

*DRAFT*

**JOINT REGION MARIANAS  
NAVAL BASE GUAM  
UNGULATE MANAGEMENT PLAN**



**SEPTEMBER 2012**



## ACKNOWLEDGMENTS

This plan is a revision and expansion of the Naval Base Guam Ungulate Management: Purpose, Policy, and Strategy, authored by SWCA Environmental Consultants and Globteck Group Guam in 2011 (Navy 2011). Several of the recommendations of the 2011 plan have been revised to reflect the current ungulate control needs and recommendations stated in Biological Opinions (BOs) from the U.S. Fish and Wildlife Service (USFWS) on Navy lands.

## ACRONYMS AND ABBREVIATION

AAFB	Andersen Air Force Base
APHIS	Animal and Plant Health Inspection Service
BO	Biological Opinion
CNMI	Commonwealth of the Northern Mariana Islands
CWCS	Comprehensive Wildlife Conservation Strategy
DOD	Department of Defense
ERA	Ecological Reserve Area
ESA	Endangered Species Act
EIS	Environmental Impact Statement
EO	Executive Summary
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FY	Fiscal Year
GDAWR	Guam Division of Aquatic and Wildlife Resources
GNWR	Guam National Wildlife Refuge
GovGuam	Government of Guam
INRMP	Integrated Natural Resources Management Plan
JRM	Joint Region Marianas
km	kilometers
km <sup>2</sup>	square kilometers
MBTA	Migratory Bird Treaty Act
MGD	Million Gallons Per Day
mi <sup>2</sup>	Square Miles

mph	Miles Per Hour
MSA	Munitions Storage Area
NBG	Naval Base Guam
NBG MB	Naval Base Guam Main Base
NBG TS	Naval Base Guam Telecommunications Site
NHPA	National Historic Preservation Act
NWI	National Wetlands Inventory
NMS	Naval Munitions Site
NWF	Northwest Field
OPERA	Orote Peninsula Ecological Reserve Area
OPNAVINST	Office of the Chief of Naval Operations Instruction
PZP	Porcine Zona Pellucida
RHS	Red Horse Squadron
SOGCN	Species of Greatest Conservation Need
UMA	Ungulate Management Area
U.S.C.	Unites States Code
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
USDA	U.S. Department of Agriculture
UXO	Unexploded Ordinance
VCO	Volunteer Conservation Officer

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*Prepared for*

**Joint Region Marianas  
PSC 455, Box 195  
Navy Base Guam  
FPO AP 96540- 2937**

**SEPTEMBER 2012**



## EXECUTIVE SUMMARY

1  
2 Naval Base Guam (NBG) lands contain some of the highest quality native forest and largest areas of  
3 natural habitats remaining on Guam. The majority of this natural habitat is included in the Guam  
4 National Wildlife Refuge (GNWR), which was established in 1993 to (1) protect and recover endangered  
5 and threatened species, (2) protect habitat, (3) control nonnative species with emphasis on the brown  
6 treesnake (*Boiga irregularis*), (4) protect cultural resources, and (5) provide recreational and educational  
7 opportunities to the public where possible. NBG lands provide habitat for endangered Guam rail  
8 (*Gallirallus owstoni*), Micronesian kingfisher (*Todiramphus cinnamominus*) and endangered Mariana  
9 crow (*Corvus kubaryi*) that have been extirpated from Guam; and the endangered Mariana swiftlet  
10 (*Aerodramus bartschi*), threatened Mariana fruit bat (*Pteropus mariannus mariannus*), and candidate  
11 treesnail and butterfly species.

12 The areas of NBG properties that are included in the GNWR are referred to as the Overlay Refuge units.  
13 NBG has primary jurisdiction over lands in the Overlay Refuge units and manages them in partnership  
14 with the U.S. Fish and Wildlife Service (USFWS), in accordance with the Joint Region Marianas (JRM)  
15 Integrated Natural Resources Management Plan (Navy 2012).

