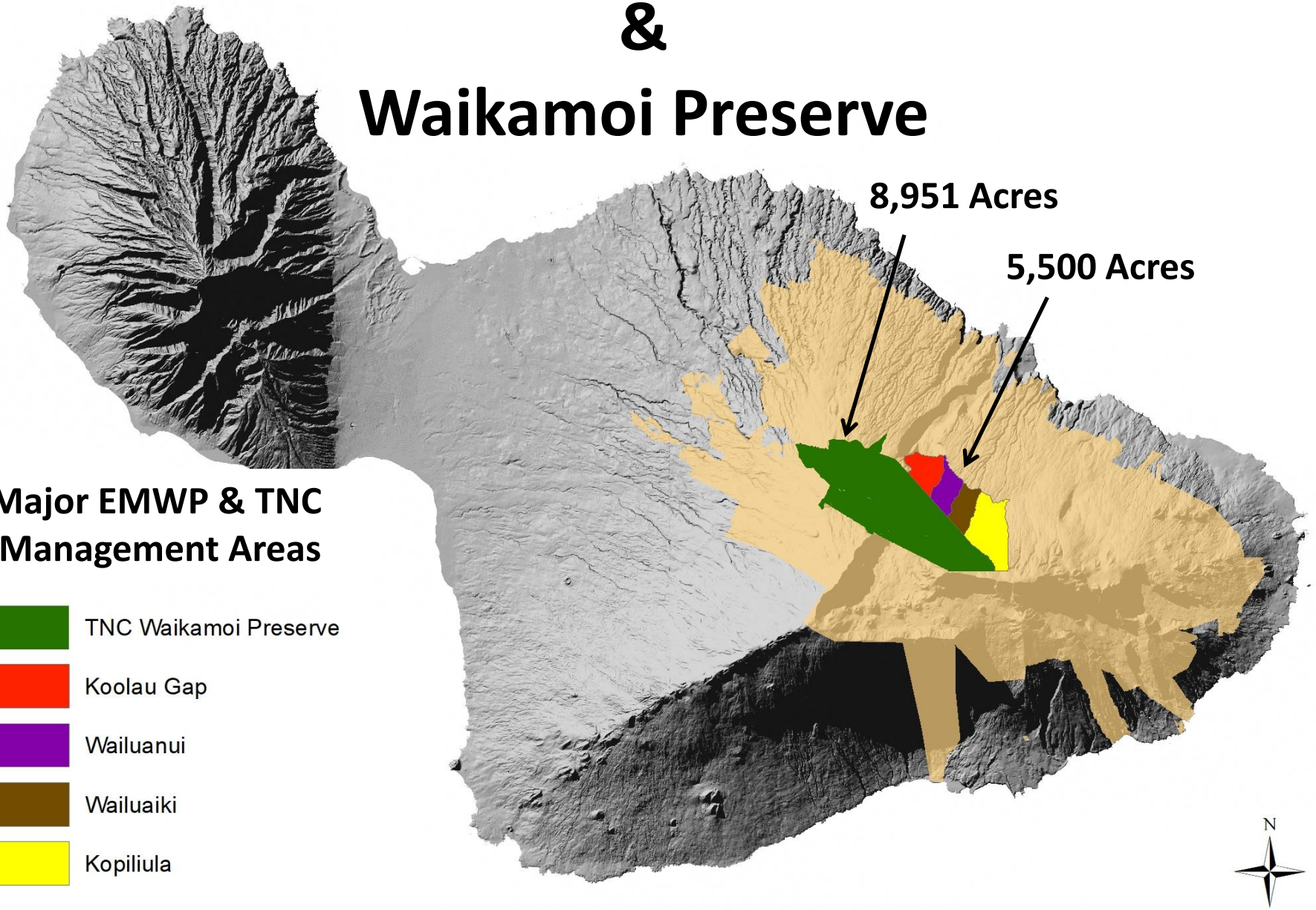
Maui Gingervitis: A Growing Threat

Keoki Kanakaokai & Kekoa Gurat

East Maui Watershed Partnership Lands
&
Waikamoi Preserve

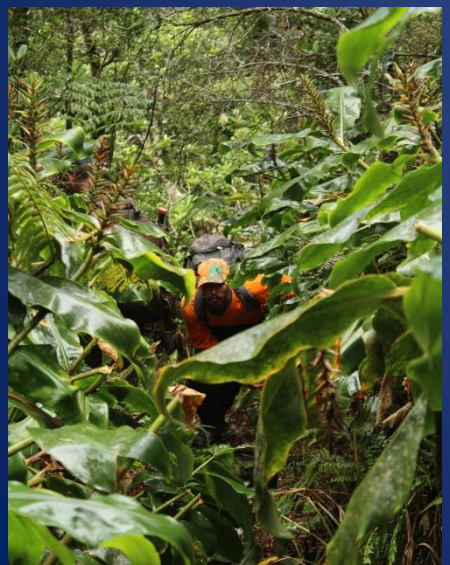


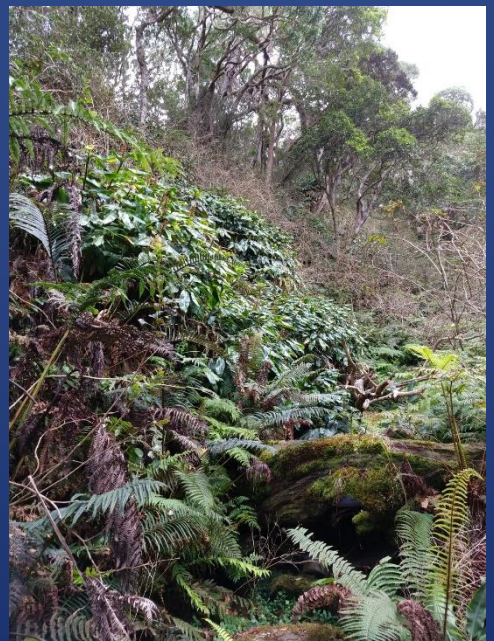
Weed Problem (*Hedychium gardnerianum*)

- Common Names: Kahili Ginger, Himalayan Ginger, Toilet Brush Ginger…
- Native to India, Nepal, Bangladesh
- Introduced to Maui 1950's or 1960's - E. Maui Cu
- Naturalized on Maui from 1,200 – 6,360 ft elevat
- Grows 1.5 – 2m Tall From Large Branching Rhizor

Weed Problem (*Hedychium gardnerianum*)

- Aggressive Growth
- Shade Tolerant
- Spreads Through Rhizomes and Frugivorous Birds
- From Seed to Reproductive Maturity in 3-4 Years
- **Average** production is >100 seeds per flower head

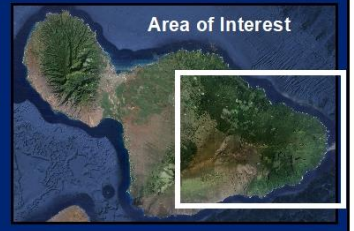




Weed Problem (*Hedychium gardnerianum*)

- Forms Dense Monotypic Thickets in Open & Closed Canopy Native Hawaiian Forests
- Smothers Young Native Seedlings, Prevents Forests Regeneration, Outcompetes Native Plants
- Reduces Nitrogen
- Promotes Erosion
- Inhibits Stream Flow

East Maui Hedychium gardnerianum Distribution



N

- Estimated Hed Gar Range Dense 2009
- Estimated Hed Gar Range Sparse 2009
- EMWP Hed Gar
- TNC Hed Gar
- HALE NPS Hed Gar
- HALE NPS Hed Gar Treatment Area
- Waikamoi Preserve
- NPS Boundary

