Final Report: APGA-USFS 2018 Scouting/Collecting Trip for *Pritchardia minor*

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February 2019

Project Summary

Over the past year (March 2018 - February 2019) conservation work and research was conducted on *Pritchardia minor* Becc. (Arecaceae), a rare Kaua'i single-island endemic palm (**Figure 1**). A total of 10 work trips (**see Table 1**) were undertaken by the National Tropical Botanical Garden (NTBG) to voucher, map, and tag individual plants, bag immature fruits, and collect mature fruits.

Figure 1. *Pritchardia minor* Becc. (Arecaceae).

Methods. Mature, individual plants were tagged utilizing a "Population Reference Code" ID system standardized within the State of Hawai'i. The unique ID was embossed on a metal tag and attached to the plant, or on an adjacent tree, using plastic-coated wire with flagging. This unique plant ID system will track maternal founders and streamline future monitoring. All associated data with a collection were entered into the NTBG Collections Management Database System. Images and videos were labelled and entered into the NTBG Digital Asset Management program using ResourceSpace. Voucher specimens were deposited in NTBG's herbarium (PTBG). Fruit on trees were accessible by a climbing method (cinching webbing line technique) that does not harm trees (developed by NTBG Research Biologist, Ken Wood). Immature fruits were protected in special metal-wire bags constructed in the office prior to the work trip. These metal bags protect developing fruit from rat predation. Previously bagged fruits were, or still need to be, revisited when mature. Seed collections from individual plants were kept separate and split evenly four ways. One-fourth of the seeds from an individual were mailed to the Montgomery Botanical Center in Florida, one-fourth to San Francisco Botanical Garden in California, one-fourth to Waimea Valley Arboretum and Botanical Garden on O'ahu, and one-fourth were propagated in NTBG's Conservation and Horticulture Center on Kaua'i for *ex situ* conservation collections in NTBG's McBryde Garden on Kaua'i and Kahanu Garden on Maui.

Results. Seeds were collected from 11 individual trees (two separate collections were made from two of the trees = 14 unique accessions) of *P. minor* during this research (**Table 1**). Six additional trees, on which immature fruit were bagged, still need to be revisited when fruit are likely to be mature (in 3-6 months).

Currently we estimate that there are ca. 200-250 individual trees of *P. minor* still surviving in the wild. These trees are found within 13 sub-populations or colonies on Kaua'i, ranging from Kalalau and Pohakuao in the northwest, and scattered throughout numerous Koke'e valleys as far south as Makaha, and spreading east into the Waimea Canyon regions including the adjacent forests of Kawaikinana, Waiakoali, Mohihi, Koaie, and Kawai'iki. The extent of occurrence (EOO) for *P. minor* is ca. 59 sq km and the area of occupancy is ca. 22 sq km (**Figure 2**).

Table 1. Summary of field work trip dates, location, access, number of trees collected from and number of seeds collected.

Trip	Date	Location	Access	# trees collected from	# seeds collected
1	March 9, 2018	Nualolo	Drive and hike	0	0
2	May 10, 2018	Kumuwela	Drive and hike	1	295
3	May 18, 2018	Mohihi	Drive and hike	0	0
4	May 23, 2018	Awaawapuhi	Drive and hike	0	0
5	June 7, 2018	Mohihi	Drive and hike	1	61
6	June 27, 2018	Koaie	Drive and hike	0	0
7	July 13, 2018	Kumuwela	Drive and hike	1	189
8	October 10–12, 2018	Kalalau	Helicopter and hike	5	465
9	November 14, 2018	Nualolo	Drive and hike	1	148
10	January 9–10, 2018	Koaie	Helicopter and hike	5	~900

