Aiding Relocation of Endangered Species

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Relocation of Vulnerable Species

A radical last resort

Yellowstone wolf relocation has been one of the best examples of success

- Unfamiliar environment
- Consequences for the ecosystem
- **Heavy manual research for scientists, including manual location scouting**

Appalachian Forest Plight

- Spruce Fir forest home to rare species
- Plighted by aphids
- Damaged by mining operations
- "Extinction hot zone"

Appalachian Spruce Fir Forest

Some endangered Species:

- North Carolina Flying Squirrel
- Rock Gnome Lichen
- Spruce Fir Moss Spider (smallest member of Tarantula family)

Manual Location Scouting

Difficulty

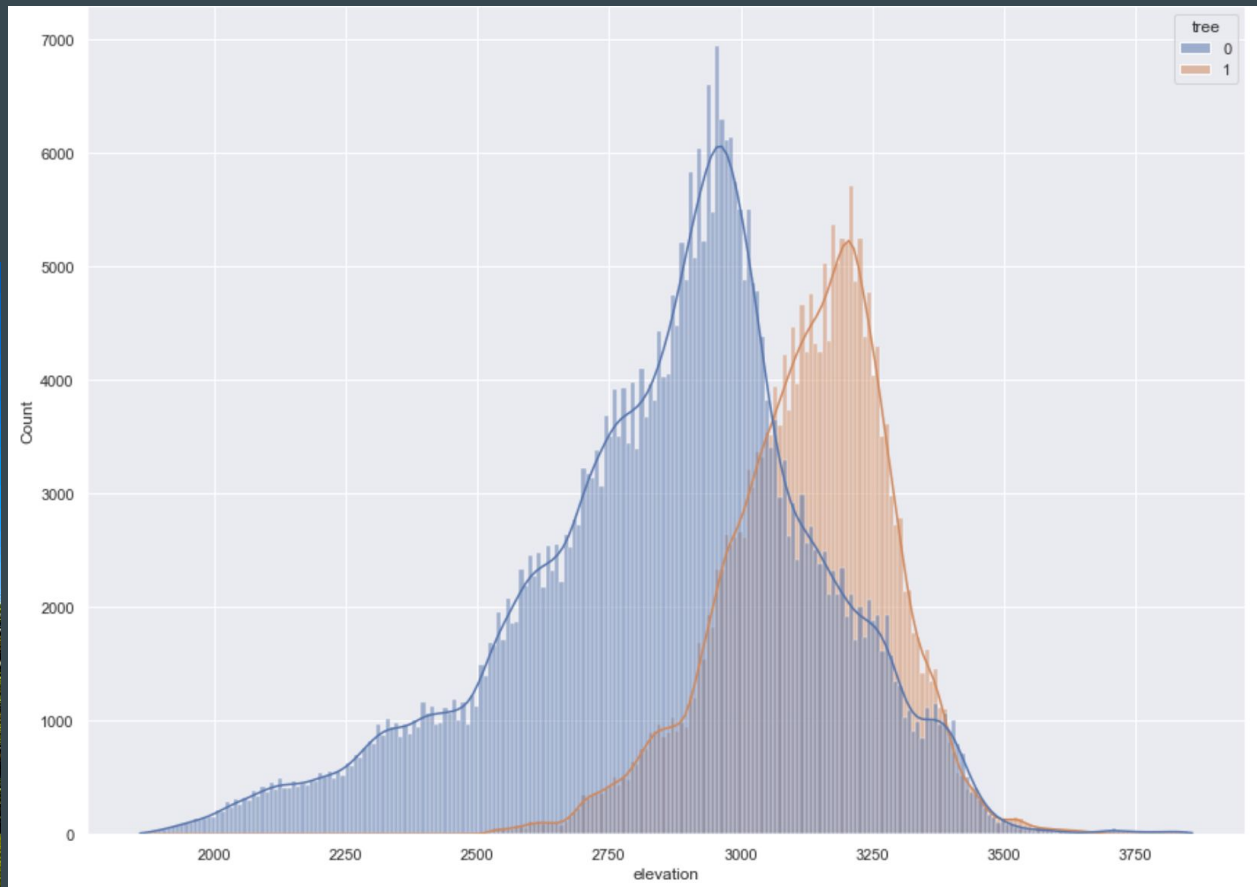- High Elevation
- Dense Wilderness
- Large Area

