MSc European Forestry
ERASMUS MUNDUS

Applied Period Presentation

"Dendrochronology basics and wood structure analysis of European beech (*Fagus sylvatica*) and Norway spruce (*Picia abies*)

Laith AL-Rahahleh

Supervisors:

Dominik Stangler

&

David Montwe

17.04.2013

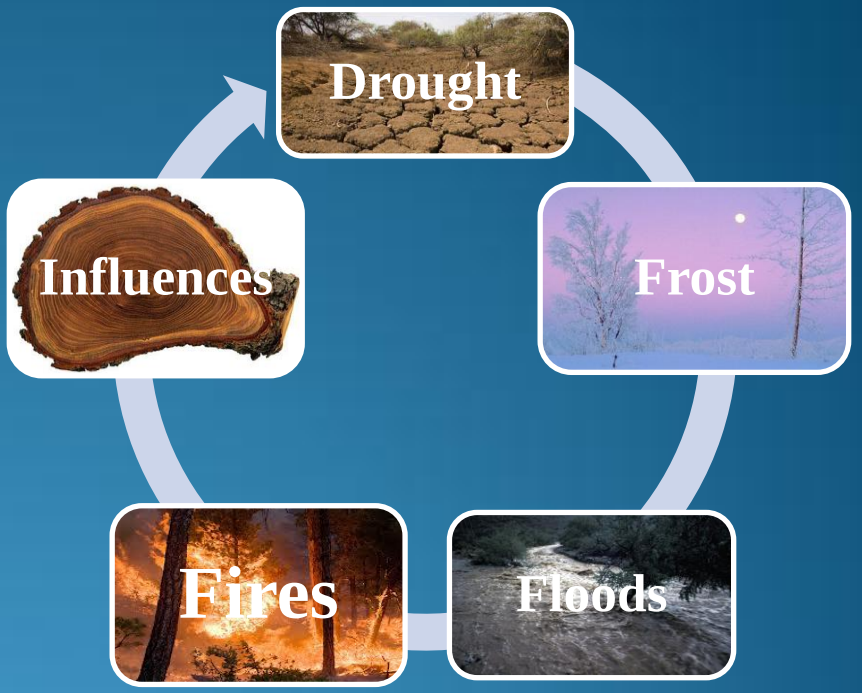
UNI FREIBURG

UNIVERSITY OF EASTERN FINLAND

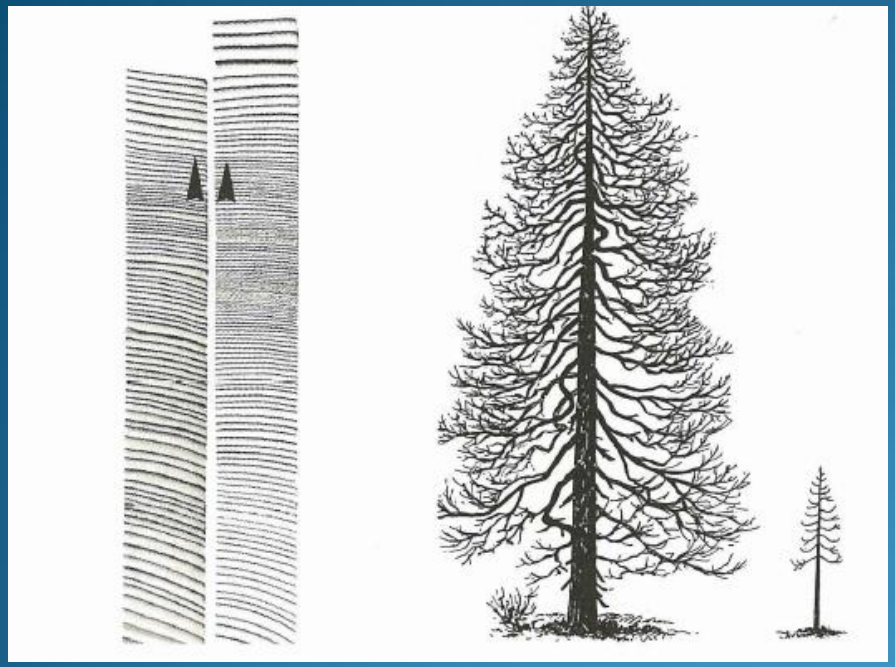
Education and Culture DG
ERASMUS MUNDUS

Background

- A Tree is not an isolated system from the surrounding Environment Conditions.
- All parts of trees reacts with external factors with a different degree.
- **There is a** response for the extreme events i.e, Wildfires, Drought, Frosts …etc. therefore, specific impact archives in the trees , particularly, Annual Tree Rings.



External factors impacts



Light

Winds

Definitions

- **Dendrochronology**

The study of trees is called *Dendrology, which is derived from* Greek (*dendros = trees or wood, logos = study).*

The science for dating of wood or trees based on Annual Rings.

- **Dendroclimatology**

The Study of Climate with the help of Tree Rings.

Example: analyzing ring widths of trees to determine how much rainfall felt on that years.

- **Dendroecology**

The science that uses tree rings to study factors that affect the earth's ecosystems. Example: analyzing the effects of air pollution on tree growth by studying changes in ring widths over time.