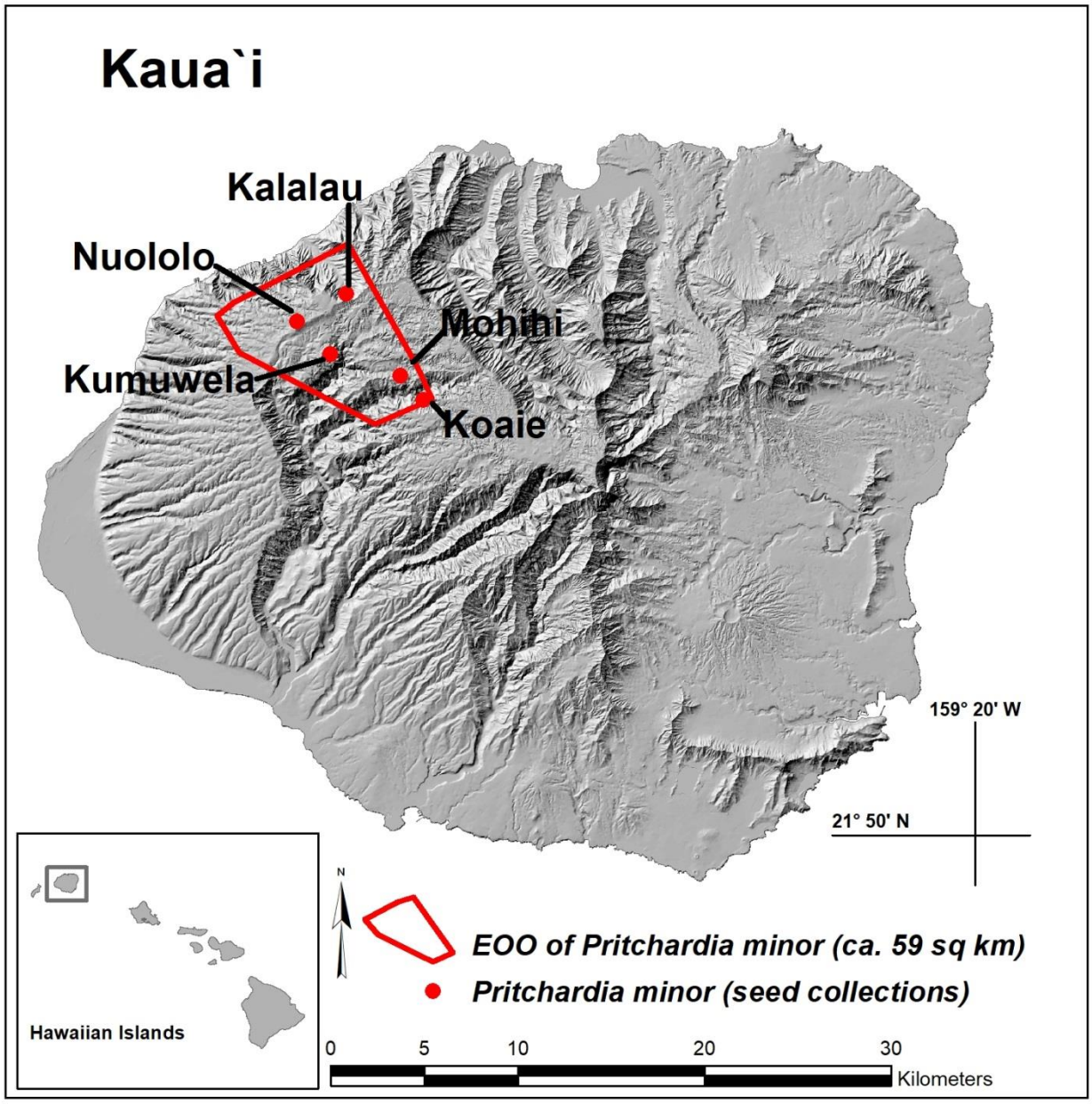

Figure 2. Extent of occurrence (EOO; polygon) and seed collection sites (red dots) in Kumuwela, Nuololo (alt. spelling Nualolo), Kalalau, Mohihi and Koaie.

Detailed Trip Narrative

Trip 1

Date: March 9, 2018

Location: Nualolo

Participants, institutions, contacts:

Seana Walsh, Conservation Biologist, NTBG, swalsh@ntbg.org

Ken Wood, Research Biologist, NTBG, kwood@ntbg.org

Threats to population: Pigs, deer, rats, *Psidium cattleianum*, *Lantana camara*, *Kalanchoe pinnata*, *Sphaeropteris cooperi*, *Rubus argutus*, *Hedychium gardnerianum*, *Erigeron karvinskianus*, *Morella faya*.

Summary: A drive and short hike brought us to the area where plants had been previously mapped, at the headwaters just west of Kaunuohua Ridge. The palms occurred in a *Metrosideros-Acacia* mixed mesic forest

with *Coprosma waimeae, Kadua affinis, Psychotria mariniana, P. hexandra, P. greenwelliae, Chrysodracon aurea, Scaevola procera, Xylosma hawaiiense, Dodonaea viscosa, Syzygium sandwicensis Polyscias waimeae, P. kavaiensis, Doodia kunthiana* and a succession of invasive non-native plant taxa that are listed under 'Threats to population' in this section above. Only one of the palms encountered had fruit, which was immature and protected in wire mesh (**Figure 3**). This individual was also tagged with a unique ID (PRI MIN NUA A 0001).

