


# Mapping Invasive Alien Plants using Imaging Spectroscopy and Machine Learning

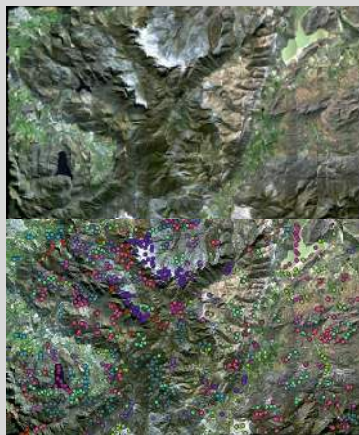
Glenn Moncrieff

The Nature Conservancy

[glenn.moncrieff@tnc.org](mailto:glenn.moncrieff@tnc.org)

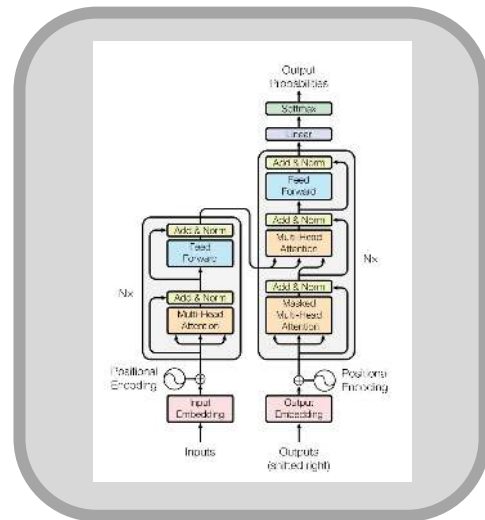
 GMoncrieff

## Labels + Features

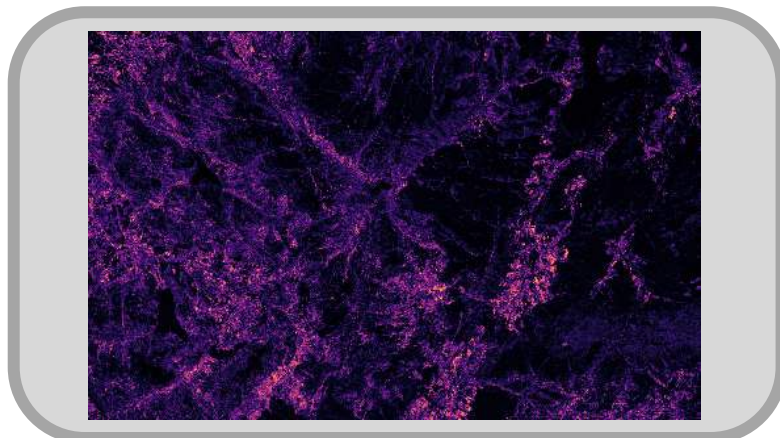


Machine learning  
modelling  
components

## Model



## Prediction

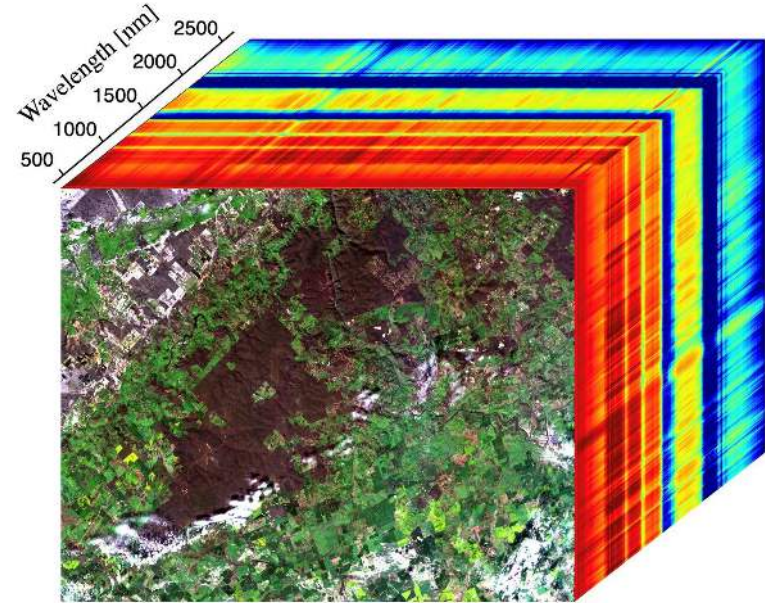
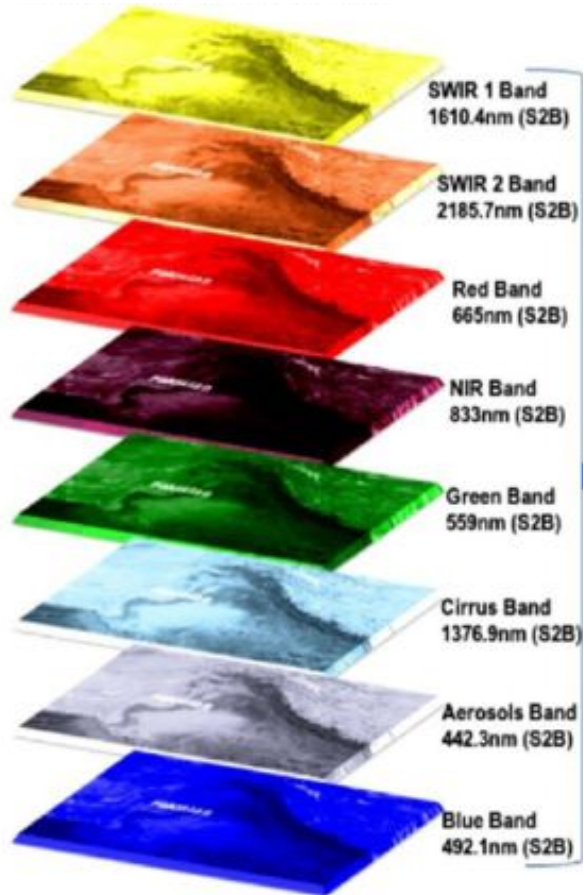


