Sandra Skowronek[1,2]

Gregory P. Asner[2]

Hannes Feilhauer[1]

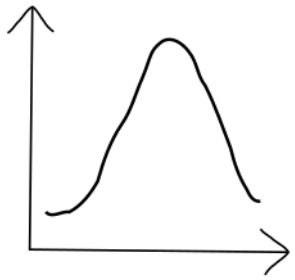
[1] University of Erlangen-Nürnberg, Germany

[2] Carnegie Institution for Science, Stanford, CA

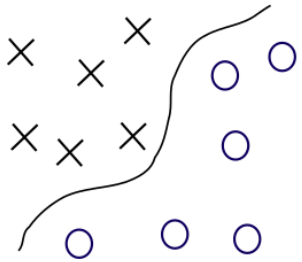
Aims and scope

- Can we detect small quantities of invasive plant species?
- Which classifier performs best?

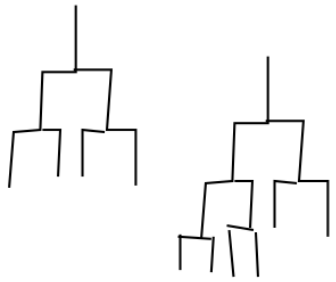
Maxent



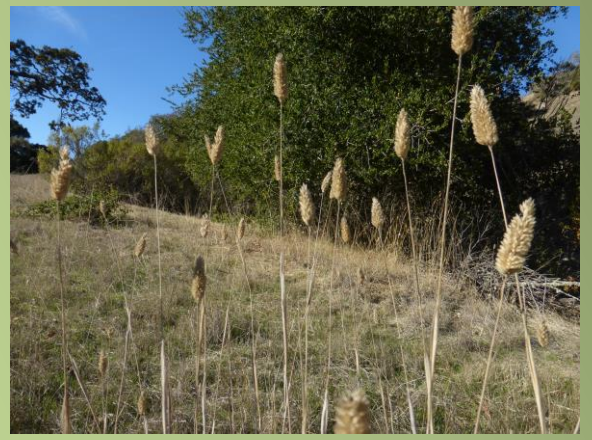
Support Vector Machines (SVM)



Boosted regression trees (BRT)

