

The potential to enhance the environment, reduce pollution, improve soils, support landscapes, wildlife/flora and amenity values

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Production efficiency



Temporary grassland



Permanent pasture



Semi-natural grassland

Other public goods



Drinking water



Recreation & tourism



Biodiversity

**Grasslands
deliver**



Flood control



Carbon management

Grassland in arable rotations



ROTHAMSTED
RESEARCH



**Halt or reverse soil
carbon losses from
continual arable
cropping**

Improve soil structure

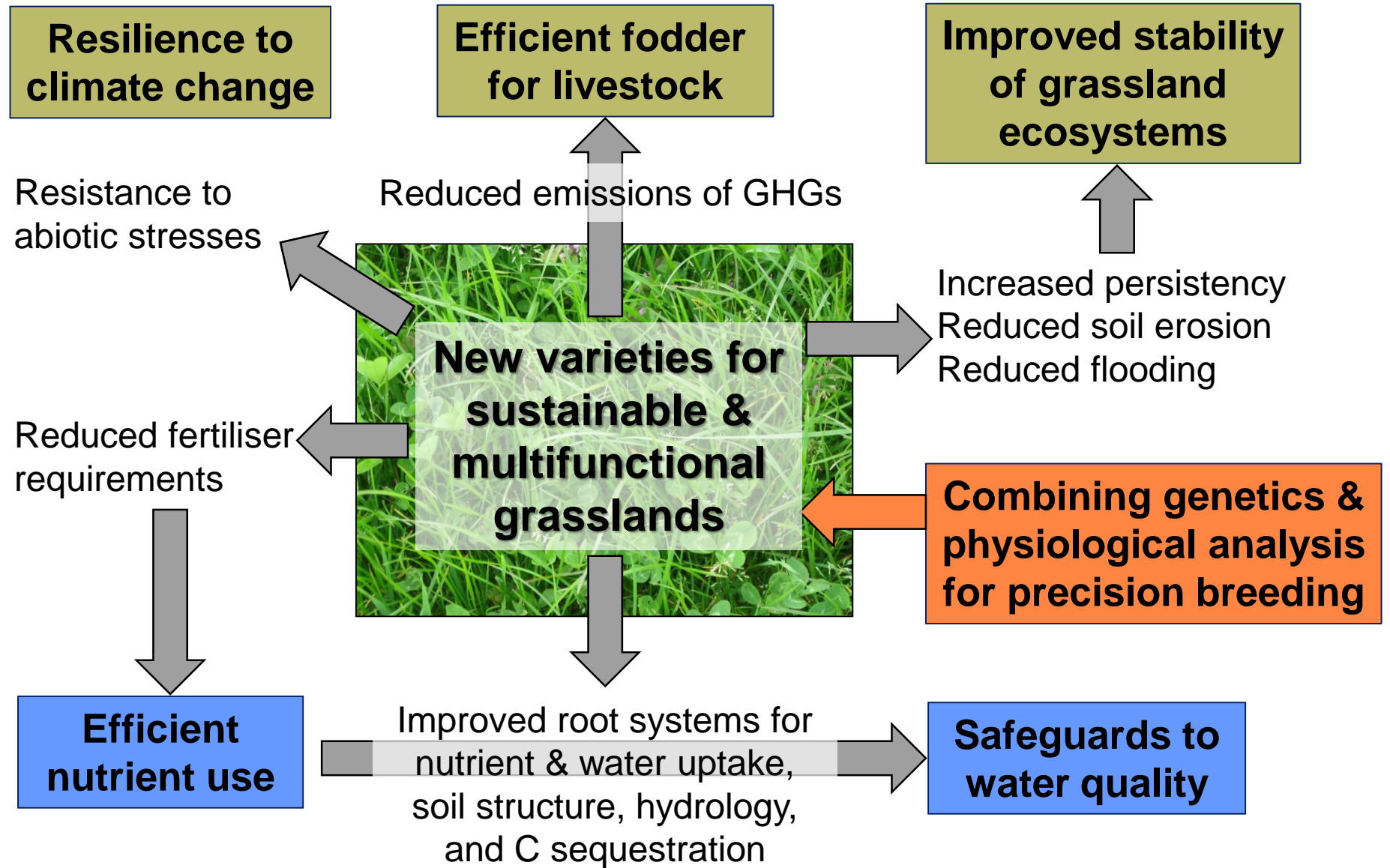
**Break weed/disease
cycles**



**Inclusion of livestock
may further enhance
soil carbon gains**

Long-term experiments

What can forage breeding do?



