SAFE HARBOR AGREEMENT
KAMEHAMEHA SCHOOLS
KEAUHOU AND KĪLAUEA FOREST LANDS
HAWAIʻI ISLAND, HAWAIʻI

2018-2019 Annual Report

August 2019

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1. Introduction

The Federal and State Safe Harbor programs encourage proactive conservation efforts by non-Federal landowners while providing them certainty that future property-use restrictions will not be imposed if those efforts attract species listed as threatened or endangered to their property, or result in increased populations of threatened or endangered species already present. In return for voluntary conservation commitments, a Safe Harbor Agreement gives the Permittee incidental take assurances allowing future alteration or modification of the enrolled property back to its original baseline conditions. This cooperative effort provides landowners with a way to manage enrolled lands to support the conservation of listed species while conducting certain other land-use practices. Without this cooperative government/private effort, the enrolled property would be less valuable to the recovery of threatened or endangered species in the future.

The Keauhou, Kaʻū Safe Harbor Agreement (the Agreement) describes how the U.S. Fish and Wildlife Service (Service), the State of Hawaiʻi Department of Land and Natural Resources (DLNR) and Kamehameha Schools (KS) will work together towards the restoration and enhancement of habitat for native plants and animals on certain privately owned lands of KS in the district of Kaʻū on the southeastern slope of Mauna Loa on the island of Hawaiʻi (Enrolled Property) totaling 32,280 acres (see Figure 1). The Agreement promotes recovery of the Federal- and State-endangered ʻAlawī or Hawaiʻi Creeper (*Loxops mana*), Hawaiʻi ʻĀkepa (*Loxops coccineus*), ʻAkiapōlāʻau (*Hemignathus wilsoni*), ʻIʻiwi (*Vestiaria coccinea*), ʻIo or Hawaiian Hawk (*Buteo solitarius*), Nēnē or Hawaiian Goose (*Branta sandvicensis*), ʻAlalā or Hawaiian Crow (*Corvus hawaiiensis*), ʻŌpeʻapeʻa or Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) and twenty-five threatened or endangered plant species (the Covered Species) through habitat restoration and management practices.

Over its 50-year term, it is expected that the Agreement will aid in increasing the current range of the Covered Species, restoring these species to part of their historic ranges, increasing the total population of these species, and reestablishing wild populations of these species, thus contributing to their overall recovery. Additionally, the Agreement will reduce habitat fragmentation by connecting a network of protected and managed state, federal, and private lands within the south central region of Hawaiʻi Island and will also benefit other native species.

This report covers year 1 of the Agreement and includes the time period from execution of the Agreement on June 22, 2018 to June 30, 2019 (FY19).

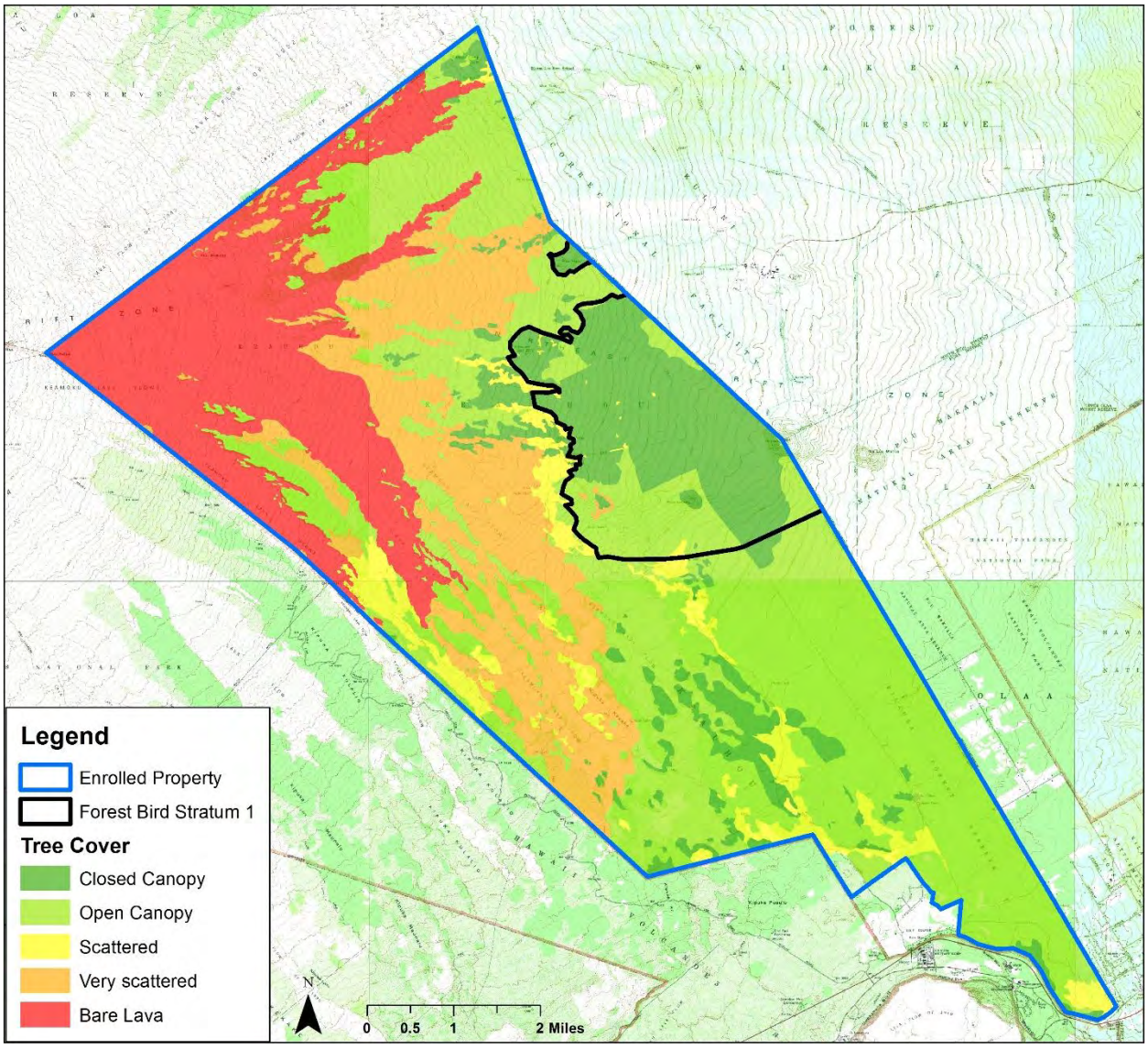


Figure 1. Map of the Enrolled Property

2. Covered Activities

2.1. Predator Control

The control of mammalian predators increases survivorship of native plants and animals. In the Agreement, KS committed to removing feral dogs and to providing access to the ʻAlalā Working Group (AWG) or other designated entity, to conduct predator control efforts for feral cats, mongooses, and rats if ʻAlalā are determined by the working group to be vulnerable to predation on the Enrolled Property in the future.

Two requests for Right of Entry agreements have been submitted by AWG members. San Diego Zoo Global submitted a request for monitoring and emergency response. DLNR submitted a

request for predator control and monitoring. Both requests are under review by KS, with anticipated execution by December 31, 2019.

2.2. Restoration Outplanting

The outplanting of common and rare native species increases biodiversity and native forest cover. In the Agreement, KS committed to plant a minimum of 20,000 seedlings during each 5-year period across the Enrolled Property.

Figure 2. Volunteer planting paʻiniu

In FY19, a total of 20,295 native plants, including 11,596 koa seedlings were planted on the Enrolled Property (see Table 1). 343 native seedlings were planted within Forest Bird Stratum 1 and 19,952 on the remainder of the Enrolled Property. Planting areas were concentrated in the lower portions of the Enrolled Property (see Figure 4). Outplanting was conducted by collaborators and vendors and included 51 educational group plantings for students and community members. A total of 1,361 volunteers of all ages helped with these reforestation efforts and learned about native plants, forest ecology, and the importance of watershed restoration (see Figure 2).

Table 1. Number of seedlings planted by species

Name	Scientific Name	Forest Bird Stratum 1	Remainder of Property	Total
Koa*	*Acacia koa*		11,596	11,596
Maile	*Alyxia stellata*		415	415
Paʻiniu	*Astelia menziesiana*		150	150
Pāpala	*Charpentiera obovata*		222	222
ʻŌlapa	*Cheirodendron trigynum* subsp. *trigynum*		549	549
Hāpuʻu pulu	*Cibotium glaucum*		11	11

ʻŌhā wai	*Clermontia hawaiiensis*	49	428	477
ʻŌhā wai	*Clermontia montis-loa*	147	107	254
ʻŌhā wai	*Clermontia parviflora*		6	6
Pilo	*Coprosma rhynchocarpa*		1,231	1,231
Coprosma sp.	*Coprosma sp.*		260	260
ʻUkiʻuki	*Dianella sandwicensis*		225	225
ʻAʻaliʻi	*Dodonaea viscosa*		1,769	1,769
Kāwaʻu	*Ilex anomala*		7	7
Kūkaemoa	*Melicope clusiifolia*		10	10
ʻŌhiʻa lehua	*Metrosideros polymorpha* var. *polymorpha*		190	190
Kōlea lau nui	*Myrsine lessertiana*	147	291	438
ʻŪlei	*Osteomeles anthyllidifolia*		0	0
Kīponapona, Pōpolo kū mai	*Phytolacca sandwicensis*		1,110	1,110
Māmaki	*Pipturus albidus*		361	361
Pāpala kēpau	*Pisonia umbellifera*		23	23
Hōʻawa	*Pittosporum hawaiiense*		14	14
Hōʻawa	*Pittosporum hosmeri*		21	21
ʻAlaʻala wai nui wahine	*Plectranthus parviflorus*		16	16
ʻĀkala	*Rubus hawaiensis*		5	5
Mānele	*Sapindus saponaria*		14	14
Māmane	*Sophora chrysophylla*		921	921
ʻĀkia	*Wikstroemia phillyreifolia*		0	0
Total Outplantings		**343**	**19,952**	**20,295**

*Includes koa silvicultural plantings

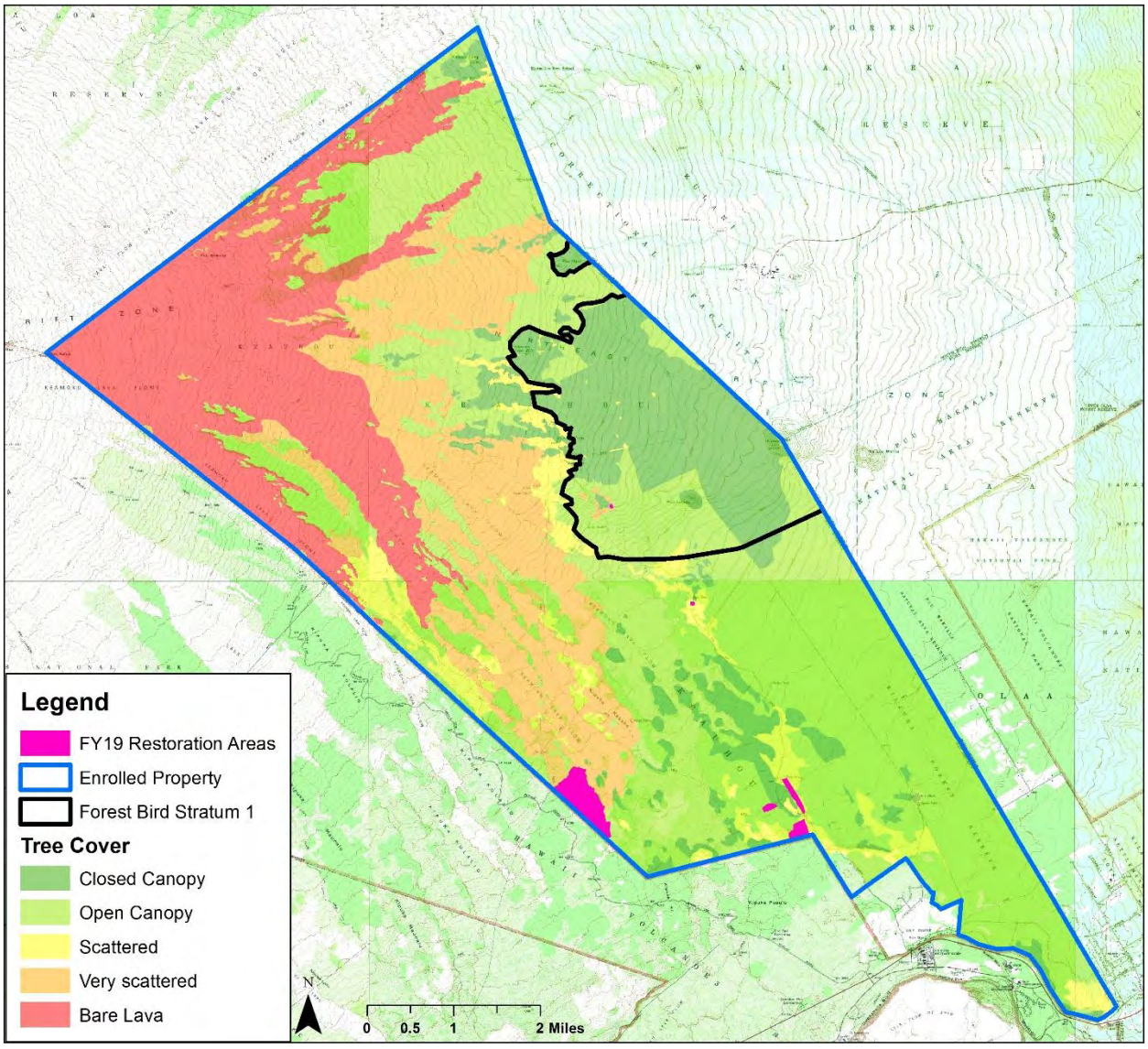


Figure 4. Map of FY19 restoration areas

2.3. Silviculture

Koa reforestation and stand improvement creates new forest in formerly logged areas and pasture lands, increases soil water retention capacity, and provides nesting and foraging habitat for Hawaiian forest birds, ʻIo, and ʻŌpeʻapeʻa. In the Agreement, KS committed to establish a minimum of 1,000 acres of new koa stands over its 50-year term.

In FY19, silviculture activities did not occur within Forest Bird Stratum 1. Outside of Forest Bird Stratum 1, 135 acres of new koa stands were planted, all of which was located within the August 2018 wildfire area (see Figure 6). Koa was planted at a density of 108 trees per acre to reduce the need for thinning in the future.

Figure 4. Three year old koa stand

In addition, 105 acres of koa were thinned (see Figure 6). Thinning occurred in stands planted in 2006, 2007, 2012, and 2015 and was conducted to target an optimal stocking rate of 108 trees per acre, as these stands were planted prior to the determination of this desired density. Trees were thinned by applying herbicide to basal cuts and were left to die standing. Other stand improvement activities included pruning of 32 acres within stands planted in 2015 to improve tree form and application of fertilizer to 156 acres of koa planted in 2016 and 2018 to improve growth.

Figure 5. Thinned koa stand

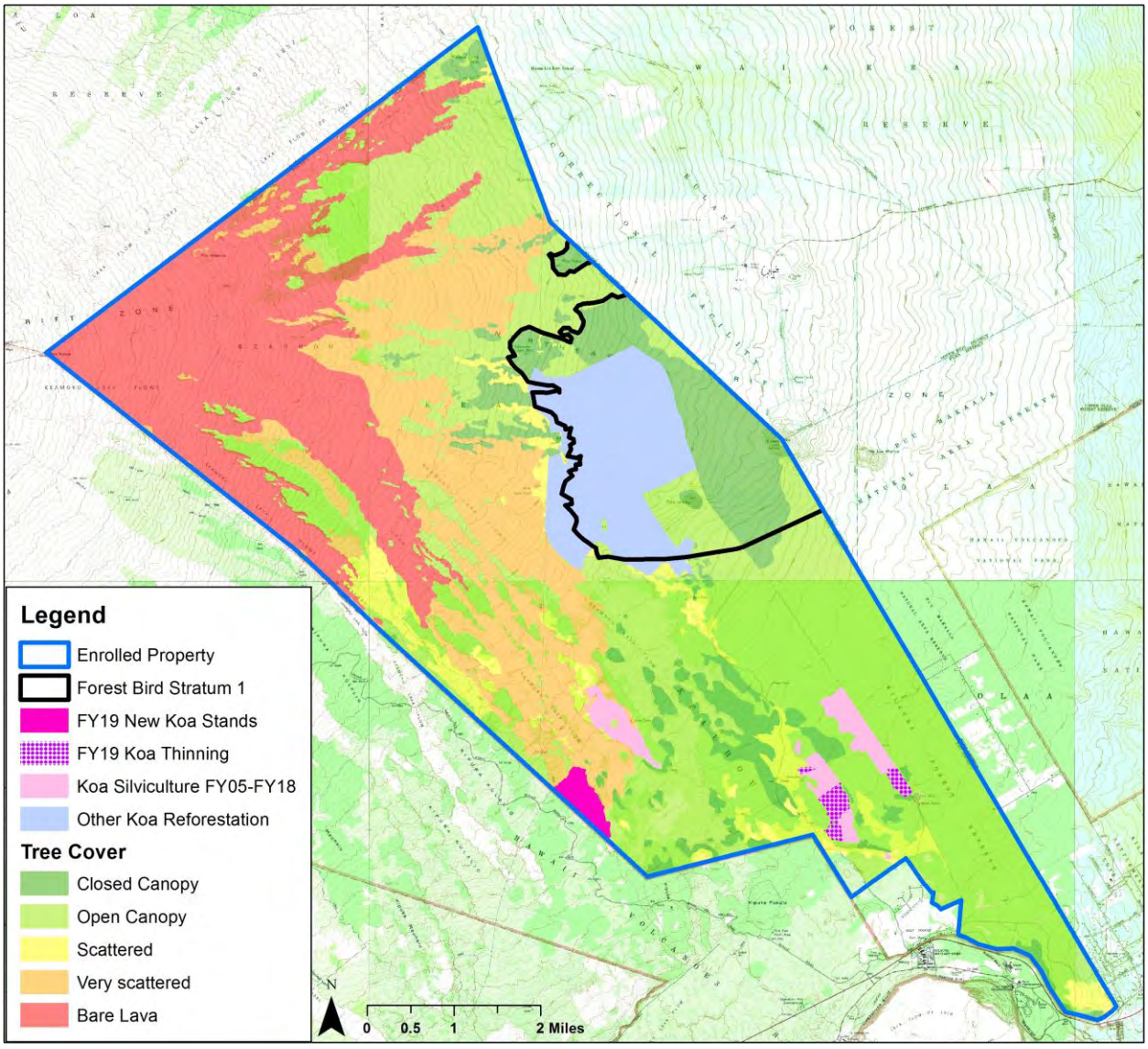


Figure 6. Map of FY19 koa silviculture

2.4. Fences and Ungulate Control

Fences provide protection to native habitats by keeping animals such as pigs, goats, and sheep out of sensitive areas. In the Agreement, KS committed to actively manage the Enrolled Property as an ungulate-free area inside fenced conservation management units (~29,000 acres) throughout its duration. Fences required to maintain zero tolerance for feral ungulates on KS lands are maintained to ensure woody vegetation around fences are cleared and fences are regularly inspected for damage from tree falls and ungulate ingress. Fence sections will be replaced as their condition deteriorates during the life of the Agreement.

In FY19, all Keauhou fencelines (approximately 25 miles) were inspected at least quarterly (see Figure 7). Fence inspection frequency is based on fence location, fence condition, potential risk to fence damage, and animal pressure. Units adjacent to areas with ungulates, which are subject to continuous animal pressure are checked more than once a month when possible. Additionally, fence sections in thickly forested areas and therefore subject to tree falls, are checked at least monthly. Minor repairs and routine maintenance such as adding pins or skirt and repairing damage from treefalls were conducted as needed. In addition, 1,700 m of fence were replaced.

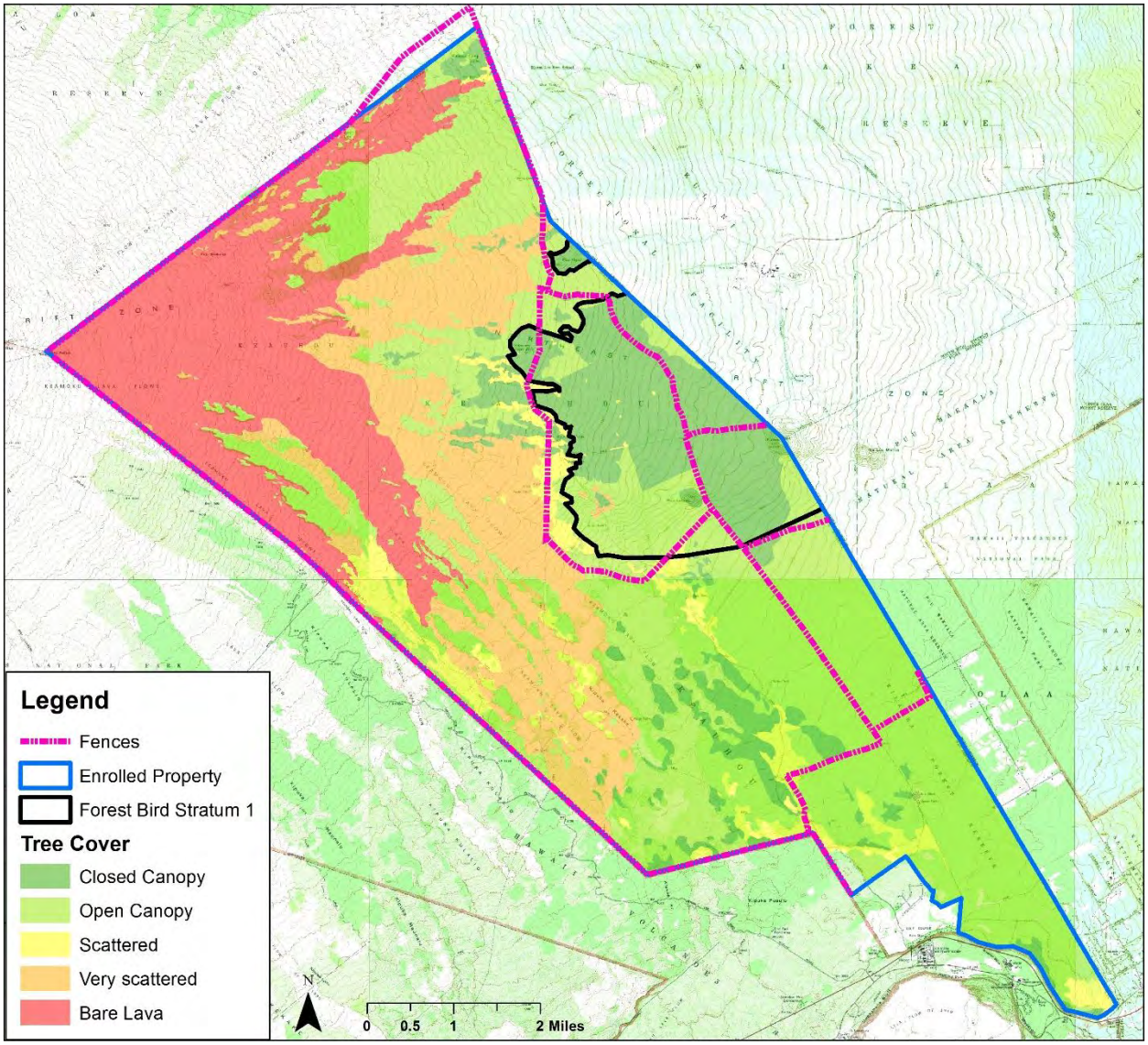


Figure 7. Map of fences maintained in FY19

Ungulate presence within fenced areas was monitored, focusing in upper Keauhou, where feral pig signs were last observed. For the fourth consecutive year, no fresh or intermediate ungulate sign was observed within fenced conservation management units.

2.5. Weed Monitoring and Control

Weed control and suppression supports the increase and diversity of native plant populations. In the Agreement, KS committed to suppress four species of priority weeds (faya (*Morella faya*), ginger (*Hedychium gardnerianum*), strawberry guava (*Psidium cattleianum*), and Himalayan raspberry (*Rubus ellipticus*)) below 10% on the Enrolled Property within conservation fences, provided that adjacent landowners' management includes continued weed control.

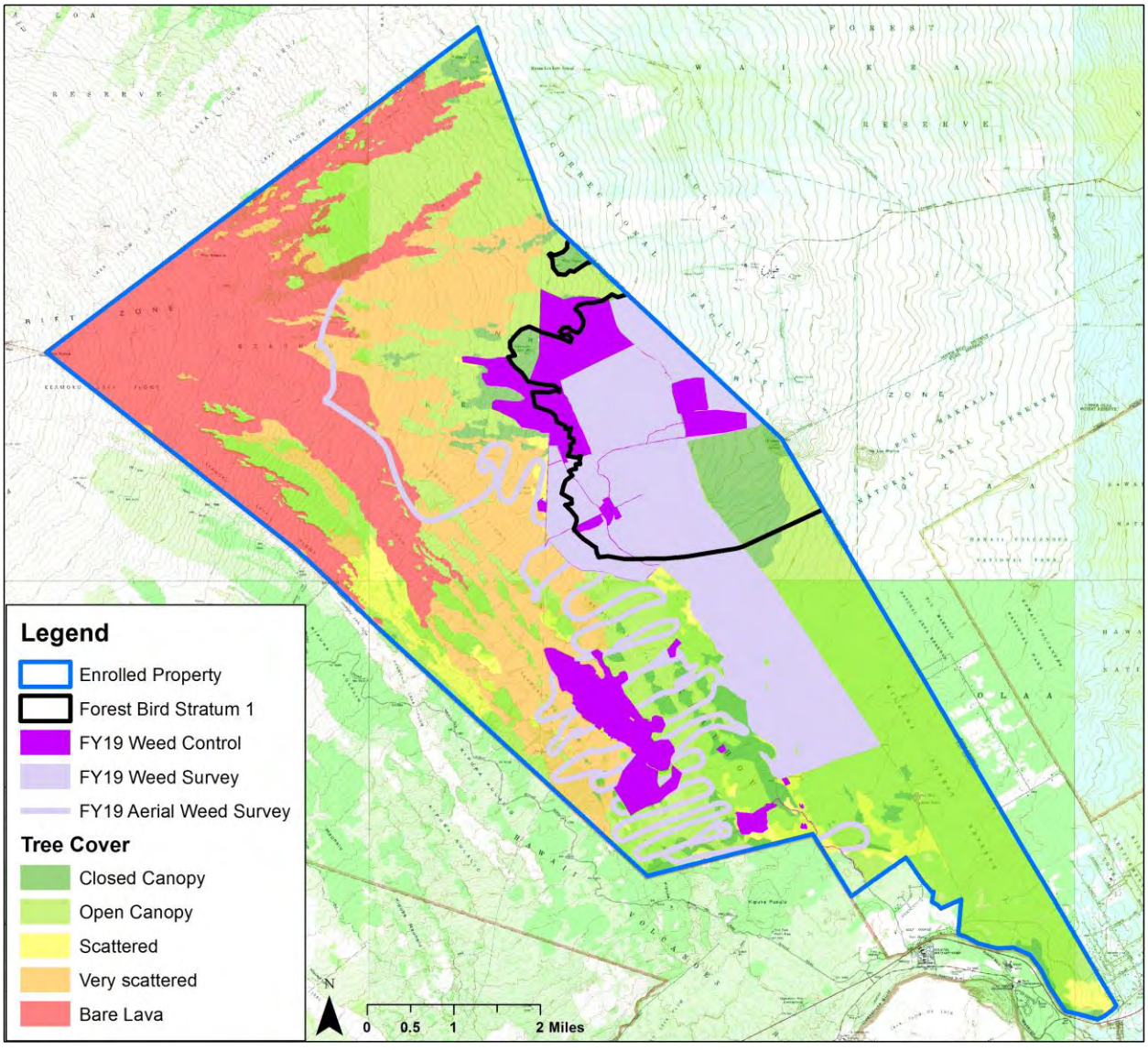


Figure 8. Map of weed monitoring and control in FY19

In FY19, KS suppressed weed species across 2,024 acres on the Enrolled Property (see Figure 8). Suppression activities occurred on 797 acres within Forest Bird Stratum 1 and 1,227 acres on the reminder of the Enrolled Property. In addition to the four priority weed species, the primary target of suppression efforts was blackberry (*Rubus argutus*).

Regular weed surveys inform prioritization of weed suppression efforts and evaluation of the efficacy of current efforts. Weed survey schedules are informed by historical target species density levels, target species biology, and human traffic levels.

In FY19, KS assessed 7,600 acres for target weed species via ground surveys. An aerial survey covering an additional 6,500 acres was conducted throughout the western portions and high elevation areas of Keauhou for incipient populations of priority weed species (see Figure 8). Results from the weed survey conducted in the Puʻu Lalaʻau management unit (~3,000 acres) are available in Appendix 1. Survey efforts from FY19 indicate populations of priority weed species remain below 10%.

2.6. Fire Threat Management

Fire risk reduction and fire preparedness reduce the incidence and severity of fire impacts to native ecosystems. In the Agreement, KS committed to maintain a similar storage capacity (225,000 gallons) and distribution of water as existed at the start of the Agreement, although actual locations of water sources may change over time. KS also committed to maintaining primary access routes.

In FY19, KS inspected and maintained all water sources (4 catchments, 12 tanks, and 3 reservoirs) and access routes (27.5 miles of primary and 3.5 miles of secondary roads) (see Figure 10). Maintenance of water sources included spraying vegetation on and around catchment and tank areas, as well as removing debris from gutters. Maintenance of access

Figure 9. New firebreak installed in FY19

routes included removal of fallen trees and encroaching vegetation. Passability was also maintained on approximately 68 miles of tertiary roadways.

In addition, following the August 2018 fire, KS installed a new 18,000 ft firebreak along the KS-National Park Service (NPS) boundary (see Figures 9 and 10). A long term maintenance schedule for this fire break will be developed in FY20.

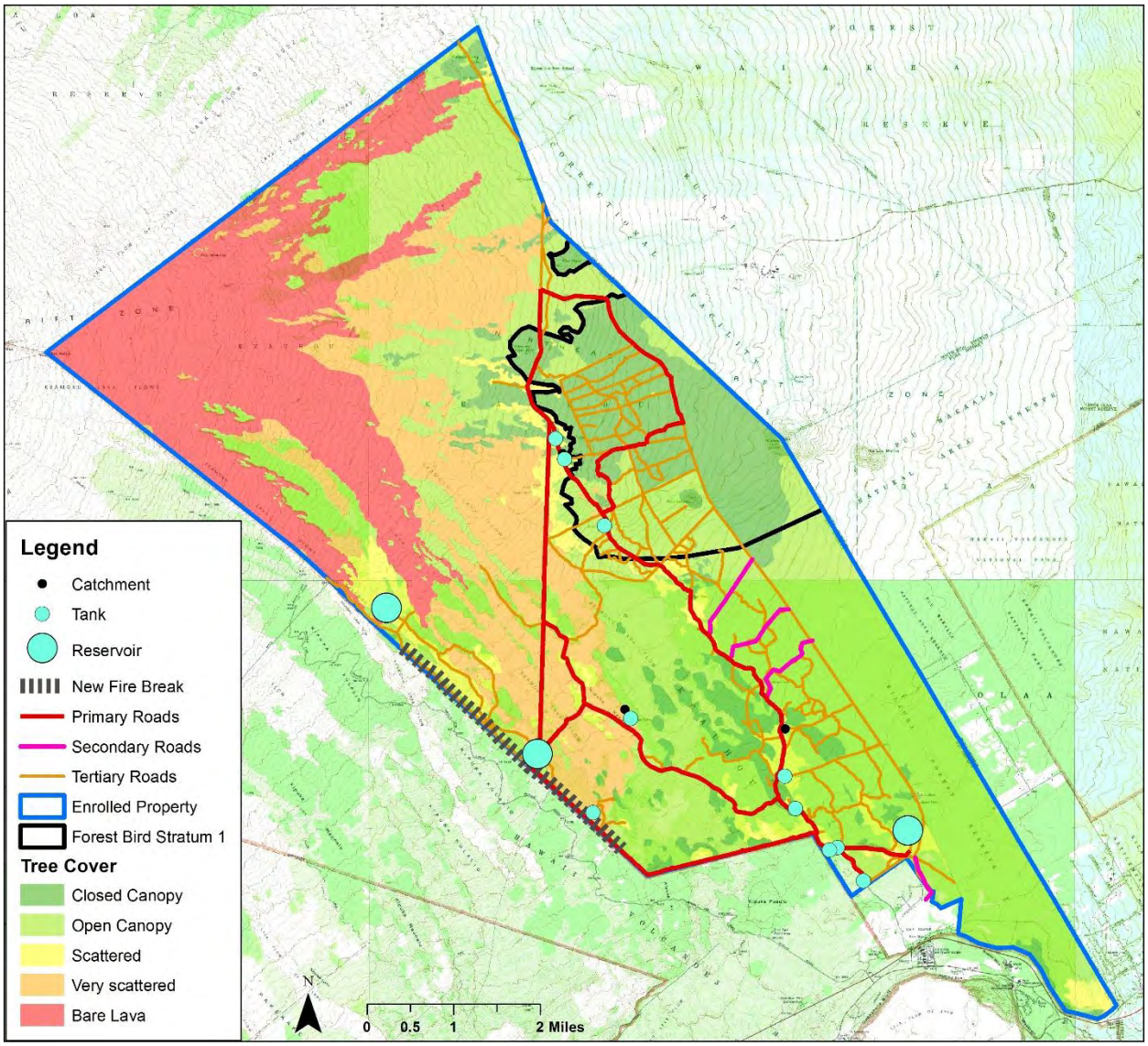


Figure 10. Map of water sources and access routes maintained in FY19

2.7. Response to Rapid ʻŌhiʻa Death

Rapid ʻŌhiʻa Death (ROD) is caused by two fungi, (*Ceratocystis lukuohia* and *Ceratocystis huliohia*). These fungi kill ʻōhiʻa by growing into the tree's vascular system and blocking water

movement to its crown. Based on recent and ongoing aerial surveys, more than 135,000 acres of ʻōhia forest on Hawaiʻi Island currently show signs of ROD (Statewide Rapid ʻŌhiʻa Death Working Group 2019).

