Mapping dead tree biomass from the recent California mortality event

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Objectives:

1. Quantify and map standing dead biomass that has resulted from the recent die-off

2. Determine how much of that biomass, and where, could be feasibly harvested for biomass energy

3. Calculate the cost of harvesting the biomass and transporting it to roadside
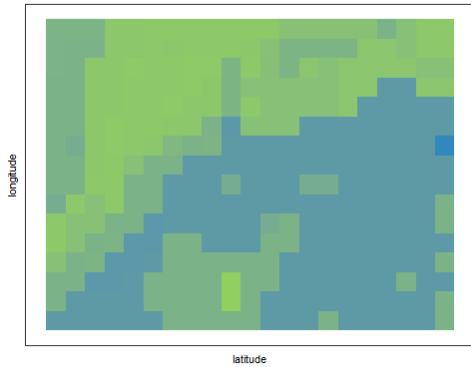
Limited data on biomass availability
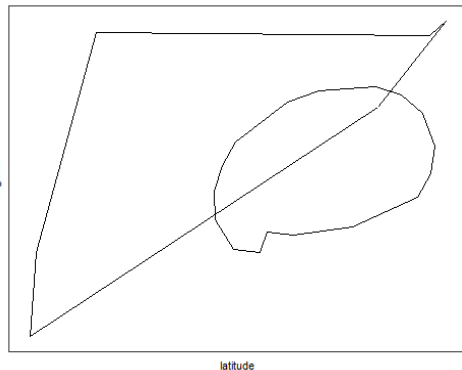
Aerial Detection Monitoring

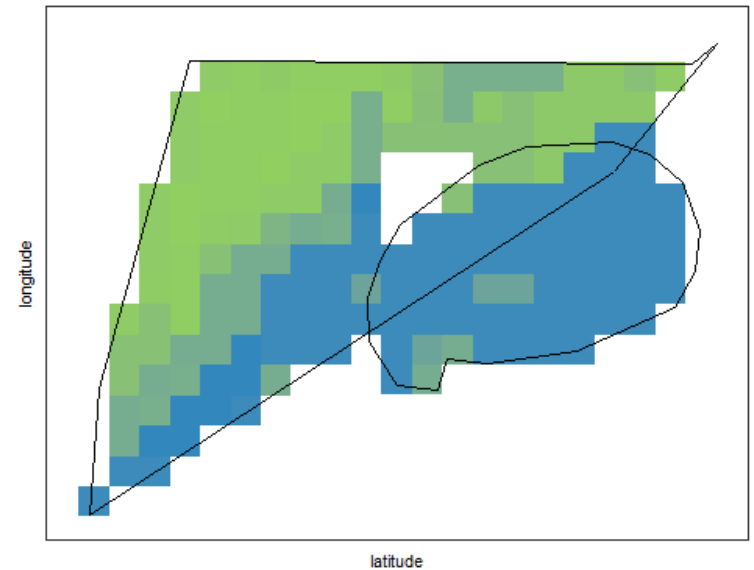https://www.uvm.edu/femc/products/long_term_update/2014/aerial_detection
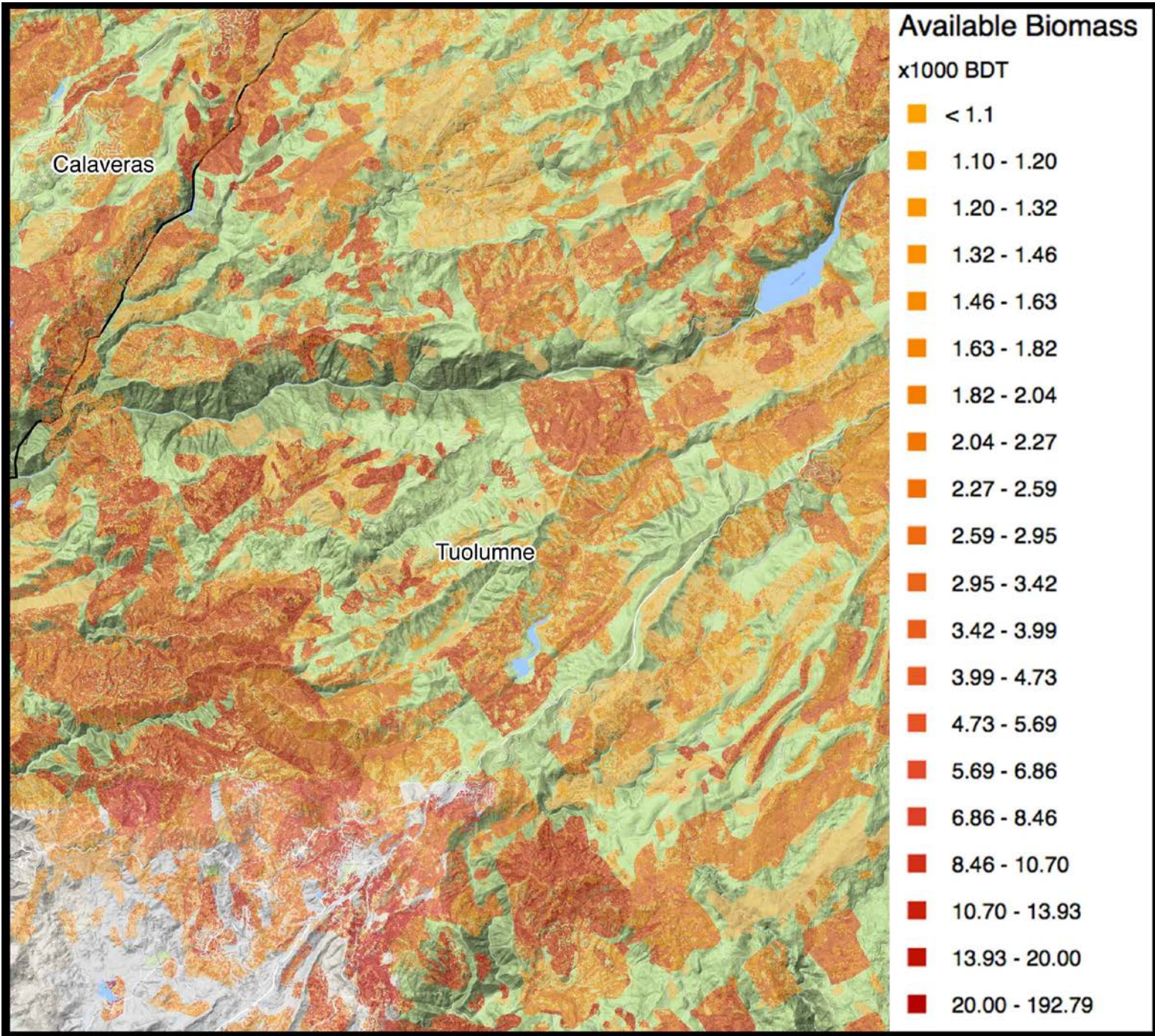
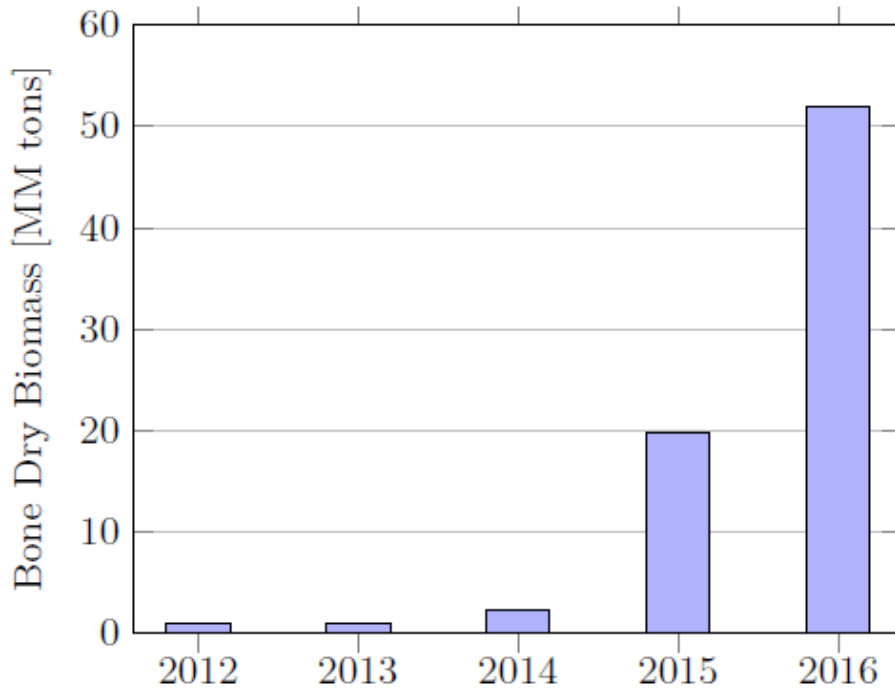# Calculating dead biomass

