PlantSoilAdapt

Plant-soil interactions under land use change: consequences for soil functioning and resilience to drought

Marina Semchenko

Grasslands provide essential ecosystem services

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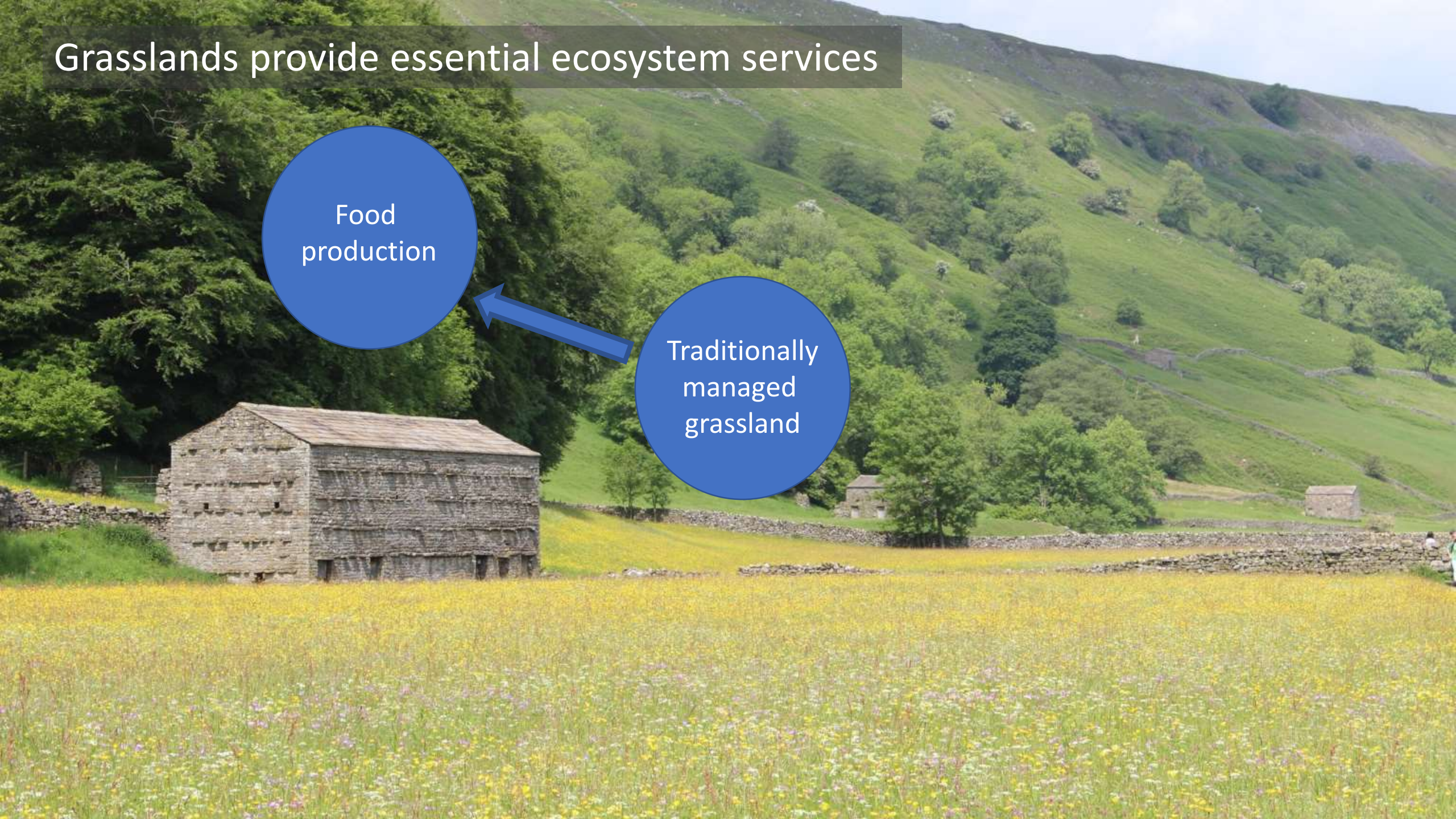
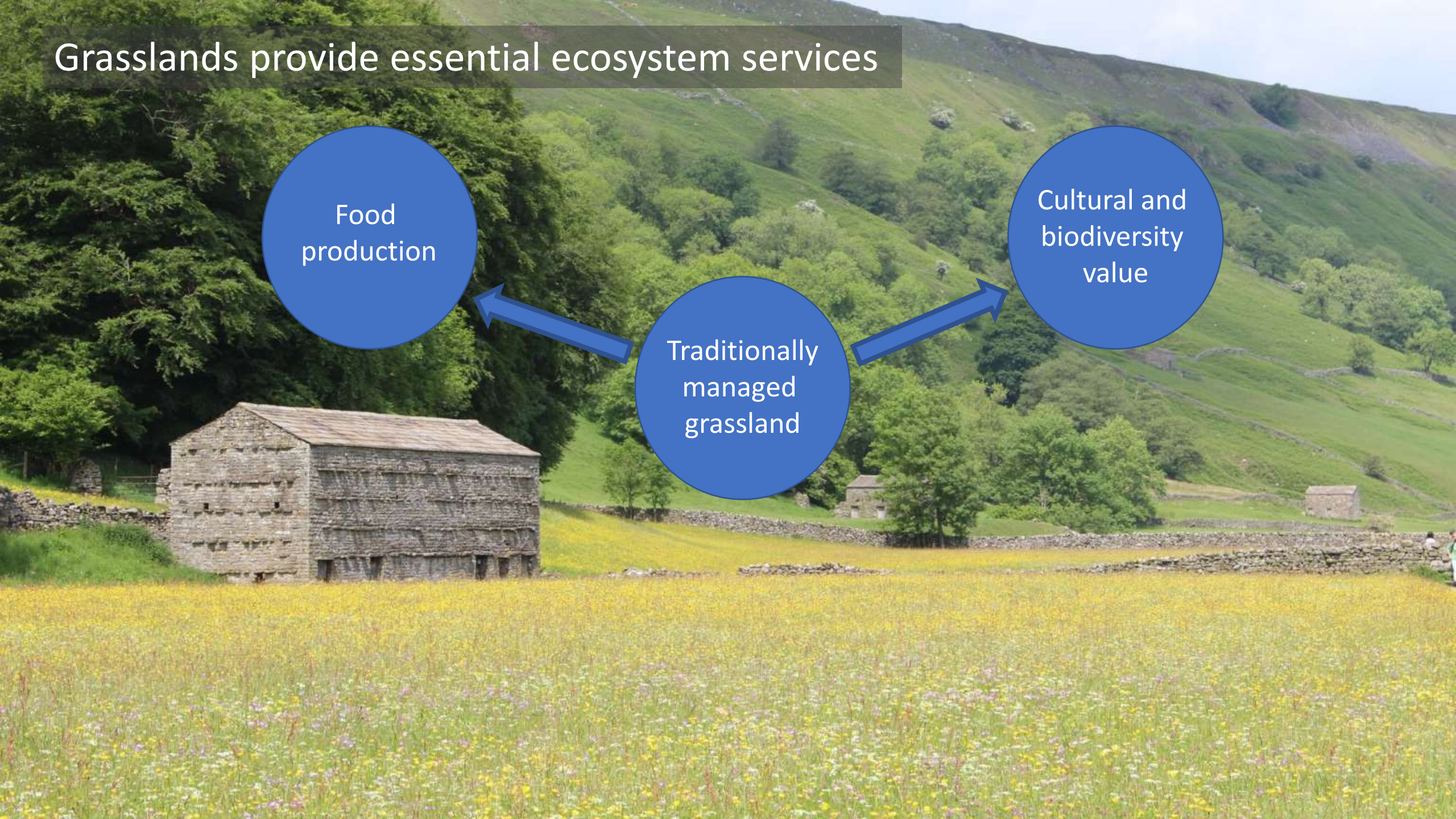


