

PROPOSAL FOR THE NAKULA NATURAL AREA RESERVE
April 2010

I EXECUTIVE SUMMARY

A portion of the Kahikinui Forest Reserve (FR), on the island of Maui, is proposed for inclusion in the State of Hawai`i Natural Area Reserve System (NARS). Designation of the area as the Nakula NAR will not only protect unique natural features and endangered species found there, but will have a positive effect on other conservation efforts in the region. The NARS Commission recommended this proposal on January 20, 2010, after approval of the proposal by the Division of Forestry and Wildlife (DOFAW).

II INTRODUCTION (General)

DLNR proposes that a portion of the Kahikinui FR, on the southern slope of Haleakala, become part of the State of Hawai`i Natural Area Reserves System. This NAR would include an area of approximately 1,517 acres in the Nakula region on the south slope of Haleakala volcano.

This proposed Nakula NAR contains a sampling of native plant communities typical of the upland slopes of leeward Haleakala. The majority of these are globally imperiled, and none are well represented within the Statewide NAR system. Special protection is needed for a tract of *Koa* dominated forest that occupies the proposed NAR. Leeward Haleakala's *Koa* forest is a unique resource that is rapidly disappearing, and establishment of a Nakula NAR will protect a significant portion of what remains.

20 species of rare plants have been reported from the proposed NAR or adjacent lands with similar habitat; 8 of these are listed as endangered. The proposed Reserve is adjacent to Federally designated Critical Habitat areas that have similar habitat types.

At present, the area is habitat for two endangered birds, the endangered Hawaiian bat, and the endangered moth *Manduca blackburni*. A forest restoration program intended to improve habitat for other rare forest birds and plants is ongoing.

III BACKGROUND AND HISTORY

Past Land Use

The proposed NAR is part of a larger tract established as the Kahikinui FR on December 22, 1928. The original Kahikinui FR included *mauka* lands at Kahikinui, Nakula, Kaupo, Nu`u, Wailaulau, and Papa`anui. These lands totaled approximately 16,013 acres that are now owned by the State of Hawai`i, private entities and the Department of Hawaiian Homelands (DHHL). Management responsibility was originally given to the Territorial Department of Forestry.

The FR System was created by the Territorial Government of Hawai`i in 1903 to provide the necessary water requirements for lowland agriculture demands and surrounding communities by protecting and enhancing important forested *mauka* lands for their abundance of public benefits and values.

Correspondence dating from this time repeatedly mentions that large herds of

feral goats, as well as cattle trespassing from neighboring ranches, were considered a critical threat to the survival of this forest.

Numerous attempts were made over the years to address these issues, typically involving construction of cattle fences along forest boundaries, and establishing accesses for goat hunters. However success was very limited and goats and cattle in the Nakula region were largely left uncontrolled due to the remoteness of the location and limited resources available, coupled with the fact that there are no important water resources harvested there as found elsewhere in other FR's (i.e. ground or surface harvested water) like in E. Maui. Some level of goat control was achieved through public hunting; primarily in the western portion of the Forest Reserve via a road and trail that started near the lower Skyline Trail above Polipoli State Park and ended at Waiopai Gulch 3.5 miles away. Access was managed and maintained by DOFAW through a cooperative agreement with the Department of Hawaiian Homelands (DHHL) that established the Kahikinui Game Management Area. In 1984, 8,747 acres of DHHL land was withdrawn from the Forest Reserve in accordance with Attorney General opinion No. 75-3, dated March 21, 1975.

In 1994, the DHHL rescinded its access and management agreement with DOFAW. While the intent of this action was to allow DHHL to manage forest lands for the benefit of settlers on Hawaiian Homelands, it has restricted DOFAW's ability to manage State lands at Nakula since the only feasible hunter access to Nakula involves crossing DHHL lands by jeep and foot trail. After the withdrawal, this access was closed to the general public. Nakula was landlocked, and public hunting has essentially ceased again leaving goats and other feral animals in the Nakula region to be largely left uncontrolled.

Present Land Use

The Nakula portion of the Kahikinui FR is presently managed by the DOFAW. It is available for daily public hunting of feral pigs and goats as part of hunting unit C. DOFAW does not maintain a hunter check station for this area, nor are harvest reports kept. There is no road or developed foot trail to the area except that through DHHL which is not open for public use. With permission, it can be accessed through the DHHL lands to the east; or through lands owned/leased by Haleakala Ranch to the south. These accesses are not available to the general public. The upper portion of Nakula cannot be reached from the Haleakala National Park due to "stay on trail" rules. No trails from the park lead to the Kahikinui FR.

Cultural/Recreational Uses

An archaeological reconnaissance study and cultural practices assessment of the area was recently conducted. The survey primarily covered the area around the parcel perimeter, and no historic sites were recorded there. The report also states that due to the steep terrain and high elevation in the area, it would be "expected to contain few sites, especially given the rugged topography of the area. If present, sites would include rock shelters, cairns, quarry sites, petroglyphs, ridge trails or other temporary-use sites." No ongoing cultural practices were identified.

