CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

This *Plan / Environmental Impact Statement for Protecting and Restoring Native Ecosystems by Managing Non-native Ungulates* (plan/EIS) *at Hawai'i Volcanoes National Park* (Hawai'i Volcanoes or the park) analyzes the impacts that could result from continuation of current management activities (the no-action alternative), as well as the impacts that could result from four action alternatives.

This chapter describes the reasons the National Park Service (NPS) is taking action at this time to evaluate a range of alternatives and management actions for the protection and restoration of native ecosystems by managing non-native ungulates (mammals with hooves). Specifically, this chapter includes the following:

- Impacts associated with non-native ungulates at the park;
- History of non-native ungulates at the park;
- History of non-native ungulate management at the park;
- Statements of the purpose and need for taking action, as well as specific objectives;
- Background information about the park;
- A discussion of issues and impact topics identified during the scoping process and considered in preparation of the plan/EIS, as well as issues dismissed from further analysis; and
- Related laws, policies, plans, and other constraints.

Hawai'i Volcanoes is located on the Island of Hawai'i (figure 1). The park boundary originally included 35,865 acres (including Haleakalā on the Island of Maui, which is now a separate national park system unit) and was expanded through the years to 333,000 acres. The most recent of these expansions was the acquisition of the Kahuku Unit, adding 116,000 acres to the park. The study area for the plan/EIS is Hawai'i Volcanoes (figure 2). Special attention will be given to areas of the park where non-native ungulate populations are known to exist. For example, the recently acquired Kahuku Unit has large concentrations of non-native feral (wild) ungulates, specifically mouflon sheep (*Ovis musimon*), pigs (*Sus scrofa*), sheep (*Ovis aries*), and small numbers of feral cattle (*Bos taurus*) and goats (*Capra hircus*). Also, feral pigs continue to impact areas of 'Ōla'a and Kīlauea units.

Upon conclusion of the plan/EIS and decision-making process, one of the alternatives, or a combination of actions from multiple alternatives, will become the plan for protecting and restoring native ecosystems by managing non-native ungulates. This plan will guide future actions for a period of approximately 15-20 years or until conditions necessitate revising the plan. While other non-native ungulates, including axis deer (*Axis axis*), have not yet been found in the park, the same management actions and methods would be applied to any non-native ungulates should they occur within park boundaries.

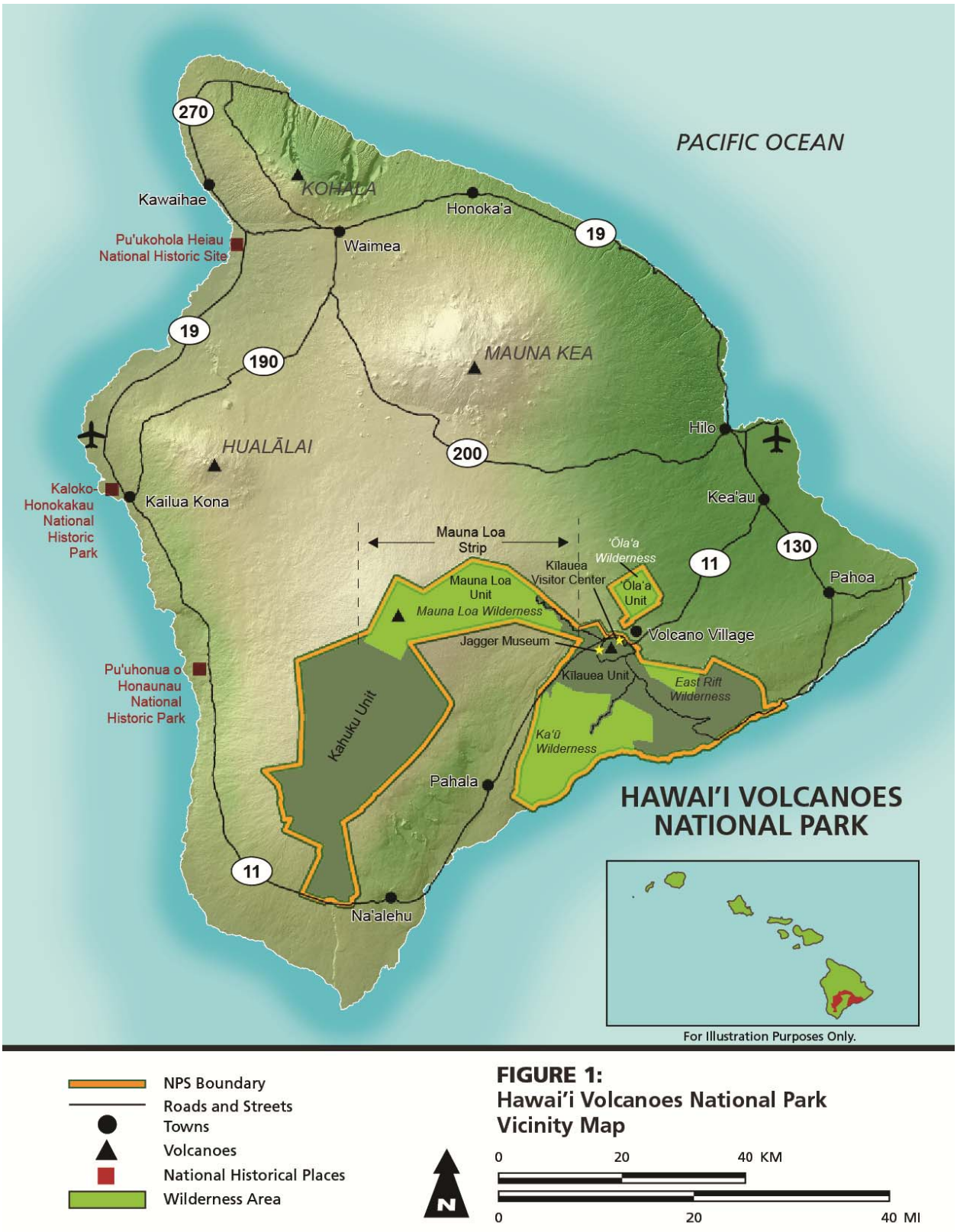

FIGURE 1:
Hawai'i Volcanoes National Park Vicinity Map

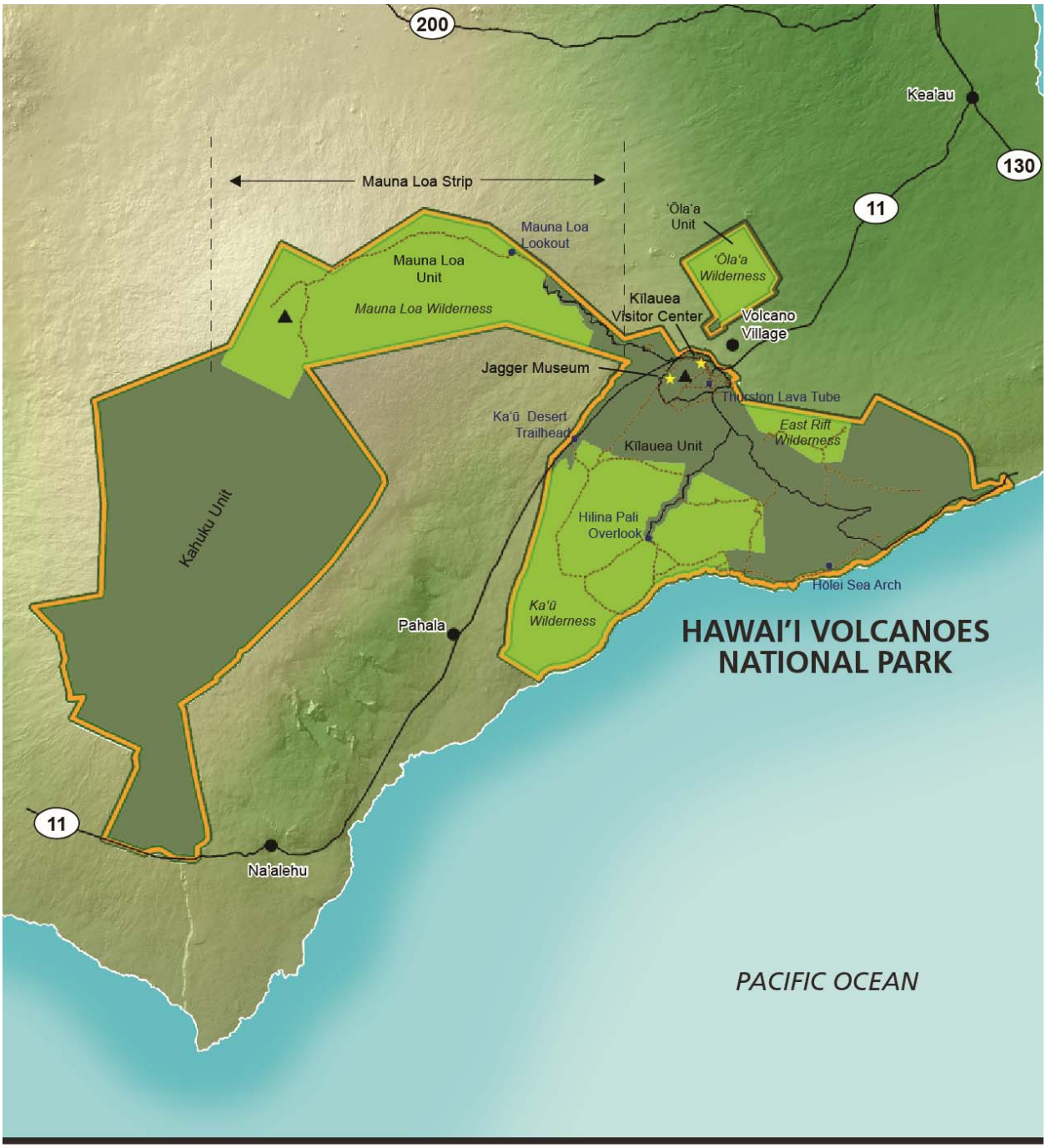

FIGURE 2:
Hawai'i Volcanoes National Park Study Area Map

IMPACTS ASSOCIATED WITH NON-NATIVE UNGULATES AT HAWAIʻI VOLCANOES NATIONAL PARK

Non-native species are those that do not naturally occur in the ecosystem and were introduced by humans, accidentally or incidentally, into the environment from elsewhere. Because the ecosystems of the Hawaiian Islands evolved over millions of years in the absence of large mammalian herbivores, they are particularly vulnerable to the effects of non-native ungulates. This is because unlike continental systems that evolved with ungulates, much of the native flora lacks defenses against browsing such as stinging hairs, repellent odors, or thorns. Non-native ungulates cause loss of vegetation, wildlife habitat degradation, and population decline for native Hawaiian species. Non-native ungulates impact native species through browsing (Scowcroft 1983), stripping bark (Scowcroft and Sakai 1983), and altering habitat by trampling (Spatz and Mueller-Dombois 1973; Drake and Pratt 2001; Busby et al. 2010), soil erosion (Stone and Loope 1987; Vitousek et al. 1987), digging (feral pigs) (Ralph and Maxwell 1984; Loope et al. 1991), and inhibiting the regeneration of native species (Scowcroft and Giffin 1983; Loope and Scowcroft 1985). Non-native ungulates increase soil disturbance and encourage the spread of non-native plants (NPS 2007a; Spatz and Mueller-Dombois 1975; Aplet et al. 1991; LaRosa 1992). Non-native ungulates detract from the natural conditions that contribute to the wilderness character of the park through the loss of native species and damage to the ecological integrity of the area.