Multi-species swards

For production *and* environment



Can they be widely utilised in productive ruminant agriculture?

How do we improve longevity and stability?

Improved resilience (to climate extremes)

Provision of micronutrients – enhanced livestock health and food quality

Less synthetic fertiliser

Improved soil structure

Biodiversity

Managing grasslands to minimise pollution



Low emission manure application techniques

Appropriate levels of nutrient use (including timing and form of nutrients)

Buffer strips / nutrient and livestock exclusions near water courses

Appropriate grazing management strategies



Policies to encourage best practice

Uplands

**LFAs account for
46% of
agricultural land
use area in UK**

**Combination of
pasture types**

Carbon stores

Water

Amenity

Culture



**Improved
upland
pasture**

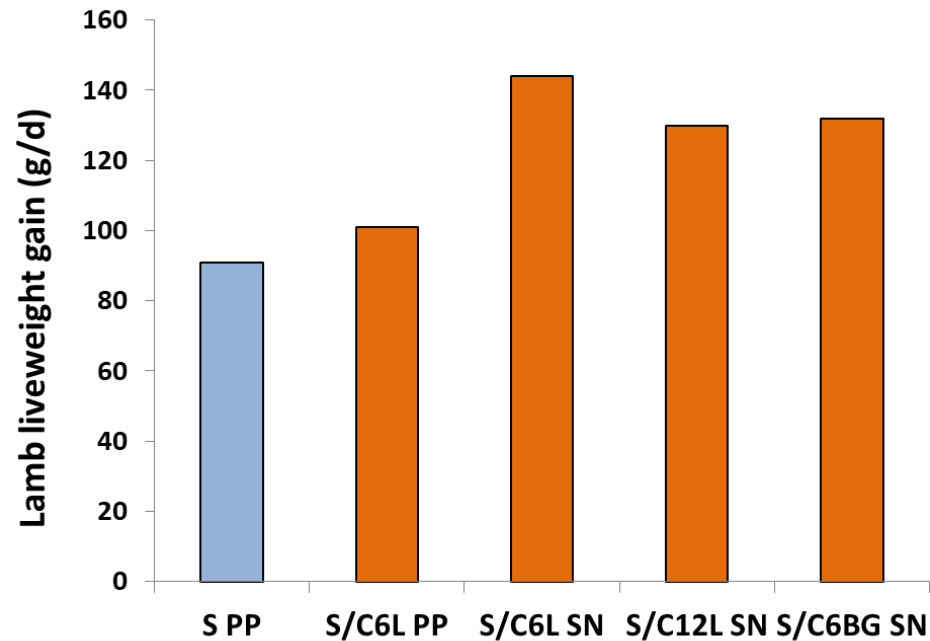
More clover

Less wastage

**Reduced
parasite burden**

Lower GHGs

Sheep with suckler cows



Meta-analysis of 4 yrs data:
System: $P < 0.001$
Year: $P < 0.01$
System x Year: ns

