

The effect of Norway spruce needle age on biophysical traits prediction from laboratory leaf-level spectra and its impact on upscaling.

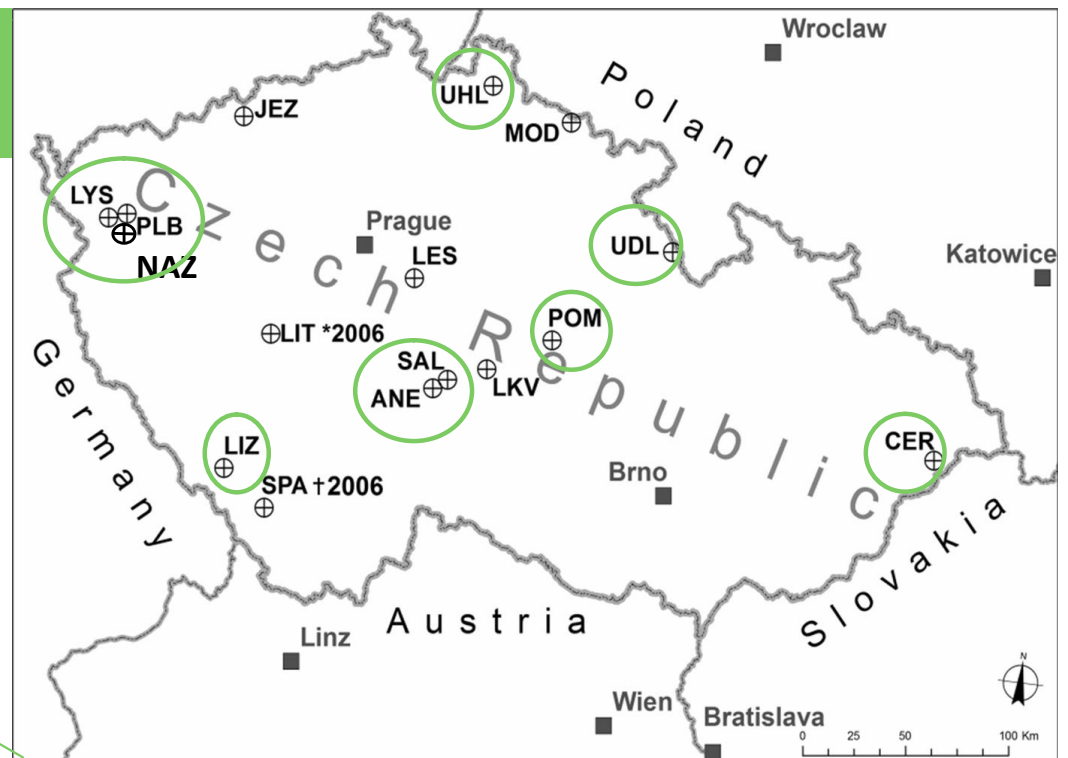
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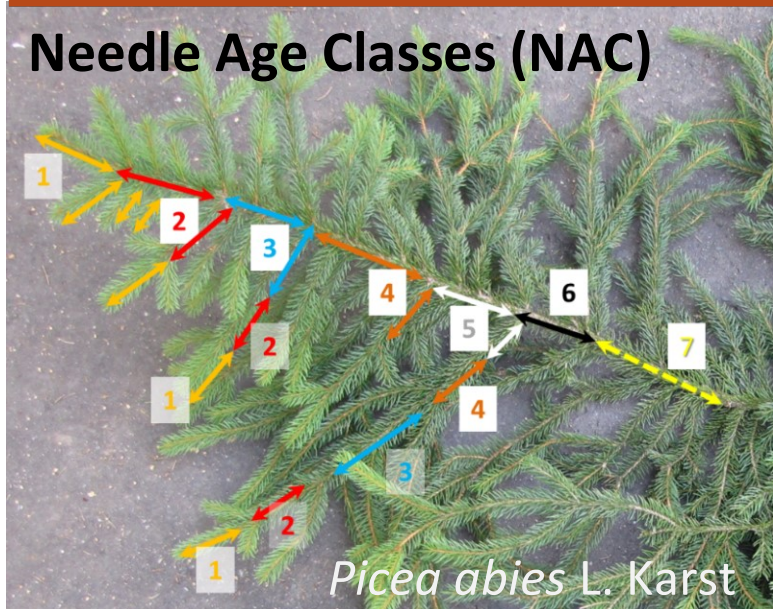
**GEOMON sites location:
10 small forested watersheds, Norway spruce**



