GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN

DAAD

HYPERSPECTRAL DATA FOR FOREST INVENTORIES

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Background

- Forests are dynamic and complex systems

  with important ecological, social and commercial functions.
- Knowledge about forest stocks is crucial
- Knowledge about forest species is crucial
- Knowledge about forest condition is crucial

➡ Remote Sensing, Field Measurements

Project topic:

Describing the biophysically forest structure

using hyperspectral radiation measurements.

Study site

Landsat 7 ETM+, 11.10.2010, RGB: 7-5-2, gapfilled, contrast enhanced

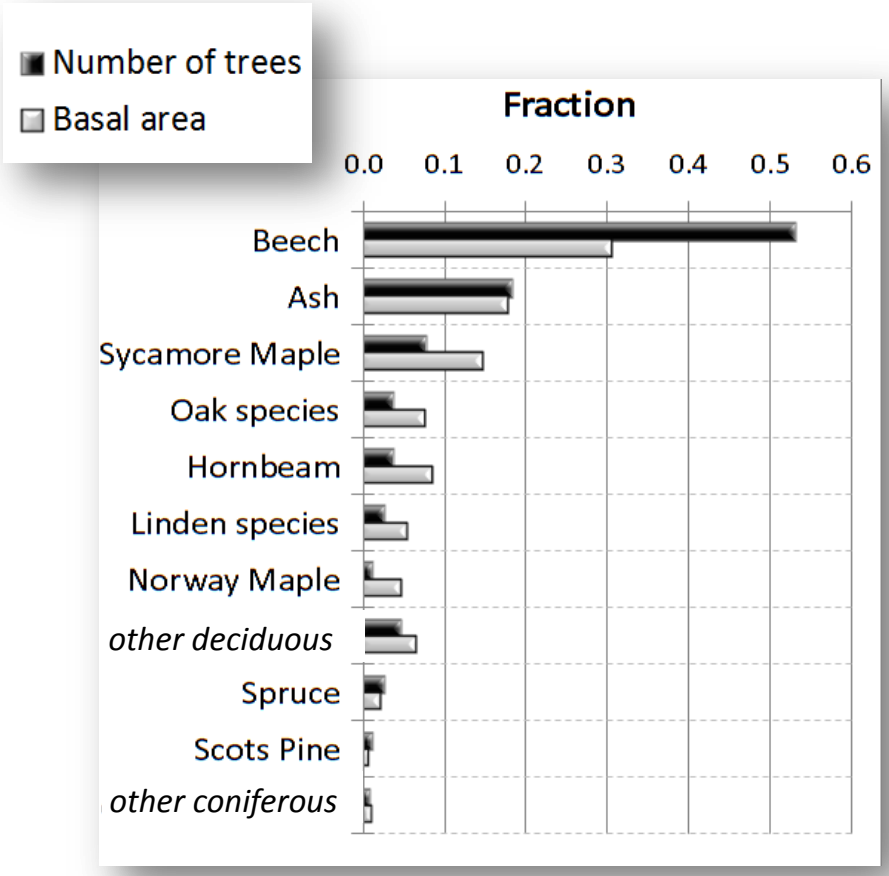
Study site

Autumn

Summer

Study site

Tree species composition in the forest:

