Comparison of aboveground biomass production efficiency for a grassland and a forest with similar edaphic and climatic conditions

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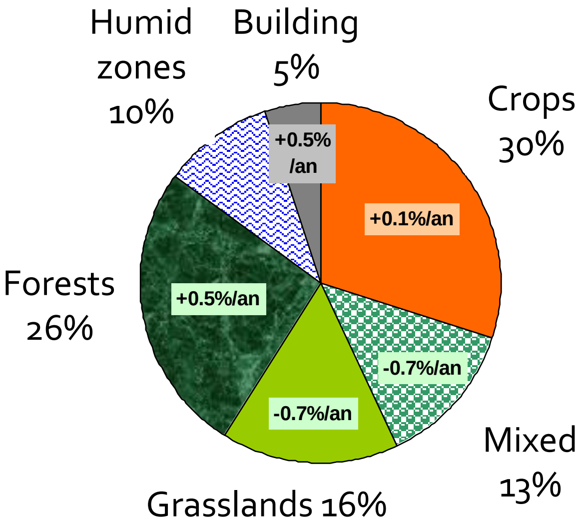
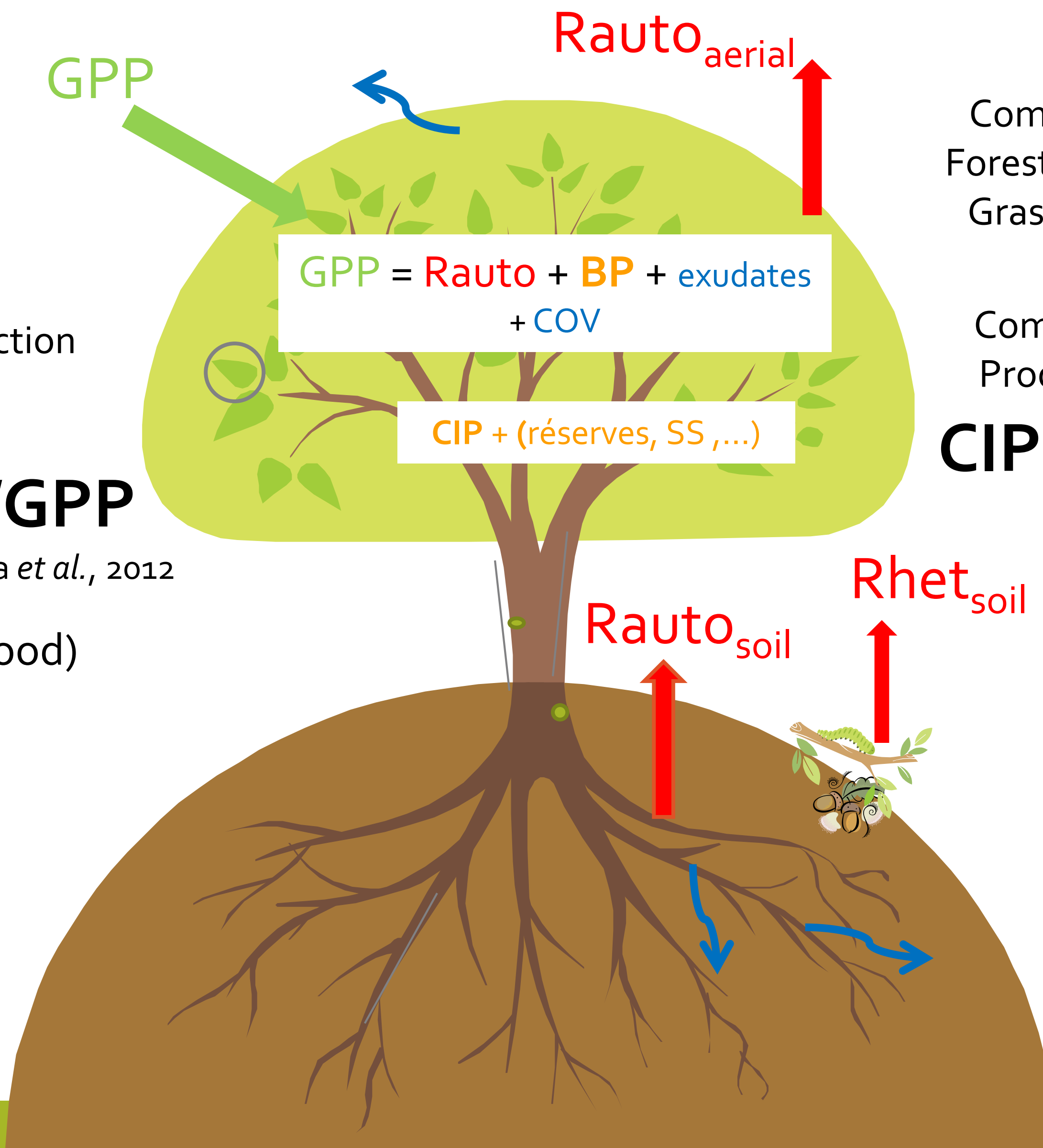
CONTEXT & OBJECTIVES

