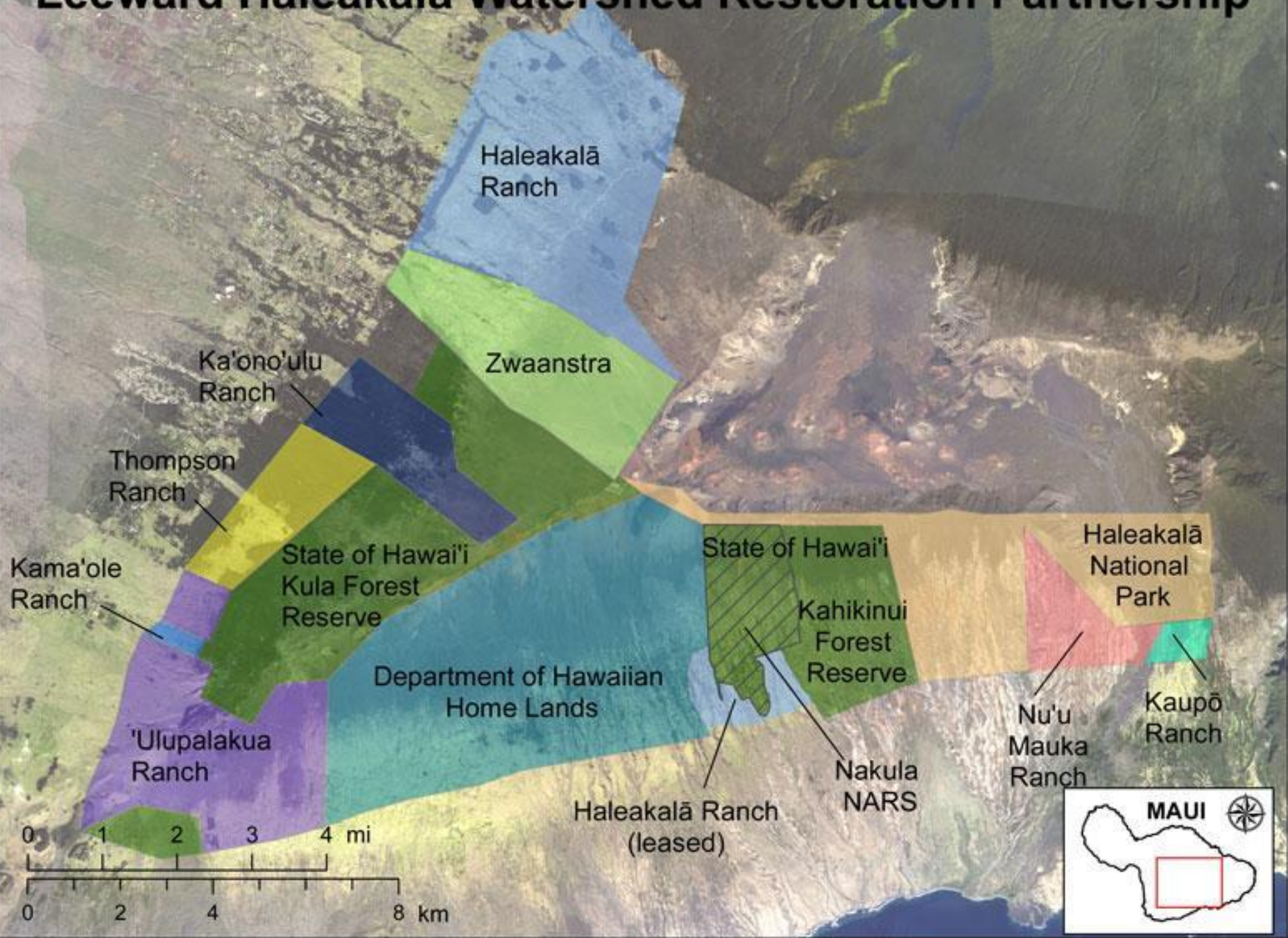


Invasive Weed Management in Highly Impacted Landscapes

Keahi Bustamente, Keali'i Ka'aikala

Leeward Haleakala Watershed Restoration Partnership (LHWRP),
Maui, HI; Pacific Cooperative Studies Unit (PCSU), University of
Hawaii at Manoa, Honolulu, HI

