Predicting forest volume growth using repeated airborne laser scanning (ALS), climate and soil data

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Outline

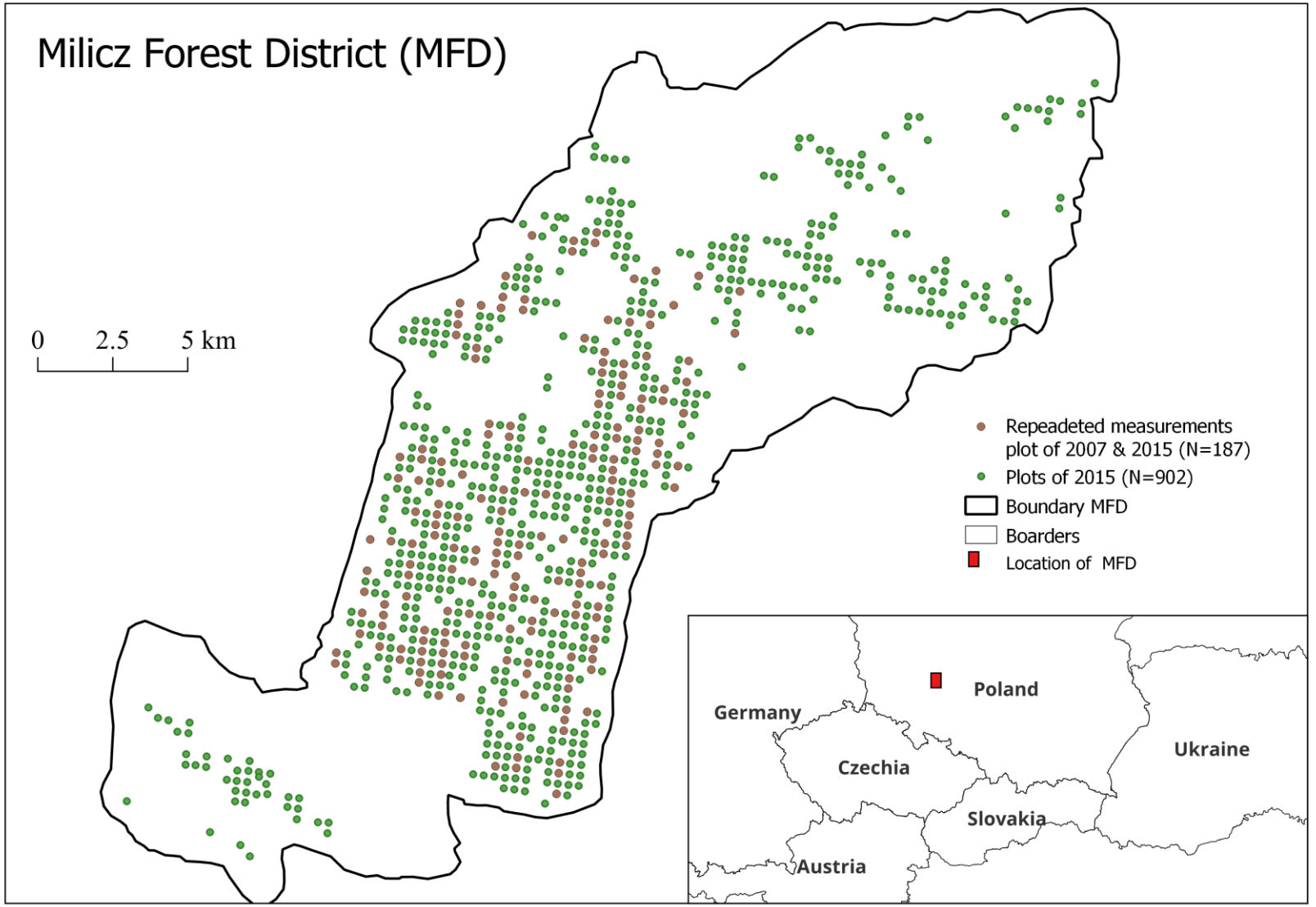
- Motivation
- Study area
- Variables and models
- Preliminary results
- Conclusion