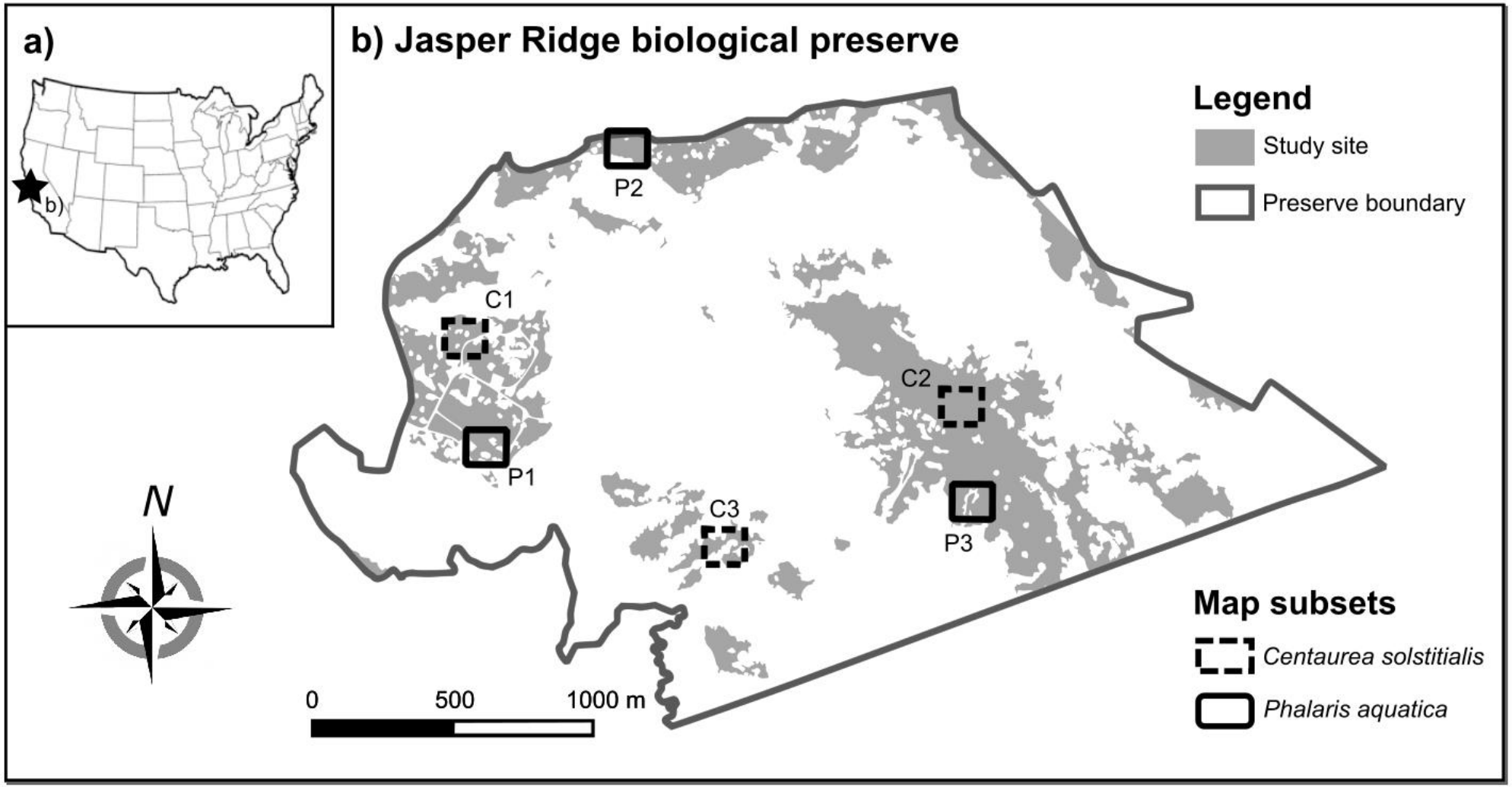


Centaurea solstitialis

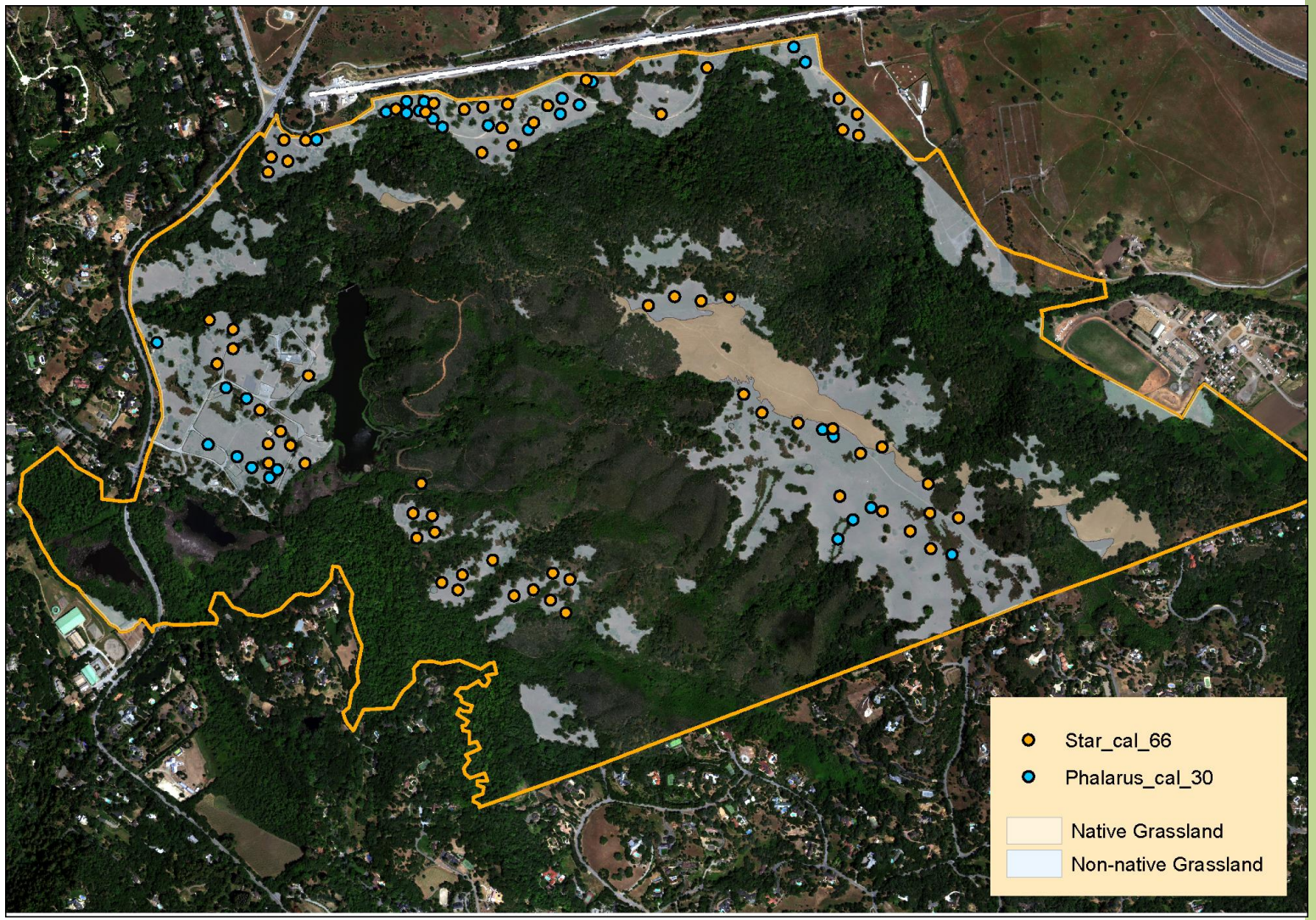


Phalaris aquatica

Study area

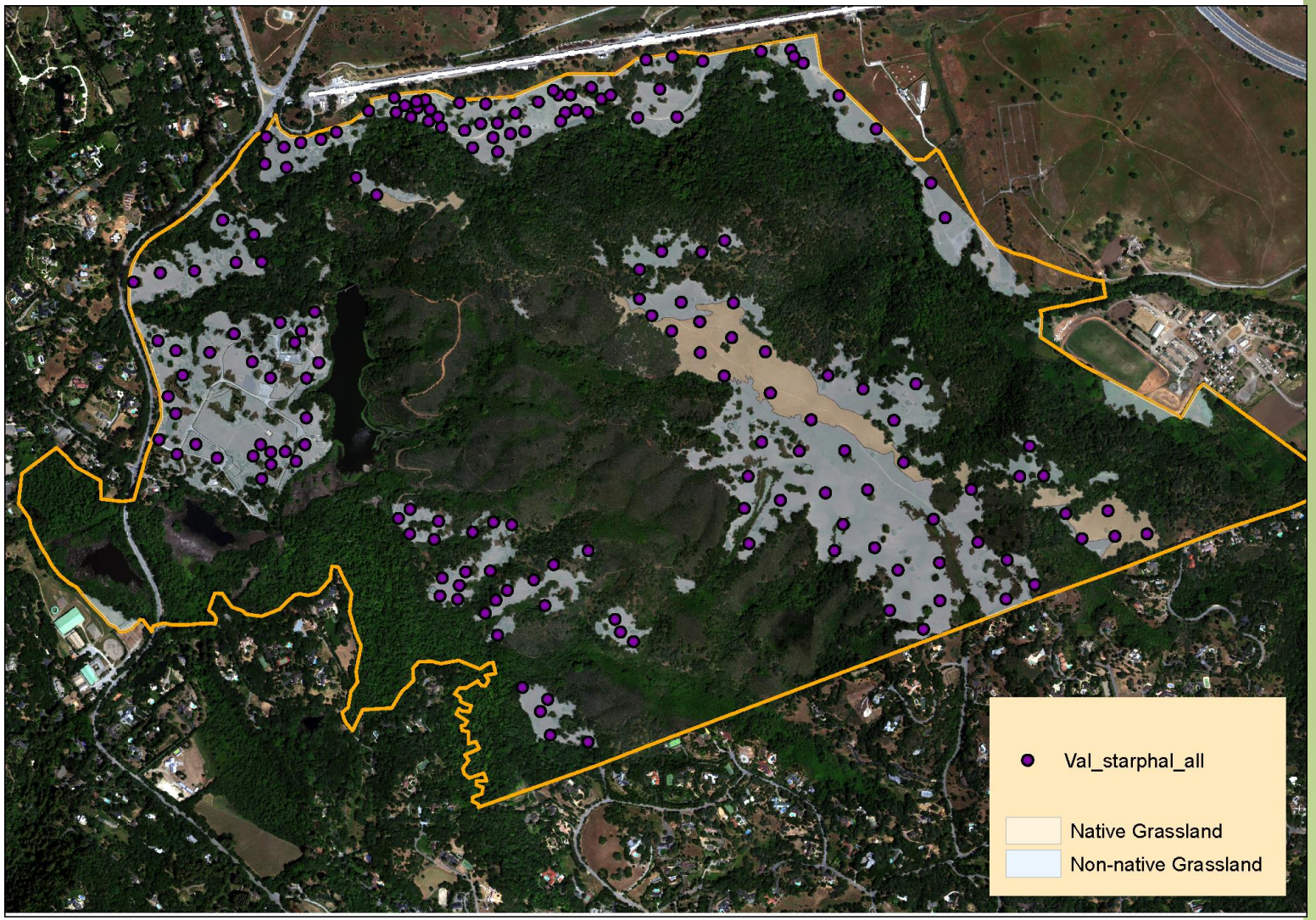

a)
b)
b) Jasper Ridge biological preserve
Legend
Study site
Preserve boundary
P1
P2
P3
C1
C2
C3
N
0
500
1000 m
Map subsets
Centaurea solstitialis
Phalaris aquatica

Field data - calibration



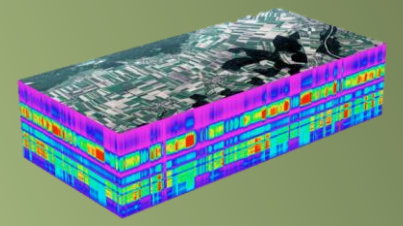
- 3 m x 3 m plots
- 66 plots Starthistle
- 33 plots Phalaris

