An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

Research Stimulus Fund

Final Report

Smart Grassland Systems – Innovative Management Systems to Maximise Resource Use Efficiency in Grasslands (SMARTGRASS)

DAFM Project Reference No: 11/S/147

Start date: 20/01/2013

End Date: 19/01/2018

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Dr Suzanne Higgins, AFBI.

Please place *one* "x" below in the appropriate area on the research continuum where you feel this project fits

Basic/Fundamental → Applied → Pre Commercial

1	2	3	4	5X	6	7

Please specify priority area(s) of research this project relates to from the National Prioritisation Research Exercise* (NRPE) report;

Priority Area (s)	Sustainable Food Production and Processing

Key words: Multispecies swards, sustainable livestock systems, biodiversity, nitrogen fertiliser

1. Rationale for Undertaking the Research

Grass is generally regarded as fundamental to sustainable livestock production systems. Approximately 135 grass species are known to occur in Ireland (Feehan et al., 2012). However, agricultural improvement of temperate grasslands over the last ~50 years, has largely focused on the simplification and homogenisation of swards by reducing their botanical diversity through reseeding, and overcoming insofar as possible, natural constraints to grass growth through processes such as draining, fertilising and liming.

Most of the agricultural grassland research over the same period has focused on the use of perennial ryegrass *Lolium perenne* L. (PRG) and this species currently accounts for approximately 95% of annual forage grass seed sales in Ireland (DAFM, 2021). There are many good reasons for this, not least of which are its ability to produce high yields of good quality forage, adaptability to a range of growing conditions (McDonagh et al., 2016), ability to recover quickly following defoliation (Lee et al., 2010) and reliable germination. However, it is a nutrient hungry species that requires high inputs of nitrogen (N) in particular, to achieve its agronomic potential. Where it does not receive its required N inputs, it is quickly lost from the sward (Sheridan et al., 2008).

Fertiliser N represents a very significant (and increasing) direct cost to farmers; N losses to the wider environment can result in pollution, loss of biodiversity and elevated levels of the noxious Green House Gas (GHG) nitrous oxide (N_2O). Therefore, continued reliance on grassland systems that are fundamentally dependent on high levels of fertilizer N is neither economically nor environmentally sustainable or indeed socially acceptable.

Therefore, the overarching objective of the SmartGrass project was to identify other sward types that could produce comparable levels of good quality dry matter as PRG swards but requiring lower N inputs to achieve this. The project also sought to determine the performance of these alternative sward types under animal grazing and their impact on animal performance, their potential to produce good quality silage, and their impacts on soils and biodiversity relative to perennial ryegrass monocultures.

2. Research Approach

A review of the available scientific literature was undertaken to identify species other than perennial ryegrass (PRG) that showed agronomic potential. The outcome of this process was the identification of species from three plant functional groups i.e. grasses, legumes and forage herbs. These included: grasses – Timothy (*Phleum pratense*), Cocksfoot (*Dactylis glomerata*); legumes – white clover (*Trifolium repens*), red clover (*Trifolium pratense*) and greater birds foot trefoil (*Lotus pedunculatus*); forage herbs – chicory (*Cichorium intybus*), ribwort plantain (*Plantago lanceolata*) and yarrow (*Achillea millifolium*).

A plot experiment was established at UCD Lyons Farm (53°18'N, 6°32'W) in August 2013. Plots were sown with 1-9 species from the three functional groups, included in different proportions in the seed mixture. The performance of the different sward types was investigated under 0, 45, 90 and 135 kg N ha^{-1} yr^{-1} and compared with perennial ryegrass monocultures receiving 250 kg N ha^{-1} yr^{-1}. Plots were harvested 8 times over the growing seasons in 2014-16 and dry matter yield, herbage quality, abundance of unsown species, sown species persistence and invertebrate diversity were measured.

An additional 20 larger (10x10m) plots were established to investigate the impact of cattle grazing versus cutting on the species yield and composition of 5 sward types i.e. 1) PRG monoculture (250 kg N ha^{-1} yr^{-1}), 2) PRG monoculture, 3) PRG and white clover, 4) 6 species mix (grasses and legumes), 5) 9 species mix (grasses, legumes and forage herbs), with each of sward types 2-5 inclusive receiving 90 kg N ha^{-1} yr^{-1}. Dry matter yield, herbage quality and species persistence and unsown species were recorded across plots during 2015 and 2016.

