Chamaesyce herbstii

- **Scientific name:** *Chamaesyce herbstii* W. L. Wagner
- **Hawaiian name:** *`akoko*
- **Family:** Euphorbiaceae (Spurge family)
- **Federal status:** Listed endangered on October 10, 1996
- **Requirements for MIP Stability**
  - **3 Population Units (PUs)**
  - **25 reproducing individuals in each PU (long-lived perennial)**
  - **Stable population structure**
  - **Threats controlled**
  - **Complete genetic representation of all PUs in storage**
- **Description and biology:** *Chamaesyce herbstii* is a milky-sapped tree 3-8 m tall. The leaves are usually 8-19.5 cm long, oppositely arranged, and held in a horizontal plane. The inflorescences are open, branched, measure 7-17 cm long, and bear 3-15 cyathia (specialized flower-like inflorescences with a single central female flower surrounded by much-reduced male flowers). The capsules measure 5-10 mm long, and up to 8 mm in diameter, are colored green or green and red, and contain three seeds (excerpt from MIP 2003).
- **Known distribution:** *Chamaesyce herbstii* has a disjunct range. It has been recorded from elevations of 530-700 m. The main portion of the species' range is in the northern portion of the Waianae Mountains in the Mokuleia region. Two population units were known from this region: Makaleha and the adjacent gulches of Pahole and Kapuna. The third unit was known from the southern Waianaes in South Ekahanui Gulch in Honouliuli. (excerpt from MIT 2003).

Makua Implementation Team (MIT). 2003. Final Makua Implementation Plan. Prepared for the U.S. Army Garrison, Schofield Barracks, HI..

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- **Population trends:** *C. herbstii*'s population units have been decreasing in number, and the numbers of plants in them have been shrinking . Only 1 of the 3 recorded *C. herbstii* population units is now extant. The population in South Ekahanui Gulch was first discovered in the late 1970's, when 15 mature trees and several seedlings were reported. In 1987, the number was reported to be about 11 trees. The number declined to four trees by 1991, and two trees by 2000. The last two trees died in 2001. In Makaleha, it was described as being "locally dominant" in a very small area in 1950 (Hatheway 1952). In 1987, 10-12 were recorded by Steve Perlman, but none were observed when he searched the site again in 2001. The only extant population unit is in Pahole and Kapuna gulches of the Pahole NAR. It was estimated to have about 170 trees in the MIP in 2003. By 2005, the estimates were revised and 56 trees were known. In 2008, a total of 45 wild plants were known.

- **Habitat:** *Chamaesyce herbstii* typically grows in gulch bottoms and on gulch slopes. It usually occurs in mesic forests dominated by a diverse mix of tree species.

