Taking into account soils and climate change in assessing the production potential of a legume crop of interest: pea

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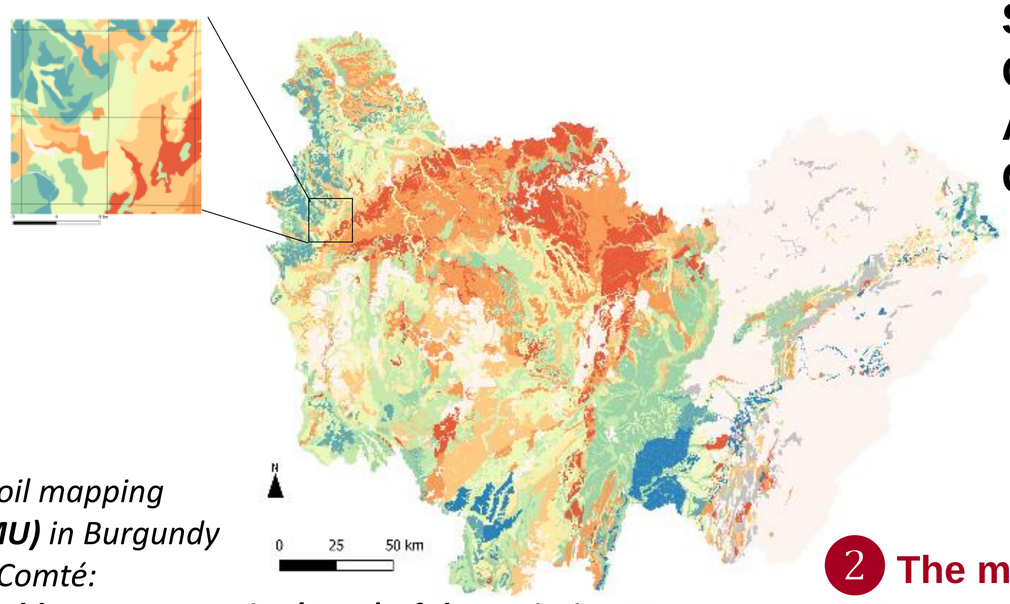
Context

Climate change and the increasing pressure on resources are challenging the mode of agricultural production. To meet the challenge of more autonomous, efficient and sustainable protein production, it is necessary to acquire knowledge on the evolution of the protein crops production potential.

Pea (*Pisum sativum* L) is an annual seed legume cultivated for its high protein content and for its environmental services (e.g. symbiotic fixation of atmospheric N_2)

Processing of "SOIL" semantic and cartographic data necessary to simulate pea production potential at an agricultural scale in the Burgundy Franche-Comté county (France)

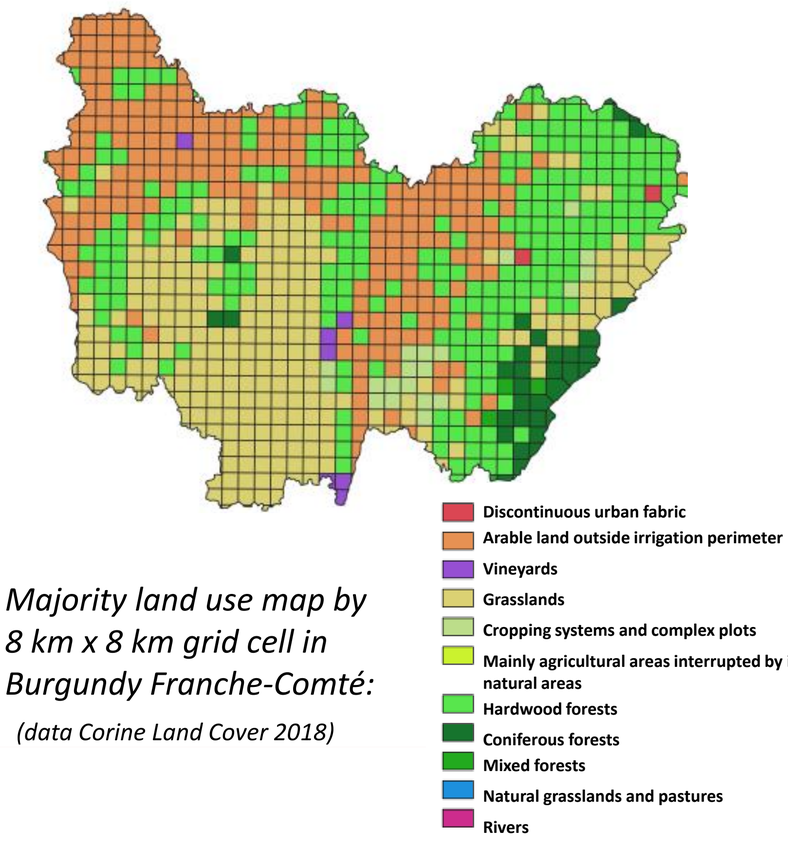
1 The **majority Soil Type Unit (STU)** (excluding forest) is assigned to each SMU



*Map of soil mapping units **(SMU)** in Burgundy Franche-Comté:*
soil available water capacity (AWC) of the majority STU