- **Evolution in ecosystem management**
  - Intensification, soil changes (structure, fertility,…)
- **Climate change (Temperature, Pluviometry)**
  - Drift & extreme events (drought, heat wave, flood,…)
- **Need of better understanding of ecosystem C balance**
  - Strategies in C allocation, sequestration & emission (Trumbore, 2006)
  - Uncertainties around the spatio-temporal variability of theses strategies (Campioli et al., 2



NEE= GPP + Reco



Compounds of Interest
Forest : aerial Structural C
Grassland: Digestible C

Compound of Interest Production Efficiency

CIPE= CIBP/GPP

Biomass Production Efficiency

BPE = BP/GPP

Vicca *et al.*, 2012

aBPE (leaves, wood)
bBPE (roots)

- **Only annual BPE/aBPE**

- **Large variability in annual BPE/aBPE**
  - Ecosystem type, Nutriments availability, Mean annual temperature, Specie, Age, Management, [CO_2]

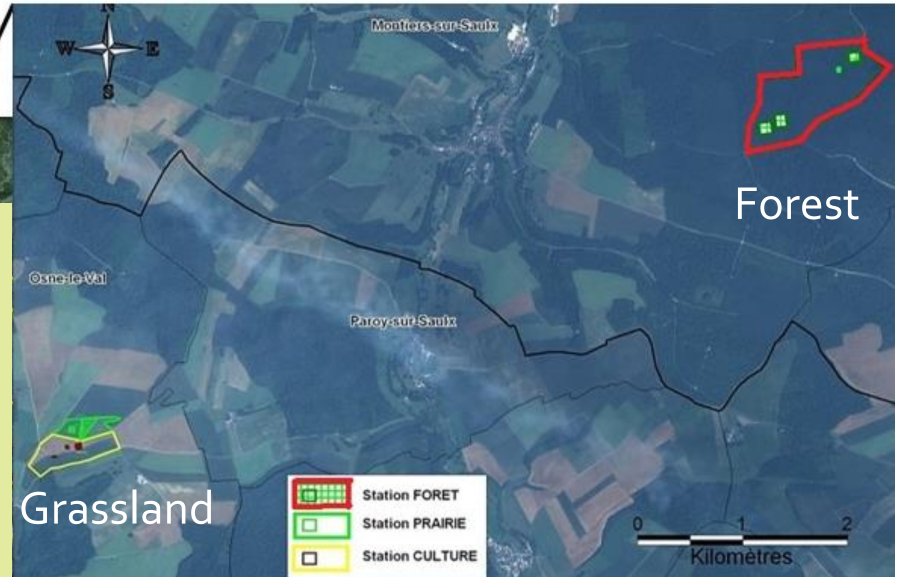
⇛ **Seasonal variability of aBPE ?   Which drivers ?**

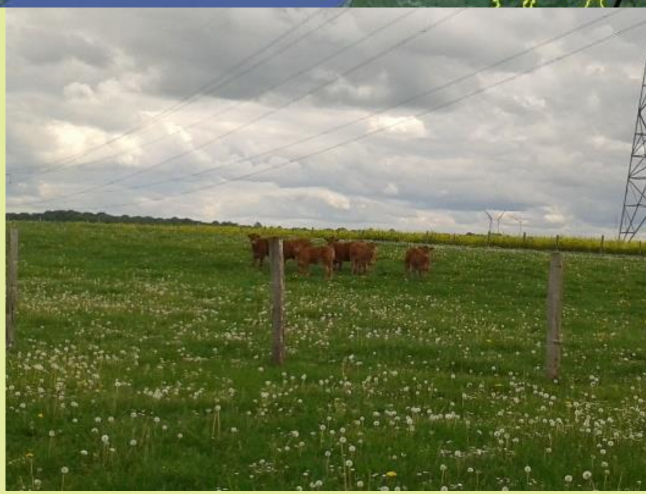
⇛ **Comparing aBPE evolutions of Forest *vs* Grassland**

