

Where in the basin are they?

Validating habitat suitability models for 22 rare plant species.



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Background

National forests are tasked with:

- 1) maintaining viable populations of TES species
- 2) preventing degradation of suitable habitat

What constitutes suitable habitat?

How much of it occurs on the landscape and where is it?

LTBMU

25 sensitive botanical species

(19 vascular plants, 4 bryophytes, 1 lichen, 1 fungi)

2 candidate species: *Rorippa subumbellata* (Tahoe Yellowcress)
Pinus albicaulis (Whitebark Pine)*

*Warranted but precluded from listing under ESA, July 2011

Binary GIS Models

- Species distribution predicted from environmental variables
- Classify landscape: suitable vs. non-suitable
- Model Builder: Boolean AND/OR analysis of various environmental data (GIS layers) to determine suitable habitat

Products

- Total area of suitable habitat
- Spatial pattern/location of suitable habitat



- 15 habitat models, cover 22 species total
- known or likely to occur in Lake Tahoe basin

Wet/Riparian

Botrychium spp.
*Bruchia bolanderi**
Epilobium howellii
Meesia spp./*Helodium blandowii*
*Peltigera hydrothyria**



Upland/Forested

Arabis rectissima v. *simulans*
Arabis rigidissima v. *demota*
*Arabis tiehmii**
Eriogonum umbellatum v. *torreyanum**
*Hulsea brevifolia**
*Lewisia kelloggii**



Alpine

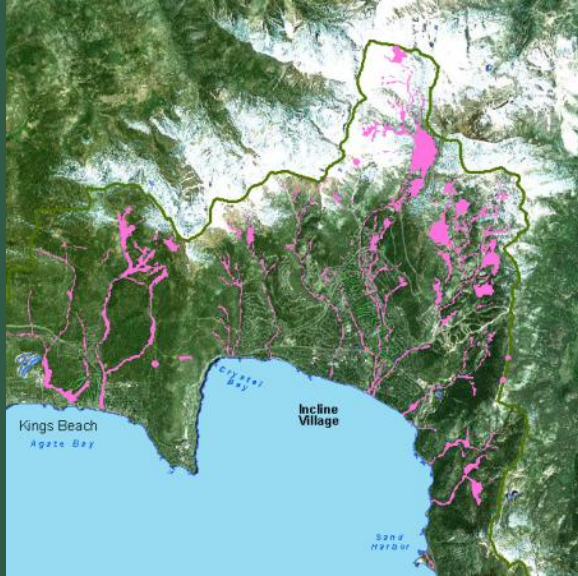
Draba asterophora v. *asterophora*
Draba asterophora v. *macrocarpa*
Draba-Union
Lewisia longipetala



Example: *Lewisia longipetala*

General Criteria	GIS Dataset	Refined Criteria (AND)
Northerly Aspect	Aspect	0-90°, 270-360°
High Elevation	Elevation	>8300 ft
Subalpine & Alpine Communities	Potential Natural Vegetation	TSME, TSME-ABMA, Rocky, Scree-subalpine/alpine
Granitic soils	Geology	Igneous intrusive, and extrusive, sedimentary





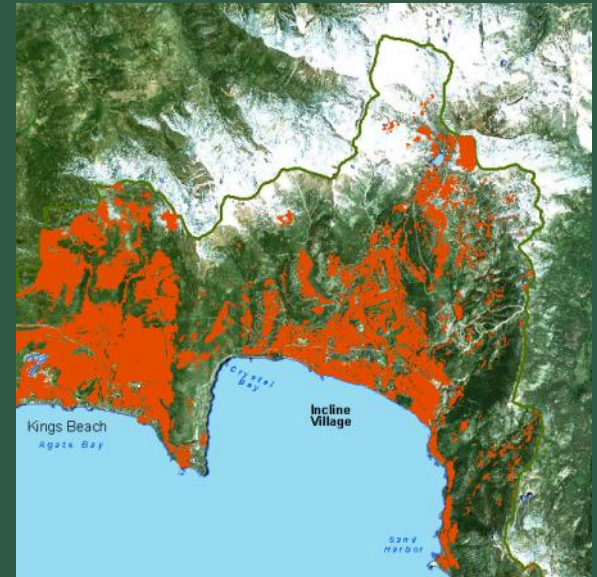
Botrychium spp.
(Moonwort complex)