16 Three nonnative invasive ungulates (or hoofed animals), feral pig (*Sus scrofa*), Philippine deer (*Cervus*  
17 *mariannus*), and feral water buffalo or carabao (*Bubalus bubalis*) have significantly impacted natural  
18 ecosystems on NBG lands, including those in the Overlay Refuge. These invasive ungulates destroy  
19 vegetation and expose soil through browsing, trampling, wallowing, and rooting. Loss of vegetative  
20 cover increases rates of erosion and associated stream and reef siltation. These activities also promote  
21 loss of native plant and animal species, dispersal and establishment of invasive plants and overall  
22 degradation of native species' habitat. Pigs and carabao disturb soil around munitions magazines  
23 resulting in compromised integrity of the structures and costly repairs.

24 NBG land is prone to moderate to severe ungulate damage to installation ecosystems, facilities, and  
25 infrastructure. These areas attract illegal hunters (poachers) creating additional security and safety issues.  
26 Poachers frequently set wildfires to reduce cover and attract deer to young grass which sprouts after a  
27 burn. These fires are regularly uncontained and result in destruction of wildlife habitat, increased rates of  
28 erosion, larger sediment loads into water sources and threats to infrastructure. Siltation of Fena Reservoir  
29 is a major problem because it causes loss of water storage capacity and increases the cost of water  
30 treatment.

31 Without effective management to reverse the destruction caused by feral pig, deer, and carabao, some of  
32 Guam's last remaining natural biological resources will continue to decline and NBG facilities will incur  
33 progressively higher maintenance costs. Management of these nonnative invasive ungulates on NBG is  
34 also a requirement the of 2010 USFWS Biological Opinion for the Joint Guam Program Office  
35 Relocation of the U.S. Marine Corps from Okinawa to Guam and Associated Activities on Guam and  
36 Tinian (USFWS 2010).

37 The NBG Ungulate Management Plan describes the impact of these animals on NBG and reviews the  
38 biology of the species. The UMP evaluates possible management and control strategies and recommends  
39 a course of action. Where reference is made to decision making by NBG or installation commanders  
40 regarding the specifics of plan execution, the decisions will be informed by the installation Natural  
41 Resources Specialists via the Installation Environmental Program Manager and the Public Works Officer.

42 The NBG Ungulate Management Plan is a practical long-term, sustained reduction program for ungulates  
43 with a focus on the NBG Naval Munitions Site (NBG NMS), NBG Computer and Telecommunications  
44 Annex (NBG TS), and NBG Main Base (NBG MB) properties, which have the largest areas of natural

1 habitat impacted by feral ungulates. The plan’s objectives are to achieve sustained reduction of ungulate  
2 densities in unfenced areas through effective control methods. These objectives will be achieved by  
3 implementing and monitoring results of recommended ungulate-control methods in perpetuity or until  
4 control activities are no longer needed.

5 Ungulate control on Navy lands will be conducted by one or more contracted professional ungulate  
6 control companies. The contracted ungulate control company will have a proven track record of managing  
7 ungulate numbers to the desired levels in previous projects undertaken.

8  
9 The ungulate control company will use standard methods for removing ungulates including live trapping,  
10 snaring, baiting, and ground shooting. When compared to other techniques, these methods have a higher  
11 probability of achieving the stated goals and objectives in a shorter time period. In addition, assessment  
12 of the viability of conducting a carabao calf giveaway will be conducted, and if determined feasible, the  
13 program will be implemented as part of ungulate management on NBG.

14  
15 Eradication of ungulates is not possible since none of the management units are totally enclosed by  
16 fencing. The effectiveness of control methods will be assessed and adaptively managed to maintain low  
17 numbers. The ultimate goal is forest regeneration and self sustained populations of native animals.  
18 Regular monitoring of ungulate density and the recovery of vegetation in the absence of ungulate  
19 browsing will be used to evaluate the need for increased or decreased management actions. When  
20 feasible, temporary fencing will be used to cordon off small sub-units to contain animals, reduce labor  
21 and increase control effectiveness.

22  
23 Carcass disposal or distribution will be determined by the installation commander. Deer and carabao  
24 carcasses could be donated to charity or to the Government of Guam (GovGuam) for distribution to  
25 village mayors providing that possible health risks and liability issues are addressed. Carcasses in remote  
26 locations would be left to recycle nutrients into the ecosystem. Currently it is not possible to donate pig  
27 meat due to disease risk (see **Appendix A**).

