threatened species. Surveys for fruit bats were conducted by U.S. Navy biologists on Tinian and Aguiguan in 2008. No bats were found on Tinian. Twenty five to 28 individuals were observed on Aguiguan (Brooke 2008a).

## **4.2 Threatened and Endangered Species, and Species of Interest**

### **4.2.1 Birds**

#### 4.2.1.1 Micronesian Megapode (*Megapodius laperouse laperouse*), Sasangat

Status: Federally Endangered.

Micronesian megapodes have rarely been reported on Tinian. While the bird is known to utilize native forest habitat on the island, reports have never cited large numbers present (O'Daniel and Krueger 1999). Current population demographics remain unknown. It is possible that megapode movement occurs from Aguiguan or Saipan to Tinian (O'Daniel and Krueger 1999, U.S. Navy 2009). Megapodes were detected in The Maga region in 2001, 2004, and 2005 (Witteman 2001, Vogt 2008a). However, megapodes were not detected during surveys on Tinian in 2006, 2007, and 2008 (Vogt 2008a, Camp et al. 2009a) with the exception of one heard in 2009 by a DLNR employee near the Seabees Monument (P. Radley 2010, CNMI-DFW, personal communication).

#### *Threats to the Micronesian Megapode on Tinian*

The Micronesian megapode on Tinian faces threats from human exploitation, predation, and resource competition (Vogt 2009a). Hunting has been reported (Vogt 2009c). This is not unexpected as hunting adults and harvesting eggs by humans is known to occur in many locations where human and megapode populations coexist (Dekker et al. 2000). Consequently, human take could be the reason that islands with the longest histories of human absence tend to support the largest megapode populations (e.g., Sarigan and Guguan) (Vogt 2009a). Feral cats and monitor lizards are also potential predators of megapodes, primarily hatchlings (Vogt 2009a). The invasive house shrew occurs on Tinian in high numbers and is known to be a voracious consumer of many of the same prey items of the megapode. Quantification of the average daily diet of the shrew indicates it may be a significant competitor for the megapode (Vogt 2009a).

Disturbance of megapode in terms of increases in noise, pedestrian land navigation, movement of vehicles, brown treesnake transportation, general invasive species introduction, and wildfires as a result of military training could occur.

*Management Strategy*

- Restrict the use of cross country off-road vehicles and other activities in designated areas that may disturb ESA listed species or degrade habitat.
- Bivouac training restrictions prohibiting the clearing of additional vegetation.
- Fire management planning within the EMUA (U.S. Navy 2009).

*Associated Projects*

- Monthly monitoring for the Micronesian megapode and forest avifauna.
- Native forest enhancement.
- Increase Conservation Area in the MLA.

4.2.1.2 Mariana Common Moorhen (*Gallinula chloropus guami*), Pulatatt

Status: Federally Endangered.

Moorhens occurring on Tinian and Saipan are considered a distinct population. In 2001, Takano and Haig (2004) estimated 41 birds on Tinian. Hagoi Wetland on Tinian supports the largest number of adult moorhens in the area. Other Tinian wetlands are not conducive to supporting more than a few individuals.

*Threats to the Mariana Common Moorhen on Tinian*

Loss of wetland habitat is the most critical factor in the moorhen decline (U.S. Navy 2009). Additional threats include habitat degradation due to invasive vegetation and ungulates, predation by predators such as cats, dogs, rats, and monitor lizards, and poaching (Takano and Haig 2004, U.S. Navy 2009).

Military associated threats to the moorhen are increases in noise, pedestrian land navigation, movement of vehicles, inadvertent brown treesnake transportation, general invasive species introduction, and wildfires.

*Management Strategy*

- Hagoi wetland designated "No Training Area".
- Aircraft training restrictions over wetlands. Helicopters are restricted to a minimum altitude of 1,000 ft (305 m) over Hagoi. Over-flights above Mahalang and Bateha will be avoided. Live-fire activities associated with aviation are prohibited.
- No ground training will occur in the Hagoi "No Training Area".
- No vegetation removal is permitted in the "No Training Area".
- Restrictions in designated areas on cross country off-road vehicles and other activities that may disturb ESA listed species or degrade habitat.
- Bivouac training restrictions prohibiting the clearing of additional vegetation.
- Fire management planning within the EMUA (U.S. Navy 2009).

*Associated Projects*

- Monthly monitoring of the Hagoi wetland for the Mariana common moorhen.
- Rat exclusion study.
- Habitat enhancement for the Mariana common moorhen.

#### 4.2.1.3 Tinian Monarch (*Monarcha takatsukasae*), Chichirikan Tinian

Status: Not federally listed. Species of Concern.

The Tinian monarch was delisted as an endangered species 1<sup>st</sup> September 2004 (69 FR 56367). This delisting occurred as a result U.S. Navy funded surveys that yielded population numbers higher than previously estimated. A monitoring plan for the monarch to ensure population stability after the removal of federal protection was developed between the DoD and the USFWS. Implementation of post-delisting monitoring began in 2006. Survival of Tinian monarchs from 2006 to 2007 was estimated at 61 percent, approximately 19 percent lower than the average annual survival of other Pacific island monarchs such as, Rarotonga monarch (*Pomarea dimidiata*), 'elepaio (*Chasiempis sandwichensis*) (Vanderwerf et al. 2007).

##### *Threats to the Tinian Monarch*

The Tinian monarch may be affected by increases in military training within the EMUA. A direct effect may be an increase in noise from munitions and movement of troops through forested habitat.

##### *Management Strategy*

- Restrict the use of cross country off-road vehicles and other activities in designated areas that may disturb ESA listed species or degrade habitat.
- Bivouac training restrictions prohibit the clearing of additional vegetation.
- Fire management planning within the EMUA (U.S. Navy 2009).

##### *Additional Proposed Management Strategies*

- Alter construction schedules to minimize impacts on nesting monarchs.
- Education for all construction personnel in regards to the Tinian monarch.
- Establish a protected area with interpretive signs for the Tinian monarch.
- Conduct pre-construction surveys for monarchs within the MLA (U.S. Navy 2009).

##### *Associated Projects*

- Monthly monitoring for the Micronesian megapode and forest avifauna.
- TMAPS project.
- Tinian forest bird management plan.
- Native Forest Enhancement.
- Increase Conservation Area in the MLA.

#### 4.2.1.4 Mariana Swiftlet (*Aerodramus bartschi*), Chachaguak

Status: Federally Endangered.

The Mariana swiftlet is considered extirpated from Tinian.

#### **4.2.2 Mammals**

##### 4.2.2.1 Mariana Fruit Bat (*Pteropus mariannus mariannus*), Fanihi

Status: Federally Threatened.

No permanent Mariana fruit bat colony is currently known to be present on Tinian. Although rare, sightings have been reported on the island. Sightings of two and as many as four fruit bats in the Kastiyu forest occurred in 1979 and 1983-1984, respectively (Wheeler 1980, Wiles et al. 1989b). In 1994, a single bat was observed flying at the southern end of the island and in 1995 another fruit bat was noted near San Jose Village (Krueger and O'Daniel 1999). The maximum number of fruit bats recently reported from Tinian was five in 2005 (Brooke 2008b). Observations of fruit bats on Tinian may be individuals moving from or to Aguiguan (Brooke 2008b).

##### *Threats to the Mariana Fruit Bat on Tinian*

The most serious threat to the Mariana fruit bat is illegal hunting. Despite its current status as a federally listed threatened species, poaching remains unchecked (Brooke 2008b). Between 1975 and 1981, the CNMI legally exported 15,805 fruit bats to Guam to supply market demand (Wiles 1992). During these six years, 1,366 fruit bats were exported from Tinian. It is likely that many of these fruit bats originated from Aguiguan (Wiles et al. 1989b). Habitat destruction is also an ongoing threat to the bat, as is the possible introduction of the brown treesnake (U.S. Navy 2009).

Threats to the fruit bat associated with military training are increases in noise, pedestrian land navigation, movement of vehicles, brown treesnake transportation, general invasive species introduction, wildfires, and inappropriate night lighting (U.S. Navy 2009).

##### *Management Strategy*

- Restrict the use of cross country off-road vehicles and other activities in designated areas that may disturb ESA listed species or degrade habitat.
- Bivouac training restrictions prohibit the clearing of additional vegetation.
- Fire management planning within the EMUA (U.S. Navy 2009).

##### *Associated Projects*

- Native forest enhancement.
- Increase Conservation Area in the MLA.

#### **4.2.3 Reptiles**

##### 4.2.3.1 Sea Turtles

Hawksbill sea turtle (*Eretmochelys imbricata*), Haggan karai

Status: Federally Endangered.

Green sea turtle (*Chelonia mydas*), Haggan

Status: Federally Threatened.

The green and hawksbill sea turtles are known to nest in several of the northern beaches located within the EMUA. No turtle activity was documented in 2006. In 2007, three possible nests were recorded on Chulu beach. All three showed evidence of poaching and there was no sign of any turtle hatching event (Vogt 2009c). However, nests seen in 2009 did not show any apparent predation, human or otherwise (Wenninger 2010b).

*Threats to the Green and Hawksbill Sea Turtle on Tinian*

Poaching of turtle eggs from nests is a serious threat to successful reproduction on Tinian (Vogt 2009c). Additionally, feral cats, dogs, and rats are all capable of turtle nest predation (U.S. Navy 2009). Loss of beach habitat due to expanding tourism and coastal development will also impact nesting beaches (Craig 2002 as referenced in U.S. Navy 2009). Strand vegetation can also be degraded by the presence of ungulates such as pigs, cows, deer, and goats (U.S. Navy 2009). Driving on sandy beaches, although not officially allowed, is common (Figure 40). Operating a vehicle across the beach causes the sand to compact and may crush sea turtle eggs in nests beneath the surface.

Possible military associated threats to turtles include the compaction of beach sand due to increases in noise, vehicle movement, the usage of heavy equipment on beaches, invasive species introduction, and inappropriate lighting on beaches at night (U.S. Navy 2009). Three turtle nests were observed on Unai Chulu, a beach in the EMUA used for amphibious landing, in 2009 (U.S. Navy 2009, Wenninger 2010b).



Figure 40. Evidence of beach driving at Unai Dångkolo may destroy existing sea turtle nests or deter females from laying in the vicinity. Photo: SWCA

*Management Strategy*

- Landing area for any amphibious vehicle is surveyed at maximum six hours prior to exercise. Potential turtle nests are flagged for avoidance.
- A “beach master” is designated to wave off approaching vehicles that may harm any turtles in the water or nests on the land.
- Air Cushioned Landing Crafts (LCAC) are scheduled for high tide to prevent coral heads from breaking off and causing beach scour, which would degrade foraging and nesting habitat for sea turtles.
- Amphibious Assault Vehicles (AAVs) which land at Unai Babui are restricted to an established approach lane and can only approach the beach one vehicle at a time at high tide (U.S. Navy 2009).

*Associated Projects*

- Sea turtle migration monitoring.
- Semi-annual in-water surveys.
- Monthly inspection of sandy beaches in the EMUA.
- Sea turtle nesting habitat restoration at Unai Dangkolo.

**4.2.4 Invertebrates**

**4.2.4.1 Coconut Crab (*Birgus latro*), Ayuyu**

Status: Not federally listed. Species of Concern.

On Tinian, the coconut crab density is estimated at 2 crabs/ac (5.0 crabs/ha) in native forest and 0.7 crabs/ac (1.8 crabs/ha) in tangantangan forest (Vogt 2008b). Coconut crabs are a CNMI game species and may be legally hunted during the designated hunting season. Individual hunters are allowed a bag limit of five and a season limit of 10 crabs between 15 September and 15 November. Harvesting crabs with a carapace width less than three inches and all females carrying eggs is prohibited (DLNR 2000).

*Threats to the Coconut Crab on Tinian*

Coconut crabs are valued as a food source by the indigenous people of the Marianas. Harvesting of this species occurs throughout the year with disregard for legal hunting season (P. Wenninger 2010, NAVFACMAR, personal communication). Current harvested rates are unsustainable (Vogt 2008b).

*Management Strategy*

- There is no current management strategy for the coconut crab. However, a study on coconut crab densities on Tinian was completed by the U.S. Navy in 2008.

*Associated Projects*

- There are no current projects for the coconut crab.

**4.2.4.2 Mariana Islands Tree Snail (*Partula gibba*), Denden**

Status: Candidate for federal listing. Species of Concern.

The Mariana Islands tree snail has not been observed recently and may be extirpated from Tinian. As recently as 2008, empty shells were found along cliff-line tracts in the EMUA causing extirpation to be questionable (A. Brooke 2010, NAVFACMAR, personal communication). Surveys conducted in 2008 by USFWS are not yet available for review.

*Management Strategy*

- There is no current management strategy for the Mariana Islands tree snail.

*Associated Project*

- Partulid snail study.

**4.2.5 Marine Mammals**

Sixteen marine mammals are known to occur in the Mariana island chain (Table 9). The most recent survey in the waters surrounding Tinian was conducted by USFWS in 2008. During the survey, three species were observed; spinner dolphin, spotted dolphin (identification tentative), and short-finned pilot whale (Minton et al. 2009).

Table 9. Marine mammal species known to utilize the waters surrounding the Marianas archipelago. Source: (Wiles 2005).

Common Name	Genus	Species
Bryde’s whale	<i>Balaenoptera</i>	<i>edeni</i>
Sperm whale	<i>Physeter</i>	<i>macrocephalus</i>
Spinner dolphin	<i>Stenella</i>	<i>longirostris</i>
Risso’s dolphin	<i>Grampus</i>	<i>griseus</i>
Melon-headed whale	<i>Peponocephala</i>	<i>electra</i>
False killer whale	<i>Pseudorca</i>	<i>crassidens</i>
Common bottlenose dolphin	<i>Tursiops</i>	<i>truncates</i>
Pantropical spotted dolphin	<i>Stenella</i>	<i>attenuate</i>
Striped dolphin	<i>Stenella</i>	<i>coeruleoalba</i>
Killer whale	<i>Orcinus</i>	<i>orca</i>
Short-finned pilot whale	<i>Globicephala</i>	<i>macrorhynchus</i>
Dugong	<i>Dugong</i>	<i>dugong</i>
Dwarf sperm whale	<i>Kogia</i>	<i>sima</i>
Pygmy sperm whale	<i>Kogia</i>	<i>breviceps</i>
Humpback whale	<i>Megaptera</i>	<i>novaeangliae</i>
Sei whale	<i>Balaenoptera</i>	<i>borealis</i>

*Threats to Marine Mammals of Tinian*

The life cycle of federally listed marine mammals occurring in the waters surrounding Tinian are not dependant on the MLA and are not be impacted by activities on military leased land.

*Management Strategy*

- There is no current management strategy for the marine mammals.

*Associated Projects*

- Marine mammal management strategy.
- Semi-annual in-water surveys.

### **4.3 Wetlands**

Hagoi, Tinian's largest and only permanent wetland is situated within the EMUA. The smaller and more ephemeral wetlands, Mahalang and Bateha, are located within the LBA. The Hagoi wetland is habitat critical for the endangered Mariana common moorhen and is considered the most undisturbed wetland habitat in the Mariana archipelago.

*Threats to Hagoi*

Habitat loss due to over growth of vegetation (e.g., edge *shoenoplectus littoral* and phragmites) in open water areas is a threat to the Hagoi ecosystem. Encroachment of the wetland species *Phragmites karaka* can be attributed to the loss of open water space at Hagoi (Mueller-Dombois and Fosberg 1998). Invasive species are of concern as feral cats and rats prey on the native bird species and their eggs. The introduction of new invasives could also cause habitat disturbance.

*Management Strategy*

- Hagoi is listed as a "No Training Area".
- Aircraft training restrictions over wetlands. Helicopters are restricted to a minimum altitude of 1,000 ft (305 m) over Hagoi. Over-flights above Mahalang and Bateha will be avoided. Live-fire activities associated with aviation are prohibited.
- No ground training will occur in the Hagoi "No Training Area".
- No vegetation removal is permitted in the "No Training Area".
- Fire management planning within the EMUA (U.S. Navy 2009).

*Associated Projects*

- Rat exclusion study.
- Habitat enhancement for the Mariana common moorhen.

### **4.4 Fish and Wildlife Resources**

Tinian's fish and wildlife species are valued by the local people for consumption. Fish and invertebrates inhabiting the reefs surrounding the island are frequently fished and collected. Fruit bats are a historically significant food source for the Chamorros (Wiles et al. 1989b). Laws concerning the ban of the hunting of fruit bats have existed in the CNMI since 1977 (Wiles et al. 1989b). The coconut crab continues to be legally harvested on the island. The legal coconut hunting season in the CNMI is from September 15<sup>th</sup> to November 15<sup>th</sup> and take is limited to crabs larger than 3 in (76 mm) (Vogt 2008b). Females carrying eggs are prohibited for collection at any size (Vogt 2008b). The Micronesian megapode, which has occasionally been sighted on the island, and its eggs are potentially utilized as a food source

(Vogt 2009a). Tinian's forest birds such as the Mariana fruit-dove may also be subjected to local hunting (A. Brooke 2010, NAVFACMAR, personal communication).