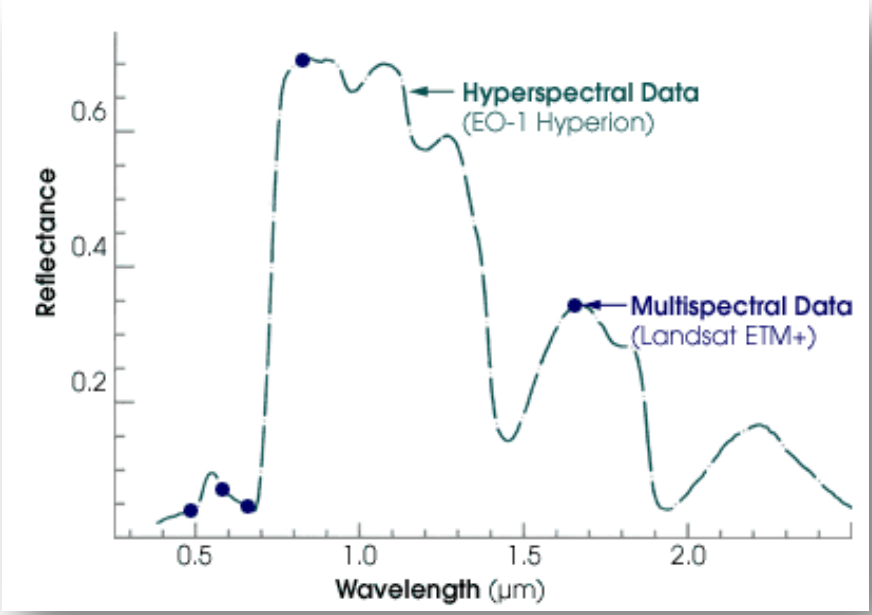


- Derived from a subset (n=580) of permanent inventory plots
- 29 species occur → high diversity

What is "hyperspectral"?

- Compared to "multispectral": increased number of bands (~3-10 *vs.* 60-<360!)
  - ➡ finer resolution
- Large spectral range
  - ➡ additional information