Hunting for pigs and goats is presently allowed in the DOFAW administered portion of the Kahikinui FR. The area is extremely remote, and there is no public access across the private and leased lands that surround it. As a result, DOFAW does not maintain check stations or other means to monitor hunting or other activity in the area.

The region continues to have an abundance of game animals, primarily goats as was noted from the 1920's. Hunters who have permission to use the surrounding lands are easily able to take their 'bag limit' long before reaching the Nakula tract; the core of this remote area rarely, if ever, sees hunters. There are no developed trails or roads to the area; it can only be traversed by following rugged cross-country routes.

Conservation History

Until recently, very little conservation activity had taken place at Nakula. The need for forest protection was obvious when FR designation occurred 1928. Goat and cattle control were sporadically undertaken when resources became available.

During the 1980's, a strategic fence intended to protect rare plants in a very small portion of Manawainui gulch (on DHHL lands adjacent to Nakula) was installed, but this is not regularly maintained.

After the Kahikinui lands reverted to DHHL, community interest in forest restoration began to increase. In 1995, the Kahikinui Forest Partnership Working Group submitted a community forest management plan to the DHHL. This group later took the name Living Indigenous Forest Ecosystems (LIFE) and assumed a lease over a portion of the DHHL owned forest lands. Their goal is to involve settlers on Hawaiian Homelands with the stewardship of the Kahikinui Forest. One ongoing LIFE project involves construction of a fence to protect the most intact forested area on DHHL lands. This project is adjacent to the proposed Nakula NAR.

In 2003, ten land owners, including the State of Hawai'i, signed a memorandum of understanding for the Leeward Haleakala Watershed Restoration Partnership. The intent of the partnership is to support restoration of native ecosystems [primarily *Koa* forests] on 43,000 acres of leeward Haleakala above 3500' elevation, creating framework for regional cooperation and fund raising.

In 2004, DOFAW began work on an ungulate proof fence intended to enclose a portion of the Nakula tract. The purpose of the fence is to exclude ungulates, allowing regrowth of *Koa* forest, and subsequent reintroduction of endangered forest birds to an improved habitat on leeward Haleakala. The project is being undertaken in cooperation with DHHL and LIFE, as the fence will protect forest on their lands as well. By late 2005, the lower boundary fence of the Nakula tract (between Waiopae and Pahihi gulches) had been completed, and funds for additional sections had been encumbered.

The NARS Commission advises the governor and the department about preservation of natural resources in Hawai'i, and has the statutory duty under HRS § 195-7 to "Conduct studies of areas for possible inclusion within the reserves system; Recommend to the governor and the department areas suitable for inclusion within the reserves system." To fulfill these duties, the Commission has studied, discussed, and prioritized areas that would be appropriate to include into the NARS. In 2005, this area was prioritized, and a proposal was presented to the Maui Branch of DOFAW in 2007. In 2008, the Enhancement Initiative of the NARS Commission again prioritized this area as

“biologically important.” In 2009, a NAR proposal that contained the entire FR, except for 900 acres of the southeast portion, was discussed with staff from the Maui and Administration branches of the Division of Forestry and Wildlife, and a NARS Commissioner. That meeting discussed the public access and current fencing situation, potential recreational values, and highlighted the imperiled ecosystem and species. There was also discussion and positions taken about various options for the original NAR proposal, no NAR proposal, and a proposal that included all of Kahikinui FR.

The NARS Commission Enhancement Subcommittee asked that further discussions with Maui Branch yield management recommendations for the area. In May 2009, the Maui Branch met and consensus was made on a revised and smaller NAR proposal, which did not include the eastern portion of the FR. Additionally, the branch agreed that public access should also continue to be pursued, especially for hunters.

Previous Studies

A biological survey was done as part of an Environmental Assessment. Medeiros, et al. (1986) surveyed Nakula as part of a larger survey of South Haleakala’s native vegetation. Over the course of his career, Robert Hobdy, retired Maui Forester, often spent time in the area and documented numerous rare plants.

No inventory of the area specifically proposed for NAR designation has been conducted.

IV JUSTIFICATION (Specifics)

Scientific Value

The primary reason for designation of the Nakula NAR is to protect an example of the leeward Haleakala *Koa* forest. This forest once covered an estimated 40,000 acres, extending from Makawao to Kaupo. It has been so badly impacted by human activities (primarily logging and cattle ranching) that it has been reduced to perhaps 5% of its’ original range, and even this has been severely degraded. Active protection is necessary to prevent this last remnant of forest from disappearing.

