Abutilon sandwicense

- **Scientific name:** *Abutilon sandwicense*
- **Hawaiian name:** Ko`oloa
- **Family:** Malvaceae
- **Federal status:** listed endangered on October 29, 1991
- **Requirements for OIP Stability**
  - 4 Population Units (PU) (4 due to presence in both Makua and Oahu AAs)
  - 50 reproducing individuals in each PU (short-lived perennial)
  - Stable population structure
  - Threats controlled
  - Complete genetic representation of all PUs in storage
  - Tier 1 stabilization priority

- **Description and biology:**
  - **Habit**- *Abutilon sandwicense* is a large shrub or a tree. Its branches grow to up to 10 m (33 ft) long (Degener 1932). The plant is covered with white to yellowish stellate hairs and glandular tomentulose pubescence. For the purposes of the OIP, *A. sandwicense* is categorized as a short lived plant (<10 year life span).
  - **Leaves**- The leaf blades are cordate-ovate to cordate-orbicular in shape, and measure 8-22 cm (3.1-8.7 in) in length.

Modified from: Oahu Implementation Plan, 2008. Oahu Army Natural Resource Program.

Abutilon sandwicense

- **Description and biology continued:**
  - **Flowers-** The pendulous flowers are solitary in leaf axils. The petals are 4-5 cm (1.6- 2 in) long and 1.4-2 cm (0.55-0.79 in) wide at the distal end, yellowish green to reddish in color, and extend beyond the calyx. The flowers of *A. sandwicense* are large and showy, suggesting that the original pollinating agent of the species may have been nectar-feeding birds. Currently, introduced honeybees can be observed visiting flowers. Flowering can be observed at any time of the year, but the peak flowering months are April through June. Petals can be bright green to reddish brown with green veins.

  - **Fruit-**The fruits are vase-shaped capsules 17-25 mm (0.7-1.0 in) long comprised of 8-10 mericarps. Each mericarp contains several seeds.

  - **Seeds**-The dull brown seeds are sparesely pubescent, up to 3 mm (0.1 in) long, and are triangular-reniform in shape. The seeds are probably viable for years, as are many Hawaiian Malvaceae species. Dispersal agents for this species are unknown. Reproduction in this species is primarily by seed . Cultivated plants usually take at least 3-4 years to reach maturity (Lau pers. comm.).

  - **Distribution:** *Abutilon sandwicense* is endemic to the Waianae Mountains of Oahu between Puu Palehua and Kahanahaiki Valley. It occurs on both the windward and leeward sides of the range, from 293-732 m (960-2,400 ft) in elevation.

Modified from: Oahu Implementation Plan, 2008. Oahu Army Natural Resource Program.

Abutilon sandwicense

- **Population trends:** Only a few population sites have been tracked for more than a few years. Some have increased in population size, and others have decreased. Initial observations of plants at the Huliwai (HUL-A), North Mikilua (MIK-A), and Halona (HAL-A) sites in 1994 were of just a few individuals. Subsequent observations have documented an increase in the number of immature plants at these sites suggesting that reproduction was continuing or new plants continued to emerge from the soil seed bank. Population trends have been difficult to determine due to intermittent monitoring, infrequent flowering and inconsistent observers which can make it difficult to differentiate increases in known sites from increases due to finding new plants. As monitoring of sites becomes standardized and regular, population trends may be able to be determined. Also, seedlings observed within these PUs may have been misidentified as *A. sandwicense* but actually be *A. grandifolium*. Pictures of the two taxa are included below to help staff discriminate between them in the future.

  Population estimates of the Kaawa to Puulu PU shown in the Population Estimate History Table below show that the total number of mature and immature individuals known in 2005 (118) had declined by about 6% by 2012 (110). However, these data do not fully reflect the decline from initial estimates at most known sites, a reclassification of immature plants to mature plants based on size class, and the discovery of several new sites. These are significant as little reproduction has been observed within the PU and the transition from immature to mature plants is only based on size class. This suggests that the plants noted as immature may actually be mature, meaning that there may be population structure may be even less than the current data suggest. At nine of the thirteen sites known before 2010, the number of plants has been documented to decline. Only a single site known before 2010 (ALI-B) has the number of plants been observed to increase. Since 2010, three new sites with a total of seven plants have been discovered increasing the total for this PU by 6%.