## Evaluation

Accuracy: 49.14%

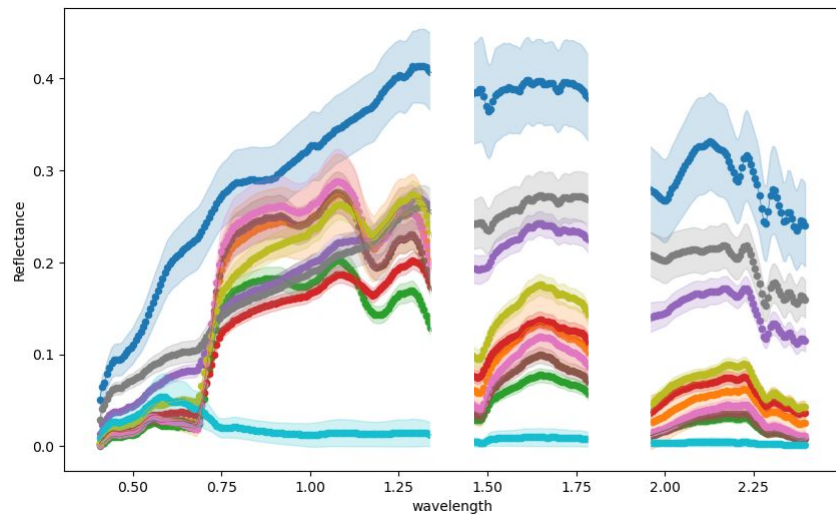
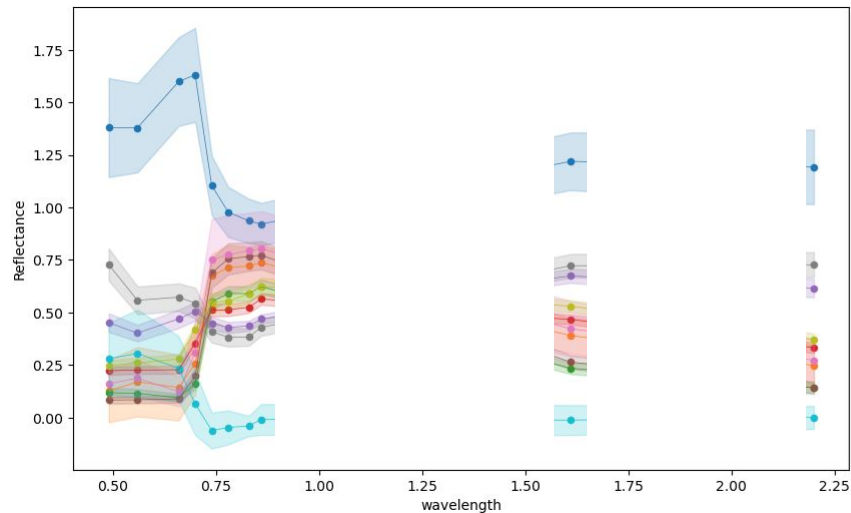
1	83.0%	0.0%	0.0%	77.8%	9.8%	15.2%	1.6%	0.0%	0.0%	0.0%	0.5%	0.0%		
2	7.0%	0	0	17	5	5	1	0	0	0	0	3		
3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%		
4	0.0%	43.8%	5.6%	0.0%	12.1%	7.9%	0.0%	0.2%	0.3%	0.0%	6.4%	7.2%		
5	0	67	1	0	4	5	0	1	2	0	37	13		
6	0.1%	0.0%	41.6%	5.6%	0.0%	0.0%	1.6%	4.8%	0.2%	0.2%	30.8%	1.9%		
7	1	0	64	1	0	0	1	1	1	1	44	11		
8	9.8%	0.0%	0.0%	5.8%	24.7%	0.0%	0.0%	4.8%	0.2%	0.0%	0.2%	0.0%		
9	110	0	0	1	0	0	0	1	1	0	0	1		
10	8.1%	0.0%	0.0%	0.0%	5.9%	18.2%	0.0%	14.3%	3.5%	0.0%	8.0%	11.9%		
11	91	0	0	0	3	8	0	3	20	0	46	20		
12	0.4%	0.0%	1.3%	0.0%	0.0%	21.2%	74.6%	0.0%	2.0%	0.0%	4.3%	0.0%		
13	5	0	2	0	0	0	0	0	13	0	25	0		
14	1.5%	0.0%	0.6%	0.0%	0.0%	9.1%	0.0%	9.5%	8.0%	4.1%	2.1%	9.3%		
15	17	0	1	0	0	3	0	2	46	27	3	54		
16	0.4%	0.0%	0.6%	3.9%	3.0%	4.8%	28.6%	49.3%	22.3%	0.0%	2.9%	6.6%		
17	4	2	1	1	2	1	3	8	26	147	0	17		
18	0.1%	0.0%	0.6%	0.0%	2.0%	0.0%	0.0%	9.5%	17.7%	53.6%	7.7%	5.7%		
19	1	0	1	0	1	0	0	2	102	333	11	33		
20	0.0%	0.0%	1.9%	0.0%	0.0%	3.0%	0.0%	4.8%	1.0%	2.1%	3.7%	27.0%		
21	0	0	3	0	0	1	0	1	6	14	166	6		
22	8.3%	0.0%	9.7%	0.0%	7.8%	6.1%	0.0%	4.8%	13.0%	14.4%	7.0%	20.8%		
23	94	0	15	0	4	2	0	1	75	95	10	120		
24	6.9%	0.0%	0.0%	5.9%	12.1%	9.5%	19.0%	6.9%	0.9%	0.0%	12.8%	37.0%		
25	79	0	0	0	3	4	9	4	49	5	0	74		
		1	2	3	4	5	6	7	8	9	10	11	12	13

