4.9 TERRESTRIAL BIOLOGY

Section 4.9 describes the specific direct and indirect impacts on terrestrial biological resources that could result from implementation of the proposed action. Both the construction and operation elements of the proposed action have the potential to impact the terrestrial biological resources of both Tinian and Pagan.

4.9.1 Approach to Analysis

A variety of laws, regulations, Executive Orders, plans, and policies, such as the Endangered Species Act and the Migratory Bird Treaty Act, are applicable to evaluating the proposed action impacts for terrestrial biology. A complete listing of applicable regulations is provided in Appendix E, *Applicable Federal and Local Regulations*.

The terrestrial biology impact analysis addresses potential effects to vegetation communities, wildlife, and special-status species (i.e., species protected by federal or local law). Representations of the Tinian and Pagan RTAs and their associated support facilities/infrastructure construction footprints (described in Chapter 2, *Proposed Action and Alternatives*) were quantified using Geographic Information System analysis. Training area disturbance footprints were also accounted for to ensure that the full range of potential impacts was identified. Under the proposed action, impacts may be either temporary (reversible) or permanent (irreversible). Direct and indirect impacts are distinguished as follows.

Direct impacts occur at the same place and/or time as actions generated by proposed construction (e.g., ground-disturbing activities) and training operations (e.g., range use). These impacts may include, but are not limited to, the following:

- Permanent loss of habitat due to vegetation removal during construction
- Temporary loss of habitat due to vegetation removal during construction (e.g., some areas would be revegetated after construction), noise, lighting, and/or human activity
- Permanent loss of habitat due to human activity, noise, and/or lighting that could prevent a wildlife species, including special-status species, from occupying otherwise suitable habitat
- Temporary or permanent injury or mortality of wildlife or special-status species caused by the action and occurring at the same time and place as the action
- Permanent or temporary loss of habitat due to potential wildfires generated by training activities

Direct impacts from construction ground disturbance and operational vegetation clearing were assumed within all areas labeled as facility footprints and as “Vegetation Maintenance” in Appendix F, *Geology and Soils Technical Memo*.

Indirect impacts are caused by or result from project-related activities, are usually later in time, and are reasonably foreseeable. Potential causes of indirect impacts include, but are not limited to, the following:

- Introduction of new or increased dispersal of existing non-native, invasive species within the CNMI

- Permanent or temporary loss of habitat due to potential wildfires generated by training activities (e.g., increased erosion, spread of invasive species)
- Pollutants that are released during military training
- Temporary or permanent impacts on reproductive success or survival of wildlife or special-status species caused by the action but occurring later in time

Indirect impacts from construction ground disturbance and operational vegetation clearing were assumed within all areas labeled as facility footprints and as "Vegetation Maintenance" in Appendix F, *Geology and Soils Technical Memo*.

General principles used to evaluate impacts are:

- The extent, if any, that the action would result in substantial loss or degradation of habitat or ecosystem functions (natural features and processes) essential to the persistence of native flora or fauna populations
- The extent, if any, that the action would diminish the population size, distribution, or habitat of special-status species or regionally important native plant or animal species
- The extent, if any, that the action would permanently degrade ecological habitat qualities that special-status species depend upon, and which partly determines the species' prospects for conservation and recovery
- The extent, if any, that the action would be likely to jeopardize the continued existence in the wild of any species listed or proposed for listing under the Endangered Species Act

Specific evaluation criteria are discussed below. If significant impacts were determined, then mitigation may be proposed to minimize or offset the impacts.

4.9.1.1 Vegetation Communities

To determine whether impacts to vegetation communities were significant, a vegetation base map was overlaid onto the footprint of proposed ground disturbance using a Geographic Information System. This impact quantification focused on areas of high- and medium-intensity disturbance (i.e., vegetation removed [high] or habitat changed [medium]), with the rarity of the affected plant community taken into consideration in making an impact determination.

Native limestone forests are especially important because they retain the functional habitat for native species, particularly special-status species, and because restoration to replace cleared, native forest would be a decades-long process. Similarly, wetlands provide required habitat for native wildlife and special-status species and provide important hydrologic functions. Impacts to vegetation communities were evaluated for significance primarily based on the extent and landscape context (i.e., fragmentation) of temporary or permanent loss of primary limestone forest or wetland communities.

4.9.1.2 Native Wildlife

To identify potential impacts to wildlife, the activities associated with the proposed action were considered in the context of affected species' life history and ecology (e.g., nesting behavior and habitat, foraging habitat, mobility, and migration). An action would be considered significant if there was physical loss of or exclusion from required habitat, death, or decreased productivity of native wildlife

populations. Assessment of the likelihood of these impacts was based on information from published scientific literature and the knowledge of subject matter experts.

Impacts were determined significant if native wildlife species are present and the proposed project would result in the decrease in population sizes or distributions of regionally important native wildlife species (excluding special-status wildlife species that are addressed separately below). Potential causes of impacts to native wildlife may include, but are not limited to:

- Permanent removal or degradation of a natural community or ecosystem that would substantially decrease the size or distribution of wildlife populations
- Permanent loss of vegetation or wildlife habitat identified as declining or rare in the region (i.e., native limestone forest and wetlands)
- Permanent loss or long-term disruption of a regionally important wildlife movement corridor.
- Inadvertent introduction of the brown treesnake to Tinian or Pagan by personnel, equipment, or supply movement from Guam
- Disruptions of key elements of the life history (e.g., breeding, nesting, foraging, resting) of wildlife species from human activities such as noise or lights

4.9.1.3 Special-status Species

Similar to the criteria applied to evaluate impacts to wildlife, the significance of impacts to special-status species were based on the presence of these species and the anticipated level of disturbance to the areas where they are present. The presence of species and their estimated densities were determined based on field surveys and wildlife inventories. A base map of this information was overlaid onto the footprint of potential disturbance from construction and operation, and the magnitude of impacts was then identified.

4.9.1.3.1 Endangered Species Act-listed Species

In accordance with section 7 of the Endangered Species Act of 1973 (16 U.S. Code 1531 *et seq.*), a Biological Assessment is being prepared to analyze the potential effects of Department of Defense actions on listed threatened and endangered species and those proposed for listing under the jurisdiction of the U.S. Fish and Wildlife Service. Section 7(a)(2) of the Endangered Species Act requires federal agencies to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any federally threatened or endangered species or result in the destruction or adverse modification of critical habitat. In accordance with Section 102 of NEPA, the Department of Defense is in section 7 consultation with the U.S. Fish and Wildlife Service regarding the potential impacts from actions proposed under the preferred alternative presented in this EIS/OEIS on Endangered Species Act-listed species and is in section 7 conference for those species proposed to be listed. Those species that are addressed in the section 7 consultation and conference process with the U.S. Fish and Wildlife Service are as follows:

- Mariana fruit bat – threatened
- Mariana common moorhen – endangered
- Micronesian megapode – endangered
- Green turtle (nesting) – threatened

- Hawksbill turtle (nesting) – endangered
- Humped tree snail – proposed endangered
- Slevin's skink – proposed endangered
- Pacific sheath-tailed bat – proposed endangered
- *Heritiera longipetiolata* – proposed endangered
- *Dendrobium guamense* – proposed endangered
- *Solanum guamense* – proposed endangered
- *Tuberolabium guamense* – proposed endangered
- *Cycas micronesica* – proposed threatened
- *Bulbophyllum guamense* – proposed endangered

Impacts of the proposed action under section 7 of the Endangered Species Act are analyzed as impacts to individuals (as defined by "take" under the Endangered Species Act). In contrast, analysis of impacts to species under NEPA, presented here, relates to the impacts on populations of these species. The proposed avoidance, minimization, and mitigation measures described in this EIS/OEIS to benefit Endangered Species Act-listed and proposed species are preliminary, are focused on population-level benefits, and may be revised or augmented to further minimize impacts to individuals during Endangered Species Act section 7 consultation.

4.9.1.3.2 Migratory Bird Treaty Act-listed Species

The Migratory Bird Treaty Act prohibits the taking, killing, or possession of migratory birds unless permitted by regulation. An activity has a significant effect if, over a reasonable period, it diminishes the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. In 2007, the U.S. Fish and Wildlife Service finalized a rule authorizing the Department of Defense to "take" migratory birds in the course of military readiness activities, as directed by the 2003 National Defense Authorization Act. Congress defined military readiness activities as all training and operations of the armed forces that relate to combat and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. Military readiness activities do not include: (A) routine operation of installation support functions such as administrative offices, military exchanges, water treatment facilities, schools, housing, storage facilities, and morale, welfare, and recreation activities; (B) the operation of industrial activities; and (C) the construction or demolition of facilities used for a purpose described in A or B (50 CFR).

For the purposes of this EIS/OEIS, the operation of the proposed Tinian and Pagan RTAs is considered a military readiness activity and the construction of the proposed Tinian and Pagan RTAs is considered a non-military readiness activity. The Department of Defense must confer and cooperate with the U.S. Fish and Wildlife Service on developing and implementing conservation measures to minimize or mitigate adverse effects of a military readiness activity if that activity has a significant adverse effect on a population of a migratory bird species. Migratory bird conservation relative to non-military readiness activities is addressed separately in a Memorandum of Understanding developed in accordance with Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds.

Potential causes of impacts to special-status species may include, but are not limited to:

- Permanent removal or degradation of a natural community or ecosystem that would substantially decrease the population size or distribution of any special-status species
- Permanent loss of or decrease in populations or habitat of any Endangered Species Act-listed species, any species that has been proposed for listing under the Endangered Species Act, any Migratory Bird Treaty Act-protected species, any CNMI-listed species, or any CNMI Species of Special Conservation Need
- Permanent loss or long-term disruption of a regionally important corridor for the movement of any special-status species
- Inadvertent introduction of the brown treesnake to Tinian or Pagan by personnel, equipment, or supply movement from Guam
- Disruptions of key elements of the life history (e.g., breeding, nesting, foraging, resting) of any population of a special-status species from noise, lighting, or other components of the action

4.9.2 Resource Management Measures

Resource management measures that are applicable to terrestrial biological resources include the following:

4.9.2.1 Avoidance and Minimization Measures

- *Bird/Animal Aircraft Strike Hazard Plan.* Preparation and implementation of a Bird/Animal Aircraft Strike Hazard Plan. The plan would include safeguards for aircraft and flight crews, and would decrease impacts to wildlife and special-status species by avoiding and minimizing potential aircraft strikes of birds and other animals.
- *Range Environmental Vulnerability Assessment.* Preparation of a Range Environmental Vulnerability Assessment to assess the potential impacts to human health and the environment from live-fire training operations. The purpose of the Range Environmental Vulnerability Assessment is to identify whether there is a release or a substantial threat of a release of munitions constituents from the operational range or range complex areas to off-range areas and determine if the release causes an unacceptable risk to human health and/or the environment (see Appendix D, *Best Management Practices,* for further details).
- *Range Fire Management Plan.* Preparation and implementation of a Range Fire Management Plan (within the Range Training Area Management Plan). Implementation of the plan would reduce the risk of fire originating from the RTAs, thereby minimizing potential for impacts to biological resources from fire.
- *Biosecurity.* Adherence to Commander Navy Region Marianas Instruction 3500.4A (*Marianas Training Manual*) Appendix A: Brown Treesnake Control and Interdiction Requirements; Commander Navy Region Marianas Instruction 5090.10A (*Brown Tree Snake Control and Interdiction Plan*)*;* anticipated final Joint Region Marianas Instruction 5090.4, which will replace Instruction 5090.10A; and 36 Wing Instruction 32-7004 (*Brown Tree Snake Management*) will minimize the likelihood of brown treesnake introduction to Tinian or Pagan (see Appendix L, *Biological Resources Supporting Documentation*). In addition, for CJMT activities, per Department of Defense Transportation Regulations Chapter 505 protocols, the Department of

Defense will commit to implementing 100% inspection of all outgoing aircraft and all outgoing cargo transported via ship or aircraft from Guam to Tinian or Pagan with qualified quarantine officers and dog detection teams. Repeat (redundant) 100% inspections will also be conducted on Guam within snake-free quarantine areas for all cargo transported from Guam to Tinian or Pagan. These brown treesnake sterile areas will be subject to: (1) multiple day and night searches for snakes with qualified canine interdiction teams, (2) snake trapping, and (3) human visual inspection for snakes. For all brown treesnake interdiction work, the skills and standards required to certify an inspection team as "qualified" will be agreed upon mutually by the Department of Defense, U.S. Geological Survey Biological Resources Discipline, and U.S. Fish and Wildlife Service.

The Department of Defense is a participating department in the development of the Regional Biosecurity Plan (previously referred to as the Micronesia Biosecurity Plan), with the National Invasive Species Council, U.S. Department of Agriculture Animal and Plant Health Inspection Service, U.S. Geological Survey Biological Resources Discipline, and the Smithsonian Environmental Research Center. The Regional Biosecurity Plan is intended to coordinate and integrate inter-agency non-native invasive species management efforts such as species control, interdiction, eradication, and research. When the Regional Biosecurity Plan is completed, the Department of Defense will work cooperatively with the U.S. Fish and Wildlife Service in the development and implementation of protocols for interdiction and control methods in accordance with recommendations in the plan that are determined to be applicable to CJMT activities.

4.9.2.2 Best Management Practices and Standard Operating Procedures

Best management practices and standard operating procedures that are applicable specifically to the terrestrial biology resources include:

- *Brown Treesnake Interdiction*. Joint Region Marianas has established a comprehensive brown treesnake interdiction program to ensure that military activities do not contribute to the spread of brown treesnakes to the CNMI or other locations. Interdiction requirements specified in Commander Navy Region Marianas instructions will be implemented for CJMT activities.
- *Integrated Pest Management Plan*. The U.S. military would develop and implement a comprehensive Integrated Pest Management Plan. This Plan would encompass all activities regarding the importation, handling, storage, use, and application of pesticides as well as address prevention of the introduction of potential invasive species to the CNMI.
- *Invasive Species Interdiction*. Executive Order 13112, Invasive Species, directs federal agencies to prevent the spread of any invasive species in their work. To implement this directive for CJMT activities, the Department of Defense will require development and implementation of Hazard Analysis and Control Point plans for all construction, transport, and logistics activities related to CJMT actions.

- *Biosecurity Outreach and Education*. A biosecurity outreach and education program will be implemented to inform contractors and Department of Defense civilian and military personnel about native versus non-native invasive species and the impacts of non-native invasive species on native ecosystems.
- *Regional Biosecurity Plan*. DoN funded the development of a Regional Biosecurity Plan to coordinate inter-agency invasive species management efforts, including control, interdiction, eradication, and research. Protocols for interdiction and control methods will be developed and implemented for Regional Biosecurity Plan recommendations that are applicable to CJMT activities.
- *Contractor Education Program*. The DoN has developed an education program to ensure construction contractor personnel are informed of the biological resources in the project area, including special-status species, avoidance measures, and reporting requirements.

For further details refer to Appendix D, *Best Management Practices*.

4.9.3 Tinian

4.9.3.1 Tinian Alternative 1

4.9.3.1.1 Construction Impacts

4.9.3.1.1.1 Vegetation Communities

Vegetation communities affected during construction activities associated with Tinian Alternative 1 are listed in Table 4.9-1 and shown in Figures 4.9-1a and 4.9-1b. Under this alternative, approximately 1,798 acres (728 hectares) of undeveloped or non-barren land would be impacted, representing approximately 8% of the island and 12% of the Military Lease Area. Two proposed facilities comprise approximately half of the total impacts to vegetation communities: the High Hazard Impact Area (527 acres [213 hectares]) and the Drop Zone (456 acres [185 hectares]). The majority of the impacted vegetation communities (1,737 acres [703 hectares]) are composed of tangantangan (780 acres [316 hectares] or 9% of total on island), mixed introduced forest (622 acres [252 hectares] or 9% of total on island), and herbaceous scrub (335 acres [135 hectares] or 7% of total on island). In addition, 6.3 acres (2.5 hectares), or 0.5% of total on island, of native limestone forest would be removed.

Native limestone forest has been significantly reduced on Tinian due to past activities, including widespread cultivation of non-native species (e.g., sugar cane), activities during World War II, intentional and accidental introduction of non-native plants and animals, and grazing by non-native ungulates. Limestone forests on Tinian are important because they retain the functional ecological components of native forest that provide habitat for the majority of Tinian's native species, including Endangered Species Act-listed and proposed species, and the CNMI-listed species. These forests also help maintain water quality and reduce fire risk. Non-native plant species (e.g., tangantangan) significantly alter the native forest structure, composition, and resilience of the forest to other disturbances and also provide less suitable conditions for native flora and fauna species than a native forest (Morton et al. 2000; Tang et al. 2011; DoN 2013).

Table 4.9-1. Potential Direct Impacts to Vegetation Communities with Implementation of Tinian Alternative 1

*Project Area**	*Vegetation Community (acres)*[1]											
	NLF	***MIF***	***TT***	***HS***	***Cas***	***Coco***	***BS***	***Wet***	***Ag***	***Bar***	***Dev***	***Total***
High Hazard Impact Area[2]	3.3	73.9	293.7	145.1	0	0	0	0.5[3]	0	0	11.0	527.5
Combat Pistol Range	0	2.1	0	0	0	0	0	0	0	0	0	2.1
Multi-purpose Range Complex[4]	0	8.3	0	14.3	0.6	0	0	0	0	0	0.2	23.4
Battle Sight Zero Range	0	2.1	0	0	0	0	0	0	0	0	0	2.1
Anti-armor Tracking Range (Automated)	0	6.1	2.8	6.4	0.6	0	0	0	0	0	0.2	16.1
Multi-purpose Automated Unknown Distance Range/Field Fire Range	0	9.2	0.4	21.4	0	0	0	0	0	0	0	31.0
Infantry Platoon Battle Course	0	16.2	0	6.4	0	0	0	0	0	0	0.6	23.2
Urban Assault Course (South)	0	20.1	0	0	0	0	0	0	0	0	0	20.1
Northern Battle Area Complex	0	0	9.6	0	1.6	0	0	0	0	0	0	11.2
Urban Assault Course (North)	0	0.8	12.8	0	2.0	0	0	0	0	0	0.2	15.8
Drop Zone	0	0	302.2	42.7	14.0	0	0	0	0	0	96.5	455.4
Field Artillery Indirect Fire Range (Firing Points)	0.4	18.9	32.2	14.1	1.5	0	17.0	0	0	0	0.9	85.0
Convoy Course Engagement Areas	0	11.3	15.4	1.0	2.4	0	0	0	0	0	1.0	31.1
Convoy Course	0	13.0	15.9	5.1	0.4	0.5	0	0	0	0	30.7	65.6
Tracked Vehicle Driver's Course	1.5	33.1	39.8	18.1	0.7	0.3	0.1	0	<0.1	0.1	6.4	100.1
Tactical Amphibious Landing Beach (Unai Chulu)	0	0	0.1	0.9	0	0	0	0	0	3.0	0	4.0
Landing Zones	0	7.0	5.3	6.1	0	0	0	0	0	0	1.4	19.8
Range Control Observation Points	0	1.7	9.4	3.7	0	0	<0.1	0	0	<0.1	0	14.8
Surface Radar Sites	0	0.1	0.6	0.1	0	0	0.1	0	0	<0.1	0	0.9
Roadway Improvements	0	4.0	4.4	2.4	0	0	0	0	0	0	32.4	43.2
Fences	1.1	10.9	9.0	9.0	0.1	0	0	0	0	<0.1	5.7	35.8
Munitions Storage Area	0	5.9	27.0	4.9	0	0	0	0	0	0	<0.1	37.8
Airport Improvements and Staging Area	0	147.8	0	23.3	7.9	0	0	0	0	0	48.7	227.7
Tinian Port Improvements and Staging Area	0	0	0	0	0	0	0	0	0	0	4.5	4.5
Base Camp	0	229.9	0	10.5	3.3	0	0	0	0	0	12.5	256.2
Total Impacted under Alternative 1	**6.3**	**622.4**	**780.6**	**335.5**	**35.1**	**0.8**	**17.2**	**0.5**	**<0.1**	**3.1**	**252.9**	**2,054.4**
Total on Tinian	*1,355.7*	*6,853.1*	*8,443.6*	*4,819.0*	*353.9*	*97.9*	*551.0*	*64.9*	*331.7*	*199.9*	*1,915.7*	*24,986.4*
% Impacted under Alternative 1 on Tinian	*0.5%*	*9.1%*	*9.2%*	*6.9%*	*9.7%*	*0.9%*	*3.1%*	*0.7%*	*<0.1%*	*<0.1%*	*13.2%*	*8.2%*

Notes: *Project areas are based on areas depicted and labeled in Section 2.4.

[1]NLF = native limestone forest; MIF = mixed introduced forest; TT = tangantangan; HS = herbaceous-scrub; Cas = *Casuarina* forest; Coco = coconut forest; BS = beach strand; Wet = wetlands habitat; Ag = agriculture; Bar = barren; Dev = developed; < = less than.

[2]Includes fire break/buffer, perimeter road, Hand Grenade Range, Mortar Range, Light Anti-armor Weapon Range, Grenade Launcher Range, targets for Close Air Support Range, targets for Offensive Air Support Range, targets for Field Artillery Indirect Fire Range.

[3]Although two ephemeral ponds associated with the Mahalang Complex would be impacted under Alternative 1, these are not considered wetlands.

[4]Includes Anti-armor Tracking Range, Tank/Fighting Vehicle Stationary Target Range, and Multi-purpose Range Complex.

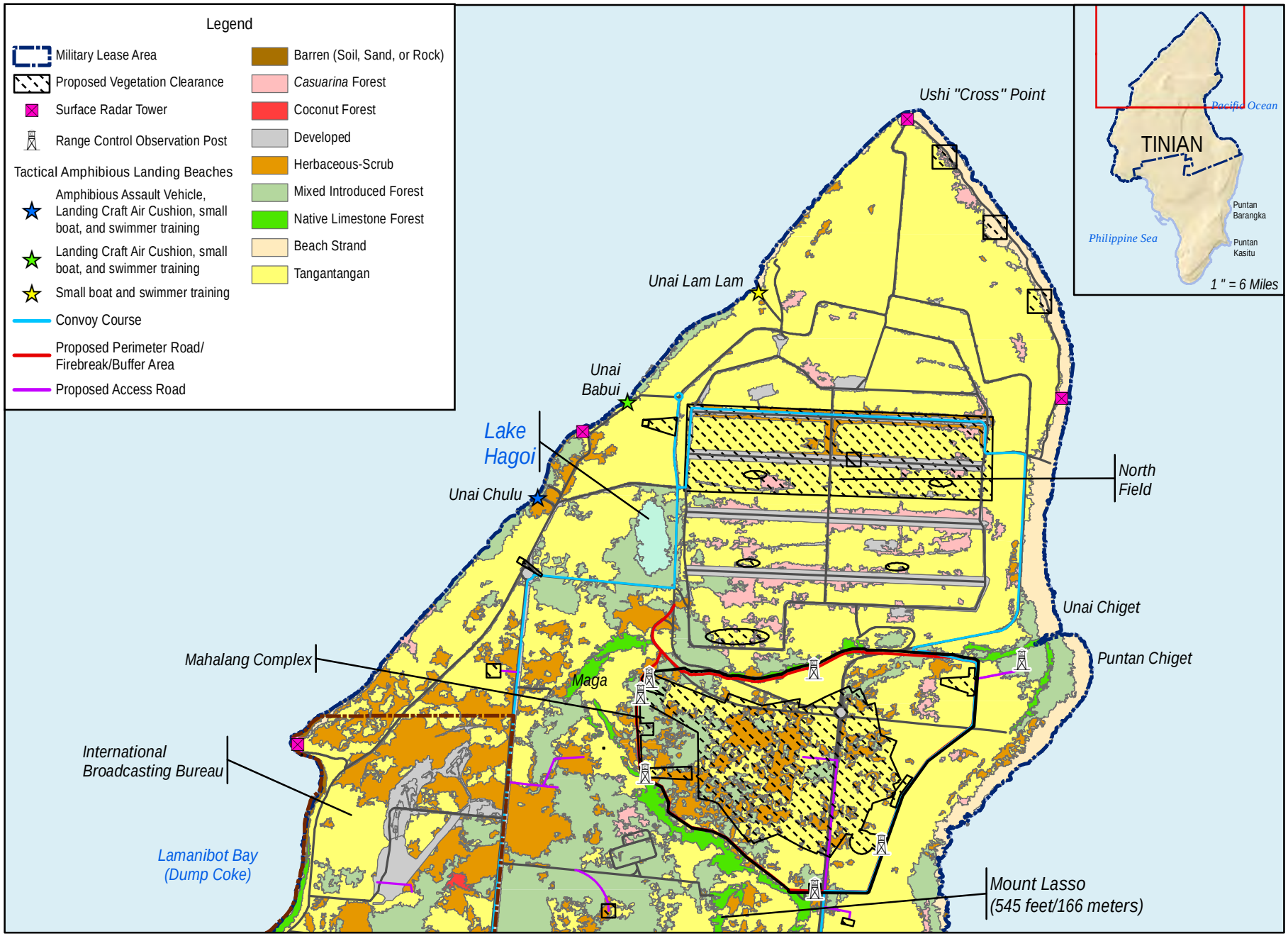

Figure 4.9-1a
Northern Military Lease Area - Tinian Alternative 1,
Vegetation Communities

Sources: Amidon 2009; DoN 2013b

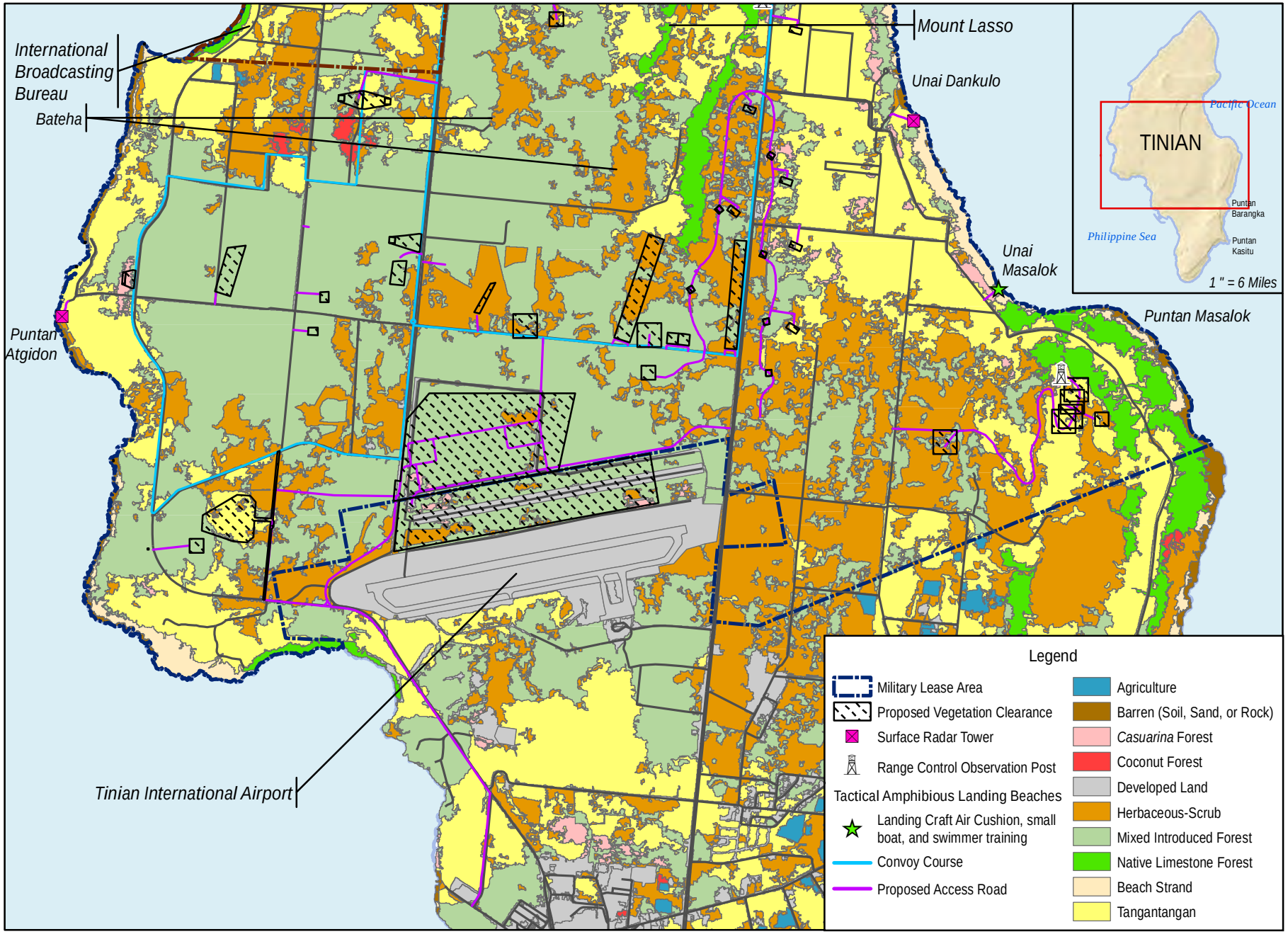

Figure 4.9-1b
Southern Military Lease Area - Tinian Alternative 1,
Vegetation Communities

Sources: Amidon 2009; DoN 2013b

Under Tinian Alternative 1, 6.3 acres (2.5 hectares) of native limestone forest, or 0.5% of the total acreage for this community on the island, would be removed, primarily within the High Hazard Impact Area (see Table 4.9-1). Therefore, given the importance of native limestone forest habitat for native species and the continuing loss of limestone forest on Tinian, the conversion of 6.3 acres (2.5 hectares) to developed area under Tinian Alternative 1 would result in significant, direct impacts to the regional vegetation community and its function.

