

# ROTA SPECIAL RESOURCE STUDY

## 2023

### Appendices

A photograph of a concrete wall with vines growing on it, overlooking a lush green landscape under a blue sky. The wall is on the left side of the frame, and the vines are climbing up it. The background shows a dense forest of green trees and a clear blue sky with a few wispy clouds. The word "APPENDICES" is written in white capital letters in the upper right quadrant of the image.

# APPENDICES



Strategic viewpoint from the Japanese World War II defensive complex at Ginalagan. Photo: NPS.

## APPENDIX A: STUDY LEGISLATION

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On December 19, 2014, President Barack Obama approved the Carl Levin and Howard P. “Buck” McKeon National Defense Authorization Act for Fiscal Year 2015 as Public Law 113-291. Division B, Title XXX, Subtitle D, Section 3051 authorized the National Park Service to conduct a special resource study of the “prehistoric, historic, and limestone forest sites on the island of Rota, Commonwealth of the Northern Mariana Islands” to evaluate the national significance of the sites and the feasibility of designating them as a unit of the national park system. The following is the text of the legislation that pertains to the Rota Special Resource Study.

**CARL LEVIN AND HOWARD P.  
“BUCK” MCKEON NATIONAL  
DEFENSE AUTHORIZATION ACT, 2015  
(PUBLIC LAW 113-291)**

**December 19, 2014**

113th Congress

**Section 3051: Special Resource Studies**

- a. IN GENERAL.—The Secretary of the Interior (referred to in this section as the “Secretary”) shall conduct a special resource study regarding each area, site, and issue identified in subsection (b) to evaluate—
  1. the national significance of the area, site, or issue; and
  2. the suitability and feasibility of designating such an area or site as a unit of the National Park System.
- b. STUDIES.—The areas, sites, and issues referred to in subsection (a) are the following:

...

3. ROTA, COMMONWEALTH OF NORTHERN MARIANA ISLANDS.—Prehistoric, historic, and limestone forest sites on the island of Rota, Commonwealth of the Northern Mariana Islands.

...

- c. CRITERIA.—In conducting a study under this section, the Secretary shall use the criteria for the study of areas for potential inclusion in the National Park System described in section 8(c) of Public Law 91-383 (commonly known as the “National Park System General Authorities Act”) (16 U.S.C. 1a-5(c)).
- d. CONTENTS.—Each study authorized by this section shall—
  1. determine the suitability and feasibility of designating the applicable area or site as a unit of the National Park System;
  2. include cost estimates for any necessary acquisition, development, operation, and maintenance of the applicable area or site;
  3. include an analysis of the effect of the applicable area or site on—
    - A. existing commercial and recreational activities;
    - B. the authorization, construction, operation, maintenance, or improvement of energy production and transmission or other infrastructure in the area; and
    - C. the authority of State and local governments to manage those activities;

4. include an identification of any authorities, including condemnation, that will compel or permit the Secretary to influence or participate in local land use decisions (such as zoning) or place restrictions on non-Federal land if the applicable area or site is designated as a unit of the National Park System; and
  5. identify alternatives for the management, administration, and protection of the applicable area or site.
- f. REPORT.—Not later than 3 years after the date on which funds are made available to carry out a study authorized by this section, the Secretary shall submit to the Committee on Natural Resources of the House of Representatives and the Committee on Energy and Natural Resources of the Senate a report that describes—
1. the findings and recommendations of the study; and
  2. any applicable recommendations of the Secretary.

Approved December 19, 2014

## APPENDIX B: NATIONAL PARK UNIT ALTERNATIVE

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The National Park Service considered several approaches to preservation and interpretation of Rota's nationally significant resources as required by the study's authorizing legislation (see Appendix A: Study Legislation §3051d). As part of this process, the NPS evaluated a range of possible management alternatives to help better understand the feasibility of administering the study area as a new unit of the national park system, and to determine whether NPS management of Rota's sites would be the optimal management approach.

In 2020, the NPS shared three preliminary alternative concepts with the public, including two different national park unit concepts that would involve some level of co-stewardship with the CNMI. The concepts were described and illustrated in a [newsletter](#) released to the public in August 2020. See Chapter 7: Consultation and Coordination for a description of public comments received on the preliminary alternative concepts. The national historical park alternative presented below is a refined and updated management concept that combines elements of the two concepts presented to the public in 2020.

While this study does not recommend establishing a new unit of the national park system at this time, describing this alternative helps illustrate how a national park unit on Rota might be established, how it could function, how the NPS and the CNMI could collaborate on stewardship and management, and what the implications might be of managing the study area as a unit of the national park system.

The national historical park alternative serves as a basis of comparison with the other possible management alternatives, including existing management, and allows for a more complete analysis of potential costs associated with administering the study area as a new unit of the national park system. The alternative described below was evaluated by the NPS as part of this study's feasibility and need for NPS management analysis. It was developed based

on information gathered from public and stakeholder input, internal NPS discussions, evaluation of special resource study criteria, and NPS management models.

### NATIONAL HISTORICAL PARK ALTERNATIVE

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#### Concept

Under this alternative, Congress could authorize the establishment of a national park unit, dependent on the execution of a management agreement between the CNMI government and the National Park Service. The national park unit is described here as a national historical park, but it could also be designated as another type of unit, such as a national preserve, a national monument, or another type of designation. Congressional legislation could describe an authorized boundary but delay formal establishment of a unit until a management agreement is adopted, satisfying requirements of both the NPS and the CNMI government and identifying specific lands, management responsibilities, and a management structure.

Under this alternative, the authorized boundary of the national historical park could include the Chamorro archeological sites of Mochong, Måya, As Nieves, Gampapa, Dugi, Chugai Cave, and Alaguan, and the I'Chenchon Park Wildlife Conservation Area. The archeological sites would need to be protected within their limestone forest settings with sufficient lands to allow for public access and visitor facilities. Areas of limestone forest would need to be included in expanses that are sufficiently continuous to protect habitat connectivity, ecosystem integrity, and the forest's dense and intact physical structure.

The National Park Service recognizes the local community's expertise in managing Rota's resources and interpreting their importance and could therefore seek to implement a co-stewardship arrangement with CNMI agencies

to enhance existing resource management efforts. The CNMI and the NPS could together preserve the sites, provide interpretation and educational opportunities, and operate the unit of the national park system.

## Definition

A national historical park (NHP) extends beyond single properties or buildings, and typically protects an area of greater extent and complexity than a national historic site. Resources in an NHP include a mix of significant historic features and may include significant natural features that contribute to the historic setting and cultural importance of the area. National historical parks preserve places and commemorate persons, events, and activities important in the nation's history.