For example, feral pigs preferentially browse or uproot some native plants such as tree ferns (*Cibotium* spp.), native mints, and native shrubs. Feral pigs facilitate the establishment of non-native plants by damaging the native vegetation, opening the tree fern canopy (allowing more light to penetrate the understory), disturbing soil, and dispersing non-native and invasive weed seeds. Goats heavily browse vegetation and prefer palatable native plants that lack defenses against non-native ungulates. Mouflon sheep prefer a valuable plant community dominated by the native trees koa (*Acacia koa*), māmane (*Sophora chrysophylla*), and shrubs ʻā ʻaliʻi (*Dodonaea viscosa*). Feral sheep have contributed to the decline in populations of the māmane, an endemic leguminous tree that occurs in the subalpine woodland ecosystem, by stripping the bark off the trees, which facilitates damage from insects and other disease-causing organisms. They also appear to prefer native perennial grasses to non-native species (Scowcroft and Conrad 1992). In old growth forests, both domestic and feral cattle destroy native understory plants, leading to species loss and facilitating invasive weeds. While large canopy trees often persist for some time despite this disturbance, natural regeneration of canopy species is suppressed, and forest integrity declines dramatically (USFWS 2007).

Feral sheep have contributed to the decline in populations of the māmane, an endemic leguminous tree that occurs in the subalpine woodland ecosystem, by stripping the bark off the trees, which facilitates damage from insects and other disease-causing organisms.

In addition to direct ecosystem impacts, loss of vegetation and soil disturbance caused by trampling, digging, and rooting can increase soil erosion and deterioration of watersheds (Cuddihy and Stone 1990). Loss of native soil macroinvertebrates has been associated with pig disturbance (Vtorov 1993). Through their rooting and wallowing habits, feral pigs create unnatural pockets of standing water, including troughs created in fallen tree fern trunks, which are favorable breeding places for *Culex* mosquitoes. These mosquitoes can transmit avian malaria and avian pox, two main factors of loss of native forest birds (NPS 1999a; USGS 2005a). This is an issue particularly in young rainforests on Kīlauea and Mauna Loa where soils are porous and there are few natural sources of standing water.

The potential impacts of non-native ungulates are recognized as significant threats in several U.S. Fish and Wildlife Service (USFWS) recovery plans for listed species (USFWS 1996a, 1996b, 1997, 1999, 2003, 2004, 2006a, 2008a). In the park, this was evidenced in the mid-1990s when several mouflon sheep breached a boundary fence and preferentially browsed on populations of the federally listed endangered Mauna Loa silversword (*Argyroxiphium kauense*) and threatened Hawaiian catchfly (*Silene hawaiiensis*) (NPS 1999a; Belfield and Pratt 2002). Outside the park, feral sheep have also been found to be a substantial factor in the decline of the Mauna Kea silversword (Welsh 2002). Predation of eggs and goslings of the federally listed endangered nēnē or Hawaiian goose (*Branta sandvicensis*) has been attributed to feral pigs (USFWS 2004).

Non-native ungulates also have the potential to affect cultural resources at the park, which include archeological sites, cultural landscapes, and ethnographic resources. Ground disturbance caused by trampling, digging, and rooting could impact archeological sites. Trampling affects surface and subsurface (cave) features and built structures that can be knocked down (Moniz-Nakamura pers. comm.). Non-native ungulates that use caves may damage fragile artifacts. Alterations in the ecosystem of an area could impact the characteristics that contribute to its designation as a cultural landscape. Traditional uses and ethnographic resources could be impacted by the loss of native plant and animal communities important to the culture of native peoples.

People who visit Hawai‘i Volcanoes to see natural ecosystems may be affected by the degradation and modification of native habitat and the effects of non-native ungulates on native species.

HISTORY OF NON-NATIVE UNGULATE SPECIES AT HAWAI‘I VOLCANOES NATIONAL PARK

Non-native ungulates were first introduced to the Hawaiian Islands over 1,000 years ago when Polynesians brought domestic pigs to the islands. In the late 18th century, goats, European pigs, sheep, and cattle were introduced as a food source, and eventually some animals became feral (wild). Other non-native ungulates, such as the mouflon sheep that were introduced in the 1950s, were brought as game animals. Axis deer were brought to the Hawaiian Islands from India in late 1867 as a gift to Kamehameha V. Populations of these herbivores flourished because of the mild climate, an abundant food source, and a lack of predators. These animals are described in more detail below.

FERAL PIG

Polynesians introduced domestic pigs to the Island of Hawai‘i over 1,000 years ago. European pigs introduced to the Hawaiian Islands in the late 18th century became feral and interbred, and largely replaced the smaller Polynesian pigs. Animals eventually moved further away from human settlements and moved upland, where their numbers have multiplied. Outside of managed units, pigs occupy a wide range of habitats in the park, with higher concentrations of animals in mesic and wet forest than in dry lowland environments.

Example of Hollowed Out Tree Ferns by Feral Pigs at Kahuku

FERAL GOAT

Captain Cook introduced domestic goats to the Hawaiian Islands in 1778 and Captain George Vancouver brought additional animals in 1793 (NPS 1972). By the 1850s, large populations of feral goats had established on the Island of Hawai‘i. In 1970, the goat population at Hawai‘i Volcanoes was estimated at more than 14,000 animals in spite of removal efforts from 1916 to 1970. However, the goat population in the park has been virtually eliminated since the implementation of a systematic approach to goat control in 1970 (NPS 1999a). Today there are only a few individual goats in Kahuku.

FERAL SHEEP

Captain Colnett, who reached the Island of Hawai‘i by 1793, introduced sheep to the Hawaiian Islands. By 1822, feral sheep were well established on Mauna Kea. By 1960, populations were estimated at 8,000 animals on the Island of Hawai‘i (HDLNR 1975). In the park, several hundred sheep occupy the remote north corner of Kahuku.

FERAL CATTLE

Historically, domestic cattle impacted several areas of the park. On Mauna Loa, animals from the adjoining cattle ranches were allowed to freely graze in koa ‘ōhi‘a forest, inflicting much damage on the native forest and a number of rare plant species, until the practice was discontinued in 1948 (Morris 1967). Other areas where cattle grazing occurred include Kahuku and ‘Āinahou. These commercial cattle ranches were established prior to park acquisition. Today, all domestic animals have been removed and feral cattle occur mainly on forested state lands and occasionally wander into the adjacent Kahuku Unit of the park.

MOUFLON SHEEP

Mouflon sheep were introduced to the Island of Hawai‘i in 1957, where they were crossbred with feral sheep already on the island to create a hybrid animal. Hybrid animals were released on Mauna Kea as part of a game management program, in addition to a population of purebred mouflon sheep that were released on the island in 1962. During the next 4 years, additional introductions of the species were made, resulting in a total release of 46 rams and 48 ewes. By spring of 1979, this introduced population grew to an estimated 525 animals (HDLNR 1979). At the Kahuku Ranch, a newly acquired unit of Hawai‘i Volcanoes, records indicate that eight mouflon sheep were brought to the site in 1968, and an additional three animals were brought to the site in 1974 from the Honolulu Zoo. The Kahuku population numbered several hundred in 1986, and more recent surveys estimated the mouflon sheep population was 2,586 ± 705 in November 2004; however, NPS management actions resulted in a decline by 30 percent to 1,797 ± 688 by December 2006 (Stephens et al. 2008).

Mouflon Sheep at Kahuku

AXIS DEER

Axis deer were brought to the Hawaiian Islands from India in late 1867 as a gift to Kamehameha V, and were released on Moloka‘i in early 1868. Some axis deer were subsequently moved to O‘ahu before 1898, to Lana‘i in 1904, and to Maui in 1959 (Hawai‘i Conservation Alliance 2007). Recent sightings of individuals have been reported on the Island of Hawai‘i. Although no axis deer have been confirmed in the park, the management actions described in this plan/EIS would be implemented to remove any non-native ungulates found during the life of this plan.

HISTORY OF NON-NATIVE UNGULATE MANAGEMENT AT HAWAIʻI VOLCANOES NATIONAL PARK

The detrimental impacts of non-native ungulates in Hawaiʻi were recognized before establishment of the park in 1916. In 1903, the Hawaiʻi Territorial Government Board of Agriculture and Forestry established a forest reserve system to protect remaining watersheds and forests on the islands. In 1910, a Noxious Animal Eradication Program was established, and through 1958 an aggressive campaign to eliminate feral cattle, goats, and pigs was carried out by the Territorial Government that included animal control (1927–1931) within Hawaiʻi Volcanoes. Park-led efforts began in 1932 and continue to the present. The following summarizes non-native ungulate management at Hawaiʻi Volcanoes.

NON-NATIVE UNGULATE CONTROL FROM 1916 TO 1970S

At Hawaiʻi Volcanoes, non-native ungulate management measures were first implemented in a concentrated manner beginning in 1927, when the Territorial Government conducted goat removal as part of a regional effort to protect Hawaiʻi's watershed. Between 1927 and 1931, these efforts resulted in the removal of 17,389 goats from the park. Efforts by the Territorial Government ceased after 1931. The NPS took over control efforts and relied on private hunters to remove non-native ungulates in the park on a permit basis between 1932 and 1934. These efforts proved to be ineffective in reducing animal numbers and were subsequently discontinued. After 1934, virtually no control of non-native goats or other non-native species occurred at the park until 1938, when the Civilian Conservation Corps used organized drives to remove the animals from the park. These drives were supplemented with boundary and internal fencing. Although successful in removing large numbers of non-native ungulates from the park, Civilian Conservation Corps efforts were suspended in 1941 due to World War II and fences deteriorated (NPS 1972).

Starting in 1944, the NPS hired private companies for goat control. These companies would round up goats from the park and then sell them at a profit. This method continued until 1955, when it was discontinued due to lack of effectiveness. Starting in 1955 and lasting until 1970, the NPS relied exclusively on park staff to eliminate non-native ungulates within the park. During this time, more than 30,000 goats were removed from the park through a variety of techniques such as organized hunts and drives. However, a lack of steady funding and inadequate fencing did not allow for a level of sustained management that would reduce the population. In 1970, the park had over 14,000 goats residing within its boundary (NPS 1972).

Along with feral goat eradication efforts, attempts to control feral pigs were carried out in the park. Approximately 7,000 pigs were eliminated from the older part of the park from 1930 to 1971 (Katahira et al. 1993). These efforts were not successful in eliminating pigs, largely due to the inability of NPS employees to carry out sustained reduction efforts and prevent reentry of pigs into ungulate-control areas.

During this period of feral ungulate control, domestic cattle from the adjoining ranches would wander and graze within the park. The most impacted areas included Mauna Loa and portions of Kīlauea. Although authorized grazing was discontinued in 1948, a small number of stray cattle (both domestic and feral) remained in the park until the early 1970s (Tunison et al. 1995). A small population of feral sheep was eliminated when the NPS assumed ownership of ʻĀinahou Ranch in the early 1970s (Harry, pers. comm. n.d.).

NON-NATIVE UNGULATE CONTROL FROM 1970S TO PRESENT

In the 1970s, the NPS changed management strategies to include a systematic approach of direct reduction and fencing, including the use of volunteers in management efforts. The strategy included the use of boundary and internal fences to isolate populations, removal of individuals at greater rates than they can be replenished by reproduction and ingress, boundary fence inspection and maintenance, and monitoring and removal to prevent population increases (NPS 1974, 1986, 1993, 1997a, 1997b, 1999b, 2001b). Since the approach was adopted, NPS staff have eliminated nearly all goats below 9,000 feet in elevation (excluding the Kahuku Unit) and pigs from approximately 40,000 acres of interior fenced units or pig control units. Ingress of feral ungulates (goats, mouflon sheep, pigs and cattle) into managed units has occurred at very low, manageable rates since the 1970s. In Kahuku, large numbers of mouflon sheep are present along with feral pigs and a few feral goats and cattle. Several hundred feral sheep are in the remote north corner of Kahuku. Between 2004 and 2006, approximately 1,900 mouflon sheep were removed from Kahuku along with construction of fence segments along the park boundary; however, populations remain high in many areas (estimated at 1,797 ± 688 by December 2006) due to an annual population increase estimated between 21.1 and 33.1 percent (Stephens et al. 2008; USGS 2006a).