28 Annual costs for implementation of the NBG Ungulate Management Plan would range from \$290,000 to  
29 \$530,000. Costs for a 10-year period would range from \$2,950,000 to \$5,350,000 (see **Section 6.9** for  
30 details on cost estimations)<sup>1</sup>. **Table 6-3** presents a breakdown of costs for the first year, the second  
31 through tenth years, and the entire ten years period. Length of time for the initial reduction of ungulate  
32 numbers will depend on the intensity and effectiveness of the control actions. Long-term monitoring and  
33 periodic control will be needed to maintain low ungulate numbers after the initial reduction in numbers is  
34 completed.

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<sup>1</sup> Costs are based on 2011 economy, and could be higher in the future due to inflation.

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# 1. INTRODUCTION

1  
2 The physical isolation of islands and the dynamic nature of colonization on these islands often leads to a  
3 unique biota. These same characteristics also leave islands particularly vulnerable to the introduction of  
4 invasive species (Clements and Daehler 2007). Invasives are nonnative species that have an economic or  
5 environmentally adverse effect on the ecosystems they invade (Pattison et al. 1998). Their introduction to  
6 areas that are not adapted to their presence can disturb the balance of predators and prey because native  
7 species could lack suitable defense mechanisms (Dickman 1996, Fritts and Rodda 1998).

8 Impacts from invasive species on plant or animal groups that are not represented in the native island flora  
9 or fauna can be particularly severe. For example, many islands have no native herbivorous mammals, and  
10 the introduction of these species can be devastating to the native ecosystems. Introduced grazers such as  
11 ungulates (hoofed mammals) are known to facilitate the spread of alien plants and to open forest canopy  
12 by creating forest gaps and inhibiting recruitment of canopy species through browsing. Forest gaps and  
13 edges increase the penetration of sunlight, which ultimately increases light, heat, and wind and decreases  
14 moisture. Such conditions further enhance the likelihood that nonnative plants will become established.  
15 Many invasive plants are able to take advantage of the higher light levels and are able to withstand  
16 adverse conditions better than the native forest species, and soon take over the clearings. Introduced  
17 ungulates facilitate the spread of these plants into the native forest interior by creating open trails and  
18 spreading seeds through their feces (Morton and Amidon 1999). This spreads the edge effect into the  
19 forest interior and carves up large tracts of forest into many smaller pieces.

20 Guam, situated in the western Pacific Ocean, is a notable example of invasion potential and associated  
21 devastation to native communities with the introduction of a number of nonnative vertebrate species over  
22 the past century. At least 9 mammal, and 32 amphibian and reptile species, including the brown treesnake  
23 (*Boiga irregularis*), have been introduced to Guam since western settlement (Savidge 1987, Fritts and  
24 Rodda 1998, McCoid 1999, Christy et al. 2007). Most notably, the majority of native forest birds on  
25 Guam are now extinct or extirpated from the island because of their vulnerability to the introduced brown  
26 treesnake (Case and Bolger 1991, Dickman 1996, Fritts and Rodda 1998).

27 Three invasive ungulates, Philippine deer (*Cervus mariannus*), feral pig (*Sus scrofa*), and feral water  
28 buffalo or carabao (*Bubalus bubalis*), have significantly impacted Guam's natural ecosystems by causing  
29 extensive soil erosion, stream and reef siltation, loss of native plant and animal species, and degradation  
30 of native species' habitat. In addition to the damage caused to natural ecosystems, feral ungulates cause  
31 damage to infrastructure, such as buildings, fences, and reservoirs, through their day-to-day activities.  
32 Without effective management to reverse the destruction caused by feral pig, deer, and carabao, some of  
33 Guam's last remaining natural biological resources will be placed under increasing survival pressure and  
34 man-made facilities and infrastructure will incur progressively higher maintenance costs.