In addition, two ephemeral ponds within the Mahalang Complex totaling less than 0.5 acre (0.2 hectare) of wetlands habitat would be lost due to construction of the hand grenade and grenade launcher ranges within the High Hazard Impact Area. Based on recent wetlands surveys on Tinian, one of these two ephemeral ponds is considered an isolated wetland that supports ephemeral wetland habitat during years of high rainfall. The loss of less than 0.5 acre (0.2 hectare) of wetland habitat would not be significant.

Mitigation measures may be implemented to mitigate potential significant direct, long-term impacts of proposed construction activities on vegetation communities with implementation of Tinian Alternative 1. To mitigate for these significant impacts to 6.3 acres (2.5 hectares) of native limestone forest, the DoN would propose to implement forest enhancement on a minimum of 6.3 acres (2.5 hectares) of mixed introduced forest. Implementation of proposed mitigation measures would reduce the impact to less than significant. Forest enhancement would include but is not limited to the following:

- Propagating, planting, and establishing dominant and rare species that are characteristic of native limestone forest habitats (e.g., *Cynometra ramiflora*, *Neisosperma oppositifolia*, *Eugenia palumbis, Guamia mariannae*, pandanus, banyan tree, and tropical almond)
- Removing non-native, invasive vegetation
- Controlling non-native predators (e.g. rats, feral cats)

The Department of Defense would prepare a Forest Enhancement/Restoration and Monitoring Plan that would provide detailed guidance on proposed forest enhancement activities on Tinian as well as long-term monitoring of the success of the proposed forest enhancement measures. Although the exact locations of the proposed forest enhancement areas have not been identified, prior to implementing any forest enhancement activities appropriate environmental compliance documentation would be prepared, including coordination with cultural resources personnel under Section 106 of the National Historic Preservation Act regarding the potential occurrence of cultural resources within any proposed forest enhancement site.

The anticipated benefit of implementing these potential mitigation measures is improved habitat quality for native flora and fauna, including wildlife and special-status species. Forest enhancement also supports natural regeneration and seed propagation, reduces erosion, and increases water retention which reduces fire risk.

4.9.3.1.1.2 Native Wildlife

Potential impacts from construction activities under Tinian Alternative 1 to native bird species on Tinian that are not listed under the Migratory Bird Treaty Act are described in this section. Impacts to native bird species protected under the Migratory Bird Treaty Act are addressed separately below in the *Special-status Species* section.

As discussed above in Vegetation Communities, a total of approximately 1,798 acres (728 hectares) of habitat for native species would be removed because of proposed construction activities under Tinian Alternative 1 (see Table 4.9-1). This is approximately 12% and 8% of the total habitat within the Military Lease Area and on all of Tinian, respectively. Table 4.9-2 provides the number of birds that may be impacted for the five monitored bird species due to the loss of 1,745 acres (706 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats. Estimated numbers were derived from the 2013 native bird surveys on Tinian (DoN 2014a).

The Tinian monarch nests in native limestone forest, mixed introduced forest, and tangantangan forest habitats. The Military Lease Area comprises roughly 66% of the current monarch habitat on the island and supports about 52% of the total monarch population (DoN 2014a). Based on estimated 2013 densities (DoN 2014a), the number of Tinian monarchs that would potentially be permanently displaced by loss of habitat through construction would be 6,600 birds (Table 4.9-2). The Tinian monarch is found only on Tinian, was previously listed as endangered under the Endangered Species Act, was delisted in 2004 (U.S. Fish and Wildlife Service 2004), and was petitioned in 2013 for relisting (Center for Biological Diversity 2013).

Table 4.9-2. Potential Direct and Permanent Impacts to Five Native Bird Species from Proposed Construction Activities under Tinian Alternative 1

Species	*Number of Birds Impacted by Removal of Habitat**				*Total*	*Estimated 2013 Total Tinian Population*	*% of Tinian Population Impacted*
	NLF	*MIF*	*TT*	*HS*			
Bridled white-eye	114	13,312	14,951	4,749	33,126	442,073	7.5%
Micronesian honeyeater	7	607	504	236	1,354	20,660	6.6%
Micronesian starling	11	1,044	1,240	578	2,873	40,489	7.1%
Rufous fantail	41	3,957	3,857	986	8,841	125,668	7.0%
Tinian monarch	29	2,764	3,164	676	6,633	91,420	7.2%

Notes: *NLF = native limestone forest, MIF = mixed introduced forest, TT = tangantangan, HS = herbaceous scrub.
Source: DoN 2014a.

The current Tinian Military Retention Land for Wildlife Conservation (or Conservation Area), which was established for the protection of Tinian monarch habitat under a previous Endangered Species Act consultation (U.S. Fish and Wildlife Service 1998; Government of the CNMI and United States of America 1999), would be impacted by proposed construction activities. Four areas are being assessed as potential conservation areas for the protection of the Tinian monarch and other wildlife species (Figure 4.9-2). These areas may also be used for additional natural resource conservation actions such as forest enhancement and/or invasive species control. The Department of Defense is coordinating with the Federal Aviation Administration and the U.S. Fish and Wildlife Service on these potential conservation areas.

Proposed construction activities would remove 1,745 acres (706 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats currently available to native birds on Tinian. In particular, the removal of forested and herbaceous scrub habitats would result in the loss of nesting, foraging, and resting areas for these bird species as well as other native wildlife species.

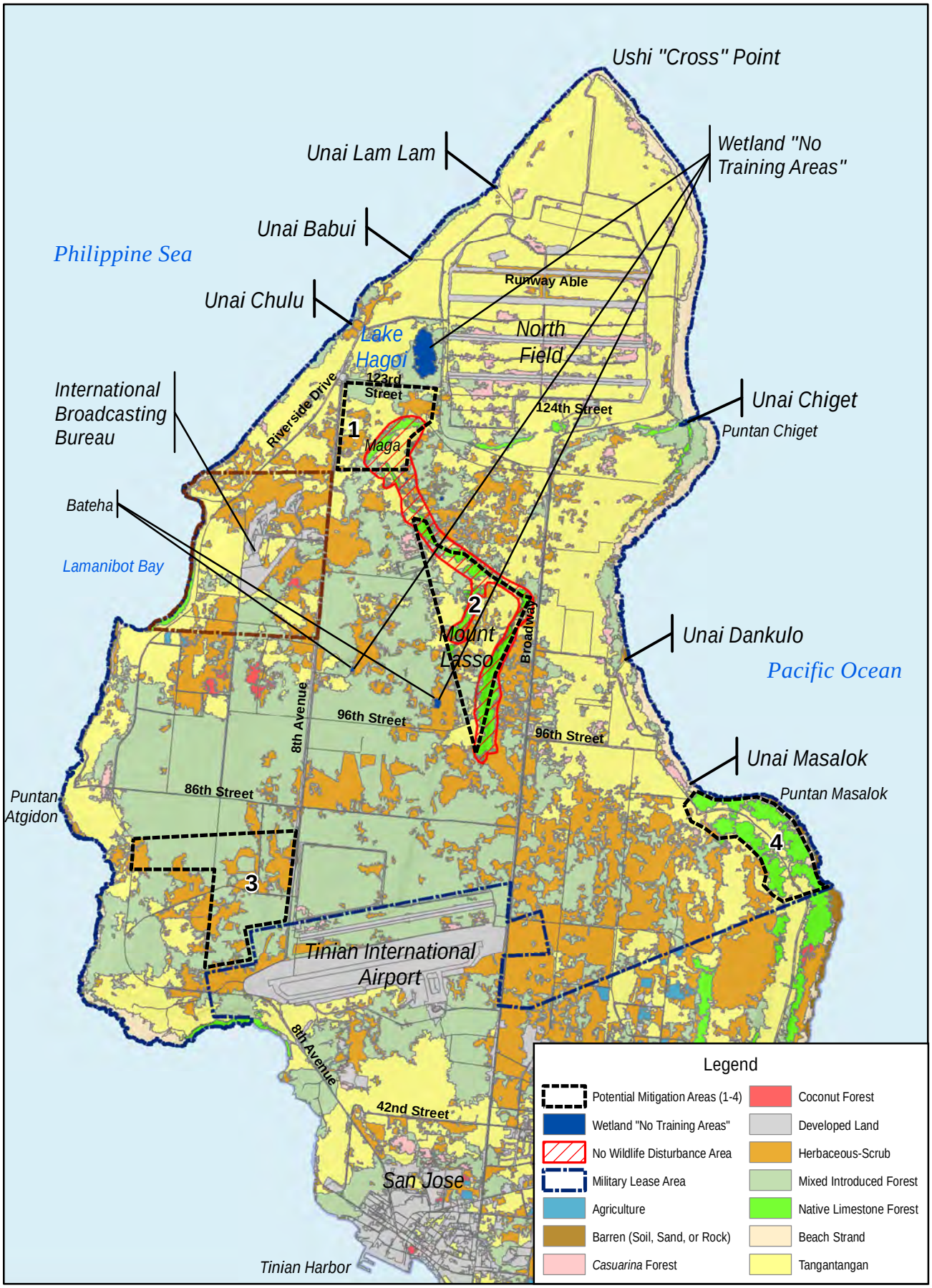

Figure 4.9-2
Potential Mitigation Areas with Implementation of Tinian Alternatives 1, 2 or 3

Sources: Amidon 2009; DoN 2013b

In addition, noise and the presence of construction equipment and human activity may cause wildlife to temporarily avoid areas in the immediate vicinity of construction activities. Nesting or breeding adults of various wildlife species may be disturbed by noise and construction activities, which may result in abandonment or depredation of eggs or young. These activities may also temporarily displace wildlife from breeding habitat, resulting in reduced breeding success. Direct mortality from construction equipment is unlikely because noise associated with pre-construction activities and human presence is likely to disperse wildlife prior to any equipment use, although vehicle traffic would increase the potential for wildlife collisions. Although construction would occur over an 8 to 10 year period, these noise impacts would be short-term and minor because only a small number of range and support facilities would be under construction at any given time. As such, these temporary direct impacts to wildlife populations from construction noise and human activities would be less than significant.

Overall, implementation of Tinian Alternative 1 would result in significant direct impacts to the populations of bridled white-eye, Micronesian honeyeater, Micronesian starling, rufous fantail, and Tinian monarch due to the permanent removal of approximately 1,745 acres (706 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats. These bird species are territorial, meaning that a minimum area is required for each bird or breeding pair for all of their foraging and nesting activities. For most animal species, and particularly within island ecosystems, available but unoccupied habitat is rare (if it does exist, it is generally very low-quality habitat). This is the case unless populations are limited not by habitat, but by predators, disease, or over-hunting. Based on available data, there is no indication that there are large areas of available but unoccupied habitat on Tinian, particularly for forest and shrub breeding bird species. For these reasons, the loss of 1,745 acres (706 hectares) of habitat would be significant, even with forest enhancement efforts. Although bird densities are higher in higher-quality habitats and more birds are expected to eventually occupy areas of proposed forest enhancement, the proposed area of forest enhancement is not large enough to make up for the overall loss of available habitat under Alternative 1. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

To mitigate the potential significant direct, long-term impacts to forested and herbaceous scrub habitats used by native bird and other wildlife species, the DoN would propose to implement forest enhancement of native limestone forest, mixed introduced forest, tangantangan forest, and herbaceous scrub habitats. This is in addition to the forest enhancement of 6.3 acres (2.5 hectares) of native limestone forest or mixed introduced forest described above in the *Vegetation Communities* section. Forest enhancement would include but is not limited to the following:

- Propagating, planting, and establishing dominant and rare species that are characteristic of native limestone forest habitats (e.g., *Cynometra ramiflora*, *Neisosperma oppositifolia*, *Eugenia palumbis*, *Guamia mariannae*, pandanus, banyan tree, and tropical almond)
- Removing non-native, invasive vegetation
- Controlling non-native predators (e.g. rats, feral cats)

Tinian Military Retention Land for Wildlife Conservation. Under Tinian Alternative 1, portions of the existing Wildlife Conservation Area would be impacted by proposed construction activities. Four areas are being considered as potential conservation areas for the protection of the Tinian monarch and other

wildlife species (see Figure 4.9-2). These areas may also be used for additional natural resource conservation actions such as forest enhancement and/or invasive species control. The Department of Defense is coordinating with the Federal Aviation Administration and the U.S. Fish and Wildlife Service on these potential conservation areas.

Even with implementation of mitigation measures, impacts to native wildlife would be significant and unavoidable due to vegetation removal associated with range construction.

Mitigation monitoring would be required for these potential mitigation measures. Therefore, the DoN would prepare a Forest Enhancement/Restoration and Monitoring Plan that would provide detailed guidance on proposed forest enhancement activities on Tinian as well as long-term monitoring of the success of the proposed forest enhancement measures.

The DoN, in coordination with the U.S. Fish and Wildlife Service, would also prepare a Forest Bird Monitoring and Tinian Monarch Management Plan to monitor the potential effects of proposed CJMT activities on the Tinian monarch and other forest birds within the Military Lease Area. The proposed Management Plan would be based on continuing the forest bird surveys conducted along a series of transects surveyed in 1982, 1996, 2008, and 2013. The continued surveys would assess the species' overall status and allow evaluation of long-term trends in population size and distribution through comparison with the four previous island-wide surveys of forest birds on Tinian. The data from this monitoring effort would enable the DoN to determine if the Tinian monarch is experiencing declines in abundance or distribution. The Management Plan would also provide recommendations for habitat management to benefit the Tinian monarch population, including, for example, predator control.

4.9.3.1.1.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Based on historical data and surveys conducted in support of this EIS/OEIS, Figures 4.9-3a and 4.9-3b provide the general locations of special-status species within the Military Lease Area. Potential direct impacts to special-status species from proposed construction activities associated with Tinian Alternative 1 include the removal of habitat, fragmentation of remaining habitat, and associated noise, light, and human activities. Individual special-status species are discussed below.

Mariana Fruit Bat

Of the existing 720 acres (291 hectares) of suitable foraging and roosting habitat (i.e., native limestone forest, *Casuarina* forest, and coconut forest) for the Mariana fruit bat, proposed construction activities associated with Tinian Alternative 1 would remove approximately 45 acres (18 hectares). However, due to historic hunting pressure on the species and limited suitable habitat, the Mariana fruit bat no longer regularly occurs on Tinian. As stated in Section 3.9.4.4, the greatest number of recent sightings from Tinian occurred in 2005 when approximately five individuals were sighted in cliff-line forest in the Maga region. Surveys in 2008 resulted in no observations of fruit bats at eight separate count stations at seven locations on Tinian. Fruit bats may occasionally move between Tinian and Aguiguan, which supports a small colony, but currently there is no fruit bat population on Tinian (DoN 2014a).

Because of the rarity of occurrence of Mariana fruit bats on Tinian, the lack of fruit bat roost sites on the island, and the area of native limestone forest that would remain on Mount Lasso Ridge and elsewhere within the Military Lease Area, potential impacts to Mariana fruit bats from proposed construction activities under Tinian Alternative 1 would be less than significant.

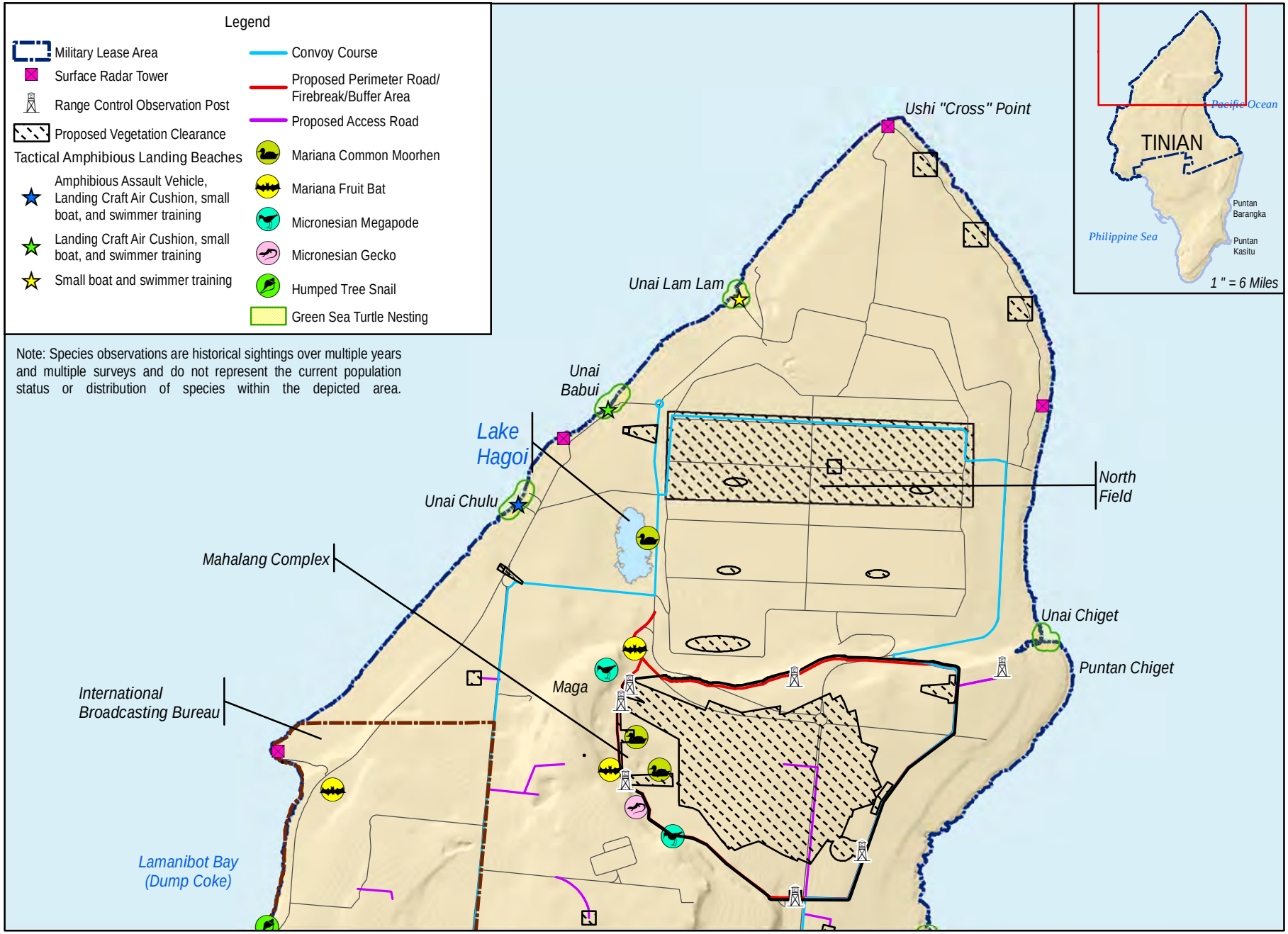

Figure 4.9-3a
Northern Military Lease Area - Tinian Alternative 1,
Occurrence of Special-status Species

Sources:
Hawaiian Agronomics 1985; Krueger and O'Daniel 1999; O'Daniel and Krueger 1999; Witteman 2001; Vogt 2008; USFWS 2009, 2010; Wenninger 2012; DoN 2013a, 2013b, 2013d, 2014a, 2014c

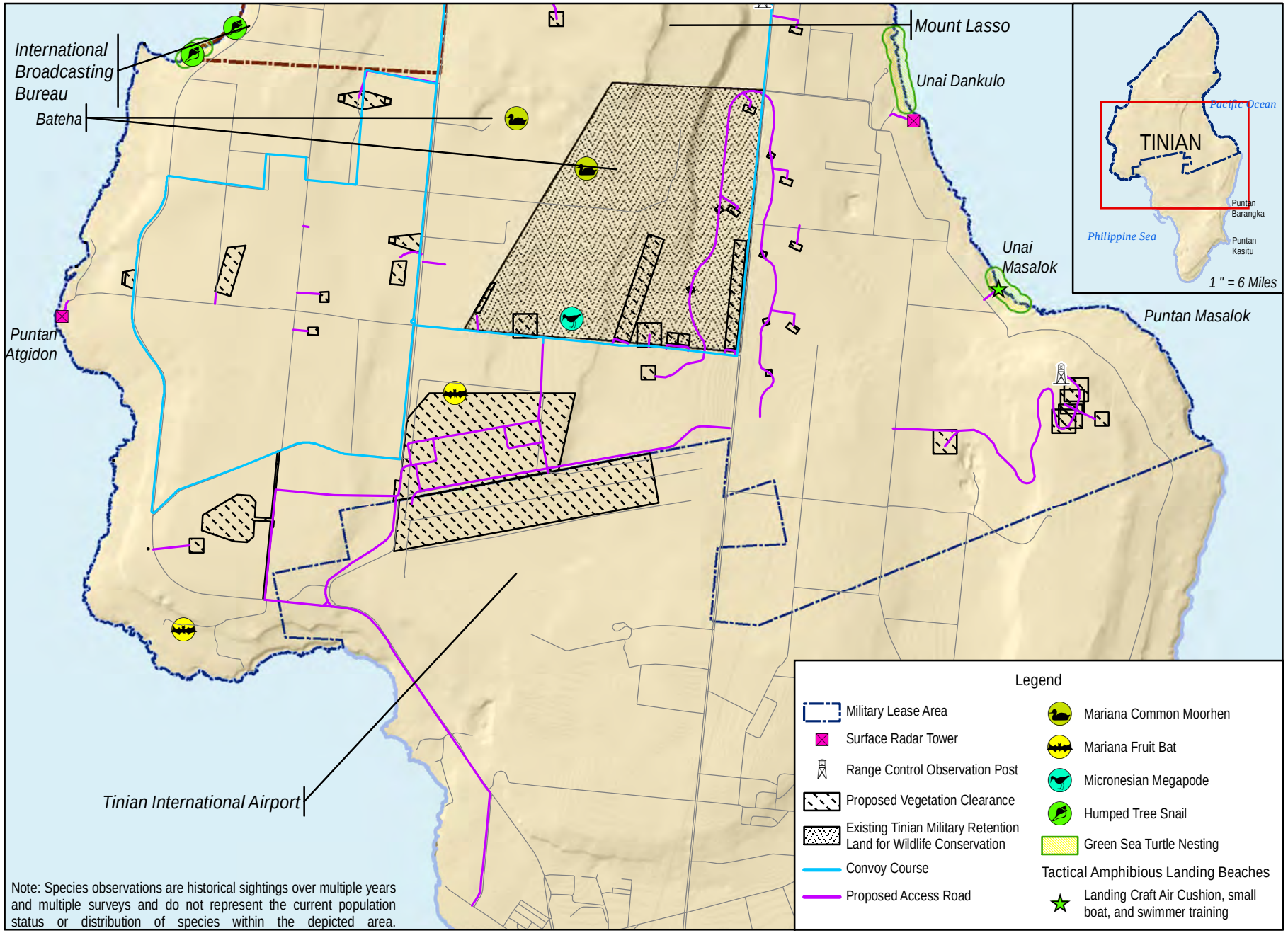

Figure 4.9-3b
Southern Military Lease Area - Tinian Alternative 1,
Occurrence of Special-status Species

Sources:
Hawaiian Agronomics 1985; Krueger and O'Daniel 1999; O'Daniel and Krueger 1999; Witteman 2001; Vogt 2008; USFWS 2009, 2010; Wenninger 2012; DoN 2013a, 2013b, 2013d, 2014a, 2014c

In addition, the potential mitigation measures described above in the *Vegetation Communities* section would also result in a conservation benefit to the Mariana fruit bat due to the proposed forest enhancement of foraging habitat if Mariana fruit bats from Aguiguan or Saipan begin frequenting Tinian in the future.

Mariana Common Moorhen

Construction for road improvements and creation of training ranges on Tinian is anticipated to generate noise levels of 70-90 decibels at a distance of 50 feet (15 meters). The majority of moorhens found on Tinian are located at Lake Hagoi and the Bateha sites, which would not be directly impacted by construction. As construction activities would occur more than 50 feet (15 meters) from Lake Hagoi and the Bateha sites, moorhens using these areas would not be exposed to construction noise, such that impacts to moorhens in these areas are not anticipated.

Noise from vegetation clearing and construction of the Hand Grenade Range and Grenade Launcher Range and a perimeter road around the High Hazard Impact Area within the vicinity of the Mahalang sites may result in moorhens flushing from and temporarily avoiding the Mahalang ephemeral ponds during the wet season.

In addition, proposed construction of the Hand Grenade Range and Grenade Launcher Range within the western portion of the High Hazard Impact Area would remove two ephemeral ponds totaling less than 0.1 acre (0.04 hectare) of suitable moorhen resting and foraging habitat within the Mahalang complex (see Table 4.9-1). None of the ephemeral ponds associated with the Mahalang complex are known to support nesting moorhens, and the sites are used only during the wet season, when they retain sufficient ponded water to support resting or foraging by moorhens. Noise associated with proposed construction activities within the High Hazard Impact Area may cause moorhens to avoid the Mahalang sites; however, moorhens would likely move to available foraging or resting habitat at Lake Hagoi or the Bateha sites.

Therefore, due to the lack of construction noise impacts on moorhens at Lake Hagoi and the Bateha isolated wetlands, and the ability of moorhens to move from the Mahalang sites to Hagoi or Bateha in response to construction noise, construction activities under Tinian Alternative 1 would result in less than significant direct and indirect impacts to the Mariana common moorhen population.

Micronesian Megapode

As stated in Section 3.9.4.4, Micronesian megapodes occur in very low numbers on Tinian with only individual megapodes rarely detected during surveys of the Mount Lasso and Maga areas. Taped-playback surveys in 2013 and 2014 did not detect any megapodes within the Mount Lasso or Maga areas. Megapodes may occasionally move between Tinian and Aguiguan or Saipan, both of which support small breeding populations, but currently there is no megapode population on Tinian within the Military Lease Area.

Although a megapode within the Mount Lasso Ridge or Maga areas could potentially hear noise associated with construction activities, based on the limited use of lands within the Military Lease Area by megapodes and that the area of suitable habitat within the Mount Lasso and Maga areas would not be impacted, potential impacts to Micronesian megapodes from proposed construction activities under Tinian Alternative 1 would be less than significant.