Same meteo and soil

MATERIAL ET METHOD

Sites





- Type of soil: calcisol (7.1 <pH<8)
- Beech (88%) stand ~55 ans
- Vegetation: Bromus hordaceus (53.8%), Bellis perennis (16.8%)
- Soil type: calcisol (7.1 <pH<8)
- Ste
- He
- LA

Dates	Event
30/03/2014	Fertilization (NPK)
13/04/2014	Grazing (Part 1)
05/06/2014	**Mowing (Part 2)**
12/07/2014	Grazing (Part 1 +2)

CO_2 Flux and weather measurements

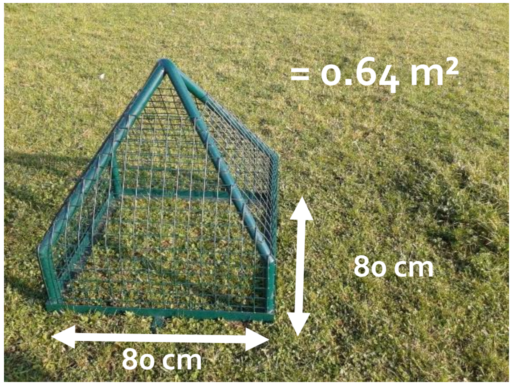
- « Traditional » equipment with LI-7200 enclosed
- Data processing : Frequency correction (Fratini); Flux quality selection (Mauder, u*threshold), Gapfilling & Partitioning (Reinschtein)





Biomass measurements

Cages excluding grazing



x 10 dispatched randomly on the 5.1ha

Dates	Sampling
23/02/2014	*Cleaning 1*
16/04/2014	*Growth 1 (Cleaning 2)*
23/05/2014	*Growth 2 (Cleaning 3)*
05/06/2014	**Cleaning 4**
24/07/2014	*Growth 3 (Cleaning 5)*
11/09/2014	*Growth 4 (Cleaning 6)*
06/11/2014	*Growth 5*

Lab analyses of cleaning biomass for C content

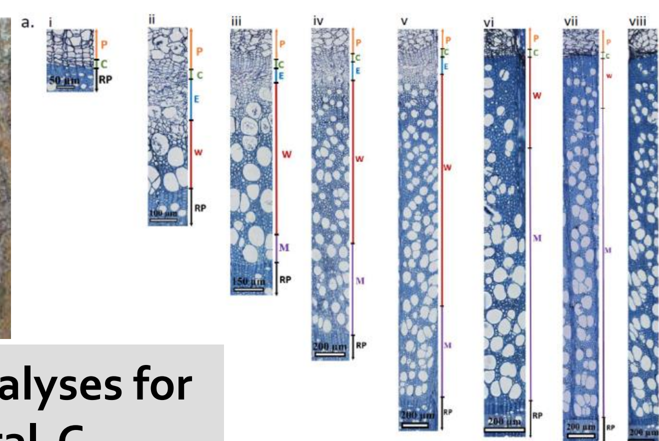
Dendrometers

Allometric equations fitted on the site (diameter, age, height)