#### *Threats to Tinian Fish and Wildlife Resources*

The islands in the southern Marianas are known to be subjected to heavy fishing pressure. Recent surveys of the reefs Unai Babui, Unai Dångkolo, and Unai Chulu showed lower densities of large fish when compared to reefs experiencing little fishing (Minton et al. 2009). Commercially valuable fish were rare or absent from the study. This rarity and absence also included several invertebrate species, such as the spiny lobster (*Panulirus* spp.) and octopus (*Octopus cyanea*) (Minton et al. 2009).

Overhunting of fruit bats has had a direct impact on the decline of the species on Tinian and other islands in the southern Marianas (Wiles 1990). During the 1970s, fruit bats were heavily hunted on Tinian for export to Guam and Saipan. On average, 210 bats were shipped to Guam annually during this period (Wiles 1990). Although fruit bats are not common on Tinian today, it is likely that hunting will continue opportunistically on the island.

The coconut crab continues to be heavily harvested on Tinian. Although a specified hunting season is in place, locally harvesting practices are unchecked and occurs throughout the year. Of the crabs collected during a 2007 study only 6 percent were of a legal harvest size (Vogt 2008b).

Harvest pressure on the Micronesian megapode may be reflected a higher population density on Marianas islands not inhabited by humans such as Sarigan and Guguan (Dekker et al. 2000, Vogt 2009a).

#### *Management Strategy*

- There is no management strategy for Tinian hunting practices.

#### *Associated Projects*

- There are no associated projects in regards to local take of fish and wildlife.

## **4.5 Forests**

Due to historical use of the island for sugar cane production and WWII activities, only five percent or approximately 1334 ac (540 ha) of Tinian's native forests remain (Wescom 2005). The largest of this remnant forest patch occurs within the EMUA and is habitat for the Micronesian megapode and Tinian monarch.

#### *Threats to Tinian Forests*

Forests ecosystems on the MLA are threatened by loss of native vegetation, loss of native wildlife, and invasive species. The remaining native forests are primarily located on

limestone cliffs and steep slopes and were subsequently not functional agriculture land. Therefore, they are not under direct threat from human encroachment. Several native forest trees have adapted to the frequent occurrence of typhoon by regenerating from broken branches and utilizing newly created open canopy for growth. Because the forests have been reduced and fragmented and compromised by non-native plant invasions, typhoons may still have a significant detrimental impact to the remaining forest patches.

Threats to native forest associated with military activity are trampling of vegetation by pedestrians, vehicular movements, trash accumulation, introduction of invasive plant and animal species, and wildfires.

#### *Management Strategy*

- In 2000 U.S. Navy awarded a contract to plant native forest trees on 10 ac (4 ha) of lowland forest adjacent to a cliff-line native forest within the MLA.
- In 2001 U.S. Navy awarded a contract to plant native forest trees on 12 ac (4.8 ha) of land adjacent land set aside for the 2000 contract.
- Eight acres (3 ha) of native forest were planted as a result of a U.S. Navy effort in 2007.
- Cycad relocation project involving the planting of 1,000 cycads from Guam and continued protection of young plants.
- Restrictions in designated areas on cross country off-road vehicles and other activities that may disturb ESA listed species or degrade habitat.
- Bivouac training restrictions prohibiting the clearing of additional vegetation.
- Fire management planning within the EMUA (U.S. Navy 2009).

#### *Associated Projects*

- Monthly monitoring for the Micronesian megapode and forest avifauna.
- TMAPS project.
- Tinian forest bird management plan.
- Native forest enhancement.
- Long-term habitat monitoring and vegetation surveys.
- Increase Conservation Area in the MLA.
- Rat exclusion study.

## **4.6 Vegetation**

No vegetation on Tinian is federally listed. However, the epiphytic clubmoss, *Lycopodium phlegmaria* var *longiform*, is locally listed in the CNMI as endangered. Some native plant species include *Pisonia grandis*, *Ficus* spp., *Cerbera* spp., and *Guamia mariannae*. The majority of Tinian's current flora is introduced. Tangantangan is an example of an introduced tree which now dominates the north end of the island. The cycad was planted on Tinian in a relocation effort to protect the species from the invasive scale insect that was established on Guam and Rota. These cycads are located within native limestone forest surrounding Mt. Lasso in the EMUA.

### *Threats to Tinian vegetation*

The most serious threats to Tinian's flora are habitat loss due to human encroachment and introduced species (Figure 41). Invasive plant species of concern on Tinian are *Lantana camara*, *Chromolaena odorata*, and *Coccinia grandis*. Typhoons are also a potential threat to vegetation. The majority of Tinian's native flora species have evolved in face of reoccurring typhoons, however because the native flora is so reduced, typhoons may still have a significant detrimental impact to what remains of the native plants.

The health of the relocated cycads is of concern as they represent an important Marianas population that has been safe-guarded from the invasive scale afflicting the cycads on the islands of Guam and Rota.



Figure 41. Trees in a Tinian forest covered by invasive vines. Photo: SWCA

### *Management Strategy*

- Restrict the use of cross country off-road vehicles and other activities in designated areas that may disturb ESA listed species or degrade habitat.
- Bivouac training restrictions prohibiting the clearing of vegetation.
- Contract awarded in 2000 to plant native forest trees on 10 ac (4 ha) of lowland forest adjacent to a cliff-line native forest within the MLA.
- Contract awarded in 2001 to plant native forest trees on 12 ac (4.8 ha) of land adjacent land set aside for the 2000 contract.
- Additional 8 acres (3 ha) of native forest planted in 2007.
- Cycad relocation project involving the planting and monitoring of 1,000 cycads from Guam.
- Fire management planning within the EMUA (U.S. Navy 2009).

### *Additional Management Strategies*

- Utilization of prevention methods such as Hazard Analysis and Critical Control Points (HACCP) (U.S. Navy 2009).

*Associated Projects*

- Vegetation monitoring.
- Native forest enhancement.
- Long-term habitat monitoring and vegetation surveys.
- Cycad health monitoring and maintenance.
- Tinian wildfire management plan.
- Rat exclusion study.

## **4.7 Coastal and Marine Resources**

Beaches occurring within the EMUA are Unai Dångkolo (Long Beach), Unai Chulu, Unai Masalok, and Unai Lamlam. The outermost boundary of the MLA coastal ecosystem is its “near-shore” waters.

*Threats to Tinian’s Coastal and Marine Resources*

Fishing and hunting pressure effect Tinian’s coastal and marine resources. Two sea turtle species, the green sea turtle and the hawksbill sea turtle, are known to use beaches located in the EMUA. Both species are federally listed and both are subjected to heavy illegal hunting pressure by humans. Additionally, trash and debris build up on beaches known to support sea turtle reproduction has impacted turtle nesting (Figure 42). Biologists have observed green sea turtles pushing aside trash near Unai Dångkolo to lay eggs (P. Wenninger, NAVFACMAR. personal communication). Even if a sea turtle were able to lay eggs amongst the trash, the ability of the nestlings to traverse the littler beach and safely navigate to the water could be compromised.

Local regulations regarding fishing are in place, however fishing continues to impact the local fish species (Minton et al. 2009). Maritime traffic can impact the environment by the transportation of alien species in bilge water and attached to hulls and petroleum product releases.

Threats from increased military activity are possible. Coastal habitat destruction caused by beach craft landing, trampling of nests or disturbance of nesting behavior during exercises may occur. The movement of supplies and equipment associated with training exercises may facilitate the introduction of invasive species. In addition, the use of flashlights or other temporary night-lighting may impact migration of various species or disrupt foraging or breeding behavior.



Figure 42. Trash and debris accumulation at Unai Dångkolo. Photo: SWCA

#### *Management Strategy*

- Landing area for any amphibious vehicle is surveyed at maximum six hours prior to exercise. Potential turtle nests are flagged for avoidance.
- A “beach master” is designated to wave off approaching vehicles that may harm any turtles in the water or nests on the land.
- LCACs are scheduled for high tide to prevent coral heads from breaking off and causing beach scour, which would degrade foraging and nesting habitat for sea turtles.
- Amphibious Assault Vehicles (AAVs) which land at Unai Babui are restricted to an established approach lane and can only approach the beach one vehicle at a time at high tide.

#### *Associated Projects*

- Sea turtle migration monitoring.
- Marine mammal management strategy.
- Semi-annual in-water surveys.
- Monthly inspection of sandy beaches in the EMUA.
- Sea turtle nesting habitat restoration at Unai Dångkolo.

## 4.8 Non-native Species

Five mammal, four bird, five reptile, one amphibian species, and an unknown number of invertebrates on Tinian are non-native. The majority of Tinian's flora is introduced, with approximately 75 percent of the monocots and 66 percent of the dicots being non-native (Hawaiian Agronomics Inc. 1985). To date, only five percent or approximately 1334 ac (540 ha) of Tinian's native forests remain (Wescom 2005).

### *Threats to Tinian's Natural Resources from Non-native Species*

Non-native bird species such as the Eurasian tree sparrow compete with native forest birds for food, roosting and nesting resources. Feral cats depredate birds, eggs, reptiles, and sea turtle hatchlings. Rats will also destroy sea turtle eggs and consume *Pisonia grandis* seedlings, which may contribute to the tree's rare status on Tinian (A. Brooke 2010, NAVFACMAR, personal communication). On Diego Garcia, *Pisonia grandis* is reportedly more abundant with greater recruitment success in areas free from rats than Tinian (Topp 1988). The musk shrew, common on Tinian, is a potential resource competitor with the Micronesian megapode and will depredate native gecko species (Rodda and Fritts 1992, Vogt 2009a). Introduced reptiles compete with native reptiles for resources and also act as a prey base to support other invasive species. The presence of non-native geckos and skinks on Guam is an important factor in the subsistence of the detrimental invasive predator, the brown treesnake on Guam (Fritts and Rodda 1998) and could assist the snake in establishing an incipient population on Tinian.

An introduction of the BTS to Tinian is a serious concern. The BTS was accidentally transported to Guam via post World War II U.S. military movements. The snake is considered responsible for the extirpation of 13 of Guam's 22 native breeding birds, and has contributed to the extirpation of several species of native lizards (Rodda and Fritts 1992, Rodda and Savidge 2007). Of these, nine of 12 forest birds were eliminated and the remaining were severely reduced, one to the verge of extirpation (Fritts and Rodda 1998, Wiles et al. 2003).

Several non-native invertebrate species are a threat to native Tinian wildlife. The Mariana Islands tree snail may be extirpated from the island. Contributing to the species decline and possible absence are an invasive flat worm and two land snails (i.e. giant African snail and wolf snail) that are known to kill native land snails. The predatory tropical paper wasp (boonie bee) is abundant on Tinian and may be preventing the presence of native butterflies.

Invasive vegetation contributes to further habitat losses. Encroachment of vegetation is a major threat to moorhen habitat on the Hagoi wetland. *Lantana camara*, *Chromolaena odorata*, and *Coccinia grandis* are all invasive plants on Tinian that spread prolifically and are capable of out competing native plants. *Coccinia grandis* (commonly known as the scarlet gourd) is particularly aggressive and is capable of altering landscape by growing over and entangling forest trees (IUCN/SSG 2005).

#### *Management Strategy*

- All personnel participating in military training are responsible for conducting self inspections. Inspections include all gear and clothing for soil, seeds, invertebrates, and BTS.
- Outbound aircraft from Guam is inspected for BTS prior to departure.
- Area Training coordinated meetings for BTS interdiction prior to training execution phase and after activity reviews.
- Adherence to preventative BTS measures outlined by the BTS interdiction plan.

#### *Additional Management Strategies*

- Participation in the Regional Biosecurity Plan.
- Utilization of prevention methods, such as Hazard Analysis and Critical Control Points (HACCP).
- Development of Regional Training Standard Operating Procedures and Exercise Planning (U.S. Navy 2009).

#### *Associated Projects*

- Vegetation monitoring.
- Long-term habitat monitoring and vegetation surveys.
- Rat exclusion study.

## **4.9 Wildfires**

Wildfires can result from field clearing practices, abandoned campfires, smoking, and arson. The EMUA is comprised of large areas of tangantangan, secondary forest, and open fields. Grass fires are common on Tinian and are more likely to occur during the dry season. Most fires are intentionally lit. Fires initiated in open fields have the potential to persist when forest habitat is reached, resulting in a direct threat to federally listed species (U.S. Navy 2009). Incidental sightings of intentionally set fires have been reported to be occurring in the EMUA. The purpose of these fires is unknown, though some speculate that the fires may be started by locals to facilitate collection of coconut crabs or scrap metal (P. Wenninger, 2010, NAVFACMAR, personal communication). There are no records of wildfires on Tinian resulting from U.S. military training activities (U.S. Navy 2009).

Also, as a conservation requirements in the 2010 Biological Opinion for the Joint Guam Planning Office, the military is required "to facilitate fire management planning and implementation of daily fire suppression staffing, immediately establish remote automated weather stations on Guam and Tinian and maintain weather and fire danger data in the interagency weather information management system".

#### *Management Strategy*

- North Field is the only area within the EMUA authorized for open fires and pyrotechnics.
- Cooking is not allowed in outdoor training areas.
- Air runways in North Field act as access roads and firebreaks.

- The Tinian Fire Department maintains a 300-gallon pumper truck and fire crew to respond to any wildfires in the EMUA (U.S. Navy 2009).

*Associated Projects*

- Tinian wildfire management plan.
- Install remote automated weather station to track weather and fire dangers.

## **4.10 Land Management**

The primary purpose of DoD lands and waters is to support the mission. Land management issues, within the scope of the INRMP, are associated with soil and water conservation, freshwater management, non-point source pollution, agricultural out-leasing, floodplain protection, coastal resource and habitat management, invasive species management. In order to address land management concerns, detailed information is needed concerning the installations land-use, resident ecosystems, and environmental factors of concern. On-going adaptive management into these parameters is essential in achieving this goal.

*Land management factors specific to Tinian*

- Habitat loss due to human encroachment.
- Invasive plants.
- Accidental establishment of the BTS and other non native species.
- The importance of forest ecosystems to resident endangered fauna.
- The importance of the Hagoi wetland to the endangered Mariana common moorhen.

*Management Strategy*

See sections;

- 4.1 Listed species and species of concern
- 4.2 Wetland management
- 4.4 Forests
- 4.5 Vegetation
- 4.6 Coastal and marine resources
- 4.7 Invasive species
- 4.8 Wildfire and
- 4.10 Floodplains
- 4.11 Outdoor recreation

*Associated Projects*

- Vegetation monitoring.
- Native forest enhancement.
- Long-term habitat monitoring and vegetation surveys.
- Increase Conservation Area in the MLA.
- Tinian wildfire management plan.
- Rat exclusion study.

- Habitat enhancement for the Mariana common moorhen.
- Sea turtle nesting habitat restoration at Unai Dångkolo.

#### **4.11 Floodplains**

Floodplains are low-lying areas subject to flooding as a result of excessive rains and runoff of surface water from higher elevations. Tinian's elevation is relatively uniform and because there is little surface water runoff, flooding is not an important natural hazard on Tinian.

Flood Zone A is a Federal Emergency Management Agency (FEMA) classification for areas that are likely to be inundated in a 100-year flood event. Areas designated as Zone A within the EMUA are Hagoi and portions of North Field (FEMA 1985).

##### *Management Strategy*

- There is no management strategy for Tinian's floodplains.

##### *Associated Projects*

- There are no proposed projects relating to Tinian's floodplains.

#### **4.12 Outdoor Recreation**

Although the EMUA is considered a military exclusion zone, the area is not closed off from public access. There are several sites of interest located within the EMUA utilized by tourists. These sites are Unai Dångkolo beach, the blowhole, Shinto Shrine, the atomic bomb pit, and Invasion Beach (Unai Chulu). The LBA can be accessed by the public at all times and has some tourist attractions (e.g., Japanese Village Ruins, original San Jose Village).

The local people engage in fishing and hunting activities. Fishing and coconut crab harvesting are regulated by the local government. The two sea turtle species known to use Tinian's beaches for reproduction are federally protected. The poaching of turtle eggs is common and a serious threat.

##### *Management Strategy*

- Civilian access is prohibited during military training exercises.

##### *Associated Projects*

- There are no proposed projects associated with recreation.

#### **4.13 Bird Aircraft Strike Hazard**

A Bird/Animal Aircraft Strike Hazard (BASH) refers to a collision between an airborne animal and a flying aircraft. These collisions have the potential to cause accidents with human casualties (Cleary et al. 2006). Tinian does not qualify for a BASH program or plan (A. Brooke 2010, NAVFACMAR, personal communication).

##### *Management Strategy*

- There is no current management strategy for BASH.

##### *Associated Projects*

- There are no BASH associated projects proposed.