Examples include:

- War in the Pacific National Historical Park: Guam
- Kalaupapa National Historical Park: Moloka'i, Hawai'i
- Nez Perce National Historical Park: Montana, Idaho, Washington, Oregon
- Chaco Culture National Historical Park: New Mexico
- Salt River Bay National Historical Park and Ecological Preserve: St. Croix, Virgin Islands

## Potential Area

The national historical park could be established on lands within an authorized boundary, all on publicly owned land. See Map 7 for an illustration of a potential unit boundary. The exact configuration of a park boundary could be determined by the CNMI and the NPS as part of the management agreement process. In this alternative, the authorized boundary encompasses about 2,380 acres (963 hectares) and is composed of the small site at As Nieves Quarry and a contiguous linear area along the eastern and southern coastline of Rota. A final boundary could include more or fewer acres and could be identified collaboratively with the CNMI based on shared goals for land use and

resource management. The lands identified through the management agreement would need to be of a sufficient size and configuration to constitute a manageable unit. In order to fully address landownership and access, the management agreement for a park unit on Rota would need to reflect co-stewardship goals and be developed in accordance with CNMI law and policy, including the 1975 Covenant and the CNMI Constitution.

## Management

The national historical park alternative focuses on partnership between the CNMI and NPS to protect and interpret Chamorro archeological sites and their landscape settings. Management could occur through collaborative processes, and the specific roles and responsibilities of each managing entity could be identified through the agreement process with the NPS and CNMI. The agreement could also determine land uses for the unit and take into account whether and where traditional uses could occur.

The intention behind a shared management approach would be to enhance existing management efforts where NPS responsibilities and expertise would be complementary. If a park unit were established, the NPS could contribute to: 1) overall interpretation and education, including the development of interpretive media and programs; 2) technical assistance in preservation of park sites to supplement ongoing activities; and 3) site operation activities, including management of visitor and administrative facilities, such as trails, roads, and visitor contact facilities.

## Resource Protection

Within the unit, the NPS could allocate park staff to work with the CNMI and other partners to conduct research and preserve Chamorro archeological sites and their limestone forest settings. Management plans would be needed to guide appropriate historic preservation documentation and treatment for cultural resources, as well as management activities for natural resources. A management

agreement between the CNMI and NPS would address how the park would meet federal law and policy requirements for resource management, research, and collections ownership and management.

## Visitor Experience

Visitors could have enhanced opportunities to learn about Rota’s Chamorro culture—past and present—and experience the island’s remarkably intact latte village sites and other archeological resources, set within the unique landscapes and ecosystems that have sustained the Chamorro people for millennia. Visitors could also have the chance to be immersed within intact expanses of Rota’s limestone forest and experience and learn about the endemic flora and fauna of the island. A wide variety of interpretive and educational programs could be provided in formats that are accessible and relevant to diverse audiences and generations. Interpretation could be provided in multiple languages, including Chamorro, to reflect the composition of the local community as well as the different cultural backgrounds of many of the potential park’s visitors.

Programs could be provided by NPS rangers or CNMI staff, by other partners, and by volunteers. Virtual visitor experiences could be explored to share information more broadly about Rota and its ancient Chamorro sites. The NPS and CNMI could additionally partner with a cooperating association to expand capacity for interpretation and education efforts.

A management plan could suggest whether existing structures could be rehabilitated for visitor contact facilities and could identify locations for additional new visitor-serving facilities, including trails, trailheads, and signage.

## Operations

Following establishment, a management plan could be developed to identify park priorities and provide guidance for resource management, development, visitor use and

experience, and park operations. Management planning would need to be undertaken collaboratively by the NPS and CNMI and could provide additional guidance for co-stewardship roles and responsibilities.

## STAFFING

Until a budget is provided, the site would receive limited support, and most services would be supplied remotely from the mainland and Hawai‘i. National Park Service staff could partner with CNMI agency staff to conduct resource protection and interpretation activities as determined by the management agreement. On-site staffing could be supplemented over time as funding became available, and in a co-stewardship environment, both the NPS and the CNMI would provide staff to support the park unit. The authorizing legislation for the park could identify a preference for hiring local residents for park positions.

While no formal estimates of operating costs have been completed for this study, current parks of similar scale illustrate the potential range. Established park units of similar acreage have staff ranging from 8 to 14 full-time equivalent (FTE) positions, although more recently designated parks typically have fewer positions. As noted in the “Operational Costs” section of Chapter 5, the NPS contribution to the annual operating budget for a unit on Rota could reach \$350,000 to \$650,000 in ten years, in 2021 dollars, based on evaluation of comparable new park units. However, it is important to note that initial NPS operating budgets for new parks are more likely to begin in the range of approximately \$110,000 to \$180,000 a year.

CNMI agencies would be assumed to retain staff in existing resource protection roles, with types and numbers dependent on their specific functions. A management agreement between the NPS and CNMI would define the co-stewardship or shared management arrangement between the two entities and could indicate the number and type of NPS staff needed to operate the unit in addition to CNMI staff.



**ONE-TIME FACILITY DEVELOPMENT COSTS**

Were a national historical park to be established, planning would be undertaken to determine appropriate facility types and balance types and levels of development with resource protection and visitor experience. Most initial development at the park would be preceded by these planning efforts, but needs would likely include trails, signage and interpretive waysides, roadway improvements in select locations, parking areas, and restroom upgrades.

A list of these potential initial development projects is provided below. Were a park unit to be established on Rota, up-to-date estimates for one-time capital costs would need to be developed to understand the expected range. Escalation factors would also need to be considered to reflect the cost of construction in a remote location such as Rota. Facility development costs for a potential park could be funded by NPS construction or repair/rehabilitation funds, or by other sources.

Additional facility development needs could be anticipated for a park in the longer-term, but these would be identified through a future management planning process. Potential future projects might include facilities for visitor contact, administration, and maintenance; additional trail and trailhead construction; and additional signage and interpretive waysides. Limited improvements

to the existing unpaved roadway to Gampapa and Chugai Cave may be needed; however, roadway improvements along this alignment (and others in the region between Sinapalo and I'Chenchon Park) have been identified as long-range capital projects in the 2009 CNMI Comprehensive Highway Master Plan (CNMI DPW 2009, 176–180). Implementation planning could explore opportunities for persons of all abilities to access and experience Rota's nationally significant Chamorro archeological sites. The cost of new developments on Rota would vary according to the size of the park and the operational responsibilities identified through the management agreement between the CNMI and the NPS.

Long-term facility development needs on Rota are limited, however, as the NPS and CNMI could seek to use existing buildings and infrastructure wherever possible by leasing from willing owners. Buildings could be adaptively reused for park operations including visitor services, administration, and maintenance. This approach could result in annual lease costs based on fair market value for existing structures. Costs for facility rehabilitation would vary depending on the size, condition, and program identified for the building in question. The NPS could also share administrative and operational facilities with CNMI agencies or other partner organizations.