Using cartographic features, estimate the forest type to aid researchers in finding suitable relocation location

The Data

- Colorado Theodore Roosevelt National Forest
- Cartographic and GIS features:
  - Elevation
  - Slope
  - Aspect
  - Soil Type
  - Brightness at times of day
  - Horizontal distance to roadways, water, and fire ignition points
  - Vertical distance to water
  - Climate Zone
  - Rockiness
  - Geo_zone
- Forest type label

Spruce Fir Forest
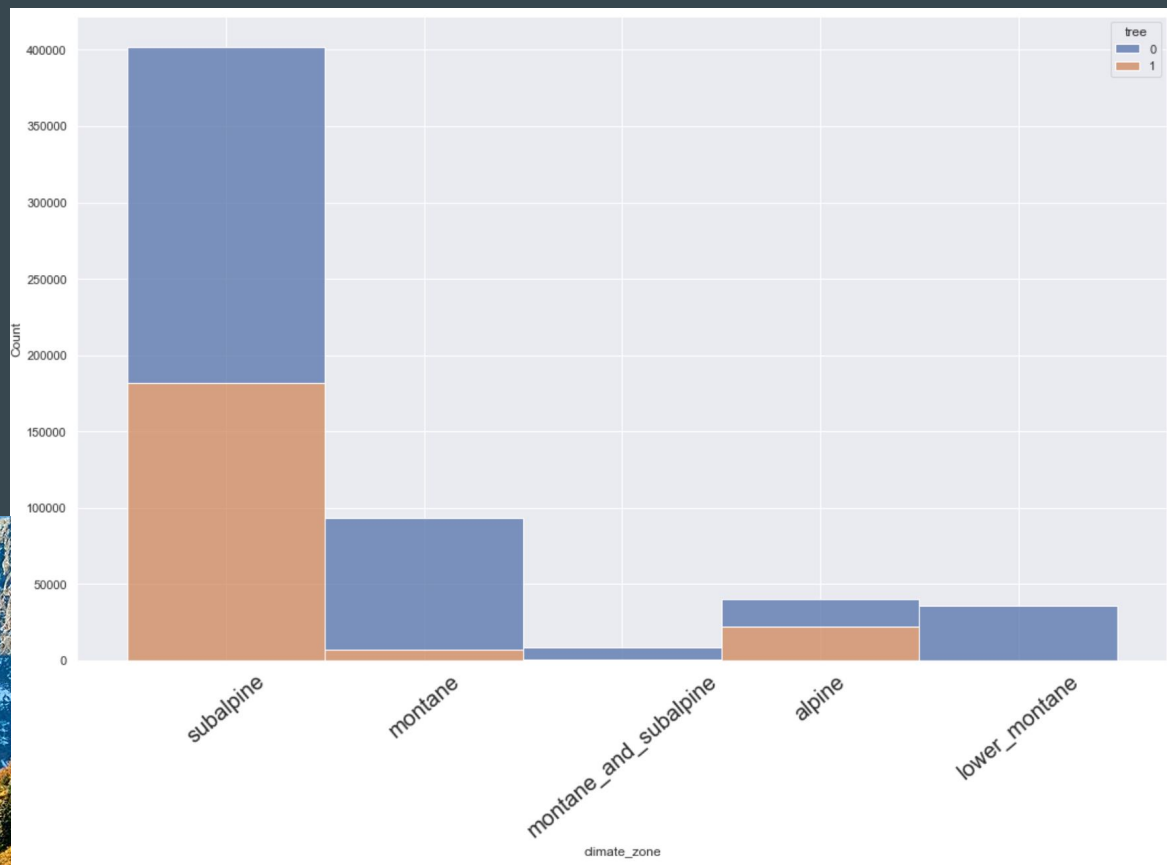
Common at higher elevations(in meters)