A farmlet experiment to investigate the impact of different sward types on animal performance was established at UCD Lyons Farm in September 2014. The four sward types included: 1) PRG monoculture (163 kg N ha^{-1} yr^{-1}), 2) PRG and white clover, 3) six species (PRG, timothy, white and red clover, chicory and ribwort plantain, 4) nine species (the same 6 species that were included in the previous mix plus cocksfoot, greater birdsfoot trefoil and yarrow). Sward types 2-4 inclusive received 90 kg N ha^{-1} yr^{-1}. Each farmlet was 2.4ha and was managed in a 5 paddock rotational system, stocked with 30 twin-rearing ewes at a stocking rate of 12.5 ewes ha^{-1} and grazed following a leader-follower system. During 2015 and 2016 sward performance was measured through dry matter yield and herbage quality; animal health and performance was measured through lamb live weight, body condition score and faecal egg count (FEC) which were recorded fortnightly, with lambs drafted for slaughter at 45kg. Ewe live weight and body condition score were recorded on five occasions annually.

Two further plot experiments were established at the Teagasc Research Centre, Grange (53.52ºN, 6.66ºW) to investigate multispecies swards consisting of the same species as listed above, in terms of their yield, chemical composition, ensilage characteristics and persistence compared to grass and red clover monocultures and grass-red clover binary mixtures. These experiments were also designed to determine if any / all of the traits listed above were similarly influenced across sward type, by altering management practices such as rate of inorganic N input, number of spring grazing rotations and timing of harvest for first cut silage.

3. Research Achievements/Results

Findings from plot experiments at UCD Lyons Farm:

- Five of the mixtures tested showed the capacity to produce higher annual herbage when receiving 90 or 135 kg N ha^{-1} yr^{-1}, when compared with PRG monocultures receiving 250 kg N ha^{-1} yr^{-1}. Legume content of the mixtures is essential to achieving these yields at lower N fertiliser input rates.
- In spring and autumn, the high legume containing mixtures demonstrated the highest levels of dry matter production and therefore did not compromise the seasonal distribution of herbage production.

- Multispecies mixtures had a lower dry matter and a higher ash content than grass only swards, and all legume containing swards had a higher crude protein than grass only swards.
- Encroachment by unsown species wasn't a particular problem across any of the mixtures except the PRG monocultures receiving 0 N ha^{-1} yr^{-1}. However, this was mainly encroachment by unsown legumes, which rapidly decreased as the rate of N fertiliser increased. Mixtures which were sown with at least 30% legume had least weeds at low N application rates. However, it is worth noting that this plot experiment was established in land that had previously been under long-term tillage rather than grassland.
- The proportion of dry matter from herb species in particular, decreased significantly between 2014 and 2016.
- Earthworm activity (as indicated by numbers of surface casts) was higher in the legume containing swards (PRG & WC, six and nine species multispecies) compared with PRG only swards and this in turn resulted in a significant increase in water infiltration rates. Legume inclusion in swards resulted in increased biomass, abundance and species richness of earthworms. Increased plant functional group richness resulted in increased insect abundance and diversity.
- Modelled estimates of nitrous oxide emissions, based on sward DM yield, type and timing of N fertiliser inputs, indicated that emissions associated with the legume containing swards (PRG & WC, six and nine species) managed at 90 kg N ha^{-1} yr^{-1}, were approx. 10% of those associated with the PRG swards receiving 250 kg N ha^{-1} yr^{-1}.

Findings of the grazing v's cutting experiment at UCD Lyons Farm:

- Biomass production was greater from the legume containing swards i.e. PRG & WC and the two multispecies swards, compared to the PRG only swards at the same N application rate.
- Annual dry matter production was higher under simulated compared with actual grazing for the PRG & WC, and both multispecies swards. However, method of defoliation did not impact herbage production from the PRG only swards.
- The proportion of sward DM from herb and legume components showed a greater decrease under grazing compared with cutting.

Findings from the farmlet experiment at UCD Lyons Farm:

- Ewes grazing the multispecies swards were heavier and in better condition throughout the production cycle compared to ewes grazing the PRG monocultures.
- Lambs grazing the PRG & white clover swards, the six and nine species mixes were heavier at weaning than lambs grazing the PRG only swards. This subsequently translated into a reduced time to slaughter i.e. approx. 2 weeks.
- Lambs grazing the six and nine species swards required less chemical anthelmintics than those grazing PRG only swards. This translated into an approx. 50% reduction in the case of the six species swards.

Findings from the plot experiments at Teagasc, Grange

- Under favourable ensiling conditions, multispecies mixtures preserved comparably well relative to PRG. However, when conditions were challenging prior to ensiling, multispecies mixtures preserved more poorly than PRG.