ROD was first confirmed at Keauhou in June 2017 near the 2012 wildfire area in lower Keauhou (see Figure 11). To date, symptomatic trees have primarily been found in lower Keauhou. KS staff regularly attend meetings of the statewide ROD Working Group to keep updated on current research and management recommendations. In addition, KS has provided access to the Enrolled Property to U.S. Forest Service researchers monitoring the presence, patterns, and impacts of ROD.

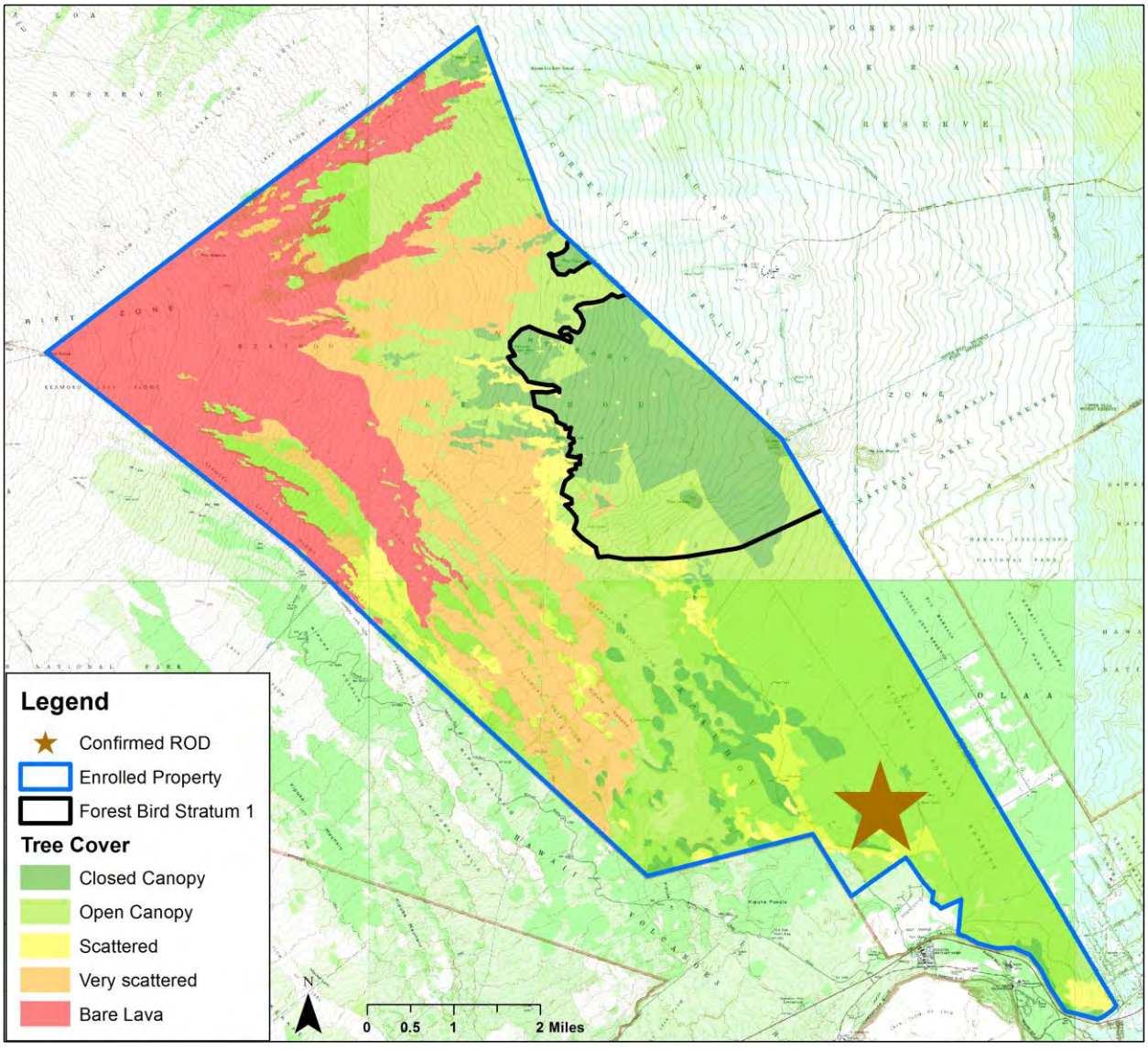


Figure 11. Map of confirmed ROD locations

2.8. Other Activities

2.8.1. Forest Birding Field School

KS funded the development and delivery of a forest birding field school to develop primary observer capacity on Hawaiʻi Island (see Appendix 2). The week-long course was held at Keauhou from January 28-February 1, 2019 and was led by Three Mountain Alliance (TMA) and DLNR Natural Area Reserve System (NARS) staff. The goal of the field school was to increase the number of primary observers able to identify all Hawaiian forest birds, including endangered species, by sight and sound. The weeklong course included field-based training sessions focused on forest bird vocalizations, identification by sight and sound, and survey methods. Invited experts presented on forest bird conservation topics in the afternoons. 16 students participated in the school, ranging in age and experience. Eight students achieved "Primary Observer" status, meaning they acquired the skills necessary to identify all forest birds on Hawaiʻi Island by sight and sound, including endangered species. The remaining eight students earned "Secondary Observer" status meaning they were still gaining or developing the skills needed to identify all birds by sight and sound. Two of these remaining eight students achieved "Primary Observer" status during the Spring 2019 survey season, for a total of ten new primary observers.

3. Monitoring of Covered Species

3.1. Endangered Forest Birds

Four species of forest birds are covered under the Agreement, the ʻAkiapōlāʻau, ʻAlawī, ʻĀkepa, and ʻIʻiwi. Baseline monitoring for forest birds involves canopy assessment every 10 years and species occupancy annually. Occupancy is determined via point-transect sampling and is planned annually for the seven transects situated primarily in Forest Bird Stratum 1. Every 5 years, an additional 12 transects (19 total) will be surveyed for forest birds outside of Forest Bird Stratum 1 to ascertain the presence of the covered forest bird species. Occupancy surveys are conducted by USFWS and DLNR (the Agencies) or associated cooperating parties agreeable to KS. In the event that these organizations are not able to conduct the occupancy surveys, KS will be responsible for completing them at a minimum frequency of once every 5 years.

Forest bird surveys were conducted in February 2019 (see Appendix 3). The surveys were coordinated by TMA and supported by various agency and community volunteers. Observers used the variable circular plot method to record detections of all birds seen and heard. A total of 150 stations along seven transects were surveyed primarily within Forest Bird Stratum 1. All four species of forest birds covered by the Agreement, along with ʻIo were detected (see Table 2). No ʻAlalā were detected. Data were entered into an MS Access database using the Avian Monitoring Entry Form. Entered and proofed data were passed on to the U.S. Geological

Survey for inclusion in the Hawaiʻi Forest Bird Interagency Database and possible future analysis of population trends.

Table 2. Covered bird species detected in February 2019

Name	Scientific Name	# Detected	Stations Occupied
ʻIʻiwi	*Drepanis coccinea*	181	93
ʻAkiapōlāʻau	*Hemiganthus wilsoni*	40	30
ʻĀkepa	*Loxops coccineus*	1	1
ʻAlawī	*Loxops mana*	21	15
ʻIo	*Buteo solitarius*	4	4

3.2. ʻAlalā

ʻAlalā from the 2017 and 2018 release cohorts have shown consistent use of KS lands with activity being focused around the Puʻu Kipu area during the morning and evening hours (AWG 2018, AWG 2019). To date, ʻAlalā have not demonstrated behavior indicating occupation of habitat on KS lands such as nest construction or defense of habitat.

3.3. ʻIo

Baseline monitoring for ʻIo involves canopy assessment every 10 years and species occupancy every 5 years. Occupancy is determined via circular variable plot count methodology and will be conducted by the Agencies or associated cooperating parties agreeable to KS. Canopy assessment will be completed by FY28 and occupancy surveys by FY23.

240 acres of ʻIo habitat, including 2 acres of closed and 238 acres of open tree cover habitat (see Table 5) were lost in the August 2018 fire. KS requests that this be considered a *force majeure* event beyond the control of KS and that the baseline conditions for ʻIo be revised to reflect the new circumstances (see discussion in Section 6.1 of this report).

3.4. Nēnē

Baseline conditions for Nēnē were determined by the number of breeding pairs present on the Enrolled Property. Surveys during Nēnē breeding season (October-March) are conducted by DLNR Division of Forestry and Wildlife (DOFAW) staff on an annual basis and provide information on population estimates, nesting success, and fledging success.

DOFAW staff conducted Nēnē activity and nesting surveys once a month during Nēnē breeding season. Visual ground surveys were conducted at each site once a month, between the hours of 7:00 am to 3:30 pm, from October 2018 through March 2019 (Table 3). No nests were

observed at any site, however, nesting habits were observed and goslings and fledglings were captured on remote camera traps near the Keauhou Nēnē Cabin (see Appendix 4).

Table 3. Nēnē detections during monthly surveys

	Keauhou, Kaʻū	ʻŌhiʻa Ranch	4 Boys Ranch	Volcano Winery	Total
October 2018	4	0	0	0	4
November 2018	6	2	0	0	8
December 2018	2	0	0	0	2
January 2018	2	3	3 (flyover)	0	8
February 2018	1	5	0	0	6
March 2018	1	9	0	0	10

3.5. ʻŌpeʻapeʻa

Baseline monitoring for ʻŌpeʻapeʻa involves canopy assessment every 10 years and species occupancy every 5 years. Occupancy is determined via acoustic monitoring and will be conducted by the Agencies or associated cooperating parties agreeable to KS. Canopy assessment will be completed by FY 2028 and occupancy surveys by FY 2023.

240 acres of ʻŌpeʻapeʻa habitat, including 2 acres of closed and 238 acres of open tree cover habitat (see Table 5) were lost in the August 2018 fire. KS requests that this be considered a *force majeure* event beyond the control of KS and that the baseline conditions for ʻŌpeʻapeʻa be revised to reflect the new circumstances (see discussion in Section 6.1 of this report).

3.6. Endangered Plant Species

Baseline monitoring for threatened and endangered plant species follow protocols established or approved by the Plant Extinction Prevention Program (PEPP). Plant surveys for PEPP species founders (those with 50 or less remaining plants in the wild) and any natural regeneration are conducted annually by PEPP. Non-PEPP species will be surveyed every 2 years and outplants every 5 years by the Agencies or other cooperating parties agreeable to KS. In the event that these organizations are not able to conduct these surveys, KS will be responsible for completing them at a minimum frequency of once every 5 years.

Figure 12. *Vicia menziesii* seedling at Puʻu Kipu

KS contracted PEPP to conduct a comprehensive survey of all threatened and endangered plant species on the Enrolled Property. Preliminary results are available in Appendix 5 and summarized in Table 4. All three species for which surveys have been completed show declining population numbers, due to poor survival of outplants and lifespan considerations. Once the survey is complete, KS intends to request administrative revision of the baseline for threatened and endangered plant species per Section 5 of the Agreement (see discussion in Section 6.2 of this report). Evidence of natural regeneration of two species, *Cyanea shipmanii* and *Vicia menziesii*, was also noted (see Figure 12).

Table 4. Preliminary covered plant survey results

Name	Scientific Name	Baseline	FY19 # Detected	Regeneration?
	Asplenium peruvianum var. *insulare*	128	tbd	tbd
ʻOhā wai	*Clermontia lindseyana*	24	tbd	tbd
Hāhā	*Cyanea shipmanii*	463	283	Yes
Hāhā	*Cyanea stictophylla*	104	tbd	No
Kīponapona	*Phyllostegia racemosa*	4	0	No
	Phyllostegia velutina	38	tbd	tbd
	Plantago hawaiensis	1	tbd	tbd
	Vicia menziesii	27	20	Yes

4. Avoidance and Minimization

In association with TMA and PEPP, KS developed a Safe Harbor Agreement Training specific to Keauhou, Kaʻū (see Appendices 6 and 7). The training was designed to enable those leading activities at Keauhou, Kaʻū to:

1. Understand basic endangered species law in relation to the Agreement,
2. Identify covered species and their habitats at Keauhou, Kaʻū, and
3. Understand and be able to consistently apply the avoidance and minimization measures contained in the Agreement.

Figure 13. Trainees learning how to identify covered plant species

Two trainings were held on October 18, 2018 and January 1, 2019 (see Figure 13). Thirty-two individuals from four organizations were trained. Training will continue to be offered on an as needed basis. In addition, improved field reference guides are being developed for trained individuals.

5. Changed or Unforeseen Circumstances

5.1. Kīlauea Eruption

In 2018, Kīlauea experienced its largest lower East Rift Zone eruption and caldera collapse in at least 200 years. Throughout much of May and June 2018, Keauhou was affected by ash fall, poor air quality, and intense seismic activity due to summit explosive events and near daily summit collapse events. These conditions impacted and delayed operations on the Enrolled Property. In particular, the closure of Hawaiʻi Volcanoes National Park from early May to late September 2018 severely impacted TMA greenhouse operations. Staff, equipment, and plants were relocated offsite, no new seedling trays were started, and seedling mortality was high due to challenges with pest control, watering during extreme vog events, and overall growing conditions.

5.2. Wildfire

In August 2018, Keauhou was impacted by a large wildfire, which consumed approximately 3,739 acres, including 649 acres of open forest, native shrubland, and alien grassland on KS land within the Enrolled Property (see Figure 16). The fire was accidently ignited at Keauhou during restoration operations at approximately 11am on Sunday, August 5, 2018. The fire spread quickly due to steady winds, low relative humidity, and non-native grasses. Flames spread into the canopy and crowns of the trees, flame lengths were reported to be 50-75 feet with rapid rates of spread and 300 yard spotting (see Figure 14). Fire response was provided by Hawaiʻi County Fire, NPS, DLNR, KS staff and contractors. No further fire spread was observed after August 12, 2018 and the fire was declared contained on KS land by August 17, 2018 and on NPS land by August 23, 2018.

Figure 14. Fire burning in koa stand

In addition to installation of a new firebreak along the KS-NPS boundary (see Figure 8), KS has planted 135 acres of the burn area in koa (see Figure 3) and installed monitoring plots to track recovery of native vegetation.

Figure 15. Pre- (top) and post-fire (bottom) comparison of the area surrounding the Powerline Road reservoir (looking southwest towards the NPS boundary)

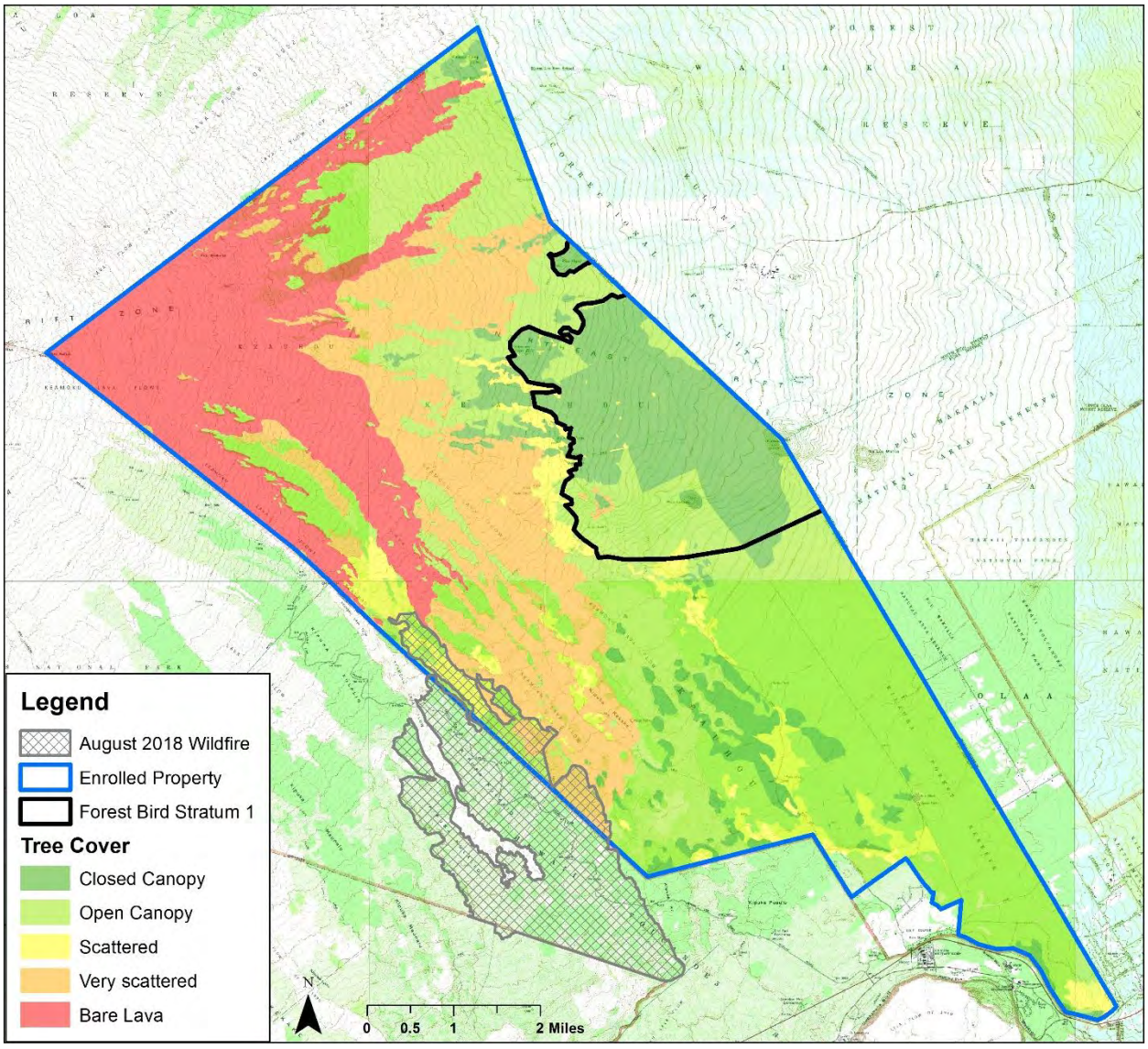


Figure 16. Map of August 2018 wildfire

6. Baseline Adjustments

6.1. ʻIo and ʻŌpeʻapeʻa Habitat

2 acres of closed and 238 acres of open canopy tree cover habitat were lost in the August 2018 fire (see Table 5). KS requests that this be considered a *force majeure* event beyond the control of KS, per section 13.7 of the Agreement. This event reduced ʻIo and ʻŌpeʻapeʻa habitat below original baseline conditions through no fault or negligence of KS. Per section 13.7 of the Agreement, in such circumstances the Parties shall work collaboratively to reach agreement to revise the baseline conditions to reflect the new circumstances.

Table 5. Tree cover impacted by the August 2018 wildfire

Tree Cover	Acres	Plant Communities
Closed	2	Closed koa dry forest w/ mixed grasses & native shrubs Closed koa-ʻōhiʻa mesic forest w/ native shrubs & alien grasses
Open	238	Open koa-native trees dry forest w/ mixed grasses & native shrubs Open ʻōhiʻa dry woodland w/ native understory
Scattered	169	Scattered koa-native trees dry community w/ mixed grasses & native shrubs
Very Scattered	240	Very scattered koa-native trees dry community w/ alien grasses & native shrubs Very scattered ʻōhiʻa dry shrub community w/ scattered native shrubs
Total	649	

6.2. Endangered Plant Species

Per Section 5 of the Agreement, the baseline for threatened and endangered plant species may be revised administratively with approval by the Agencies and the Endangered Species Recovery Committee (ESRC), due to the documented poor survival of outplants of some species, the long-term uncertainty of survival for outplants not regenerating naturally, and lifespan considerations. Revision will occur based on a comprehensive survey of all outplants currently in the baseline for a species, documenting the number of individuals still alive and dead. Acceptance of the baseline revision will occur upon submission of a report documenting the survey methods and results submitted to the agencies within the first two years of the Agreement.

KS has contracted PEPP to conduct a comprehensive survey of all outplants and will submit the final survey report to the Agencies within the first two years of the Agreement. Preliminary results are available in Appendix 5.

7. Agency Visits and Reporting

Two meetings were held with USFWS and DLNR staff in FY 2019. Meetings took place on:

- September 7, 2018- USFWS and DLNR (by phone), included visit to fire area
- April 16, 2019- USFWS and DLNR, included visits to various locations across the Enrolled Property

8. References

ʻAlalā Working Group. 2018. ʻAlalā Working Group Weekly Reports.

ʻAlalā Working Group. 2019. ʻAlalā Working Group Monthly Reports.

Statewide Rapid ʻŌhiʻa Death Working Group. 2019. Statewide Rapid ʻŌhiʻa Death Working Group Monthly Meeting Minutes.

APPENDIX 1
PUʻU LALAʻAU WEED SURVEY REPORT

Pu‘u Lala‘au Invasive Weed Surveys

Weed surveys in Pu‘u Lala‘au Management Unit take place annually in winter/spring along 14 transects. TMA staff use seven existing marked forest bird survey transects and extend them to cover the area between the Powerline and Palakea fence lines. Seven additional transects are also surveyed. Since these transects and the forest bird survey transect extensions are not flagged, staff navigated along the transects using GPS coordinates.

Staff focus efforts on recording blackberry (*Rubus argutus*) density, however, all priority invasive weed species are also recorded. Observers record density of target species in 50-meter sections along each transect in a belt that extends five meters to left and right of the transect. These surveys were first conducted in 2012, at that time we used five cover classes for blackberry abundance (% coverage). Intensive blackberry control by TMA and later by FSI has significantly reduced blackberry presence; to be more accurate about blackberry density, we adjusted the abundance categories in 2017 as shown below; the same categories were used this year.

- 0%,
- ≤1%,
- >1-5%,
- >5-10%,
- >10-25%,
- >25-50%,
- >50-75%,
- >75%-100%

FY19 surveys took place in March 2019; results are illustrated in the maps below. Only a few small blackberry plants were detected in two places along the five northernmost transects (Tr. 282-291; Figure 2). Blackberry density along the remaining transects was generally low with the exception of a stretch along transect 6 (Figure 4) near the Powerline fence (similar to last year’s results.) Staff did not detect other priority weeds along the transects.

Table 1. Blackberry density in 50 m sections along transects

BB density category	# transect sections in 2019	# transect sections in 2018
0	563	522
≤1%	62	88
>1-5%	28	35
>5-10%	5	6
>10-25%	6	9
>25-50%	1	2
>50-75%	0	2
>75-100%	2	0

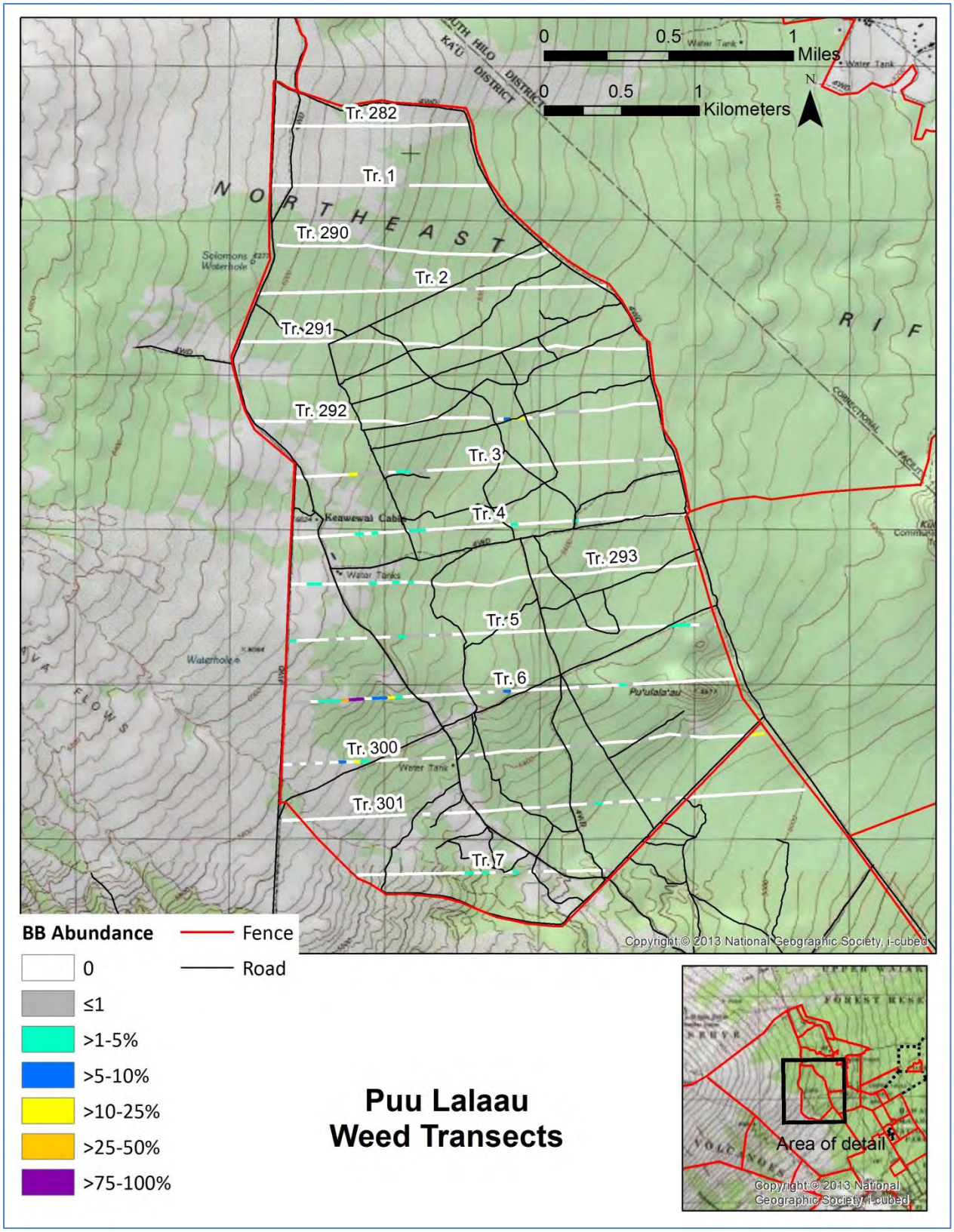


Figure 1. Overview of weed transects and blackberry detections in Pu‘u Lala‘au.

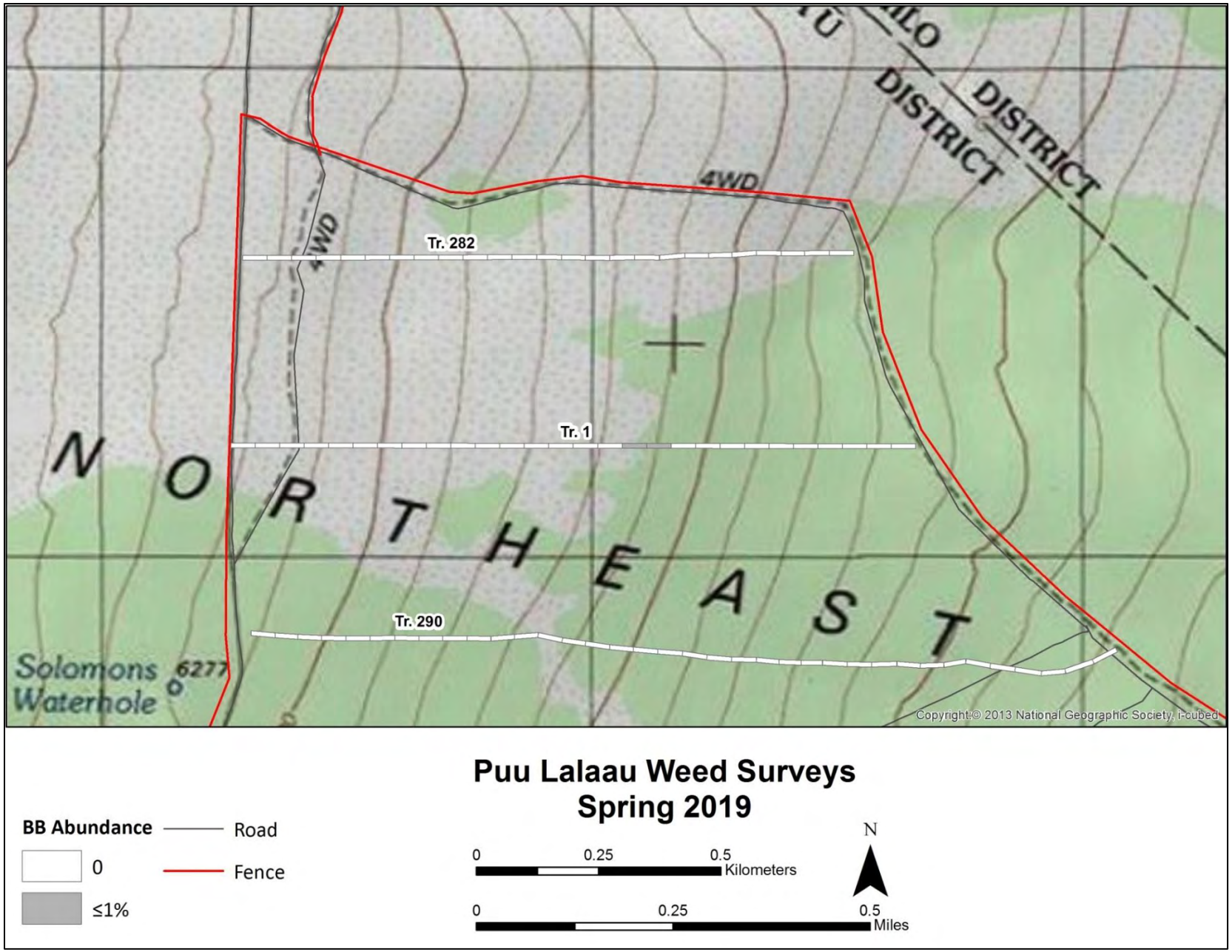


Figure 2. Detailed view of survey results for transects 282, 1, and 290.

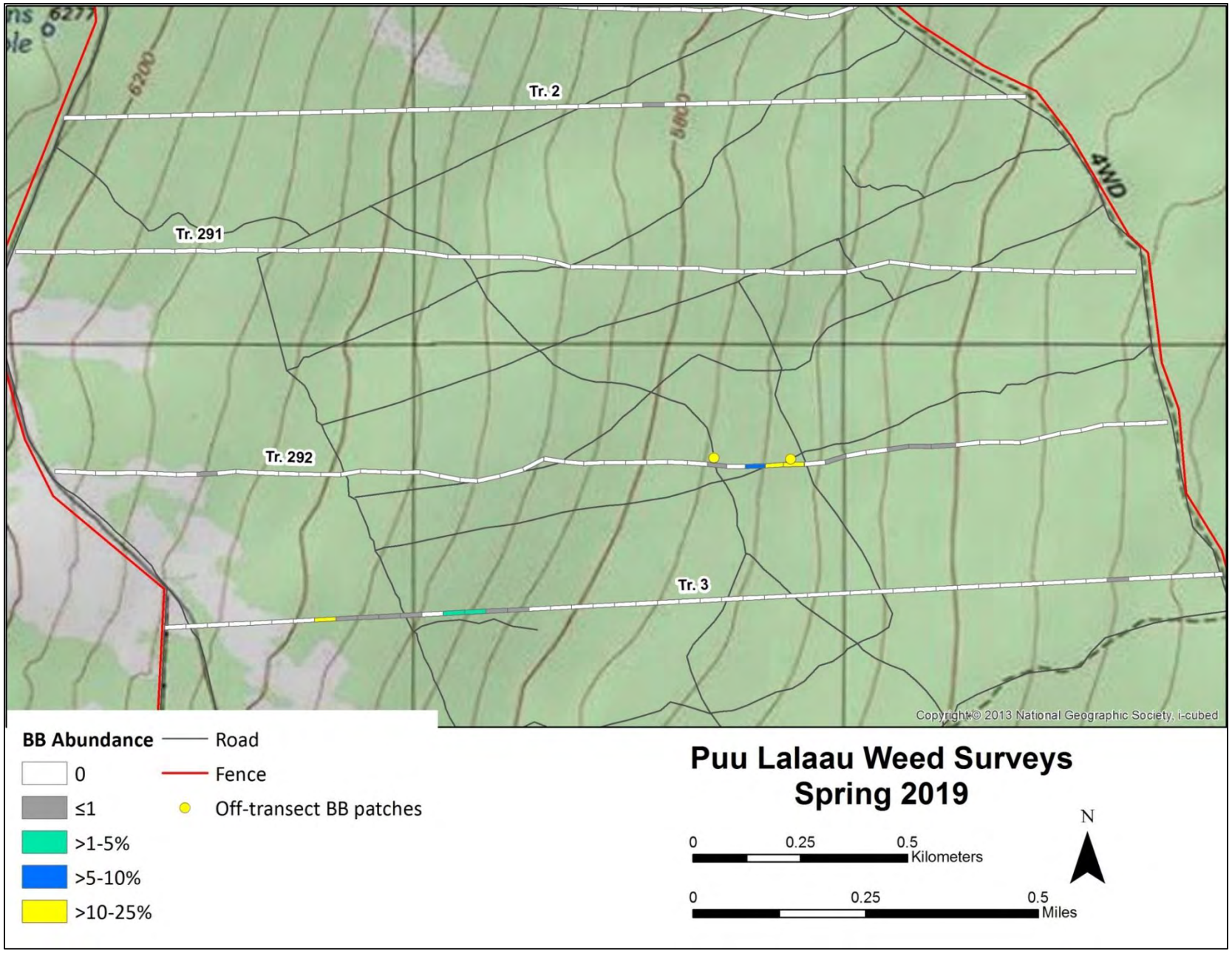


Figure 3. Detailed view of survey results for transects 2, 291, 292 and 3.