Modified from: Oahu Implementation Plan, 2008. Oahu Army Natural Resource Program.

Abutilon sandwicense

- **Habitat:** *A. sandwicense* grows on gulch slopes and in gulch bottoms in dry to dry-mesic forests, which are commonly dominated by the native trees lama (*Diospyros sandwicensis*), lonomea (*Sapindus oahuensis*), and/or wiliwili (*Erythrina sandwicensis*). Other common associated species include mehame (*Antidesma pulvinatum*), nioi (*Eugenia reinwardtiana*), kokio keokeo (*Hibiscus arnottianus*), kolea (*Myrsine lanaiensis*), olopua (*Nestegis sandwicensis*), mamaki (*Pipturus albidus*), papala kepau (*Pisonia sandwicensis*), hoawa (*Pittosporum* spp.), halapepe (*Pleomele forbesii* and *P. halapepe*), alahee (*Psydrax odorata*), hao (*Rauvolfia sandwicensis*), and ohe makai (*Polyscias sandwicensis*).

- **Taxonomic background:** There are four species of *Abutilon* native to Hawaii. Three are endemic to Hawaii (*A. sandwicense*, *A. menziesii* and *A. eremitopetalum*), and one also occurs naturally outside Hawaii (*A. incanum*). Two of the endemic species (*A. menziesii* and *A. sandwicense*), are listed as endangered. Three of the native *Abutilon* are known to occur on Oahu: *A. sandwicense*, *A. menziesii,* and *A. incanum*.

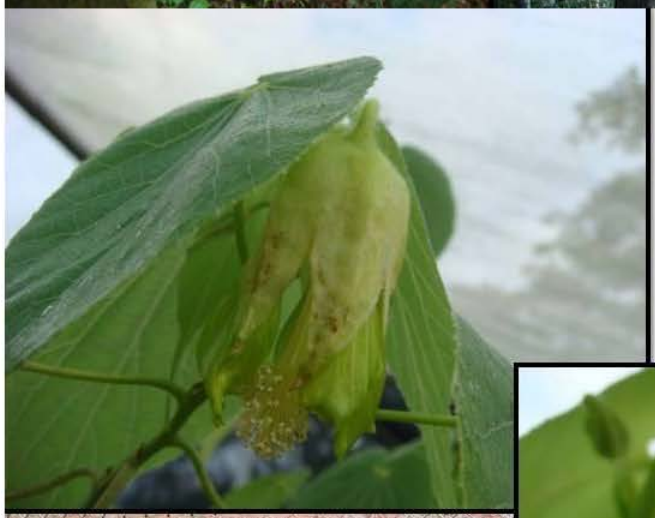
Modified from: Oahu Implementation Plan, 2008. Oahu Army Natural Resource Program.

Selected Historic Collections of *A. sandwicense*

Area	Year	Collector	Pop. Reference Code/Notes
Kauhiuhi	1932	Christophersen, E.	"var. welchii"
Manuwai	1932	Russ, G.W.	E. slope at FR fence, (Near ANU-D)
Manuwai	1932	Degener, O.	Holotype (near ANU-D). "Weed covered rocky partly forested slope"
Makaha	1933	Russ, G.W.	Makaha Makai PU
Ekahanui	1939	Bush, W.	EKA-A
Kanehoa	1939	Caum, E.L.	May be HUL-A
Kaomokunui Gulch	1955	St.John, H.	Green petals
Kamaohanui-Pane	1969	Herbst, D.R.	Dark Yellowish petals
Makaleha	1975	Herbst, D.R.	
Makaha	1986	Lau, J.	Makaha Mauka PU
Palikea Gulch	1986	Obata, J.	
Nanakuli	1987	Perlman, S.	
Palikea Gulch	1987	Perlman, S.	
Waianae Kai (Kawiwi)	1987	Perlman, S.	WAI-A
Waianae Kai (Kawiwi)	1992	Obata, J.	WAI-A. Red petals
Palikea Gulch		Degener, O.	#6040

Data compiled from Bishop Museum Herbarium Records provided by Clyde Imada 2011.