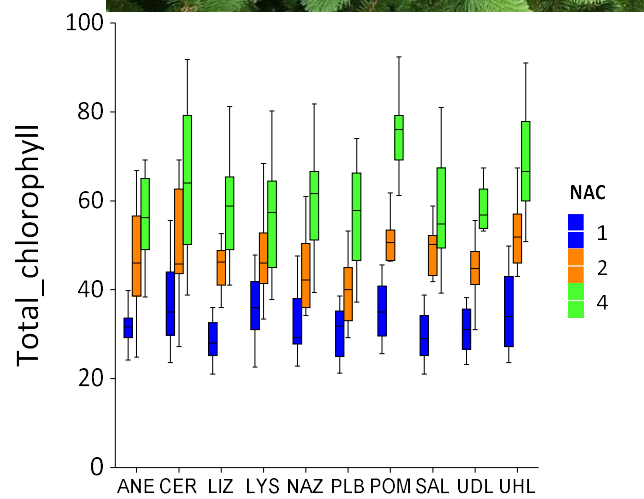
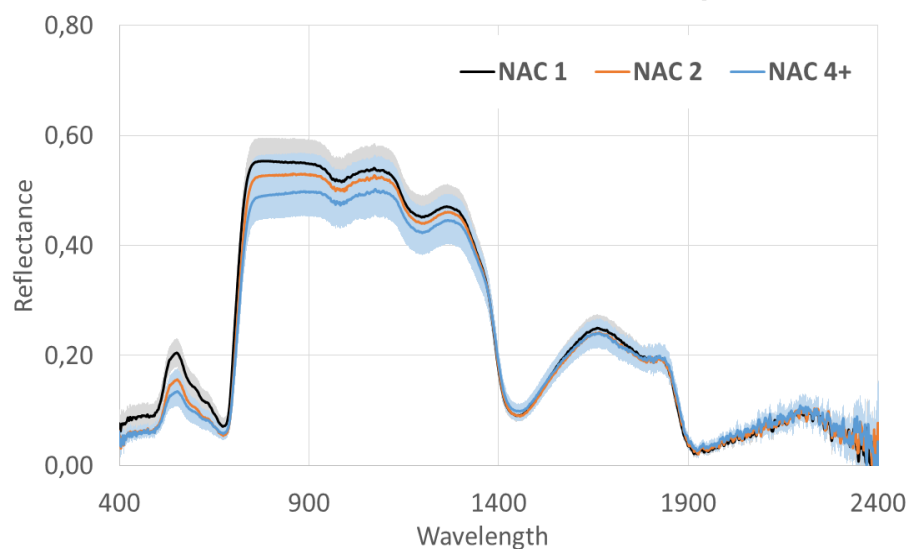
Research Question:

➤ What is the best practice for „groundtruthing“ in conifers with long-living needles?

Needle Age Classes (NAC)