Forest structure data

(LEMMA GNN maps)

Mortality polygons

Biomass map

Methods

Available Biomass

x1000 BDT

- ■ < 1.1
- ■ 1.10 - 1.20
- ■ 1.20 - 1.32
- ■ 1.32 - 1.46
- ■ 1.46 - 1.63
- ■ 1.63 - 1.82
- ■ 1.82 - 2.04
- ■ 2.04 - 2.27
- ■ 2.27 - 2.59
- ■ 2.59 - 2.95
- ■ 2.95 - 3.42
- ■ 3.42 - 3.99
- ■ 3.99 - 4.73
- ■ 4.73 - 5.69
- ■ 5.69 - 6.86
- ■ 6.86 - 8.46
- ■ 8.46 - 10.70
- ■ 10.70 - 13.93
- ■ 13.93 - 20.00
- ■ 20.00 - 192.79

Calaveras
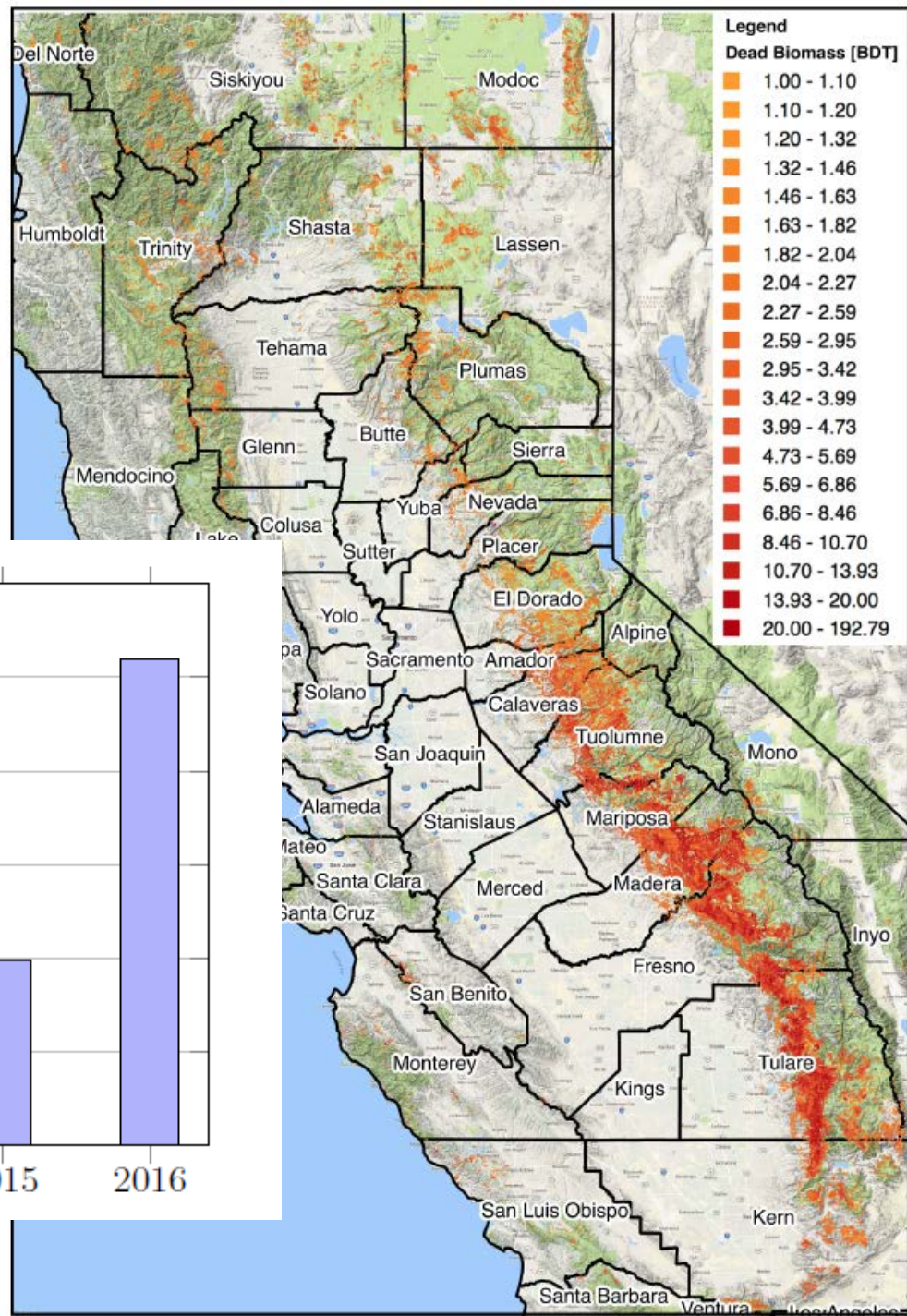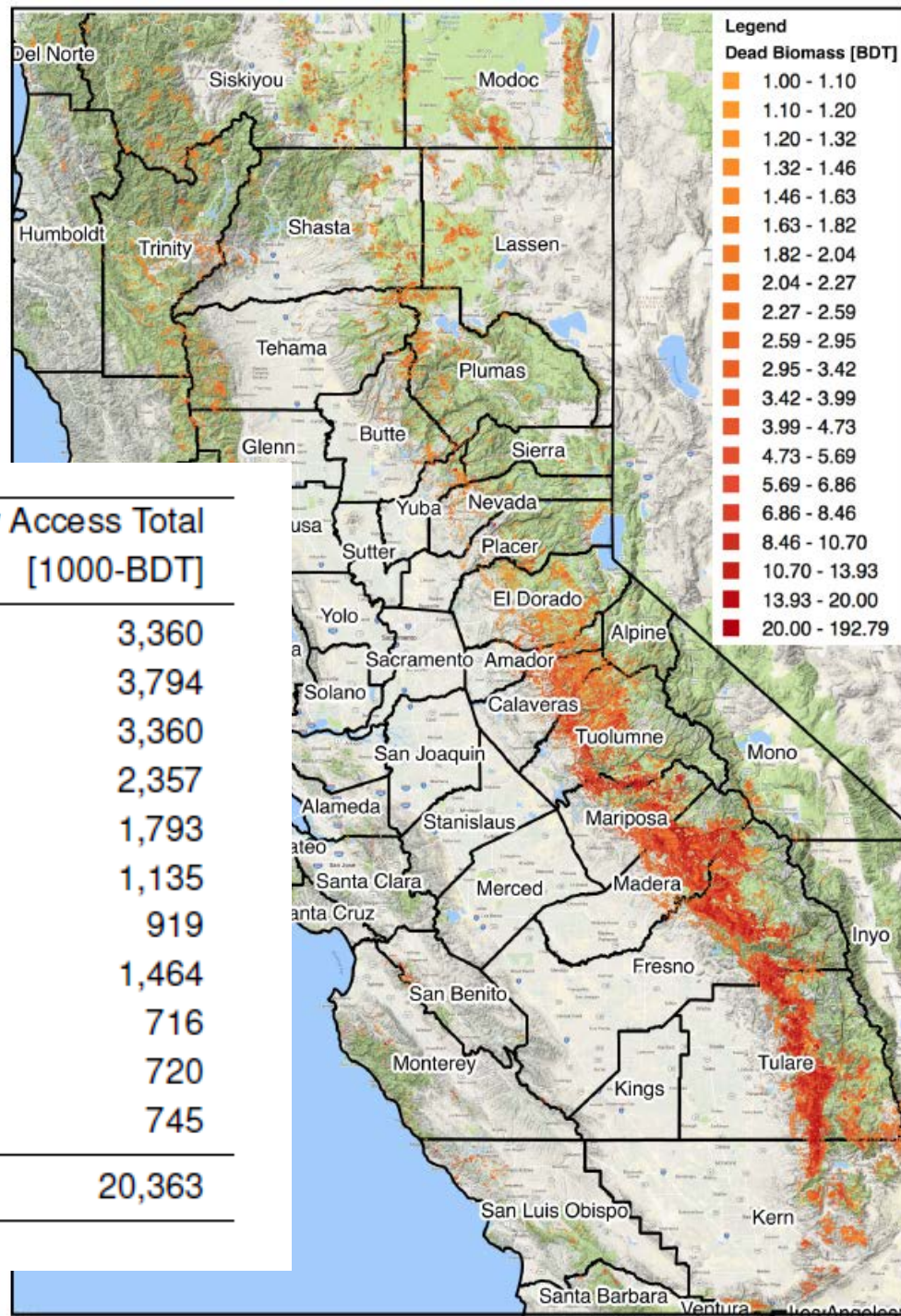
Tuolumne

