Applied period at Albert Ludwig University of Freiburg. Chair of Forest Growth.

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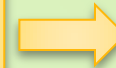
1. General information about the host Organisation.

Albert Ludwig University of Freiburg → **Faculty of Environment and Natural Resources** → **Chair of Forest Growth**

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1. General information about the host Organisation.

- **Albert Ludwig University of Freiburg:**

- Founded in the year 1457.

- Focus on the **interactions** between **environment and society**: sustainable use and conservation of natural resources.

- Around 25,000 students from over 100 nations are matriculated in 180 degree programs at 11 faculties. 7000 professors and lecturers.

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1. General information about the host Organisation.

- **Faculty of Environment and Natural Resources**:

- 3 institutes (Forest Sciences, Earth and Environmental Sciences and Environmental Social Sc. And Geography).

- Around 1300 students and 250 PhD.

- 35 full professors.

- 17 Chairs.

- Main research areas: Sustainable use of natural resources and renewable energy, defense of natural resources, adaptation to global change and natural hazards.

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1. General information about the host Organisation.

- **Chair of Forest Growth**

- **Around 18 PhD students.**
- **8 external lecturers: Brazil, USA…**

- 5 main research areas:

  ✓ **Forest growth and environment**.
  ✓ **Trees as natural resource and carbon storage**.
  ✓ **Trees as archive of environmental conditions.**
  ✓ **Methods of forest growth research.**
  ✓ **International research networks.**

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1. General information about the host organisation.

2. **Description of my work and activities.**

    2.1. Main project and related work.

    2.2. Laboratory work.

    2.3. Data analysis and results.

    2.3. Other activities.

3. Analysis of the host Organisation.

2.1. Main proyect and related work.

- Name of the Project: **Dendroecological wood structure analysis of European Beech.**

- Main goals:

    - To assess the **environmental signals** through the **wood anatomical features** in order to achieve a better **adaptation** of beech to **climate change.**

    - A better understanding of the responses of **xylem anatomy** under **stressful conditions**.

2.1. Main proyect and related work.

- ## **Why is this project important?**

- **Beech distribution in Europe.**

- **Climate change impacts**: water limitation, higher stress…

- European forest system is very inert (Schelhaas et al., 2015): need to study the **adaptation mechanisms** beforehand to be prepared on time.

- Crucial role of **water transport** in plant performance and survival: Nowadays deeplier study thanks to **computerized image-analysis systems.**

2.1. Main proyect and related work.

Experiment desing:

2 different aspects:

3 treatments:

1. No thinning (control)
2. Light thinning: BA=15 m2/ha.
3. Strong thinning: BA=10 m2/ha.

Source: www.agrobyte.com

NE: climate in 2015   **SW**: expected climate in 50-100 y

Gleichläufigkeit 81,2%
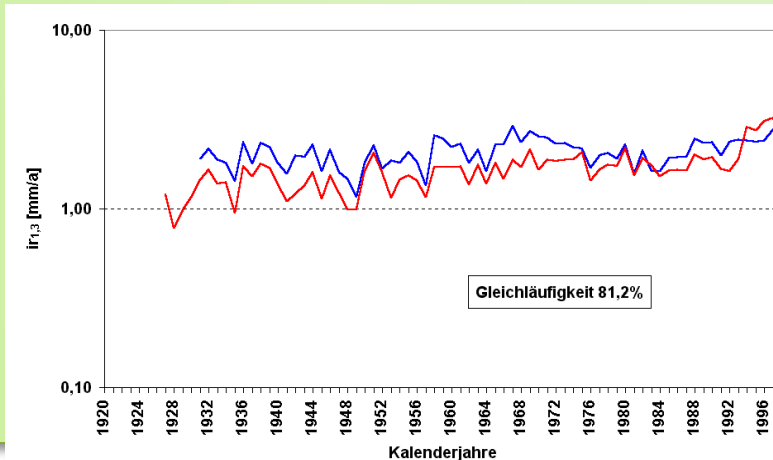
Previous studies of this proyect: Growth in NE aspect is higher than SW.

2.2. Laboratory work.

My main task in this process:
Hydraulic response of European beech to aspect and thinning.