#### **4.14 Law Enforcement**

Although a valuable military training ground, does not have any resident DoD staff. Currently, Tinian receives infrequent enough use by the military to render the stationing of permanent staff on the island impractical. As a result, DoD does not have any permanent presence in regards to law enforcement. The responsible agent for all local law enforcement is the CNMI DFW.

##### *Management Strategy*

- There is no current law enforcement management strategy.

##### *Associated Projects*

- There are no law enforcement associated projects proposed.

#### **4.15 Agricultural Out-leasing**

There is no agricultural out-leasing on Tinian.

#### **4.16 Other Leases**

There are no non-agricultural leases on Tinian.

#### **4.17 Migratory Birds**

Under the National Defense Act of 2003, military training exercises are rendered exempt from the requirement of a take permit under the MBTA. However, in regards to military training, the department of the defense will take effects on migratory birds into account when planning training exercises and will consult with the Secretary of Defense to:

- minimize and mitigate, to the extent practicable, any adverse impacts of authorized military readiness activities on affected species of migratory birds; and
- monitor the impacts of such military readiness activities on affected species of migratory birds.

There are no large concentrations of seabirds on Tinian. Shorebirds are the largest group of migratory birds to pass through Tinian. They migrate primarily from summer nesting areas of northern Asia and Alaska and most frequently use the fresh water areas of the Tinian's wetlands.

#### *Threats to Migratory Birds on Tinian*

Loss of wetland habitat and habitat degradation due to invasive vegetation encroachment could result in diminished migratory bird populations.

Military associated threats to migratory birds are increases in noise, pedestrian land navigation, movement of vehicles, BTS transportation, general invasive species introduction, and wildfires.

#### *Management Strategy*

- The Hagoi wetland is listed as a "No Training Area".
- Aircraft training restrictions over wetlands. Helicopters are restricted to a minimum altitude of 1,000 ft (305 m) over Hagoi. Over-flights above Mahalang and Bateha will be avoided. Live-fire activities associated with aviation are prohibited.
- No ground training will occur in the Hagoi "No Training Area".
- No vegetation removal is permitted in the "No Training Area".
- Fire management planning within the EMUA (U.S. Navy 2009).

#### *Associated Projects*

- There are currently no projects associated with migratory birds on Tinian.

## **4.18 Research Needs**

Research is an important component of a management strategy for natural resources. Any implemented plan would be ineffective without proper information on resident species and ecosystems. In addition to baseline knowledge on community composition and natural history, ongoing research provides information essential in understanding population trends. Monitoring population trends is a component of an adaptive management plan. Regular reviews of current scientific data will allow resource managers to understand whether current management strategies are working or if conservation measures need to be reassessed.

#### *On-going Projects Incorporating Research*

- Monthly monitoring for the Micronesian Megapode and forest avifauna.

- Quarterly monitoring of the Hagoi Wetland for the Mariana common moorhen.
- Semi-annual in-water surveys.
- Vegetation monitoring

*Additional Associated Research*

- TMAPS project.
- Sea turtle migration monitoring.
- Long-term habitat monitoring and vegetation surveys.
- Rat exclusion study.

#### **4.19 Use of GIS**

The geographic information system (GIS) is a mapping tool that allows researchers and managers to visualize data in a way that can reveal patterns and trends in information on a landscape level. GIS can be used in natural resource management to monitor population demographics and their associated habitats.

*Proposed Projects for Tinian Potentially Utilizing GIS*

- TMAPS project.
- Partulid snail study.
- Sea turtle migration monitoring.
- Long-term habitat monitoring and vegetation surveys.
- Cycad health monitoring and maintenance.
- Habitat enhancement for the Mariana common moorhen.



# Farallon de Medinilla

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1 **5.0 FDM CURRENT CONDITIONS AND USE**

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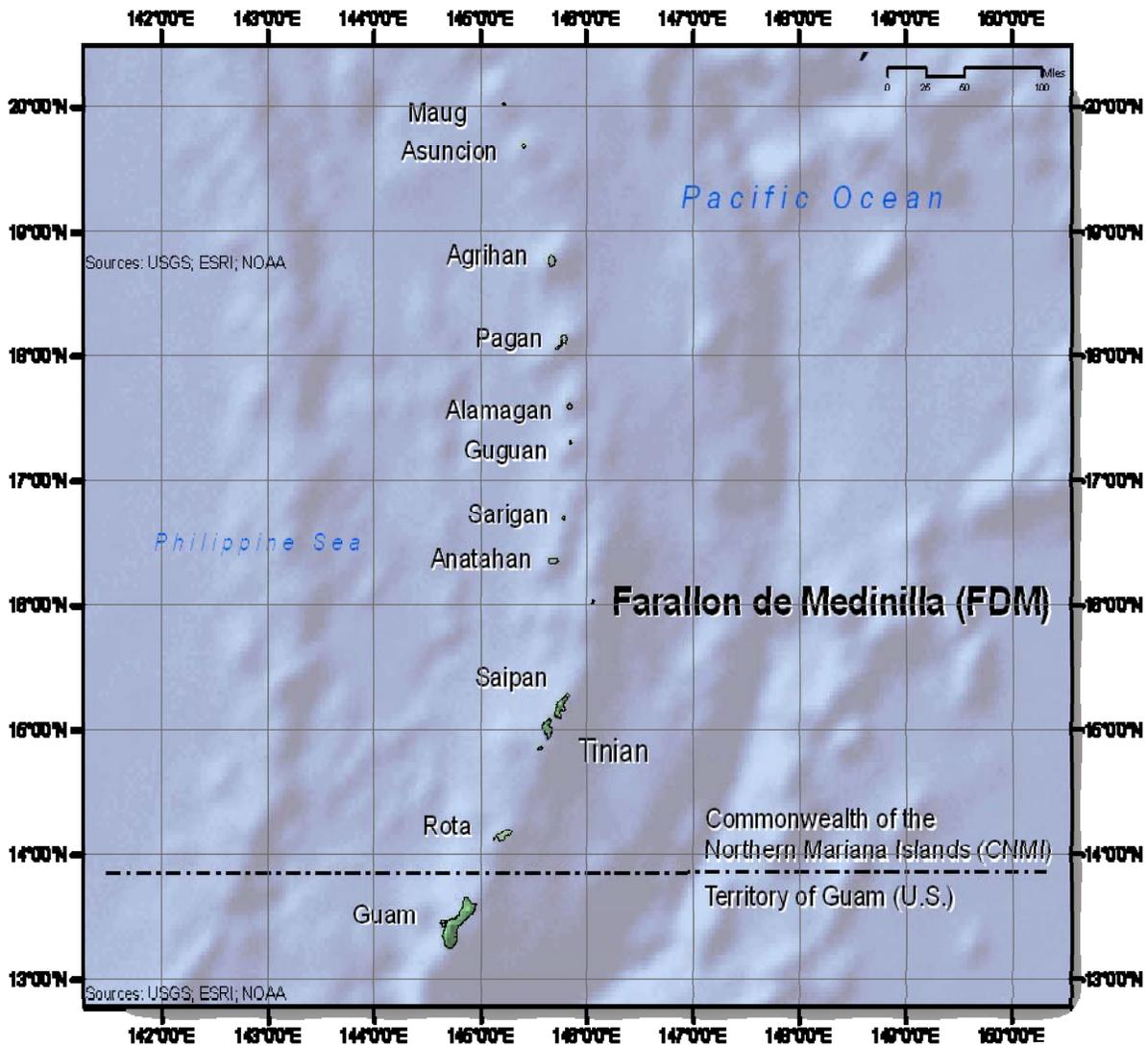
4 **5.1 Location**

5

6 Farallon de Medinilla (FDM) is in the Marianas archipelago and a part of the CNMI (Figure  
 7 43). The island, located at 16° 01'N, 146° 04'E, is approximately 1.7 mi (2.8 km) long and  
 8 0.3 mi (450 m) wide covering approximately 182 ac (74 ha). It is the northernmost island  
 9 of the southern volcanic arc of the Mariana archipelago, which places it north of Saipan and  
 10 south of Anatahan. FDM is an uninhabited island and is physically difficult to access except  
 11 by helicopter.

12

13



14

15 Figure 43. Map showing location Farallon de Medinilla (FDM) in the Marianas archipelago

1 **5.2 Current Military Land Use Practices**

2  
3 The entire land mass of FDM and associated designated R-7201 restricted airspace is leased  
4 by NBG from the CNMI government (U.S. Navy 2009). The lease expires in 2075 (Smith and  
5 Marx 2009). The island is the Pacific Fleet’s only U.S. controlled range available for live-fire  
6 training. The island has been used as bombing range since 1971, both for live and inert-fire  
7 bombing. It supports activities such as surface to ground and air to ground Gunner Exercise  
8 (GUNEX), Bombing Exercise (BOMBEX), Missile Exercise (MISSILEX), Fire Support, and  
9 Precision Weapons (U.S. Navy 2009). FDM can be divided into five zones, oriented north to  
10 south (Figure 44):

- 11  
12 Zone 1 - no fire/no drop zone  
13 Zone 2 - impact area allowing inert ordnances only  
14 Zone 3 - impact area permitting live and inert ordnances  
15 Zone 4 - no fire/no drop zone  
16 Zone 5 - impact area allowing live and inert ordnances.

17  
18 Zone 5 is the primary live-fire zone (Smith and Marx 2009,U.S. Navy 2009).  
19  
20

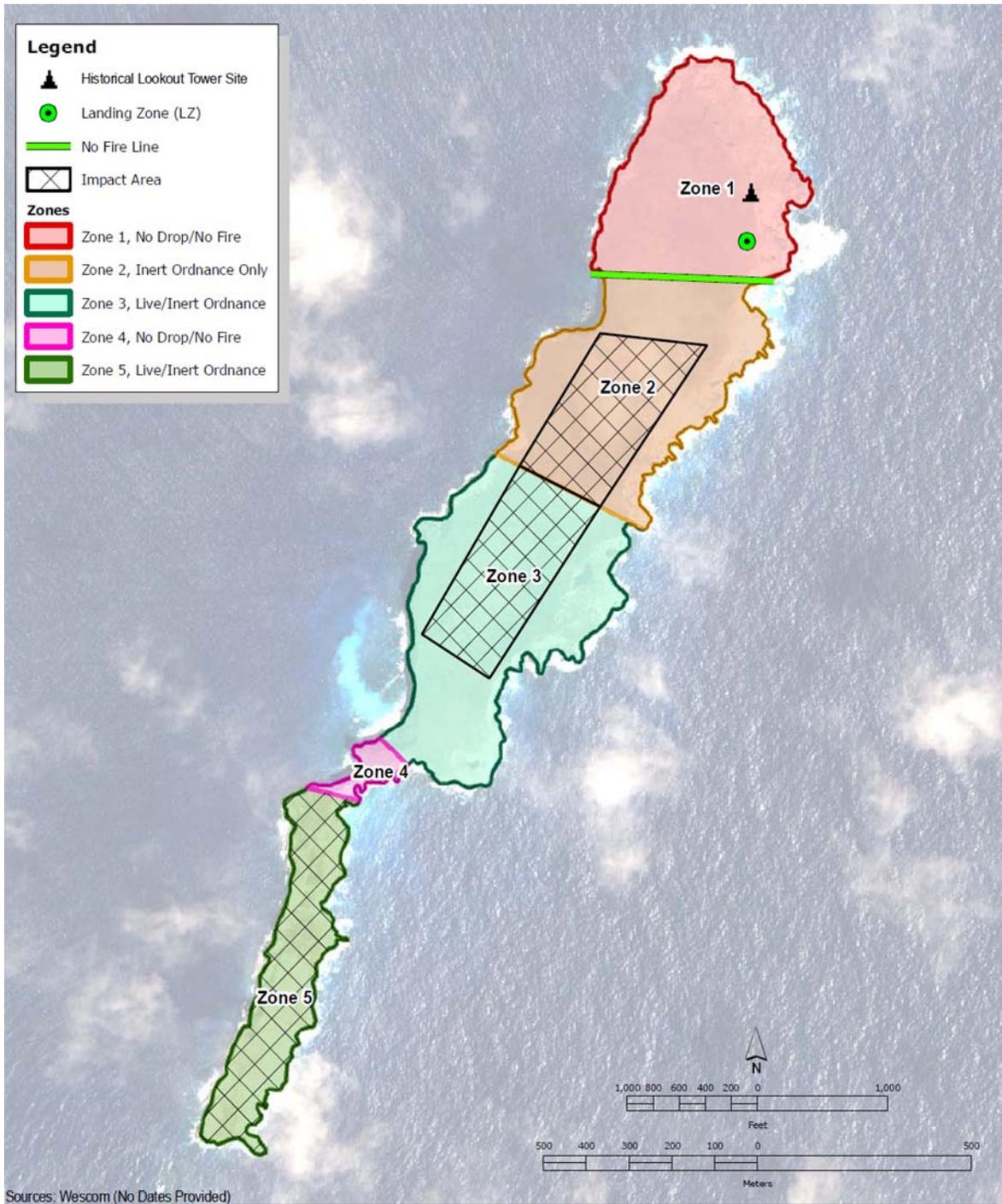
21 **5.3 History and Pre-Military Land Use**

22  
23 An archaeological survey conducted in 1997 concluded it is unlikely that a permanent  
24 human population ever resided on FDM due to the lack of water, exposed environment, and  
25 difficult beach landing (Belt Collins 1997).  
26

27 The island does have a history of exploitation for human consumption. At the turn of the  
28 20<sup>th</sup> century, exotic feathers for the European, American, and Australian hat industry were  
29 in high demand. Historical records show that between 1897 and 1914 more than 3.5 million  
30 seabirds were killed on islands in the central Pacific Ocean, including FDM and other islands  
31 in the Marianas (Spennemann 1998, 1999). The Northern Marianas at the time were  
32 controlled by German, purchased from Spain in 1898 (Spennemann 1999). Germany  
33 supplied licenses to private companies for the harvest of native birds with little regulatory  
34 control. Tropic birds, brown boobies, frigatebirds, and white terns were especially sought  
35 after and hunted to the verge of extinction (Spennemann 1999).  
36

37 FDM was leased by Germany in 1909 for the exploitation of birds after typhoons wrecked  
38 Alamagan, Pagan, and Anatahan. The lease was eventually terminated in 1911 after a  
39 leaser breached the contract by failing to plant coconut trees (Spennemann 1999). By the  
40 end of the lease, bird numbers were reduced to the point where further hunting became  
41 uneconomical. German control over the Northern Mariana islands was lost in 1914 when it  
42 was annexed by Japan (Spennemann 1999).  
43

44 Japan retained possession of FDM until 1944 when United States defeated Japan during  
45 World War II.  
46



1  
2 Figure 44. FDM land use map including military training constraints and opportunities. The  
3 five zones represent the different areas of bombardment regulations  
4

1

## 2 **5.4 Regional Land Uses**

3

4 DoD live-fire and inert ordnance training is the only land use permitted on FDM. The U.S.  
5 Navy has leased FDM from the CNMI since 1971 and negotiated a 50-year agreement in  
6 1983 with an option to renew for another 50 years. Public access to FDM is prohibited and  
7 there are no commercial or recreational activities on the island. During training exercises,  
8 marine vessels are restricted within a 3-mi (5 km) radius of the island.

9

10

## 11 **5.5 General Physical Environment**

12

### 13 **5.5.1 Climate**

14

15 FDM climate is tropical with mean daily temperatures of 75.2-89.6° F (24-32° C). Annual  
16 rainfall averages 78.7-102.4 in (200-260 cm) per year (Lusk et al. 2000b). The dry season  
17 occurs between January-April, with a rainy season from mid-July to mid-November. FDM is  
18 located within the northeast trade wind belt and can be frequently affected by typhoons  
19 (Falanruw et al. 1989).

20

### 21 **5.5.2 Topography and Geology**

22

23 FDM consists of coastal near-shore areas, perimeter cliff-lines (Figure 45), and interior flat  
24 mesic areas. The northern two-thirds of the island are separated from the southern  
25 peninsula by a partially collapsed isthmus. The surface elevation of the plateau is relatively  
26 flat, and gradually slopes east to west. The highest elevation is 82 ft (25 m).



27

28 Figure 45. Southern cliff line of FDM. Photo: SWCA

29

30 Geologically, FDM is formed from uplifted lithified limestone substrata with steep vertical  
31 walls with numerous wave-cut caves, notches, and collapsed sinkholes. The perimeter is  
32 characterized by steep eroding sea cliffs to 82 ft (25 m) from the surrounding ocean. There

1 is substantial natural erosion resulting in many regions of mass wasting where large  
2 sections of deteriorated rock have slid into the ocean.

### 3 **5.5.3 Soil**

4  
5 There is no published information on the island's soil. The island's uplifted limestone geology  
6 is similar to Tinian and Rota and it is likely that similar soils have formed on FDM. Soils  
7 found on FDM are most likely shallow with frequent rock outcrops. Pockets of deeper soil  
8 may be present. The beaches are composed of very coarse carbonate sand and small  
9 rubble/cobble fragments.