**POTENTIAL INITIAL DEVELOPMENT PROJECTS, NATIONAL HISTORICAL PARK ALTERNATIVE**

POTENTIAL INITIAL DEVELOPMENT PROJECT
New or formalized trails: approx. 2.5 miles (4 kilometers)
Unpaved parking areas or trailheads: for 5–6 sites, approx. 9,600 square feet (892 square meters)
Improvements to unpaved roadways for vehicle access: Mochong and Måya, approx. 0.3 miles (0.5 kilometers)
Restroom upgrades at I'Chenchon Park Wildlife Conservation Area
Signage, kiosks, and interpretive waysides: includes 4 entrance signs, 4 kiosks, and 4 waysides

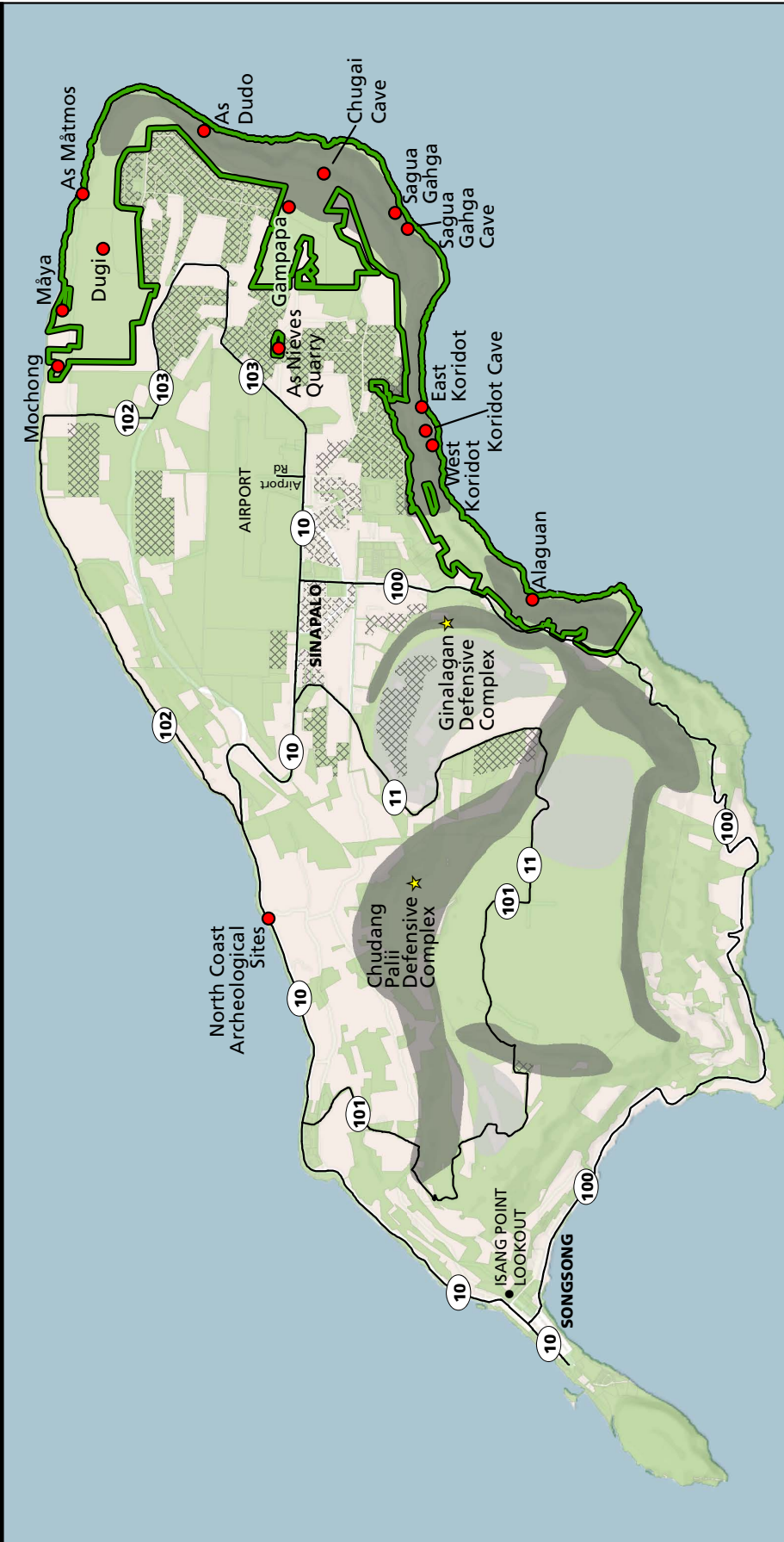
## FACILITY OPERATIONS AND MAINTENANCE COSTS

Management of a national park unit on Rota could be funded both through CNMI appropriations and federal appropriations as part of the annual NPS budget. Management support could also be provided by potential partners and grants. Funding for capital improvements could be awarded through the CNMI and/or NPS competitive funding processes. A variety of other public and private funding sources could be sought by the CNMI and NPS to assist in implementation efforts. Other NPS units have successfully found partners to help with funding major projects, and some of the costs associated with actions in the alternative may prove to be less expensive if donated materials, labor, and other support can be secured.

If a park were authorized by Congress and established through agreement with the CNMI, it is likely that funding for the new unit would grow slowly over time. Many of the activities described in the alternative would have to be phased in as NPS and CNMI funding and staffing allow, and it would be many years before the park would be fully operational as described.

# Rota Special Resource Study Map 7: National Historical Park Alternative

National Park Service  
U.S. Department of the Interior



**Potential Authorized Boundary: National Historical Park Alternative**

- Potential Authorized Boundary, Cultural Resources, Places, Basemap
- Public Land
- Homesteads: Existing and Proposed
- Highest quality stands of limestone forest
- Possible high quality stands - need further investigation

**Selected Cultural Resources**

- Prehistoric Chamorro sites
- WWII sites (1940s)

**Data Sources:**  
 NPS: Potential Authorized Boundary, Cultural Resources, Places, Basemap  
 CNMI/DPL/NPS: Public Land, Homesteads  
 U.S. Census Bureau: Roads

Produced by National Park Service, DOI Regions 8, 9, 10 and 12 GIS Group  
 Date: January 2023

The data on this map is derived from the CNMI government and other agencies. The National Park Service gives no warranty, expressed or implied, as to the accuracy, reliability, or completeness of the maps and is not liable for positioning inaccuracies, subsequent updates, errors, or unintentional omissions of data. These graphics are not legal documents and are not intended to be used as such.

