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## A functional ecology approach to co-design crop mixtures

Malick S Ouattara, Raphaël Paut, Muriel Valantin-Morison, Safia Médiène

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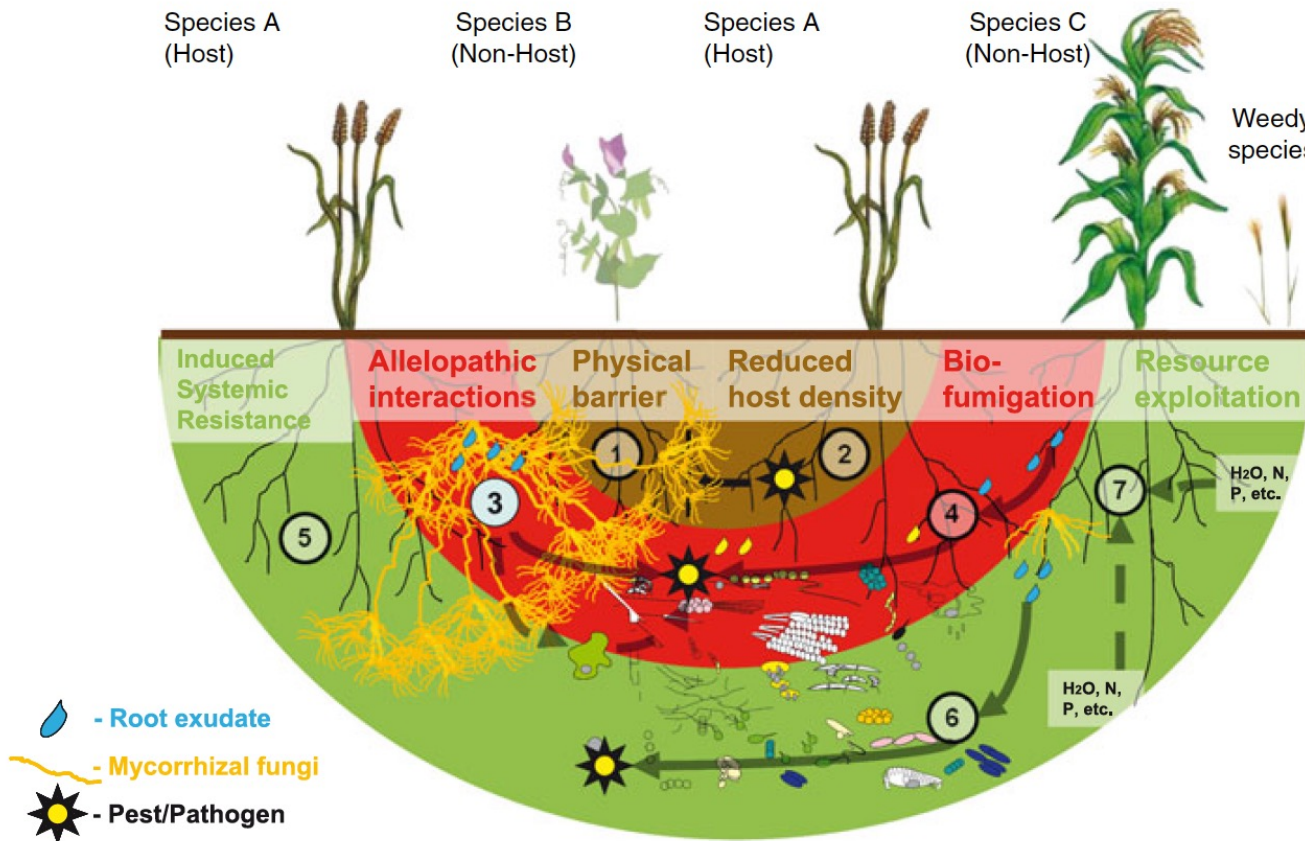
# European Scientific Conference