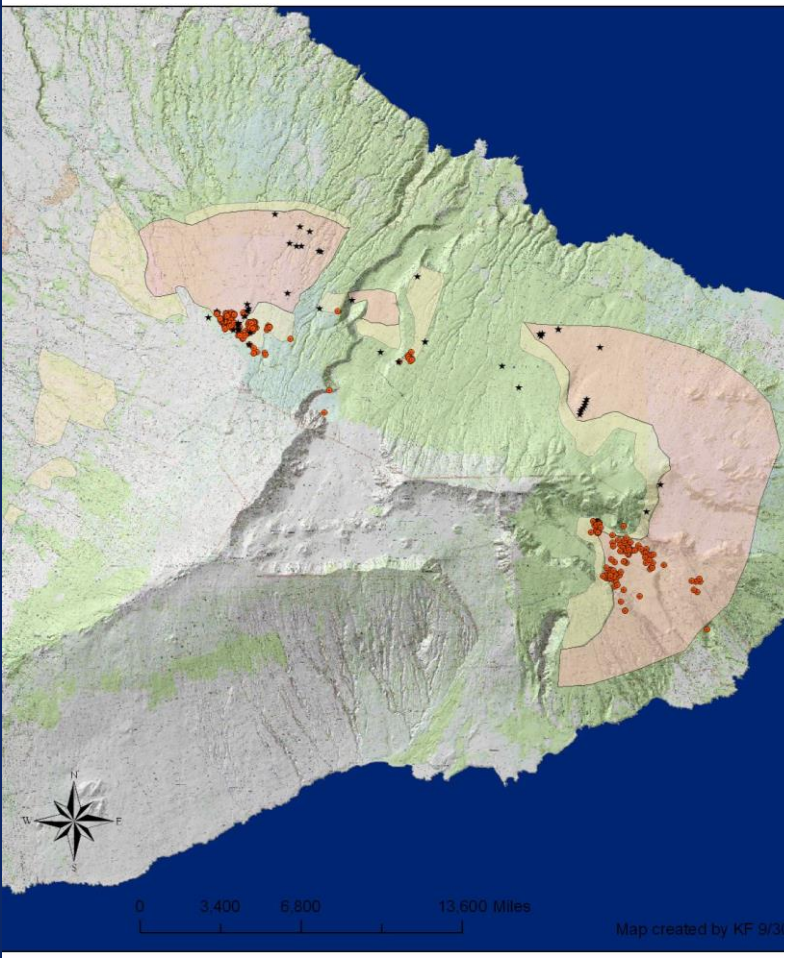
EMWP Units

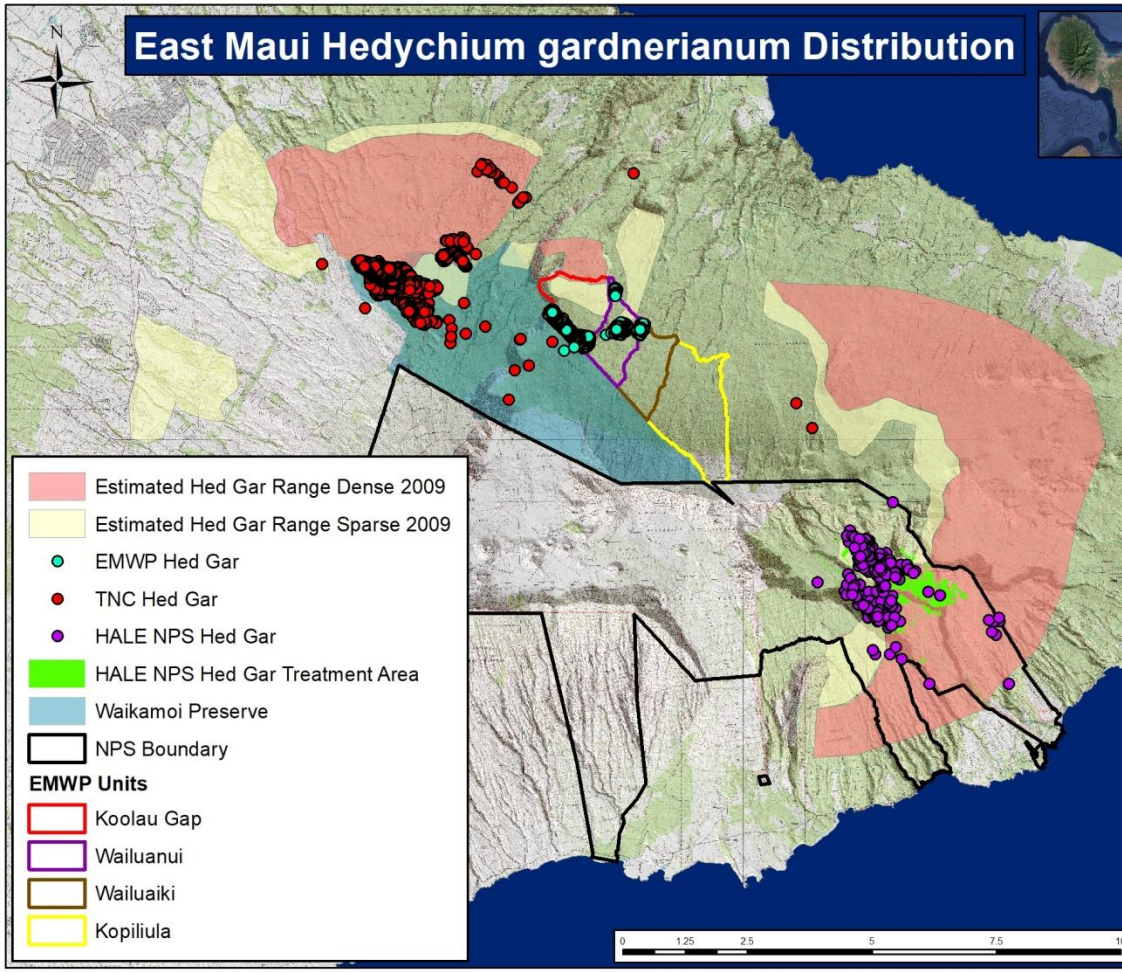
- Koolau Gap
- Wailuanui
- Wailuaiki
- Kopiliula

0 1.25 2.5 5 7.5 10 Miles

2008

2020


0
3,400
6,800
13,600 Miles
Map created by KF 9/3


East Maui Hedychium gardnerianum Distribution
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Estimated Hed Gar Range Dense 2009
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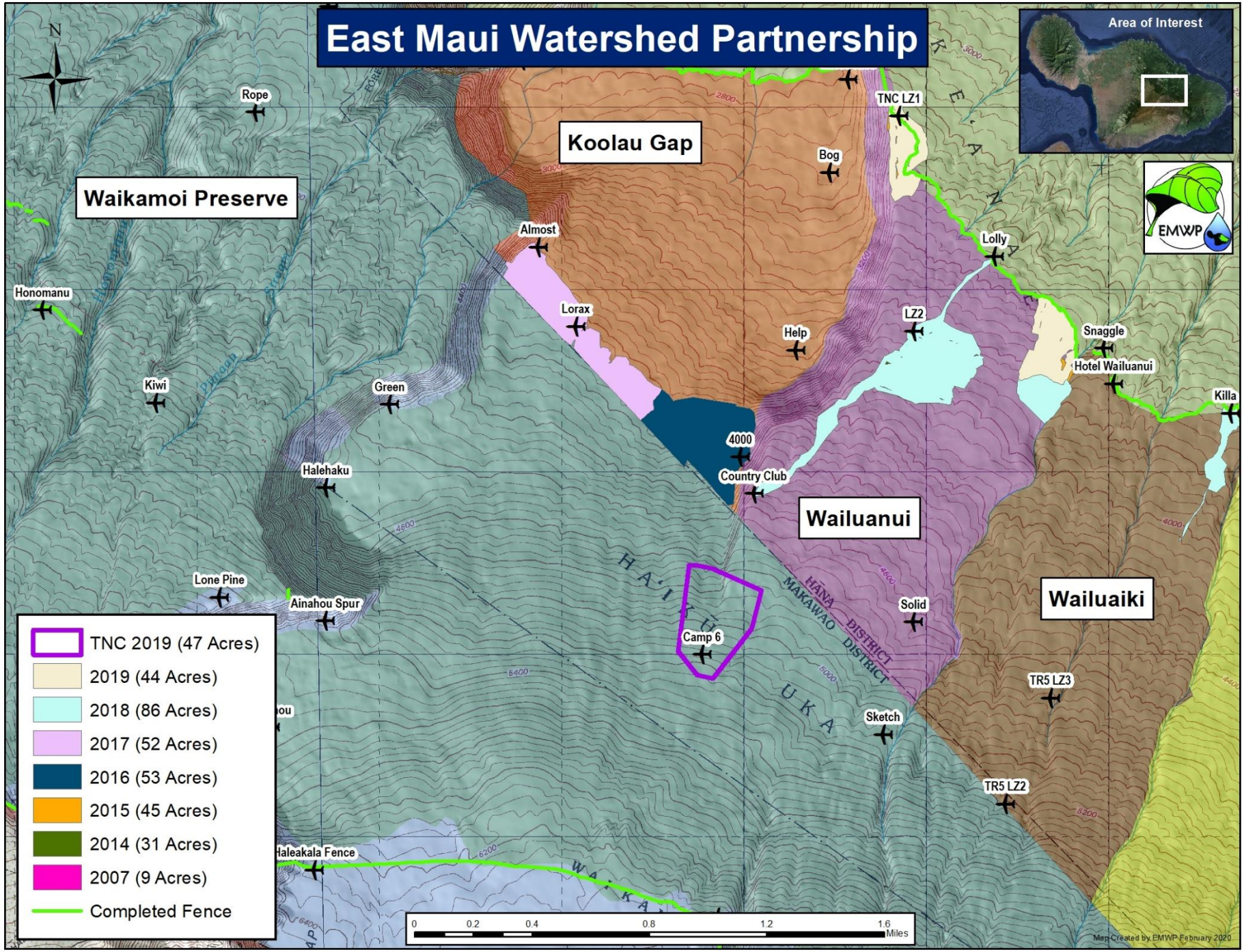
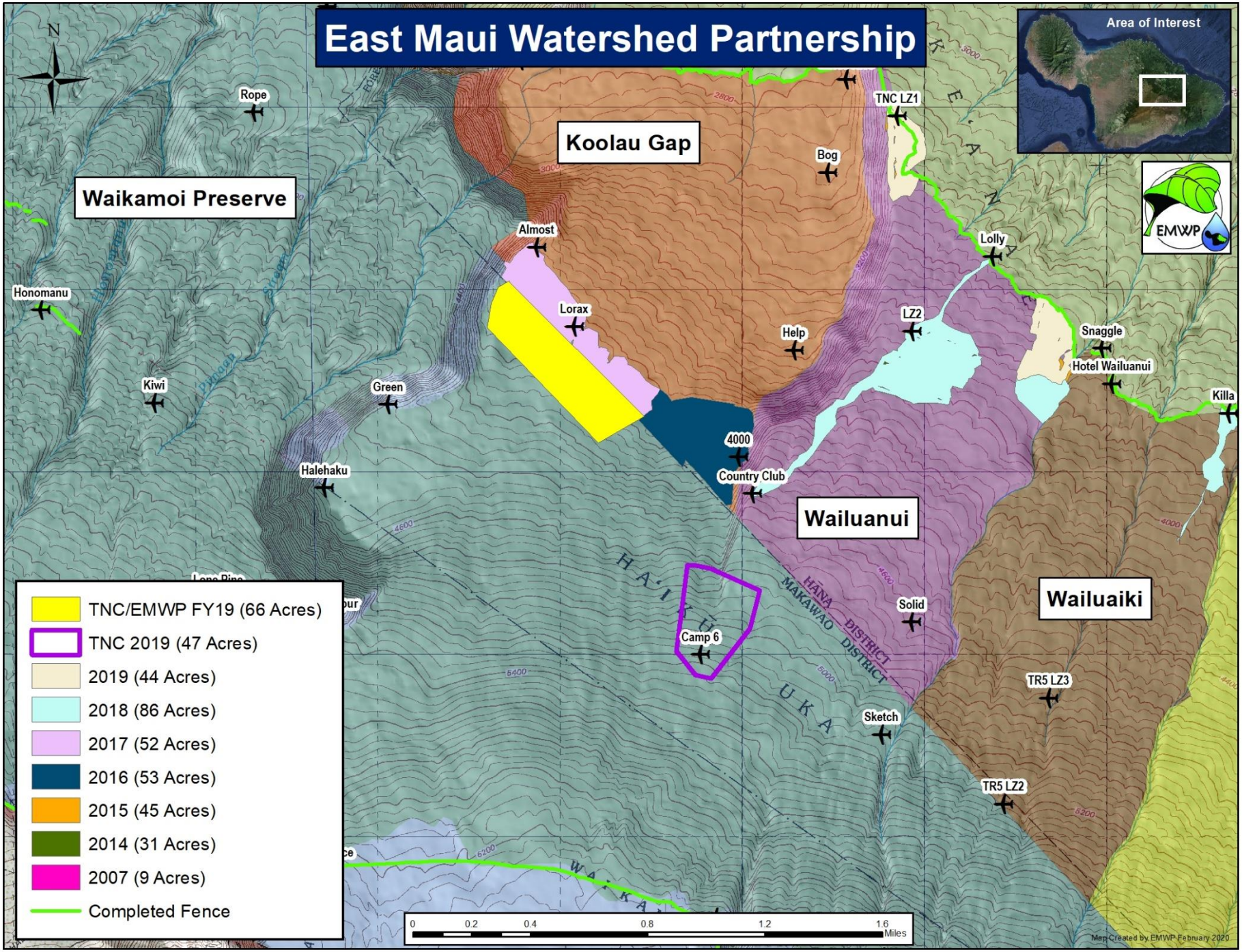
NPS Boundary
EMWP Units
Koolau Gap
Wailuanui
Wailuaiki
Kopiliula
0
1.25
2.5
5
7.5