$$Reflectance = \frac{Reflected\ radiation}{Incident\ radiation}$$



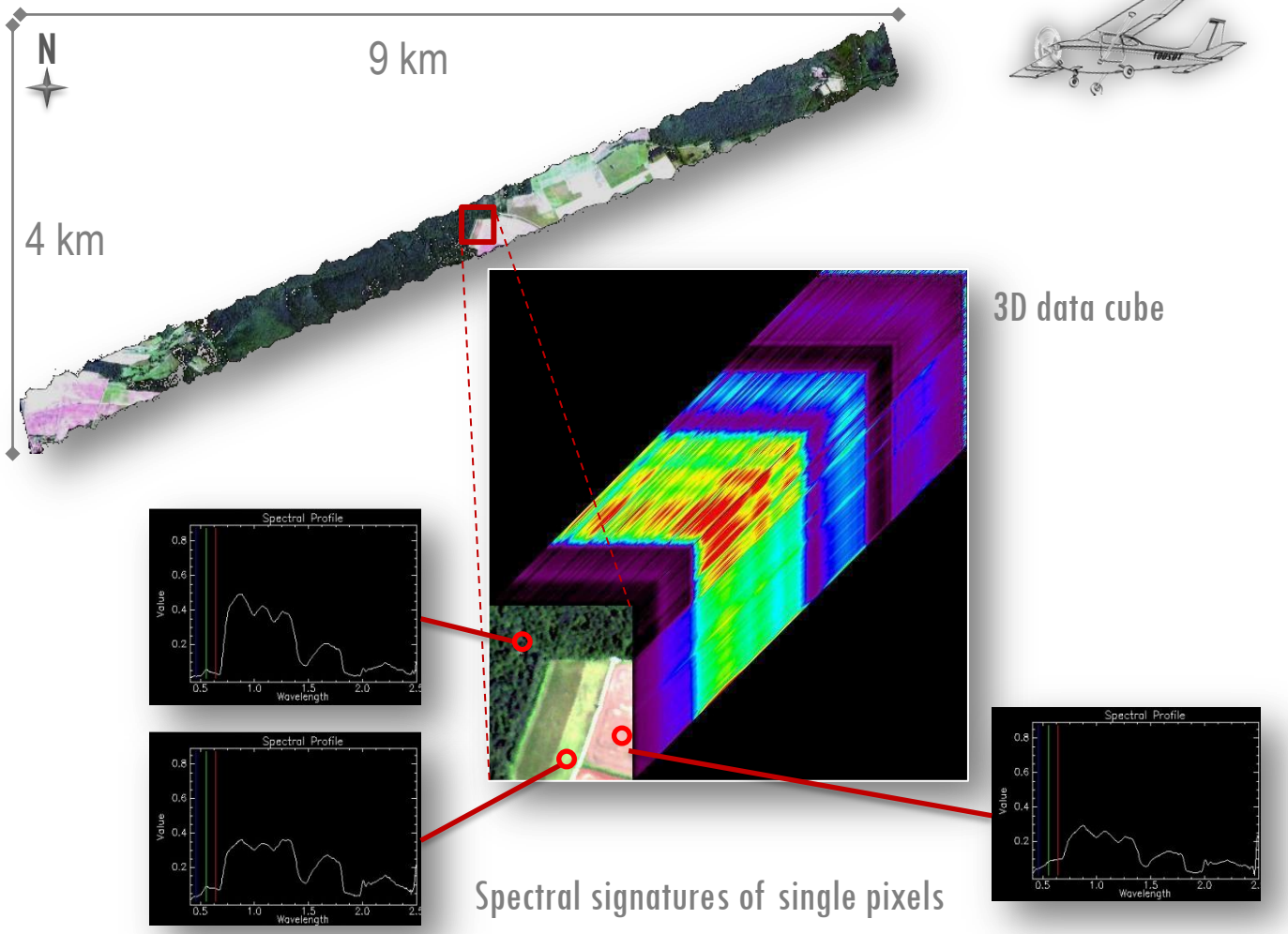
EARTHOBSERVATORY.NASA.GOV