Figure 3. NTBG Research Biologist Ken Wood bags immature *Pritchardia minor* fruit in Nualolo on March 9, 2018.

Trip 2
Date: May 10, 2018
Location: Kumuwela
Participants, institutions, contacts:
Seana Walsh, Conservation Biologist, NTBG, swalsh@ntbg.org
Ken Wood, Research Biologist, NTBG, kwood@ntbg.org
Threats to population: Pigs, goats, deer, rats, *Grevillea robusta*, *Lantana camara*, *Morella faya*, *Acacia mearnsii*, *Psidium cattleianum*, *Erigeron karvinskianus*, *Hedychium gardnerianum*, *Lonicera japonica*, *Rubus argutus*, *Rubus rosifolius*.

Summary: A 4x4 drive and hike got us into Kumuwela for the day. Two separate groups, one with three trees and the other with five trees, were discovered. The area was above and west of Po‘omau Stream in *Metrosideros-Acacia* montane mesic forest with *Myrsine lanaiensis, Planchonella sandwicensis, Bobea brevipes, Coprosma waimeae, Melicope anisata, M. barbigera, Cheirodendron trigynum, Kadua affinis, Dianella sandwicensis, Peperomia tetraphylla, Psychotria mariniana, Chrysodracon aurea, Dryopteris glabra, Asplenium aethiopicum, A. macraei, A. polyodon, A. caudatum, Carex wahuensis, Dodonaea viscosa, Odontosoria chinensis, Doodia kunthiana, Elaphoglossum paleacea* and a succession of invasive non-native plant taxa that are listed under ‘Threats to population’ in this section above. Only four of the trees encountered had fruit, which were immature, so infructescences were bagged with wire mesh. One of the trees had some mature fruit (PRI MIN KOK A 0003) that we collected (accession 20180230). The population was vouchered (**Figure 4**) and all reproductive trees were mapped and tagged with a unique ID.

Figure 4. NTBG Research Biologist Ken Wood prepares voucher specimens of *Pritchardia minor* at Kumuwela on May 10, 2018.

Trip 3
Date: May 18, 2018
Location: Mohihi
Participants, institutions, contacts:
Steve Perlman, Statewide Specialist, Plant Extinction Prevention Program (PEPP), sperlman707@gmail.com
Seana Walsh, Conservation Biologist, NTBG, swalsh@ntbg.org
Ken Wood, Research Biologist, NTBG, kwood@ntbg.org
Threats to population: Pigs, rats, *Rubus argutus*, *R. rosifolius*, *Psidium cattleianum*, *Cyperus meyenianus*, *Sphaeropteris cooperi*, *Hedychium gardnerianum*, *Ageratina riparia*.

Summary: A 4x4 drive and hike got us to a previously mapped individual in Mohihi, which we tagged with a unique ID (PRI MIN MOH A 0001). The individual had immature fruit, which were protected from rat predation with wire mesh (**Figure 5**). The area was on the slopes north of the Mohihi-Waialae trail in *Metrosideros* mixed montane wet forest with *Polyscias waialealae*, *Syzygium sandwicensis*, *Cheirodendron* spp, *Charpentiera elliptica*, *Cyanea hirtella*, *C. leptostegia*, *Dodonaea viscosa*, *Santalum pyrularium*, *Psychotria mariniana*, *Perrottetia sandwicensis*, *Melicope clusiifolia*, *M. anisata*, *Vaccinium calycinum*, *V. dentatum*, *Kadua affinis*, *Wikstroemia oahuensis*, *Dubautia laevigata*, *Diplazium sandwichianum*, *Coniogramme pilosa*, *Asplenium contiguum* and a succession of invasive non-native plant taxa that are listed under 'Threats to population' in this section above.

Figure 5. NTBG Conservation Biologist Seana Walsh bags immature *Pritchardia minor* fruit in Mohihi on May 18, 2018.