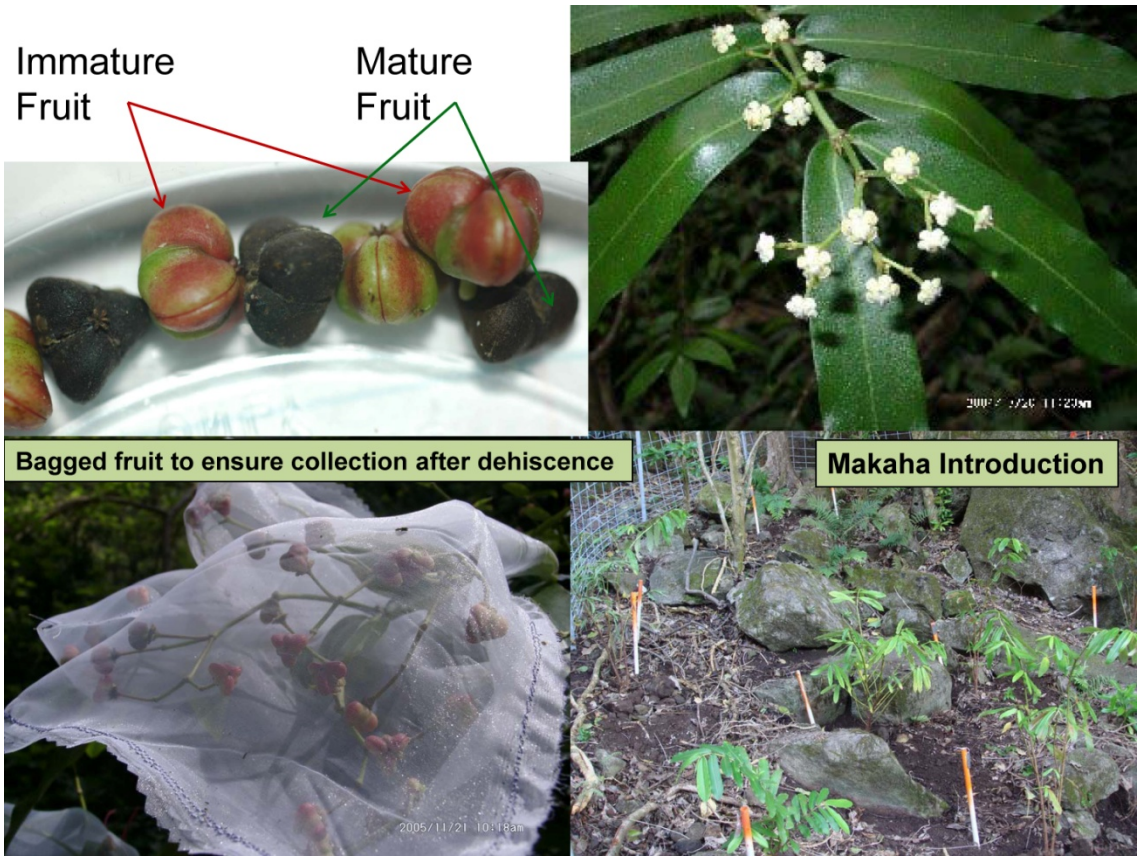
- **Taxonomic background:** There are 16 native species of *Chamaesyce* in Hawaii; all are endemic. Several alien species of this genus are also found in Hawaii. The genus *Chamaesyce* is considered by some to be a subgenus of the large genus *Euphorbia* (Koutnik 1987). The elevation of *Chamaesyce* to the genus level leaves only a single Hawaiian *Euphorbia*, *E. haeleeleana*, which occurs only on Kauai and the Waianae Mountains of Oahu.

Reproductive Biology Table

	Observed Phenology			Reproductive Biology		Seeds	
Population Unit	Flower	Immature Fruit	Mature Fruit	Breeding System	Suspected Pollinator	Average # Per Fruit	Dormancy
ALL	July-Oct	Aug-Jan	Oct-Feb	Monoecious (cyathia)	Insect	3*	Not Dormant

* Ovary 3-carpellate but often only 0-1 seed per fruit observed

- Bees and flies visit the flowers of *C. herbstii* (Lau pers. comm. 2000), and presumably act as pollination agents for the taxon.
- Mature *Chamaesyce* capsules split open explosively when they dry, flinging the seeds for a short distance.
- *C. herbstii* has a copious amount of sticky substance on its seeds. Dispersal of its seeds in pre-human times is thus theorized to have been carried out by birds, including the many now extinct flightless Hawaiian birds (excerpt from MIT 2003).



Population Units

Manage For Stability Population Units	PU Type	Which Action Area is the PU inside?	Management Units for Threat Control
Pahole to Kapuna	In situ and Augmentation	MMR	Pahole and Kapuna
Makaha	Introduction	None	Makaha Subunit I
West Makaleha	Reintroduction	None	West Makaleha
Genetic Storage Population Units			
None			

Population Structure

- In the Pahole to Kapuna PU, seedlings are observed and become established as immature plants at both the in situ and augmentation sites.
- In Makaha, outplanted immature plants have been observed to mature and flower. Seedlings were observed at the reintroduction in Makaha less than two years after reintroducing immature plants.
- As the population structure develops, OANRP will track survivorship of seedlings and immature plants.
- If population structure in Makaha will maintain the stabilization goal of 25 mature plants, no further planting may be needed. If monitoring shows that survivorship may not be sufficient to maintain the stability goal, the management strategy will be adapted.