Leeward *Koa* forests on slopes of the larger Hawaiian volcanoes, are unique in that the forest depends largely on precipitation and fog drip from afternoon clouds created by convection and diurnal heating. They differ markedly from *Koa* forest that occurs on the windward slopes of the islands (an example is present at Hanawi NAR). Those forests are affected by the trade winds, and are much wetter, with a different suite of associated species.

Another important natural attribute of the proposed Nakula NAR are the numerous small gullies that incise the mountain slope. These sheltered gulches provide moist, shady habitat for several rare plant species in what is otherwise a harsh, dry environment. The steep walls of the gulches have provided refuges in which the plants have been saved from goat browsing till now, but may not last for much longer.

The dramatic elevation change across the proposed reserve (5600 vertical feet in 2½ miles), and the corresponding change in moisture regimes has compressed several native habitats (from alpine summit desert to the moist forest of the afternoon fog belt)

into a relatively small area. In addition to allowing for great species diversity in a compact area, the Reserve has potential to serve as a natural transect for studying such things as changes in vegetation in response to climate change.

Upland leeward *Koa* forest occurs on Mauna Loa, Mauna Kea and Hualalai volcanoes on the island of Hawai`i. Only a few examples are protected, primarily in Hawai`i Volcanoes National Park, Manuka NAR and Kipahoe NAR. Nakula has a much older geologic substrate than these Big Island locations, providing opportunities to compare patterns of plant succession and soil development.

The proposed Nakula NAR supports several different native habitats and a variety of native plant species. Numerous rare plant species are known from the area and surrounding lands. Common native forest birds inhabit the area; two endangered bird species and the Hawaiian bat are also present. The area has been proposed as a reintroduction site for the endangered Maui Parrotbill, Maui `Alauahio, and `Akohekohe. The Revised Recovery Plan for Hawaiian Forest Birds for the Maui Parrotbill populations states:

On southern and western exposures of East Maui (Haleakala), a continuous “lei” or ring of suitable forest should be reconnected around the mountain, especially at upper elevations where mosquitoes are rare. Although the current parrotbill population is restricted to the wet ohia forest of windward East Maui, this may represent a contraction of range into marginal habitat following widespread habitat loss and degradation (Simon et al. 1998). Parrotbills were once found throughout leeward areas and are thought to prefer koa for foraging (Perkins, 1903). Habitat restoration and reestablishment of a population on the leeward or western exposures of East Maui is needed to help reduce extinction risk, and to increase the ecological breadth of the species to help buffer against climatic fluctuations. The restoration of koa to these montane regions is a key element of habitat restoration in these areas.

A small amount of unprotected, remnant mesic koa forest currently exists on State Forest Reserve and Department of Hawaiian Homelands properties in the Kahikinui region of southern Haleakala. This area holds great potential to provide suitable habitat for the parrotbill. (USFWS, 2006)

The Recovery Plan also states that recovery actions for the `Akohekohe, including reestablishment of a leeward population, are similar to plans for the Parrotbill (USFWS, 2006). Regarding conservation actions for the Maui `Alauahio: “ongoing fencing and ungulate control on Department of Hawaiian Homes Lands at Kahikinui will likely benefit the small `alauahio population there, and in general conservation efforts should also include continued protection and management of wildlife sanctuaries and refuges” (Mitchell, et al. 2006).

Invertebrates in the area are poorly studied, but it is likely to be important habitat for native insects. For example, the mesic *Koa* forest is habitat for native Carabid beetles. Recent surveys of relict *Koa* elsewhere on Haleakala revealed surprising beetle diversity, including new species and rediscoveries of insects thought to be extinct. The *Koa* at Nakula, which has never been inventoried, has a potentially rich beetle fauna as well.

Designation of this area as a NAR will “complete” the protection of representative examples of the natural communities found on the leeward slope of Haleakala. When combined with the nearby Kanaio NAR and Auwahi Preserve (mid-elevation dry and mesic forests), ‘Ahihi-Kina‘u NAR (marine and low elevation xeric habitat) and the Pu‘u O Kali Preserve (lowland dry forest), designation of a Nakula NAR that includes montane and subalpine habitats will create a system of protected areas that encompass the entire range of elevation on leeward Haleakala – from sea to summit.

Representativeness

Most of the native habitats in the proposed reserve have been degraded to some degree; primarily by grazing animals such as cattle and goats. Excellent examples of native vegetation persist at higher elevations and on the walls of canyons too steep for ungulates to access. While the often severe alteration of natural conditions in some areas might be seen as a reason to preclude NAR designation for Nakula, the unique nature of this ecosystem, and the potential for recovery make it desirable for inclusion.

HRS Chapter 195 specifically allows for the preservation of areas “as relatively unmodified as possible”, and “as natural a condition as practicable.” Given that the Nakula tract contains the best remnant of a unique ecosystem as yet unprotected on Maui, some level of degradation can be accepted. All of the lands within the NAR system can be said to be altered from their natural condition to some degree; the Nakula tract is no more degraded than many other Reserves.