- **Dendrohydrology**

The science that uses tree rings to study changes in river flow, surface runoff, and lake levels. Example: determine the sequence of lake level changes over time.

Sample Preparation

- Samples Collecting From Healthy Trees and A void slope Tension

- Marking the Samples into eight Segments based on Directions

- Sawing the Discs into 8 division
- Use the Fly cutter Machine OR Microtomes (Depend on spp.) to produce a high Quality surface

Note : Microtome machine recommended for beech species rather than Oak species.

Wood Anatomy

- **Broadleaves**

The plants consists of Vessels , in addition to parenchyma tissues and Fiber Tissues

Vessels plays as Conducting and supporting role

Examples, Fagus spp., Acer spp., Platanus spp., Qurcus spp.

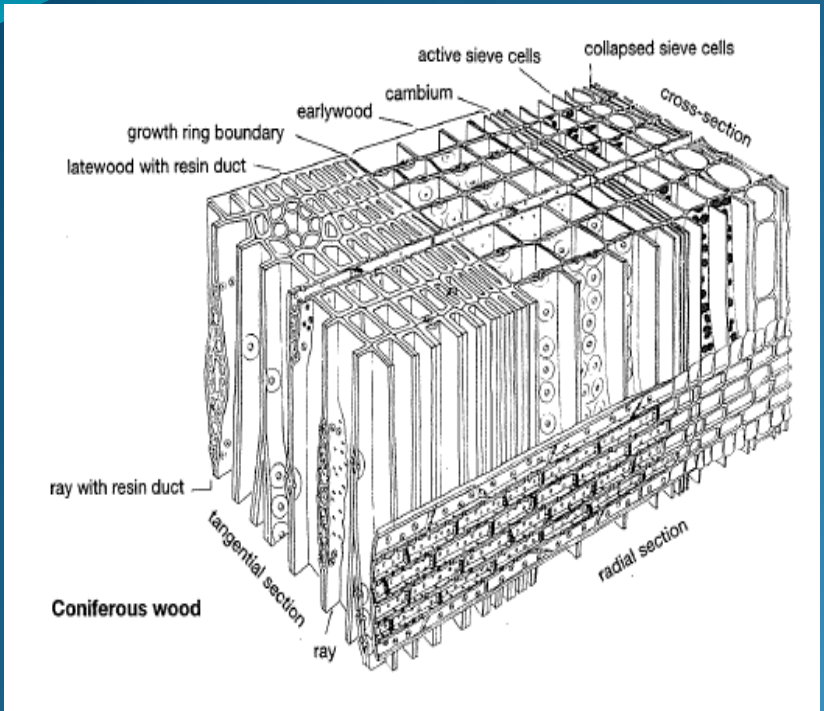
- **Based on Vessels Distribution they are**