June 02 and 03, 2022 – Towards Pesticide Free Agriculture

## A functional ecology approach to co-design crop mixtures

Malick OUATTARA, Raphaël PAUT, Muriel VALANTIN-  
MORISON, Safia MEDIENE

# Why to promote a biodiversity-based agriculture ?



Ehrmann and Ritz, 2014

- >> To increase ecological, biochemical and physical processes involved in plants natural defence mechanisms
- >> But, many combinations between species are possible (Verret et al., 2020)
- >> And little is known about how to mix species (and varieties) to provide ecosystem services

# Need to produce knowledge and tools to help design crop mixtures

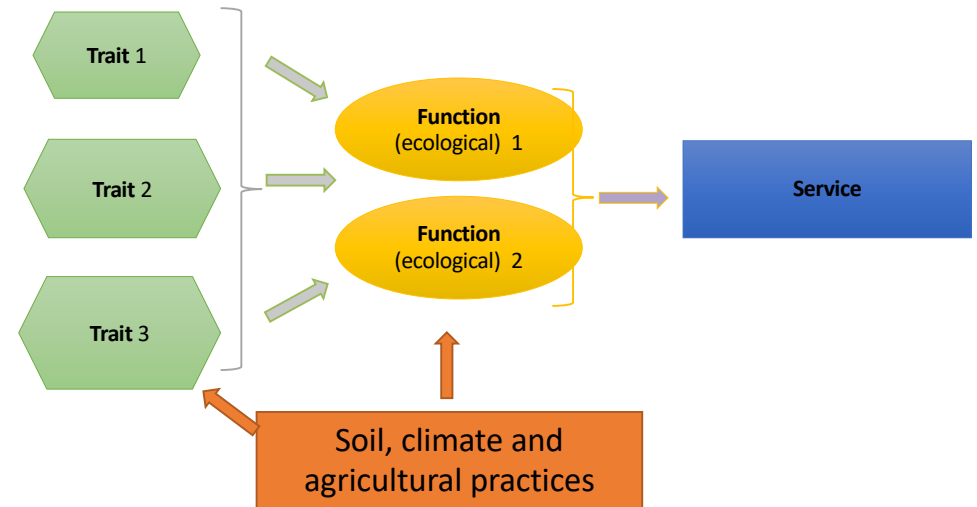


Empirical Knowledge

Scientific Knowledge



## Functional Ecology

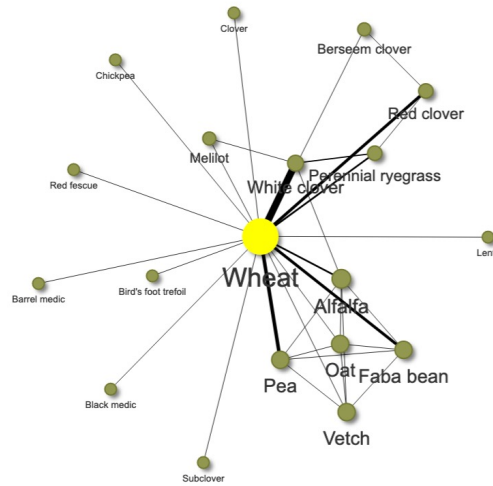


Classification of species mixtures according to their capacity to provide the expected services in the local production context

# First outputs of the EcosystemMIX prototype

Online interactive database on crop mixtures: <https://umr-agronomie.shinyapps.io/EcoSystemmix/>