Population Unit Monitoring History

Population Unit	2003 Mat/Imm/Seedling	2005 Mat/Imm/Seedling	2007 Mat/Imm/Seedling	2008 Mat/Imm/Seedling	2009 Mat/Imm/Seedling
Pahole to Kapuna **in situ**	(170)/0 (combined Mat & Imm)	40/5/0	49/12/0	34/1/0	32/7/0
Pahole to Kapuna **outplanted**	0	0	0/18/0	21/44/0	23/67/3
Makaha **outplanted**	0	0	0/22/0	6/22/0	19/29/28

Monitoring Plan

- All PUs will be monitored annually for population structure, trends and threats.
- All individuals at outplanting sites will be monitored twice annually for reproductive status, vigor and growth.
- New seedlings at all sites will be counted and areas with seedlings will be delineated on sketch maps. New immature plants at all in situ sites will be tagged and monitored to track survivorship and growth.
- After three years of records from the annual census of seedlings and growth rates and survivorship of immature plants, projections of population structure will be developed.

Genetic Storage Plan

What propagule type is used for meeting genetic storage goal?	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	Reintroductions	Seed banking	5+ years	Yes	Collections will be made from reintroductions as needed.

Genetic Storage Plan Comments: Seed storage protocols are still being developed. Complete five-year results, with storage condition recommendations, will be available in 2012. Seeds have germinated after four years of storage. To allow for as much in situ regeneration as possible, collections for genetic storage are not made from wild plants. Collections from wild plants are grown and outplanted. Seed collections from the outplanted individuals will be stored to represent all available founders.

Reintroduction Plan

Population Unit	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
Pahole to Kapuna	Pahole: PAH-R	112	Immature plants	Kapuna & Pahole	56	To Be Determined	1 gal. round or tall
Pahole to Kapuna	Kapuna: KAP-A (NARS planting)	0					
Makaha	Makaha: MAK- A	112	Immature plants	Kapuna & Pahole	56	To Be Determined	1 gal. round or tall
West Makaleha	LEH- A – Not yet established	112	Immature plants	Kapuna & Pahole or Makaha	56	To Be Determined	1 gal. round or tall

Reintroduction Plan Comments

- The reintroduction in the Pahole to Kapuna PU began in February 2006 and will continue until the founders are balanced. Most founders are currently represented at this site and the planting may require two more years to complete.
- The Kapuna site is not an OANRP site and is not used. Oahu NARS staff had grown two immature plants from seed collected in the area and planted them in 1995. Both plants have matured and flowered and are still there and healthy.
- *C. herbstii* was first planted in Makaha by OANRP in March of 2007. This planting may require three more years to complete.
- There has been regeneration of seedlings in the outplanting sites at both the Makaha and Pahole to Kapuna PUs so that a single outplanting effort may result in a healthy population structure.
- The West Makaleha reintroduction will begin once construction of the management unit fence is complete. This reintroduction will be established using seed collected from the founders remaining in the in situ sites in the Pahole to Kapuna PU. If that founder has died and is represented in the Makaha reintroduction, collections from those plants will be used to represent it.