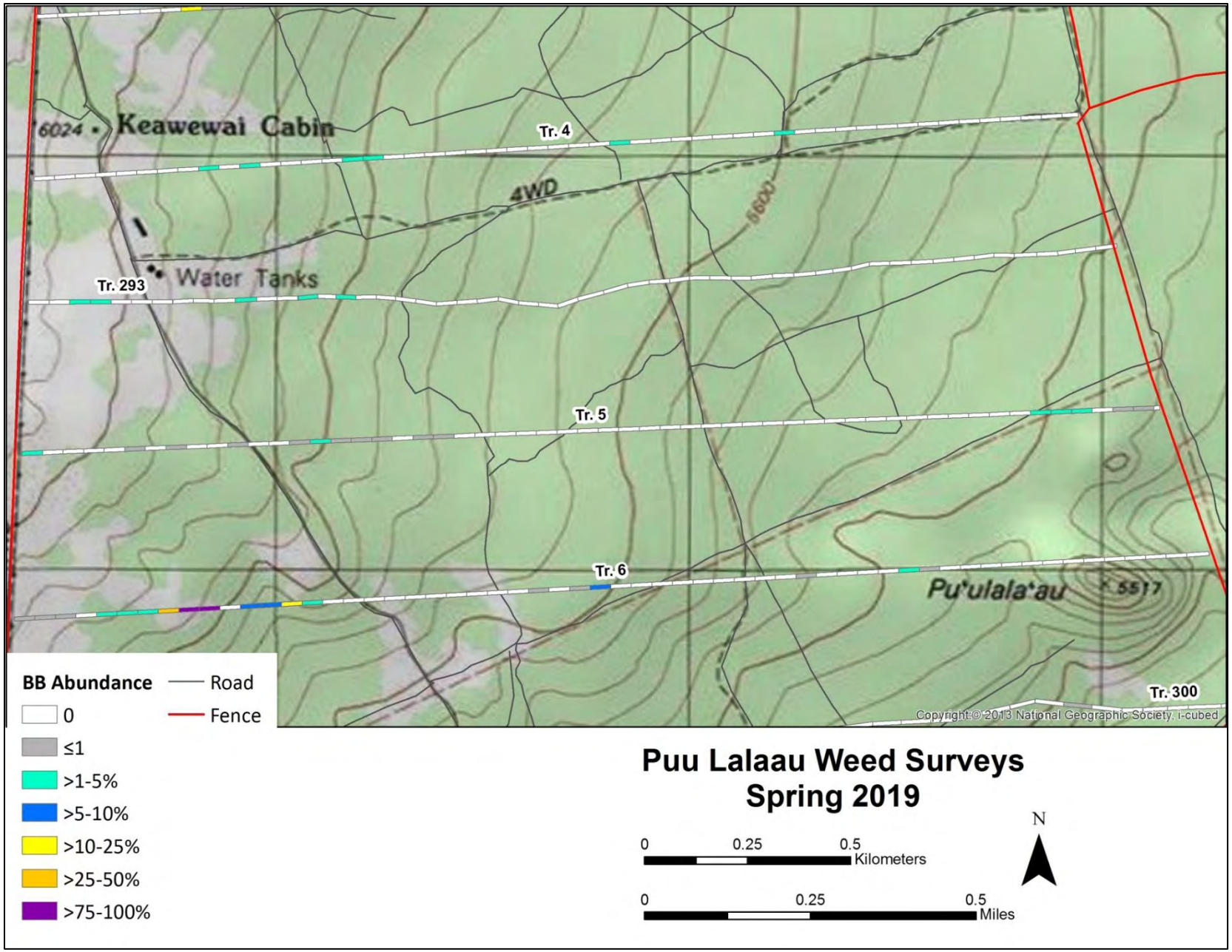


Figure 4. Detailed view of survey results for transects 4, 293, 5 and 6.

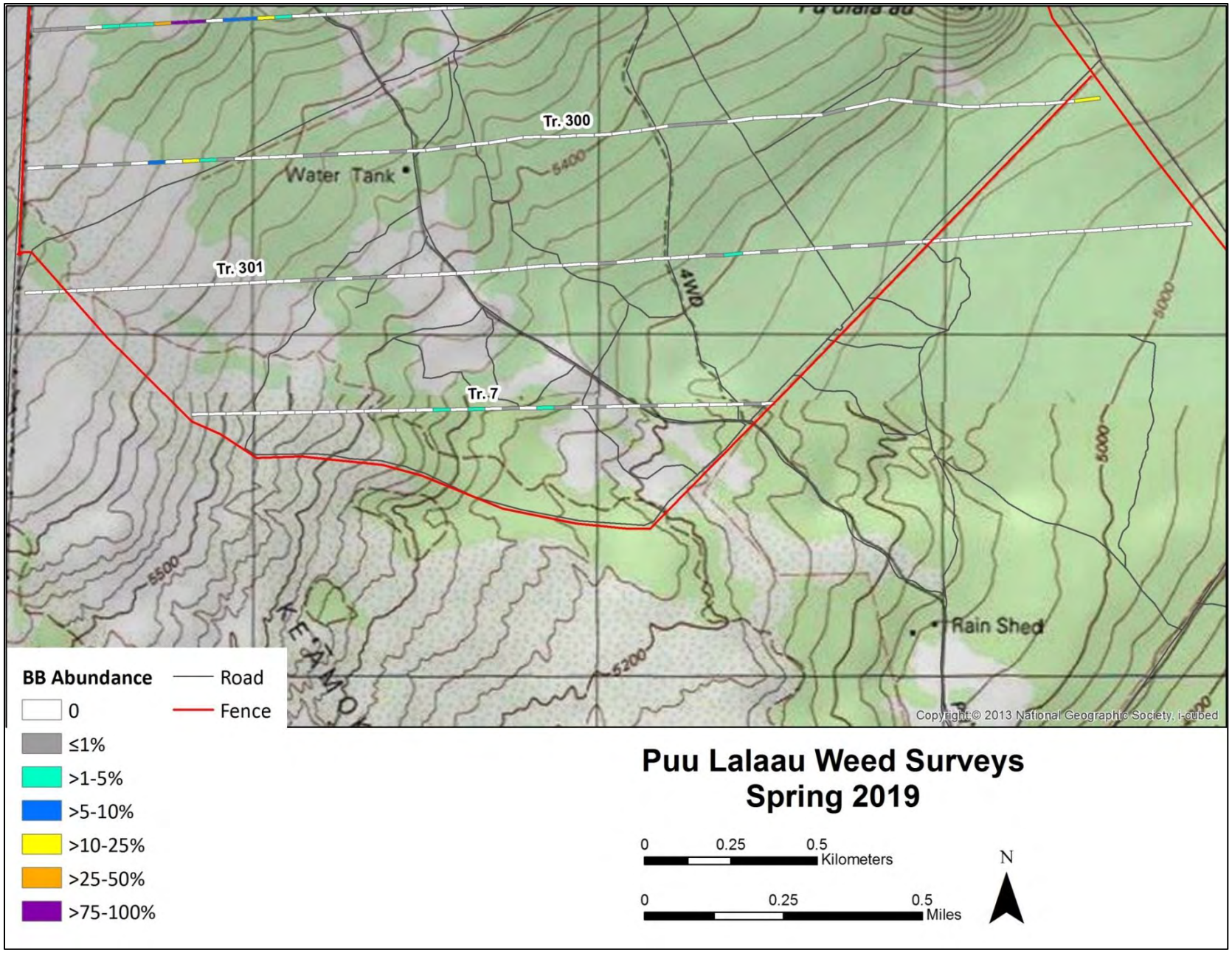


Figure 5. Detailed view of survey results for transects 300, 301, and 7.

APPENDIX 2
FOREST BIRD FIELD SCHOOL REPORT

Three Mountain Alliance (TMA) and Three Mountain Alliance Foundation (TMAF)
Final Report for TMA Forest Bird Field School

TMA partnered with staff from DLNR-DOFAW Natural Area Reserves System (NARS) to hold a week-long course on Hawaiian forest bird identification January 28 – February 1, 2019. The field school was held at Keauhou and participants stayed at the Keawewai Cabin. Field school leaders were Colleen Cole (TMA) and Alex Wang (NARS). The goal of the field school was to increase the number of primary observers able to identify all Hawaiian forest birds, including endangered species, by sight and sound. Primary observers are needed to conduct forest bird surveys, providing land managers with important information on native bird populations.

We sent out a call for applications in the fall and received over 40 applicants. We limited the field school to 16 participants because of available space in the Keawewai Cabin but also to keep an effective student/teacher ratio. We prioritized Hawai‘i Island-based applicants who committed to participating in at least one forest bird survey on Hawai‘i Island in spring 2019. We also selected students who had at least some experience in identifying forest birds in Hawai‘i as this school was not meant for beginner birders.

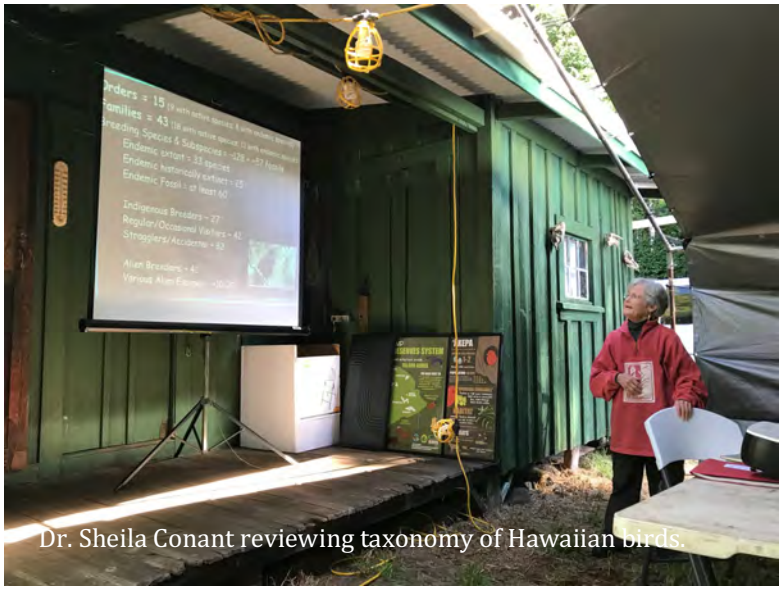
We selected 16 students who ranged in age and experience, from undergraduate to retired. All but one of the students resided on Hawai‘i Island. One student lived on O‘ahu but traveled to Hawai‘i Island frequently to participate in forest bird surveys and had worked on natural resource management and conservation projects on Hawai‘i Island in the past. Half of the students were born and raised in Hawai‘i.


Students practicing forest bird identification skills.

Students received a packet for the week which included the schedule, selected articles on Hawaiian forest birds, habitat assessment guides, maps, and practice survey books. Each student received a copy of Hawai'i's Birds published by the Hawai'i Audubon Society. TMA purchased 15 pairs of binoculars for students to borrow for the week.

Students were placed into five teams (named after forest birds found in the area) for the week: 'Akiapōlā'au, 'Elepaio, 'Apapane, 'Alawī, and 'Akepa. Each team was balanced so that more advanced students could assist the less experienced. Teams helped each other throughout the week, working together to aid each other in spotting birds and identification techniques.

The weeklong course included training sessions in the field focusing on forest bird vocalizations, identification by sight and sound, and survey methods (Appendix 1). Students worked closely with field leaders and mentor birders to improve their birding and survey skills. In the afternoons, invited ornithologists and other experts led presentations on Hawaiian forest bird biology and conservation, survey methods and data collection, and Hawaiian perspectives and understandings of birds (Appendix 1).


Dr. Sheila Conant reviewing taxonomy of Hawaiian birds.

Fourteen guest experts provided assistance for the field school as speakers or mentors. Guest speakers included Dr. Pat Hart (UH-Hilo), Dr. Sheila Conant (UH-Mānoa, retired), Dr. Thane Pratt (USGS, retired), Dr. Paul Banko (USGS), Dr. Jim Jacobi (USGS), Kevin Brinck (USGS), and Noah Gomes (KS). Additionally, experts provided critical support as mentor birders, assisting students with forest bird identification in the field. These experts have

years of experience conducting forest bird surveys in Hawai‘i and studying native birds. These mentor birders included: Dr. Thane Pratt (USGS, retired), Iwi Joaquin (KS), Steve Kendall (USFWS, Hakalau Forest Wildlife Refuge), Donna Ball and Eldridge Naboa (USFWS, Ecological Services); and, Josh Pang-Ching and Ian Cole (DLNR-DOFAW). Additionally, Laura Berthold from the Maui Forest Bird Recovery Project (MFBRP) attended three days of the field school to observe as MFBRP is considering conducting a similar field school on Maui. Laura also served as a mentor birder during her stay.


Kevin Brinck discussing survey methods and best practices.

TMA staff from ‘Imi Pono no ka ‘Āina provided critical logistical support by shopping for all meals and preparing dinners. ‘Imi Pono staff also prepared food for students to make their own breakfasts and lunch each day. Additionally, ‘Imi Pono staff ferried guest speakers and mentor birders to and from the Keauhou Ranch House to Keawewai Cabin or other sites around Keauhou. This support by ‘Imi Pono staff was important in allowing students and field school leaders to focus on the content of the course and not be distracted by logistics and associated challenges.

On the last day of the course, students were tested by conducting a practice forest bird survey along established transects at Keauhou. A small group of students surveyed 5 stations with a mentor birder. The goal was for students to have the same or very similar observations as the mentor birder, including same number of species and same (or close to) number of individuals. Detections of endangered species were especially critical, and students must be able to identify those species consistently to achieve primary observer status. Eight students achieved “Primary Observer” status, meaning they possess the skills necessary to identify all forest birds on Hawai‘i Island by sight and sound, including endangered species. The remaining eight students earned “Secondary Observer” status meaning they are still gaining or developing skills to identify all birds by sight and sound.

We provided each student with a brief evaluation of their forest bird and survey skills, highlighting their strengths but also areas to work on.


Field school students practice dry forest survey skills at Kaʻohe.

All students participated as primary or secondary observers in Hawaiʻi Island forest bird surveys including:

- Pallia/Mauna Kea
- Keauhou/Kīlauea
- Kūlani/Puʻu Makaʻala Natural Area Reserve
- Kaʻū Forest
- Hakalau Forest National Wildlife Refuge (including Hakalau and Kona units)

At least two students who earned secondary observer status at the field school achieved primary observer status later over the course of the spring survey season, resulting in 10 primary observers from the field school.


Forest Bird field school graduates, field leaders, and guest experts.

Appendix 1. TMA Forest Bird Field School Schedule

Monday January 28, 2019		
Morning	**Afternoon** (1- 4 pm)	**Evening (**after dinner)
8:00 am Welcome (Iwi) - Welcome group to Keauhou, provide history of site, things to know -Group Introductions **10:00 Hawaiian Birding 101** (Alex) -issue binoculars, point count books, Bird ID books -Alex overview - identification by sight of common birds using field marks (plumage, size, etc.) and vocalizations. Using binoculars. -Break into Teams (1-5) and work with mentor birder	**Ornithology 101** (Sheila Conant & Pat Hart) – Presentations focus on passerines (perching birds) and families found in Hawai'i: finches, thrushes, flycatchers, hawks, corvids. Review biology, breeding behavior, life history, and vocalizations.	Hawaiian Bird Jeopardy!
Tuesday - January 29, 2019		
Morning	**Afternoon** (1- 4 pm)	**Evening** (after dinner)
7am-9am Birding with mentors - working alongside expert birders to practice identifying vocalizations of common birds. **9am-10am Survey Methods** - mock point counts (species level only). **10 -11:30am Vegetation Assessment** (Jim Jacobi) - training and background of rapid vegetation assessment for surveys	**Ornithology 102** (Thane Pratt) –"Why Point Counts?" Point count methodology, rationale and history of counts in Hawai'i. **Hawaiian Forest Birds: History of Decline and Extinction** (Paul Banko) – The role of specialization in forest bird decline.	Hawaiian Bird Trivia Night
Wednesday – January 30, 2019		
Morning	**Afternoon** (1- 4 pm)	**Evening** (after dinner)
7am-9am Birding with mentors (Upper Powerline or Palakea) **-** Focus on identifying endangered species**.** Continue practice of identifying vocalizations	**Hawaiian Cultural Perspectives** (Noah Gomes & Sheila Conant) – overview on historic and current cultural relationships with birds including featherwork and bird catching.	Hawaiian bird vocalization & photo ID quizzes (2 Prizes awarded)

9am - 10am Survey methods: Mock point counts include species and number of individuals. **10am-11:30am Distance Calibration/Stats** (Kevin/Ayesha) – in field, near cabin. Introduction to distance calibration and statistics used to analyze survey results.		
Thursday – January 31, 2019		
Morning	**Afternoon** (1- 4 pm)	**Evening** (after dinner)
MAUNA KEA (Ka'ohe) **Overview of Mauna Kea Forest Restoration Project -** Kalā Asing **Birding in small groups** - Identify Mauna Kea dry forest bird species **Survey methods**: Distance calibration. Mock point counts with species, number & distance.	**MAUNA KEA (Ka'ohe)** **Current Conservation** (Paul Banko) – Updated information on status of Hawaiian birds, how we use survey data, where are the birds **Current Management** (Kalā Asing) - How are managers working to address Palila conservation? Successes and challenges	Birding Talk Story
Friday – February 1, 2019		
Morning	**Afternoon** (1- 4 pm)	**Evening** (after dinner)
Final! Teams survey with mentor on 5 stations on transects at Keauhou/Kīlauea: 290, 291, 292, 293	Pack Up/Clean Presentation of Certificates Goodbyes & Mahalos!	

APPENDIX 3

2019 KEAUHOU-KĪLAUEA FOREST BIRD SURVEY REPORT

Three Mountain Alliance Forest Bird Surveys

at Keauhou-Kīlauea

Summary of Detections in 2019

Report to Kamehameha Schools

July 2019

THREE MOUNTAIN ALLIANCE

The annual TMA forest bird surveys at Keauhou-Kīlauea took place February 20-21, 2019. Survey efforts were led by Colleen Cole, TMA Coordinator; assistance was provided by TMA staff and volunteers from partner agencies and the community (Table 1).

Table 1. Participants, 2019 Keauhou-Kīlauea Forest Bird Surveys

Name	Affiliation	Counter type
Brooks Rownd	Community Volunteer	Primary
Bret Mossman *	DOFAW-NARS	Primary
Alex Wang	DOFAW-NARS	Primary
Iwikau Joaquin	Kamehameha Schools	Primary
Noah Gomes	Kamehameha Schools	Primary
Lila Fried *	Kupu/DOFAW	Primary
Emily Leucht *	TMA	Primary
Colleen Cole	TMA	Primary
Eric Hamren *	Community Volunteer	Secondary
Kirk Olsen *	Community Volunteer	Secondary
Jacob Drucker	Community Volunteer	Secondary
Ande Buskirk	DOFAW-NARS	Secondary
Amelie Sterling	TMA	Secondary
Lea Kaahaaina	TMA	Secondary
Sam Foote	TMA	Secondary
Karin Schlappa	TMA	Secondary
Taylor Warner	TMA	Secondary
Parker Powell	TMA	Secondary

* Surveyors who graduated from the TMA Forest Bird Field School in January 2019

Observers used the variable circular plot method (VCP). At each station species, distance and detection method (audible and/or visual) were recorded for each individual bird detected during an 8-minute interval. For rare birds, detection before or after the count period and detections between stations were also recorded. Data were entered into a MS Access database using the Avian Monitoring Entry Form. Entered and proofed data were passed on to USGS for inclusion in Hawai‘i Forest Bird Database and possible future analysis of population trends. This report provides a short summary of the detections.

A total of 150 stations along 7 transects were surveyed in the Keauhou, Pu‘u Lala‘au, Pu‘u Kīpū and Kūlani Cone units (Table 2, Figure1). One observer could not find the flagging for station 25 on transect 300; thus, there are no data for that station. Furthermore, although data were collected for stations 18 – 30 on transect 292, data are not present because an observer misplaced the booklet. Results are shown in Table 3. Figures 2-9 illustrate detections for endemic species and figures 10-17 illustrate detections for introduced species.

Table 2. Transect and stations surveyed during 2019 Keauhou-Kīlauea bird surveys.

Transect	Stations surveyed	# Stations surveyed
282	1-10	10
290	1-22	22
291	1-25	25
292	1-17; 31	18
293	1-30	30
300	1-24, 26-27	26
301	1-19	19

Table 3. Species detections at stations for 2019 Keauhou-Kīlauea forest bird surveys. Birds per station data for 2018 are listed for comparison.

Alpha Code	Common Name	Scientific Name	Origin†	Status*	2019 # Stations Occupied	2019 # Detected	2019 Percent Occurrence	2019 Birds per Station	2018 ** Birds per Station
AKIP	ʻAkiapōlāʻau	*Hemiganthus wilsoni*	End	E	30	40	19.87	0.26	0.11
APAP	ʻApapane	*Himatione sanguinea*	End		150	1058	99.34	7.01	9.60
CHUK	Chukar	*Alectoris chukar*	Int		1	1	0.66	0.01	-
COMW	Common Waxbill	*Estrilda astrild*	Int		1	2	0.66	0.01	-
ERFR	Erckel's Francolin	*Pternistis erckelii*	Int		5	5	3.31	0.03	0.08
HAAK	Hawaiʻi ʻĀkepa	*Loxops coccineus*	End	E		1	0.66	0.01	0.03
HAAM	Hawaiʻi ʻAmakihi	*Chlorodepanis virens*	End		148	501	98.01	3.32	2.25
HAEL	Hawaiʻi ʻElepaio	*Chasiempis sandwichensis*	End		115	269	76.16	1.78	0.70
HCRE	Hawaiʻi Creeper, ʻAlawī	*Loxops mana*	End	E	15	21	9.93	0.14	0.09
HWAH	ʻIo, Hawaiian Hawk	*Buteo solitarius*	End	E	4	4	2.65	0.03	0.01
IIWI	ʻIʻiwi	*Drepanis coccinea*	End	T	93	181	61.59	1.20	1.20
JABW	Japanese Bush-Warbler	*Cettia diphone*	Int		36	47	23.84	0.31	0.49
JAWE	Japanese White-eye	*Zosterops japonicus*	Int		136	395	90.07	2.62	3.24
KAPH	Kalij Pheasant	*Lophura leucomelanos*	Int		7	8	4.64	0.05	0.04
NOCA	Northern Cardinal	*Cardinalis cardinalis*	Int		36	42	23.84	0.28	0.32
OMAO	ʻŌmaʻo	*Myadestes obscurus*	End		140	352	92.72	2.33	2.39
RBLE	Red-billed Leiothrix	*Leiothrix lutea*	Int		59	101	39.07	0.67	0.81
YFCA	Yellow-fronted Canary	*Serinus mozambicus*	Int		9	14	5.96	0.09	0.02

†End = endemic, Int = introduced, Ind = Indigenous; * E = endangered; T = threatened

** 2018: 336 stations were surveyed along 19 transects

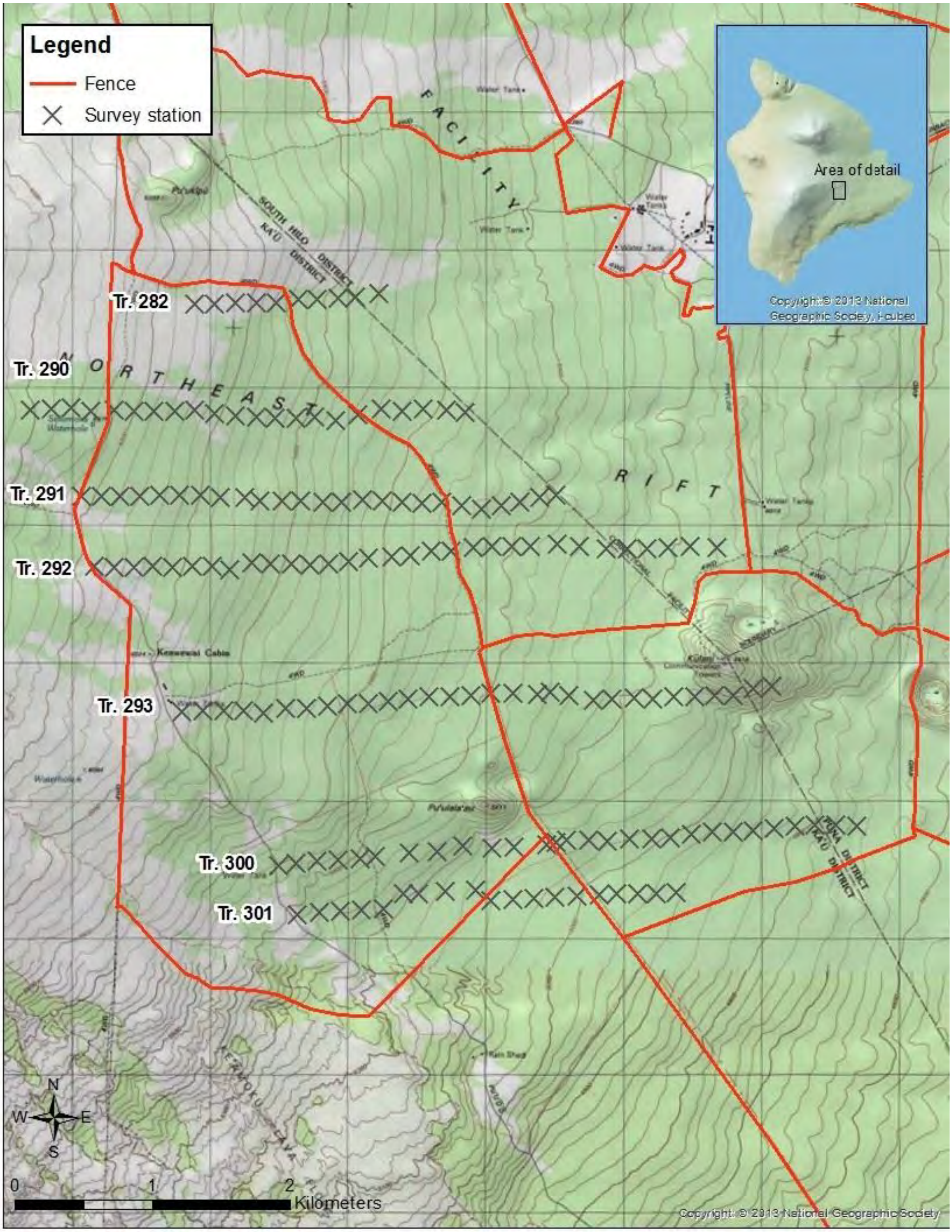


Figure 1. Transects and stations surveyed during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

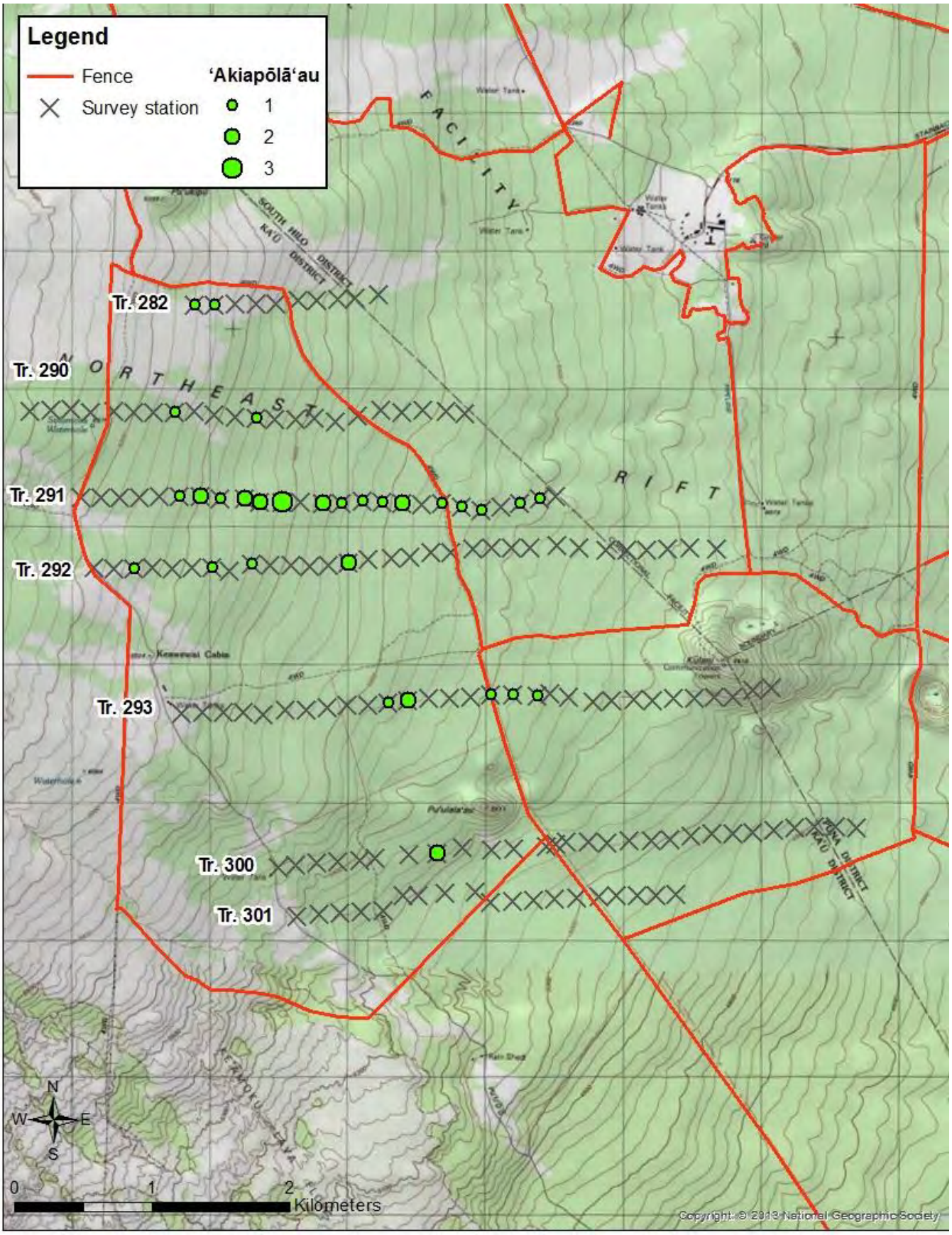


Figure 2. Detections of 'Akiapōlā'au *Hemiganthus wilsoni*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

