

Appendix A

**Natural Resources Surveys
University of Nations Expansion Property
North Kona District, Island of Hawai'i
AECOS Inc., January 2020**

Natural resources surveys for University of Nations expansion property (TMK: (3) 7-5-010:085) North Kona District, Island of Hawai'i

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Eric B. Guinther, David Miranda, and Reginald David¹

AECOS Inc.

Kamehameha Highway, Kāne'ohe, Hawai'i 96744

Phone: (808) 234-7770 Fax: (808) 234-7775 Email: guinther@aecos.com

Introduction

The University of Nations Kona is starting a process to expand the existing campus ("Project"). The expansion entails a 62-ac (~25-ha) parcel (TMK: 7-5-010:085) directly adjacent on the south to the existing campus off Kuakini Highway in Kailua-Kona (see Figures 1 and 2). This report² presents results of a survey of the expansion parcel for natural resources that may be of concern during the construction process, including initial land clearing (grading and grubbing).

The survey area (Fig. 2) is undulating, sloping ground (slopes down to the west), at the upper end bordering on Hawaii Belt Road (Rte 11) approximately 100 ft (30 m) above sea level. Much of the site is rocky with shallow soil accumulation. Although covered mostly by vegetation, parts are disturbed with a former quarry, two house structures, two water reservoirs (on a separate included parcel that project plans show as moved to a new location), and numerous fences of various types, presumably for raising of livestock (although no farm animals were seen).

¹ Rana Biological Consulting, Kailua-Kona, Hawai'i.

² This report was prepared for use by g70 to become part of the public record of the entitlements process.