Motivation

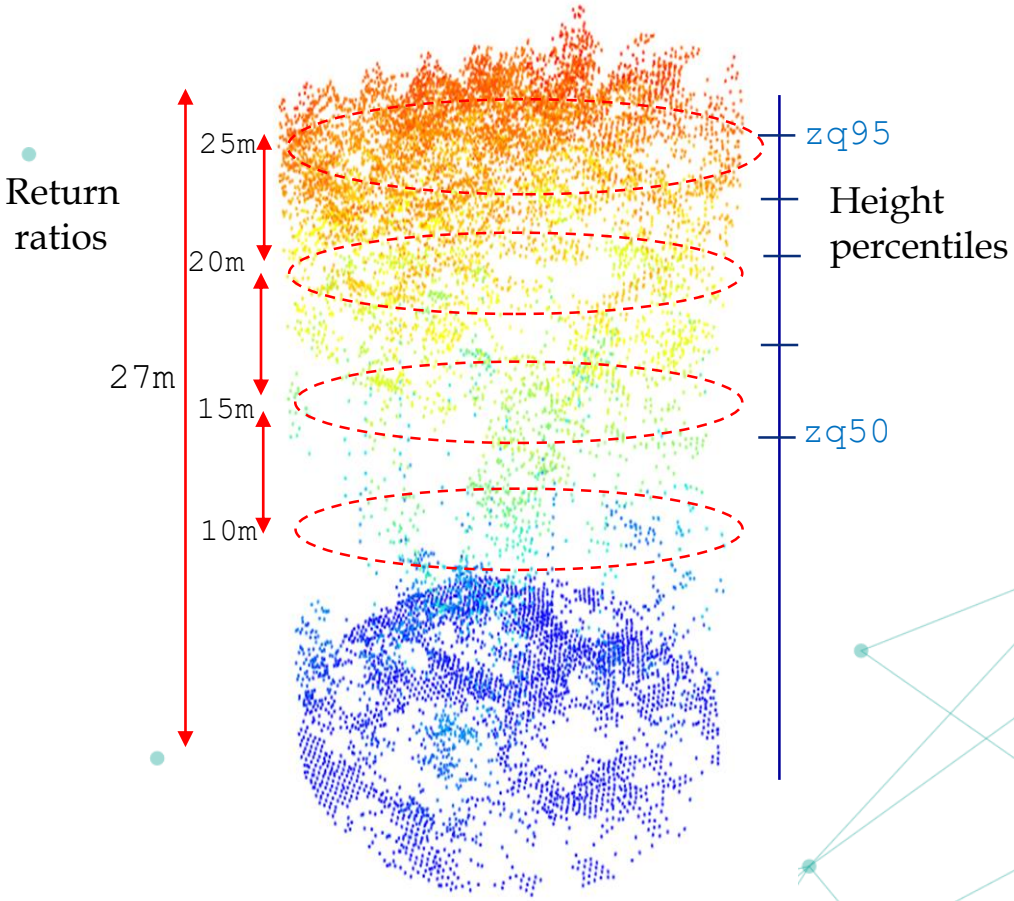
- Evaluate potential to improve growth volume estimates
- Compare growth and estimate change
- Evaluate model sensitivity to climate and site factors