Habitat and wild plants in the Kaawa to Puulu PU



Plants grown from clones of the single wild plant from the Kahanahaiki PU


Flowering plants in the Makaha Makai PU
Seedling
Seeds
Mature Fruit
Mature Fruit


A. sandwicense vs. A. grandifolium (weed)
Forest & Kim Starr
Kaluaa Outplanting of Huliwai Stock

Reproductive Biology Table

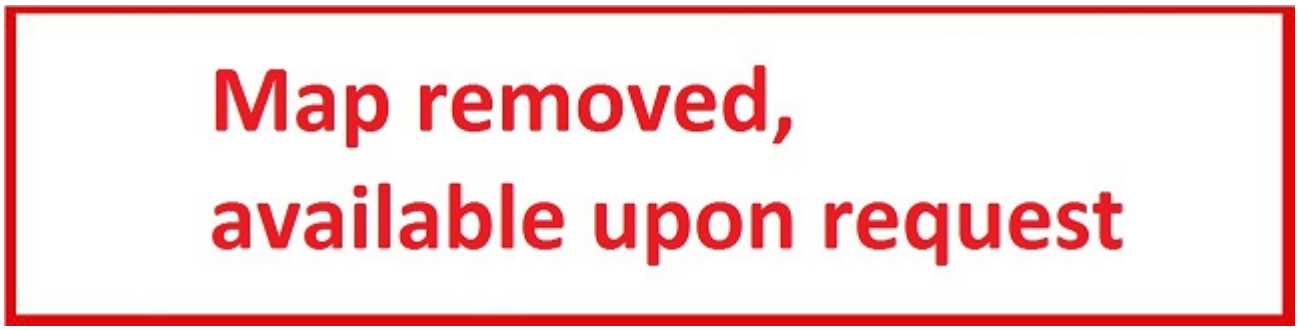
	Observed Phenology			Reproductive Biology		Seeds	
Population Unit	Flower	Immature Fruit	Mature Fruit	Breeding System	Suspected Pollinator	Average # Per Fruit (viable)	Dormancy
Kaawa to Puulu	Feb	No Obs.	Sep	Hermaphroditic	Insect or Bird	Unknown	PY+PD
Kahanahaiki	No Obs.	No Obs.	No Obs.	Hermaphroditic	Insect or Bird	Unknown	PY+PD
Ekahanui and Huliwai	Apr-Jul	Jul-Sep	Jul-Oct	Hermaphroditic	Insect or Bird	17 ± 5 (EKA) 11 ± 5 (HUL)	PY+PD
Makaha Makai	Apr-Jul	Jul-Oct	Jul-Oct	Hermaphroditic	Insect or Bird	19 ± 9	PY+PD

- The Kahanahaiki founder (MMR-A-1) has only been observed to be reproductive in the nursery. Neither the wild plant nor any outplanted clones were observed to flower. We have, however, observed plants of this stock flowering in the nursery in March. No fruit were produced.
- It is currently assumed that the breeding system, suspected pollinator, and seed dormancy would be consistent regardless of PU. If future data indicate otherwise, the table will be updated accordingly.
- PY+PD = Physical and physiological dormancy. Seeds are water impermeable and require scarification prior to germination. Seeds, however, do not germinate immediately following scarification. It is uncertain if it is a physiological, morphological, or combinational mechanism inhibiting germination. Studies continue to determine the length of time in storage that will yield maximum germination following scarification, as well as whether or not the mechanism is morphological (the embryo is not fully developed at the time of seed maturation).