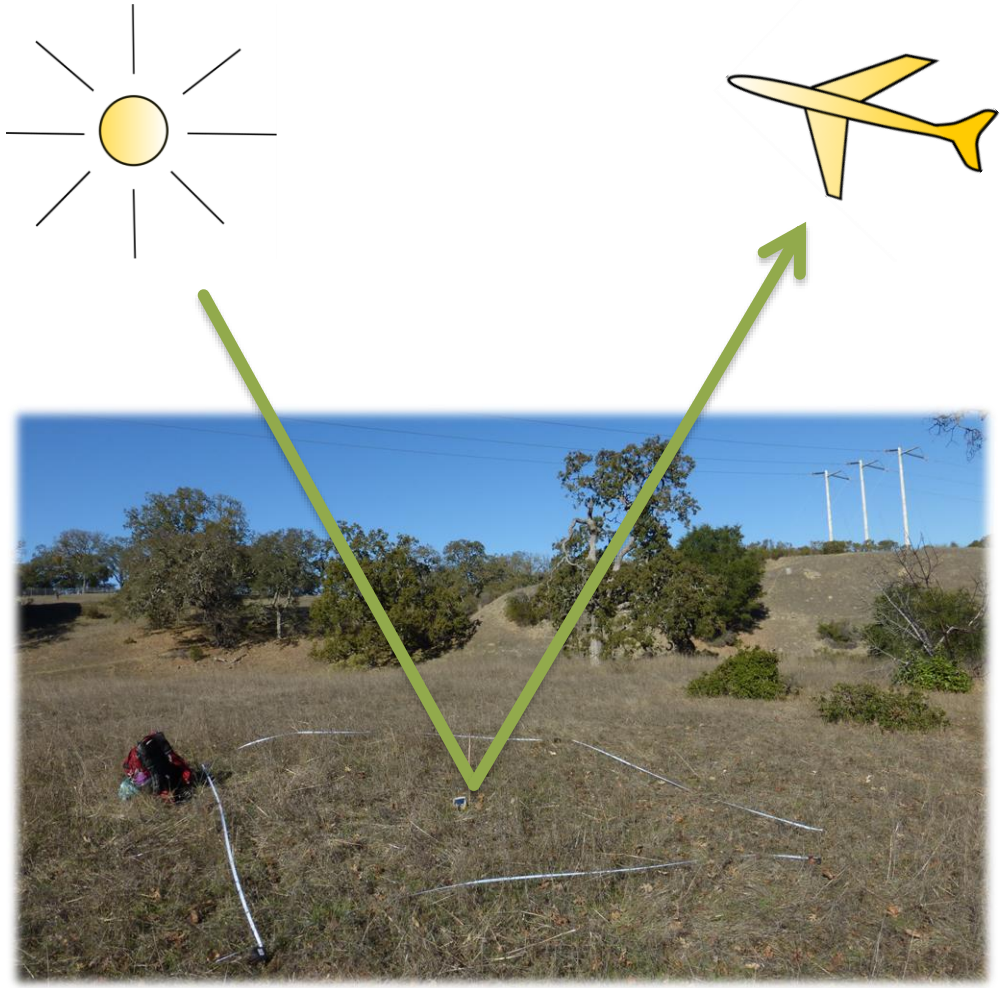
Field data - validation



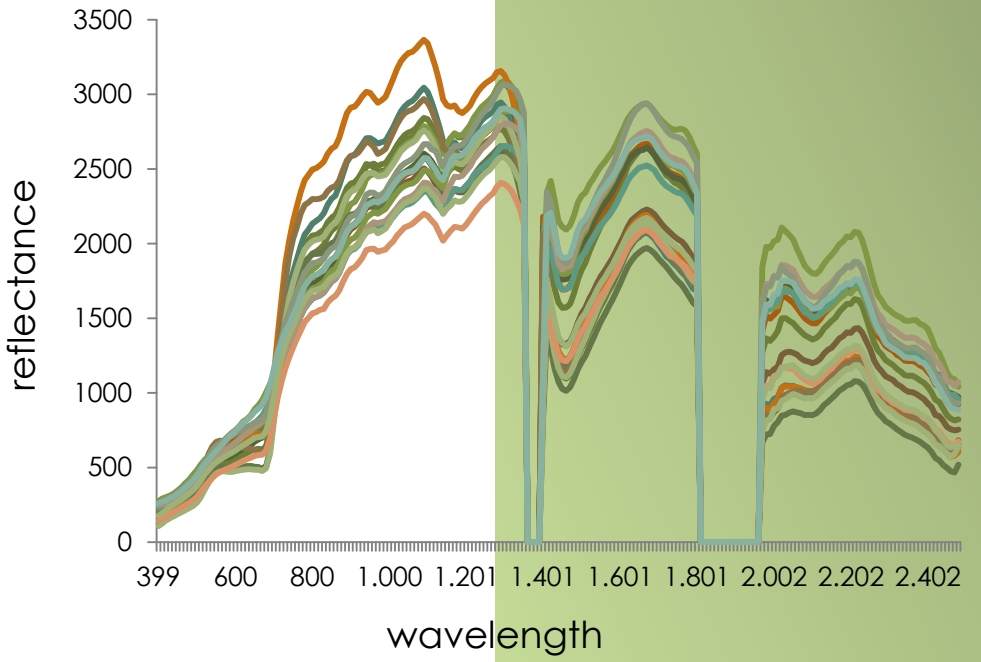
- 3 m x 3 m plots
- total of 173 plots

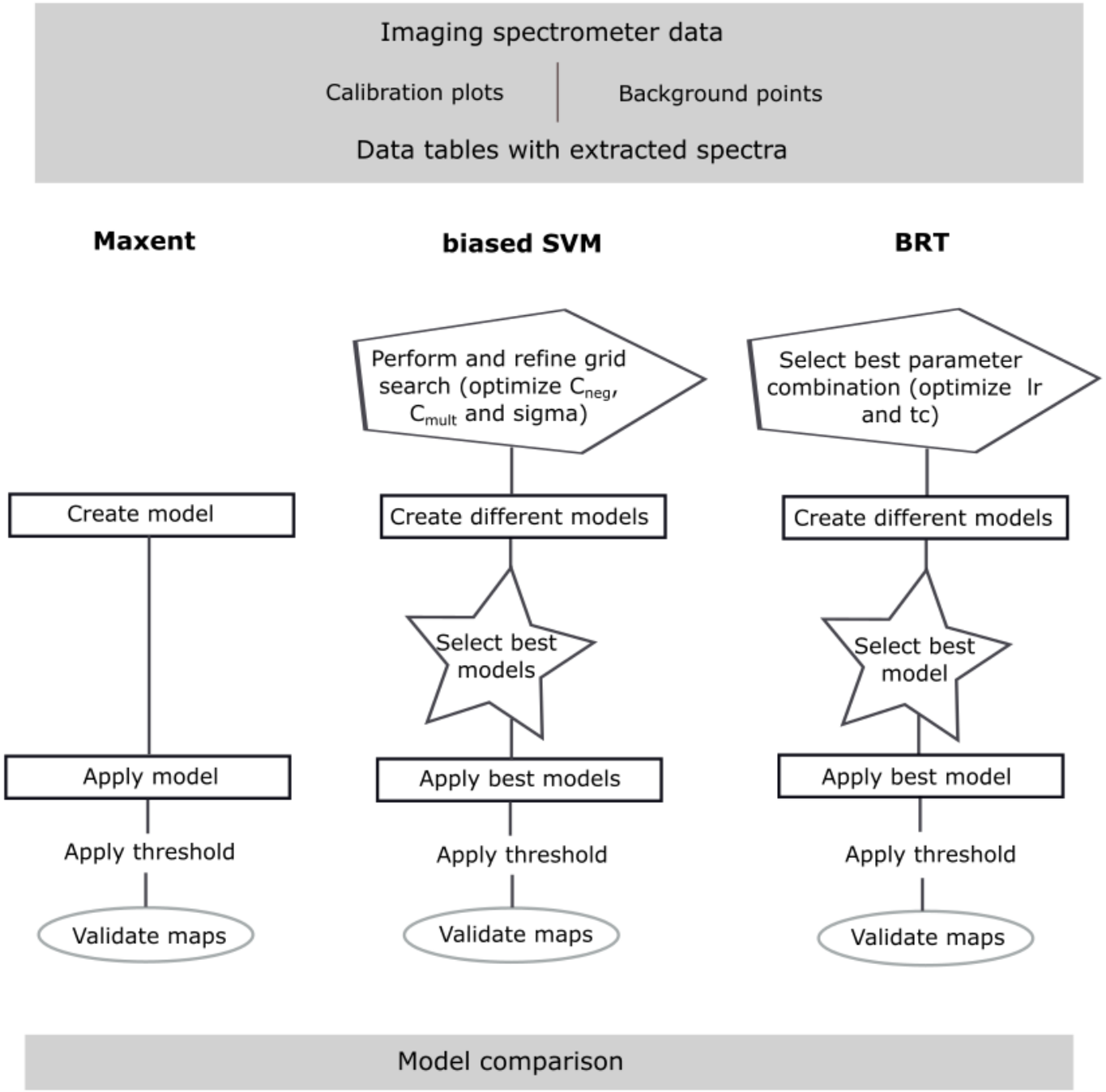
Hyperspectral remote sensing data





- 168 spectral bands
- 400-2500 nm
- 1 m x 1 m pixels
- 6th of May 2014

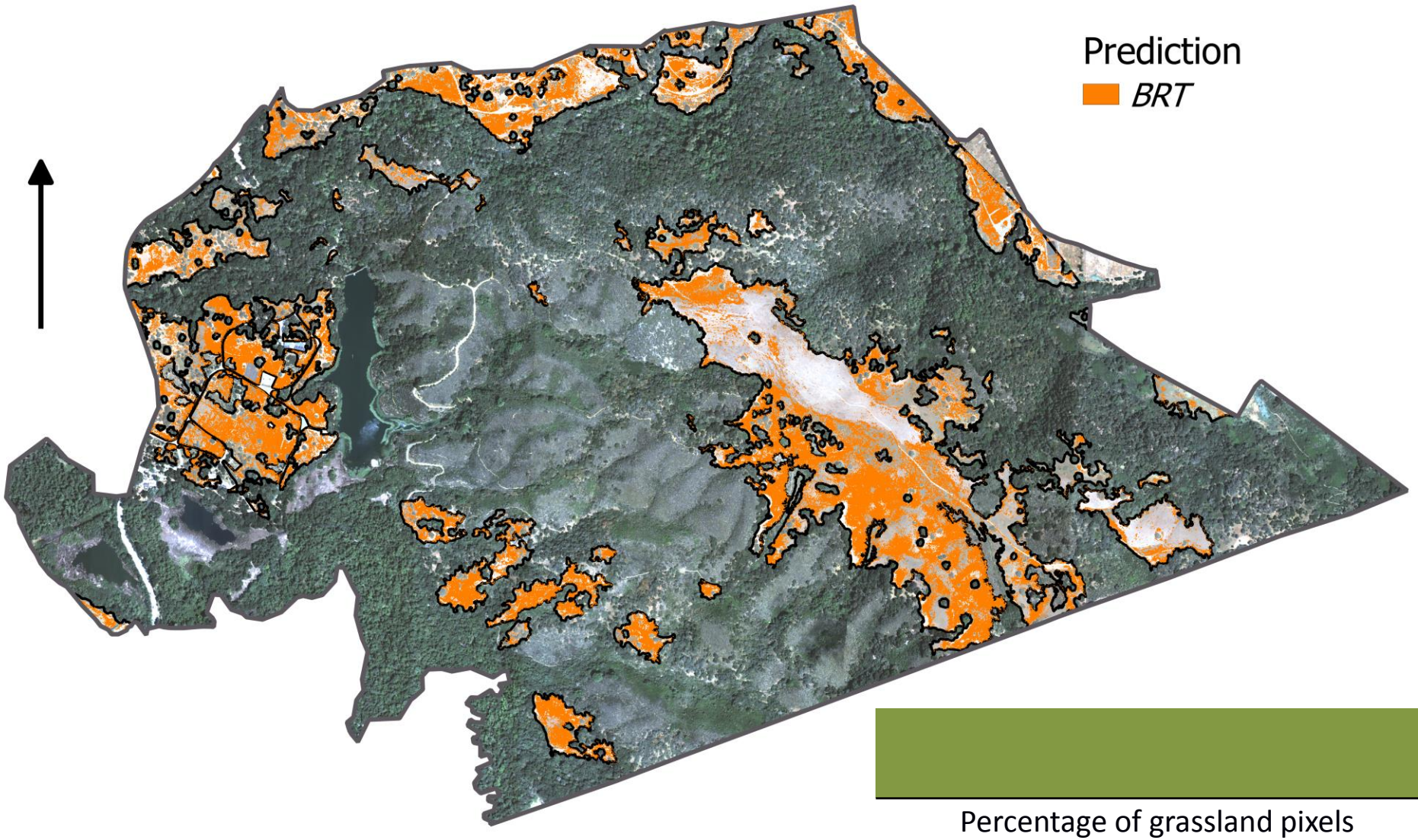



Imaging spectrometer data
Calibration plots
Background points
Data tables with extracted spectra
Maxent
biased SVM
BRT
Perform and refine grid search (optimize C_{neg}, C_{mult} and sigma)
Select best parameter combination (optimize lr and tc)
Create model
Create different models
Create different models
Select best models
Select best model
Apply model
Apply best models
Apply best model
Apply threshold
Apply threshold
Apply threshold
Validate maps
Validate maps
Validate maps
Model comparison