Study area - Milicz

Period:
2007 and 2015



Variables



Point cloud (ALS) variables

Climate

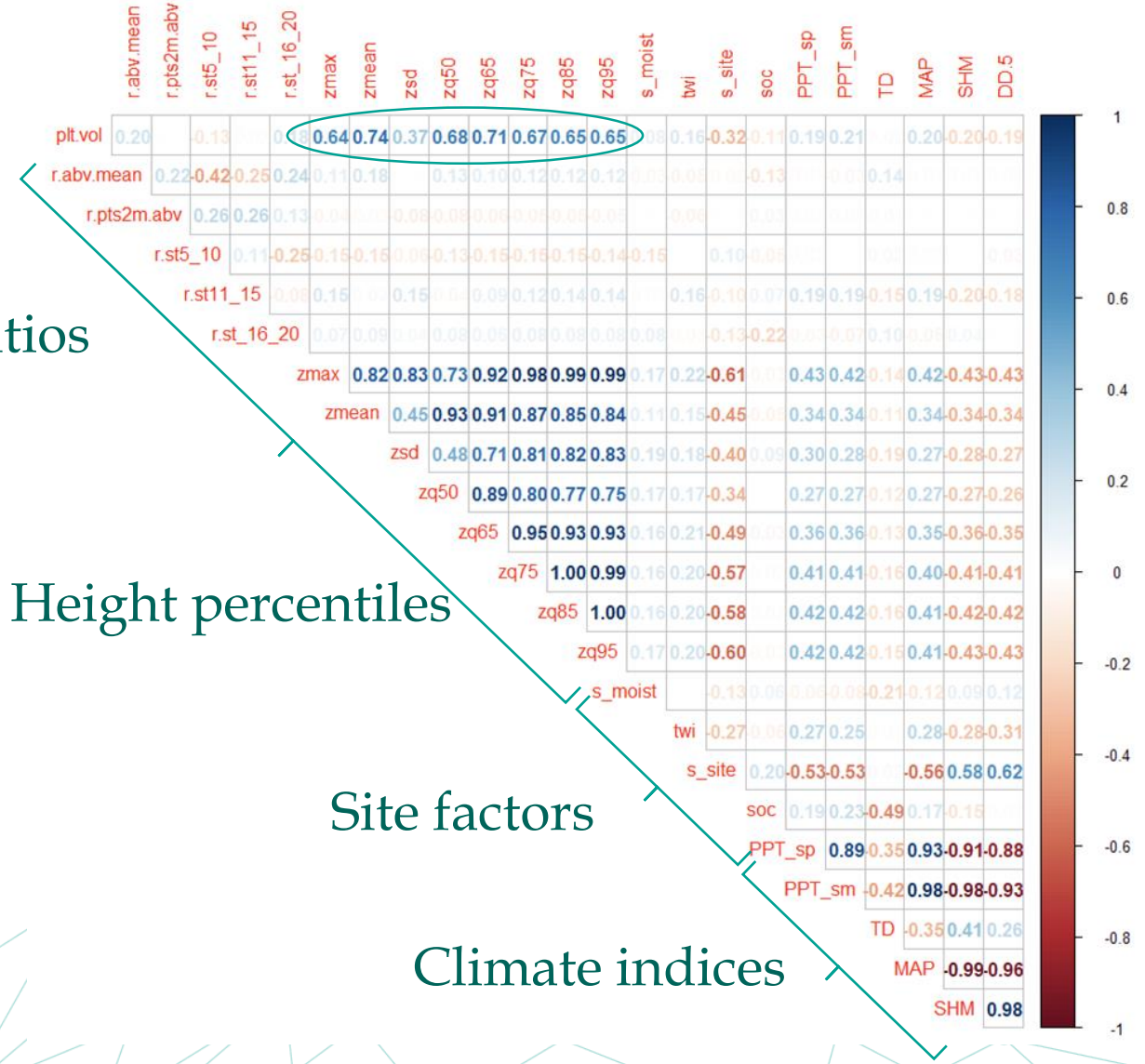
- seasonal
- annual