There are five native vegetation communities within the proposed Nakula NAR. They include a dry subalpine shrubland, two dry subalpine forest types, and two types of montane mesic forests. All four of the forest communities are considered globally imperiled due to their limited remaining range and severity of threats. The shrubland is considered vulnerable. Protection of the *Koa/‘Ohi‘a Montane Mesic Forest* is the primary reason for creation of the Nakula NAR. While this plant community exists elsewhere, the leeward Haleakala occurrence has a unique mix of associated plant (and invertebrate) species. As such, it is important to preserve this last remaining example of a previously widespread forest.

Above the 1600m elevation is classified as subalpine, with the remainder of the proposed Reserve in the montane mesic zone, except for a small portion of dry cliff in Wailaulau gulch (TNC, 2006). The NARS currently represent very small portions of subalpine (10 acres) and montane mesic (340 acres) habitat on Maui, located on the windward side of Haleakala in Hanawi NAR (Menard, 2008).

Besides the *Koa/‘Ohi‘a* forest, the other natural vegetation communities of Haleakala’s leeward uplands are not well represented in the Hawai‘i NARS. Similar montane and subalpine habitats are protected in the Manuka and Kipahoe NARs on Hawai‘i, but in limited extent and on very different geologic substrate.

Some Dry Montane and Subalpine shrublands and forests are protected in Haleakala and Hawai‘i Volcanoes National Parks. All of these occurrences are threatened by fire, and on the Big Isle, by volcanic activity as well. Tropical dryland forests (especially those at high elevation) are among the most imperiled ecosystems in the world. Establishment of a Nakula NAR would be an important step in preserving what remains of this rapidly vanishing habitat.

Natural Communities and their Status

Plant community classifications follow Gagne and Cuddihy in Wagner et al., 1999.

Between the top of the proposed reserve at 9200' and approximately 8000' *Pukiawe/Oheo Dry Subalpine Shrubland* predominates, and is relatively intact. A dense *pukiawe* shrubland predominates, interspersed with native grass and fern patches. Feral goats and pigs are present, and have disturbed limited areas.

Between 8000' and 6500', the vegetation has been severely impacted by goats and the mountain has been mostly denuded of native vegetation. However, remnants of '*Ohi'a Subalpine Dry Forest* and *Mamane Subalpine Dry Forest* can still be found in some of the steeper gulches, or in areas where the underlying substrate has resisted erosion.

Below the temperature inversion layer at about 6500' elevation, a *Koa/Ohi'a Montane Mesic Forest* develops. At the upper reaches, this forest is a dry subtype, with *Koa* canopy and an understory of tall 'A'ali'i shrubs. As moisture increases with decreasing elevation, species diversity and tree size increase, with this community being best expressed between 3500' and 4500' elevation. Most of the rare species listed later in this document would be expected to occur in this habitat. Due to ungulate grazing, the natural forest understory has been largely eliminated and replaced by introduced pasture grasses. However, gulches, cliff faces and other protected areas still contain a diverse assemblage of native ferns and other understory plants.

This portion of the Reserve also contains numerous gulches that provide a unique sheltered microhabitat, as well as springs and seeps that feed intermittent streams.

Below 3500' elevation, moisture decreases, and the vegetation grades into a very degraded remnant of what was once a diverse assemblage of dryland trees; classified loosely as *Olopua Montane Mesic Forest*. This community is found in a very small area at the lower extent of the proposed Reserve; within the canyon of Wailaulau gulch.

Rarity

Three plant species listed as endangered (E) or candidates for listing (C) for have recently been recorded within the boundaries of the proposed Nakula NAR, as well as two Species of Concern (SOC). There are an additional 15 rare plant species recorded from similar habitat in the immediate surrounding area (6 E, 5 C, 4 SOC) that could potentially occur within the proposed NAR, or would be appropriate for reintroduction. See Table 1 in the Appendix for a complete listing of rare plants known from the area.

East of Pahihi gulch falls within unit "H" of Federally designated critical plant habitat (CH) on the island of Maui. It includes critical habitat for the following endangered plants: *Argyroxiphium sandwicense ssp. macrocephalum* (Haleakala silversword), and *Bidens micrantha ssp. kalealaha* (ko'oko'olau).

Critical habitat for numerous other species was designated on the lands immediately adjacent to Nakula (the DHHL lands). The State Forest Reserve was excluded from CH designation to prevent adding additional regulatory burdens to conservation practices on the land, but is still important habitat. The exemption from CH designation implies that the State intends to implement protective management on these

lands independent of Federal mandate. NAR designation is consistent with this goal.