Remote sensing

AISA Eagle & Hawk hyperspectral airborne camera system:

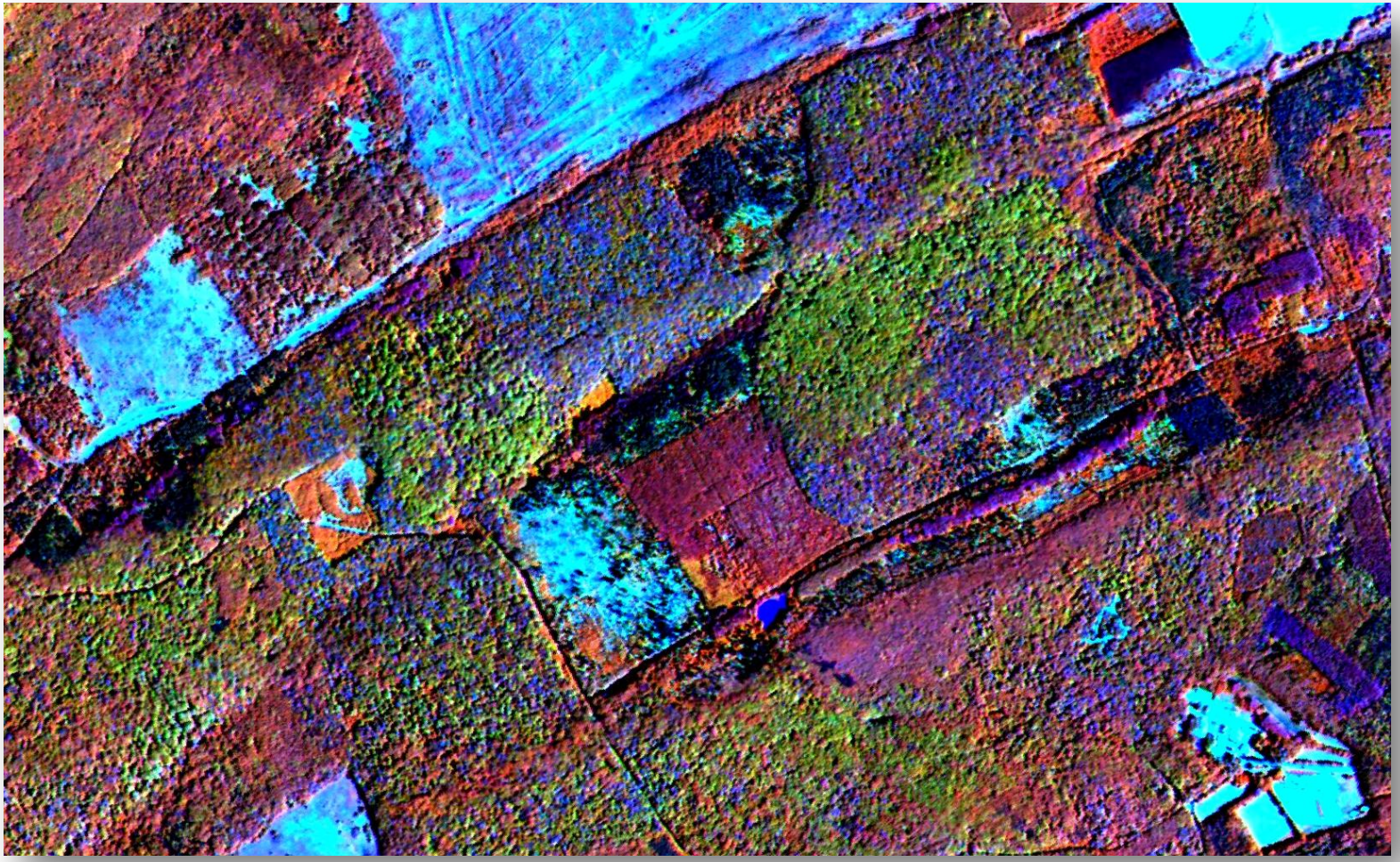
Flight stripe:

- 2 m GSD
- 368 bands
- 8 GB file size



Remote sensing

AISA Eagle & Hawk hyperspectral airborne camera system:



„Nearby sensing“

ASD High Resolution Field Spectroradiometer 3

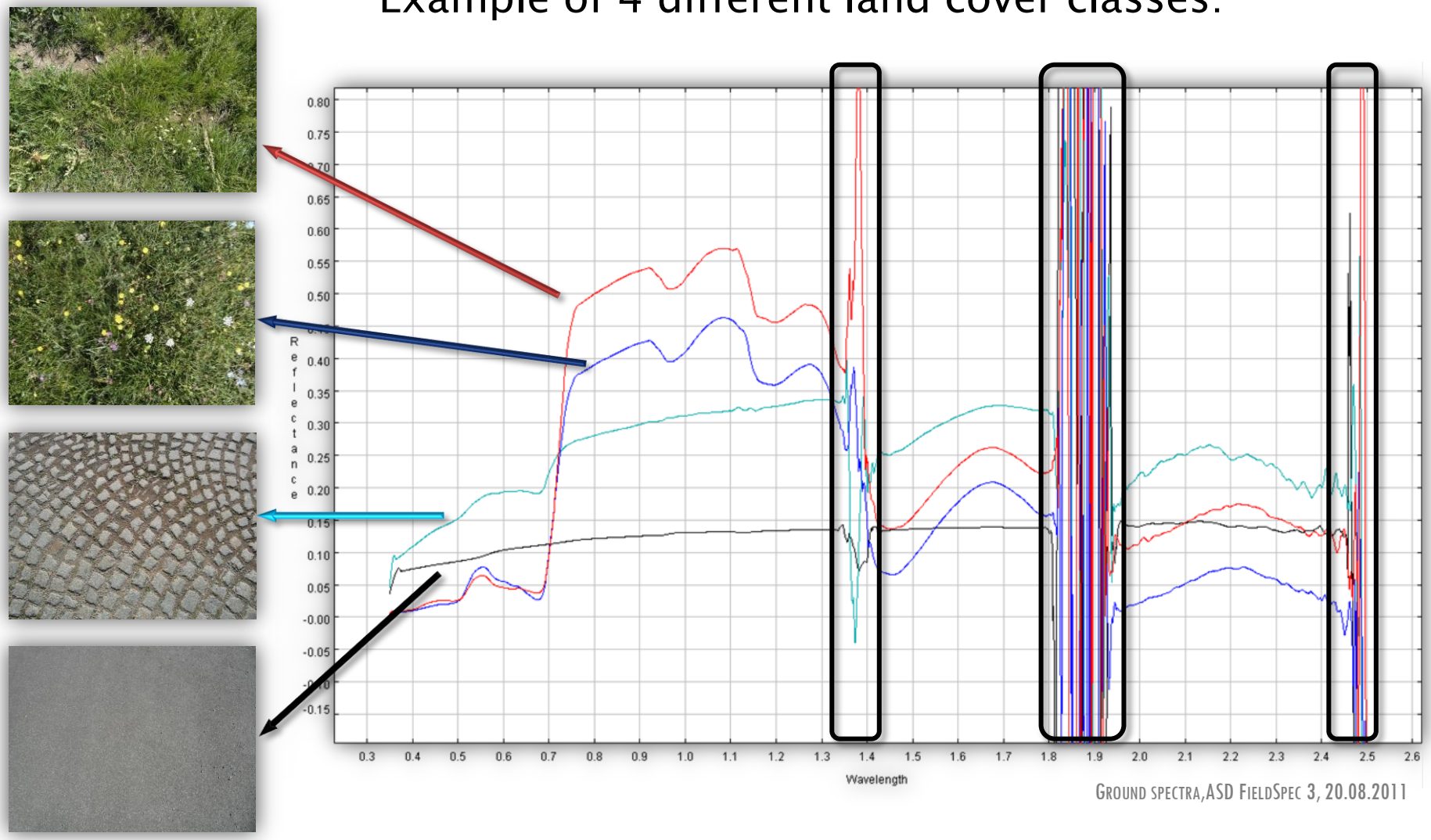
„Nearby sensing“

Many ways to measure...

Milton et al., 2010

„Nearby sensing“

Example of 4 different land cover classes:

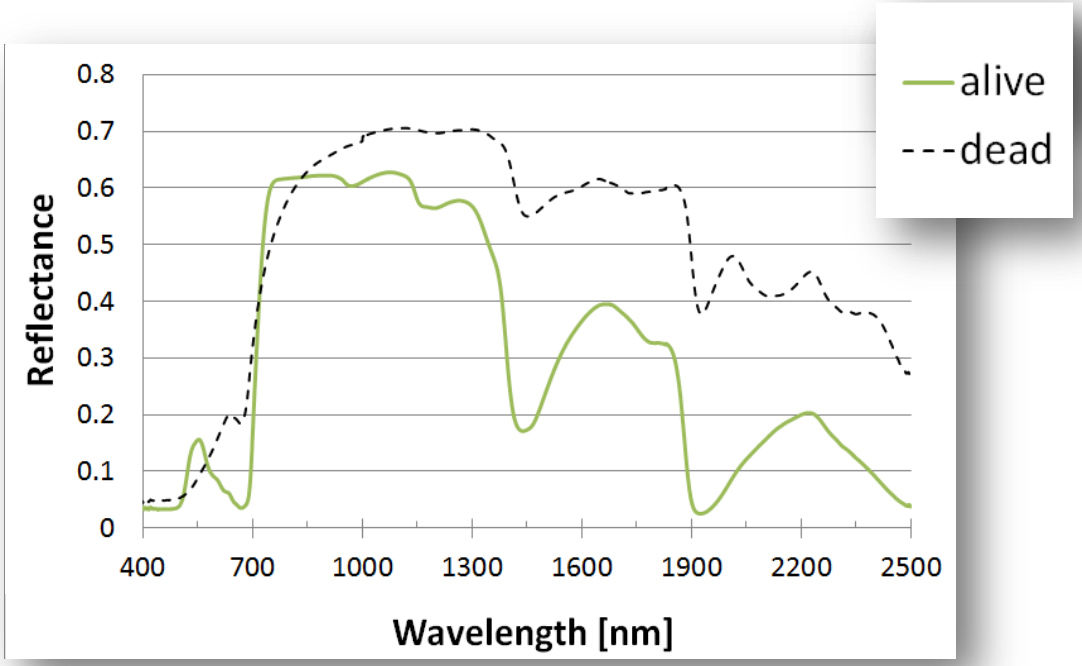


Ground spectra, ASD FieldSpec 3, 20.08.2011

„Nearby sensing“

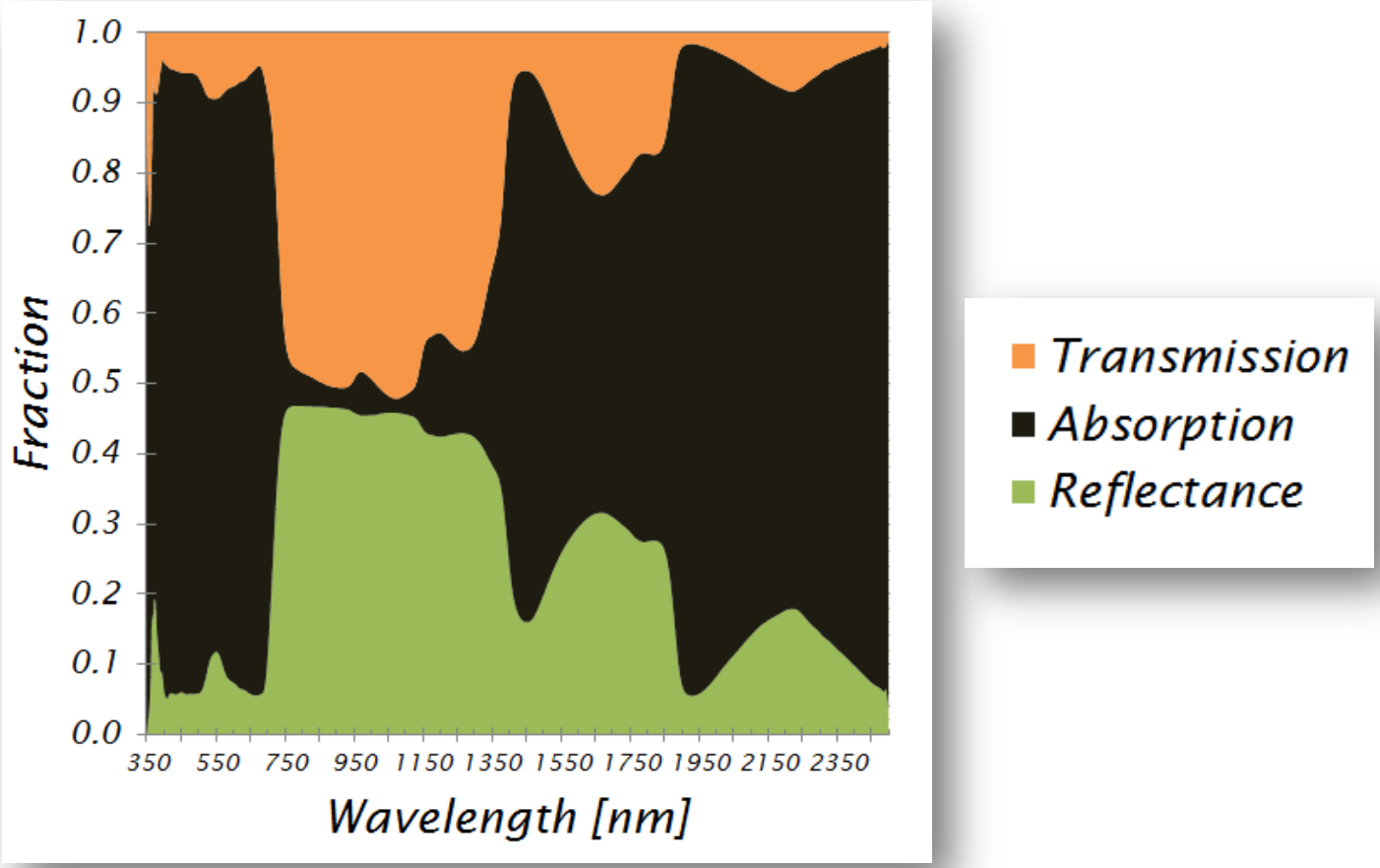
Measuring at a different scale: leaf level