workflow

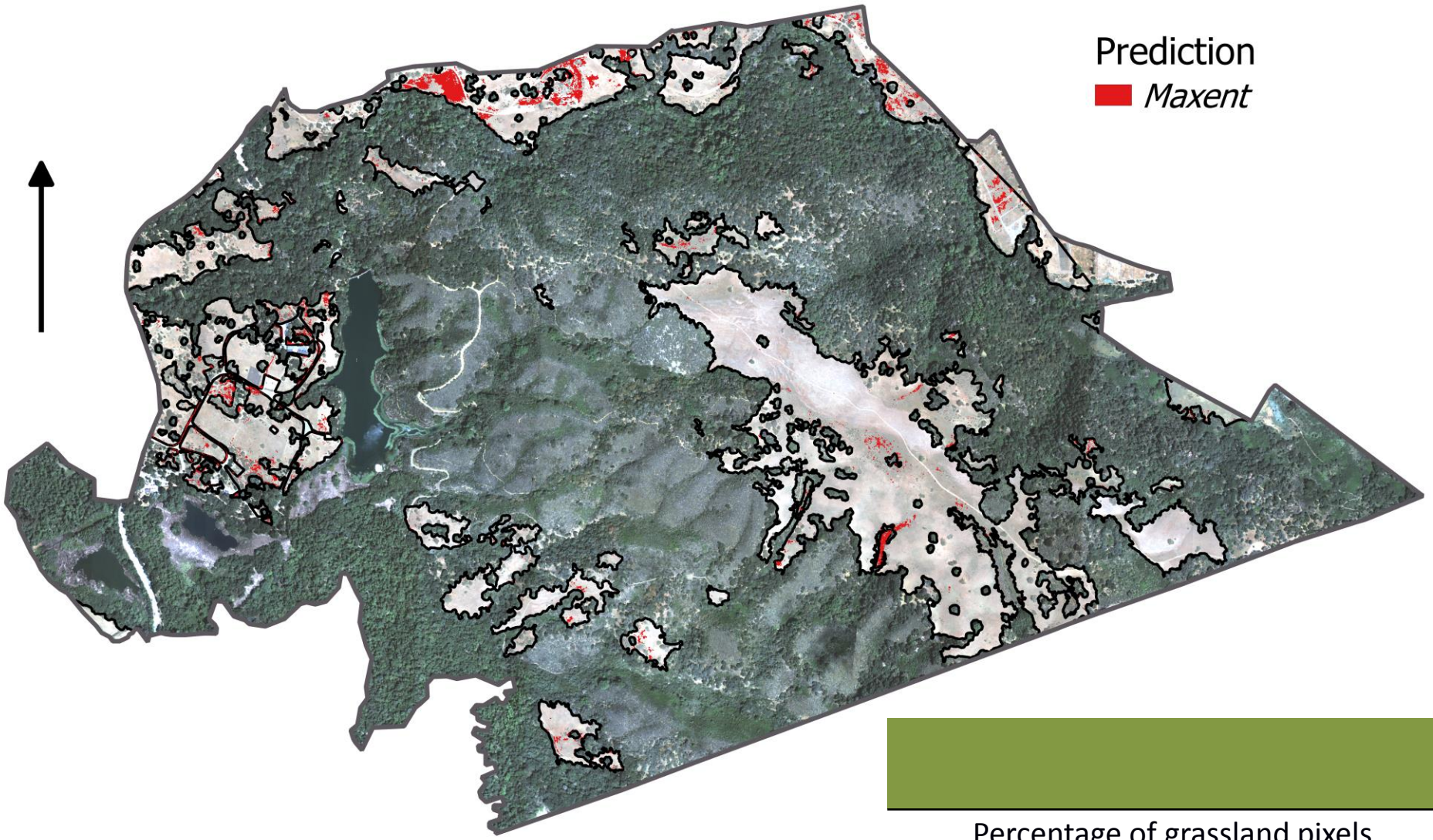
predictions

Centaurea solstitialis



	Max-ent	Biased SVM	BRT
Percentage of grassland pixels with *Centaurea solstitialis*	46.2	40.3	41.1