Habitat Characteristics for *In Situ* Sites in MFS PU

PU	*in situ* PRC	Elev. (ft.)	Slope	Canopy Cover	Topography	Aspect	Average Annual Rainfall (mm)	Average Annual Max. Temp. (F)
Kaawa to Puulu	AAW-A	1700	Moderate	Open – Closed	Lower - Mid Slope	NW	1665	75
	ALI-A,B,C,D	900-1600	Moderate	Open – Closed	Lower - Mid Slope	NE, WNW, E, NW, NW	1265-1347	76.33-77
	ANU-A,B, C,D,E,F,G, H,J	1000-1500	Mod. - Steep	Open - Closed	Lower - Upper Slope	Varies: N, E, W NE, NW, WNW	1304-1416	77-78
	IKI-A	1100	Steep	Open	Mid Slope	NW	1345	78
	IMU-A	1500-1700	Mod. - Steep	Intermediate	Mid Slope - Gulch Bottom	NW	1358	77
	KIH-A	1100	Mod. - Steep	Intermediate	Lower - Mid Slope	N	1191	78
Kahanahaiki	MMR-A	1160	Steep	Closed	Lower Slope	NW	1490	78
Ekahanui & Huliwai	EKA-A	1900	Mod. - Steep	Intermediate	Mid Slope	NW	1154	76
	HUL-A	1900	Mod. - Steep	Closed	Mid Slope	SE	1193	76.33
Makaha Makai	KAM-A	2500	Flat	Closed	Gulch Bottom - Lower Slope	N	1366	75
	MAK-B	1600	Moderate	Intermediate	Upper Slope	N	1648	76.80
	MAK-C	1800	Moderate	Open	Lower Slope	NW	1707	75
	MAK-D	2000	Flat - Mod.	Intermediate	Gulch Bottom	NW	1826	77

Information was compiled from OANRP observation forms & GIS data; Temperature and rainfall data complied from PRISM Climate Group (PRISM 2004). PRC = Population Reference Code.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available upon request

Population Units

Manage For Stability Population Units	PU Type	Which Action Area is the PU inside?	Management Units for Threat Control
Kaawa to Puulu	in situ	OIP	Manuwai
Kahanahaiki	extirpated and reintroduction*	MIP	Kaluakauila & Kahanahaiki II
Ekahanui and Huliwai	in situ and augmentation	None	Ekahanui I & III
Makaha Makai	in situ	None	Makaha Makai
Genetic Storage Population Units			
Kaluakauila	Reintroduction	MIP	Kaluakauila MU
Keaau	in situ	MIP	None
East Makaleha	in situ	None	None
Halona	in situ	None	Navy PU fence
Makaha Mauka	in situ	None	None
Nanakuli	in situ	None	None
North Mikilua	in situ	None	Navy PU fence
South Mikilua	in situ	None	None
Waianae Kai	in situ	None	Some in Waianae Kai MU
West Makaleha	in situ	None	None

*= outplanting not started yet

Population Structure

- Some population structure has been observed at the larger PUs. Small and large immature plants have been observed at the Makaha Makai, Makaha Mauka, Kaawa to Puulu and Ekahanui and Huliwai PUs. These are the PUs with many mature plants, but seedlings are rarely seen at any of the PUs. It is not known how long an individual plant will take to mature. See Population Trend notes above for more background on the Population Structure observed in each PU.

- The Kaawa to Puulu PU has rarely been observed flowering and it is unknown what influence this has had on the lack of population structure at this PU. OANRP has one record of the plants in Palikea Gulch flowering in February 1999. Hawaii Biodiversity and Mapping Program records indicate that Steve Perlman observed plants with flowers and fruits in Palikea Gulch in June 1987. Management at this PU has not been as frequent compared to OANRP observations of plants in other PUs and this lack of data makes the phenology more uncertain. It is also uncertain if infrequent and/or low flowering is a recent phenomenon or has always occurred in these populations. As management in this area increases, we are hopeful that observations of flowering will be made. These will be used to guide collection times and help to determine the likelihood that sufficient population structure will develop as ungulate threats are removed from the Manuwai MU.