# Data: Features



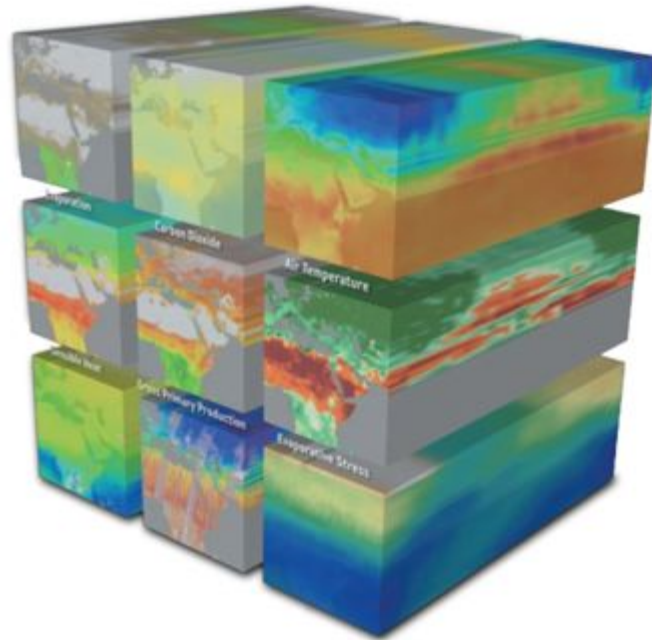
NASA/JP  
L

# Data: Features

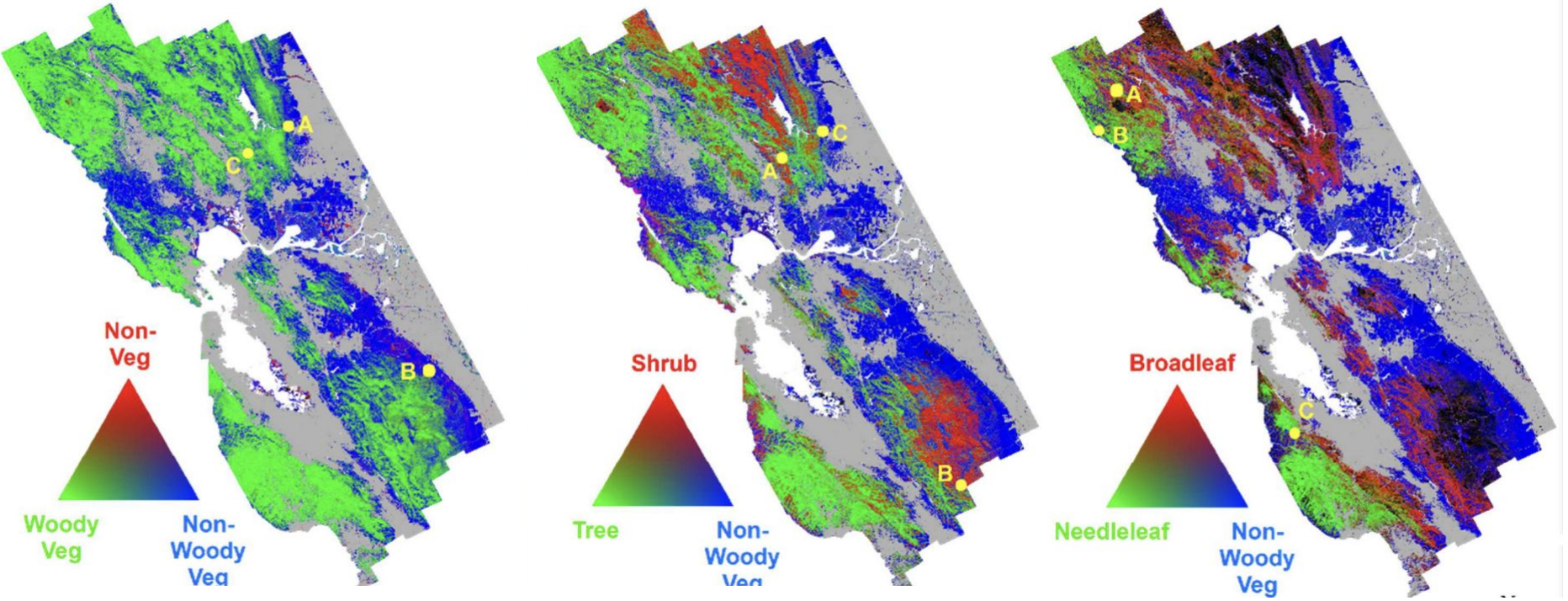


- Bare Ground
- Black Wattle
- Dense Pines
- Fynbos High Density
- Fynbos Low Density
- Gum
- Indigenous Forest
- Rock
- Wetland
- Water