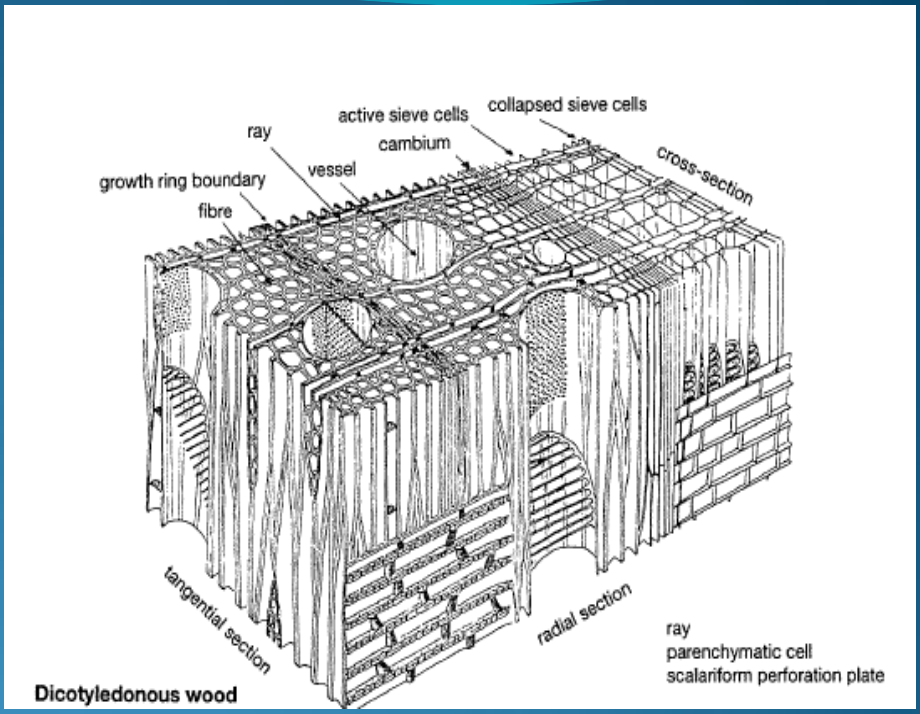
Diffuse Porous Rings and Porous Rings

- **Coniferous**

No vessels , but there is Trachieds, varying in shapes, sizes

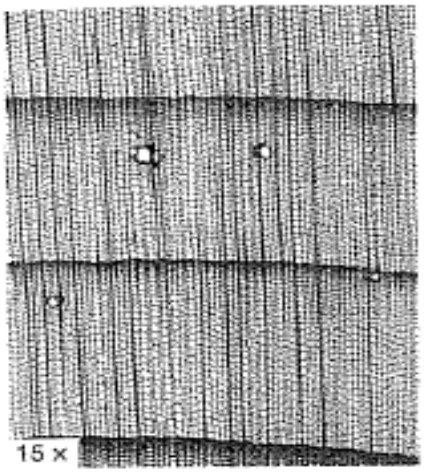
Dominants in North Hemisphere

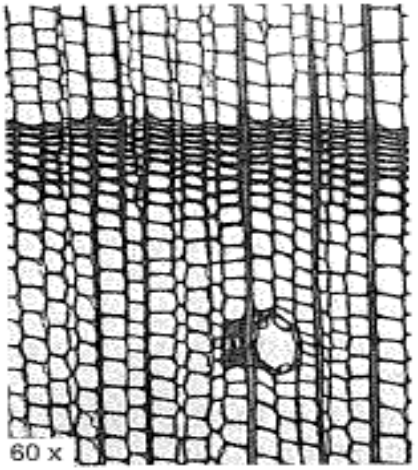


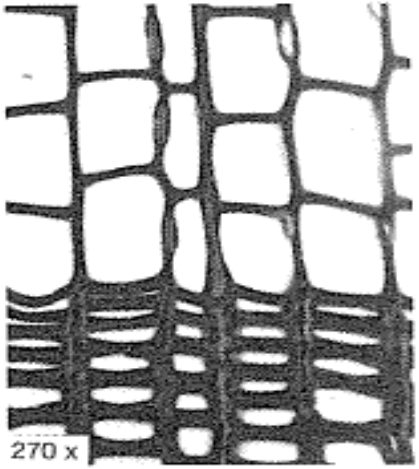


Coniferous

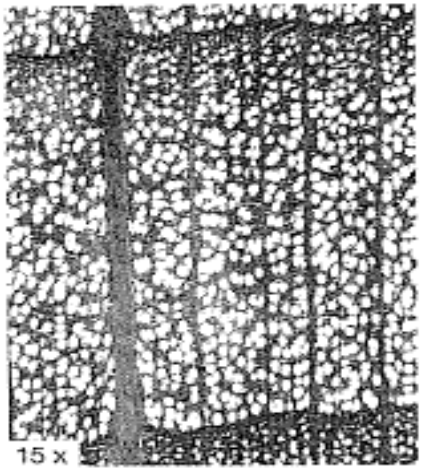
Broadleaves

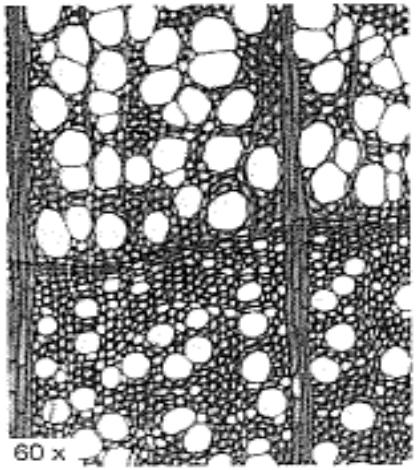


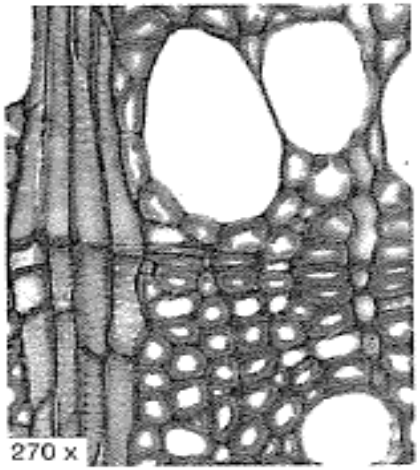




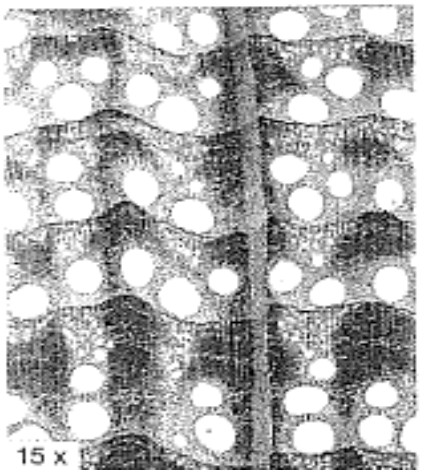
Spruce

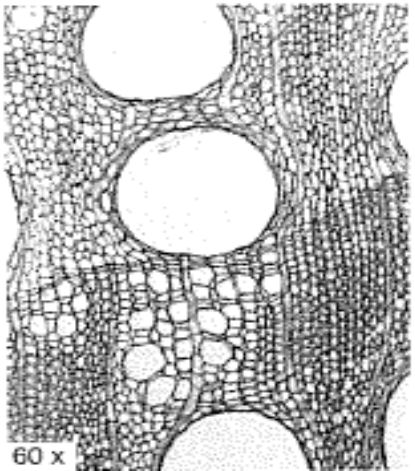


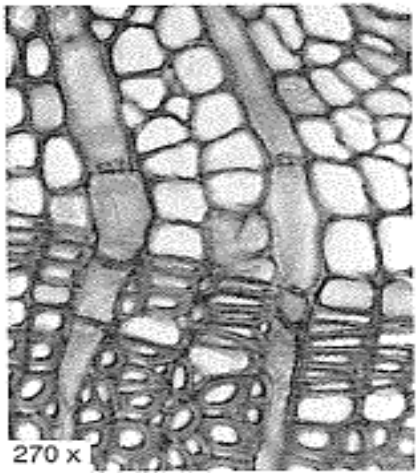




Beech







Oak

Tree Rings

QUESTION

Dose all plants species form Annual Rings ???