35 Areas of high ungulate densities on Guam are particularly attractive to illegal hunters (poachers), creating  
36 additional security and safety issues. Poachers intentionally set wildfires to attract animals to seedlings  
37 freshly sprouted after a burn. These fires are regularly uncontained and result in destruction of native  
38 vegetation, wildlife habitat, and infrastructure; increased erosion and sedimentation of water bodies;  
39 spread of nonnative flora; and modification of forest canopy cover. Loss of forest structure results in  
40 greater destruction from typhoons that occur regularly in the region. Water quality and availability are  
41 also impacted by the presence of feral ungulates on Guam. The original design capacity of Fena  
42 Reservoir, the Navy's principal source of potable water in southern Guam, has been significantly reduced  
43 by sediment loading as a direct result of erosion caused by unrestricted grazing by feral ungulates and  
44 fires set by poachers.

## 1.1 Purpose and Objectives

The purpose of the Naval Base Guam (NBG) Ungulate Management Plan is to define management actions for reduction in the number of ungulates on NBG lands. This management plan is the result of regulatory requirements from U.S. Fish and Wildlife Service (USFWS) for the installation-wide reduction in ungulates to a level that allows for forest regeneration and self-sustaining numbers of native animals on NBG lands. This plan is part of the 2012 Joint Region Marianas (JRM) Integrated Natural Resources Management Plan (INRMP).

The NBG Ungulate Management Plan will provide management prescriptions for the sustained reduction of pig, deer, and carabao on NBG. The Overlay Refuge lands on Navy properties are part of the Guam National Wildlife Refuge (GNWR), which was established in 1993 to (1) protect and recover endangered and threatened species, (2) protect habitat, (3) control nonnative species with emphasis on the brown treesnake, (4) protect cultural resources, and (5) provide recreational and educational opportunities to the public where possible. NBG has primary jurisdiction over lands in the Overlay Refuge units and manages them in partnership with the USFWS, in accordance with the JRM INRMP.

The NBG Ungulate Management Plan discusses effects of ungulates on native ecosystems in terms of habitat modification, degradation, fire, and erosion. The document summarizes the biology and status on Guam of Philippine deer, feral pig, and feral carabao, including discussion of ungulate density. Plausible management actions are discussed and strategies for ungulate control are compared and evaluated.

The NBG Ungulate Management Plan is a practical long-term, sustained reduction program for feral ungulates with a focus on the NBG Naval Munitions Site (NBG NMS), NBG Computer and Telecommunications Annex (NBG TS), and NBG Main Base (NBG MB) properties, which have the largest areas of natural habitat impacted by feral ungulates. The plan's objectives are to achieve sustained reduction of ungulate densities in unfenced areas of NBG, and achieve eradication of feral ungulates within fenced enclosures where they can be established.

These objectives will be met through effective control methods to protect native ecosystems and threatened and endangered species habitat, allow for recovery of damaged ecosystems, and adhere to legal requirements placed on the Department of Defense (DOD) regarding ungulate control. These objectives will be achieved by implementing and monitoring results of recommended ungulate control methods in perpetuity or until control activities are no longer needed. The goals of the plan are as follows:

1. Comply with legal requirements (see **Section 1.1.1**).
2. Maintain and improve biological resources, soil structure, infrastructure, and human health and safety concerns on NBG lands.
3. Improve water quality and decrease costs associated with siltation of the Fena Reservoir, watersheds, and marine environments.
4. Reduce or eliminate ongoing disturbances to NBG ecosystems caused by feral ungulates.
5. Prevent further listing of federally threatened or endangered species and contribute to recovery efforts through reduction in habitat disturbance/destruction caused by feral ungulates.
6. Prevent the designation of critical habitat on NBG lands.
7. Protect native plant and animal species by controlling ungulates.
8. Decrease the potential of wildfires either deliberately lit by illegal hunters or caused by modification to vegetation structure through selective ungulate browsing.

- 1 9. Lessen security risk on NBG properties by reducing illegal hunter trespass through reduction of  
2 ungulate densities.
- 3 10. Effectively implement ungulate management in a way that has a high probability of success.
- 4 11. Minimize long-term diversion of NBG personnel and resources from other resource management  
5 projects.
- 6 12. Provide stewardship for the lands under NBG care, as outlined in Office of the Chief of Naval  
7 Operations Instruction (OPNAVINST) 5090.1C, Environmental Readiness Manual.