Litter traps

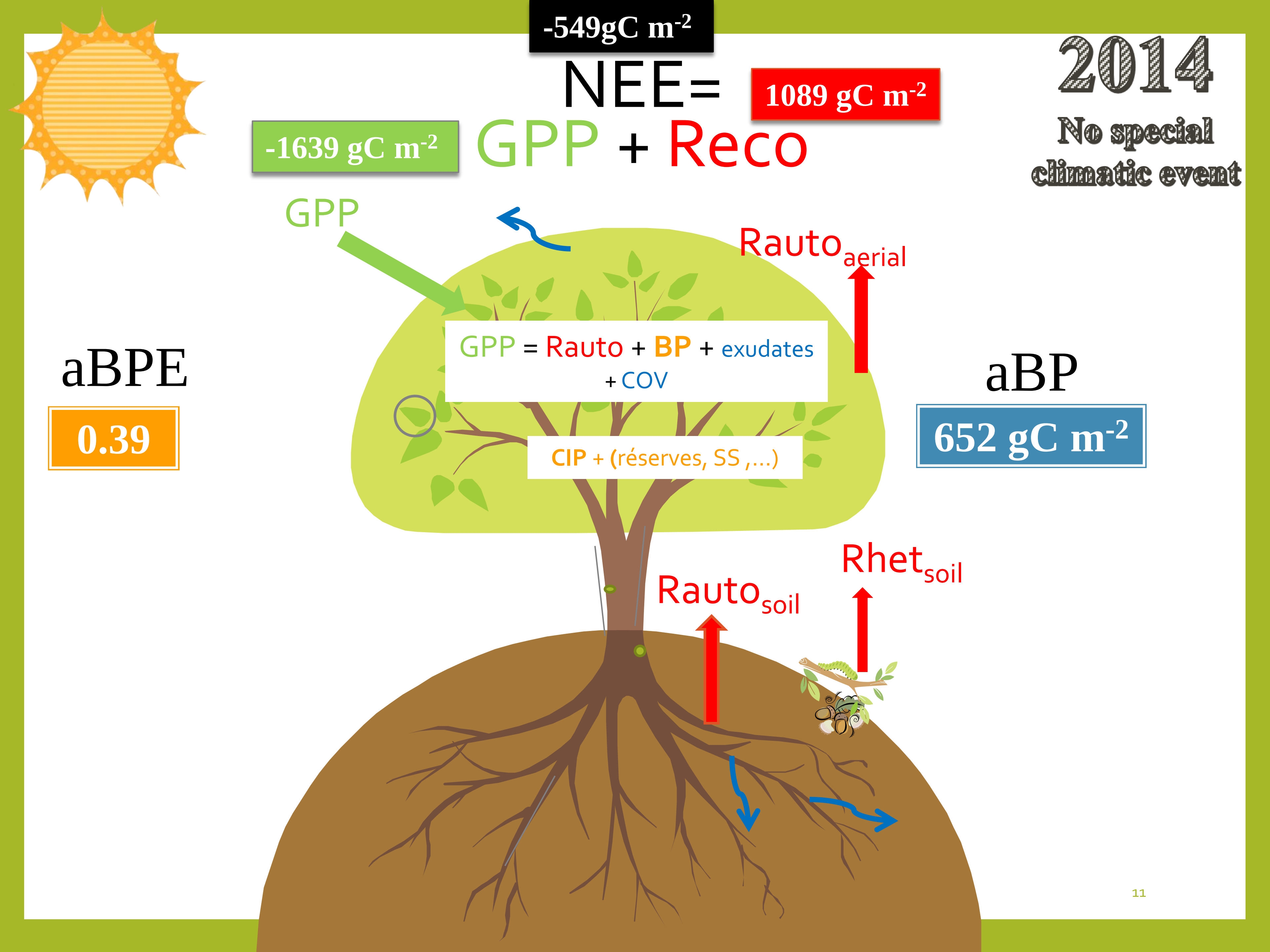
Lab analyses of collected litter for C content