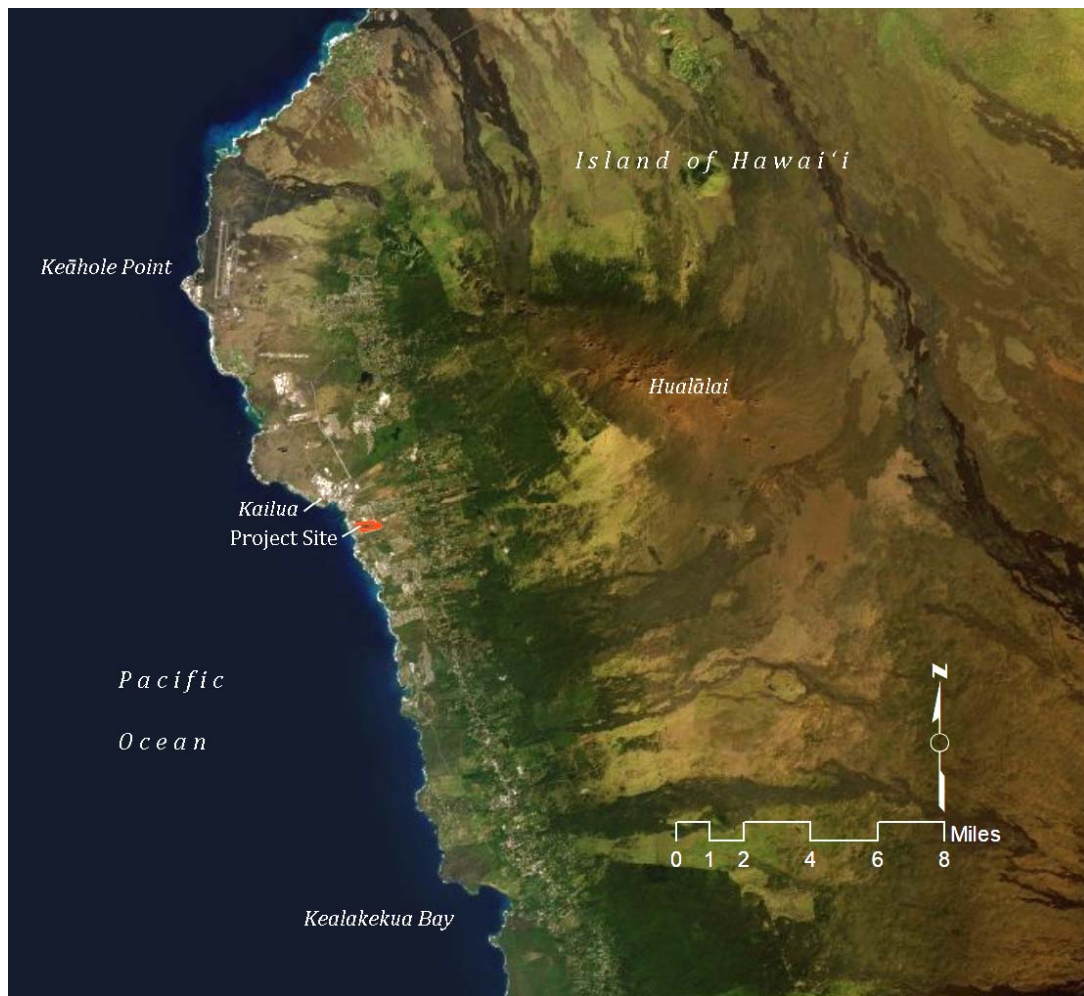


Figure 1. University of Nations Kailua-Kona expansion Project location (in red) on the leeward side of the Island of Hawai'i.

Methods

Jurisdictional Waters Reconnaissance

The site presented no expectations of wetland or stream presence that might raise an issue of federal jurisdiction (waters of the U.S.).



Figure 2. University of Nations survey area outlined in red.

Plant Survey

A property boundary (survey area) map was loaded on a Trimble 6000 Series GNSS unit (GeoXH) for use during the botanical survey conducted by Eric Guinther and David Miranda on September 3, 2019. The GNSS unit recorded the progress tracks of the lead botanist, providing real time feedback on location and adequacy of coverage during a wandering (pedestrian) transect survey and served as a guide to the survey area (property line) limits. Plant species were identified as they were encountered and notes taken to develop a relative abundance for each species recorded. Any plant not immediately recognized during the survey was photographed and/or a representative feature (flower, fruit, etc.) collected for later identification at the laboratory.

Plant species names in this report follow *Manual of the Flowering Plants of Hawai'i* (Wagner, Herbst, & Sohmer, 1990; Wagner & Herbst, 1999) for native and naturalized flowering plants and *A Tropical Garden Flora* (Staples & Herbst,

2005) for ornamental plants. More recent name changes for naturalized plant species follow Imada (2012).

Bird and Mammal Survey

Reginald David conducted the bird and mammal survey during the morning of September 3, 2019. Eight, roughly equidistant, avian point-count stations were established within the survey property. A single eight-minute avian point-count was made at each of the eight stations. The avian counts were conducted in the early morning hours with the aid of Leica 8 X 42 binoculars and by listening for vocalizations. Mr. David walked the entire site and time not spent counting at point-count stations was used to search for species and habitats not detected during station counts. Weather conditions were excellent with unlimited visibility and winds of between 2 and 5 kilometers per hour, and no precipitation. Avian phylogenetic order and nomenclature used in this report follows the AOS Check-List of North and Middle American Birds 2018 (Chesser et al., 2018, 2019).

The survey of mammals was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. A running tally was kept of all terrestrial vertebrate mammalian species detected within the survey area. Mammal scientific names follow *Mammal species of the world: a taxonomic and geographic reference* (Wilson and Reeder, 2005).

Results

Vegetation

The site is characterized by a mixture of scattered *kiawe* (*Prosopis pallida*) and short-stature *koa haole* (*Leucaena leucocephala*) with moderately dense Guinea grass (*Megathyrsus maximus*) at the upper end and more open *koa haole* and areas of dense herbaceous growths of coffee senna (*Senna occidentalis*) and 'uhaloa (*Waltheria americana*) in disturbed areas (Figure 3).

Flora

A listing of the plant species observed during the botanical survey is given in Table 2. Included in this list are plants identified by Terry and Hart (2002) for a survey of the same area conducted in July 2002. The "Notes" column indicates those species common to the two surveys ("<2>") and those species only seen in 2002 ("<3>"). Plant species recorded in 2019 total 62 taxa and have an



Figure 3. Two views of the vegetation typical of a majority of the site.