10

### 11 **5.5.4 Hydrology and Ground Water Resources**

12

13 No published data exists on the hydrology or aquifer presence on FDM (Belt Collins 1999).

14

### 15 **5.5.5 Surface Water**

16

17 FDM possess no standing fresh water.

18

### 19 **5.5.6 Infrastructure**

20

21 U.S. Navy has placed various metal targets within designated impact areas over the years.  
22 Historically, a 50 ft (15.24 m) tall observation tower was located in the elevated far  
23 northeastern interior part of FDM (Figure 44), but all that remains are remnants of the  
24 structure's foundation.

25

26

## 27 **5.6 General Biotic Environment**

28

### 29 **5.6.1 Ecosystems**

30

31 Three ecosystems can be found on FDM and are defined as coastal, cliff-line, and interior  
32 mesic terrace.

33

#### 34 5.6.1.1 Coastal

35 The island has two small intertidal beaches (e.g., Figure 46), one on the northeast coast  
36 and the other on the west coast, north of the isthmus. These beaches are composed of  
37 coarse carbonate sand and small rubble fragments (TEC Inc. 2005). Both beaches are  
38 inundated during high tide. These beaches appear to be shrinking each year due to  
39 landslides (Smith and Marx 2009).

40

41 The topographic structure of the coastal submerged lands is generally homogeneous around  
42 the entire island with several exceptions. The submerged shoreline just below the water line  
43 consists of a nearly vertical wall, which is the extension of the emergent cliff area. The  
44 underwater cliff extends to a depth of approximately 20 to 30 ft (6 - 9 m). Large submerged  
45 caves that reach into the base of the island are present in several areas. Submerged

1 limestone boulders lie at the base of the submerged cliff face (Marine Research Consultants  
2 and Belt Collins 2000). A shallow or shoal area composed of fossilized limestone extends  
3 seaward from the base of submerged shoreline cliffs with a depth of approximately 22 to 82  
4 ft (10 - 25 m) and a width of 98 to 164 ft (30 - 50 m).



5  
6 Figure 46. Aerial photo of FDM beach. Photo: A Brooke, NAVFACMAR  
7

8  
9 5.6.1.2 Cliff-line

10  
11 The cliff-line ecosystem consists of the vegetative communities on the steep sea cliffs  
12 (Figure 47). Migratory and resident seabirds use this habitat for nesting and resting.  
13 Substantial natural erosion has occurred in many these communities due to areas where  
14 large sections of deteriorated rock have fallen into the ocean. Ground dwelling and  
15 sprawling woody shrubs that are adapted to shallow soils, low soil moisture, and salt spray  
16 dominate cliff-line ecosystems. Plant communities do not appear to exist on vertical cliff  
17 faces or where rocks are inundated by wave action.  
18



1  
2 Figure 47. FDM has steep and dramatic cliff-line around most of the island. Photo: SWCA  
3 5.6.1.3 Wetland

4  
5 There are no wetlands occurring on FDM.

6  
7 5.6.1.4 Mesic Terrace

8  
9 The mesic terrace ecosystem consists of the interior portions of the island located on the  
10 high elevated flat plateau areas surrounded by cliff-line (Figure 48). This habitat includes  
11 grasslands and native forest areas used by migratory birds, Micronesian megapode, and  
12 Mariana fruit bat.  
13



1  
2 Figure 48. Aerial view of FDM mesic terrace. Photo by SWCA  
3

4  
5 5.6.1.5 Coral reefs  
6

7 True coral reefs are not found in FDM waters. Corals are usually scattered and occupy cliff  
8 faces (Figure 49), boulders, exposed bed rock, and dropped ordnance items (Smith and  
9 Marx 2009). Coral beds can contain the species from the genera of *Pocillopora*, *Acoropora*,  
10 *Porites*, *Montipora*, and *Millepora*. The leeward coast is more favorable for marine resources  
11 than the windward coast with its strong wave action. Based on a percentage of sea floor  
12 coverage, frequency of occurrence, and species diversity, stony corals (Scleratinia) are the  
13 dominant coral group at FDM. The two most abundant species of Scleratinia were  
14 *Pocillopora meandrina* and *Pocillopora eydouxi*. The coral found in the waters surrounding  
15 FDM are protected on both a federal and local level.  
16 During a 2006 study, all coral taxa present were considered in good health. However, a  
17 subsequent survey in 2007 found that the fire coral (*Millepora*), stony coral (*Scleratinia*),  
18 and soft coral (*Alconacea*) showed evidence of slight to severe bleaching (Figure 50). The  
19 coral bleaching around FDM was most apparent in the eastern portion of the southern half  
20 of the island. By 2008, all the fire and soft corals and 75 percent of hard coral had  
21 recovered from the 2007 bleaching event (Smith and Marx 2009).

22



1  
2 Figure 49. Example of lace coral (Order Stylasterina) in a cave off the coast of FDM at a  
3 depth of about 90 ft (27 m). Photo: D. Marx, NAVFAC. Source: (Smith and Marx 2009)  
4

5 Figure 50. A study in 2007 reported a regional bleaching event affecting the coral in FDM  
6 waters. Photo: S. H. Smith, NAVFAC. Source: (Smith and Marx 2009)  
7

8  
9 The crown of thorn starfish is an echinoderm which destroys corals by feeding on their  
10 polyps. This coral predator is well known from Guam and other islands in the Marianas  
11 (Randall 1972, Eldredge 2003). No crown of thorns were seen around FDM in surveys  
12 conducted in 2005, 2006, 2007, or 2008 (Smith and Marx 2009). The absence of the crown  
13 of thorns starfish on the coral of FDM was notable compared to abundant records around  
14 other islands in the Marianas. The lack of crown of thorns at FDM may be explained by the  
15 number and size of napoleon wrasse which persist due to the fishing restrictions around  
16 FDM. Napoleon wrasse is one of the few known predators of the crown of thorns (Smith and  
17 Marx 2009).  
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**5.6.2 Fauna**

Despite limited site visits and surveys conducted on FDM, the terrestrial fauna reported includes 25 birds, two mammals, two reptiles, and one land crustacean (Table 10).

Table 10. Terrestrial fauna recorded from FDM. Codes: R = Resident native, breeding; M = Migratory; U = Reported, but status unknown. Sources: Reichel and Glass (1991), Lusk et al. (2000b), Vogt (2009b).

	<b>Common Name</b>	<b>Genus</b>	<b>Species</b>	<b>Status on FDM</b>	
<i>Birds</i>	Black noddy	<i>Anous</i>	<i>minutus</i>	R	
	Bristle-thighed curlew	<i>Numenius</i>	<i>tahitiensis</i>	M	
	Brown booby	<i>Sula</i>	<i>leucogaster</i>	R	
	Brown noddy	<i>Anous</i>	<i>stolidus</i>	R	
	Cattle egret	<i>Bulbulcus</i>	<i>ibis</i>	M	
	Eurasian tree-sparrow	<i>Passer</i>	<i>montanus</i>	U	
	Fork-tailed swift	<i>Apus</i>	<i>pacificus</i>	M	
	Great frigatebird	<i>Frigata</i>	<i>minor</i>	M	
	Island collared-dove	<i>Streptopelia</i>	<i>bitorquata</i>	U	
	Mariana fruit-dove	<i>Ptilinopus</i>	<i>roseicapilla</i>	U	
	Masked booby	<i>Sula</i>	<i>dactylatra</i>	R	
	Micronesian megapode		<i>Megapodius</i>	<i>laperouse</i>	R
				<i>laperouse</i>	
		Micronesian starling	<i>Aplonis</i>	<i>opaca</i>	U
		Pacific golden-plover	<i>Pluvialis</i>	<i>fulva</i>	M
		Pacific reef-heron	<i>Egretta</i>	<i>sacra</i>	U
		Red-footed booby	<i>Sula</i>	<i>sula</i>	R
		Red-tailed tropicbird	<i>Phaethon</i>	<i>rubricauda</i>	U
		Ruddy turnstone	<i>Arenaria</i>	<i>interpres</i>	M
		Sooty tern	<i>Sterna</i>	<i>fuscata</i>	M
		Wandering tattler	<i>Heteroscelus</i>	<i>incanus</i>	M
		Wedge-tailed shearwater	<i>Puffinus</i>	<i>pacificus</i>	M
		Whimbrel	<i>Numenius</i>	<i>phaeopus</i>	M
		White tern	<i>Gygis</i>	<i>alba</i>	R
		White-tailed tropicbird	<i>Phaethon</i>	<i>lepturus</i>	U
	White-throated ground-dove	<i>Gallinolumba</i>	<i>xanthonura</i>	U	
<i>Mammals</i>	Mariana fruit bat	<i>Pteropus</i>	<i>mariannus</i>	U	
			<i>mariannus</i>		
	Rat	<i>Rattus</i>	spp.	U	
<i>Reptiles</i>	Pacific blue-tailed skink	<i>Emoia</i>	<i>caeruleocauda</i>	U	
	Oceanic snake-eyed skink	<i>Cryptoblepharus</i>	<i>poecilopleurus</i>	U	
<i>Crustacean</i>	Coconut crab	<i>Birgus</i>	<i>latro</i>	R	

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### **5.6.3 Threatened and Endangered Species**

#### 5.6.3.1 Birds

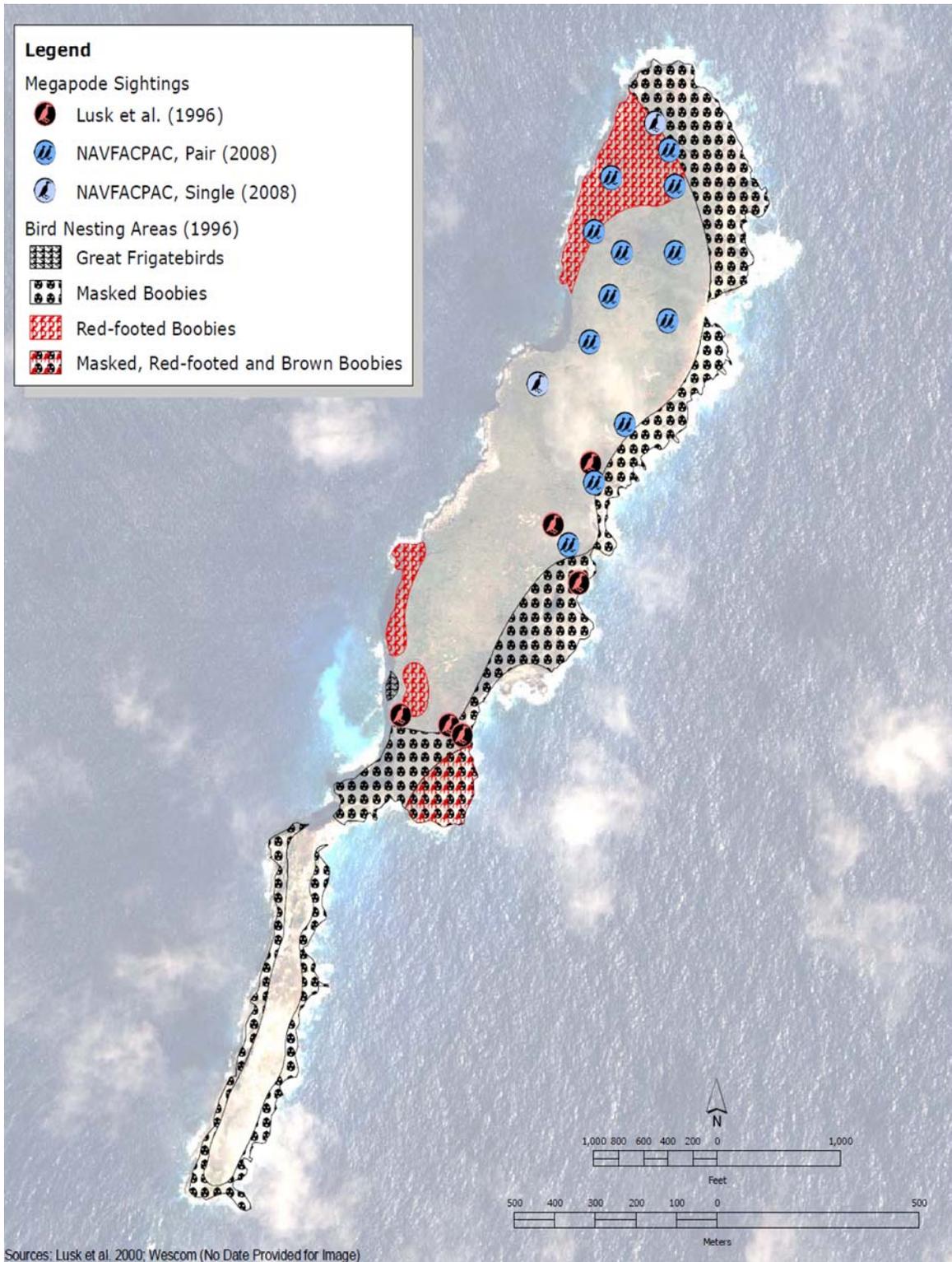
*Micronesian Megapode (Megapodius laperouse laperouse), Sasangat*

The Micronesian megapode (Figure 51) listed as federally endangered in 1970 (USFWS 1970), is the only federally endangered species present on FDM. In the past, the megapode was presumed absent from FDM (Falanruw 1975). In 1991, the megapode was listed as potentially inhabiting the island, based on a possible vocalization by H.D. Pratt and T.O. Lemke in 1984 (Reichel and Glass 1991). Four megapodes were observed by biologists in November 1996 and two were observed during a U.S. Navy site visit in December 1996 (Lusk et al. 2000b). Sixteen megapode detections representing a minimum of 11 birds were recorded during a December 2007 survey (Vogt 2009b). In August 2008, 12 pairs and four individual birds were detected during surveys, resulting in a minimum estimate of 28 megapodes on FDM (Vogt 2009b). Figure 52 shows FDM locations of Micronesian megapode sightings.

Burrows similar in shape and size to ones used by megapodes for nesting in the Northern Mariana Islands were noted in 1996 (Lusk et al. 2000b). Evidence of reproduction was documented in August 2008 when one juvenile and one chick were observed on the island (Vogt 2009b). Megapodes on FDM may serve as a critical genetic link for the rest of the population throughout the Mariana archipelago. The island is also believed to be a stopover location for dispersing megapodes from other islands (Lusk et al. 2000b).



1  
2 Figure 51. Micronesian megapode on FDM. Photo: S. Vogt, NAVFACPAC



1  
2 Figure 52. FDM biotic environment. Map includes sea bird breeding colonies and locations of  
3 sightings for the Micronesian megapode

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5.6.3.2 Mammals

*Mariana Fruit Bat (Pteropus mariannus mariannus), Fanihi*

The Mariana fruit bat is a medium-sized colonial flying fox that was listed as federally endangered on Guam by USFWS in 1984 (USFWS 1984). However, in 2005, the USFWS determined that movement of fruit bats between all islands in the Mariana archipelago occurs, resulting in exchange of genetic material. Consequently, Mariana fruit bats on Guam and throughout the CNMI comprise one subspecies and are now listed as federally threatened throughout their entire range (USFWS 2005c). In the Mariana Islands, the Mariana fruit bat is known to occur on all islands extending northward from Guam to Maug (Wiles et al. 1989b, Johnson 2001, Vogt 2009b).

In 1971, fishermen reported modest numbers of fruit bats on the island prior to bombing (Wiles et al. 1989b). Since then, observations of the Mariana fruit bat have occurred twice on FDM during ground surveys. A single fruit bat was observed by T. Sutterfield in the interior mesic terrace ecosystem during a 1996 U.S. Navy survey (Figure 53) (A. Brooke, 2009, NAVFACMAR, personal communication). During Micronesian megapode surveys in August 2008, one fruit bat (Figure 54) was observed flying south in the northern region of the island, just north of the No Fire Line. The bat was being harassed and chased by a group of four to seven brown noddies, which altered the bat’s flight path to the north and out of the observer’s sight (S. Vogt 2010, NAVFACPAC, in litteris). These observations suggest that the island is utilized by a small number of bats, possibly as a stopover location. The limited availability of foraging and roosting habitat may restrict the number of fruit bats recorded on FDM to solely individuals moving between islands.



1  
2 Figure 53. Mariana fruit bat sighted on FDM in 1996. Photo: T. Sutterfield, NAVFACPAC



3  
4 Figure 54. Mariana fruit bat observed on FDM in August 2008. Photo: S. Vogt, NAVFACPAC

5  
6 5.6.3.3 Reptiles

7  
8 Two species of sea turtle recorded in FDM's waters are federally listed: the green sea turtle  
9 (threatened) and hawksbill turtle (endangered). Enforcement of the ESA for sea turtles is  
10 shared between the USFWS and the NMFS. USFWS's jurisdiction applies when listed sea

1 turtles utilize beaches for nesting purposes and NMFS retains jurisdiction when the species  
2 are present in the marine environment. There are no terrestrial reptiles federally listed as  
3 threatened or endangered on FDM.