Grasslands provide essential ecosystem services



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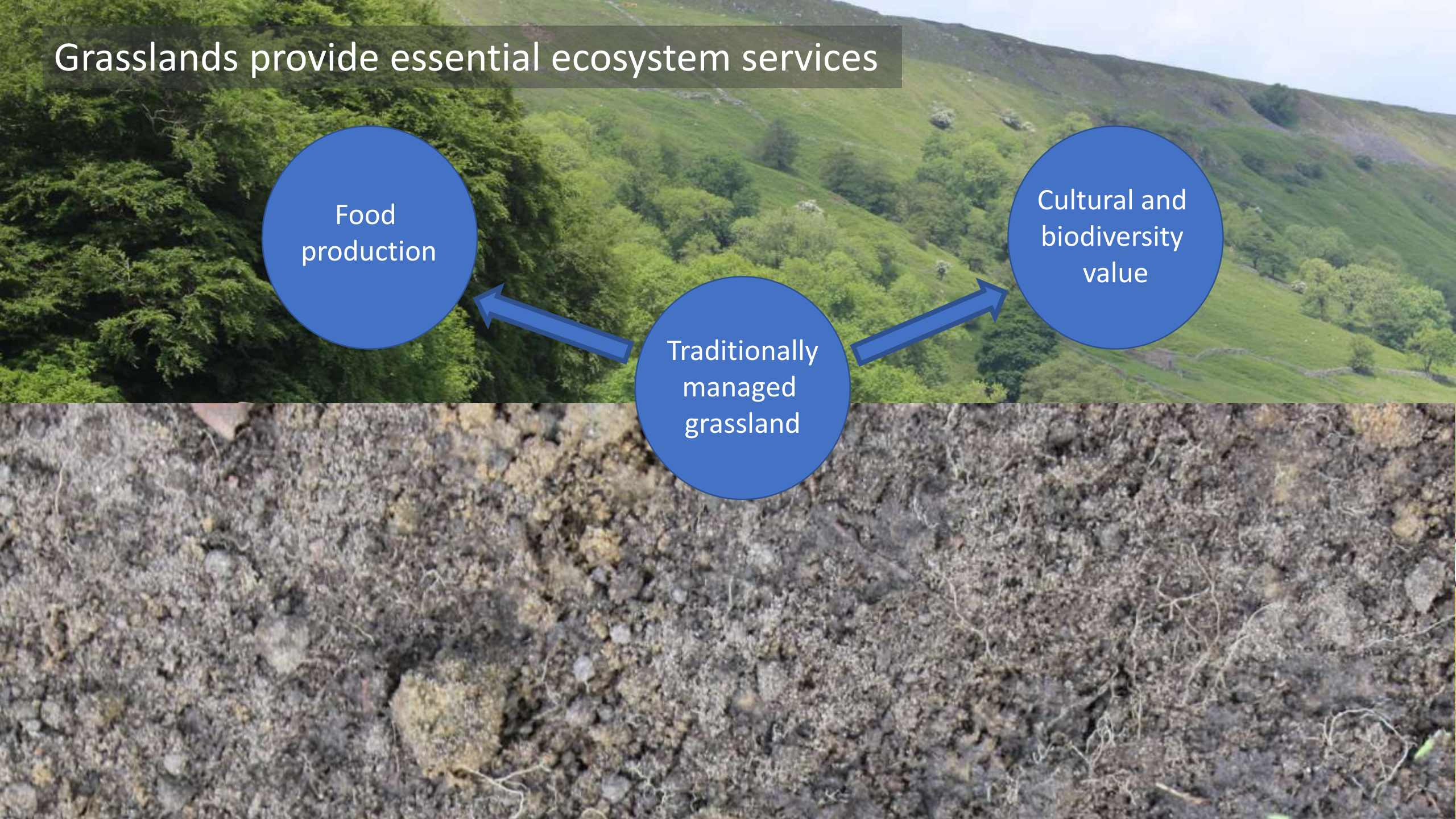

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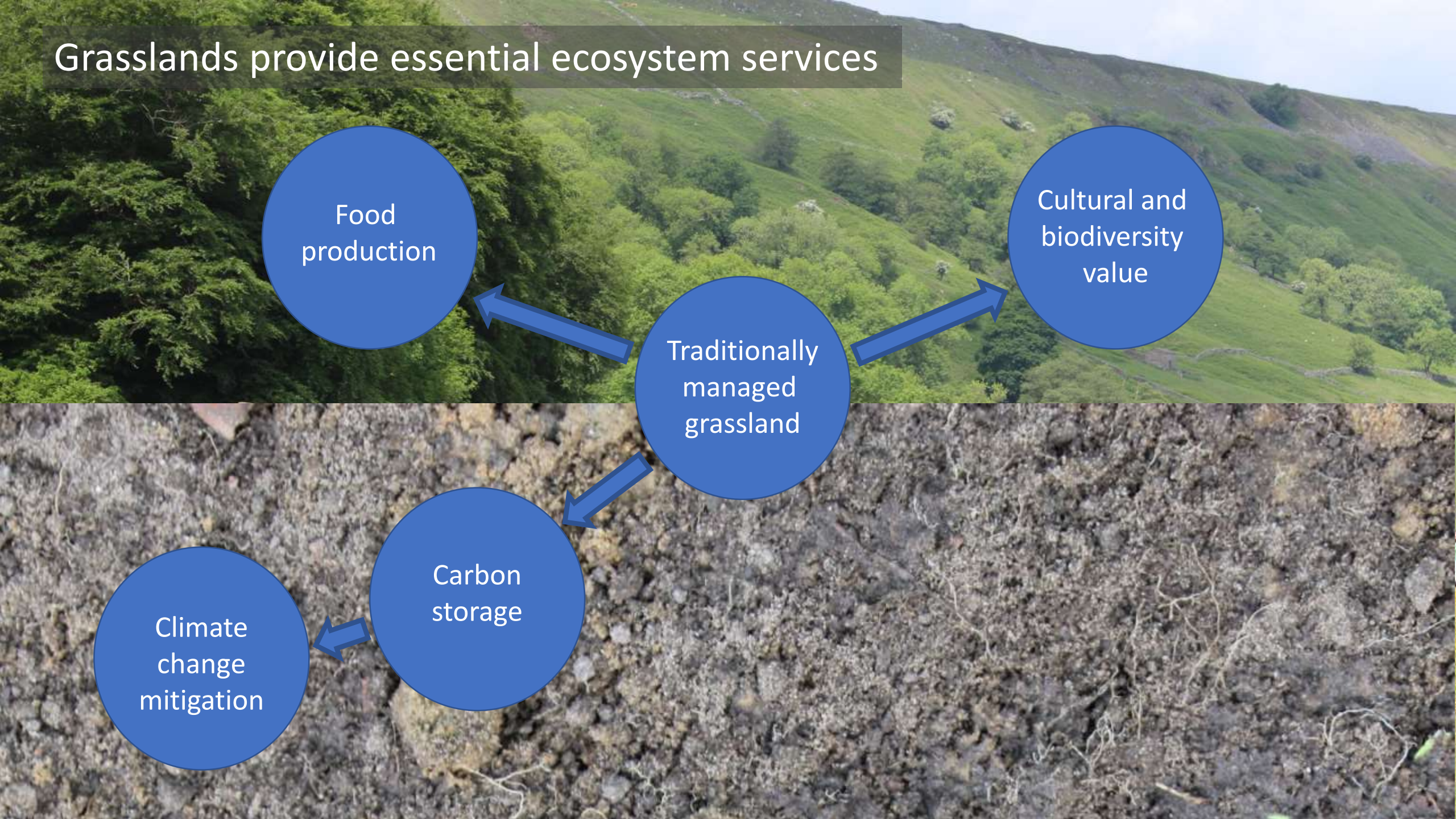