Table 1. Listing of plants (flora) for a proposed campus expansion area, University of Nations Kona.

| Species | Common name | Status | Abundance | Notes |
|--|------------------------|--------|-----------|-------|
| <i>FLOWERING PLANTS</i> | | | | |
| <i>DICOTYLEDONES</i> | | | | |
| <i>ACANTHACEAE</i> | | | | |
| <i>Asystasia gangetica</i> (L.) T. Anderson | Chinese violet | Nat | R | |
| <i>AMARANTHACEAE</i> | | | | |
| <i>Alternanthera pungens</i> Kunth | khaki weed | Nat | R | |
| <i>ANACARDIACEAE</i> | | | | |
| <i>Schinus terebinthefolius</i> Raddi | Christmasberry | Nat | -- | <3> |
| <i>APOCYNACEAE</i> | | | | |
| <i>Catharanthus roseus</i> (L.) G. Don | Madagascar periwinkle | Nat | R | <2> |
| <i>ARALIACEAE</i> | | | | |
| <i>Polycias guilfoyeri</i> (W. Bull) L.H. Bailey | panax | Orn | R | |
| <i>ASCLEPIADACEAE</i> | | | | |
| <i>Calotropus cf. gigantea</i> (L.) W.T. Aiton | crown flower | Nat | R | <4> |
| <i>Stapelia gigantea</i> N. E. Brown | giant toad plant | Nat | Rc | |
| <i>ASTERACEAE (COMPOSITAE)</i> | | | | |
| <i>Bidens cynapiifolia</i> Kunth | --- | Nat | R | <1> |
| <i>Bidens pilosa</i> L. | <i>kī</i> | Nat | U | <1> |
| <i>Senecio mikanioides</i> Otto ex Walp. | German ivy | Nat | R | |
| <i>Tridax procumbans</i> L. | coat buttons | Nat | R | <1> |
| <i>Verbesina encelioides</i> (Cav.) Benth. & Hook. | golden crown-beard | Nat | R | |
| <i>BIGNONIACEAE</i> | | | | |
| <i>Spathodea campanulata</i> P. Beauv. | African tulip tree | Nat | U | <2> |
| <i>BUDDLEIACEAE</i> | | | | |
| <i>Buddleia asiatica</i> Lour. | dog tail | Nat | R | |
| <i>CAPPARACEAE</i> | | | | |
| <i>Cleome gynandra</i> L. | wild spider flower | Nat | U | |
| <i>CARICACEAE</i> | | | | |
| <i>Carica papaya</i> L. | <i>mīkana</i> , papaya | Nat | R | |
| <i>CHENOPODIACEAE</i> | | | | |
| <i>Chenopodium ambrosioides</i> L. | Mexican tea | Nat | Oa | |
| <i>Chenopodium murale</i> L. | <i>'āheahea</i> | Nat | -- | <3> |

Table 1 (continued).