4  
5 *Green Sea Turtle (Chelonia mydas), Haggan*

6 Green sea turtles have been observed in the waters surrounding FDM. During marine  
7 surveys conducted between 1999 and 2004, 25 green sea turtles were recorded in FDM's  
8 waters (TEC Inc. 2005). Twenty-two sightings of green sea turtles were documented during  
9 boat and underwater surveys in 2006 and 2007 (Smith and Marx 2009).

10  
11 *Hawksbill Turtle (Eretmochelys imbricata), Haggan karai*

12 Although rarely sighted, hawksbill turtles have been detected in FDM's waters. During  
13 marine surveys in 2001 and 2004, two and one hawksbill turtles respectively, were  
14 observed at FDM (TEC Inc. 2005). Two hawksbills were sighted during surveys in 2006  
15 (Smith and Marx 2009).

16  
17 Monthly surveys of sea turtles are carried out from a helicopter at FDM by U.S. Navy  
18 biologists. Identifying turtles to species is not possible because of the altitude of the  
19 helicopter, but most turtles are believed to be green sea turtles (Vogt 2008c). The number  
20 of individuals recorded during each survey is usually low (1-3). However, 12 turtles were  
21 sighted in November 2007 (Vogt 2008c). Neither green sea nor hawksbill turtles are known  
22 to nest on FDM's beaches. The beaches on FDM are unsuitable for sea turtle nesting (TEC  
23 Inc. 2005, Smith and Marx 2009).

24  
25 **5.6.4 Species of Interest**

26  
27 5.6.4.1 Migratory Birds

28  
29 FDM serves as an important stopover location for migratory bird species, including a  
30 number of shorebirds, waterbirds, and seabirds. These birds use FDM to carry out resting  
31 and foraging activities during their respective non-breeding seasons. Migratory birds  
32 identified on FDM include the whimbrel, bristle-thighed curlew, Pacific golden-plover, sooty  
33 tern, cattle egret, wandering tattler, and ruddy turnstone (Lusk et al. 2000b). A list of  
34 migratory birds that have been recorded from FDM can be found in Table 10.

35  
36 5.6.4.2 Resident Breeding Seabirds

37  
38 Six species of seabird are breeding residents on FDM: black noddy, brown noddy, masked  
39 booby (Figure 55), red-footed booby (Figure 56), brown booby (Figure 57), and white tern  
40 (Figure 58). The location of masked booby, red-footed booby, brown booby and great  
41 frigate bird recorded by Lusk et al. (1996) and Vogt (2009b) are shown in Figure 52.  
42 Monthly systematic surveys of the three booby species were carried out by U.S. Navy  
43 biologists between 1999 and 2009, and now quarterly surveys are conducted. Red-footed  
44 boobies, which roost and nest in trees, appear more common than masked and brown  
45 boobies, which roost and nest on the ground. Results from 40 surveys conducted between  
46 January 2005 and December 2007 showed an average of 511 red-footed boobies, 119

1 masked boobies, and 108 brown boobies were tallied each month (Vogt 2008c). However,  
2 individual numbers of all three booby species fluctuate seasonally (P. Wenninger 2010,  
3 NAVFACMAR, in litteris). FDM is especially important for the masked booby as it is the  
4 largest known nesting site for the species in the Mariana archipelago (Lusk et al. 2000b).



5  
6 Figure 55. Masked boobies on FDM. Photo: SWCA



7  
8 Figure 56. Red-footed booby on FDM. Photo: SWCA  
9



1  
2 Figure 57. Brown booby adult and nestling on FDM. Photo: S. Vogt, NAVFAC PAC



3  
4 Figure 58. White tern. Photo: A. Brooke, NAVFACMAR

5  
6 5.6.4.3 Invertebrates

7  
8 *Coconut Crab (Birgus latro), Ayuyu*

9 Coconut crabs occur on every island in the Mariana archipelago (Berger et al. 2005). The  
10 coconut crab (Figure 59) is the largest land invertebrate in the world and can attain large  
11 sizes with a leg span of approximately 3 ft (90 cm) and weight over 10 lbs (5 kg) (Vogt and  
12 Williams 2004). Due to its large size and edible flesh, the coconut crab is a valued food item  
13 for indigenous people of the Marianas (Vogt 2008b). The crab is an omnivorous scavenger,  
14 consuming invertebrates, carrion, fruit, and decaying vegetation (Berger et al. 2005).

15  
16 Coconut crabs, including one female with eggs, were observed on FDM in August 2008 (N.  
17 Johnson, 2008, SWCA Environmental Consultants, personal observation). The coconut crab  
18 is not listed as threatened or endangered by the USFWS or CNMI government. It is a CNMI  
19 game species and is legally hunted during the 15 September to 15 November hunting  
20 season. Each hunter is allowed a bag limit of five and a season limit of 10 crabs, with the

- 1 harvest of all crabs with carapace width less than three inches and females carrying eggs  
2 prohibited (DLNR 2000).



3  
4 Figure 59. Coconut crab. Photo: SWCA

5  
6 5.6.4.4 Fishes

7  
8 There were at least 42 fish families identified in the waters surrounding FDM in surveys  
9 conducted in 2006, 2007, and 2008 (Smith and Marx 2009). These include surgeonfish and  
10 unicorn fish (Acanthuridae), triggerfish (Balistidae), parrotfish (Scaridae), wrasse  
11 (Labridae), soldierfish and squirrel fish (Holocentridae), and the chubs and rudderfish  
12 (Kyphosidae).

13  
14 Wrasses are one of the most abundant taxonomic groups in FDM waters and include the  
15 Napoleon or humphead wrasse (*Cheilinus undulatus*). In 2004, the humphead wrasse was  
16 listed in the Federal Register as a species of concern (NOAA 2004). The humphead wrasse is  
17 also listed as endangered by the IUCN Red List (Russell 2004). The most common large  
18 snapper was the twin-spot snapper (*Lutjanus bohar*). The most common medium-sized  
19 groupers were the peacock grouper (*Cephalopholis argus*) and the lyretail grouper (*Variola*  
20 *louti*). Numerically, sleek unicornfish (*Naso hexacanthus*) were dominant among the  
21 surgeonfishes. Bluefin trevallies (*Caranx melampygus*), black jacks (*Caranx lugubris*),  
22 bigeye trevallies (*Caranx sexfasciatus*), and rainbow runners (*Elagatis bipinnulata*) were the  
23 most frequently sighted jacks (Smith and Marx 2009).

24  
25 Five species of shark have been consistently recorded in biennial surveys of 50 U.S. Pacific  
26 Islands including the Marianas from 2000 to 2007. These include the grey reef shark  
27 (*Carcharhinus amblyrhynchos*), Galapagos shark (*Carcharhinus galapagensis*), whitetip reef  
28 shark (*Triaenodon obesus*), blacktip reef shark (*Carcharhinus melanopterus*), and tawny  
29 nurse shark (*Nebrius ferrugineus*) (Nadon et al. 2008). Results from 2006, 2007, and 2008  
30 surveys conducted around FDM, found the whitetip reef shark was the most common shark  
31 noted. The largest shark identified was the tawny nurse shark seen in 2006 and 2008 and  
32 estimated at 10 ft (3 m) (Smith and Marx 2009). Shark numbers in the Marianas have been  
33 in decline due to overfishing. Several species of ray have been identified, with the spotted

1 eagle ray (*Aetobatis narinari*) and the black blotched stingray (*Taeniura meyeni*) being the  
2 most common (Smith and Marx 2009).

3

#### 4 **5.6.5 Introduced Species**

5

6 The island collared-dove and Eurasian tree-sparrow are the only introduced bird species  
7 recorded from FDM (Reichel and Glass 1991, Lusk et al. 2000b). Sparrows are believed to  
8 have colonized FDM from Saipan (Lusk et al. 2000b). Four sparrows were observed in 1996  
9 (Lusk et al. 2000b), but none were recorded in August 2008 (Vogt 2009b). Small-sized rats,  
10 believed to be *Rattus exulans*, were commonly observed in 2008 (Vogt 2009b). Specimens  
11 were not collected so identification to species level was not possible.

12

#### 13 **5.6.6 Flora**

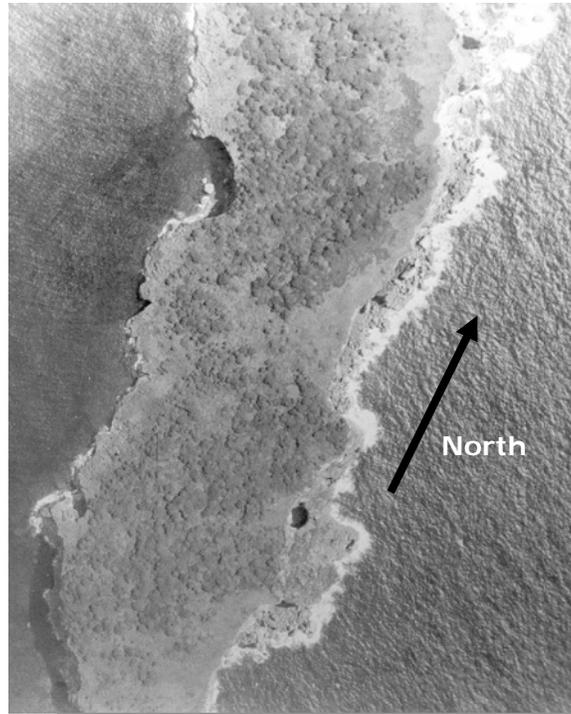
14

15 Few vegetation surveys have been conducted on FDM. The first published flora record by  
16 Fritz in 1902 described the island as a plateau covered by brush approximately 13 ft (4 m)  
17 high (Mueller-Dombois and Fosberg 1998). A brief botanical survey of the northern portion  
18 of the island carried out in 1996 identified 43 plant species, 32 of which were native  
19 (Whistler 1996). During Micronesian megapode surveys in August 2008, common and  
20 identifiable plant species were also recorded (Vogt 2009b). Table 11 provides a list of plant  
21 species observed during the 1996 and 2008 trips to FDM.

22

23 The impact that typhoons and military bombardment have had on the island flora over time  
24 are unknown. Aerial images from 1944 show larger areas of taller forest than are currently  
25 found on the island (Figure 60 and 61).

26



1  
2 Figure 60. Aerial photograph from 1944 showing forest within the mesic terrace ecosystem.  
3 Photo: A. Brooke, NAVFACMAR



4  
5 Figure 61. Aerial photograph from 2009 showing few forested areas within the mesic terrace  
6 ecosystem. Photo: P. Wenninger, NAVFACMAR

1

Table 11. Plant species recorded on FDM in 1996 and 2008. Codes: N = Native; I = Introduced. Sources: Whistler (1996), Vogt (2009b)

Family	Genus	Species	Common Name	Local name	Description	Status
Acanthaceae	<i>Blechum</i>	<i>brownei</i>		Yerbas babui	Herb	I
Aizoaceae	<i>Sesuvium</i>	<i>portulacastrum</i>	Seaside purslane	Chara	Succulent herb	N
Amaranthaceae	<i>Achyranthes</i>	<i>canenscens</i>			Herb	N
	<i>Amaranthus</i>	<i>viridis</i>		Kulettes apaka	Perennial herb	I
Amaryllidaceae	<i>Crinum</i>	<i>asiaticum</i>	Crinum	Piga-palayi	Herb	N
Asteraceae	<i>Wollastonia</i>	<i>biflora</i>	Beach sunflower	Masigsig	Herb	N
Capparaceae	<i>Capparis</i>	<i>cordifolia</i>	Spiny caper	Atkaparas	Woody shrub	N
Caricaceae	<i>Carica</i>	<i>papaya</i>	Papaya	Bweibwayul mwel	Small tree	I
Clusiaceae	<i>Calophyllum</i>	<i>inophyllum</i>	Alexandrian laurel	Da'og	Tree	N
Convolvulaceae	<i>Ipomoea</i>	<i>pes-caprae</i>	Beach morning glory	Alalag-tasi	Trailing vine	N
	<i>Operculina</i>	<i>ventricosa</i>			Vine	I
Cyperaceae	<i>Fimbristylis</i>	<i>cymosa</i>			Grass	N
	<i>Mariscus</i>	<i>javanicus</i>			Grass	N
Euphorbiaceae	<i>Chamaesyce</i>	<i>hirta</i>	Garden spurge	Golandrina	Herb	I
	<i>Excoecaria</i>	<i>agallocha</i>	Blinding tree		small tree	N
	<i>Phyllanthus</i>	<i>amarus</i>		Maigo-lalo	Herb	I
Fabaceae	<i>Pongamia</i>	<i>pinnata</i>		Gulos	Tree	N
Mimosaceae	<i>Leucaena</i>	<i>leucocephala</i>	Hedge acacia	Tangantangan	Small tree	I
Malvaceae	<i>Abutilon</i>	<i>indicum</i>	Mallow	Matbas	Tall shrub	N
	<i>Gossypium</i>	<i>hirsutum</i> var. <i>taitense</i>	Cotton	Algodon	Small tree	N
	<i>Hibiscus</i>	<i>tiliaceus</i>	Beach hibiscus	Pago	Shrub	N
Moraceae	<i>Ficus</i>	<i>prolixa</i>	Banyan	Nunu	Large tree	N
Myrtaceae	<i>Eugenia</i>	<i>reinwardtiana</i>		A'abang	Small tree	N
Nyctaginaceae	<i>Boerhavia</i>	<i>albiflora</i>		Dafao	Herb	N
	<i>Boerhavia</i>	<i>repens</i>		Dafao	Herb	N
	<i>Pisonia</i>	<i>grandis</i>		Umumu	Tree	N
Poaceae	<i>Brachiaria</i>	aff. <i>reptans</i>			Small tree	I
	<i>Cynodon</i>	<i>dactylon</i>	Bermuda grass		Grass	I
	<i>Digitaria</i>	<i>gaudichaudii</i>			Grass	N

Family	Genus	Species	Common Name	Local name	Description	Status
	<i>Digitaria</i>	<i>radicosa</i>			Grass	N
	<i>Heteropogon</i>	<i>contortus</i>	Tangle-head		Grass	N
	<i>Lepturus</i>	<i>repens</i>		Lesaga	Grass	N
Portulacaceae	<i>Portulaca</i>	<i>australis</i>				N
	<i>Portulaca</i>	<i>lutea</i>	Sea purslane		Herb	N
	<i>Portulaca</i>	<i>oleracea</i> var.	Purslane	Botdolagas	Herbaceous weed	N
Rubiaceae	<i>Bikkia</i>	<i>tetrandra</i>		Gausali	Shrub	N
	<i>Hedyotis</i>	<i>strigulosa</i>			Shrub	N
	<i>Morinda</i>	<i>citrifolia</i>	Indian mulberry	Lada	Small tree	N
Solanaceae	<i>Physalis</i>	<i>angulata</i>	Wild cape gooseberry	Tomate chaca	Herb	I
Sterculiaceae	<i>Melochia</i>	<i>villosissima</i>		Sayafe	Shrub	N
Verbenaceae	<i>Callicarpa</i>	<i>candicans</i>		Qualitay	Woody shrub	N
	<i>Premna</i>	<i>serratifolia</i>		Ahgao	Shrub	N
	<i>Stachytarpheta</i>	<i>jamaicensis</i>	False verbena		Herb	I

### 5.6.7 Threatened and Endangered Species

There are presently no federally listed plant species on FDM. However, because botanical information is limited, the presence of listed species is possible. Two plants recorded on the island in 1996 (*Digitaria gaudichaudii* and *Gossypium hirsutum* var. *taitense*) are considered rare in the Mariana Islands (Whistler 1996). *D. gaudichaudii* was the only endemic plant species noted during the 1996 survey.

### 5.6.8 Vegetation Communities on FDM

#### 5.6.8.1 Coastal Ecosystem

Along the windward shoreline of FDM are large boulders interspersed with a cobble-covered bottom. The boulders are covered with microalgae of the genera *Padina*, *Liagora*, and *Asparagopsis*. The emergent portion of the beach is comprised of rubble/cobbles with little sand and no vegetation (TEC Inc. 2005).

In the region of the isthmus is a reef terrace in the form of a ridge and spur system with sand channels. Algae of the genera *Padina*, *Dictyota*, *Hamimeda*, *Lyngbya*, *Liagora*, *Neomeris*, and *Calupera* cover the upper surface of the ridges (TEC Inc. 2005).

Along the leeward coastline is a structurally unique submerged shoreline forming a vertical wall to a depth of 49 to 66 ft (15 to 20 m), undercut by ledges and caves. The exposed wall supports the green calcareous algae *Halimeda* and calcareous red algae (TEC Inc. 2005).