Peltigera hydrotheria
(Veined Water Lichen)

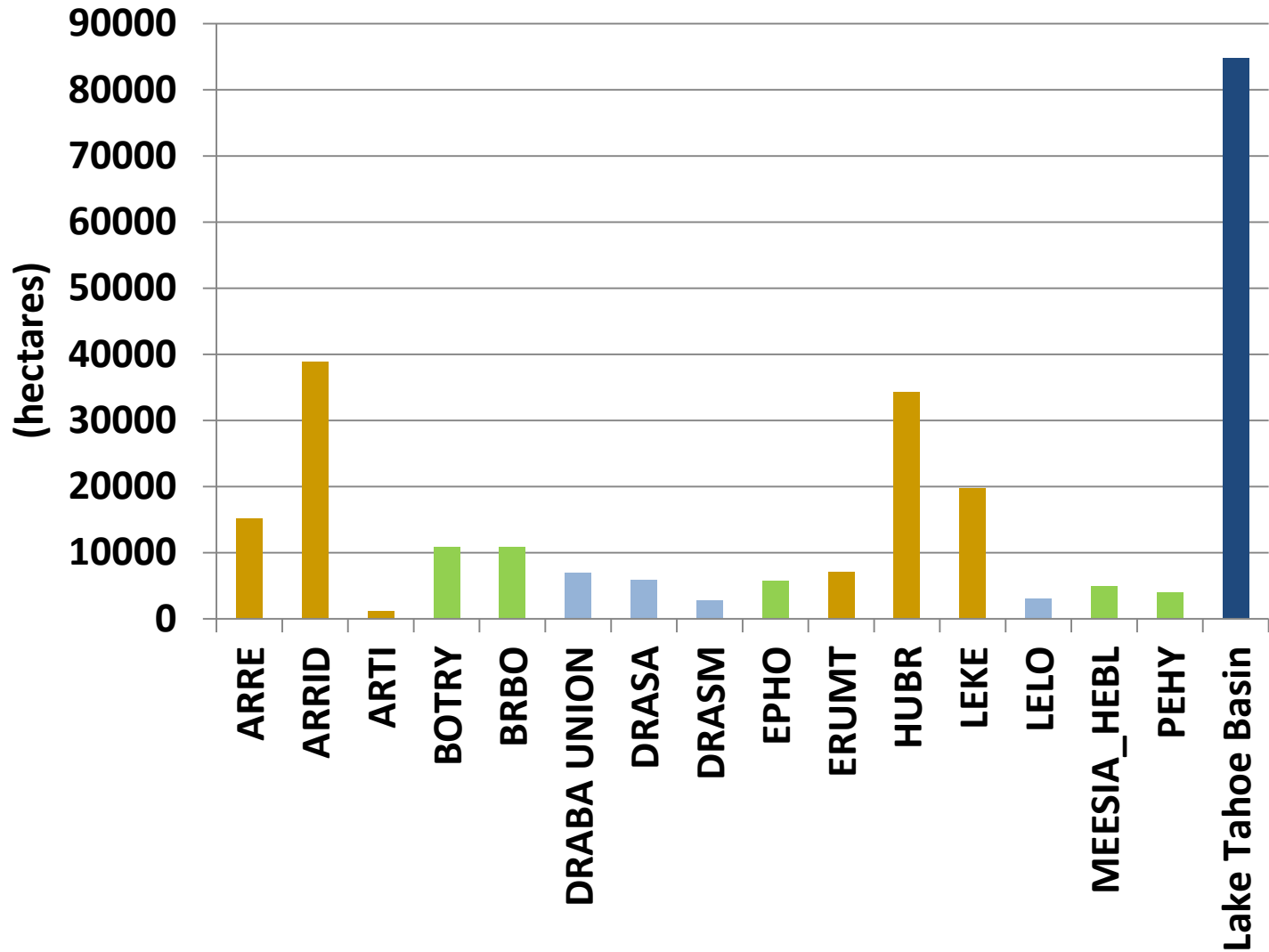


Draba asterophora v. asterophora
(Tahoe Draba)