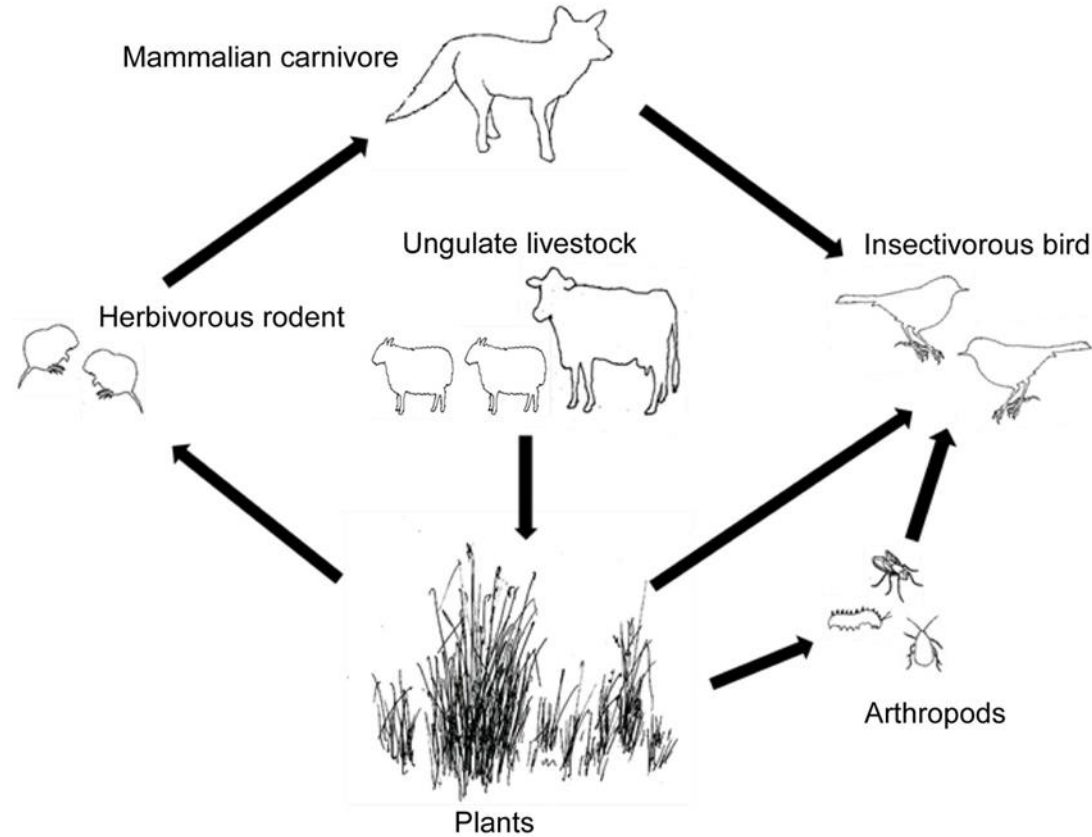
Mixed grazing improved the liveweight gains of lambs, particularly post weaning, regardless of the duration of cattle grazing or the cattle:sheep ratio.

Semi-natural rough grazing

More structural heterogeneity

Increased botanical diversity

Improved habitat value



	TREATMENT			
	I	II	III	IV
Plants	Red	Yellow	Yellow	Green
Arthropods	Red	Yellow	Yellow	Green
Herbivorous rodent	Red	Orange	Yellow	Green
Insectivorous bird	Yellow	Orange	Green	Red
Mammalian carnivore	Red	Orange	Yellow	Green

I = commercial sheep grazing (2.72 ewes ha⁻¹)

II= low intensity sheep grazing (0.91 ewes ha⁻¹),

III = low intensity mixed-herbivore grazing with equivalent off-take to treatment II

IV = no grazing

Harnessing new technologies

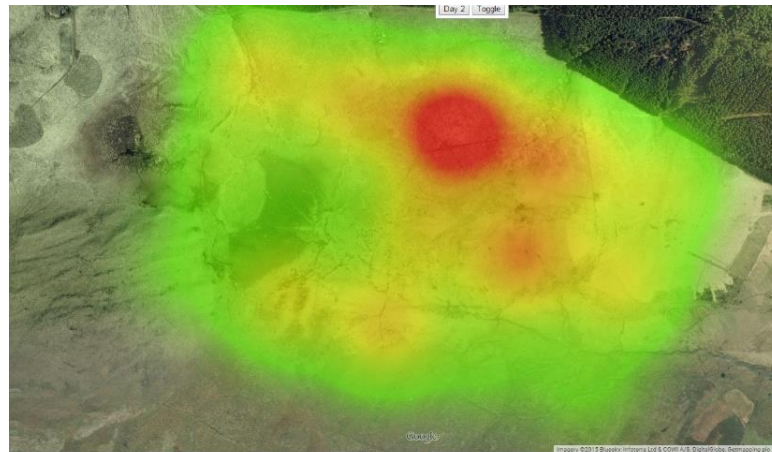
**Livestock
tracking using
RF enabled
ear tags, with
UAV receiver**



**DNA metabarcoding
of faecal samples**

**Quantifying diet
composition with
greater accuracy**

Whose poo?



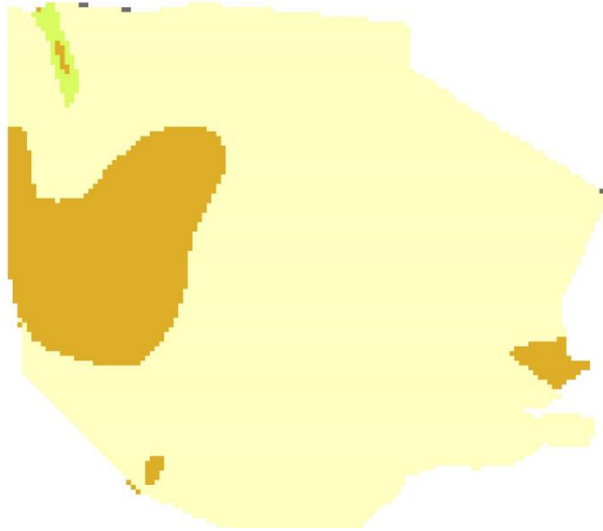
**Defining and manipulating
localised stocking rates**