# Data: Features

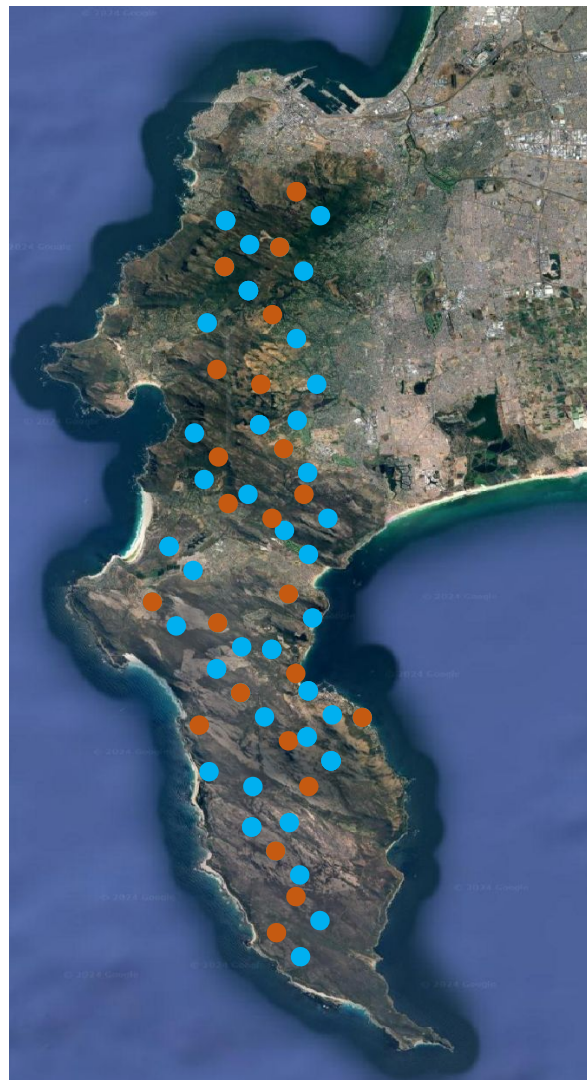
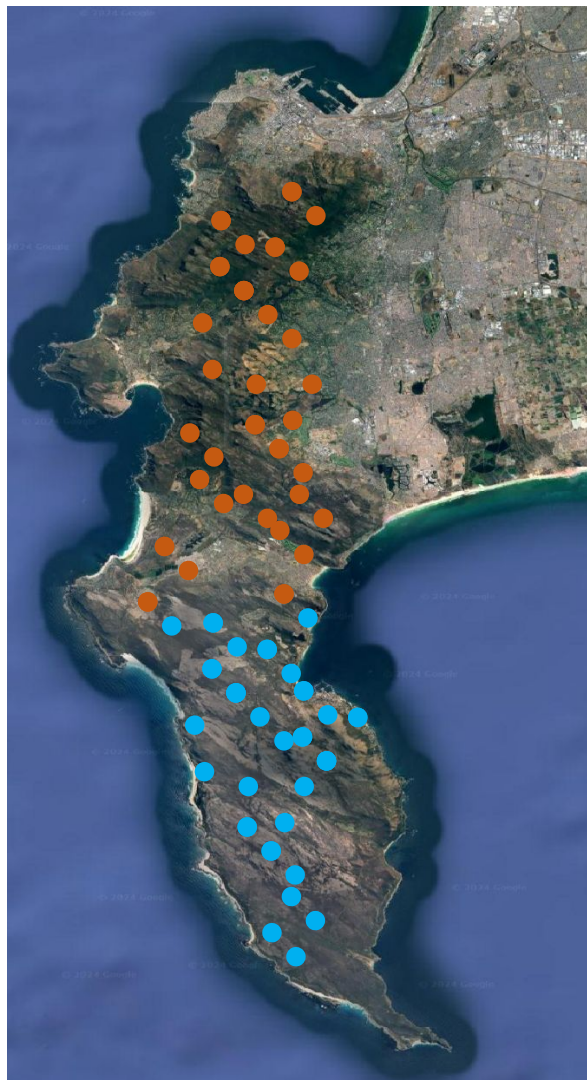