Sea Turtles

Construction for road improvements and creation of training ranges on Tinian is anticipated to generate noise levels from 70-90 decibels at a distance of 50 feet (15 meters). The majority of proposed construction activities do not occur in proximity to beaches that may support nesting sea turtles; construction at Unai Chulu is addressed below. However, all construction activities would be carried out during daylight hours, such that exposure to construction noise for green turtles nesting on the beaches at night is not anticipated. Potential impacts to eggs or embryos within nests on beaches from construction noise is considered discountable given the distance of the nests from proposed construction activities and the fact that sound would be attenuated or prevented from reaching eggs or embryos that are buried beneath sand.

Under Tinian Alternative 1, 3.0 acres (1.2 hectares) of beach would be impacted due to disturbance resulting from the construction associated with the Tactical Amphibious Landing Beach at Unai Chulu. To minimize and avoid potential impacts from hazardous substances associated with construction equipment and vehicles, appropriate resource management measures (e.g., Spill Prevention, Control and Countermeasures Plan) would be implemented during all construction activities. Proposed construction would involve construction equipment and human activity on the beach for approximately 8 months. For this reason, it is assumed that construction at Unai Chulu would result in the loss of one turtle nesting season on this beach, as turtles would likely avoid the construction equipment and human activity. Modification of the beach slope and dunes adjacent to these areas could impact turtle nesting habitat. However, following construction, any adjacent beach strand habitat that has been altered would be restored. Although loss of sea turtle nesting habitat would occur over one nesting season at Unai Chulu, impacts would occur at the level of individual nesting turtles, and not at the population level. Therefore, construction activities under Tinian Alternative 1 would result in less than significant direct and indirect impacts to nesting sea turtles.

Assessment of potential impacts to sea turtles in the marine environment is provided in Section 4.10, *Marine Biology*.

Humped Tree Snail

The humped tree snail was historically present on Tinian and was thought to have been extirpated (i.e., no longer occurring on Tinian) until two discrete populations were discovered during surveys in June 2013 near the southern end of Lamanibot Bay, known locally as Dump Coke. Other surveys within potentially suitable native limestone habitat throughout the Military Lease Area did not detect any other living tree snails (DoN 2014a). There are no proposed construction activities within or adjacent to the Dump Coke population of humped tree snails. Therefore, construction activities under Tinian Alternative 1 would not result in any direct or indirect impacts to humped tree snails.

Heritiera longipetiolata

Within the Military Lease Area, the tree species *H. longipetiolata* has been found in coastal forests near Unai Masalok on the east coast and along the Lamanibot Bay (Dump Coke) escarpment (Hawaiian Agronomics International, Inc. 1985; DoN 2014a). There are no proposed construction activities within or adjacent to these populations. Therefore, construction activities under Tinian Alternative 1 would not result in any direct or indirect impacts to *H. longipetiolata*.

Dendrobium guamense

Currently, a single population of the orchid *D. guamense* is known from Tinian near Unai Dankulo along the east coast (U.S. Fish and Wildlife Service 2014). There are no proposed construction activities within or adjacent to this population. Therefore, construction activities under Tinian Alternative 1 would not result in any direct or indirect impacts to *D. guamense*.

4.9.3.1.1.4 Special-status Species: Migratory Bird Treaty Act-listed Species

Of the 44 native bird species that have been reported on Tinian, 39 are protected under the Migratory Bird Treaty Act. The majority are seabirds or shorebirds found primarily in coastal areas (e.g., noddies, terns, boobies, plovers, tattlers, sandpipers, herons, egrets). The Pacific golden plover is one of the most common species observed on Tinian during migration, primarily in open grassy fields and along the coast. Additional species include waterfowl or ducks, which are rare transient visitors during migration and are typically observed at Lake Hagoi, the Bateha sites, or along the coast.

As discussed above in *Vegetation Communities*, approximately 1,798 acres (728 hectares) of habitat for native species would be removed because of Tinian Alternative 1 proposed construction activities (see Table 4.9-1). Construction impacts to landbird species protected under the Migratory Bird Treaty Act would be similar to those described above for native wildlife. Table 4.9-3 provides the number of landbirds that may be impacted for three monitored Migratory Bird Treaty Act-listed species due to the loss of 1,745 acres (706 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats. The estimates of bird numbers using these habitats were derived from the 2013 native bird surveys on Tinian (DoN 2014a). The number of birds impacted was calculated by multiplying the number of acres of a specific habitat or vegetation community that would be removed by the estimated density of each species of bird within that habitat.

Table 4.9-3. Potential Direct and Permanent Impacts to Three Migratory Bird Treaty Act-listed Species from Proposed Construction Activities under Tinian Alternative 1

Species	*Number of Birds Impacted by Removal of Habitat**				*Total*	*Estimated Total Tinian Population*	*% of Tinian Population Impacted*
	NLF	*MIF*	*TT*	*HS*			
Collared kingfisher	1	60	46	51	158	2,508	6.3%
Mariana fruit-dove	1	123	98	53	275	4,042	6.8%
White-throated ground-dove	2	150	50	64	266	4,879	5.4%

Notes: *NLF = native limestone forest, MIF = mixed introduced forest, TT = tangantangan, HS = herbaceous scrub.
Source: DoN 2014a.

Proposed construction activities would remove 1,745 acres (706 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats currently available to Migratory Bird Treaty Act-listed species on Tinian. There would be no impacts to coastal or grassland habitats used by seabird or shorebird species. In particular, the removal of forested and herbaceous scrub habitats would result in the loss of nesting, foraging, and resting areas for these bird species protected under the Migratory Bird Treaty Act. In addition, nests in the immediate vicinity of construction activities may be disturbed by noise, light, and human activities and susceptible to abandonment by adults and predation of eggs or young. These activities may also temporarily displace birds from breeding habitat, resulting in reduced reproductive success. Direct mortality from construction equipment is unlikely because noise associated with pre-construction activities and human

presence is likely to disperse wildlife prior to any equipment use, although vehicle traffic would increase the potential for wildlife collisions. Although construction would occur over an 8 to 10 year period, these noise impacts would be short-term and minor because only a small number of range and support facilities would be under construction at any given time. As such, these temporary and direct impacts to bird populations from construction noise and human activities would be less than significant.

Therefore, implementation of Tinian Alternative 1 and the removal of approximately 1,745 acres (706 hectares) of forested and herbaceous scrub habitats would result in less than significant impacts to Migratory Bird Treaty Act-listed species, but significant impacts to the populations of forest- and scrub-nesting Migratory Bird Treaty Act-listed species due to removal of habitat. Forest- and scrub-nesting Migratory Bird Treaty Act-listed bird species are territorial, meaning that a minimum area is required for each bird or breeding pair for all of their foraging and nesting activities. For most animal species, and particularly within island ecosystems, available but unoccupied habitat is rare (if it does exist, it is generally very low-quality habitat). This is the case unless populations are limited not by habitat, but by predators, disease, or over-hunting. Based on available data, there is no indication that there are large areas of available but unoccupied habitat on Tinian, particularly for forest and shrub breeding bird species. For these reasons, the loss of 1,745 acres (706 hectares) of habitat would be significant, even with forest enhancement efforts. Although bird densities are higher in higher-quality habitats and more birds are expected to eventually occupy areas of proposed forest enhancement, the proposed area of forest enhancement is not large enough to make up for the overall loss of available habitat under Alternative 1. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

Tinian Alternative 1 construction activities would have potential significant direct, long-term impacts on forest- and scrub-nesting Migratory Bird Treaty Act-listed species due to loss of habitat. To mitigate the potential significant direct, long-term impacts of the removal of 1,745 acres (706 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats, the DoN proposes to implement forest enhancement of native limestone forest, mixed introduced forest, tangantangan forest, and herbaceous scrub habitats. This is in addition to the forest enhancement of 6.3 acres (2.5 hectares) of native limestone forest or mixed introduced forest described above in the *Vegetation Communities* section. Forest enhancement would include but is not limited to the following:

- Propagating, planting, and establishing dominant and rare species that are characteristic of native limestone forest habitats (e.g., *Cynometra ramiflora*, *Neisosperma oppositifolia*, *Eugenia palumbis*, *Guamia mariannae*, pandanus, banyan tree, and tropical almond)
- Removing non-native, invasive vegetation
- Controlling non-native predators (e.g. rats, feral cats)

A Forest Enhancement/Restoration and Monitoring Plan would be prepared and implemented that would provide detailed guidance on proposed forest enhancement activities on Tinian as well as long-term monitoring of the success of the proposed forest enhancement measures. Although the exact locations of the proposed forest enhancement areas have not been identified, prior to implementing any forest enhancement activities appropriate environmental compliance documentation would be

prepared, including coordination with cultural resources personnel under Section 106 of the National Historic Preservation Act regarding the potential occurrence of cultural resources within any proposed forest enhancement site.

In addition, the DoN, in coordination with the U.S. Fish and Wildlife Service, would prepare a Tinian Forest Bird Monitoring and Tinian Monarch Management Plan to monitor the potential effects of proposed CJMT activities on Migratory Bird Treaty Act-listed forest birds within the Military Lease Area. The proposed Management Plan would be based on continuing the forest bird surveys conducted along a series of transects surveyed in 1982, 1996, 2008, and 2013. The continued surveys would assess the overall status of Migratory Bird Treaty Act-listed forest birds and allow evaluation of long-term trends in population size and distribution through comparison with the four previous island-wide surveys of forest birds on Tinian. The data from this monitoring effort would enable the DoN to determine if the Migratory Bird Treaty Act-listed forest birds are experiencing declines in abundance or distribution.

4.9.3.1.1.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the Mariana common moorhen, Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are all CNMI-listed threatened/endangered species. These species are discussed above within the *Endangered Species Act-listed Species* section. The CNMI-listed Micronesian gecko is discussed below.

Micronesian Gecko

This gecko was believed to have been extirpated in 1946 until it was collected in 2003 in southern Tinian and in 2008 within the Mount Lasso area. The proposed construction activities would not remove native limestone forest within the Mount Lasso area, the only known location within the Military Lease Area that supports the Micronesian gecko. Potential mitigation measures described above in the *Vegetation Communities* section would also result in a conservation benefit to the Micronesian gecko. For this reason, implementing Tinian Alternative 1 would result in no impacts to the Micronesian gecko.

4.9.3.1.2 Operation Impacts

4.9.3.1.2.1 Vegetation Communities

Foot traffic associated with training in the Military Lease Area is currently an authorized, ongoing activity. Implementing Tinian Alternative 1 would increase the frequency of on-foot training throughout the Military Lease Area, although it would be concentrated within the northern Battle Area Complex, Multi-purpose Range Complex, and Infantry Platoon Battle Course. The increased foot traffic would result in the trampling and breaking of vegetation; however, vegetation cutting is not proposed within the maneuver areas, and bivouac or camping sites would only be established in the region of the base camp. In addition, in accordance with previous Endangered Species Act section 7 consultations with the U.S. Fish and Wildlife Service, Lake Hagoi and a surrounding buffer would remain a "No Training Area," and all native limestone forest within the Military Lease Area would be designated a "No Wildlife Disturbance Area" with limited, non-invasive, on-foot military training allowed (see Figure 4.9-2) (U.S. Fish and Wildlife Service 2010).

Outside of these specially designated maneuver areas, foot traffic associated with training would occur up to 20 weeks per year. Any potential impacts to vegetation associated with foot traffic would not be

significant as land training within the Military Lease Area would be short-term, infrequent, diffuse, and vary in location across training events; if trampled or broken, vegetation on Tinian is known to recover quickly; and ecosystem functions provided by the vegetation would remain intact.

Impacts to vegetation from vehicle use would be localized, as vehicle travel is restricted to existing or proposed roads and trails. Amphibious operations on the beaches would disturb beach habitat, however the DoN would use hand-tools to restore beach contours and smooth divots. Ordnance use would be limited to designated impact areas (i.e., High Hazard Impact Area, range targets, objective areas, and engagement areas) that would be cleared of vegetation during construction.

Fire potential would increase due to proposed live-fire range operations. Fire can result in direct effects to vegetation by killing or damaging individual plants; or indirect effects by increasing erosion, allowing non-native species to invade, and altering wildlife habitat by reducing food resources, breeding habitat, and shelter. Native habitats on Tinian are adapted to a humid, tropical climate and are not adapted to a fire driven ecosystem (U.S. Fish and Wildlife Service 2008). To reduce the potential for fires, designated target areas, including the High Hazard Impact Area, would be cleared of vegetation during construction and maintained to remain within 6 inches (15 centimeters) of the ground. The High Hazard Impact Area would also be surrounded by a perimeter road and firebreak, and fire prevention and management activities would be implemented upon initiation of CJMT live-fire training per a Fire Prevention and Management Plan that would be developed. This plan would outline standard procedures for safe range usage and risk reduction related to fire management (e.g., water trucks present at each range during training activities).

Potential impacts to vegetation communities from training operations would be avoided and minimized by implementing resource management measures summarized in Section 4.9.2 and presented in detail in Appendix D, *Best Management Practices*. In particular, with establishment of a firebreak around the High Hazard Impact Area, vegetation management within the associated target areas and firebreak, and implementation of a Fire Prevention and Management Plan, which establishes management and fire suppression and emergency response procedures, implementation of the training activities associated with Tinian Alternative 1 would result in less than significant direct and indirect impacts to vegetation communities.

4.9.3.1.2.2 Native Wildlife

This section describes the potential impacts to native wildlife species on Tinian from training activities under Alternative 1. Impacts to special-status species are addressed separately. Potential direct impacts to all wildlife species would result from maneuver training, munitions use (including noise), noise from aircraft overflights, aircraft strikes of native and Migratory Bird Treaty Act-listed birds, and fire. Indirect impacts to all wildlife species may result from pollutants and potential non-native species introductions.

Maneuver Training

As presented above under Vegetation Communities, disturbance from Tinian Alternative 1 foot traffic would occur throughout the Military Lease Area. Camping, ground disturbance, or direct disturbance of any wildlife species would be prohibited. While wildlife may react to military personnel moving through forest or other habitats, these reactions are expected to be insignificant as land training within the Military Lease Area would be short-term, infrequent, diffuse, and vary in location across training events.

Although vehicle maneuver training on roads could result in mortality of wildlife species, vehicle speeds would be limited to 25 miles per hour (40 kilometers per hour) or less and wildlife would be able to avoid injury by moving away from vehicles.

Munitions Use

Fragments of non-dud producing ammunition may fall within the surface danger zones; however, the likelihood of any single animal being struck is negligible. Ordnance explosions could result in direct impacts to wildlife if a species occurs within the High Hazard Impact Area during live-fire operations. However, the High Hazard Impact Area would be cleared of vegetation and would be less likely to attract wildlife species due to the decrease in habitat suitability.

Fires

Although there are no records of wildfires on Tinian resulting from U.S. military training activities (DoN 2014a), fire potential would be increased from live-fire and vehicle maneuvering operations. Indirect impacts to wildlife habitat adjacent to the High Hazard Impact Area from potential fire hazard would be reduced due to clearing of vegetation, a perimeter road and firebreak, and water trucks present at each range during operations. Fire can result in direct effects to all wildlife through mortality or smoke inhalation. Native plants, animals, and their habitats on Tinian are adapted to a humid, tropical climate and are not adapted to a fire-driven ecosystem. Fire potential is higher in non-native communities such as grasslands and tangantangan forests, particularly in the dry season (U.S. Fish and Wildlife Service 2008). The alteration or removal of habitats by fire could reduce food sources, prevent or inhibit breeding, or create competition for feeding and sheltering, particularly for species that establish discrete territories. However, due to the proposed vegetation clearing during construction, vegetation management, and the preparation and implementation of a Fire Prevention and Management Plan (see previous discussion under Vegetation Communities); the potential for wildfire outside the High Hazard Impact Area would be minimized.

Noise

Direct impacts from noise would be limited to times of active live-fire training operations, which would occur up to 20 non-consecutive weeks per year (but not 24/7). Noise modeling studies were conducted for the proposed training activities; noise levels and noise contours are provided in Section 4.5, *Noise*. Wildlife within the Military Lease Area would be exposed to noise of more than 85 decibels A-weighted day-night average sound exposure level and 104 decibels Peak level from small-caliber weapons (see Figures 4.5-1 and 4.5-2), 70 decibels C-weighted day-night average sound level and 130 decibels Peak level from large-caliber weapons (see Figures 4.5-3 and 4.5-4), and 75-80 decibels (A-weighted) noise levels from aircraft operations, primarily adjacent to the Tinian International Airport (see Figure 4.5-6).

It is important to note that all operational noise disturbances would be temporary and would not be continuous for several reasons. First, the type of activity (small- and large-caliber firing, and aircraft overflights) consists of non-continuous events. Second, training events would only occur up to 20 non-consecutive weeks per year. Third, some ranges would likely not be used on any given training day.

No noise studies have been conducted specifically on wildlife species present on Tinian; however, noise studies have been conducted on the effects of military noise on wildlife species associated with other ranges that are similar to those proposed for use on Tinian. Wildlife response from noise under the

proposed training activities may vary among individuals because of habituation, in which after a period of exposure to a stimulus, an animal stops responding to the stimulus. In general, a species can often habituate to human-generated noise when the noise is not followed by an adverse impact (i.e., physical injury).

In addition to noise level, the frequency and regularity of the noise also affect species sensitivity. That is, different types of noise sources produce varied effects on different species. Noise from aircraft overflights may not produce the same response from a wildlife species as noise from a land-based source such as a vehicle, chainsaw, or gunshot. Wildlife species often do not react to a noise source when unaccompanied by a visual cue, but often do react to the visual component associated with that noise source. For example, birds may not react to just the sound of a chainsaw, but when that sound is coupled with a human walking near the bird, the bird will flush. This is also shown in reactions by various species to aircraft overflights (airplanes and helicopters). An overflight with just a sound component does not elicit a strong response, but if a bird hears and then sees the aircraft, the bird will more likely flush and move away (Manci et al. 1988; U.S. Forest Service 1992; Krausman et al. 1993; Bowles 1995).

Aircraft disturbances have been found to impact native and non-native species at an individual and community level (e.g., Gladwin et al. 1987; National Park Service 1994). Wildlife generally respond to low-altitude aircraft, although the ways in which they respond varies depending on life history, habitat, aircraft and flight activities, as well as previous exposure to aircraft (Burger 1981). Physiological and/or behavioral responses can reduce an animal's fitness and ability to survive, or increase its propensity to relocate. It is thought that low-altitude overflights can cause excessive stimulation, alertness, or stress (Manci et al. 1988; Fletcher 1990). Aircraft overflights of Lake Hagoi and the two Bateha isolated wetlands would be restricted to altitudes of greater than 500 feet (150 meters) above ground level. As such, the primary impacts to wildlife would be from noise associated with aircraft overflights.

Vanderwerf et al. (2000) studied the effects of military noise on the Oahu elepaio (*Chasiempis sandwichensis*), an endangered Pacific flycatcher in the same family as the Tinian monarch. The study provides some indirect evidence that the Tinian monarch, and other native birds, may not be highly sensitive to live-fire noise.

The study evaluated the responses of Oahu elepaio at the Schofield Barracks Range in Hawaii to 282 high explosive artillery (60-millimeter, 105-millimeter, and 155-millimeter) and demolition blasts located 330 to 3,300 feet (100 to 1,000 meters) from elepaio nests, ranging in intensity from 81 to 116 decibels A-weighted. Responses to artillery blast noise were only detected in two instances. The response was minor and short-lived in both cases; the male lowered its head and resumed preening 1-2 seconds after each blast noise had subsided. In neither instance did an elepaio flush from the nest or pause when returning to the nest in response to artillery noise. This study suggests that Oahu elepaio reproductive success is not negatively impacted by noise associated with live-fire training, particularly artillery (VanderWerf et al. 2000). It should be noted the elepaio studied at Schofield Barracks Range may be habituated to the noise associated with live-fire training and because live-fire training has not been conducted on Tinian recently, it may take some time for the birds to habituate to the noise. Birds habituate to noises and may not respond to stimuli when they do not perceive a direct threat (e.g., a visual threat connected to the noise event).

In addition to the elepaio study, coastal California gnatcatchers (*Polioptila californica*) regularly occur and nest successfully within 400 feet (122 meters) of the local Sheriff's Training Range and a Trap and Skeet Range at Marine Corps Air Station Miramar in California (DoN 2011). Furthermore, the federally listed black-capped vireo (*Vireo atricapilla*) and golden-cheeked warbler (*Dendroica chrysoparia*) are bird species that are known to nest within live-fire training ranges, including the live-fire impact area at Fort Hood in Texas, despite the occurrence of ongoing training activities similar to that proposed under Tinian Alternative 1 (U.S. Fish and Wildlife Service 2005).

A cooperative study between the Department of Defense and the U.S. Fish and Wildlife Service, assessed the response of the red-cockaded woodpecker (*Picoides borealis*) to a range of military training noise events, including artillery, small arms, helicopter, and maneuver noise (Delaney et al. 2000). The project findings show that the red-cockaded woodpecker successfully acclimates to military noise events. Depending on the noise level that ranged from innocuous to very loud, the birds responded by flushing from their nest cavities. When the noise source was closer and the noise level was higher, the number of flushes increased proportionately. In all cases, however, the birds returned to their nests within a relatively short period of time (usually within 12 minutes). Additionally, the noise exposure did not result in any mortality or statistically detectable changes in reproductive success (Delaney et al. 2000). Red-cockaded woodpeckers did not flush when artillery simulators were more than 400 feet (122 meters) away and sound exposure levels were 70 decibels.

Because training would not be continuous and wildlife species have been shown to habituate to noise associated with military live-fire training activities, there would be less than significant impacts to native wildlife species under Tinian Alternative 1.

Introduction of Non-native Species

Training activities would result in increased transport of material and personnel by ship and aircraft between Guam, other CNMI locations, and Tinian. These activities have the potential to introduce non-native invasive species that could degrade the ecosystem on Tinian. The brown treesnake is one of the most serious potential non-native species that could be inadvertently brought to Tinian. Non-native insects such as the little fire ant, coconut rhinoceros beetle, and cycad scale would also severely damage Tinian's native species and habitats. Invasive plant species (e.g., refer to Space and Falanruw 1999) also pose a risk to native wildlife. Such non-native invasive plant and animal species have the potential to increase the mortality of native species, degrade habitats by altering species composition and structure, increase rates of depredation, and increase competition between species.

Section 4.9.2, *Resource Management Measures*; Appendix D, *Best Management Practices*; and Appendix L, *Biological Resources Supporting Documentation;* provide details regarding applicable biosecurity measures that the U.S. military would implement to ensure that risk from transporting invasive species to Tinian is controlled.

Aircraft Strikes

Under Tinian Alternative 1, the potential for bird/animal aircraft strikes would increase from the current baseline with increased use of North Field and the Tinian International Airport. However, in accordance with DoN requirements, a Bird/Animal Aircraft Strike Hazard Plan would be prepared to address all aircraft operations on Tinian. This plan would be prepared to minimize the occurrence of bird/animal

aircraft strikes, and would provide detailed procedures to monitor and react to heightened risk of bird/animal strikes. When risk increases, limits would be placed on low-altitude flight and some types of training. Special briefings would be provided to pilots whenever the potential exists for increased bird/animal strikes within the airspace.

With implementation of these resource management measures described above, potential direct and indirect impacts to native wildlife species from proposed operations would be less than significant.

4.9.3.1.2.3 Special-status Species: Endangered Species Act-listed Species and Proposed Species

Potential impacts to special-status species from munitions, non-native species, and potential wildfires from training activities associated with Tinian Alternative 1 would be similar to those discussed above under Native Wildlife, and would be less than significant. Impacts from noise and human activity are discussed below.

Mariana Fruit Bat

Mariana fruit bats are rare transient visitors to Tinian, possibly moving between Aguiguan and Saipan. Under Alternative 1, noise associated with live-fire training activities, physical disturbance, and habitat removal or degradation may occur in potential Mariana fruit bat habitat (i.e., native limestone forest, mixed introduced forest, *Casuarina* forest) on Tinian due to the proposed action. However, given the rarity of occurrence of fruit bats on Tinian, and that there are no known fruit bat roost sites on Tinian, exposure to these stressors would be discountable or insignificant.

Based on the limited use of Tinian by Mariana fruit bats, Tinian Alternative 1 training activities would result in less than significant direct and indirect impacts.

Mariana Common Moorhen

The majority of moorhens found on Tinian are located at Lake Hagoi, with some use of the Bateha sites and ephemeral ponds at the Mahalang complex. Lake Hagoi and the two Bateha isolated wetlands would remain designated by Department of Defense as "No Training Areas" (see Figure 4.9-2). The only military training activities in a "No Training Area" are troop and vehicle movements along established boundary roads, and ground disturbance and vegetation removal of any kind would be prohibited. To avoid and minimize effects to the Mariana common moorhen at Lake Hagoi, the DoN has established a 215-acre (87-hectare) "No Training Area" around Lake Hagoi. The "No Training Area" is bounded by existing roads, with the closest road within 246 feet (75 meters) of the wetland.

Noise levels from munitions training and aircraft operations were modeled for Lake Hagoi, the Mahalang complex, and the two Bateha isolated wetlands to assess potential effects to Mariana common moorhens. At Lake Hagoi, noise from small-caliber weapons training would expose moorhens to 63 decibels A-weighted day-night average sound level and 108 decibels Peak noise levels (see Figures 4.5-1 and 4.5-2 and Table 4.5-3). Noise generated by large-caliber weapons would expose moorhens at Lake Hagoi to 77 decibels C-weighted day-night average sound level, and 124 decibels and 135 decibels Peak during neutral and unfavorable weather conditions, respectively (see Figures 4.5-3, 4.5-4, and 5.4-5 and Tables 4.5-7 and 4.5-9). Aircraft operations would result in 63 decibels A-weighted day-night average sound level for Lake Hagoi (see Figure 4.5-6 and Table 4.5-13). Sound levels from large-caliber weapons

training on Tinian may cause periodic startle responses or flushing of moorhens at Lake Hagoi. Effects of these responses may include altered foraging or breeding behaviors. Moorhens are not likely to flush from nests in response to these noise levels, such that effects on reproductive success are not anticipated.

At the Mahalang complex, noise from small-caliber weapons training would expose moorhens to 67 decibels A-weighted day-night average sound level and 104 decibels Peak noise levels (see Figures 4.5-1 and 4.5-2 and Table 4.5-3). Noise generated by large-caliber weapons would expose moorhens at Mahalang to 89 decibels C-weighted day-night average sound level, and 138 decibels and 147 decibels Peak during neutral and unfavorable weather conditions, respectively (see Figures 4.5-3, 4.5-4, and 5.4-5 and Tables 4.5-7 and 4.5-9). Aircraft operations would result in 65 decibels A-weighted day-night average sound level for Mahalang (see Figure 4.5-6 and Table 4.5-13). Sound levels from small- and large-caliber weapons training on Tinian may cause moorhens to flush from and avoid the Mahalang area periodically or permanently. Effects of these responses may include altered foraging behaviors, as moorhens may move to Lake Hagoi or the Bateha wetlands for foraging during the wet season.

At the two Bateha isolated wetlands, noise from small-caliber weapons training would expose moorhens to 65 and 75 decibels A-weighted day-night average sound level and 107 and 108 decibels Peak noise levels at the north and south sites, respectively (see Figures 4.5-1 and 4.5-2 and Table 4.5-3). Noise generated by large-caliber weapons would expose moorhens at the north Bateha site to 70 decibels C-weighted day-night average sound level, and 117 and 130 decibels Peak during neutral and unfavorable weather conditions, respectively (see Figures 4.5-3, 4.5-4, and 5.4-5 and Tables 4.5-7 and 4.5-9). Large-caliber weapons noise at the south Bateha site would expose moorhens to 71 decibels C-weighted day-night average sound level, and 119 and 131 decibels Peak during neutral and unfavorable weather conditions, respectively. Aircraft operations would result in 62 and 67 decibels A-weighted day-night average sound level for the north and south Bateha sites, respectively (see Figure 4.5-6 and Table 4.5-13). Sound levels from small- and large-caliber weapons training on Tinian may cause moorhens to exhibit startle behaviors or flush from the Bateha sites periodically. Effects of these responses may include altered foraging behaviors within the Bateha sites or as moorhens move to Lake Hagoi for foraging during the wet season.