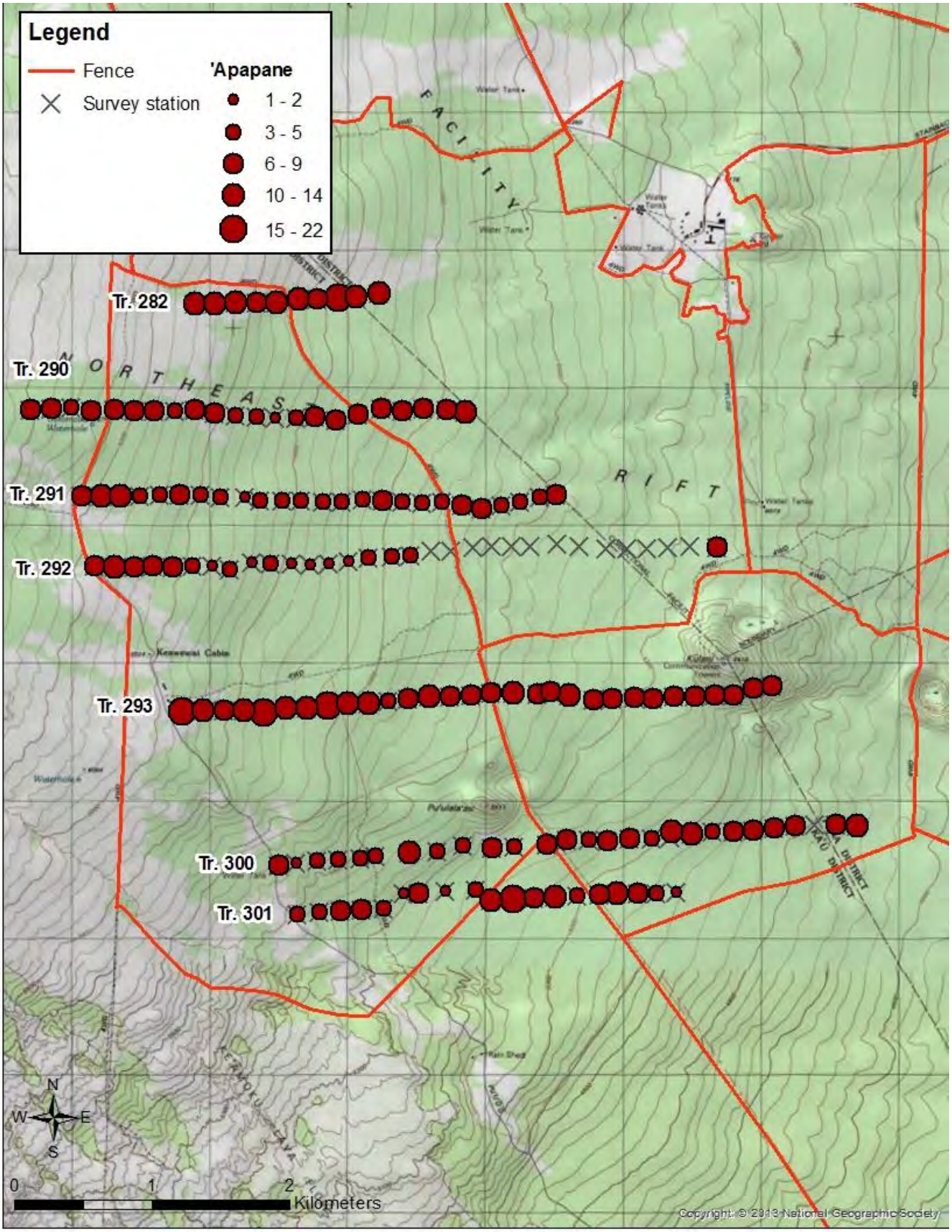


Figure 3. Detections of ‘Apapane (*Himatione sanguinea*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

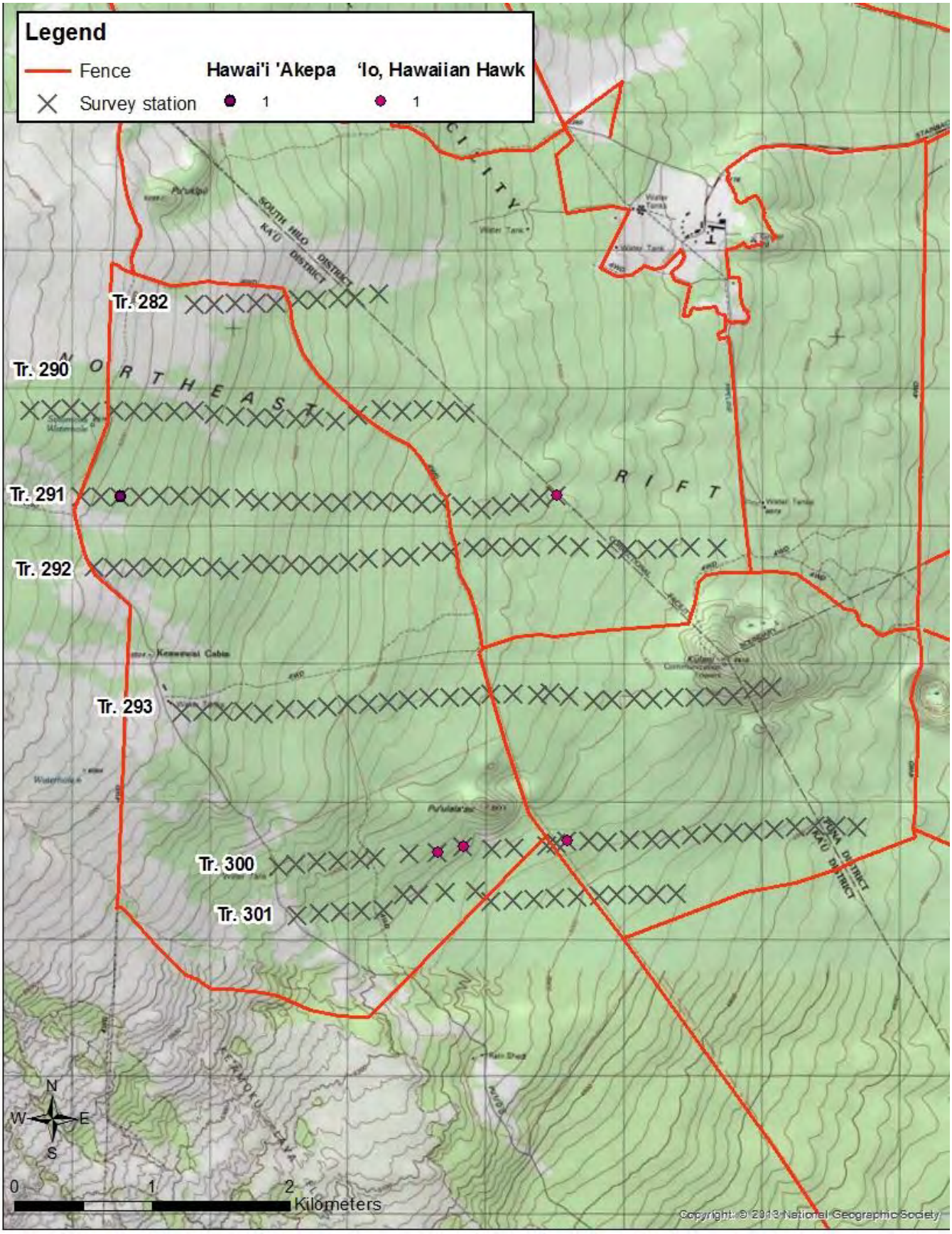


Figure 4. Detections of Hawai'i 'Ākepa (*Loxops coccineus coccineus*) and 'Io (*Buteo solitarius*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

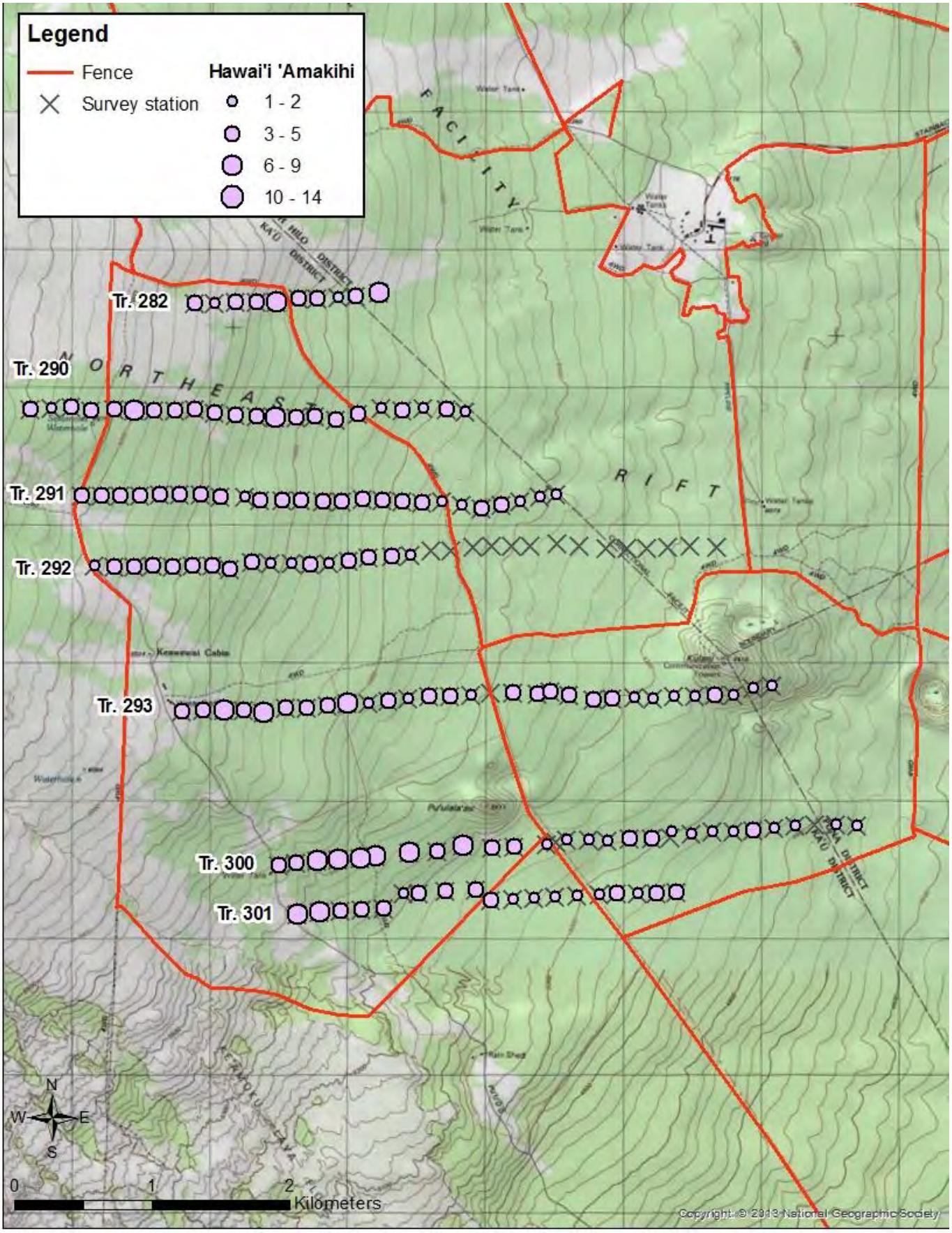


Figure 5. Detections of Hawai'i 'Amakihi (*Chlorodepanis virens*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

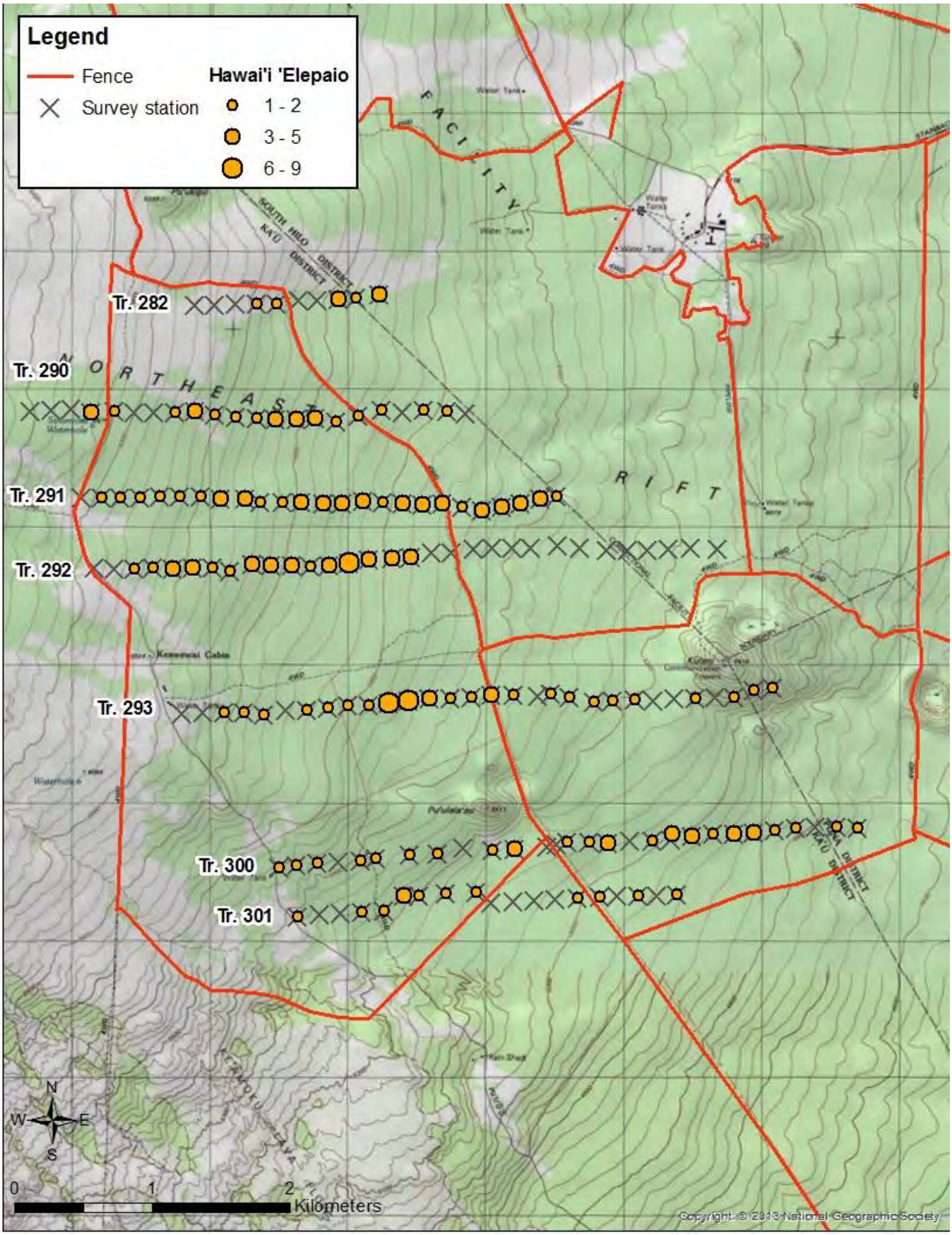


Figure 6. Detections of Hawai‘i ‘Elepaio (*Chasiempis sandwichensis*) during 2019 TMA forest bird surveys at Keauhou-Kīlauea.

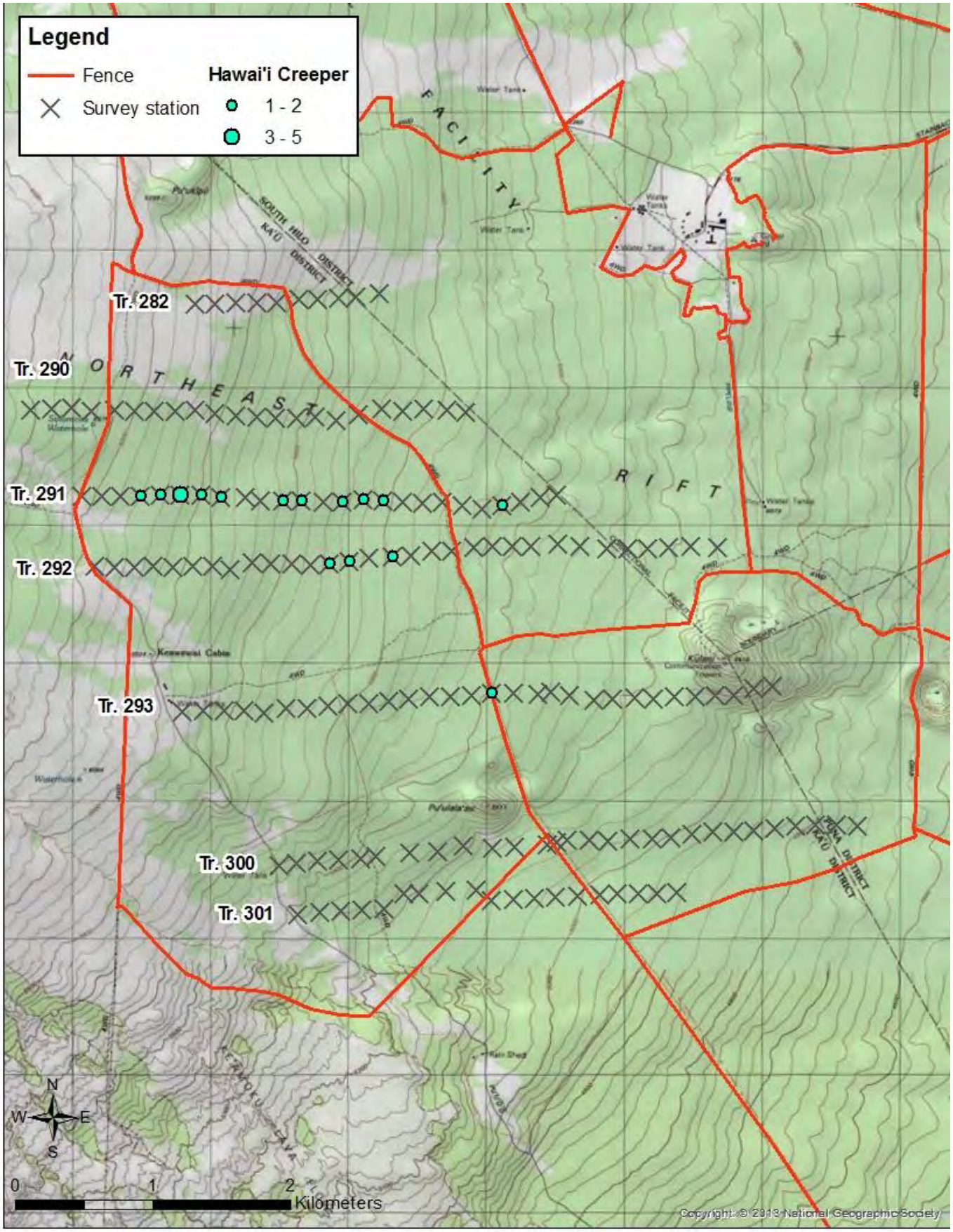


Figure 7. Detections of ‘Alawī or Hawai‘i Creeper (*Loxpos mana*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

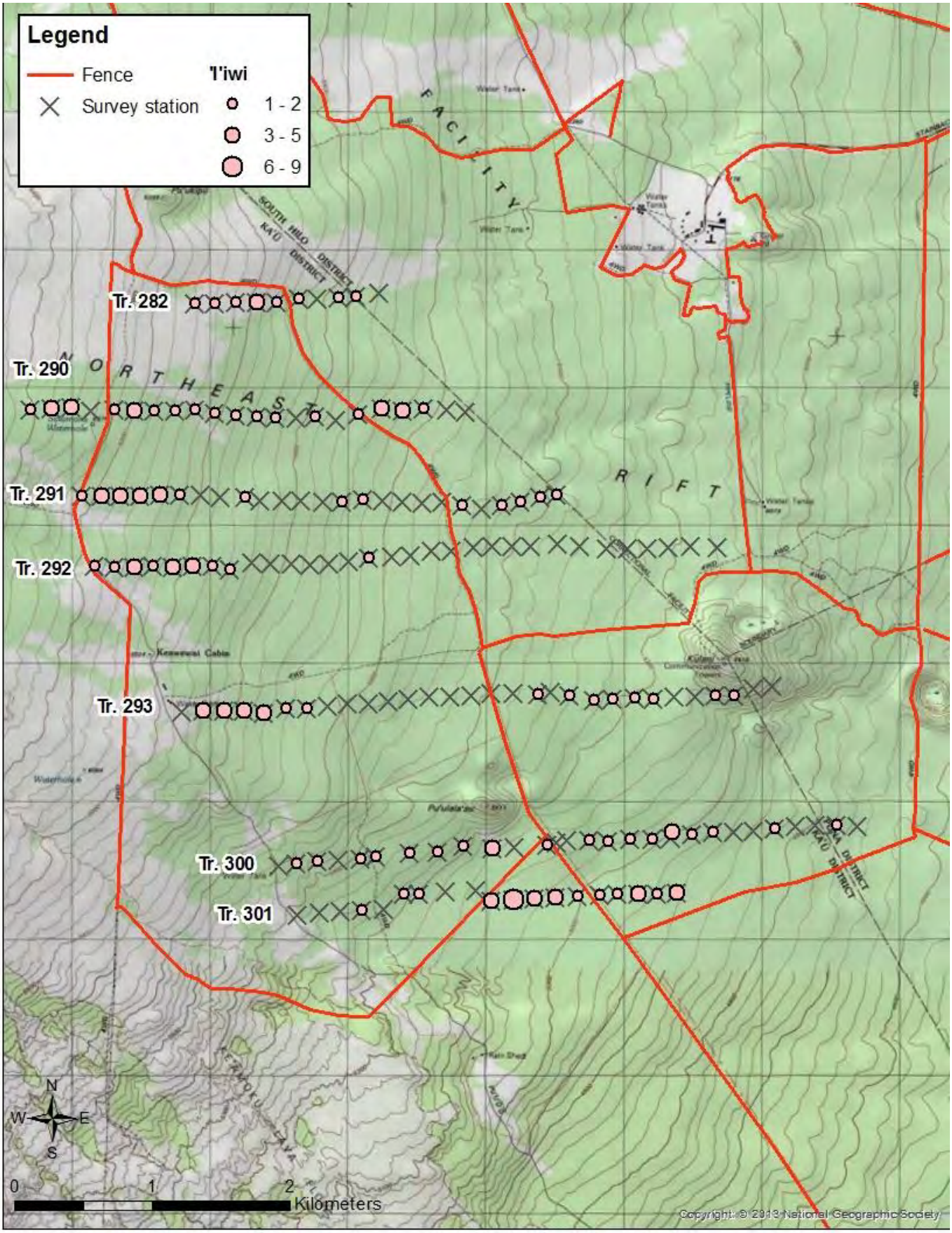


Figure 8. Detections of ʻIʻiwi (*Drepanis coccinea*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

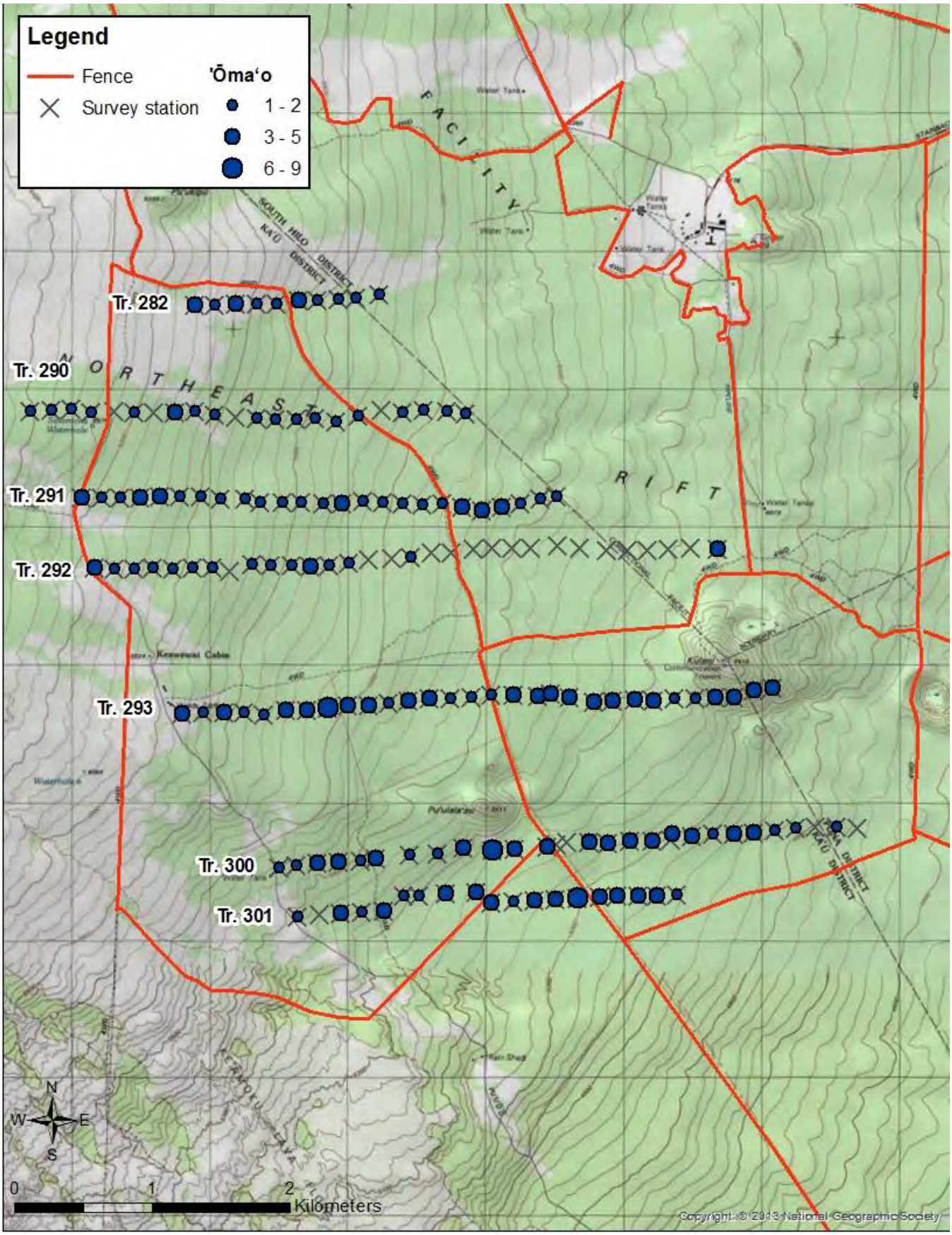


Figure 9. Detections of ‘Ōma‘o (*Myadestes obscurus*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

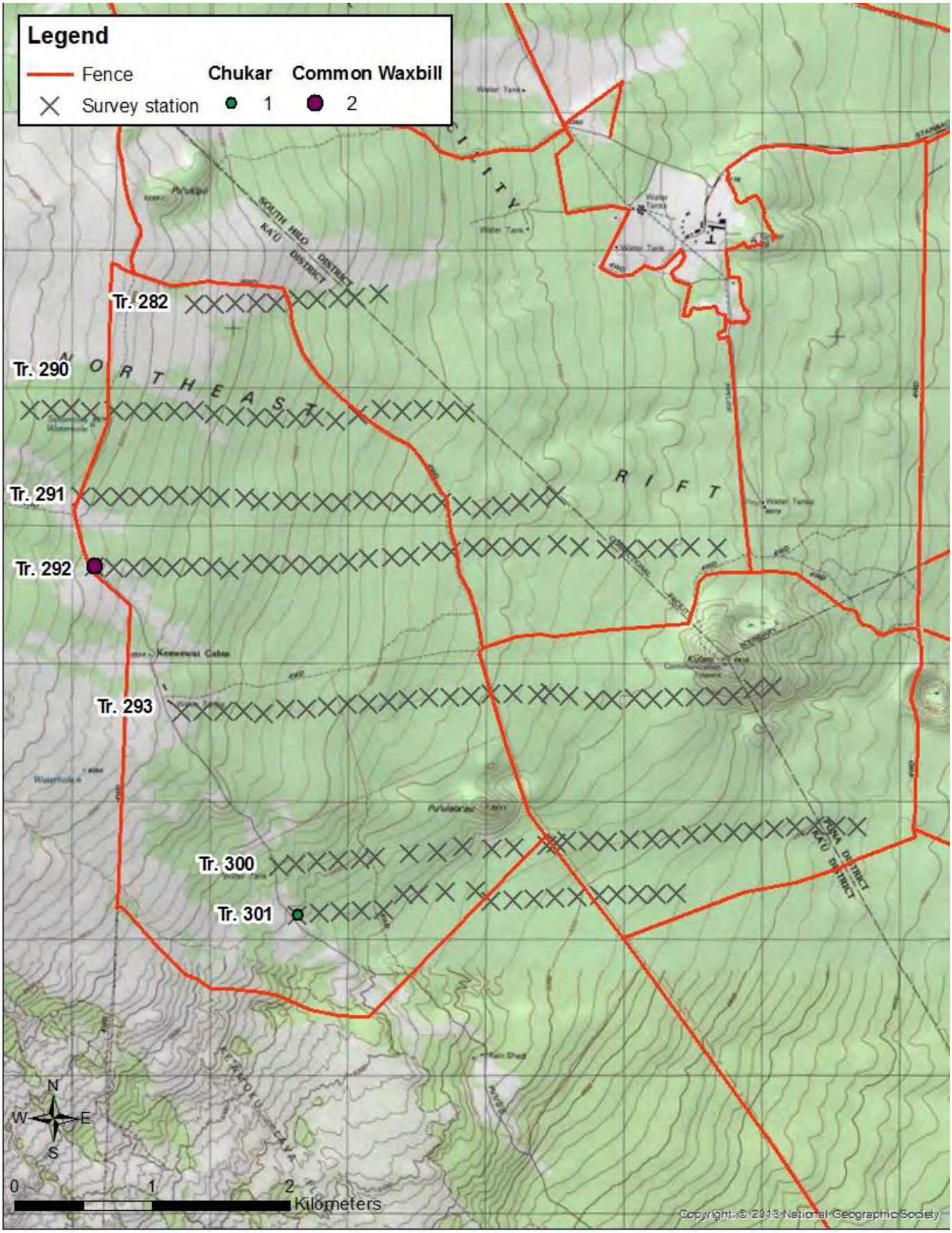


Figure 10. Detections of Chukar (*Alectoris chukar*) and Common Waxbill (*Estrilda astrild*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

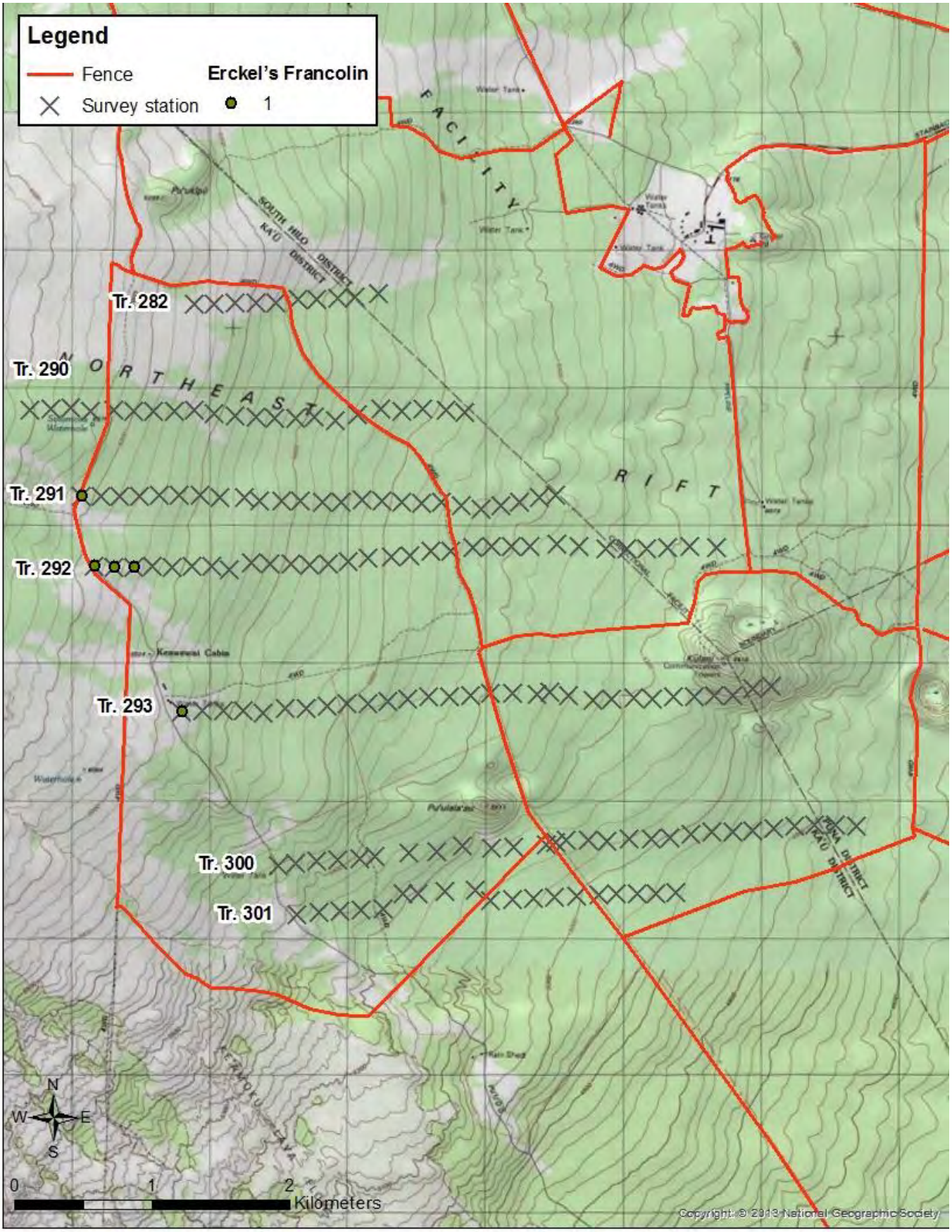


Figure 11. Detections of Erckel's Francolin (*Pternistis erckelii*) 2019 TMA forest bird surveys at Keauhou-Kīlauea.