# Data: Labels



Cooper et al 2020 RSE

Data: Labels

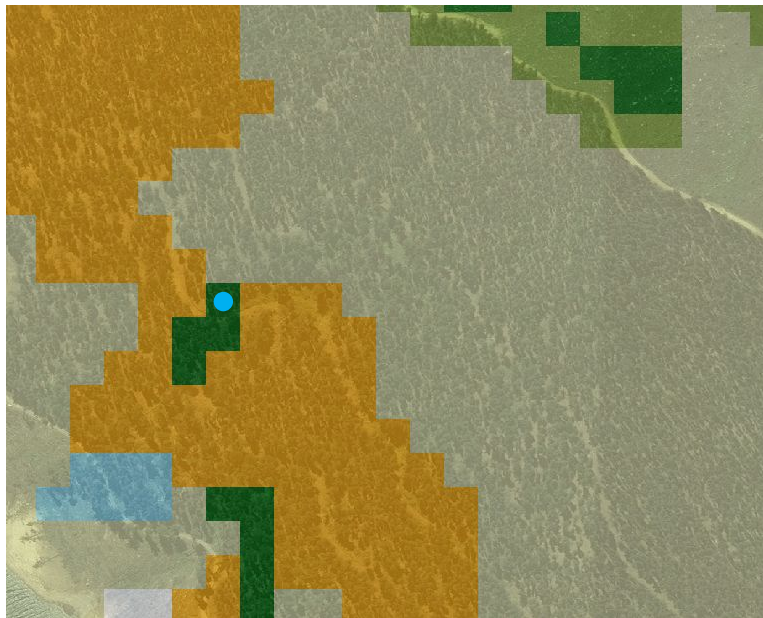


Data: Labels





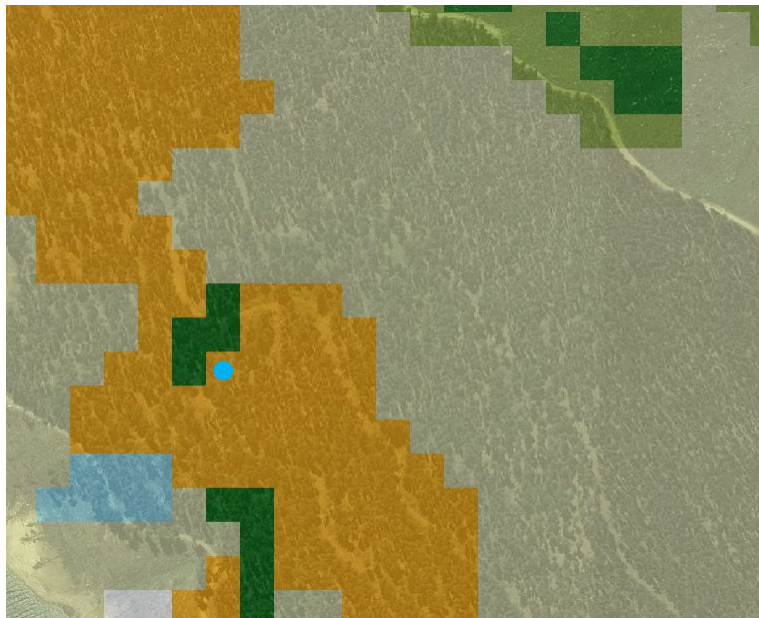
# Data: Labels



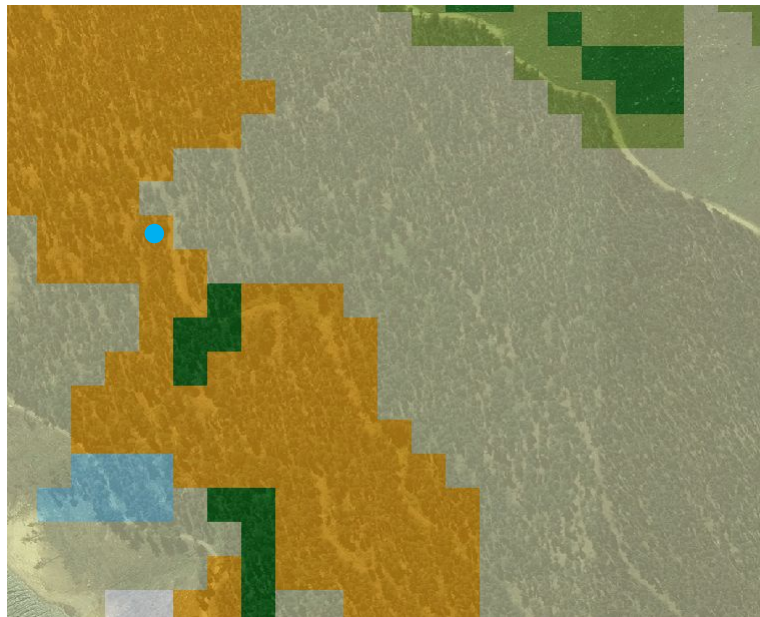
# Data: Labels



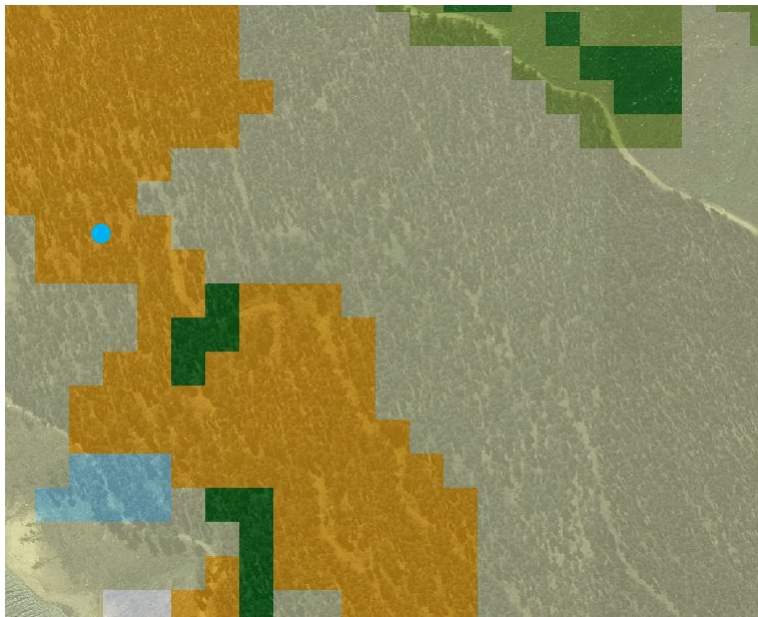
# Data: Labels



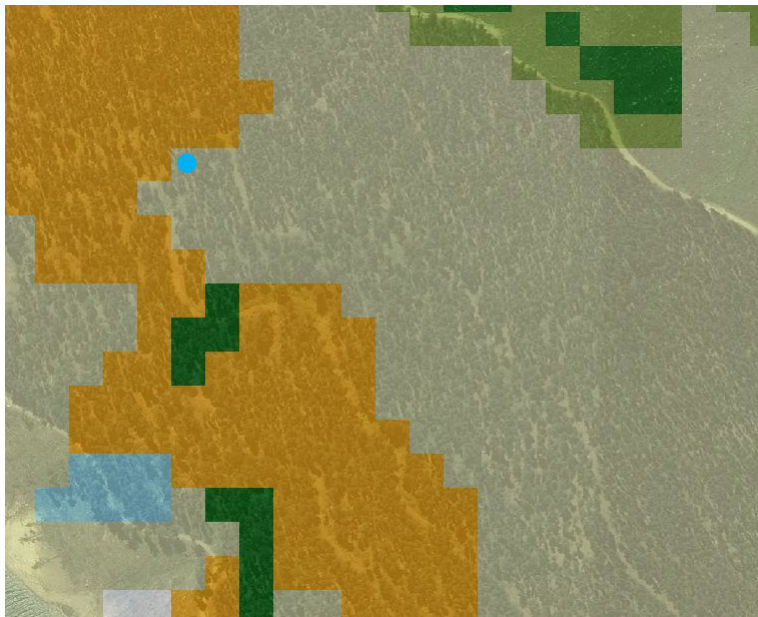
# Data: Labels



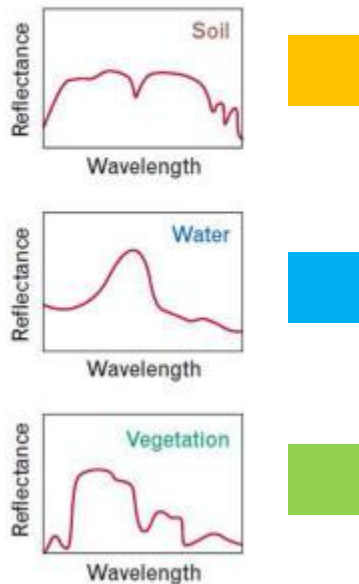