Non-porous wood (oak)
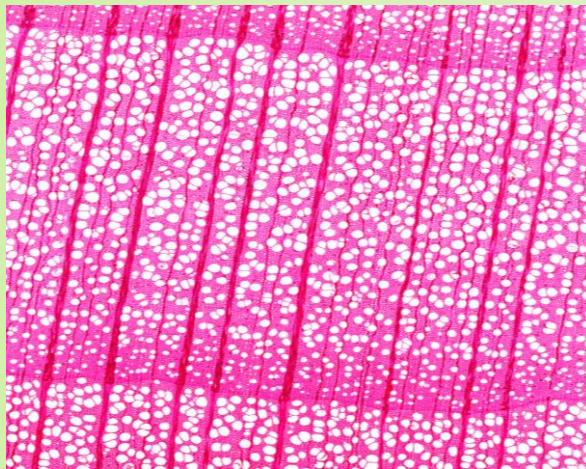
Cortex
Phloem Ray
New Vessels Forming
Vessels Open
Young Red Oak
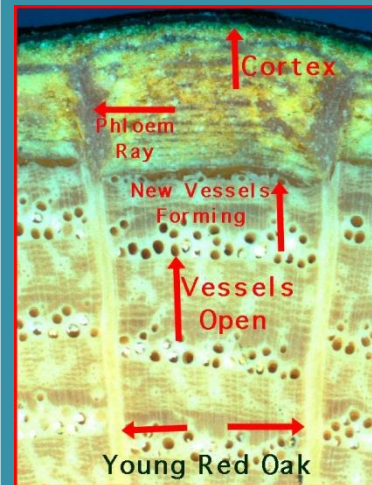
Porous wood (beech)
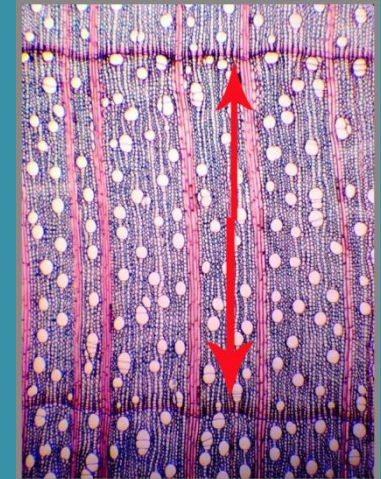
→ **RCTA** - Mean percentage of conductive area within xylem; CTA / XA [%].
→ **MCA** - Mean conduit size [microns2].
→ **CD** - Global mean conduit density; CNo / XA [no./mm2].
→ **sum Kh** - Accumulated Potential **hydraulic conductivity** [kg*m*Mpa-1*s-1] as approximated by Poiseuille's law and adjusted to elliptical tubes.

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2.2. Laboratory work.

• **Sample preparation**: Working with a microtome.