80.7 million metric tons of standing dead biomass

88% of dead biomass is in 10 counties

County	Raw Total [1000-BDT]	Easy Access Total [1000-BDT]
Tulare	21,555	3,360
Fresno	14,330	3,794
Madera	9,638	3,360
Tuolumne	7,046	2,357
Mariposa	6,916	1,793
Kern	3,606	1,135
Calaveras	2,190	919
Modoc	1,916	1,464
Siskiyou	1,824	716
El Dorado	1,573	720
Lassen	912	745
Total	71,397	20,363

Legend
Dead Biomass [BDT]
- 1.00 - 1.10
- 1.10 - 1.20
- 1.20 - 1.32
- 1.32 - 1.46
- 1.46 - 1.63
- 1.63 - 1.82
- 1.82 - 2.04
- 2.04 - 2.27
- 2.27 - 2.59
- 2.59 - 2.95
- 2.95 - 3.42
- 3.42 - 3.99
- 3.99 - 4.73
- 4.73 - 5.69
- 5.69 - 6.86
- 6.86 - 8.46
- 8.46 - 10.70
- 10.70 - 13.93
- 13.93 - 20.00
- 20.00 - 192.79

Percent biomass loss by management unit
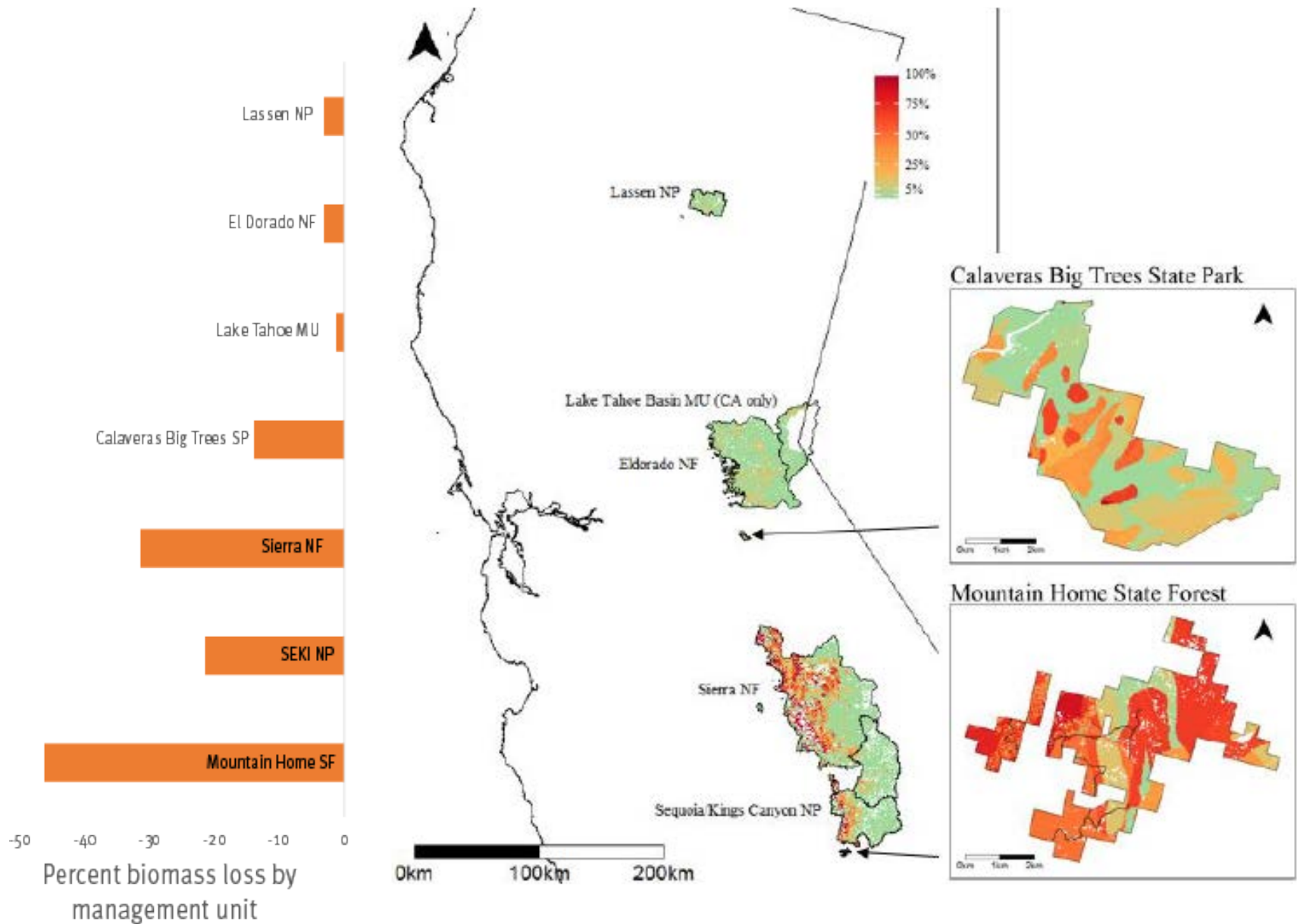
Applicable to any land area in CA

GitHub, Inc. [US] | https://github.com/carmentubbesing/drought_tree_carbon

ops   R Getting started with   E Guide for authors - Fi   M Gmail - Inbox   O Going It Alone | Outs   Ceanothus cordulatu   Ceanothus integerrin   Sign in to GitHub · Gi   joker-x/Leaflet.geoCS   Leaflet for R - Introdu   carmentubbesing

Steps to calculating biomass loss on any management unit

1. Go to https://github.com/carmentubbesing/drought_tree_carbon (this page) and download the entire github repository by clicking the big green button and selecting "Download ZIP". The newly downloaded folder will be called `drought_tree_carbon-master`. Create a new folder anywhere on your computer and place the entire unzipped `drought_tree_carbon-master` directory into it.