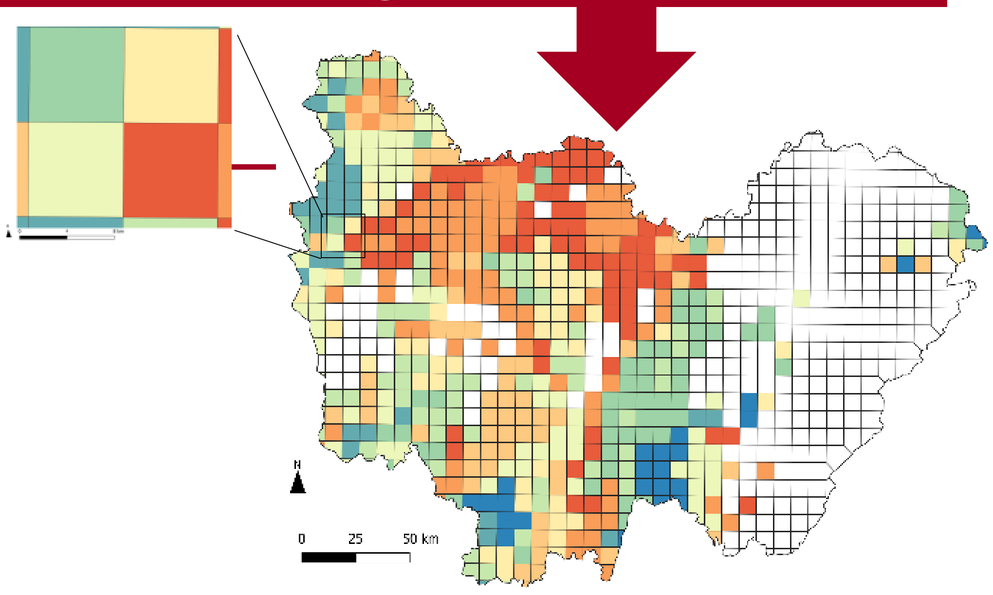
AWC at pF 1,5: Available water capacity (mm) (Bruand *et al.* 2004)
Bd: Bulk density (Keller *et al.* 2010)
Soil_d: Soil depth (cm)
$CaCO_3$: Total calcium carbonate content (%)
Arg: Clay content (%)
Corg: Organic carbon content (%)

2 **The majority Soil Map Unit - SMU** (excluding forest and urban areas) is assigned to each 8 km x 8 km grid cell



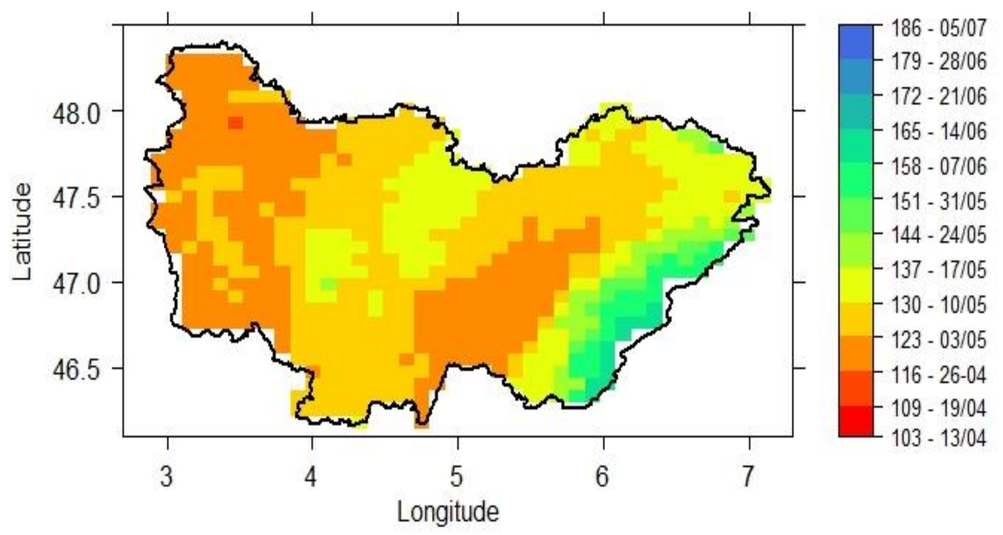
Majority land use map by 8 km x 8 km grid cell in Burgundy Franche-Comté:
(data Corine Land Cover 2018)

***Majority SMU in each grid cell of 8 km x 8 km grid:** simulation scale*



Flowering date in each 8 km x 8 km grid cell, simulated as a function of temperature since sowing and photoperiod.

Winter pea variety (Isard) - Near future (2006-2049)



Crop model AZODYN-Pea

SOIL
- NitrogenSoil
- WaterSoil *Water Deficit*

CROP
- PhenologyPea
- NitrogenPlantPea
  NitrogenFixationPea *Soil compaction*
- PlantGrowthPea
  RootGrowthPea *Soil compaction*
- YieldPea

STRESS
- StressT
- Frost
- StressNitrogenPea

Daily climate data, 8 km x 8 km grid cell simulated for the 1980-2005 and 2006-2100 periods (RCP 4.5 and 8.5).

- Temperature **(Tmin, Tmax)**
- Solar radiation **(Rs)**
- Precipitation **(P)**
- Potential evapotranspiration **(ETP)**

Simulation results:
PRODUCTION Yield, seed protein content
ABIOTIC STRESSES encountered by the crop

AZODYN-Pea simulates the functioning of a pea plot at a daily time step, integrating the effect of different abiotic stresses (water deficit, frost, high temperatures, soil compaction) and of some varietal characteristics.