# Data: Labels



# Data: Labels

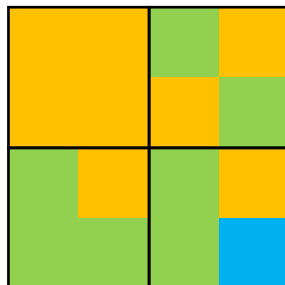


# Models



## Unmixing

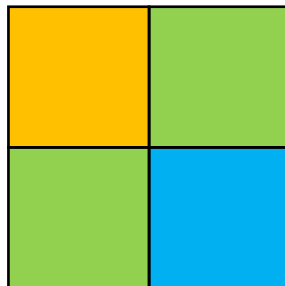
### Reality



### Prediction

W: 0%	W: 0%
S: 100%	S: 50%
V: 0%	V: 50%
W: 0%	W: 25%
S: 25%	S: 25%
V: 75%	V: 50%

## Classification

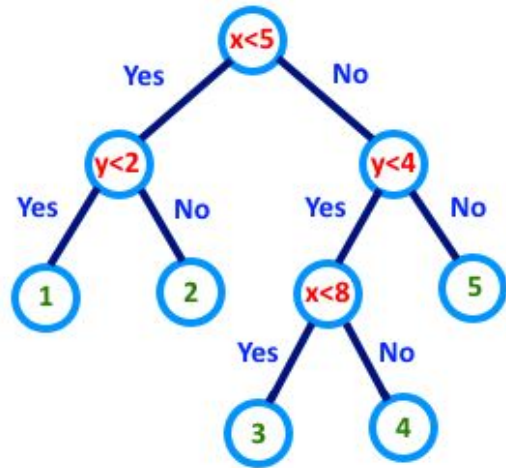


W: 3%	W: 3%
S: 93%	S: 12%
V: 4%	V: 85%
W: 1%	W: 98%
S: 22%	S: 1%