Leeward Haleakalā Watershed Restoration Partnership



The most threatening tree species on Haleakala

- *Pinus patula*, Mexican Weeping Pine
- *Pinus radiata* var. *radiata*, Monterey Pine
 - Rare in three sites on central coast of California; populations in San Mateo and Santa Cruz counties, Monterey County, and San Luis Obispo County
- var. *binata*
 - Rare, only on Guadalupe Island, Mexico
- var. *cedrosensis*
 - Rare, only on Cedros Island, Mexico

- 50-115 (-150) ft tall
- 24-36 in diameter
- Can reach maturity within a few years
- Cones mature in 2 yrs , but may remain on tree, closed, for several years
- Seeds viable for decades
- *P. radiata* grows better over a wider elevational range than any other pine planted in Hawaii (US Forest Service 1989).
- “In at least one area, Kalialinui, on Maui, growth equal to the best in Aotearoa was measured in 14 yr-old trees (Skolmen 1963).”
- Freaks may grow up to 10 ft per year. (Ask da boys)

Leeward Haleakalā Watershed Restoration Partnership

Monterey pine (*Pinus radiata*)

Control efforts and estimated distributions



Pinus radiata

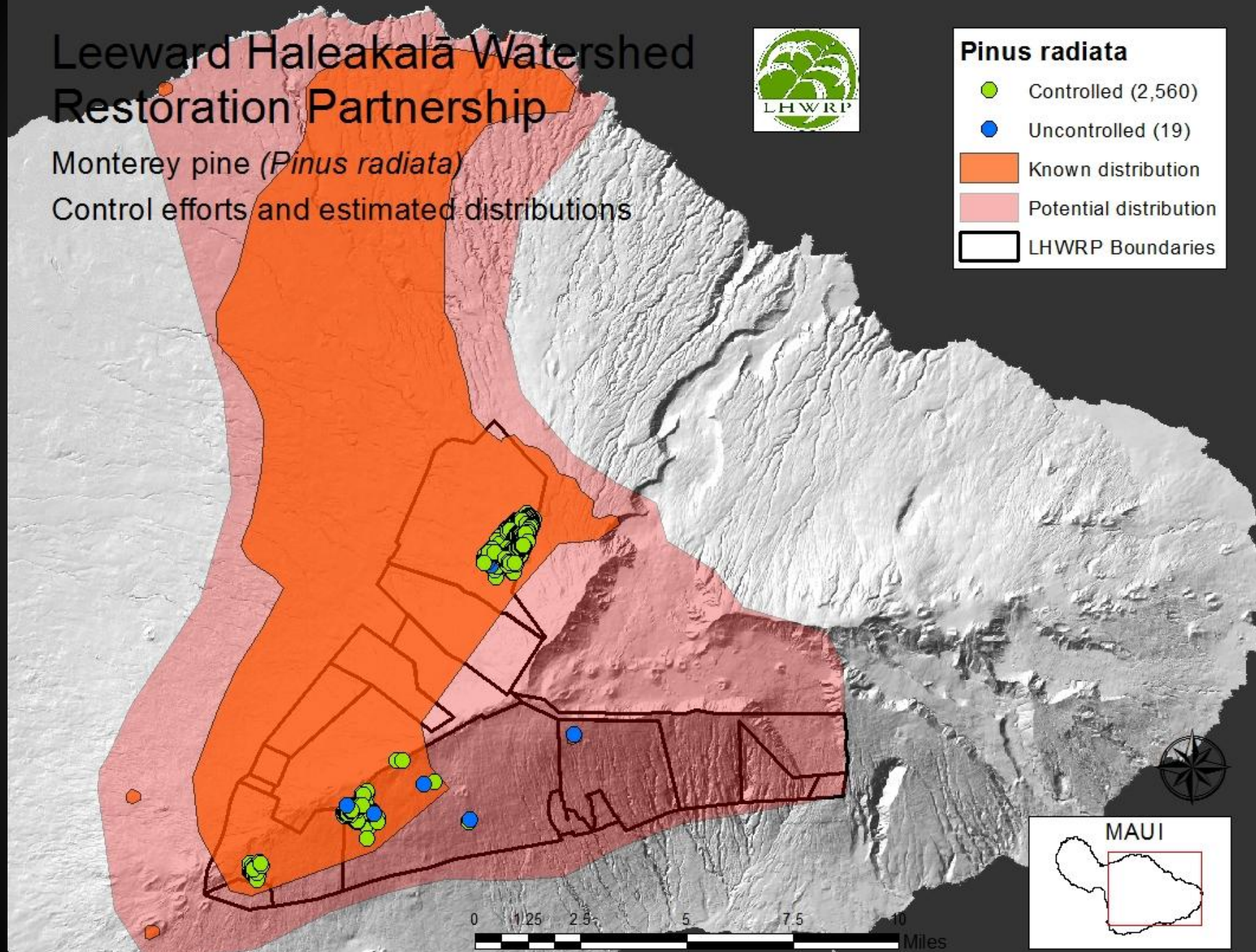
● Controlled (2,560)