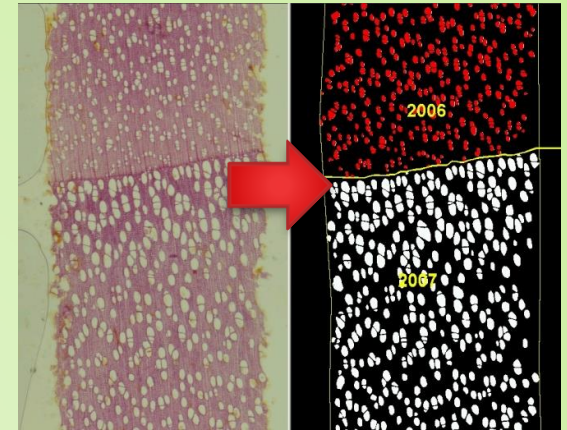• Pictures obtained wtih a **scanned transmitted-light microscope.**
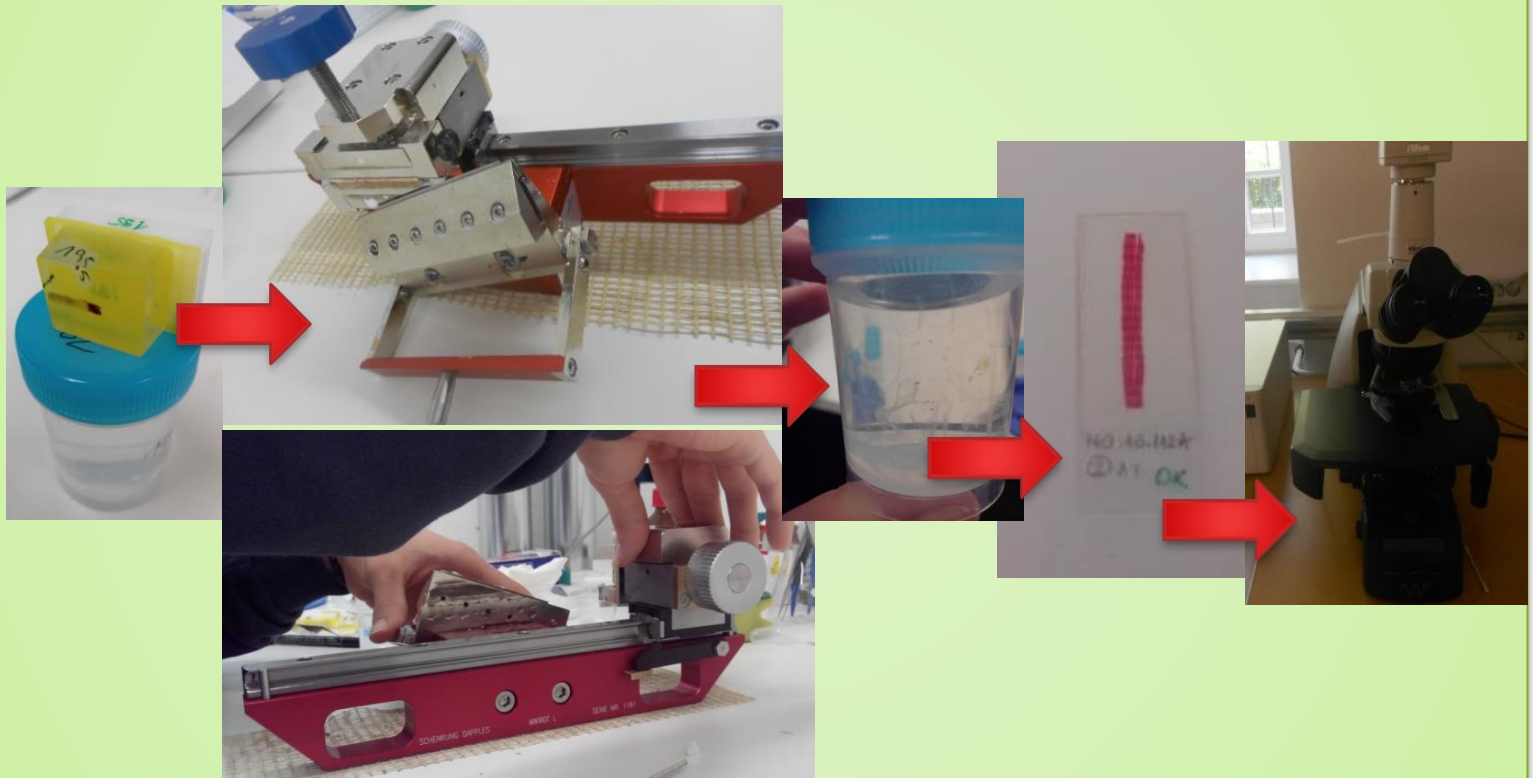
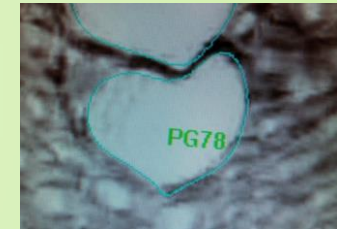Years measured: 5 years before and 5 years after the thinnings (1998-1999)

2.2. Laboratory work.

How to **analyze** the xylem vessels?

- Software **Roxas + Image-Pro plus.**

- **Image preparation**: modifying colour, contrast…

- Steps followed during this process:

1. Determining the **ring borders**.
2. The **software** looks for the **vessels** in the selected area (s).
3. **Vessels undetected** by the software are manually detected.
4. **Finding mistakes** in the selection, lost vessels…
5. **Correcting** mistakes.

