



Department  
for Environment  
Food & Rural Affairs



# A Roadmap for Delivering Improved Forage Systems

## Stakeholder workshop

23 January 2024

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# Agenda



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<b>10:00</b> – Welcome, project aims and objectives	John Williams
<b>10:05</b> – Literature review findings	John Langley-Randall
<b>10:20</b> – Stakeholder interview findings	Natasha Alonso
<b>10:35</b> – Questions	John Williams
<b>10:40</b> – Summary of findings and recommendations	John Langley-Randall
<b>10:50</b> – Short break	
<b>10:55</b> – Breakout rooms	ADAS staff
<b>11:40</b> – Feedback from breakout rooms	
<b>11:55</b> – Wrap up	John Williams

# What's the big deal?



Forage crops underpin ruminant production in the UK:

- Cheapest source of food
- UK climate and soils support good forage production

Issues:

- Climate change is a risk to current fodder production (extended periods of dry or wet weather)
- Environmental challenges – biodiversity, GHGs and nutrients

How can we address these challenges to maintain and improve forage production systems?



# Questions Defra have asked.

1. Why are certain promising forage crops underutilised? How can evidence gaps and other barriers be overcome to enhance utilisation?
2. What methods are required to provide improved forage systems, providing optimum sustainability, resilience, and productivity benefits? Where are the research capabilities that could deliver these improvements?
3. How can improved forage systems be used in combination with other management systems, such as silvopasture (e.g. willow)?
4. What are the public good arguments for developing improved forage systems?



# Project structure

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## Work Packages

- WP1: Literature, technology and knowledge update.
- WP2: Developing a network of researchers and stakeholders.
- WP3: Information collection.
- WP4: Information sharing and knowledge exchange.
- WP5: Understanding the best approach for improving forage systems and creation of a roadmap.

## Background

- Defra-funded review project: “Scoping Study on the Opportunities and Barriers of Improved Forages for Livestock Sustainability and Productivity (ForaGIN)” - 2021.
- Potential of improved forages to enhance farm productivity, sustainability and resilience to meet the future needs of ruminant agriculture in the UK.

## Objective

- *To update the ForaGIN review with more recent information.*
- *Focus on work from NW Europe (i.e. similar agro-climatic conditions)*



# Shortlisted species (from ForaGIN)



- Forage grasses – perennial ryegrass (PRG) & festulolium
- White clover
- Red clover
- Other clovers
- Sainfoin
- Lucerne
- Birdsfoot trefoil
- Vetch
- Ribwort plantain
- Chicory
- Fodder beet
- Forage trees
- Herbal leys and multi-species swards



## Impacts relating to the:

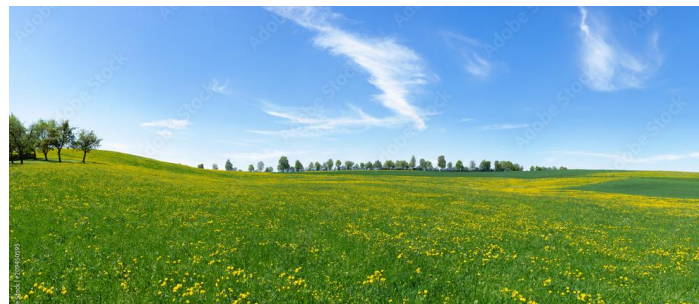
### Productivity of livestock systems:

- Yield
- Digestibility
- Protein value
- Micro-nutrient content or other health impacts



### Resilience of forage supply:

- Drought and waterlogging tolerance
- Susceptibility to pests/disease
- Reliability of forage supply
- Reliability for conservation (storage)



### Environmental impact:

- Enteric methane (CH<sub>4</sub>)
- Greenhouse gas (GHG) and other gaseous emissions
- Nitrogen (N) losses
- Biodiversity
- Soil carbon (C) content and other soil quality impacts

### Attitudes and barriers

- Multispecies/herbal leys
- Agroforestry/silvopasture



# Overview of literature



Country	Number of papers
UK	24
ROI	22
Germany	13
France	8
Sweden	4
Switzerland	4
Belgium	4
Denmark	2
Various	4
Other	16
<b>Total</b>	<b>103</b>

Plus...

