



Mycosylvicultural diagnosis at the forest scale

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- Territories evaluations for edible mushroom production : a major goal and interest



- Fit under a double dynamics background :
(1) Spatial → *where ?* , (2) temporal → *when ? How long ?* ; At various scales

Forest territory knowledge provides fundamental bases ; how can we improve this knowledge ? Two types of methods used :

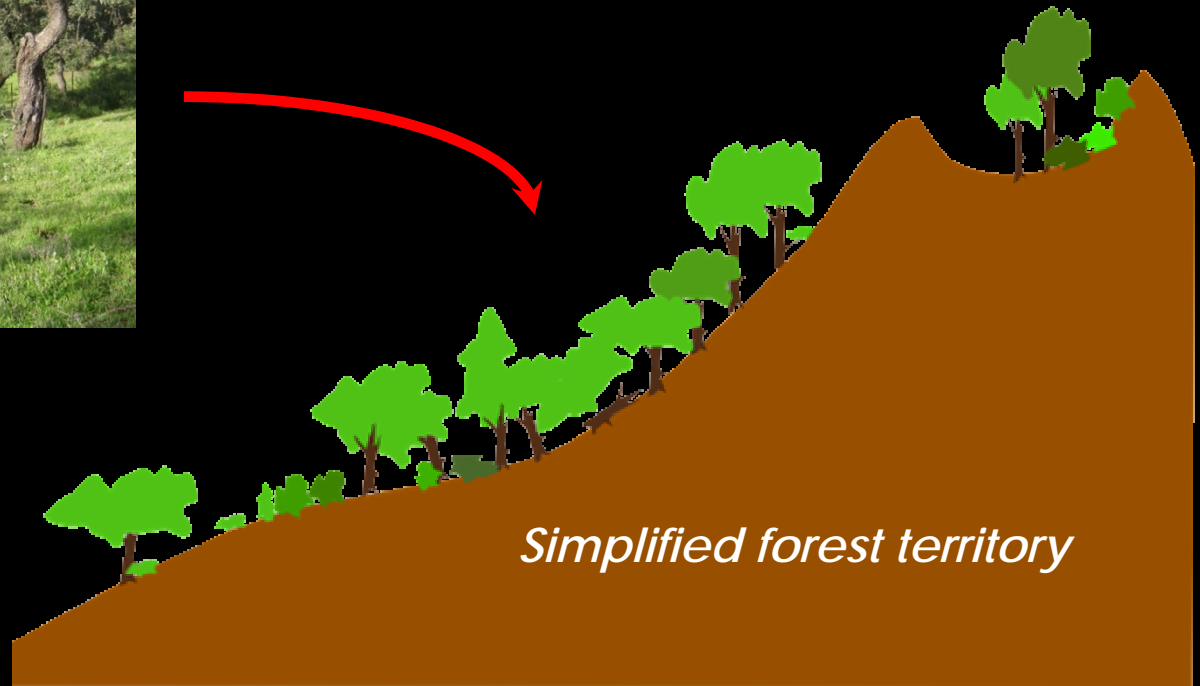
- mapping of the whole forest territory;
- Fragmentation of the territory in fonctionnal sub-units, using mycosylvicultural diagnosis in reference areas, then scale transfert



Fragmentation of the forest territory ?