Examples of Boundary Fence at Kahuku

Examples of Boundary Fence and Koa Forest Recovery Following Ungulate Removal on Kahuku (left photo) and Mauna Loa (right photo)

PURPOSE OF AND NEED FOR ACTION

Purpose is a broad statement of goals that the NPS intends to fulfill by taking action. Need answers to the question, "Why is action being taken at this time?" Objectives are what must be achieved to a large degree for the action to be considered a success.

The purpose of this plan/EIS is to develop a comprehensive and systematic framework for managing non-native ungulates, including any new introductions, that supports long-term ecosystem protection; supports natural ecosystem recovery and provides desirable conditions for active ecosystem restoration; and supports protection and preservation of cultural resources. A plan/EIS is needed to address the impacts of non-native ungulates, which include loss of native ecosystems, especially native plant and animal communities; loss of sensitive native species, including state- and federally listed species; and loss of irreplaceable cultural resources. The park's most recent plan for non-native ungulate control was written over 30 years ago. The new plan/EIS will provide a parkwide framework to systematically guide non-native ungulate management activities over the next decades that considers the recently acquired Kahuku Unit; new invasive species challenges, especially those presented by mouflon sheep; and current NPS policy and guidance.

OBJECTIVES IN TAKING ACTION

Objectives are "what must be achieved to a large degree for the action to be considered a success" (Director's Order 12 Handbook [NPS 2001a]). All alternatives selected for detailed analysis must meet all objectives to a large degree and resolve the purpose of and need for action. Objectives for managing non-native ungulate populations at Hawai'i Volcanoes must be grounded in the park's enabling legislation, purpose, significance, and mission goals, and must be compatible with direction and guidance provided in the park's strategic plan, the 1974 natural resources management plan, the 1975 master plan, the 1986 natural resource management plan, and the 1999 resource management plan (NPS 1974, 1975a, 1986, 1999a), and other management guidance. Any plan the park develops must be consistent with the laws, policies, and regulations that guide the NPS. The following objectives relate to the management of non-native ungulates at Hawai'i Volcanoes.

MANAGEMENT METHODOLOGY

- Develop or refine informed, scientifically based methods for management of non-native ungulate populations to allow for the protection and recovery of park resources.

VEGETATION

- Protect native plant communities and assist with their natural recovery from impacts of non-native ungulates.
- Provide desirable conditions for active restoration of native plant communities degraded by non-native ungulate activity to a native state.

NATIVE WILDLIFE AND WILDLIFE HABITAT

- Protect native wildlife and wildlife habitat and assist with their natural recovery from impacts of non-native ungulates.

RARE, UNIQUE, THREATENED, OR ENDANGERED SPECIES

- Protect endangered, threatened, and rare plant and animal species and assist with their natural recovery from impacts of non-native ungulates.

CULTURAL/HISTORIC RESOURCES

- Prevent impacts to archeological resources, historic structures, cultural landscapes, and ethnographic resources from non-native ungulate activity.

WILDERNESS

- Using the minimum tools necessary to meet minimum requirements per the *Wilderness Act*, limit the impacts of non-native ungulates, as well as management actions, on wilderness areas located within the park.
- Assist in the recovery of natural conditions that have been impacted, or may be impacted, by non-native ungulates.
- Determine the minimum requirements to restore wilderness character in areas impacted by non-native ungulates.

SOILS

- Minimize the impacts of non-native ungulates on soil erosion and disturbance.

VISITOR USE AND EXPERIENCE

- Provide visitors with the opportunity to experience native ecosystems and cultural landscapes that have not been impacted by non-native ungulate activity.
- Enhance visitor awareness and understanding of non-native ungulate management actions and why they are necessary for the protection of park resources.
- Minimize limitations to visitor access as a result of non-native ungulate management activities.

PARK MANAGEMENT AND OPERATIONS

- Minimize long-term impacts (in terms of reduced staff time and resources) to programs at the park incurred by continued monitoring and management of non-native ungulates.

COORDINATION AND OUTREACH

- Coordinate with neighboring land managers implementing non-native ungulate management actions beneficial to the protection of park resources.
- Coordinate with other stakeholders regarding non-native ungulate management and the protection of park resources.
- Enhance public awareness and understanding of the impacts of non-native ungulates and the need for management to protect and restore park resources.

PARK BACKGROUND

Hawai‘i Volcanoes National Park, located on the Island of Hawai‘i, was established by Congress on August 1, 1916. The park extends from sea level to 13,677 feet (4,169 meters) and is home to two of the world’s most active volcanoes, Kīlauea (4,000 feet (1,219 meters) high) and Mauna Loa (13,677 feet (4,169 meters) high). Kīlauea has been in nearly continuous eruption since 1983; Mauna Loa last erupted in 1984. The park encompasses over 10 percent of the land on the Island of Hawai‘i, including the summits and most of the southwest and east rift zones of Kīlauea and portions of the southwest and northeast rift zones of Mauna Loa (NPS n.d.b, 2004a, 2009e). These two volcanoes are primary features of the park, and the principal reason for its establishment by Congress as a unit of the national park system (NPS 2006a).

Hawai‘i Volcanoes stretches over several ecosystems from the summit of Mauna Loa to where lava from Kīlauea meets the Pacific Ocean (NPS 2004a). The park’s various environments (coastal dry lowland, mid-elevation seasonally dry, montane rain forest, montane seasonally dry, subalpine, and alpine) harbor distinct plant and animal communities (Mueller-Dombois and Fosberg 1974). More than 90 percent of the native Hawaiian flowering plants and animals are endemic to the Hawaiian Archipelago; in other words, unique (found naturally nowhere else) to the Hawaiian Islands. This level of endemism is unsurpassed in the world and is the product of over 30 million years of evolution in a remote island setting. Included among the endemic species are many rare plants and animals. Approximately 30 percent of all federally listed threatened and endangered species are found in the Hawaiian Islands (USFWS 2011). Hawai‘i Volcanoes provides habitat for over 50 federally listed endangered, threatened, and candidate plants and animals (including species historically at the park and non-resident species). The international biosphere reserve designation, conferred in 1980, recognizes the park’s long-term commitment to scientific study, monitoring, and protection of the range of unique tropical forests and woodlands. The world heritage designation, conferred in 1987, is based on the “ongoing geologic processes of volcanism, of endemic and native biota and human interrelationships with the lands” (UNESCO 1987).

HAWAI‘I VOLCANOES NATIONAL PARK ENABLING LEGISLATION

Congress established Hawai‘i National Park (later to become Hawai‘i Volcanoes National Park) on August 1, 1916, declaring:

> The tracts of land on the Island of Hawai‘i and the Island of Maui, in the Territory of Hawai‘i … shall be perpetually dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people of the United States … [and provide for] … the preservation from injury of all timber, birds, mineral deposits, and natural curiosities or wonders within said park, and their retention in their natural condition as nearly as possible.

This plan/EIS is expected to fulfill the enabling legislation through the active restoration of the native ecosystem through the removal of non-native ungulates, which will assist in returning the park’s ecosystem to its natural condition.

The enabling legislation of the park has been modified throughout the years, both to establish the national parks on the islands of Hawai‘i and Maui as separate parks and to expand the boundary of Hawai‘i Volcanoes. The following amendments were made to the enabling legislation:

- Act of 1920: Authorized the governor of the Territory of Hawai‘i to acquire privately owned lands and rights-of-way within the boundaries of Hawai‘i National Park.
- Act of 1922: Added additional lands to the park, specifically those lands of the Ka‘ū Desert and Kapāpala.
- Act of 1928: Modified the park boundary on the Island of Hawai‘i.
- Act of 1930: Stated that the United States had sole and exclusive jurisdiction over Hawai‘i National Park and further defined the purpose of the park and the activities allowed or prohibited. Specifically, the act stated:

  > All hunting or the killing, wounding, or capturing at any time of any wild bird or animal, except dangerous animals when it is necessary to prevent them from destroying human lives or inflicting personal injury, is prohibited within the limits of said park … That the Secretary of the Interior shall make and publish such general rules and regulations as he may deem necessary and proper for the management and care of the park and for the protection of the property therein, especially for the preservation from injury or spoliation of all timber, natural curiosities, or wonderful objects within said park, and for the protection of animals and birds in the park from capture or destruction, and to prevent their being frightened or driven from the park.

- Act of 1938: Added additional lands, known as the Kalapana extension, to Hawai‘i National Park.
- Act of 1959: Formed part of the legislation for the admission of Hawai‘i to the Union, approved March 18, 1959.
- Act of 1961: Separated the parks on Maui and Hawai‘i, officially establishing the park on the Island of Hawai‘i as “Hawai‘i Volcanoes National Park.”
- Act of 1978: Added 269 acres to Hawai‘i Volcanoes National Park.
- Act of 2000: Eliminated restrictions on the acquisition of certain lands contiguous to Hawai‘i Volcanoes National Park.

PURPOSE AND SIGNIFICANCE OF HAWAI‘I VOLCANOES NATIONAL PARK

Purpose

The following park purpose statement was developed for the *Hawai‘i Volcanoes National Park General Management Plan*, which is currently being developed:

> Hawai‘i Volcanoes National Park protects, studies, and provides access to Kīlauea and Mauna Loa, two of the world’s most active volcanoes; and perpetuates endemic Hawaiian ecosystems and the traditional Hawaiian culture connected to these landscapes (NPS n.d.a).

Significance

Park significance statements capture the essence of the park's importance to the nation's natural and cultural heritage. Understanding park significance helps managers make decisions that preserve the resources and values necessary to the park's purpose. The following significance statements were developed for the *Hawai'i Volcanoes National Park General Management Plan*, which is currently being developed:

- Hawai'i Volcanoes National Park protects and interprets the largest and most continuously active shield volcanoes in the United States, and provides the best physical evidence of island building processes that continue to form the 2,000-mile-long Hawaiian Archipelago.
- Hawai'i Volcanoes National Park's active volcanoes serve as a living laboratory for scientific investigations that began over a century ago and continue to advance global understanding of volcanic processes.
- Hawai'i Volcanoes National Park protects, restores, and studies unique and diverse ecosystems and endemic species that are the result of over 30 million years of evolution on an active volcanic landscape, wide climate variation, and the extreme isolation of the Hawaiian Islands.
- Hawai'i Volcanoes National Park encompasses the largest and most ecologically diverse wilderness in the Pacific Islands.
- Hawai'i Volcanoes National Park embraces the Native Hawaiian spiritual significance of this landscape and interprets related cultural traditions.
- Hawai'i Volcanoes National Park encompasses sites, structures, objects, and landscapes that document over 600 years of human life and activities on an active volcanic landscape.
- Hawai'i Volcanoes National Park provides access to two of the most active volcanoes in the world and an opportunity to understand and appreciate the distinctive geology and natural and cultural adaptations to the land (NPS n.d.a).

ISSUES AND IMPACT TOPICS

National Environmental Policy Act (NEPA) regulations require an "early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 CFR 1501.7). Issues are problems, opportunities, and concerns regarding the current and potential future management strategies for managing non-native ungulates and impacts of management actions that are included in this plan/EIS. The issues were identified by the NPS, the public, and other interested parties through the scoping process (for additional information, see "Chapter 5: Consultation and Coordination"). The impact topics are a more refined set of concerns analyzed for each of the management alternatives. The impact topics were derived from issues and in "Chapter 4: Environmental Consequences," the impact topics were used to examine the extent to which a resource would be affected by the actions of a particular alternative.

The issues were identified by the NPS, the public, and other interested parties through the scoping process (for additional information, see "Chapter 5: Consultation and Coordination").

