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in partnership with:



Evaluating performance of machine learning models for detecting polyphagous shot hole borer infestations in urban trees in Johannesburg, South Africa using satellite data

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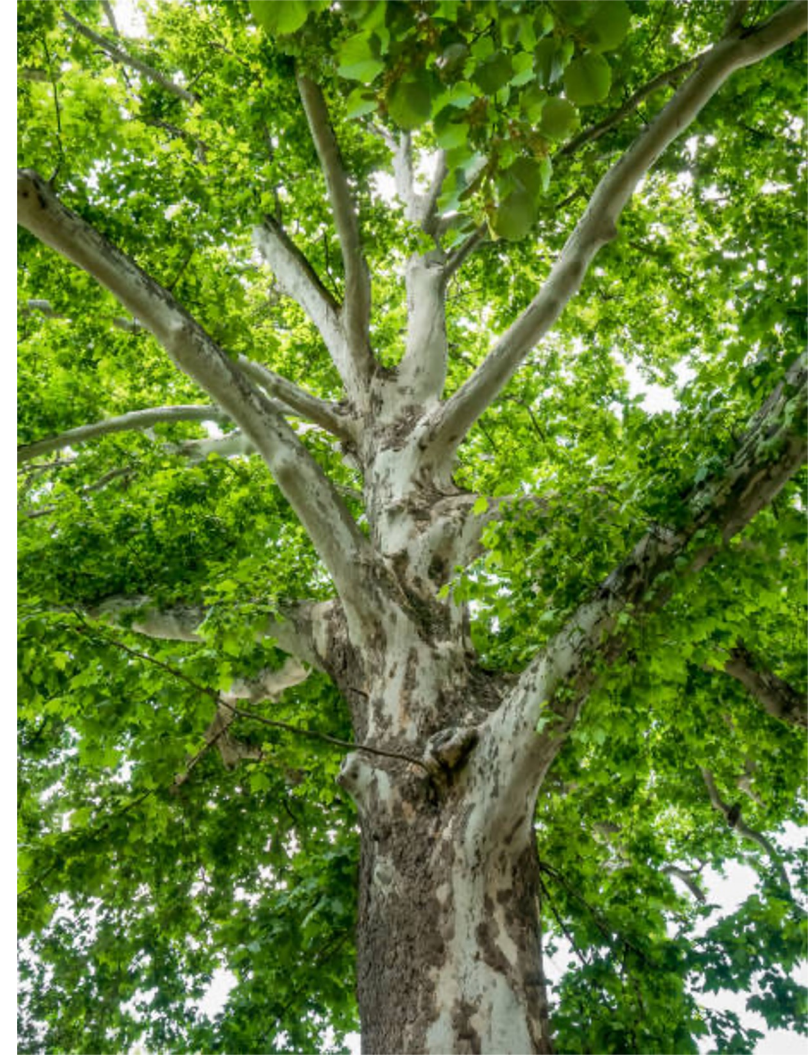


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Introduction

- Trees are key components of urban ecosystems
- Trees threatened by invasive pests
- PSHB spread- urban pest
- 1st incidence of PSHB- London plane tree
- In South Africa- native and exotic trees are attacked