Lewisia kelloggii
(Kellogg's Lewisia)

Predicted Area of Suitable Habitat w/in Lake Tahoe Basin



(1 hectare = ~2.5 acres)

Field Validation

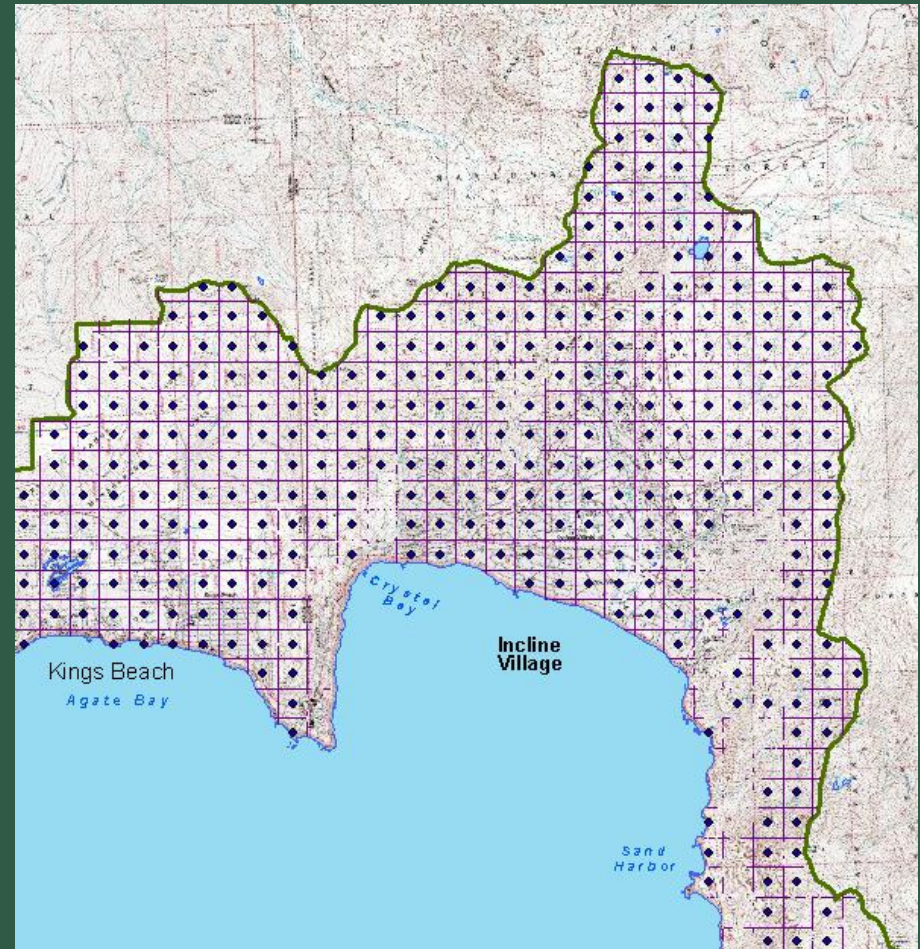
- 500m x 500m grid
- 100 randomly selected points
- 15 excluded (private property)
- 85 total points
- Field visit: presence/absence of suitable habitat & species
- **45 of 85 completed**