VEGETATION

Hawai‘i Volcanoes National Park is home to a wide diversity of vegetation types including rain forests, subalpine shrublands, dryland forests, and sparsely vegetated lava flow communities, among others. A spectrum of tropical environments ranging from persistently or seasonally wet to dry, account for the floral diversity found in the park. The diversity can also be attributed to the varied elevations in the park (sea level to 13,677 feet (4,169 meters)) and volcanic activity, which results in a mosaic of successional stages throughout the park (UNEP 1995).These environments support unique flora, including many rare species. Thirty-six plant species listed as threatened, endangered, or candidate species under the *Endangered Species Act* (ESA) are located in the park and its vicinity, while 69 plant species are identified as species of special concern or rare (NPS 2006f). The activities of non-native ungulates can impact the structure and function of these unique vegetative communities by altering the succession of the ecosystem. For example, feral goats have impacted dry and mesic park environments, extending from sea level to the alpine zone, by destroying trees and shrubs and preventing regeneration of many native plant species (UNEP 1995). Impacts from other non-native ungulates include direct reduction of vegetation from browsing or rooting up plants. Many of the impacts on vegetation from non-native ungulates occurred prior to park acquisition and continued into current times. The park has been addressing these impacts by removing non-native ungulates and restoring vegetation. Non-native ungulate removal has the potential to change fire regimes in the park by changing fuel loads (because of increasing vegetation) and altering microclimate conditions as a result of less or no grazing. This could also affect vegetation.

Issue Statement. Non-native ungulates impact native vegetation by foraging on, digging up, and trampling native vegetation. However, the removal of non-native ungulates could also affect vegetation by changing the fire regime in the park.

Non-native ungulate activity, such as browsing, trampling, and seed dispersal through animal waste, has the potential to increase the number and type of non-native plant species within the park. As the number of non-native plant species increases, the native plant species within the park encounter increased competition and are adversely affected. Beneficial impacts would result from the removal of non-native species from the ecosystem, as directed in the NPS *Management Policies 2006* (NPS 2006b). Conversely, as vegetation increases, new non-native plant species may invade following ungulate removal.

Issue Statement. Non-native ungulate activities can promote non-native plant species through habitat alteration and seed dispersal. An increase in non-native plant species could have a negative impact on the park’s native plant communities. Conversely, new non-native plant species may invade following ungulate removal.

NATIVE WILDLIFE AND WILDLIFE HABITAT

Hawai‘i Volcanoes is home to a unique assemblage of native wildlife. The Hawaiian hoary bat (*Lasiurus cinereus semotus*) is the only native land mammal in the park and in the Hawaiian Islands. Most of the endemic bird species are rare or endangered (UNEP 1995). The park is also home to endemic invertebrates (including two federally endangered *Drosophila*), which are key contributors to island biodiversity. Non-native ungulate species have been identified as a primary factor in the success of invasive species (any species that has moved into an area and reproduced so aggressively that it has replaced some of the original species) and the loss of native biodiversity. Destruction of native vegetation by non-native ungulates has contributed to the decline and loss of wildlife habitat. One example of how non-native ungulates have impacted native species includes the creation of conditions that promote malaria among native forest bird species.

Issue Statement. Non-native ungulate activity reduces habitat and forage availability through browsing, trampling, bark stripping, and seed dispersal, and can also lead to the spread of disease among bird species. While all wildlife species could be impacted, there could be disproportionate impacts to the native bird communities from the presence of non-native ungulates.

Past non-native ungulate management actions at the park have included the use of vehicles, helicopters, firearms, and dogs. The noise created from these actions is short term, lasting only for the duration of the management action. The noise from these actions has the potential to create short-term localized disturbances to all animal species in the park.

Issue Statement. Native wildlife in Hawai‘i Volcanoes may be impacted by non-native ungulate management activities, such as the visual intrusion and noise produced from humans, vehicles, firearms, helicopters, fences, and machinery (for fence construction), and by the trampling and clearing of vegetation.

RARE, UNIQUE, THREATENED, OR ENDANGERED SPECIES

More than 90 percent of the native flowering plant and animal species are considered unique and are endemic to the Hawaiian Islands. Many of these species are also listed as state- or federally threatened or endangered. Approximately 30 percent of the federally listed threatened and endangered species in the United States can be found on the Hawaiian Islands. Hawai‘i Volcanoes provides habitat for over 50 species that are listed as threatened, endangered, or candidate. These include 35 plant and 19 animal species that are present or were historically documented in the park. An additional 69 plant and 13 animal species are identified as species of concern or rare. Some of these species, including some recently extirpated species, are the federally endangered ‘ākepa (honeycreeper, *Loxops coccineus*), ‘akiapōlā‘au (*Hemignathus munroi*), ‘alauahio (Hawai‘i creeper, *Oreomystis mana*), nēnē (Hawaiian goose, *Branta sandvicensis*), ‘ua‘u (Hawaiian petrel, *Pterodroma sandwichensis*), ‘io (Hawaiian hawk, *Buteo solitarius*), ‘ō‘ū (honeycreeper, *Psittirostra psittacea*—historically found in the park), ‘a‘o (Newell’s shearwater, *Puffinus auricularis newelli*—historically found in the park), ‘alalā (Hawaiian crow, *Corvus hawaiiensis*—historically found in the park), and the ‘ōpe‘ape‘a (Hawaiian hoary bat).

Overall, non-native ungulate species have been identified as a primary factor in the success of invasive species and the loss of native biodiversity, including the loss of threatened and endangered species. Many of the USFWS recovery plans for endangered species identify the removal of non-native ungulates as essential for the protection of these species and their habitat. One example of how non-native ungulates have impacted these species includes the creation of conditions that promote malaria among native bird species. There are also direct impacts to threatened and endangered species, such as herbivory of silverswords by goats and mouflon sheep. Management activities may also cause impacts, such as potential wildlife (e.g., petrel and Hawaiian hoary bat) striking fences for managing non-native ungulate populations. These occurrences can be mitigated through fence design and use of flagging, which is currently implemented at the park.

Issue Statement. Rare, unique, threatened, or endangered species within Hawai‘i Volcanoes are impacted by non-native ungulate populations and their related activities (e.g., trampling, direct herbivory, and seed dispersal) through direct predation, herbivory, habitat destruction, or other direct and indirect impacts, such as creating conditions that breed diseases detrimental to the native wildlife populations.

Issue Statement. Rare, unique, threatened, or endangered species within Hawai‘i Volcanoes may be impacted by non-native ungulate management activities that disturb the soundscape, such as the use of vehicles, firearms, or helicopters. Other disturbances could result from human activity in the area during a management practices.

Due to its unique ecosystems, Hawai‘i Volcanoes was designated as a biosphere reserve (areas of terrestrial and coastal/marine ecosystems or a combination thereof, which are internationally recognized) in 1980 and a world heritage site (places that are of outstanding universal value to humanity and should be protected for future generations to appreciate and enjoy) in 1987. Hawai‘i Volcanoes is a unique example of island-building through ongoing volcanic processes, and represents the most recent activity in the formation of the Hawaiian Islands. The park contains significant areas of nearly intact subalpine and alpine ecosystems and unique assemblages of native subtropical rain forest, mesic forest, and dryland biota, providing an example of succession following dynamic volcanic activity, as well as providing habitat for listed threatened and endangered endemic species. Further, the park is on the Nature Conservancy's (TNC's) list of globally imperiled areas (UNESCO 1987). The presence and abundance of threatened and endangered species in part contributes to the park's listing by these organizations. The presence of non-native ungulates impacts the native and threatened and endangered populations that contribute to these listings through direct and indirect impacts such as browsing, trampling, rooting, bark stripping, predation, depredation, and facilitation of non-native plants as competitors.

Issue Statement. Rare, unique, threatened, or endangered species in Hawai‘i Volcanoes contribute to the park's designation as a biosphere reserve and world heritage site. Any decline in these species resulting from the presence and activities of non-native ungulates could impact the characteristics of the park that make it eligible for these listings.

CULTURAL/HISTORIC RESOURCES

The extent of cultural resources at Hawai‘i Volcanoes documents nearly 600 years of human activity and includes a range of resources from indigenous island cultural adaptations to a unique lava landscape (Tuggle and Tomonari-Tuggle 2008). Cultural resources in the park include archeological resources, cultural landscapes, ethnographic resources, and historic structures. Although some data is needed to determine the extent of impacts that non-native ungulate management activities could have on cultural landscapes and historic resources, potential impacts on archeological resources could occur from digging, rooting, trampling, or other ground-disturbing activities. Ground disturbance could also occur during management actions if fencing is used, potentially impacting these resources. Traditional uses by native populations still occur today, including ceremonial activities. Non-native ungulates could have both beneficial and adverse impacts on activities of native populations. The presence of non-native ungulates impacts native vegetation and wildlife that native populations use to continue traditional practices. Hawaiian plants and animals were held in special regard by native populations who believed they represented the physical forms of their ancestral deities (Burrows et al. 2007). Consequently the damage to native species and habitat caused by non-native ungulates remaining on the landscape could result in adverse impacts. Management of non-native ungulates may also result in short-term adverse impacts, as areas where these traditional uses occur may close temporarily for management activities. Additional impacts could result from noise associated with management activities that occur in or near areas that are considered sacred. Removing non-native ungulates could also cause regeneration of vegetation that may cover archeological/ethnographic resources (such as petroglyphs).

Issue Statement. Non-native ungulates could impact cultural resources through ground disturbance (e.g., from digging and rooting) and by damaging the native plants and animals traditionally valued by native populations. Management activities also have the potential to cause adverse impacts (such as those from the installation of fencing and from temporary site closures in the park). However, more information is needed to determine the potential impacts on cultural landscapes and historic structures.

Though not an ancient traditional use, hunting has become a component of contemporary practice (Burrows et al. 2007). Impacts of non-native ungulate management actions on recreational and subsistence hunters in the park are expected to be low as there is no history of legal hunting for recreational or subsistence purposes in the park. Prior to park acquisition, the general public was not allowed to hunt in Kahuku; hunting was limited to ranch employees and occasional recreational hunters who paid private guides. Park management actions may influence animal populations and indirectly affect hunting opportunities outside the park.

Issue Statement. Hunting is a local contemporary practice and management of non-native ungulates in the park could impact surrounding animal populations outside the park.

WILDERNESS

In 1978, areas of Hawai‘i Volcanoes were designated by Congress as wilderness. The park contains 123,100 legislated acres in four management units that fall under this designation. These areas preserve diverse segments of Hawai‘i in an undeveloped state. Units within the wilderness area are the Mauna Loa Unit on the southwest-facing slope and summit of Mauna Loa above 5,000 feet (1,254 meters) in elevation; the Ka‘ū Desert Unit, encompassing the Ka‘ū Desert below 3,000 feet (914 meters) in elevation; the ‘Ōla‘a Unit, including the ‘Ōla‘a rain forest; and the East Rift Unit in the upper East Rift Zone. As recognized in the 1975 *Final Environmental Statement for the Proposed Wilderness Areas* (NPS 1975b), management of non-native ungulates requires entry into these wilderness areas and has impacts such as noise from management activities (firearms, helicopters, vehicles, people) and trampling of vegetation. Other potential impacts include the visual intrusion from control installations, such as traps, snares, and solar power panels.

Issue Statement. The management of non-native ungulates could impact wilderness areas through additional noise and disturbance during management activities.

Issue Statement. Removing non-native ungulates will assist in the recovery of natural conditions in wilderness.

SOILS

Because the geology of the area is a result of the volcanic history of the island, soils at Hawai‘i Volcanoes are generally shallow, although deeper soils occur on older substrates on Mauna Loa. In addition, the primarily rainy climate at the park creates an increased likelihood for soil erosion. Park staff noted that the overabundance of non-native ungulates has led to soil erosion and disturbance in dry, mesic communities in the past (Baker and Reeser 1972). Furthermore, evidence indicates that non-native ungulates contribute to erosion and water runoff that feeds into intermittent streams that flow below the park into the Ka‘ū Forest Reserve during heavy rains. This disturbance results from digging by feral pigs or general disturbance related to non-native ungulates, such as grazing by large numbers of goats and sheep. Control of these non-native species could result in beneficial impacts through a reduction of soil disturbance and erosion.

Issue Statement. Non-native ungulate populations lead to soil disturbance and erosion, which can impact the soils that support native vegetation and wildlife.

