DECOMPOSITION RATE AND OTHER INDICATORS FOR ECOSYSTE SERVICES EVALUATION IN AFRICAN AGROECOSYSTEMS

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INTRODUCTION

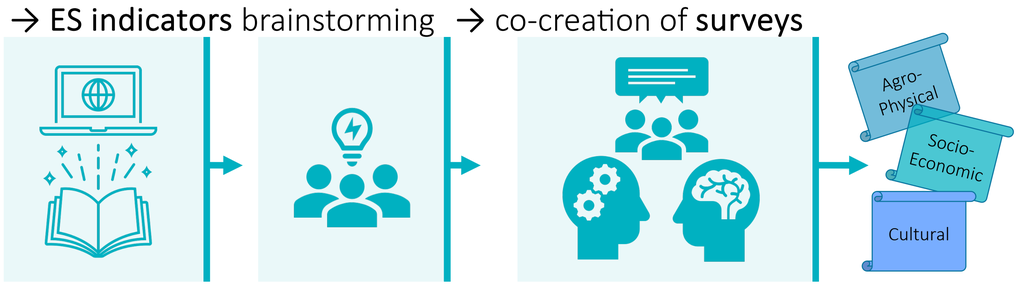
Ecosystem Services (ES), are considered the contributions of nature to human well-being, derived from ecological interactions between living beings and surrounding abiotic environment. In **agroecosystems**, the natural bio-geo-chemical cycles, have been disturbed by human actions. To estimate the impact of this disturbance one can use ES indicators.

While crop yield is a straightforward indicator of **provisioning services** in agriculture, to fully evaluate ES in agroecosystems, it is important to determine the long-term **ecological sustainability** of the agroecosystem by evaluating also **regulation & maintenance services**, as well as **cultural services**, together with their **trade-offs**. Different agricultural management options (e.g., type and variety of crop species used, soil mobilization, agrochemical input, re-use of residues) will render different impacts on ES delivery.

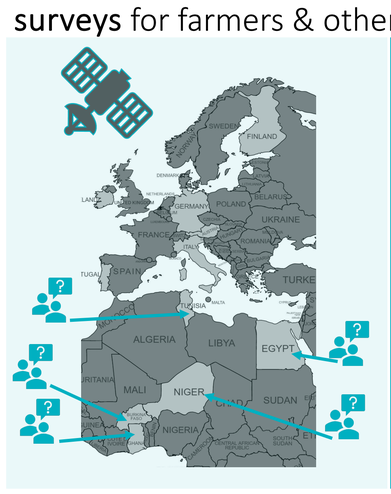
In the **SustInAfrica** project we aim to evaluate the trade-off of ES between the conventional agroecosystems and the project proposals to balance sustainability with increased productivity, in countries of the West & North Africa (**Burkina-Faso, Egypt, Ghana, Niger and Tunisia**).

METHODS – phase I

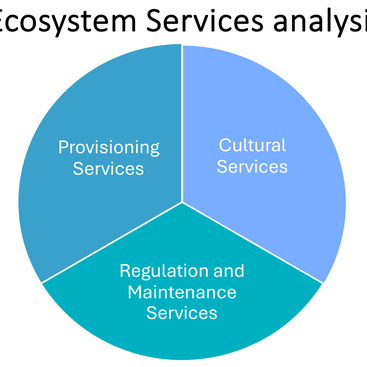
- **Data collection** on baseline /conventional farming systems
  → **ES indicators** brainstorming → co-creation of **surveys**



- **On-site** implementation of **focus-groups, household & community surveys** for farmers & other agricultural stakeholders + **Remote-sensing**

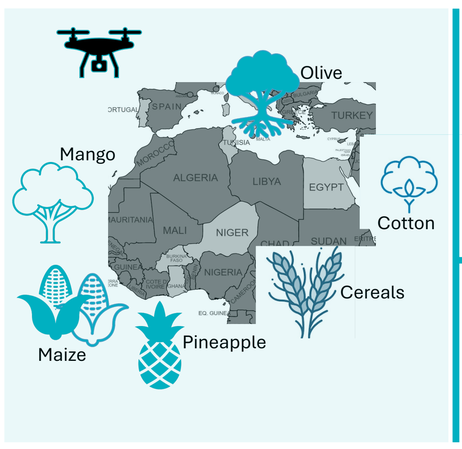


- **Database development**
- **Ecosystem Services analysis**



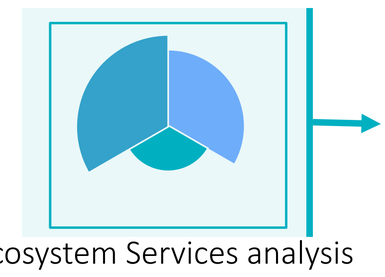
METHODS – phase II

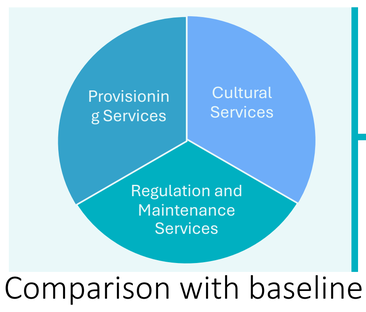
- **Testing set-ups** in agro-systems for **sustainable intensification** of food production