Ginger Control Strategy & Approach


East Maui Watershed Partnership
Area of Interest
EMWP
Waikamoi Preserve
Koolau Gap
Wailuanui
Wailuaiki
Rope
TNC LZ1
Bog
Almost
Lolly
Honomanu
Lorax
Help
LZ2
Snaggle
Hotel Wailuanui
Killa
Kiwi
Green
4000
Country Club
Halehaku
Lone Pine
Ainahou Spur
Camp 6
Solid
TR5 LZ3
Sketch
TR5 LZ2
Haleakala Fence
HĀNA DISTRICT
MAKAWAO DISTRICT
TNC 2019 (47 Acres)
2019 (44 Acres)
2018 (86 Acres)
2017 (52 Acres)
2016 (53 Acres)
2015 (45 Acres)
2014 (31 Acres)
2007 (9 Acres)
Completed Fence
0 0.2 0.4 0.8 1.2 1.6 Miles
Map Created by EMWP February 2020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Rope
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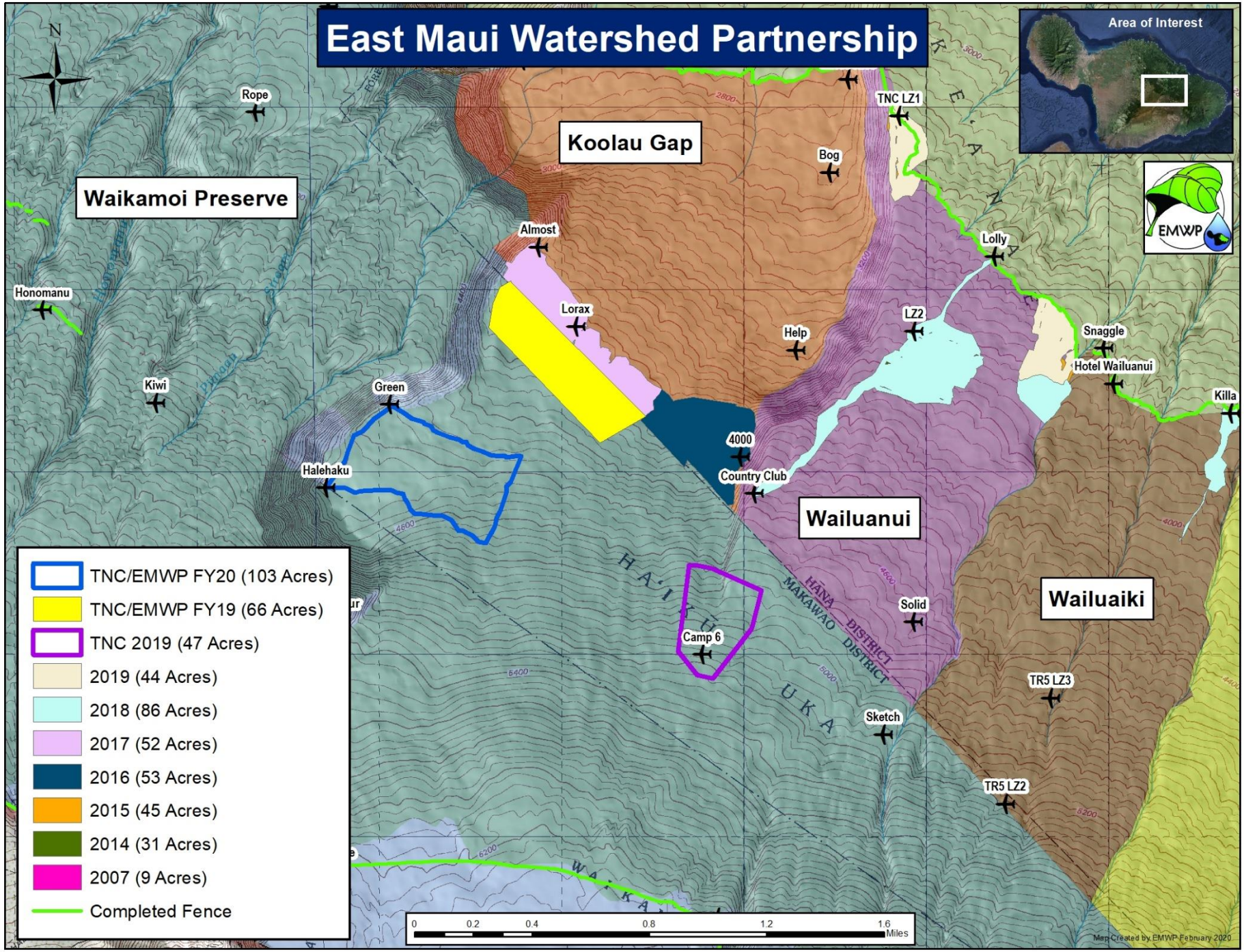
Killa
Kiwi
Green
4000
Country Club
Halehaku
Solid
Camp 6
TR5 LZ3
Sketch
TR5 LZ2
HĀNA DISTRICT
MAKAWAO DISTRICT
TNC/EMWP FY19 (66 Acres)
TNC 2019 (47 Acres)
2019 (44 Acres)
2018 (86 Acres)
2017 (52 Acres)
2016 (53 Acres)
2015 (45 Acres)
2014 (31 Acres)
2007 (9 Acres)
Completed Fence
0 0.2 0.4 0.8 1.2 1.6 Miles
Map Created by EMWP February 2020


East Maui Watershed Partnership
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LZ2
Help
Snaggle
Hotel Wailuanui
Killa
4000
Country Club
Solid
Camp 6
Sketch
TR5 LZ3
TR5 LZ2
HĀNA DISTRICT
MAKAWAO DISTRICT
HALEAKALA
WAIKAMOI
TNC/EMWP FY20 (103 Acres)
TNC/EMWP FY19 (66 Acres)
TNC 2019 (47 Acres)
2019 (44 Acres)
2018 (86 Acres)
2017 (52 Acres)
2016 (53 Acres)
2015 (45 Acres)
2014 (31 Acres)
2007 (9 Acres)
Completed Fence
0 0.2 0.4 0.8 1.2 1.6 Miles
Map Created by EMWP February 2020

Ginger Control Techniques

- Cut Stump Using Sickle + Stabbing
- Spot Spray Rhizomes With Herbicide

1/2 gram Escort + 10 ml Methylated Seed Oil (MSO) per liter Water

- Cover Treated Area With Cut Ginger Leaves
- GPS Point (Square Meters, Mature/Immature)

GROUP 2 HERBICIDE

Escort® XP

HERBICIDE

Dry Flowable

Active Ingredient	By Weight
Metsulfuron methyl Methyl 2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]-carbonyl]amino]sulfonyl]benzoate	60%
Other Ingredients	40%
TOTAL	100%

EPA Reg. No. 432-1549
EPA Est. No. 065604-AR-001

Nonrefillable Container

KEEP OUT OF REACH OF CHILDREN

CAUTION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

See inside leaflet for complete First Aid Instructions, Precautionary Statements, Directions for Use and Storage and Disposal Instructions.