- growth indices

Site factors

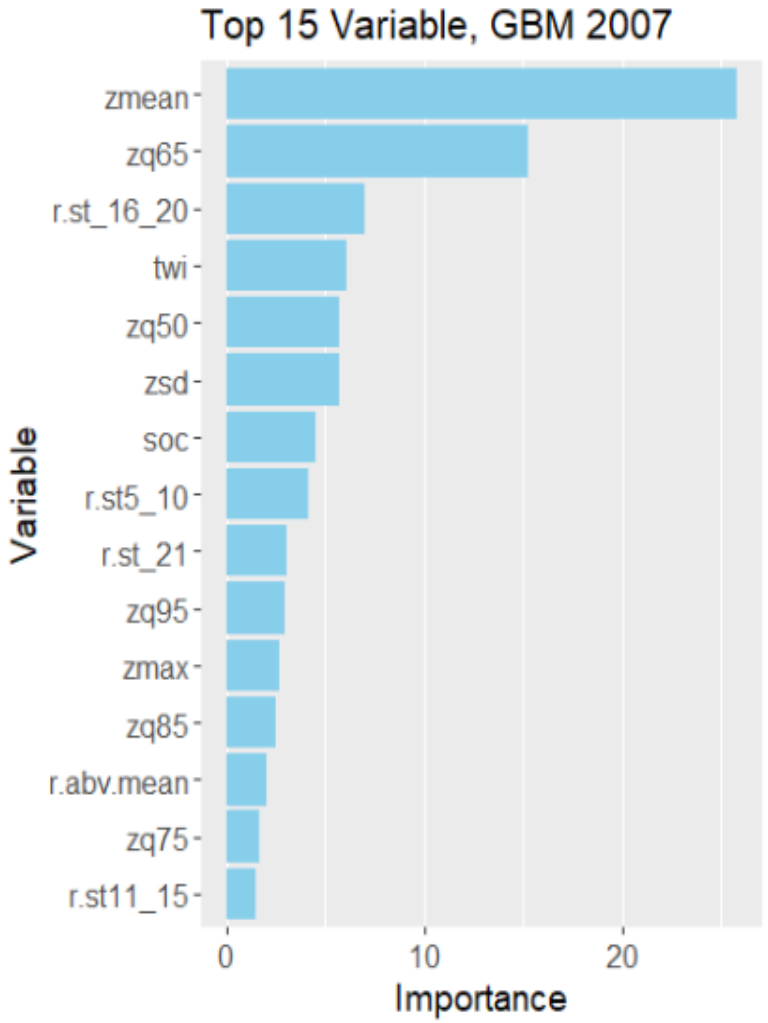
- Site type
- Site moisture

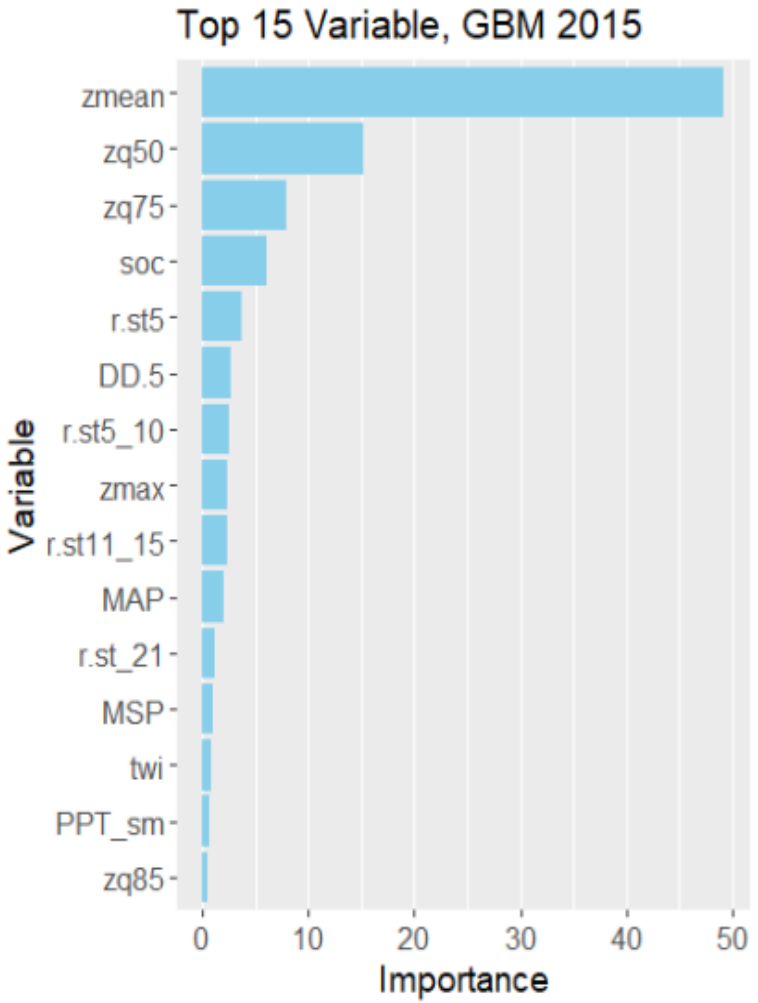
Organic carbon (soc)

Correlation