**Crop mixture network**  
here, for the service:  
« weed regulation » and  
the crop « wheat »

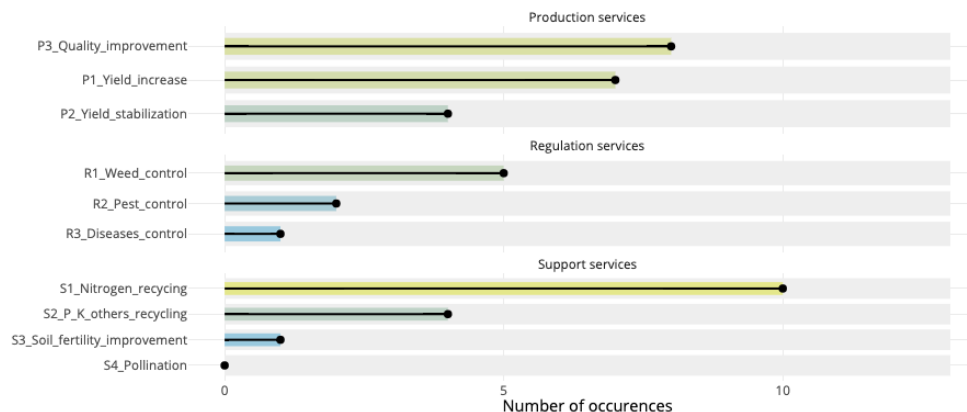


Ajouter nombres d'espèces ou de mélanges de la database

## General overview

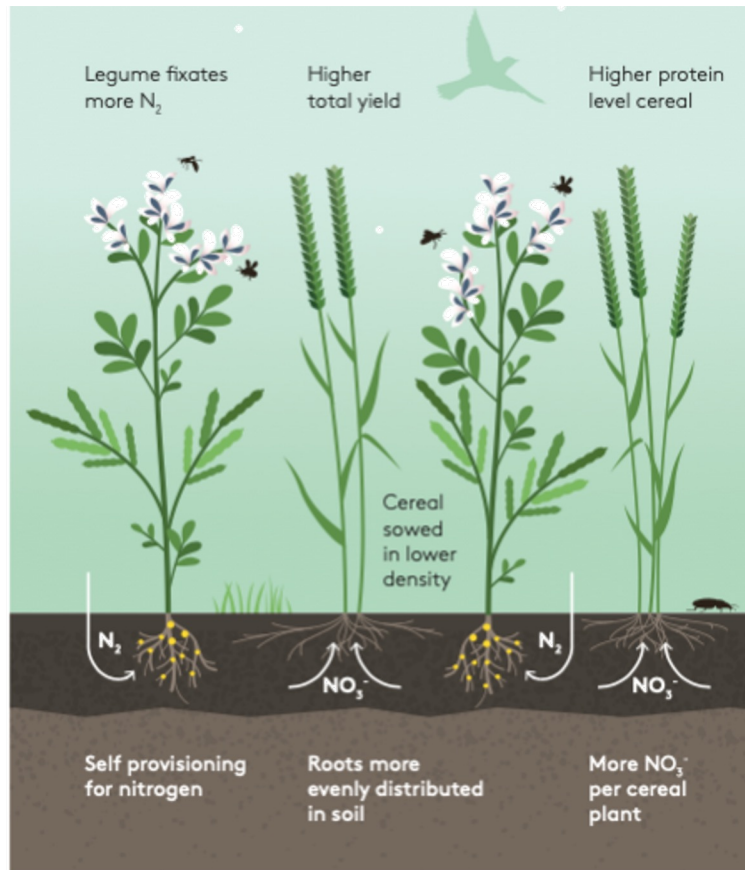
	P1_Yield_increase	P2_Yield_stabilization	P3_Quality_improvement	R1_Weed_control	R2_Pest_control	R3_Diseases_control	S1_Nitrogen_recycling	S2_P_K_others_recycling	S3_Soil_fertility_improvement	S4_Pollination
Barley-Buckwheat	1									1
Barley-Clover-Pea				1						
Barley-Faba bean	2	1	1	1	1			1	1	
Barley-Grass pea				1	1					
Barley-Lentil	1				1					
Barley-Maize						1				1
Barley-Oilseed rape										
Barley-Oilseed rape-Pea										
Barley-Pea	7	1	2	3				7	6	
Barley-Perennial ryegrass					1					
Perennial ryegrass-White clover					2					
Barley-Red clover										
Barley-White clover								1	1	1 1