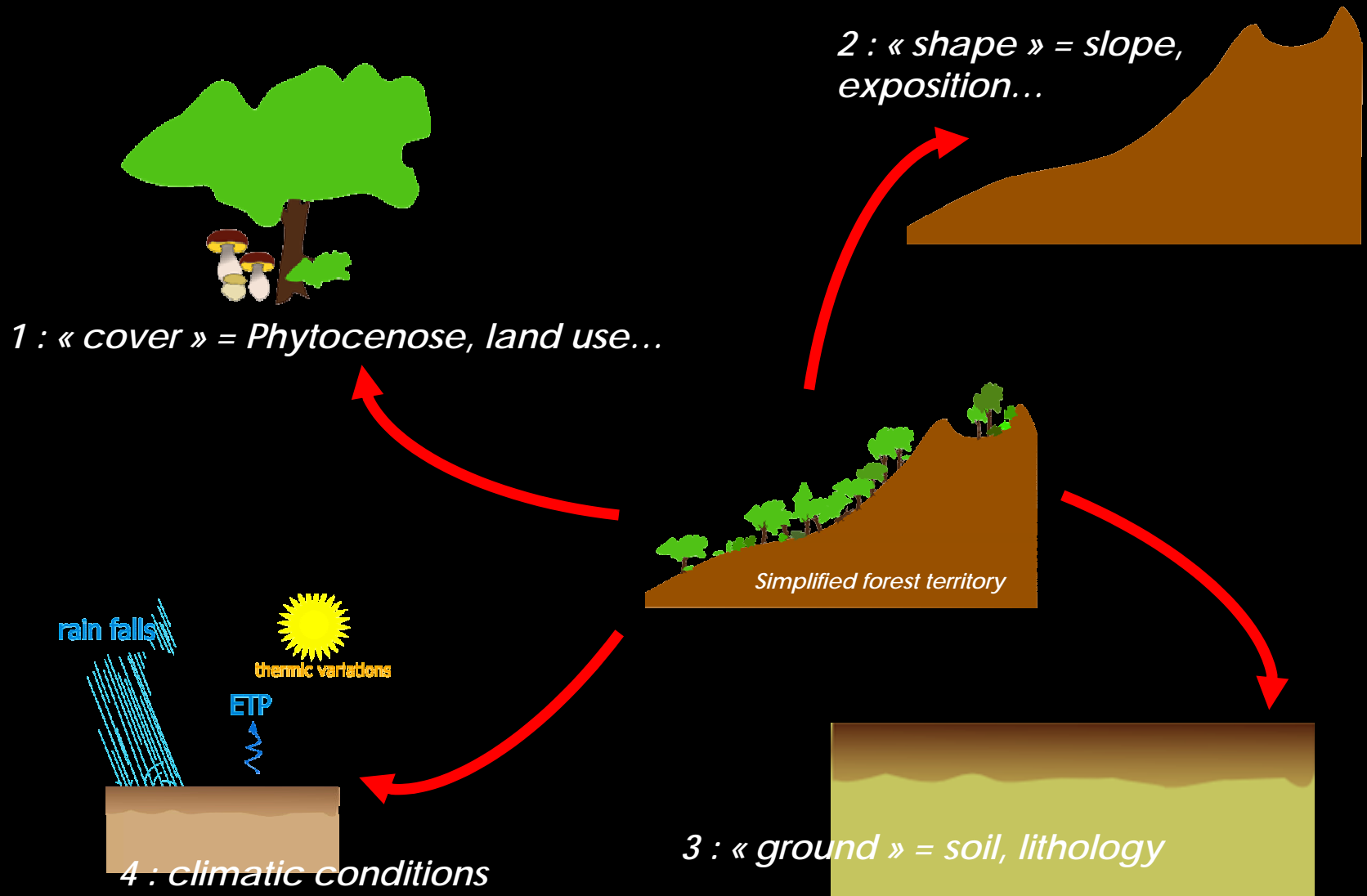


Monte de Pias, Portugal

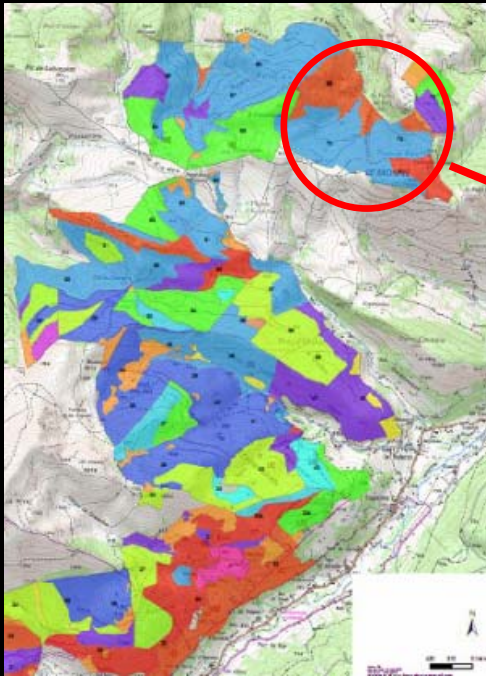


Simplified forest territory

Fragmentation of the forest territory



Territory fragmentation : « cover »