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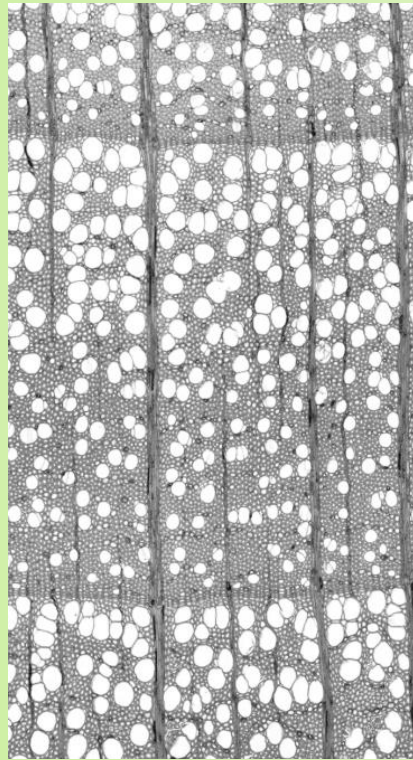## 2.2. Laboratory work.
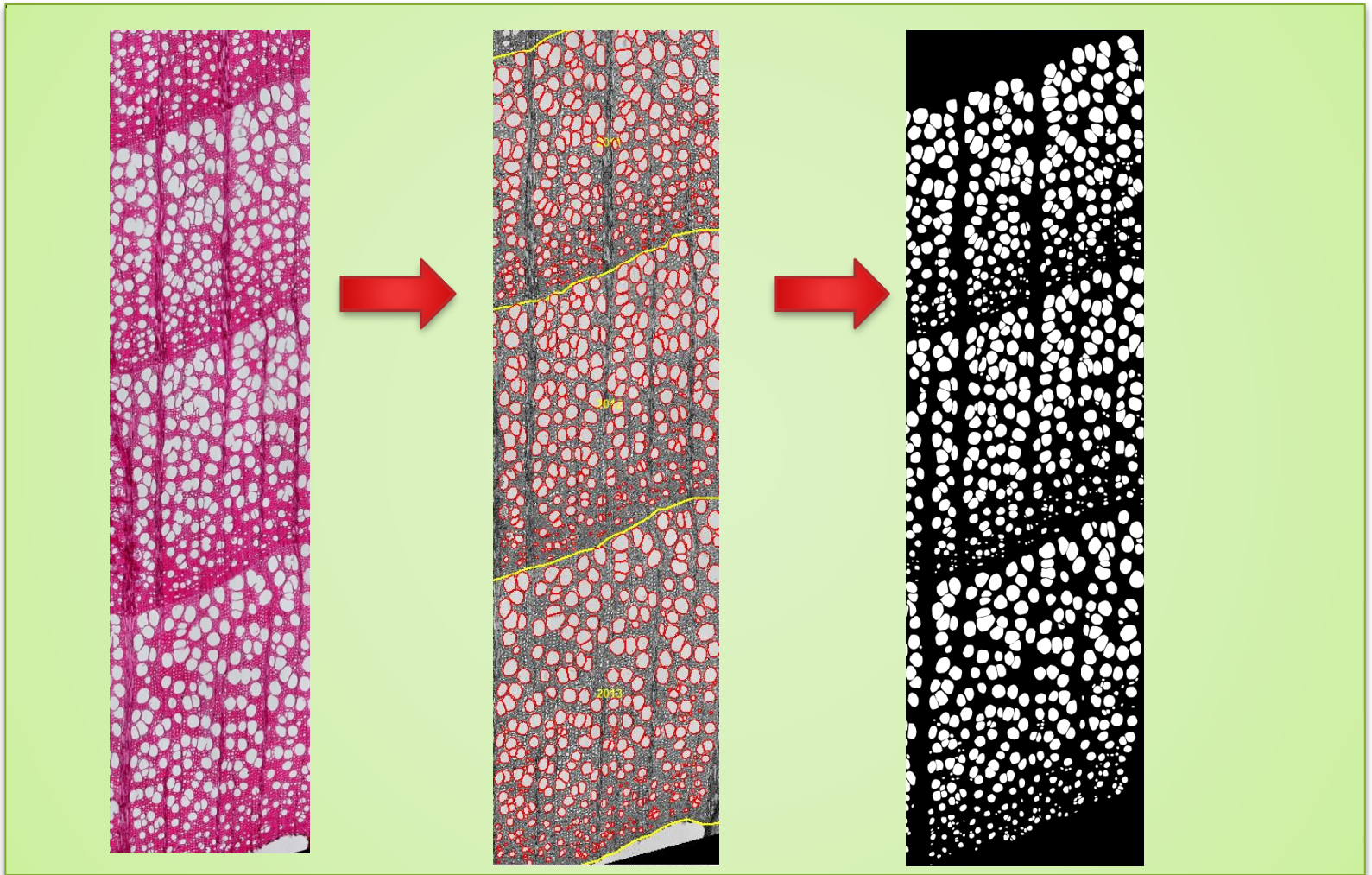
2.2. Laboratory work.