## APPENDIX C: SELECTED LIMESTONE FOREST PLANTS OF ROTA

The below chart includes limestone forest plants identified in the 2005 National Park Service reconnaissance survey of significant natural areas and cultural sites for the Island of Rota (NPS 2005). Other sources consulted include: vegetation surveys conducted by the U.S. Forest Service in 1989 and 2004 (Falanruw et al. 1989, Kauffman et al. 2011); a chart of plants of cultural

importance included in Appendix G, Chapter 4 (Cultural Resources) of the 2010 Guam and CNMI Military Relocation Environmental Impact Statement (Naval Facilities Engineering Command 2010); and published literature on medicinal plants in the Mariana Islands (Nandwani et al. 2008, Lizama 2014, McMakin 1978, Pobutsky-Workman et al. 1994).

CHAMORRO NAME (ENGLISH NAME)	SCIENTIFIC NAME	USES	LOCATION(S)	NOTES
mapunao, mapunyao	<i>Aglaia mariannensis</i>	timber		
kalaskas (siris tree)	<i>Albizia lebbek</i>		lower terraces	Introduced, naturalized. Carolinian name: schepil kalaskas
	<i>Allophylus</i> sp.		lower terraces	
nanagu	<i>Alyxia</i> sp.		upper terraces	
	<i>Angiopteris evecta</i>		upper terraces	
lemai (breadfruit)	<i>Artocarpus altilis</i>	food, medicinal, timber	middle, upper terraces	
dugdug (seeded breadfruit)	<i>Artocarpus mariannensis</i>	food, timber, cordage, thatch, weaving, medicinal	middle, upper terraces	
galak dangkulo, galak fedda' (bird's nest fern)	<i>Asplenium nidus</i>	medicinal, decorative	middle, upper terraces	
putting, puting, puteng (fish-kill tree)	<i>Barringtonia asiatica</i>	medicinal, timber, used for killing fish	lower terraces	
siboyas halumtanu, siboyan halom tano	<i>Bulbophyllum guamense</i>		upper terraces (Sabana)	Threatened (USFWS)
pakao, akankang	<i>Caesalpinia major</i>	medicinal	lower terraces	
sibukao	<i>Caesalpinia sappan</i>	medicinal		
panao	<i>Claoxylon marianum</i>		upper terraces	
	<i>Coelogyne guamense</i>		middle, upper terraces	
fadang (cycad)	<i>Cycas micronesia</i>	food, medicinal	lower terraces	Threatened (USFWS)
gulos	<i>Cynometra ramiflora</i>	food	lower terraces	Introduced, naturalized.
pugua' machena	<i>Davallia solida</i>	medicinal, decorative	middle, upper terraces	
	<i>Dendrobium guamense</i>			Threatened (USFWS)
otot	<i>Discocalyx megacarpa</i>		upper terraces	
yoga, joga	<i>Elaeocarpus joga</i>	timber	upper terraces	
agate lang, agatelang	<i>Eugenia palumbis</i>	medicinal	lower terraces	
a'abang	<i>Eugenia reinwardtiana</i>	timber	lower terraces	
toto	<i>Eugenia thompsonii</i>	food, timber	lower terraces	

CHAMORRO NAME (ENGLISH NAME)	SCIENTIFIC NAME	USES	LOCATION(S)	NOTES
	<i>Excoecaria agallocha</i>		coastal spray zone	
	<i>Fagraea berteriana</i>		upper terraces	
nunu (banyan)	<i>Ficus prolixa</i>	medicinal	upper terraces	
hodda (dyer's fig)	<i>Ficus tinctoria</i>		lower, upper terraces	
fianiti	<i>Freycinetia reineckeii</i>		middle, upper terraces	
paipai	<i>Guamia mariannae</i>		lower, upper terraces	
panao (zebrawood)	<i>Guettarda speciosa</i>	timber, medicinal	lower, upper terraces	
ufa halumtanu, ufa halom tano	<i>Heritiera longipetiolata</i>		lower, middle terrace (Sabana)	Endangered (USFWS), only one known individual on Rota.
	<i>Hernandia labyrinthica</i>		upper terraces	
nonak (lantern tree)	<i>Hernandia sonora</i>	medicinal, timber	lower terraces	
pago, pagu (beach or sea hibiscus)	<i>Hibiscus tiliaceus</i>	medicinal, timber, cordage, thatch, weaving	lower, middle, upper terraces	
	<i>Historiopteris incisa</i>		upper terraces	
Ifit	<i>Intsia bijuga</i>	timber	lower terraces	
palilolia	<i>Laportea interrupta</i>		lower, upper terraces	
kotdon di San Francisco (cat's tail, disciplina)	<i>Lycopodium phlegmaria</i> var. <i>longifolium</i>		upper terraces	Threatened/ endangered (CNMI)
pengua	<i>Macaranga thompsonii</i>	medicinal	lower, middle, upper terraces	
	<i>Maesa walkeri</i>		upper terraces (Sabana)	Threatened (USFWS)
chopak	<i>Mammea odorata</i>	medicinal, timber	lower terraces	
luluhot, luluhut, lulujut	<i>Maytenus thompsonii</i>	medicinal	lower terraces	
gafos	<i>Medinilla medinilliana</i>		upper terraces	
lada (noni)	<i>Morinda citrifolia</i>	food, medicinal	lower terraces	
	<i>Muntingia calabura</i>		lower terraces	Introduced, naturalized.
fago, fagot	<i>Neisosperma oppositifolium</i>	food, timber	lower terraces	
sensen hale' hanom	<i>Nervilia jacksoniae</i>	medicinal	upper terrace (Sabana) in <i>Pandanus</i> forest	Threatened (USFWS)
	<i>Nesogenes rotensis</i>		southeastern Sabana coastal spray zone	Endangered (USFWS)
	<i>Osmoxylon mariannese</i>		middle, upper terraces (Sabana)	Endangered (USFWS), endemic to Rota.
pahong (pandanus)	<i>Pandanus dubius</i>	food, cordage, thatch, weaving	lower, upper terraces	
kafu, akgak (pandanus, screwpine)	<i>Pandanus tectorius</i>	food, cordage, thatch, weaving, medicinal	lower, upper terraces	

CHAMORRO NAME (ENGLISH NAME)	SCIENTIFIC NAME	USES	LOCATION(S)	NOTES
nigas	<i>Pemphis acidula</i>	timber	coastal spray zone	
pupulon aniti	<i>Piper guahamense</i>	medicinal	lower, middle, upper terraces	
atmagayan, amahadyan (silvery pipturus)	<i>Pipturus argenteus</i>	fiber, medicinal	lower, middle, upper terraces	
umumu	<i>Pisonia grandis</i>	timber	lower terraces	
	<i>Pisonia umbellifera</i>		upper terraces	
kamachili (monkeypod)	<i>Pithecellobium dulce</i>	medicinal	lower terraces	Introduced, naturalized. Carolinian name: ghamasiligh
	<i>Polyscias grandifolia</i>		lower terraces	
ahgao (false elder)	<i>Premna obtusifolia</i>	medicinal, timber	lower terraces	
aplokateng, aploghating	<i>Psychotria mariana</i>	timber, medicinal	upper terraces	
nanaso (half-flower)	<i>Scaevola taccada</i>	timber, medicinal	coastal spray zone	
tronkon guafi (fire tree)	<i>Serianthes nelsonii</i>		lower, middle terrace (Sabana)	Endangered (USFWS), threatened/ endangered (CNMI)
	<i>Sophora tometosa</i>		coastal spray zone	
	<i>Tabernaemontana rotensis</i>			Threatened (USFWS)
talisai (tropical almond)	<i>Terminalia catappa</i>	timber, food	lower terraces	
banalo (rosewood)	<i>Thespesia populnea</i>	timber	lower terraces	
hunek, hunik (velvet leaf)	<i>Tournefortia argentea</i>	timber, medicinal	coastal spray zone	
lemonchina	<i>Triphasia trifolia</i>	food, timber	lower terraces	
	<i>Tuberolabium guamense</i>			Threatened (USFWS)