| Species | Common name | Status | Abundance | Notes |
|--|------------------------------|--------|-----------|-------|
| CLUSIACEAE | | | | |
| <i>Clusia rosea</i> Jacq. | autograph tree, copey | Nat | O | <2> |
| CONVOLVULACEAE | | | | |
| <i>Ipomoea obscura</i> (L.) KerGawl. | --- | Nat | U | |
| <i>Ipomoea triloba</i> L. | little bell | Nat | -- | <3> |
| CRASSULACEAE | | | | |
| <i>Kalanchoë pinnata</i> (Lam.) Pers. | air plant | Nat | -- | <3> |
| CUCURBITACEAE | | | | |
| <i>Coccinia grandis</i> (L.) Voigt | scarlet-fruited gourd | Nat | -- | <3> |
| <i>Cucumis dipsaceus</i> Ehrenb. & Spach | teasel gourd | Nat | -- | <3> |
| <i>Momordica charantia</i> L. | wild bittermelon | Nat | C | <2> |
| EUPHORBIACEAE | | | | |
| <i>Euphorbia heterophylla</i> L. | <i>kaliko</i> | Nat | -- | <3> |
| <i>Euphorbia hirta</i> L. | garden spurge | Nat | Uc | <1> |
| <i>Euphorbia prostrata</i> L. | prostrate spurge | Nat | R | |
| <i>Ricinus communis</i> L. | castor bean | Nat | U | <2> |
| FABACEAE | | | | |
| <i>Abrus precatorius</i> L. | black-eyed Susan | Nat | R | |
| <i>Albizia lebeck</i> (L.) Benth. | siris tree | Nat | R | |
| <i>Albizia saman</i> (Jacq.) F. Muell. | monkey pod | Nat | R | |
| <i>Chamaecrista nictitans</i> (L.) Moench | <i>lauki</i> , partridge pea | Nat | -- | <3> |
| <i>Crotalaria incana</i> L. | fuzzy rattlepod | Nat | R | |
| <i>Desmanthus virgatus</i> (L.) Willd. | virgate mimosa | Nat | R | <2> |
| <i>Desmodium tortuosum</i> (Sw.) DC. | Florida beggarweed | Nat | R | |
| <i>Indigofera suffruticosa</i> Mill. | indigo | Nat | O | <2> |
| <i>Leucaena leucocephala</i> (Lam.) deWit | <i>koa haole</i> | Nat | AA | <2> |
| <i>Macroptilium lathyroides</i> (L.) Urb. | wild bean, cow pea | Nat | R | <1> |
| <i>Mimosa pudica</i> L. | sensitive plant | Nat | U | <1> |
| <i>Pithecellobium dulce</i> (Roxb.) Benth. | ' <i>opiuma</i> | Nat | U | <2> |
| <i>Prosopis pallida</i> (Humb. & Bonpl. ex Willd.) Kunth | <i>kiawe</i> | Nat | C | <2> |
| <i>Senna occidentalis</i> (L.) Link | coffee senna | Nat | AA | <2> |
| <i>Vachellia farnesiana</i> (L.) Wight & Arnott | <i>klu</i> | Nat | U | <2> |

Table 1 (continued).

| Species | Common name | Status | Abundance | Notes |
|--|---------------------------------------|------------|-----------|-------|
| LAMIACEAE | | | | |
| <i>Leonotis nepetifolia</i> (L.) R. Br. | lion's ear | Nat | U | <2> |
| <i>Ocimum gratissimum</i> L. | wild basil | Nat | R | <2,4> |
| MALVACEAE | | | | |
| <i>Abutilon grandifolium</i> (Willd.) Sweet | hairy abutilon | Nat | C | <2,4> |
| <i>Malvastrum coromandelianum</i> (L.) Garcke | false mallow | Nat | -- | <3> |
| <i>Sida ciliaris</i> L. | --- | Nat | O | |
| <i>Sida fallax</i> Walp. | 'ilima | Ind | Oc | |
| <i>Sida rhombifolia</i> L. | Cuba jute | Nat | R | <1> |
| <i>Sida spinosa</i> L. | pickly sida | Nat | R | <1> |
| <i>Waltheria indica</i> L. | 'uhaloa | Ind | AA | <2> |
| MORACEAE | | | | |
| <i>Ficus benjamina</i> L. | weeping fig | Orn | -- | <3> |
| MORINGACEAE | | | | |
| <i>Moringa oleifera</i> Lam. | horseradish tree, <i>malunggay</i> | Orn | R | |
| NYCTAGINACEAE | | | | |
| <i>Boerhavia coccinea</i> Mill. | false alena | Nat | R | |
| PHYTOLACCACEAE | | | | |
| <i>Rivina humilis</i> L. | coral berry | Nat | -- | <3> |
| PLUMBAGINACEAE | | | | |
| <i>Plumbago auriculata</i> Lam. | blue plumbago | Orn | R | |
| <i>Plumbago zeylanica</i> L. | 'ilie'e | Ind | -- | <3> |
| POLYGONACEAE | | | | |
| <i>Polygonum captatum</i> F. Ham. | | Nat | R | <4> |
| PORTULACACEAE | | | | |
| <i>Portulaca oleracea</i> L. | pig weed | Nat | -- | <3> |
| <i>Portulaca pilosa</i> L. | --- | Nat | Uo | <2> |
| <i>Talinum fruticosum</i> (L.) Juss. | --- | Nat | Oc | |
| PHYTOLACCACEAE | | | | |
| <i>Rivina humilis</i> L. | coral berry | Nat | -- | <3> |
| RUBIACEAE | | | | |
| <i>Spermacoce assurgens</i> Ruiz & Pav. | buttonweed | Nat | O | |
| RUTACEAE | | | | |
| <i>Murraya paniculata</i> (L.) W. Jack | mock orange | Nat | R | |
| VERBINACEAE | | | | |
| <i>Lantana camara</i> L. | lantana | Nat | Uo | <2> |