2009- 9 points

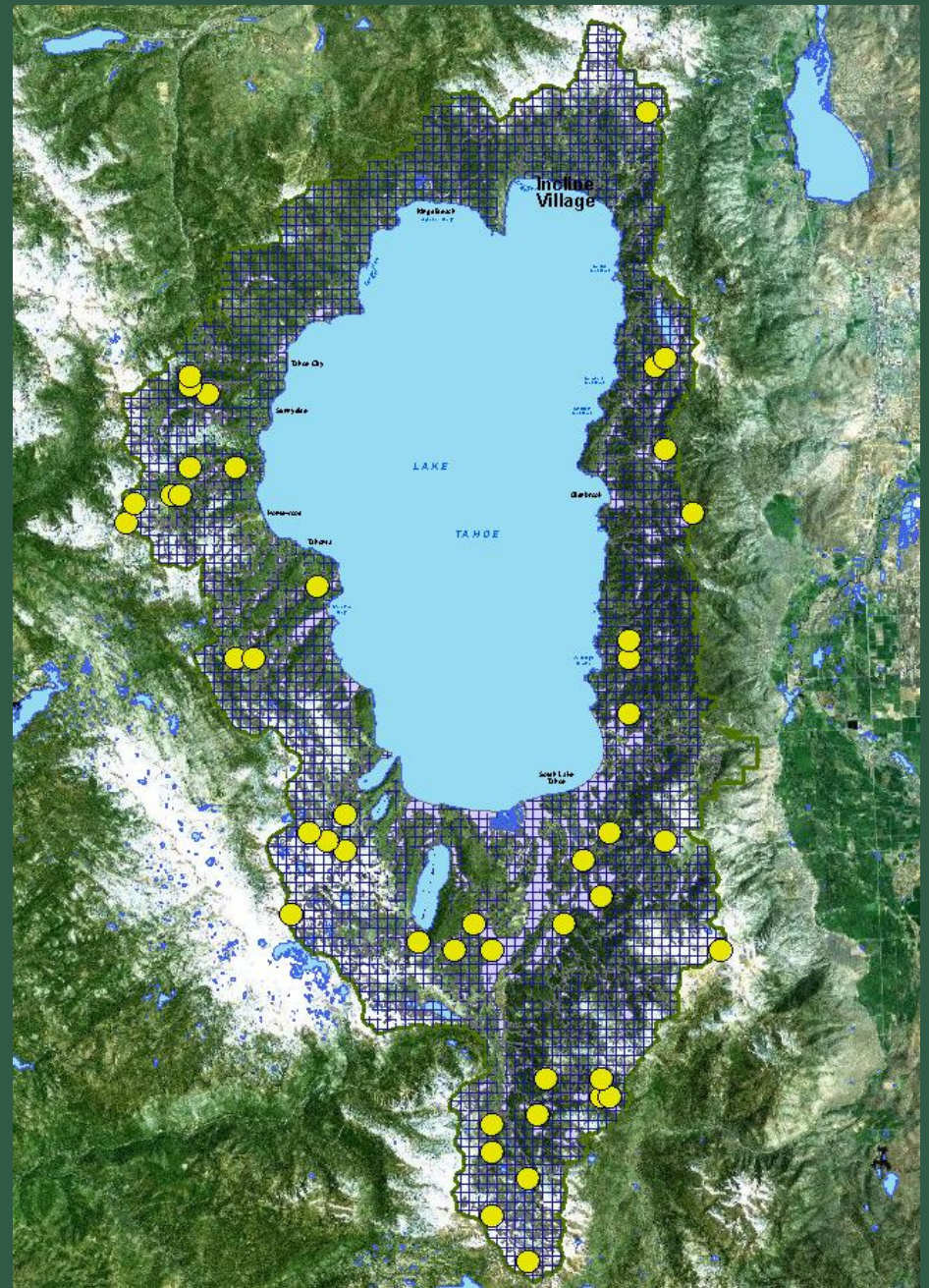
2010- 4 points

2011- 32 points

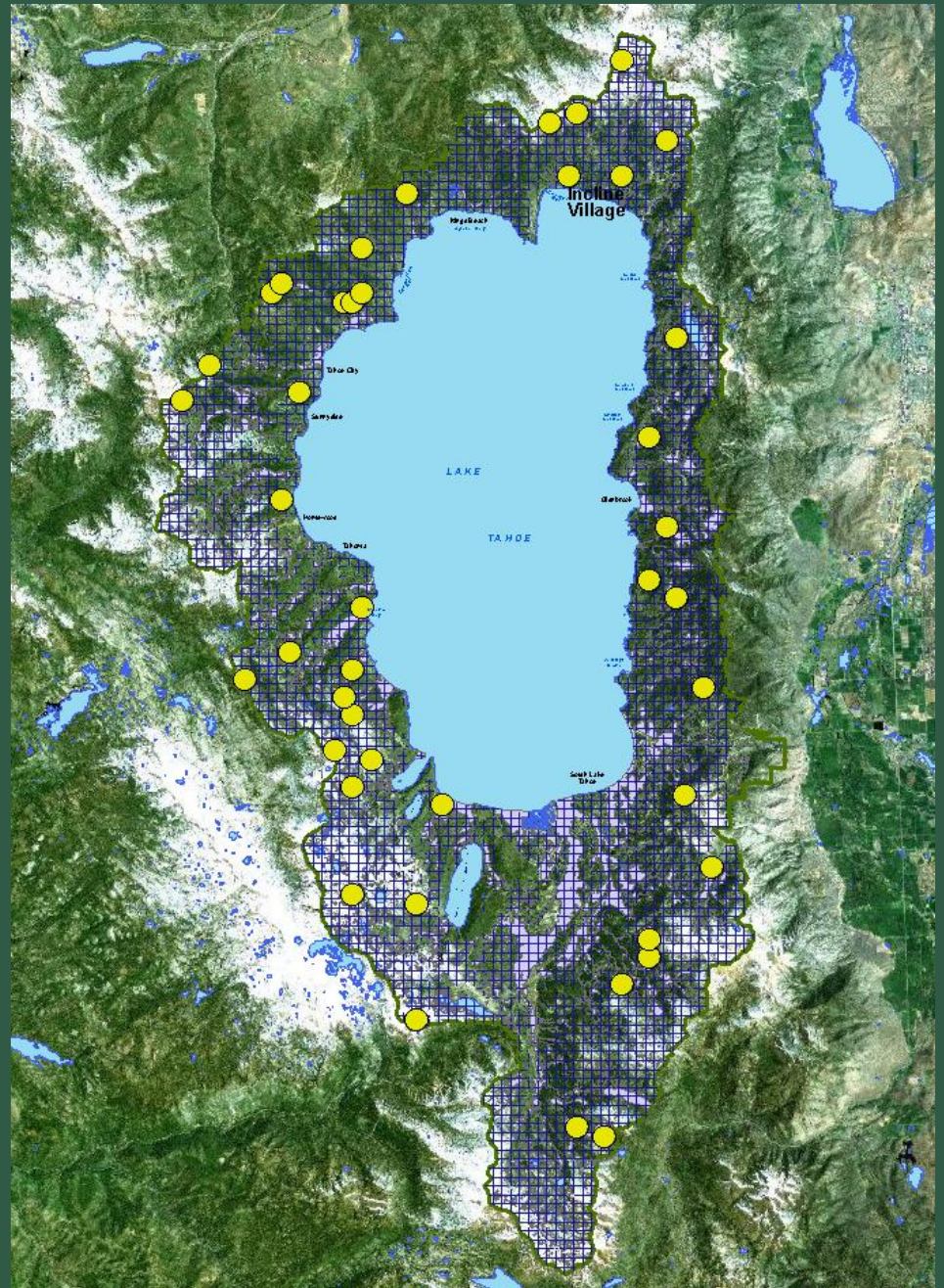
2012- 40 points planned... any volunteers?!



45 Visited Points:
Few points on North Shore
All elevations
All species



40 Remaining Points:
Throughout the basin
All elevations
All species



Preliminary results:

- 7 of 15 models had >90% accuracy
- mostly over-prediction
- all upland and alpine species

Species	% Sites Habitat Predicted	% Model Agreement	% Over- predict	% Under- predict	Habitat
<i>Arabis tiehmii</i>	2.2	100	0	0	Upland
<i>Draba</i> -Union	3.1	97	0	3	Alpine
<i>Draba asterophora</i> v. <i>macrocarpa</i>	13.3	96	4	0	Alpine
<i>Draba asterophora</i> v. <i>asterophora</i>	15.6	93	7	0	Alpine
<i>Lewisia longipetala</i>	15.6	93	7	0	Alpine
<i>Arabis rigidissima</i> v. <i>demota</i>	57.8	91	9	0	Upland
<i>Eriogonum umbellatum</i> v. <i>torreyanum</i>	11.1	91	7	2	Upland