Forest territory
Scale > 1000ha
/ 50 years



Forest plot Scale : 1 ha
15 – 50 years

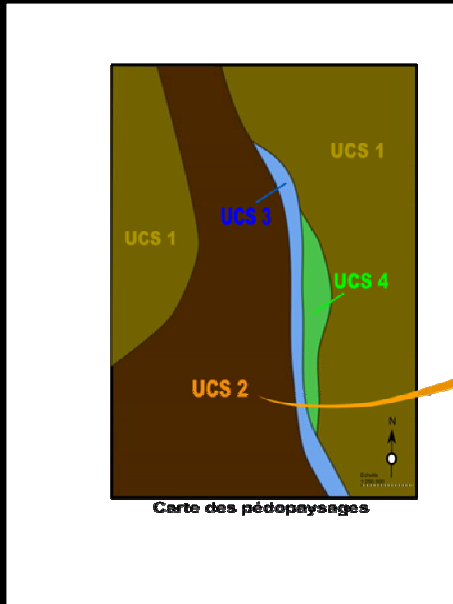


ECM fungal community
Scale : 10m / 10 - 50 years



ECM cycle
Scale : <cm – year

Territory fragmentation : the ground > soil



Soil association
Scale > 100m /
> 500 years



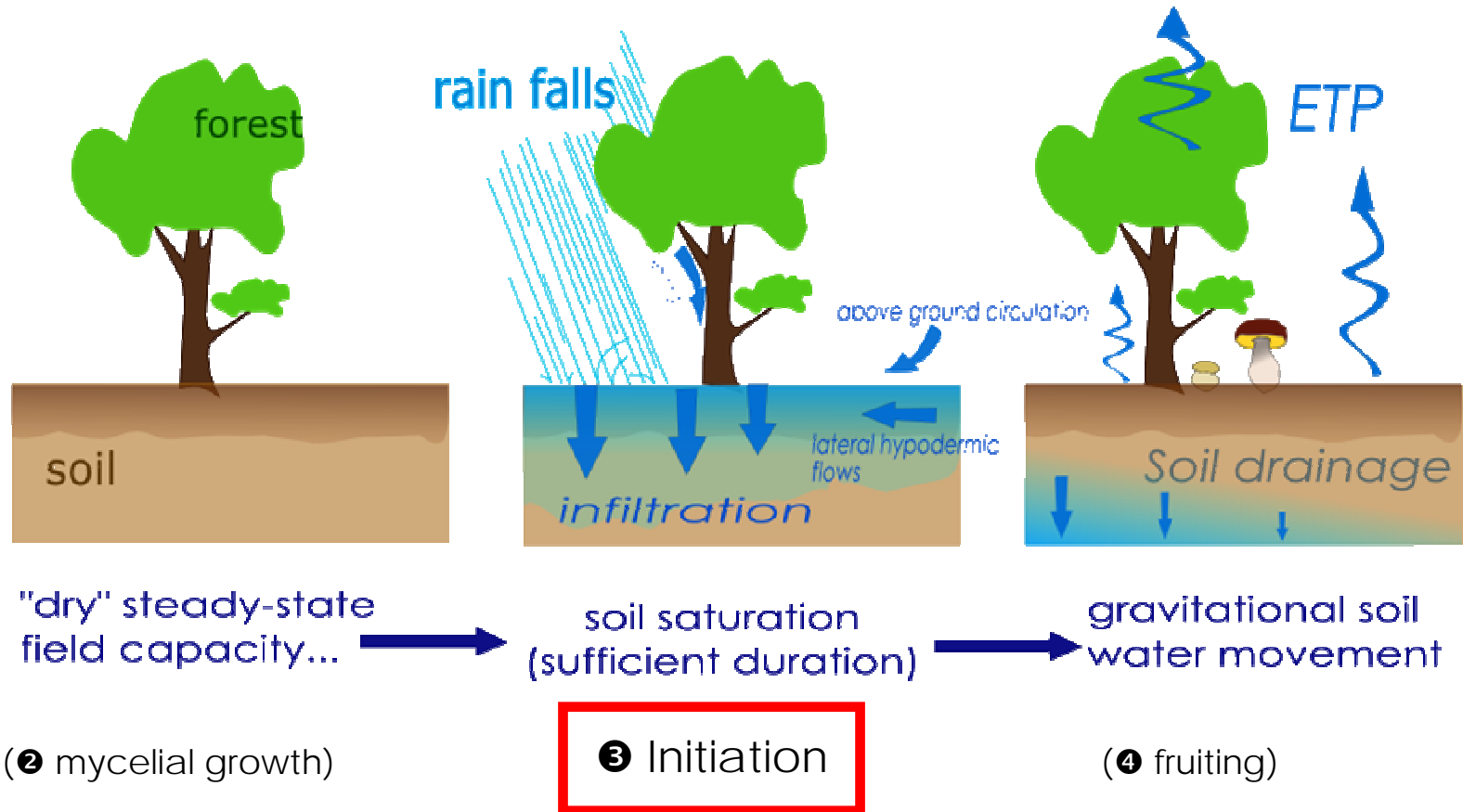
Organic matter
accumulation - humus forms
Scale : cm / 1 – 3 years

Biological activity

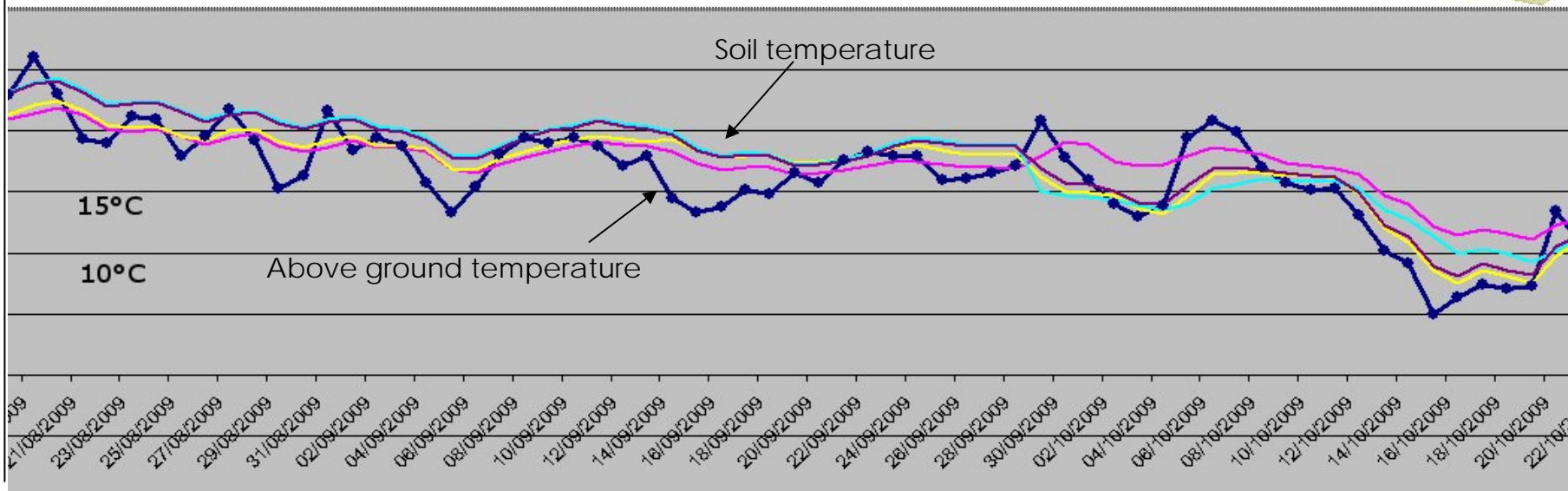
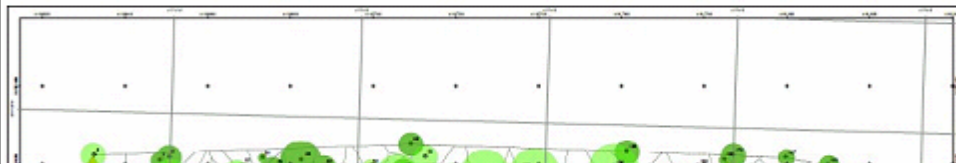
Scale : mm – weeks or days