- Many studies from New Zealand, Australia, N. America etc.
- Large number from China on grass breeding

Not fully assessed in this study... but findings should be evaluated in a UK context

## Knowledge gaps (from ForaGIN)

- Improving PRG climate resilience
- Improving PRG nutritional value, disease resistance, agronomic performance and N use efficiency (NUE).
- Integrating improved PRG varieties (and other species) into existing swards without a full re-seed.
- Differences between *Festuloliums* and benefits.
- Applied research on using *Festuloliums* in practice



## New findings

### PRG

- Many studies on breeding for a changing environment:
  - Focus on resistance to drought, high temperature and salinity (much from outside NW Europe)
  - Plus, tolerance to waterlogging/anaerobic soils, low temperatures, PTEs, pathogens and improving NUE
- Some UK/ROI studies on impact of varieties on agronomic performance, ruminant efficiency and livestock production.

### *Festuloliums*

- Field studies (UK, ROI, Denmark) show they can perform well under NW Europe soil/climate conditions
- Some can decrease N losses and increase soil OC

## Knowledge gaps (from ForaGIN)

- All legumes - more applied/integrated research and demonstration in UK systems
- White clover – improving climate resilience
- Vetch – feed quality
- Lupins – benefits compared with more common legumes



## New findings

### White/red clovers.

- Many new studies from NW Europe on productivity and environmental impacts
- Some research on white clover resilience (not UK)
- Red clover - positive effects on livestock productivity, but concerns over persistence

### Other clovers

- Less studied; similar nutritive characteristics to lucerne; yields can be maintained under drought/heavy rainfall.

### Vetch.

- 2 UK studies (Wales/Scotland) demonstrated potential for grazing/silage production.

### Sainfoin/lucerne/birdsfoot trefoil/forage lupins

- Little new information found on individual species

## Knowledge gaps (from ForaGIN)

- Assess NZ evidence in UK context
- Demonstrate sward integration in practice
- Assess difference between fodder beet varieties



## New findings

- Considerable recent research interest
- Variable impact on livestock performance and resilience
- Plantain - can reduce N losses and CH<sub>4</sub> emissions
- Chicory - variable impact on CH<sub>4</sub> emissions
- Fodder beet – very little new evidence

**More work needed to improve recommendations and advice.**

# Multispecies swards/herbal leys

## Knowledge gaps (from ForaGIN)

“Need for work integrating basic, applied and knowledge exchange, to address the range of species interaction effects both during plant growth and within livestock diets as these are relatively poorly understood, and hence difficult to manage in practice. “



## New findings

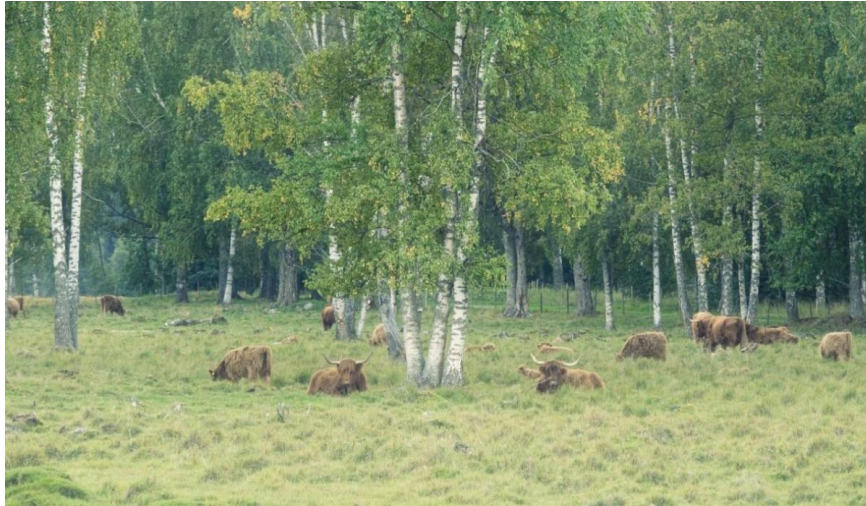
- Very many new papers - focus on reviews/meta-analyses
- Performance affected by many factors (e.g. species mix, climate, weather, soil type, grazing management etc.) - difficult to draw firm conclusions
- Most studies recorded positive effects on livestock performance (BUT some negative impacts also found).
- Many studies report environmental benefits (e.g. soil quality, GHG emissions, C sequestration and biodiversity)