## ID card of a crop mixture (ex: wheat/pea)



Pault et al., 2021

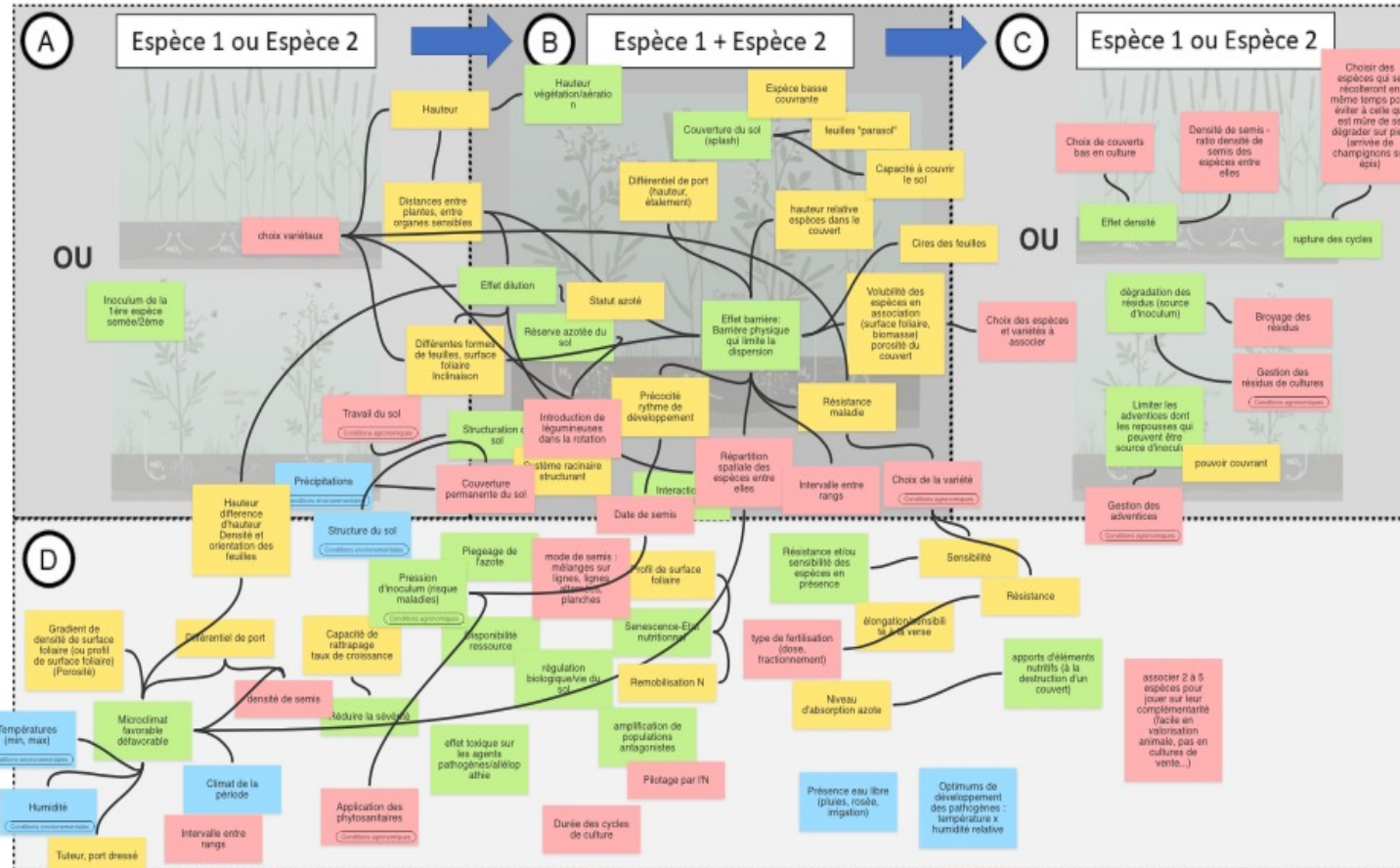
## Generic and functional representation of crop mixtures