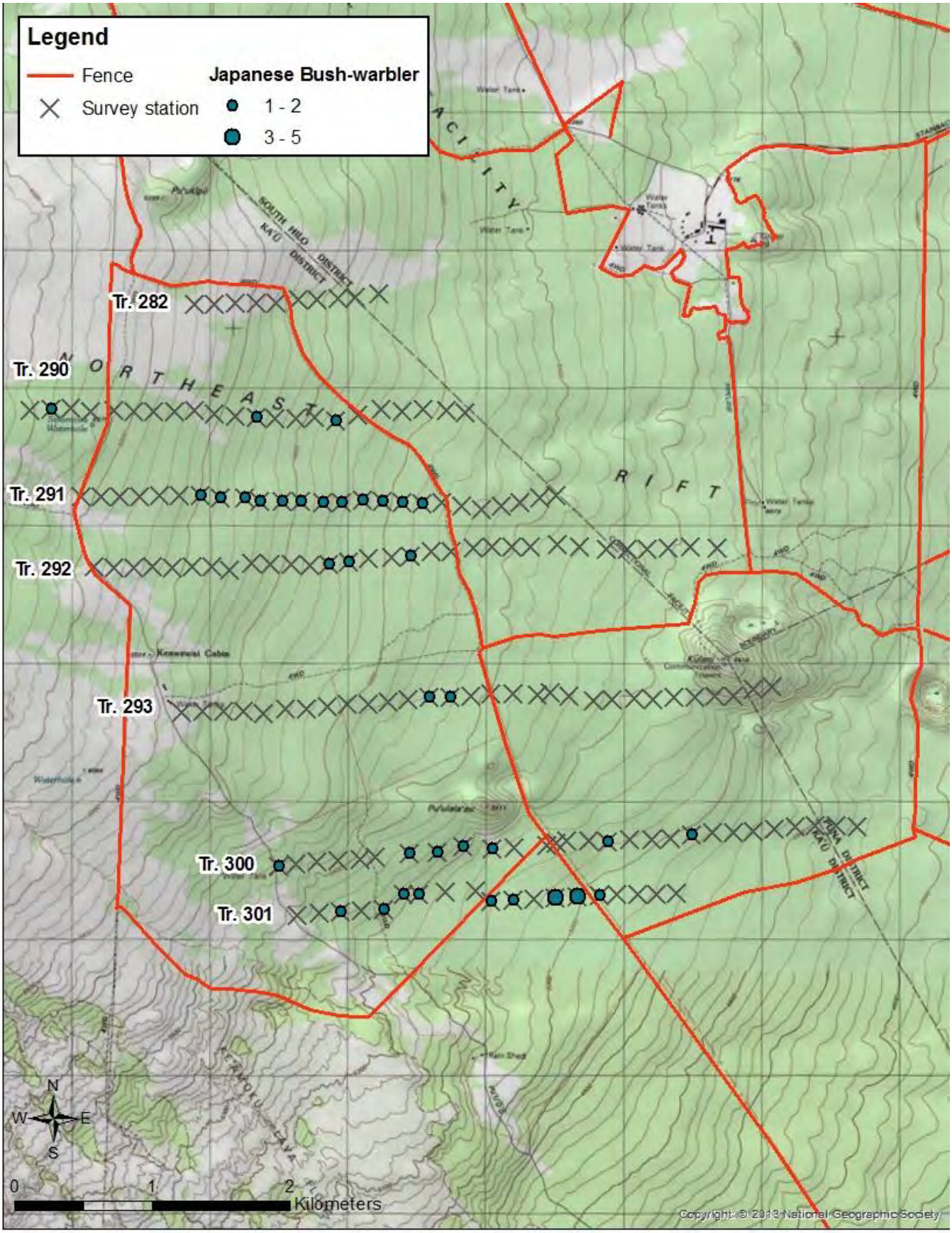


Figure 12. Detections of Japanese Bush-Warbler (*Cettia diphone*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

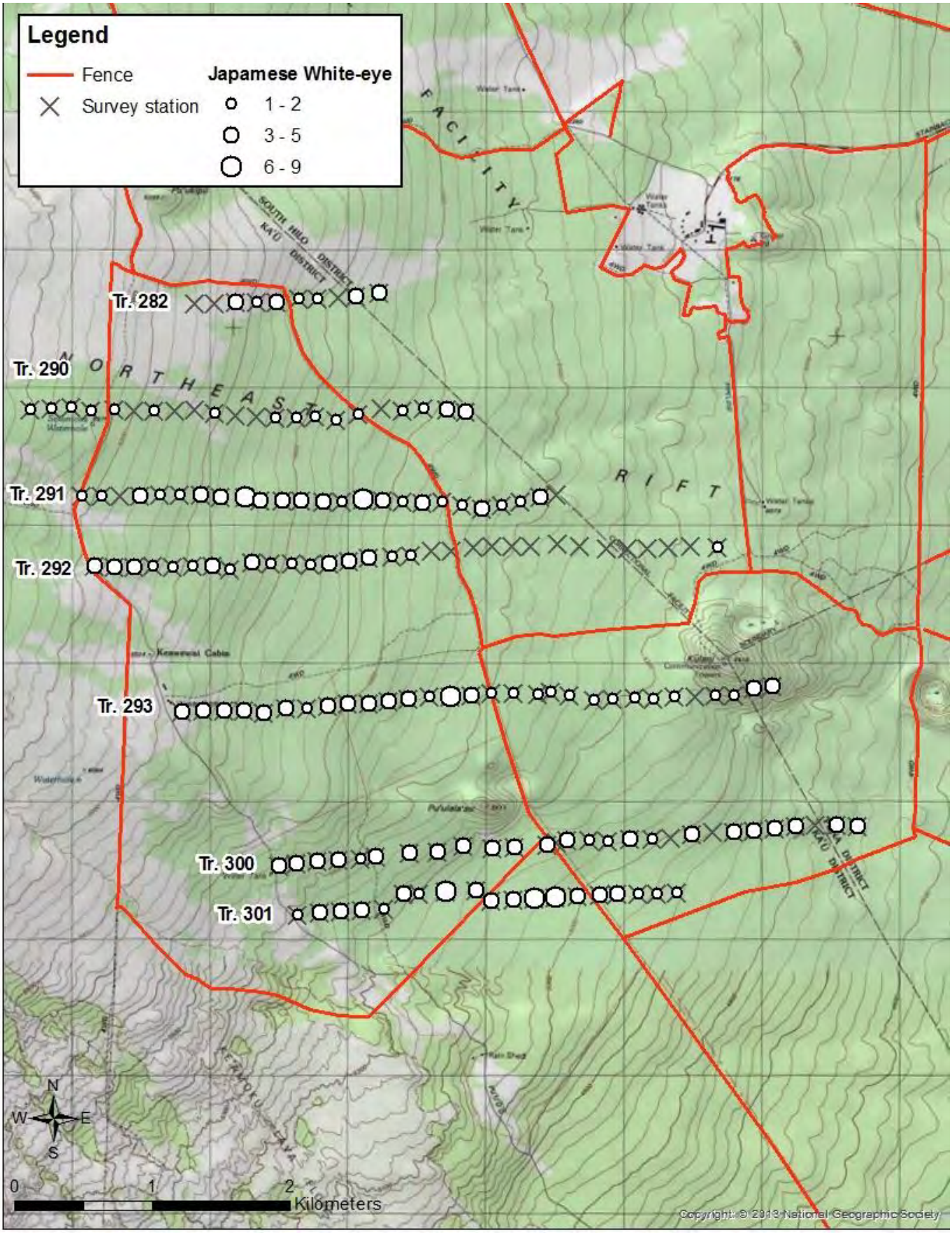


Figure 13. Detections of Japanese White-eye (*Zosterops japonicus*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

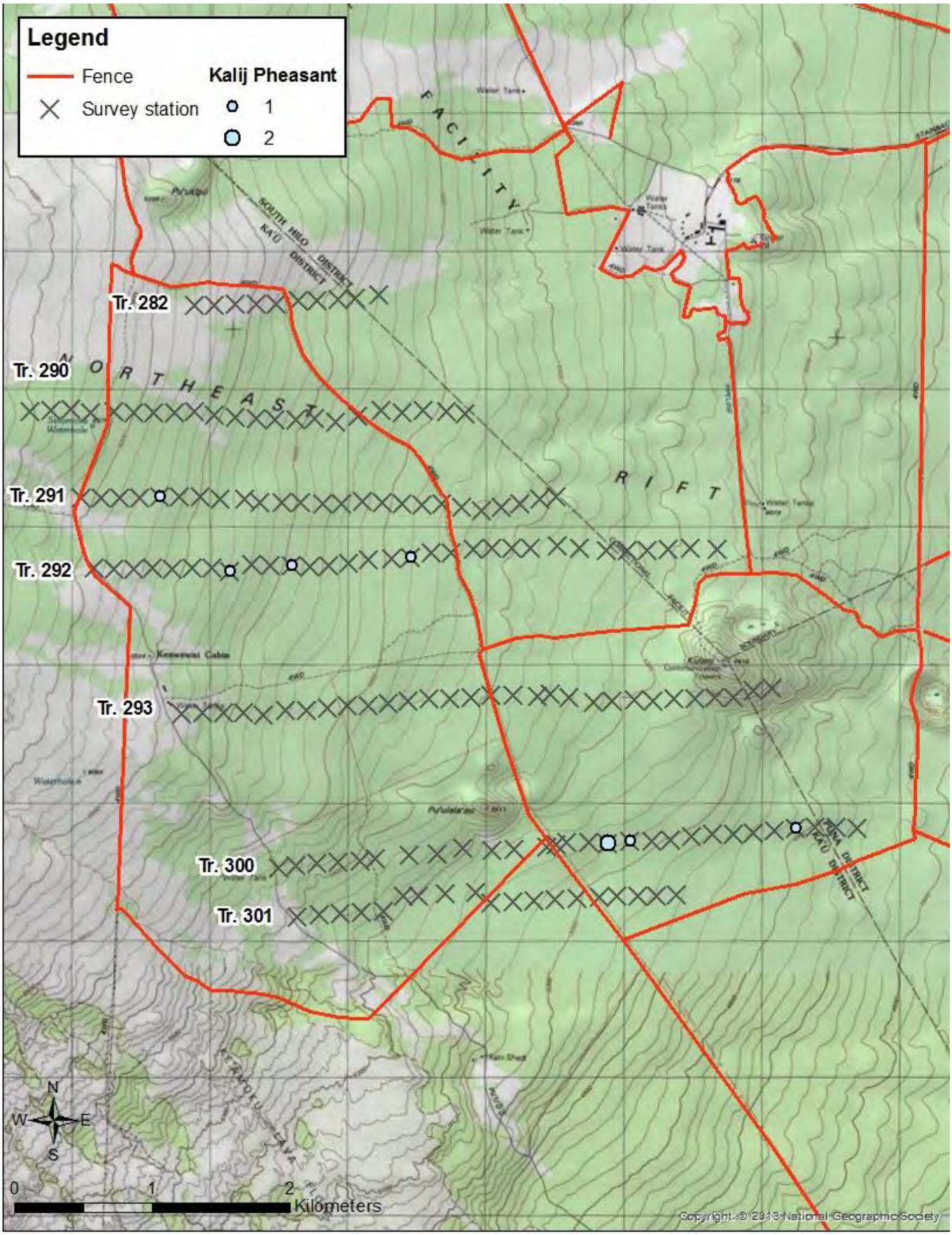


Figure 14. Detections of Kalij Pheasant (*Lophura leucomelanos*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

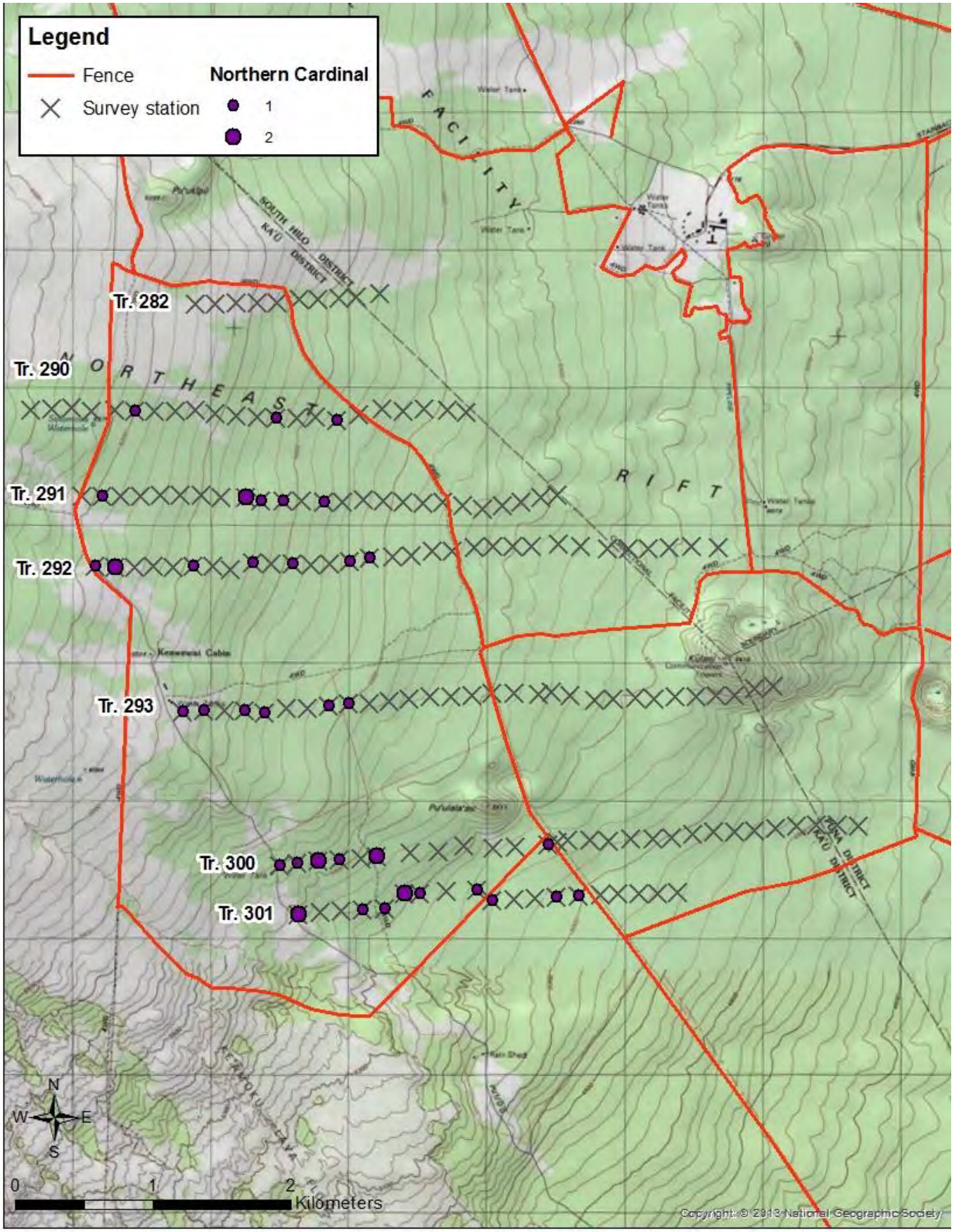


Figure 15. Detections of Northern Cardinal (*Cardinalis cardinalis*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

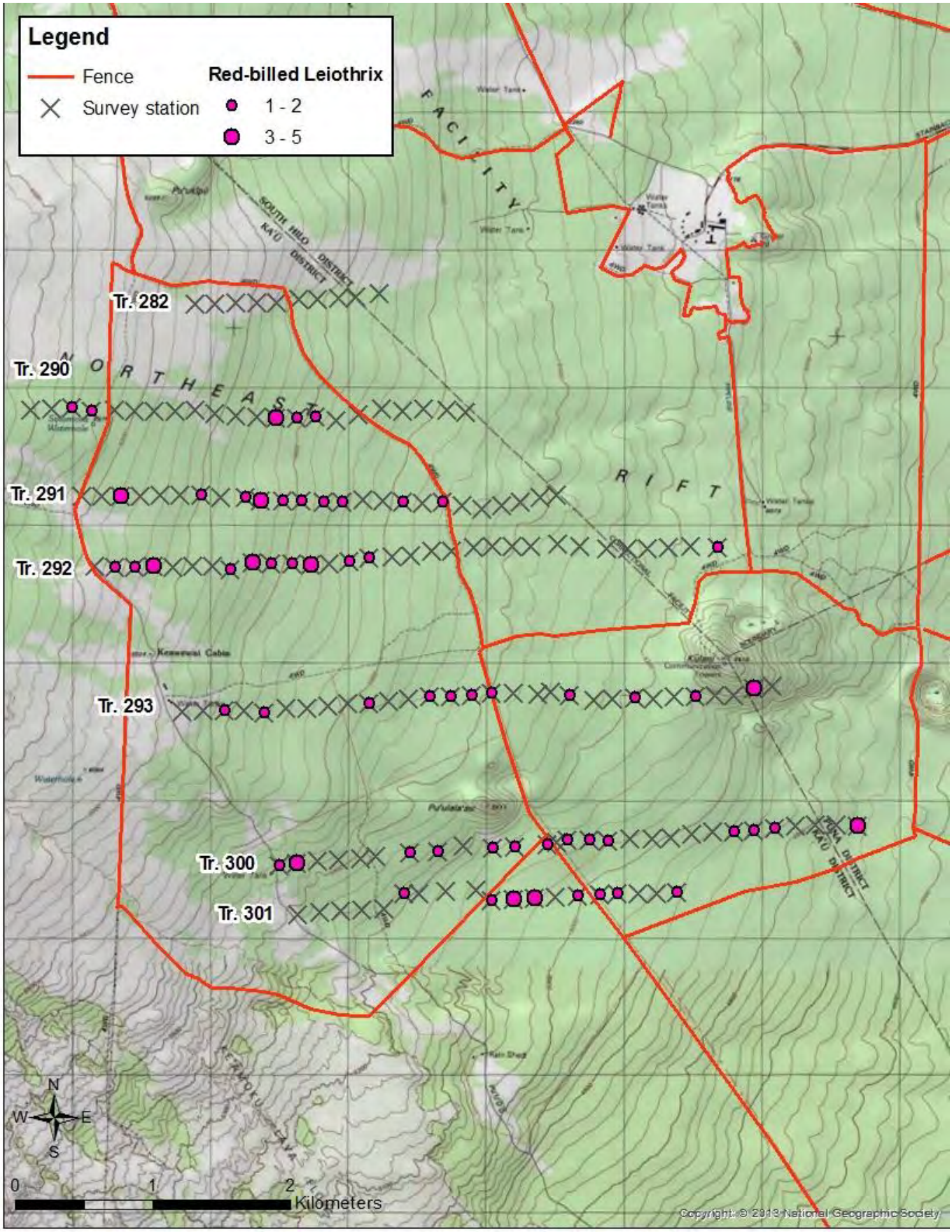


Figure 16. Detections of Red-billed Leiothrix (*Leiothrix lutea*) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

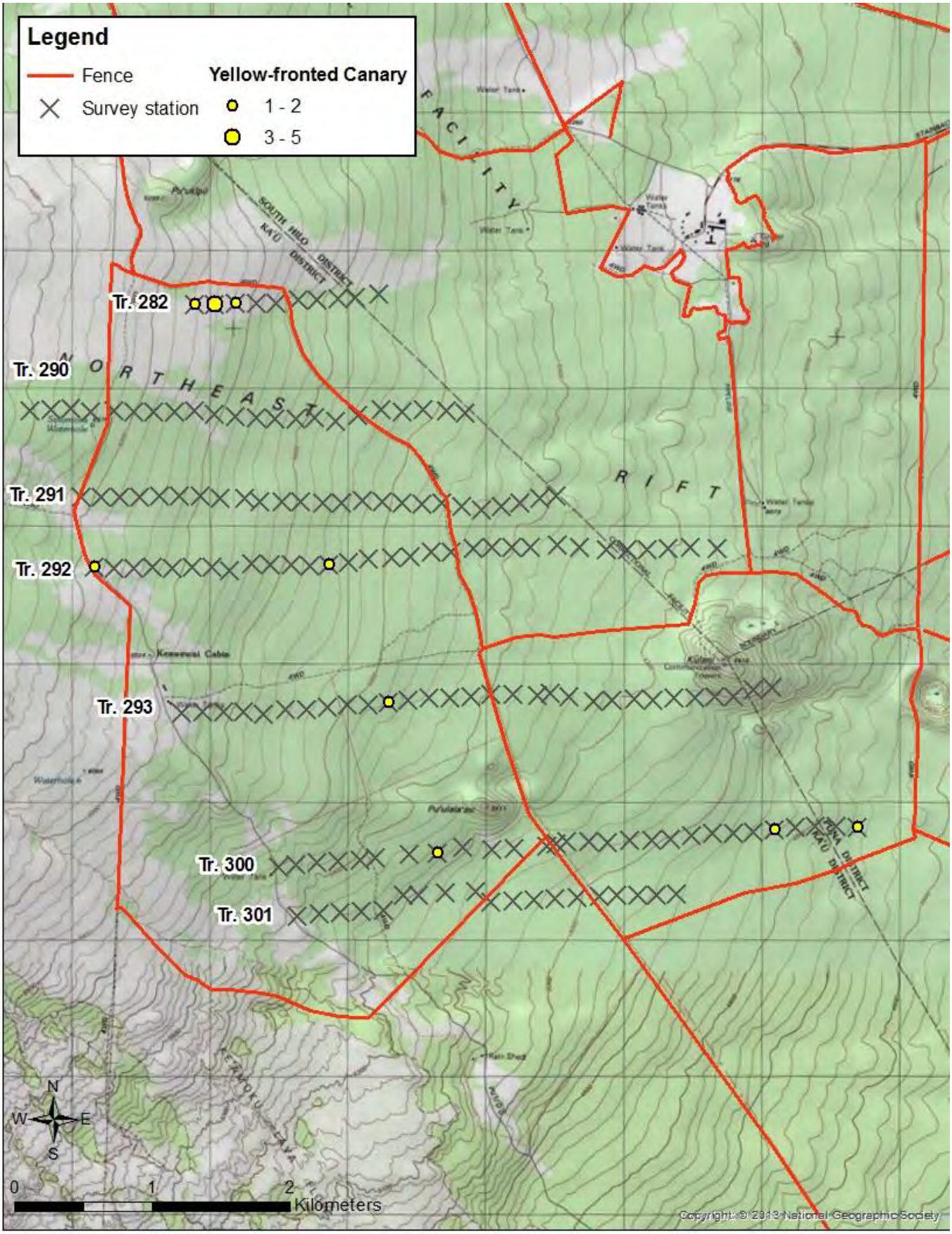


Figure 17. Detections of Yellow-fronted Canary (Serinus mozambicus) during the 2019 TMA forest bird surveys at Keauhou-Kīlauea.

APPENDIX 4
2019 NĒNĒ SURVEY REPORT

Nene Survey Results for 2019 Kamehameha Schools Safe Harbor Agreement

As part of the Safe Harbor Agreement between Kamehameha Schools (KS), U.S. Department of the Interior, Fish and Wildlife Service (USFWS), and Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR DOFAW), nene (Branta sandvicensis) activity and nesting surveys were conducted in Kamehameha School's land (Keauhou Ranch, Ohi'a Ranch, 4 Boy's Ranch, and Volcano Winery) (Figure 1) once a month during peak nene nesting season. Visual ground surveys were conducted by a DLNR-DOFAW wildlife biologist or trained wildlife technician at each site once a month, between the hours of 7:00am to 3:30pm, from October 2018 thru March 2019 (Table 1). No nests were observed at any site, however, nesting habits were observed and goslings and fledglings were captured on remote camera traps at Keauhou Ranch, as discussed below.

Keauhou Ranch

Nene were observed during each of the monthly surveys in Keauhou Ranch. A pair of nene frequented the Keauhou Reservoir but nesting was not observed. A pair of nene were also observed along the road in the coals of the last year's wildfire (Figure 1), but they were only seen on one occasion and therefore it is believed the nene were using this area in transit.

The Nene Cabin and surrounding nene pen and reservoir area showed consistent use. In November, a pair of nene were hidden just outside of the fenced reservoir area. The male nene was guarding and later a female nene walked out of the bushes. We returned to the area two weeks later to see if the nene pair were still there, but they had moved on. Subsequent visits to the area showed no signs of the nene or of any signs of a nest.

In January we installed a gravity feeder and a remote camera near the cabin reservoir as a way to get a better idea of nene usage in the area. This remote camera recorded images of adults and goslings using the feeder (Figure 2). This is the first time we observed any evidence of nene raising young within Keauhou Ranch. Three a24 Goodnature traps were deployed in the area to control for predators such as rats. Subsequent camera check in March show that the young nene (near adult size but lack the black collar around the neck) grew out their flight feathers and likely fledged from the area (Figure 3).

Ohi`a Ranch

Ohi`a Ranch is located near the Volcano Golf Course, which is known to have a constant number of nene year-round. Nene activity was fairly high at Ohi'a Ranch, increasing in number later in the nene nesting season, with the most number of nene sighted in the area in March (9 individuals) at the Ohi'a Ranch Reservoir. Despite the activity levels, no nesting habits or nests were observed, and no young nene were ever seen frequenting the area (Table 1).

4-Boy's Ranch

Is located north of the Ohi'a Ranch and is adjacent to several small farms that encountered nene issues along Mahi'ai Road in the past. Despite the close proximity to areas nene are known the frequent, no nene were seen on the ground using the area during these surveys, however 3 nene were seen flying over the ranch on one occasion. These three nene could have also been the three nene seen on the ground in Ohi'a Ranch that same day.

Volcano Winery

The Volcano Winery is located near the entrance to Keauhou Ranch. In previous years, nene were seen using their grounds between the grape vines and in their mulch piles, however no nene activity was observed during this 2019 nene survey.

Overall, nene are known to frequent the Kamehameha Schools Keauhou Ranch and Kilauea Forest Lands. While we did not find any actual nene nests during the 2019 nesting season, we can presume that nesting occurred near the Keauhou Ranch Nene Cabin site. The implementation of remote cameras has shown to be very useful when surveying for nene during their behaviorally shy nesting season. Through the use of a remote camera, we were able to identify goslings as they grew to fledging from Keauhou Ranch.

Figure 1. Nene activity was surveyed in Kamehameha Schools land, including Keauhou Ranch, Ohi`a Ranch, 4 Boy's Ranch, and Volcano Winery. Nene were observed using areas in Keahou Ranch and Ohi`a Ranch.

Table 1. Monthly surveys were conducted during the nene nesting season, from October 2018 thru March 2019. Consistent activity was seen in Keauhou Ranch and Ohi`a Ranch, and nene were seen flying over 4 Boy's Ranch.

		Keauhou Ranch	Ohi`a Ranch	4 Boy's Ranch	Volcano Winery
2018	October	4	0	0	0
2018	November	6	2	0	0
2018	December	2	0	0	0
2019	January	2	3	3 (flyover)	0
2019	February	1	5	0	0
2019	March	1	9	0	0

Figure 2. Remote cameras were placed at the Nene Cabin reservoir in January 2019. While not observed during the survey, goslings and fledglings were captured on our remote camera.

Figure 3. Remote cameras were placed at the Nene Cabin reservoir in February. While not observed during the survey, goslings and fledglings were captured on our remote game cameras. The nene lacking the black collar around their neck are fledglings.

APPENDIX 5

PEPP RARE PLANT SURVEY AT KĪLAUEA AND KEAUHOU- PRELIMINARY RESULTS

PEPP RARE PLANT SURVEY AT KĪLAUEA AND KEAUHOU

PRELIMINARY RESULTS FROM PHASE ONE: SURVEY OF EXISTING POPULATIONS

By

The Hawaiʻi Island Plant Extinction Prevention Program

Joshua VanDeMark

And

Reid Loo

Submitted to

Kamehameha Schools

August 2019

SUMMARY

The Hawai‘i Island Plant Extinction Prevention Program is conducting a reassessment of all wild and out-planted threatened and endangered species identified in the 2018 Keauhou Safe Harbor Agreement (KSHA). The KSHA identified the presence of eight species with federal protection at Keauhou and Kīlauea, totaling 789 individuals. We are using information from within the KSHA, from previous surveys (Fraiola and Rubenstein 2007), location information provided by the Three Mountain Alliance (TMA), as well as conversations and anecdotal information from others who have had a role in rare plant work at Keauhou and Kīlauea over the years to ensure that we revisit all the locations that contributed to the baseline population requirements for each of the eight species. The following update outlines our work on each species so far and borrows tables from Fraiola and Rubenstein 2007 to show the original population units and numbers of individuals compared to what we have relocated at each site we have visited (in red text).

Asplenium peruvianum* var. *insulare

We have not yet visited the historic locations for this species. It is one of the last remaining species we need to evaluate. We anticipate we can visit these sites and reassess the populations during 2/3 days in the first week of September (2019).

Location		Population Units	Individuals
Above Power line Road	Keauhou	4/?	82/?
Pu‘u Lala’au Unit	Keauhou	3/?	46/?
	TOTAL	7/?	128/?

Clermontia lindseyana

Wild individuals of *Clermontia lindseyana* were known from Pu‘u Kipu, along the upper cross fence near site 4, and one individual in the central part of the Pu‘u Kulani Unit roughly half way between Pu‘u Lalaau and Pu‘u Kulani. During our efforts to locate the single individual at Pu‘u Kipu and the outplanted *Cyanea shipmanii* there, we located a total of 8 individuals. Some of these were large trees and some were smaller, perhaps juvenile individuals. We have not heard of *Clermontia lindseyana* behing planted at Pu‘u Kipu and suspect these plants represent plants missed in the older surveys or natural regeneration that has occurred since. Outplantings at Sites 2, 3, and 4 did not have high survivorship. We only located 5 individuals surviving at Site 2 and only one at Site 3. Neither plant at Site 4 appears to have survived. We plan to finish

surveying for the remaining CLELIN individuals on our next visit, in addition to finishing our survey of the CYASTI outplantings.

Location		Population Units	Individuals
Pu‘u Kipu Unit	Kīlauea Forest	1/1	4/8
Pu‘u Kūlani Unit	Kīlauea Forest	1/1	1/need to check
Pu‘u Kipu Unit (Site 2 - reintrouduced)	Kīlauea Forest	1/1	10/5
Pu‘u Kipu Unit (Site 3 - reintroduced)	Kīlauea Forest	1/1	7/1
Mauka Cross Fence (site 4 – reintroduced)	Kīlauea Forest	1/0	2/0
	TOTAL	5/4	24/14-15?

Cyanea shipmanii

This species was planted at 3 sites in the Pu‘u Kipu Unit in the early 2000s. The largest number of individuals was planted on Pu‘u Kipu itself (Site 1). We have completed surveying all three of these sites. The highest survivorship was observed at Site 1 (72%) and the lowest at Site 3 (9%). Generally, the surviving plants look healthy at all the sites and many had flowers and buds in January and February and immature fruit in March and April. One presumed example of natural regeneration within these restoration populations was discovered at Site 1. A small keiki CYASHI was discovered near the summit of the Pu‘u among the many mature outplanted individuals. Given the small stem and height of this plant (<10 cm tall) it is likely it is the offspring of outplanted plants. Shortly after we discovered the presumed seedling, we found it with the apical portion of the stem broken off. It was hard to tell if this was caused by an animal or tree fall. We did construct a small hog panel cage around the plant to protect it from potential animal impacts. Upon our last monitoring of this plant (April 2019) it appeared to be re-sprouting from the base of the stem and is expected to survive.

Location		Population Units	Individuals
Pu‘u Kipu Unit (Site 1 - reintroduced)	Kīlauea Forest	1/1	356/257

Pu‘u Kipu Unit (Site 2 - reintroduced)	Kīlauea Forest	1/1	64/21
Pu‘u Kipu Unit (Site 3- reintroduced)	Kīlauea Forest	1/1	54/5
	TOTAL	3/3	474/283

Cyanea stictophylla

A total of 104 CYASTI were planted in 2003 and 2004 at 8 “sub” sites near the intersection of the Palakea Fence and the Upper Cross Fence at what was collectively called Site 4. Each of the sub-sites were given a letter code from “A” to “H”. So far we have re-surveyed sub-sites Sites C, D, and E. We will be completing the remaining sites (A, B, F, G, and H) on our next visit. Of the sites surveyed so far, C had 7/10 plants remaining, D had 6/6, and E had 8/10. The combined survivorship at these sites is 81%. From previous quick monitoring of these sites we know there are surviving individuals at all of the sites, if survivorship is similar at the other sites we might expect the total remaining number of CYASTI to be somewhere around 84 individuals.

Location		Population Units	Individuals
Pu‘u Kipu Unit (Site 4, A-H)	Kīlauea Forest	1	104/?
	TOTAL	1	104/?

Phyllostegia velutina

We have not yet visited the historic locations for this species. It is one of the last remaining species we need to evaluate. We anticipate we can visit these sites and reassess the populations during 2/3 days in the first and second week of September (2019). They are clustered in a small area near other species we are currently working on.

Location		Population Units	Individuals
Pu‘u Kipu Unit	Kīlauea Forest	5/?	28/?
Pu‘u Lala‘au Unit	Keauhou	1/?	1/?
Pu‘u Kipu Unit (Site 4 - reintroduced)	Kīlauea Forest	1/?	9/?
	TOTAL	7/?	38/?

Phyllostegia racemosa

Unfortunately this species no longer appears to be present at Pu‘u Kipu despite that, from accounts from those involved in this restoration efforts with this species, these plants did thrive and reproduce. Perhaps there is a seed bank and future monitoring will discover seedlings emerging. If not, this species is still in cultivation and could be re-introduced again. We have also checked several of the old wild plant points even though these were not extant at the time of the SHA. No plants have been discovered.

Location		Populations	Individuals
Pu ʻu Kipu Unit (Site 1 – reintroduced)	Kīlauea Forest	1/0	24/0
	TOTAL	1/0	24/0

Plantago hawaiensis

We have not yet checked this location. It is near one of the ASPPERINS population units and we will check it at the same time in early September.

Location		Populations	Individuals
Above Power line Road	Keauhou	1/?	1/need to check
	TOTAL	1/?	1/?