Preliminary Results





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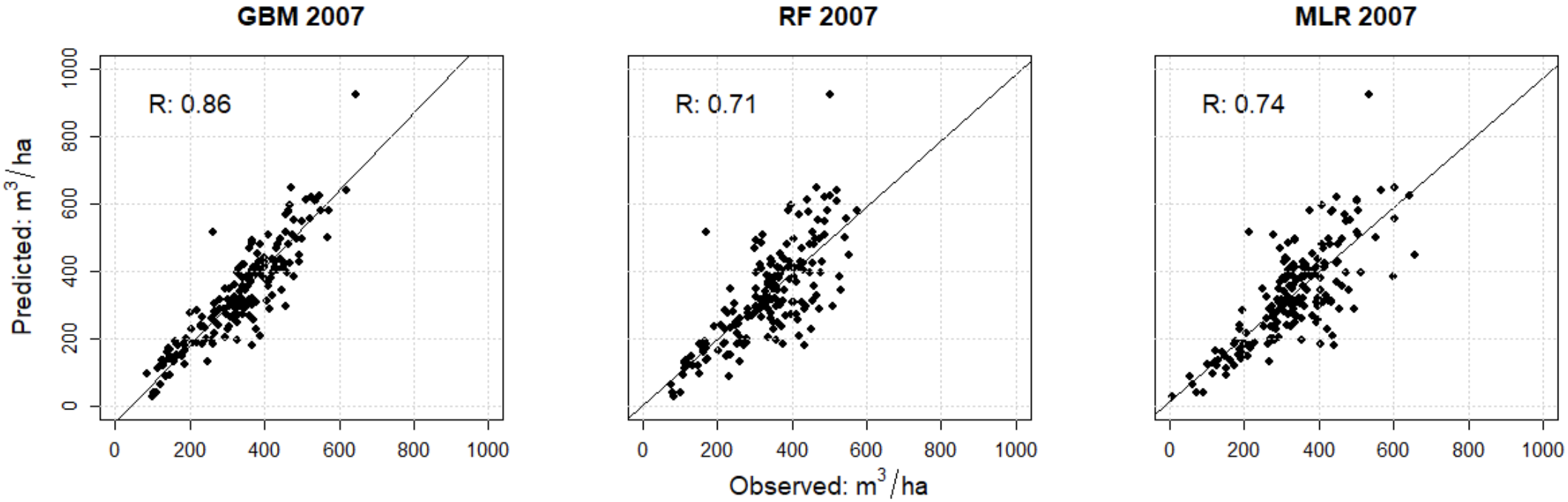
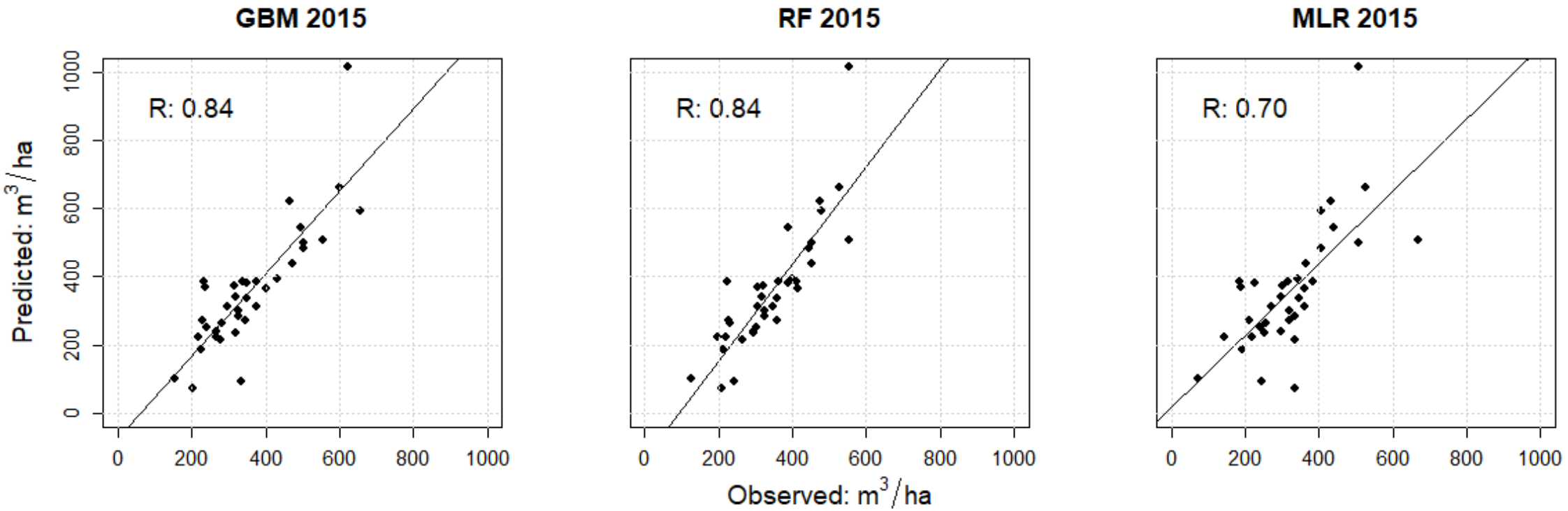