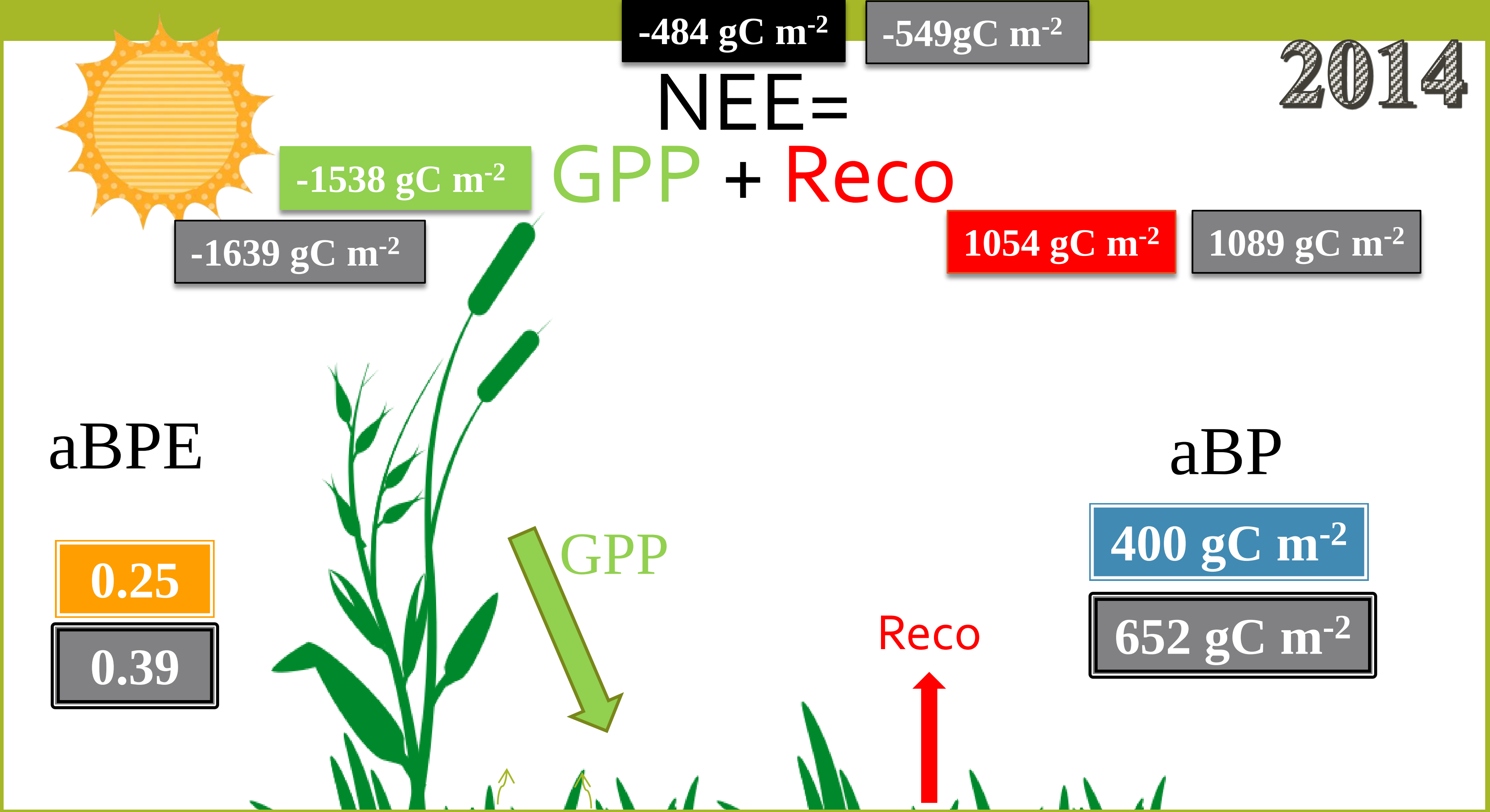
Lab analyses of wood micro-cores for wood density and C content