V: 77%	V: 1%

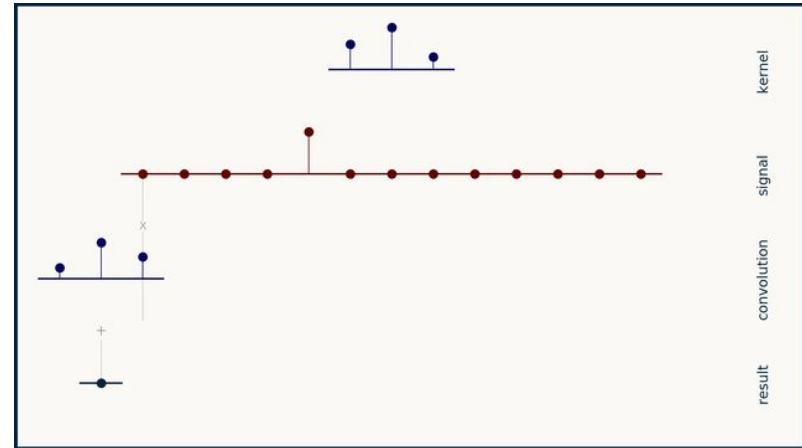
Soil	Veg
Veg	Water

# Models

## Trees



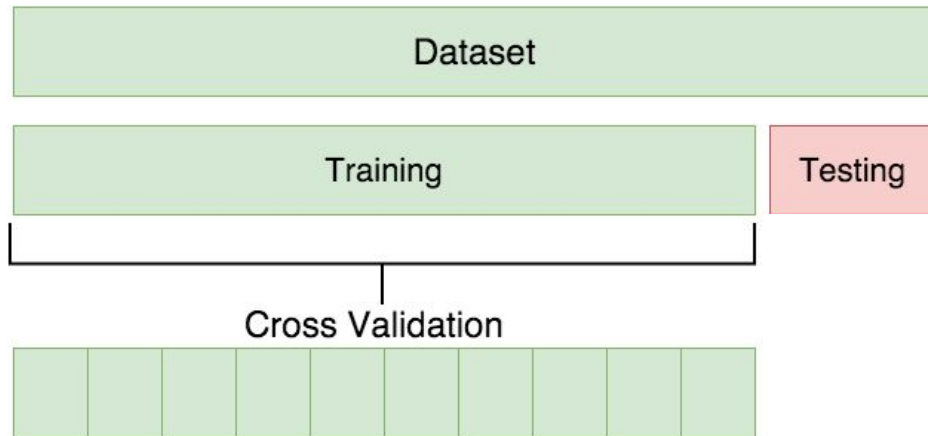
## Neural networks



Decision tree < Random Forest < Boosted Trees



# Evaluation



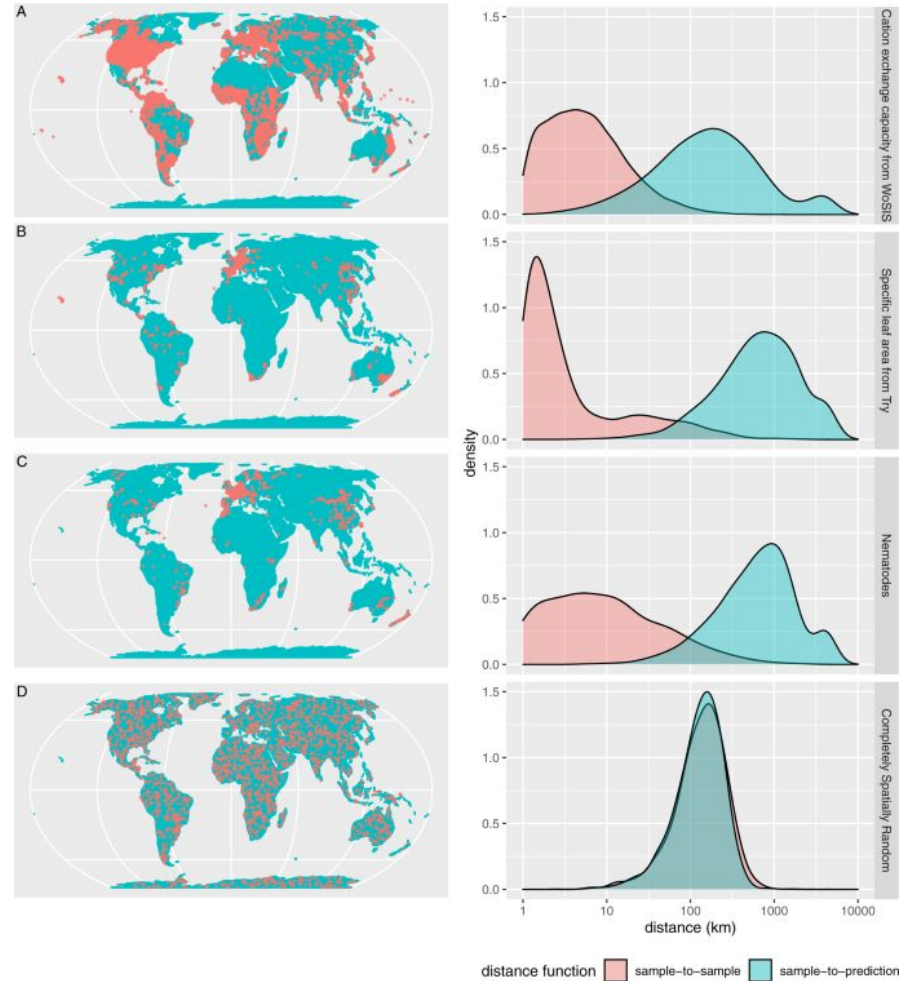
# Evaluation

Validation Fold

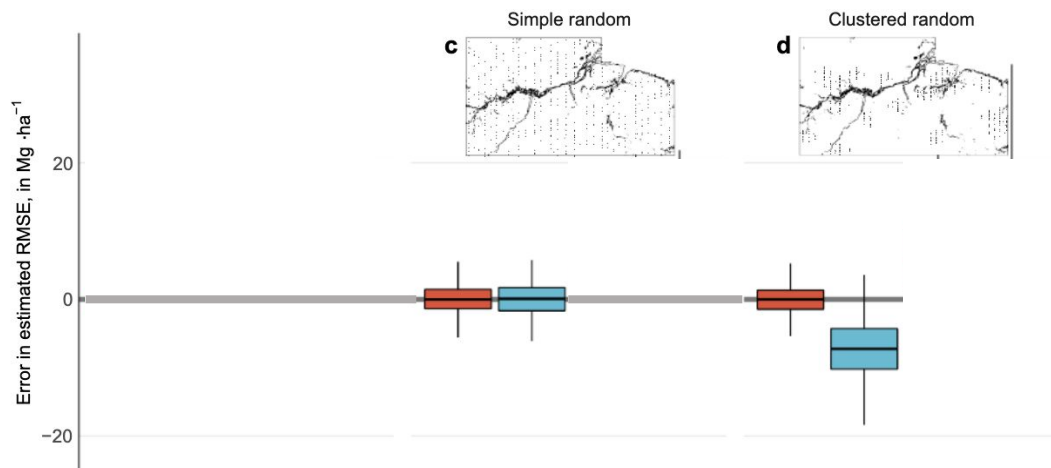
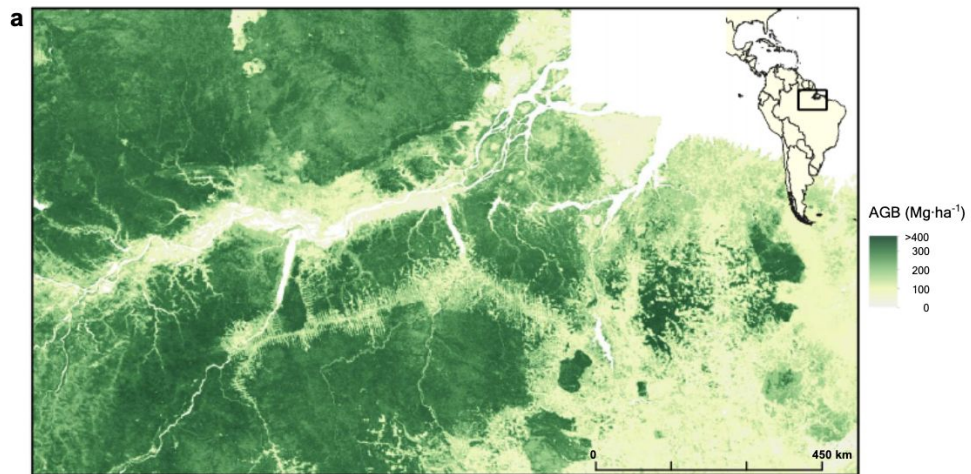
Training Fold