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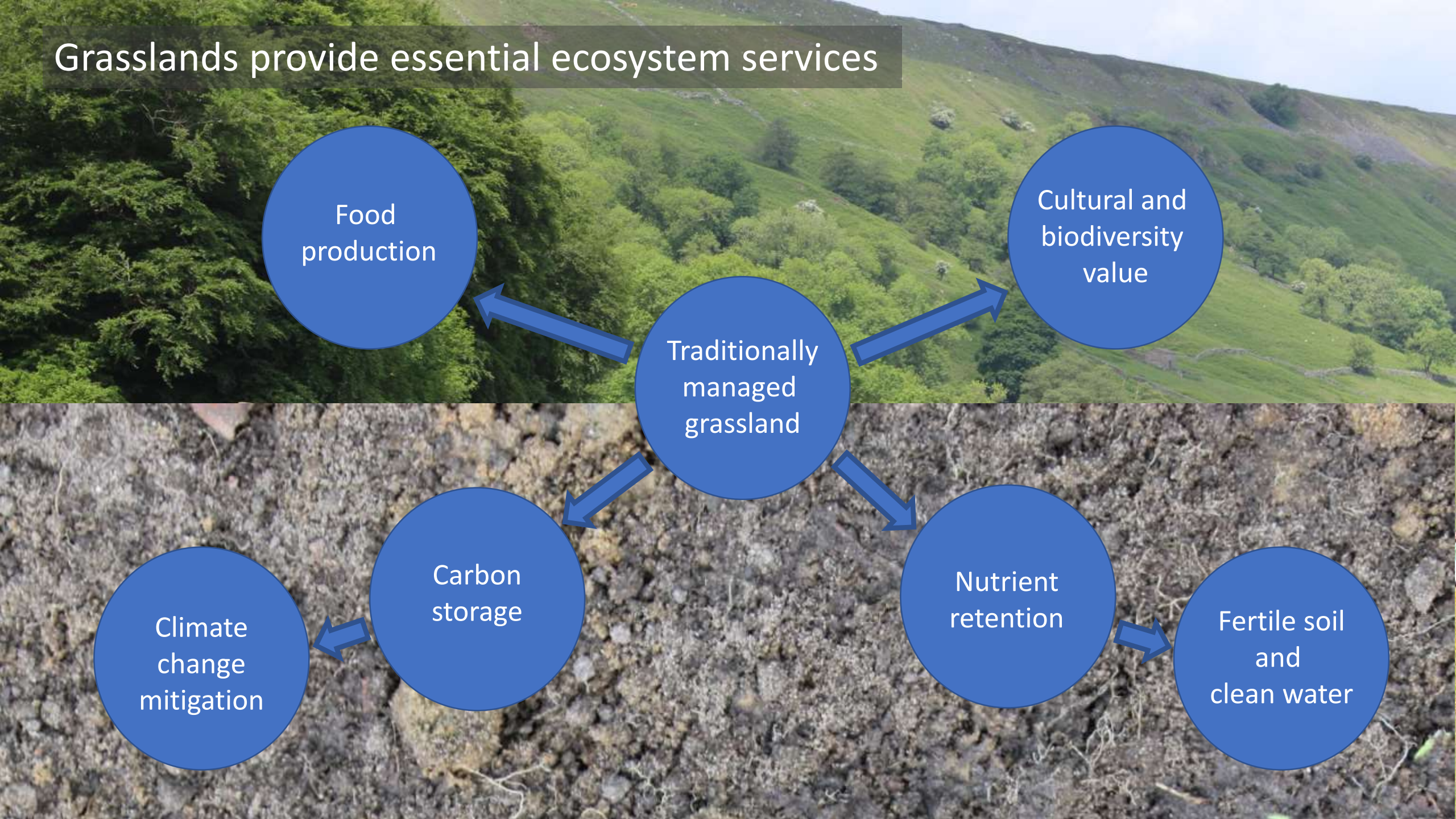



Traditionally managed grassland

Intensification

Traditionally managed grassland

From 1950-s

Intensification

Traditionally managed grassland

Abandonment

From 1950-s

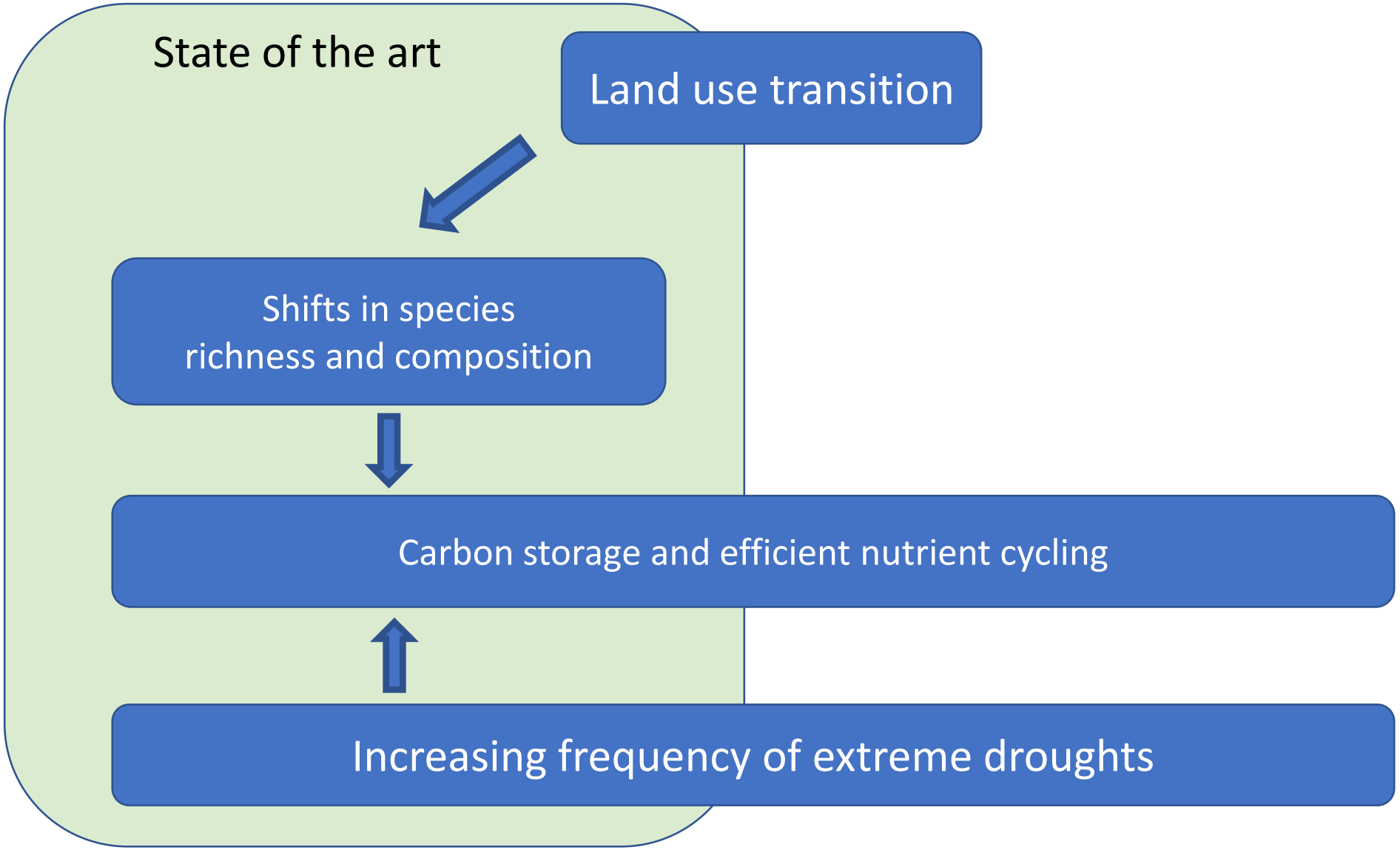
Climate change: increasing frequency of extreme drought events