Net Weight
1 Pound
84122394
A01798371 150622AV4

FIFRA Section 24(c) Special Local Need Label

FOR DISTRIBUTION AND USE ONLY WITHIN THE STATE OF HAWAII

For Spot Treatment for the Control of Wild Ginger

Escort XP Herbicide®

EPA Reg. No. 432-1549 SLN. No. HI-160002

THIS LABEL IS VALID UNTIL 10/10/2021 UNLESS OTHERWISE AMENDED, WITHDRAWN, CANCELED, OR SUSPENDED.

Escort Herbicide is a dispersible granule that is mixed in water and applied as spray. The use of Escort XP Herbicide under this Special Local Need registration is specific to spot application(s) for control of wild ginger (*Hedychium sp.*) in forests (montane wet forest, mesic forest), forest margins, and other mid to high elevation wildland areas where this plant is invasive.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. This label must be in the possession of the user at the time of pesticide application. Follow all applicable directions, restrictions, Worker Protection Standard requirements, and precautions on the EPA registered label.

Escort XP Herbicide is recommended for the control of wild ginger (*Hedychium sp.*) in forests, forest margins, and access roads and trails.

Apply Escort XP Herbicide at 0.067-0.133 ounces (1.9 -3.8 grams) per gallon of water (½ -1 gram Escort XP Herbicide per liter of water) for spot treatments, not to exceed 3 ounces (85 grams) per acre per year within the spot treatment area.

HOW TO USE

Spot applications may be made using backpack sprayers, hand-held tanks, spray bottles, or lab squirt applicator bottles. Apply to the leaves, exposed rhizomes, and cut surface or stalks and rhizomes. To maximize uptake when treating cut ginger stems and rhizomes, cut into dormant corms and apply Escort XP Herbicide solution. When applying Escort XP herbicide solution, avoid run-off or overspray onto soil by directing spray at ginger surface rhizomes or foliage only.

Escort XP Herbicide may be combined with non-ionic surfactant to improve foliar uptake.

The use of dye is recommended to track spray solution.

Spot applications to limit regrowth may be made on as-needed basis.

ACCEPTED

October 11, 2016

Under Hawaii Pesticides Law as Supplement to Product No. 9346.388

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Label Limit

- 85g / Acre / Year
- .5g/L (Our Mix)
- 85g = 42.5gal

“How To Determine Whether The Pesticide Legal Limit Has Been Reached or Exceeded in Your Management Area Using ArcGIS 10.0”

HowToDetermineWhetherThePesticideLegalLimitHasBeenReachedUsingArcGIS10v2.pdf - Adobe Acrobat Reader DC

File Edit View Window Help

Home Tools AO2019-6.pdf HowToDetermineW... Sign In

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ResearchGate

How To Determine Whether The Pesticide Legal Limit Has Been Reached Using ArcGIS 10v2

Method · July 2014

1 author:

Theresa Menard
The Nature Conservancy
6 PUBLICATIONS 18 CITATIONS
SEE PROFILE

Available on ResearchGate

How To Determine Whether The Pesticide Legal Limit

Has Been Reached Or Exceeded In Your Management Area Using ArcGIS 10.0.

(Or what Theresa Menard and Kerri Fay did with the Maui Pesticide Data, April 2014…)

Determine what the legal limit of your pesticide is by reading the official pesticide label for your pesticide product. In this case, we wanted to know if we exceeded the legal limit for Escort XP (EPA Reg. No 352-439), which is “not to exceed 85 g (3 oz) per acre per year within the spot treatment area” (http://www.cdms.net/LDat/ld5QT025.pdf). Escort XP is metsulfuron methyl (60%) manufactured by Dupont.

1. Open the ArcMap Document you will be using to do the analysis (e.g. MauiPesticideUse.mxd) .

2. Add or Create the 1-acre Fishnet grid (“Fishnet 1acAreaPoly2clip.shp”) that you will be using to mash everything up to.

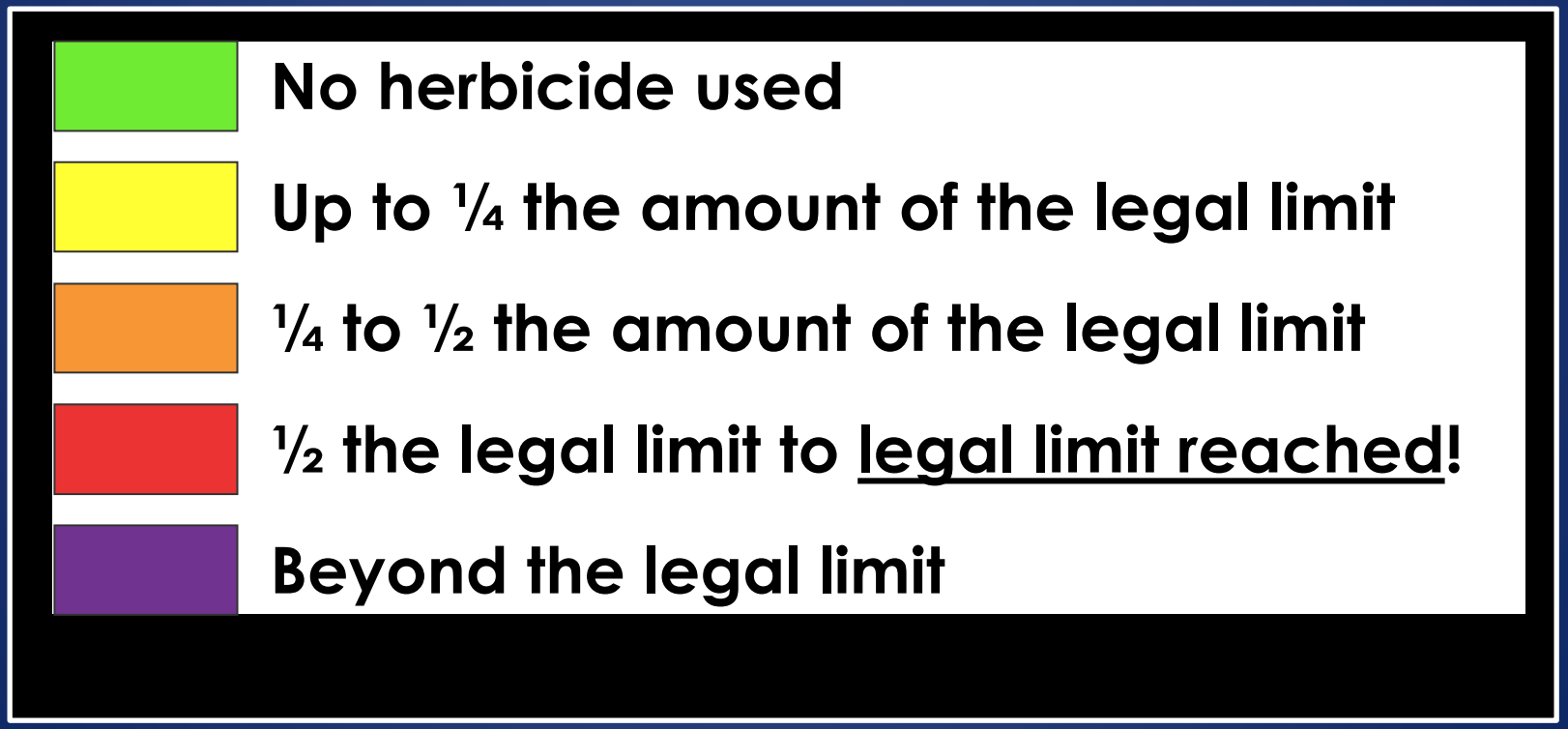
   To create a fishnet grid, Theresa used XTools Pro as follows. In ArcMap, use the XTools Pro toolbar, to find and click on “Create Fishnet”. To create a grid of one acre squares, the sides of each square have to be 63.61 meters (1 acre = 4046.86 square meters and the square root of that is 63.61 meters). Change the Rows\Height to 63.61 and Columns\Height to 63.61. Check the “Clip output cells box” and navigate to the “Overlay” you want to create a fishnet of (in our case it was AreaPoly2.shp which Kerri derived from the Maui TMK files for Waikamoi and surrounding parcels).

   Or if you don’t have XTools Pro, and you want to create a fishnet using ArcToolbox, then use the Data Management Tools\Feature Class\Create Fishnet. In the pop up, name the “Output Feature Class”. Set the Cell Size Width and Cell Size Height to 63.61. Set the Number of Rows and Columns to “0”. Un-check the “Create Label Points” option. Select the “POLYGON” Geometry Type. The fishnet should appear in your mxd as a big rectangle (Kerri named it AreaPoly2Fishnet.shp). This should be clipped to your management area. To do this: use the Clip tool in the Geoprocessing Toolbar. For the “Input Features” use the fishnet (e.g. AreaPoly2Fishnet.shp), and the “Clip Feature” is the AreaPoly2.shp. Name the output feature class, ex: “fishnet1acareapoly2clip.shp”.