- Silage dry matter digestibility (DMD) was primarily influenced by the DMD of the herbage pre-ensiling. However, when conservation losses were high, the silage DMD was negatively affected.
- The application of inorganic N had no measured effect on the ensilability or fermentation of the multispecies mixtures.
- The ensilability of grass-red clover binary mixtures was not readily predicted from the ensilability of their constituent species in monoculture.
- Delaying the date of the primary growth harvest increased yield and decreased digestibility of herbage from all sward species treatments. However, the rate of digestibility decline was slower in binary and multispecies mixtures compared with grass monocultures.

4. Impact of the Research

Agricultural reliance on high levels of chemical inputs such as nitrogen fertilisers to support and enhance productivity is not sustainable or indeed socially acceptable. The Farm to Fork Strategy reflects this, with a requirement for Member States to decrease fertiliser usage by 20% by 2030. The EU Biodiversity Strategy (EC, 2020) also recognises the threat of intensive agricultural practices to biodiversity and lists a significant increase in the adoption of agro-ecological practices as a key commitment to help address loss of biodiversity from farmed land. From a GHG perspective, agriculture accounted for approximately 37.1% of Irish national emissions in 2020 (EPA, 2022). The Climate Action Plan includes an emissions reduction target of 22-30% for Irish agriculture by 2030 and a core measure to achieve this is to reduce chemical nitrogen use on farms to <350,000 tonnes by 2025 and <325,000 tonnes by 2030. These examples illustrate the pressures that are on the agricultural sector to reduce its reliance on fertiliser N inputs.

To the best of our knowledge SmartGrass was the first nationally funded research project (certainly in recent times) to investigate the agronomic and environmental potential of multispecies swards. The findings from SmartGrass have started a national shift with respect to both grassland research and farming. These findings have demonstrated that a modest increase in sward species richness (a relatively small number of carefully selected species) can provide a biological tool to help address a number of the challenges facing livestock production systems through facilitating a shift from high input – high output to low input-high output systems.

The impact of SmartGrass is clearly demonstrated by the rapidly increasing numbers of farmers sowing multispecies swards over the last 3-4 years. In addition, establishing multispecies swards has recently been incorporated as a measure within the Results Based Environment Agri Pilot Programme – REAP. Furthermore, the Minister for Agriculture, Food and the Marine, Charlie McConalogue TD announced that grant aid to support the planting of multispecies swards would be implemented as part of his Departments 2022 budget commitments.

4(a) Summary of Research Outcomes

(i) Collaborative links developed during this research

SmartGrass facilitated the deepening of existing collaborations and development of new collaborative links between the participating researchers and research performing organisations. From a research perspective, these links have given rise to further collaboration on a number of more recent research projects e.g. the DAFM funded SmartSward and FaSTEN projects. SmartGrass also resulted in the development of strong international collaborative links e.g. through The Global Farm Platform. Furthermore, the dissemination of outputs and learnings from SmartGrass has resulted in the development of strong industry and farmer collaborative links.

(ii) Outcomes where new products, technologies and processes were developed and/or adopted

To the best of our knowledge, most Irish seed companies would not have had multispecies seed mixes in stock 5 years ago. However, this has changed due to the rapidly growing interest by farmers in establishing these swards.

(ii) Outcomes with economic potential

N/A

(iv) Outcomes with national/ policy/social/environmental potential

As outlined above, the agri-sector is facing very significant challenges in terms of reducing its agri-environment footprint. This includes national, EU and global policy commitments. The findings from SmartGrass have demonstrated the potential of multispecies swards as a biological tool to help address many of the targets required, while not compromising sward productivity or quality.

4 (b) Summary of Research Outputs

(i) Peer reviewed publications:

Shnel, A., Tracy, S., Schmidt, O., Murphy, P., Lynch, M.B., Grace, C., Boland, T.M., Sheridan, H. (2021) The importance of forage legume inclusion in agricultural swards to enhance earthworm activity and water infiltration rates. Proceedings of: International Grassland and Rangeland Conference 2021 https://uknowledge.uky.edu/igc/24/4/4/

Moloney, T., Sheridan, H., Grant, J., O'Riordan, E.G., O'Kiely, P. (2021) Conservation efficiency and nutritive value of silages made from grass-red clover and multispecies swards compared with grass monocultures. Irish Journal of Agricultural and Food Research Vol.59(1): 150-166.