Intensification

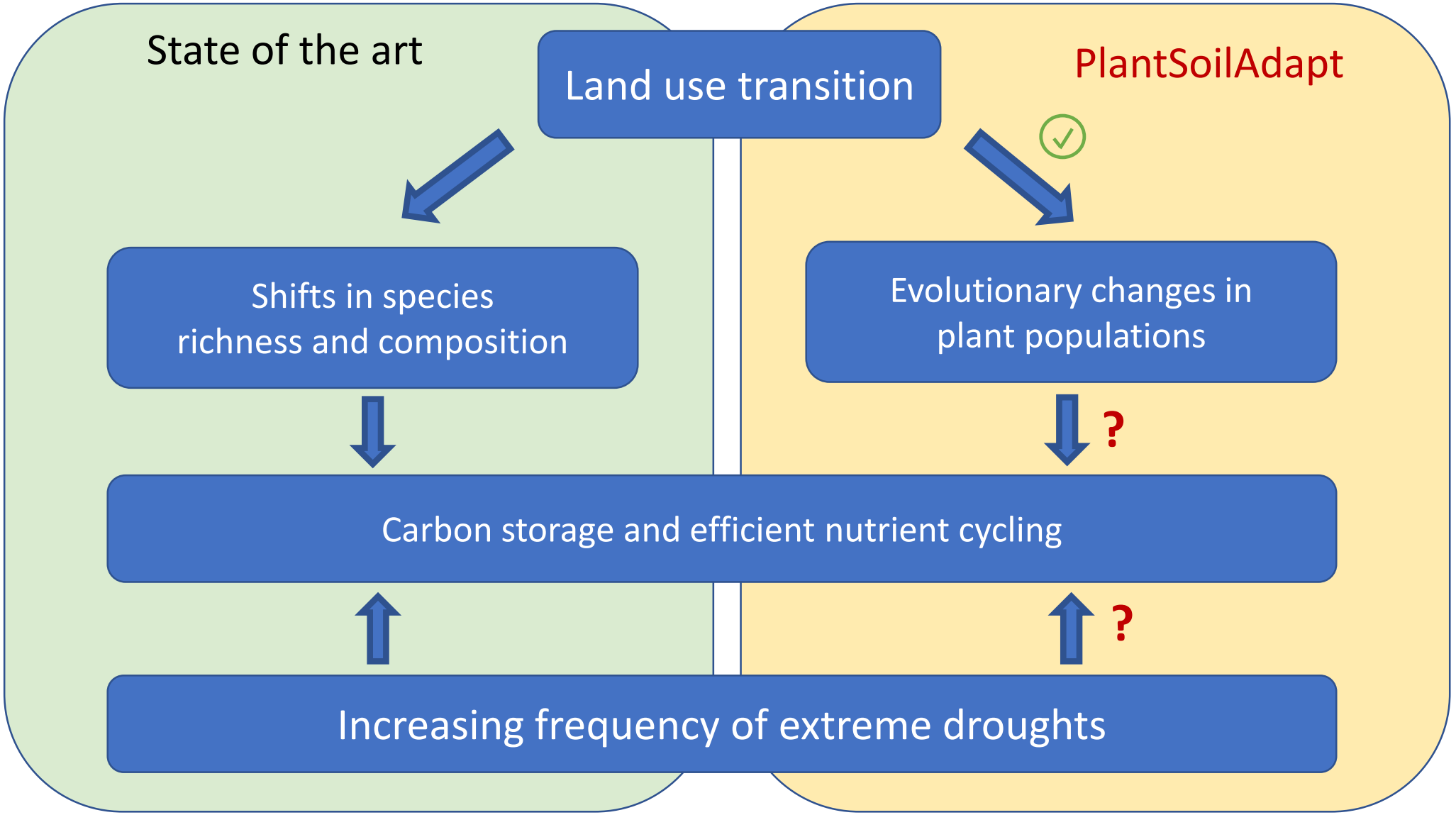
Traditionally managed grassland

Abandonment

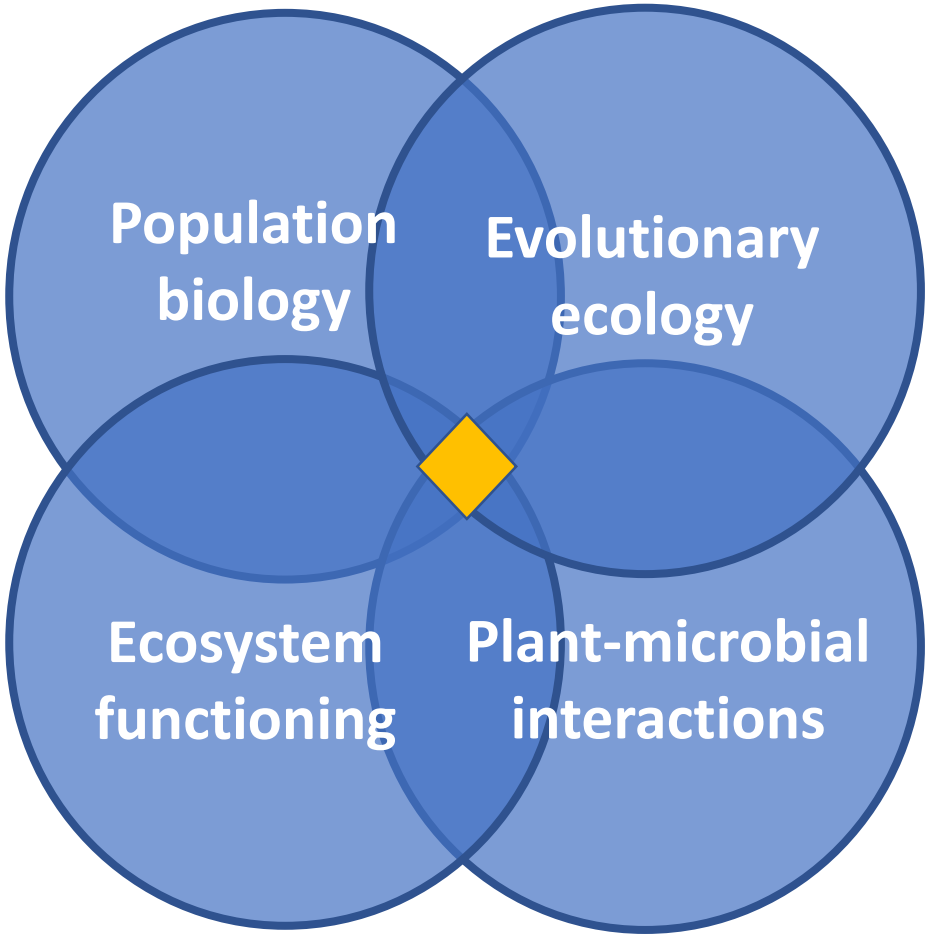
From 1950-s

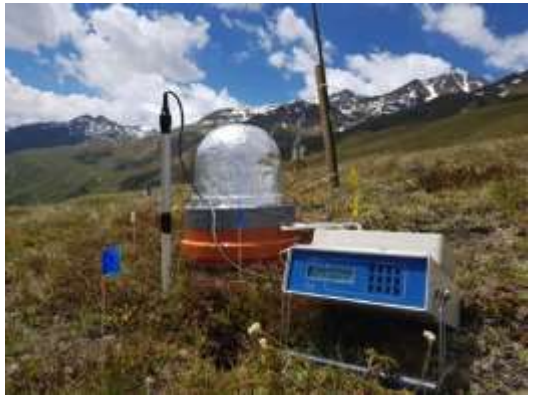

State of the art
Land use transition
Shifts in species
richness and composition
Carbon storage and efficient nutrient cycling
Increasing frequency of extreme droughts

Evolutionary changes in plant populations – an overlooked pathway by which land use can impact ecosystem resilience



The challenge of merging disciplines





Grasslands under major land use transitions: overarching hypothesis

Land use change triggers evolutionary shifts in plant-microbial interactions that undermine efficient soil functioning and the capacity of grasslands to resist extreme drought events