● Uncontrolled (19)

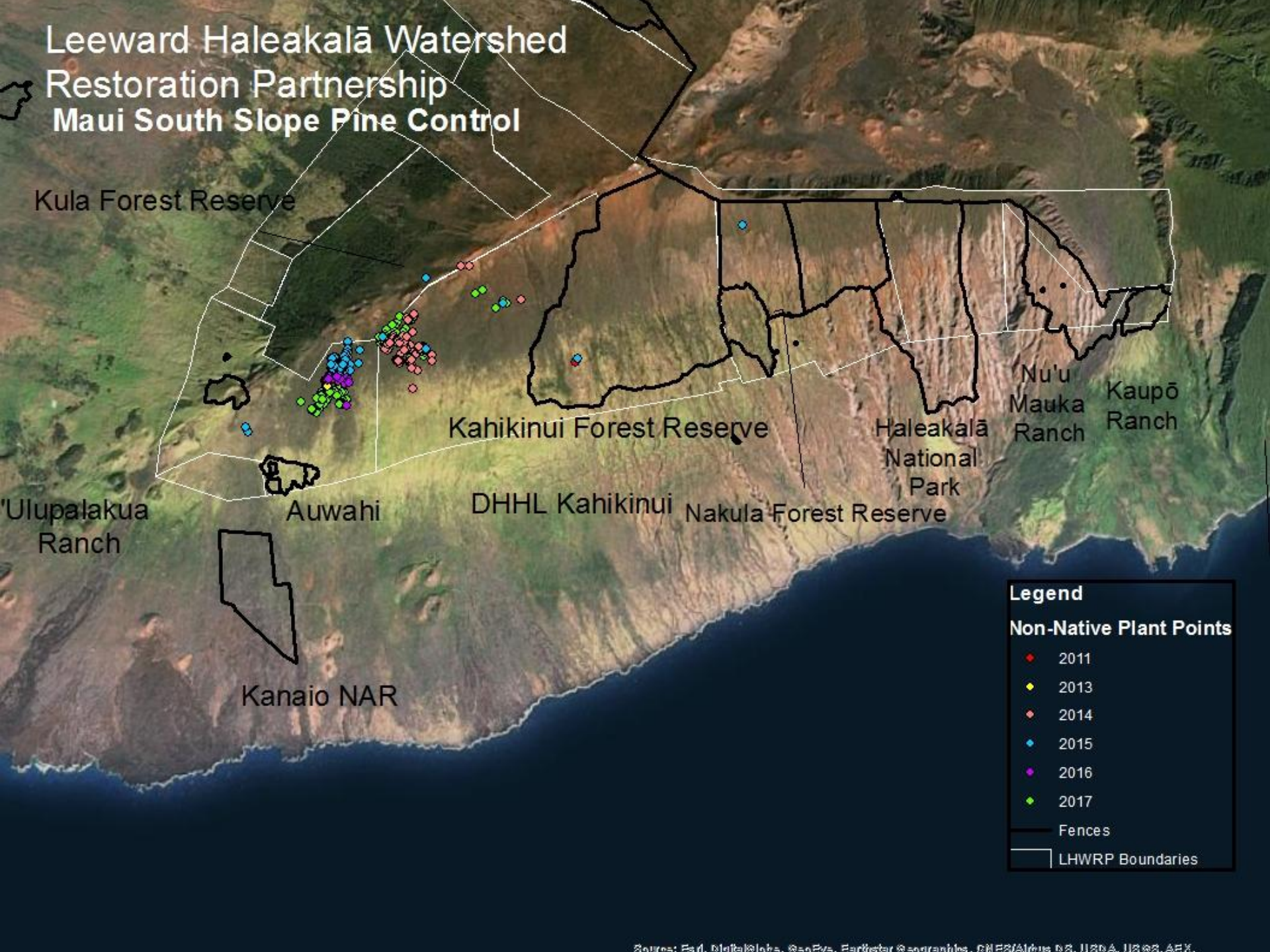
Known distribution

Potential distribution

LHWRP Boundaries



Leeward Haleakalā Watershed Restoration Partnership Maui South Slope Pine Control