Polyphagous shot hole borer



PSHB infestations signs on host trees

Platanus x acerifolia



Acer negundo



Acer buergerianum

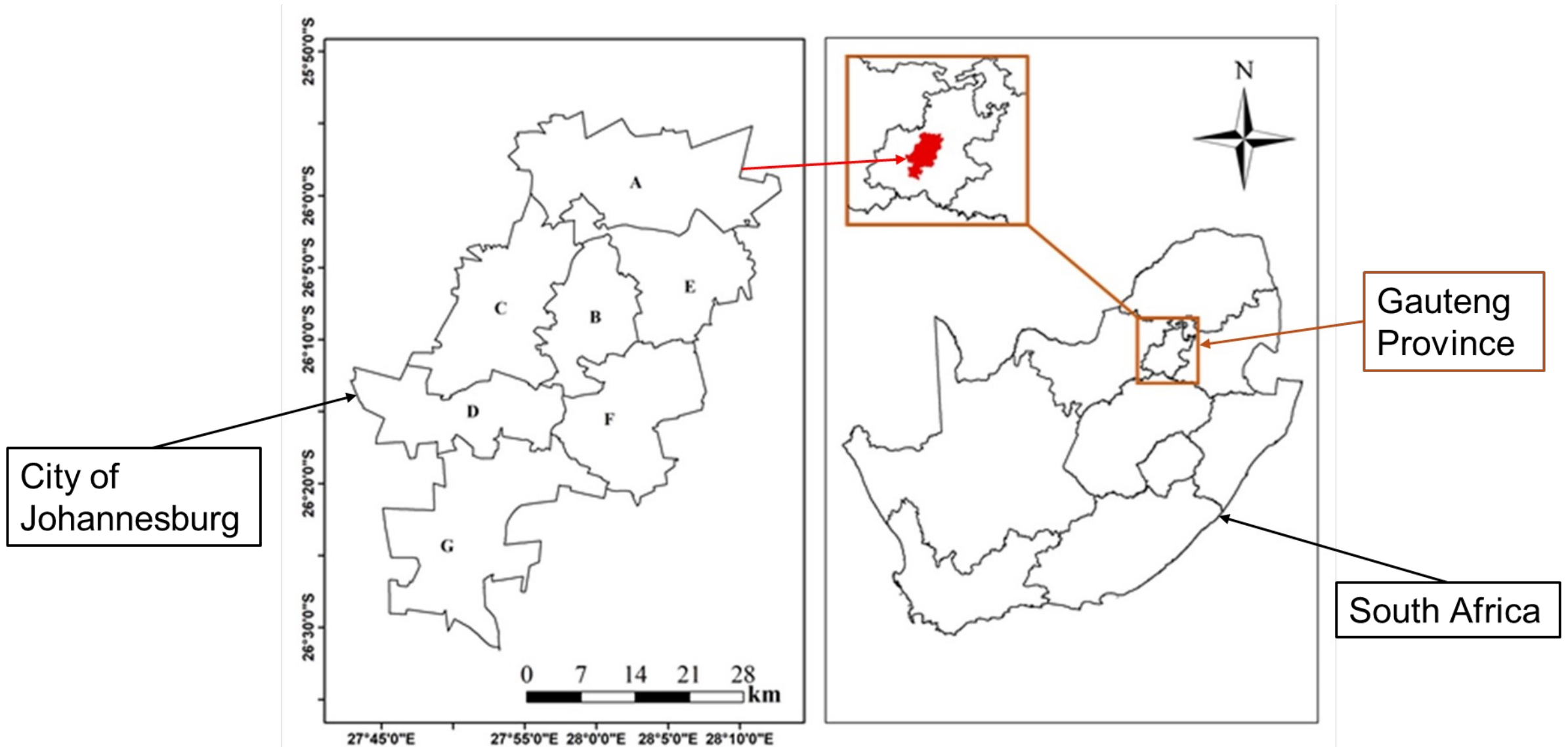


Aim

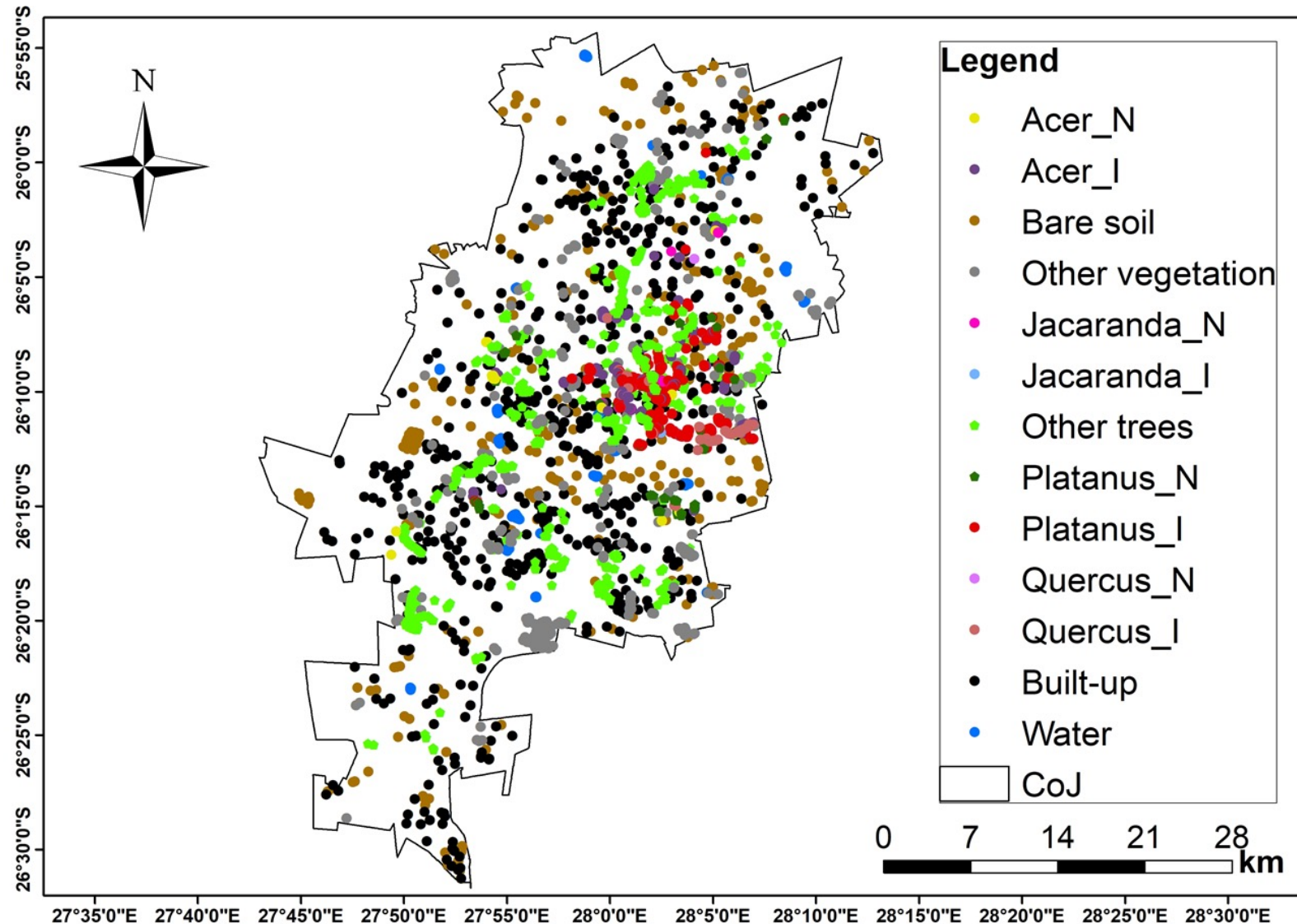
To evaluate performance of remote sensing methods in detecting PSHB infestations in urban trees using Sentinel-2 satellite data



Methods



Common urban trees



Class	Count
Acer_N	31
Acer_I	209
Bare soil	300
Other vegetation	600
Jacaranda_N	18
Jacaranda_I	10
Other trees	536
Platanus_N	127
Platanus_I	536
Quercus_N	3
Quercus_I	90
Built-up	600
Water	300

N = non infested

I = infested



Sentinel 2- map of Johannesburg



28/10/2022



Classifier algorithms

Individual algorithms



- Random forest
- Gradient Boosting
- Neural Network
- Linear SVM
- SVM (RBF)
- AdaBoost