Moloney, T., Sheridan, H., Grant, J., O'Riordan, E.G., O'Kiely, P. (2021) Yield of binary and multispecies swards relative to single species swards in intensive silage systems. Irish Journal of Agricultural and Food Research vol 59(1): 12-26.

Moloney, T., Sheridan, H., Grant, J., O'Riordan, E.G., O'Kiely, P. (2020). Herbage nutritive value of binary and multispecies swards relative to single species swards in intensive silage systems. Irish Journal of Agricultural and Food Research vol. 59(1): 167-184.

Grace, C., Lynch, M.B., Sheridan, H., Lott, S., Fritch, R., Boland, T.M. (2019) Grazing multispecies swards improves ewe and lamb performance. Animal 13:8 pp 1721-1729.

Grace, C., Boland, T.M., Sheridan, H., Brennan, E., Fritch, R., Lynch, M.B. (2019) The effect of grazing versus cutting on dry matter production of multispecies and perennial ryegrass-only swards. Grass and Forage Science. https://doi.org/10.1111/gfs.12440

Grace, C., Boland, T.M., Sheridan, H., Lott, S., Brennan, E., Fritch, R., Lynch, M.B. (2018) The effect of increasing pasture species on herbage production, chemical composition and utilization under intensive sheep grazing. Grass and Forage Science https://doi.org/10.1111/gfs.12379

Murphy, P.N.C., Higgins, S., Grace, C., Lynch, B., Tracy, S., Fritch, R., O'Rourke, S.M., Sheridan, H. (2018) Estimated nitrous oxide emissions from nitrogen fertiliser use on multispecies grassland compared to monocultures. The 27th European Grassland Federation General Meeting, Cork, Ireland June 2018. http://hdl.handle.net/10197/10471

Moloney, T., O'Riordan, E., Sheridan, H., O'Kiely, P. (2016) The effects of defoliating grass in winter or spring on herbage yields and ensilage characteristics. *Grass and Forage Science,* doi: 10.1111/gfs.12207.

(ii) Popular non-scientific publications and abstracts including those presented at conferences

Presentations at scientific conferences:

Fritch, R., Schmidt, O., Kirwan, L., Cuddy, H., Duignan, L., Gallone, A., Geraghty, K., Shevlin, K., Sheridan, H (2015) Multispecies grassland swards can deliver increased invertebrate populations while maintaining agricultural yields. Annual Meeting British Ecological Society, 13-16th Dec 2015, Edinburgh, Scotland.

Grace, C., Boland, T., Fritch, R., Sheridan, H., Lynch, B (2016). The effect of grazing multispecies swards on lamb performance and herbage production. The 26th General Meeting of the European Grassland Federation, Trondheim, Norway, 04 Sep 2016 - 08 Sep 2016. The multiple roles of grassland in the European bioeconomy. Proceedings of the 26th General Meeting of the European Grassland Federation. 04 Sep 2016.

Moloney, T., Sheridan, H., O'Riordan, E.G., O'Kiely, P (2016) Nitrogen fertilisation effects on multi-species and *Lolium perenne* yields and composition under silage management. The 26th General Meeting of the European Grassland Federation, Trondheim, Norway, 04 Sep 2016 - 08 Sep 2016. The multiple roles of grassland in the European bioeconomy. Proceedings of the 26th General Meeting of the European Grassland Federation. 04 Sep 2016.

Fritch, R., Grace, C., Lynch, B., Boland, T., Sheridan, H (2016) Plant functional group richness decreases weed invasion and maintains dry matter herbage yields in a simulated grazing experiment. 1st meeting of the Irish Ecological Association, Sligo, 24-26th Nov 2016.

Grace, C., Lynch, B., Fritch, R., Sheridan, H., Boland, T. (2017) The role of multispecies pastures in the sustainable production of sheep meat. International Sheep Veterinary Congress 2017. Proceedings of the International Sheep Veterinary Congress 2017.

Grace, C., Lynch, B., Fritch, R., Sheridan, H., Boland, T. (2017) The role of multispecies pastures in the sustainable production of sheep meat. International Sheep Veterinary Congress. Proceedings of the International Sheep Veterinary Congress, Harrogate, UK May 2017.

Grace, C., Boland, T., Sheridan, H., Kirwan, L., Fritch, R., Lynch, M.B. (2018) Effect of nitrogen on the production of multispecies swards compared to perennial ryegrass only swards. European Grassland Federation Conference. Proceedings of the European Grassland Federation Conference 2018.

Grace, C., Lynch, B., Sheridan, H., Kelly, A., Fritch, R., Lott, S., Boland, T. (2018) More diverse swards improve lamb performance and reduce anthelmintic requirement compared to perennial ryegrass only swards. British Society of Animal Science Annual Meeting. Advances in Biosciences.