#### 5.6.8.2 Cliff-line Ecosystem

The dominant plant species in the cliff-line communities are *Exocoecaria aqallocha*, with less coverage by *Digitaria gaudichaudii*, *Bikkia tetandra* (Figure 62), *Hedyotis stringulosa*, and *Portulaca oleracea* (Whistler 1996).



Figure 62. *Bikkia tetandra*, locally known in the CNMI as gausali. Photo: SWCA

### 5.6.8.3 Mesic Terrace Ecosystem

Most of the mesic terrace ecosystem is dominated by dense herbaceous plant communities (Figure 63). Soils on the terrace are more developed and have higher moisture content than the cliff-line ecosystem soils. As a result, the once forested mesotropical environment supports greater diversity of plant species than observed in the cliff-line ecosystem.



Figure 63. Mesic terrace ecosystem on FDM. Photo: SWCA

The central region of the mesic terrace ecosystem is dominated by *Crinum asiaticum*, which is a large herbaceous lily. The spider lily (*Hymenocallis spp.*) is also common (P. Wenninger 2010, NAVFACMAR, in litteris). Other dominant species include *Wollastonia biflora*, *Mariscus javanicus*, *Capparis spinosa*, *Ipomoea pes-caprae*, *Boerhavia spp.*, *Portulaca lutea*, *Operculina ventricosa*, and *Pisonia grandis* (Whistler 1996). There is minimal vertical stratification of plant communities and few plants are greater than 6 ft (2 m) in height. The plant communities do not appear homogeneous and there is no discernable boundary between communities.

### **5.6.9 Introduced Species**

Only two introduced plant species are common on FDM – spider lilies (family Amaryllidaceae), and *Operculina ventricosa*. These species, native to tropical America, possibly arrived via floatation of its seeds from other islands (Whistler 1996). Less common are *Blechnum brownei*, *Amaranthus viridis*, *Leucaena leucocephala*, *Physalis anguilata*, and *Stachytarpheta jamaicensis* (Whistler 1996). *Physalis anguilata* may be visited by Mariana fruit bats, as *Physalis spp.* are known to be pollinated by Old World bats (Fleming et al. 2009).

## **6.0 FDM PROGRAM ELEMENTS**

### **6.1 Current and Completed Projects for FDM Supported by the U.S. Navy**

The U.S. Navy, in an effort to protect and preserve the biodiversity of FDM supports many on-going projects, as well as projects designed especially for mitigation of potential adverse impacts to the native species of the island. Continuing projects for FDM include regular fauna surveys, sea turtle monitoring, and monitoring for marine ecosystem health. A special project conducted on the CNMI islands of Sarigan and Anatahan was undertaken by the U.S. Navy to offset any adverse effects the Micronesian megapode may be experience as a result of military use.

#### **6.1.1 Long-term Projects for Island Health and Species Protection**

##### 6.1.1.1 Wildlife Monitoring via Helicopter

Surveys targeting FDM's seabirds occur quarterly. As the helicopter flies over the island, the island is visually sectioned off and searched for masked, red-footed, and brown boobies roosting or nesting on the island. The only flighted bird data collected is the great frigatebird. Any sea turtles and marine mammals spotted in the surrounding waters below are also recorded. These surveys have shown that masked and brown booby numbers have remained stable 2005-2007, while red-footed booby numbers were statistically lower in 2006-2007 than in 2005 (Vogt 2008c). Brown booby numbers have a mid-year peak, masked boobies a slight summer peak and red-footed boobies oscillate with no obvious pattern. Great frigate birds are seen most often from November to February (Vogt 2008c).

##### 6.1.1.2 Marine monitoring

The near-shore waters of FDM have been surveyed annually since 1999 for the health of its marine mammal, fish populations, invertebrates and coral. The presence of UXO is noted (Figure 64) along with a review of military use impacts to the marine community. These surveys have been able to help identify natural trends and distinguish between natural and anthropogenic impacts. Recent surveys of FDM waters have found its communities in good health one of the best near shore marine resources in the Mariana archipelago (Smith and Marx 2009). Underwater surveys conducted less than a week after major training exercises found no significant adverse effects to the marine natural resources (Smith and Marx 2009).



Figure 64. Inert bomb on FDM sea floor at a depth of 12m (2007). Photo: S. Smith, NAVFAC. Source: (Smith and Marx 2009)

## **6.1.2 Completed Projects**

### 6.1.2.1 Ungulate removal from Sarigan

As mitigation for impacts imposed on Micronesian megapodes on FDM, feral pigs and goats (Figure 65) were removed from the island of Sarigan to impede further habitat degradation by these species. The intended outcome of this project was to halt and reverse forest loss while improving habitat for the Micronesian megapode. Removal of goats and pigs was conducted via helicopter, ground shooting, trapping, and tracking with dogs in 1998. Additional control was conducted in 1999 and 2000 to ensure complete removal. As a result of this initiative, Sarigan is now considered free of feral ungulates. Preliminary vegetation monitoring has demonstrated the desired outcome of increases in plant species richness and recruitment (Kessler 2004).

### 6.1.2.2 Ungulate removal from Anatahan

Also as mitigation for impacts to Micronesian megapodes on FDM, feral pigs and goats were removed from Anatahan. This project was initiated after the ungulate work conducted on Sarigan. The project has experienced many difficulties due to the eruption of the island's volcano. However, to date all goats have been removed. One large boar was shot in a return trip to the island in May 2009. There are estimated to be 5 or less pigs remaining on the island (Kessler 2010). The May 2009 trip reported that many parts of the island are still bare from the volcanic eruption, however native plants (e.g., *Hibiscus tiliaceus*, *Morinda citrifolia*, *Barringtonia asiatica*, and *Ficus spp.*) were observed. One fruit bat was seen during the trip (Kessler 2010).



Figure 65. Feral goats on Sarigan. Photo: N. Johnson

## 6.2 Threatened and Endangered Species, and Species of Interest

### 6.2.1 Birds

#### 6.2.1.1 Micronesian Megapode (*Megapodius laperouse laperouse*), Sasangat

Status: Federally Endangered.

FDM was surveyed for the presence of megapodes in December 2007 and August 2008. Sixteen birds were documented in the 2007 study and 28 birds in 2008. In 2008, one chick and one juvenile were documented. The 2008 survey result is considered a minimum population estimate for the island. Megapode numbers from these two surveys are consistent with past findings for the island. The presence of the chick and juvenile in 2008 indicates that breeding is occurring. A small population is present on the island in spite of FDM's usage as an active range with the majority of the megapodes located in the "no fire zone" of FDM (Vogt 2009b).

#### *Threats to the Micronesian Megapode on FDM*

General threats to the megapode on FDM are habitat loss and the introduction of invasive species such as the brown treesnake. The introduction of the brown treesnake to FDM would likely have a negative effect on the megapodes present on the island.

Military associated live fire activities on FDM are thought to directly impact megapode populations and contribute to occasional megapode mortality. Impacts to the megapode in relation to an augmented military presence are noise increases, a raised risk of BTS introduction, wildfire, percussive forces from explosions, direct strikes from munitions, and wildfires (U.S. Navy 2009).

*Management Strategy*

- Targeting restrictions from vessels and aircraft (MISSILEX A-G, GUNEX A-G, FIREX, AAV), including;
  - No targeting eastern cliffs;
  - West only firing direction;
  - No firing south of “No Fire Line”.
- Specific BOMBEX and MISSILEX A-G restrictions, including;
  - Target restrictions to two impact areas on the southern peninsula interior plateau;
  - Cluster bombs and fuel-air explosives or other incendiary devices are prohibited;
  - Direct fire at designated targets in place to avoid conservation areas (U.S. Navy 2009).

*Associated Projects*

- Avian monitoring.
- FDM rat eradication.
- Megapode life history study.
- Megapode abundance surveys every five years.
- Home range and habitat use of megapodes on FDM.
- Bird survey data consolidation.

**6.2.2 Mammals**

**6.2.2.1 Mariana Fruit Bat (*Pteropus mariannus mariannus*), Fanihi**

Status: Federally Threatened.

Although limited, Mariana fruit bat sightings do occur on FDM. These observations suggest that the island is utilized by a small number of bats, possibly as a stopover location. The limited availability of foraging and roosting habitat may restrict the number of fruit bats recorded on FDM to solely individuals moving between islands.

*Threats to the Mariana Fruit Bat on FDM*

The primary threat to the Mariana fruit bat in its range is illegal hunting by humans. However, as FDM is unoccupied and an active range, hunting is of minimal concern on the island.

Mariana fruit bats utilizing FDM land could be exposed to threats associated with military live-fire training. Amplified military efforts would result in the increase of noise, potential BTS or other invasive species introduction, wildfire, percussive force from explosions, or direct strike from munitions.

*Management Strategy*

- Targeting restrictions from vessels and aircraft (MISSILEX A-G, GUNEX A-G, FIREX, AAV), including;
  - No targeting eastern cliffs;
  - West only firing direction;

- No firing south of "No Fire Line".
- Specific BOMBEX and MISSILEX A-G restrictions, including;
  - Target restrictions to two impact areas on the southern peninsula interior plateau;
  - Cluster bombs and fuel-air explosives or other incendiary devices are prohibited;
  - Direct fire at designated targets in place to avoid conservation areas(U.S. Navy 2009).

*Associated Projects*

- There are no proposed projects in relation to the Mariana fruit bat on FDM.

### **6.2.3 Reptiles**

#### **6.2.3.1 Sea Turtles**

*Hawksbill sea turtle (Eretmochelys imbricata), Haggan karai*

Status: Federally Endangered.

*Green sea turtle (Chelonia mydas), Haggan*

Status: Federally Threatened.

The green sea turtle are regularly observed in FDM's near-shore waters. Eighteen green sea turtle were observed in the waters surrounding FDM between the years of 2006-2008. Two hawksbill turtles were observed during 2006 (Smith and Marx 2009). Due to the lack of sandy beaches on the island, FDM is not considered suitable habitat for sea turtle nesting (TEC Inc. 2005,Smith and Marx 2009).

*Threats to Sea Turtles in FDM Water*

Sea turtles are a valued food source for the local people of the Marianas. It is possible that illegal take by fisherman in the waters surrounding FDM is occurring.

*Management Strategy*

- There is no management strategy specific to sea turtles.

*Associated Projects*

- Sea turtle monitoring.
- Marine monitoring.
- FDM marine preserve.

### **6.2.4 Invertebrates**

There are no invertebrates of concern known on FDM. The coconut crab does occur on the island and is protected by the CNMI government. However, protection is in relation to human consumption which is not a factor on FDM.

### 6.2.5 Marine Mammals

Confirmed sightings include two marine mammal species sighted between the years 2006-2007, and a pod of approximately 6 orcas were observed in June 2010. The species observed were the humped-back whale (*Megaptera novaeangliae*) and spinner dolphin (*Stenella longirostris*). These marine mammals were sighted approximately 400 m off FDM. An unconfirmed sighting could have potentially been a Brydes whale (*Balaenoptera brydei*) or Minke whale (*Balaenoptera acutorostrata*) was seen 50 km north of Saipan (Vogt 2008c).

#### *Threats to Marine Mammals in FDM Water*

There are no identified threats specific to marine mammals in the vicinity of FDM.

#### *Management Strategy*

- There is no management strategy specific to marine mammals.

#### *Associated Projects*

- Marine monitoring.
- FDM marine preserve.

### 6.3 Wetlands

There is no wetland habitat supported on FDM.

### 6.4 Fish and Wildlife Resources

No human population resides on FDM and hunting of wildlife on the island is not known to occur. Fishing is allowed in the waters surrounding FDM when military training activities are not in progress.

#### *Threats to Fish and Wildlife Resources of FDM*

While the fish population of FDM appears healthier than that of the waters surrounding Guam, commercial fishing has been reported to occur near FDM (Smith and Marx 2009). Over fishing has had a detrimental effect to the islands of the Marianas by reducing fish populations and minimizing fish biomass (Minton et al. 2009). Additionally, shark populations in the Marianas have experienced a marked decline resulting from human fishing practices. The harvesting of the green and hawksbill sea turtles in the Marianas is illegal, however these turtles are considered a desirable food source by local residents and illegal take of sea turtles may occur.

#### *Management Strategy*

- There is no management strategy specific to fish and wildlife resources.

#### *Associated Projects*

- Sea turtle monitoring.
- Marine monitoring.
- FDM marine preserve.

## 6.5 Forests

The majority of FDM's flora communities occur in the mesic terrace ecosystem located on the island's plateau. Predominate plant types are herbaceous plants and woody shrubs. Minimal vertical stratification occurs within the plant communities and few plants reach a height greater than 6 ft (2 m). Woody trees are absent or few. The trees that have been identified are *Carica papaya*, *Leucaena leucocephala*, *Ficus prolixa*, *Eugenia reinwardtiana*, *Pisonia grandis*, and *Morinda citrifolia* (Whistler 1996).

### *Threats to FDM Forests*

The live-fire training occurring on FDM could have a negative impact to FDM forests. The primary forest is located at the northern end of the island outside of the active range. However, forest vegetation could be damaged in the event of a fire. Typhoons are a common occurrence in the CNMI and can severely damage FDM forests. For example, typhoons that struck in September and October 2009 severely impacted trees and other vegetation on FDM, where many trees were knocked down and soil erosion was evident on the island. Additionally, herbivory by rats on sapling trees is known to hinder forest regeneration.

### *Management Strategy*

- Targeting restrictions from vessels and aircraft (MISSILEX A-G, GUNEX A-G, FIREX, AAV), including;
  - No targeting eastern cliffs;
  - West only firing direction;
  - No firing south of "No Fire Line".
- Specific BOMBEX and MISSILEX A-G restrictions, including;
  - Target restrictions to two impact areas on the southern peninsula interior plateau;
  - Cluster bombs and fuel-air explosives or other incendiary devices are prohibited;
  - Direct fire at designated targets in place to avoid conservation areas (U.S. Navy 2009).

### *Associated Projects*

- FDM rat eradication.
- FDM vegetation study.

## 6.6 Vegetation

Difficulties in physically accessing FDM have limited the amount of plant surveys for the island. The first survey of the island was conducted in by helicopter in 1984. That same year, 13 plant species were collected in a second survey, of which 12 were positively identified (Whistler 1996). In 1996, a more thorough survey was conducted, resulting in 40 positively identified species (Whistler 1996). Plant communities are dominated by salt and drought adapted ground dwelling and woody shrubs on the cliffs and herbaceous plants on the plateau.

### *Threats to the Vegetation of FDM*

Vegetation threats on FDM consist of biodiversity loss in the event of an invasive species introduction, wildfire, and ground disturbance from explosives. Herbivory by rats on sapling trees may hinder forest regeneration.

### *Management Strategy*

- Targeting restrictions from vessels and aircraft (MISSILEX A-G, GUNEX A-G, FIREX, AAV), including;
  - No targeting eastern cliffs;
  - West only firing direction;
  - No firing south of “No Fire Line”.
- Specific BOMBEX and MISSILEX A-G restrictions, including;
  - Target restrictions to two impact areas on the southern peninsula interior plateau;
  - Cluster bombs and fuel-air explosives or other incendiary devices are prohibited;
  - Direct fire at designated targets in place to avoid conservation areas.
- All personnel participating in military training are responsible for conducting self inspections. Inspections include all gear and clothing for soil, seeds and invertebrates (U.S. Navy 2009)

### *Associated Projects*

- FDM rat eradication.
- FDM vegetation study.

## **6.7 Coastal and Marine Resources**

The marine community surrounding FDM is less biologically diverse than the waters surrounding the larger islands in the Marianas. This is due to the islands small size, absence of reef, and lack of shallow water (Smith and Marx 2009). Fish communities sampled in 2006, 2007, and 2008 indicated a healthy fish fauna (Smith and Marx 2009). The invertebrate communities (i.e. algae, coral, macroscopic benthic invertebrates) sampled in the same surveys were abundant, diverse, and healthy when compared to other islands in the Mariana archipelago (Smith and Marx 2009). Commercially viable crustaceans are rare (Smith and Marx 2009). Reports have been made that commercial spear fishermen and commercial hook and line fishermen visit FDM (Smith and Marx 2009). As with many shark populations around the world, the Marianas archipelago has seen a decline in shark numbers as a result of over fishing (Smith and Marx 2009).

### *Threats to FDM Coastal and Marine Resources*

No sea turtles observed on 2006, 2007, or 2008 showed signs of fibropapilloma tumors, lesions, barnacles or abnormalities of any kind. Fish populations found in surrounding are either similar or healthier in numbers than those of the populated southern islands of the chain. No concerning fishing pressure is obvious (Smith and Marx 2009). However, commercial fishing has been reported to occur in the waters surrounding FDM.

Military range activity seems not to cause adverse effects to the surrounding marine communities. Smith and Marx (2009) indicated the coral communities at FDM are healthy and show no serious impacts from exploded ordnances. Additionally, no notable effects have been seen in regards to military activities for algae, marine invertebrates, or fish (Smith and Marx 2009).

#### *Management Strategy*

- There is no management strategy specific to FDM in regards to coastal resources.