Although noise may impact individual moorhens at Lake Hagoi, the Mahalang sites, and the Bateha isolated wetlands, the birds may move between sites in response to the intermittent noise events. The periods of noise disturbance from live-fire weapons training and aircraft operations on Tinian would not be continuous during any single day, all live-fire ranges and aircraft operations would not operate at the same time during any given day, and training exercises would occur approximately 20 non-consecutive weeks per year. Birds habituate to noises and may not respond to stimuli when they do not perceive a direct threat (e.g., a visual threat connected to the noise event). As stated previously under Native Wildlife, because training would not be continuous and wildlife species have been shown to habituate to noise associated with military live-fire training activities, noise impacts to the Mariana common moorhen population on Tinian are anticipated to be less than significant.

Micronesian Megapode

Under Tinian Alternative 1, native limestone forest, where megapodes are most often observed on Tinian, would be designated as a “No Wildlife Disturbance Area,” and only limited, non-invasive, on-foot

military training would be allowed. As megapodes would not occur within or near live-fire ranges or the High Hazard Impact Area, there would be no potential for direct mortality from live-fire training operations. Direct impacts to megapodes on Tinian from noise would be similar to those described above for native wildlife and would be less than significant. In addition, megapodes on Farallon de Medinilla, a DoN live-fire bombing range to the north of Tinian, are subject to intensive live-fire activities and associated noise from ordnance use. Megapodes persist on Farallon de Medinilla and do not appear to be affected by noise levels associated with ordnance use.

Given the above, and the extremely rare occurrences of megapodes on Tinian, noise associated with ordnance within the Tinian Alternative 1 High Hazard Impact Area on Tinian is expected to result in less than significant direct and indirect impacts to megapodes on Tinian.

Sea Turtles

Results of noise modeling indicate that small-caliber weapons training on Tinian would expose nesting green turtles to less than 60 decibels A-weighted day-night average sound level at Unai Chiget, Unai Masalok, and Unai Lam Lam, and less than 65 decibels A-weighted day-night average sound level at Unai Chulu and Unai Dankulo. Small-caliber weapons fire would generate less than 97 decibels Peak and less than 110 decibels Peak at these same beaches. Noise generated by large-caliber weapons would potentially expose nesting green turtles to 66-78 decibels C-weighted day-night average sound level and 110 to 127 decibels and 121 to 138 decibels Peak during neutral and unfavorable weather conditions, respectively. Aircraft operations on Tinian would expose nesting green turtles to 56.7 to 66.0 decibels A-weighted Day-Night Average Sound Level.

Approximately 70% of green turtle nesting activity within the Tinian Military Lease Area over the past 4 years has occurred on Unai Dankulo. Adjacent to the proposed High Hazard Impact Area, Unai Dankulo would be exposed to noise levels from large-caliber weapons of 78 decibels C-weighted day-night average sound level and 127 and 138 decibels Peak noise during neutral and unfavorable weather conditions, respectively. Although the periods of noise disturbance from live-fire weapons training on Tinian would not be continuous, training exercises would occur approximately 20 non-consecutive weeks per year. Sound levels from large-caliber weapons training at night may cause adult turtles to avoid nesting beaches or to abandon nesting attempts during periods of training. Effects of these responses include altered nesting behavior that may reduce reproductive success.

Under Tinian Alternative 1, proposed annual amphibious operations would include 213 Amphibious Assault Vehicles landings, 72 Landing Craft Air Cushion landings, and 96 small boat landings. Activities and personnel associated with amphibious landings on Tinian would potentially disturb sea turtle nesting habitat. Noise during amphibious training activities could also startle nesting female sea turtles or prevent them from ascending the beach zone to excavate a nest. There is an elevated risk to sea turtles during nighttime training activities as sea turtle nesting occurs primarily at night. However, implementation of the training restrictions such as those described by the *Biological Opinion for the Mariana Islands Range Complex, Guam and the Commonwealth of the Northern Mariana Islands 2010-2015* (U.S. Fish and Wildlife Service 2010) would ensure that these disturbances would not affect sea turtles on the beach or their nests. Restrictions include implementing a monitoring program during amphibious training events that includes pre-event surveys to delineate boundaries around nest sites as well as postponing landing activities when a nesting sea turtle is observed on land. The DoN also uses

hand-tools to restore beach contours and smooth divots that may trap hatchlings after landing activities. Further, data from the DoN's monthly monitoring program are used to prioritize beaches for landing activities that are less important to sea turtle nesting. Thus far, the DoN's implementation of avoidance and minimization measures have resulted in no takes of nesting sea turtles. Similar training and measures within the Hawaii Island Range Complex and other training locations that also support sea turtle nesting have also proven effective in protecting turtles and their nests.

Therefore, there would be less than significant direct and indirect impacts to sea turtles from military training activities associated with Tinian Alternative 1. Potential impacts to sea turtles in the Tinian marine environment are discussed in Section 4.10, *Marine Biology*.

Humped Tree Snail

Training operations under Tinian Alternative 1 would not occur within or in the vicinity of the only known populations of humped tree snails on Tinian. Therefore, there would be no impacts to humped tree snails with implementation of Tinian Alternative 1.

Heritiera longipetiolata

Training operations under Tinian Alternative 1 would not occur within or in the vicinity of the only known population of *H. longipetiolata* on Tinian. Therefore, there would be no impacts to *H. longipetiolata* with implementation of Tinian Alternative 1.

Dendrobium guamense

Training operations under Tinian Alternative 1 would not occur within or in the vicinity of the only known population of *D. guamense* on Tinian. Therefore, there would be no impacts to *D. guamense* with implementation of Tinian Alternative 1.

4.9.3.1.2.4 Special-status Species: Migratory Bird Treaty Act-listed Species

Direct and indirect impacts from operational activities on the 39 protected bird species are similar to those discussed under the *Native Wildlife* section and would be less than significant.

4.9.3.1.2.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the Mariana common moorhen, Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are all CNMI-listed threatened/endangered species. These species are discussed above within the *Endangered Species Act-listed Species* section.

Micronesian Gecko

Noise and visual stimuli associated with training activities under Tinian Alternative 1 would not affect Micronesian geckos because their known habitat on Mount Lasso would not be disturbed. Therefore, Tinian Alternative 1 operations would result in no impacts to Micronesian geckos.

4.9.3.2 Tinian Alternative 2

4.9.3.2.1 Construction Impacts

4.9.3.2.1.1 Vegetation Communities

The vegetation communities that would be impacted during proposed construction activities under Tinian Alternative 2 are shown in Figures 4.9-4a and 4.9-4b and listed in Table 4.9-4. Under Alternative 2, approximately 1,938 acres (784 hectares) of undeveloped or non-barren land would be impacted, representing approximately 8% of the island and approximately 13% of the Military Lease Area. The High Hazard Impact Area (527 acres [213 hectares]) and the Drop Zone (456 acres [184 hectares]) comprise approximately half of the total impacts to vegetation communities. The majority of the impacted vegetation communities (1,877 acres [760 hectares]) are composed of tangantangan (817 acres [331 hectares] or 10% of total on island), mixed introduced forest (693 acres [280 hectares] or 11% of total on island), and herbaceous scrub (367 acres [148 hectares] or 8% of total on island). In addition, 6.3 acres (2.5 hectares), or 0.5% of total on island, of native limestone forest would be removed, primarily within the High Hazard Impact Area (see Table 4.9-5).

As discussed previously under Alternative 1, given the importance of native limestone forest habitat for native species and the continuing loss of limestone forest on Tinian, the conversion of 6.3 acres (2.5 hectares) to developed area under Tinian Alternative 2 would result in significant direct impacts to the regional vegetation community and its function.

In addition, two ephemeral ponds within the Mahalang Complex totaling less than 0.5 acre (0.2 hectare) of wetlands habitat would be lost due to construction of the hand grenade and grenade launcher ranges within the High Hazard Impact Area. Based on recent wetlands surveys on Tinian, one of two ephemeral ponds is considered an isolated wetland that supports ephemeral wetland habitat during years of high rainfall. This loss of less than 0.5 acre (0.2 hectare) of wetland habitat would not be significant.

The same potential mitigation measures discussed previously under Alternative 1 to mitigate potential significant direct, long-term impacts of proposed construction activities on native limestone forest would be applicable under Alternative 2 (i.e., forest enhancement of 6.3 acres [2.5 hectares] of mixed introduced forest). Implementation of proposed mitigation measures would reduce the impact to less than significant. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

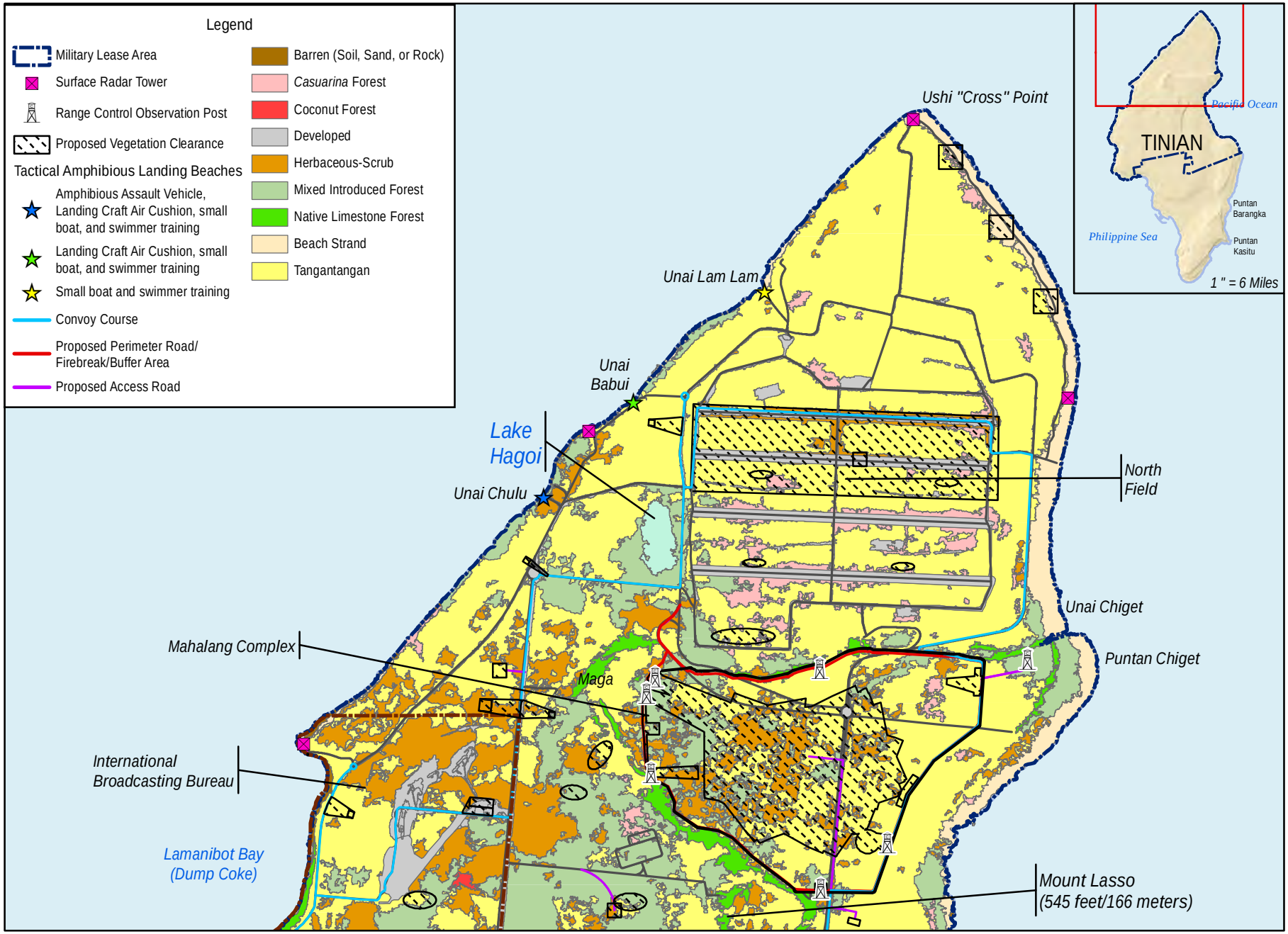

Figure 4.9-4a
Northern Military Lease Area - Tinian Alternative 2,
Vegetation Communities

Sources: Amidon 2009; DoN 2013b

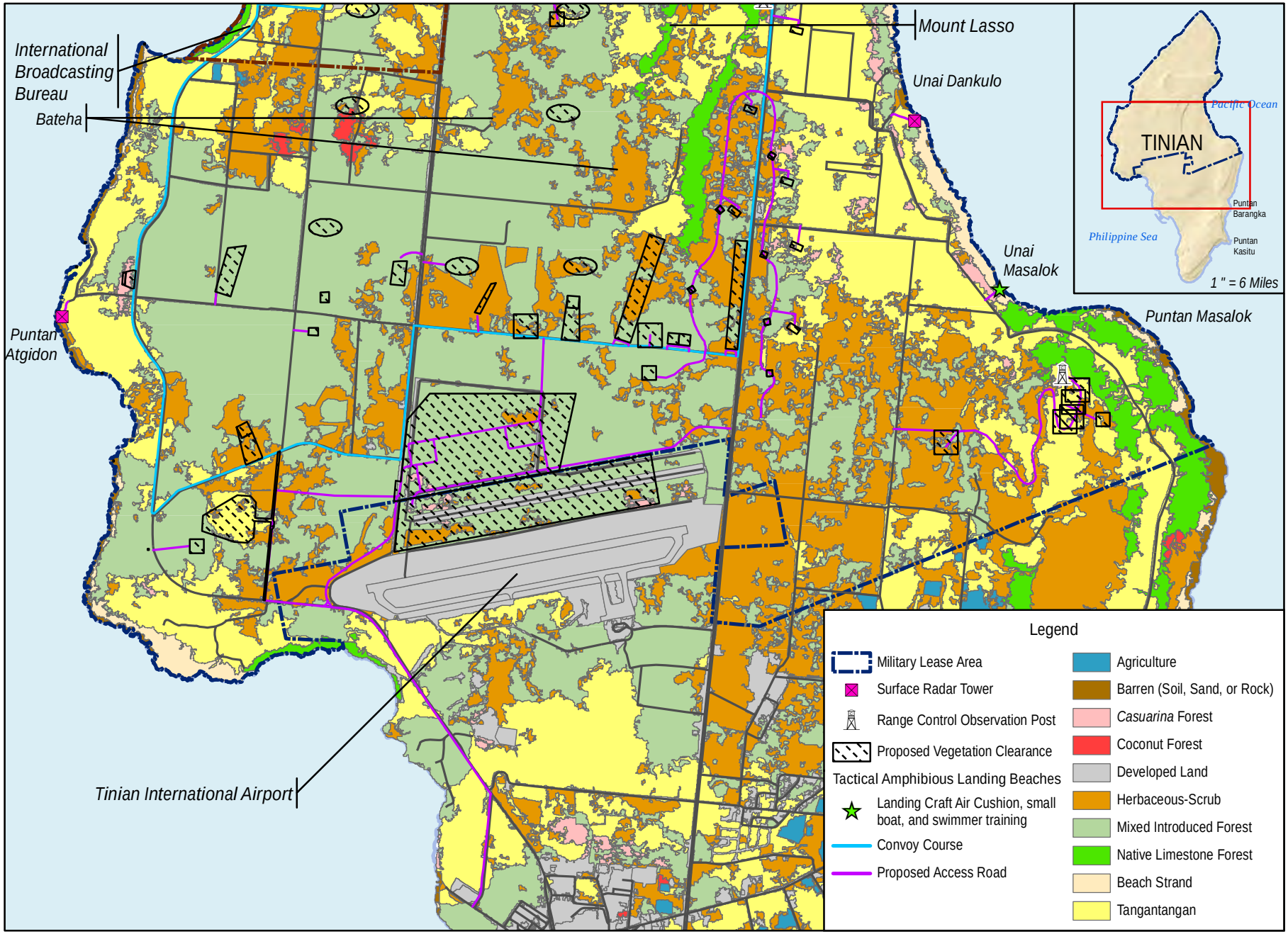

Figure 4.9-4b
Southern Military Lease Area - Tinian Alternative 2,
Vegetation Communities

Sources: Amidon 2009; DoN 2013b

Table 4.9-4. Potential Direct Impacts to Vegetation Communities with Implementation of Tinian Alternative 2

*Project Area**	*Vegetation Community (acres)*[1]											
	NLF	***MIF***	***TT***	***HS***	***Cas***	***Coco***	***BS***	***Wet***	***Ag***	***Bar***	***Dev***	***Total***
High Hazard Impact Area[2]	3.3	73.9	293.7	145.1	0	0	0	0.5[3]	0	0	11.0	527.5
Combat Pistol Range (Automated)	0	2.1	0	0	0	0	0	0	0	0	0	2.1
Multi-purpose Range Complex[4]	0	6.1	2.8	6.4	0.6	0	0	0	0	0	0.2	16.1
Battle Sight Zero Range	0	2.1	0	0	0	0	0	0	0	0	0	2.1
Multi-purpose Training Range	0	8.3	0	14.3	0	0	0	0	0	0	0	22.6
Multi-purpose Automated Unknown Distance Range/Field Fire Range	0	9.2	0.4	21.4	0	0	0	0	0	0	0	31.0
Infantry Platoon Battle Course	0	16.2	0	6.4	0	0	0	0	0	0	0.6	23.2
Urban Assault Course (South)	0	20.1	0	0	0	0	0	0	0	0	0	20.1
Southern Battle Area Complex	0	69.8	11.8	12.1	0.1	2.5	0	0	0	0	0	96.3
Northern Battle Area Complex	0	0	9.6	0	1.6	0	0	0	0	0	0	11.2
Urban Assault Course (North)	0	0.8	12.8	0	2.0	0	0	0	0	0	0.2	15.8
Drop Zone	0	0.2	302.2	42.7	14.0	0	0	0	0	0	96.5	455.6
Field Artillery Indirect Fire Range (Firing Points)	0.4	18.9	32.2	14.1	1.5	0	17.0	0	0	0	0.9	85.0
Convoy Course Engagement Areas	0	13.2	34.6	22.0	2.4	0	0	0	0	0	8.6	80.8
Convoy Course	0	9.8	20.9	3.5	0.4	0	0	0	0	0	27.5	62.1
Tracked Vehicle Driver's Course	1.5	33.1	39.8	18.1	0.7	0.3	<0.1	0	0.1	0.1	6.4	100.2
Tactical Amphibious Landing Beach (Unai Chulu)	0	0	0.1	0.9	0	0	0	0	0	3.0	0	4.0
Landing Zones	0	7.0	5.3	6.1	0	0	0	0	0	0	1.4	19.8
Range Control Observation Points	0	1.7	9.4	3.7	0	0	<0.1	0	0	<0.1	0	14.8
Surface Radar Sites	0	1.8	0.6	0.1	0	0	0.1	0	0	<0.1	0	2.6
Roadway Improvements	0	4.0	4.4	2.4	0	0	0	0	0	0	32.4	43.2
Fences	1.1	10.9	9.0	9.0	0.1	0	0	0	0	<0.1	5.7	35.8
Munitions Storage Area	0	5.9	27.0	4.9	0	0	0	0	0	0	<0.1	37.8
Airport Improvements and Staging Area	0	147.8	0	23.3	7.9	0	0	0	0	0	48.7	227.7
Tinian Port Improvements and Staging Area	0	0	0	0	0	0	0	0	0	0	4.5	4.5
Base Camp	0	229.9	0	10.5	3.3	0	0	0	0	0	12.5	256.2
Total Impacted under *Alternative 2*	**6.3**	**692.8**	**816.6**	**367.0**	**34.6**	**2.8**	**17.2**	**0.5**	**0.1**	**3.1**	**257.1**	**2,198.1**
Total on Tinian	*1,355.7*	*6,853.1*	*8,443.6*	*4,819.0*	*353.9*	*97.9*	*551.0*	*64.9*	*331.7*	*199.9*	*1,915.7*	*24,986.4*
% Impacted under Alternative 2 on Tinian	*0.5%*	*10.1%*	*9.7%*	*7.5%*	*9.8%*	*2.9%*	*3.1%*	*0.7%*	*<0.1%*	*1.5%*	*13.4%*	*8.7%*

Notes: *Project areas are based on areas depicted and labeled in Section 2.4.

[1]NLF = native limestone forest; MIF = mixed introduced forest; TT = tangantangan; HS = herbaceous-scrub; Cas = Casuarina forest; Coco = coconut forest; BS = beach strand; Wet = potential wetlands; Ag = agriculture; Bar = barren; Dev = developed; < = less than.

[2]Includes fire break/buffer, perimeter road, Hand Grenade Range, Mortar Range, Light Anti-armor Weapon Range, Grenade Launcher Range, targets for Close Air Support Range, targets for Offensive Air Support Range, targets for Field Artillery Indirect Fire Range.

[3]Although two ephemeral ponds associated with the Mahalang Complex would be impacted under Alternative 2, these have not been delineated as wetlands at this time.

[4] Includes Anti-armor Tracking Range, Tank/Fighting Vehicle Stationary Target Range, and Multi-purpose Range Complex.

4.9.3.2.1.2 Native Wildlife

Potential impacts from construction activities under Tinian Alternative 2 to native bird species on Tinian that are not listed under the Migratory Bird Treaty Act are described in this section. Impacts to native bird species protected under the Migratory Bird Treaty Act are addressed separately below in the *Special-status Species* section.

As discussed above in vegetation, a total of approximately 1,938 acres (784 hectares) of habitat for native species would be removed because of proposed construction activities under Tinian Alternative 2 (see Table 4.9-4). This is approximately 13% and 8% of the total habitat within the Military Lease Area and on all of Tinian, respectively. Table 4.9-5 provides the number of birds that may be impacted for five monitored bird species due to the loss of 1,883 acres (762 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats (DoN 2014a). Estimated numbers were derived from the 2013 native bird surveys on Tinian (DoN 2014a).

Table 4.9-5. Potential Direct and Permanent Impacts to Five Native Bird Species from Proposed Construction Activities under Tinian Alternative 2

Species	*Number of Birds Impacted by Removal of Habitat**				*Total*	*Estimated 2013 Total Tinian Population*	*% of Tinian Population Impacted*
	NLF	*MIF*	*TT*	*HS*			
Bridled white-eye	114	14,821	15,938	5,269	36,142	442,073	8.1%
Micronesian honeyeater	7	675	537	262	1,481	20,660	7.1%
Micronesian starling	11	1,162	1,322	642	3,137	40,489	7.7%
Rufous fantail	41	4,405	4,111	1,093	9,650	125,668	7.6%
Tinian monarch	29	3,078	3,373	750	7,230	91,420	7.9%

Notes: *NLF = native limestone forest, MIF = mixed introduced forest, TT = tangantangan, HS = herbaceous scrub.
Source: DoN 2014a.

Under Tinian Alternative 2, approximately 7,230 Tinian monarchs would potentially be permanently displaced by loss of habitat through construction (see Table 4.9-5). Therefore, because of the amount of habitat removed and the number of birds potentially impacted, significant direct impacts to the Tinian monarch would occur under Tinian Alternative 2.

As discussed under Alternative 1 (see Section 4.9.3.1), four areas are being assessed as potential conservation areas for the protection of the Tinian monarch and other wildlife species (see Figure 4.9-2). These areas may also be used for additional natural resource mitigation measures such as forest enhancement and/or invasive species control. The Department of Defense is coordinating with the Federal Aviation Administration and the U.S. Fish and Wildlife Service on these potential conservation areas.

Similar to Tinian Alternative 1, impacts under Alternative 2 from proposed construction activities would reduce the amount of habitat available to native birds on Tinian (see Section 4.9.3.1). Therefore, the removal of approximately 1,883 acres (762 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats under Alternative 2 would result in significant, unavoidable direct impacts to the populations of bridled white-eye, Micronesian honeyeater, Micronesian starling, rufous fantail, and Tinian monarch. These bird species are territorial, meaning that a minimum area is required for each bird or breeding pair for all of their foraging and nesting activities. For most animal species, and particularly within island ecosystems, available but unoccupied habitat is rare (if it does exist, it is generally very low-quality habitat). This is the case unless populations are

limited not by habitat, but by predators, disease, or over-hunting. Based on available data, there is no indication that there are large areas of available but unoccupied habitat on Tinian, particularly for forest and shrub breeding bird species.

The same potential mitigation measures discussed previously under Alternative 1 to mitigate potential significant direct, long-term impacts of proposed construction activities on native forest birds would be applicable under Alternative 2 (i.e., forest enhancement of native limestone forest, mixed introduced forest, tangantangan forest, and herbaceous scrub habitats). However, the loss of 1,883 acres (762 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitat would be significant, even with forest enhancement efforts. Although bird densities are higher in higher-quality habitats and more birds are expected to eventually occupy areas of proposed forest enhancement, the proposed area of forest enhancement is not large enough to make up for the overall loss of available habitat under Alternative 2.

In addition, mitigation monitoring would be conducted with the preparation of a Forest Enhancement/Restoration and Monitoring Plan and a Forest Bird Monitoring and Tinian Monarch Management Plan.

Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.3.2.1.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Figures 4.9-5a and 4.9-5b provide the general locations of special-status species within the Military Lease Area in relation to Tinian Alternative 2. Direct impacts to special-status species from proposed construction activities include the removal of habitat, fragmentation of remaining habitat, and associated noise, light, and human activities. Individual special-status species are discussed below.

Mariana Fruit Bat

Impacts to Mariana fruit bats resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to Mariana fruit bats from proposed construction activities under Tinian Alternative 2 would be less than significant.

Mariana Common Moorhen

Impacts to Mariana common moorhens resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts from proposed construction activities under Tinian Alternative 2 would be less than significant.

Micronesian Megapode

Impacts to Micronesian megapodes resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to Micronesian megapodes from proposed construction activities under Tinian Alternative 2 would be less than significant.