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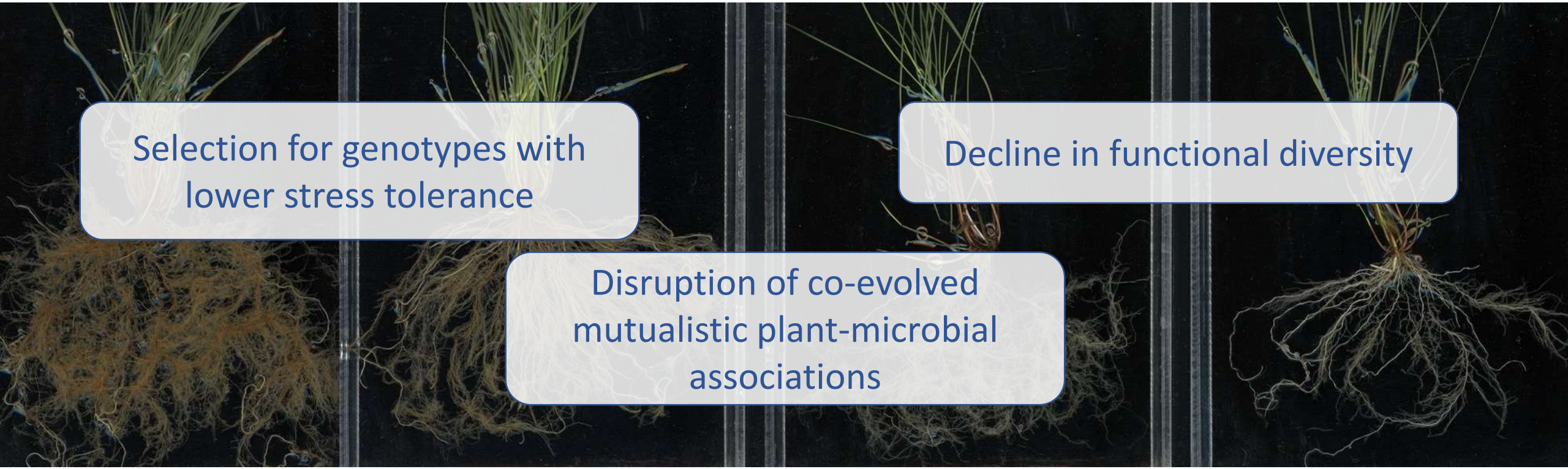
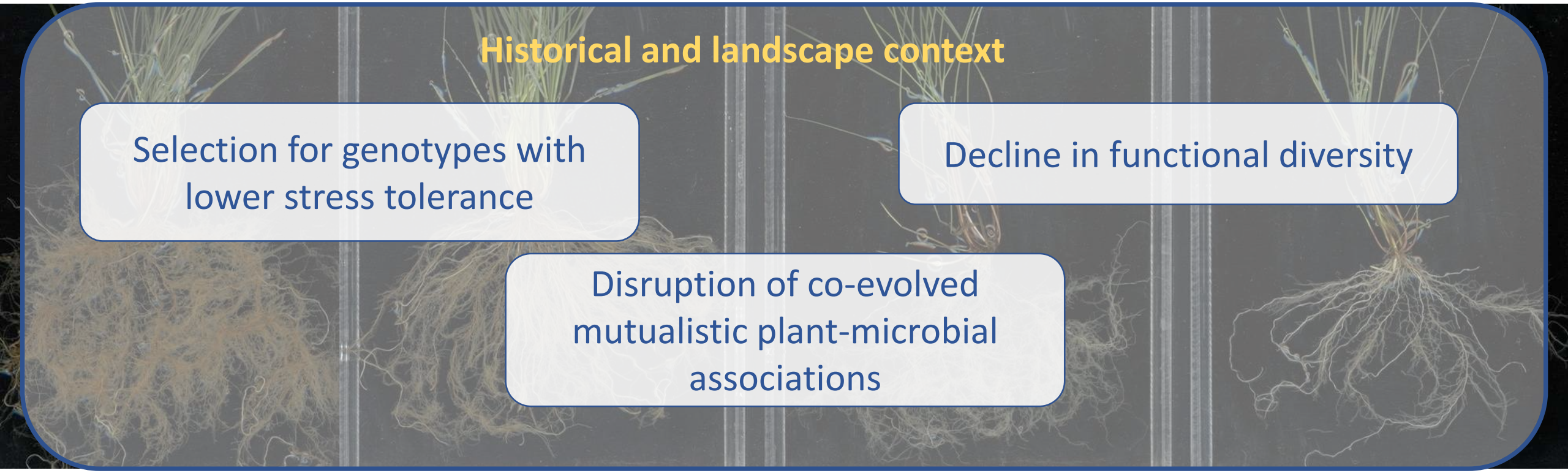


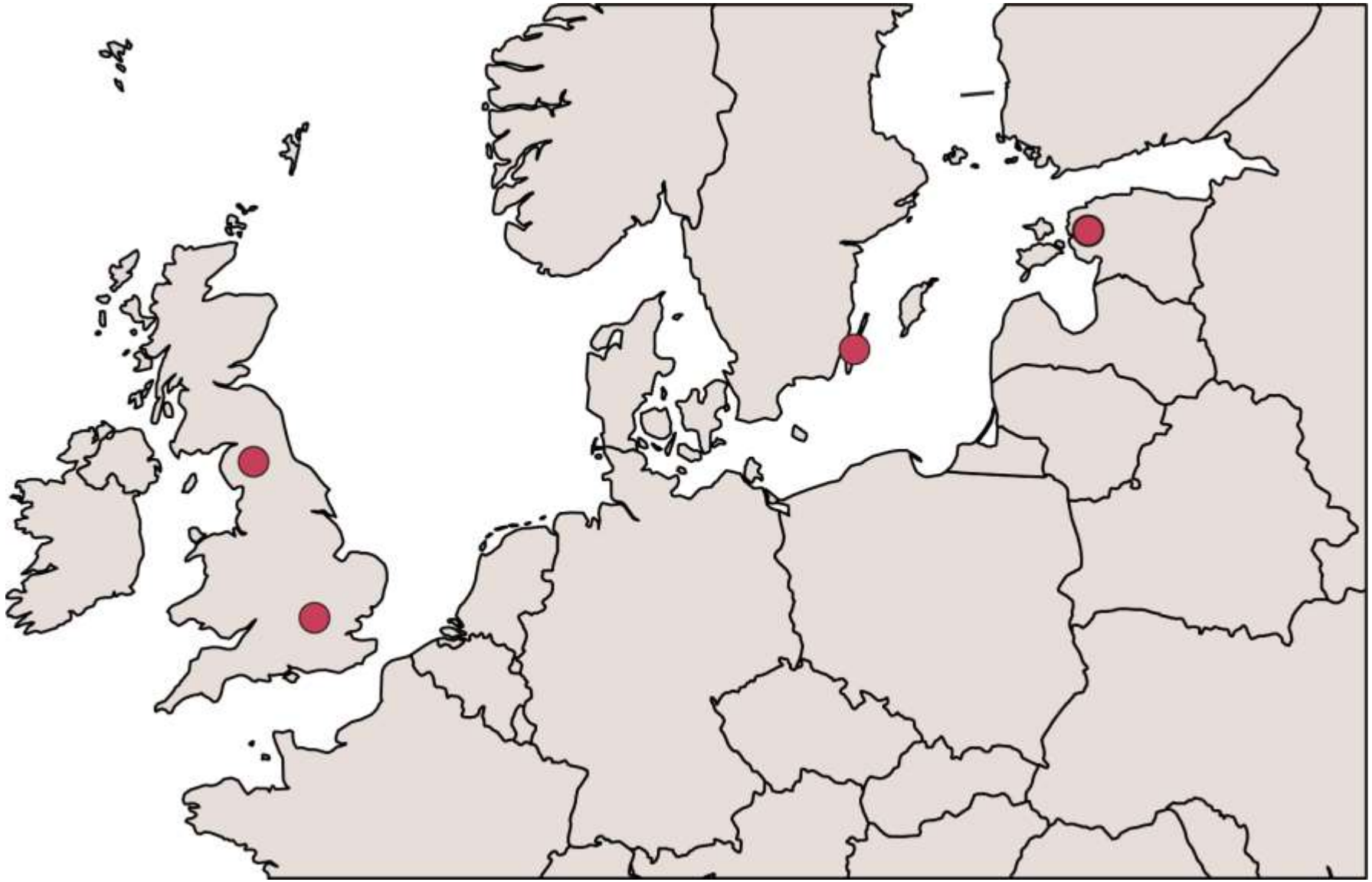
Land use change triggers evolutionary shifts in plant-microbial interactions that undermine efficient soil functioning and the capacity of grasslands to resist extreme drought events

Grasslands under major land use transitions: overarching hypothesis



Land use change triggers evolutionary shifts in plant-microbial interactions that undermine efficient soil functioning and the capacity of grasslands to resist extreme drought events