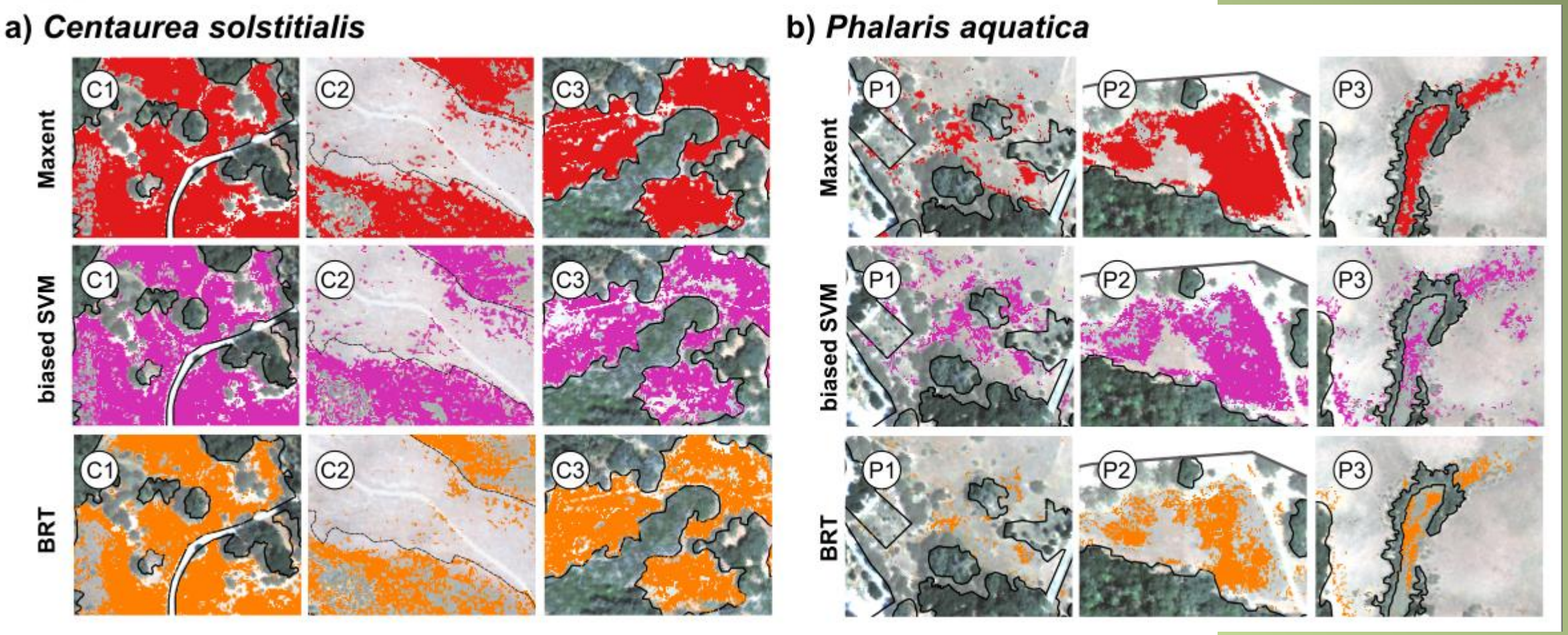
Phalaris aquatica



predictions

	Max-ent	Biased SVM	BRT
Percentage of grassland pixels with *Phalaris aquatica*	3.8	7.2	3.0

Subsets


a) Centaurea solstitialis
b) Phalaris aquatica
Maxent
biased SVM
BRT
C1
C2
C3
P1
P2
P3

Confusion matrices - *Centaurea solstitalis*

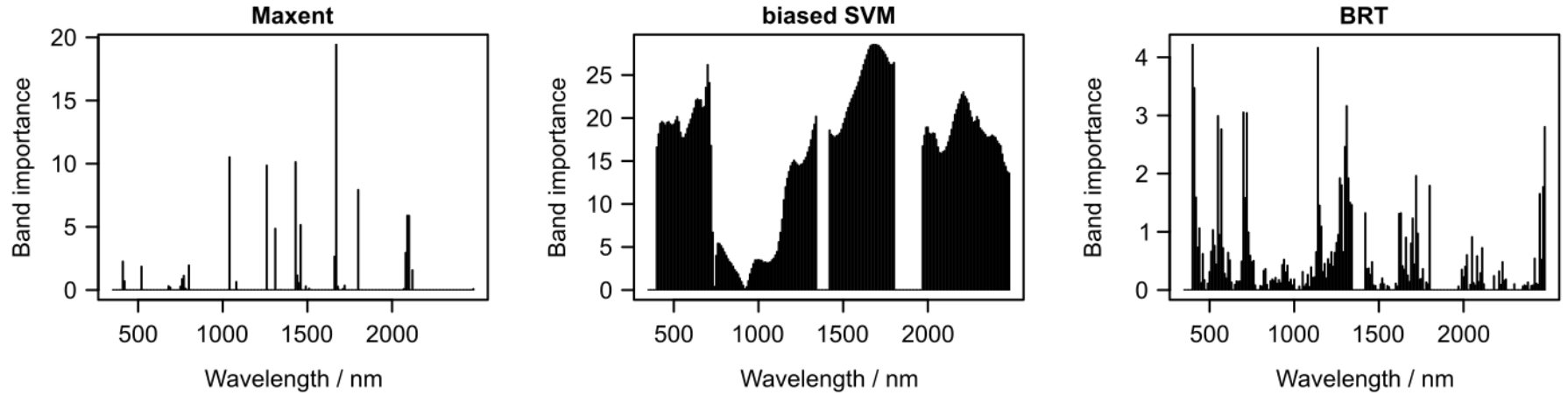
Maxent			SVM			BRT		
	0 - pred	*1 - pred*		*0 - pred*	*1 - pred*		*0 - pred*	*1 - pred*
0 - field	**35 (TN)**	32 (FP)	*0 - field*	**44**	23	*0 - field*	**47**	20
1 - field	11 (FN)	**88 (TP)**	*1 - field*	23	**76**	*1- field*	25	**74**
Overall accuracy	0.74			0.72			0.73	

Confusion matrices - *Phalaris aquatica*

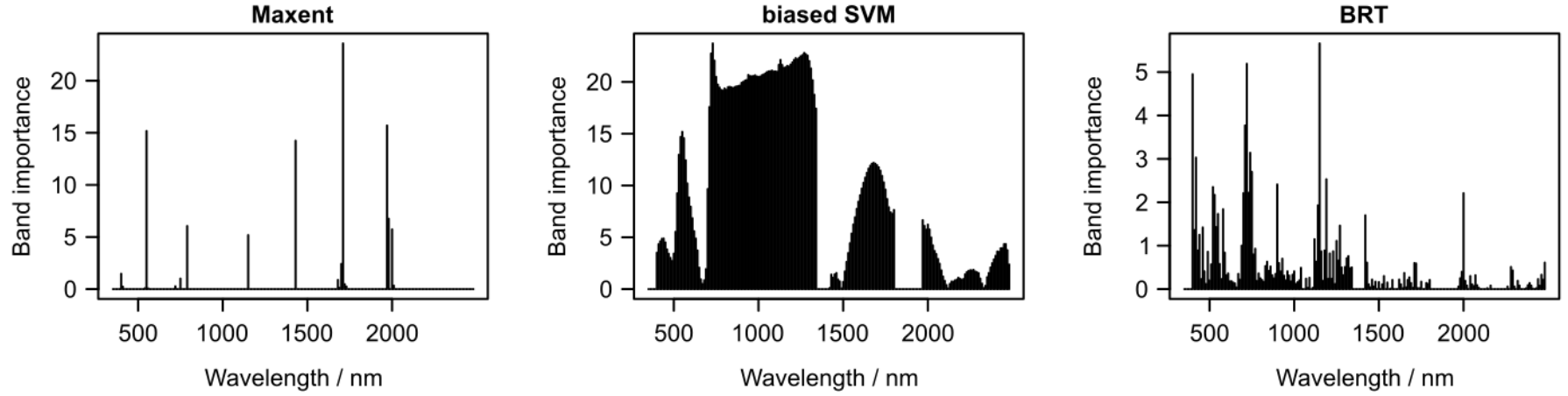
	Maxent			SVM			BRT	
	0 - pred	*1 - pred*		*0 - pred*	*1 - pred*		*0 - pred*	*1 - pred*
0 - field	**137**	6	*0 - field*	**128**	15	*0 - field*	**139**	4
1 - field	15	**15**	*1 - field*	14	**16**	*1 - field*	16	**14**
Overall accuracy	0.88			0.83			0.88	