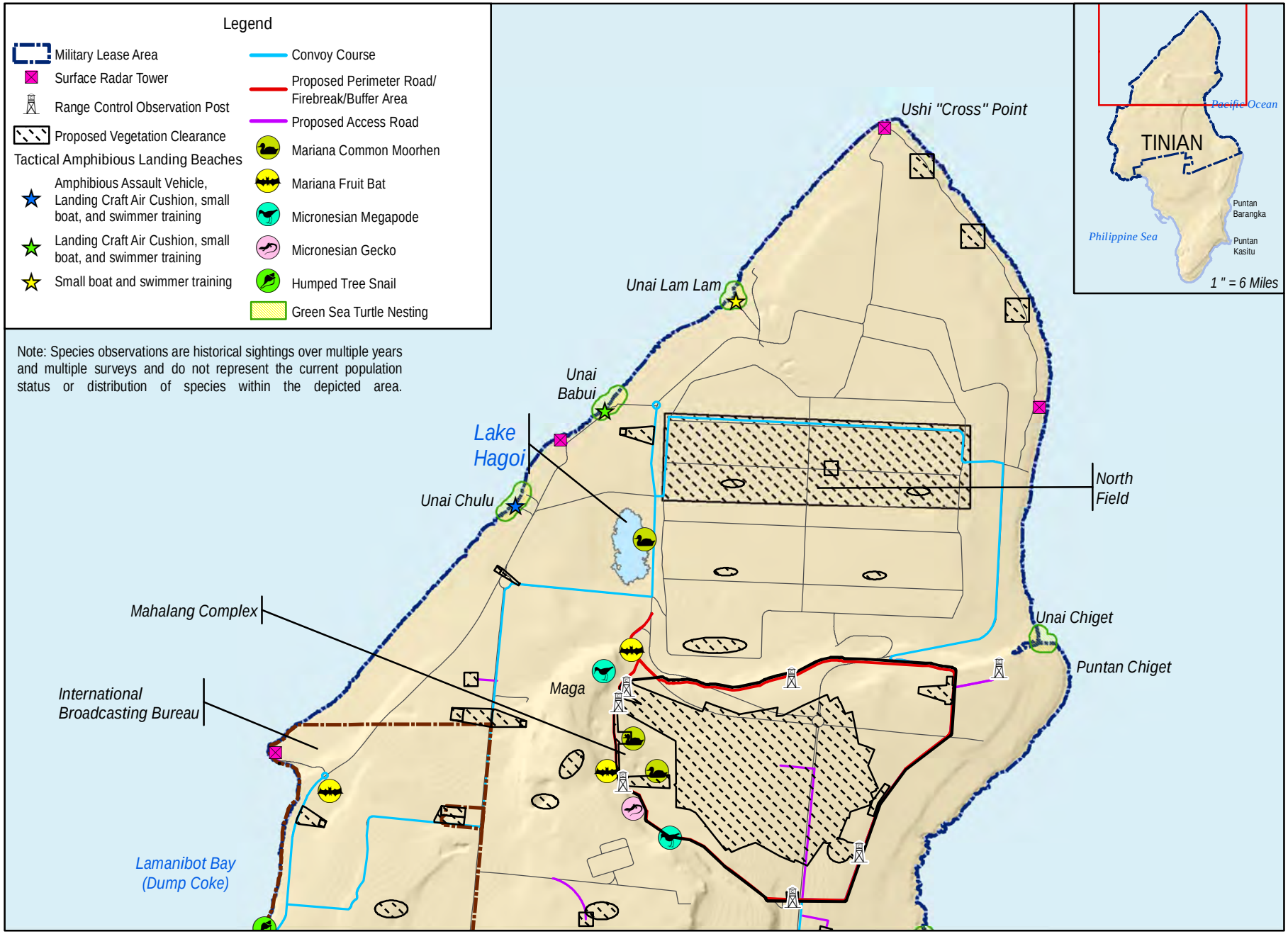

Figure 4.9-5a
Northern Military Lease Area - Tinian Alternative 2,
Occurrence of Special-status Species

Sources:
Hawaiian Agronomics 1985; Krueger and O'Daniel 1999; O'Daniel and Krueger 1999; Witteman 2001; Vogt 2008; USFWS 2009, 2010; Wenninger 2012; DoN 2013a, 2013b, 2013d, 2014a, 2014c

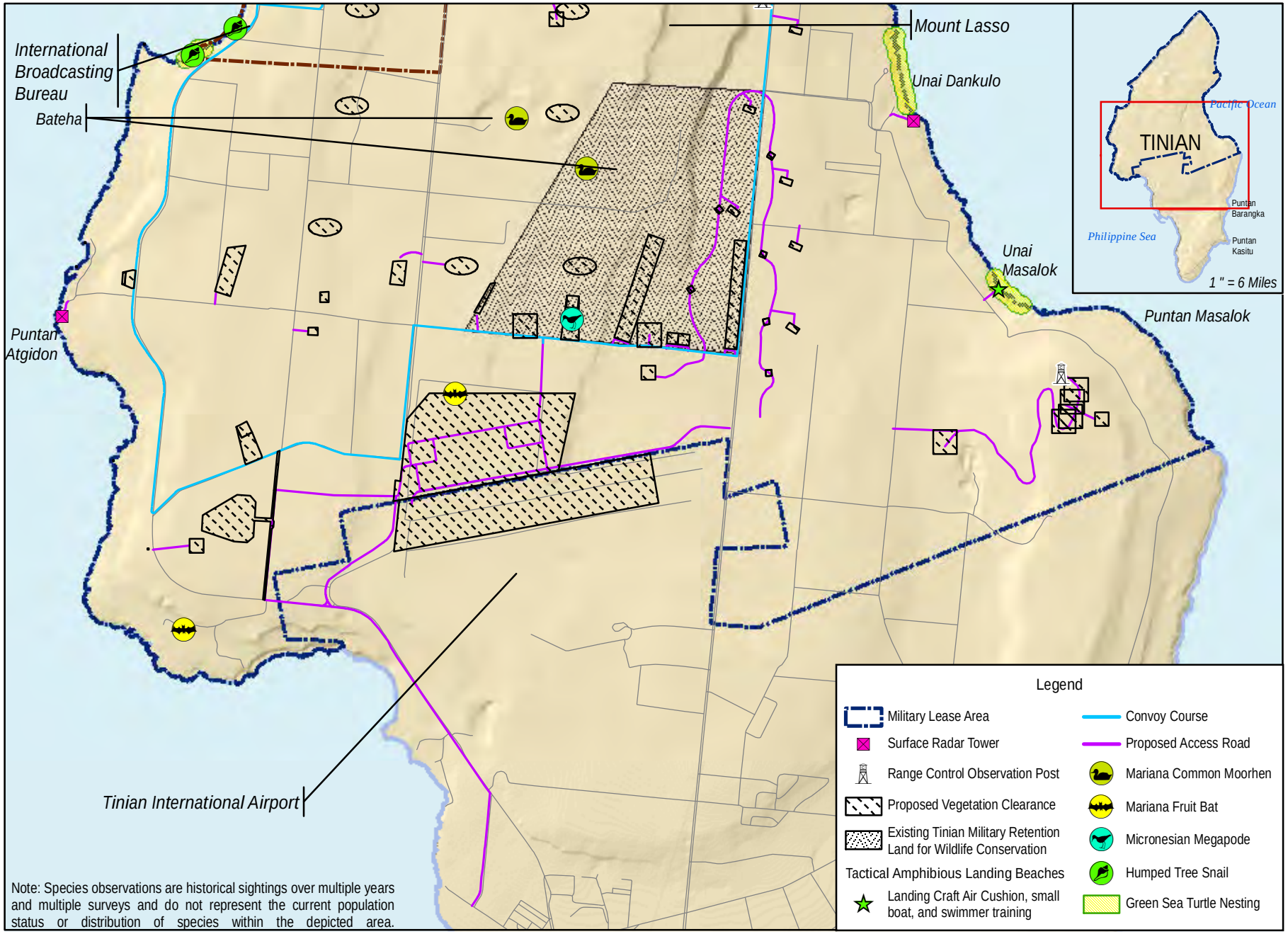

Figure 4.9-5b
Southern Military Lease Area - Tinian Alternative 2,
Occurrence of Special-status Species

Sources:
Hawaiian Agronomics 1985; Krueger and O'Daniel 1999; O'Daniel and Krueger 1999; Witteman 2001; Vogt 2008; USFWS 2009, 2010; Wenninger 2012; DoN 2013a, 2013b, 2013d, 2014a, 2014c

Sea Turtles

Impacts to nesting sea turtles resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to sea turtles from proposed construction activities under Tinian Alternative 2 would be less than significant. The assessment of potential impacts to sea turtles in the marine environment is provided in Section 4.10, *Marine Biology*.

Humped Tree Snail

Impacts to humped tree snails resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to humped tree snails from proposed construction activities under Tinian Alternative 2.

Heritiera longipetiolata

Impacts to *H. longipetiolata* resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to *H. longipetiolata* from proposed construction activities under Tinian Alternative 2.

Dendrobium guamense

Impacts to *D. guamense* resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to *D. guamense* from proposed construction activities under Tinian Alternative 2.

4.9.3.2.1.4 Special-status Species: Migratory Bird Treaty Act-listed Species

As discussed above in vegetation communities, approximately 1,938 acres (784 hectares) of habitat for native species would be removed because of proposed construction activities associated with Tinian Alternative 2 (see Table 4.9-4). Table 4.9-6 provides the number of birds that may be impacted for three monitored Migratory Bird Treaty Act-listed bird species due to the loss of 1,883 acres (762 hectares) of forested and herbaceous scrub habitats (DoN 2014a).

Table 4.9-6. Potential Direct and Permanent Impacts to Three Migratory Bird Treaty Act-listed Species from Proposed Construction Activities under Tinian Alternative 2

Species	*Number of Birds Impacted by Removal of Habitat**				*Total*	*Estimated 2013 Total Tinian Population*	*% of Tinian Population Impacted*
	NLF	*MIF*	*TT*	*HS*			
Collared Kingfisher	1	67	49	57	174	2,508	6.9%
Mariana Fruit-dove	1	136	104	58	299	4,042	7.4%
White-throated Ground-dove	2	167	54	71	294	4,879	5.9%

Notes: *NLF = native limestone forest, MIF = mixed introduced forest, TT = tangantangan, HS = herbaceous scrub.
Source: DoN 2014a.

Direct and indirect impacts to Migratory Bird Treaty Act-listed bird species under Tinian Alternative 2 would be similar to those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Under Tinian Alternative 2, proposed construction activities would remove 1,883 acres (762 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats available to Migratory Bird Treaty Act-listed birds on Tinian. Therefore, implementation of Tinian Alternative 2 and the removal of approximately 1,883 acres (762 hectares) of forested and

herbaceous scrub habitats would result in less than significant direct and indirect impacts to Migratory Bird Treaty Act-listed species seabirds and shorebirds, but significant direct impacts to populations of forest- and scrub-nesting bird species. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

The same potential mitigation measures discussed previously for Alternative 1 to mitigate potential significant direct, long-term impacts of proposed construction activities on Migratory Bird Treaty Act-listed species would be applicable under Alternative 2. Under Alternative 2, forest enhancement of forested and herbaceous scrub habitats would occur. However, impacts from the loss of 1,883 acres (762 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitat would be significant, even with forest enhancement efforts. In addition, mitigation monitoring would be conducted with the preparation of a Forest Enhancement/Restoration and Monitoring Plan and a Forest Bird Monitoring and Tinian Monarch Management Plan.

Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.3.2.1.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the Mariana common moorhen, Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are all CNMI-listed threatened/endangered species. These species are discussed above within the *Endangered Species Act-listed and Proposed Species* section.

Micronesian Gecko

Impacts to Micronesian geckos resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to Micronesian geckos from proposed construction activities under Tinian Alternative 2.

4.9.3.2.2 Operation Impacts

4.9.3.2.2.1 Vegetation Communities

Impacts to vegetation communities from training operations under Tinian Alternative 2 would be the same as those previously discussed for Tinian Alternative 1 (see Section 4.9.3.1). Therefore, implementation of the training activities associated with Tinian Alternative 2 would result in less than significant direct and indirect impacts to vegetation communities.

4.9.3.2.2.2 Native Wildlife

Impacts to native wildlife resulting from Tinian Alternative 2 training operations would be the same as those previously discussed for Tinian Alternative 1 (see Section 4.9.3.1). Therefore, implementation of the training activities associated with Tinian Alternative 2 would result in less than significant direct impacts to native wildlife. In addition, as discussed under Alternative 1, the DoN, in coordination with the U.S. Fish and Wildlife Service, would prepare a Tinian Forest Bird Monitoring and Tinian Monarch Management Plan to monitor the potential effects of proposed CJMT activities on Migratory Bird Treaty

Act-listed forest birds within the Military Lease Area. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.3.2.2.3 Special-status Species

Impacts to Endangered Species Act-listed and proposed species, Migratory Bird Treaty Act-listed species, and CNMI-listed species resulting from implementation of Tinian Alternative 2 would be similar to those previously discussed for Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be less than significant direct and indirect impacts to special-status species from proposed training activities under Tinian Alternative 2.

4.9.3.3 Tinian Alternative 3

4.9.3.3.1 Construction Impacts

4.9.3.3.1.1 Vegetation Communities

The vegetation communities that would be affected by Tinian Alternative 3 construction activities are shown in Figures 4.9-6a and 4.9-6b listed in Table 4.9-7. Approximately 1,914 acres (775 hectares) of undeveloped or non-barren land would be impacted, representing approximately 8% of the island and approximately 13% of the Military Lease Area. Two project areas comprise approximately half of the total impacts to vegetation communities: The High Hazard Impact Area (527 acres [213 hectares]) and the Drop Zone (456 acres [184 hectares]). The majority of the impacted vegetation communities (1,856 acres [751 hectares]) are comprised of tangantangan (799 acres [323 hectares] or 10% of total on island), mixed introduced forest (690 acres [279 hectares] or 11% of total on island), and herbaceous scrub (367 acres [148 hectares] or 8% of total on island). In addition, 6.3 acres (2.5 hectares), or 0.5% of total on island, of native limestone forest would be removed, primarily within the High Hazard Impact Area (Table 4.9-7).

As discussed previously under Alternative 1, given the importance of native limestone forest habitat for native species and the continuing loss of limestone forest on Tinian, the conversion of 6.3 acres (2.5 hectares) to developed area under Tinian Alternative 3 would result in significant direct impacts to the regional vegetation community and its function.

In addition, two ephemeral ponds within the Mahalang Complex totaling less than 0.5 acre (0.2 hectare) of wetland habitat would be lost due to construction of the hand grenade and grenade launcher ranges within the High Hazard Impact Area. Based on recent wetlands surveys on Tinian, one of these two ephemeral ponds is considered an isolated wetland that supports wetland habitat during years of high rainfall. This loss of less than 0.5 acre (0.2 hectare) of wetland habitat would not be significant.

The same potential mitigation measures discussed previously under Alternative 1 to mitigate potential significant direct, long-term impacts of proposed construction activities on native limestone forest would be applicable for Alternative 3 (i.e., forest enhancement of 6.3 acres [2.5 hectares] of mixed introduced forest). Implementation of proposed mitigation measures would reduce the impact to less than significant. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

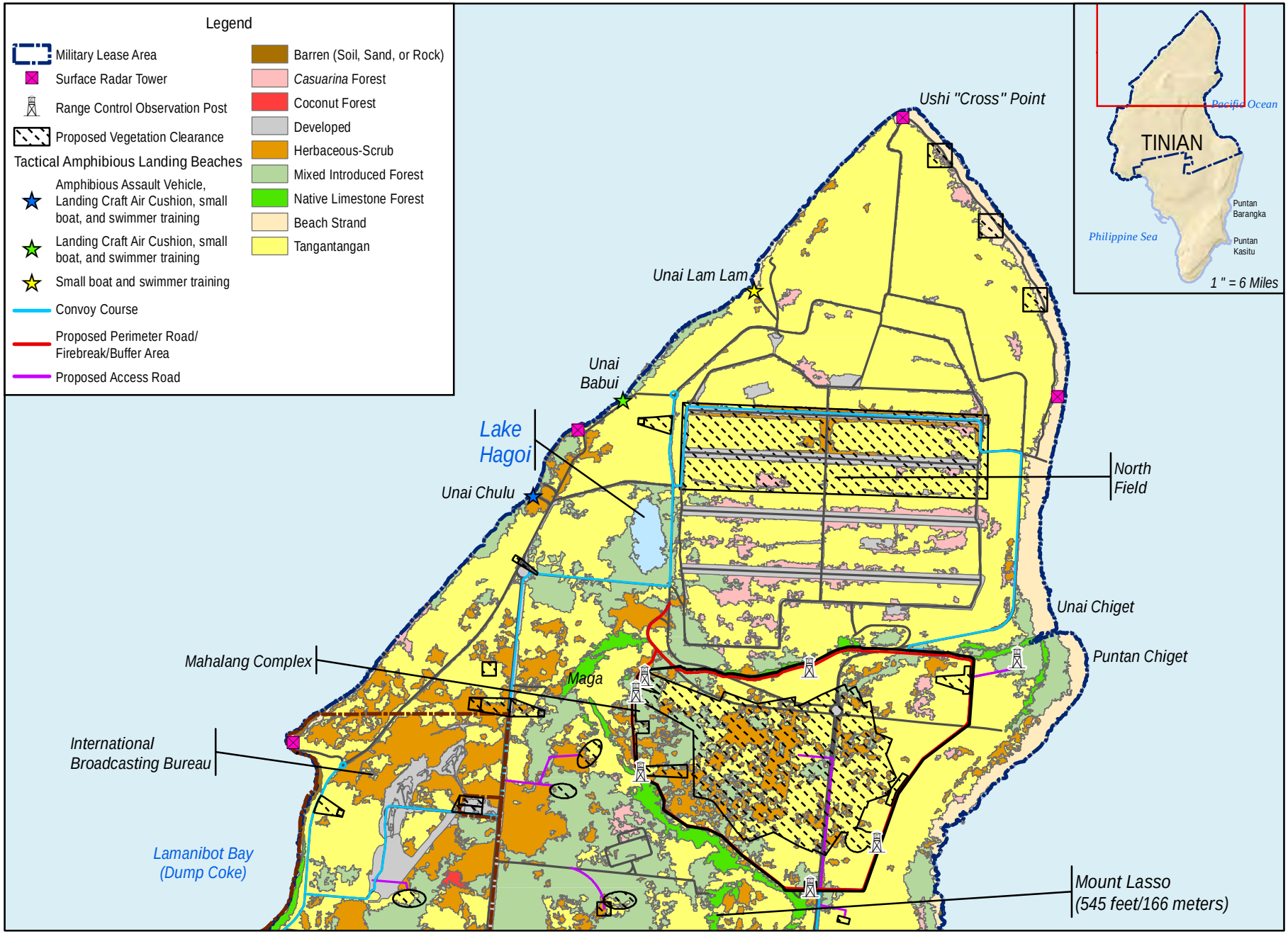

Figure 4.9-6a
Northern Military Lease Area - Tinian Alternative 3,
Vegetation Communities

Sources: Amidon 2009; DoN 2013b

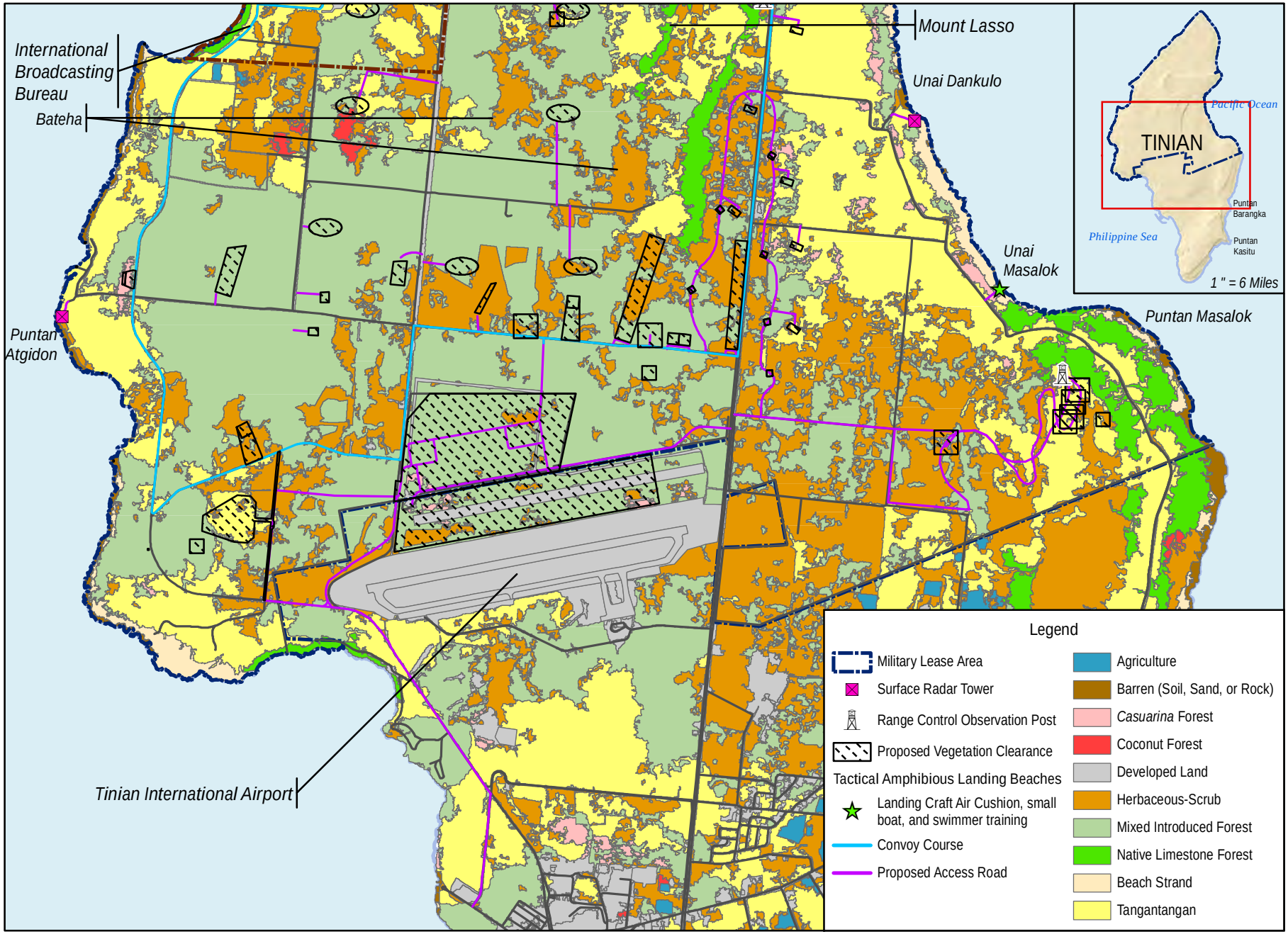

Figure 4.9-6b
Southern Military Lease Area - Tinian Alternative 3,
Vegetation Communities

Sources: Amidon 2009; DoN 2013b

Table 4.9-7. Potential Direct Impacts to Vegetation Communities with Implementation of Tinian Alternative 3

*Project Area**	*Vegetation Community (acres)*[1]											
	NLF	***MIF***	***TT***	***HS***	***Cas***	***Coco***	***BS***	***Wet***	***Ag***	***Bar***	***Dev***	***Total***
High Hazard Impact Area[2]	3.3	73.9	293.7	145.1	0	0	0	0.5[3]	0	0	11.0	527.5
Combat Pistol Range	0	2.1	0	0	0	0	0	0	0	0	2.1	4.2
Multi-purpose Range Complex[4]	0	6.1	2.8	6.4	0.6	0	0	0	0	0	0.2	16.1
Battle Sight Zero Range	0	2.1	0	0	0	0	0	0	0	0	0	2.1
Multi-purpose Training Range	0	8.3	0	14.3	0	0	0	0	0	0	0	22.6
Multi-purpose Automated Unknown Distance Range/Field Fire Range	0	9.2	0.4	21.4	0	0	0	0	0	0	0	31.0
Infantry Platoon Battle Course (Automated)	0	16.2	0	6.4	0	0	0	0	0	0	0.6	23.2
Urban Assault Course (South)	0	20.1	4.6	0	0	0	0	0	0	0	0	24.7
Southern Battle Area Complex	0	69.8	11.8	12.1	0.1	2.5	0	0	0	0	0	96.3
Drop Zone	0	0.2	302.2	42.7	14.0	0	0	0	0	0	96.5	455.6
Field Artillery Indirect Fire Range (Firing Points)	0.4	18.9	32.2	14.1	1.5	0	17.0	0	0	0	0.9	85.0
Convoy Course Engagement Areas	0	13.2	34.6	22.0	2.4	0	0	0	0	0	8.6	80.8
Convoy Course	0	9.8	20.9	3.5	0.4	0	0	0	0	0	27.5	62.1
Tracked Vehicle Driver's Course	1.5	33.1	39.8	18.1	0.7	0.3	0.1		0.1	0.1	6.4	100.2
Tactical Amphibious Landing Beach (Unai Chulu)	0	0	0.1	0.9	0	0	0	0	0	3.0	0	4.0
Landing Zones	0	7.0	5.3	6.1	0	0	0	0	0	0	1.4	19.8
Range Control Observation Points	0	1.7	9.4	3.7	0	0	<0.1	0	0	<0.1	0	14.8
Surface Radar Sites	0	0.1	0.6	0.1	0	0	0.1	0	0	<0.1	0	0.9
Roadway Improvements	0	4.0	4.4	2.4		0	0	0	0	0	32.4	43.2
Fences	1.1	10.9	9.0	9.0	0.1	0	0	0	0	<0.1	5.7	35.8
Munitions Storage Area	0	5.9	27.0	4.9	0	0	0	0	0	0	<0.1	37.8
Airport Improvements and Staging Area	0	147.8	0	23.3	7.9	0	0	0	0	0	48.7	227.7
Tinian Port Improvements and Staging Area	0	0	0	0	0	0	0	0	0	0	4.5	4.5
Base Camp	0	229.9	0	10.5	3.3	0	0	0	0	0	12.5	256.2
Total Impacted under *Alternative 3*	**6.3**	**690.3**	**798.8**	**367.0**	**31.0**	**2.8**	**17.2**	**0.5**	**0.1**	**3.1**	**259.0**	**2,176.1**
Total on Tinian	*1,355.7*	*6,853.1*	*8,443.7*	*4,819.0*	*353.9*	*97.9*	*551.0*	*64.9*	*331.7*	*199.9*	*1,915.7*	*24,986.4*
% Impacted under Alternative 3 on Tinian	*0.5%*	*10.1%*	*9.5%*	*7.5%*	*9.1%*	*2.9%*	*3.1%*	*0%*	*0.0%*	*0.1%*	*13.4%*	*8.7%*

Notes: *Project areas are based on areas depicted and labeled in Section 2.4.

[1]NLF = native limestone forest; MIF = mixed introduced forest; TT = tangantangan; HS = herbaceous-scrub; Cas = *Casuarina* forest; Coco = coconut forest; BS = beach strand; Wet = potential wetlands; Ag = agriculture; Bar = barren; Dev = developed; < = less than.

[2]Includes fire break/buffer, perimeter road, Hand Grenade Range, Mortar Range, Light Anti-armor Weapon Range, Grenade Launcher Range, targets for Close Air Support Range, targets for Offensive Air Support Range, targets for Field Artillery Indirect Fire Range.

[3]Although two ephemeral ponds associated with the Mahalang Complex would be impacted under Alternative 3, these have not been delineated as wetlands at this time.

[4]Includes Anti-armor Tracking Range, Tank/Fighting Vehicle Stationary Target Range, and Multi-purpose Range Complex.

4.9.3.3.1.2 Native Wildlife

Potential impacts from construction activities associated with Tinian Alternative 3 to native bird species that are not listed under the Migratory Bird Treaty Act are described in this section. As discussed above in vegetation, a total of approximately 1,914 acres (775 hectares) of habitat would be removed because of proposed construction activities under Tinian Alternative 3 (see Table 4.9-7).

Table 4.9-8 provides the number of birds that may be impacted for five monitored bird species due to the loss of 1,862 acres (754 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats (DoN 2014a).

Table 4.9-8. Potential Direct and Permanent Impacts to Five Native Bird Species from Proposed Construction Activities under Tinian Alternative 3

Species	*Number of Birds Impacted by Removal of Habitat**				*Total*	*Estimated 2013 Total Tinian Population*	*% of Tinian Population Impacted*
	NLF	*MIF*	*TT*	*HS*			
Bridled white-eye	114	14,821	15,715	5,269	35,919	442,073	8.0%
Micronesian honeyeater	7	675	529	262	1,473	20,660	7.0%
Micronesian starling	11	1,162	1,304	642	3,119	40,489	7.6%
Rufous fantail	41	4,405	4,054	1,093	9,593	125,668	7.6%
Tinian monarch	29	3,078	3,325	750	7,182	91,420	7.8%

Notes: *NLF = native limestone forest, MIF = mixed introduced forest, TT = tangantangan, HS = herbaceous scrub.
Source: DoN 2014a.

Under Tinian Alternative 3, approximately 7,182 Tinian monarchs would potentially be permanently displaced by loss of habitat associated with construction (see Table 4.9-8). Therefore, because of the amount of habitat removed and the number of birds potentially impacted, significant direct impacts to the Tinian monarch would occur from implementation of Tinian Alternative 3.

As discussed under Alternative 1 (see Section 4.9.3.1), four areas are being assessed as potential conservation areas for the protection of the Tinian monarch and other wildlife species (Figure 4.9-2). These areas may also be used for additional natural resource mitigation measures such as forest enhancement and/or invasive species control. The Department of Defense is coordinating with the Federal Aviation Administration and the U.S. Fish and Wildlife Service on these potential conservation areas.