#### *Associated Projects*

- Sea turtle monitoring.
- Marine monitoring.
- FDM marine preserve.

## **6.8 Non-Native Species**

The current presence of invasive species on FDM is limited to a species of rat thought to be the Pacific rat (*Rattus exulans*), which is present in the interior mesic ecosystem. Rats are known to reduce forest regeneration. Any future introductions of other non-native species would likely occur as a result of the placement of new bomb targets.

#### *Threats to FDM from Non-native Species*

Rats are known to prey upon bird eggs and nestlings. Mortality from rat predation can occur for the migratory and shore birds breeding on the island, as well as the Micronesian megapode. An introduction of the BTS, an invasive predator on Guam, is of serious concern to any island located in the CNMI. The BTS preys upon birds and is thought to be responsible for the extinction and extirpation of the majority of Guam's native forest birds.

Neighboring islands, including Saipan, possess invasive weed species like the scarlet gourd (*Coccinia grandis*), which could result in a loss of vegetative biodiversity in the event of its introduction (IUCN/SSG 2005).

#### *Management Strategy*

- All personnel participating in military training are responsible for conducting self inspections. Inspections include all gear and clothing for soil, seeds, invertebrates, and BTS.
- Outbound aircraft from Guam is inspected for BTS prior to departure.
- Area Training coordinated meetings for BTS interdiction prior to training execution phase and after activity reviews.
- Adherence to preventative BTS measures outlined by the BTS interdiction plan (U.S. Navy 2009).

#### *Additional Management Strategies*

- Participation in the Regional Biosecurity Plan.
- Utilization of prevention methods, such as Hazard Analysis and Critical Control Points (HACCP).

- Development of Regional Training Standard Operating Procedures and Exercise Planning.  
(U.S. Navy 2009)

*Associated Projects*

- FDM rat eradication.

## 6.9 Wildfire Land

FDM possess areas of grassland and forest that may support wildfires started by the detonation of explosive ordnance.

*Threats to FDM from Wildfires*

Wildfires may alter plant species composition. Fire-related destruction within the plant community may impede successional growth and facilitate the establishment of fire tolerant species. Fire can also cause direct mortality to faunal species in addition to habitat loss.

*Management Strategy*

- Targeting restrictions from vessels and aircraft (MISSILEX A-G, GUNEX A-G, FIREX, AAV), including;
  - No targeting eastern cliffs;
  - West only firing direction;
  - No firing south of “No Fire Line”.
- Specific BOMBEX and MISSILEX A-G restrictions, including;
  - Target restrictions to two impact areas on the southern peninsula interior plateau;
  - Cluster bombs and fuel-air explosives or other incendiary devices are prohibited;
  - Direct fire at designated targets in place to avoid conservation areas (U.S. Navy 2009)

*Additional Management Strategies*

- Clearing of UXOs on FDM will begin in 2010.
- Vegetation clearing is to occur in the area of the live fire range (A. Brooke 2010, NAVFAC, personal communication)

*Associated Projects*

- No projects have been proposed in relation to FDM wildfires.

## 6.10 Land Management

The primary purpose of DoD lands and waters is to support the mission. Land management issues within the scope of the INRMP are associated with soil and water conservation, freshwater management, non-point source pollution, agricultural outleasings, floodplain protection, coastal resource and habitat management, invasive species management. In order to address land management concerns, detailed information is needed concerning the

installations land-use, resident ecosystems, and environmental factors of concern. On-going research into these parameters is essential in achieving this goal.

*Land Management Factors Specific to FDM*

- Habitat loss due to military training activities.
- Invasive plants.
- An accidental establishment of the BTS.
- The importance of forest ecosystem to resident endangered and fauna.

*Associated Projects*

- FDM rat eradication.
- Mapping of FDM seabird nesting areas.
- FDM vegetation study.

### **6.11 Floodplains**

There are no flood planes on FDM.

### **6.12 Outdoor Recreation**

There is no outdoor recreation on FDM.

### **6.13 Bird/Animal Aircraft Strike Hazard**

A Bird/Animal Aircraft Strike Hazard (BASH) refers to a collision between an airborne animal and a flying aircraft. These collisions have the potential to cause accidents with human casualties (Cleary et al. 2006). FDM does not qualify for a BASH program or plan (A. Brooke 2010, NAVFACMAR, personal communication).

*Management Strategy*

- There is no current management strategy for BASH.

*Associated Projects*

- There are no BASH associated projects proposed.

### **6.14 Law Enforcement**

Due to the lack of human inhabitants on FDM, law enforcement on the island is not required. However, in the event law enforcement for FDM is necessary, it would fall to the responsibility of the CNMI DFW.

### **6.15 Agricultural Out-leasing**

No agricultural out-leasing occurs on FDM.

## 6.16 Other Leases

There are no other leases for FDM.

## 6.17 Migratory Birds

Historical debate has occurred with regard to the status of the Armed Forces and their susceptibility to the take of migratory birds as defined under the Migratory Bird Treaty Act (MBTA). Much of this debate centers on the use of FDM. The MBTA was passed in 1918 prohibiting the possession or killing of migratory birds unless provided with permission by the Secretary of the Interior. The U.S. Court of Appeals for the District of Columbia ruled in July of 2000 that the MBTA applies to all federal agencies. In March of 2002, there was an additional ruling by the U.S. District Court of Appeals for the District of Columbia that stated military training exercises conducted by the U.S. Navy which resulted in the take of migratory birds was in violation of the MBTA. This ruling was the result of a private lawsuit brought about by the use of FDM as a live-fire range. U.S. Navy training exercises on FDM were temporarily brought to a halt.

The Defense Authorization Act 2003 (DAA) states under section 315, that the Secretary of the Interior will authorize as is permitted under section 704(a) of the MBTA the exemption of the armed forces from regulations regarding the incidental take of birds. While the MBTA permit regulations are not in effect for military training activities, the 2003 DAA states that the DoD will give consideration to the protection of migratory birds while planning and executing military readiness activities, however not at the cost of diminishing those activities. The DoD will consult with the Secretary of the Interior to identify measures to:

- minimize and mitigate, to the extent practicable, any adverse impacts of authorized military readiness activities on affected species of migratory birds; and
- monitor the impacts of such military readiness activities on affected species of migratory birds.

The masked booby, red-footed booby, and brown booby are nesting, resident seabirds of FDM (Lusk et al. 2000b, Wiles 2005, Vogt 2008c). These three species are protected under the MBTA. Migratory birds identified on FDM are the whimbrel, bristle-thighed curlew, Pacific golden-plover, sooty tern, cattle egret, wandering tattler, and ruddy turnstone (Lusk et al. 2000b).

### *Threats to Migratory Birds on FDM*

Military associated live fire activities on FDM could affect migratory birds and contribute to occasional mortality. Impacts to the birds in relation to an augmented military presence are noise increases, a raised risk of BTS introduction, percussive forces from explosions, direct strikes from munitions, and wildfires (U.S. Navy 2009).

### *Management Strategy*

- Targeting restrictions from vessels and aircraft (MISSILEX A-G, GUNEX A-G, FIREX, AAV), including;

- No targeting eastern cliffs;
  - West only firing direction;
  - No firing south of "No Fire Line".
  - Specific BOMBEX and MISSILEX A-G restrictions, including;
    - Target restrictions to two impact areas on the southern peninsula interior plateau;
    - Cluster bombs and fuel-air explosives or other incendiary devices are prohibited;
    - Direct fire at designated targets in place to avoid conservation areas.
- (U.S. Navy 2009)

*Associated Projects*

- Avian monitoring.
- FDM rat eradication.
- Migratory bird population study.
- Bird survey data consolidation.
- Enhancement of migratory bird nesting sites.
- Mapping of seabird nesting areas.

## **6.18 Research Needs**

Research is an important component of an adaptive management strategy for natural resources. Any implemented plan would be ineffective without proper information on resident species and ecosystems. In addition to baseline knowledge on community composition and natural history, ongoing research provides information essential in understanding population trends. Monitoring population trends is a component of an adaptive management plan. Regular reviews of current scientific data will allow resource managers to understand whether current management strategies are working or if conservation measures need to be reassessed.

*On-going Projects Incorporating Research*

- Quarterly avifauna surveys.
- Quarterly sea turtle surveys.
- Marine monitoring.

*Additional Associated Research*

- Megapode life history study.
- Megapode abundance surveys every five years.
- Migratory bird population study.
- Home range and habitat use of megapodes on FDM.

## **6.19 Use of GIS**

The geographic information system (GIS) is a mapping tool that allows researchers and managers to visualize data in a way that can reveal patterns and trends in information on a landscape level. GIS can be used in natural resource management to monitor population demographics and their associated habitats.

*Proposed Projects for FDM Potentially Utilizing GIS*

- Megapode life-history study.
- Migratory bird population study.
- Mapping of FDM seabird nesting areas.
- FDM vegetation study.



# Implementation and Compliance

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## 7.0 INRMP PROCESSES

### 7.1 Project Drivers

The following legislation and government policies are integral in establishing the need for this document and its associated projects.

- Sikes Act of 1960 (16 USC 670) as amended by the Sikes Act Improvement Act of 1997.
- Endangered Species Act of 1973 (16 USC 1531)
- Migratory Bird Treaty Act of 1918 (16 USC 703)
- Coastal Zone Management Act of 1972 (16 USC 1451)
- Marine Mammal Protection Act of 1972 (16 USC 1361)
- Magnuson-Stevens Fishery and Conservation Management Act of 1976 (16 USC 1801-1882)
- Nonindigenous Aquatic Nuisance and Control Act of 1990 (16 U.S.C 4701-4751)
- Brown Tree Snake Control and Eradication Act of 2004 (Public Law 108-384)
- EO 13112 Invasive Species (3 February 1999)
- EO 13089 Coral Reefs (11 June 1998)
- EO 11990 Protection of Wetlands (24 May 1977)
- DoD Directive 4710.1 Archeological and Historic Resources Management (21 June 1984)
- DoD Instruction 4715.3 Environmental Conservation Program (3 May 1996)
- DoD Instruction 5090.10A Brown Treesnake Control and Interdiction Plan (14 February 2005)
- DoD Instruction 5090.1C Natural Resource Management (30 October 2007)
- DoD Instruction 11010.4 Encroachment Management Program (27 March 2007)
- Marianas Island Range Complex Record of Decision (September 2010)

## **7.2 Environmental Planning and Mission Sustainability**

The SAIA necessitates that an INRMP be prepared for all DoD installations in the United States possessing significant natural resources. According to the 2006 INRMP Guidance for Navy Installations, a successful INRMP will “ensure the sustainability of all ecosystems encompassed by an installation and ensure no net loss of the capability of installation lands to support the DoD mission.” These goals are complementary and not mutually exclusive. Healthy maintained natural resources preserve the environmental uniqueness of the installation. The installation's unique environment provides a varied natural setting for military training, which in turn increases military readiness. Managing natural resources in a sustainable fashion that provides for the continued use of the installation is in the best interest of the mission.

## **7.3 Achievement of No Net Loss**

Section 101 (16 USC 670a) stipulates that an INRMP must ensure the preparedness of the armed forces and be designed in such a way that there is “no net loss in the capability of the military installation lands to support the military mission of the installation”.

The primary suggested management components of the INRMP are comprised of mitigation and monitoring measures. No conservation projects are included in this INRMP that would alter the current training capacity of the military on Tinian or FDM or affect the overall goal of the mission.

## **7.4 Cooperative Agreements**

A cooperative agreement is authorized under section 103a (USC 670c-1A) of the Sikes Act as a means of providing for the maintenance and benefit of natural resources and natural and historic research on DoD installations. These agreements can be established between the Secretary of a military department and with States, local governments, non-governmental organizations, and individuals. Funds appropriated to the DoD may be allocated for the cost of goods and services provided for under a cooperative agreement during any 18-month period beginning in that fiscal year in accordance to the Sikes Act.

## **7.5 NEPA Compliance**

This INRMP is a revision of the INRMP prepared for Tinian and FDM in 2004. U.S. Navy policy states that either an EA or an EIS is to be completed prior to implementation of the INRMP. An EA was prepared in 2004 prior to the release of the original INRMP with a Finding of No Significant Impact (included as Appendix 1). The EA evaluates the environmental effects of the INRMP and meets the following requirements and guidance documents:

- NEPA (42 U.S. Code [USC] §4321-4347), as implemented by the Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508);
- Chief of Naval Operations [CNO], Instruction (OPNAVINST) 5090.1B Change-4, Environmental and Natural Resources Program Manual of 4 June 2003;

- Navy's Guidance on Preparing National Environmental Policy Act Documents for INRMPs (CNO 30 November 1998); and
- Navy's Procedures for Implementing the National Environmental Policy Act, 32 CFR 775 (23 February 2004).

The content of the NEPA analysis is programmatic in that it evaluates alternative programs for managing the MLAs resources. Specific projects are proposed with the intent to capture their overall impacts in a broad sense. The projects provide a framework for reviewing changes to on-going practices of natural resources management. A programmatic approach provides the installation opportunity to accommodate unforeseen projects and changes to projects as long as they are consistent with the goals and objectives of the INRMP. Additional project-specific NEPA documentation may be required prior to implementation of an individual project. Per ESA, any project that involves handling threatened and endangered species has potential for adverse impact and an ESA Section 7 consultation with USFWS and NMFS will be required prior to implementation.

## 7.6 Funding Processes

The DoD budget process is referred to as the Planning, Programming and Budgeting System (PPBS). One full cycle of the PPBS forecasting process includes the next budgeted fiscal year and projections for the following five-year period. Similarly, the INRMP upper command review cycle is five years. The PPBS process is as follows (DoD Directive 7045.14):

- Program managers (at the individual installation level of the Command hierarchy) present a list of proposed projects for a five-year interval. The list is referred to as a Future Year Defense Plan (FYDP).
- Annually, program managers reassess their budget requirements and reprioritize FYDP projects based on changing needs. The budget for the next fiscal year is proposed, as well as the subsequent 5 fiscal years. These five years are referred to as Program Objectives Memorandum (POM) 1 through 5.
- The POM review process occurs in the fall of each year and is the responsibility of the command level higher than the installation (i.e., Chief of Naval Operations (CNO)). The POM is submitted to the Office of the Secretary of Defense in the Spring.
- The Office of Secretary of Defense develops the President's budget that is submitted to Congress every February. Installations submit data to support the budget requests in the Spring and Fall of every year.

DoD Instruction 4715.3 Environmental Conservation Program, and OPNAVINST 5090.1B Change 1, Environmental Policy, Organization and Funding, describes the classification guidance for funding priorities.

*Class 0* – Recurring Natural and Cultural Resources Conservation Requirements, including administrative and personnel costs associated with program management that are necessary to meet compliance requirements:

- Permits and fees;
- Testing, monitoring and analysis;

- Equipment maintenance; and
- Program evaluations/assessments of progress.

*Class 1* – Projects required because the installation is currently (or imminently) out of compliance, including:

- Projects and activities are immediate and essential to maintain readiness of military mission; and
- Installation has received a consent order or enforcement action.

*Class 2* – Projects that could become Class I projects if established deadlines are not met.

*Class 3* – Enhancement actions, beyond compliance including activities that enhance conservation resources, however, are not specifically required under regulation or EO or not of an immediate nature. This classification includes CNO goals that demonstrate Federal leadership and good will.

The Office of Secretary of the Defense typically recommends funding for all Class 0, 1 and many Class 2 requirements.

Projects are submitted to EPR, a web-based database for project managers used for the programming and funding of conservation and natural resource projects. A level of U.S. Navy Environmental Readiness Level (ERL1-4) is then assigned to the project. U.S. Navy Environmental Readiness Levels are defined in OPNAVINST 5090.1C.

*Environmental Readiness Level 4 (ERL4)*

- Supports all actions specifically required by law, regulation or EO (DoD Class I and II requirements) just in time.
- Supports all DoD Class 0 requirements related to a specific statute such as hazardous waste disposal, permits, fees, monitoring, sampling and analysis, reporting and record keeping.
- Supports recurring administrative, personnel and other costs associated with managing environmental programs that are necessary to meet applicable compliance requirements (DoD Class 0).
- Supports DoD policy requirement to comply with overseas FGS and Overseas Environmental Baseline Guidance Document (OEBGD).
- Supports minimum feasible U.S. Navy executive agent responsibilities formally designated by OSD, participation in Office of the Secretary of Defense (OSD) sponsored inter-department and inter-agency efforts, and OSD mandated regional coordination efforts.

*Environmental Readiness Level 3 (ERL3)*

- Supports all capabilities provided by ERL4.
- Supports existing level of U.S. Navy EA responsibilities, participation in OSD sponsored inter-department and inter-agency efforts, and OSD mandated regional coordination efforts.
- Supports proactive involvement in the legislative and regulatory process to identify and mitigate requirements that will impose excessive costs or restrictions on operations and training.
- Supports proactive initiatives critical to the protection of U.S. Navy operational readiness.