But this is not so easy…

Material on the glass.
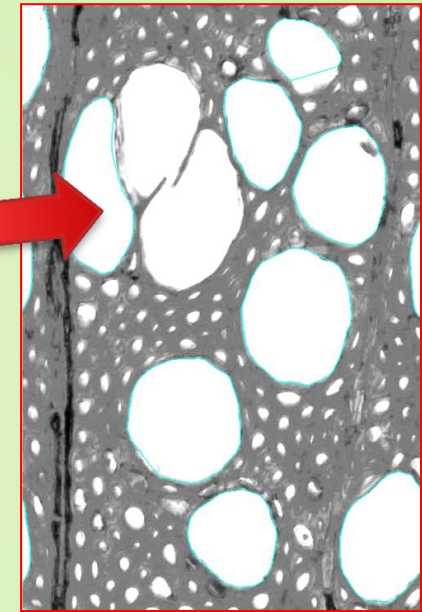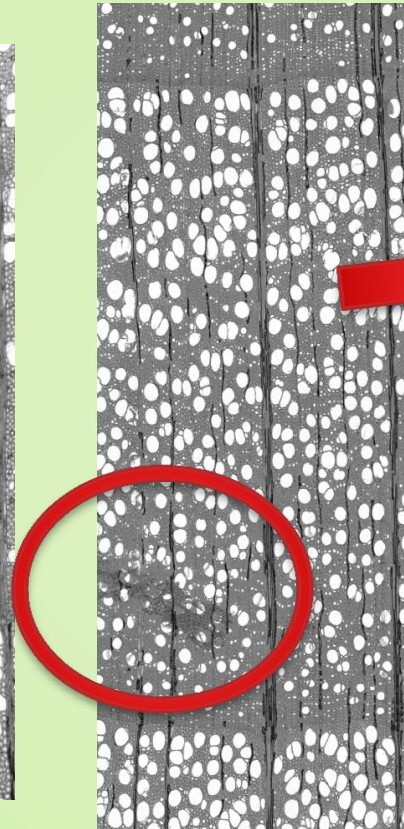
Joint vessels.

2.2. Laboratory work.

Analyzing software: main inconvenients.

- **Problems with not-powerful computers:** up to 11 min. to analyze certain images, slow responses when changing tools…high levels of patience required.

- **Analysis capacity** heavy relays on the quality of the picture taken, which cannot be determined beforehand.
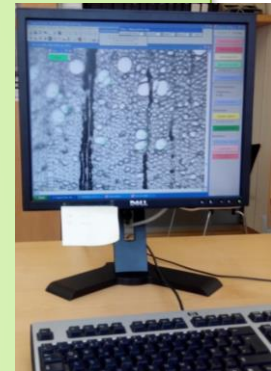
It also depends on:

✓ The **number of years** showed in the picture and **lenght** of the intra-annual surface.

✓ The **numbers and size of vessels found**: some pictures have 80% of them found by the program, others 10%.

✓ Random mistakes are **very difficult** to determine and solve!

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   2.3. Other activities.

3. Analysis of the host Organisation.

2.2. Data analysis and results.

Analyzing the data:

- The **output** of this software is very complete.

- **Excel datafiles**→Discovering **Rstudio** programme.

- Still few years measured.