Example : knowledge about fruit-body initiation (case of *Boletus*) – by coupling climatic conditions and soil properties (incidence of soil hydrodynamic properties)



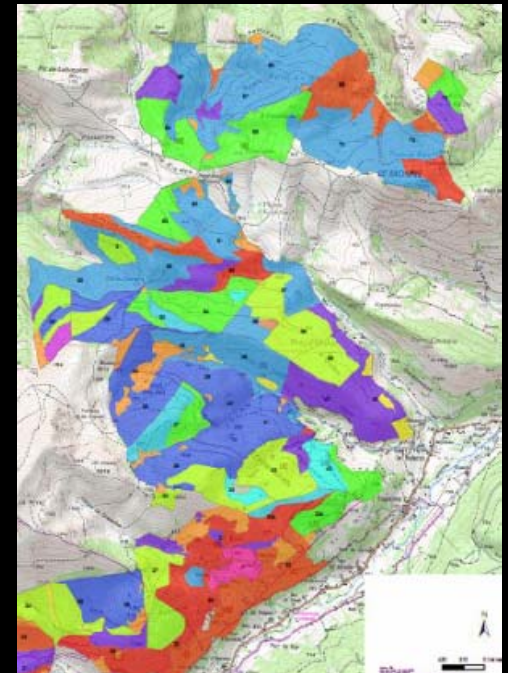
Example : knowledge about biological activity : by coupling climatic conditions / forest canopy and soil properties



Consequences :

- Fragmentation of the territory considering fonctionnings and adequate scales ; best parameters identified
- On a representative area : « reference sector »
- Extrapolation of the parameters using adapted tools : Scale transfert
- For various management proposals

Example : study in the Lesponne valley



First step : identification of soil types, boletus production and their distribution pattern (on a small representative area of lesponne valley)



Soil diagnosis, hydrodynamic characteristics, and distribution ; boletus species ; fine soil and mushroom mapping.



Second step : factors leading to distribution pattern



A

- **ALOCRISEL TYPIQUE**, de schistes, peu à moyennement épais
- forme d'humus de type **oligomull** à **mésomull**
- à **forte activité mycogène**
- géomorphologie de **versant** rectiligne, pente accusée
- carpophores plus nombreux en position de **milieu de versant**
- hêtraie, strate herbacée réduite à absente
- **exposition** sud-ouest à sud-est
- quantité d'**irradiation** solaire d'avril à novembre > 4511 Wh/m²/j



A

- *B. pinophilus* en milieu de versant
- carpophores en tâches isolées auprès des hêtres
- soit dans les zones d'accumulation de litière
- soit dans les zones de réception hydrique
- croissance des carpophores du printemps à l'automne, jusqu'à tardivement en bonne exposition
- forte productivité en carpophores, régularité interannuelle

B

- *B. edulis* en sommet de crête, en domaine peu pentu
- carpophores dispersés en nappes au milieu des hêtres
- sans localisation préférentielle
- croissance des carpophores plutôt à l'automne
- après stress thermique ($\Delta T = -5^{\circ}\text{C}$)
- productivité faible à moyenne, plus aléatoire



B

- **ALOCRISEL TYPIQUE**, de schistes, épais
- forme d'humus de type **oligomull** à **dysmull**
- géomorphologie de **crête** et sommet de versant (convexité), pente peu accusée
- hêtraie à Myrtilier
- **exposition** sud, sud-est à nord
- quantité d'**irradiation solaire** d'avril à novembre < 4511 Wh/m²/j



