

# GEMM\_EST

A project for assessing the feasibility of tapping resinous species from Eastern France and extending the resin products offering

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Resin extraction as a building block of sustainable forest multifunctionality Bordeaux Pierroton March 5<sup>th</sup>/6<sup>th</sup>, 2019

# CONTEXT

- Regional willingness for finding added-values along the forest-wood chains
- Extraforest project: extractive resources in forests & industrial by-products
- Lorraine University of Excellence, « Mirabelle+ » call
- Increasing societal demand for high-quality turpentine  
and other bio-molecules
- Large resin production from maritime pine could be completed  
by other resinous species

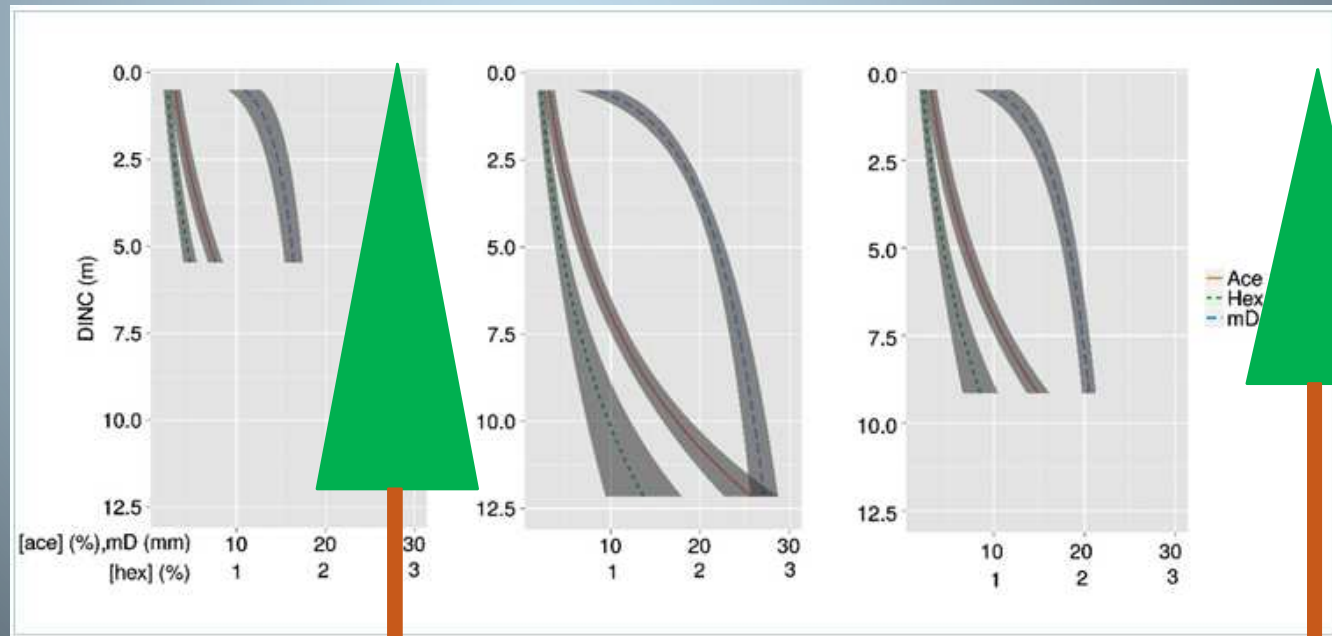


# CONTEXT

My own concern: variability / biodiversity

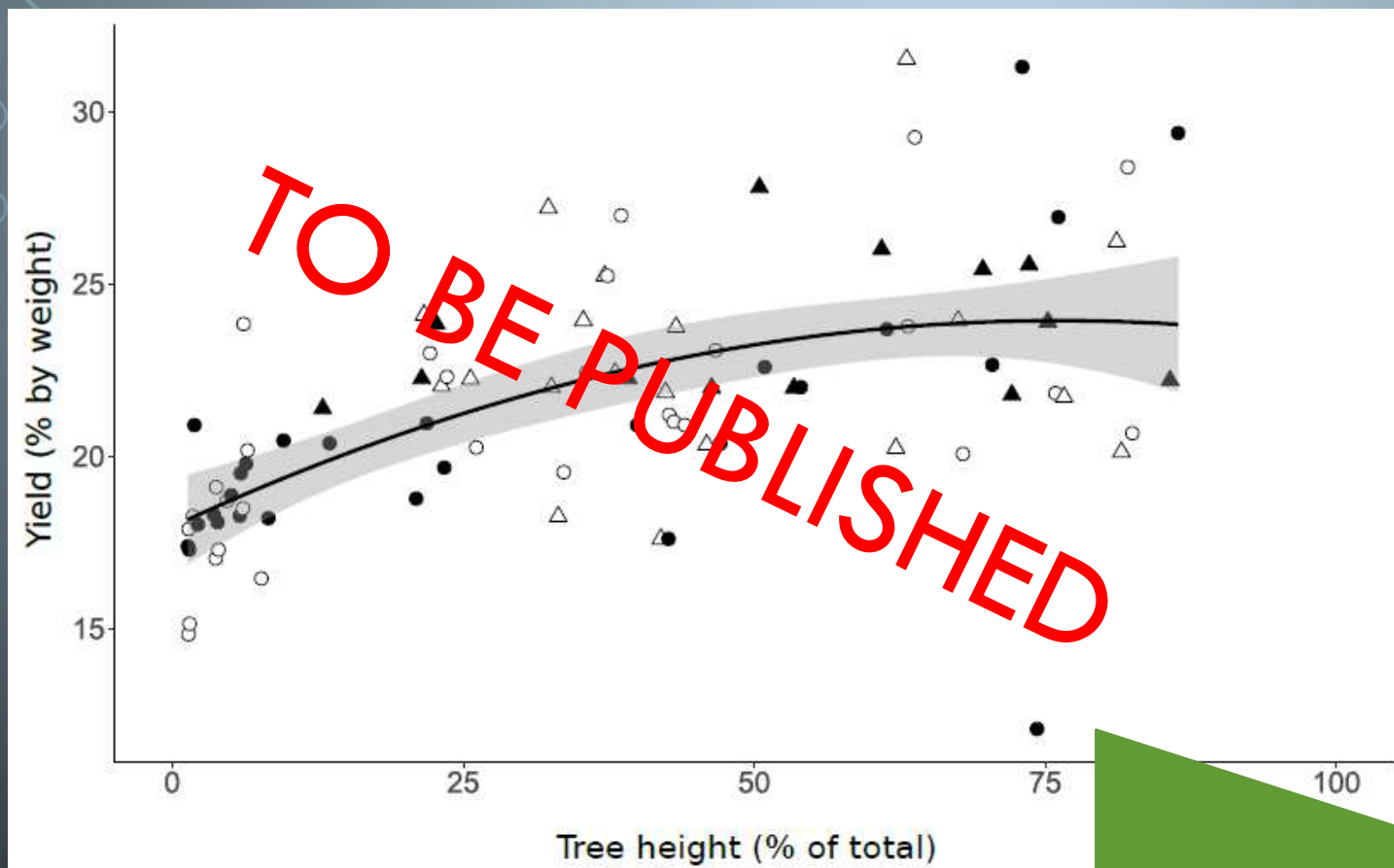
Kebbi-Benkeder  
et al., 2017 Trees

Sapin dispositif  
ONF Saint-Prix



Prédictions et IC à 95% des taux d'extraits  
dans l'hexane (gauche), dans l'acétone (centre)  
et des diamètres moyens de branche (droite) versus la distance depuis l'apex

pour un arbre co-dominant de la modalité témoin(a),  
un dominant de la modalité "classique" (b),  
un dominant de la modalité dynamique (c).