¬ without atmospheric influences



„Nearby sensing“

Leaf optical properties of Small-Leaved Lime (*Tilia cordata*)



„Nearby sensing“

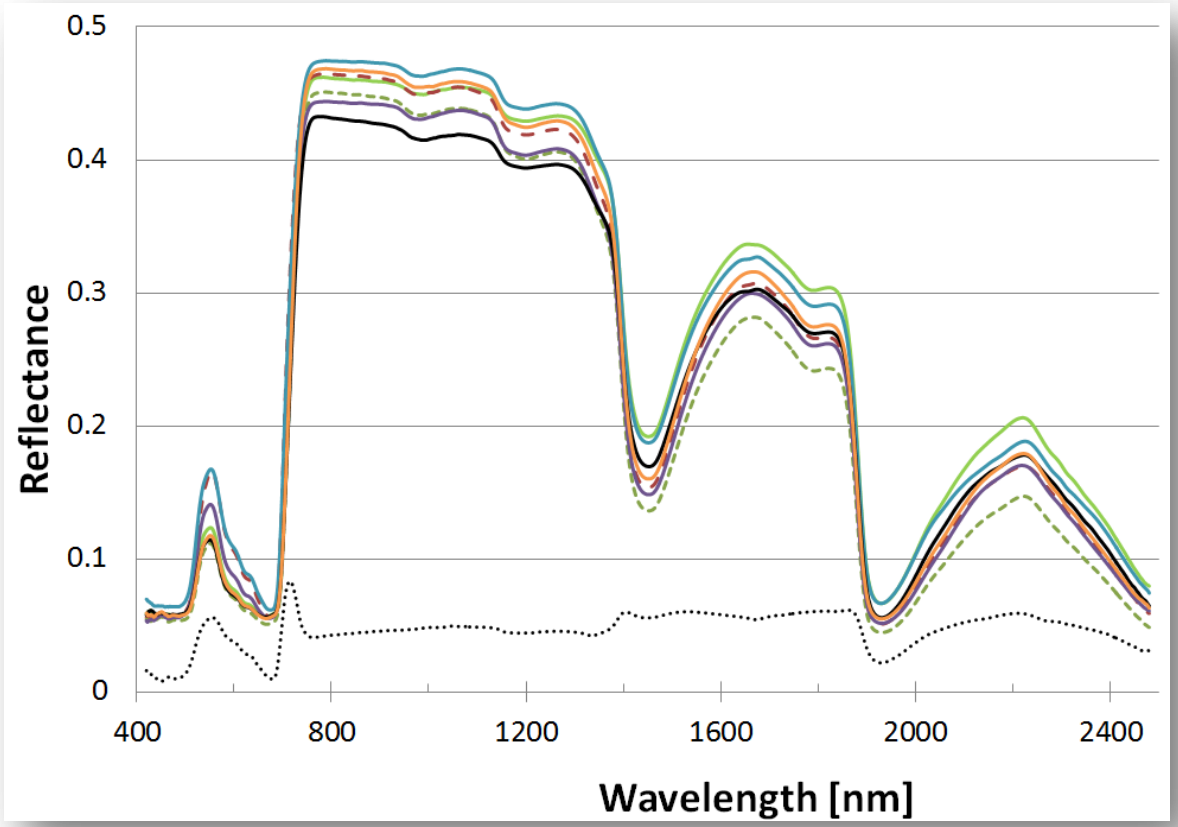
How to get leaves…?