→ **Monitoring data & sample collection**
from test sites (e.g., yield, soil composition)

→ **Decomposition experiments**
(teabags' method – see videos)


Ecosystem Services analysis (phase II)



Comparison with baseline results (phase I)

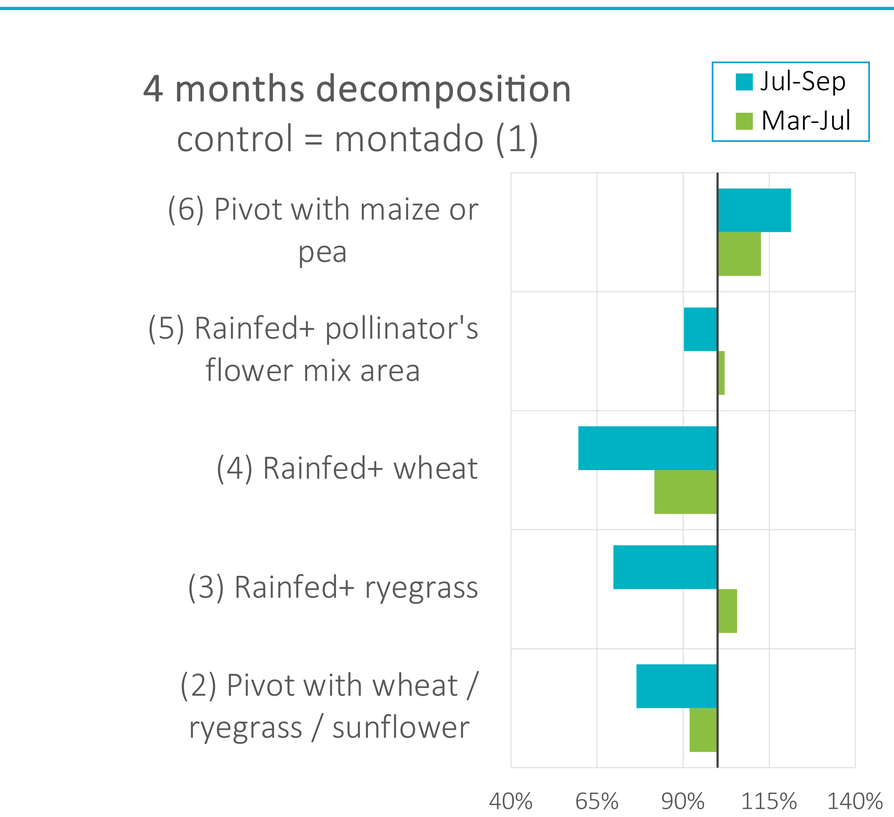
Expected Results:


ES trade-offs evaluation between productivity & sustainability of the proposed agro-systems

The **regulation services of nutrients and carbon cycles**, are associated with the organic matter **decomposition processes,** essential for restoring **soil fertility** by the turnover between organic and mineral forms. That, is achieved by physical, chemical, and biological action, at several biodiversity levels, that convert back the organic molecules into plant-assimilable nutrients.

Teabags decomposition rate (Keuskamp at al. 2013, and forwards**)**, an indicator of the service of nutrient cycling, depends on the quality and quantity of the leaf-litter present, the local environment (soil and climate) and on the biodiversity and activity of the local decomposer organisms.

Comparing the different agricultural practices with a more natural ecosystem (control), can provide the clues to the **ecological sustainability of the agroecosystem**.



*_Segunda Via_ Project 2020-2021

Example of teabag decomposition results*

Evaluation of 4 months decomposition of teabags in an agroecosystem with: **(1)** a silvopastoral system (**cork-oak *montado*** grazed by cows) with low human input (control area); **(2)** a pivot area with rotation of wheat (*Triticum* spp.), ryegrass (*Lollium* spp.) and sunflower (*Helianthus annuus*); **(3)** a corner outside the pivot with ryegrass culture only; **(4)** A corner outside the pivot with wheat culture only; **(5)** A former pivot area seeded with pollinator's flower mix **(6)** A pivot area with maize (*Zea mays*) in rotation with pea - *Pisum sativum* - every two years.

Take home message

In more natural systems, at local scale, biodiversity drives decomposition, while in agroecosystems human's inputs modify those processes. This method can help to identify which management systems are better to reduce the trade- offs in ES, and thus decomposition rate is a promising indicator for ES in agroecosystems.

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