Model	R2sq	rRMSE(%)	Bias
Random forest	0.54	31	-5.31
Gradient boosting	0.53	32	-0.28
MLR	0.55	**30**	**0.006**

$$Vol.2007 = 1013.5 + 12.22zq65 + 13.61zq95 - 20.41zsd + 100.08MAT - 29.12soc - 26.26s\_site + 10soc:s\_site$$

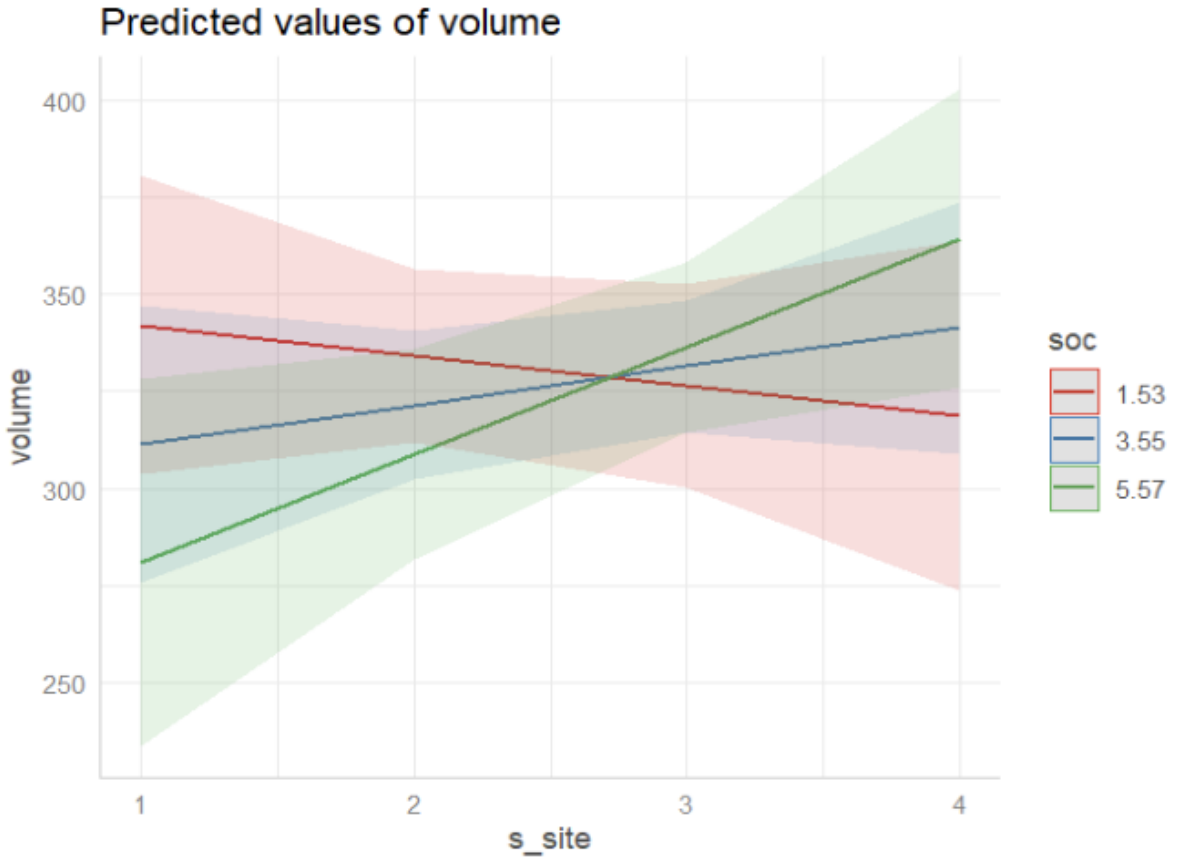
Preliminary Results

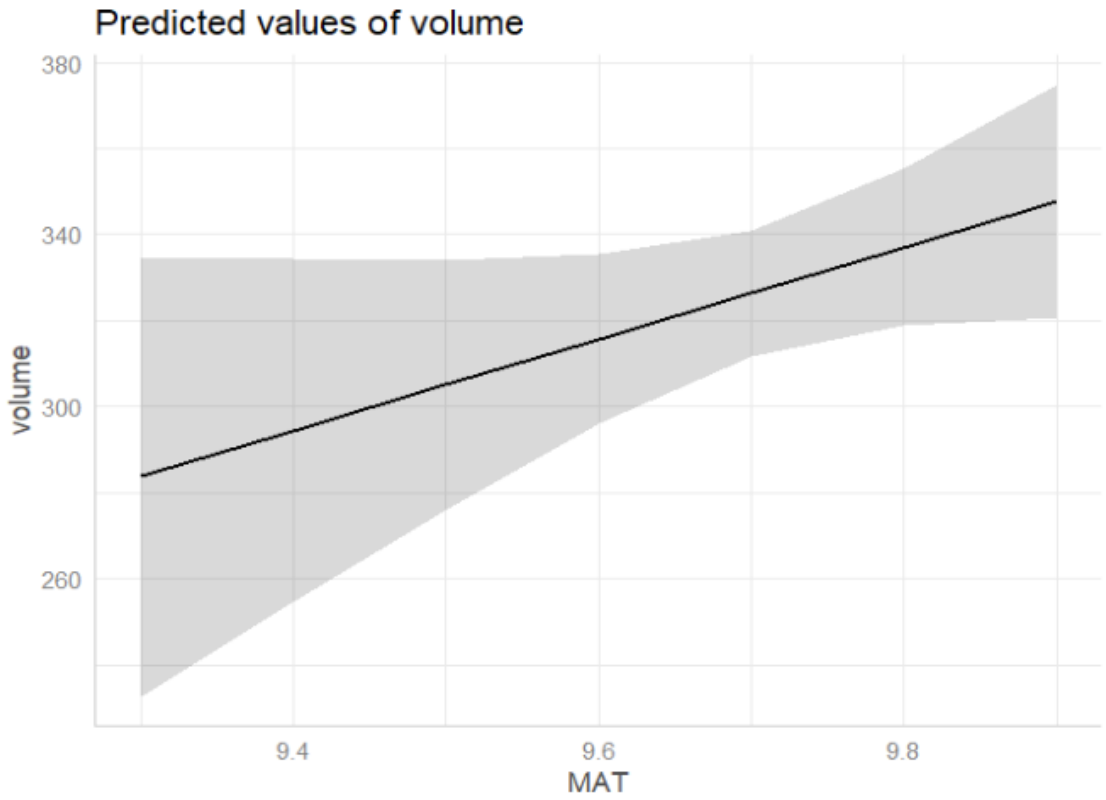


Model	Rsq	rRMSE(%)	Bias
Random forest	0.63	**27**	**-0.99**
Gradient boosting	0.55	28	1.13
MLR	0.48	30	-36.5