**Still many areas where knowledge is lacking.**

**Need for longer-term studies and evaluation on commercial farms.**

## Knowledge gaps (from ForaGIN)

- Investigate nutritional benefits of tree fodders
- Selection of tree species for silvopasture



## New findings

- UK literature review of 289 temperate agroforestry studies (Jordan *et al.*, 2020)
  - Some evidence that agroforestry can reduce pasture productivity. Need to understand driving factors.
- One UK study on nutritional quality of goat willow, oak and alder
- One UK study (AHDB) on soil quality impacts

**Further work needed to better characterise the nutritional value of tree fodder.**

**Field-based UK evidence required on the environmental benefits/disbenefits of agroforestry/silvopasture systems**

# Attitudes and barriers

## Herbal leys

UK research (Jordan *et al.*, 2023)

- Perceived benefits
  - Improved livestock performance (forage protein)
  - Improved forage mineral/trace element content
  - Anthelmintic properties
- Challenges
  - Reduced palatability
  - Controlling broadleaved weeds
  - Cost of reseeded/seed mixes
  - Variable establishment/retention
  - Overall cost-effectiveness

Adoption decision driven by fear of the unknown and farmer's outlook/values

## Agroforestry/silvopasture

Studies from Europe (3) and Sweden (2)

- Perceived benefits
  - Biodiversity/wildlife habitats
  - Livestock health and welfare
  - Landscape aesthetics
- Challenges
  - Increased labour
  - Complexity of work
  - Increased costs and admin burden
  - Lack of education/awareness/field demonstrations
  - Lack of financial incentives/policy

Adoption decision linked to level of farmer understanding

**More research needed**

## WP2: Developing a network of researchers and stakeholders



21 interviews completed

- 2 were with silvopasture experts

Aim: To understand what is currently occurring in forage systems and explore the motivators and infrastructure required to improve them.

**Core Theme 1:** Emerging underutilised forage crops, evidence gaps and barriers to progress utilisation.

**Core Theme 2:** Effective methods to achieve forage systems that have greater productivity and are sustainable.

**Core Theme 3:** Ideas and examples of improved forage systems alongside other management systems.

**Core Theme 4:** Public good drivers.

- All stakeholders contacted want to be involved with the network

Stakeholder group	Number of interviewees
AgriChem manufacturers	1
Consultants/Agronomists/Advisors	3
Farmers	3
Fertiliser manufacturers	1
Laboratories	1
Livestock nutritionists	4
Machinery company	1
Seed breeders	2
Silvopasture experts	2
System-wide experts	1
University/Research	2
<b>Total</b>	<b>21</b>



# Forage crops currently utilised

*Most common: Grass, herbal leys/mixed swards, maize*



**Mixed swards:** not seen to persist in semi-intensive to intensive grazing systems.

- Clarity needed regarding the nutrient value of individual or mixed swards

**Ryegrass:** usage reduced, remains in the herbal leys as a small proportion of the whole seed mixture.

**Bird's-foot trefoil:** in mixed swards seed mixes out-competed by grasses, clovers, plantain and chicory.

**Chicory:** reduced amount in seed mixes due to its dominance.

**Fodder beet:** not providing a balanced diet, causing it to be difficult to manage. Paradoxically, fodder beet was also praised by others for its high yields and was used to replace kale as a forage crop.