SOUNDSCAPES

Elements of non-native ungulate management strategies discussed during internal scoping include the use of vehicles, helicopters, and firearms. Noise resulting from management activities could affect park visitors and wildlife. These potential impacts would be of short duration, lasting only the length of the management activity. Current sources of ambient noise in the park where management actions would occur include minimal visitor use, as well as air tours in the area. Acoustical data on helicopter noise was collected for the air tour management plan (ATMP). For the ATMP, the park was divided into acoustic sampling areas and ambient noise levels were measured. Throughout the park, the noise level does not exceed 55 decibels (except near roadways); the maximum in many places is as low as 35 decibels. Typical measures of noise are a soft whisper (30 decibels) or conversational speech (65 decibels). Many areas of the park fall within these levels and could be impacted by non-native ungulate management activities. The impact of soundscapes could carry over to other resource areas such as threatened and endangered species, adjoining land uses, and visitor use, and may be discussed under those impact topics.

Issue Statement. Certain non-native ungulate management activities such as the use of vehicles, helicopters, or firearms may cause temporary disturbance to park soundscapes for both visitors and wildlife.

LAND MANAGEMENT ADJACENT TO THE PARK

The lands surrounding Hawai‘i Volcanoes contain numerous stakeholder interests, including federal, state, local, and private landholders. Some of these interests include homeowners who support non-native ungulate management because they view the native plant and animal communities at the park as an asset to their land value, and others who may value the presence of non-native ungulates as a game animal. These values are considered in this plan/EIS. Actions by neighboring landowners that may impact the park, such as keeping non-native ungulates as domestic livestock, are also considered. These animals have the potential to cross onto park lands and become feral, potentially impacting the park’s wildlife and vegetation, as discussed above. The plan/EIS also considers management actions with the potential for animals to relocate outside of the park, transferring their impacts to neighboring land uses, both private and governmental. The park also has numerous partnerships and other relationships with surrounding landowners that complement park conservation efforts. Plans from other agencies considered in the development of this plan/EIS include those being implemented by members of the Three Mountain Alliance (TMA) (e.g., USFWS, TNC, Department of Land and Natural Resources (DLNR), and Kamehameha Schools) in areas surrounding the park. Planned activities by the state were taken into account, including state watershed, game, and non-native ungulate management plans for the Natural Areas Reserve System, Forest Reserves, and Game Management Areas.

Issue Statement. The management of non-native ungulates in the park could impact surrounding lands and conflict with the land use plans of adjoining lands. Non-native ungulate management could relocate the population to adjacent lands. The actions of adjoining landowners may also impact the number of non-native ungulates in the park, introducing (through accidental release) or removing (through other management programs) these species.

SOCIOECONOMICS

Non-native ungulate management actions in the park would not be expected to create employment or impact property values. Potential impacts to socioeconomics include purchasing management supplies from island businesses and impacts on the businesses that serve tourists if management actions increase or decrease park visitation. In fiscal year 2007 total spending associated with Hawai‘i Volcanoes National Park was estimated to be $114 million, of which $109 million was spent by nonlocal visitors. The total labor income generated by this spending was almost $43 million and the gross regional product was over $67 million. This economic activity supported 2,199 jobs in the local economy (Stynes 2008).

Issue Statement. Proposed non-native ungulate management activities may impact local businesses through the amount of supplies purchased. Local businesses related to tourism would also be impacted if management actions change the level of park visitation.

VISITOR USE AND EXPERIENCE

Many people visit Hawai‘i Volcanoes to enjoy the natural areas and experience an environment that cannot be found anywhere else. The park is traditionally an area of high visitor use on the Island of Hawai‘i and received an average of 1.375 million visitors annually between 1998 and 2007 (NPS 2009b). If the number of visitors increases, the number of facilities (e.g., restrooms and parking areas) to accommodate the use may also need to increase. Future park visitation may also be influenced by the new Kahuku Unit of the park, which would provide new visitor opportunities when funding is available.

The use at Hawai‘i Volcanoes is mainly day use, with visitation centering on the Crater Rim Drive and Chain of Craters Road. Visitation opportunities at Hawai‘i Volcanoes include viewing and understanding volcanic processes; seeing the park’s natural and cultural resources; practicing traditional cultural activities; and experiencing the relative solitude of the park’s backcountry (NPS 2004b). Other visitor use activities dependent on the environment include bird-watching and nature photography. Currently, unmanaged non-native ungulate populations are altering these natural communities, which are a large component of the visitor experience at the park. Direct impacts include trampling, browsing, preying on, or otherwise disturbing native plants and animals. Other impacts are indirect, such as the impact that feral pigs have on bird species by promoting the establishment of standing water, which breeds mosquitoes. Management of non-native ungulates would be expected to have beneficial impacts on visitor use and experience, because the threat to native ecosystems from these non-native species would be addressed. Addressing this threat would help to continue and reestablish some of the natural features that attract visitors. Active restoration of native ecosystems could also be possible.

Issue Statement. The natural ecosystems in the park are an important component of the visitor experience. The impact to these ecosystems from non-native ungulates through habitat destruction and modification, which cause declines in native species, could adversely impact visitor use and experience.

The variety of visitor uses at Hawai‘i Volcanoes may be impacted by non-native ungulate management activities because these activities may require closing areas of the park for short periods. Although these impacts would be short term, many people only visit the park a single time because of the time and travel involved to reach the site. Visitors who are only at the park for 1 day may not be able to have their desired visitor experience while management activities are being conducted.

Issue Statement. Proposed non-native ungulate management activities may require certain areas of the park to be closed to the general public during management activities, which may affect visitor use and experience.

VISITOR AND EMPLOYEE SAFETY

Visitor and employee concerns related to safety include the use of firearms by volunteers and park staff during removal actions, and visitors encountering management actions while in the park. A danger may also be posed by physically encountering non-native ungulates while in the park.

Issue Statement. Impacts to health and safety of the public and park employees could occur during management actions (especially those actions that use firearms) and through interactions between humans and wildlife.

PARK MANAGEMENT AND OPERATIONS

The operating budget of Hawai‘i Volcanoes for fiscal year 2008 was approximately $6,740,143; this supports 84 employees responsible for the management of 333,000 acres of land (NPS n.d.b; Yoshida 2009b). The implementation of a non-native ungulate management plan would require park staff to plan and carry out management actions. These actions could impact park staff by redirecting them from other activities in the park to conduct non-native ungulate management actions. Park operations were also an issue considered in the development of alternatives because the *Antideficiency Act* does not allow federal agencies to commit to expenditures for which there is no funding.

Issue Statement. Non-native ungulate management activities could impact park management and operations by redirecting park operations from other activities to the management of non-native ungulates.

ISSUES DISMISSED FROM FURTHER CONSIDERATION

The following impact topics and issues were removed from detailed consideration in the plan/EIS.

Geohazards. A geohazard is an event related to geological features and processes that cause loss of life and severe damage to property and the natural and built environment, such as an earthquake or rockslide. Although the volcanoes in the park are considered geohazards, the activity from these volcanoes would not be impacted by management of non-native ungulates.

Air Quality. Potential sources of air quality emissions from the implementation of a non-native ungulate management plan include the use of vehicles and helicopters to carry out the prescribed management activities. Since Hawai‘i is designated as in attainment with all six Environmental Protection Agency (EPA) criteria pollutants, it was determined that the increase in air emissions from these activities would be minimal and short term, resulting in only negligible impacts on the regional air quality.

Greenhouse Gas Emissions and Climate Change. There is strong evidence linking global climate change to human activities, especially greenhouse gas emissions associated with the burning of fossil fuels (IPCC 2007). Some of the activities associated with non-native ungulate management may result in fossil fuel consumption, such as the use of helicopters for aerial shooting. Some specialized activities, such as direct reduction and trapping, may require vehicular travel to assist in carrying out management activities. However, greenhouse gas emissions associated with the plan would be negligible in comparison to park-related, local, and regional greenhouse gas emissions. Furthermore, the implementation of any of the action alternatives could result in beneficial impacts to local greenhouse gas levels because the restoration of native plant species would act as a “sink” for greenhouse gases. Therefore, the issue of the contribution of non-native ungulate management activities to climate change through greenhouse gas emissions was dismissed from further analysis.

Streamflow Characteristics. The management of non-native ungulates would not occur in any areas or involve management actions that would potentially impact streamflow. There are no permanent streams in the park. Minimal surface waters, including a small number of temporary streams that occur during heavy rain events, are located in or adjacent to the park; therefore, the possibility that this resource would be impacted by management activities would be negligible.

Water Quality or Quantity. The management of non-native ungulates would not occur in any area or involve management actions that would potentially impact water quality or quantity. Minimal surface waters, including a small number of temporary streams that occur during heavy rain events, are located in or adjacent to the park; therefore, the possibility that this resource would be impacted by management activities would be negligible. Please refer to the "Marine and Estuarine Resources" section below for more information about anchialine pools.

Floodplains and Wetlands. There are no designated floodplains in the park that would be impacted by management of non-native ungulates. In Kahuku, vegetation mapping surveys in the 1970s and in 2005 failed to locate significant bogs in the area. The park has some small semi-bog areas in wet forests in ʻŌlaʻa that could be affected by management activities, particularly the management of feral pigs. However, these adverse impacts would be negligible, with possible minor beneficial impacts.

Marine and Estuarine Resources. The boundary of Hawaiʻi Volcanoes National Park includes the shoreline and associated habitats along the Pacific Ocean. Within the park, brackish anchialine pools along the shoreline serve as the only habitat for certain species. None of the actions proposed in this plan would affect the shoreline, estuaries, or marine environments of the park because past management of non-native ungulates has excluded animals directly upslope from these areas. In addition, it is not anticipated that upstream water quality or quantity would be measurably affected by the proposed actions; therefore downstream impacts would be negligible.

- Because impacts on marine and estuarine habitats would not likely be measurable, impacts on species inhabiting these environments are not anticipated. Of particular concern in these environs are federally listed threatened and endangered species. These include the Hawaiian monk seal (*Monachus schauinslandi*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricate*), and a candidate endangered endemic shrimp (*Metabetaeus lohena*).
- The Hawaiian monk seal is endangered throughout its range, with critical habitat designated in the Northwest Hawaiian Islands (a remote archipelago of small islands, largely protected as a marine reserve). Within the park, Hawaiian monk seals have been observed to haul out and bask along the shoreline. Because the use of the park by this species is limited, and because the marine and shoreline habitats of the park would not be affected under the proposed actions, the Hawaiian monk seal is not carried forward for analysis.
- Green sea turtles are most commonly found in fairly shallow waters (except when migrating) inside reefs, bays, and inlets. They prefer lagoons and shoals with an abundance of marine grass and algae, and require open beaches with a sloping platform and minimal disturbance for nesting (USFWS 2009i). The green sea turtle may forage offshore and occasionally haul out to bask on the park's beaches, but there are no known nesting sites at the park. Because the use of the park by this species is limited to basking on the shoreline, and because the marine and shoreline habitats of the park would not be affected under the proposed actions, the green sea turtle is not carried forward for analysis.
- Hawksbill turtles occur along the shoreline and surrounding waters of the island (NPS 2009i). They are typically found feeding in the vicinity of rock or reef habitats in shallow tropical waters with little turbidity (NMFS and USFWS 1998). Preferred nesting habitat includes low-energy

sandy beaches under the cover of woody vegetation (NMFS and USFWS 1998). Hawksbill nests are monitored and protected at ʻĀpua Point, Halapē, and Keauhou in the park. Because the marine and shoreline habitats of the park would not be affected under the proposed actions, the hawksbill sea turtle is not carried forward for analysis.

- The brackish-water shrimp is known to occur in low- to high-salinity anchialine pools. Anchialine pools are rare, localized brackish waters along coastal lava flows that are subject to tidal fluctuations but are not openly connected to the ocean (USFWS 2009c; USGS 2005b). Recent surveys (2004–2009) for *Metabetaeus* in Hawaiʻi's national parks have documented that it is widespread in this unique habitat type. Current studies indicate that adults are sensitive to increases in pool salinity (Foote 2009b). Because none of the proposed actions would affect water quantity, quality, or salinity in the shoreside anchialine pools, this species is not carried forward for analysis.