## APPENDIX D: THREATENED AND ENDANGERED SPECIES DESCRIPTIONS

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### Animals

#### *Acropora globiceps* *Seriatopora aculeata*

Coral, kuraling, yeal

Threatened

Both of these coral species are found in reef habitats in the Indo-Pacific, including the Northern Mariana Islands. Both species are considered threatened, with primary threats of ocean warming, disease, and ocean acidification (NOAA n.d. (a) and (b)).

#### *Corvus kubaryi*

Mariana crow, aga, mwii'lup

Endangered

The Mariana crow, or aga, is endemic to Rota and Guam. It is an omnivorous bird that nests in native limestone forest. There are no longer any crows on Guam, due to predation by the brown tree snake. The population on Rota has been steadily declining. The primary factors in this species' decline on Rota are uncertain, but it is likely a combination of habitat loss, poaching and harassment, and predation by feral cats. Six thousand thirty-three acres (2442 hectares) of critical habitat for the Mariana crow have been designated on Rota. (USFWS 2004 and 2012a).

#### *Chelonia mydas*

Green sea turtle, haggan, wong mool

Endangered

The green sea turtle is found in coastal waters worldwide, primarily in tropical and subtropical areas. They spend almost their entire lives in the ocean but use beaches for egg laying. There are 11 distinct population segments worldwide, which vary in species status and threats; the Marianas are part of the Central West Pacific distinct population segment, which is considered endangered. Threats to the Central West Pacific distinct population segment include habitat loss (including destruction, barriers to nesting habitat, and alterations due to both human activities and climate change), hunting and egg

gathering, predation, fisheries bycatch, and ingestion of trash (USFWS 2015a and 2016). Green sea turtles are frequently found in the waters off Rota (Kolinski et al. 2006, Wiles et al. 1990). Summers et al. (2018) note that 113 *Chelonia mydas* nests were found on Rota based upon 10-day and 64-night turtle nesting surveys from 2009 to 2016. Haggan have been identified as a species of cultural/ social importance in the CNMI (Liske-Clark 2015).

#### *Eretmochelys imbricata*

Hawksbill sea turtle, haggan karai, wong maaw

Endangered

The hawksbill turtle inhabits shallow coastal waters throughout the tropical and subtropical world, including the Mariana Islands. Populations in the Pacific are declining, and only five to ten females are estimated to nest in the Mariana Islands. The turtles may still be present in the waters off Rota but have not been observed nesting for many decades. Worldwide, threats to the species include habitat loss (including direct destruction and alterations due to climate change), hunting and egg gathering, fishery bycatch, ingestion of trash, and oil spills (USFWS 2013, Wiles et al. 1990).

#### *Gallinula chloropus guami*

Mariana common moorhen, puláttat, gherel bweel

Endangered

The Mariana common moorhen is a member of a species found worldwide; the Mariana subspecies is endemic to the Marianas. It is a nonmigratory freshwater wetland dweller. Moorhens occurred on Rota prehistorically but were extirpated due to loss of wetlands, hunting, or introduced predators. From 1995 to at least 2002 they were observed in a manmade wetland at the Rota golf course, indicating that they are capable of moving between islands. The primary threat to this species is habitat loss (USFWS 1991 and 2009a).

*Ischnura luta*

Rota blue damselfly, dulalas Luta

Endangered

The Rota blue damselfly is endemic to the streams of Rota. The species lives in an extremely limited range in the Talakhaya watershed area, where it has been observed in two nearby streams, one of which is the sole water supply for the island of Rota. The area is somewhat protected by its remote and inaccessible location, but if municipal demand for water increases the species may no longer be able to inhabit that stream. Introduction of nonnative fish and small population size are other potential threats to this species (USFWS 2015b).

*Partula gibba*

Humped tree snail, akaleha', denden

Endangered

The humped tree snail is endemic to the forests of the Mariana Islands. They live in the subcanopy in areas of dense forest and may be found on both native and nonnative plants. The largest of five known populations on Rota is presumed gone after its habitat was cleared for development. The primary threats to this species are habitat loss and predation by nonnative species, particularly flatworms and snails (USFWS 2015b).

*Pteropus mariannus mariannus*

Mariana fruit bat, fanihi, pai'scheei

Threatened

The Mariana fruit bat, or fanihi, is endemic to the Mariana Islands. It is a medium-sized bat that lives in large colonies, which roost in trees. It primarily forages and roosts in native limestone forest. Fanihi is an important traditional food in Chamorro culture. The primary threats to this species include habitat loss and overhunting (USFWS 2009b). From 2010 to 2012, the population of fanihi on Rota nearly doubled; this was credited to increased enforcement of hunting bans, particularly on maternity colonies (USFWS 2012b). Fanihi are identified as a species of cultural/social importance in CNMI (Liske-Clark 2015).

*Samoana fragilis*

Fragile tree snail, akaleha'

Endangered

The fragile tree snail is endemic to the forests of Rota and Guam. It occupies the same subcanopy habitat as the humped tree snail (above) and is currently known in a single population on Rota and two on Guam. The primary threat to this species is habitat loss (USFWS 2015b).

*Sphyrna leweni*

Scalloped hammerhead shark

Threatened

The scalloped hammerhead shark is found in coastal open water worldwide. There are four distinct population segments, which vary in species status; the Marianas are part of the Indo-West Pacific distinct population segment, which is considered threatened. Threats to this distinct population segment include bycatch and the shark fin trade (NOAA 2015).

*Vagrans egistina*

Mariana wandering butterfly,

ababbang, libweibwogh

Endangered

The Mariana wandering butterfly is endemic to the forests of Rota and Guam. The larvae of the species feed on the endemic plant *Maytenus thompsonii* (luluhut). The species is considered extirpated (locally extinct) on Guam. The last survey for the species on Rota, in 1995, identified it in one location. If the species persists, it is likely in very low numbers, and surveys are needed to determine its status. The primary threat to this species is habitat loss and destruction by rats and typhoons (USFWS 2015b).