8 Silver fir trees

Water+ethanol 50/50

Brennan et al., 2019  
Trees (submitted)



# FOUNDING IDEAS

- Tapping is reviving in South-western Europe especially on maritime pine
  - Other species than maritime pine offered  
other resins/turpentines and maybe other minor chemicals
    - Venice's or Briançon's turpentine
    - Vosges mountains turpentine
    - Strasbourg's turpentine
    - German turpentine
- ➔ A large panel of products could be provided  
with larger volumes for maritime pine products

# AIM OF GEMM\_EST

Deliver the (preliminary) scientific, technological, socio-economic basis for proposing

an innovative tapping of resinous species others than *Pinus pinaster*

Species: Silver fir, Norway spruce, Douglas fir, *Pinus sylvestris*, Larch

Area: Eastern France

# ORGANIZATION & RESOURCES

Tasks	Year1	Year2	Leaders	Laboratory /organization
0. Project management			Dr F. Colin	Silva
1. Ethnology&literature			Dr F. Colin/Dr N. Celzard	MNHN_Paris, Silva
2. Site&tree prospecting			Ing. A. Colin	IGN
3. Tapping technology			Dr F. Colin	Silva
4. Chemistry			Pr P. Gérardin	Univ. Lorraine_LERMAB
5. Anatomy			Dr J. Ruelle	Silva-Tech
6. Genomics			Pr Y. Jolivet/Dr JF. Hausmann	Silva, LIST_Luxembourg
7. Bioeconomy			Dr S. Caurla	BETA, Silva, IGN

140 000 Euros asked

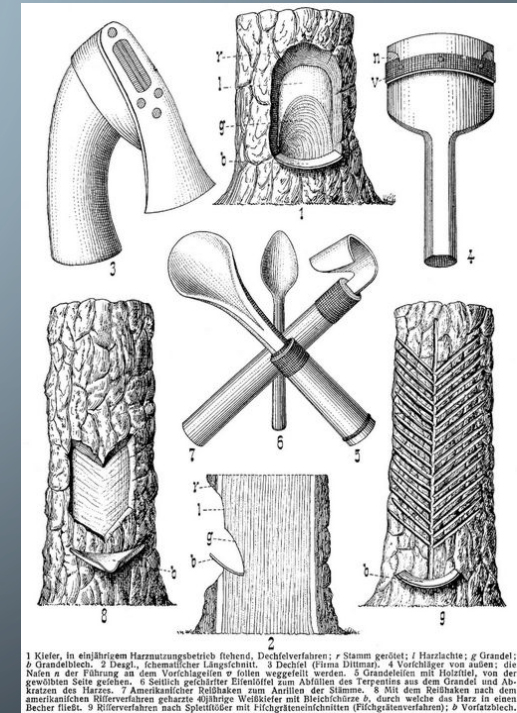
A two-year long post-doctoral position (in wood properties, wood chemistry, genomics..)