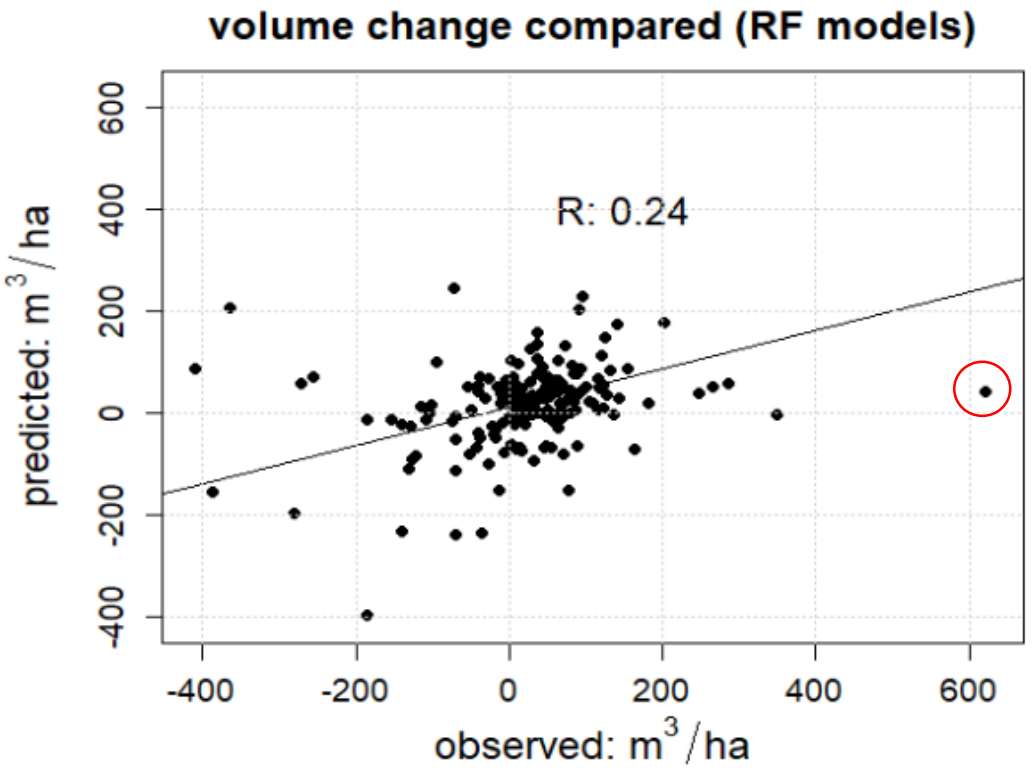
$$Vol.2015 = -28.9 + 0.07s\_site + 0.07zq75 + 1.63MAT + 0.04MAP - 0.07soc$$