Trip 4
Date: May 23, 2018
Location: Awaawapuhi
Participants, institutions, contacts:
Tim Flynn, Herbarium Collections Manager, NTBG, tflynn@ntbg.org
Seana Walsh, Conservation Biologist, NTBG, swalsh@ntbg.org
Ken Wood, Research Biologist, NTBG, kwood@ntbg.org

Threats to population: Pigs, deer, rats, fire, *Erigeron karvinskianus, Psidium cattleianum, Lantana camara, Rubus argutus, R. rosifolius, Adiantum hispidulum, Blechnum appendiculatum, Hedychium gardnerianum, Kalanchoe pinnata, Sphaeropteris cooperi.*
Summary: We found two individual trees after a drive and hike into the *Metrosideros-Acacia* mesic forest of Awaawapuhi. One of the individuals had many infructescences with immature fruit, two of which were protected with wire mesh (**Figure 6**). The individual was also mapped and tagged with a unique ID (PRI MIN AWA A 0001).

Figure 6. NTBG Research Biologist Ken Wood bags immature *Pritchardia minor* fruit in Awaawapuhi on May 23, 2018.

<u>Trip 5</u>
Dates: June 7, 2018
Locations: Mohihi
Participants, institutions, contacts:
Steve Perlman, Statewide Specialist, PEPP, sperlman707@gmail.com
Seana Walsh, Conservation Biologist, NTBG, swalsh@ntbg.org
Ken Wood, Research Biologist, NTBG, kwood@ntbg.org

Threats to population: Pigs, rats, slugs, *Rubus argutus, R. rosifolius, Cyperus meyenianus, Paspalum urvillei, Sphaeropteris cooperi, Hedychium gardnerianum, Ageratina riparia, Psidium guajava*.
Summary: The Mohihi area was accessed by a 4x4 drive and hike. We discovered another individual tree since the previous trip to Mohihi on May 18, 2018. The individual was tagged with a unique ID (PRI MIN MOH A 0002) and fruit were collected (accession 20180453). The area was on the northern slopes of the Mohihi-Waialae trail in *Metrosideros* mixed montane wet forest with *Dicranopteris linearis, Polyscias waialealae, Syzygium sandwicensis, Cheirodendron* spp.*, Dodonaea viscosa, Planchonella sandwicensis, Santalum pyrularium, Psychotria mariniana, Perrottetia sandwicensis, Labordia degeneri, Melicope clusiifolia, M. anisata, M. barbigera, Vaccinium calycinum, V. dentatum, Kadua affinis, Wikstroemia oahuensis, Dubautia laevigata, Diplazium sandwichianum, Coniogramme pilosa, Asplenium contiguum, Microlepia strigosa, Dryopteris fusco-atra* and a succession of invasive non-native plant taxa that are listed under 'Threats to population' in this section above.

Trip 6
Dates: June 27, 2018
Locations: Koaie
Participants, institutions, contacts:
Seana Walsh, Conservation Biologist, NTBG, swalsh@ntbg.org
Ken Wood, Research Biologist, NTBG, kwood@ntbg.org
Threats to population: Pigs, rats, slugs, *Rubus argutus, R. rosifolius, Cyperus meyenianus, Paspalum urvillei, Sphaeropteris cooperi, Hedychium gardnerianum, Ageratina riparia, Psidium guajava*.
Summary: For access to this particular area of Koaie, we drove (4x4) and hiked. We discovered several palms in the upper southern slopes, west of the Mohihi-Waialae trail, in Kipalau sub-gulch. The individuals either did not have fruit or the fruit was very small and immature so we decided bagging fruit that early would cause damage to fruit development. We mapped the trees to monitor and hope to collect fruit at a later time. The area was a *Metrosideros-Cheirodendron-Dicranopteris* mixed montane wet forest with *Polyscias waialealae, Syzygium sandwicensis, Cheirodendron* spp., *Dodonaea viscosa, Planchonella sandwicensis, Santalum pyrularium, Psychotria mariniana, Perrottetia sandwicensis, Melicope clusiifolia, M. anisata, M. barbigera, Ilex anomala, Coprosma waimeae, Vaccinium calycinum, V. dentatum, Kadua affinis, Wikstroemia oahuensis, Dubautia laevigata, Dianella sandwicensis, Diplazium sandwichianum, Coniogramme pilosa, Asplenium contiguum, A. caudatum, Microlepia strigosa, Dryopteris fusco-atra, Panicum nephelophilum, Cyperus hypochlorus* and a succession of invasive non-native plant taxa that are listed under 'Threats to population' in this section above.