Vicia menziesii

We have completed our re-census of all 34 historic VICMEN locations given to us by TMA and we feel confident that we have searched all of the 27 population units identified in the KSHA. Sadly this species appears to have experienced substantial decline from the population estimates prior to and included in the KSHA. We detected live vine at only 9 of the 27 population units. As mentioned in the KSHA and in Fraiola and Rubenstein, it is difficult to determine the exact number of individuals at each of these population units, given the viney and sprawling growth form. We were conservative in our assessment of the number of individuals at each site and only counted vines as separate plants when there was at least 5 m between rooted points, or if the stem was very slender and appeared to have juvenile vegetation. The two population units at Pu‘u Kipu proper both had mature individuals with flowers in May and the unit near the summit had what appeared to be several seedlings. Only two other population units/individuals were reproductive. Both were in the Pu‘u Lalaau Unit but at separate locations. One of these individuals monitored in early August had immature and mature fruit.

Location		Population Units	Individuals
Kūlani Cone Unit	Kīlauea Forest	12/3	14/3
Pu‘u Kipu Unit	Kīlauea Forest	2/2	3/12
Pu‘u Lala’au Unit	Keauhou	12/4	12/5
Pu‘u Kipu Unit - outplanting Site 1	Kīlauea Forest	1/0	4/0
	TOTAL	27/9	33/20

DISCUSSION

Preliminary findings show a range of survivorship across the species monitored so far. Wild individuals of VICMEN have declined substantially, despite some signs of natural recruitment. The decline in wild numbers elevates the importance of bringing this species into cultivation and to establish restoration populations at protected sites throughout its historic range. Wild CLELIN appears to be doing well at Puʻu Kipu, with what looks like natural recruitment occurring. The reintroduced CYASHI individuals at the same site also seem to be thriving and the appearance of a naturally recruited individuals is exciting. Hopefully we will see more of this with future monitoring. With the absence of non-native ungulates and several years of flowering and fruiting at this site, it is perplexing that we did not see more recruitment. Similarly at the CYASTI reintroduction sites. These plants have been reproductive for at least 5 years, why we don’t see keiki at these sites is somewhat concerning. Future work to identify threats to seedling establishment and survival could be important for these restoration populations. Generally, the *Cyanea* species seemed to do better in the sites with seemingly lower densities of hapuʻu (*Cibotium* spp.), however, these sites are typically lower in elevation so it is not clear hapuʻu density is the only factor causing lower survivorship. Similarly, VICMEN survival seemed to be lower in areas of Kīlauea Forest where hapuʻu are abundant. We suspect that the constant frond fall from these tree ferns

impacts VICMEN vines and the *Cyaneas*. Deeper shade in the understory because of frond density could be another factor. We have yet to monitor the ASPPERINS, PLAHAW, and PHYVEL but plan on completing the census of these species in September (2019). We expect to have the field component of this part of the survey completed by early October.

WORKS CITED

Fraiola, H. and Rubenstein, T. 2007. Endangered Plant Distribution Kamehameha Schools Lands at Kīlauea and Keauhou. Report prepared for the ʻŌlaʻa-Kīlauea Partnership.

APPENDIX 6
SAFE HARBOR AGREEMENT TRAINING

APPENDIX 6
SAFE HARBOR AGREEMENT TRAINING

Keauhou, Kaʻū Safe Harbor Agreement Training

2019

Nā Pahu Hope:
Learning Objectives

1. Understand what a Safe Harbor Agreement is

2. Identify covered species and their habitats at Keauhou, Kaʻū

3. Understand and be able to consistently apply avoidance and minimization measures

Nā ʻĀina Hoʻoilina o Kamehameha Schools:
The Land Lineage of Kamehameha Schools

Kamehameha Schools is a private landed trust established by the will of Bernice Pauahi Bishop.

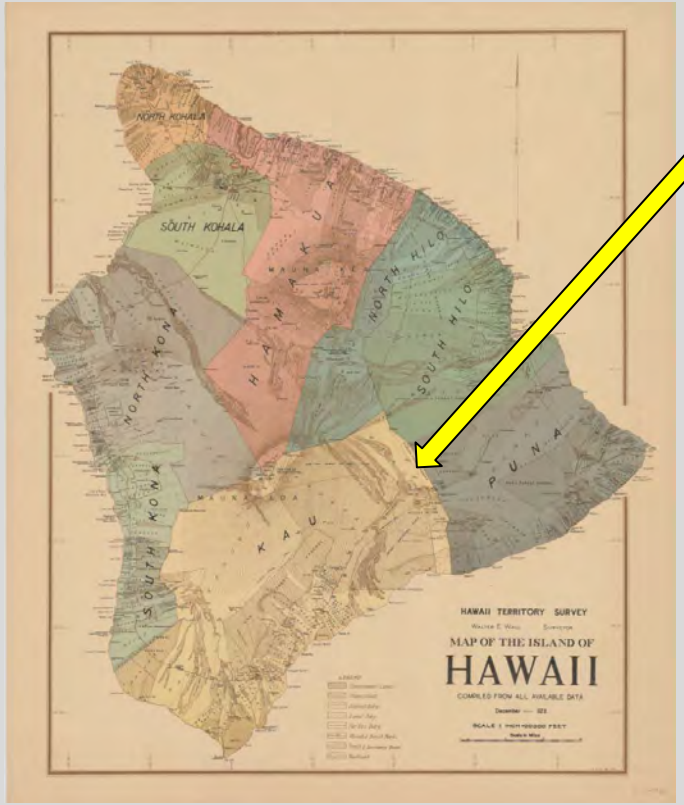
Mission: Improve capability & well-being of people of Hawaiian ancestry

Vision: Thriving Lāhui

Landholdings include 363,000 acres inherited from the Kamehameha lineage of chiefs.

Healthy, functioning native ecosystems are the foundation of Hawaiian cultural identity and well-being.

Ka ʻIli Kūpono ʻo Keauhou ma Kaʻū:
The Land Division of Keauhou, Kaʻū



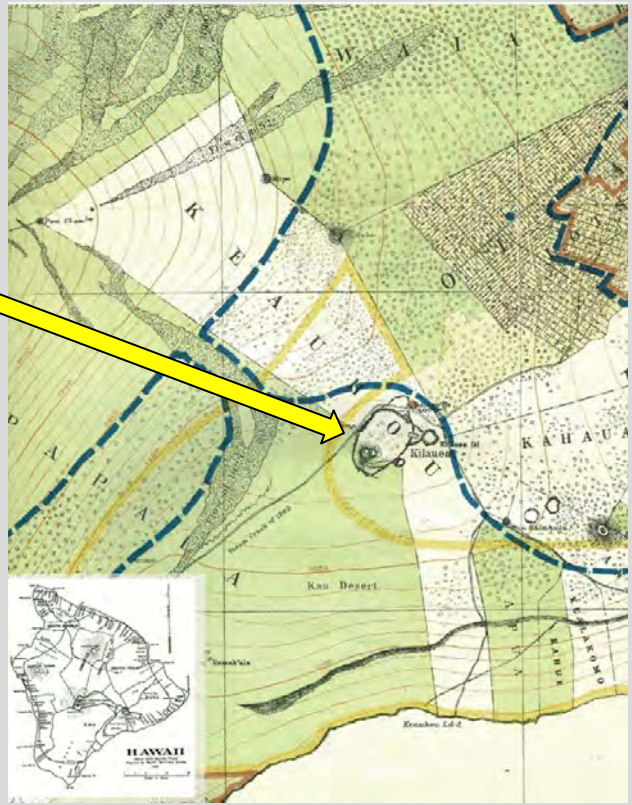
ʻIli kūpono in the district of Kaʻū and ahupuaʻa of Kapāpala

Includes Halemaʻumaʻu

Touches North Hilo, South Hilo, and Puna

Claimed by Kamāmalu in the Māhele

Stewarded for ecosystem health and educational and cultural uses



Endangered Species Law

Species in danger of extinction are “listed” as Threatened or Endangered under State and Federal endangered species laws.

- ★ It is illegal to “take” a listed species without a permit.
- ★ Take is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.” “Harm” includes “significant habitat modification or degradation.”

Ka Palapala ʻAelike Safe Harbor no Keauhou, Kaʻū:
The Keauhou, Kaʻū Safe Harbor Agreement

A **Safe Harbor** is a <u>voluntary</u> agreement between a private landowner and State and Federal wildlife agencies for recovering listed species.

- ★ Allows the private landowner to conduct certain activities which otherwise wouldn't be allowed if populations of endangered species were to increase
- ★ Requires that there be an overall benefit to the covered species
- ★ Establishes safeguards for activities to protect covered species (avoidance and minimization measures (AMM))

Ka Palapala ʻAelike Safe Harbor no Keauhou, Kaʻū:
The Keauhou, Kaʻū Safe Harbor Agreement

SAFE HARBOR AGREEMENT
KAMEHAMEHA SCHOOLS
KEAUHOU AND KĪLAUEA
FOREST LANDS

JULY 2017

Benefits to Native Species:

- ★ Increased management & monitoring = progress towards recovery goals
  - ★ Improved habitat
  - ★ Increased populations

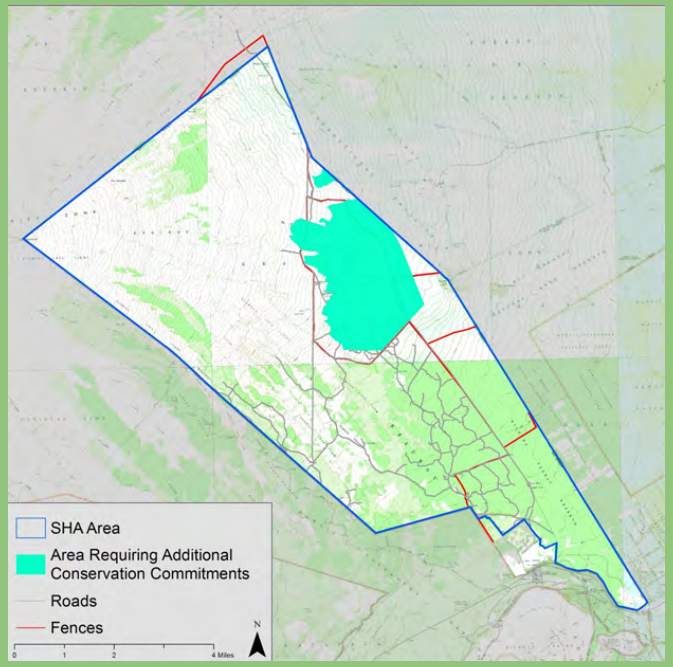
32,280 acres
50 year term
33 listed species
8 wildlife
25 plants

Benefits to Kamehameha Schools:

- ★ Certainty about the management activities and avoidance measures that have been committed to
- ★ Ability to continue stewardship, educational, and cultural activities (including koa silviculture)

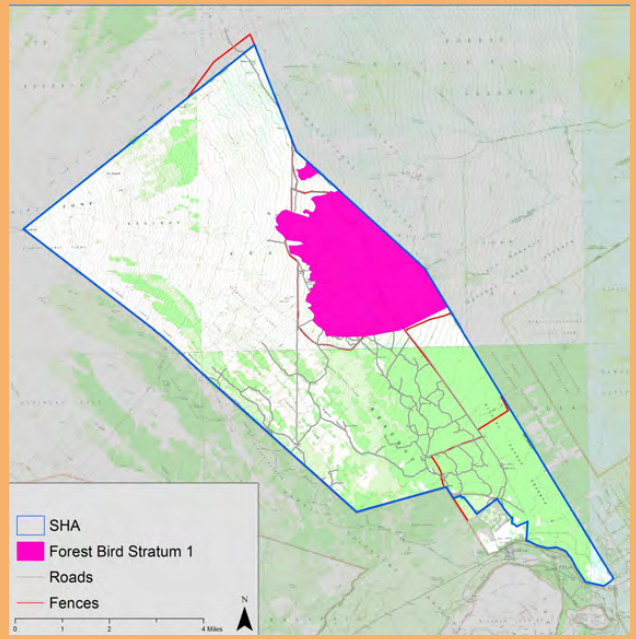
Ka Palapala ʻAelike Safe Harbor no Keauhou, Kaʻū:
The Keauhou, Kaʻū Safe Harbor Agreement

The areas below are home to higher numbers of endangered species and require additional AMM.



PLANTS

“Area Requiring Additional Conservation Commitments”



WILDLIFE

“Forest Bird Stratum 1”

Nā Lā‘au:
Covered Plant Species

25 = *Covered plant species:*
- **3** – *Species of Special Concern*
- **6** – *Other covered species*
- **16** – *Species not present at Keauhou*

Special-Concern Species:

Vicia menziesii

Phyllostegia racemosa

Cyanea stictophylla

Other Covered Species:

Asplenium peruvianum insulare

Clermontia lindseyana

Cyanea shipmanii

Phyllostegia velutina

Plantago hawaiensis

Clermontia peleana

Covered species not present:

1) *Argyroxiphium kauense*
2) *Cyanea tritomantha*
3) *Cyrtandra giffardii*
4) *Cyrtandra tintinnabula*
5) *Hibiscadelphus giffardianus*
6) *Joinvillea ascendens*
7) *Melicope zahlbruckneri*
8) *Neraudia ovata*
9) *Nothocestrum breviflorum*
10) *Phyllostegia floribunda*
11) *Phyllostegia parviflora*
12) *Ranunculus hawaiiensis*
13) *Sicyos alba*
14) *Sicyos macrophylla*
15) *Silene hawaiiensis*
16) *Stenogyne angustifolia*

Nā Manu:
Covered Wildlife Species

8 = *Covered wildlife species:*
- ***4*** - *Forest Birds*
- ***3*** - *Other Birds*
- ***1*** - *Bat*




Forest Birds: ʻAkiapōlāʻau ʻĀkepa ʻAlawī ʻIʻiwi

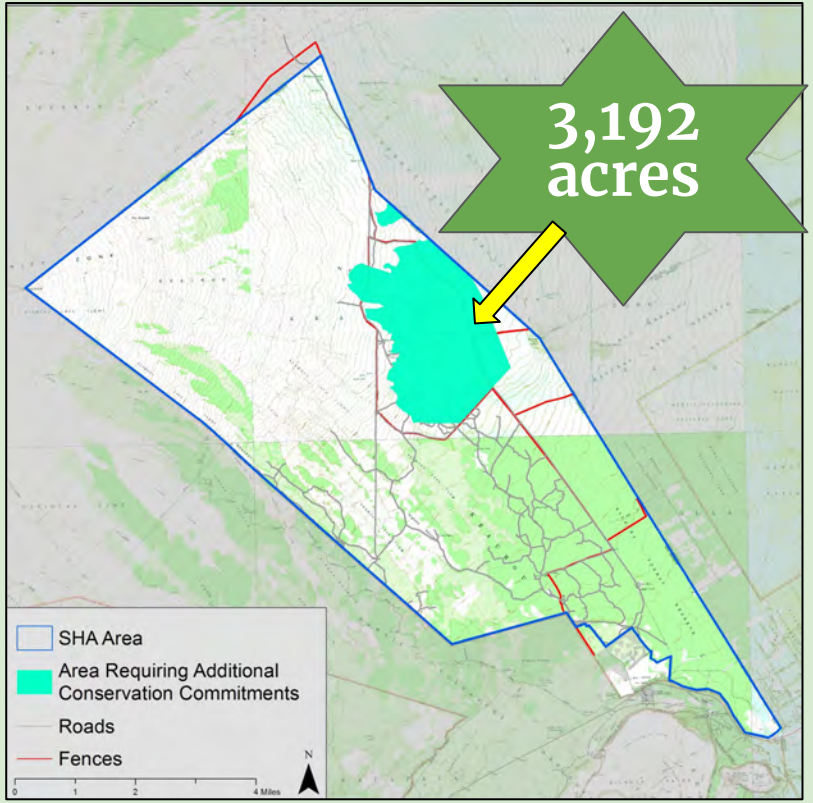



Other: ʻIo ʻAlalā Nēnē ʻŌpeʻapeʻa

Nā Lāʻau Kakaʻikahi:
"Special-Concern" Plant Species

Contains three extremely rare species that are found at Keauhou, Kaʻū:

1) *Vicia menziesii*
2) *Phyllostegia racemosa*
3) *Cyanea stictophylla*



Nā Lāʻau Kakaʻikahi:
"Special-Concern" Plant Species

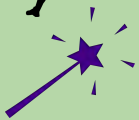
Vicia menziesii

founders
27/0
outplants

Only exists at Keauhou, Kaʻū

A member of the legume family, its leaves look similar to pea plants.

A vine, grows climbing trees and logs.



Ephemeral, meaning plants can come and go or 'disappear'.

Very hard to find. Often grows hiding in other things. Easy to mistake for vines such as Banana poka.

Nā Lāʻau Kakaʻikahi:
"Special-Concern" Plant Species

Vicia menziesii

Hawaiian Mints

Haplostachys

Phyllostegia

Stenogyne

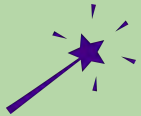
Nā Lāʻau Kakaʻikahi:
"Special-Concern" Plant Species

Kīponapona

(Phyllostegia racemosa)

founders
0/4
outplants

Often seen crawling on the forest floor and over trees and logs.

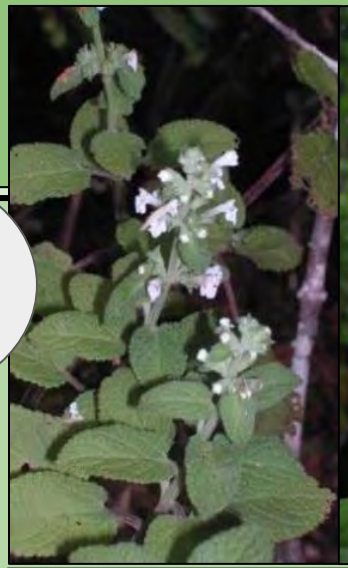


Ephemeral, meaning plants can come and go or 'disappear'.

Square Stem.

Has small fragrant white flowers with a large lower "lip" (petal).

Insect pollinated.



Kīponapona

(Phyllostegia racemosa)

Hawaiian Lobelioids

Nā Lāʻau Kakaʻikahi:
"Special-Concern" Plant Species

founders
0/104
outplants

Hāhā
(Cyanea stictophylla)

Possesses Milky Sap

Fruit look like an orange jellybean.

Looks like a jurassic papaya tree.

Has prickles which are thought to be a defense from the now extinct, Moa nalo, a large flightless goose.

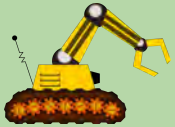
Hāhā
(Cyanea stictophylla)

Nā Lā‘au ‘Ē A‘e:
Other Existing Plant Species

Asplenium peruvianum var. insulare

Very hard to find.

Most often found growing in caves or rocky outcroppings.



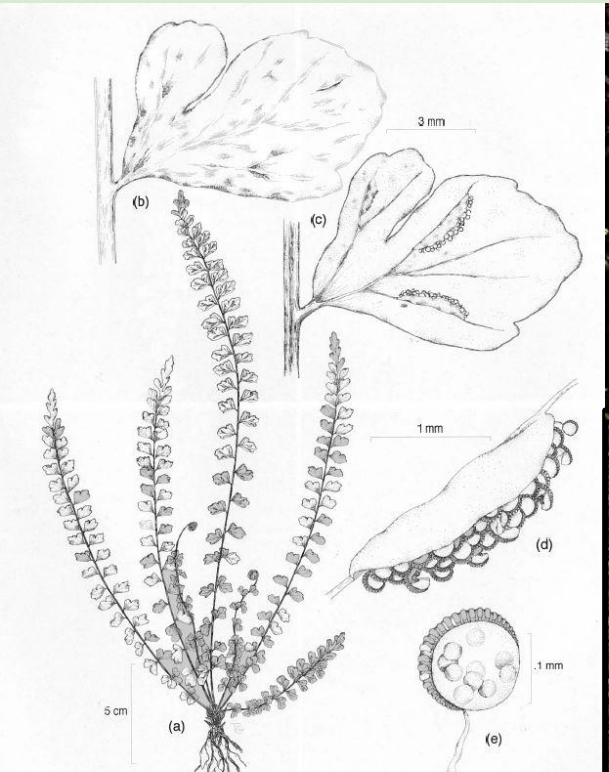
Caution: No heavy equipment use in areas of potential habitat.

Difficult to identify.

https://calphotos.berkeley.edu

Nā Lāʻau ʻĒ Aʻe:
Other Existing Plant Species

Asplenium peruvianum var. insulare



Nā Lāʻau ʻĒ Aʻe:
Other Existing Plant Species

ʻŌhā wai
(Clermontia lindseyana)

founders
5/19
outplants

Possesses Milky Sap

Has small pumpkin shaped fruit which are about 1-2 inches in diameter

Grows like a plumeria tree.

Flowers are large and grow in pairs.

Nā Lāʻau ʻĒ Aʻe:
Other Existing Plant Species

ʻŌhā wai
(Clermontia lindseyana)

Nā Lāʻau ʻĒ Aʻe:
Other Existing Plant Species

Hāhā
(Cyanea shipmanii)

Possesses Milky Sap

Has small orange fruit (about ½ inch long).

Looks like a jurassic papaya tree.

Theory: Has thorns which are thought to be a defense from the now extinct, Moa nalo, a large flightless goose.

Nā Lāʻau ʻĒ Aʻe:
Other Existing Plant Species

Hāhā

(Cyanea shipmanii)

Nā Lāʻau ʻĒ Aʻe:
Other Existing Plant Species

founders
29/9
outplants

Phyllostegia velutina

Leaves are very silvery.

Square Stem.

Has small fragrant white flowers with a large lower “lip” (petal)

Insect pollinated.

Name means “velvety”

Nā Lāʻau ʻĒ Aʻe:
Other Existing Plant Species

Laukahi kuahiwi
(Plantago hawaiiensis)

founders
1/0
outplants

Easy to mistake for other plants such as non-native ground orchids.

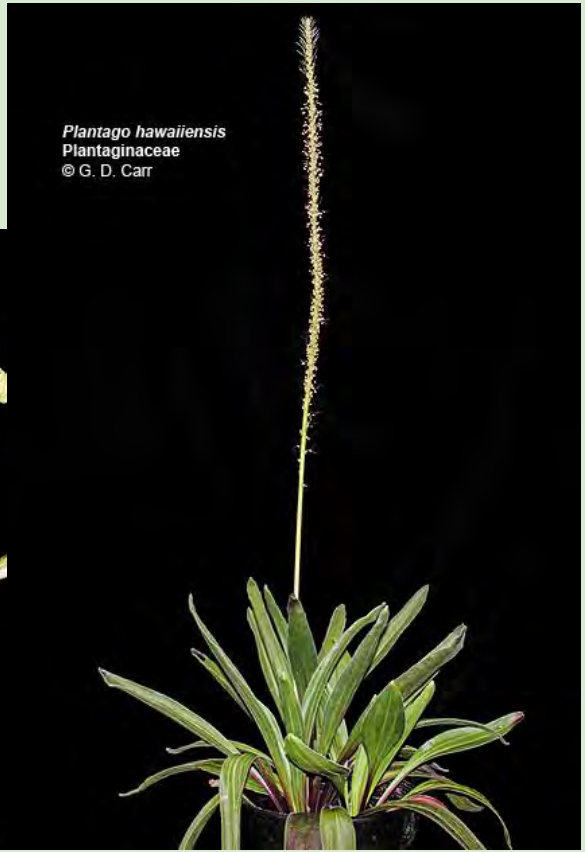
Has a very long flower stalk.

Leaves grow from a central point, in a rosette pattern.

Looks similar to the medicinal, non-native “Laukahi”

Nā Lāʻau ʻĒ Aʻe:
Other Existing Plant Species

Laukahi kuahiwi
(Plantago hawaiiensis)



‘Ōhā wai

(Clermontia peleana)

founders
0/?
outplants

Possesses Milky Sap

Possesses purple flowers and purple veins on leaves.

Produces copious nectar which drips from flowers.

Has small pumpkin shaped fruit
About an inch in diameter

Nā Lāʻau ʻĒ Aʻe:
Other Existing Plant Species

ʻŌhā wai

(Clermontia peleana)

Nā Lāʻau ʻĒ Aʻe:
Other Covered Plant Species (not currently present)

ʻĀhinahina
Argyroxiphium kauense

ʻAkū
Cyanea tritomantha

Nā Lāʻau ʻĒ Aʻe:
Other Covered Plant Species (not currently present)

Haʻiwale
Cyrtandra giffardii

Haʻiwale
Cyrtandra tintinnabula

Nā Lāʻau ʻĒ Aʻe:
Other Covered Plant Species (not currently present)

Hau kuahiwi

Hibiscadelphus giffardianus

ʻOhe

Joinvillea ascendens

Nā Lāʻau ʻĒ Aʻe:
Other Covered Plant Species (not currently present)

Alani

Melicope zahlbruckneri

Maʻaloa

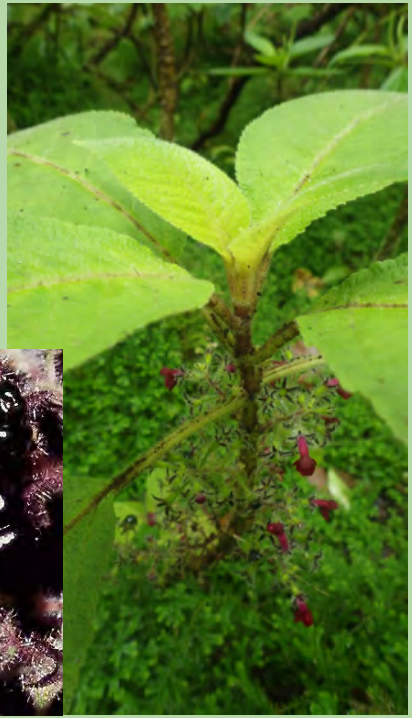
Neraudia ovata

Nā Lāʻau ʻĒ Aʻe:
Other Covered Plant Species (not currently present)

ʻAiea

Nothocestrum breviflorum

Phyllostegia floribunda



Nā Lāʻau ʻĒ Aʻe:
Other Covered Plant Species (not currently present)

Phyllostegia parviflora

Makou

Ranunculus hawaiiensis

Nā Lāʻau ʻĒ Aʻe:
Other Covered Plant Species (not currently present)

ʻĀnunu
Sicyos albus

ʻĀnunu
Sicyos macrophyllus

Nā Lāʻau ʻĒ Aʻe:
Other Covered Plant Species (not currently present)

Hawaiian Catch Fly
Silene hawaiiensis

Stenogyne angustifolia

Hawaiian Honeycreepers

https://images.indiegogo.com/file_attachments/1062412/files/20141201154408-Picture1.png?1417477448

Nā Manu:
Covered Wildlife Species

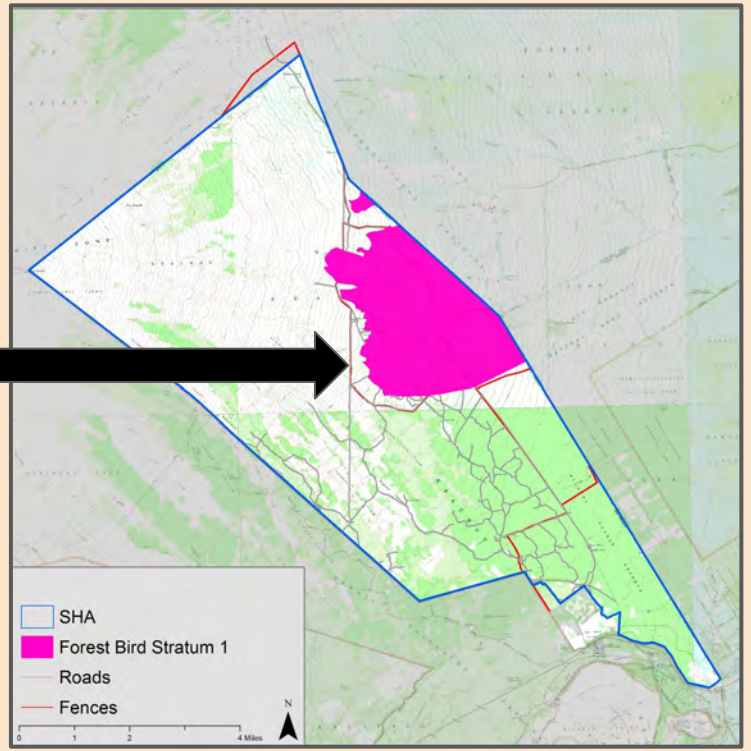
8 = *Covered wildlife species:*
- ***4*** - *Forest Birds*
- ***3*** - *Other Birds*
- ***1*** - *Bat*

Forest Birds: ʻAkiapōlāʻau ʻĀkepa ʻAlawī ʻIʻiwi

Other: ʻIo ʻAlalā Nēnē ʻŌpeʻapeʻa

Nā Manu o ka Nāhele:
Forest Birds



Nā Manu o ka Nāhele:
Forest Birds

ʻAkiapōlāʻau
(*Hemignathus munroi*)

Breeding Season: February - July

Insects and larvae found in dead and dying branches.

Very loud whistle and song.

Acts like a woodpecker. May hear “pecking” noises.

Swiss Army Knife Bill

Nā Manu o ka Nāhele:
Forest Birds

ʻAkiapōlāʻau
(*Hemignathus munroi*)

Male

Adult males are bright yellow and have a distinct dark mask.

Females are duller in color, less distinct mask and have a white chin

Female

ʻAkiapōlāʻau
(*Hemignathus munroi*)

ʻĀkepa
(*Loxops coccineus*)

Breeding Season: March - September

Insects
Small caterpillars in ʻōhiʻa buds.

Small crossed bill.

Males are safety vest orange.

Weight = 10-12 plain m&ms

Nā Manu o ka Nāhele:
Forest Birds

ʻĀkepa
(*Loxops coccineus*)

Male

Female

ʻĀkepa
(*Loxops coccineus*)


Bird Forum

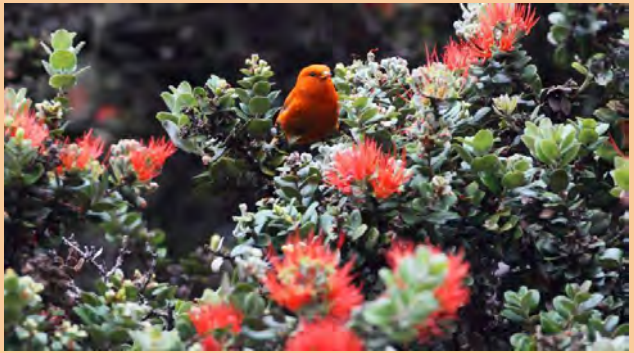

Jack Jeffery

Juvenile

Nā Manu o ka Nāhele:
Forest Birds

ʻĀkepa

(*Loxops coccineus*)



Nā Manu o ka Nāhele:
Forest Birds

ʻAlawī, Hawaiʻi Creeper
(Oreomystis mana)

Breeding Season: January - June

Insects
Nectar from Koa and ʻŌhiʻa

"Creeps" along main trunks or branches systematically foraging for insects.

Easy to mistake for ʻAmakihi.

ʻAlawī, Hawaiʻi Creeper
(Oreomystis mana)

Adult

Juvenile

Nā Manu o ka Nāhele:
Forest Birds

ʻAlawī
Vs.
ʻAmakihi

ʻAlawī

(Oreomystis mana)

Nā Manu o ka Nāhele:
Forest Birds

ʻIʻiwi
(*Vestiaria coccinea*)

Breeding Season: January to June

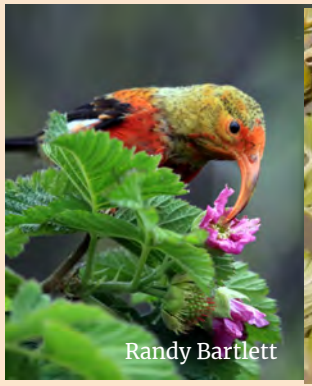
Insects
Nectar of ʻŌhiʻa and Hawaiian lobeliads

Tongue is like a paint brush which allows ʻIʻiwi to collect nectar and pollen more efficiently.

Can sometimes act as a bully when foraging near other forest birds.

Nā Manu o ka Nāhele:
Forest Birds

ʻIʻiwi
(*Vestiaria coccinea*)



Juveniles

Adult

Nā Manu o ka Nāhele:
Forest Birds

ʻIʻiwi
(*Vestiaria coccinea*)

ʻIʻiwi taking nectar from rare lobelia. Notice how flowers are shaped to fit the bill?

ʻIʻiwi love ʻakala flowers! This is an alternate source of nectar when lehua are not as abundant.

Nā Manu Nui:
Large Birds

Hawaiian Hawk, ʻIo

(Buteo solitarius)

Breeding Season: March - September

A raptor, eats small vertebrates include mice, rats, forest birds.

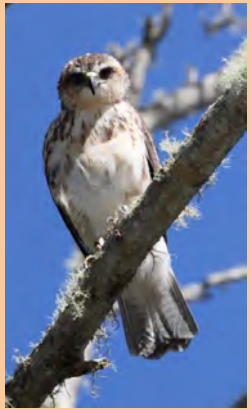
Very vocal, especially if you are near a nest.

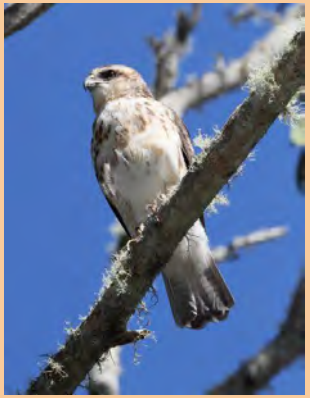
Only hawk* in Hawaiʻi.