Table 1 (continued).

| Species | Common name | Status | Abundance | Notes |
|---|---------------------|------------|-----------|-------|
| MONOCOTYLEDONES | | | | |
| COMMELINACEAE | | | | |
| <i>Commelina diffusa</i> N.L. Burm. | <i>honohono</i> | Nat | -- | <3> |
| CYPERACEAE | | | | |
| <i>Cyperus polystachyos</i> Rottb. | --- | Ind | R | <1> |
| POACEAE (GRAMINEAE) | | | | |
| <i>Cenchrus ciliaris</i> L. | bufflegrass | Nat | Ua | <1,2> |
| <i>Chloris barbata</i> (L.) Sw. | swollen fingergrass | Nat | R | <1> |
| <i>Digiteria ciliaris</i> (Retz) Koeler | Henry's crabgrass | Nat | R | <1> |
| <i>Digitaria insularis</i> (L.) Mez ex Ekman | sourgrass | Nat | U | |
| <i>Eragrostis amabilis</i> (L.) Wight & Arnott | Japanese lovegrass | Nat | Uo | |
| <i>Megathyrsus maximus</i> (Jacq.) B.K. Simon & W.L. Jacobs | Guinea grass | Nat | AA | <2> |
| <i>Melinis repens</i> (Willd.) Zizka | Natal redtop | Nat | O | |
| <i>Pennisetum setaceum</i> (Forssk.) Chiov. | fountain grass | Nat | U | <1> |

Legend to Table 1

Status = distributional status

End = endemic; native to Hawaii and found naturally nowhere else.**Ind** = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.**Nat** = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.**Orn** = exotic, ornamental or cultivated; plant not naturalized (not well-established outside of cultivation).**Pol.** = Polynesian introduction before 1778.

Abundance = occurrence ratings for plants in Project area on September 5, 2019

R - Rare - only one or two plants seen.

U - Uncommon - several to a dozen plants observed.

O - Occasional - found regularly, but not abundant anywhere.

C - Common - considered an important part of the vegetation and observed numerous times.

A - Abundant - found in large numbers; may be locally dominant.

AA - Abundant - abundant and dominant; defining vegetation type.

Lowercase letters (u, o, c, or a) following qualitative rating of abundance indicate a localized abundance that is greater than the occurrence rating. For example, Ra would be a plant encountered perhaps only once or twice, but very numerous where encountered.

Notes:

<1> Only seen in road verge areas such as along Hawaii Belt Road (mostly ruderal species).

Table 1 (continued).

- <2> Also reported from this site by Terry and Hart (2002).
- <3> Reported from site by Terry and Hart (2002), but not observed in 2019.
- <4> Observed plant lacked flowers or fruit; identification uncertain.

abundance value provided in the table. Included in Table 1 are 13 species only observed along the verge of Kuakini Highway, presumably just off the property. These are marked with note “<1>” if not recorded from the property, although their proximity to the site indicates a good possibility that one or more of these species could occur in disturbed areas on the site.

Considering the entire list of species in Table 1, only four native (indigenous) plants were recorded: ‘ilima (*Sida fallax*), ‘uhaloa (*Waltheria indica*), ‘ilie’e (*Plumbago zeylanica*), and a common sedge (*Cyperus polystachyos*). All three are widespread in the Islands and of no conservation concern. ‘uhaloa is particular abundant across the lower half of the site. This native is known to be common in disturbed areas as well as areas of marginal growing conditions.