Lab Biochemical analyses for (non-) structural C

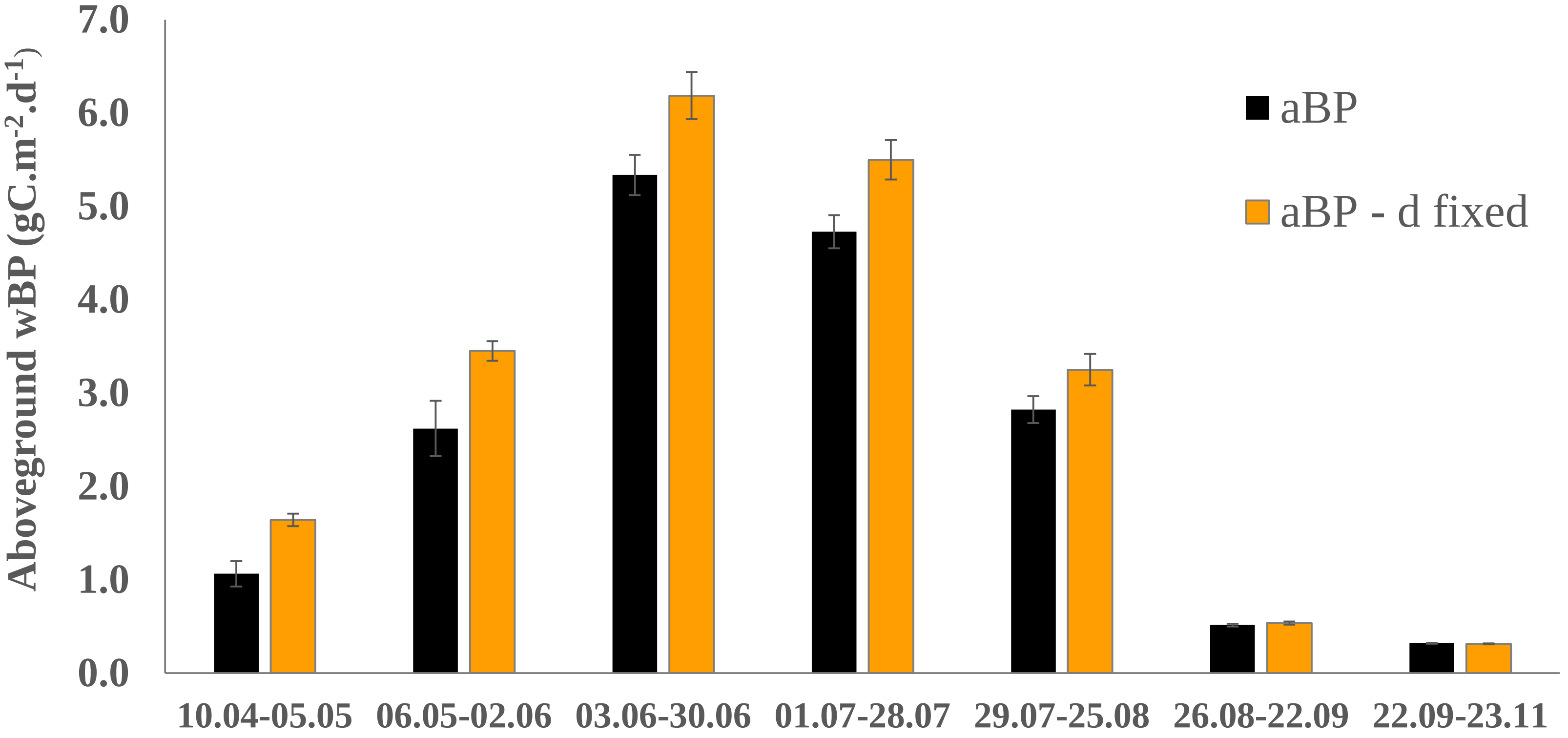
RESULTS


-549gC m-2
NEE=
1089 gC m-2
2014
No special climatic event
-1639 gC m-2
GPP + Reco
GPP
Rauto aerial
GPP = Rauto + BP + exudates + COV
CIP + (réserves, SS ,...)
aBPE
0.39
aBP
652 gC m-2
Rhet soil
Rauto soil



1. Forest : more assimilated C dedicated to aboveground biomass
2. Grassland : Belowground or Rauto ? (soil ingrowth cores)

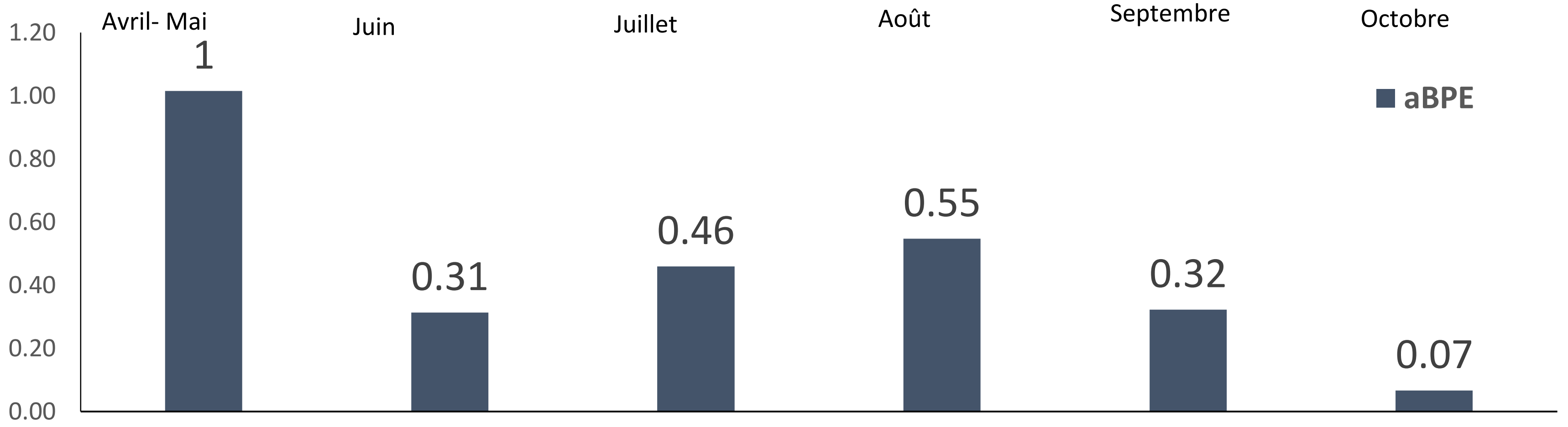
Intra-annual variability (Forest)