PlantSoilAdapt: Study systems



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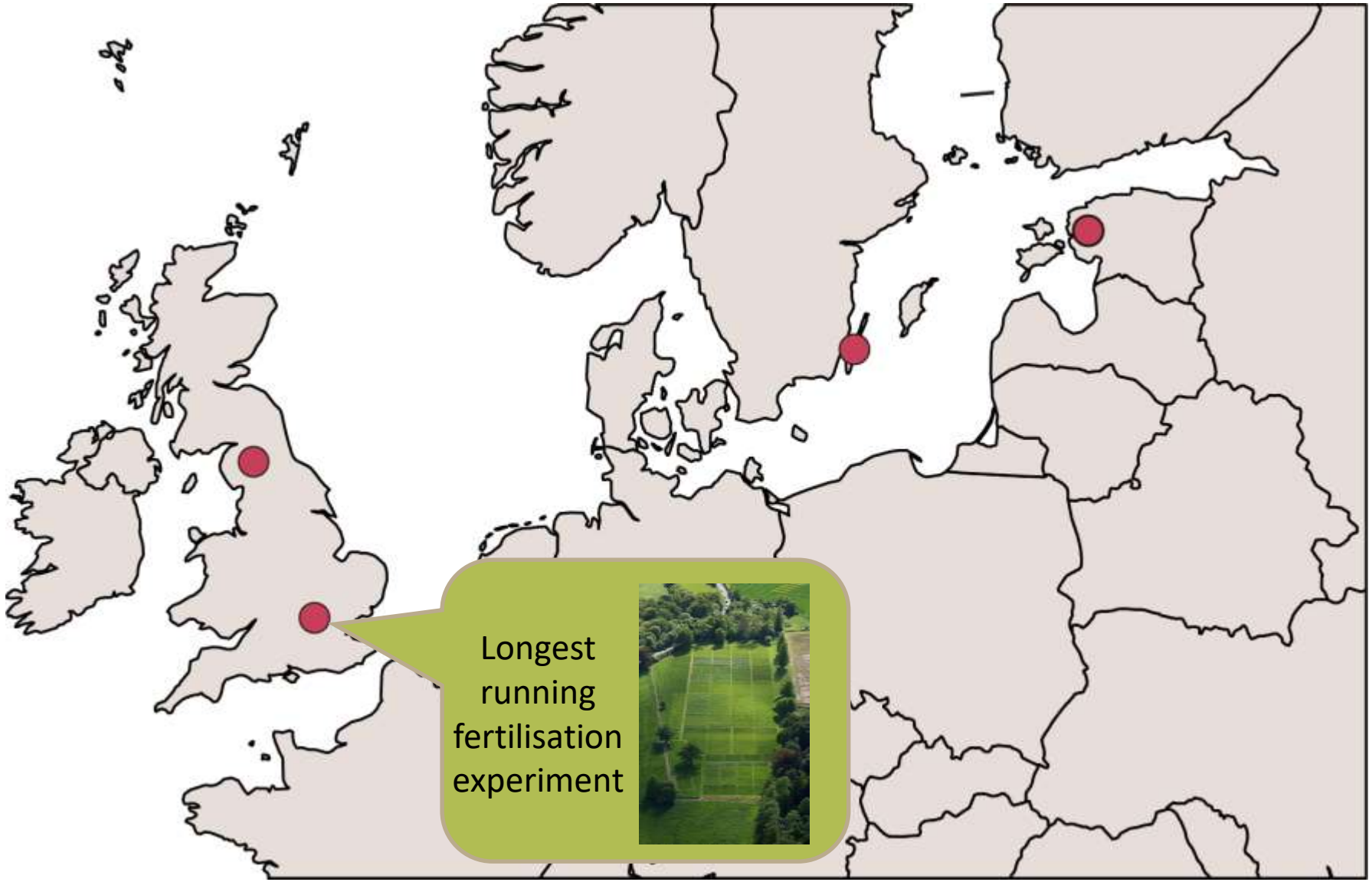

PlantSoilAdapt: Study systems

Paired extensively and intensively managed sites

Longest running fertilisation experiment

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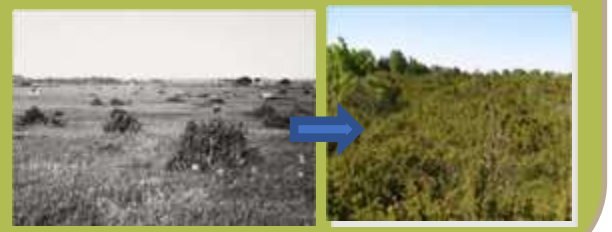
Paired extensively and intensively managed sites

Longest running fertilisation experiment

Network of managed and abandoned grasslands



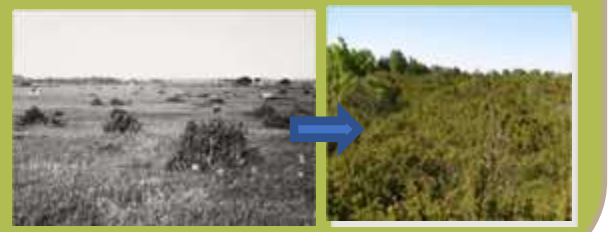
PlantSoilAdapt: Study systems

Paired extensively and intensively managed sites

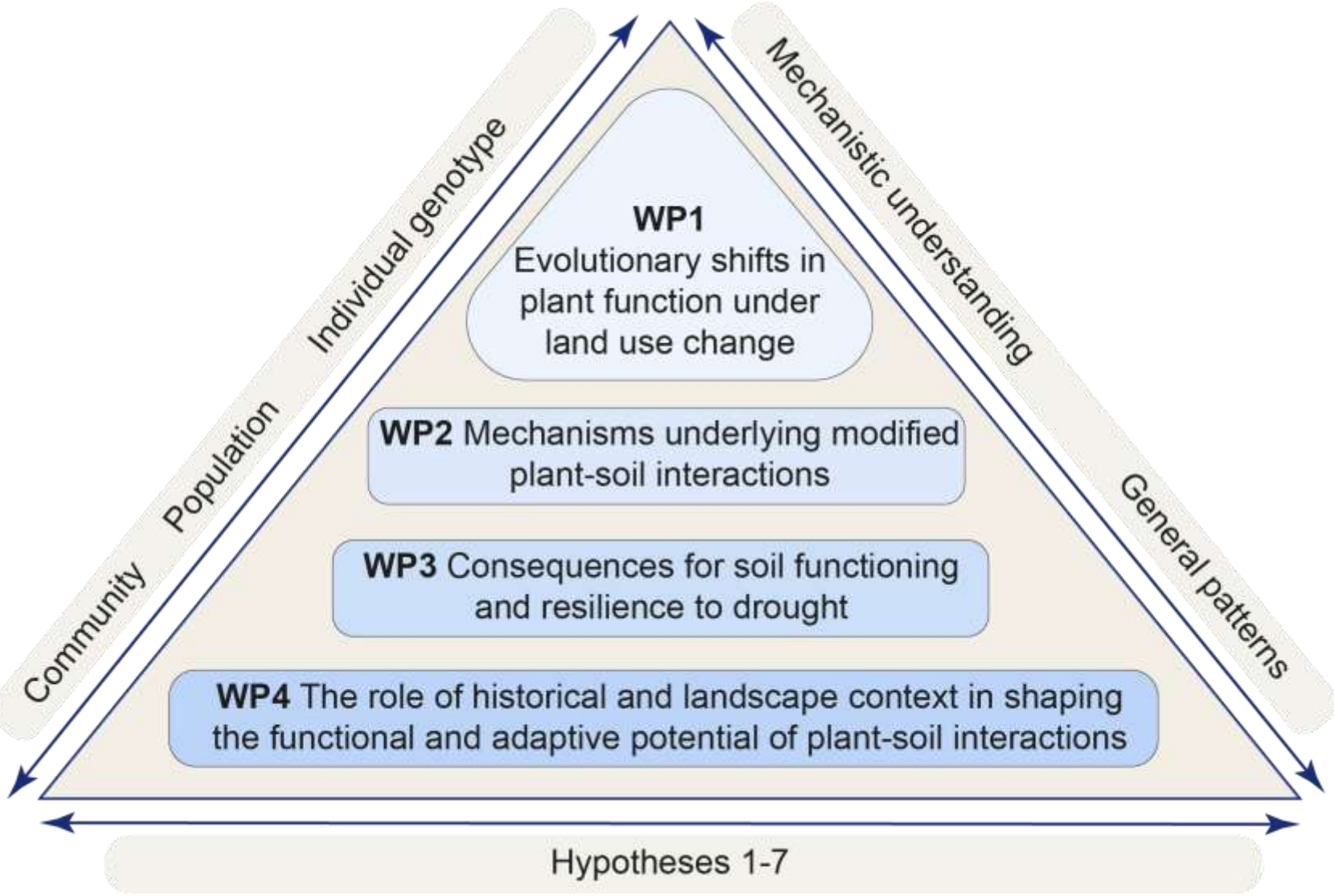
Co-evolution of plant-soil systems over 280 years of grassland development