Two master2 positions



# SOCIO-ETHNOLOGY. LITERATURE

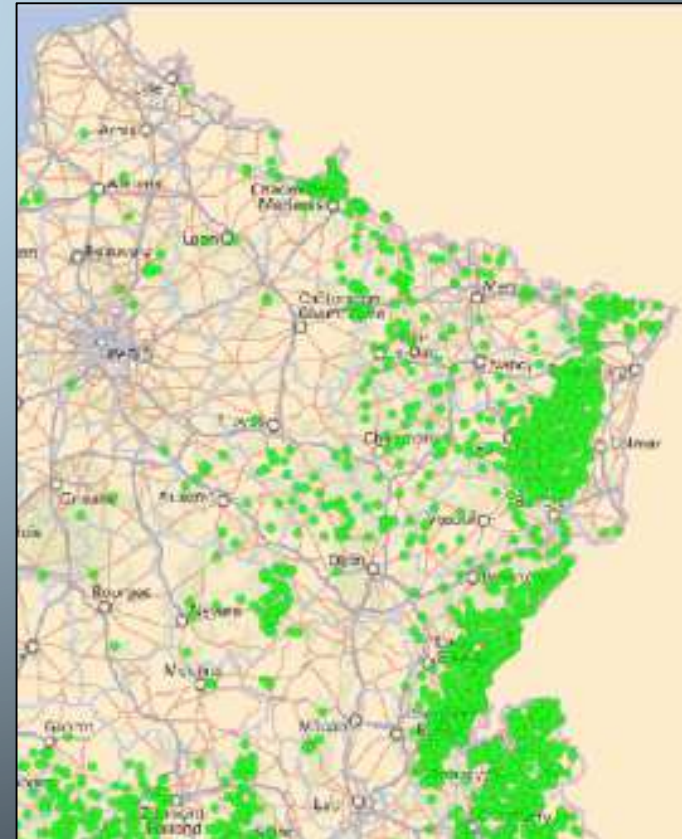
- In which area it was (is still) performed?
- Which part of the tree was injured?
- Who performed tapping?
- When during the year?
- What were the methods? The devices?  
The tools?
- Markets? Commodity chains?
- Reasons of decline?



# SITE & TREE PROSPECTING

Set-aside resource:

- Large DBH
- Difficult access
- Poor quality → low inserted branches



*Picea abies*



# TECHNOLOGY: APPLY THE BEST TO DATE



# CHEMISTRY

- **Yield**

- **Composition** → diversify of raw materials for industries of fragrance, painting, adhesives, inks, chewing gum, rubber, etc.).

- **Selection of**

- the 1-2 most productive species
- the most significant biosynthesis pathways

- oleoresin: mainly terpens, especially monoterpens and resin acids

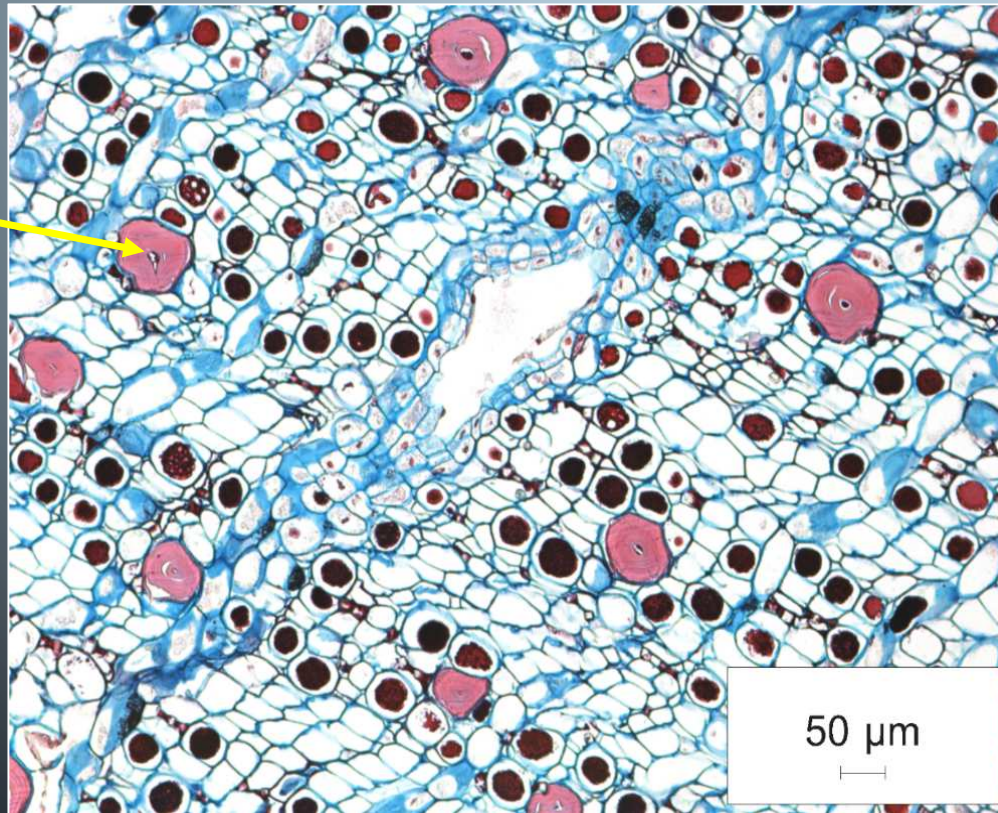
- polyphenolic compounds present in the exudates, in PPcells and around the wounding: lignans, hydroxycinnamic acid derivatives