Needle reflectance - differences among NACs

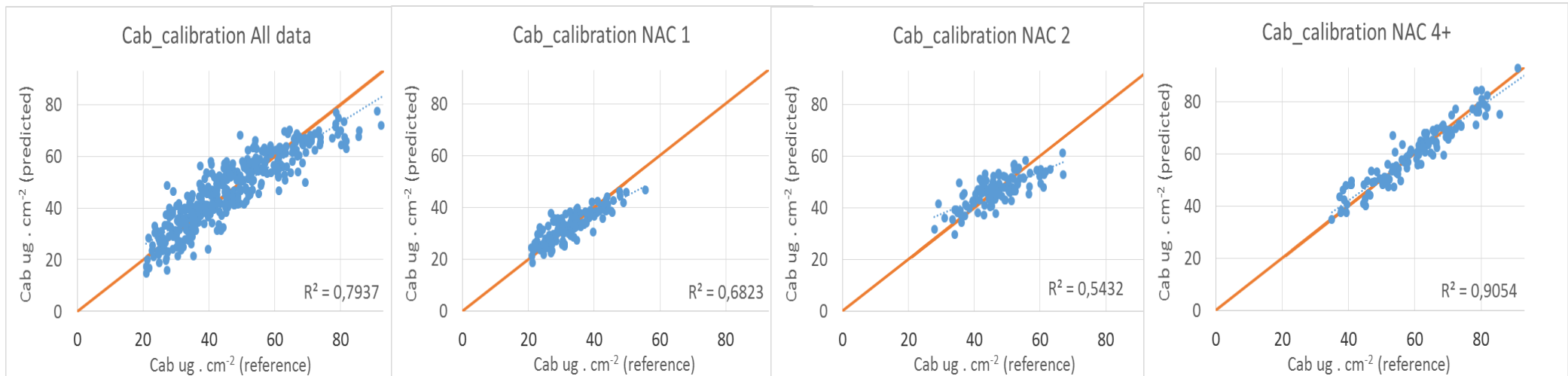


TASK 1: Model comparison according to NAC dataset

LEVEL: needle + laboratory spectra



	Dataset	RMSEP	R ² (P)	R ² (V)	n
Cab	All Data	7,00	0,7937	0,6993	369
	NAC 1	4,03	0,6823	0,4634	121
	NAC 2	5,37	0,5432	0,2752	108
	NAC 4+	4,15	0,9054	0,5397	119

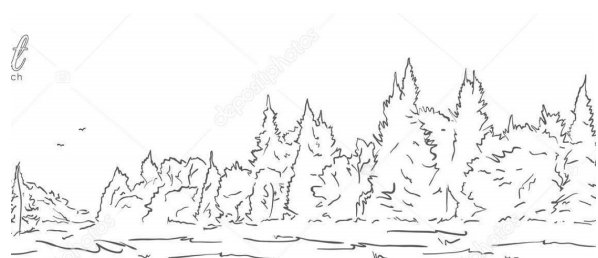
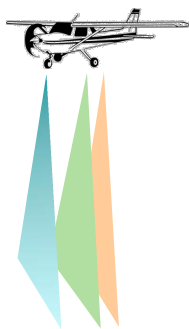


Better model performance for dataset including all NACs
model stability and robustness due to larger dataset