Similar to Tinian Alternative 1, proposed construction activities would reduce the amount of habitat available to native birds on Tinian and impacts under Alternative 3 (see Section 4.9.3.1). Therefore, implementation of Tinian Alternative 3 and the removal of approximately 1,862 acres (754 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats would result in significant direct impacts to the populations of bridled white-eye, Micronesian honeyeater, Micronesian starling, rufous fantail, and Tinian monarch. These bird species are territorial, meaning that a minimum area is required for each bird or breeding pair for all of their foraging and nesting activities. For most animal species, and particularly within island ecosystems, available but unoccupied habitat is rare (if it does exist, it is generally very low-quality habitat). This is the case unless populations are limited not by habitat, but by predators, disease, or over-hunting. Based on available data, there is no indication that there are large areas of available but unoccupied habitat on Tinian, particularly for forest and shrub breeding bird species.

The same potential mitigation measures discussed previously under Alternative 1 to mitigate potential significant direct, long-term impacts of proposed construction activities on native forest birds would be applicable under Alternative 3 (i.e., forest enhancement of native limestone forest, mixed introduced forest, tangantangan forest, and herbaceous scrub habitats). However, impacts from the loss of 1,862 acres (754 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitat would be significant, even with forest enhancement efforts. Although bird densities are higher in higher-quality habitats and more birds are expected to eventually occupy areas of proposed forest enhancement, the proposed area of forest enhancement is not large enough to make up for the overall loss of available habitat under Alternative 3.

In addition, mitigation monitoring would be conducted with the preparation of a Forest Enhancement/Restoration and Monitoring Plan and a Forest Bird Monitoring and Tinian Monarch Management Plan.

Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.3.3.1.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Figures 4.9-7a and 4.9-7b provide the general locations of special-status species within the Military Lease Area in relation to Tinian Alternative 3. Direct impacts to special-status species from proposed construction activities include the removal of habitat, fragmentation of remaining habitat, and associated noise, light, and human activities. Individual special-status species are discussed below.

Mariana Fruit Bat

Impacts to Mariana fruit bats resulting from implementation of Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to Mariana fruit bats from proposed construction activities associated with Tinian Alternative 3 would be less than significant.

Mariana Common Moorhen

Impacts to Mariana common moorhens resulting from implementation of Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to Mariana common moorhens from proposed construction activities associated with Tinian Alternative 3 would be less than significant.

Micronesian Megapode

Impacts to Micronesian megapodes resulting from implementation of Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to Micronesian megapodes from proposed construction activities associated with Tinian Alternative 3 would be less than significant.

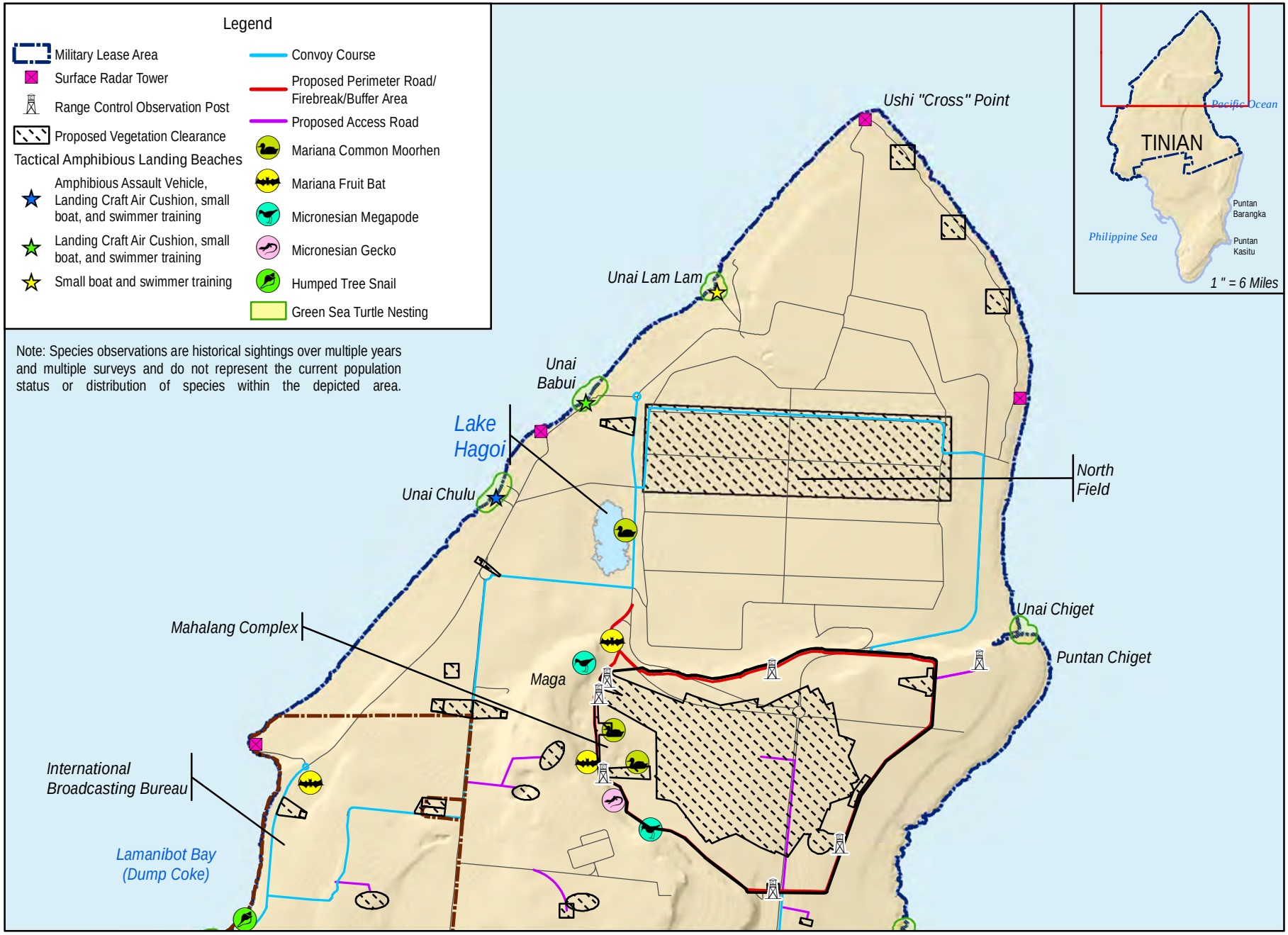

Figure 4.9-7a
Northern Military Lease Area - Tinian Alternative 3,
Occurrence of Special-status Species

Sources:
Hawaiian Agronomics 1985; Krueger and O'Daniel 1999; O'Daniel and Krueger 1999; Witteman 2001; Vogt 2008; USFWS 2009, 2010; Wenninger 2012; DoN 2013a, 2013b, 2013d, 2014a, 2014c

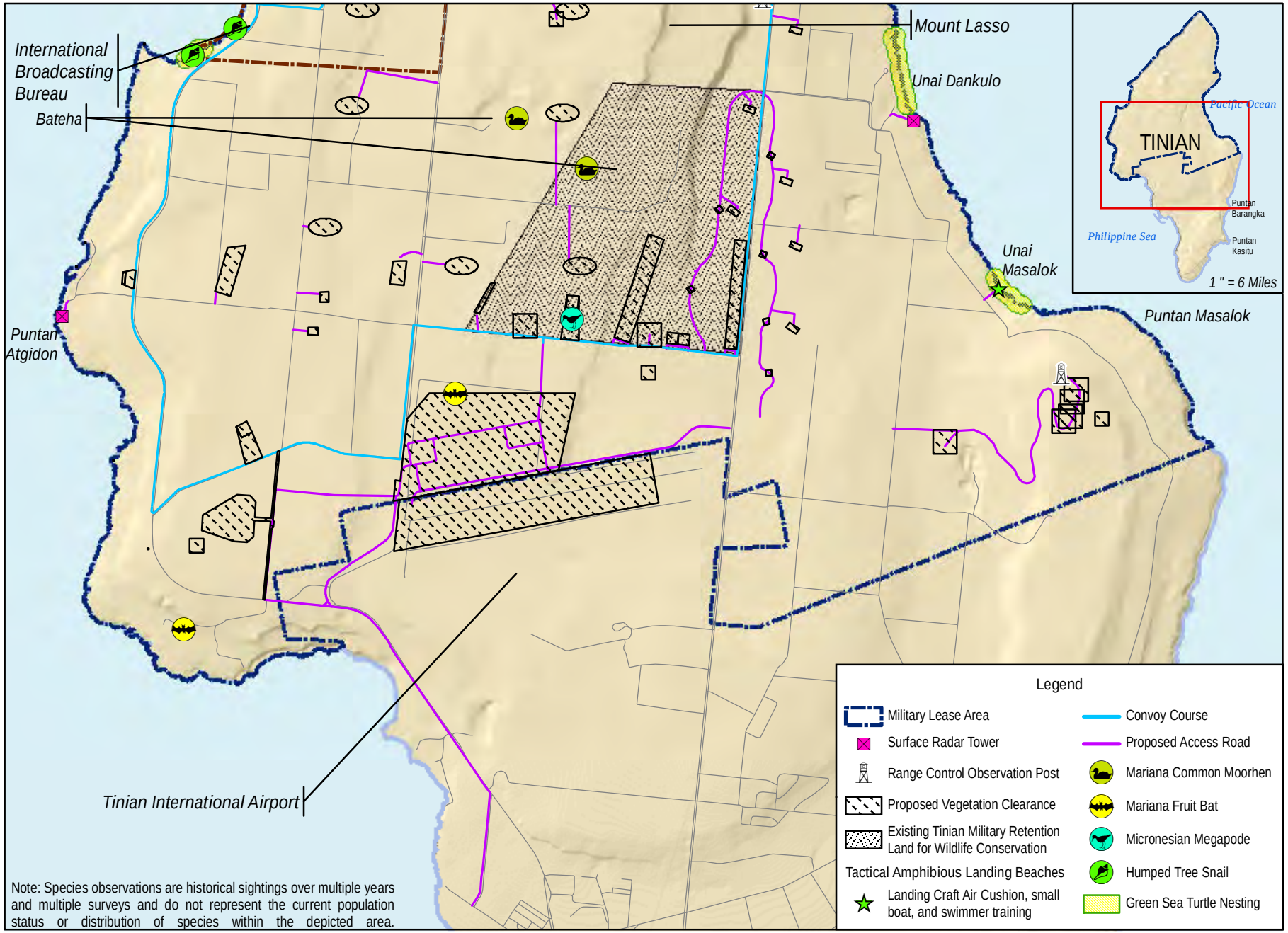

Figure 4.9-7b
Southern Military Lease Area - Tinian Alternative 3,
Occurrence of Special-status Species

Sources:
Hawaiian Agronomics 1985; Krueger and O'Daniel 1999; O'Daniel and Krueger 1999; Witteman 2001; Vogt 2008; USFWS 2009, 2010; Wenninger 2012; DoN 2013a, 2013b, 2013d, 2014a, 2014c

Sea Turtles

Impacts to nesting sea turtles resulting from implementation of Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to sea turtles from proposed construction activities associated with Tinian Alternative 3 would be less than significant. The assessment of potential impacts to sea turtles in the marine environment is provided in Section 4.10, *Marine Biology*.

Humped Tree Snail

Impacts to humped tree snails under Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to humped tree snails from proposed construction activities under Tinian Alternative 3.

Heritiera longipetiolata

Impacts to *H. longipetiolata* under Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to *H. longipetiolata* from proposed construction activities under Tinian Alternative 2.

Dendrobium guamense

Impacts to *D. guamense* under Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to *D. guamense* from proposed construction activities under Tinian Alternative 3.

4.9.3.3.1.4 Special-status Species: Migratory Bird Treaty Act-listed Species

As discussed above in vegetation communities, approximately 1,914 acres (775 hectares) of habitat for native species would be removed because of proposed construction activities associated with Tinian Alternative 3 (see Table 4.9-7). Table 4.9-9 provides the number of birds that may be impacted for three monitored Migratory Bird Treaty Act-listed bird species due to the loss of 1,862 acres (754 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats (DoN 2014a).

Table 4.9-9. Potential Direct and Permanent Impacts to Three Migratory Bird Treaty Act-listed Species from Proposed Construction Activities under Tinian Alternative 3

Species	*Number of Birds Impacted by Removal of Habitat**				*Total*	*Estimated 2013 Total Tinian Population*	*% of Tinian Population Impacted*
	NLF	*MIF*	*TT*	*HS*			
Collared Kingfisher	1	67	49	57	174	2,508	6.9%
Mariana Fruit-dove	1	136	103	58	298	4,042	7.4%
White-throated Ground-dove	2	167	53	71	293	4,879	5.9%

Notes: *NLF = native limestone forest, MIF = mixed introduced forest, TT = tangantangan, HS = herbaceous scrub.
Source: DoN 2014a.

Direct and indirect impacts to Migratory Bird Treaty Act-listed species resulting from implementation of Tinian Alternative 3 would be similar to those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Under Tinian Alternative 3, proposed construction activities would remove 1,862 acres (754 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats available to Migratory Bird Treaty Act-listed species on Tinian. Therefore,

implementation of Tinian Alternative 3 and the removal of approximately 1,862 acres (754 hectares) of forested and herbaceous scrub habitats would result in less than significant direct and indirect impacts to Migratory Bird Treaty Act-listed seabirds and shorebirds, but significant impacts to populations of forest- and scrub-nesting bird species. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of best management practices (see Section 4.9.2).

The same potential mitigation measures discussed previously under Alternative 1 to mitigate potential significant direct, long-term impacts of proposed construction activities on Migratory Bird Treaty Act-listed species would be applicable under Alternative 3. Under Alternative 3, forest enhancement of forested and herbaceous scrub habitats would occur. However, impacts from the loss of 1,862 acres (754 hectares) of forested and herbaceous scrub habitat would be significant, even with forest enhancement efforts. In addition, mitigation monitoring would be conducted with the preparation of a Forest Enhancement/Restoration and Monitoring Plan and a Forest Bird Monitoring and Tinian Monarch Management Plan.

Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.3.3.1.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the Mariana common moorhen, Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are all CNMI-listed threatened/endangered species. These species are discussed above within the *Endangered Species Act-listed Species* section.

Micronesian Gecko

Impacts to Micronesian geckos resulting from implementation of Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1).

4.9.3.3.2 Operation Impacts

4.9.3.3.2.1 Vegetation Communities

Impacts to vegetation communities from training operations associated with Tinian Alternative 3 would be the same as those previously discussed for Tinian Alternative 1 (see Section 4.9.3.1). Therefore, implementation of Tinian Alternative 3 would result in less than significant direct and indirect impacts to vegetation communities.

4.9.3.3.2.2 Native Wildlife

Impacts to native wildlife from training operations associated with Tinian Alternative 3 would be the same as those previously discussed for Tinian Alternative 1 (see Section 4.9.3.1). Therefore, implementation of Tinian Alternative 3 would result in less than significant direct impacts to native wildlife. In addition, as discussed under Alternative 1, the DoN, in coordination with the U.S. Fish and Wildlife Service, would prepare a Tinian Forest Bird Monitoring and Tinian Monarch Management Plan to monitor the potential effects of proposed CJMT activities on Migratory Bird Treaty Act-listed forest birds within the Military Lease Area. Potential indirect impacts associated with potential introduction of

non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.3.3.2.3 Special-status Species

Impacts to Endangered Species Act-listed and proposed species, Migratory Bird Treaty Act-listed species, and CNMI-listed species resulting from the implementation of Tinian Alternative 3 would be the same as those previously discussed for Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be less than significant direct and indirect impacts to special-status species from operational activities associated with Tinian Alternative 3.

4.9.3.4 Tinian No-Action Alternative

Vegetation and ground disturbance activities would be minor and localized during the periodic non-live-fire military training exercises that occur within the Military Lease Area. Vehicular noise and air emissions would also occur during these periodic training exercises. All existing mitigation and compensation measures would be adhered to in order to minimize any adverse impacts to terrestrial biological resources, including special-status species. Biosecurity measures on Tinian are in place to minimize the introduction or spread of invasive species including the brown treesnake. The Guam and CNMI Military Relocation EIS (DoN 2010a) included the establishment of the four live-fire training ranges on Tinian that would introduce significant but mitigable impacts to native habitat and special-status species (see Table 10.2-13; DoN 2010a). No impacts to terrestrial biology resources would occur due to Mariana Islands Range Complex operations (see Table 3.11-6, *Summary of Effects to Enlisted Species Act-listed Species*, and Table 3.11-7; DoN 2010b). Therefore, overall, significant but mitigable impacts would occur under the no-action alternative.

4.9.3.5 Summary of Impacts for Tinian Alternatives

Table 4.9-10 provides a comparison of the potential impacts to terrestrial biology resources for the three Tinian alternatives and the no-action alternative.

Table 4.9-10. Summary of Impacts for Tinian Alternatives

	Tinian (Alternative 1)		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Resource Area	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Vegetation Communities	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Native Wildlife	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Special-status Species: Endangered Species Act – Listed and Proposed Species	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode, sea turtles). NI (humped tree snail, Heritiera longipetiolata, Dendrobium guamense)*	*LSI (Mariana fruit bat, Micronesian megapode, Mariana common moorhen sea turtles). NI (humped tree snail, Heritiera longipetiolata, Dendrobium guamense)*	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode, sea turtles). NI (humped tree snail, Heritiera longipetiolata, Dendrobium guamense)*	*LSI (Mariana fruit bat, Micronesian megapode, Mariana common moorhen sea turtles). NI (humped tree snail, Heritiera longipetiolata, Dendrobium guamense)*	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode, sea turtles). NI (humped tree snail, Heritiera longipetiolata, Dendrobium guamense)*	*LSI (Mariana fruit bat, Micronesian megapode, Mariana common moorhen sea turtles). NI (humped tree snail, Heritiera longipetiolata, Dendrobium guamense)*	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode). NI (sea turtles, humped tree snail)*	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode). NI (sea turtles, humped tree snail)*
Special-status Species: Migratory Bird Treaty Act	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Special Status Species: CNMI-listed Species	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*

Legend: *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.9.3.6 Summary of Potential Mitigation Measures for Tinian Alternatives

Table 4.9-11 provides a summary of the potential mitigation measures for terrestrial biology resources for the three Tinian alternatives.

Table 4.9-11. Summary of Mitigation Measures for Tinian Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*Tinian Phase*	
			Construction	*Operation*
TERRESTRIAL BIOLOGY				
Vegetation Communities *Alternatives 1, 2, and 3*: The conversion of 6.3 acres (2.5 hectares) of native limestone forest on Tinian to developed land would be unavoidable.	*SI*	• Department of Defense may implement forest enhancement on 6.3 acres (2.5 hectares) to replace the area of native limestone forest removed during construction. Forest enhancement would include removal of non-native vegetation and establishment of native species that are characteristic of native limestone forest habitats. • To avoid and minimize impacts to native limestone forest on Tinian, the Department of Defense will implement training restrictions within native limestone forest. All limestone forest habitat within the Military Lease Area will be designated as "No Wildlife Disturbance Areas," with the following actions prohibited: off-road vehicle travel; vehicle parking except on existing roads or trails; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; and aircraft landings. Any maneuvers conducted in native limestone forest will be on foot (no off-road vehicle maneuvers), and units will be tactical, with no support camps. Limestone forest "No Wildlife Disturbance Area" restrictions will be implemented upon initiation of CJMT training activities on Tinian. • Department of Defense may implement forest enhancement in areas of tangantangan or herbaceous scrub habitat to replace the forested habitats removed during construction. Forest enhancement would include removal of non-native vegetation and establishment of native species that are characteristic of native forest habitats.	X	

Table 4.9-11. Summary of Mitigation Measures for Tinian Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*TinianPhase*	
			Construction	*Operation*
Native Wildlife *Alternative 1:* The removal of 1,745 acres (706 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the Tinian monarch, and other native wildlife species would be unavoidable. *Alternative 2*: The removal of 1,883 acres (762 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the Tinian monarch, and other native wildlife species would be unavoidable. *Alternative 3*: The removal of 1,862 acres (754 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the Tinian monarch, and other native wildlife species would be unavoidable.	*SI*	• Department of Defense may implement forest enhancement in areas of mixed introduced forest, tangantangan, or herbaceous scrub habitat to replace the forest habitat removed during construction. Forest enhancement would include removal of non-native vegetation and establishment of native species that are characteristic of native forest habitats. • Department of Defense may replace the current Tinian Military Retention Land for Wildlife Conservation by establishing a conservation area(s) for the protection of the Tinian monarch and other wildlife species with one or more conservation sites within the Military Lease Area. Forest enhancement and invasive species control may also be implemented within the replacement Wildlife Conservation site(s). • To improve habitat quality for native wildlife on Tinian, the Department of Defense may implement monitoring and control of non-native invasive species within forest habitat, including control of invasive plant, mammal, and insect species. • To avoid and minimize impacts to native wildlife species that use native limestone forest on Tinian, the Department of Defense will implement training restrictions within native limestone forest. All limestone forest habitat within the Military Lease Area will be designated as "No Wildlife Disturbance Areas," with the following actions prohibited: off-road vehicle travel; vehicle parking except on existing roads or trails; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; and aircraft landings. Any maneuvers conducted in native limestone forest will be on foot (no off-road vehicle maneuvers), and units will be tactical, with no support camps. Limestone forest "No Wildlife Disturbance Area" restrictions will be implemented upon initiation of CJMT training activities on Tinian.	X	

Table 4.9-11. Summary of Mitigation Measures for Tinian Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*TinianPhase*	
			Construction	*Operation*
Special-status Species: Endangered Species-Act-listed and Proposed Species	*LSI*	• To avoid impacts to Mariana common moorhens at the Lake Hagoi and two Bateha wetland sites, the Department of Defense will designate the three wetland sites as "No Training Areas." Ground disturbance and vegetation removal of any kind will be prohibited within these "No Training Areas." In addition, CJMT-associated aircraft overflights of these sites will be limited to a minimum altitude of 500 feet (152 meters) above ground level. Wetland "No Training Area" restrictions would be implemented upon initiation of CJMT training activities on Tinian. • To mitigate for loss of Mariana common moorhen foraging habitat at Mahalang, the Department of Defense may implement portions of the DoN Tinian Wetlands Management Plan at Hagoi and two Bateha sites. This may include invasive plant surveys, monitoring, and control; habitat restoration and improvement; baseline surveys for moorhen predators; and predator control at Hagoi and Bateha. • To avoid and minimize impacts to special-status species that use native limestone forest on Tinian, the Department of Defense will implement training restrictions within native limestone forest. All limestone forest habitat within the Military Lease Area will be designated as "No Wildlife Disturbance Areas," with the following actions prohibited: off-road vehicle travel; vehicle parking except on existing roads or trails; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; and aircraft landings. Any maneuvers conducted in native limestone forest will be on foot (no off-road vehicle maneuvers), and units will be tactical, with no support camps. Limestone forest "No Wildlife Disturbance Area" restrictions will be implemented upon initiation of CJMT training activities on Tinian. • To avoid and minimize impacts to nesting sea turtles, the Department of Defense will implement training protocols at all beaches used for amphibious operations on Tinian. Biologists trained in identifying sea turtle nests will survey landing beaches no		X

Table 4.9-11. Summary of Mitigation Measures for Tinian Alternatives

Impacts	Category	Potential Mitigation Measures	Tinian Phase: Construction	Tinian Phase: Operation
		more than 6 hours prior to the first craft landing or use of other beach landing equipment. Any potential sea turtle nests will be flagged, with a buffer zone of 20 feet (6 meters) from the edge of the nesting activity (area disturbed by the turtle) to ensure complete avoidance. The flagged area will be avoided by landing craft and personnel. Beach training activities will also be coordinated with monthly sea turtle nest monitoring, during which any potential turtle nests will be flagged, with a buffer zone of 20 feet (6 meters) to ensure avoidance. If an active nest with a pre-hatch hole is discovered on a beach during monitoring, night training over the next 5 nights will be conducted only on other beaches. If beach sand is compacted by landing craft, the beach topography will be restored within 3 days using non-mechanized methods (e.g., rakes or other hand tools). The Department of Defense will implement beach training protocols upon initiation of CJMT amphibious training activities.		
Special-status Species: Migratory Bird Treaty Act-listed Species *Alternative 1*: The removal of 1,745 acres (706 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the collared kingfisher, Mariana fruit dove, and white-throated ground-dove, would be unavoidable. *Alternative 2*: The removal of 1,883 acres (762 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the collared kingfisher, Mariana fruit dove, and white-throated ground-dove, would be unavoidable. *Alternative 3*: The removal of 1,862 acres (754 hectares) of forested and herbaceous scrub habitats (including Tinian	*SI*	• Department of Defense may implement forest enhancement in areas of tangantangan or herbaceous scrub habitat to replace the mixed introduced forest and herbaceous scrub removed during construction. Forest enhancement would include removal of non-native vegetation and establishment of native species that are characteristic of native forest habitats. • Department of Defense may establish a conservation area for the protection of the Tinian monarch and other wildlife species with one or more conservation sites within the Military Lease Area. Forest enhancement and invasive species control may also be implemented within the wildlife conservation site(s). • To avoid and minimize impacts to Migratory Bird Treaty Act-listed species that use native limestone forest on Tinian, the Department of Defense will implement training restrictions within native limestone forest. All limestone forest habitat within the Military Lease Area will be designated as "No Wildlife Disturbance Areas,"	X	

Table 4.9-11. Summary of Mitigation Measures for Tinian Alternatives

Impacts	Category	Potential Mitigation Measures	Tinian Phase: Construction	Tinian Phase: Operation
Military Retention Land for Wildlife Conservation) used by native landbirds, including the collared kingfisher, Mariana fruit dove, and white-throated ground-dove, would be unavoidable.		with the following actions prohibited: off-road vehicle travel; vehicle parking except on existing roads or trails; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; and aircraft landings. Any maneuvers conducted in native limestone forest will be on foot (no off-road vehicle maneuvers), and units will be tactical, with no support camps. Limestone forest "No Wildlife Disturbance Area" restrictions will be implemented upon initiation of CJMT training activities on Tinian. • To improve habitat quality for native wildlife on Tinian, Department of Defense may implement monitoring and control of non-native species within forest habitat, including control of invasive plant, mammal, and insect species. • To avoid and minimize impacts to Mariana fruit bats and sea turtles, hooded lights will be used to the maximum extent practicable at all new roads and facilities within sea turtle nesting habitat and fruit bat foraging and roosting habitat. "Night-adapted" lights will be installed in the briefing and bleacher areas. Illumination of forests, coastlines, and beaches will be kept to an absolute minimum. Lighting will be designed to meet minimum safety, anti-terrorism, and force protection requirements. • To avoid impacts to Migratory Bird Treaty Act-listed species that use the Lake Hagoi and two Bateha wetland sites, the Department of Defense will designate the three wetland sites as "No Training Areas." Ground disturbance and vegetation removal of any kind will be prohibited within these "No Training Areas." In addition, the CJMT-associated aircraft overflights of these sites will be limited to a minimum altitude of 500 feet (152 meters) above ground level. Wetland "No Training Area" restrictions would be implemented upon initiation of CJMT training activities on Tinian.		

Legend: *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.
Note: Mitigation measures associated with terrestrial biology do not alter the significance of the impacts.

4.9.4 Pagan

4.9.4.1 Pagan Alternative 1

4.9.4.1.1 Construction Impacts

4.9.4.1.1.1 Vegetation Communities

Vegetation communities that would be impacted during construction activities under Pagan Alternative 1 are listed in Table 4.9-12 and shown in Figure 4.9-8. While bare ground, lava, and sand areas do not have vegetation that would be impacted, the acreage within the project footprints for these community types is included for habitat area reference.