*Zosterops rotensis*

Rota white-eye, nosa Luta

Endangered

The Rota bridled white-eye is a diminutive bird endemic to the island of Rota, where it lives in a small area of mature limestone forest above 490 feet (150 meters) on the Sabana. The white-eye prefers wetter, denser forests, and changes to the forest structure may be



altering the distribution and population of the species (Amidon 2000, Zarones et al. 2013). The population size has fluctuated over the past three decades, though further studies are needed to understand why. The primary threats to this species are habitat loss and a small, concentrated population that could be wiped out by a random event. Predation by introduced species is another potential threat. In 2006, the entire range of the white-eye was designated as critical habitat (USFWS 2007a and 2014b).

## Plants

### *Bulbophyllum guamense*

Siboyan halom tano

Threatened

*Bulbophyllum guamense*, a member of the orchid family, is endemic to Rota and Guam. It grows in large mats on the branches of trees in forested areas. On Rota, it is found primarily on the Sabana at elevations above 980 feet (300 meters). The primary threats to this species are habitat loss and predation by nonnative invertebrates (USFWS 2015b).

### *Cycas micronesica*

Fadang, Federico palm

Threatened

*Cycas micronesica*, a member of the cycad family, is found on Rota, Guam, Palau, and Yap, where it grows in the forest ecosystem. Populations on Rota are found on the northeast, northwest, and south shores, along with the Taipingot (Wedding Cake) Peninsula. Since the introduction 10 years ago of the nonnative insect, cycad aulacaspis scale (*Aulacaspis yasumatui*), this species is experiencing mortality rates of over 90% across all life stages. This species may be extirpated from Rota and Guam in the near future, unless an effective control is found for the scale (USFWS 2015b).

### *Dendrobium guamense*

No common name

Threatened

*Dendrobium guamense*, a member of the orchid family, is found in the forests of Guam, Rota, Tinian, and Aguiguan, and historically on Saipan. On Rota, it has primarily been

observed on the western third of the island. While it is rare on other islands, the species is abundant across its forest habitat on Rota, with a healthy population structure, and population numbers are likely in the thousands. The primary threats to this species are habitat loss and predation by nonnative insects (USFWS 2015b).

### *Heritiera longipetiolata*

Ufa-halomtano

Endangered

*Heritiera longipetiolata*, a small tree in the hibiscus family, is endemic to the forests of the Mariana Islands. There is one known individual on Rota, out of a total of approximately 200 known individuals on Guam, Saipan, Rota, and Tinian. Herbivory by pigs and deer may be killing seedlings and seeds before they are able to mature, but this hypothesis is based only on observations from Guam. The primary threat to this species is habitat loss (USFWS 2015b).

### *Maesa walkeri*

No common name

Threatened

*Maesa walkeri*, a small tree in the primrose family, is endemic to the forests of Rota and Guam. While only two individuals are known on Guam today, the species is abundant across the Sabana of Rota. The Sabana population includes a healthy mix of seedlings, juveniles, and adults. The primary threat to this species is the loss of its niche habitat on the Sabana, particularly due to degradation from fire and nonnative plants and animals (deer and rats) (USFWS 2015b).

### *Nervilia jacksoniae*

No common name

Threatened

*Nervilia jacksoniae*, a member of the orchid family, is endemic to the forests of Rota and Guam. On Rota, it is found primarily on the Sabana, often in Pandanus forest. The primary threat to this species is the loss of its niche habitat on the Sabana, particularly due to degradation from fire, typhoons, and nonnative plants and animals (deer and rats) (USFWS 2015b).

*Nesogenes rotensis*

No common name

Endangered

*Nesogenes rotensis*, an herb in the verbena family, is endemic to Rota. It grows on exposed, unforested limestone flats adjacent to the coast, where it is hit by salt spray during severe storms. The primary threat to this species is habitat loss (USFWS 2007b).

*Osmoxylon mariannense*

No common name

Endangered

*Osmoxylon mariannense*, a tree in the ginseng family, is endemic to Rota. It grows in the limestone forest of the Sabana. Ongoing recovery efforts include outplanting nursery-raised seedlings. The primary threat to this species is habitat loss (USFWS 2007b).

*Serianthes nelsonii*

Hayun lågu (Guam), tronkon guafi (Rota)

Endangered

*Serianthes nelsonii* is a tree endemic to the forests of Rota and Guam. Only one adult tree is known on Guam, while 60 to 80 individuals are known on Rota, all in limestone forest. Nursery-raised seedlings have also been planted on both Guam and Rota. Seedling survival is very poor, and a substantial number of mature trees were damaged or destroyed by typhoons in 2003 and 2004. The primary threat to this species is lack of regeneration caused by deer herbivory of seedlings and insect predation on seeds. (USFWS 2012c).

*Tabernaemontana rotensis*

No common name

Threatened

*Tabernaemontana rotensis*, a small tree in the dogbane family, is endemic to the forests of Rota and Guam. Only nine naturally occurring individuals are known on Rota, along with 30 planted individuals. On Guam, the population of about 21,000 includes a healthy mix of seedlings, juveniles, and adults. The primary threat to this species is habitat loss (USFWS 2015b).

*Tuberolabium guamense*

No common name

Threatened

*Tuberolabium guamense*, a member of the orchid family, is endemic to the Mariana Islands. The species grows on the branches of native canopy trees, particularly *Hernandia labyrinthica*, *Premna obtusifolia*, and *Elaeocarpus joga*. While only one individual is known today on Guam, a few hundred individuals in a healthy population structure were recently identified on Rota. The primary threats to this species are habitat loss, particularly loss of the large native canopy trees on which the species grows, and predation by nonnative insects (USFWS 2015b).

## APPENDIX E: MARINE AND SUBMERGED RESOURCES

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Public Law 113-291 authorized the National Park Service to conduct a special resource study of the “prehistoric, historic, and limestone forest sites on the island of Rota, Commonwealth of the Northern Mariana Islands” to evaluate the national significance of the sites and the feasibility of designating them as a unit of the national park system (P.L. 113-291, Title XXX, §3051; see Appendix A). The authorizing legislation for this study therefore did not include an evaluation of marine resources. However, marine habitats and other submerged resources are undeniably a critical component of Rota’s ecosystems, cultural practices, and heritage. The information below provides context for Rota’s marine setting, however further study of inshore waters, coral reefs, and other submerged resources should be undertaken in the future.