Light and dark “morphs”

ʻIo, Hawaiian Hawk

(Buteo solitarius)





Adult (light morph)

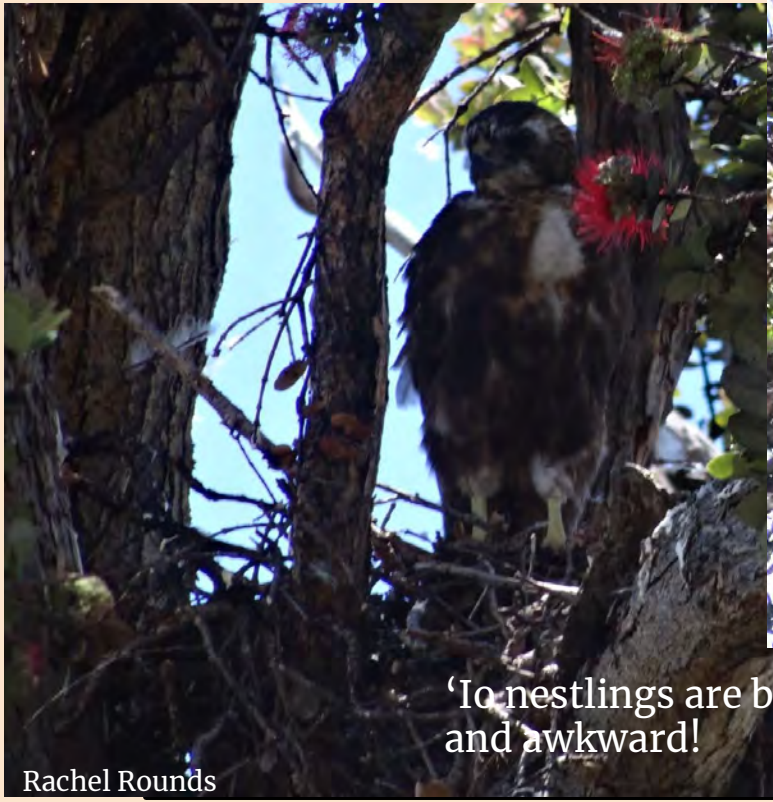
Juvenile

ʻIo, Hawaiian Hawk
(Buteo solitarius)

Adult (dark morph)

Nā Manu Nui: Large Birds

ʻIo chick on nest



ʻIo nestlings are big, fluffy and awkward!

Rachel Rounds

ʻIo nests are constructed of sticks, are relatively large and easy to spot.

Nā Manu Nui:
Large Birds

ʻAlalā, Hawaiian Raven
(*Corvus hawaiiensis*)

Breeding Season: March - Sept.

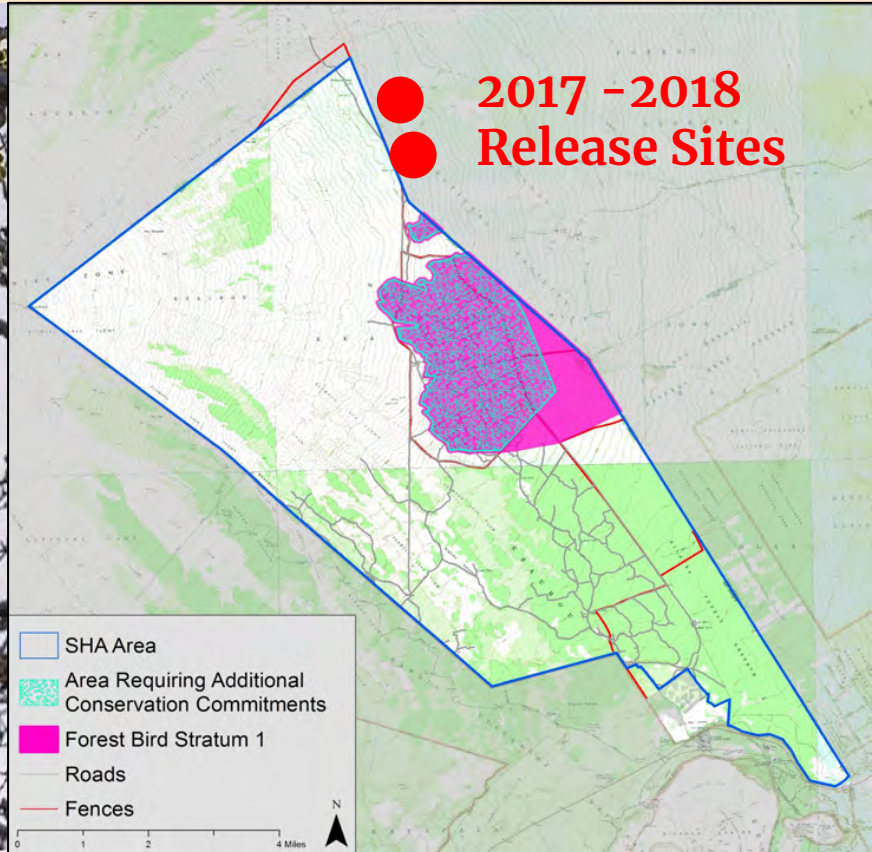
Fruit, berries, insects, and small vertebrates

Only corvid in Hawaiʻi.

None currently inhabiting Keauhou. Extremely rare with only 19 residing in the wild.

Easy to mistake for kalij.

Nā Manu Nui:
Large Birds



ʻAlalā, Hawaiian Raven

(*Corvus hawaiiensis*)

Nēnē, Hawaiian Goose

(*Branta sandvicensis*)

Breeding Season: Oct.–Mar.

Native berries
Young grass, leaves, seeds

Has a loud honking call.

Only native goose.

Nā Manu Nui: Large Birds

Nēnē (*Branta sandvicensis*)

Adult with juvenile

Nēnē family group: adults with goslings

Canada Goose vs. Nēnē

Other large birds at Keauhou: Pueo


Nancy Johnston

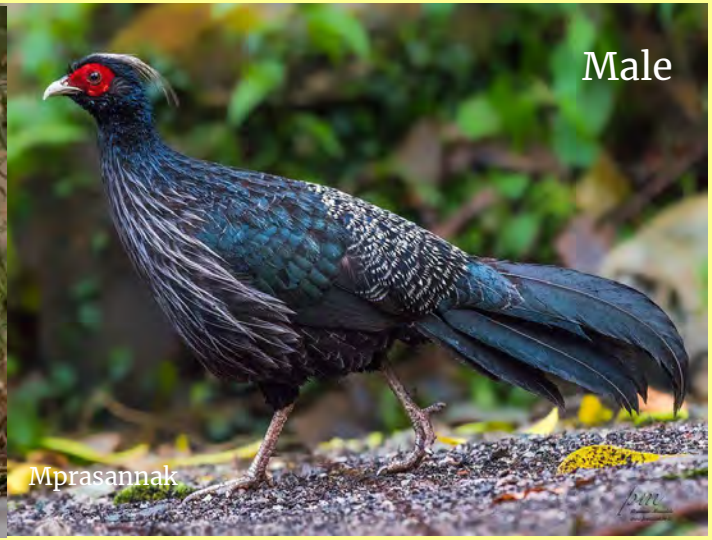

Caleb Slemmons

Other large birds at Keauhou

DETOUR

Barn Owl

Kalij Pheasant



Nā Manu Nui:
Large Birds

ʻŌpeʻapeʻa, Hawaiian Hoary Bat (*Lasiurus cinereus semotus*)

Active during the night and at dawn and dusk.

Breeding Season: June - Sept 15

Insects

The name “hoary” refers to the frosted appearance of its fur.

Most often roost (rest) in trees higher than 5m, in shady areas.

Pinzari

Nā Hana Hoʻomalu:
Avoidance and Minimization Measures

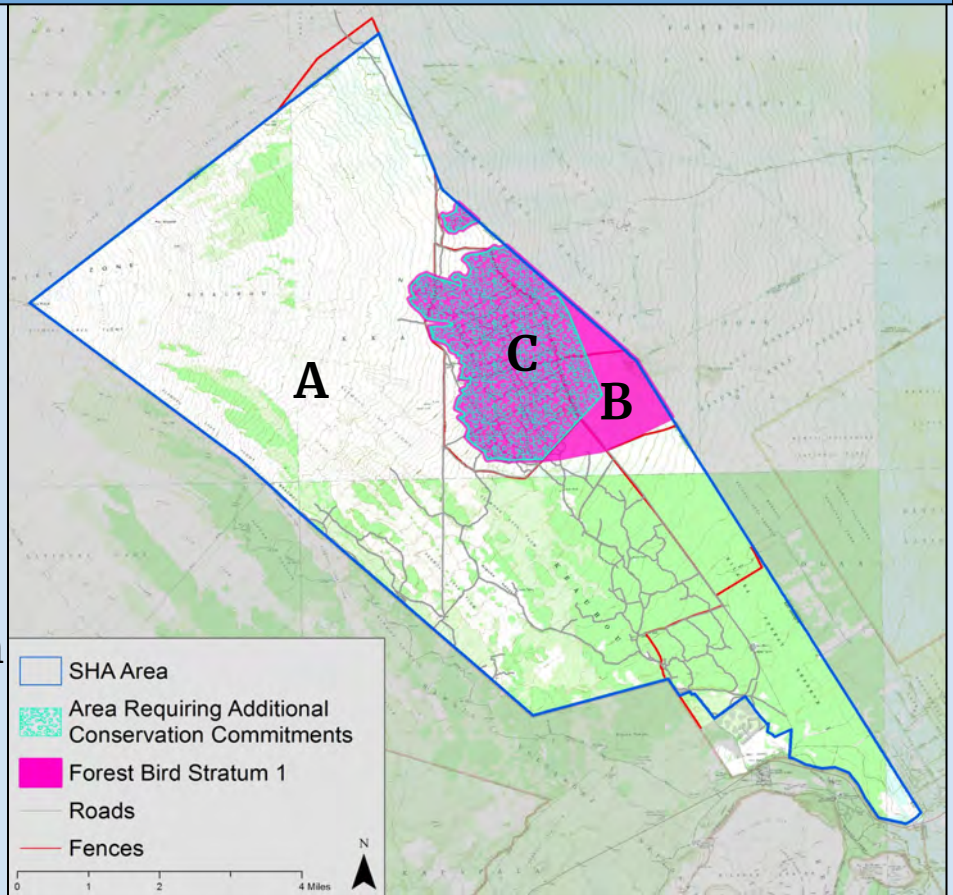
Every person working at Keauhou will be oriented to the SHA and/or be supervised in the field by someone who has undergone training.

No, really, every person.

Nā Hana Hoʻomalu:
Avoidance and Minimization Measures

Where am I?

- **A** General Keauhou = Entire Area
- **B** Forest Bird Stratum One Only
- **C** Forest Bird Stratum 1 & Area Requiring Additional Conservation Commitments



Nā Hana Hoʻomalu:
Avoidance and Minimization Measures

Zone A: General Keauhou

Sensitive breeding period in areas outside of FBSO March - Sept.

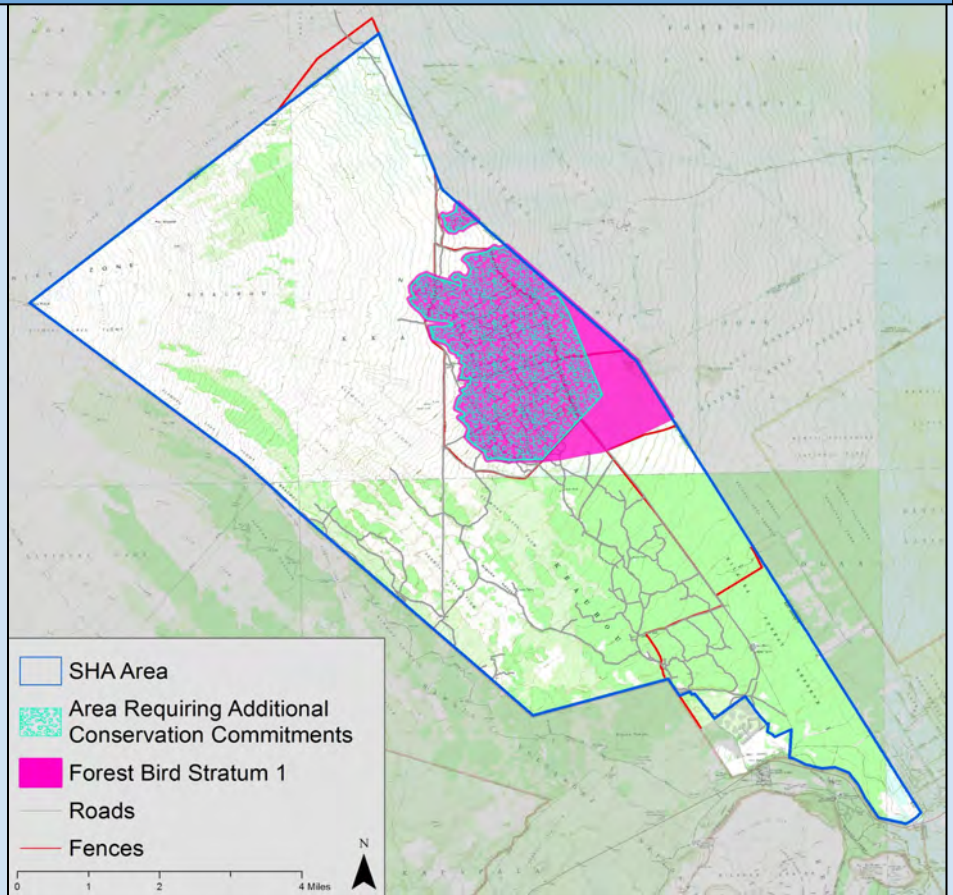
Everytime you work at Keauhou, Kaʻū:

Always ask, **where am I** working and **what am I doing**?

Time activities outside of sensitive breeding seasons.

No work will occur around known nests of covered wildlife species.

Minimum 50 ft buffer zones will established around covered plant species.



Nā Hana Hoʻomalu:
Avoidance and Minimization Measures

Zone A: General Keauhou

OUTPLANTING, SILVICULTURE, WEED CONTROL:

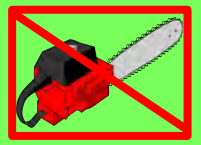
At least a 50 ft buffer around all known covered plant species will be established.

WEED CONTROL :

No chemical herbicides will be used on trees with known nests of covered species or any other trees within 50 ft.

KOA SILVICULTURE:

Table 6: Tree trimming, harvesting, and thinning activities are limited to:

Forest Bird Stratum 1	October-December	 No chainsaw work will be performed on trees with known nests of covered species or any other trees within 50 ft.
General Keauhou	taller than 15 ft: Oct.- Feb. shorter than 15 ft: Year Round	

Nā Hana Hoʻomalu:
Avoidance and Minimization Measures

Zone A: General Keauhou

TRAIL CLEARING, ROAD/FACILITY CONSTRUCTION, TREE SALVAGE:

Work will occur outside of wildlife breeding seasons and the tree/shrub cutting restrictions outlined in table 6.

FENCING AND UNGULATE CONTROL:

No barbed wire will be used in construction of new fences and old barbed wire will be removed in conjunction with fence replacement.

HELICOPTER OPERATIONS:

Helicopter landing zones will not be designated in known nesting areas.

RAPID ʻŌHIʻA DEATH RESPONSE:

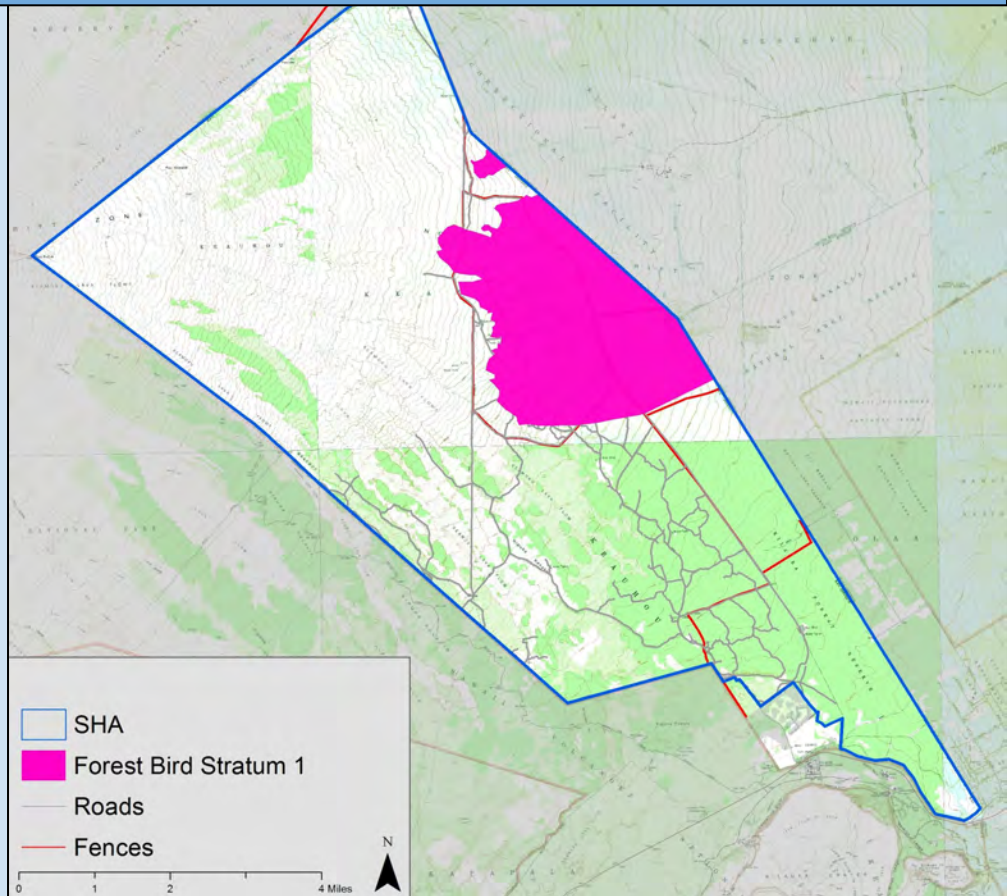
Consult ROD working group for current protocols.

Follow tree/shrub cutting restrictions in table 6.

Nā Hana Hoʻomalu:
Avoidance and Minimization Measures

Zone B: Forest Bird Stratum 1

- Home to all covered wildlife species.
- Certain activities must be timed to avoid sensitive breeding periods.
- Sensitive breeding seasons last from January – September.



Nā Hana Hoʻomalu:
Avoidance and Minimization Measures

Zone B: Forest Bird Stratum 1

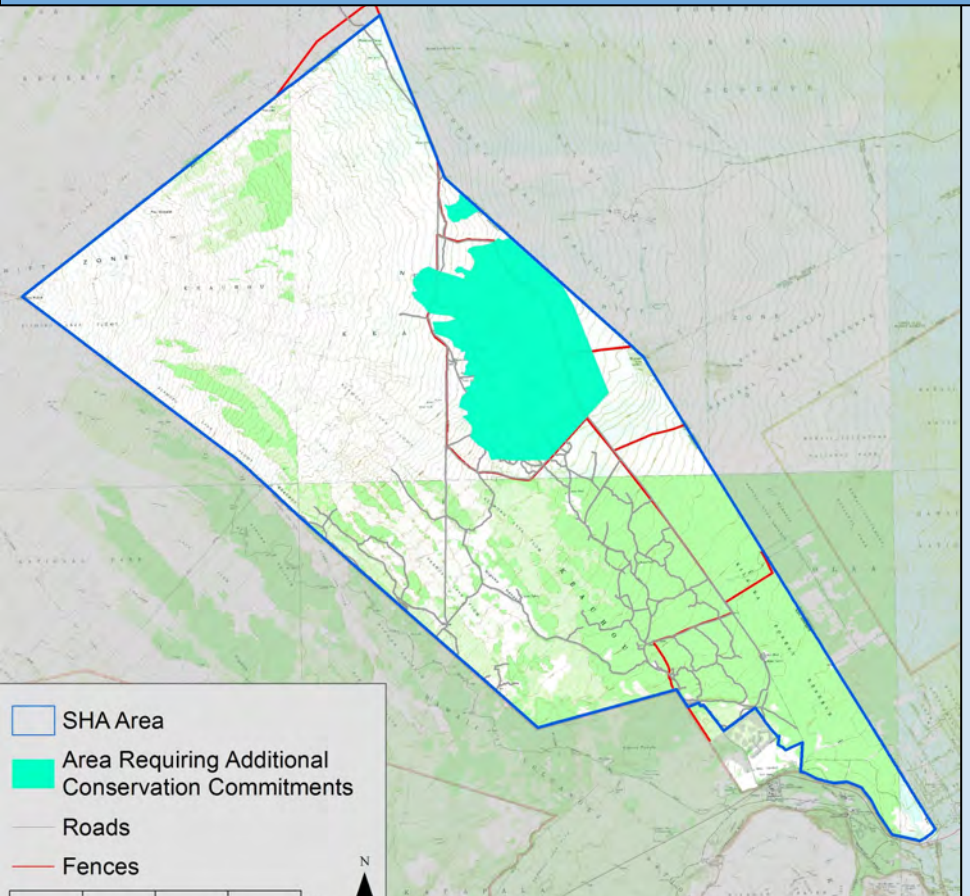
No work will occur around known nests of covered wildlife species.

No chemical herbicides will be used on trees with known nests of covered species or any other trees within 50 ft.

No chainsaws will be used within 50ft. of known nests .

Thinning and other koa silviculture activities are only allowed from October-December.

Nā Hana Hoʻomalu:
Avoidance and Minimization Measures



Zone C: Area Requiring Additional Conservation Commitments (also includes Forest Bird Stratum 1)

- Home to the highest numbers of covered plant species including the three species of special concern:
  1) *Vicia menziesii*
  2) *Phyllostegia racemosa*
  3) *Cyanea stictophylla*

- Reference Table 7 for prescribed AMM.

Nā Hana Hoʻomalu:
Avoidance and Minimization Measures

AMM Required in Zone C:

EVERY ACTIVITY :

Every person working at Keauhou will be oriented to the SHA and its requirements.

Prohibit ground-disturbing machinery within 50- ft buffer area

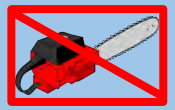
EVERY ACTIVITY *(except hand-pulling weeds)*:

Monitor 50 ft buffer areas after any disturbance.

SILVICULTURE, SOIL SCARIFICATION, FENCE CONSTRUCTION, HERBICIDE USE, NEW ROAD/TRAIL:

Conduct a vegetation survey of 50 ft buffer area around special concern and/or T&E founders.

At least a 50 ft buffer around all known covered plant species will be established.



No chainsaw work will be performed on trees with known nests of covered species or any other trees within 50 ft.

Nā Hana Hoʻomalu:
Avoidance and Minimization Measures

AMM Required in Zone C: Table 7

Required Protective Measure for Special-Status Plants and T&E Founders	Outplant	Koa Thin/ Cut	Soil Scarify	New Fence	Weed Pull	Herb-icide Use	New Road/ Trail
Training before activity	✓	✓	✓	✓	✓	✓	✓
Conduct a survey of 50 ft buffer area before activity		✓	✓	✓		✓	✓
Prohibit ground-disturbing machinery within 50-ft buffer area	✓	✓	✓	✓	✓	✓	✓
No large trees felled within 50 ft buffer area		✓		✓			✓
Conduct monitoring after a disturbance within 50 ft buffer area	✓	✓	✓	✓		✓	✓

Nā Hana Hoʻomalu:
Avoidance and Minimization Measures

What am I doing?

Everytime you work at Keauhou, Kaʻū:

Always ask, **where am I** working and **what am I doing**?

Time activities outside of sensitive breeding seasons.

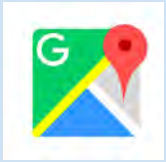
No work will occur around known nests of covered wildlife species.

Minimum 50 ft buffer zones will established around covered plant species.

Covered Activities

1. Restoration and Outplanting
2. Koa Silviculture
3. Fencing and Ungulate Control
4. Weed Control
5. Fire Threat Management
6. Rapid ʻŌhiʻa Death Response
7. Other Activities

What if I find something?

-  Take note of what you've found, current conditions, etc.
-  Detail your location (GPS and written description)
-  Take photos.
-  Notify your supervisor and/or KS.

Nā Hana Hoʻomalu:
Avoidance and Minimization Measures

What if something happens or “goes wrong”?

1. Stop what you’re doing and call your supervisor and/or KS for advice on how to proceed.
2. Document:
   a. Take written notes on what happened, where you are and any other details about the occurrence.
   b. GPS your location.
   c. Take photos if possible.
3. Contact your supervisor and KS immediately to report the incident.

Resources
Appendix 10. AMM for Covered Activities

Avoidance and Minimization Measures for Covered Activities
(consolidated from the main SHA text)

Covered Activity	Section	Specific Avoidance/Minimization Measures
Removal of Predators	6.1.1	No specific measures required
Restoration Outplanting	6.1.2	•All personnel working on forest restoration will receive training on the tasks they are performing and on avoiding impacts to Covered Species prior to starting work, or be directly overseen by an individual so-trained during field work. •Buffer distances of a minimum of 50 ft will be established where no disturbance will occur around known individual founder plants of Covered Species. •No work will occur around known nests of birds during the breeding seasons (Table 6).
Koa Silviculture	6.1.3	•Stand improvement activities (selective thinning) or harvest that will occur in young koa stands (trees smaller than a 65 cm dbh), will take place outside sensitive breeding seasons (Table 7). •Buffer distances of a minimum of 50 ft will be established where no disturbance will occur around known individual founder plants of Covered Species. •No more than two live standing old growth ʻōhiʻa and koa trees > 10 m in height and > 65 cm dbh will be cut every 10 years in the Forest Bird Stratum 1.
Fences and Ungulate Control	6.1.4	•Since Hawaiian Hoary Bats are known to be killed by barbed wire, barbed wire above grass level will not be used on any new management fences. •Remaining barbed wire will be replaced on adjacent ranch lands as leases are renewed by KS. Additionally, any barbed wire from remnant ranch fencing which remains exposed above grass will be removed by KS. •New and replacement fence routes will be planned to follow natural topographical features when possible and planned to avoid Covered Species of plants. Tree/shrub removal will be restricted as described in Table 7. •Inside Forest Bird Stratum 1 no fence construction will occur around known nests of birds during the breeding seasons (Table 5). Emergency fence repairs that cannot be planned around species' breeding seasons but are necessary to maintain the integrity of the fencing may be periodically necessary, but these situations are anticipated to be rare, and most commonly associated with downed trees and severe weather events.
Weed Control	6.1.5	•All personnel working on weed control will receive training on the tasks they are performing and on avoiding impacts to Covered Species prior to starting work, or be directly overseen by an individual so-trained during field work. •Buffer distances of a minimum of 50 ft will be established where no disturbance will occur around known individual founder plants of Covered Species. •No work will occur around known nests of birds during the breeding seasons (Table 6). •Inside Forest Bird Stratum 1 no chemical herbicides (or chainsaws) will be used on trees with known nests of Covered Species or within 50 feet of known nest trees during the breeding season. •Inside and outside Stratum 1, no chemical herbicides or chainsaws will be used within 50 feet of known Nēnē or ʻIo nests during their breeding seasons. •Low-impact weed suppression such as herbicide spraying with a backpack may occur year-round on the Enrolled Property provided that 50 foot buffers are established near known nests of Covered Species.
Fire Threat Management	6.1.6	• Except in the situation of suppression of an active fire, tree/shrub cutting restrictions shown in Table 7 will be followed.
Response to Rapid ʻŌhiʻa Death	6.1.7	•Unless otherwise directed by the Service and DOFAW in writing, all tree/shrub cutting restrictions as shown in Table 7. •All personnel working will receive training on the tasks they are performing and on avoiding impacts to Covered Species (animal and plant) prior to starting work, or be directly overseen by an individual so-trained during field work. •To prevent the spread of Rapid ʻŌhiʻa Death the most up to date guidance will be followed. •All actions taken will avoid direct impacts to Covered Species plants.
Other Activities	6.1.8	•Helicopter landing zones will not be designated in areas where Covered Species of birds (ʻAkiapōlāʻau, Hawaiʻi Creeper, Hawaiʻi Ākepa, Nēnē, ʻAlalā, and Hawaiian hawk) are known to nest. •Any clearing activities for trails will occur outside the breeding period for Covered Species (Table 5) and with the tree/shrub cutting restrictions listed in Table 6. •Any road construction activities would occur outside the breeding season for Covered Species within Forest Bird Stratum 1 (Table 5) and with the tree/shrub cutting restrictions listed in Table 6 and disturbance would be kept to the minimum necessary to conduct these activities. •When salvaging trees that are dead and fallen or dead standing trees any salvaging will be done outside the breeding season for Covered Species within Forest Bird Stratum 1 (Table 5) and with the tree/shrub cutting restrictions listed in Table 6. •Construction of infrastructure facilities will not occur during the breeding season of any Covered Species known to have an active nest in the area. •Natural resource management activities will comply with the tree/shrub cutting restrictions listed in Table 6.

Resources
Table 7. AMM for Area of Additional Conservation Commitments

AMM Required in AACC: Table 7

Required Protective Measure for Special-Status Plants and T&E Founders	Outplant	Koa Thin/ Cut	Soil Scarify	New Fence	Weed Pull	Herb-icide Use	New Road/ Trail
Training before activity	✓	✓	✓	✓	✓	✓	✓
Conduct a survey of 50 ft buffer area before activity		✓	✓	✓		✓	✓
Prohibit ground-disturbing machinery within 50-ft buffer area	✓	✓	✓	✓	✓	✓	✓
No large trees felled within 50 ft buffer area		✓		✓			✓
Conduct monitoring after a disturbance within 50 ft buffer area	✓	✓	✓	✓		✓	✓

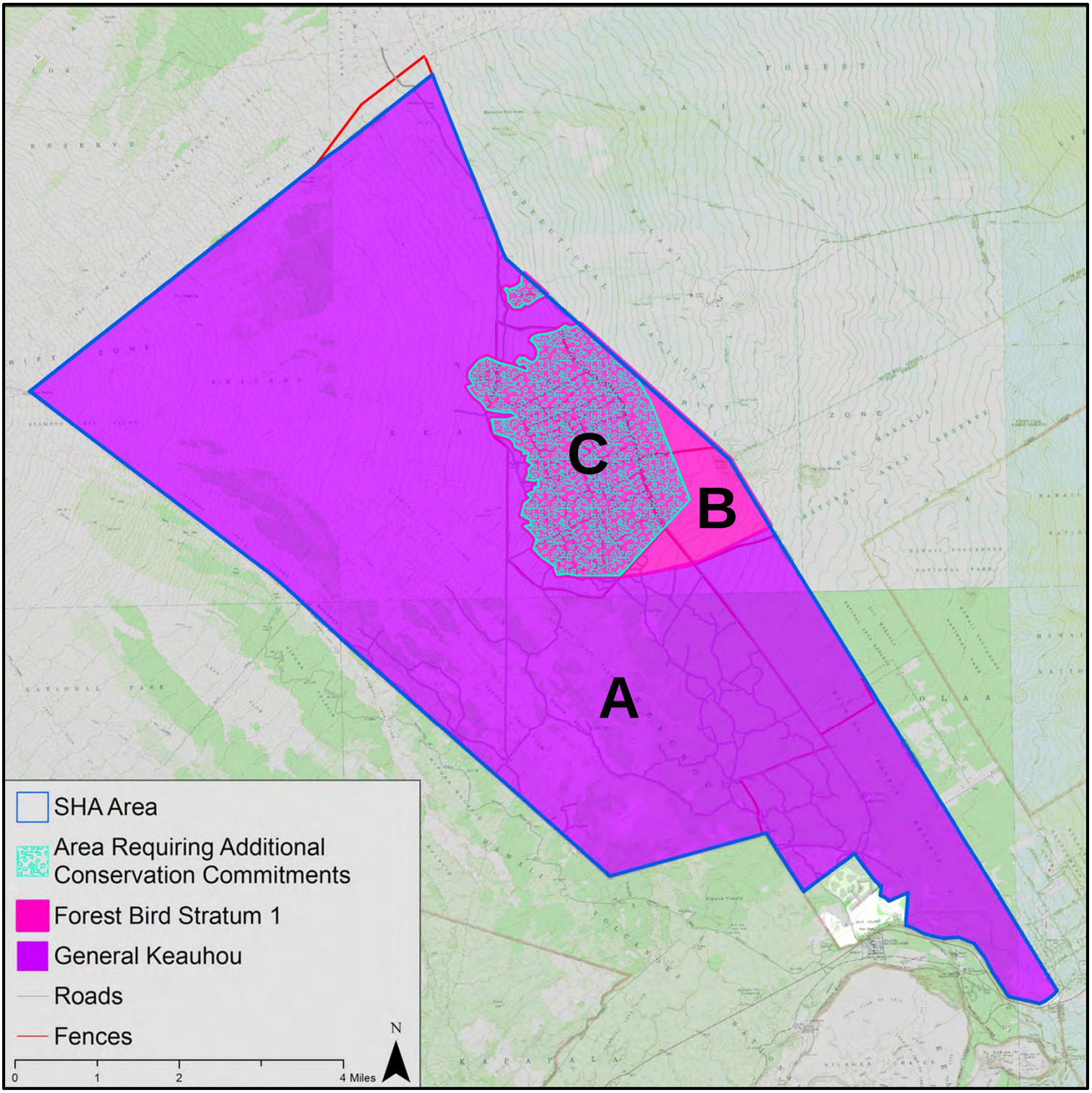
Resources
Table 5. Bird Breeding Seasons

Table 5. Wildlife Breeding Seasons			
ʻAkiapōlāʻau  Feb. - July	ʻAlawī  Jan. - June	ʻĀkepa  March - Sept.	ʻIʻiwi  Jan. - June
ʻIo  Mar. - Sept.	ʻŌpeʻapeʻa  June - Sept.	ʻAlalā  March - Sept.	Nēnē  August - April

Questions?