2. Download the files below from https://drive.google.com/drive/u/1/folders/0B81g0LRLmd0fVXlfZDFfS2VQRDg and place them in the same folder as the github repository. Since these files are large, it's best if you **download them individually** rather than trying "DOWNLOAD ALL".

    i. LEMMA.gri (7.8 GB)
    ii. LEMMA.grd (35 MB)
    iii. drought.Rdata (30 MB)
    iv. drought16.Rdata (15 MB)

- Note: It will take several minutes or longer to download these files from Google Drive, as they are large.
- Note: Make sure these files are in the same folder as `drought_tree_carbon-master` but are *not* **within** `drought_tree_carbon-master`.
    - For example, if you created a directory called `biomass_calculations` such that your file structure is `biomass_calculations/drought_tree_carbon-master`, the data files from Google Drive should be in `biomass_calculations`, so you have `biomass_calculations/LEMMA.gri`, `biomass_calculations/LEMMA.grd`, etc.

1. Obtain a shapefile of the boundary of the land area you're interested in. Place a folder containing your shapefile into the directory `drought_tree_carbon-master/data/active_unit`.

    - The shapefile can have any coordinate reference system.
    - The folder and shapefile can be named anything, but keep in mind that the folder name will be used in labeling the output tables and map.
    - Note: Be sure there are no extra files in `drought_tree_carbon-master/data/active_unit`. If you run these calculations for multiple shapefiles, you will need to clear the `active_unit` folder between each calculation.
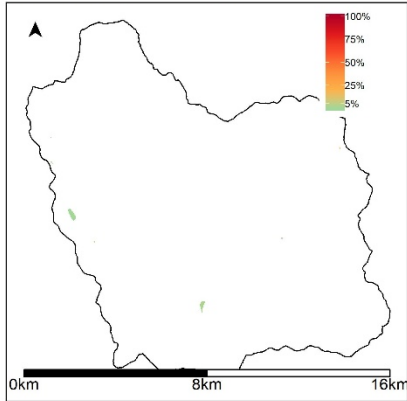
2. Run the script called "install_packages". You only need to do this once.

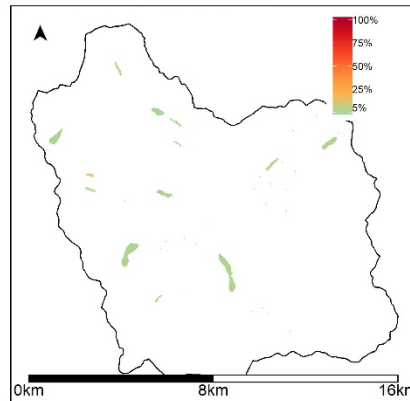3. Open the R file `code/GET_RESULTS.R`.

4. Make sure your working directory is set to `drought_tree_carbon-master/code`

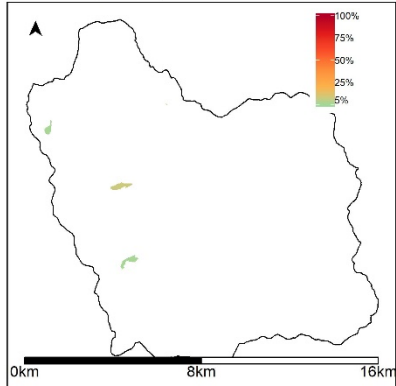github.com/carmentubbesing/drought_tree_carbon

Percent loss of live adult tree aboveground biomass , 2012 , Illilouette
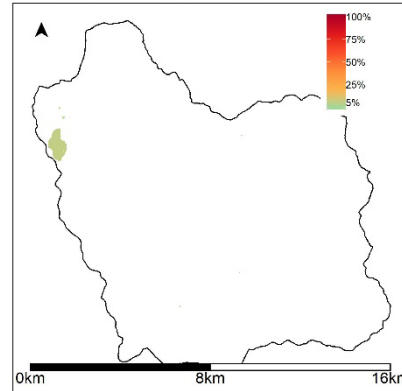
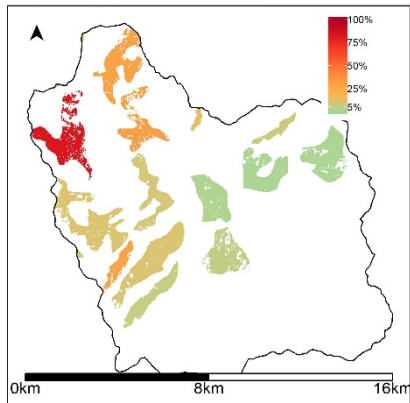Percent loss of live adult tree aboveground biomass , 2013 , Illilouette

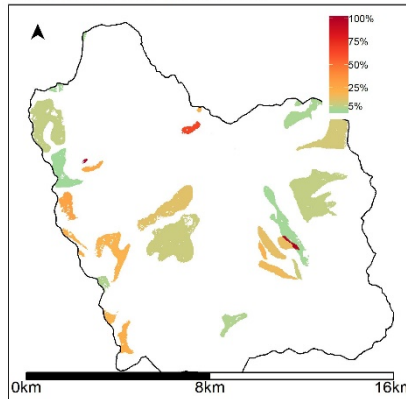Percent loss of live adult tree aboveground biomass , 2014 , Illilouette