5 Year Action Plan

	Proposed Actions for the following years:				
Population Unit	MIP YEAR 6 Oct 2009 – Sep 2010	MIP YEAR 7 Oct 2010 – Sep 2011	MIP YEAR 8 Oct 2011 – Sep 2012	MIP YEAR 9 Oct 2012- Sep 2013	MIP YEAR 10 Oct 2013- Sep 2013
Pahole to Kapuna	•Reintroduce •Monitor all sites •Collect for propagation	•Reintroduce •Monitor all sites •Collect for propagation	•Monitor all sites •Collect for propagation	•Monitor	•Monitor
Makaha	•Reintroduce •Monitor outplantings	•Reintroduce •Monitor outplantings	•Monitor •Collect for propagation & GS	•Monitor •Collect for propagation & GS	•Monitor & Collect
West Makaleha	•None	• Begin fence construction	•Reintroduce •Monitor	•Reintroduce •Monitor	•Reintroduce •Monitor

2008-2009 Stabilization Goals Update

MFS Population Units	PU Stability Target		MU Threat Control						Genetic Storage
	Has the Stability Target for mature plants been met?	Does the PU have observed structure to support the stability target in the long-term?	Ungulates	Weeds	Rodents	Fire	Slugs	BTB	Are there enough propagules in Genetic Storage?
Pahole to Kapuna	YES	NO	YES	YES	NO	NO	NO	NO	YES
Makaha	YES	NO	YES	YES	NO	NO	NO	NO	N/A
West Makaleha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

West Makaleha will be established once the fence is complete, therefore N/A for many columns. Pahole to Kapuna is the only PU with in situ stock. Makaha and West Makaleha will be established with this stock. Although structure to support stability targets has not yet been meet there is regeneration on site. Hopefully, these goals can be met with more mature plants within the PUs. Other threats have not been observed to impact this taxa.

2008-2009 Highlights

Major Highlights/Issues MIP Year 5

- The stability goal of 25 individuals is met for the Pahole to Kapuna PU. There are new naturally occurring seedlings and immature plants in the wild and reintroduction sites.
- The Makaha fence was declared pig free in the summer of 2009 and OANRP continue to assist NARS in removing ungulates from the Kapuna fences.
- OANRP continue to supplement the reintroduction at the Makaha PU with additional founders. Naturally occurring seedlings and immature plants are at this site and the stability goal of 25 reproducing individuals should be met in the next year.

Plans for MIP Year 6

- Conduct census monitoring and continue to track survivorship of F1 plants
- Continue to supplement the reintroduction for the Makaha PU
- Collect seeds from unrepresented founders in the Pahole to Kapuna PU to propagate for the reintroduction sites
- Collection for genetic storage will begin once the remaining founders are represented in the reintroductions and begin to flower

2008-2009 Taxon Status Table

Action Area: In

TaxonName: Chamaesyce herbstii **TaxonCode: ChaHer**

Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2008	NRS Immature 2008	NRS Seedling 2008	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kapuna to Pahole	Manage for stability	32	7	0	25	67	0	57	55	0	57	74	0	More plants were added to the reintroduction site and three new juvenile plants were observed within the outplanting
	Total for Taxon:	32	7	0	25	67	0	57	55	0	57	74	0	

Action Area: Out

TaxonName: Chamaesyce herbstii **TaxonCode: ChaHer**

Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2008	NRS Immature 2008	NRS Seedling 2008	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Makaha	Manage reintroduction for stability	0	0	0	19	29	28	6	23	0	19	29	28	18 immatures were planted and many new immature plants and seedlings were observed in the last year
West Makaleha	Manage reintroduction for stability	0	0	0	0	0	0	0	0	0	0	0	0	The reintroduction will begin once the MU fence is complete
	Total for Taxon:	0	0	0	19	29	28	6	23	0	19	29	28	

2008-2009 Genetic Storage Status Table

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >=1 Microprop	# Plants >=1 Army Nursery	# Plants that Met Goal
Chamaesyce herbstii							
Kapuna to Pahole	32	7	27	20	0	14	10
				Total # Plants w/ >=10 Seeds in Seedbank	**Total # Plants w/ >=1 Microprop**	**Total # Plants w/ >=1 Army Nursery**	**Total # Plants that Met Goal**
				20	0	14	10