Population Estimate History

Population Monitoring History							
	2005	2006	2008	2009	2010	2011	2012
Manage For Stability Population Units (number of matures/immatures/seedlings)							
Kaawa to Puulu	34/84/0		36/88/6	31/77/5	47/72/2	52/69/2	55/55/1
Kahanahaiki	0/0/0						0/0/0
Ekahanui and Huliwai	17/15/0	16/31/0	14/30/0	16/28/0	14/27/11	14/29/0	17/24/0
Makaha Makai	50/7/0		73/27/6			71/51/1	54/43/1
Genetic Storage Population Units (number of matures/immatures/seedlings)							
Kaluakauila	0/6/0	0/22/0	0/21/0	0/19/0	0/13/0	0/7/0	0/7/0
Keaau	1/0/10						1/0/10
East Makaleha	2/2/40						0/0/0
Halona	1/4/0						No data
Makaha Mauka	40/100/0		5/58/4				10/51/0
Nanakuli	30/0/0						No data
North Mikilua	2/39/0						9/11/0
South Mikilua	4/0/0						No data
Waianae Kai	15/17/0	2/0/0					2/1/0
West Makaleha	0/2/0						0/0/0

Monitoring Plan

- All *in situ* sites in MFS PUs will be monitored annually using the Hawaii Rare Plant Restoration Group (HRPRG) Rare Plant Monitoring Form (RPMF) to record population structure and the age class, reproductive status and vigor of all known plants. The sites will be searched for new seedlings and all new juvenile plants will be tagged. If there is any threat to the health and safety of plants due to repeated monitoring and/or tagging, reductions in the number of tagged individuals will be made so that no harm is done to the plants. This monitoring data will serve to document the populations at the remaining sites to guide *in situ* threat management and genetic storage needs.

- The reintroduction sites will be monitored annually in the winter (January-March) using the HRPRG RPMF to record population structure, age class, reproductive status and vigor. All outplants will be accounted for along with a total population census. This data will be used to guide future outplanting. The total number of mature recruits per total number of plants outplanted will be used to guide the number of outplants needed to establish 50 mature recruits. The goal is to be able to have continual replacement of at least 50 mature plants in the hopes that stable population structure will be reached. Additional monitoring may be needed to observe the plants in flower or fruit since this is not expected during the winter census monitoring.

- Plants in the Kaawa to Puulu MFS PU will be monitored quarterly until flowering is observed and phenology can be documented. A select group of *in situ* sites will be selected and visited while conducting other management in the area.

- Several of the genetic storage PUs have not been observed in many years and will be visited over the next few years to determine if any plants are extant. These sites are a lower priority and will be visited while conducting other management as much as possible.

Genetic Storage Plan

What propagule type is used for meeting genetic storage goals?	What is the source for the propagules?	What is the Genetic Storage Method used to meet the goal?	What is the proposed re-collection interval for seed storage?	Is seed storage testing ongoing?	Plan for maintaining genetic storage.
Seeds	In situ populations	Seed Banking: -18C & 20% RH	5*	Yes	In situ and Reintroductions

*No decline in viability after four years of storage. This is the longest known time period that this taxon has been stored. The congener, *A. menziesii*, also shows a similar storage trend.

Genetic Storage Plan Comments:

- Seeds are water impermeable and require scarification to germinate. Seeds likely show combinational dormancy, as seeds do not germinate immediately after scarification and often rot when seeds are collected, scarified, and sown within several weeks. Germination rates have never been greater than 20% within the first year after collection, and are often 0%. Due to some level of combinational dormancy, current protocols include storing seeds dry and frozen for one year prior to sowing to promote increased germination within a shorter time period so seedlings can be propagated in cohorts.
- There is concern of hybridization with *A. grandifolium* (alien) as both species occupy similar habitat and can be seen growing together at most PUs. Concern should be had for collecting fruit where *A. grandifolium* could have been flowering in the vicinity at the same time. Hand-pollination crosses could be performed to quantify possibility for hybridization. No hybridization has yet been detected in plants grown from seed collected from sites with both taxa. Weed control will be directed at removing *A. grandifolium* from sites with *A. sandwicense*.
- An insect, *Niesthrea louisianica* Sailer (Rhopalidae), introduced for bio-control on *Abutilon theophrasti*, is known to reduce seed viability by 98% in this taxon (Patterson et. al. 1987). While we have seen substantial damage to seeds of *Hibiscus brackenridgei* subsp. *mokuleianus* in Makua from *N. louisianica*, we have yet to observe damage to seeds of *A. sandwicense*. OANRP seed lab staff will continue to monitor fruit collections for this insect.
- A living collection in the nursery and at gardens will be established to secure clones of the single Kahanahaiki plant and be used as stock for cuttings and hand-pollination attempts.