Percent loss of live adult tree aboveground biomass , 2015 , Illilouette
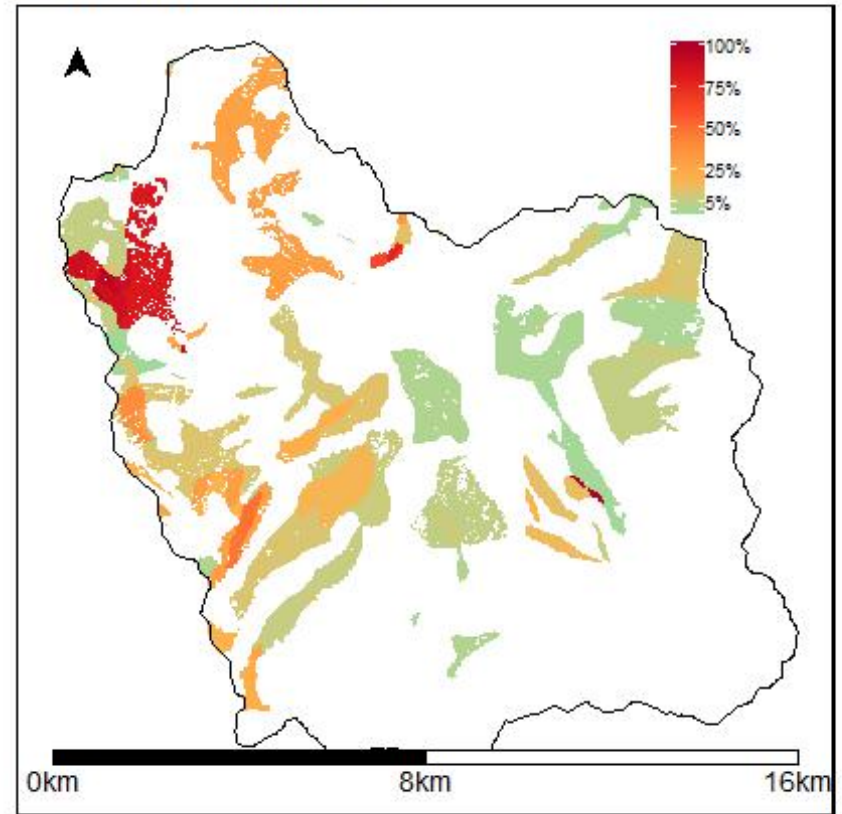
Percent loss of live adult tree aboveground biomass , 2016 , Illilouette

Percent loss of live adult tree aboveground biomass , 2017 , Illilouette
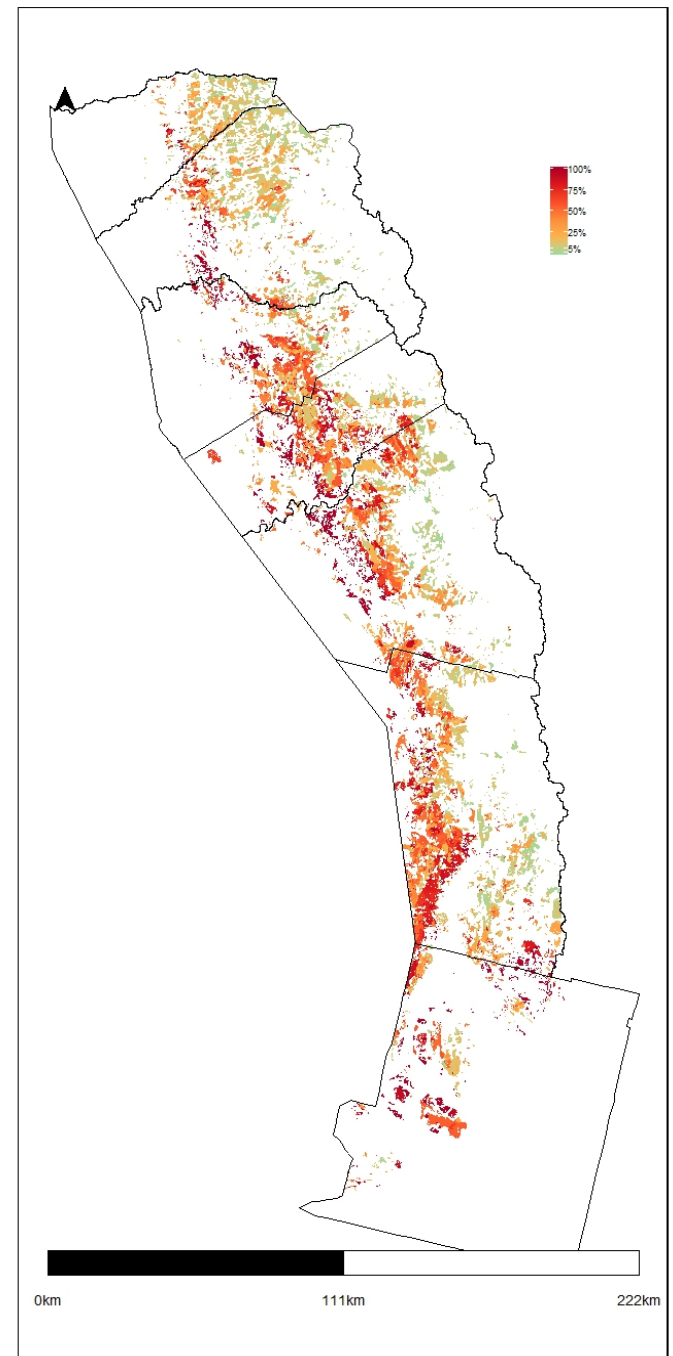
Percent loss of live adult tree aboveground biomas 2012-2017, Illilouette

Next steps

- Add 2017 mortality
  - Example: Madera county
    - 2012-2016 39.9% biomass loss from forested areas
    - 2017: only 2.4% more