**Kale:** difficult to strip graze due to its growth height meaning cows were less likely to eat them and resulting in issues for the following crop.

**Lupins, triticale, pulse and cereal crop mixes:** avoided due to their varying ripening times.

Main providers: AHDB recommended lists and seed companies

## Gaps

- Applied research (more done in Ireland and New Zealand), particularly for warmer, wetter winters and hotter, drier summers → **caution for applicability to the UK**
- “...grass is a very different beast from what it was 40 years ago...we’ve got these high sugar varieties now which feed and perform a lot better...but they’re all dependent on the weather...even where farms have used high sugar varieties...”*

**Livestock nutritionist**

- Indicators of success
- Utilisation of data

## Opportunities

- ❖ Investigation of different pasture species that could be natural methane inhibitors
- ❖ Examining the emissions intensity of different pasture species
- ❖ Consumer confidence and perceptions for a strong presence in continental markets such as baby formula could be built on as it is perceived to be a nutritious product derived from grass-fed livestock.



# Alternative forage systems



Mob grazing, rotational grazing and bale grazing

*“I'm starting to realise it doesn't matter what farming system you do...if you do it well you'll be OK” Farmer*

## Mob grazing

**Advantages:** Reduced input costs, increased profitability and improved both herd temperament and herd fertility.

**Disadvantages:** Fencing and water infrastructure.

**Next step: ‘Forage system’ needs to be defined.**

*Working towards a silvopasture definition: “Feasible way to integrate trees on farms, without having a significant impact on productivity and output of the farm”*

## Silvopasture – stakeholder opinions

**Perceived advantages:** Shelter for heat stress, reduced inputs

**Perceived disadvantages:** Practicalities of cropping, shading effects, stuck for the long-term

**Next step: More data on economic productivity and environmental benefits.**

# Public good drivers

- Food production for human consumption
  - Increased levels of Omega-3 fatty acids from pasture-fed meat
- Improved soil health
  - To maintain/increase soil organic matter content, water holding capacity and improve drainage
- Landscape/land management care
  - Maintaining aesthetics of the land to benefit mental well-being
  - Protect nature, preserve the local economy, support thriving rural communities

*“I think the health benefits of when you look outside the window and you see your really beautiful landscape that we have shaped...even if you just maintain it as it is now.”* **Consultant/Advisor/Agronomist**

*“...keeping and maintaining vets working and...all the other allied industries having sort of facilities...and food security.”* **Consultant/Advisor/Agronomist**
- Cleaner water and biodiversity

*“...it's making the best use of land where we couldn't grow other human food or fibre crops.”*



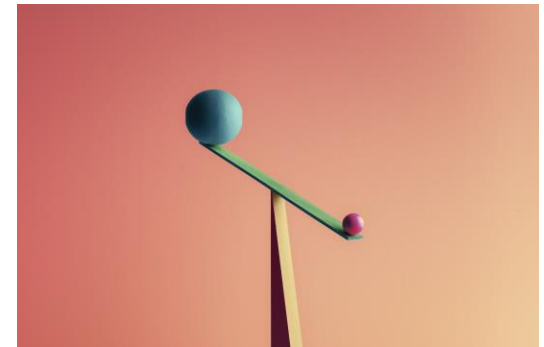


# Trade-offs

- Increased management time
- Soil damage from increased stocking rates
- Affecting the identity of farmers as they gain value in the social license of providing a public good, yet it shifts farmers away from their current operations
- Psychological and financial cost associated with learning curve of implementing something different

*“Whenever you try something new, you always make mistakes and I'm still waiting for the year where I get everything right.”* **Farmer**

- Disturbing permanent pastures which have been storing carbon for a long time → plus potential lack of capacity to sequester more carbon.