- Annual Rings Consists both Early and Lately Wood

- Early Wood Lighter than Late wood
- The Reason behind that,

- Cell Walls less thickness in Coniferous
- Large Vessels in Broadleaves
- In some cases , there is dark band follow the early wood and not late wood it is called IADFs
- IADFs is consider as a function of change in Cell Walls Density.

True Rings Criteria

Coniferous

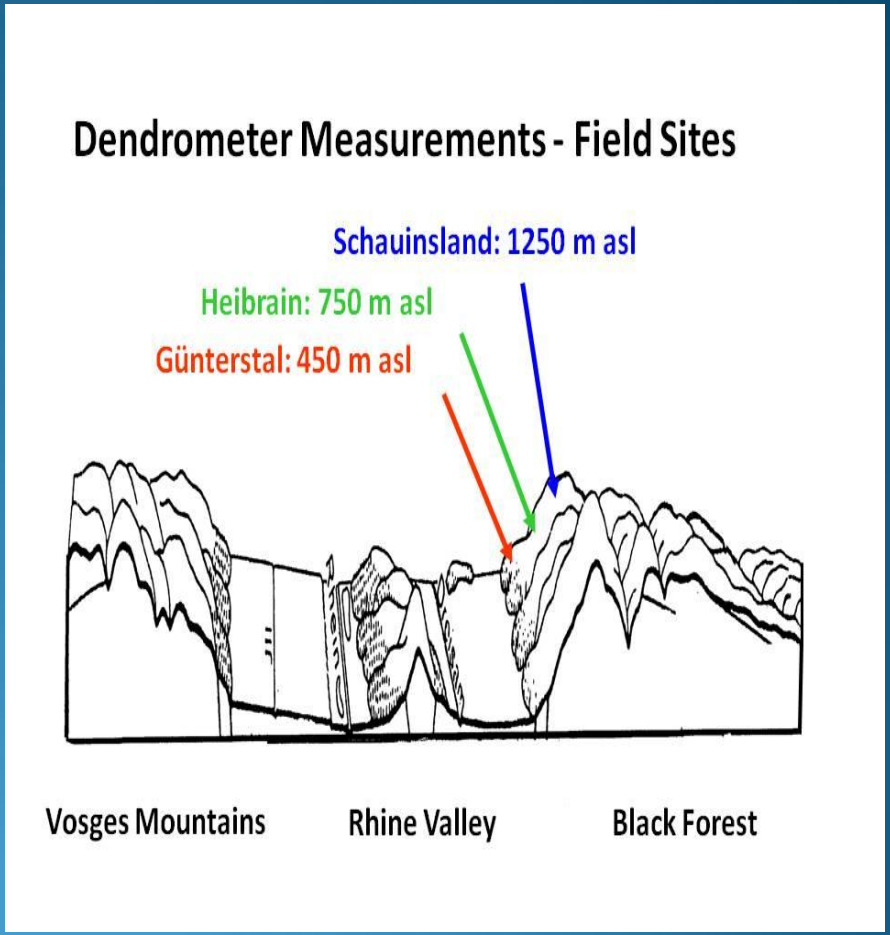
- Sharply change in Cell size.
- Sharply change in cell walls thickness.