Longest running fertilisation experiment

Network of managed and abandoned grasslands



Objectives and timeline

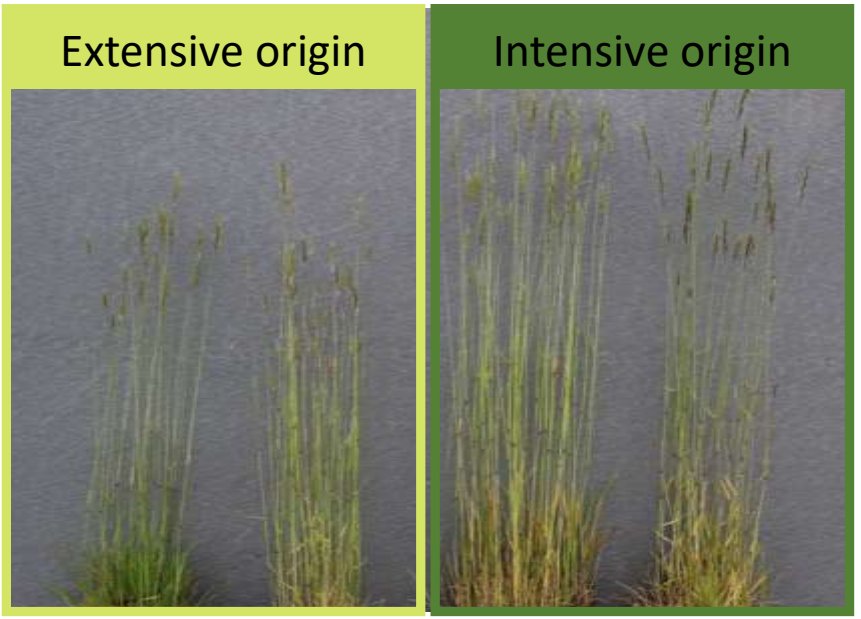


WP 1. Evolutionary shifts in plant function under land use change

Field measurements
4 study systems
39 populations

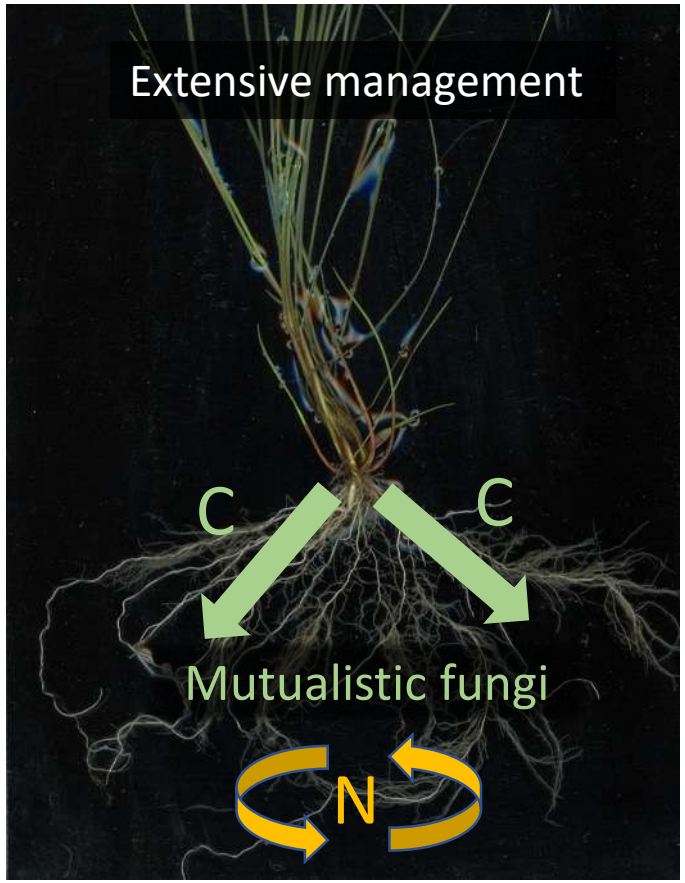
Phenotypic plasticity + heritable changes

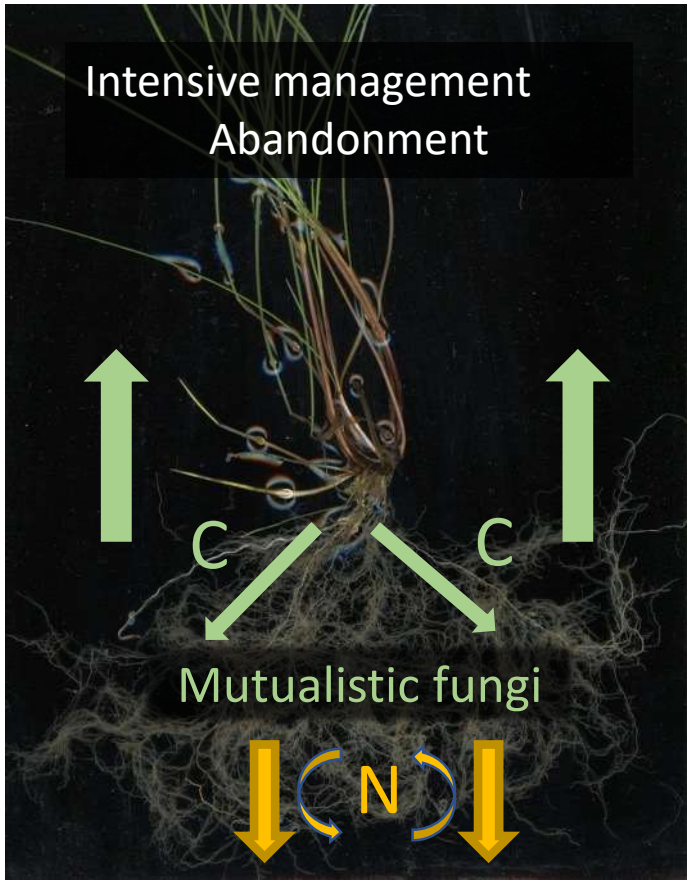
Propagation and phenotyping under common conditions



Heritable changes

WP 2. Processes underlying shifts in plant-microbial interactions and soil functioning