8 NBG properties have a diversity of plant species that are particularly vulnerable to grazing, browsing,  
9 wallowing, and rooting by ungulates. Isolated islands typically do not have naturally occurring ungulates,  
10 and their plants often lack chemical or physical defenses (Bowen and Van Vuren 1997). The effects of  
11 introduced ungulates on island ecosystems are wide-ranging and potentially devastating; deforestation,  
12 erosion, reef sedimentation, and decline or extinction of unique species have all been linked to ungulate  
13 damage. Collectively, deer, pig, and carabao pose a substantial threat to the native natural resources,  
14 long-term resource and infrastructure management programs, cultural resources, and human safety on  
15 DOD lands. Ungulates on NBG NMS negatively affect the quality of water entering Fena Reservoir,  
16 increase the cost of treating the water, and reduce the volume of the reservoir. Feral ungulates spread  
17 diseases such as Leptospirosis into water bodies on Guam, where they can then be picked up by humans.  
18 Pig rooting increases maintenance costs of munitions storage magazines. Fences and other structures are  
19 damaged by feral pigs and carabao through rooting, trampling, and rubbing on fences and posts. In  
20 addition, ungulate management is required to ensure continued, safe access to NBG properties for military  
21 training and operations.

22 Ungulate control is a sensitive issue on Guam and community relation concerns are important. During  
23 the preparation of the NBG Ungulate Management Plan, the role of special interest groups in ungulate  
24 control was considered and is addressed in the document. However, management actions needed to aid  
25 NBG in meeting the goals and objectives of the plan are the primary focus of this plan. The Joint Guam  
26 Program Office (JGPO) Biological Opinion (BO) by the USFWS states that “Eradication (of ungulates) is  
27 the goal; however, if eradication is not feasible, ungulate control will be implemented with the goal of  
28 sustained suppression to levels that allow for forest regeneration and self-sustaining numbers of native  
29 animals.”

### 30 1.1.1 Legal Background and Requirements

31 The following subsections provide brief summaries of legal requirements regarding invasive ungulate  
32 control on DOD lands, and, in some cases excerpts of text (indicated by italics) from the named  
33 documents, highlighting the intent of the listed document.

#### 34 Endangered Species Act

35 The Endangered Species Act (ESA) requires actions that are authorized, funded, or carried out by Federal  
36 agencies, including DOD, are not likely to jeopardize the continued existence of any endangered species  
37 or threatened species or result in the destruction or adverse modification of critical habitat. Under Section  
38 7(a)(2) of the ESA (16 United States Code [U.S.C.] section 1536), DOD is required to consult with the  
39 USFWS on any action, including taking no action, that could affect listed species or critical habitat.

40 Migratory Bird Treaty Act 16 U.S.C. 703; Memorandum of Understanding (MOU) between the  
41 Department of Defense and the U.S. Fish and Wildlife Service to Promote the Conservation of

1 **Migratory Birds, 31 July 2006; and Executive Order (EO) 13186, responsibilities of Federal Agencies**  
2 **to Protect Migratory Birds.**

3 Compliance with all three of these Federal mandates will take place when the NBG Ungulate  
4 Management Plan is implemented. In accordance with the MOU, which supports meeting the EO 13186  
5 objectives, migratory bird conservation measures will be addressed in the JRM INRMP and potential  
6 incidental takes would be addressed for proposed actions that might affect migratory birds.

7 **Sikes Act 16 U.S.C. 670a, as amended in the Fiscal Year (FY) 2004 Defense Authorization Act**

8 The Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of  
9 natural resources on military installations.

10 The Sikes Act directs the Secretary of each DOD service to prepare and implement an INRMP for  
11 military installations that will provide for the conservation and rehabilitation of natural resources. This  
12 Ungulate Management Plan is part of the JRM INRMP (JRM 2012).

13 **EO 13112 – Invasive Species**

14 EO 13112 was issued to prevent the introduction of invasive species; provide for their control; and  
15 minimize the economic, ecological, and human health impacts that invasive species cause. This EO  
16 defines invasive species, requires Federal agencies to address invasive species concerns and not to  
17 authorize or carry out new actions that would cause or promote the introduction of invasive species, and  
18 established the Invasive Species Council. The goals of DOD’s Invasive Species Management Program  
19 are prevention, control of invasive species on military installations, and restoration using native plants  
20 (NISC Web site).