In addition to the individual rare species, the *Mesic Montane Koa*/*'Ohi'a* forest ecosystem that is the ‘centerpiece’ of the proposed NAR is itself rare. Logging, cattle ranching and fire have greatly reduced the extent of this forest type statewide. On Maui, it has been reduced to perhaps 5% of the original range, of which the Nakula tract is a significant portion. This forest type, as well as the dry subalpine *Mamane* and *'Ohi'a* forests at higher elevation, are considered globally imperiled.

The Hawaiian goose or *Nene* has been observed in the area, and the rocky Subalpine uplands are potential nesting sites for the Hawaiian petrel or *'Ua'u*. The Hawaiian hoary bat (*'Opeape'a*) is also a likely resident of the area. All three of these are endangered species.

As stated earlier, the aim of the forest restoration project is to restore the *Koa* forest community in order to expand habitat to provide for reintroduction of the endangered Maui parrotbill. Other rare Maui forest birds such as the *'Alauahio* and *'Akohekohe* may also benefit.

Biological/Ecological Design

The boundaries of the proposed Nakula NAR were drawn to include areas where native canopy still exists, where soil loss and noxious weed invasion are limited, and where restoration efforts would be feasible. Extremely steep and/or highly degraded areas were excluded.

A primary consideration in the design of the Reserve was to capture the dramatic elevation change (5600 vertical feet in 2½ miles), and the corresponding change in moisture regimes (from the moist forest of the afternoon fog belt up to the harsh desert at the summit), that compresses several native habitats into a relatively small area.

A secondary consideration was to capture as much lateral variation along the mountain contour as possible. Geologic or climactic factors seem to be influencing timberline and forest composition across the mountain slope. *Koa* dominated forest is prevalent on the western side of the proposed Reserve, while a dry forest of *'Ohi'a* trees persists at high elevations to the east.

Noteworthy geologic features include highly dissected exposures of the Kula volcanic series, mantled with soils derived from ash and cinder deposits. The Pu'u Ali'i cinder cone is a prominent feature located at 8000' elevation.

The numerous gullies and gulches along the heavily dissected mountain slope provide sheltered micro-habitats that allow forest vegetation to ‘finger’ upslope into the subalpine region. These drainages also hold numerous springs and seeps which may provide habitat for native invertebrates.

From a regional perspective, the proposed Nakula NAR is important because of the contrast it will provide to activities on surrounding lands. A major force driving the Leeward Haleakala Watershed Restoration Partnership is the desire to develop a sustainable commercial *Koa* forestry industry on Maui. Having a protected Natural Area at the core of an area where natural resources are available for industrial and/or indigenous use is in line with sustainable land use model applied world-wide.

Another consideration in the design of this preserve relates to the protection of *Koa* forest on a statewide level. *Koa* is by far the most valuable native tree species in

Hawaii. Protecting natural genetic diversity is an important consideration for development of a commercial forest industry.

Koa occurs on most of the major Hawaiian islands. On the larger islands, there are often disjunct populations, with different tree morphology; roughly corresponding to lowland/windward/wet and montane/leeward/mesic subtypes. The second subtype (present at Nakula) generally produces the most valuable timber.

Table 3 in the appendix provides a matrix of the distribution of these *Koa* subtypes state-wide, and lists some of the areas that the *Koa* forest is (or could be) under active management with a mandate for preservation of the ecosystem and genetic diversity. A review of this table shows that establishing a Nakula NAR will fill the last major gap in protection of important areas of *Koa* diversity state-wide.

Location and Size

The proposed Nakula NAR is located on the southern slope of Haleakala on Maui in the Hana District, and includes approximately 1,517 acres (out of 3,700) of land presently within the State's Kahikinui FR. The area is identified as a portion of TMK 2-1-8-1-6 and 2-1-8-1-9. Final survey will determine exact boundaries, attached map contains approximate location and is subject to change.

The NAR boundaries are designed to encompass a wide elevational gradient. The lower elevation portion of the Kahikinui FR (the most makai 900 acres), which is part of what is excluded from this proposal is highly degraded and may be better suited for other uses, such as game management.

Neighboring the proposed reserve to the north (uphill) and is Haleakala National Park. To the west are lands administered by the Department of Hawaiian Homelands (DHHL). South and east neighbors are State-owned lands leased for pasture, and that portion of the Kahikinui FR not proposed for NAR designation.

Threats (Human/Biological)

The greatest immediate threat to the proposed Nakula NAR is continued grazing and trampling by feral ungulates, including goats, cattle, deer and pigs.

Secondary threats include fire, and invasion by non-native weeds, including pasture grasses, as well as trees such as *Bocconia*, and *Grevillea*.

Tertiary threats include the loss of genetic diversity as population of native plants, birds and invertebrates decline.

Present Level of Protection

The proposed NAR lies within the State Conservation District, Resource (R) Sub-zone.