Avian Survey

A total of 349 individual birds of 21 species and representing 12 separate families, was recorded during station counts (Table 2). The Hawaiian Hawk (*Buteo solitarius*)—one individual of which species was observed flying over the site—was listed as an endangered species (DLNR 2015; USFWS, n.d.). However, the Hawaiian Hawk has been delisted (effective February 3, 2020; USFWS, 2020) by the U.S. Fish and wildlife Service, yet remains listed by the State of Hawai‘i. The remaining 20 species recorded across the site are all established alien or domestic species.

Table 2. Avian Species Detected During Point Counts for the University of the Nations Kona expansion site in September 2019.

| Common Name | Scientific Name | ST | RA |
|----------------|--------------------------------------|----|------|
| | PHASIANIDAE - Pheasants & Partridges | | |
| | Phasianinae - Pheasants & Allies | | |
| Gray Francolin | <i>Francolinus pondicerianus</i> | A | 0.25 |
| Chicken | <i>Gallus sp.</i> | D | 0.75 |

Table 2 (continued).

| Common Name | Scientific Name | ST | RA |
|--|--------------------------------|----|------|
| COLUMBIFORMES | | | |
| COLUMBIDAE – Pigeons & Doves | | | |
| Spotted Dove | <i>Streptopelia chinensis</i> | A | 2.88 |
| Zebra Dove | <i>Geopelia striata</i> | A | 5.00 |
| PELECANIFORMES | | | |
| ARDEIDAE - Herons, Bitterns & Allies | | | |
| Cattle Egret | <i>Bubulcus ibis</i> | A | 0.25 |
| ACCIPITRIFORMES | | | |
| ACCIPITRIDAE - Kites, Eagles & Hawks | | | |
| Hawaiian Hawk | <i>Buteo solitarius</i> | EE | 0.13 |
| PSITTACIFORMES | | | |
| PSITTACIDAE – African and New World Parrots | | | |
| Arinae – New World Parakeets, Macaws & Parrots | | | |
| Red-masked Parakeet | <i>Psittacara erythrogenys</i> | A | 1.50 |
| PASSERIFORMES | | | |
| ZOSTEROPIDAE – White-eyes | | | |
| Japanese White-eye | <i>Zosterops japonicus</i> | A | 8.13 |
| MIMIDAE - Mockingbirds & Thrashers | | | |
| Northern Mockingbird | <i>Mimus polyglottos</i> | A | 0.25 |
| STURNIDAE – Starlings | | | |
| Common Myna | <i>Acridotheres tristis</i> | A | 2.75 |
| FRINGILLIDAE – Fringilline and Carduline Finches & Allies | | | |
| Carduelinae – Carduline Finches and Hawaiian Honeycreepers | | | |
| House Finch | <i>Haemorhous mexicanus</i> | A | 1.25 |
| Yellow-fronted Canary | <i>Ceithagra mozambica</i> | A | 2.00 |
| PASSERIDAE – Old World Sparrows | | | |
| House Sparrow | <i>Passer domesticus</i> | A | 1.63 |
| CARDINALIDAE – Cardinals & Allies | | | |
| Northern Cardinal | <i>Cardinalis cardinalis</i> | A | 2.00 |
| THRAUPIDAE – Tanagers | | | |
| Thraupinae – Core Tanagers | | | |
| Yellow-billed Cardinal | <i>Paroaria capitata</i> | A | 1.88 |

Table 2 (continued).

| Common Name | Scientific Name | ST | RA |
|--|---------------------------|----|------|
| THRAUPIDAE (cont.) Thraupinae (cont.) | | | |
| Saffron Finch | <i>Sicalis flaveola</i> | A | 4.25 |
| ESTRILDIDAE – Estrildid Finches | | | |
| Common Waxbill | <i>Estrilda astrild</i> | A | 3.00 |
| Red Avadavat | <i>Amandava amandava</i> | A | 0.25 |
| African Silverbill | <i>Euodice cantans</i> | A | 1.13 |
| Java Sparrow | <i>Lonchura oryzivora</i> | A | 4.38 |