21 **Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) 7 U.S.C. 136**

22 Implementation of the NBG Ungulate Management Plan could require sedating carabao to relocate them  
23 or to fit radio-tracking devices on to animals. Authorized DOD personnel or contractors in accordance  
24 with FIFRA and DOD regulations would use immobilization drugs and drug delivery equipment. Most  
25 likely the drugs would be supplied through the Navy’s Bollard Veterinary clinic and the Guam Territorial  
26 Veterinarian would be present when animals are sedated.

27 **Animal Damage Control Act, 7 U.S.C. 426**

28 The Secretary of Agriculture was given broad authority to investigate and remove predatory, wild,  
29 injurious, or nuisance animals for protection of birds and other wildlife.

30 **Clean Water Act, 33 U.S.C. 1251, Section 404**

31 In the event that ungulate management activities affect wetlands found on DOD lands on Guam, the  
32 U.S. Army Corps of Engineers would be contacted and applicable permits would be obtained to ensure  
33 protection of wetlands.

34 **Coastal Zone Management Act, 16 U.S.C. 1451**

35 Supports the removal of nonnative pest species that damage the coastal zone and wildlife that lives in the  
36 zone. The Act was established to “preserve, protect, develop and where possible restore or enhance the  
37 resources of the nation’s coastal zones.”

1 National Historic Preservation Act, 16 U.S.C. 470 et seq., Archeological Resources Protection Act,  
2 16 U.S.C. 470aa-11

3 Addresses protection of cultural and historic resources from disturbance and damage.

4 OPNAVINST 5090 1C

5 *Navy Environmental and Natural Resources Program Manual.* Natural Resources Management  
6 (Chapter 24) calls for meeting dual roles of stewardship and readiness essential in the long-term  
7 maintenance of both military and natural resources sustainability.

8 In addition to these overarching regulations, DOD is required to conduct ungulate control in the Overlay  
9 Refuge lands on NBG as part of conservation measures for the Guam and CNMI Military Relocation EIS  
10 BO (2010). Excerpted text from the document is presented in the following paragraphs.

11 ***Guam and CNMI Military Relocation Biological Opinion, July 2010***

12 *The Department of Navy (DoN's) preparation and implementation of a Navy Joint Region Marianas*  
13 *Ungulate Management Plan addressing the control and potential eradication of ungulates on DOD lands*  
14 *managed by Naval Facilities Engineering Command Marianas on Guam will minimize future*  
15 *degradation of forest habitat resulting from ungulates. The proposed action includes the development of*  
16 *an ungulate management plan as well as implementation of a long-term program and methods for a*  
17 *sustained reduction of ungulates on DoN lands. Eradication is the goal; however, if eradication is not*  
18 *feasible, ungulate control will be implemented with the goal of sustained suppression to levels that allow*  
19 *for forest regeneration and self-sustaining numbers of native animals. The DoN will request the (U.S.*  
20 *Fish & Wildlife) Service's review and comments regarding the draft Ungulate Management Plan.*

21 *The Ungulate Management Plan will be finalized by the DoN for DOD lands on Guam to include specific*  
22 *management and control of ungulates. The objective of the Ungulate Management Plan is to improve*  
23 *habitat quality for special status species, reduce erosion, and reduce habitat degradation on DOD lands.*  
24 *Implementation of the plan will begin within one year of plan finalization (DoN 2010a, p. 129). The*  
25 *Service will be provided a 30-day period, from the date of receipt of the draft Ungulate Management*  
26 *Plan, to provide comments and recommendations for the DoN's consideration. The initial phase of*  
27 *management will entail significant effort; sustained maintenance and control will require less ongoing*  
28 *effort.*

29 From: USFWS. 2010. Biological Opinion for the Joint Guam Program Office Relocation of the  
30 U.S. Marine Corps from Okinawa to Guam and Associated Activities on Guam and Tinian.

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