### Marine Resources

Rota is surrounded by a fringing coral reef, with approximately 9.5 square miles (24.6 square kilometers) of shallow reef habitat. Fringing reefs are typical around newly emergent land masses and are located adjacent to shore. As the land mass ages and subsides, the reef transitions to a barrier reef (separated from the shore by a lagoon) and finally an atoll reef (fully subsided land mass, leaving only a reef around a lagoon). A sea level platform fringing reef, the type of reef found at Rota, is typically described in five zones, each with different physical conditions and biological communities. Starting at the shore, the shoreline intertidal is the zone between low and high tide, where species are limited to those able to tolerate the fluctuations of being submerged and exposed. The reef flat platform is a shallow area, which may be exposed or only shallowly covered at low tide. Reef flat habitats include sandy bottoms, eelgrass, rubble, algal pavement, or coral, depending on the exact environmental conditions of the site. More corals tend to be found towards the seaward edge. At the edge of the reef flat platform is the reef margin, which is exposed

to breaking waves, and is home to a variety of corals, fish, and algae adapted to the high energy conditions of breaking waves. The reef front occupies the area between the reef margin and the base of the waves and is exposed to strong surging water. The reef front zone generally includes areas with the most vigorous growth of corals, coralline algae, and other reef-building organisms. Finally, the seaward reef slope extends down from the reef front. A number of different habitats and species assemblages are found within this zone, depending on the depth, slope, exposure, substrate, and other factors, giving this zone high biological diversity (Liske-Clark 2015).

The reef platform at Rota, including the shoreline intertidal, reef flat, and reef margin, is just over 1 square mile (2.5 square kilometers), and the reef slope, including the reef front and seaward reef slope, covers 8.5 square miles (22 square kilometers). There are no reef lagoons. This fringing reef is quite narrow in most places but extends up to 800 feet (244 meters) in the leeward area north of Songsong Village. The eastern shore has steep cliffs and high wave exposure, meaning that reef formation is limited in this area. Much of Rota’s shoreline is emergent fossilized reef exposed by geologic uplift and sea level drop in recent geologic history (mid-Holocene), resulting in a reef flat that is exposed at lower tides. This emergent reef geology also means that substantial groundwater makes its way into the reef. This combination of exposure and groundwater results in low biological production and coral cover compared to other islands in the Marianas. An exception is the Sasanhaya Bay Fish Reserve, or Coral Gardens Marine Protected Area, located on the eastern edge of Sasanhaya Bay south of Songsong Village, which has relatively high coral cover (Liske-Clark 2015).

Recent surveys on the status, resilience, and stressors of CNMI reefs found that marine recruitment and diversity are slightly less on Rota than other islands, but Rota also has the least exposure to anthropogenic stresses as compared to Tinian and Saipan (Maynard et al. 2015). Houk et al. (2014) found that Rota's reefs are more resilient to invasive Crown-of-Thorns starfish damage than other Mariana Islands.

Archeological surveys at coastal settlements on Rota reveal that precontact Chamorro relied on specialized fishing skills as early as 2,500 years ago. Excavations at coastal village sites such as Mochong and Alaguan have unearthed a variety of artifacts associated with fishing, as well as fish bone assemblages representing at least 27 fish families (Amesbury and Hunter-Anderson 2008, 43). Analysis of the assemblages indicates that parrotfish were most commonly consumed, followed by pelagic fish such as mahi-mahi, dolphinfish, marlin, sailfish, swordfish, wahoo, and yellowfin and skipjack tuna (Amesbury and Hunter-Anderson 2008, Leach et al. 1990). Fishing remains an important cultural practice for residents in the Marianas today, including on Rota, although present-day fishermen report that fish are not as plentiful as they once were. Current fishermen cite overfishing, pollution, climate change, and the invasive Crown-of-Thorns starfish as key reasons for the decline (Amesbury and Hunter-Anderson 2008, 141).

### **Selected Submerged Resources**

Rota's cultural resources are identified in Chapter 2: Context and Resource Description, which includes a description of archeological resources and historic structures on the island from multiple historical periods. This analysis of cultural resources was conducted by Micronesian Archaeological Research Services (MARS) on behalf of the NPS and included a small number of shipwreck sites from both the Spanish period and World War II. These resources are not part of the study scope; however, they are included below for reference.

### **SANTA MARGARITA SHIPWRECK**

The Spanish galleon *Santa Margarita* ran aground off Rota's north coast, near Teteto, in February 1601 (Driver 1993, Woodman 2009). The ship was heading east from Manila when it was demasted in a storm, floundering at sea for eight months before wrecking off Rota. Fewer than 50 of the original 300 sailors on board remained alive. Some of these survivors were killed by Chamorro on Rota in retaliation for threats and abuses the Spaniards had perpetrated once onshore. Others were taken to Guam and Tinian, and some were rescued by westbound galleons in 1601 and 1602 (Driver 1993; Russell 2002, 26; Brunal-Perry et al. 2009, 107).

From 1996 until 2006, IOTA Partners, a commercial treasure-salvor venture, conducted intermittent excavation of the *Santa Margarita*. Religious art, Ming dynasty porcelain, gemstones, a cache of ivory carvings, and other valuables were recovered (Trusted 2013). No reports were produced on the salvage operations.

The integrity of the shipwreck is in question as the decade of commercial treasure hunting by IOTA Partners may have stripped the galleon of its cargo while destroying many of the vessel's defining elements.

### **SHŌUN MARU SHIPWRECK AND OTHER WORLD WAR II SHIPWRECKS**

The known Japanese shipwrecks lost in World War II around Rota include the *Shōun Maru*; two submarine chasers (CHA-54 and CHA-56) in Sasanhaya Bay sunk in air raids on June 15 and 17, 1944; and the cargo ship/gunboat *Shotoko Maru*, torpedoed by the submarine USS *Tunny* in deep water near the island on June 28, 1943 (Carrell 1991, 335–355; Mohlman et al. 2011).

The *Shōun Maru* was a Japanese merchant ship torpedoed by U.S. forces while anchored in Sasanhaya Bay (Carrell 1991, 337–345; Carrell 2009, 395–405). The 4,396-ton bulk cargo ship transported supplies, munitions, and equipment to Rota, where it was loaded with phosphate ore for delivery to Japan. In June of 1944, the *Shōun Maru* had just returned to Rota after transporting base personnel and materials for Japanese Air Group 265 from Yokohama to Saipan (Carrell 2009, 396). It was anchored offshore of the phosphate loading dock when the American invasion of Saipan began on June 11. In a precarious position and probably without armed escort, *Shōun Maru* was riding at anchor when it was attacked and sunk on June 21, 1944 by a torpedo launched by a TBF torpedo bomber based on the escort carrier USS *White Plains*.

Shortly after being sunk, personnel from the Japanese navy salvaged material from the ship (Denfeld 1997, 129). Sitting upright in 70 to 110 feet (21.3–33.5 meters) of water on the sandy bottom of the bay, the shipwreck is now a favored scuba diving spot. Limited archeological investigations have been conducted on the *Shōun Maru*. The site has been archeologically monitored by Toni L. Carrell, who reports that the forward holds were dynamited open as part of a commercial salvage effort for scrap metal in the late 1950s or early 1960s (Carrell 2009, 396). She observed that between 1987 and 2009, the ship, without a reef to protect it from ocean swells, has deteriorated and “is slowly collapsing and will soon be a part of the ocean floor, except for the engine and boilers” (Carrell 2009, 405).