Kula Forest Reserve

Kahikinui Forest Reserve

Haleakalā
National
Park

Nu'u
Mauka
Ranch

Kaupō
Ranch

'Ulupalakua
Ranch

Auwahi

DHHL Kahikinui Nakula Forest Reserve

Kanaio NAR

Legend

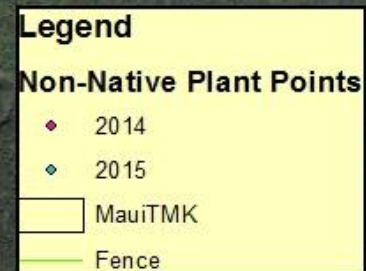
Non-Native Plant Points

- 2011
- 2013
- 2014
- 2015
- 2016
- 2017

Fences

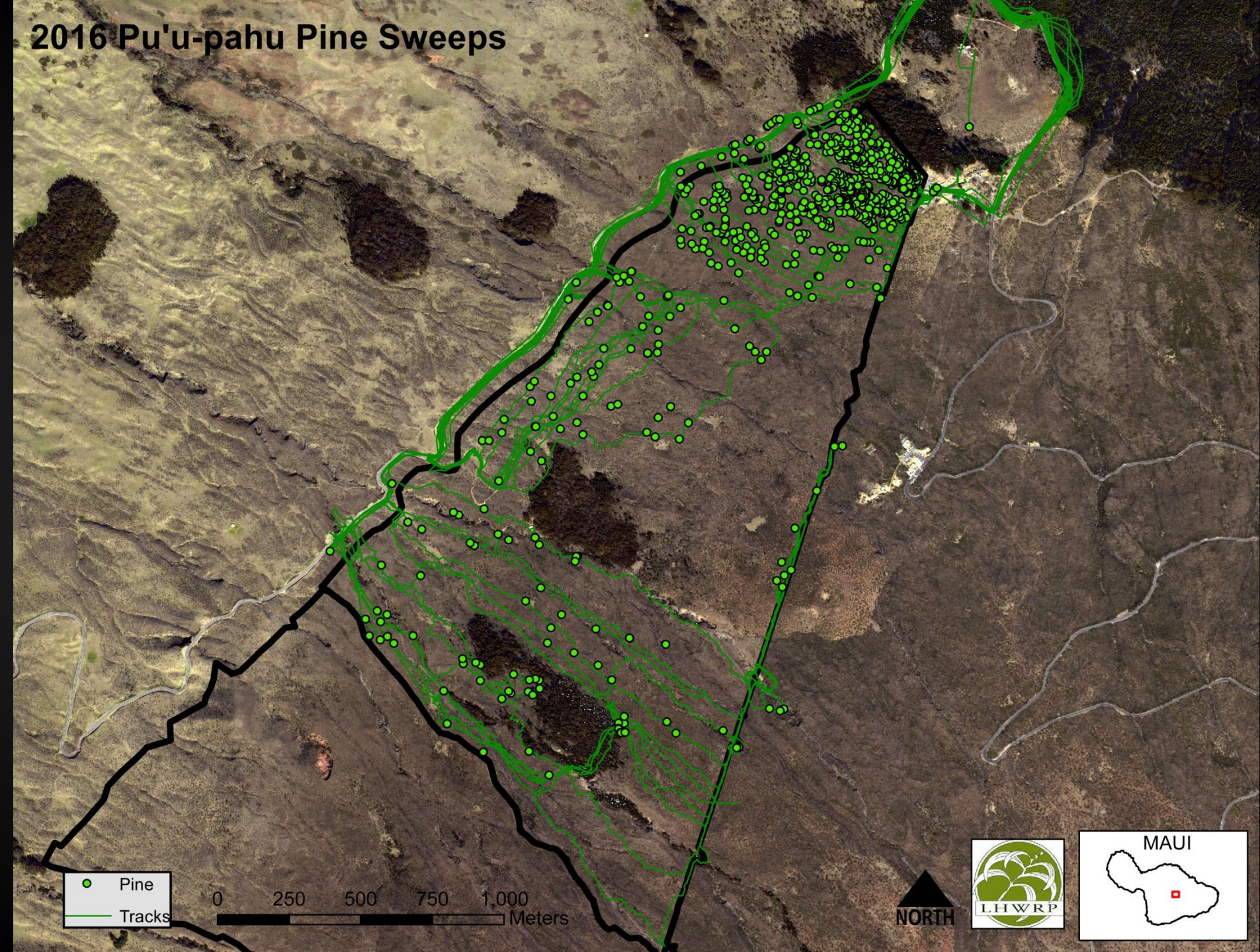
LHWRP Boundaries

LHWRP Pine Control Pahu



0 0.225 0.45 0.9 1.35 1.8 Miles

2016 Pu'u-pahu Pine Sweeps



Current Challenges and Limitations

- Large trees, over 30 ft tall
- Man power
- Heli funds

2018

- Multi-agency sweep at Ulupalakua Ranch on the South Slope.
- Two year followup control at Puu-pahu
- Look for heli funds for future control