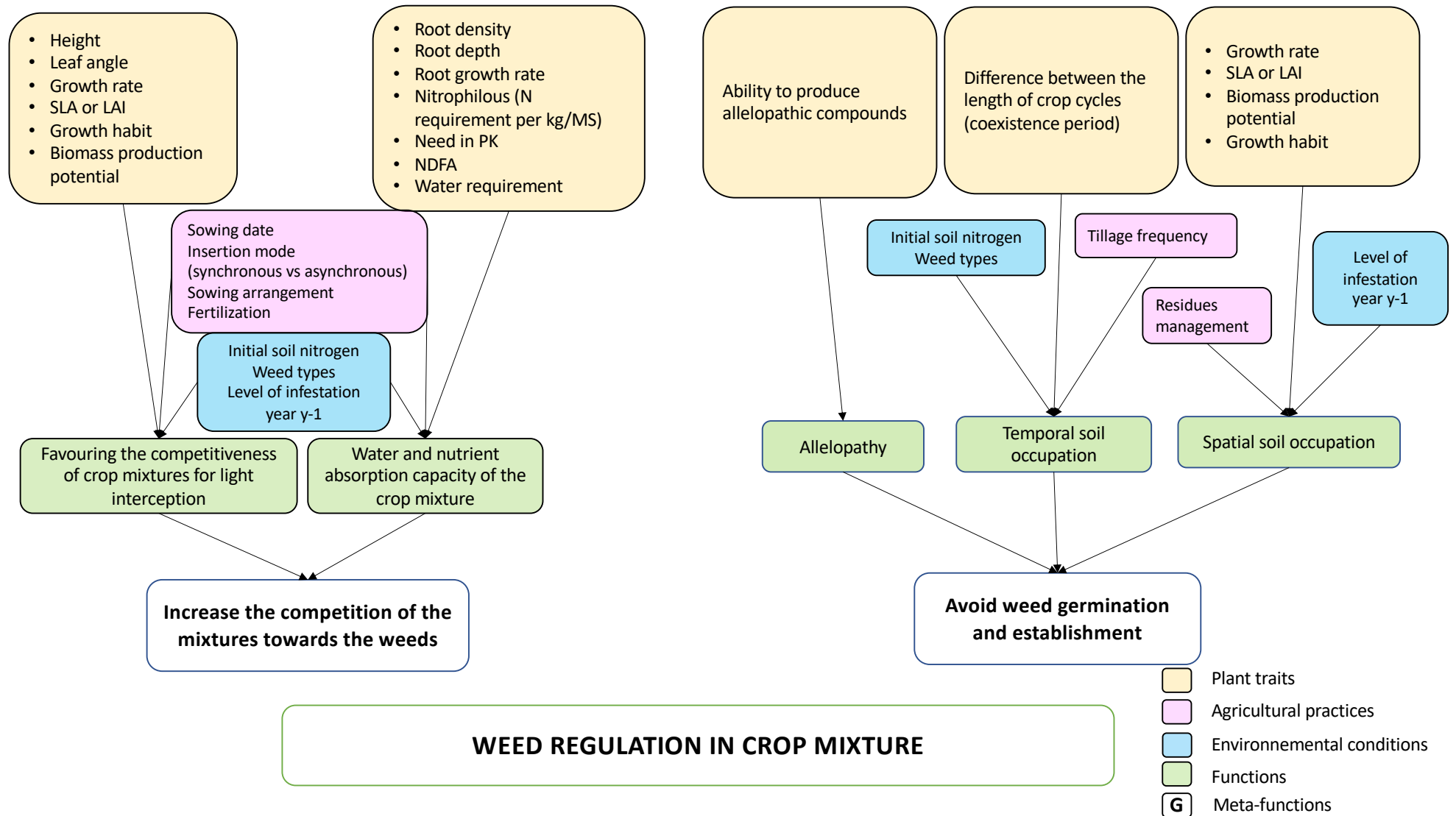
- › Workshops with practitioners and scientists to share knowledge on plant mixtures
- › 5 ecosystem services:
  - › Nitrogen recycling
  - › Weed regulation
  - › Pest regulation
  - › Disease regulation
  - › Production provisioning