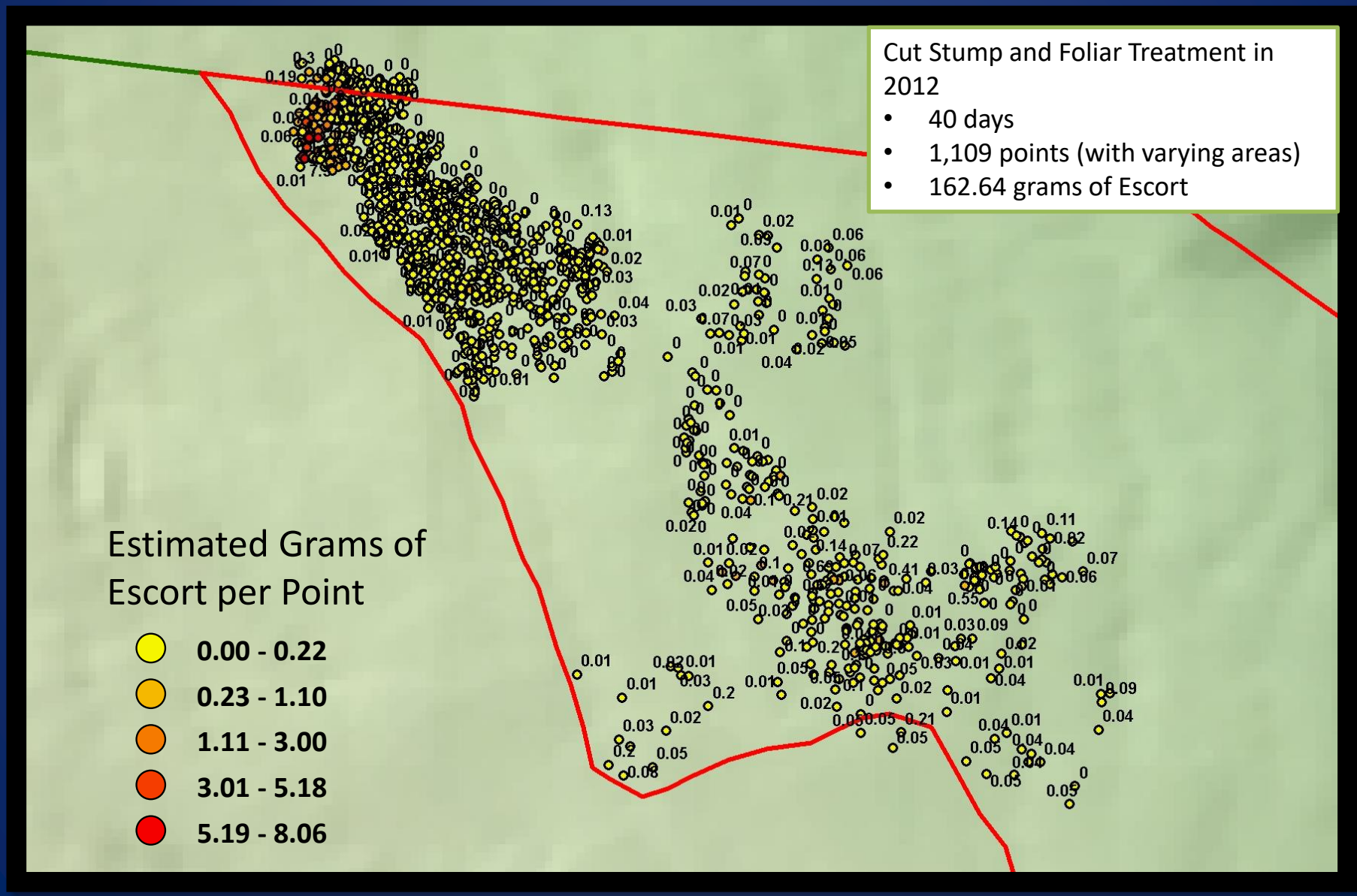
3. Now, add the weed data from the Maui GIS Database to your mxd by navigating to it: AddData\S:\Fieldwork\TNC_Maui_GIS.mdb\Weedpoint (it’s a feature class in the geodatabase). *Note: the weed data we are working with is point data. One can do a similar analysis with polygon data but the steps would be a little different. Ask Theresa Menard how to do it.*

Is TNC's pesticide use within the legal limits on the product label?

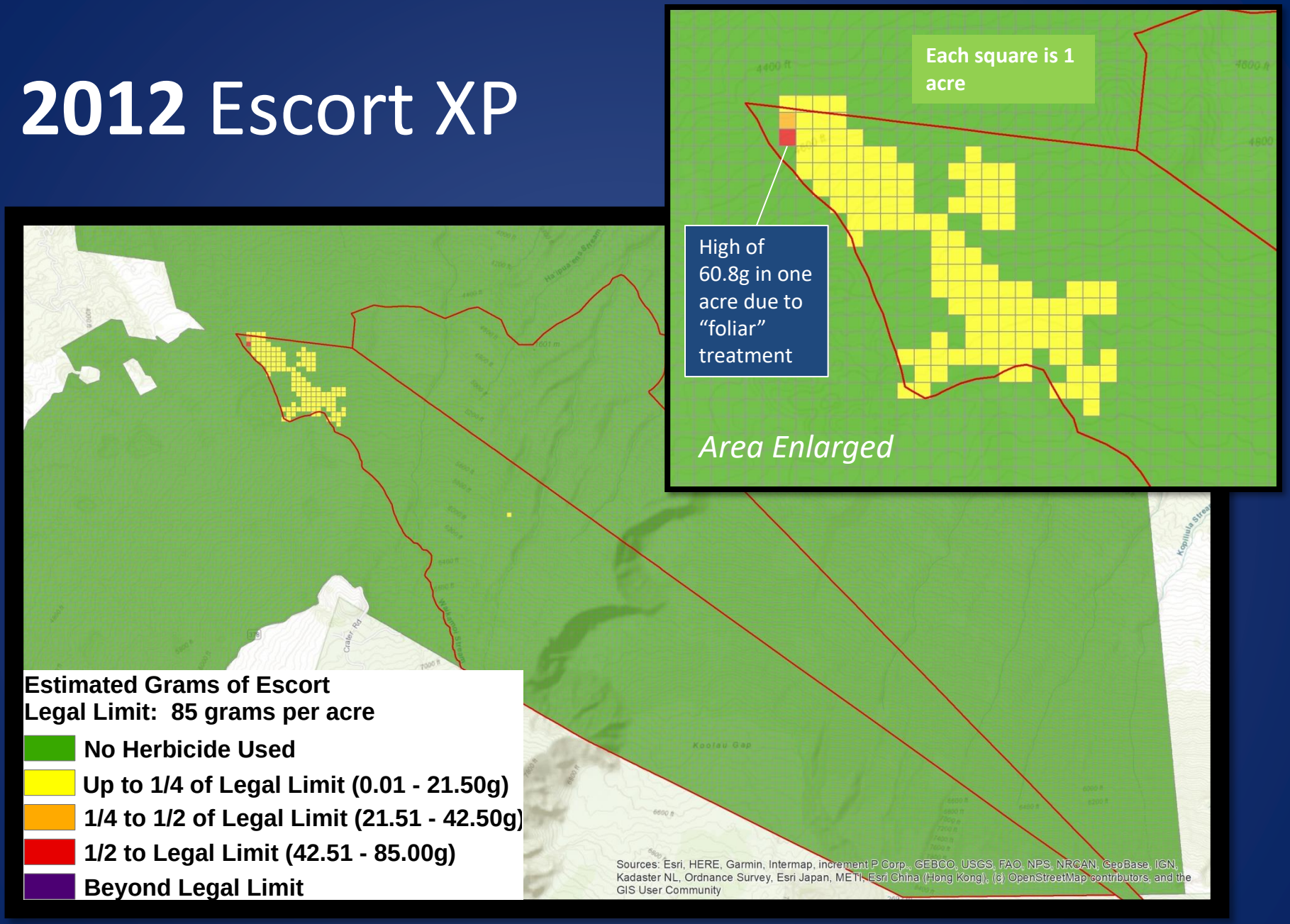
- We developed the following "warning legend" to quickly assess legal limits on the maps:



Escort XP
Herbicide Use at Waikamoi in 2012



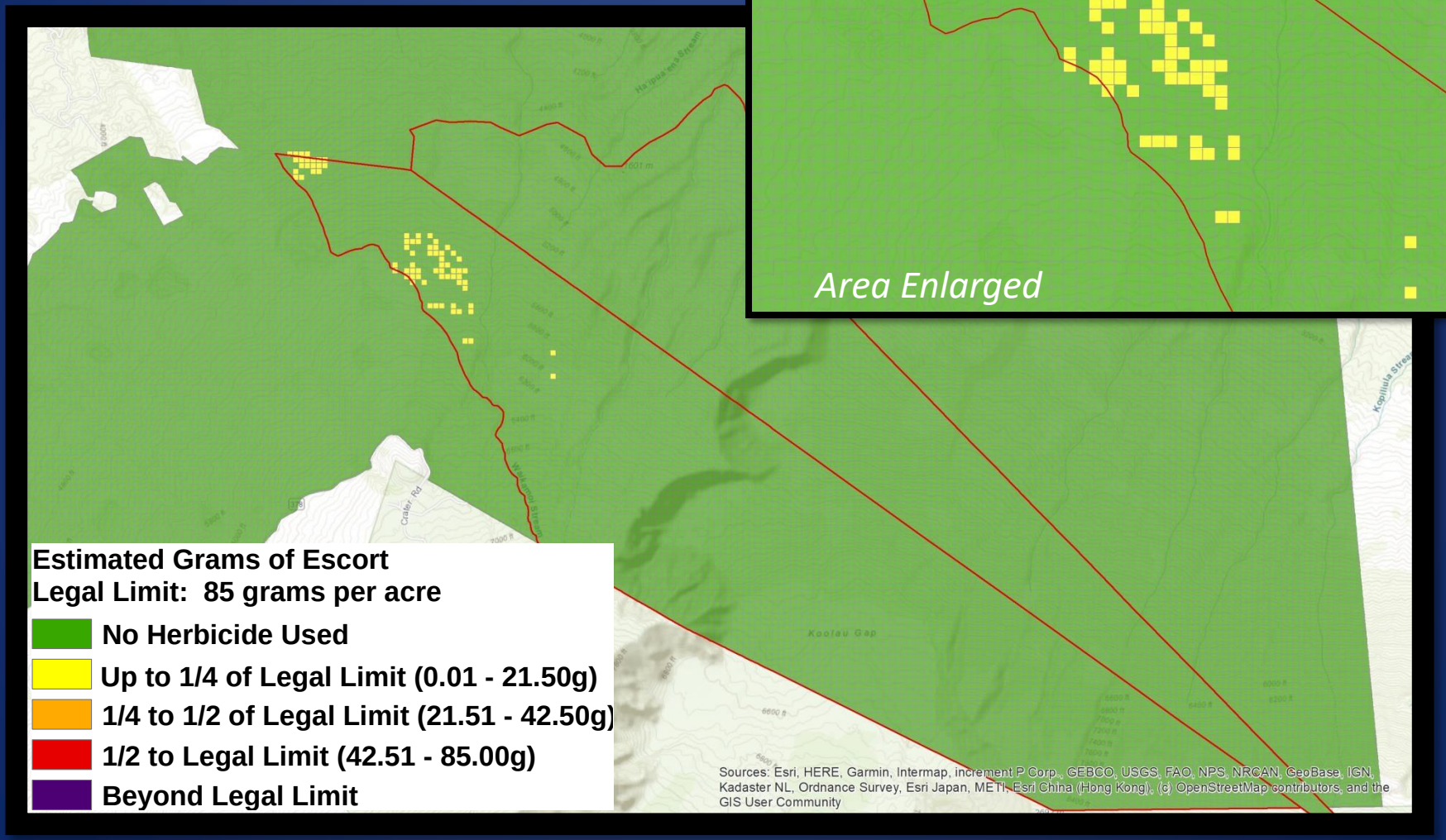
2012 Escort XP



Metsulfuron methyl (60%)

Data Analysis and Map by Theresa Menard,
TNC GIS Specialist. September 2013

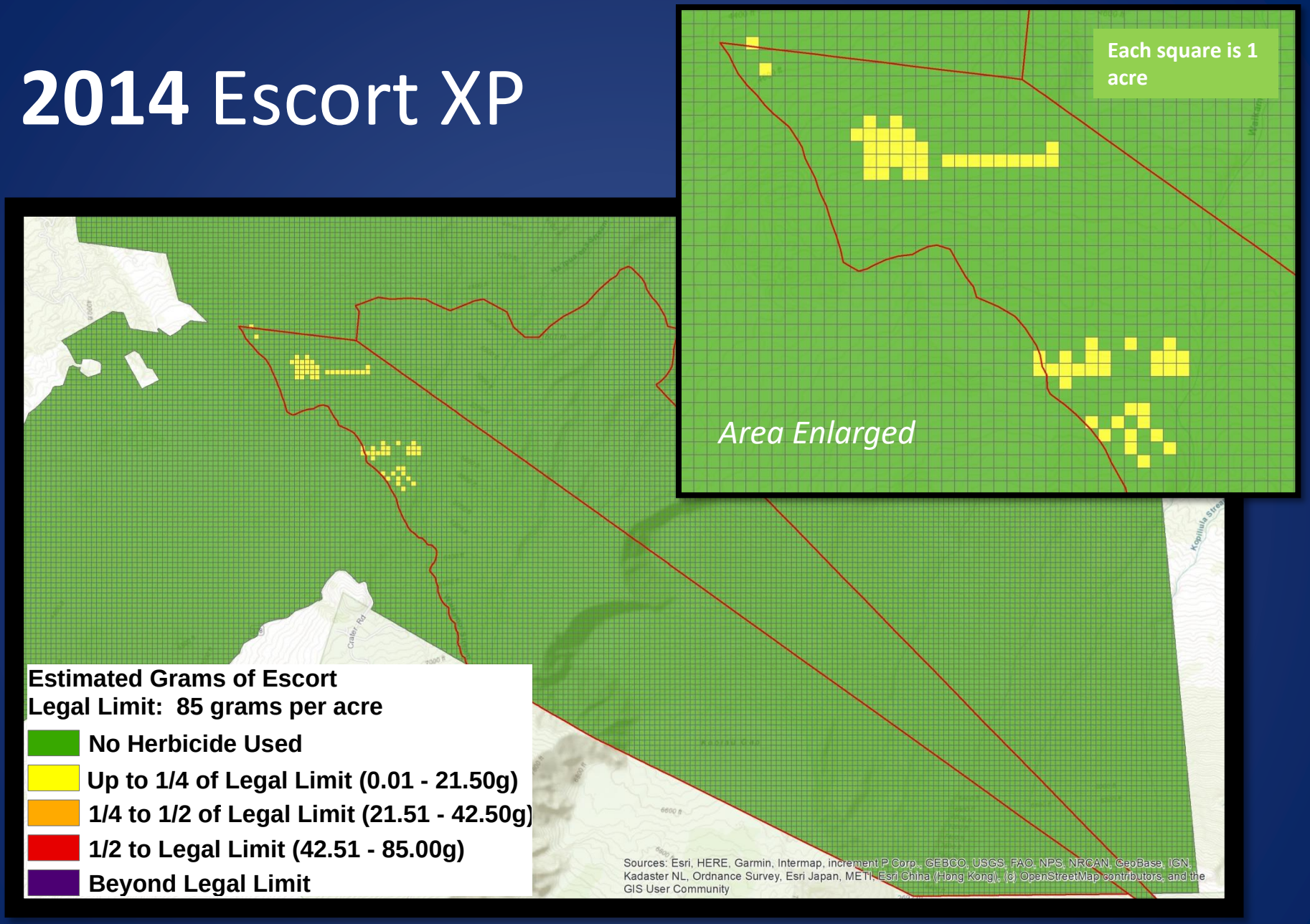
2013 Escort XP



Metsulfuron methyl (60%)

Data Analysis and Map by Theresa Menard,
TNC GIS Specialist. September 2013

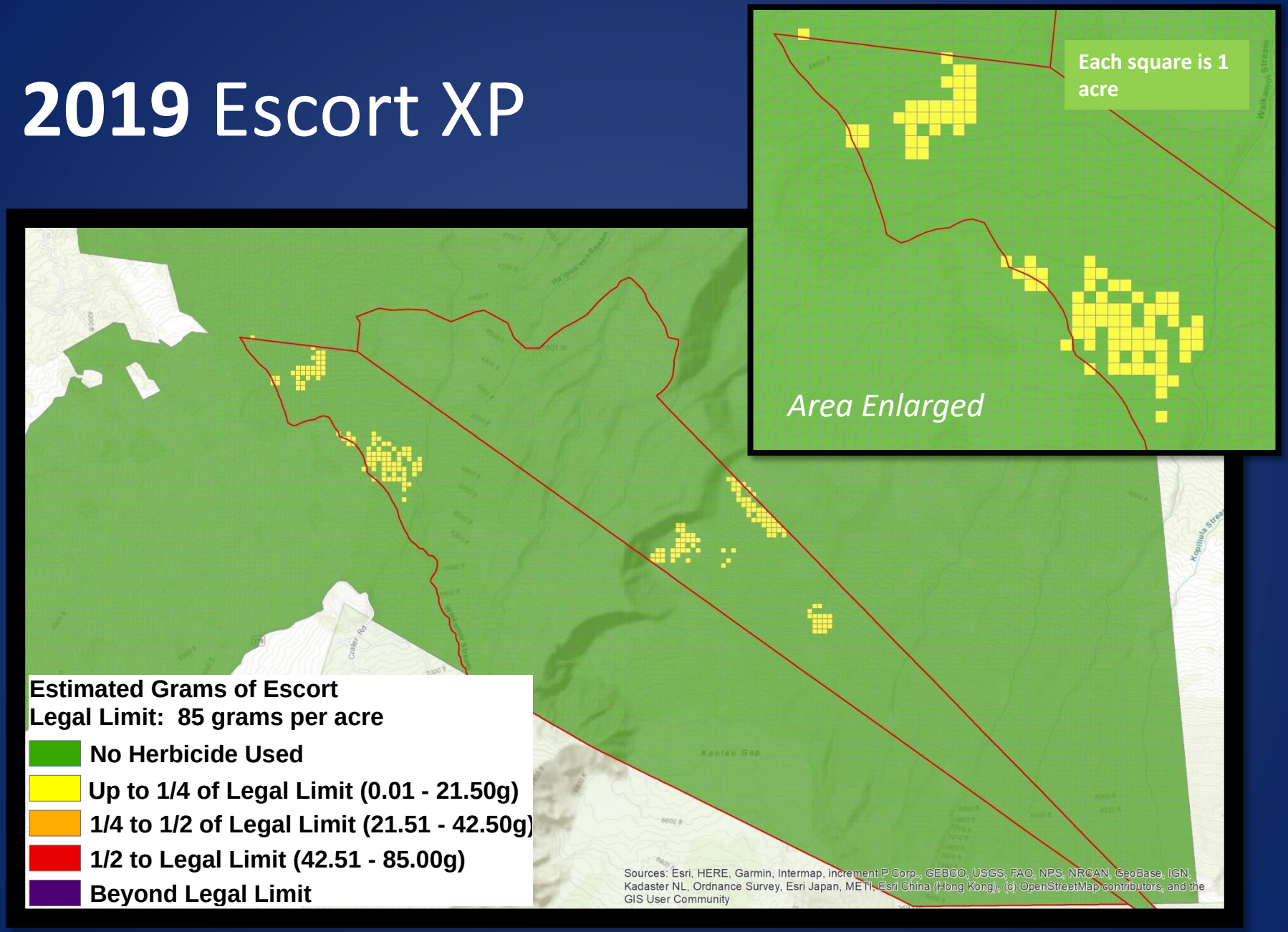
2014 Escort XP



Metsulfuron methyl (60%)