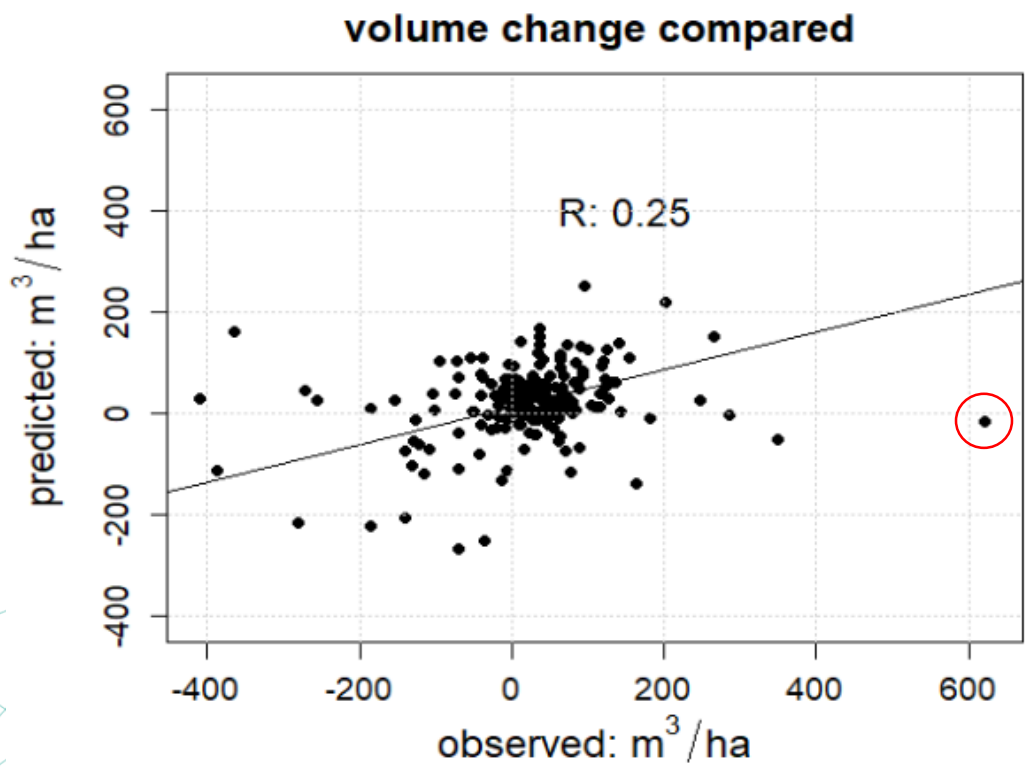
Partial effects



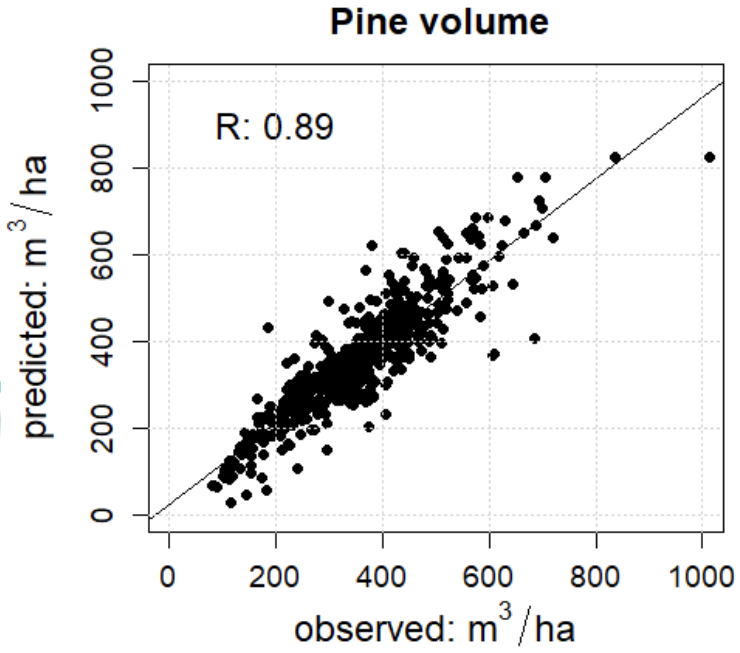


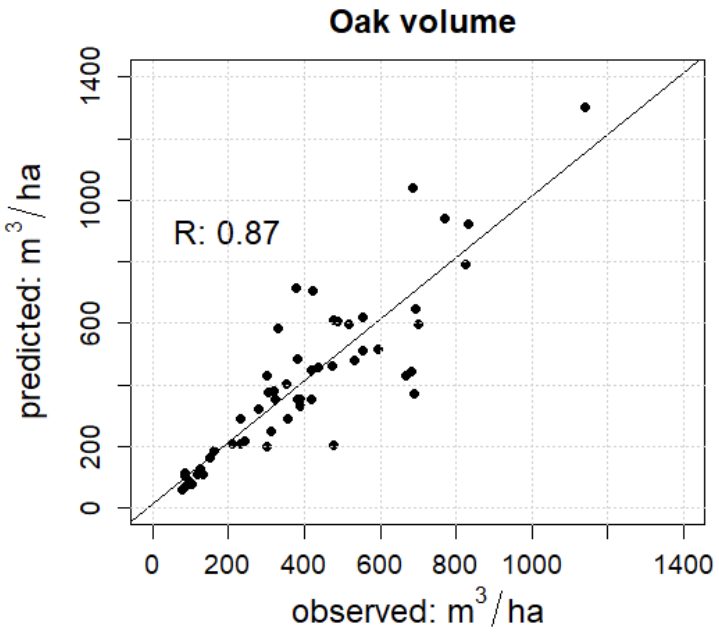
Preliminary results

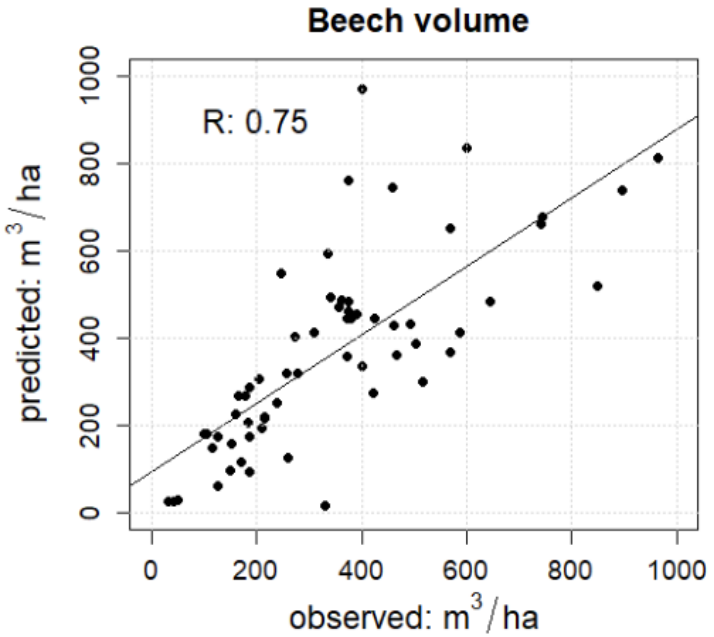




Preliminary Results







Model	R2	rRMSE(%)	Bias
Pine –MLR (N=563)	0.80	16	-3.7
Oak –MLR (N= 53)	0.78	31	-13.65
Beech –MLR (N=61)	0.56	42	-19.7

```
Pine_vol = 0.86 -0.1zsd + 0.031zq50 +  0.41zq85 + -0.002zq85^2
           -0.21zq95 + 0.78MCMT -0.032MAT + 0.1DD.5
```

Conclusions

- Volume growth is largely controlled by vegetation structure.
- Site factor and climate contribution are small but equally important.

Options for Improvement

- Model with microclimate data.
- Try mixed effects models.
- Aggregate variables into a composite indicator?

Thank you for your attention

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