Reintroduction Plan

Manage for Stability Population Units	Reintroduction Site(s)	Number of Plants to be planted	Propagule Type	Propagule Population(s) Source	Number of Founders in Source Population	Plant Size	Pot Size
Kaawa to Puulu	TBD*	TBD	Immature Plants	AAW, ALI, ANU, IKI, IMU, KIH	~50	25-100cm	6 inch or ½ gallon
Kahanahaiki	MMR-D*	100	Mature Plants	MMR-A-1	1	25-100cm	6 inch or ½ gallon
Ekahanui and Huliwai	EKA-C*	100	Immature Plants	EKA-A, HUL-A	~20	25-100cm	6 inch or ½ gallon
Makaha Makai	MAK-F*	100	Immature Plants	KAM-A, MAK-B, MAK-C, MAK-D	~50	25-100cm	6 inch or ½ gallon

*=reintroduction not started yet

- Outplantings will be conducted using nursery plants grown from wild collected seeds and cuttings from the Kahanahaiki plant. Seeds from stored collections from the Makaha Makai PU and the Ekahanui and Huliwai PU will be used to augment those PUs. Since only a single plant has ever been observed in the Kahanahaiki PU, clones of that individual will be used to establish that PU. In order to secure more founders for this PU, efforts will be made to locate additional plants to incorporate into the Kahanahaiki outplanting. If no additional founders are discovered and reproduction on plants in outplantings or living collections is not observed within the next five years, other strategies will be proposed to achieve stability goals.
- The Kaluakauila outplanting of the Kahanahaiki stock was initially established in 2005 with six plants. It was supplemented with additional plants annually from 2006 to 2008. None of the plants were observed to flower at the outplanting site and most have been noted to be in 'Poor' or 'Moderate' health since being planted. There are currently seven of the 22 outplants remaining at the sites and two were observed to be healthy in 2012. Since the outplanting sites occur in areas that are lower in elevation and drier than the original wild site, the decision was made to postpone additional planting here in favor of another site with more favorable conditions.
- Outplantings at the Kaawa to Puulu PU and Makaha Makai PU may be needed if population structure fails to develop once ungulates are controlled. The need for outplanting to achieve and sustain stability goals will be determined in OIP Year 8. Data from census monitoring of the tagged mature and immature plants and observations of seedlings will be used to determine if these PUs will require outplanting to meet and sustain stability goals. Population data will be revised as individual plants are revisited and determined to be mature or immature.
- Outplantings will be conducted in the winter (January-March) in sites selected by staff from OANRP, Board of Water Supply and State of Hawaii where applicable. Planting holes will be made with an auger where possible. Follow-up watering will be done as needed through the summer following planting and then stopped.

Stabilization Goals Update for MFS PUs

PU	PU Stability Target		MU Threat Control						Genetic Storage
	Has the Stability Target for mature plants been met?	Does population structure support long-term population stability?	Ungulates	Weeds	Rodents	Fire	Slug	Black Twig Borer	Are Genetic Storage goals met?
Kaawa to Puulu	Yes	No	No	No	No	No	No	No	No
Kahanahaiki	No	No	No	No	No	No	No	No	Yes
Ekahanui and Huliwai	No	No	Partial (71%)	No	No	No	No	No	No
Makaha Makai	Yes	No	No	No	No	No	No	No	No