- Create web tool for site-based biomass estimates

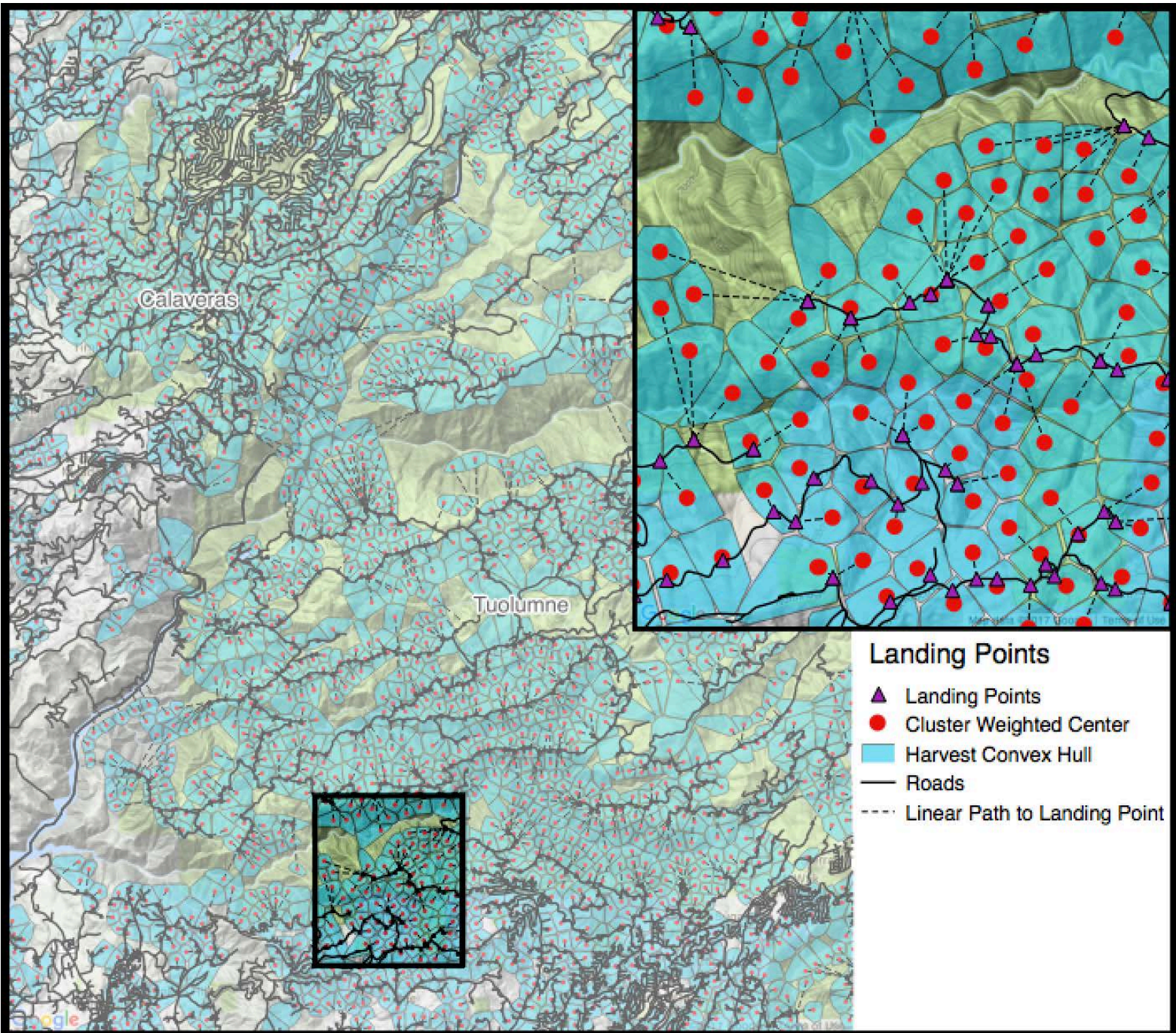# Acknowledgements

Questions?

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Filtering

- Slope
  - Kept pixels ≤40% slope

- Tree volume
  - Kept pixels with ≤11.3 cubic m on average
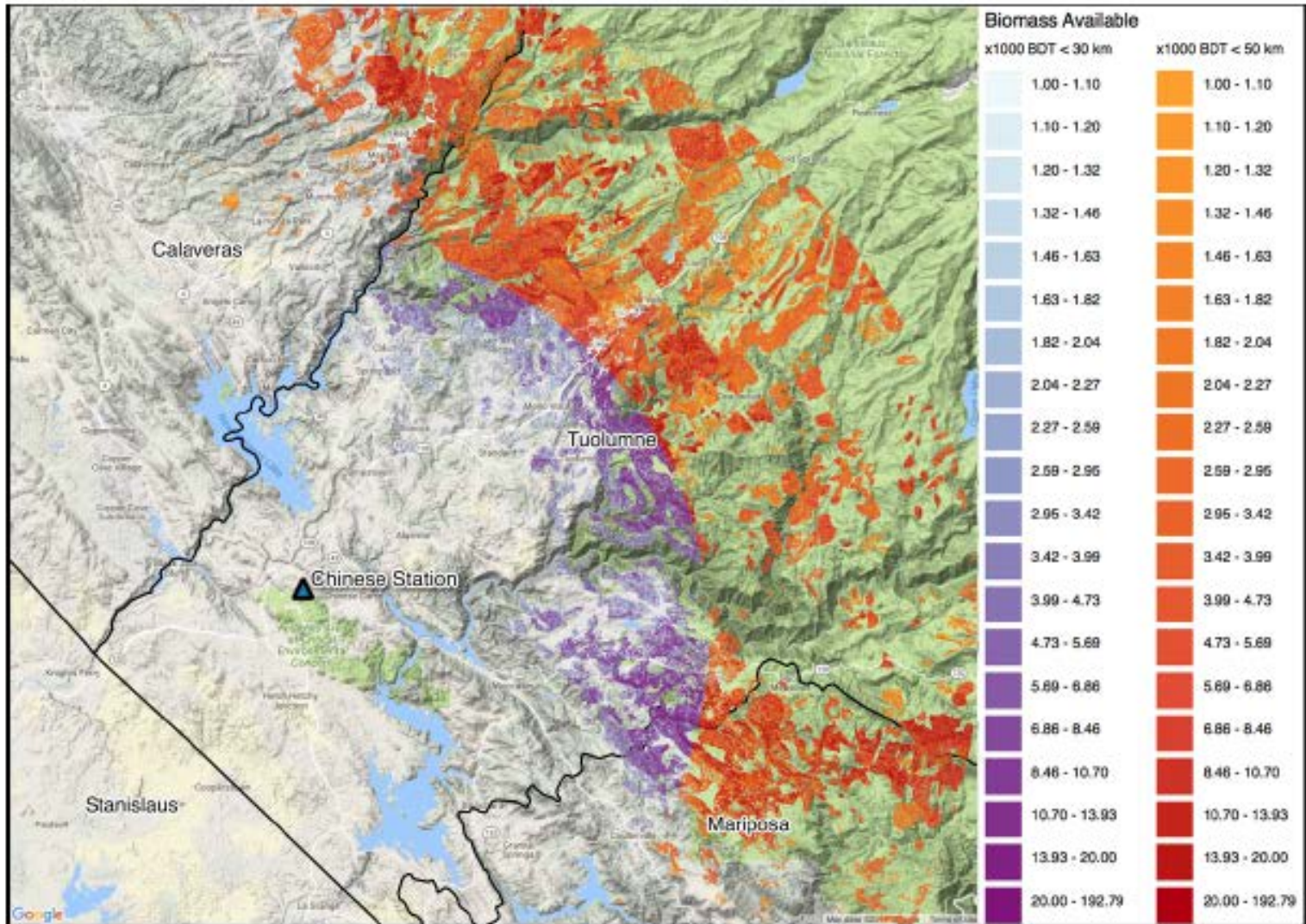
Cost calculations