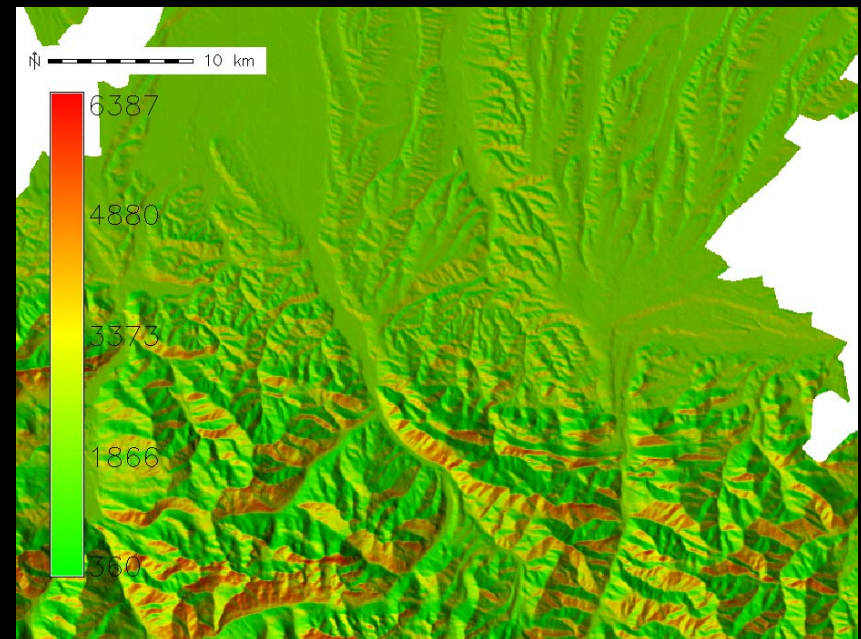
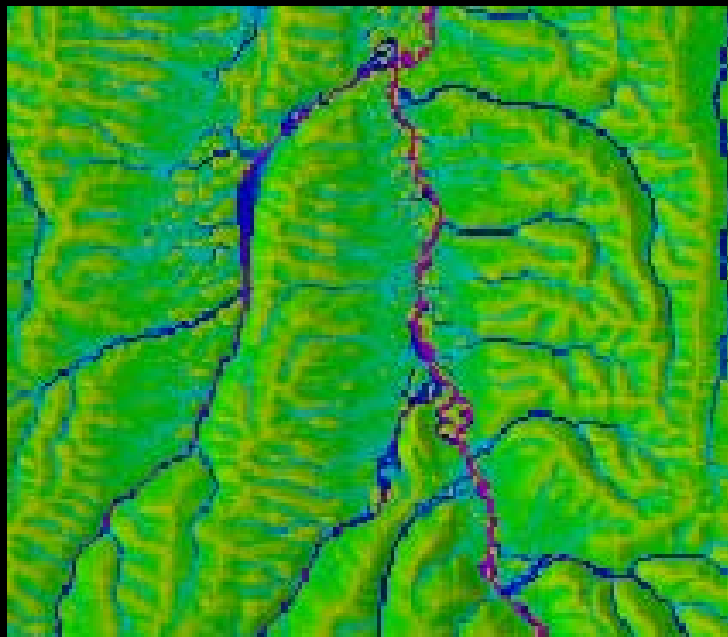
Third step : Reference area definition (about 10 ha)

Extrapolation of these factors to the territory (whole Lesponne valley)

Use of geomorphology patterns based on DTM maps

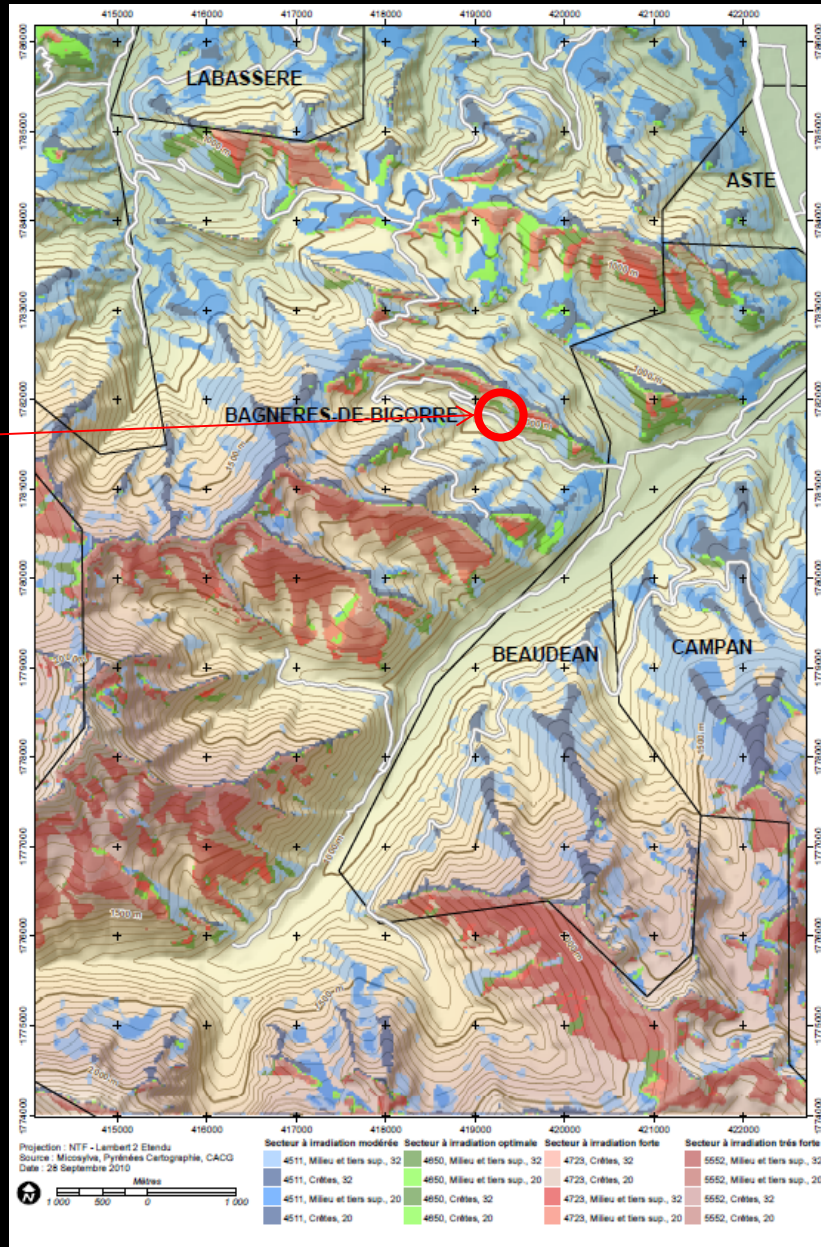
Use of geological informations....