TASK 2: Model comparison according to NAC averaging

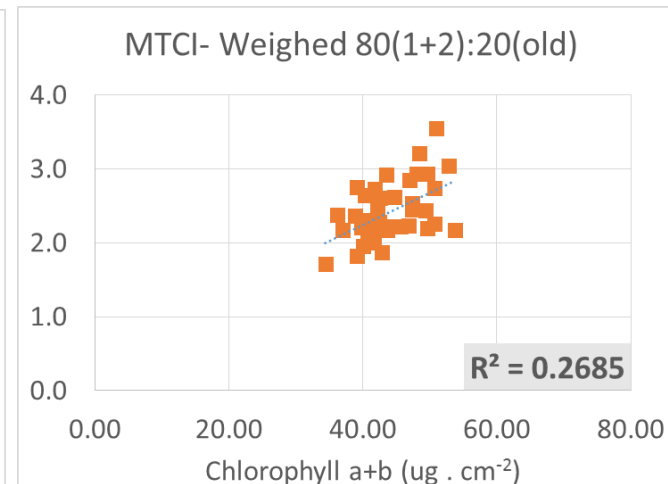
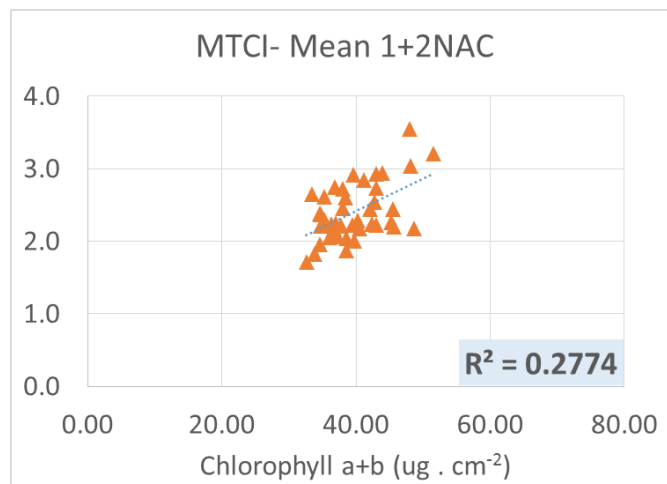
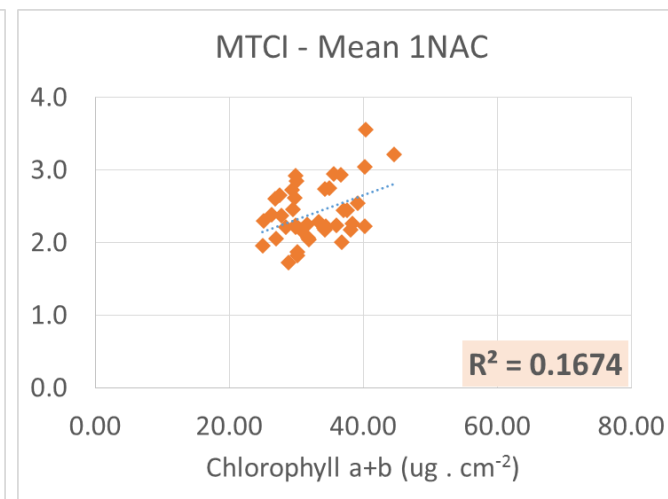
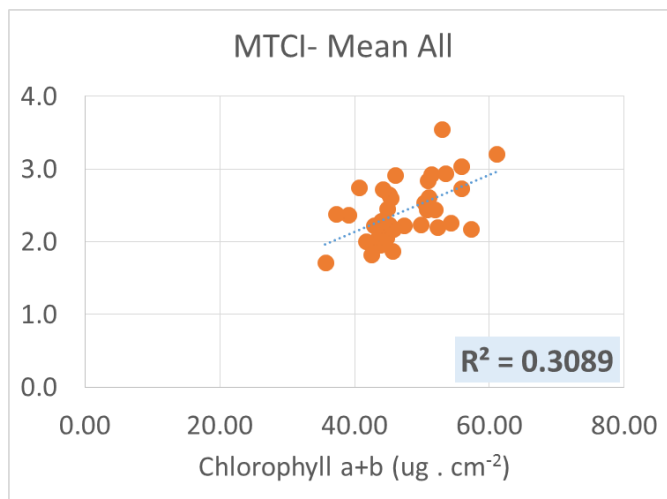
LEVEL: needle chlorophyll + air-borne canopy spectra

CASI Itres 1.0m
400-1000 nm
2km



MTCI

$$\frac{R_{740} - R_{705}}{R_{705} - R_{665}}$$

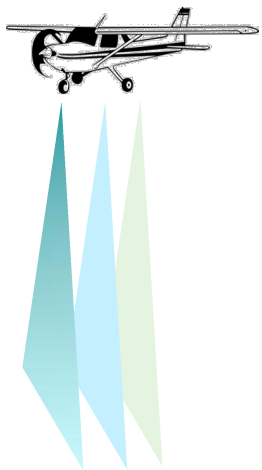


The relationship between chlorophyll content and canopy reflectance derived index MTCI, was strongest if all NACs were included. All scenarios that included at least one older needle age class showed higher R^2 than the scenario with only current year needles.

CONCLUSIONS:



Strong age-dependence of needle traits (spectral, biochemical) affects performance of PLSR models for their prediction from reflectance spectra at needle level.



It is recommendable to include not only the current but also older needle's biochemical traits as a ground truth for Norway spruce and probably other conifers bearing several needle age classes.