- Landing sites based on weighted cluster centers

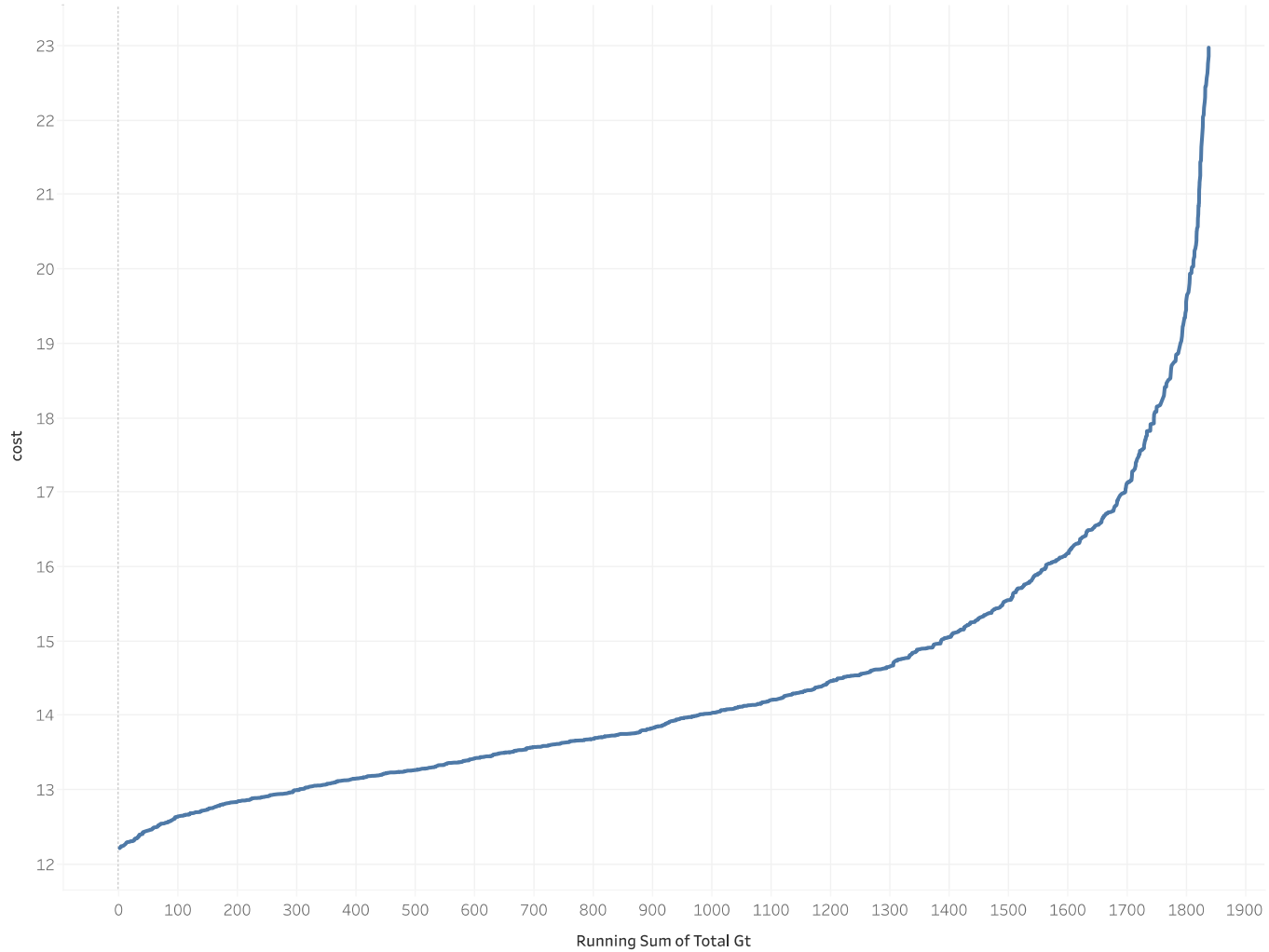- Costs based on Fuel Reduction Cost Simulator (FRCS)

Landing Points

▲ Landing Points
● Cluster Weighted Center
▬ Harvest Convex Hull
— Roads
--- Linear Path to Landing Point

Example use case:
Pacific Ultrapower Chinese Station

Cost Curves

Supply Curve for Polygon 23510

Next steps

- Calculate road transportation costs
  - Determine ideal biomass facility locations
  - Determine feasibility of distributed biomass gasification
- Create web tool for site-based biomass estimates

Allpowerlabs.com