LHWRP Pine Control South Slope

Legend

Non-Native Plant Points

Year

- 2011
- 2013
- 2013
- 2014
- 2015
- 2016
- 2016
- 2017

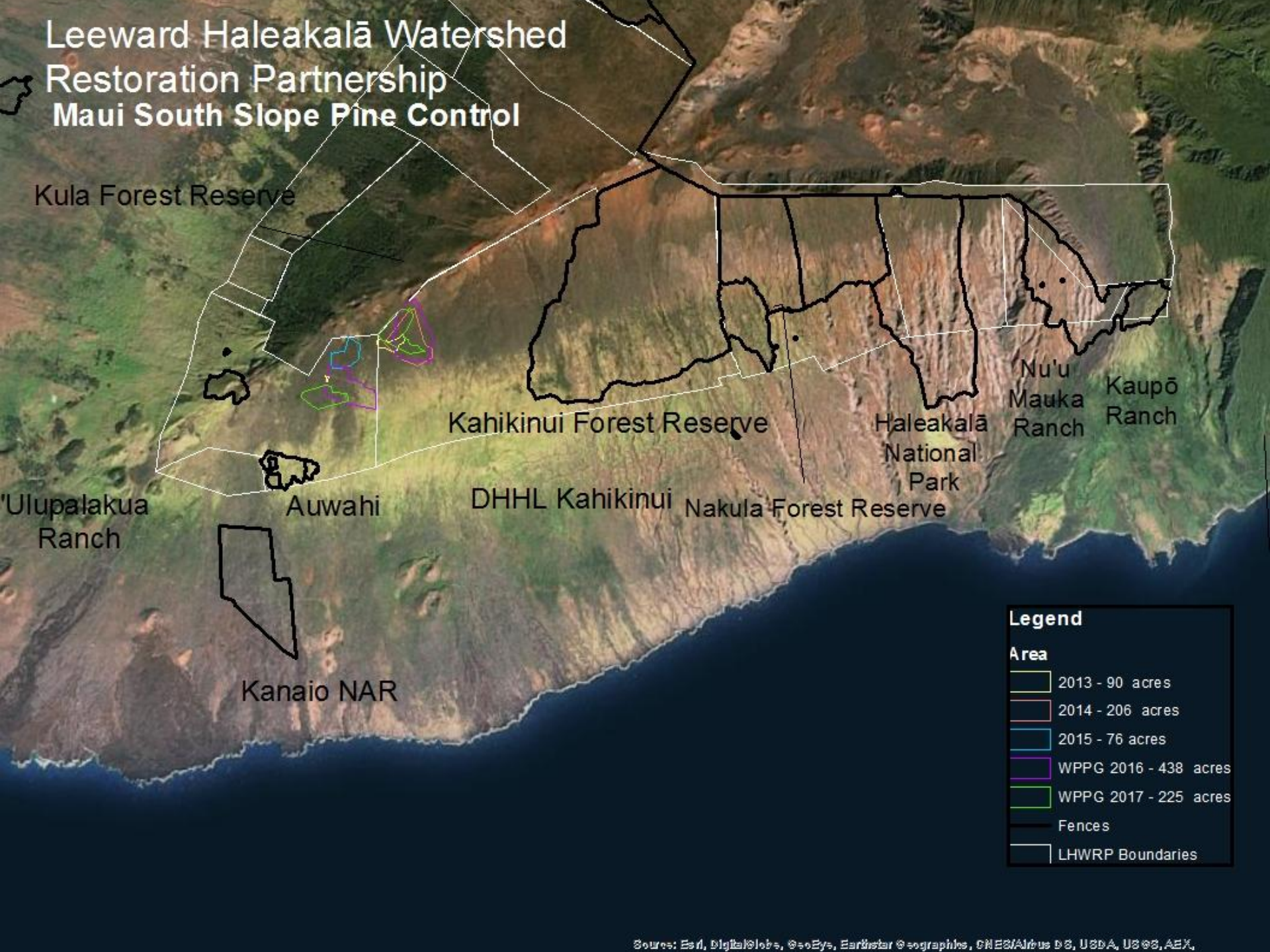
MauiTMK

N

0 0.25 0.5 1 1.5 2 Miles

Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, Aero, Se mapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Leeward Haleakalā Watershed Restoration Partnership Maui South Slope Pine Control



Legend

Area

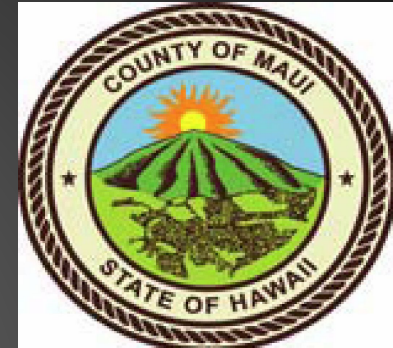
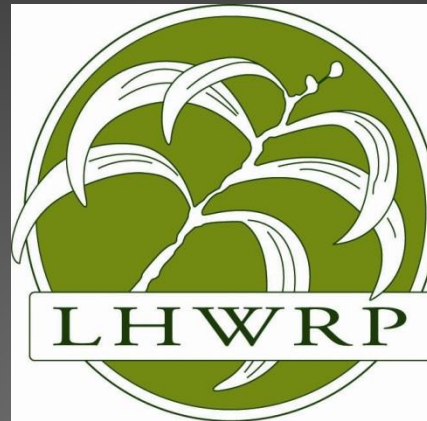
- 2013 - 90 acres
- 2014 - 206 acres
- 2015 - 76 acres
- WPPG 2016 - 438 acres
- WPPG 2017 - 225 acres

Fences

LHWRP Boundaries

Sources

- Cope, Amy B. 1993. *Pinus radiata*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). <http://www.fs.fed.us/database/feis/>
- Farjon, A. 2013. *Pinus radiata*. The IUCN Red List of Threatened Species 2013: e.T42408A2977955. <http://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T42408A2977955.en>.
- Little, Elbert L., and Roger G. Skolmen. *Common forest trees of Hawaii: (Native and introduced)*. United States Department of Agriculture Forest Service, 1989.



The Nature
Conservancy



MAHALO pest of *P. radiata* in Hawaii

- Eurasian pine adelgid, *Pineus pini*
(Hemiptera, Adelgidae)
closely related to aphids
- Fungus, *Diplodea pinea*,
*has killed most Monterey pines planted on
Molokai*