Preliminary results:

- 4 of 15 models had 80-89% accuracy
- all over-predict, some under-prediction
- riparian and upland species

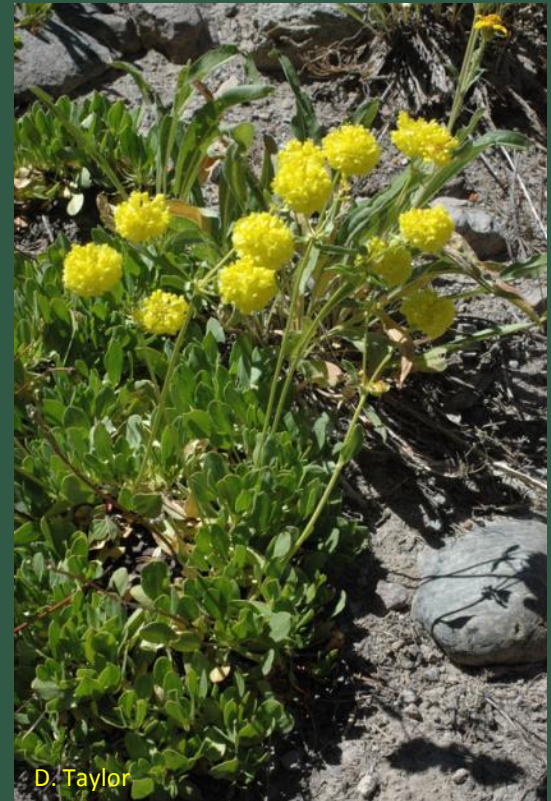
Species	% Sites Habitat Predicted	% Model Agreement	% Over- predict	% Under- predict	Habitat
<i>Botrychium</i> spp.	86.7	89	11	0	Wet/Riparian
<i>Arabis rectissima</i> v. <i>simulans</i>	28.9	82	9	9	Upland
<i>Bruchia bolanderi</i>	84.4	82	16	2	Wet/Riparian
<i>Hulsea brevifolia</i>	62.2	80	20	0	Upland

- Preliminary results:**
- 4 of 15 models had low (67-71%) accuracy
 - most over-predict AND under-predict
 - mostly riparian species
 - missing some mesic habitats

Species	% Sites Habitat Predicted	% Model Agreement	% Over- predict	% Under- predict	Habitat
<i>Peltigera hydrothyria</i>	57.8	71	20	9	Wet/Riparian
<i>Lewisia kelloggii</i>	73.3	69	29	2	Upland
<i>Epilobium howellii</i>	48.9	67	4	29	Wet/Riparian
<i>Meesia</i> spp. & <i>Helodium blandowii</i>	46.7	67	16	18	Wet/Riparian

What's working...

- Elevation, aspect, slope, high elevation forests
(*Draba*, *Lewisia*)
- Conifer/forest types- generalists
(*Arabis*, *Eriogonum*)
- Larger areas of meadow and riparian habitat



Scale

- understory layers, ground cover (e.g. thick duff or bare ground)
- vegetation layer- small patches of riparian vegetation, wet meadow, wet habitats
- forest openings, canopy cover



Other Challenges

- substrate within perennial streams, dry gullies predicted as perennial streams
- species not known from LTBMU- less information on suitable habitat
- geologic restrictions



Detection of 8 new occurrences of 3 sensitive species:

1. ***Botrychium crenulatum*** (BOCR2, BOCR3)
(South Lake Tahoe & Zephyr Cove)
2. ***Draba asterophora v. asterophora*** (DRASA 1p, 2n, 2o)
(Job's Sister & Heavenly Ski Area)
3. ***Lewisia longipetala*** (LELO 4a, 4b, 4c)
(Jack's Peak)





Future Steps

- Equal effort: under-prediction vs. over-prediction
- Functionality of the model vs. true suitable habitat detection
- Goal: 80% accuracy
- *Pinus albicaulis*: use TEUI layer? Existing Veg Map? Remaining points?
- LIDAR & multispectral imagery? Maybe for trees but not herbaceous species



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