⇒ Soil prediction, daily thermic variations for various periods ...



> All the parameters may be extrapolated ?

Reference
sector



First results :

Extrapolation map of adapted plots for Boletus production (according to natural conditions) at the scale of a wider territory ...

... but also mapping of water accumulation areas, soil temperature estimations...

... Identifying the best adapted management patterns...

... at various scales.

Work in progress : model validation, taking into account forest settlements

In summary, mycosylvicultural diagnosis at forest scale :



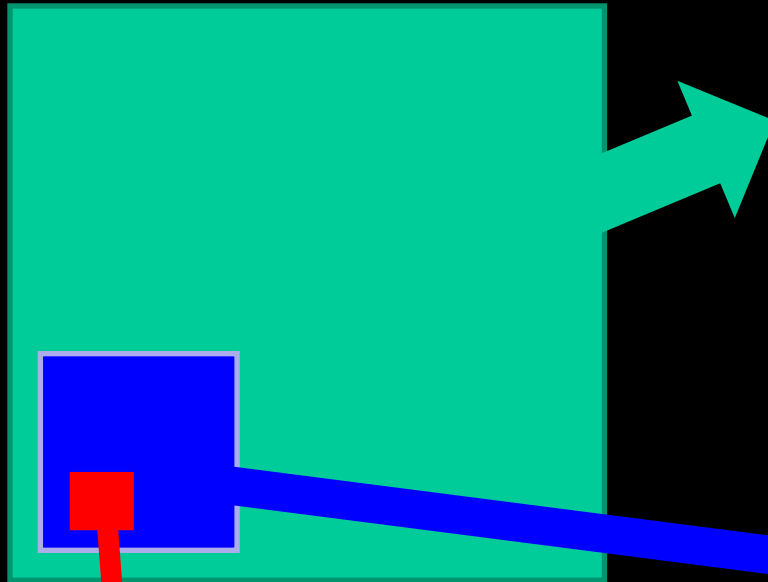
Level 1

- Forest Territory, various settlements
- Potential mapping
- > 1000 ha



Level 2

- Settlement structure
- Management proposals
- « 2000m² »