- 10,000ft = 3048 meters

Spruce Fir Forests
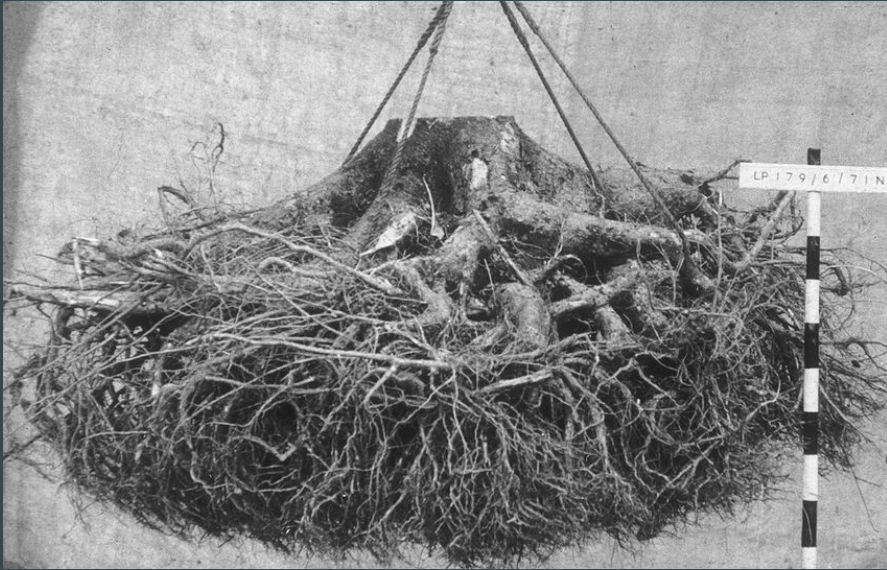
Commonly found in subalpine and alpine regions

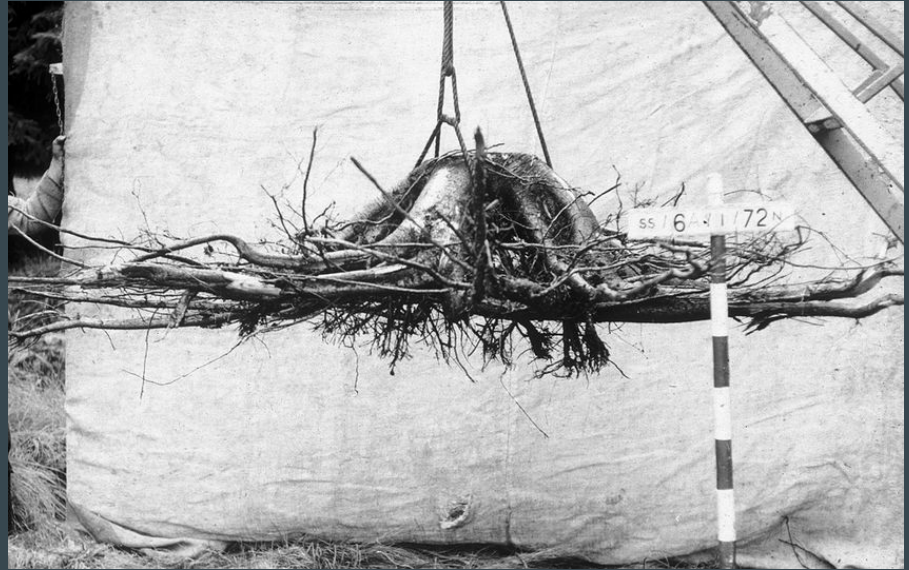Areas below dominated by Lodgepole pine

- Alpine and subalpine is characterized by rockier, shallower soil

Why?

Lodgepole Pine root system

Sitka spruce (relative) root system

At Lower Elevations, deep dense root systems of the Lodgepole Pine tend to overwhelm the Spruce root systems

Metrics

What do researchers care about?