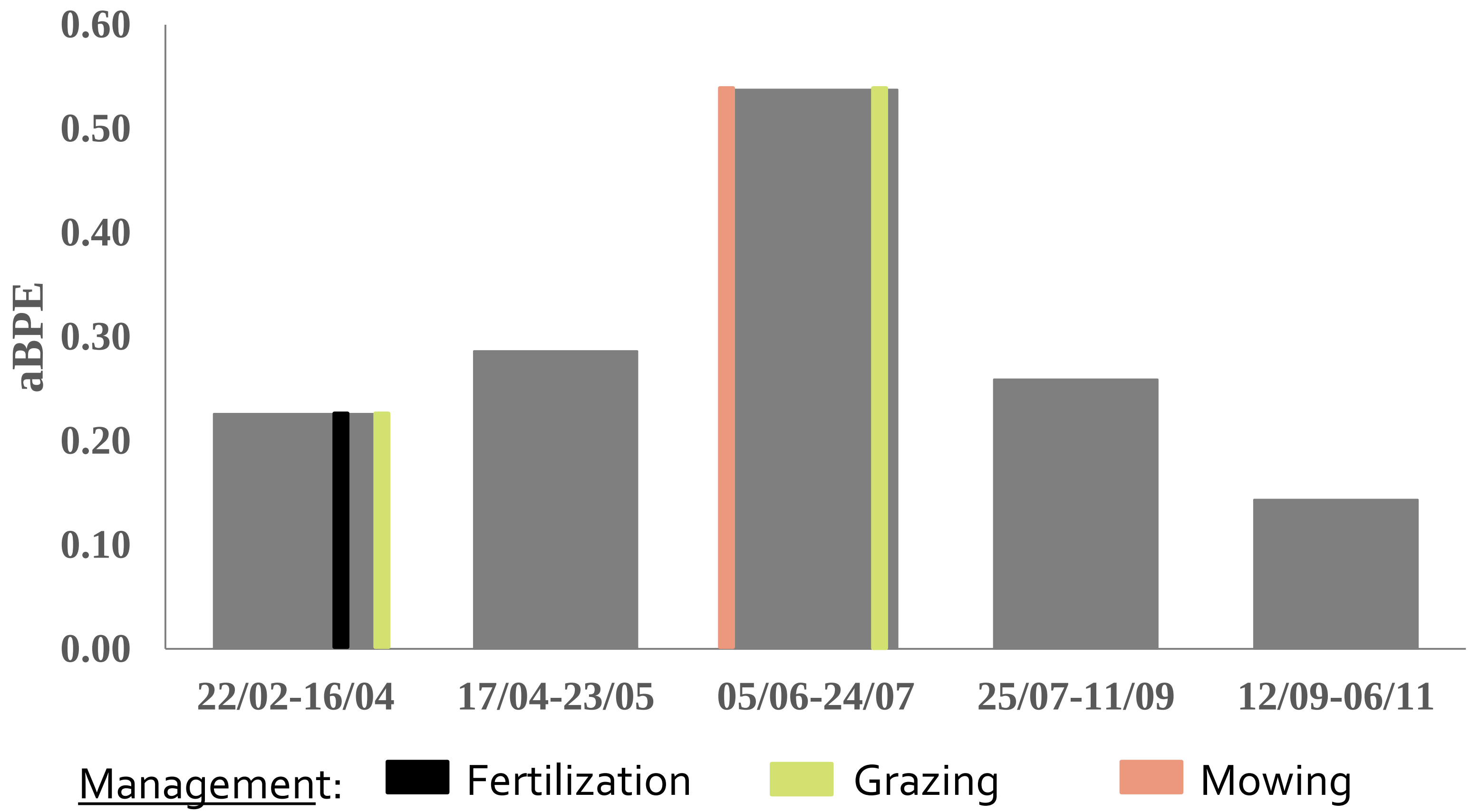
1. Density correction up to 22%
2. Can't be neglected for studies on C allocation seasonal variability

Intra-annual variability (Forest)