# Support needs

- Breeding selection
- Financial assistance
  - To reduce risk for farmers and enable change

*“Because it’s a fairly novel idea, it’s an opportunity for novel thinking, but it should be outputs based.”* **Silvopasture expert**
  - For infrastructure such as temporary or permanent fencing and water pipes
  - Technical support

*“...nutritionists are really just rationing advisors...it’s really hard to find somebody who fully understands the system without external supplements...”* **Consultant/Advisor/Agronomist**

## Who to provide?

- ❖ Levy-boards
- ❖ Government provide the initial push for support through policy-change
- ❖ Industry - collect and share data through case studies and demonstration activities.

**Information dissemination:** Farmer-to-farmer, case studies



Any questions?

The common findings across the literature review and interviews:

- Some species (clovers, chicory, plantain) have received more attention in recent years and are already included in multi-species mixes
- Multi-species swards require specific management to maintain sown species

## Recommendations

- Alternative forage species - more evidence needed in UK agro-climatic conditions
- The introduction of forage species should not be at the expense of production
- A mechanism is required to reduce the risk for farmers





# Road map: Plan of action

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## Strategy:

- Further the understanding and implementation of alternative forage systems

## Goals:

- Maintain the productivity of forage systems while creating a system that is adaptable and resilient to a changing climate and changing market pressures

## Actions:

- Demonstrate species combinations that are able to adapt to heat/drought stress
- Promote the benefits of closed systems and highlight the potential for a reduction in imported/bought-in animal food
- Develop options for farmers to reduce enteric methane emissions
- Outline mechanisms to reduce the farm risk of introducing alternative forage systems/species

# Road map priorities



Research	Development		Knowledge exchange
<ul style="list-style-type: none"> <li>• Fill knowledge gaps identified in literature review – yields, climate resilience of existing and new varieties e.g. agronomic performance, stress tolerance, rooting, persistence.</li> <li>• Assess laboratory techniques to ensure the most effective are used</li> </ul>	<p><u>Sward invigoration</u></p> <ul style="list-style-type: none"> <li>• Understand suitability and availability of alternative species.</li> <li>• Develop management guides for each species e.g. grazing and cutting strategies, fertiliser use.</li> <li>• Develop an understanding of factors and limitations for seed mixes e.g. soil type, rainfall and temperature</li> </ul>	<p><u>Other issues</u></p> <p>Introducing silvopasture systems:</p> <ul style="list-style-type: none"> <li>• Develop an agreed definition</li> </ul> <p>Integrating alternative non-grassland forage crops e.g., fodder beet, kale, maize etc.</p>	<p>Peer-to-peer led:</p> <ul style="list-style-type: none"> <li>• Identify “lighthouse” farms in each region/sector</li> <li>• Farmers to introduce MSS and run demonstration events</li> <li>• Encourage peer-to-peer learning.</li> </ul>

# Road map: Dependencies

## Research

Knowledge gaps

Identify suitable forage species

## Development

Understand species management needs

Develop suitable species combinations

## Knowledge exchange

Introduce alternative forage species on farms

# Suggested timelines for roadmap framework priorities



Theme	Who's involved	Timescale
Research	Academia Industry	10 years
Development	Farmers Industry/supply chain Academia	5 – 15 years
Knowledge exchange	Farmers Advisers Industry Agencies Levy boards	On-going



Time for a break



# Breakout rooms – Key questions

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1. What key goals and initiatives should be included in the road map?
2. What priorities are missing from the review and interview summaries?
3. What are the main barriers to uptake of improved forage systems and what needs to be included in the roadmap to overcome them?
4. What sort of knowledge exchange activities should be included in the roadmap?
5. How best to de-risk the adoption of improved forage systems?
6. Are the suggested timelines appropriate?



# Feedback

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## Next Steps

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- Feedback from the breakout rooms will be included in the development of the roadmap
- Findings from the project will be uploaded to [www.farmpep.net](http://www.farmpep.net)



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**Thank you for your participation.**

**Any further questions, please contact:**

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