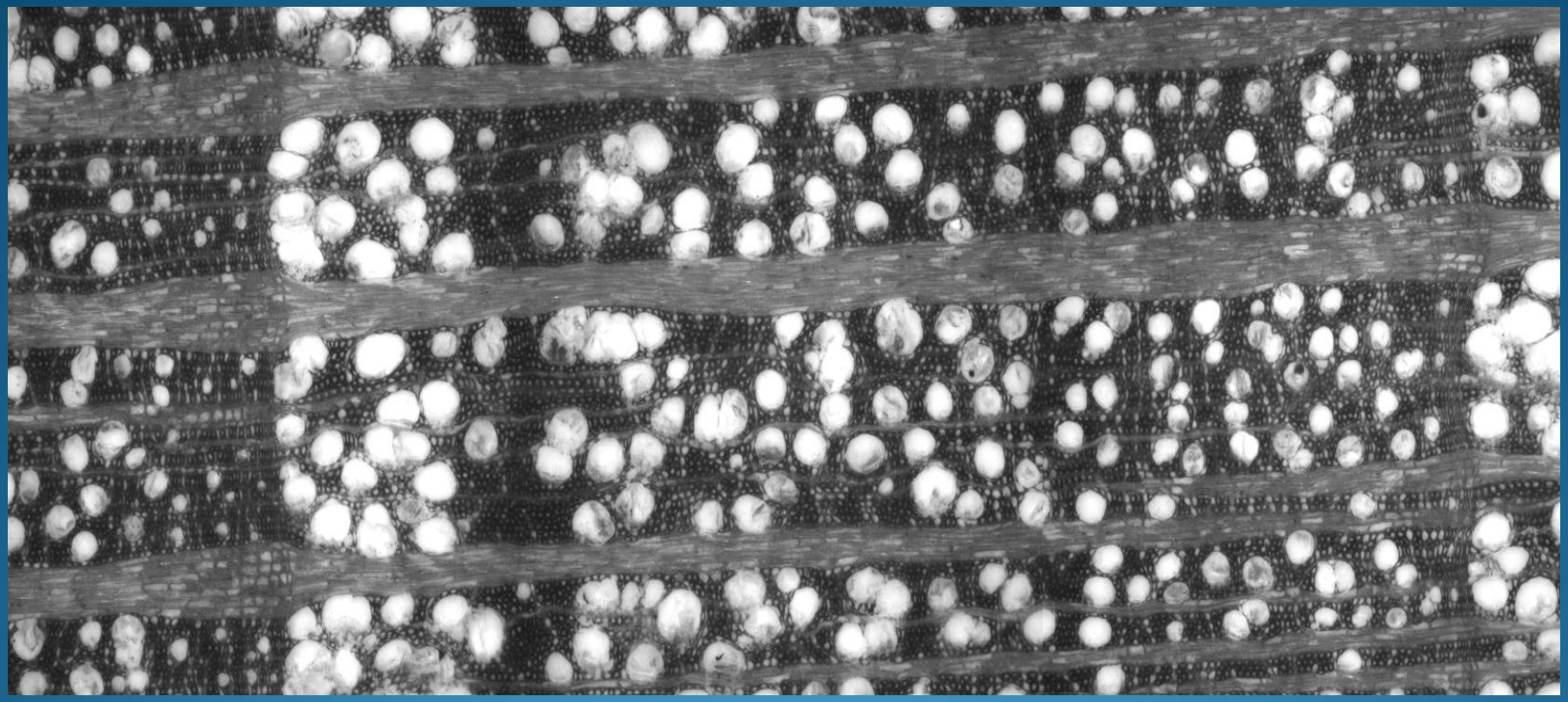
Broadleaves

- Sharp change from Large Vessels to small.
- Parenchyma tissues gets large then get narrow
- Fiber tissues change in Sizes