According to Hawai`i Revised Statutes, Title 13, Chapter 5, the objective of the Resource Sub-zone is to "...develop, with proper management, areas to sustain use of the natural resources." Some allowable activities identified for the Resource subzone include national, state, county or private parks; outdoor recreation; commercial forestry; mining and extraction; astronomy facilities, and aquaculture.

However, the R Sub-zone may not be appropriate for this area. The Limited (L)

Sub-zone is recommended for areas “...susceptible to floods and soil erosion, lands undergoing major erosion damage requiring corrective action...”, and areas with a “general slope of 40 percent or more.” The Protective (P) Sub-zone includes lands “necessary for protecting watersheds” and “necessary for preserving natural ecosystems of native plants, fish and wildlife, particularly those which are endangered.”

Given the environmentally fragile nature of this area, and the presence of endangered species, a change in Sub-zone to L or P is warranted, particularly if NAR designation takes place.

The area proposed as a NAR is presently within the FR system.

Long-term Ecological Viability

Despite being degraded by years of cattle and goat activity, the Nakula forest has great potential for natural regeneration. It has been repeatedly demonstrated that *Koa* forest can rapidly reclaim disturbed areas once grazing animals are removed. Restoration of degraded areas at higher elevations may be problematic, but it should still be possible to restore native vegetative cover to many of the now denuded areas.

If Kahikinui and the other areas adjacent to the Nakula tract are not protected, this area will be difficult to sustain as a natural system. However, the recent interest in restoration of the regional watershed is encouraging. Designating this important core section of Haleakala’s leeward forest as a NAR would enhance the ability of the Reserve System to participate and contribute to conservation and restoration actions across the entire watershed.

Environmental Consequences of No Action

The environmental consequences of no action will likely be the continued degradation and eventual loss of this unique remnant of Maui’s natural heritage.

Urgency

Degradation of this area by cattle and goats is well documented and has been happening for almost 200 years.

With the recent push for fencing and restoration, it is entirely appropriate that native ecosystem restoration efforts be placed under the purview of the NARS program.

NAR designation will allow better cooperation and increased resources available for the Partnership.

V. MANAGEMENT NEEDS

Threats Requiring Management

As noted earlier, threats to the proposed addition to the proposed Nakula NAR include:

- Grazing and trampling by feral ungulates, including goats, cattle, deer and pigs.
- Invasion by non-native plants, including pasture grasses and non-native weeds.
- Fire.

- Loss of genetic diversity.

Protective management would primarily entail construction of fences (on-going) to exclude feral ungulates from the reserve, and the removal of any animals within the fences.

Weed control would focus primarily on eradicating incipient populations of non-native tree species. Natural regrowth/replanting of Koa may provide a natural control for pasture grasses as increased canopy cover may shade them out.

Fire threats could be mitigated by developing fuel breaks or shade belts to slow fire spread, as well as developing infrastructure such as reservoirs and helicopter dip tanks.

Outplanting, predator control and translocation of native wildlife would address the loss of native biodiversity.

Administrative (size, boundaries, access: roads & trails, maps more specific than in introduction, TMKs)

Final survey will determine exact boundaries, attached map contains approximate location and is subject to change. The overall size of the proposed Nakula NAR is approximately 1,517 acres. It includes all of TMK 2-1-8-1-9, and the western portion of TMK 2-1-8-1-6. Maps 1 and 2 in the appendix depict the general location of the proposed NAR, and its' relationship to adjoining properties. This land is under Section 5 (b) of the Hawaii Admission Act.

Approximately 2,200 acres would remain in FR designation. The southernmost part of the FR at a lower elevation has been almost completely denuded of native vegetation. It is also extremely steep and dissected by deep gulches, making fencing or other management difficult if not impossible.

The Nakula NAR would be a rectangle (roughly 2 miles long by 1.3 mile wide), with a triangular protrusion at the south-western corner extending an extra .5 miles. Elevations range from 3,600 to 9,200 feet in elevation. The boundaries are subject to change based on final survey, and are as follows: The western boundary approximately follows the canyon carved by Waiopai stream; a ridge between the two forks of Pahihi stream forms the eastern boundary. The upper boundary is marked by Haleakala National Park's perimeter fence.

The lower boundary of the proposed NAR is more complex. East of Wailaulau canyon, it follows a line at roughly the 5,000' elevation. On the western side the boundary dips downhill to include the triangular area between major forks of Wailaulau. Between Pahihi and Waipae gulches, this lower boundary is marked by the newly constructed fence between the FR and pasture leased to Haleakala Ranch.

There are no publicly accessible roads or trails accessing the proposed NAR. Foot travel routes typically taken to enter this area contour across the mountain through the Kahikinui FR, or below the National Park boundary fence.

An important component for the success of regional conservation efforts on Leeward Haleakala is public support. While reforestation of the area will receive strong support, there is also a need to address the interests of the hunting public on Maui.