5 Year Action Plan

	Proposed Actions for the following years:				
Manage for Stability Population Units	OIP YEAR 6 October 2012 – September 2013	OIP YEAR 7 October 2013 – September 2014	OIP YEAR 8 October 2014 – September 2015	OIP YEAR 9 October 2015 – September 2016	OIP YEAR 10 October 1 2016- September 2017
Kaawa to Puulu	•Monitor/Collect	•Monitor/Collect	•Monitor/Collect •Determine if augmentation is needed	•Monitor/Collect •Begin augmentation if needed	•Monitor/Collect •Complete augmentation if needed
Kahanahaiki	•Construct fence •Begin reintroduction •Monitor annually	•Continue reintroduction •Monitor annually	•Complete reintroduction •Monitor annually	•Monitor annually	•Monitor annually
Ekahanui and Huliwai	•Continue augmentation •Monitor/Collect	•Continue augmentation •Monitor/Collect	•Complete augmentation •Monitor/Collect	•Monitor/Collect	•Monitor/Collect
Makaha Makai	•Monitor/Collect •Construct Fence	•Monitor/Collect	•Monitor/Collect •Determine if augmentation is needed	•Monitor/Collect •Begin augmentation if needed	•Monitor/Collect

5 Year Action Plan

	Proposed Actions for the following years:				
Genetic Storage Population Units	**OIP YEAR 6 October 2012 – September 2013**	**OIP YEAR 7 October 2013 – September 2014**	**OIP YEAR 8 October 2014 – September 2015**	**OIP YEAR 9 October 2015 – September 2016**	**OIP YEAR 10 October 1 2016- September 2017**
Keaau		•Monitor/Collect		•Monitor/Collect	
East Makaleha			•Survey		
Halona	•Monitor/Collect		•Monitor/Collect		
Makaha Mauka		•Monitor/Collect		•Monitor/Collect	
Nanakuli	•Monitor/Collect		•Monitor/Collect		
North Mikilua			•Monitor/Collect		•Monitor/Collect
South Mikilua			•Monitor/Collect		•Monitor/Collect
Waianae Kai		•Monitor/Collect		•Monitor/Collect	
West Makaleha			•Survey		

Management Discussion for *Abutilon sandwicense*

To date, OANRP management has focused on securing collections in *ex situ* storage and on constructing fence units (Ekahanhui III and Manuwai MUs) to allow for threat control and habitat management. Genetic storage collections have been prioritized for the MFS PUs with lower numbers of mature plants that may consequently need outplanting to meet OIP stability goals (Ekahanui and Huliwai, Kahanahaiki), but collections will continue from all PUs. Initial estimates for the number of plants in the Makaha Makai PU and the Kaawa to Puulu PU have been revised as management has begun in those areas and more plants are being discovered. However, observations at the known sites indicate a decline in the number of mature plants and a lack of population structure to replace mature plants. As the threats are controlled, conditions for recruitment may improve and outplanting may not be needed to meet stability goals. The next three years of monitoring data will be used to adapt management plans for outplanting in these PUs.

Outplantings have been conducted by TNC and OANRP staff in the past and the methods developed at these sites (planting technique, plant size, watering) will be used to establish outplants in the Ekahanui and Huliwai PU and Kahanahaiki PU. Construction of the MU fences needed for the Kahanhaiki PU and the Makaha Makai PU is expected within the next five years. The stability goal for the number of mature plants may be met in the next five years for all PUs if outplants survive to maturity as expected (based on monitoring of the past TNC and OANRP outplantings). Genetic storage collections will continue at all PUs as staff time allows. Priority will be given to the MFS PUs, PUs with a high fire threat, and PUs with low numbers of remaining plants.

References

- OIP 2008. Oahu Implementation Plan. United States Army Garrison, Hawaii, Directorate of Public Works, Environmental Division, Schofield Barracks, HI.
- Patterson, D.T., R.D. Coffin and N.R. Spencer. 1987. Effects of Temperature on Damage to Velvetleaf *Abutilon theophrasti* by the Scentless Plant Bug *Niesthrea louisianica*. Weed Science: 35: 324-327.
- PRISM. 2004. Prism Climate Group. Oregon State University. http://prism.oregonstate.edu.