Table 4.9-12. Potential Direct Impacts to Vegetation Communities with Implementation of Pagan Alternative 1

Project Area	*Vegetation Community (acres)**								
	NF	***MNIF***	***HS***	***Cas***	***Coco***	***Grass***	***Sand***	***Bar***	***Total***
Northern High Hazard Impact Area	7.1	0	22.2	104.1	0	0	0	186.3	319.7
Isthmus High Hazard Impact Area	7.2	22.1	4.0	0	16.1	128.3	0	0	177.7
Field Artillery Direct Fire Range	0	0	0	0	0	0	0	9.9	9.9
Field Artillery Indirect Fire Range	0	0	2.1	0.1	0	7.7	0	9.9	19.8
Airfield Clear Zone	0	22.9	51.1	27.5	0.5	106	0	181.7	389.7
Munitions Storage Area	0.8	0	3.5	1.0	0	0.9	0.2	3.5	9.9
Landing Zones	<0.1	1.9	9.4	10.5	2.9	8.3	0	3.3	36.3
Military Training Trails	4.7	0.6	5.9	23.4	4.2	16.6	0.4	14.8	69.7
Total Impacted under Alternative 1	**19.8**	**47.5**	**98.2**	**166.6**	**23.7**	**266.0**	**0.6**	**409.4**	**1,032.7**
Total on Pagan	*418*	*398*	*1,362*	*3,197*	*858*	*1,706*	*28*	*2,531*	*11,502*
% Impacted under Alternative 1 on Pagan	*4.5%*	*11.9%*	*6.9%*	*5.2%*	*2.8%*	*15.6%*	*1.4%*	*16.0%*	*8.9%*

Notes: *Impact areas are based on areas depicted and labeled in Chapter 2, *Proposed Action and Alternatives,* Figure 2.6-4. Numbers may not add precisely due to rounding

Legend: Bar = barren: lava, cinder, or bare ground; Cas = *Casuarina* forest; Coco = coconut forest; Grass = grassland; HS = herbaceous scrub; MNIF = mixed native-introduced forest; NF = native forest; Sand = sand.

Under Pagan Alternative 1, approximately 623 vegetated acres (252 hectares) would be cleared within the northern part of the island and represents approximately 7% of the island's vegetation. The majority of the removed habitat comprises approximately 47 acres (19 hectares) of mixed native-introduced forest (12% of total on island), 98 acres (40 hectares) of herbaceous scrub (7% of total on island), and 167 acres (68 hectares) of *Casuarina* forest (5% of total on island). Approximately 20 acres (8 hectares) (4% of total on island) of native forest would be removed, primarily within the High Hazard Impact Areas (see Table 4.9-11). Given the importance of native forest habitat for native species, this permanent loss of native vegetation would be a significant and unavoidable direct impact. Potential indirect impacts to vegetation associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2 and Appendix D, *Best Management Practices*).

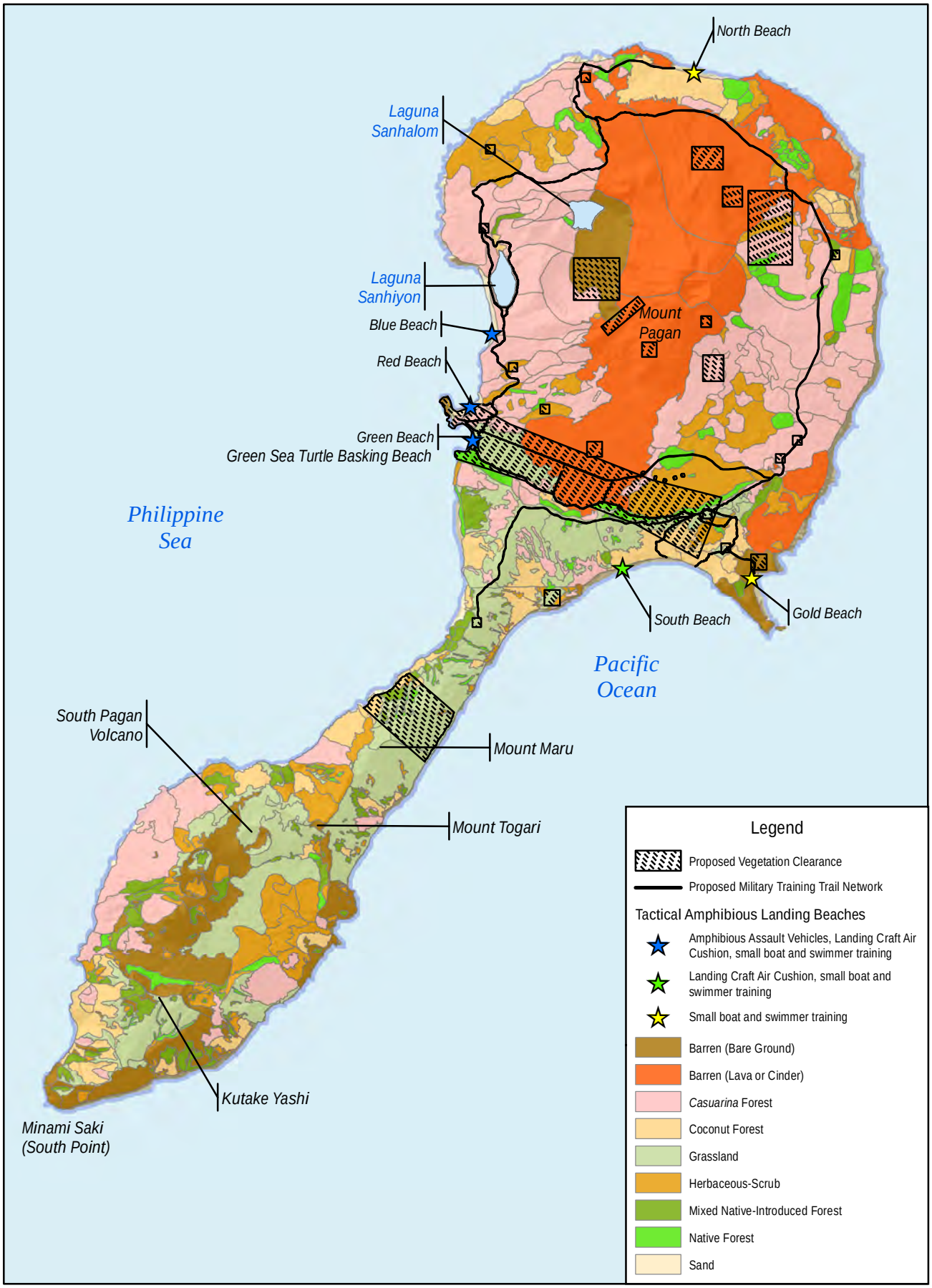

Figure 4.9-8
Pagan Alternative 1, Vegetation Communities

Source: Rogers 2010.

To mitigate for significant impacts to native forest on Pagan, the Department of Defense may facilitate native forest regeneration on southern Pagan by implementing feral ungulate removal. This would consist of active control (i.e. trapping, snaring, shooting) of animals, with the goal of eradicating all feral ungulates from southern Pagan. The Department of Defense may also implement monitoring and control of non-native invasive species within forest habitat on Pagan, including control of invasive plant, mammal, and insect species.

4.9.4.1.1.2 Native Wildlife

Potential impacts from construction activities associated with Pagan Alternative 1 to native bird species on Pagan that are not listed under the Migratory Bird Treaty Act are described in this section. Species protected under the Migratory Bird Treaty Act are addressed separately in the *Special-status Species* section. Long-term habitat loss would result from the construction of the proposed facilities. Approximately 258 acres (104 hectares) of forested habitat would be removed by construction (see Table 4.9-11). This permanent loss of habitat would affect approximately 5% of the island's forest habitat and reduce the available habitat for wildlife populations.

Therefore, implementation of Pagan Alternative 1 and the removal of approximately 258 acres (104 hectares) of forested habitats would result in less than significant direct impacts to native wildlife populations. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.4.1.1.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Based on historical data and surveys conducted in support of this EIS/OEIS, Figure 4.9-9 provides the general locations of special-status species in relation to Pagan Alternative 1. Direct impacts to special-status species from proposed construction activities include the removal of habitat, fragmentation of remaining habitat, and associated noise and human activities. With the exception of the Mariana fruit bat, none of the areas proposed for construction would occur within the vicinity of federally listed or proposed species habitat on Pagan, as most Endangered Species Act-listed species are located on southern Pagan south of the isthmus. Therefore, there would be no impacts to these species resulting from construction. Construction in the northern portion of the island would remove potential foraging habitat for the Mariana fruit bat (4% of native forest, 12% of mixed native introduced forest, and 5% of Casuarina forest). In addition, construction activities could potentially temporarily displace fruit bats from their foraging areas due to noise and human presence.

Construction noise on Pagan would occur with the extension of the expeditionary airfield, clearing of landing zones, and clearing for an unpaved perimeter road around the northern portion of the island (see Figures 2-13 and 2-14). Noise levels from equipment and other construction activities are anticipated to generate noise levels from 70-90 decibels at a distance of 50 feet (15 meters). Fruit bats on the northeastern end of Pagan may flush from and temporarily avoid the roosting site and foraging locations in this area during clearing for the perimeter road. Effects of such flushing may include temporary disruption of roosting and foraging behaviors. As there are no proposed construction activities within southern Pagan, the two fruit bat colonies in southern Pagan would not be exposed to construction noise.

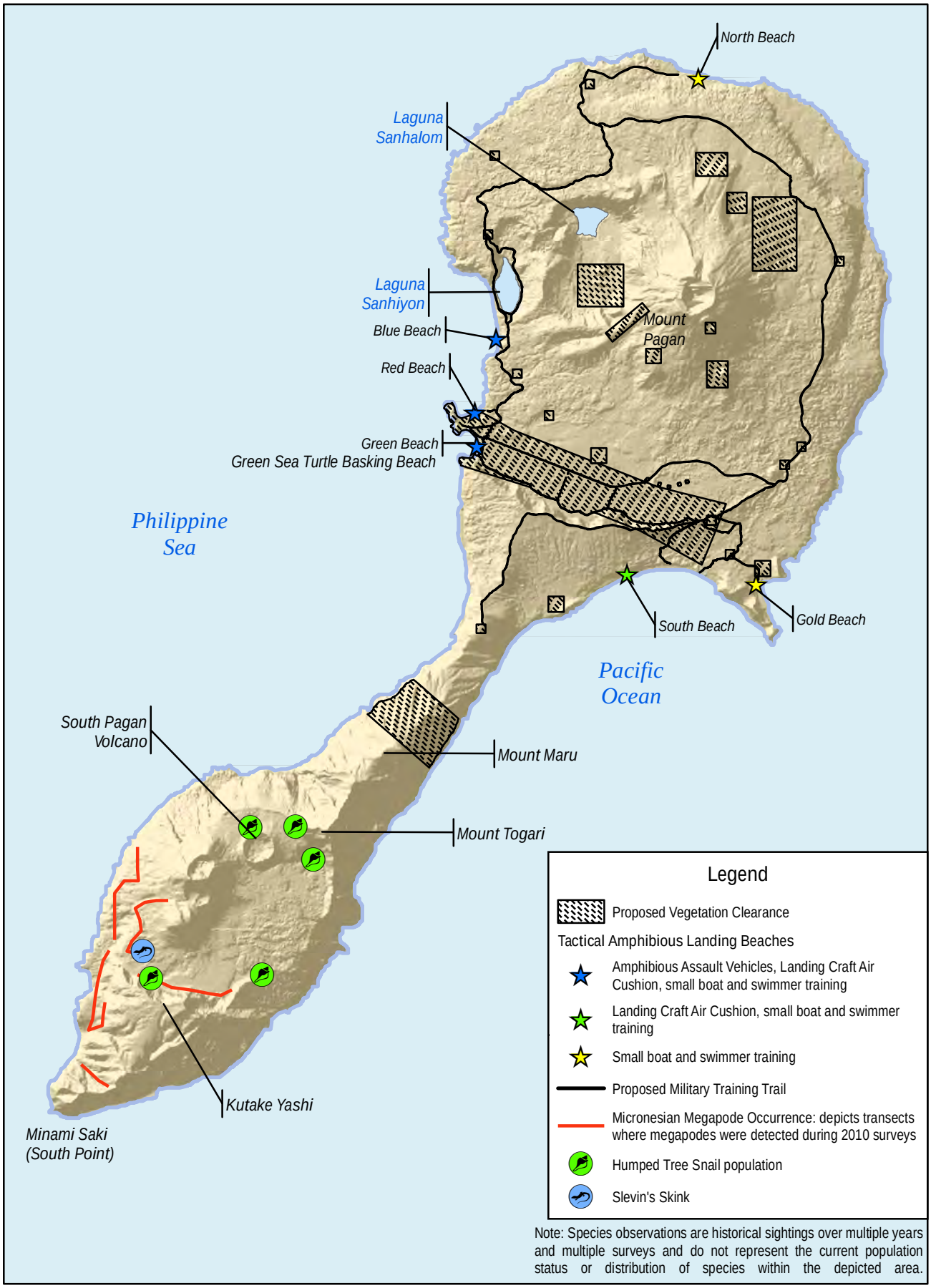

Figure 4.9-9
Pagan Alternative 1, Occurrence of Special-status Species

Sources: Reed et al. 2010; Amidon et al. 2011

Based upon the above information, direct impacts to the Mariana fruit bat population from construction activities associated with Pagan Alternative 1 would be less than significant.

4.9.4.1.1.4 Special-status Species: Migratory Bird Treaty Act-listed Species

Of the 12 bird species that have been observed on Pagan and are protected under the Migratory Bird Treaty Act (Table 3.9-7), 9 species are seabirds and 3 are landbirds. As discussed above in *Vegetation Communities*, approximately 258 acres (104 hectares) of forested habitat for native species would be removed because of Pagan Alternative 1 proposed construction activities (see Table 4.9-12). Construction impacts to landbird species protected under the Migratory Bird Treaty Act would be similar to that described above for wildlife. Therefore, implementation of Pagan Alternative 1 and the removal of approximately 258 acres (104 hectares) of forested habitats through construction activities would result in less than significant direct and indirect impacts to populations of Migratory Bird Treaty Act-listed forest birds.

4.9.4.1.1.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the federally listed Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are also listed as threatened/endangered by the CNMI. Impacts to these species are discussed previously under the *Special-status Species: Endangered Species Act-listed and Proposed Species* section. No other CNMI-listed species occur on Pagan.

4.9.4.1.2 Operation Impacts

4.9.4.1.2.1 Vegetation Communities

Potential impacts to vegetation communities from training operations associated with Pagan Alternative 1 include foot traffic, vehicle use, and fire potential. There would be no impacts to vegetation from vehicle use in the southern portion of the island as vehicle travel would be restricted to only the northern portion of the island where the topography allows. Off-road vehicle use in the Northern Live-Fire Maneuver Area would increase the potential of soil erosion and cause direct vegetation disturbance. Soil erosion could also be generated through ongoing training exercises where lands are cleared and/or disturbed for bivouac sites and digging. Large amounts of foot traffic, camping, equipment staging, and ordnance deployment would result in the crushing, breaking, removal, and reduction of overall vegetative cover; and could potentially cause erosion during the rainy season. However, the location of foot traffic would vary during training throughout the maneuver areas, thereby minimizing impacts in any one area. In addition, vegetation growth on Pagan is fairly robust and it is expected that vegetation would regrow rapidly.

Fire potential would increase due to proposed live-fire range operations. Fire can result in direct effects to vegetation by killing or damaging individual plants; or indirect effects, for example, increasing erosion, allowing non-native species to invade and altering wildlife habitat by reducing food resources, breeding habitat, and shelter. The majority of the northern High Hazard Impact Area would be located within lava/cinder and bare ground areas. Vegetation in both the northern and isthmus High Hazard Impact areas would be maintained at approximately 6 inches (15 centimeters) above ground. In addition, the isthmus High Hazard Impact Area would contain a fire break established around the perimeter, and targets would be placed in areas of sparse vegetation. The potential for the spread of wildfire would thus be minimized. A fire prevention and management plan would be developed prior to

initiation of live-fire training that would outline standard procedures for safe range use and management of fire risk.

Potential impacts to vegetation communities from training operations would be avoided and minimized by implementing resource management measures summarized in Section 4.9.2 and presented in detail in Appendix D, *Best Management Practices*. In particular, establishment of a firebreak around the High Hazard Impact Area, vegetation management within the associated target areas and firebreak, and implementation of a Fire Prevention and Management Plan, which establishes management and fire suppression and emergency response procedures, would minimize fire risk. Given implementation of resource management measures, implementation of the training activities associated with Pagan Alternative 1 would result in less than significant direct and indirect impacts to vegetation communities due to foot traffic and vehicle use.

4.9.4.1.2.2 Native Wildlife

Potential direct and indirect impacts to native wildlife species may result from direct strikes during maneuver training and munitions use, fires, noise from munitions training and aircraft, and direct strikes from aircraft. Indirect impacts to wildlife species may result from potential non-native species introductions.

Direct Strikes from Maneuver Training and Munitions Use

Heavy vehicle movement both on roads and off-road as well as ordnance explosion could result in direct impacts to wildlife including wildlife injury/mortality and indirect impacts such as degradation and/or loss of habitat. The majority of the High Hazard Impact Areas would be located where there is limited wildlife habitat within lava/cinder and bare ground areas in the higher elevations of the Pagan or in areas where vegetation has been cleared. In addition, direct strike of wildlife by munitions is unlikely, as animals would flush and move away from target areas in response to munitions noise. Stray ammunition may fall within the surface danger zones; however, the likelihood of any single animal being struck is negligible. There is the potential for certain wildlife species to be crushed by vehicles, but most wildlife would be able to move away from the maneuvers to avoid this.

Disturbance from foot traffic throughout the island as well as off-road vehicle maneuvering in the northern maneuver area could cause some limited degradation and fragmentation of habitat. However, the location of foot traffic would vary during training throughout the maneuver areas minimizing impacts in any one area. In addition, vegetation growth on Pagan is fairly robust and it is expected that vegetation would regrow rather rapidly. As a result, it is expected that there would be less than significant direct and indirect impacts to wildlife due to direct strikes associated with maneuver training and munitions use under Pagan Alternative 1.

Fires

As stated in the *Vegetation Communities* section, fire potential would be increased from live-fire and vehicle maneuvering operations. Fire can result in direct effects to all wildlife through mortality from smoke inhalation or incineration. Native plants, animals, and their habitats on Pagan are adapted to a humid, tropical climate and are not adapted to a fire-driven ecosystem (U.S. Fish and Wildlife Service

2008). The alteration or removal of habitats by fire could reduce food sources, prevent or inhibit breeding, or create competition for feeding and sheltering, particularly for species that establish discrete territories. However, due to the proposed vegetation clearing during construction, vegetation management, and the preparation and implementation of a Fire Prevention and Management Plan (see previous discussion under *Vegetation Communities*), the potential for wildfire would be minimized. With implementation of these measures, direct and indirect impacts to native wildlife from fire are not anticipated under Pagan Alternative 1.

Noise

Direct impacts from noise would be limited to times of active training operations, which would occur up to 16 non-consecutive weeks per year (but not 24/7). Noise modeling studies were conducted for the proposed small arms and large caliber munitions and aircraft activities; noise levels and noise contours are provided in Section 4.5, *Noise*. Wildlife within the northern portion of Pagan would be exposed to noise of more than 85 decibels A-weighted day-night average sound level and 104 decibels Peak level from small-caliber weapons (see Figures 4.5-7 and 4.5-8), 70 decibels C-weighted day-night average sound level and 130 dB Peak level from large-caliber weapons (see Figures 4.5-9 and 4.5-10), and 65-70 decibels A-weighted day-night average sound level from aircraft operations (see Figure 4.5-12).

It is important to note that all operational noise disturbances would be temporary and would not be continuous for several reasons: (1) the type of activity (small- and large-caliber firing, and aircraft overflights) consists of non-continuous events; (2) training events would only occur up to 16 non-consecutive weeks per year; and (3) some ranges would likely not be used on any given training day.

No noise studies have been conducted specifically on wildlife species present on Pagan. However, noise studies have been conducted on the effects of military noise on wildlife species associated with other ranges that are similar to those proposed for use on Pagan. Refer to Tinian Alternative 1, *Native Wildlife* (see Section 4.9.3.1) for a summary of potential wildlife responses to noise associated with military training.

Training on Pagan would not be continuous, and some wildlife species have been shown to habituate to noise associated with training activities. However, due to the noise levels, time of day, and large geographic extent of noise that would be generated by live-fire training, there would be less than significant impacts to native wildlife species due to noise associated with Pagan Alternative 1 training operations.

Aircraft Strikes

Implementation of Pagan Alternative 1 would result in the potential for bird/animal aircraft strikes. However, in accordance with DoN requirements, a Bird/Animal Aircraft Strike Hazard Plan would be prepared to address all aircraft operations on Pagan. This plan would be prepared to minimize the occurrence of bird/animal aircraft strikes, and would provide detailed procedures to monitor and react to heightened risk of bird strikes. When risk increases, limits would be placed on low-altitude flight and some types of training. Special briefings would be provided to pilots whenever the potential exists for increased bird/animal strikes within the airspace.

With implementation of these procedures, potential direct and indirect impacts to native wildlife species from aircraft strikes resulting from implementation of Pagan Alternative 1 would be less than significant.

Introduction of Non-native Species

Training activities would result in increased transport of material and personnel by ship and aircraft between Guam, other CNMI locations, and Pagan. These activities have the potential to introduce non-native species that could degrade habitat. The brown treesnake is the most serious potential non-native species that could be brought to Pagan. In addition, several non-native plant species (e.g., refer to Space and Falanruw 1999) could be introduced due to the proposed training activities. These and other species have the potential to prey on or compete with native species and degrade native forest habitats.

Section 4.9.2 discusses in detail applicable biosecurity measures that the U.S. military would implement to ensure that risk from transporting invasive species to Pagan is controlled. Refer to Appendix D, *Best Management Practices*, and Appendix L, *Biological Resources Supporting Documentation*, for a detailed discussion of biosecurity measures.

With implementation of resource management measures, the introduction of non-native species would be avoided and potential direct and indirect impacts to native wildlife species would be less than significant.

4.9.4.1.2.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Potential direct and indirect impacts to special-status species from direct strikes during maneuver training and munitions use, fires, direct strikes from aircraft, and non-native species introduction would be similar to those previously discussed for wildlife. There would be significant direct and indirect impacts from munitions noise on the Mariana fruit bat population on Pagan.

Mariana Fruit Bat

Currently, three Mariana fruit bat roost colonies are known on Pagan: two on southern Pagan and one on northern Pagan.

For those species of fruit bats that have been tested for hearing sensitivity, the hearing curves are very similar to those of humans, with similar upper and lower frequency limits and hearing threshold levels (Calford et al. 1985; Hall and Richards 2000). Therefore, it is likely that noise from live-fire operations at the proposed ranges would be heard by fruit bats as it would be heard by humans, and the modeled A- and C-weighted noise levels are appropriate for assessing the potential impacts of noise associated with proposed CJMT activities.

Munitions Noise. A summary of the expected noise levels at the three fruit bat colonies on Pagan due to live-fire weapons operations is presented in Table 4.9-13. Fruit bats at the colony located on northern Pagan would be exposed to small-caliber weapons noise levels of 64 decibels A-weighted day-night average sound level and 124 decibels Peak (Table 4.9-13). Received noise levels from large-caliber weapons would be 74 decibels C-weighted day-night average sound level and 147 decibels and greater than 150 decibels Peak under neutral and unfavorable weather conditions, respectively (Table 4.9-13).

Table 4.9-13. Modeled Weapons and Aircraft Noise Levels at Mariana Fruit Bat Colonies on Pagan under Alternative 1

Location	Small-caliber Weapons		Large-caliber Weapons			Aircraft Operations	
	DNL (dBA)	Peak (dB)	DNL (dBC)	Peak-n* (dB)	Peak-u* (dB)	DNL (dBA)	SEL (dBA)
Southern 1	<50	<87	55	<110	120	45.7	86.2
Southern 2	<50	<87	62	125	136	48.7	80.7
Northern	64	104	74	147	>150	64.2	78.6

Legend: dB = decibels; dBA = A-weighted decibels; dBC = C-weighted decibels; DNL = day-night average sound level; Peak-n = Peak noise level under neutral weather conditions; Peak-u = Peak noise level under unfavorable weather conditions; < = less than; > = greater than.

Sources: Army Public Health Command 2014; DoN 2014b.

The periods of potential noise disturbance from live-fire weapons training on Pagan would occur approximately 16 non-consecutive weeks per year and would occur during both day and night. Due to the proximity of the High Hazard Impact Area to the northern colony, and the high noise levels from small- and large-caliber weapons training, Mariana fruit bats are expected to flush from and avoid the northeastern portion of the island periodically or permanently. Effects of such periodic flushing may include disruption of roosting and foraging behaviors, decreased ability to regulate their body temperature, increased stress, particularly during daytime hours, and abandonment and mortality of offspring.

The fruit bat colonies on southern Pagan would be exposed to lower noise levels from live-fire of small- and large-caliber weapons. The two southern colonies would be exposed to small-caliber weapons noise levels of less than 50 decibels A-weighted day-night average sound level, while Peak levels would be less than 87 decibels (see Table 4.9-13). Received noise levels at the Southern 1 colony from large-caliber weapons would be 55 decibels C-weighted day-night average sound level, and less than 110 decibels and 120 decibels Peak under neutral and unfavorable weather conditions, respectively (see Table 4.9-13). Large-caliber weapons training on northern Pagan at the isthmus High Hazard Impact Area would expose the Southern 2 colony to noise levels of 58 decibels C-weighted day-night average sound level and 112 decibels and 124 decibels Peak under neutral and unfavorable weather conditions, respectively (see Table 4.9-13). Received noise levels on southern Pagan from large-caliber weapons training, particularly training that uses the isthmus High Hazard Impact Area, may cause Mariana fruit bats to flush from and avoid the roosting colony location near the isthmus of Pagan periodically or permanently. Effects of such periodic flushing may include disruption of roosting and foraging behaviors, decreased ability to regulate their body temperature, increased stress, particularly during daytime hours, and abandonment and mortality of offspring.

Therefore, proposed large-caliber weapons firing would result in significant direct impacts to Mariana fruit bats at the Southern 2 and Northern colonies; noise impacts to the Southern 1 colony from proposed large-caliber weapons firing are not anticipated based on modeled sound levels.

Aircraft Noise. Aircraft operations on Pagan would expose the fruit bat colony on northern Pagan to noise levels of 64.2 decibels A-weighted day-night average sound level and 78.6 decibels A-weighted day-night average sound level. Aircraft operations would expose the two fruit bat colonies on southern Pagan to noise levels of approximately 45.7 and 48.7 decibels A-weighted day-night average sound level and 86.2 and 80.7 decibels A-weighted day-night average sound level, respectively (see Table 4.9-13). These modeled noise levels are due to aircraft, primarily jets, approaching the High Hazard Impact Area

from the south over the isthmus and west of the fruit bat colonies in southern Pagan. Previous studies of Mariana fruit bat reactions to aircraft overflights at Andersen Air Force Base on Guam have shown flushing and noticeable increases in maintenance, decreased ability to regulate their body temperature, and alertness behaviors 0-10 min after aircraft overflights. However, the animals in these studies were directly beneath or immediately adjacent to the runway departure corridors where noise levels are significantly higher (J.M. Morton 1996; Joint Region Marianas, Naval Facilities Engineering Command Marianas, and Andersen Air Force Base 2012). To minimize noise impacts to the fruit bat colonies on southern Pagan, flight restrictions would be established that would limit all aircraft to greater than 500 feet (152 meters) above ground level over the fruit bat colonies on southern Pagan, and a 0.5-mile (0.8-kilometer) lateral buffer zone will be established around the southern colonies.