*Environmental Readiness Level 2 (ERL2)*

- Supports all capabilities provided under ERL3.
- Supports enhanced proactive initiatives critical to the protection of U.S. Navy operational readiness.
- Supports all U.S. Navy and DoD policy requirements.
- Supports investments in pollution reduction, compliance enhancement, energy conservation and cost reduction.

*Environmental Readiness Level 1 (ERL1)*

- Supports all capabilities provided under ERL2.
- Supports proactive actions required to ensure compliance with pending/strongly anticipated laws and regulations in a timely manner and/or to prevent adverse impact to U.S. Navy mission.
- Supports investments that demonstrate U.S. Navy environmental leadership and proactive environmental stewardship.

## **7.7 Annual INRMP Metrics**

The DoN has developed two programs to assist installations in developing their INRMPs and tracking progress on INRMP implementation. The Navy INRMP Builder Program was designed to assist installation personnel with developing, or revising, their installation INRMP. The Navy Metrics Builder Program was developed to assist installations in evaluating INRMP implementation. Annually, each installation receives a report card informing them on where they stand regarding INRMP implementation. The program also requires each installation to address specific questions related to implementation to ensure that the implemented INRMP meets all regulatory requirements. Navy guidance suggests that projects progress be updated at least twice per year in EPR-web, and the information used to answer questions in the annual Natural Resources Data Call Station, which will be used to evaluate INRMP implementation.

## **7.8 Federal Anti-Deficiency Act**

All actions contemplated in this INRMP are subject to the availability of funds properly authorized and appropriated under Federal law. Nothing in this INRMP is intended to be, nor must be construed to be a violation of the Anti-Deficiency Act (31 U.S.C. 1341 et seq.).

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## **APPENDIX E**

### **BENEFITS FOR ENDANGERED SPECIES**



## APPENDIX E

### Benefits for Endangered Species

The objective of this appendix is to identify within the INRMP all management and conservation efforts for a federally listed species that the USFWS and NOAA Fisheries would use to consider when making a determination not to designate critical habitat on an installation. This will speed the review process by identifying upfront potential projects and actions to the installation, USFWS, or NOAA Fisheries to obviate the need to designate critical habitat on military installations.

The Endangered Species Act was revised (ESA Section 4(a)(3)(b)(i)) via the National Defense Authorization Act of 2004, which states that, —*The Secretary [of the Interior] shall not designate as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan prepared under section 101 of the Sikes Act (16 U.S.C. 670a), if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation.* The USFWS has determined that, where applicable, Federal critical habitat designation is not warranted if the INRMP includes the following three criteria (DOD 2002):

1. **The plan provides a benefit to the species.** Cumulative benefits of the management activities identified in a management plan, for the length of the plan, must maintain or provide for an increase in a species' population or the enhancement or restoration of its habitat within the area covered by the plan (e.g., those areas deemed essential to the protection of the species) A benefit could result from reducing fragmentation of habitat, maintaining or increasing populations, ensuring against catastrophic events, enhancing and restoring habitats, buffering protected areas, or testing and implementing new strategies.
2. **The plan provides certainty that the management plan will be implemented.** Persons charged with plan implementation are capable of accomplishing objectives of the management plan and have adequate funding for the management plan. They have the authority to implement the plan and have obtained all necessary authorizations or approvals. An implementation schedule (including completion dates) for the management effort is provided in the plan.
3. **The plan provides certainty that the management effort will be effective.** The following criteria will be considered when determining the effectiveness of the management effort. The plan includes (1) biological goals (broad guiding principles for the program) and objectives (measurable targets for achieving the goals); (2) quantifiable, scientifically valid parameters that will demonstrate achievement of objectives and standards for these parameters by which progress will be measured are identified; (3) provisions for monitoring and, where appropriate, adaptive management; (4) provisions for reporting progress on implementation (based on compliance with the implementation schedule) and effectiveness (based on evaluation of quantifiable parameters) of the management effort are provided; and (5) a duration sufficient to implement the plan and achieve benefits of its goals and objectives.

Federally threatened and endangered species that have the potential to occur on JRM sites are included in **Table E-1**.

The Commanding Officer of each JRM site has the authority to implement the plan, which will be accomplished by the environmental staff at NAVFACMAR JRM natural resources personnel at Naval Base Guam and Andersen Air Force Base as scheduled and budgeted. Formal adoption of an INRMP by the commander constitutes a commitment to seek funding and execute, subject to the availability of

funding, all Must Fund Projects and activities in accordance with specific timeframes identified in the INRMP. Under the Sikes Act, any natural resources management activity that is specifically addressed in the plan must be implemented (subject to availability of funds). Failure to implement the INRMP is a violation of the SAIA. Annual reporting on implementation of the current INRMP to both the USFWS and GDAWR has documented the commitment of JRM to acquire funding and implement the INRMP.

Goals, objectives, and strategies for management of listed species have been developed and are included in **Chapter 5, Section 5.3** of this INRMP.

**Table E-1: Federally and Government of Guam Listed Threatened and Endangered Species**

Common Name (Chamorro Name)*	Scientific Name	Federal Status	GovGuam Status	Preferred Habitat in the Marianas	JRM Site	Current Occurrence on Guam
<b>Mammals</b>						
Sei whale	<i>Balaenoptera borealis</i>	E	---	Sub-tropical to sub-polar waters on the continental shelf edge.	Unknown	Present
Blue whale	<i>Balaenoptera musculus</i>	E	---	Sub-tropical to sub-polar waters.	Unknown	Present
Fin whale	<i>Balaenoptera physalus</i>	E	---	Deep offshore water in temperate to polar latitudes.	Unknown	Likely Present
Pacific sheath-tailed bat (payesyeyes)	<i>Emballonura semicaudata rotensis</i>	C	E	Native limestone forest for foraging, caves for roosting.	None	Extirpated
North Pacific right whale	<i>Eubalaena japonica</i>	E	---	Coastal to shelf waters in temperate to sub-polar latitudes.	Unknown	Likely Present
Humpback whale	<i>Megaptera novaeangliae</i>	E	---	Feed in cold productive coastal waters, calve in warm water.	Unknown	Likely Present
Sperm whale	<i>Physeter macrocephalus</i>	E	---	In waters > 1,968 feet (600 meters)	Unknown	Present
Mariana fruit bat (fanihi)	<i>Pteropus mariannus mariannus</i>	T	E	Native limestone forest	<ul style="list-style-type: none"> <li>- Andersen AFB</li> <li>- NBG Main Base</li> <li>- Naval Munitions Site</li> <li>- NBG TS</li> <li>- Communications Site Barrigada</li> <li>- Tinian</li> </ul>	Present

Common Name (Chamorro Name) *	Scientific Name	Federal Status	GovGuam Status	Preferred Habitat in the Marianas	JRM Site	Current Occurrence on Guam
<b>Mammals (continued)</b>						
Little Mariana fruit bat (fanihi)	<i>Pteropus tokudae</i>	E	E	Native limestone forest	None	Presumed Extinct
<b>Birds</b>						
Mariana swiftlet (Yayaguak)	<i>Aerodramus vanikorensis bartschi</i>	E	E	Limestone forested areas with caverns for roosting and nesting.	- Andersen AFB - Naval Munitions Site	Present
Micronesian starling (Sâli)	<i>Aplonis opaca guami</i>	--	E	All habitats, but higher density in forests.	- Andersen AFB - NBG TS	Present
Mariana crow (Åga)	<i>Corvus kubaryi</i>	E	E	Native limestone forest.	- Andersen AFB - NBG TS (species habitat) - Naval Munitions Site (species habitat)	Present
White-throated ground-dove (Paluman apâka'fache')	<i>Gallicolumba xanthonura</i>	--	E	Native limestone forest.	- Andersen AFB (species habitat) - Naval Munitions Site (species habitat )	Extirpated from Guam
Mariana common moorhen (Pulattat)	<i>Gallinula chloropus guami</i>	E	E	Fresh and brackish wetlands.	- NBG Main Base - Naval Munitions Site - Communications Site Barrigada - Tinian	Present

Common Name (Chamorro Name) *	Scientific Name	Federal Status	GovGuam Status	Preferred Habitat in the Marianas	JRM Site	Current Occurrence on Guam
<b>Birds (continued)</b>						
Guam rail (Ko'Ko')	<i>Gallirallus owstonii</i>	E	E	Native limestone forest. Historically, the rail has been observed in coastal forested areas, open field (mowed grass) areas, grasslands, ravine forest areas and limestone forested areas.	<ul style="list-style-type: none"> <li>- Andersen AFB (species habitat )</li> <li>- NBG Main Base (species habitat)</li> <li>- NBG TS (species habitat)</li> <li>- Communications Site Barrigada (species habitat)</li> <li>- Naval Munitions Site (species habitat )</li> </ul>	Extinct in the wild, occurs only in captivity or experimental release population (Rota)
Guam Micronesian kingfisher (Sihek)	<i>Halcyon cinnamomina cinnamomina</i>	E	E	All habitats with the exception of southern savannas.	<ul style="list-style-type: none"> <li>- Andersen AFB (species habitat )</li> <li>- NBG TS (species habitat )</li> <li>- Naval Munitions Site (species habitat )</li> </ul>	Extinct in the wild, occurs only in captivity
Micronesian megapode	<i>Mega podius laperouse</i>	E			- Tinian	Historical on Guam Present on Tinian
Guam broadbill (Chuguanguang)	<i>Myiagra freycineti</i>	-- <sup>a</sup>	--	Formerly all habitats except southern savannas. Extinct.	None	Extinct
Micronesian honeyeater (Egigi)	<i>Myzomela rubratra saffordi</i>	--	E	Beach strand, mangroves, upland forest, suburban and disturbed areas.	None	Extirpated on Guam
Mariana fruit-dove (Tottot)	<i>Ptilinopus roseicapilla</i>	--	E	Native limestone forest.	None	Extirpated on Guam

Common Name (Chamorro Name) *	Scientific Name	Federal Status	GovGuam Status	Preferred Habitat in the Marianas	JRM Site	Current Occurrence on Guam
<b>Birds (continued)</b>						
Rufous fantail (Chichirika)	<i>Rhipidura rufifrons uraniae</i>	--	E	Native limestone forest.	None	Extirpated on Guam
Guam bridled white- eye (Nosa')	<i>Zosterops conspicillatus conspicillatus</i>	E	E	Native limestone forest.	None	Presumed Extinct
<b>Reptiles</b>						
Loggerhead sea turtle	<i>Caretta caretta</i>	T	--	Offshore waters.	- Unknown	Likely Present (non- nesting)
Green sea turtle (Haggan)	<i>Chelonia mydas</i>	T	T	Nearshore waters and nesting beaches, offshore waters occasionally.	- Andersen AFB - NBG Main Base - NBG TS - Tinian	Present (nesting); species is also likely to forage and shelter in marine waters at all JRM sites with a shore line, not just at know nesting sites
Snake-eyed skink (Guali'ek halom tâno')	<i>Cryptoblepharus poecilopleurus</i>	--	E	Coastal strand in rocky beach areas in loose sandy soils.	None	Unknown
Leatherback sea turtle	<i>Dermochelys coriacea</i>	E	E	Offshore waters.	Unknown	Present (non-nesting)
Tide-pool skink (Guali'ek kanton tâsi)	<i>Emoia atrocostata</i>	--	E	Intertidal zone in rock crevices, mangroves, and tree holes.	None	Present
Azure-tailed skink (Guali'ek halom tâno')	<i>Emoia cyanura</i>	--	E	Forest edge in loose ground cover.	None	Present
Slevin's skink (Guali'ek halom tâno')	<i>Emoia slevini</i>	--	E	Native limestone forest.	None	Unknown

Common Name (Chamorro Name) *	Scientific Name	Federal Status	GovGuam Status	Preferred Habitat in the Marianas	JRM Site	Current Occurrence on Guam
<b>Reptiles (continued)</b>						
Hawksbill sea turtle (Haggan karai)	<i>Eretmochelys imbricata</i>	E	E	Nearshore waters and nesting beaches, offshore waters occasionally.	- Andersen AFB - NBG Main Base - Tinian	Present (nesting); species is also likely to forage and shelter in marine waters at all JRM sites with a shore line, not just at know nesting sites
Moth skink (Guali'ek halom tãno')	<i>Lipinia noctua</i>	--	E	Native limestone forest.	- Andersen AFB - NBG TS - Naval Munitions Site	Present
Pacific slender-toed gecko (Guali'ek)	<i>Nactus pelagicus</i>	--	E	Native limestone forest.	- Andersen AFB - NBG TS - Naval Munitions Site	Present
Micronesian gecko (Guali'ek)	<i>Perochirus ateles</i>	--	E	Native limestone forest.	None	Unknown
<b>Fish</b>						
Napoleon wrasse (Tanguisson)	<i>Cheilinus undulates</i>	SOC	SOGCN	Coral reefs around Guam.	- Andersen AFB - NBG Main Base - NBG TS	Present
Bumphead parrotfish (Atuhong)	<i>Bolbometopon muricatum</i>	C	SOGCN	Coral reefs around Guam.	- Andersen AFB - NBG Main Base - NBG TS	Present

Common Name (Chamorro Name) *	Scientific Name	Federal Status	GovGuam Status	Preferred Habitat in the Marianas	JRM Site	Current Occurrence on Guam
<b>Invertebrates</b>						
Mariana eight-spot butterfly (Ababang)	<i>Hypolimnas octucula marianensis</i>	C	SOGCN	Native limestone forest.	- Andersen AFB - NBG Main Base - NBG TS - Naval Munitions Site	Present
Humped tree snail (Akaleha')	<i>Partula gibba</i>	C	E	Native limestone forest and ravine forest, only known populations occur in the Haputo Ecological Reserve Area along the northwest coast and the Guam NWR.	- Andersen AFB - NBG TS - Naval Munitions Site	Present
Guam tree snail (Akaleha')	<i>Partula radiolata</i>	C	E	Native limestone and ravine forest, endemic to the Island of Guam.	- Andersen AFB - NBG Main Base - NBG TS - Naval Munitions Site - Communication Site Barrigada	Present
Mount Alifan tree snail (Akaleha')	<i>Partula salifana</i>	--	E	Native limestone forest near Mount Alifan. Endemic to the island of Guam, presumed extinct.	None	Presumed Extinct
Fragile tree snail (Akaleha')	<i>Samoana fragilis</i>	C	E	Native limestone and ravine forest.	- Andersen AFB - NBG TS - Naval Munitions Site	Present
Mariana wandering butterfly (Ababang)	<i>Vagrans egistina</i>	C	--	Native limestone forest.	None	Presumed Extinct

Common Name (Chamorro Name) *	Scientific Name	Federal Status	GovGuam Status	Preferred Habitat in the Marianas	JRM Site	Current Occurrence on Guam
<b>Vascular Plants</b>						
Tree fern (Såtsa)	<i>Cyathea lunulata</i>	--	E	Native limestone forest.	- Naval Munitions Site	Present
No common name (Ufa-halomtåno')	<i>Heritiera longipetiolata</i>	--	E	Native limestone forest.	- Andersen AFB - NBG Main Base - NBG TS - Naval Munitions Site	Present
Foreign wood / Northern tree (Hayun lågo)	<i>Serianthes nelsonii</i>	E	E	Native limestone forest.	- Andersen AFB - NBG Main Base - NBG TS - Naval Munitions Site	Present

Sources: USFWS 2008, USEPA 2004, USGS 2008, JGPO 2010, NAVFAC ESC 2010, and GDAWR 2005

Note: \*Chamorro Names from Government of Guam, Department of Agriculture Endangered Species Regulation No. 8 (2003)

Key:

E = Federally or Government of Guam-listed as endangered

T = Federally or Government of Guam listed as threatened

C = Federal Candidate for listing

SOC = NOAA Species of Concern

SOGCN = Guam Species of Greatest Conservation Need

<sup>a</sup>= delisted, extinct

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## **APPENDIX F**

### **MIGRATORY BIRD MANAGEMENT**



## Appendix F

### Migratory Bird Management

The Migratory Bird Treaty Act of 1918 (MBTA) (16 U.S.C. 703–712) protects all migratory birds and prohibits the taking of migratory birds, their young, nests, and eggs, except as permitted by the USFWS. The USFWS recommends that, to avoid impacting birds protected under the MBTA, JRM survey for nesting birds in proposed disturbance areas and, if necessary, wait until the nesting and fledging process is complete. Alternatively, the USFWS recommends conducting activities outside of nesting areas or outside of the general migratory bird nesting season that extends from March through August to help avoid direct impacts.

In addition, Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds) directed all Federal agencies taking actions that have a potential to affect migratory bird populations negatively to develop and implement an MOU with USFWS by January 2003 that shall promote the conservation of migratory bird populations.

Specific actions for the management of migratory birds at JRM are discussed in **Chapter 5, Section 5.5.1.2** under fish and wildlife management, and specific projects are outlined in **Appendix C, Table C-1**.

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