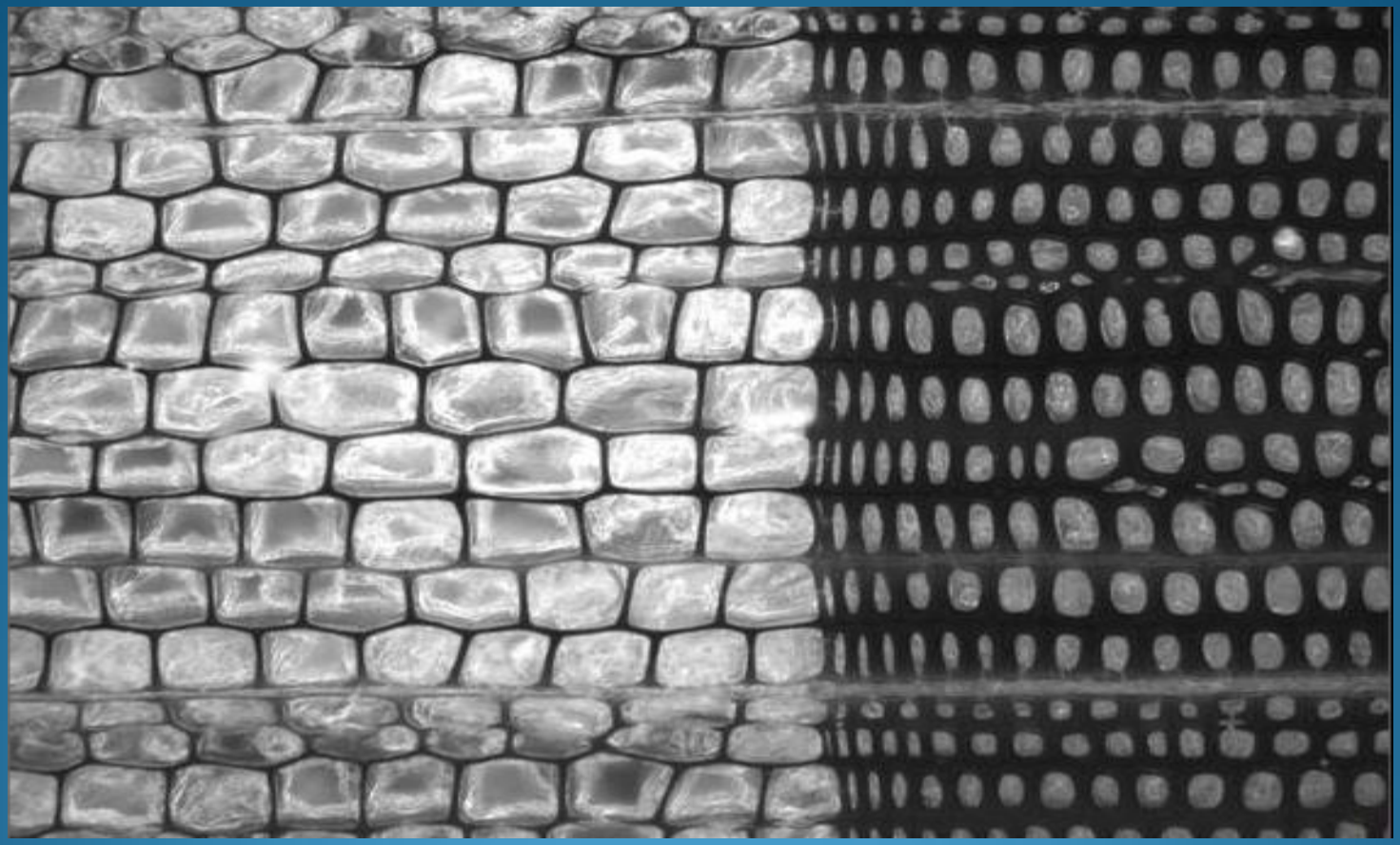
Samples Sites

- Three Dendroecological Field Measurement stations
- Elevations Ranges from 450 a.s.l up to 1250 m a.s.l
- even age stand
- Mixed with European Spruce and Beech
- The plot is located near the village Günterstal and about 7 km in southern direction far away from the city Freiburg