Unique or Essential Fish Habitat. The boundary of Hawaiʻi Volcanoes National Park includes the shoreline and associated habitats along the Pacific Ocean, but does not extend into the marine environment. Therefore, no unique or essential fish habitat is designated at Hawaiʻi Volcanoes. Because this habitat does not occur in the park, and because impacts on upstream water quality and quantity are not likely to be measurable, no impacts on nearby unique or essential fish habitat would be anticipated. Therefore, this topic is not carried forward for analysis.

Non-native Wildlife other than Ungulates. According to the Hawaiʻi Ecosystems at Risk Project (HEAR 2010), the invasion of Hawaiʻi by non-native mammals, birds, snakes, and insects is the single greatest threat to Hawaiʻi's economy and natural environment, and to the health and lifestyle of Hawaiʻi's people. These species have been introduced to the state either intentionally or by accident over hundreds of years. Within the park, there are a variety of non-native animals, including rats, mongooses, coqui frogs, and yellowjacket wasps, to mention a few. The presence of these species adversely affects native wildlife and vegetation across Hawaiʻi. Populations of these "other" non-native wildlife will be managed, as appropriate, under separate plans.

Disposal of Non-native Ungulate Carcasses. While alternatives A, B, D, and E provide for the salvage of meat from non-native ungulate carcasses, it is anticipated carcasses may also be left in the field to decompose under all alternatives. Animal carcasses left in the field have the potential to create unpleasant odors, attract flies and scavengers, transmit disease, and contaminate water. These impacts would be negligible in existing fenced units where large numbers of non-native ungulates have been excluded, the park is in the maintenance phase of management, and limited numbers of carcasses would be left in the field. In areas with larger populations of non-native ungulates proposed for future management, some impacts may occur during the reduction phase. However, this issue has been dismissed from further consideration for the following reasons:

- The potential effects of odors and flies are minimized given the rapid decomposition of carcasses in the humid and warm conditions typical to most areas of the park. Even at upper elevations where temperatures are cooler, carcasses typically take less than one month to completely decompose (barring fur and bones). Carcasses could also be moved from sensitive sites (such as roads, trails, and cultural sites), further minimizing the potential impacts of odors and flies.
- There are no native scavengers in the park, and the presence of animal carcasses during the reduction phase would only contribute to a local, temporary increase in non-native scavengers such as rats, cats, and dogs.

- Diseases such as rabies and chronic wasting disease do not occur on the islands and the potential for direct disease transmission from non-native ungulate carcasses to native animals and humans is considered very low.
- The potential effects on water quality are negligible, as minimal surface waters exist in the park (see the dismissal of Water Quality or Quantity in this section).
- Nutrients removed from the ecosystem by non-native ungulates eating vegetation, are returned to the ecosystem by leaving carcasses on site
- None of these issues would be long-lasting because once the maintenance phase is reached, the numbers of non-native ungulates removed are much lower and the potential for such impacts are reduced.

Museum Collections. Non-native ungulate management at Hawai‘i Volcanoes would mainly occur in the undeveloped areas of the park and would not impact the park's museum collections. Archeological items that could be included in the museum collection in the future are considered under the cultural/historical resources impact topic.

Historic Structures. The park contains a number of historic districts and structures listed or eligible for listing on the National Register of Historic Places (National Register). These properties include the Summit Rest House and the Mauna Loa Observatory Shelter. Although there are historic structures listed or eligible for listing on the National Register of Historic Places in the park, there would be negligible impacts on these structures from implementing non-native ungulate management. Prehistoric archeological structures, such as shrines, are addressed under the "cultural/historical resources" impact topic.

Energy Resources and Resource Conservation. Non-native ungulate management would not be expected to affect energy resources or resource conservation related to energy in the park.

Environmental Justice. The purpose of environmental justice is to ensure that (1) all people are treated fairly with respect to the development and enforcement of protective environmental laws, regulations, and policies; and (2) potentially affected community residents are meaningfully involved in the decisions that will affect their environment and/or their health. Conversely, allegations of environmental injustice refer to situations in which these social justice goals have not been met, indicating a perceived disproportionate exposure to environmental harms and risks. Examples of such risks may include health concerns (such as those associated with indoor and outdoor air quality issues and water quality issues), impacts on livelihood and subsistence, and other impacts on human health and prosperity.

Environmental justice is associated with Executive Order 12898, which was published on February 11, 1994. This executive order requires all federal agencies to incorporate environmental justice into their mission by "identifying and addressing … disproportionately high and adverse human health or environmental effects of [their] programs, policies and activities on minority and low-income populations in the United States" (Executive Order 12898, 59 FR 7629 [1994]). The broad goal of Executive Order 12898 is then tempered in Section 6-609 by the caution that "this order is intended only to improve the internal management of the executive branch and is not intended to create any right enforceable against the United States."

The EPA defines a community with potential environmental justice populations as one that has a greater percentage of minority or low-income populations than does an identified reference community. Minority populations are those populations having (1) 50 percent minority population in the affected area (EPA 1998); or (2) a significantly greater minority population than the reference area. There are no specific thresholds provided for low-income or poverty populations. For the purposes of this study, it is assumed that if the study area minority and/or poverty status populations encompass more than 10 percentage points higher than those of the reference area, there is likely an environmental justice population of concern.

Although the Big Island/Hawai‘i County was initially targeted as the study area, it was determined that further refinement was necessary to better understand the potential environmental justice populations living closer to the park. As a result, minority and poverty data was collected for Census Bureau block groups including and surrounding the park. This data was compared with environmental justice data from the Big Island/Hawai‘i County, Hawai‘i, and the nation. Figure 3 illustrates all Census Bureau block groups on the Big Island, the park boundary, and Census Bureau block groups encompassing and adjacent to the park (the study area).

In general, there are more White and Native Hawaiian and Pacific Islander populations and fewer Asian populations in the study area compared to the island as a whole. Table 1 shows that the percentage of Native Hawaiians and Pacific Islanders in Tract 213, Block Group 1 (in bold), in the westernmost part of the study area, is more than 10 percent higher than that of the island and the state.

Table 2 shows that the block groups encompassing and adjacent to the park have low-income populations, four of which (in bold) have poverty percentages that are 10 percentage points higher than those of the Big Island and of the state. Poverty rates in Tract 210.02, Block Group 4, are more than 10 percent higher than those of the state and 9 percent higher than poverty rates on the Big Island.

As these tables indicate, there are potential environmental justice populations of concern in the study area. The primary concern for these populations would be potential impacts to subsistence use as a result of achieving the desired conditions (removing all ungulates from the park). However, hunting and subsistence hunting is only allowed in units of the national park system under specific authorization by statute or regulation, per Section 4.4.3 of NPS *Management Policies 2006* (NPS 2006b). There is no such authorization in the statutes for Hawai‘i Volcanoes National Park. Under prior ownership, Kahuku was off limits to hunting by the general public (Avery 2009). Additionally, it is assumed that removal of non-native ungulates in the park would minimally impact the populations available for hunting on adjacent forest and state game reserves adjacent to Kahuku and other sections of the park. This is partly a result of ongoing boundary fence construction, which limits non-native ungulate movement between the park and adjacent lands. Therefore, park management actions would not impact environmental justice populations if they are using these surrounding areas for subsistence hunting purposes. As a result, the park ungulate management actions analyzed in this plan/EIS would have minimal to no impacts on environmental justice populations, and this impact topic was not carried forward for further analysis.

FIGURE 3:
Environmental Justice Study Area

TABLE 1: ENVIRONMENTAL JUSTICE INFORMATION FOR MINORITY POPULATIONS

Block Group	Total Population	White	Black	American Indian / Alaskan Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino
USA	281,421,906	80.00%	12.80%	1.00%	4.40%	0.20%	0.16%	1.60%	15.10%
Hawai‘i	1,211,537	29.10%	2.90%	0.50%	39.90%	8.90%	0.15%	18.60%	8.20%
Hawai‘i County	148,677	37.80%	0.90%	0.70%	24.20%	10.80%	0.19%	25.70%	11.00%
Aggregate of Block Groups	14,312	42.57%	0.71%	0.84%	14.95%	12.49%	0.96%	27.49%	8.83%
Tract 210.02, BlkGrp 3	3,367	33.65%	0.92%	0.00%	17.76%	13.25%	0.77%	33.65%	15.06%
Tract 210.02, BlkGrp 4	1,564	44.25%	0.00%	1.28%	6.33%	14.32%	1.53%	32.29%	9.53%
Tract 211.00, BlkGrp 4	2,460	53.86%	1.14%	0.77%	16.38%	8.94%	1.42%	17.48%	7.56%
Tract 212.00, BlkGrp 1	1,626	14.21%	0.00%	0.43%	42.44%	7.38%	0.49%	35.06%	7.07%
Tract 212.00, BlkGrp 2	3,179	55.21%	1.13%	1.70%	7.90%	9.15%	1.10%	23.81%	8.08%
Tract 213.00, BlkGrp 1	2,116	45.18%	0.33%	0.95%	4.68%	***22.97%**	0.43%	25.47%	2.36%

Source: U.S. Census Bureau 2009a.

*The percentage of Native Hawaiians and Pacific Islanders in this tract, in the westernmost part of the study area, is more than 10 percent higher than that of the island and the state.

TABLE 2: ENVIRONMENTAL JUSTICE INFORMATION FOR POVERTY-STATUS POPULATIONS

Block Group	Total Population	% In Poverty
USA	281,421,906	13.30%
Hawai‘i	1,211,537	9.10%
Hawai‘i County	148,677	13.40%
Aggregate of Block Groups	14,312	23.62%
Tract 210.02, BlkGrp 3	3,367	***26.50%**
Tract 210.02, BlkGrp 4	1,564	22.57%
Tract 211.00, BlkGrp 4	2,460	***24.99%**
Tract 212.00, BlkGrp 1	1,626	***24.09%**
Tract 212.00, BlkGrp 2	3,179	***24.78%**
Tract 213.00, BlkGrp 1	2,116	16.45%

Source: U.S. Census Bureau 2009a.

* These four block groups have poverty percentages that are 10 percentage points higher than those of the Big Island and of the state.

Prime or Unique Farmland Soils. Prime farmland soils are protected under the *Farmland Protection Policy Act* of 1981. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. The land must also be available for these uses: cropland, pasture land, forestland, or other land, but not water or urban built-up land. Prime farmland has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods (USDA-NRCS 2009b). Prime farmland does not include land already in or committed to urban development or water storage; land used or designated for commercial, industrial, or residential purposes is, therefore, categorically excluded from consideration. A 1973 soil survey conducted for the Island of Hawai‘i, which included Hawai‘i Volcanoes National Park, identified some soils in Hawai‘i Volcanoes that could be classified as prime or unique farmland soils. They are as follows (USDA-NRCS 2009c):

- Alapai hydrous silty clay loam consociation
- Mauna‘iu-‘Akelelu complex
- Ha‘a-Ke‘amoku complex
- Ki medial loam consociation
- Manu medial silt loam consociation.

However, areas containing these soils are not currently in active production, nor does the potential exist for them to be converted or developed, thereby precluding their potential use as productive areas in the future. As a result, prime and unique farmlands are not carried forward for further analysis.

RELATED LAWS, POLICIES, PLANS, AND CONSTRAINTS

The following laws, policies, and plans by the NPS, Hawai‘i, or agencies with neighboring land or relevant management authority are described in this section to show the framework this plan/EIS will need to operate under and the goals and policies that will be considered. It should be noted that Hawai‘i Volcanoes National Park has exclusive jurisdiction, and Hawai‘i does not have authority on park lands.

NATIONAL PARK SERVICE ORGANIC ACT, GENERAL AUTHORITIES ACT, AND MANAGEMENT POLICIES

By enacting the *Organic Act* of 1916, Congress directed the U.S. Department of the Interior and the NPS to manage units "to conserve the scenery and the natural and historic objects and wildlife therein and to provide for the enjoyment of the same in such a manner and by such a means as will leave them unimpaired for the enjoyment of future generations" (16 USC 1).