Large scale conservation efforts on Maui such as the recently formed watershed

partnerships run the risk of alienating hunters who perceive conservation efforts as encroaching on their interests. This is especially problematic on the south and eastern sides of Haleakala where there is still a significant rural and native Hawaiian population, for whom the ability to harvest game for subsistence is still important.

The Nakula NAR should be integrated into a larger landscape plan that allows for strict protection of biologically important areas, but also creates improved access for hunting and game management in appropriate areas.

VI. PUBLIC SUPPORT

Agencies, Organizations, and Individuals Contacted

Leeward Haleakala Watershed Restoration Partnership
Department of Land and Natural Resources – Division of Forestry and Wildlife Maui Branch

VII. BIBLIOGRAPHY/REFERENCES

- DHHL, Kahikinui Forest Reserve Community Management Conceptual Plan 7/1995
- DOFAW, Environmental Assessment for Kahikinui Forest Restoration Fence 2004 Scott Fretz
- Herbst, Wagner et al. Manual of The Flowering Plants of Hawai`i
- Hobdy, R. pers. comm. 2005
- Liebherr, James K. PhD, pers comm. 2005 email, Cornell University Entomology Dept.
- Medeiros, A.C., Loope, L. L., Holt, R. A. 1986 Status of the native flowering plant species on the south slope of Haleakala, east Maui Cooperative National Park Studies Unit, University of Hawai`i Technical Report 59
- USFWS Hawai`i Endangered Plant Species List 10/2005 Marie Bruegmann
- U.S. Fish and Wildlife Service, 2006. Revised Recovery Plan for Hawaiian Forest Birds. Region 1, Portland Org. 622 pp.
- Simon, J.C., T. K. Pratt, K. E. Berlin, and J. R. Kowalsky. 1998. Age and Sex Identification of Akohokohe. Journal of Field Ornithology. 69:654-660.
- Perkins, R. C. L. 1903. Vertebrata. Pp. 365-466 in D. Sharp (Editor). Fauna Hawai`iensis. Vol 1, part IV. Cambridge University Press, UK.
- Menard, T. 2008. Native Hawaiian Ecosystems Represented in Natural Area Reserves. Powerpoint presentation given to the NARS Commission on April 21, 2008.
- Ecoregional Planning Team, The Nature Conservancy Hawai`i. 2006. An Ecoregional Assessment of Biodiversity Conservation for the Hawaiian High Islands.
<http://www.Hawai`iecoregionplan.info/home.html>

Appendices

Table 1

Rare Plants Recorded From Vicinity of Proposed Nakula NAR

Scientific Name	Common Name	Federal Status	CH info	Location Info
<u><i>Argyroxiphium sandwicense</i> ssp. <i>macrocephalum</i></u>	'ahinahina, Haleakala silversword	E	B	2
<i>Bidens micrantha</i> ssp. <i>kaleaha</i>	ko'oko'olau	E	B	1
<i>Canavalia pubescens</i>	'awikiwiki	C		2
<i>Clermontia lindseyana</i>	'ohawai	E	B	1
<i>Cyanea arborea</i>	haha	SOC		2
<i>Cyanea obtusa</i>	haha	C		2
<i>Cyrtandra bisserata</i>	ha'iwale	SOC		1
<i>Cyrtandra oxybapha</i>	ha'iwale	C		2
<i>Diellia erecta</i>		E	B	2
<i>Diplazium molokaiense</i>		E	B	1
<i>Geranium multiflorum</i>	nohoanu	E	B	2
<i>Huperzia mannii</i>		E	B	2
<i>Neraudia sericea</i>		E	B	2
<i>Ochrosia haleakalae</i>	holei	C		2
<i>Phyllostegia haliakalae</i>		SOC	B	1
<i>Portulaca villosa</i>		SOC		2
<i>Ranunculus mauiensis</i>	makou	C		2
<i>Schidea diffusa</i> ssp. <i>diffusa</i>		SOC		2
<i>Stenogyne haleakalae</i>		SOC		?
<i>Zanthoxylum Hawaïiense</i>	'a'e	E		2

Federal Status E = Endangered, C = Candidate for Listing, SOC = Species of concern

CH Info Critical plant habitat designated: A = within proposed NAR, B = Adjacent lands with identical habitat

Location info 1 = recently recorded from within proposed NAR, 2 = recently recorded from lands adjacent to proposed NAR with identical habitat; could occur within NAR, ? = possibly extinct, recorded from vicinity of NAR

Table 2
Rare Animals Found in Vicinity of Proposed Nakula NAR

Hawaiian Petrel ‘u‘a‘u, Pterodroma sandwichensis
Hawaiian Goose, *nene*, Nesochen sandwichensis
Hawaiian Bat, ‘ope‘ape‘a, Lasiurus semotus cinereus
Blackburn’s Sphinx Moth, Manduca blackburni