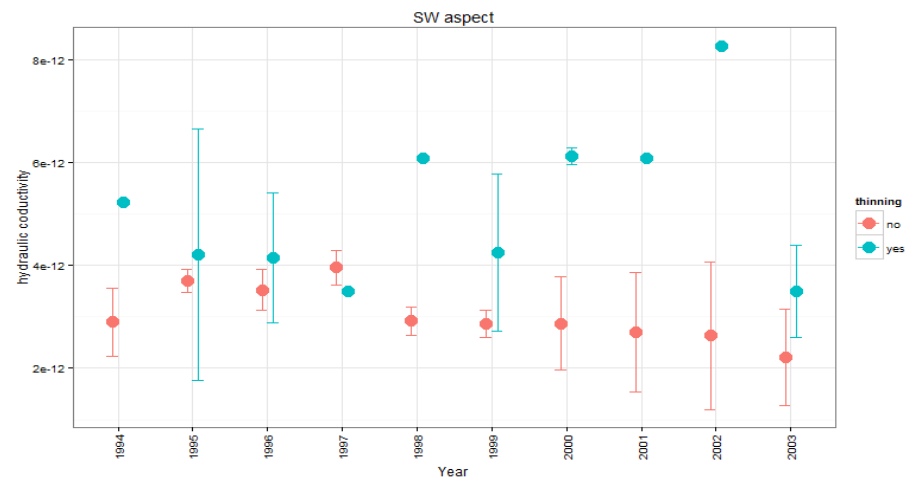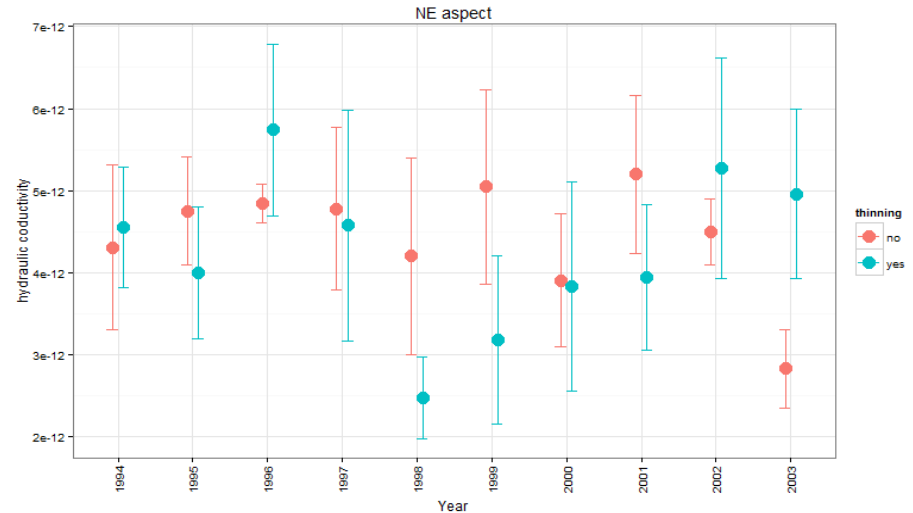## 2.2. Data analysis and results.

Hydraulic conductivity

Still **few years measured**:

-    **Thinning effect** can be clearly seen in NE aspect but not in SW.