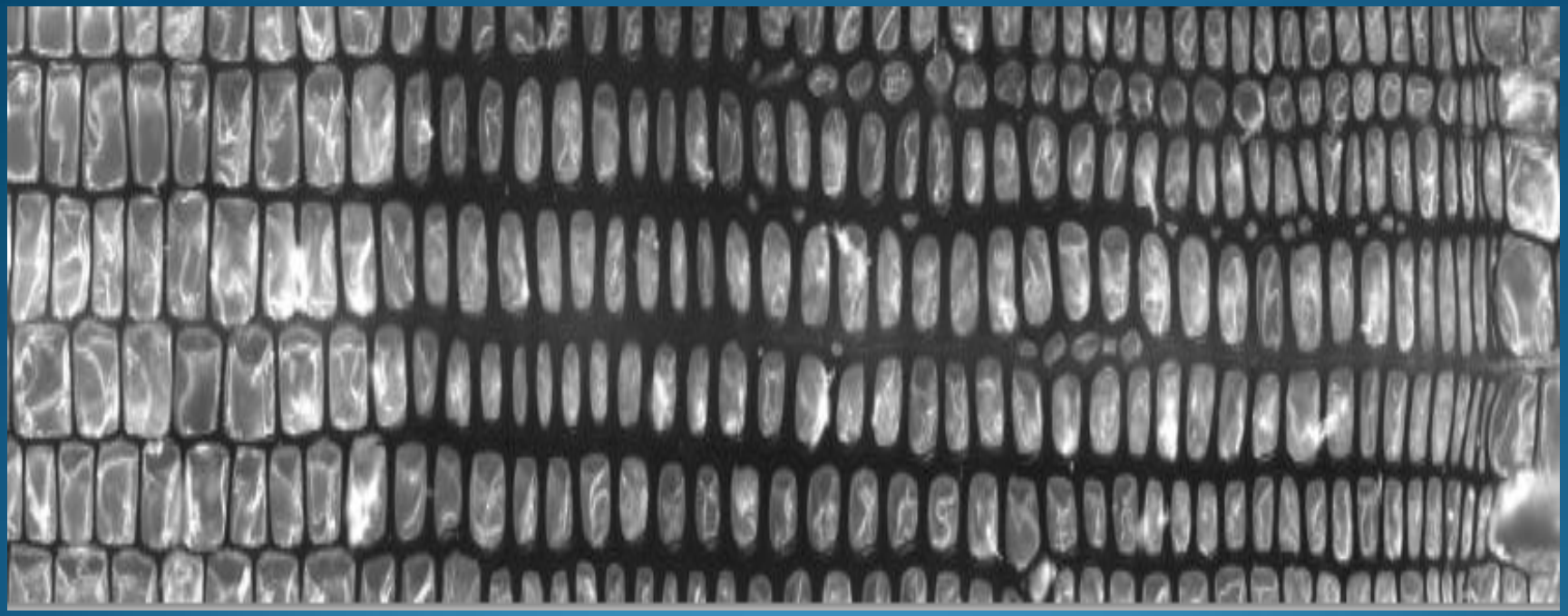




IADFs & True Ring Border, Beech 1976



True Ring Border

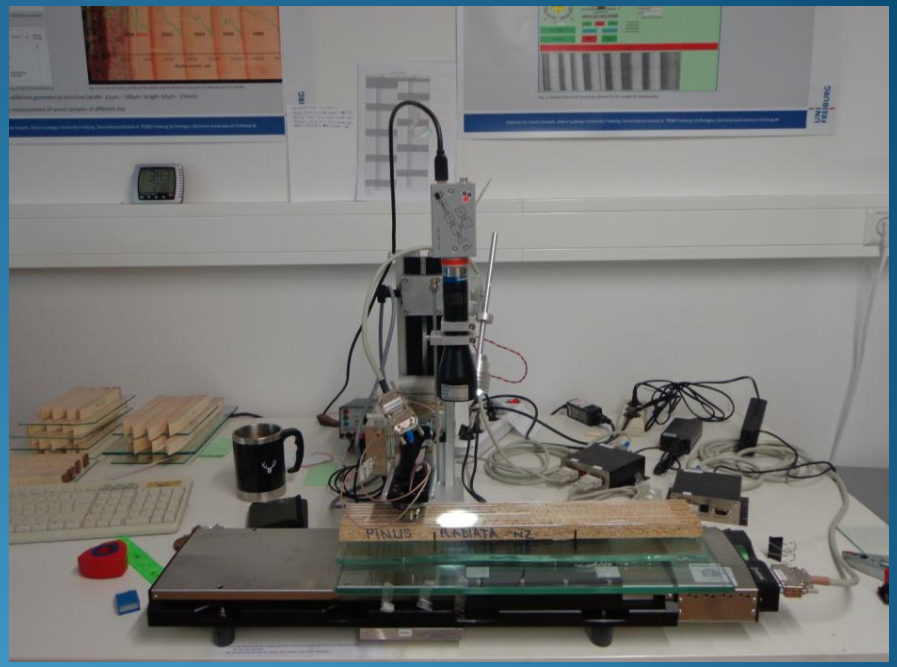


IADFs in Spruce species

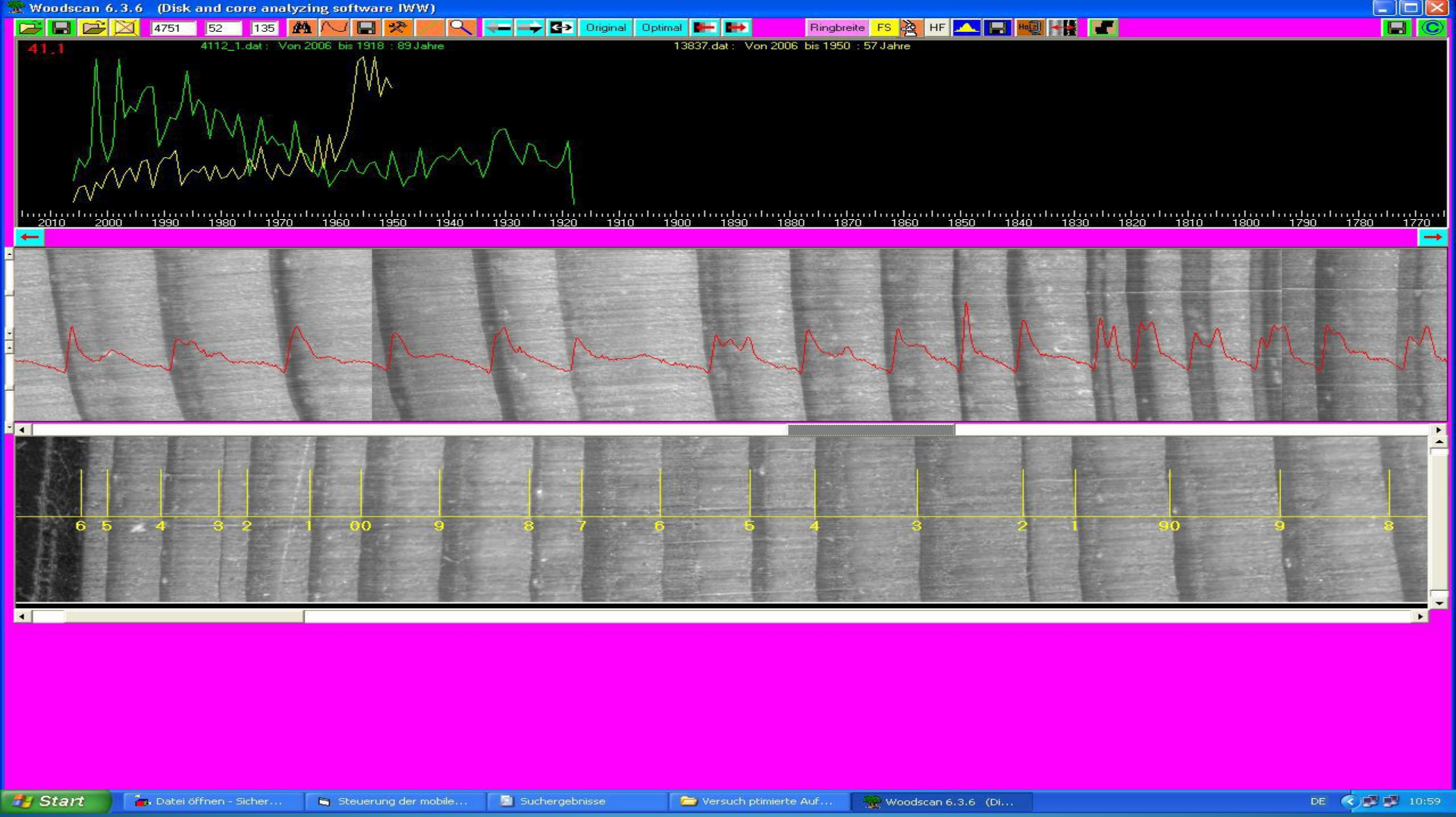
Density Measurement

The method is based on the propagation of continuous electromagnetic waves in a high-frequency (HF) transmitter- receiver.