Band importances

a) *Centaurea solstitialis*

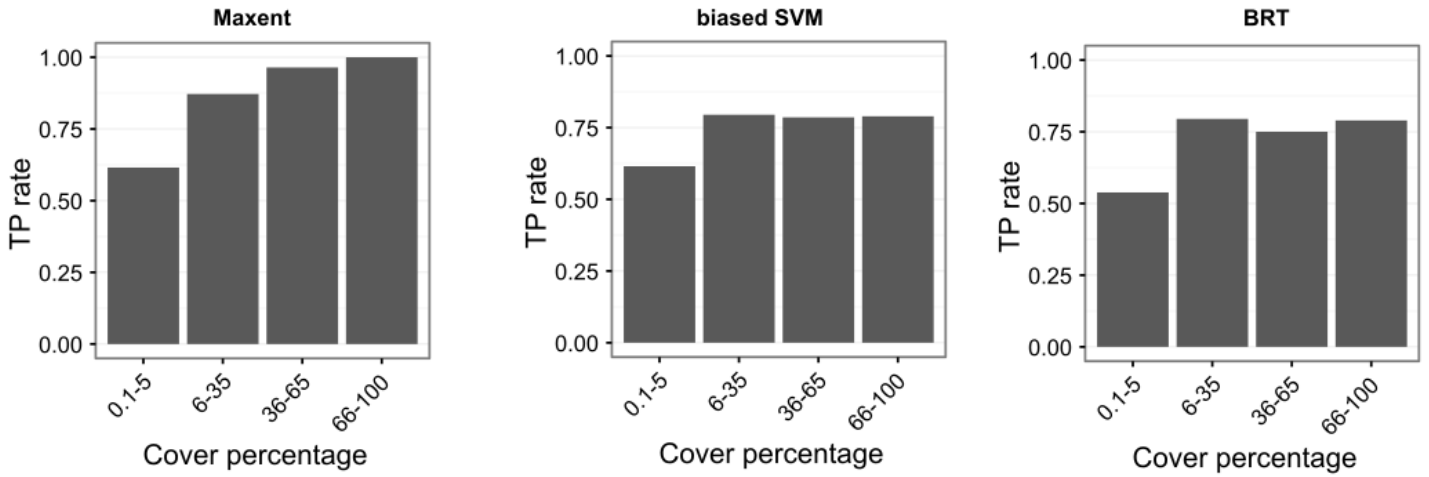


b) *Phalaris aquatica*

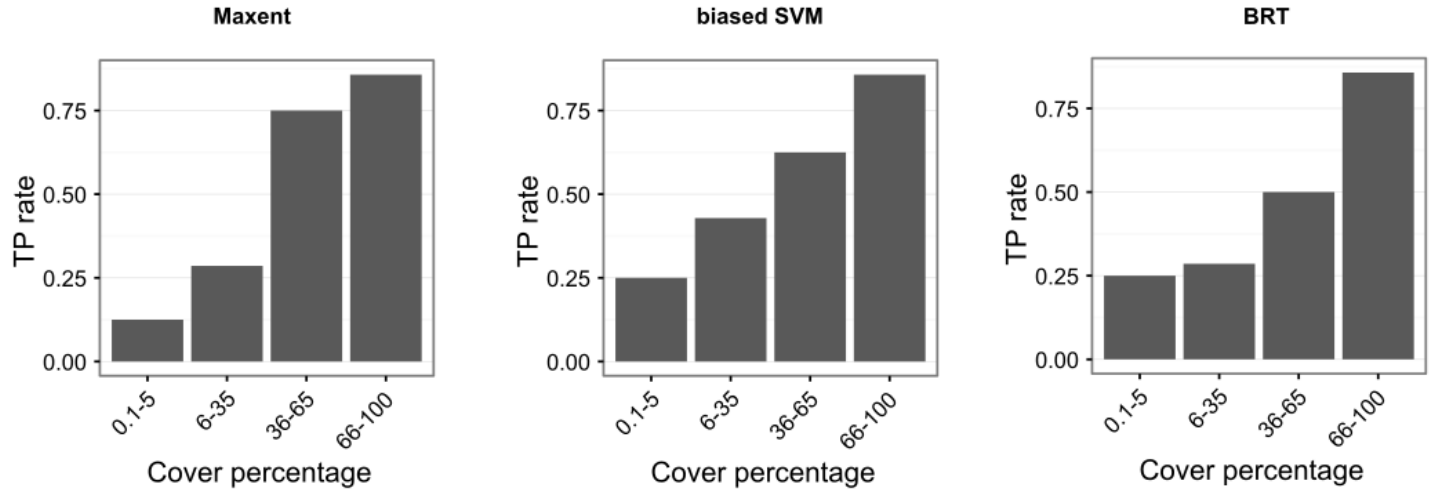


Mapping small cover fractions?

a) *Centaurea solstitialis*



b) *Phalaris aquatica*



Conclusions

- We can map both species, but much higher success of mapping small cover fractions for Starthistle

- Similar overall performance of different classifiers, but some differences in predictions and use of different band areas

Thanks for your attention!

Contact:

Sandra.Skowronek
@fau.de