Legend to Table 2

| | |
|-----------|---|
| ST | Status |
| A | Alien – Introduced to the Hawaiian Islands by humans |
| D | Domesticated – support by humans, not established in the wild on the Island of Hawai'i |
| EE | Endangered Endemic – native and unique to the Hawaiian Islands, listed as an endangered species |
| RA | Relative Abundance – Number of birds detected divided by the number of count stations ~ (8) |

Avian diversity and densities recorded were generally as expected. Four species: Japanese White-eye (*Zosterops japonicus*), Zebra Dove (*Geopelia striata*), Java Sparrow (*Lonchura oryzivora*), and Saffron Finch (*Sicalis flaveola*), accounted for 50 percent of all birds recorded during station counts. The most frequently recorded species was Japanese White-eye, which accounted for 19 percent of the total number of individual birds recorded during station point-counts. No other avian species were recorded while transiting between count stations.

Mammalian Survey

We recorded five terrestrial mammalian species while on the site. In Table 3 the type of detections recorded is shown for each species. No mammalian species currently proposed for listing or listed under either the federal or State of Hawai'i endangered species statutes was observed in this survey (DLNR 2015; USFWS, n.d.).

Table 3 – Mammalian species detected at the University of the Nations Kona expansion site in September 2019.

| Common name | Scientific name | ST | DT |
|------------------------------------|--|----|------------|
| CARNIVORA | | | |
| Flesh Eaters | | | |
| Canidae - Wolves, Jackals & Allies | | | |
| Domestic dog | <i>Canis lupus familiaris</i> | A | Sc, Tr, |
| Viverridae - Civets & Allies | | | |
| Small Indian mongoose | <i>Herpestes javanicus auropunctatus</i> | A | V, Tr., Sc |
| Felidae - Cats | | | |
| House cat | <i>Felis catus</i> | A | V, Tr |
| ATRIODACTYLA | | | |
| Even-Toed Ungulates | | | |
| Suicidae - Old World Swine | | | |
| Pig | <i>Sus scrofa</i> | A | Sc, Tr, Si |
| Bovidae - Hollow-horned Ruminants | | | |
| Domestic sheep | <i>Ovis aries</i> | A | Sc, Tr |

Legend to Table 3

ST Status

A Alien – introduced to the Hawaiian Islands by humans

DT Detection type:

V Visual – an animal seen

A Audio – an animal heard

Sc Scat – an animal detected by fecal droppings

Tr Tracks -an animal detected by the presence of tracks

Si Sign – an animal detected by sign, i.e., tunnels, beds, tree scrapping etc.

Discussion

Botanical Resources

A previous survey of the same property was conducted in 2002 (Terry & Hart, 2002). This survey listed 35 species of plants, reasonably comparable with our 49 species (as listed in Table 1 minus species seen only on the highway verge). Although the 2002 survey provides no indication of qualitative abundance, 15 (43%) of the recorded plant species were not observed in 2019. If these were mostly rare species on the site and conditions at the time were somewhat

wetter than in 2019, it is not unusual that the floras of essentially naturalized, herbaceous species is as dissimilar as this comparison suggests. Certainly a perhaps somewhat unusual aspect of our results is the number of plant species listed as “rare” (61%), meaning a species encountered no more than two or three times over the course of the survey. However, the 2002 list includes Christmasberry and weeping fig, trees that presumably could still be present and rare on the site. Including both survey results in Table 1 is justified for the reasons that not all rare species are going to be encountered in a pedestrian survey and the suite of smaller, herbaceous species is very likely to change over time.

Avian Resources

The findings of the avian survey are consistent with the location of the site and the vegetation present. A previous flora and fauna survey conducted on the site in 2002 only recorded eight avian species (Terry and Hart, 2002). Given that we recorded 21 avian species, it is difficult to compare the 2002 results with those of the current survey.