Because conservation remains predominant, the NPS seeks to avoid or to minimize adverse impacts on park resources and values. The Organic Act does give the Secretary of the Interior discretion to provide "for the destruction of such animal and of such plant life as may be detrimental to the use of any of said parks, monuments, or reservations" (16 USC 3), and the NPS Management Policies 2006 (NPS 2006b) give the NPS discretion to allow negative impacts when necessary.

The *National Park Service General Authorities Act* of 1970 supplemented the *Organic Act*, providing (as codified at 16 USC 1a-1):

> Congress declares that the National Park Service, which began with establishment of Yellowstone National Park in 1872, has since grown to include superlative natural, historic, and recreation areas in every major region of the United States, its territories and island possessions; that these areas, though distinct in character, are united through their inter-related purposes and resources into one national park system as cumulative expressions of a single national heritage; that, individually and collectively, these areas derive increased national dignity and recognition of their superb environmental quality through their inclusion jointly with each other in one national park system preserved and managed for the benefit and inspiration of all the people of the United States; and that it is the purpose of this Act to include all such areas in the System and to clarify the authorities applicable to the system.

Congress thus required the entire national park system to be managed as a whole and not as constituent parts.

The 1978 Redwood Amendment reiterates these mandates by stating that the NPS must conduct its actions in a manner that will ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress" (16 USC 1a-1). Congress intended the language of the 1978 Amendment (which was included in language expanding Redwood National Park) to reiterate the provisions of the *Organic Act*, not to create a substantively different management standard. The House committee report described the 1978 Amendment as a "declaration by Congress" that the promotion and regulation of the national park system is to be consistent with the *Organic Act* (NPS 2006a). The Senate committee report stated that under the 1978 Amendment, "The Secretary has an absolute duty, which is not to be compromised, to fulfill the mandate of the 1916 Organic Act to take whatever actions and seek whatever relief as will safeguard the

units of the national park system" (NPS 2006a). Although the *Organic Act* and the 1978 Amendment use different wording ("unimpaired" and "derogation") to describe what the NPS must avoid, both acts define a single standard for the management of the national park system—not two different standards. For simplicity, NPS *Management Policies 2006* uses "impairment," not both statutory phrases, to refer to that single standard.

Despite these mandates, the *Organic Act* and its amendments afford the NPS latitude when making resource decisions to allow appropriate visitor use while preserving resources. Because conservation remains predominant, the NPS seeks to avoid or to minimize adverse impacts on park resources and values. The NPS does, however, have discretion to allow negative impacts when necessary (NPS 2006a, Section 1.4.3, 10). Although some actions and activities cause impacts, the NPS cannot allow an adverse impact that impairs resources or values (NPS 2006a, Section 1.4.3, 10). In the administration of authorized uses, park managers have the discretionary authority to allow and manage uses, provided that the uses will not cause impairment or unacceptable impacts. The *Organic Act* and 1978 Amendment prohibit actions that impair park resources unless a law directly and specifically allows for the action (16 USC 1a-1) (NPS 2006a, Section 1.4.3.1).

Pursuant to the *NPS Guidance for Non-Impairment Determinations and the NPS NEPA Process*, a non-impairment determination for the selected alternative will be appended to the Record of Decision.

In addition, also applicable to the management of non-native ungulates is "Section 4.4.4, Management of Exotic Species." This section of the NPS *Management Policies 2006*, specifically "Section 4.4.4.2, Removal of Exotic Species Already Present," states:

> All exotic plant and animal species that are not maintained to meet an identified park purpose will be managed—up to and including eradication—if (1) control is prudent and feasible, and (2) the exotic species
>
> - interferes with natural processes and the perpetuation of natural features, native species or natural habitats, or
> - disrupts the genetic integrity of native species, or
> - disrupts the accurate presentation of a cultural landscape, or
> - damages cultural resources, or
> - substantially hampers the management of park or adjacent lands, or
> - poses a public health hazard as advised by the U.S. Public Health Service (which includes the Centers for Disease Control and the NPS public health program), or
> - creates a hazard to public safety.

These policies place a high priority on non-native species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controlled. If non-native species cannot be successfully eliminated, NPS policy directs that managers seek to contain these species to prevent further spread or resource damage.

OTHER NATIONAL PARK SERVICE AND FEDERAL LAWS, REGULATIONS, AND POLICIES

The NPS is governed by laws, regulations, and other policies before, during, and following any management action related to the development of a NEPA document.

National Environmental Policy Act of 1969, as Amended

NEPA Section 102(2)(c) requires that an environmental impact statement (EIS) be prepared for proposed major federal actions that may significantly affect the quality of the human environment.

Endangered Species Act of 1973, as Amended

The ESA requires all federal agencies to consult with the Secretary of the Interior on all projects and proposals having potential impact on federally endangered or threatened plants and animals.

Federal Noxious Weed Act of 1975

The *Federal Noxious Weed Act* (7 USC 2801–2814, January 3, 1975, as amended 1988 and 1994) provides for the control and management of non-native weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.

National Historic Preservation Act of 1966, as Amended

Section 106 of the *National Historic Preservation Act* requires federal agencies to consider the effects of their undertakings on properties listed on or potentially eligible for listing on the National Register of Historic Places. All actions affecting the park's cultural resources must comply with this legislation.

Wilderness Act of 1964

With the signing of the *Wilderness Act* by President Lyndon B. Johnson on September 3, 1964, the National Wilderness Preservation System was established to "secure for the American people of present and future generations the benefits of an enduring resource of wilderness."

The *Wilderness Act* states, "In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness." Although there is great similarity between the NPS *Organic Act* and the *Wilderness Act*, Congress applied the *Wilderness Act* to the NPS to strengthen its protective capabilities.

Under the *Wilderness Act*, the park must apply the "minimum requirement" concept to all management activities that affect the wilderness resource and character at Hawai'i Volcanoes. "Minimum requirement" is a documented process the NPS uses to determine the appropriateness of all actions affecting wilderness. This concept is intended to minimize impacts on wilderness values and resources. Managers may authorize (using a documented process) the generally prohibited activities or uses listed in Section 4(c) of the *Wilderness Act*, if deemed necessary to meet the minimum requirements for the administration of the area as wilderness and where those methods are determined to be the "minimum tool" for the project.

National Parks and Recreation Act of 1978

Public Law 95-625, passed November 10, 1978, designated 123,100 acres of land in Hawai‘i Volcanoes as wilderness. This act required that areas designated as wilderness shall be administered by the Secretary of the Interior in accordance with the applicable provisions of the *Wilderness Act*, as described above.

Antideficiency Act

The *Antideficiency Act* prohibits federal managers from making or authorizing expenditures in excess of the amount available to them from appropriations or other funds, unless authorized by law. Based on this, the plan/EIS created must be able to be implemented using expected funding sources.

Title 36, Code of Federal Regulations

Title 36 provides the regulations “for the proper use, management, government, and protection of persons, property, and natural and cultural resources within areas under the jurisdiction of the National Park Service” (36 CFR 1.1[a]).

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations”

The NPS must address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities, including planning projects, on minority populations and low-income populations.

Executive Order 13112, “Invasive Species”

This executive order requires the NPS to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

Executive Order 13186, “Responsibilities of Federal Agencies to Protect Migratory Birds”

Executive Order 13186 was established on the premise that migratory birds contribute to biological diversity, bring enjoyment to millions of Americans, and are of great ecological and economic value to this county and other countries. Under this order, federal agencies taking actions that have, or are likely to have, a measurable negative effect on the migratory bird population are directed to develop and implement a memorandum of understanding with the USFWS that promotes the conservation of migratory bird populations. This executive order also requires that the environmental analysis of federal actions required by NPS or other established environmental review processes evaluate the effects of the action and agency plans on migratory birds, with an emphasis on species of concern.

Director’s Order 77: Natural Resources Management Guideline (1991)

The *Natural Resources Management Guideline* (NPS 1991) provides guidance to park managers for all planned and ongoing natural resource management activities. Managers must follow all federal laws, regulations, and policies. This document provides the guidance for park management to design, implement, and evaluate a comprehensive natural resource management program.

Director's Order 41: Wilderness Preservation and Management (1999)

The purpose of Director's Order 41 (NPS 1999c) is to provide accountability, consistency, and continuity to the NPS wilderness management program, and to otherwise guide servicewide efforts in meeting the letter and spirit of the 1964 *Wilderness Act*.

Director's Order 28: Cultural Resource Management (1998)

This director's order sets forth the guidelines for management of cultural resources, including cultural landscapes, archeological resources, historic and prehistoric structures, museum objects, and ethnographic resources (NPS 1998). This order calls for the NPS to protect and manage cultural resources in its custody through effective research, planning, and stewardship in accordance with the policies and principals contained in the NPS *Management Policies 2006* (NPS 2006b).

Animal Welfare Act, as Amended (7 USC 2131–2159)

The *Animal Welfare Act* requires that minimum standards of care and treatment be provided for certain animals bred for commercial sale, used in research, transported commercially, or exhibited to the public. Individuals who operate facilities in these categories must provide their animals with adequate care and treatment in the areas of housing, handling, sanitation, nutrition, water, veterinary care, and protection from extreme weather and temperatures. Although federal requirements establish acceptable standards, they are not ideal. Regulated businesses are encouraged to exceed the specified minimum standards. Non-native ungulate management alternatives with a research component would be regulated by this act.

National Parks Omnibus Management Act of 1998

The *National Parks Omnibus Management Act* of 1998 (16 USC 5901 et seq.) underscores NEPA in that both are fundamental to NPS park management decisions. Both acts provide direction for articulating and connecting the ultimate resource management decision to the analysis of impacts using appropriate technical and scientific information. Both also recognize that such data may not be readily available and provide options for resource impact analysis in this case.

The *National Parks Omnibus Management Act* of 1998 directs the NPS to obtain scientific and technical information for analysis. The NPS handbook for Director's Order 12 states that if "such information cannot be obtained due to excessive cost or technical impossibility, the proposed alternative for decision will be modified to eliminate the action causing the unknown or uncertain impact or other alternatives will be selected" (NPS 2001a).

RELATIONSHIP TO HAWAI'I VOLCANOES NATIONAL PARK PLANNING DOCUMENTS

The purpose, need, and objectives for the plan/EIS should be consistent with park planning documents. These documents include the Hawai'i Volcanoes National Park Natural Resources Management Plan Final Environmental Statement (NPS 1974), Statement for Management: Hawai'i Volcanoes National Park (NPS 1985), Final Environmental Statement for the Proposed Wilderness Areas at Hawaii Volcanoes National Park (NPS 1975b), Kahuku: An Interim Operating Plan (NPS 2006a), the General Management Plan/EIS (NPS n.d.a), and various cultural and natural resource management documents described below.

Hawai‘i Volcanoes National Park Natural Resources Management Plan Final Environmental Statement (1974)

This natural resource management plan was prepared to provide direction to the park on biological research; propagating rare and endangered plant and animal species; reintroducing rare species into their former ranges; protecting rare, endemic biota from depredation by species introduced by modern man; and providing avenues for public knowledge of these unique Hawaiian ecosystems. It is consistent with the objectives of the park master plan (see discussion below) and includes specific information relative to the control of feral goats and pigs (NPS 1974).

The plan proposes reducing and controlling goat numbers and distribution to allow endangered Hawaiian plants to survive and become reestablished through the following actions: reconstructing and maintaining existing boundary and drift fences; constructing and maintaining drift and exclosure fences; removing goats using means that allow deputized citizens to assist in management actions, where effective; and removing goats by drives and roundups, as well as by direct reduction using trained goat dogs, conducted by NPS personnel (NPS 1974).

Similarly, the plan proposes reducing and controlling pig numbers and distribution to minimize effects on native Hawaiian vegetation. The plan includes actions such as removing pigs using means that allow deputized citizens to assist in management actions, where effective; direct reduction conducted by NPS personnel; and research on pig population control measures (NPS 1974).