Trip 7
Date(s): July 13, 2018
Location(s): Kumuwela
Participants, institutions, contacts:
Seana Walsh, Conservation Biologist, NTBG, swalsh@ntbg.org
Ken Wood, Research Biologist, NTBG, kwood@ntbg.org
Summary: We returned to the same population visited on May 10, 2018 to check fruit that had been previously bagged. More fruit were collected from individual PRI MIN KOK A 0003 (accession 20180451; **Figure 7**).

Figure 7. NTBG Conservation Biologist Seana Walsh climbs *Pritchardia minor* to collect fruit, and demonstrates the cinching webbing line climbing method (Kumuwela; July 13, 2018).

Trip 8
Date(s): October 10–12 , 2018
Location(s): Kalalau
Participants, institutions, contacts:

Seana Walsh, Conservation Biologist, NTBG, swalsh@ntbg.org
Ken Wood, Research Biologist, NTBG, kwood@ntbg.org
Threats to populations: Goats, rats, fire, *Clidemia hirta, Lantana camara, Rubus argutus, Psidium guajava, Kalanchoe pinnatum, Andropogon glomeratum, Cyperus meyenianus, Elephantopus mollis, Thelypteris dentata, Blechnum appendiculatum, Erigeron karvinskianus.*
Summary: A one-hour round-trip helicopter flight got us into and out of Kalalau Valley for a three day camp trip (**Figure 8** and **9**). We were exploring the back of valley, below Pihea, where *P. minor* had been mapped years previous in *Diospyros-Metrosideros* mixed lowland mesic forest with *Pouteria sandwicensis, Syzygium sandwicensis, Metrosideros polymorpha, Antidesma platyphylla, Psychotria mariniana, Myrsine lanaiensis, Bobea elatior, Rauvolfia sandwicensis, Pteralyxia kauaiensis, Santalum pyrularium, Freycinetia arborea, Chrysodracon aurea, Psydrax odorata, Dodonaea viscosa, Pisonia sandwicensis, Kadua affinis, Carex meyenii, Diplazium sandwichianum, Doodia kunthiana, Nephrolepis exaltata, Odontosoria chinensis, Ciboteum nealiae* and a succession of invasive non-native plant taxa that are listed under 'Threats to population' in this section above. We vouchered the population (**Figure 10**) and mapped and tagged six mature palms. One of them had immature fruit that we bagged with wire mesh (PRI MIN KLL A 0001). We collected fruit from the five other tagged individuals (PRI MIN KLL A 0002, accession 20180715; PRI MIN KLL A 0003, accession 20180700; PRI MIN KLL A 0004, accession 20180701; PRI MIN KLL A 0005, accession 20180716; PRI MIN KLL A 0006, accession 20180702).

Figure 8. Remote landing zone and camp site in Kalalau Valley October 11–12, 2018.

Figure 9. Helicopter landing for pick-up from Kalalau Valley on October 12, 2018.

Figure 10. NTBG Research Biologist Ken Wood prepares voucher specimens of *Pritchardia minor* in Kalalau Valley on October 11, 2018.

Trip 9
Date(s): November 14, 2018
Location(s): Nualolo
Participants, institutions, contacts:
Seana Walsh, Conservation Biologist, NTBG, swalsh@ntbg.org
Ken Wood, Research Biologist, NTBG, kwood@ntbg.org
Summary: We returned to the same population visited on March 9, 2018 to check fruit that had been bagged. More fruit was collected from individual PRI MIN NUA A 0001 (accession 20180778).

Trip 10
Date(s): January 9–10, 2019
Location(s): Koaie
Participants, institutions, contacts:
Seana Walsh, Conservation Biologist, NTBG, swalsh@ntbg.org
Ken Wood, Research Biologist, NTBG, kwood@ntbg.org
Threats to populations: Pigs, goats, rats (**Figure 11**), slugs, *Kalanchoe pinnata, Erigeron karvinskianus, Cyperus meyenianus, Sphaeropteris cooperi, Axonopus fissifolius, Lantana camara, Christella dentata, Setaria parviflora*.
Summary: A one-hour round-trip helicopter flight got us into and out of Makanani Camp in Koaie for a two-day camp trip. We were exploring along the north-facing slopes well above Koaie river in a *Metrosideros* transitional montane mesic to wet forest with *Cheirodendron* spp., *Kadua affinis, Nestegis sandwicensis, Chrysodracon aurea, Psychotria mariniana, P. greenwelliae, Planchonella sandwicensis, Santalum pyrularium, Ilex anomala, Syzygium sandwicensis, Dodonaea viscosa, Euphorbia atrococca, Coprosma waimeae, Melicope clusiifolia, Dryopteris glabra, D. sandwicensis, Doodia kunthiana, Boehmeria grandis, Carex meyenii, Cyperus sandwicensis* and a succession of invasive non-native plant taxa that are listed under 'Threats to population' in this section above. We mapped, tagged and collected fruit from five trees (PRI MIN KOA B 0001, accession 20190084; PRI MIN KOA B 0002, accession 20190081; PRI MIN KOA B 0003, accession 20190086; PRI MIN KOA B 0004, accession 20190082; PRI MIN KOA B 0005, accession 20190087).