Aircraft Strikes. Aircraft overflights of fruit bat colonies have the potential to result in aircraft strikes of fruit bats, particularly with a species such as the Mariana fruit bat that flies in large groups when moving between foraging or roosting sites. To avoid and minimize potential aircraft-fruit bat strikes, aircraft would be restricted to 500 feet (152 meters) above ground level over the fruit bat colonies in southern Pagan. Data on aircraft strikes of fruit bats in Australia have shown that the majority of strikes occurred at or below 1,000 feet (305 meters), with the largest proportion of those occurring below 492 feet (150 meters) around sunset (5-8 p.m.) (Parsons et al. 2008, 2009). In addition to avoiding and minimizing noise disturbance to fruit bat colonies, the 0.5-mile (0.8-kilometer) buffer zone around each colony would also significantly reduce the potential for aircraft strikes of fruit bats.

As a best management practice, a Bird/Animal Aircraft Strike Hazard Plan would be prepared to address all aircraft operations on Pagan. This plan will be prepared to minimize the occurrence of aircraft strikes, and it will provide detailed procedures for aviators to monitor and react to heightened risk of strikes. These procedures will also reduce the risk of aircraft strike hazard for fruit bats on Pagan.

Overall, impacts to the Mariana fruit bat population under Pagan Alternative 1 would be significant and unavoidable and unmitigable due to noise from large-caliber munitions.

Micronesian Megapode

Megapodes have been observed only within the southern portion of Pagan within *Casuarina*, coconut, and mixed native-introduced forests. These areas are located within the Non-Live-Fire Maneuver Area. No vegetation would be removed during proposed operations, and only foot traffic (no vehicle use) would occur in southern Pagan. Noise from large-caliber weapons and aircraft overflights may cause impacts to megapodes. However, the megapode population on Farallon de Medinilla, a DoN live-fire range to the north of Tinian, is subject to large-caliber live-fire munitions training and aircraft overflights. Megapodes persist on Farallon de Medinilla and do not appear to be affected by the noise levels associated with live-fire training and aircraft overflights on that range. In addition, proposed overflight altitude restrictions of a minimum of 500 feet (152 meters) over southern Pagan would minimize aircraft noise impacts to megapodes. Megapodes may be exposed to physical disturbance by troops conducting on-foot maneuvers that may result in flushing of birds. However, this level of disturbance is anticipated to have less than significant impacts on the megapode population on Pagan. Potential impacts to individual megapodes under the preferred alternative will be addressed during Endangered Species Act section 7 consultation with the U.S. Fish and Wildlife Service.

Sea Turtles

No sea turtles have been observed nesting on the beaches of Pagan. In addition, sitings of sea turtles on the beaches of Pagan are rare, with one green sea turtle observed basking on Red Beach (Kessler 2011), one of the proposed amphibious landing sites. In addition, seven beaches on Pagan were surveyed in July of 2013. No active or past nesting activity was observed on any of these beaches (DoN 2014c). Although no turtles have been observed nesting on Pagan, the potential exists. Therefore, training restrictions would be implemented to avoid and minimize effects to sea turtles.

With implementation of resource management measures, military training activities associated with Pagan Alternative 1 would result in less than significant direct and indirect impacts to green or hawksbill turtles. Potential impacts to sea turtles in the marine environment of Pagan are discussed in Section 4.10, *Marine Biology*.

Humped Tree Snail

The humped tree snail is known to occur only in native forest and mixed coconut native forest inside or along the rim of the caldera on southern Pagan. Native forest on Pagan would be designated "No Wildlife Disturbance Areas," with the following actions prohibited: vehicle maneuvers, mechanical vegetation clearing, digging or excavation without prior approval; open fires; and flights below 500 feet (152 meters) above ground level. Any maneuvers conducted in native forest will be on foot. Therefore, military training activities under Pagan Alternative 1 would result in less than significant direct and indirect impacts to the humped tree snail population on Pagan.

Slevin's Skink

Slevin's skink may still be present on Pagan, but if so, it occurs in small numbers (Reed et al. 2010). Stressors including noise and physical disturbance may occur in potential Slevin's skink habitat on Pagan with implementation of Pagan Alternative 1. However, given the rarity of occurrence of Slevin's skinks on Pagan, exposure to these stressors would be discountable or insignificant (effects are unlikely to occur or would not be meaningfully measured or detected). Therefore, military training activities under Pagan Alternative 1 would result in less than significant direct and indirect impacts to the Slevin's skink population on Pagan.

Cycas micronesica

Cycas micronesica was recently reported on Pagan in ravines of the southern part of the island (Pratt 2010). Foot maneuvers and associated physical disturbance on southern Pagan may occur with implementation of Pagan Alternative 1. However, with implementation of the proposed conservation measures, including invasive species interdiction, invasive species monitoring and control, fire prevention and management, training restrictions associated with native forest "No Wildlife Disturbance Areas," and ungulate removal or control on southern Pagan, it is expected that military training activities associated with Pagan Alternative 1 would result in less than significant direct and indirect impacts to *C. micronesia*.

Bulbophyllum guamense

Historically *B. guamense* occurred on Pagan, but has not been observed since 1984 (U.S. Fish and Wildlife Service 2014). Therefore, military training activities associated with Pagan Alternative 1 would result in no direct or indirect impacts to *B. guamense*.

4.9.4.1.2.4 Special-status Species: Migratory Bird Treaty Act-listed Species

Direct and indirect impacts to Migratory Bird Treaty Act-listed species from operations under Pagan Alternative 1 would be similar to those discussed under the *Native Wildlife* section and are therefore expected to be less than significant.

4.9.4.1.2.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the federally listed Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are also listed as threatened/endangered by the CNMI. Impacts to these species are discussed previously under the *Special-status Species: Endangered Species Act-listed and Proposed Species* section.

4.9.4.2 Pagan Alternative 2

4.9.4.2.1 Construction Impacts

4.9.4.2.1.1 Vegetation Communities

Impacts to vegetation from proposed construction activities would be similar to those described for Pagan Alternative 1; however, under Pagan Alternative 2 there would be no isthmus High Hazard Impact Area (Figure 4.9-10). Approximately 13 acres (5 hectares) of native forest would be removed, primarily in the northern High Hazard Impact Area (see Table 4.9-12). Given the importance of native forest habitat for native species, the conversion of approximately 13 acres (5 hectares) of native forest on Pagan to developed area from the implementation of Pagan Alternative 2 would result in significant direct impacts to the island vegetation community and its function.

Proposed potential mitigation measures would be the same as those previously proposed for Pagan Alternative 1 (see Section 4.9.4.1). To mitigate for significant impacts to native forest, the Department of Defense may facilitate native forest regeneration on southern Pagan by implementing feral goat and pig removal. This would consist of active control (i.e. trapping, snaring, shooting) of animals, with the goal of eradicating all feral ungulates from southern Pagan. The Department of Defense may also implement monitoring and control of non-native invasive species within forest habitat on Pagan, including control of invasive plant, mammal, and insect species. With implementation of this potential mitigation, direct impacts to native forest under Pagan Alternative 2 would be less than significant. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

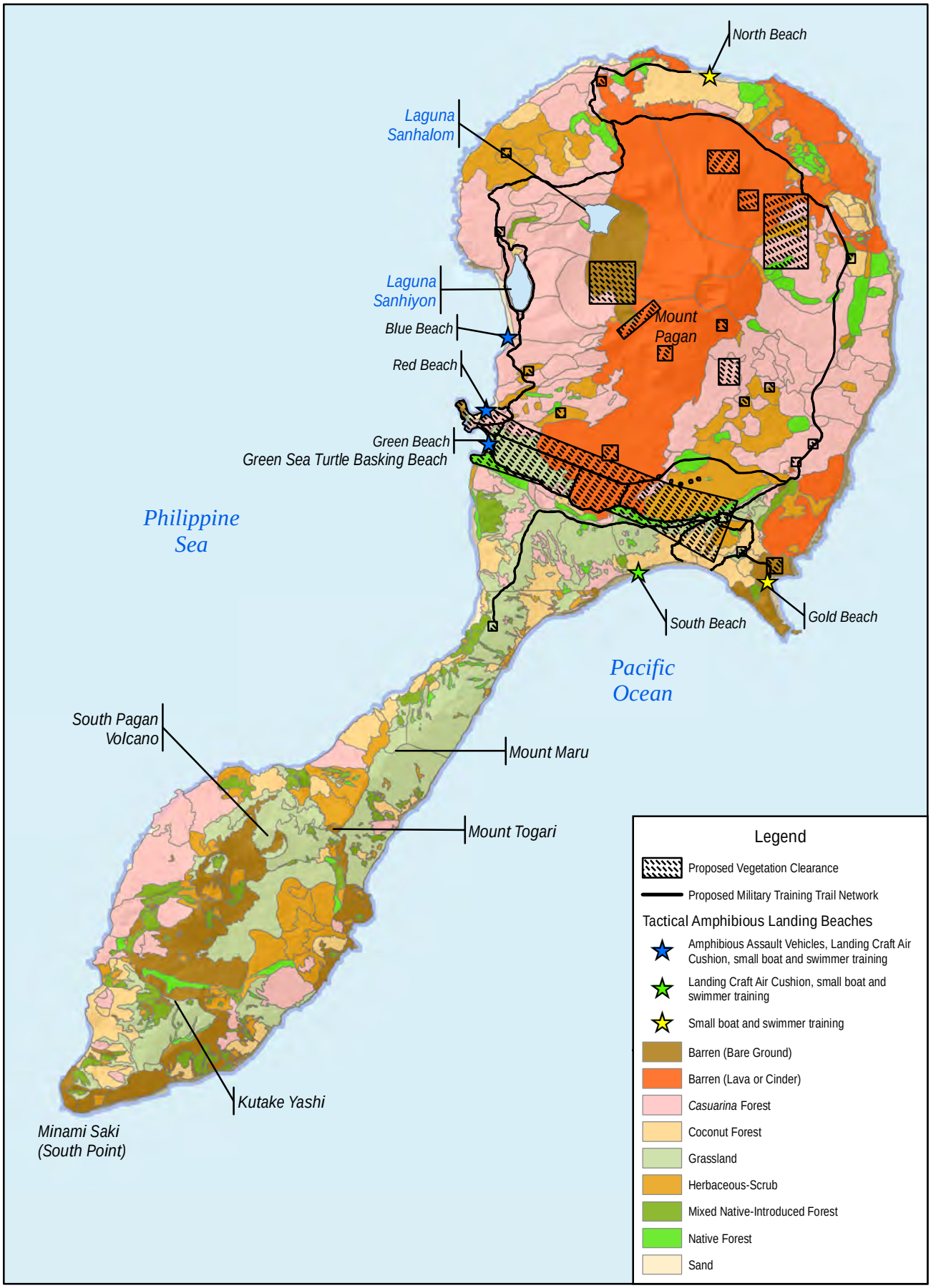

Figure 4.9-10
Pagan Alternative 2, Vegetation Communities

Source: Rogers 2010.

4.9.4.2.1.2 Native Wildlife

Direct and indirect impacts to wildlife from proposed construction activities would be the similar to that described for Pagan Alternative 1. Approximately 212 acres (86 hectares) of forested habitat would be removed during construction (Table 4.9-14). Therefore, implementation of Pagan Alternative 2 and the removal of approximately 212 acres (86 hectares) of forested wildlife habitat would result in significant impacts to native wildlife populations.

Table 4.9-14. Potential Direct Impacts to Vegetation Communities with Implementation of Pagan Alternative 2

Project Area	*Vegetation Community (acres)*								
	NF	***MNIF***	***HS***	***Cas***	***Coco***	***Grass***	***Sand***	***Bar***	***Total***
Northern High Hazard Impact Area	7.1	0	22.2	104.1	0	0	0	186.3	319.7
Field Artillery Direct Fire Range	0	0	0	0	0	0	0	9.9	9.9
Field Artillery Indirect Fire Range	0	0	2.1	0.1	0	7.7	0	9.9	19.8
Airfield Clear Zone	0	22.9	51.1	27.5	0.5	106	0.0	181.7	389.7
Munitions Storage Area	0.8	0	3.5	1.0	0	0.9	0.2	3.5	9.9
Landing Zones	<0.1	1.9	9.4	10.5	2.9	8.3	0.0	3.3	36.3
Road Development	4.7	0.6	5.9	23.4	4.2	15.7	0.4	14.8	69.7
Total Impacted under Alternative 2	**12.6**	**25.4**	**94.2**	**166.6**	**7.6**	**138.6**	**0.6**	**409.4**	**855.0**
Total on Pagan	*418*	*398*	*1,362*	*3,197*	*858*	*1,706*	*28*	*2,531*	*11,502*
% Impacted under Alternative 2 on Pagan	*2.8*	*6.4*	*6.6*	*5.2*	*0.9*	*8.1*	*1.4*	*16.0*	*7.4*

Notes: Impact areas are based on areas depicted and labeled in Chapter 2, Figure 2.6-4. Numbers may not add precisely due to rounding.

Legend: Bar = barren: lava, cinder, or bare ground; Cas = *Casuarina* forest; Coco = coconut forest; Grass = grassland; HS = herbaceous scrub; MNIF = mixed native-introduced forest; NF = native forest; Sand = sand; < = less than.

4.9.4.2.1.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Based on historical data and surveys conducted in support of this EIS/OEIS, Figure 4.9-11 provides the general locations of special-status species in relation to Pagan Alternative 2. Direct impacts to special-status species from proposed construction activities include the removal of habitat, fragmentation of remaining habitat, and associated noise and human activities.

Direct and indirect impacts to Endangered Species Act-listed species from proposed construction activities associated with Pagan Alternative 2 would similar to those described for Pagan Alternative 1. However, the amount of potential foraging habitat removed for the Mariana fruit bat would be less under Pagan Alternative 2. With the exception of the Mariana fruit bat, none of the areas proposed for construction would occur within the vicinity of Endangered Species Act-listed or proposed species habitat on Pagan. Therefore, no impacts to these species would result from construction. Potential foraging habitat for the Mariana fruit bat (1% of native forests and 2% of *Casuarina* forest) would be removed in the northern portion of Pagan; however, no fruit bat habitat in the southern portion of the island would be removed.

Therefore, direct and indirect impacts to the Mariana fruit bat population from construction activities associated with Pagan Alternative 2 would be less than significant.

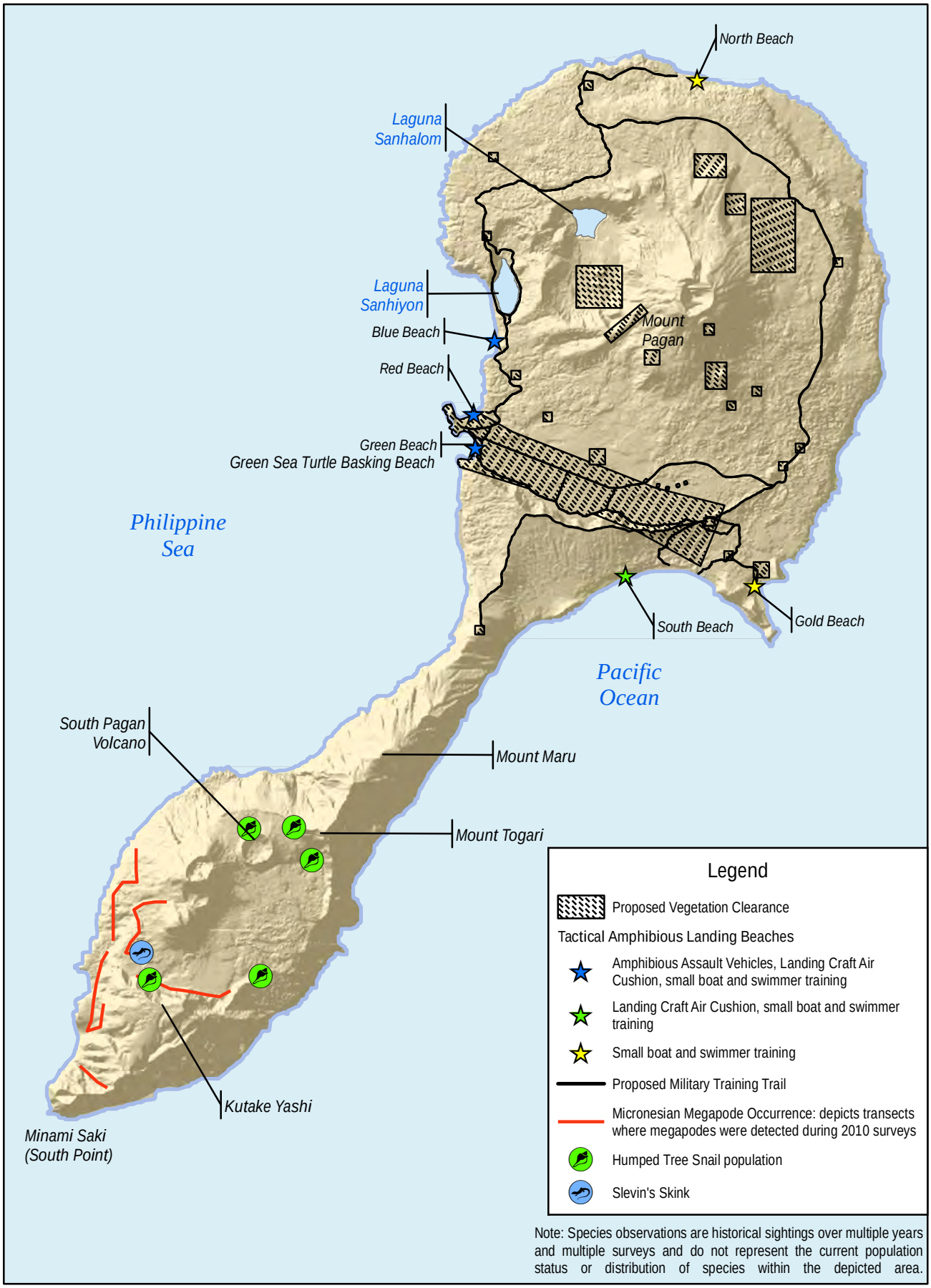

Figure 4.9-11
Pagan Alternative 2, Occurrence of Special-status Species

Sources: Reed et al. 2010; Amidon et al. 2011

4.9.4.2.1.4 Special-status Species: Migratory Bird Treaty Act-listed Species

Direct and indirect impacts to species listed under the Migratory Bird Treaty Act from proposed construction activities would be similar to those described for Pagan Alternative 1 and would be less than significant. However, the amount of habitat removed would be less under Pagan Alternative 2. As discussed above in vegetation, approximately 212 acres (86 hectares) of forested habitat for native species would be removed (see Table 4.9-14).

4.9.4.2.1.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the federally listed Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are also listed as threatened/endangered by the CNMI. Impacts to these species are discussed previously under the *Special-status Species: Endangered Species Act-listed Species* section. No other CNMI-listed species occur on Pagan.

4.9.4.2.2 Operation Impacts

4.9.4.2.2.1 Vegetation Communities

Impacts to vegetation from proposed operations would the similar to Pagan Alternative 1 (see Section 4.9.4.1); however, there would be no isthmus High Hazard Impact Area and the northern High Hazard Impact Area would be smaller, decreasing the potential for impacts to vegetation from ordnance. Therefore, implementation of the training activities associated with Pagan Alternative 2 would result in less than significant direct and indirect impacts to vegetation communities.

4.9.4.2.2.2 Native Wildlife

Impacts to native wildlife from training operations associated Pagan Alternative 2 would be the similar as those previously discussed for Pagan Alternative 1 (see Section 4.9.4.1). Therefore, implementation of Pagan Alternative 2 would result in less than significant impacts to native wildlife.

4.9.4.2.2.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Impacts to Endangered Species Act-listed and proposed species from implementation of Pagan Alternative 2 would be the same as those previously discussed for Pagan Alternative 1, with the exception of the Mariana Fruit Bat which is discussed below. Therefore, there would be less than significant direct and indirect impacts to populations of the Micronesian megapode, nesting sea turtles, humped tree snail, Slevin's Skink, *Cycas micronesica,* and *Bulbophyllum guamense* from implementation of Pagan Alternative 2. Assessment of impacts to individuals of these species will be conducted during Endangered Species Act section 7 consultation with the U.S. Fish and Wildlife Service.

Mariana Fruit Bat

Potential impacts from small-caliber munitions and aircraft noise associated with Pagan Alternative 2 would be less than significant and would be similar to those previously discussed for Pagan Alternative 1 (see Section 4.9.4.1). Proposed large-caliber weapons firing would result in significant direct impacts to Mariana fruit bats at the Southern 2 and Northern colonies; noise impacts to the Southern 1 colony from proposed large-caliber weapons firing are not anticipated based on modeled sound levels. However, impacts from noise levels associated with large-caliber weapons training would be lower with Pagan Alternative 2.

Munitions Noise: A summary of the expected noise levels at the three fruit bat colonies on Pagan due to live-fire weapons operations is presented in Table 4.9-15. Under Pagan Alternative 2, impacts to fruit bats from small-caliber noise would be the same as those under Alternative 1 (Tables 4.9-13 and 4.9-15, and Figure 4.5-8). Received noise levels from large-caliber weapons under both Pagan alternatives would be the same for the northern fruit bat colony and Southern 1 fruit bat colony. However, under Pagan Alternative 2, there would be no High Hazard Impact Area on the isthmus. This would result in the Southern 2 fruit bat colony experiencing received sound levels of 58 decibels C-weighted day-night average sound level compared to 62 decibels C-weighted day-night average sound level under Alternative 1. Large-caliber Peak noise under neutral conditions at the Southern 2 colony would be 112 decibels under Alternative 2, compared to 125 decibels under Alternative 1. Large-caliber Peak noise under unfavorable conditions at the Southern 2 colony would be 124 decibels under Alternative 2, compared to 136 decibels under Alternative 1 (Tables 4.9-13 and 4.9-15).

Table 4.9-15. Modeled Weapons and Aircraft Noise Levels at Mariana Fruit Bat Colonies on Pagan under Alternative 2

	Small-caliber Weapons		***Large-caliber Weapons***			***Aircraft Operations***	
Location	***DNL (dBA)***	***Peak (dB)***	***DNL (dBC)***	***Peak-n* (dB)***	***Peak-u* (dB)***	***DNL (dBA)***	***SEL (dBA)***
Southern 1	<50	<87	55	<110	120	45.7	86.2
Southern 2	<50	<87	58	112	124	48.7	80.7
Northern	64	104	74	147	>150	64.2	78.6

Legend: dB = decibels; dBA = A-weighted decibels; dBC = C-weighted decibels; DNL = day-night average sound level; Peak-n = Peak noise level under neutral weather conditions; Peak-u = Peak noise level under unfavorable weather conditions; < = less than; > = greater than.

Sources: Army Public Health Command 2014; DoN 2014b.

To mitigate for impacts to Mariana fruit bat habitat quality on northern Pagan due to noise from operations, the Department of Defense may facilitate forest regeneration on southern Pagan by implementing feral goat and pig removal. This would consist of active control (i.e. trapping, snaring, shooting) of animals, with the goal of eradicating all feral ungulates from southern Pagan. The Department of Defense may also implement monitoring and control of non-native invasive species within forest habitat on Pagan, including control of invasive plant, mammal, and insect species. These potential mitigations would improve roosting and foraging habitat on southern Pagan for the Mariana fruit bat population. Impacts to individual fruit bats from proposed operations associated with Pagan Alternative 2 will be addressed during Endangered Species Act consultation with the U.S. Fish and Wildlife Service.

4.9.4.2.2.4 Special-status Species: Migratory Bird Treaty Act-listed Species

Impacts to Migratory Bird Treaty Act-listed species from training operations associated with Pagan Alternative 2 would be the similar to those previously discussed for Pagan Alternative 1 (see Section 4.9.4.1). Therefore, implementation of Pagan Alternative 2 would result in less than significant direct impacts to Migratory Bird Treaty Act-listed species. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.4.2.2.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the federally listed Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are also listed as threatened/endangered by the CNMI. Impacts to these species are discussed previously in the *Special-status Species: Endangered Species Act-listed and Proposed Species* section. No other CNMI-listed species occur on Pagan.

4.9.4.3 Pagan No-Action Alternative

Under the no-action alternative, there would be infrequent and minor disturbance type activities on Pagan. Periodic visits for eco-tourism, scientific surveys and military training for search and rescue would be low impact and of short duration. Therefore, there would be no significant impacts associated with the no-action alternative on Pagan.

4.9.4.4 Summary of Impacts for Pagan Alternatives

Table 4.9-16 provides a comparison of the potential impacts to terrestrial biology resources for the two Pagan alternatives and the no-action alternative.

Table 4.9-16. Summary of Impacts for Pagan Alternatives

	Pagan (Alternative 1)		***Pagan (Alternative 2)***		***No Action Alternative***	
Terrestrial Biology	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Vegetation Communities	*SI*	*LSI*	*SI*	*LSI*	*NI*	*NI*
Native Wildlife	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*
Special-status Species: Endangered Species Act-listed and Proposed Species and CNMI-listed Species	*LSI*	*SI (Mariana fruit bat)* *LSI (Micronesian megapode, sea turtles, humped tree snail, Slevin's skink)* *NI (Cycas micronesica, Bulbophyllum guamenese)*	*LSI*	*SI (Mariana fruit bat)* *LSI (Micronesian megapode, sea turtles, humped tree snail, Slevin's skink)* *NI (Cycas micronesica, Bulbophyllum guamenese)*	*NI*	*NI*
Special-status Species: Migratory Bird Treaty Act-listed Species	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*

Legend: *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.9.4.5 Summary of Potential Mitigation Measures for Pagan Alternatives

Table 4.9-17 provides a summary of the potential mitigation measures for terrestrial biology resources for the two Pagan alternatives.

Table 4.9-17. Summary of Potential Mitigation Measures for Pagan Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*Phase*	
			Construction	*Operation*
Pagan Vegetation Communities Loss of 20 acres (8 hectares) of native forest habitat would result in an unavoidable impact.	*SI*	To minimize the effects of construction on native vegetation communities on Pagan, Department of Defense may facilitate native habitat regeneration on Pagan by implementing feral ungulate removal. This would consist of active control (i.e. trapping, snaring, shooting) of animals, with the goal of eradicating all feral ungulates from southern Pagan.	X	
Pagan Special-status Species, Endangered Species Act-listed and Proposed Species and CNMI-listed Species Large-caliber weapons firing would result in direct impacts to Mariana fruit bats associated with the northeastern colony and on the isthmus colony. Impacts would be unavoidable.	*SI*	• To minimize the effects of operations on Mariana fruit bats on Pagan, Department of Defense would facilitate native habitat regeneration on southern Pagan by implementing feral goat and pig removal. This would consist of active control (i.e. trapping, snaring, shooting) of animals, with the goal of eradicating all feral ungulates from southern Pagan. • To improve habitat quality for Mariana fruit bats on Pagan, Department of Defense may implement monitoring and control of non-native invasive species within forest habitat, including control of invasive plant, mammal, and insect species. • To avoid and minimize impacts to the Mariana fruit bat, Micronesian megapode, and tree snails, the Department of Defense will implement training restrictions within native forest on southern Pagan. All native forest habitat on southern Pagan will be designated as “No Wildlife Disturbance Areas,” with the following actions prohibited: vehicle maneuvers; firing of live or inert		X

Table 4.9-17. Summary of Potential Mitigation Measures for Pagan Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*Phase*	
			Construction	*Operation*
		munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; flights below 500 feet (152 meters) above ground level, with the exception of personnel insertion/extraction via helicopter; and aircraft landings. Any maneuvers conducted in native forest will be on foot. In addition to restricting aircraft flights to a minimum of 500 feet (152 meters) above ground level in southern Pagan, a 0.5-mile (0.8-kilometer) lateral buffer zone will be established for the two fruit bat colonies in southern Pagan. In addition to avoiding and minimizing noise disturbance to fruit bat colonies, the proposed 0.5-mile (0.8-kilometer) buffer zone around each colony will significantly reduce the potential for aircraft strikes of fruit bats. Native forest "No Wildlife Disturbance Area" restrictions will be implemented upon initiation of CJMT training activities on southern Pagan.		

Legend: SI = significant impact. Shading is used to highlight the significant impacts.
Note: Mitigation measures associated with terrestrial biology do not alter the significance of the impacts.