Level 3



- OM management
- Habitat
- Management proposals
- 10 m²

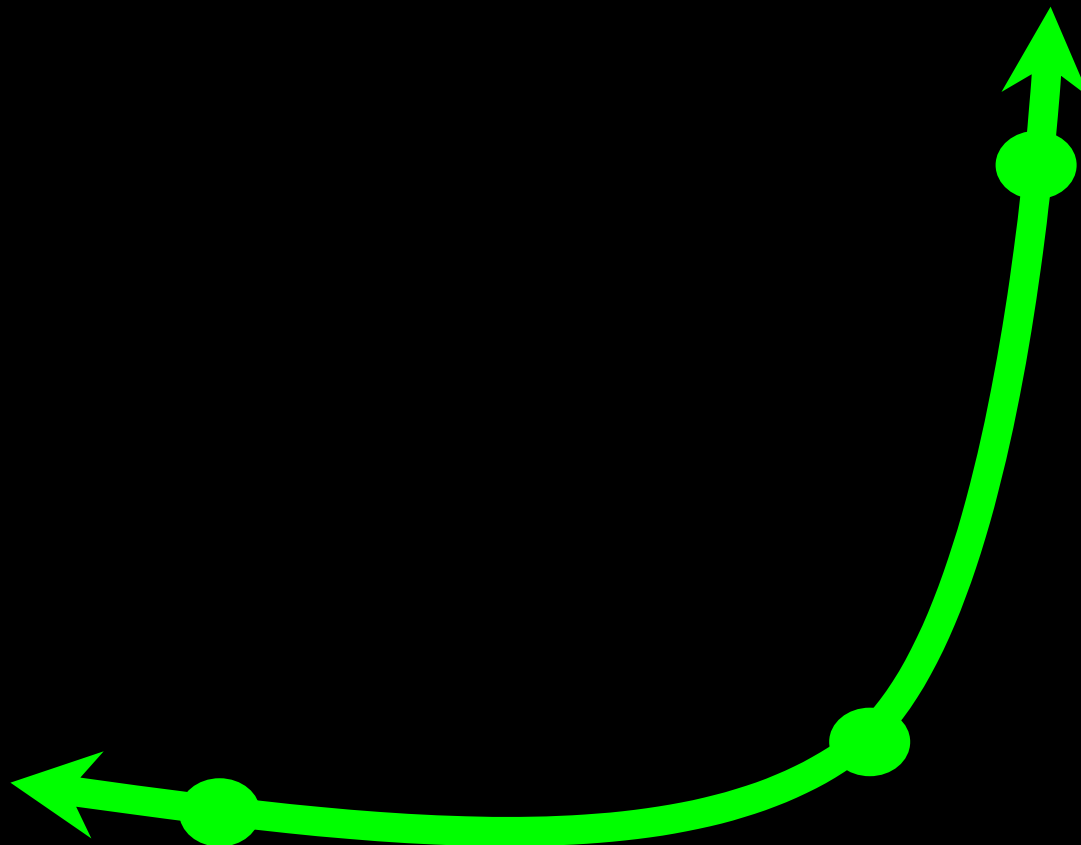
Conclusion and prospects

- Interest provided by mycosylvical diagnosis at forest scale : a tool for knowledge and a tool for understanding, multi-parameter, in fact multi-scale
- Also usefull for studies where root/tree phenology is implicated (cryptogamic diseases, oaks decline, climate changes...)
- It provides precious informations for forest stands management and sustainability, according to environmental, social and economical goals, at various scales.

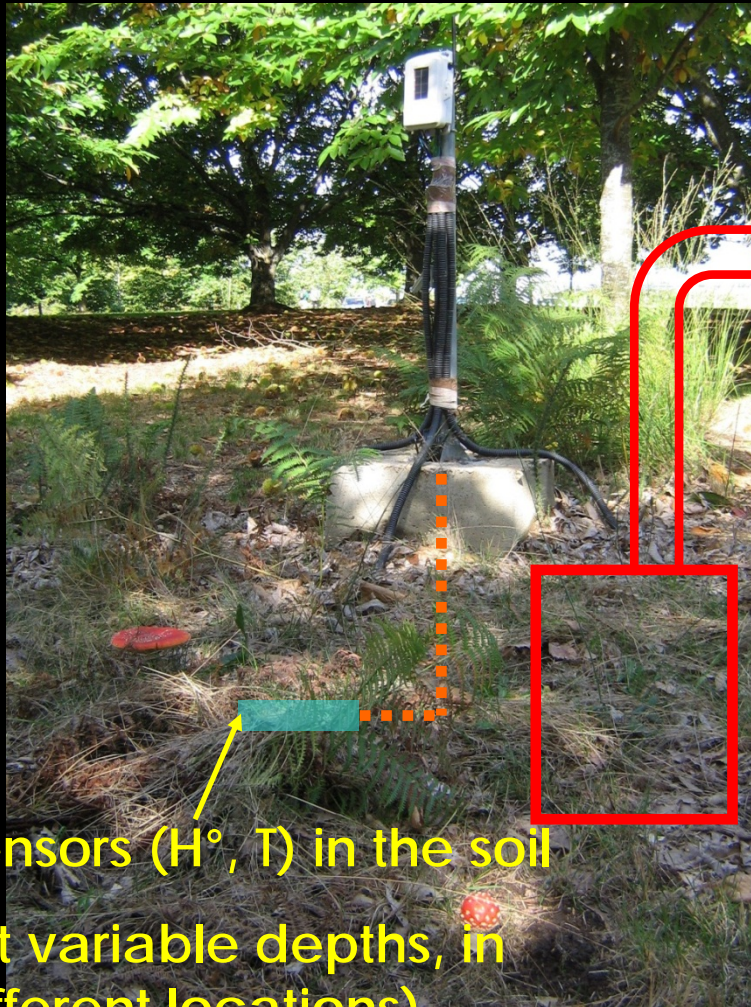
Thank you for your
attention



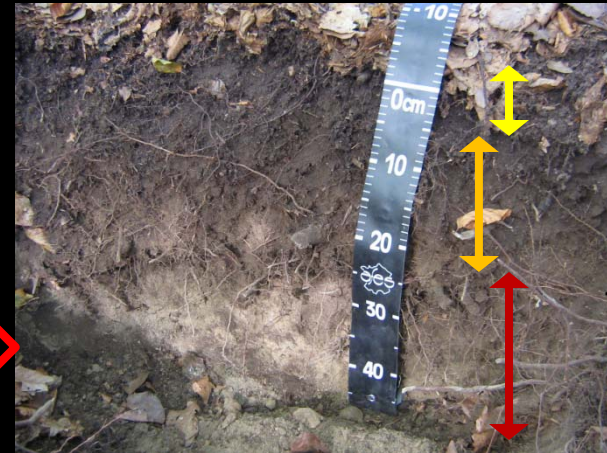




Methods and tools : observations, analyzes, for a global understanding



Sensors (H°, T) in the soil
(at variable depths, in different locations)