APPENDIX 7
SUMMARY OF AVOIDANCE AND MINIMIZATION MEASURES

Keauhou, Kaʻū Safe Harbor Agreement-
Avoidance & Minimization Measure Zones



Zone A- General Keauhou
Zone B- Forest Bird Stratum 1 Only
Zone C- Forest Bird Stratum 1 & Area Requiring Additional Conservation Commitments

Avoidance & Minimization Measures Tables

Table 5. General Breeding Periods for Covered Species

Species	**Breeding Period**
ʻAkiapōlāʻau (*Hemignathus wilsoni*)	February - July
ʻAlawī- Hawaiʻi Creeper (*Loxpos mana*)	January - June
Hawaiʻi ʻĀkepa (*Loxops coccineus*)	March - September
ʻIʻiwi (*Vestiaria coccinea*)	January - June
ʻIo- Hawaiian Hawk (*Buteo solitarius*)	March - September
ʻŌpeʻapeʻa- Hawaiian Hoary Bat (*Lasiurus cinereus semotus*)	June - September 15
Nēnē- Hawaiian Goose (*Branta sandvicensis*)	October - March
ʻAlalā- Hawaiian Raven (*Corvus hawaiiensis*)	March - September

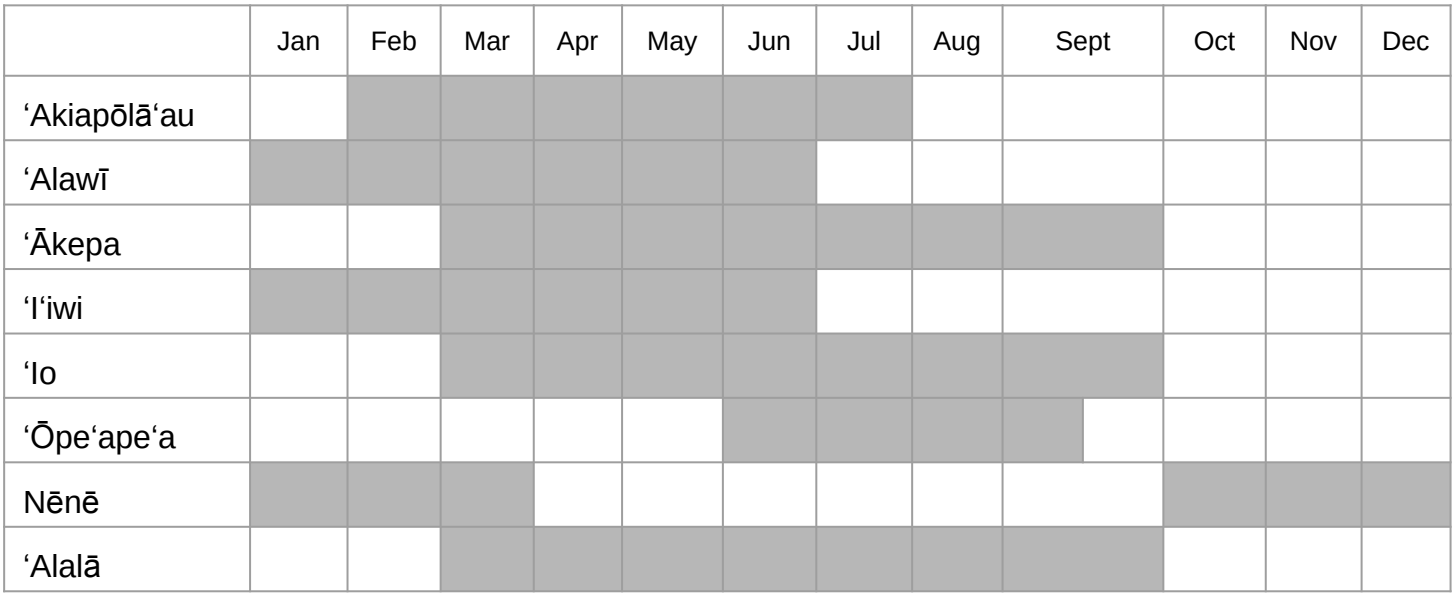
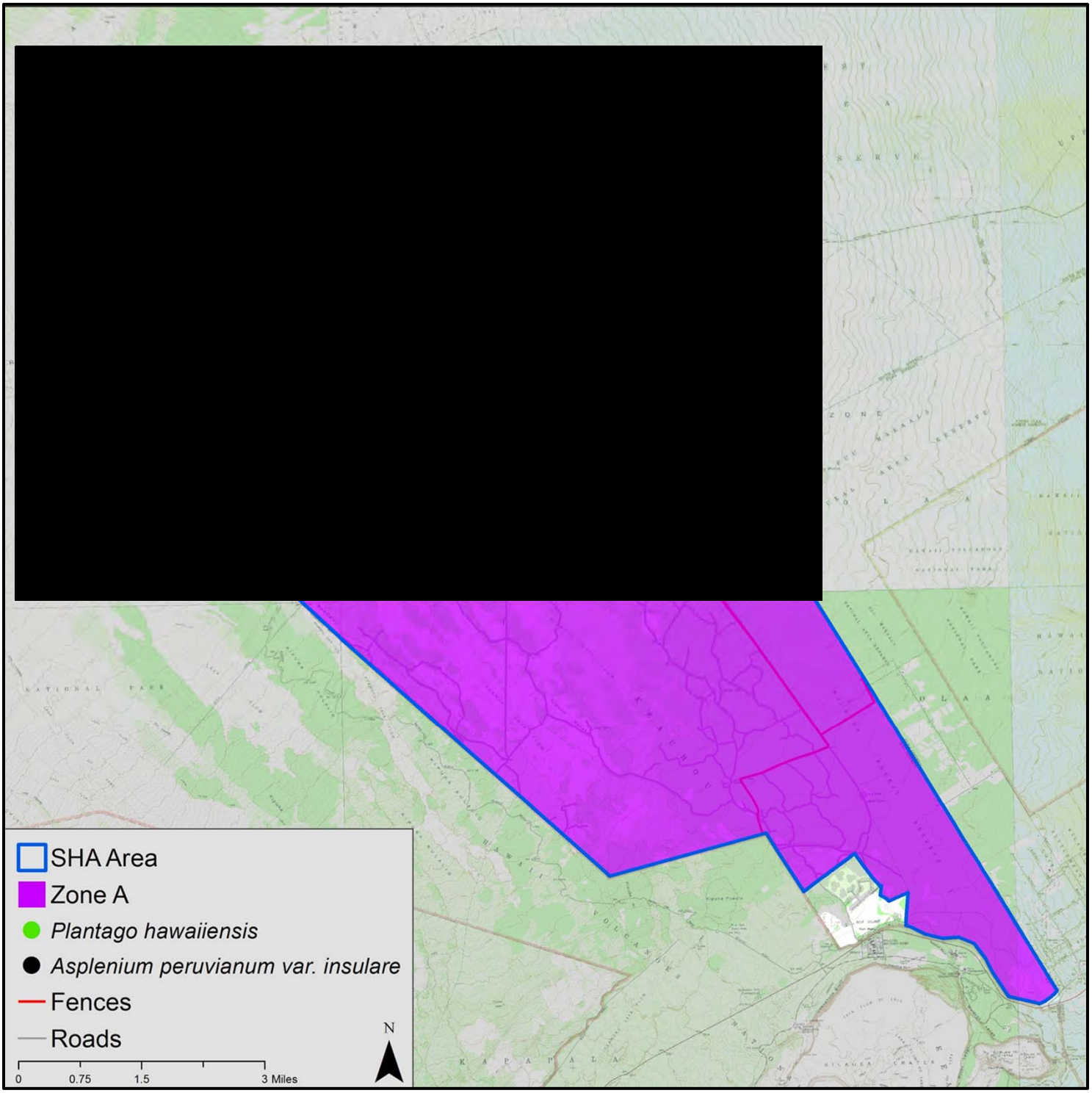


Table 6. Periods Allowed for Tree Trimming, Harvesting, and Thinning

Stratum	**Period during which tree trimming, harvesting, and thinning can occur (outside of sensitive breeding periods)**
Zones B & C (Forest Bird Stratum 1)	October 1 - December 31*
Zone A (Remainder of Property)	Vegetation below 15 feet tall: year round Vegetation above 15 feet tall: October 1 - March 1**

*Outside of this window covered bird species have their breeding seasons (see Table 5)
**Outside of this time window is the ʻIo and Hawaiian Hoary Bat breeding season (see Table 5)

Zone A- General Keauhou



Wildlife Species:

- ʻIʻiwi
- ʻIo- Hawaiian Hawk
- Nēnē- Hawaiian Goose
- ʻŌpeʻapeʻa- Hawaiian Hoary Bat

Plant Species:

- *Asplenium peruvianum* var. *insulare*
- Laukahi Kuahiwi- *Plantago hawaiiensis*

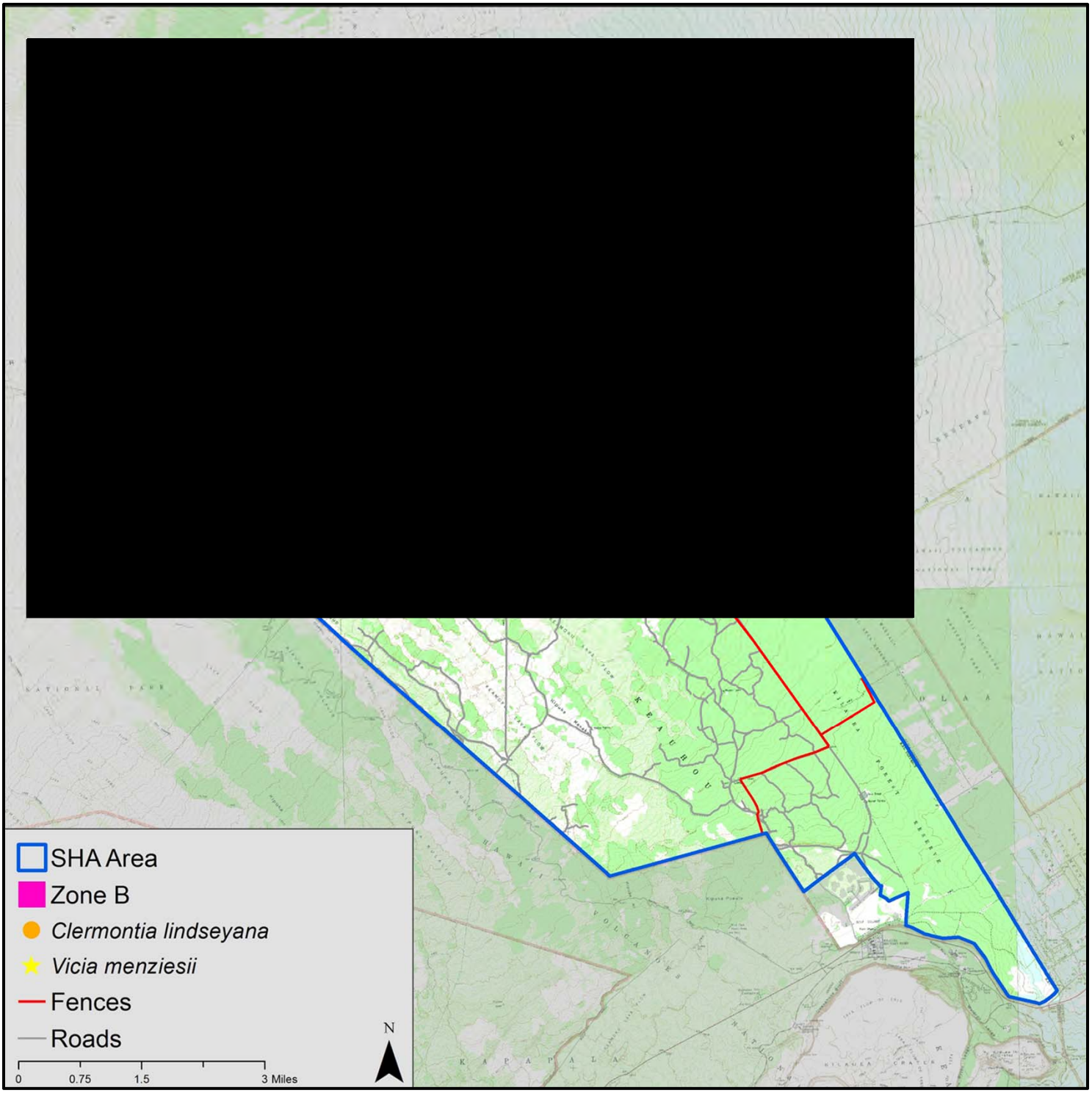
Zone A- General Keauhou

Restoration Outplanting	1. All personnel working on forest restoration will receive training on the tasks they are performing and on avoiding impacts to Covered Species prior to starting work, or be directly overseen by an individual so-trained during field work. 2. Buffer distances of a minimum of 50 ft will be established where no disturbance will occur around known individual founder plants of Covered Species. 3. No work will occur around known nests of birds during the breeding seasons (Table 5).
Koa Silviculture	1. Stand improvement activities (selective thinning) or harvest that will occur in young koa stands (trees smaller than a 65 cm dbh), will take place outside sensitive breeding seasons (Table 5). 2. Buffer distances of a minimum of 50 ft will be established where no disturbance will occur around known individual founder plants of Covered Species.
Fences and Ungulate Control	1. Since Hawaiian Hoary Bats are known to be killed by barbed wire, barbed wire above grass level will not be used on any new management fences. 2. Remaining barbed wire will be replaced on adjacent ranch lands as leases are renewed by KS. Additionally, any barbed wire from remnant ranch fencing which remains exposed above grass will be removed by KS. 3. New and replacement fence routes will be planned to follow natural topographical features when possible and planned to avoid Covered Species of plants. Tree/shrub removal will be restricted as described in Table 6.
Weed Control	1. All personnel working on weed control will receive training on the tasks they are performing and on avoiding impacts to Covered Species prior to starting work, or be directly overseen by an individual so-trained during field work. 2. Buffer distances of a minimum of 50 ft will be established where no disturbance will occur around known individual founder plants of Covered Species. 3. No work will occur around known nests of birds during the breeding seasons (Table 6). 4. No chemical herbicides or chainsaws will be used within 50 feet of known Nēnē or ‘Io nests during their breeding seasons. 5. Low-impact weed suppression such as herbicide spraying with a backpack may occur year-round on the Enrolled Property provided that 50 foot buffers are established near known nests of Covered Species.
Fire Threat Management	1. Except in the situation of suppression of an active fire, tree/shrub cutting restrictions shown in Table 6 will be followed.
Response to Rapid ‘Ōhi‘a Death	1. Unless otherwise directed by the Service and DOFAW in writing, all tree/shrub cutting restrictions as shown in Table 6. 2. All personnel working will receive training on the tasks they are performing and on avoiding impacts to Covered Species (animal and plant) prior to starting work, or be directly overseen by an individual so-trained during field work. 3. To prevent the spread of Rapid ‘Ōhi‘a Death the most up to date guidance will be followed. 4. All actions taken will avoid direct impacts to Covered Species plants.

Zone A- General Keauhou

Helicopter Landing Zones	1. Helicopter landing zones will not be designated in areas where Covered Species of birds (‘Akiapōlā‘au, Hawai‘i Creeper, Hawai‘i Ākepa, Nēnē, ‘Alalā, and Hawaiian hawk) are known to nest. 2. Natural resource management activities will comply with the tree/shrub cutting restrictions listed in Table 6.
Trail Clearing	1. Any clearing activities for trails will occur outside the breeding period for Covered Species (Table 5) and with the tree/shrub cutting restrictions listed in Table 6.
Road Construction	1. Any road construction activities would occur with the tree/shrub cutting restrictions listed in Table 6 and disturbance would be kept to the minimum necessary to conduct these activities.
Tree Salvage	1. When salvaging trees that are dead and fallen or dead standing trees any salvaging will be done with the tree/shrub cutting restrictions listed in Table 6.
Other Construction	1. Construction of infrastructure facilities will not occur during the breeding season of any Covered Species known to have an active nest in the area. 2. Natural resource management activities will comply with the tree/shrub cutting restrictions listed in Table 6.

Zone B- Forest Bird Stratum 1 Only



Wildlife Species:

- ʻAkiapōlāʻau
- ʻĀkepa
- ʻAlawī- Hawaiʻi Creeper
- ʻIʻiwi
- ʻAlalā- Hawaiian Raven
- ʻIo- Hawaiian Hawk
- Nēnē- Hawaiian Goose
- ʻŌpeʻapeʻa- Hawaiian Hoary Bat

Plant Species:

- Special-Concern
  - *Vicia menziesii*
- ʻŌhā wai- *Clermontia lindseyana*

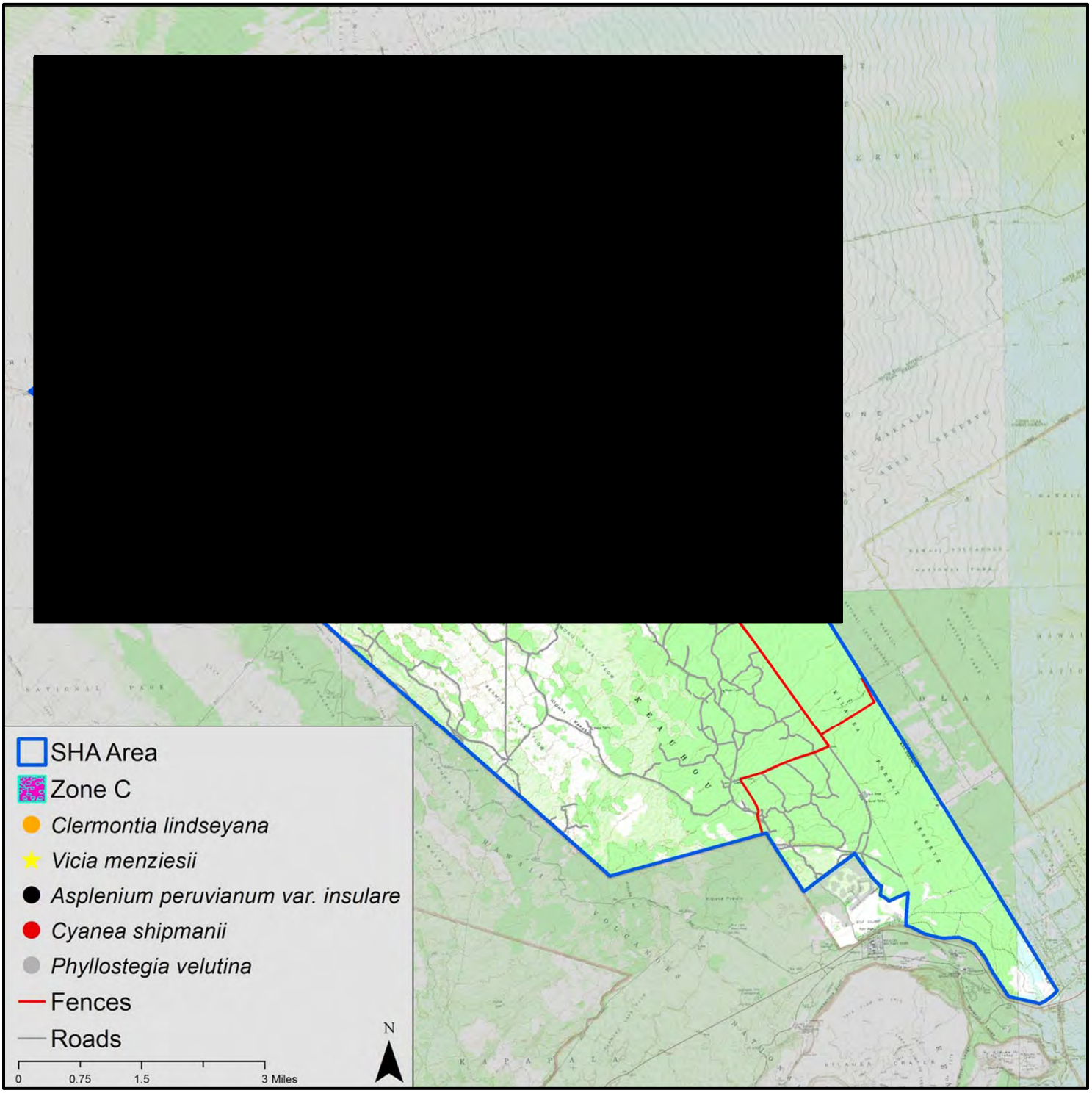
Zone B- Forest Bird Stratum 1 Only

Restoration Outplanting	1. All personnel working on forest restoration will receive training on the tasks they are performing and on avoiding impacts to Covered Species prior to starting work, or be directly overseen by an individual so-trained during field work. 2. Buffer distances of a minimum of 50 ft will be established where no disturbance will occur around known individual founder plants of Covered Species. 3. No work will occur around known nests of birds during the breeding seasons (Table 5).
Koa Silviculture	1. Stand improvement activities (selective thinning) or harvest that will occur in young koa stands (trees smaller than a 65 cm dbh), will take place outside sensitive breeding seasons (Table 5). 2. Buffer distances of a minimum of 50 ft will be established where no disturbance will occur around known individual founder plants of Covered Species. 3. No cutting of live standing old growth ‘ōhi‘a or koa trees > 10 m in height and > 65 cm dbh without prior written permission from KS.
Fencing	1. Since Hawaiian Hoary Bats are known to be killed by barbed wire, barbed wire above grass level will not be used on any new management fences. 2. Barbed wire from remnant ranch fencing which remains exposed above grass will be removed by KS. 3. New and replacement fence routes will be planned to follow natural topographical features when possible and planned to avoid Covered Species of plants. Tree/shrub removal will be restricted as described in Table 6. 4. No fence construction will occur around known nests of birds during the breeding seasons (Table 5). Emergency fence repairs that cannot be planned around species' breeding seasons but are necessary to maintain the integrity of the fencing may be periodically necessary, but these situations are anticipated to be rare, and most commonly associated with downed trees and severe weather events.
Weed Control	1. All personnel working on weed control will receive training on the tasks they are performing and on avoiding impacts to Covered Species prior to starting work, or be directly overseen by an individual so-trained during field work. 2. Buffer distances of a minimum of 50 ft will be established where no disturbance will occur around known individual founder plants of Covered Species. 3. No work will occur around known nests of birds during the breeding seasons (Table 6). 4. No chemical herbicides (or chainsaws) will be used on trees with known nests of Covered Species or within 50 feet of known nest trees during the breeding season. 5. No chemical herbicides or chainsaws will be used within 50 feet of known Nēnē or ‘Io nests during their breeding seasons. 6. Low-impact weed suppression such as herbicide spraying with a backpack may occur year-round on the Enrolled Property provided that 50 foot buffers are established near known nests of Covered Species.
Fire Threat Management	1. Except in the situation of suppression of an active fire, tree/shrub cutting restrictions shown in Table 6 will be followed.

Zone B- Forest Bird Stratum 1 Only

Response to Rapid ʻŌhiʻa Death	1. Unless otherwise directed by the Service and DOFAW in writing, all tree/shrub cutting restrictions as shown in Table 6. 2. All personnel working will receive training on the tasks they are performing and on avoiding impacts to Covered Species (animal and plant) prior to starting work, or be directly overseen by an individual so-trained during field work. 3. To prevent the spread of Rapid ʻŌhiʻa Death the most up to date guidance will be followed. 4. All actions taken will avoid direct impacts to Covered Species plants.
Helicopter Landing Zones	1. Helicopter landing zones will not be designated in areas where Covered Species of birds (ʻAkiapōlāʻau, Hawaiʻi Creeper, Hawaiʻi Ākepa, Nēnē, ʻAlalā, and Hawaiian hawk) are known to nest. 2. Natural resource management activities will comply with the tree/shrub cutting restrictions listed in Table 6.
Trail Clearing and Road Construction	1. Any clearing activities for trails will occur outside the breeding period for Covered Species (Table 5) and with the tree/shrub cutting restrictions listed in Table 6. 2. Any road construction activities would occur outside the breeding season for Covered Species (Table 5) and with the tree/shrub cutting restrictions listed in Table 6 and disturbance would be kept to the minimum necessary to conduct these activities.
Tree Salvage	1. When salvaging trees that are dead and fallen or dead standing trees any salvaging will be done outside the breeding season for Covered Species (Table 5) and with the tree/shrub cutting restrictions listed in Table 6.
Other Construction	1. Construction of infrastructure facilities will not occur during the breeding season of any Covered Species known to have an active nest in the area. 2. Natural resource management activities will comply with the tree/shrub cutting restrictions listed in Table 6.

Zone C- Forest Bird Stratum 1 & Area Requiring Additional Conservation Commitments



Wildlife Species:

- ʻAkiapōlāʻau
- ʻĀkepa
- ʻAlawī- Hawaiʻi Creeper
- ʻIʻiwi
- ʻAlalā- Hawaiian Raven
- ʻIo- Hawaiian Hawk
- Nēnē- Hawaiian Goose
- ʻŌpeʻapeʻa- Hawaiian Hoary Bat

Plant Species:

- Special-Concern:
  - Hāhā- *Cyanea stictophylla*
  - Kīponapona- *Phyllostegia racemosa*
  - *Vicia menziesii*
- *Asplenium peruvianum* var. *insulare*
- ʻŌhā wai- *Clermontia lindseyana*
- Hāhā- *Cyanea shipmanii*
- *Phyllostegia velutina*

Zone C- Forest Bird Stratum 1 & Area Requiring Additional Conservation Commitments

Restoration Outplanting	1. All personnel working on forest restoration will receive training on the tasks they are performing and on avoiding impacts to Covered Species prior to starting work, or be directly overseen by an individual so-trained during field work. 2. Buffer distances of a minimum of 50 ft will be established where no disturbance will occur around known individual founder plants of Covered Species. 3. No work will occur around known nests of birds during the breeding seasons (Table 5).
	In addition: 4. Training of persons conducting activity by PEPP staff or other recognized experts on species ID, habitat of special-concern plants and specific precautions. 5. Prohibit ground-disturbing machinery within a marked approximate 50- ft buffer around each special-concern plant or known recent location. 6. Conduct monitoring after a disturbance has occurred within 50 ft buffer of any special- concern plant; any negative results reported to PEPP and the agencies within 2 months of each survey and in annual report.
Koa Silviculture	1. Stand improvement activities (selective thinning) or harvest that will occur in young koa stands (trees smaller than a 65 cm dbh), will take place outside sensitive breeding seasons (Table 5). 2. Buffer distances of a minimum of 50 ft will be established where no disturbance will occur around known individual founder plants of Covered Species. 3. No cutting of live standing old growth ‘ōhi‘a or koa trees > 10 m in height and > 65 cm dbh without prior written permission from KS.
	In addition, for koa thinning, cutting, and scarifying: 4. Training of persons conducting activity by PEPP staff or other recognized experts on species ID, habitat of special-concern plants and specific precautions. 5. Before activity ensure a survey of the 50-ft buffer area around each known or known recent location of special-concern plant by a botanist familiar with their identification. 6. Prohibit ground-disturbing machinery within a marked approximate 50- ft buffer around each special-concern plant or known recent location . 7. No large trees felled that would fall within the established 50 ft buffer of any special-concern plant. 8. Conduct monitoring after a disturbance has occurred within 50 ft buffer of any special- concern plant; any negative results reported to PEPP and the agencies within 2 months of each survey and in annual report.
Fencing	1. Since Hawaiian Hoary Bats are known to be killed by barbed wire, barbed wire above grass level will not be used on any new management fences. 2. Barbed wire from remnant ranch fencing which remains exposed above grass will be removed by KS. 3. New and replacement fence routes will be planned to follow natural topographical features when possible and planned to avoid Covered Species of plants. Tree/shrub removal will be restricted as described in Table 6. 4. No fence construction will occur around known nests of birds during the breeding seasons (Table 5). Emergency fence repairs that cannot be planned around species' breeding seasons but are necessary to maintain the integrity of the fencing may be periodically necessary, but these situations are anticipated to be rare, and most commonly associated with downed trees and severe weather events.

Zone C- Forest Bird Stratum 1 & Area Requiring Additional Conservation Commitments

Fencing (continued)	In addition: 5. Training of persons conducting activity by PEPP staff or other recognized experts on species ID, habitat of special-concern plants and specific precautions. 6. Before activity ensure a survey of the 50-ft buffer area around each known or known recent location of special-concern plant by a botanist familiar with their identification. 7. Prohibit ground-disturbing machinery within a marked approximate 50- ft buffer around each special-concern plant or known recent location. 8. No large trees felled that would fall within the established 50 ft buffer of any special-concern plant. 9. Conduct monitoring after a disturbance has occurred within 50 ft buffer of any special- concern plant; any negative results reported to PEPP and the agencies within 2 months of each survey and in annual report.
Weed Control	1. All personnel working on weed control will receive training on the tasks they are performing and on avoiding impacts to Covered Species prior to starting work, or be directly overseen by an individual so-trained during field work. 2. Buffer distances of a minimum of 50 ft will be established where no disturbance will occur around known individual founder plants of Covered Species. 3. No work will occur around known nests of birds during the breeding seasons (Table 6). 4. No chemical herbicides (or chainsaws) will be used on trees with known nests of Covered Species or within 50 feet of known nest trees during the breeding season. 5. No chemical herbicides or chainsaws will be used within 50 feet of known Nēnē or ‘Io nests during their breeding seasons. 6. Low-impact weed suppression such as herbicide spraying with a backpack may occur year-round on the Enrolled Property provided that 50 foot buffers are established near known nests of Covered Species.
	In addition, for weed pulling: 4. Training of persons conducting activity by PEPP staff or other recognized experts on species ID, habitat of special-concern plants and specific precautions. 5. Prohibit ground-disturbing machinery within a marked approximate 50- ft buffer around each special-concern plant or known recent location. In addition, for herbicide use: 4. Training of persons conducting activity by PEPP staff or other recognized experts on species ID, habitat of special-concern plants and specific precautions. 5. Before activity ensure a survey of the 50-ft buffer area around each known or known recent location of special-concern plant by a botanist familiar with their identification. 6. Prohibit ground-disturbing machinery within a marked approximate 50- ft buffer around each special-concern plant or known recent location. 7. No large trees felled that would fall within the established 50 ft buffer of any special-concern plant. 8. Conduct monitoring after a disturbance has occurred within 50 ft buffer of any special- concern plant; any negative results reported to PEPP and the agencies within 2 months of each survey and in annual report.
Fire Threat Management	1. Except in the situation of suppression of an active fire, tree/shrub cutting restrictions shown in Table 6 will be followed.

Zone C- Forest Bird Stratum 1 & Area Requiring Additional Conservation Commitments

Response to Rapid ʻŌhiʻa Death	1. Unless otherwise directed by the Service and DOFAW in writing, all tree/shrub cutting restrictions as shown in Table 6. 2. All personnel working will receive training on the tasks they are performing and on avoiding impacts to Covered Species (animal and plant) prior to starting work, or be directly overseen by an individual so-trained during field work. 3. To prevent the spread of Rapid ʻŌhiʻa Death the most up to date guidance will be followed. 4. All actions taken will avoid direct impacts to Covered Species plants.
Helicopter Landing Zones	1. Helicopter landing zones will not be designated in areas where Covered Species of birds (ʻAkiapōlāʻau, Hawaiʻi Creeper, Hawaiʻi Ākepa, Nēnē, ʻAlalā, and Hawaiian hawk) are known to nest. 2. Natural resource management activities will comply with the tree/shrub cutting restrictions listed in Table 6.
Trail Clearing and Road Construction	1. Any clearing activities for trails will occur outside the breeding period for Covered Species (Table 5) and with the tree/shrub cutting restrictions listed in Table 6. 2. Any road construction activities would occur outside the breeding season for Covered Species (Table 5) and with the tree/shrub cutting restrictions listed in Table 6 and disturbance would be kept to the minimum necessary to conduct these activities.
	In addition: 3. Training of persons conducting activity by PEPP staff or other recognized experts on species ID, habitat of special-concern plants and specific precautions. 4. Before activity ensure a survey of the 50-ft buffer area around each known or known recent location of special-concern plant by a botanist familiar with their identification. 5. Prohibit ground-disturbing machinery within a marked approximate 50- ft buffer around each special-concern plant or known recent location. 6. No large trees felled that would fall within the established 50 ft buffer of any special-concern plant. 7. Conduct monitoring after a disturbance has occurred within 50 ft buffer of any special- concern plant; any negative results reported to PEPP and the agencies within 2 months of each survey and in annual report.
Tree Salvage	1. When salvaging trees that are dead and fallen or dead standing trees any salvaging will be done outside the breeding season for Covered Species within Forest Bird Stratum 1 (Table 5) and with the tree/shrub cutting restrictions listed in Table 6.
Other Construction	1. Construction of infrastructure facilities will not occur during the breeding season of any Covered Species known to have an active nest in the area. 2. Natural resource management activities will comply with the tree/shrub cutting restrictions listed in Table 6.