¬ *Canopy walk:*

Climate tower:

Forest spectroscopy

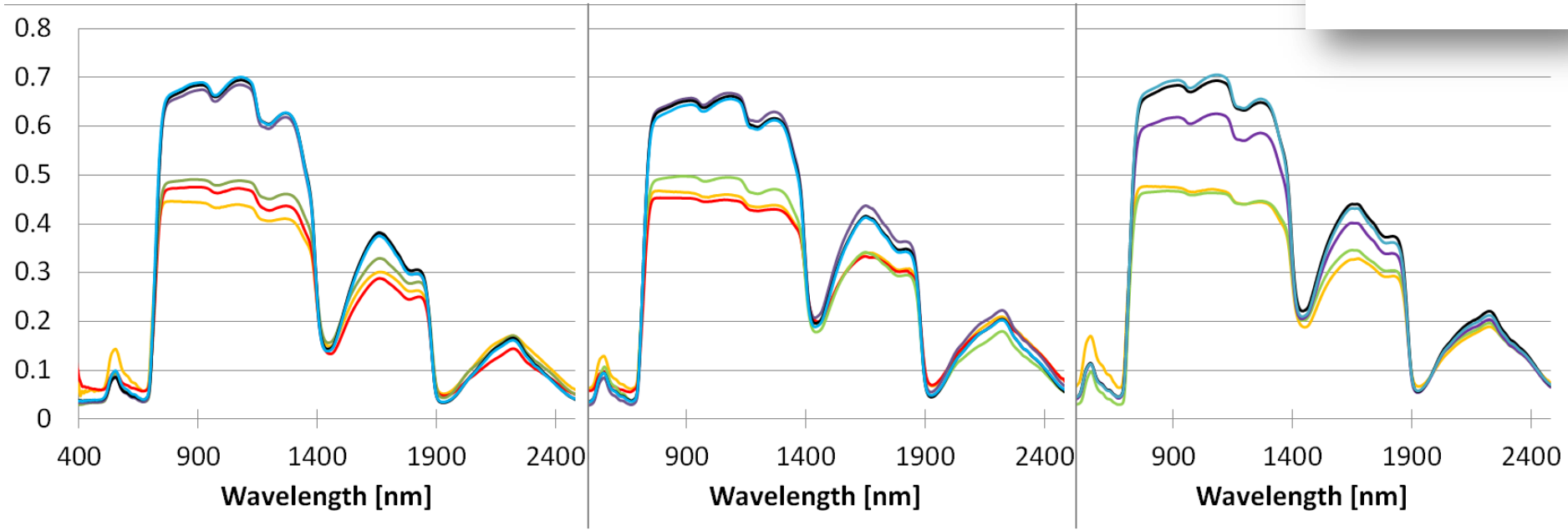
Leaf spectra of the main species



Leaf spectra, ASD FieldSpec 3, 25.05.2012

Phenology

Seasonality in reflectances



Ash

(*Fraxinus excelsior*)

Beech

(*Fagus sylvatica*)

Hornbeam

(*Carpinus betulus*)

Conclusions

- The utilization of hyperspectral data can be a powerful tool
- On leaf level species are more similar than on crown level
- Appearances/reflectances of tree leaves highly change during growing season → not "just green"
- Species specific differences in phenological reflectance

ADDITIONAL STEPS:

- Link to remotely sensed data, comparison
- Species discrimination on different scales (crown, leaf)
- Using spectra as input for modelling plots and stands

Thank you

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