-Not same **quantity of samples** per year =Not accurate results.
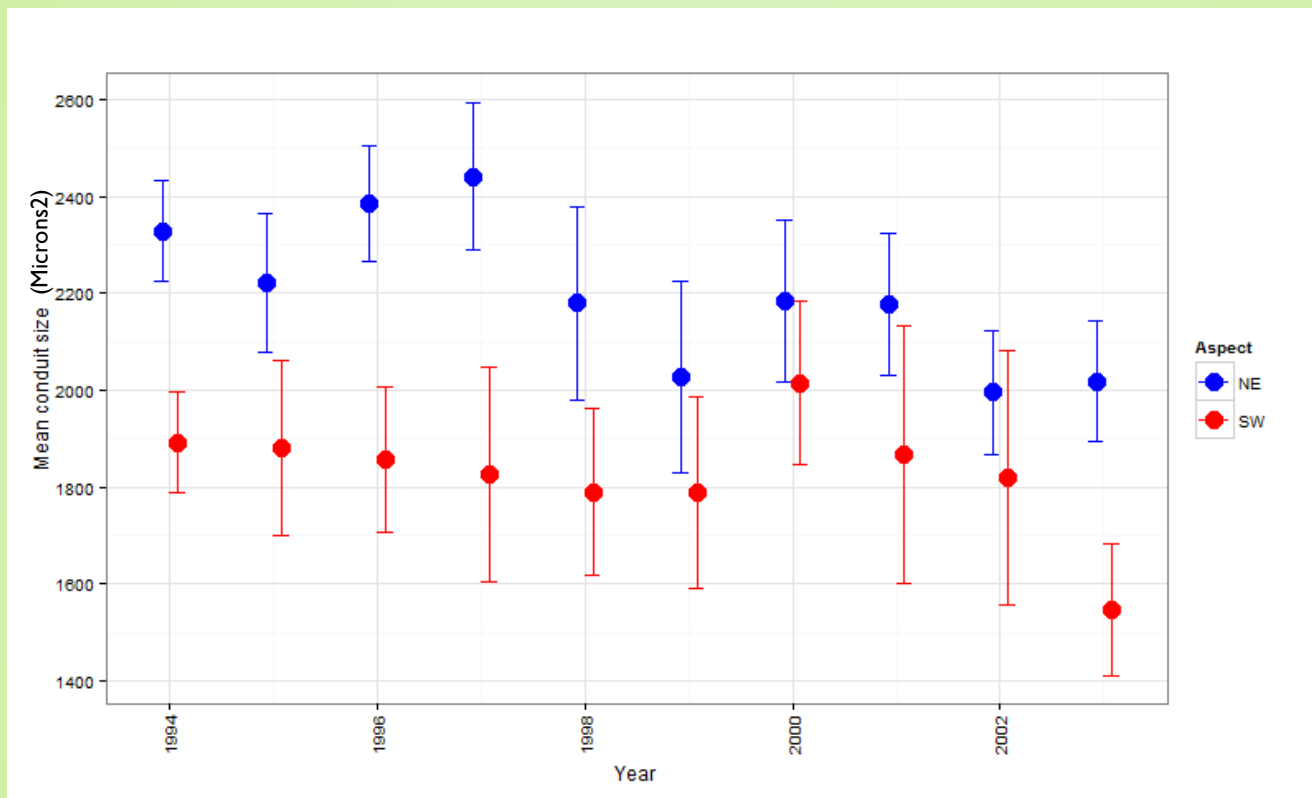
-**No clear trends** for the moment.

2.2. Data analysis and results.

Mean conduct size

Vessels significantly higher in NE aspect (no matter the treatment).

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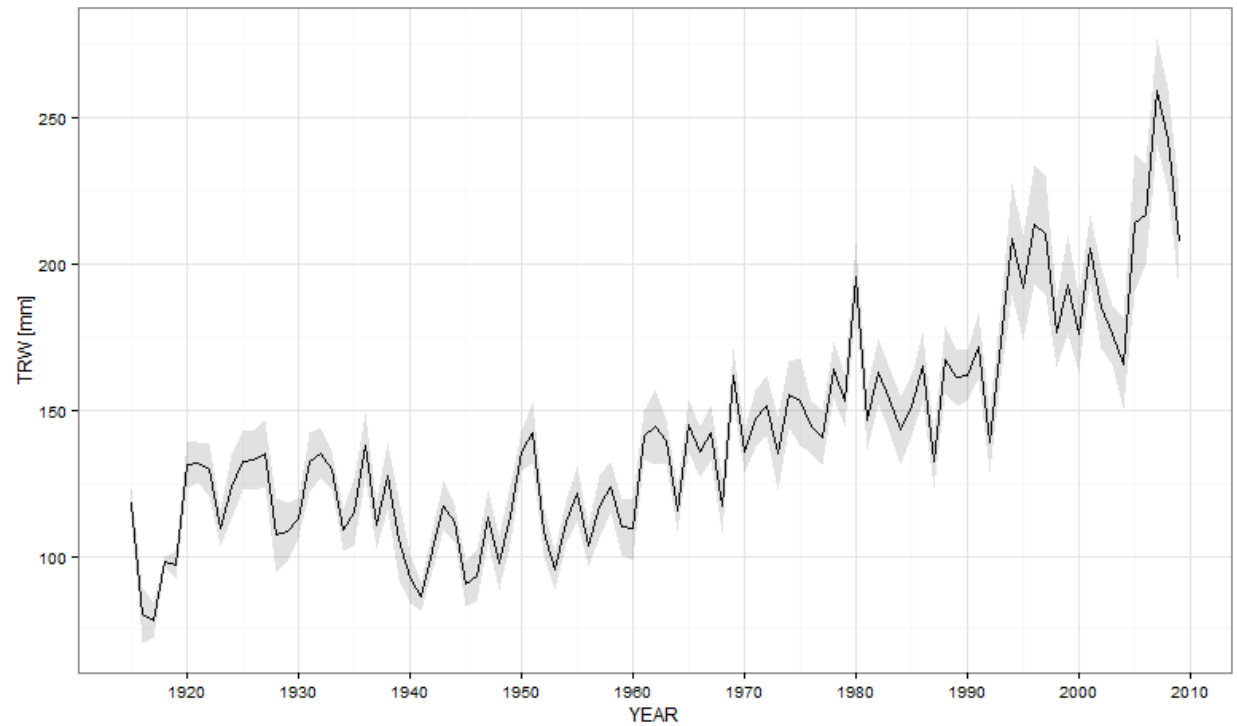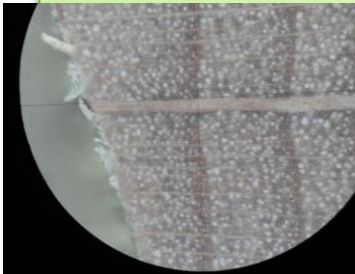3. Analysis of the host Organisation.