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## GLOSSARY

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**Ach'ot:** The middle class in Chamorro social structure, who lived with or close to the matua (upper class) and offered them support.

**Agroforest:** Forest that has been modified through human actions to produce forest crops.

**Archipelago:** An archipelago is a group of scattered islands. The CNMI makes up the 14 northern islands in the Mariana archipelago (excluding Guam in the south, which is a separate U.S. territory).

**Biophysigraphic province:** also known as a natural region.

**Bluff:** A steep bank or cliff.

**Brown tree snake (*Boiga irregularis*):** A snake species native to parts of Indonesia, the Solomon Islands, New Guinea, and Australia. It has no natural predators on Guam and therefore has decimated its bird population, but has so far been prevented from establishing in the CNMI.

**Bulwark:** A defensive wall typically built from earth or other natural materials.

**Cache:** A collection of objects that has been hidden away or stored.

**Chamorro:** The indigenous people of the Mariana Islands (including Guam). On Rota, the earliest ancestral Chamorro voyagers arrived at least 3,500 years ago, establishing small coastal settlements and introducing new species such as coconut and taro. Later populations expanded horticultural practices into inland areas. This involved clearing, terracing, and other modifications of forest and forest understory. They also made use of native forest species for food, tools, building materials, clothing, crafts, and medicine.

**Endemic:** Endemic is a word used to describe animals and plants native to a single area and found nowhere else in the world.

**Fanihi (*Pteropus mariannus mariannus*):** Mariana fruit bats, or fanihi, are a threatened species endemic to the Marianas Island. Fanihi primarily forage and roost in native limestone forest and are identified as a species of cultural/social importance in the CNMI.

**Grassland:** A large open area of land that is predominantly composed of grasses and forbs.

**Haligi:** The stone hemispherical cap that sits on a tasa, i.e., the upper component of a latte.

**Isthmus:** A thin strip of land that connects two larger land formations, with water bodies on either side.

**Karst:** An irregular topography, or landscape, formed when soluble rocks such as limestone, dolomite, and gypsum dissolve due to water passing through them. The resulting karst landscape is characterized by sinkholes and caverns. Karst landforms on Rota are composed of limestone.

**Latte period:** The latte period extends from ca. AD 1000 to ca. 1700 when, after decades of warfare with Spanish colonizers, the surviving Chamorro were forced to abandon their traditional village sites for new villages on Guam and Rota.

**Latte:** Stone archeological remains found only in the Mariana Islands. Latte are composed of pillars (haligi) topped with stone caps (tasa) and can vary in size. Latte were typically arranged in parallel sets and used as foundation support for wooden structures. Latte are considered the quintessential symbol of Chamorro history and cultural identity.

**Limestone cloud forest:** A forest formation that is unique to Rota and some parts of Guam. It occurs on Rota where higher-elevation cliffs are exposed to a persistent accumulation of clouds and higher levels of rainfall, which creates a wetter “cloud forest” environment.

**Limestone forest:** A distinct forest type, occurring on areas of raised limestone. Limestone is formed through the deposition of calcium carbonate, which comes from the exoskeletons of coral colonies. Once it has been uplifted out of the ocean through tectonic activity, it is weathered by rainwater, which slowly dissolves the limestone, making it very porous.

**Lommok:** Typically carved from basalt or limestone, lommok are stone artifacts that were used as pestles with lusong (mortars).

**Lusong:** Typically carved from basalt or limestone, lusong are stone artifacts that were used as mortars with lommok (pestles).

**Mampostería:** A style of early Spanish vernacular architecture seen in building remains of the Marianas. The construction technique consists of using thick, rough masonry walls of coral cobbles with signs of plaster on the interior walls.

**Manachang:** The lower class in Chamorro social structure, manachang lived in upland areas and were primarily farmers.

**Matua:** The highest class in Chamorro social structure, matua were born into their status through matrilineal lines of descent.

**Midden:** A midden is a mound of shells, bones, and other discarded materials marking the place where humans once lived.

**Mixed introduced forest:** This forest type consists of a variety of native and introduced tree species. It typically occurs when areas which have been heavily disturbed or cleared begin to recover.

**Pillbox:** A small, partially underground fort or building made of concrete that is used as for military defense.

**Plateau:** A land formation composed of relatively level high ground.

**Precontact:** Of or relating to the period before contact of an indigenous people with an outside culture.

**Pre-latte period:** The pre-latte period extends from initial settlement of the islands ca. 1500 BC until ca. AD 1000, which marks the early appearance of latte architecture, distinguished by alignments of upright capped stone pillars (latte) used as house supports.

**Proa:** Double-hulled boats built by the Chamorro.

**Quarry:** A location that has been excavated, from which stone and other materials have been extracted.

**Ravine forest:** On Rota this forest type occurs on volcanic soils where weathering has created steep, deep ravines with heavy soils.

**Ravine:** A ravine is a deep valley with steep sides. It is smaller than a canyon and often narrower. It is formed when running water erodes (wears away) an area of land. Sometimes the running water may continue to flow through the ravine. Some ravines may only have seasonal streams.

**Revetment:** A retaining wall built to provide protection from blasts and explosions.

**Rock art:** On Rota, rock art is principally composed of pictographs (painted figures) with pigments made from limestone, charcoal, and iron-rich soils. In some locations petroglyphs (carvings) are found interspersed among the pictographs.

**Rock shelter:** A shelter formed from stone materials; an example would be a shallow cave-like opening at the base of a cliff or bluff.

**Ruins:** The remains of a structure that are in a state of decay, damage, or destruction.

**Substrate:** An underlying material or layer.

**Tangantangan:** A dense monocultural forest made up of the *Leucaena leucocephala* tree (called tangan-tangan in Chamorro).

**Tasa:** Made from stone, the tasa is the pillar component of a latte (the base).

**Terrace:** A series of flat land areas formed on a slope that resemble a series of steps and are used for cultivation.

**Traditional Cultural Properties (TCP):** NPS guidelines define a TCP as a property associated with “cultural practices and beliefs of a living community that are (a) are rooted in that community’s history, and (b) are important in maintaining the continuing cultural identity of the community” (Parker and King 1998, 1).

**Tsunami:** A tsunami, also known as a tidal wave, is a series of large waves caused by earthquakes or volcanic eruptions that take place underwater.

**Typhoon:** A mature tropical cyclone that develops in the Northwestern Pacific Basin region.

**Ungulate:** A mammal that has hooves.

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**View of the I'Chenchon Park Wildlife Conservation Area, Rota. Photo: NPS.**

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