- 46% of our dataset is Spruce Fir forests
- False positive rate important

Important Metrics:

Accuracy

Precision

- If this project is extended to rare groups, false negative becomes important, so F1 would be better

Classification

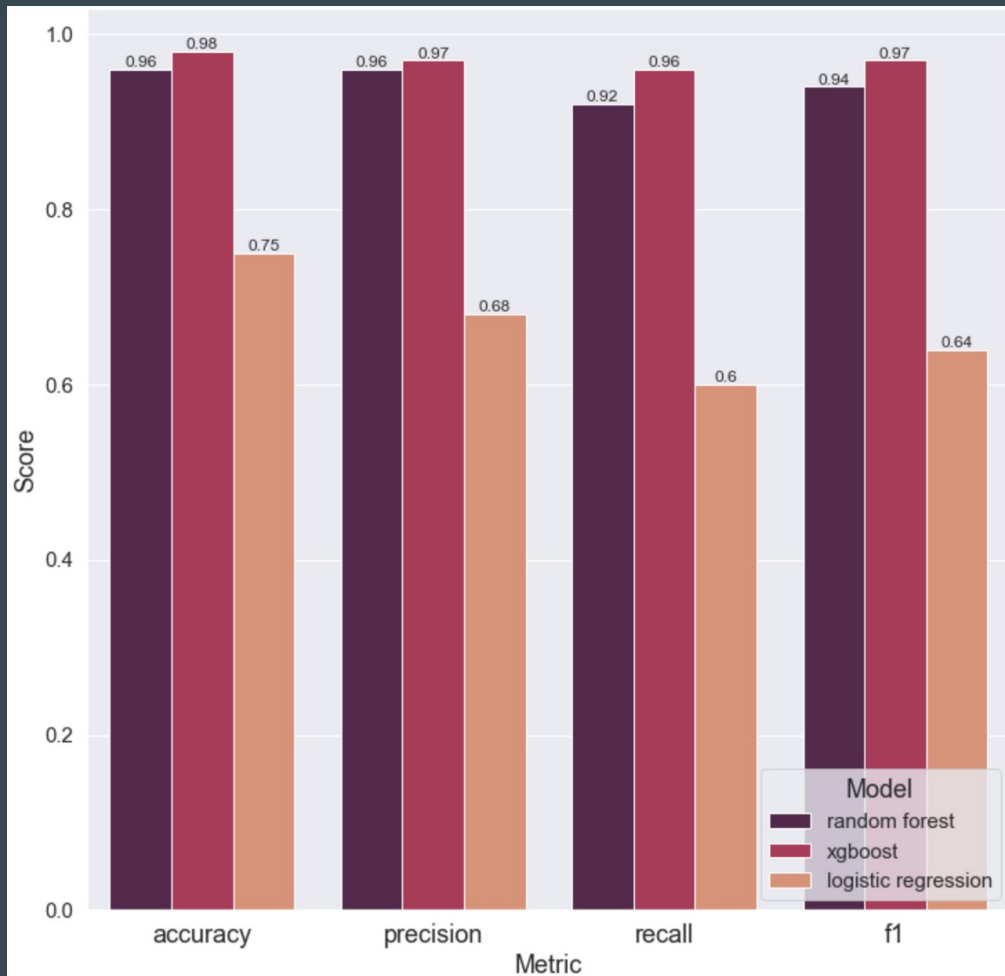Logistic Regression

Accuracy: .75

Precision: .68

Random Forest

Accuracy: .96

Precision: .96

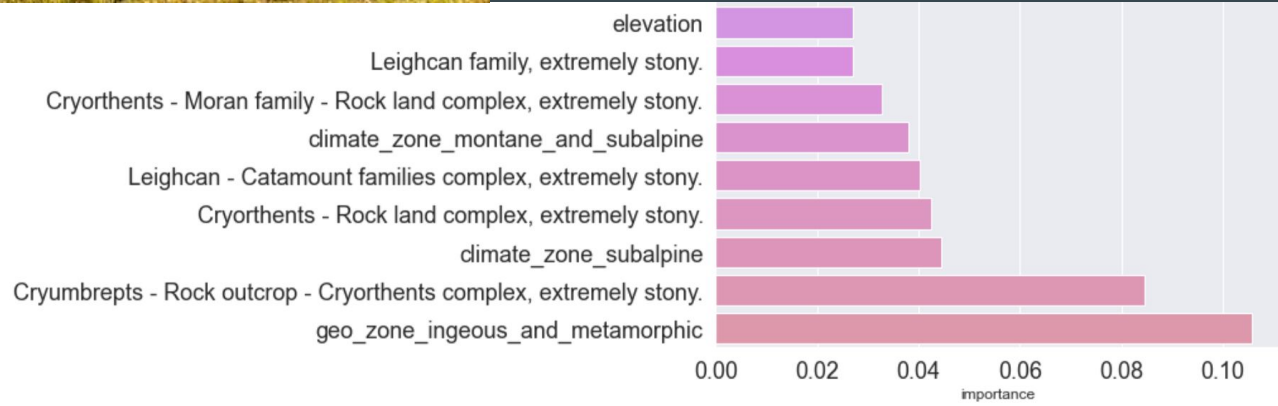XGBoost

Accuracy: .98

Precision: .97

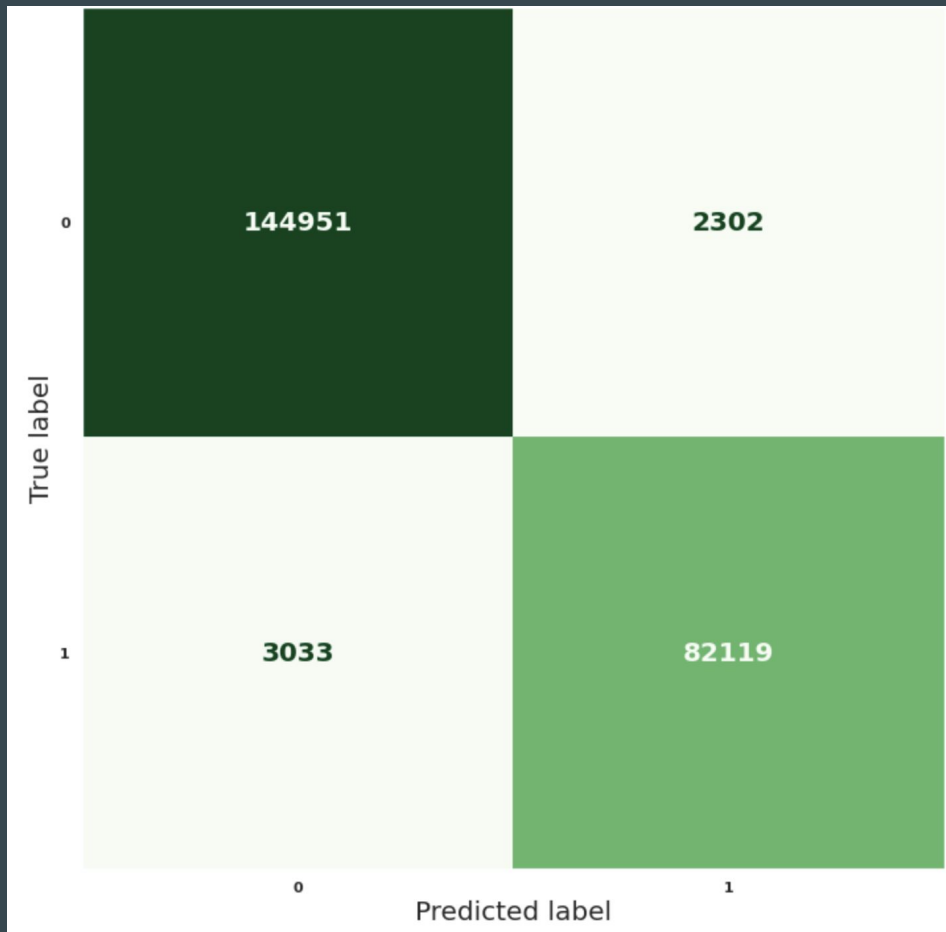# Feature Importance

Most important Features:

- Igneous Geo Zone
- Extremely stony, rocky soil
- Subalpine climate zone
- Elevation (9th after diff soil types)

Confusion Matrix

The precision and accuracy are high - .97, .98

- 2302 false positive plots

Further Filtering

- Some species require more precise conditions
  - non important features used for filtering

- Large continuous area needed

The Spruce Fir Moss Spider is the smallest member of the Tarantula Family

It lives in shaded areas on slopes with northern aspects.

Further Work

- Updated Dataset
  - USFS collects this data yearly
- Add fire information
- More forest types
- Can this be used to locate potentially extinct species?

"The phrase I like to use is 'presumably extinct.' I hope we're wrong. I hope somebody goes out and finds it, because it will immediately become a conservation priority."

–Wesley Knapp, botanist