Although not detected during this survey, Hawaiian Petrel (*Pterodroma sandwichensis*), Band-rumped Storm-Petrel (*Hydrobates castro*), and Newell’s Shearwater (*Puffinus newelli*) may over-fly the Project vicinity between April and the end of November each year. The petrel and storm-petrel are listed as endangered, and the shearwater as threatened under both federal and State of Hawai’i endangered species statutes. The primary cause of mortality for these three ground nesting seabirds is thought to be predation by alien mammalian species at the nesting colonies (USFWS, 1983; Simons and Hodges, 1998; Ainley et al., 2001). Collision with man-made structures is considered to be second-most significant cause of mortality of these seabirds in Hawai’i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds can collide with man-made structures and, if not killed outright, dazed or injured birds become prey to feral mammals (Hadley, 1961; Telfer, 1979; Sincock, 1981; Reed et al., 1985; Telfer et al., 1987; Cooper and Day, 1998; Podolsky et al., 1998; Ainley et al., 2001; Hue et al., 2001; Day et al., 2003). Neither nesting colonies nor appropriate nesting habitat for either of these listed seabird species occur within or close to the current Project site.

Potential for impact on protected seabirds that the Project poses is an increased threat to transiting birds disoriented by lights associated with the Project during the seabird nesting season from September 15 through December 1 each year. If, during construction, it is deemed expedient to conduct night-time construction activities, or if streetlights are installed as part of the proposed

action, these must be shielded (Reed et al. 1985, Telfer et al. 1987). Shielding of lights would serve the dual purpose of minimizing disorientation and downing of petrels and shearwaters, and complying with Hawai'i County Code §14 – 50 et seq., which requires shielding of exterior lights to lower ambient glare reaching the astronomical observatories located on Mauna Kea.

Mammalian Resources

The findings of the mammalian survey are consistent with the location of the property and the vegetation present. One previous flora and fauna survey conducted on the site, did not record any mammalian species (Terry and Hart, 2002). Given that we recorded five mammalian species, the previous survey results cannot be compared with those recorded during the current survey. All of the introduced mammalian species recorded during the course of this survey are deleterious to native ecosystems and the native faunal species dependent on them.

Although, no rodents were recorded during the course of this survey, it is likely that one or more of the four established alien Muridae found on the Island of Hawai'i—European house mouse (*Mus musculus domesticus*), roof rat (*Rattus rattus*), brown rat (*Rattus norvegicus*), and black rat (*Rattus exulans hawaiiensis*)—use various resources within the general project area on a seasonal basis. These human commensal species are drawn to areas of human habitation and activity. All of these introduced rodents are deleterious to native ecosystems and the native faunal species dependent on them.

No Hawaiian hoary bats were detected during the course of this survey. It is possible that this species forages over the site on a seasonal basis. The vegetation on the site is not typical of that which one would expect Hawaiian hoary bats to roost in. It is not expected that the proposed actions will result in deleterious impacts to this listed endemic species.

Protected Species

With one exception as noted, no plant or animal species currently protected or proposed for protection under either the federal or State of Hawai'i endangered species programs (HDLNR, 1998, 2015; USFWS, nd) was detected on the subject property during the course of this survey³.

³ The Hawaiian Hawk observed flying over the property has been delisted by U.S. Fish and Wildlife Service, effective February 3, 2020 (USFWS, 2020). Although likely to also be delisted by the state, the process could take several years. Consequently, the Hawaiian hawk remains as a state listed species (HDLNR, 2015).

Critical Habitat

No federally delineated Critical Habitat for any species is included in or is located close to the surveyed property. Thus, modifications of habitats on the site will not result in impacts to federally designated Critical Habitat. There is no equivalent statute under state law.

Recommendations

- If nighttime construction activity or equipment maintenance is proposed during the construction phases of the project, all associated lights should be shielded, and when large flood/work lights are used, they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground.
- If streetlights or exterior facility lighting is installed in conjunction with the project, it is recommended that the lights be shielded to reduce the potential for interactions of nocturnally flying seabirds with external lights and man-made structures (Reed et al., 1985; Telfer et al., 1987).

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