Data Analysis and Map by Theresa Menard,
TNC GIS Specialist. January 2020

2019 Escort XP



Metsulfuron methyl (60%)

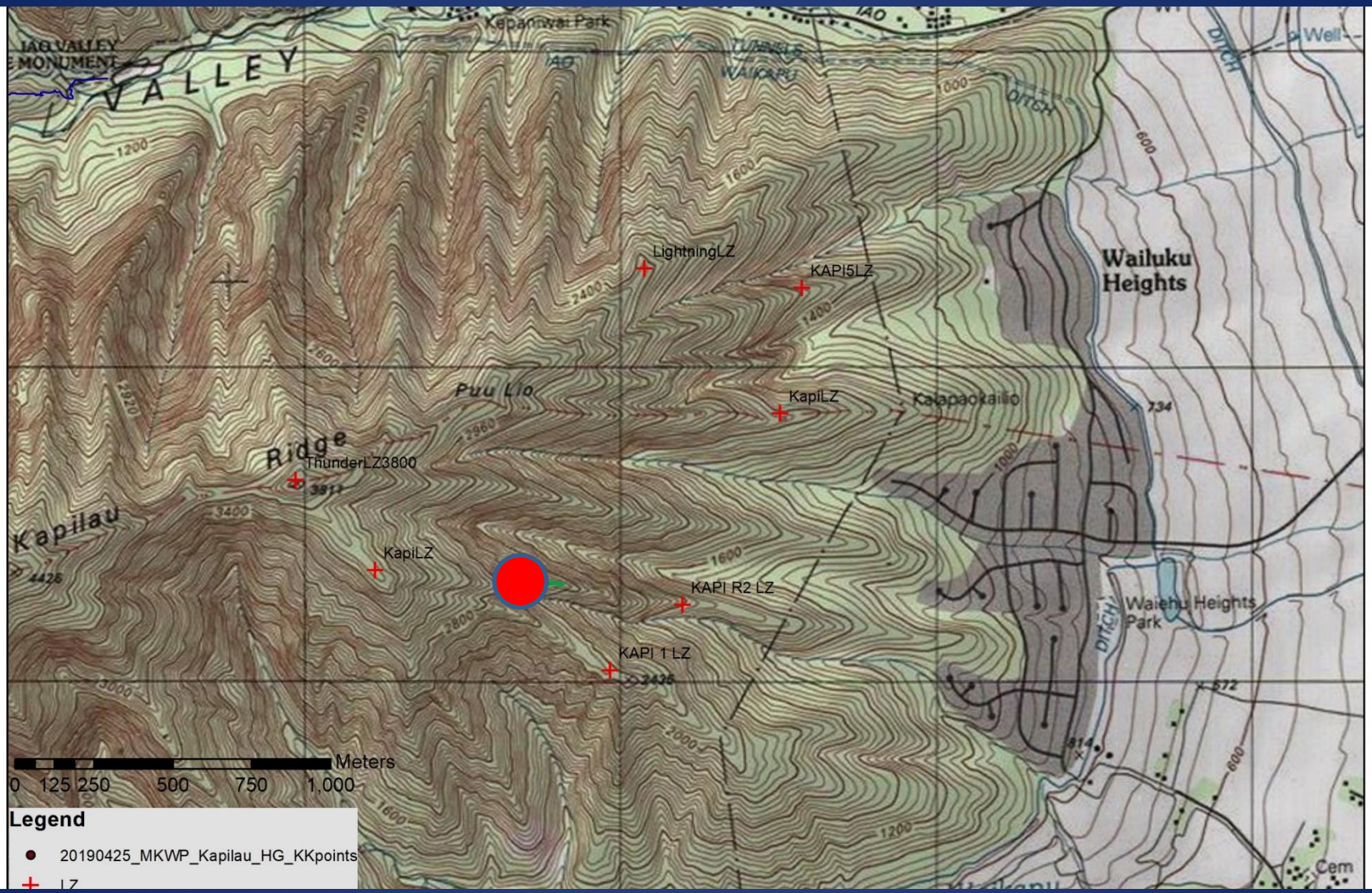
Data Analysis and Map by Theresa Menard,
TNC GIS Specialist. January 2020

The good news…

- TNC's application rate of Escort XP herbicide is way under the recommended 85 grams per acre per year.

Challenges & Limitations

- Very Wet, Rugged, Remote Environment
- Source Populations Remain
- Hard to Find & Treat Every Tiny Individual (Epiphytic)
- Resprouting If You Cut Wrong, or Don't Treat Every Rhizome (Including Subterranean) and Seedlings
- Dense Canopy Makes Aerial Detection Difficult
- Herbicide Mixture Designed for Immediate Use =Limited Storage Time
- Ginger Keeps Popping Up In New Locations – CURRENT GROUND EFFORTS ARE NOT ENOUGH!

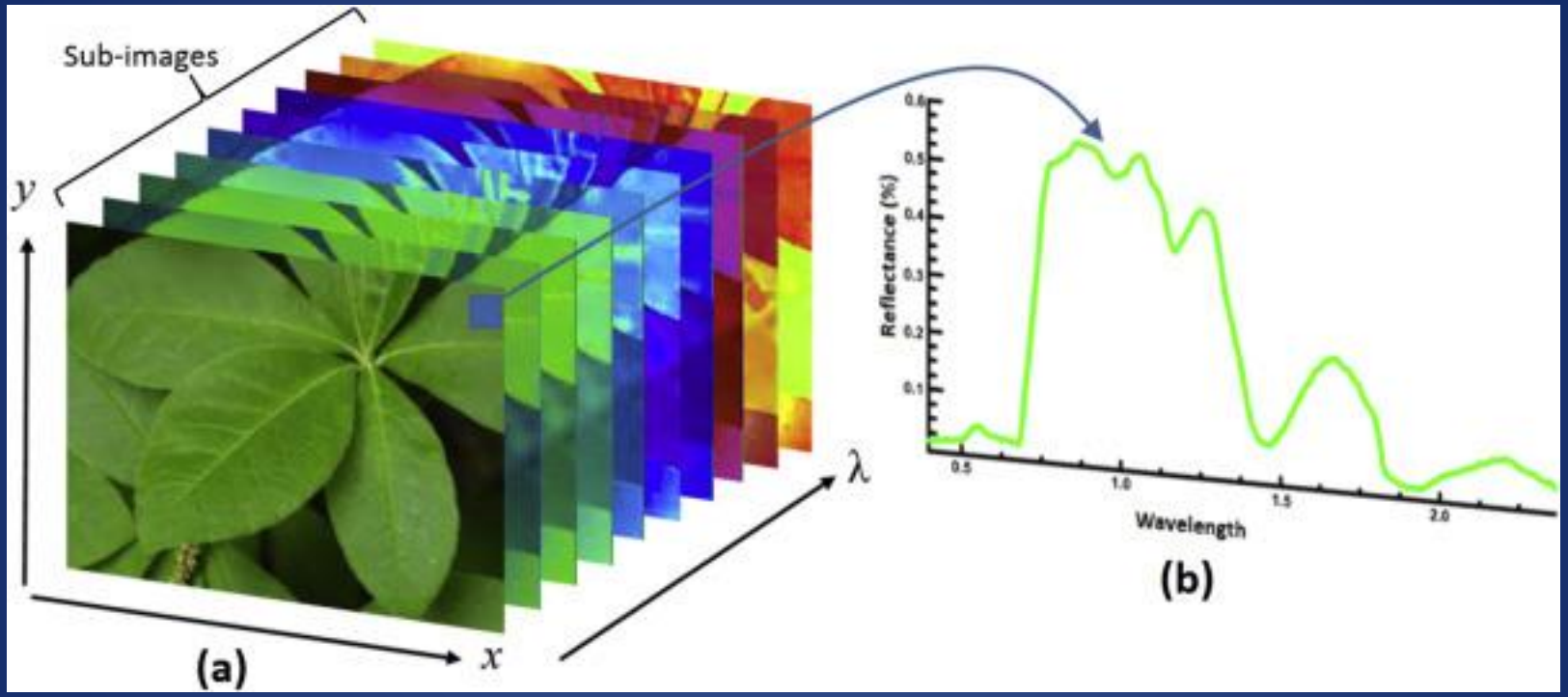

IAO VALLEY
MONUMENT
VALLEY
Kepaniwai Park
IAO
TUBBS
WAIKAPU
DITCH
Well
1200
1600
1000
600
LightningLZ
KAPI5LZ
2400
1400
Wailuku
Heights
Puu Lio
KapiLZ
Kalapaokaiao
734
Ridge
ThunderLZ3800
3811
3400
Kapilau
4428
KapiLZ
1600
KAPI R2 LZ
2800
Waiehu Heights
Park
KAPI 1 LZ
2425
3000
572
614
2000
600
1200
1600
Meters
0 125 250 500 750 1,000
Legend
20190425_MKWP_Kapilau_HG_KKpoints
LZ
Cem

Looking Ahead – 2020 Goals

- Continue to Monitor & Treat Known Populations
  - Identify and Treat Outliers
  - Collaborate With Partners - Share Data!
- Begin Re-Sweeping Koolau Gap (more potential outliers?)
- Explore Alternative Herbicide Cocktails
  - HBT
- ***Hyperspectral Imaging**
- ***Integrated Pest Management**

  <u>Pursue Biocontrol Options</u>

Hyperspectral Imaging



"Hyperspectral imaging (HSI) is a technique that analyzes a wide spectrum of light instead of just assigning primary colors (red, green, blue) to each pixel. The light striking each pixel is broken down into many different spectral bands in order to provide more information on what is **imaged**."