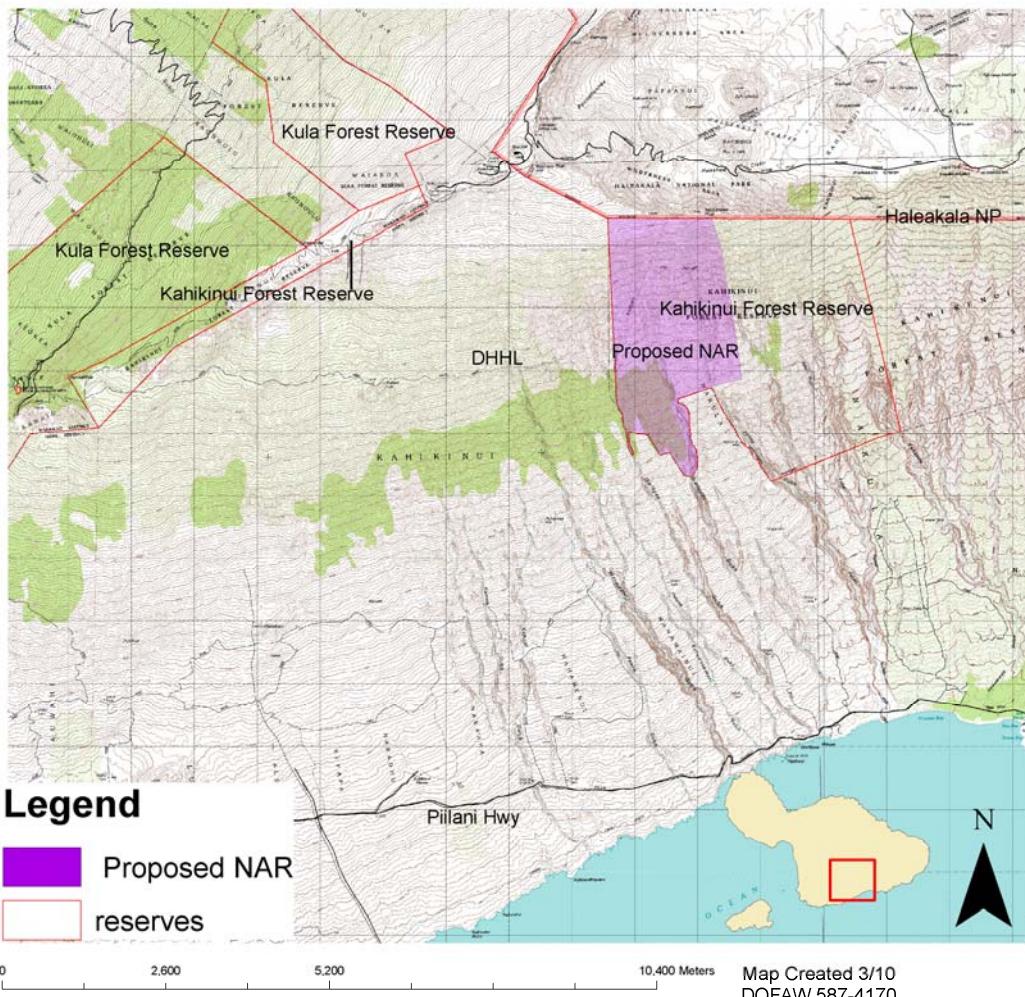
Table 3
Summary of Important Areas / Management Units for Protection of Native Koa Forest Ecosystems Statewide

<i>Island / Mountain Mass</i>	<i>Wet/Windward/ Lowland Subtype</i>	<i>Dry/Leeward/ Montane Subtype</i>
Big Island		
Mauna Kea	Laupahoehoe NAR Hakalau NWR	Hakalau NWR
Mauna Loa	Puu Makaala NAR	Hawai‘i Volcanoes NP Manuka NAR Kipahoe hoe NAR Kona Hema Preserve Hakalau NWR Kona Unit
Hualalai	?	Pu`u Wa`awa`a FBS
Kilauea	?	Hawai‘i Volcanoes NP
Maui		
Haleakala	Hanawi NAR Haleakala NP Waikamoi Preserve	NOT PROTECTED
West Maui	?	Lihau NAR
Molokai	?	?
Lanai	?	?
Oahu		
Koolau mountain	Proposed Poamoho NAR O`ahu Forest NWR	?
Waianae mountain	?	Ka`ala NAR Pahole NAR Honouliuli Preserve
Kauai	Wainiha, Lumaha`i and Limahuli valleys, Na Pali Coast SP	Ku`ia NAR

? = unknown; significant examples of Koa forest no longer remain, or Koa dominated habitat may never have existed. NAR = Natural Area Reserve, NWR = National Wildlife Refuge, NP = National Park, SP = State Park



Proposed NAR
to be withdrawn from
Kahikinui Forest Reserve



Final survey will determine exact boundaries, map contains approximate location and is subject to change.