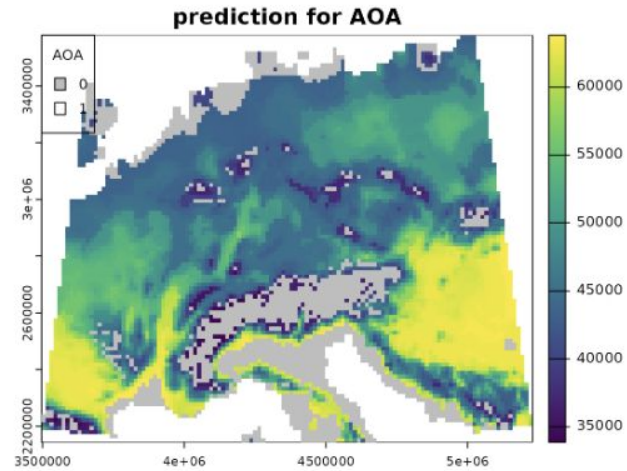
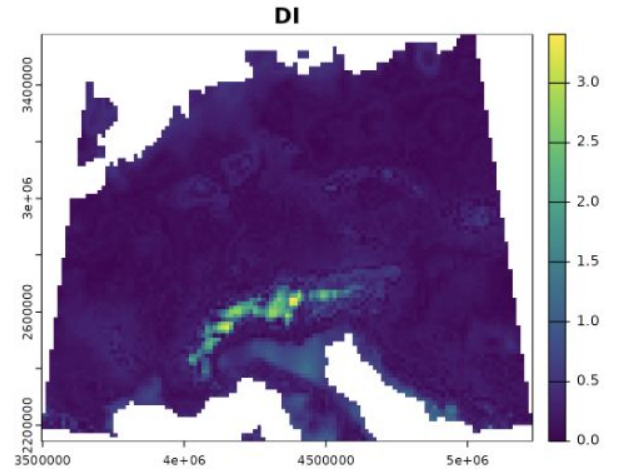
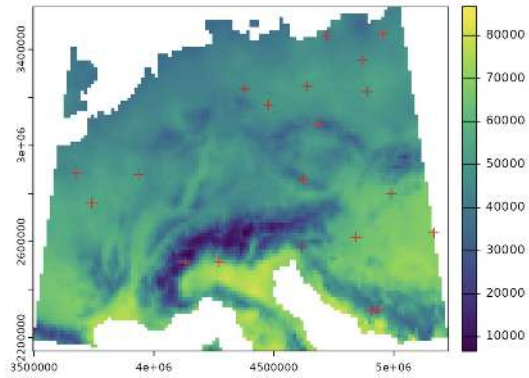
# Evaluation



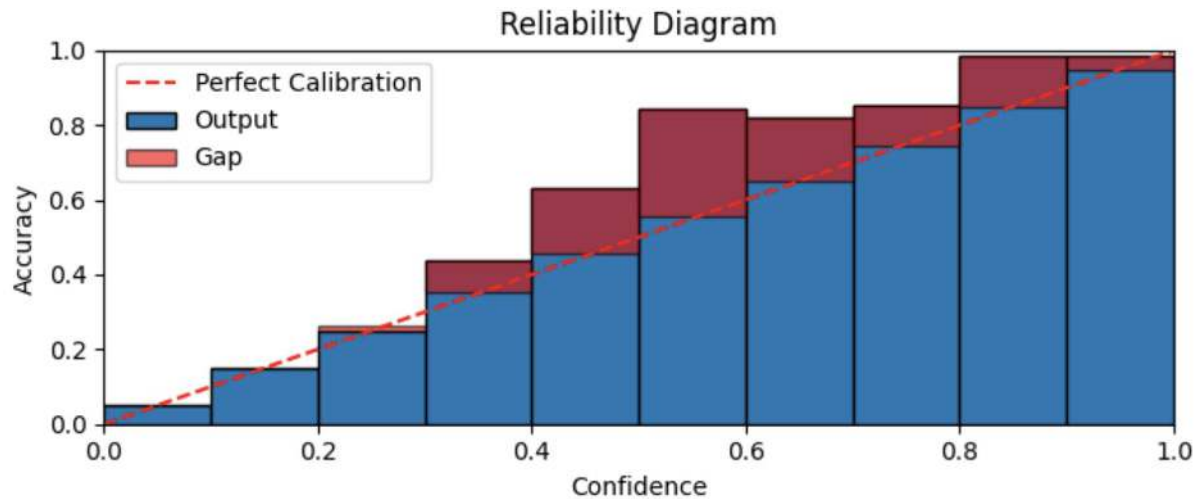
# Evaluation



# Prediction



# Prediction



# Prediction