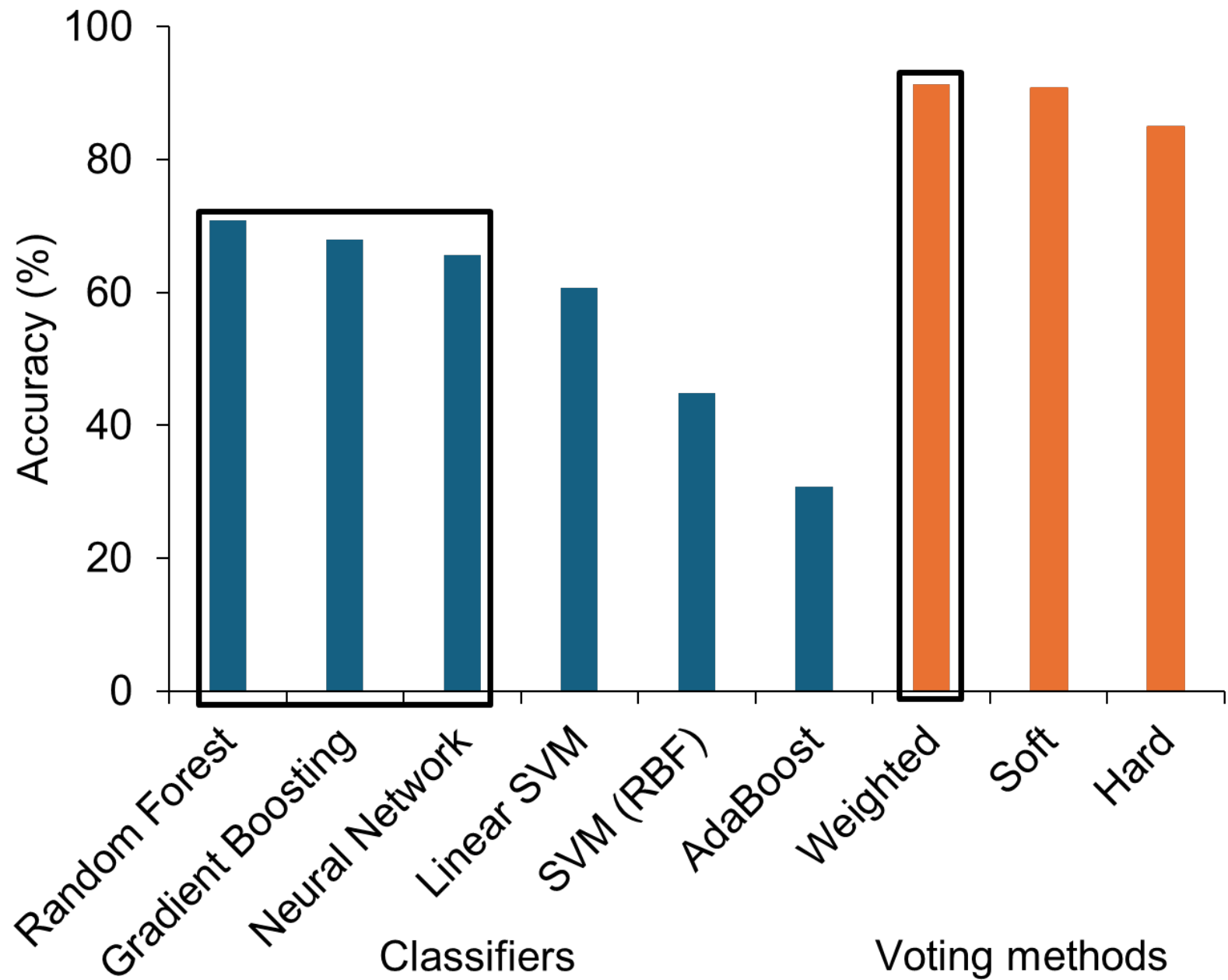
Ensemble voting



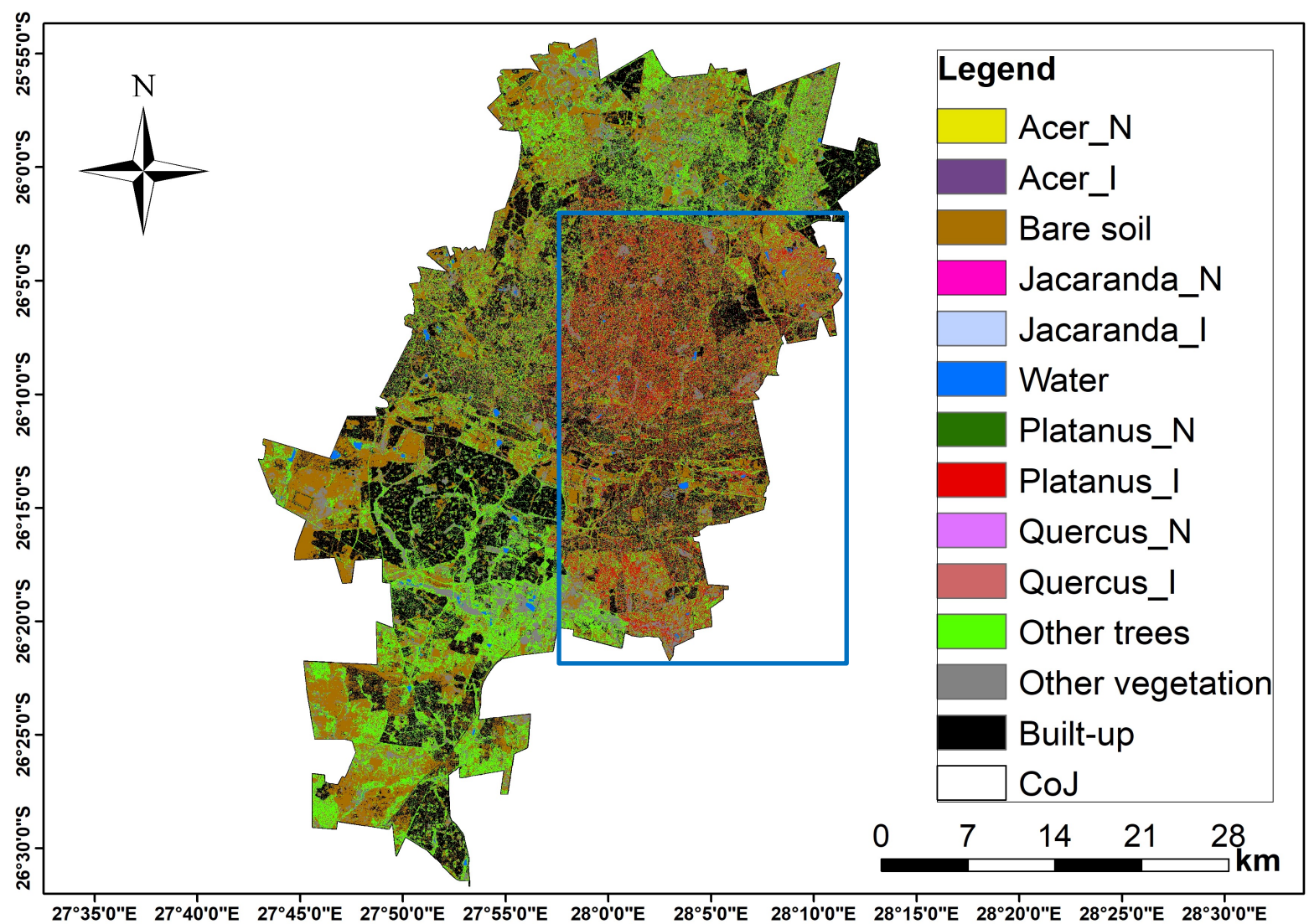
- Hard
- Soft
- Weighted



Results



Classified map of City of Johannesburg



PSHB infestation

Class	Area coverage per each region (km ²)						
	A	B	C	D	E	F	G
<i>Acer</i> _N	1.49	0.87	1.50	0.49	1.17	1.09	1.19
<i>Acer</i> _I	9.57	6.21	9.13	5.72	9.13	17.05	5.88
Bare soil	70.87	6.74	44.31	50.76	15.31	18.72	88.31
<i>Jacaranda</i> _N	7.45	8.25	9.02	0.19	8.83	0.52	5.19
<i>Jacaranda</i> _I	0.45	0.34	0.40	0.13	0.38	0.52	0.40
Water	1.53	0.56	1.73	1.48	1.19	1.03	1.93
<i>Platanus</i> _N	5.25	5.23	4.28	0.47	5.38	5.27	2.70
<i>Platanus</i> _I	13.92	43.37	24.91	2.21	50.12	53.67	6.38
<i>Quercus</i> _N	0.14	0.14	0.26	0.08	0.23	0.14	0.36
<i>Quercus</i> _I	2.67	3.72	2.93	1.12	4.27	6.56	2.57
Other trees	98.43	32.81	70.49	33.56	46.41	49.34	106.39
Other vegetation	35.22	7.82	13.09	15.93	10.42	15.37	36.18
Built-up	66.33	32.99	74.12	74.41	45.68	49.92	63.86



Conclusion

- RF model achieved highest overall accuracy compared to other individual models
- Weighted voting improved the overall performance- considers overall and class accuracy for each model
- Highest infestation area for Plane trees- regions B, E and F
- Highest infestation area for *Acer* and *Quercus*- regions E and F



Recommendations

- Regions **B**, **E** and **F** requires an urgent management intervention for all three species
- Some of the suburbs included are:
- Rosebank and Greenside - region B
- Saxonwold and Bramley Park- region E
- Kensington and Jeppestown- region F



Acknowledgements



Thank You.



Accuracy

- RF model = **70%**
- Weighted voting = **91%**