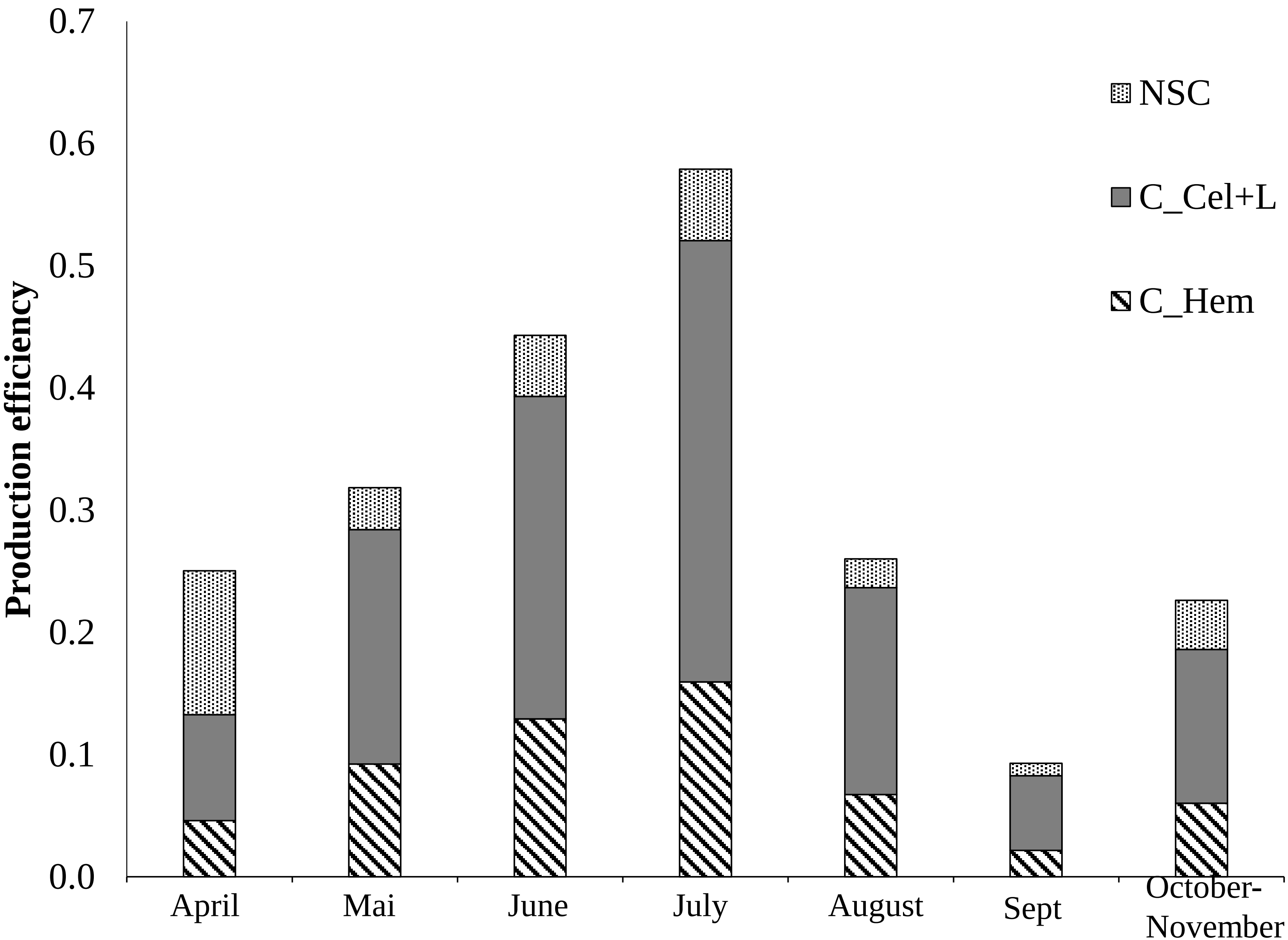
1. Large intra-annual variability
2. No apparent influence of meteo or soil conditions
3. Seasonal bell-shaped phenology similar to the photoperiod



Intra-annual variability (Grassland)



1. Larger variability ⇔ forest
2. Impact of mowing ?


0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Production efficiency
NSC
C_Cel+L
C_Hem
April
Mai
June
July
August
Sept
October-
November

TAKE HOME MESSAGE

- Forest allocated larger % of GPP to aboveground
- Large aBPE seasonal variability (larger on grassland)
- Forest : continuous curve ⇔ Grassland : impact of mowing
- Temporal evolution of the reserve/wood formation strategy

Thank