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2.3. Other activities.

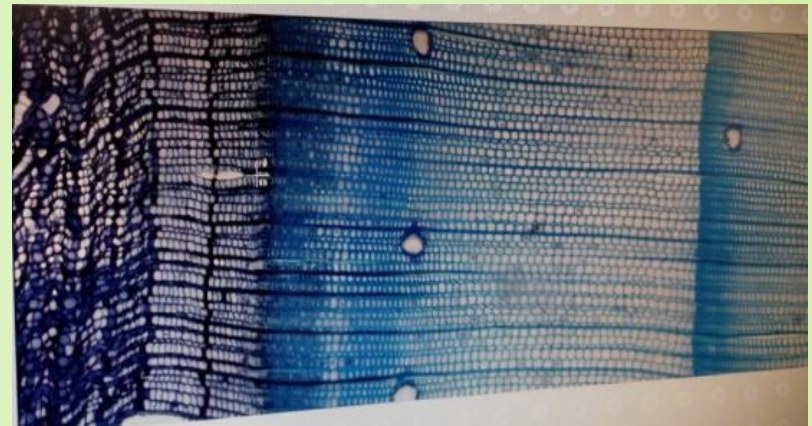• Ring measurements: high precision with the **PAST4 software**

Tree ring width(mm)

2.3. Other activities.

• Growth analysis.

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Description of my work and activities

Field trip: **Breisach mixed broadleaf research plot.**

- Main species: *Prunis avium, Acer pseudoplatanus, Fraxinus excelsior and Populus sp.*

- Aims:

✓ Development of **long-rotation forestry systems** to obtain valuable timber in combination to annual crops such as weat or maize or short rotation forestry trees such as poplars.

✓ To study the effects of **prunning treatments** on growing phenology and seasonal growth dynamics.
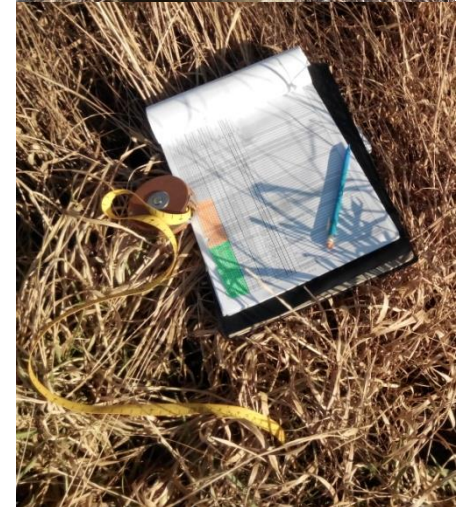
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Thank you very much for your attention!

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