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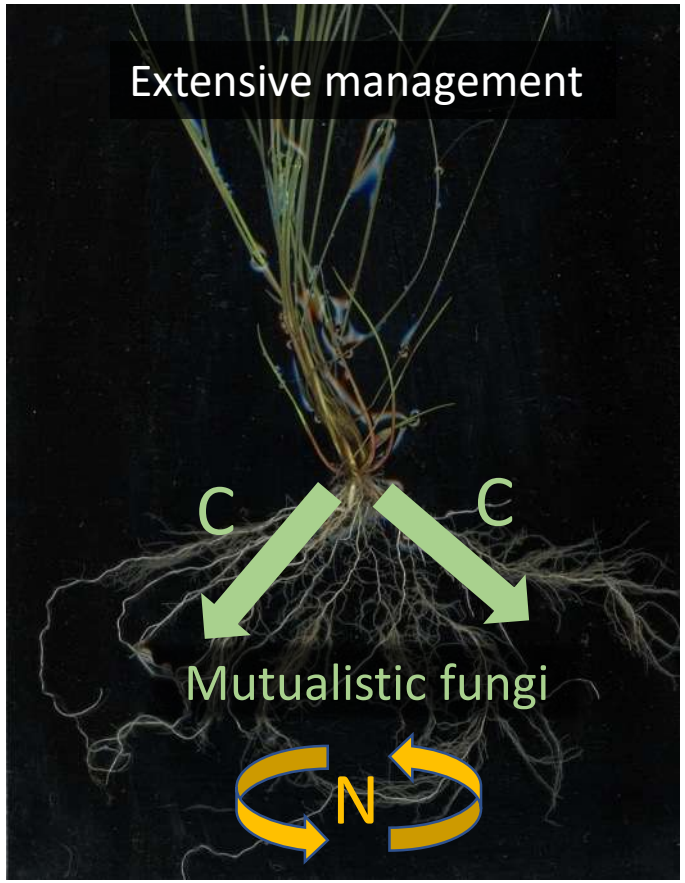
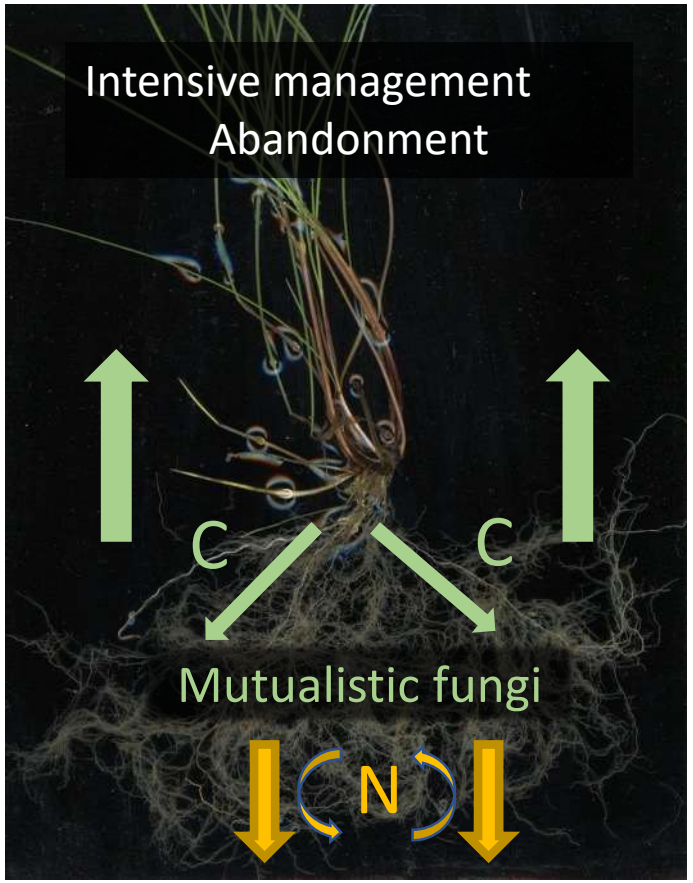
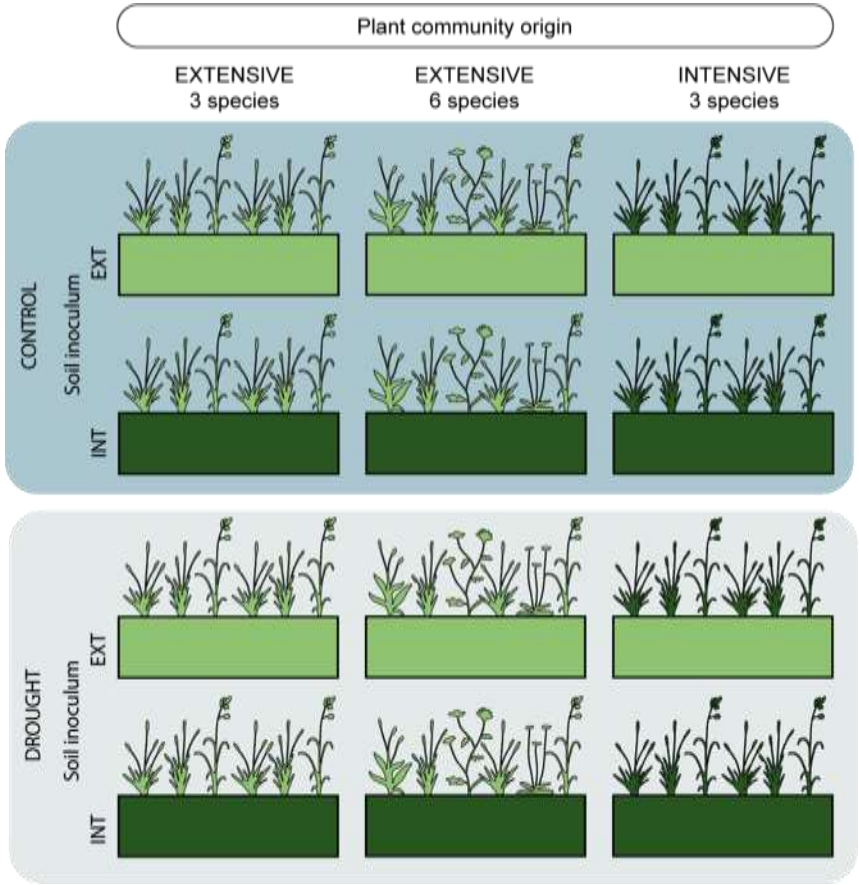
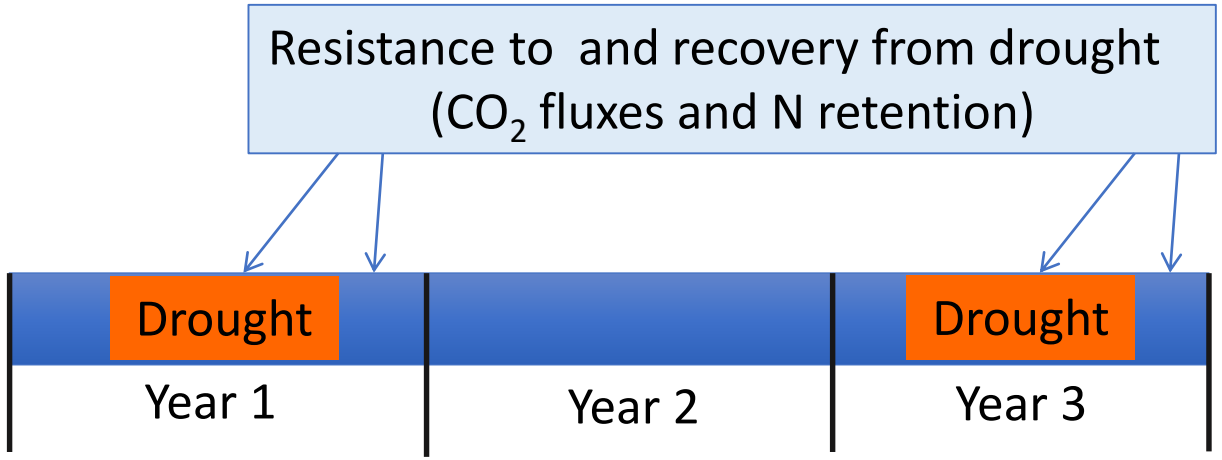




- ^{15}N and ^{13}C labelling
- Metabolomics
- Functional assays of microbial communities
- Metabarcoding
- Microbial feedbacks to plant growth

WP3. Community-level experiments: wider consequences of adaptation for soil functioning and resilience to drought

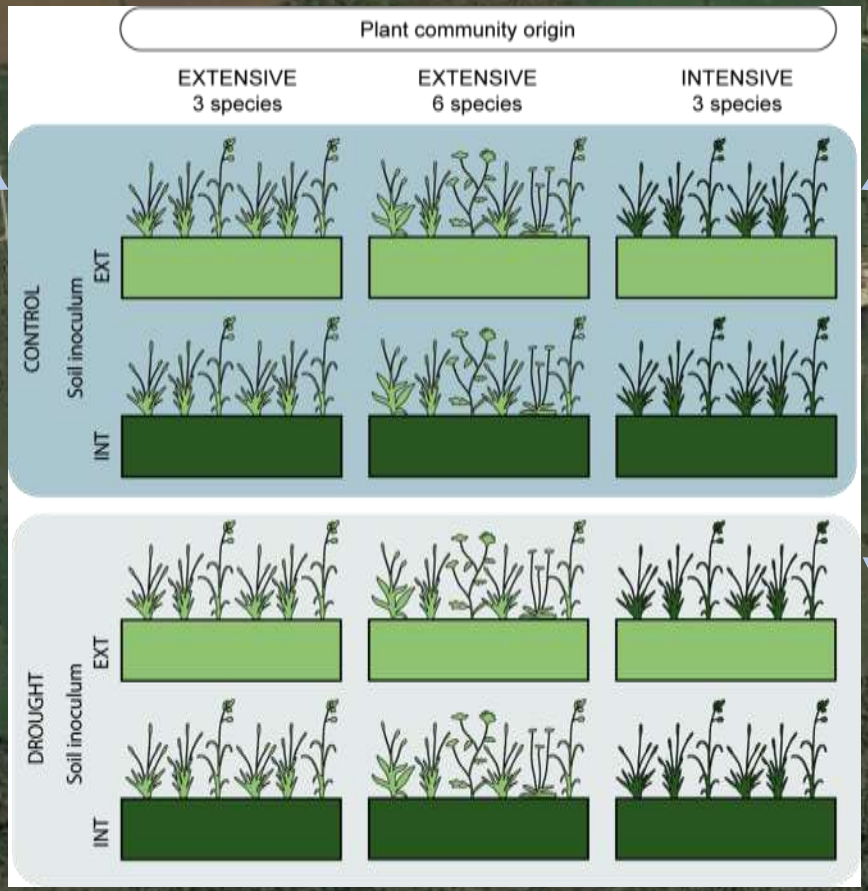




WP4. The role of landscape and historical context

Current and historical grassland connectivity

Current and historical human population density



Consistent low-intensity management and high grassland connectivity generate the highest resilience to perturbations

Continuity of management

PlantSoilAdapt

Uncover the consequences of adaptation to land use for soil functioning and capacity to endure and adapt to future perturbations.

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Uncover the consequences of adaptation to land use for soil functioning and capacity to endure and adapt to future perturbations.

Fundamental insights into the mechanisms underlying plant-microbial interactions

Create synergy between different research areas

Evidence-based management and restoration of grassland ecosystems