Simultaneous cultivation of 2 or more species in the same plot during a significant period of their cycle (Willey, 1979)

# Output of a workshop

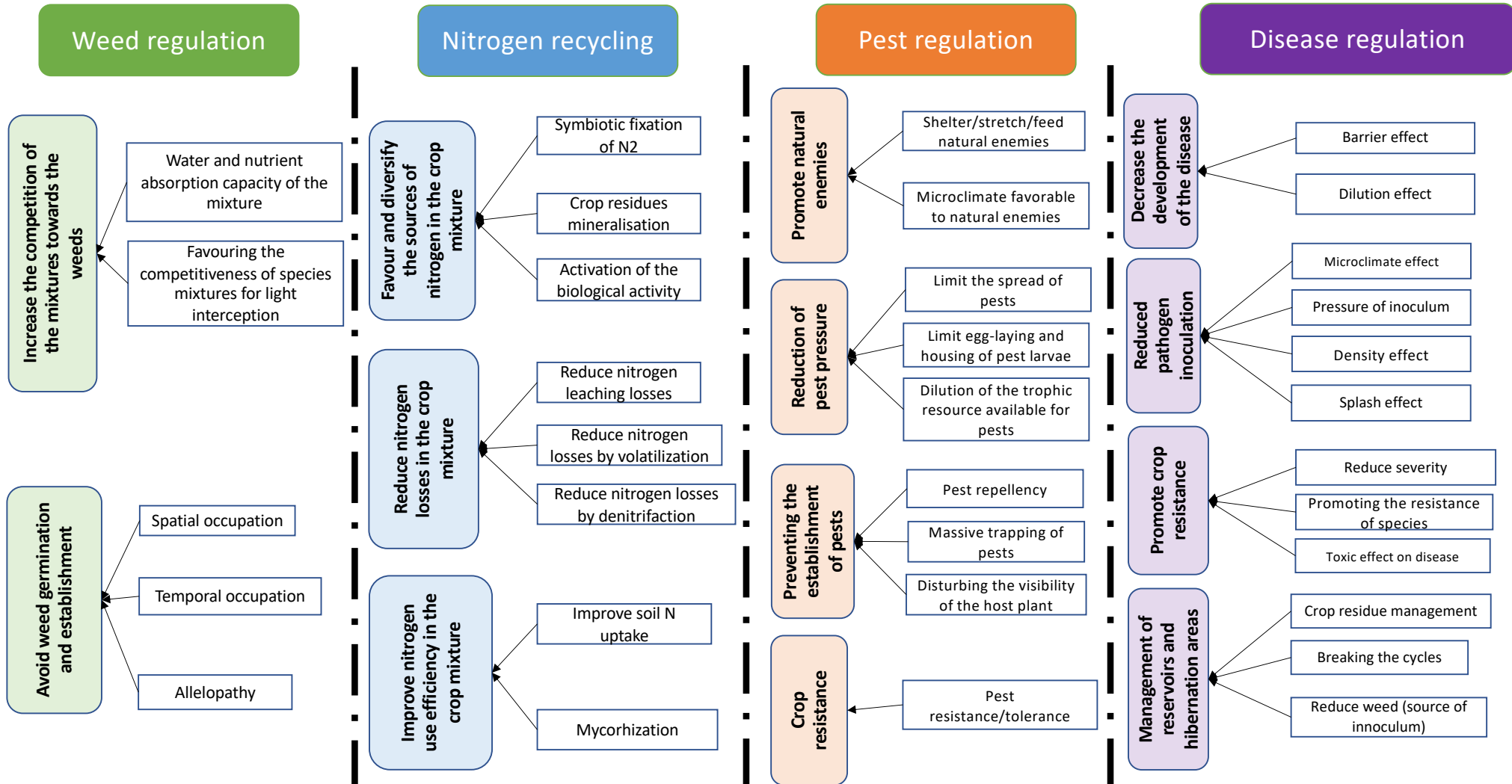


# Generic and functional representation of crop mixtures



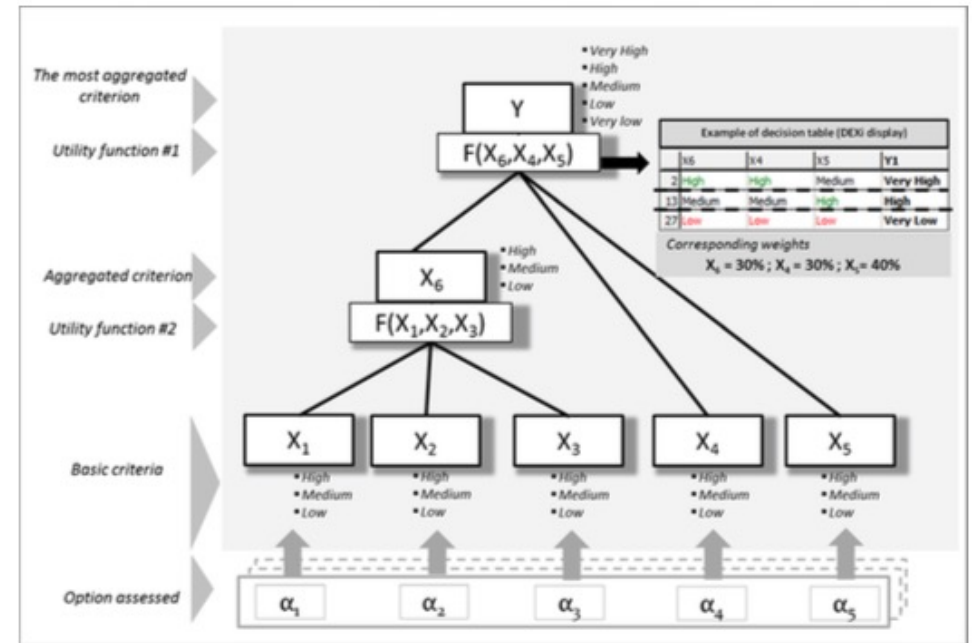


# Main functions involved in 4 ecosystem services



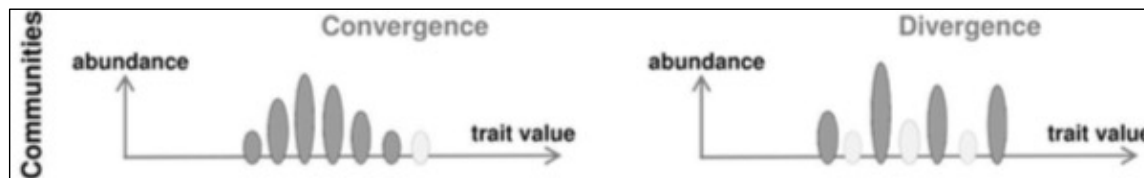
## Next steps

- Validate and quantify the functional relationships Traits/Functions/Service
- Qualitative hierarchical multi-attribute model (ex. Dexi)
- Knowledge elicitation (workshops, interviews, surveys)
- Litterature / Database/experiment



Craheix et al., 2015

- Assembly rules of traits in crop mixtures



in Loranger 2015, from de Bello et al., 2013

Thank you for your attention!

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