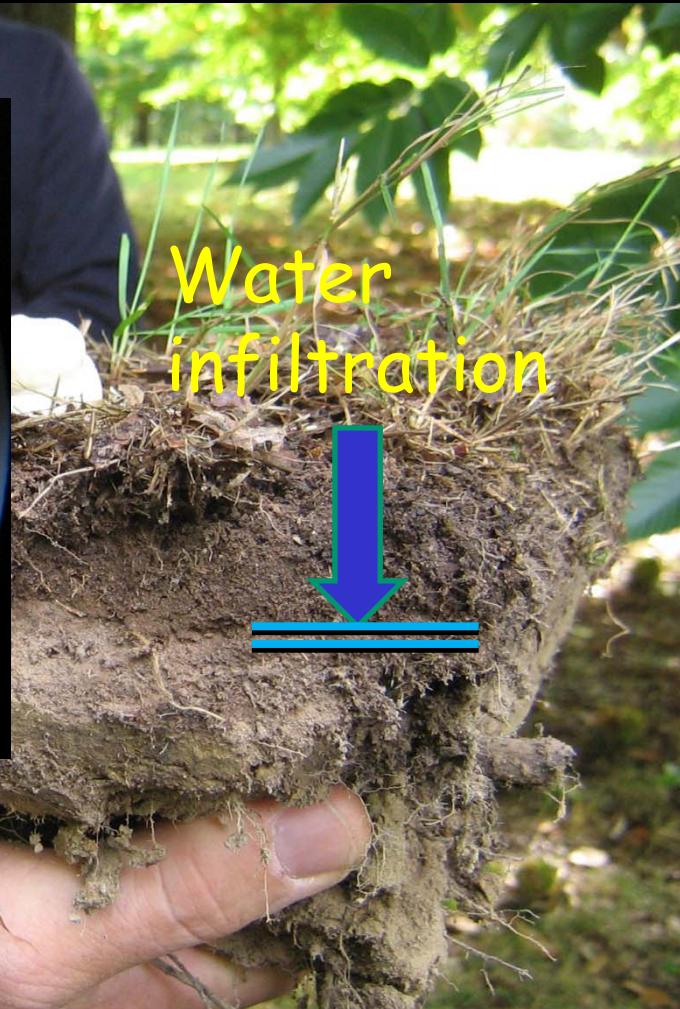
« Basic » observations : soil horizons, root density, humus forms, porosity...

« complex » measurements or observations : soil temperature, soil moisture, leaching, permeability, episolum biological functioning...

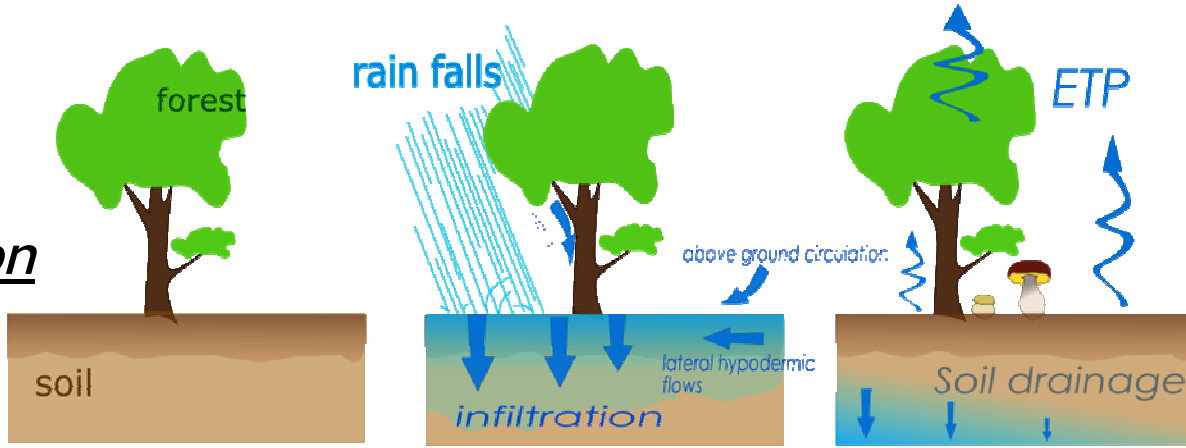
associated with mappings of mycorrhizal communities and soil analyzes

→ *soil dynamics and functionings at the plot's scale (first approach)*

Saint Médard d'Excideuil : compacted soil, low permeability from 5cm depth



Interpretation



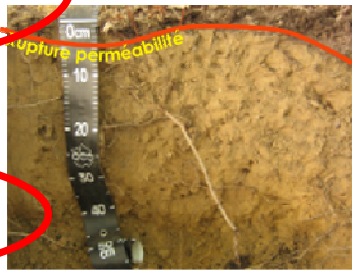
"dry" steady-state field capacity...

soil saturation (sufficient duration)

gravitational soil water movement

Amount of water for soil saturation

plot :
St Médard
8 mm



Soil water storage = 8mm up to 10mm

Plot :
Montfaucon

80 mm



Soil water storage = 60mm up to 80mm

3 - Initiation