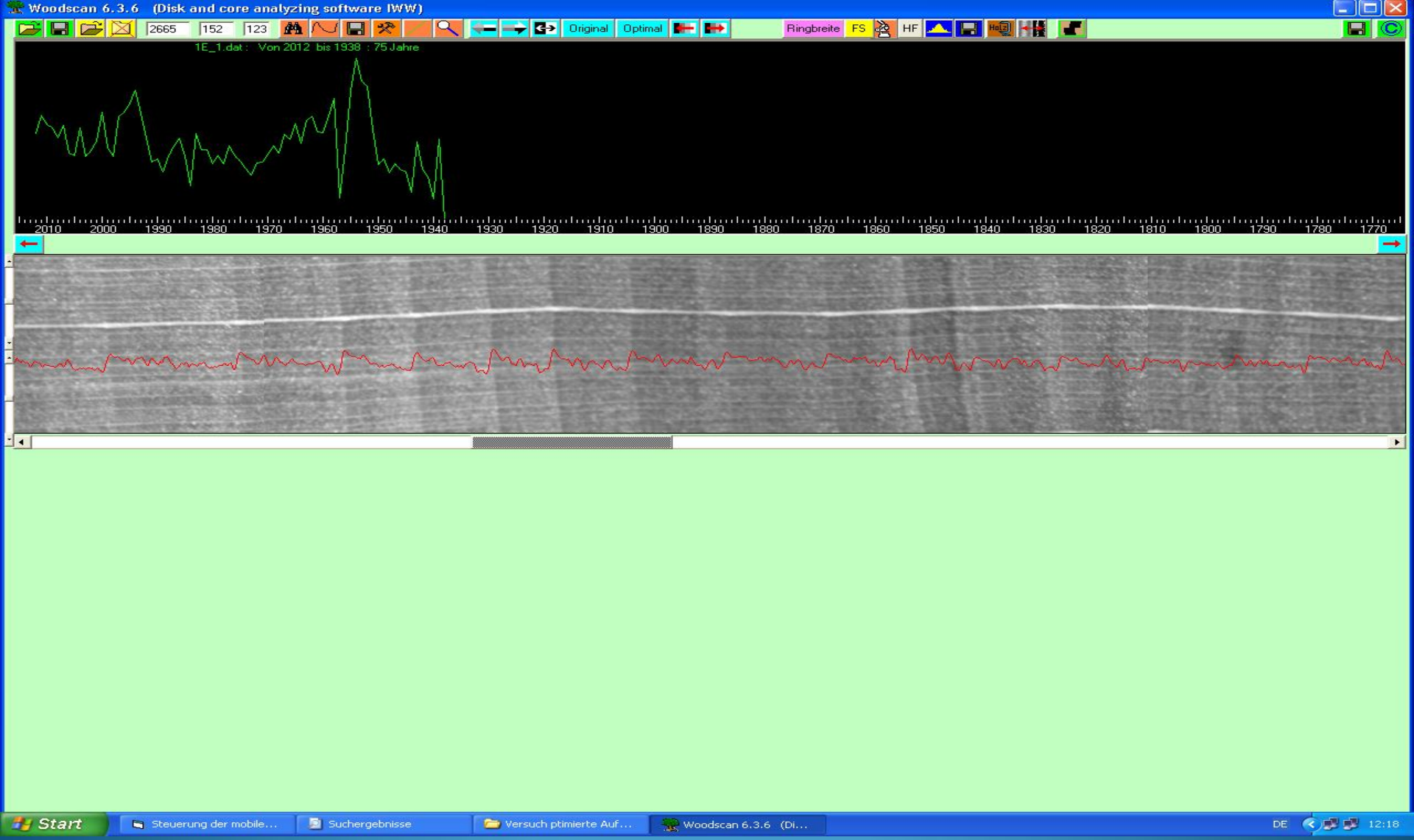
Maximum Density records at the late wood.



HF Densitometry Station



Density Profile for Spruce



Density profile for Beech

Conclusion

- Dendchronology and Dendroclimatology aiming to study the past events in retrospective

- Dendrochronology and Dendroclimatology plays an important roles to realize the consequences of Climate change

- IADFs is a pronounced message inform the experts that the trees archive all External responses in the their Rings
- Spruce borders easier to recognize by the wood scan program

- The width of the trees to some extent determine by genetic factors in addition to climate factors

- Constructing a history profile for a certain site helping the decision makers in the forest management and conservation.

References

- M.G.Schinker, N.Hansen, H.Spieker, High-Frequency Densitometry-A new method for the rapid evaluation of wood density variation, IAWA Journal,Vol. 24(3), 2003: 231-239

- Schweingruber, F.H (2007) Wood Anatomy and Environment. Swiss Federal Research institute,WSL.Bern.

- Schweingruber,F.H (1996) Tree Rings and Environment Dendroecology. Swiss Federal Research institute,WSL.Bern.

Sincere Thanks To …

- Prof. Spiecker for arranging the applied period study

- Mr. Mr. Dominik Stangler and David Montwe for the supervising me during my A.P in spite they are overload

- Ms. Marianne Stadler for the arrangement my A.P logistics

- All other members in the institute for forest Growth