**Pengaleinon
Old phase 1**

Legend

Peng_oldest

- Blanket bog
- Marshy grass
- Flush
- Upland heath

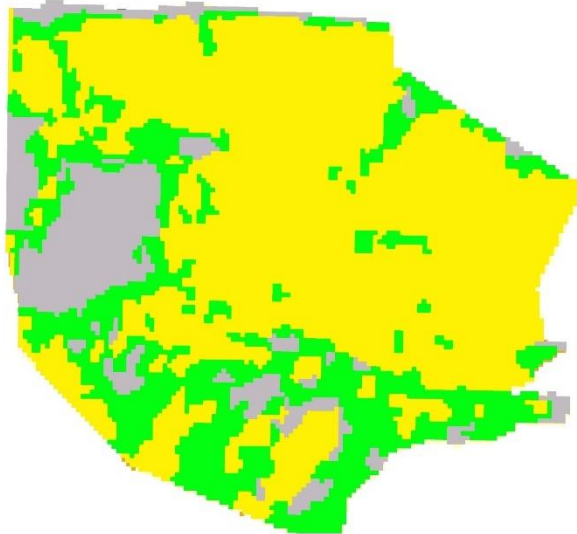


**Pengaleinon
Sentinel satellite imagery**

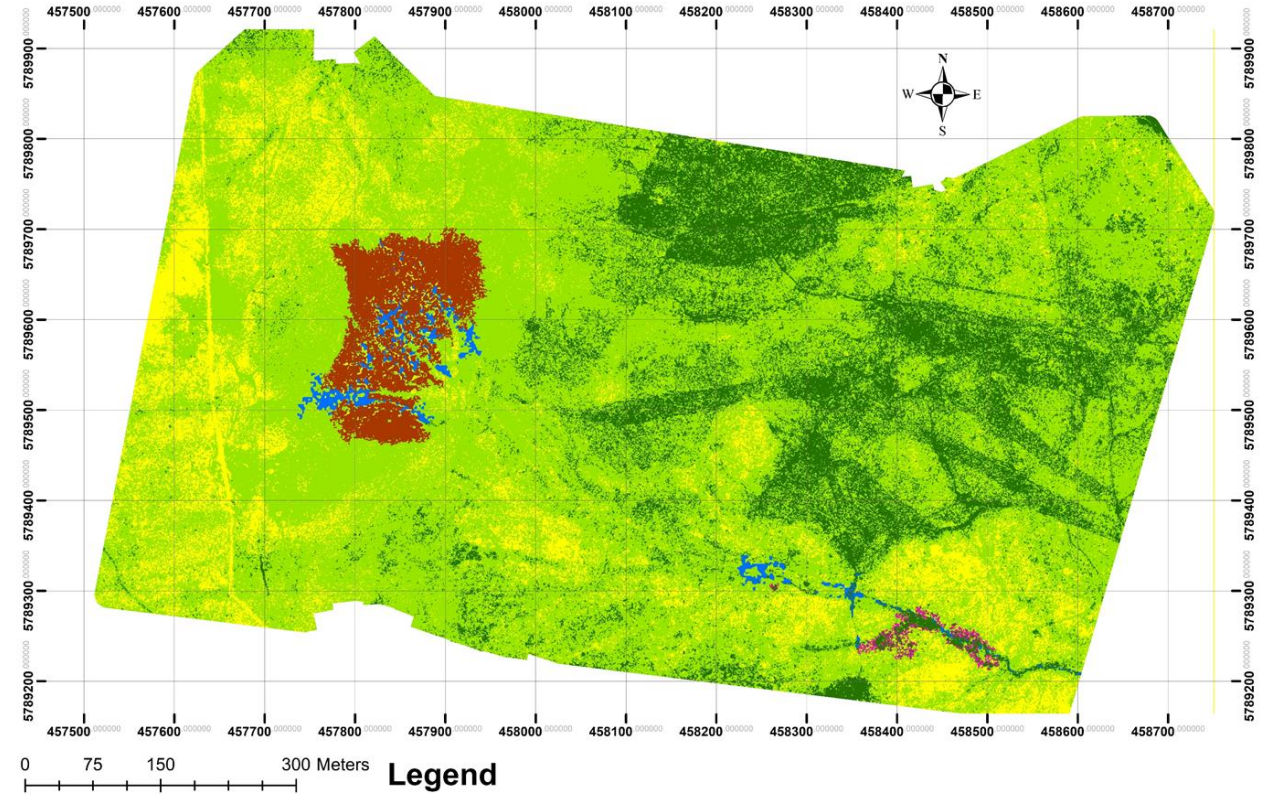
Legend

April_Peng_class

- Grass
- Blanket bog
- Molinia



**Pengaleinon
Multi-spectral imagery from UAV**



Legend

- Water
- Bog
- Deschampsia Cespitosa
- Dry Molinia
- Growing Molinia
- Other Grasses

**But what
about other
grazers?**

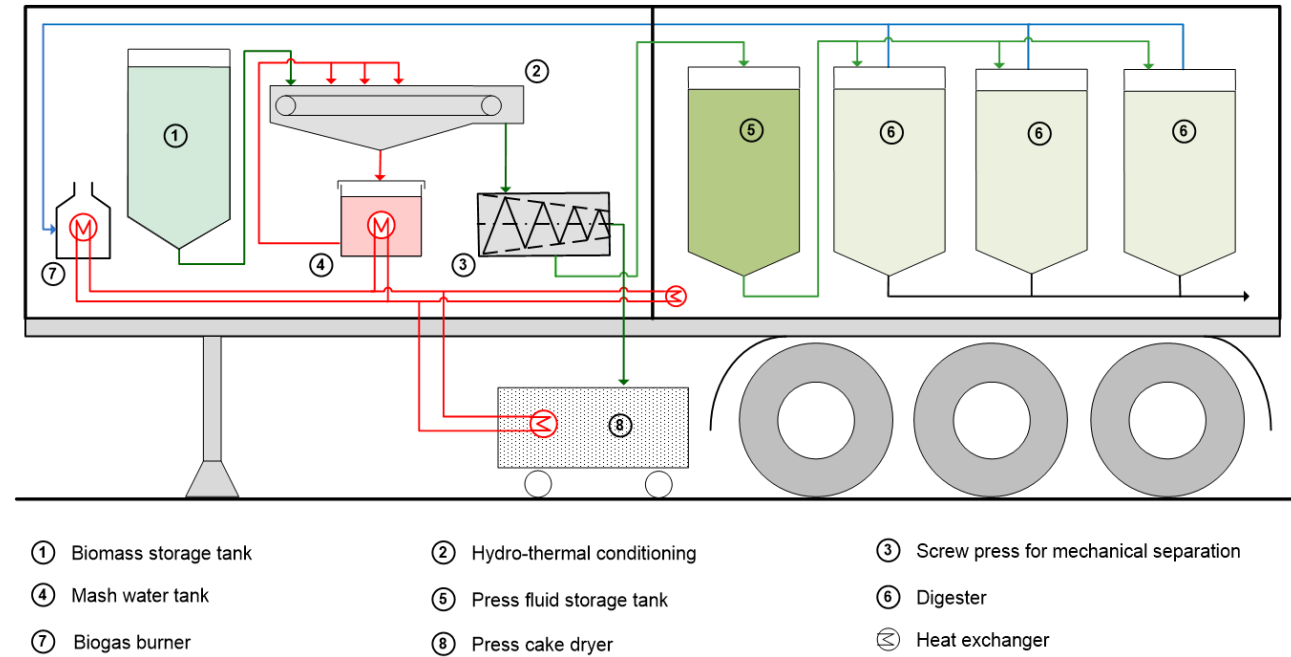
**Potential to
capitalise on
differences in
grazing**

**Novel meat and
fibre products**



Bioenergy & biorefining

- Exploits underutilised grassland
- New feedstocks
- Cutting improves floristic diversity of under-grazed grassland
- Range of processing options
- Integration with grazing



PRO
GRASS

Interreg
North-West Europe



BEACON
From plants to products
O blanhigion i gynhyrchion

Corton et al, *Biotech. Resource*, 2012
Corton et al., *Applied Energy*, 2016

Summary

- **UK grasslands deliver a wide range of public goods**
- **Plant breeding is developing varieties with new traits to support multi-functional grasslands**
- **Differences in grazing behaviour can be exploited to deliver targeted outcomes**
- **Targeted management is key to delivering desired outcomes**
- **More research is needed to provide an evidence base for new policies and support**