Figure 11. Rat predation of *Pritchardia minor* fruit observed in Koaie on January 9, 2019.

NATIONAL TROPICAL BOTANICAL GARDEN

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FLIGHT PLAN

PROJECT: KALALAU (BACK OF VALLEY) LEADER: KENNETH R. WOOD / NTBG

DATES: 10-12 OCTOBER 2018 DAYS: WEDNESDAY-FRIDAY

Vendor: Airborne Aviation (808) 651-9231
3344 Unahe Street, Lihue, HI 96766

Participants (Names and weight): Two (2) passengers

- Kenneth R. Wood, 175 lbs
- Seana Walsh, 130 lbs

KALALAU (NA PALI COAST STATE PARK)

- **Date/Time of Flight in:** Wednesday Oct 10, 2018 **Start Time:** 10:00 AM
- **Date/Time of Flight out:** Friday Oct 12, 2018 **Pick-up Time:** 2:30 PM

DETAILS OF FLIGHTS (Ken Wood will guide pilot to LZ)
10 Oct 2018 (10:00am Fly to Kalalau (back of valley) ca. ½ hr flight roundtrip
12 Oct 2018 (2:30pm Pick-up @ same location (Kalalau/back of valley)

- **Location of Pick Up:** Same as drop-off site.
- **NTBG Contact:** Kenneth R Wood / 651-3773 / kwood@ntbg.org
- **Project:** NTBG Pritchardia Project TRF 8722
- **Billing reference:** Seana Walsh / Pritchardia Project / Kalalau Oct 10-12 / TRF 8722
- **Mail Billing to:** Seana Walsh swalsh@ntbg.org / NTBG / 3530 Papalina Rd, Kalaheo, HI 96741

Notes: We have radio to communicate with Helicopter and have satellite phone for emergencies (#011 881632683246 / can receive texts on sat phone)

Emergency Contact: Dave Lorence (NTBG), 808 651-9054, Chair of Science and Conservation.

NATIONAL TROPICAL BOTANICAL GARDEN

Chartered by Congress To Create A National Resource In Tropical Botany

PROJECT: *PRITCHARDIA MINOR* RESEARCH **LEADER: KENNETH R. WOOD**

DATES: 9-10 JAN 2019 **DAYS: WED-THUR**

PERMIT REQUEST TO KAUAI DLNR DOFAW TO LAND AND CAMP AT KOAI`E CANYON / MAKANANI CAMP LZ (MAP INCLUDED) 9-10 JANUARY 2019

- **Vendor:** Airborne Aviation (808) 651-9231 / operations out of Lihue Heliport

Dates of Flights:
Wednesday 9 JAN 2019 (Fly in @ 8:00am)
Thursday 10 JAN 2019 (Pick-up @ 4:30pm)

- **Participants (Names and weight):** Three (3) passengers
  - Ken Wood, 175 lbs
  - Seana Walsh, 130 lbs
  - Possible third biologist (to be determined)

- **Location, date, and drop-off time:** Koai`e Canyon, Makanani Camp LZ, Wed 9 Jan 2019 @ 8am
- **Pick-up date and time (same location):** Thur 10 Jan 19 @ 4:30 PM
- **Location of Pick-up:** Same as drop off site.
- **NTBG Contact:** Kenneth Wood / 651-3773 / kwood@ntbg.org
- **Project:** Pritchardia Project
- **Note billing reference:** Seana Walsh / Pritchardia Project / TRF 8722
- **Mail Billing to:** Seana Walsh, Conservation Biologist
  National Tropical Botanical Garden / 3530 Papalina Rd, Kalaheo, HI 96741

Primary objective: Seed collections from *Pritchardia minor* palms.

Notes: We have radio to communicate with Helicopter and satellite phone for emergencies (#011 881632683246)

Emergency Contact: Dave Lorence (NTBG), 808 651-9054, Chair of Science and Conservation.