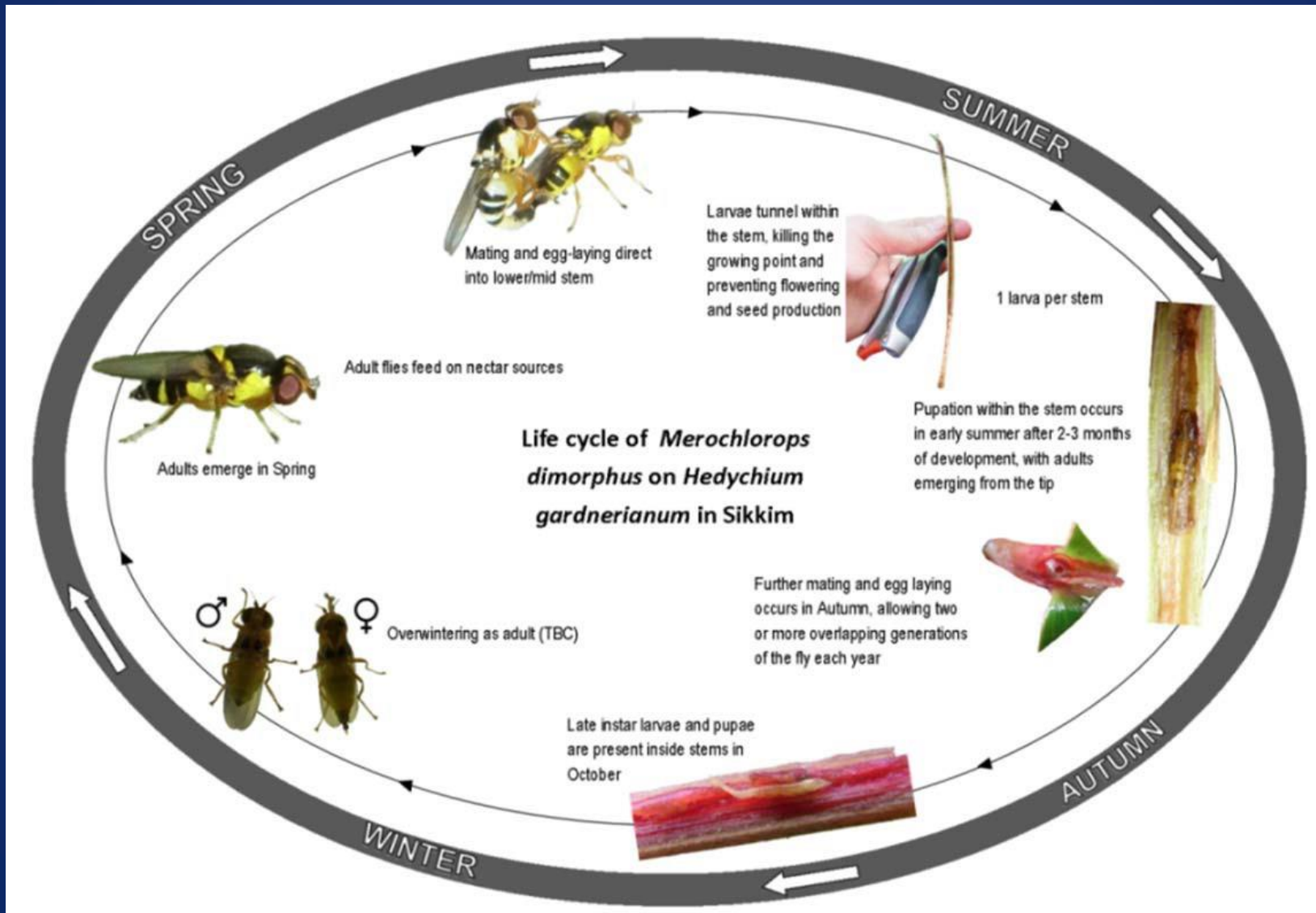
Hyperspectral Imaging

- Dr. Ryan Perroy – UH Hilo Professor
  - Small Unmanned Aerial System platforms(sUAS)
    - High resolution cameras
  - Miconia on Hawaii Island
  - Coconut Palms in Micronesia
- Phenology important for HedGar
  - Potentially reduce human footprint on native habitat

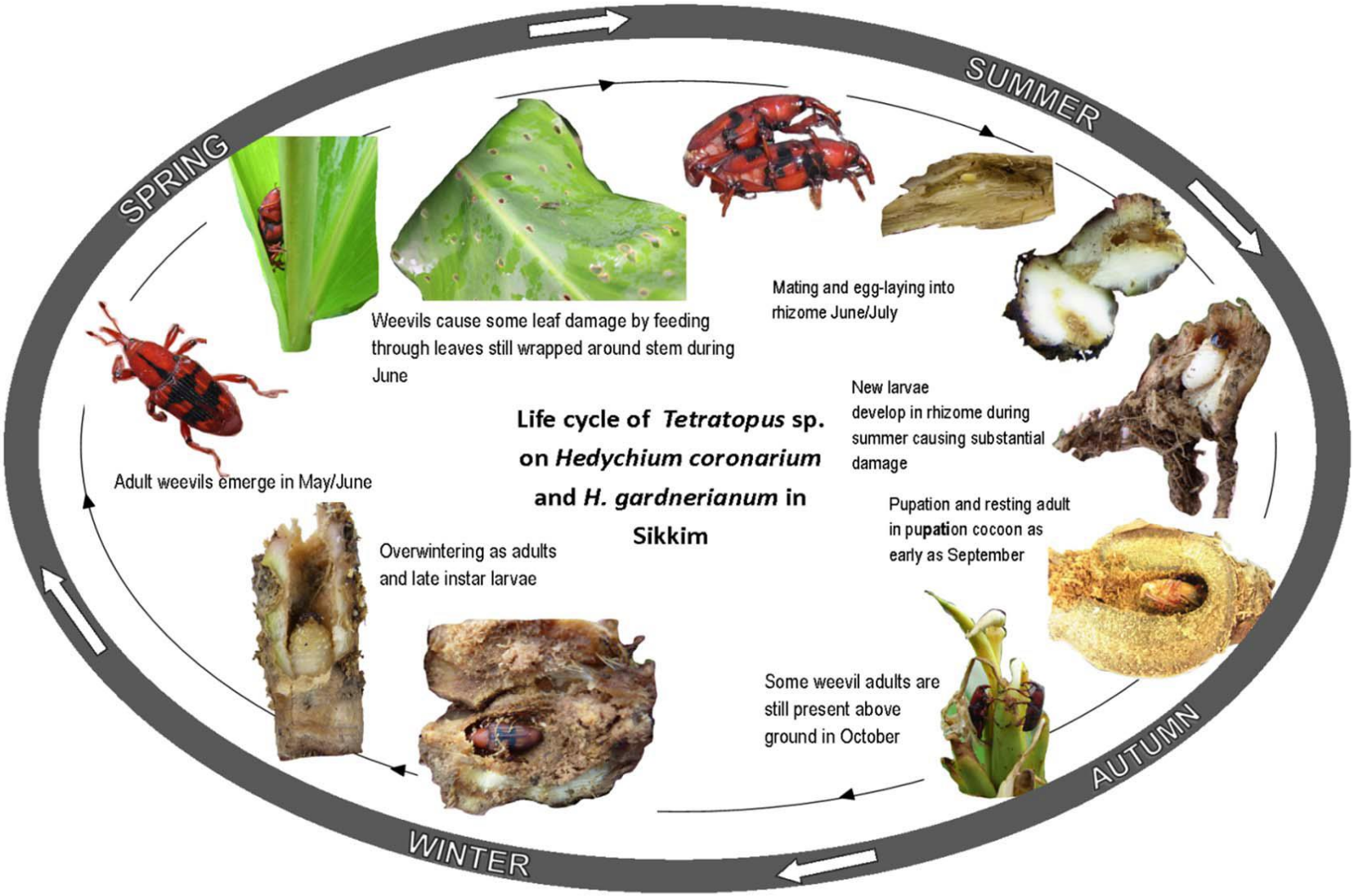
Biocontrol Possibilies for Himalayan Ginger

- Merochlorops sp.
- *Tetratopus* Weevil

Merochlorops Life Cycle



Proposed lifecycle for *Tetratopus* sp. weevil on *H. coronarium* and *H. gardnerianum*



Newly emerged adult *Tetratopus* weevil in quarantine (ex India *H. gardnerianum*-collected as larva)

Damage to *Hedychium coronarium* rhizome caused by *Tetratopus* weevil larva in quarantine

Tetratopus larva in *H. coronarium* in Sikkim

The Nature Conservancy® of Hawai'i

Mahalo!

EMWP
East Maui Watershed PARTNERSHIP

'A'OLE GINGERVITIS