Hawai‘i Volcanoes National Park Master Plan (1975)

The 1975 master plan addresses the issue of non-native animals in the park, and acknowledges that they are destroying some of the native vegetation and damaging other native animal species habitats. The plan addresses the role of future research in discovering new management methods for non-native ungulates that would provide greater options to control non-native animal populations. Past management efforts under this plan, specifically goat control programs using drives, NPS staff and local citizen participation, and drift fences, were successful in protecting portions of the park. This plan addresses further management of non-native ungulates in the park, proposing to fence an additional 40,000 acres (NPS 1975a).

Final Environmental Statement for the Proposed Wilderness Areas at Hawaii Volcanoes National Park (1975)

In relation to non-native ungulates, specifically feral pigs and goats, this document addresses the impact of non-native species in the park, indicating that feral pigs can be found in all four park units. Impacts of feral pigs addressed in the EIS include damage to native vegetation and the introduction of non-native plant species by disturbance of soils and native plant cover. Feral goats occupying the drier coastal and mountain sections of the park were also identified as needing management control. The following possible management measures for feral pigs and goats were identified: drives, roundups, and direct shooting by deputized citizens or park personnel. Other management measures included in the EIS were construction of fences and use of power tools and helicopter. The planning document acknowledges that the maintenance of native plant and bird populations is almost entirely dependent on the control of feral goats and pigs (NPS 1975b).

Statement for Management: Hawai‘i Volcanoes National Park (1985)

The *Statement for Management: Hawai‘i Volcanoes National Park* states, “regulations shall provide for the preservation from injury of all timber, birds, mineral deposits, and natural curiosities or wonders within said park, and their retention in their natural condition as nearly as possible.” It also states, “the purpose of Hawai‘i Volcanoes National Park is to conserve the volcanic features, endemic Hawaiian ecosystems, Hawaiian cultural and archeological remains, and inherent scenic values for visitor enjoyment and appreciation and for their scientific and historic values.” This document identifies the presence of non-native ungulates in the park as a major management issue, stating: “Establishing and maintaining effective control of feral animals, especially pigs, requires a substantial investment in boundary surveys, fencing, and applied research. About 4,000 feral pigs are causing irreversible damage to park forest lands, which is essential habitat for six endangered birds.” The park is further directed to “protect the park’s remnant Hawaiian ecosystems, including endangered species, from further depredation and competition by those non-native animals and plants introduced by modern people” (NPS 1985). These mandates and directives from the statement for management were taken into consideration during the development of this plan/EIS for protecting park resources from non-native ungulate impacts.

Hawai‘i Volcanoes National Park Resource Management Plan (1999)

The natural resource goals of the resource management plan state that a primary goal is to restore the park’s ecosystems through the removal of key non-native species, followed by natural recovery, and to expand restoration efforts currently focused on localized areas to a parkwide scale. The plan describes the status of non-native vertebrates on the island and how they contribute to the destruction of native flora and fauna. It also provides strategies and key actions for non-native animal control, with extensive descriptions concerning each mammal species (NPS 1999a). This document is the main resource management planning document at the park, and its goals were considered in the development of this plan/EIS for protecting park resources from non-native ungulate impacts.

Hawai‘i Volcanoes National Park Fire Management Plan (2005)

The purpose of this plan is to develop and improve the park’s fire management program to protect human life, property, and cultural resources, and to maintain or restore natural resources. This plan will facilitate the implementation of current national fire plan direction. Portions of the growing community of Volcano on the park’s boundary are threatened by fire starting in the park; park resources are threatened by fire starting in the community. In addition, the acquisition of the 116,000-acre Kahuku Ranch in 2003 posed a new wildland/urban interface issue with the adjacent community of Hawaiian Ocean View Estates (NPS 2005a).

Under the new plan, wildland and prescribed fire are used whenever appropriate as tools to achieve resource management objectives. A naturally ignited wildland fire may be managed to accomplish resource management goals, depending on the fire management unit where it occurs. Initial suppression action will be taken to minimize cost and damages and to prevent the escape of any wildland fire. The intensity of response may range from aggressive suppression action to monitoring with minimal on-the-ground actions. Guidelines for determining specific strategies are described in the fire management plan. All human-caused fires will receive a suppression response commensurate with values to be protected, firefighter and public safety, and cost efficiency (NPS 2005a).

Prescribed fires, classified as those ignited by managers to accomplish resource management objectives, generally have three main objectives: (1) wildland fire hazard reduction; (2) reintroduction of fire as an ecological process; and (3) other resource benefits. Prescribed fire may be used in support of ecosystem management to maintain or restore plant communities or cycle nutrients, reduce or remove exotic plants, and for a variety of other resource management objectives (NPS 2005a).

Kahuku: An Interim Operating Plan (2006)

The interim operating plan directs the management and public use of the Kahuku District, an 116,000-acre addition to Hawai‘i Volcanoes. This document provides guidance for managing this section of the park using established procedures and policies until an updated general management plan (GMP) is completed. Non-native ungulate control is addressed in the “natural resources” section, which describes efforts to recover approximately 6,500 acres of koa forest through the control of non-native ungulates and construction of a 10-mile fence along the park boundary bordering Kīpāhoehoe and Manukā Natural area Reserves, Kona Hema Preserve, Yee Hop Ranch, and other landholdings (NPS 2006a).

A second component of non-native ungulate management requires the construction of ungulate-resistant fences along portions of the park boundary and at strategic internal locations. Due to the success of the first 10 miles of fencing, two 8-mile fence segments were constructed and funding for additional fencing has been requested. Although the entire Kahuku plan would be considered in the development of this plan/EIS, additional management actions called for in the interim operating plan that would be applicable to the non-native ungulate management planning process include constructing small fenced exclosures to protect populations of rare plants at risk of extirpation from ungulates; monitoring vegetation in plant communities impacted by ungulates; and conducting experiments to evaluate recovery of vegetation following exclusion of animals and identify additional measures to restore native plant diversity in small fenced exclosures (NPS 2006a).

General Management Plan/EIS (Ongoing)

In the spring of 2009, the park began the process of drafting a new GMP/EIS. The plan will answer the question: “What kind of place do we want this park to be?” It will serve as a guidebook for the next 15 to 20 years to help managers make decisions about how to best protect natural and cultural resources, the appropriate levels and types of uses, the facilities that should be developed, and how people should access the park.

It has been more than 30 years since the park’s previous master plan was completed. Since that time, the park has experienced increased visitation, advances in knowledge about ecological and cultural resources, and numerous volcanic eruptions with the resultant loss of buildings and roadways. In 2003, the park grew by 116,000 acres with the acquisition of Kahuku on the southwest slope of Mauna Loa Volcano.

The park’s general management planning effort will develop a strategic vision for the entire park. This presents an opportunity to position the park as an environmental leader in creating climate-friendly and sustainable park operations, including reducing the park’s carbon footprint. It is also very likely that the GMP/EIS will address desired conditions and management actions pertaining to non-native ungulates in the park. It is expected that the GMP/EIS planning process will be completed in 2014.

NON-NATIVE UNGULATE MANAGEMENT BY OTHER FEDERAL, STATE, AND LOCAL AGENCIES/ENTITIES IN THE REGION

Hawai‘i Volcanoes is surrounded by other federal, state, and privately held land, as shown in figure 4. The agencies and organizations that own these lands include the USFWS, the Hawai‘i, Kamehameha Schools, and TNC. Each of these entities has different mandates, and further details about management of the land in the vicinity of the park is provided in “Chapter 3: Affected Environment.”

These entities, along with the park, Kulani Correctional Facility (State Department of Public Safety), U.S. Geological Survey (USGS) Biological Resource Division, U.S. Forest Service (USFS), and U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), are part of the TMA (formerly ‘Ōla‘a–Kīlauea Partnership). This alliance, the largest cooperative land management effort focused on watershed protection in Hawai‘i, seeks to manage invasive species and protect native species across land ownership boundaries. Regarding non-native ungulates specifically, the TMA seeks to eliminate and/or reduce damage in high-priority native ecosystems and watersheds while providing for increased hunting opportunities in designated areas (TMA 2007).

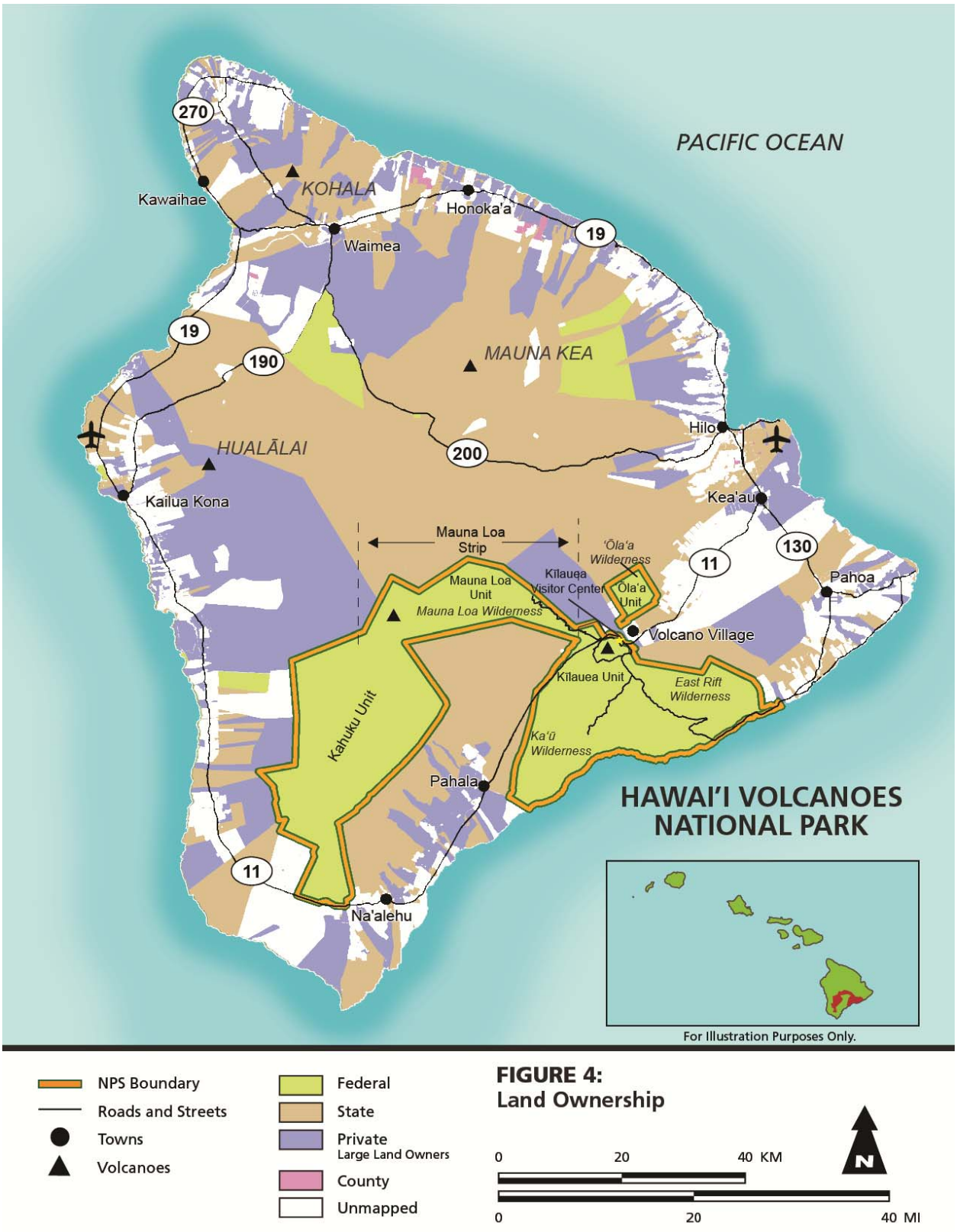

FIGURE 4:
Land Ownership