- Easy analysis by GC-MS



# ANATOMY & CHEMIO-LOCALIZATION

Sclerids



Injured *Larix* phloem

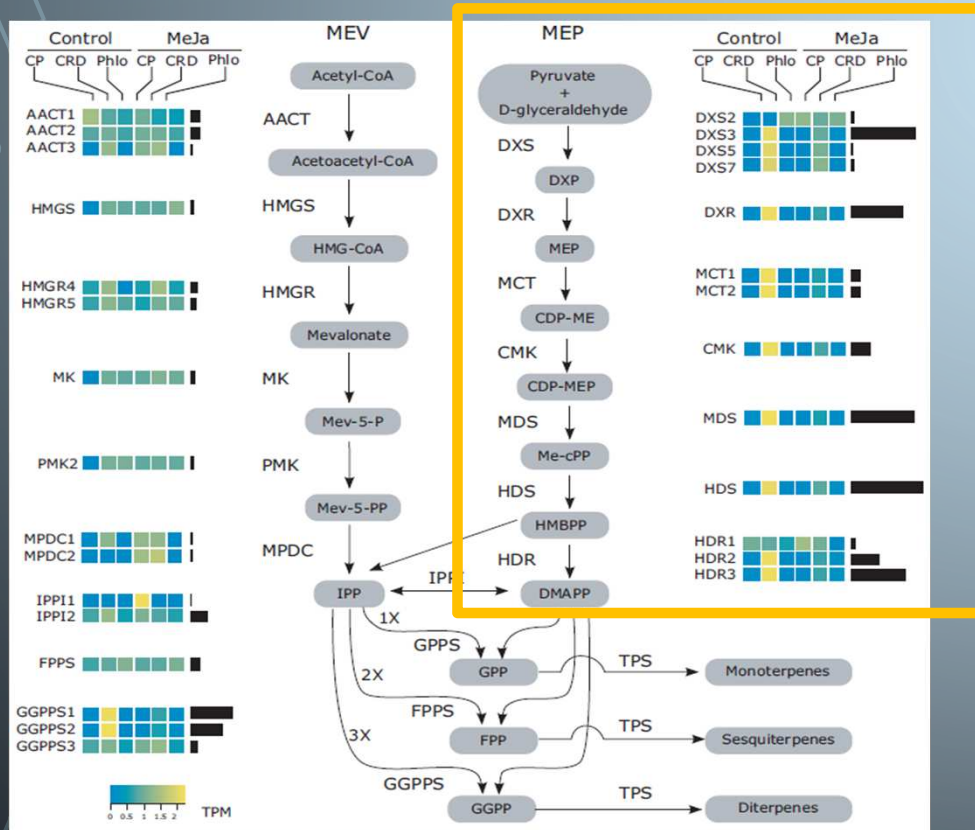
stained with FASGA

→ cellulose in blue

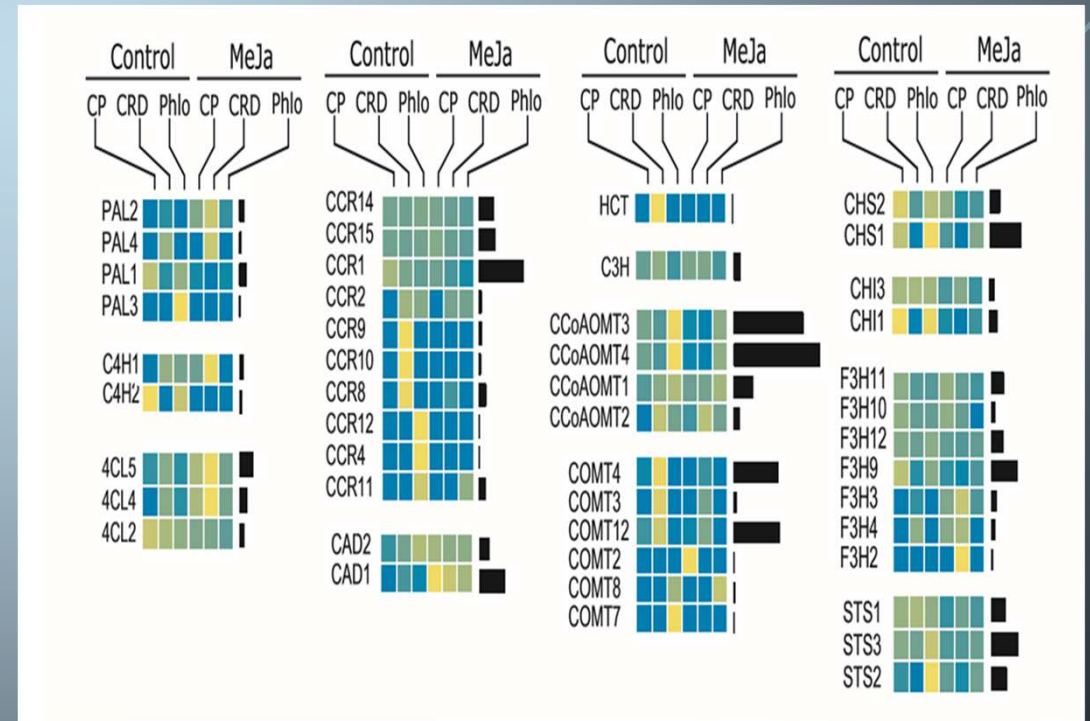
→ polyphenols in pink, red or black

Ranaivomiarana 2018

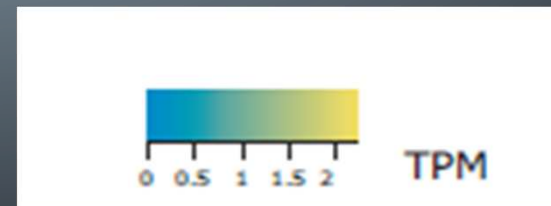
# GENOMICS FOR A FEW BIOSYNTHESIS PATHWAYS



Spatially refined expression map of terpenoid biosynthesis



Spatially refined expression map of phenolic metabolism



*Picea abies*  
Celedon et al. (2017)



# ANATOMY, CHEMIO-LOCALISATION, GENOMICS & BIOSYNTHESIS PATHWAYS:

- Identify the most responsive trunk parts
- and the chemical specificity of each
- Decipher the
  - location of biosynthesis
  - routes of translocation
  - storage zones

➔ Toward a tapping of precision

# “BIO-ECONOMY”

- 1) resource prospecting & maintenance
- 2) involvement of local stakeholders
- 3) production
- 4) logistics
- 5) supply of selected chemistry plant
- 6) profitability/feasibility
- 7) Rural activity/social impact



# CONCLUSION

- Thank you for accepting my presentation
- Your expertise is great; we need it
- Extend the panel of bio-products could be a common goal; we have to focus on the chemical biodiversity & quality
- Technological transfers from *Pinus pinaster* to other resinous species and vice versa could be accelerated with your participation
- Exchanging students between academic and R&D organisations would be also considered



THANK YOU