Grace, C., Boland, T., Sheridan, H., Fritch, R., Lynch, B. (2018) Actual grazing versus simulated grazing on multispecies swards compared to perennial ryegrass only swards. European Grassland Federation Conference. Proceedings of the European Grassland Federation Conference 2018.

Lynch, B., Grace, C., Sheridan, H., Lott, S., Brennan, E., Fritch, R., Boland, T. (2018) Incorporation of multispecies swards into an intensive sheep grazing system. 10th International Symposium on the Nutrition of Herbivores. Proceedings of the 10th International Symposium on the Nutrition of Herbivores.

Boland, T.M., Grace, C., Lynch, M.B., Murphy, P., Schmidt, O., Lott, S., Brennan, E., Higgins, S., Fritch, R., Sheridan, H. (2019) Multispecies swards deliver multiple benefits in pasture based systems. LEAP Conference (Livestock, Environment and People) 2019 https://www.leap.ox.ac.uk/files/leap19conferenceprogrammepdfpdf

Sheridan, H., Evans, A., Lynch, B., Godwin, F., Baker, S., Murphy, P., Kelly, A., Monahan, F., Jordan, E., Boland, T. (2019) UCD Lyons Farm Long Term Grassland Experiment. LEAP Conference (Livestock, Environment and People) 2019 https://www.leap.ox.ac.uk/files/leap19conferenceprogrammepdfpdf

(iii) National Report

N/A

(iv) Workshops/seminars at which results were presented:

Sheridan, H., Lynch, B., Fritch, R., Murphy, P., Grace, C., Schmidt, O., Boland, T. (2017) Smart Grassland Systems – Biodiversity for Production. Department of Agriculture, Food and the Marine symposium 'Role of Sustainable Grassland in Foodwise 2025'. DAFM, Backweston, Co. Kildare, Ireland, 07-09-2017.

Multi-species sward workshop: Findings and recommendations of the SmartGrass Project. A one-day workshop for a delegation from University of Florida was held in UCD Lyons Farm on 18/07/2017.

(v) Intellectual Property applications/licences/patents

N/A

(VI) Other

Technical articles in popular press:

What you need to know before planting multispecies swards. Irish Farmers Journal 08-05-2021. https://www.farmersjournal.ie/should-you-be-planting-multispecies-swards-on-your-farm-618893

How the plants farmers view as 'weeds' can actually boost grass yields. Farming Independent 16-06-2020. https://www.independent.ie/business/farming/tillage/how-the-plants-farmers-view-as-weeds-can-actually-boost-grass-yields-39287371.html

UCD trials indicate increased ewe milk production and lamb weight gain in flocks grazing multi-species swards. Farming Independent 16-06-2020. https://www.independent.ie/business/farming/agri-business/ucd-trials-indicate-increased-ewe-milk-production-and-lamb-weight-gain-in-flocks-grazing-multi-species-swards-39287377.html

Higher lamb growth rate and less worms when grazing multi-species swards. AgriLand 06-01-2019. https://www.agriland.ie/farming-news/higher-lamb-growth-rate-and-less-worms-when-grazing-multi-species-swards/

Multi-species: Findings form the SmartGrass Project. AgriLand 10-11-2019. https://www.agriland.ie/farming-news/multi-species-findings-from-the-smartgrass-project/

It's not just up to farmers to make positive changes. Paul Murphy. OpEd, Irish Examiner, 21 Oct 2019. https://www.irishexaminer.com/lifestyle/arid-30958533.html

Multi-species swards offer diversity. Irish Farmers Journal 20-03-2019. https://www.farmersjournal.ie/multi-species-swards-offer-diversity-448666

Smartsward – Future Proofing Irish Livestock Sustainability. Slaney Foods. 18-10-2019. https://slaneyfarmers.com/future-proofing-irish-livestock-sustainability/

How can farmers produce more food without more pollution? Soil scientists are looking at ways to reduce Irish farming's reliance on nitrogen fertiliser. Catherine Cleary, Irish Times, Nov 22 2018. https://www.irishtimes.com/news/science/how-can-farmers-produce-more-food-without-more-pollution-1.3704139

Smart Farming New grass trials show a potential 90% reduction in GHG emissions. Farming Independent 23-08-3017. https://www.independent.ie/business/farming/sheep/new-grass-trials-show-a-potential-90-reduction-in-ghg-emissions-36054164.html

Innovative Management Systems to Maximise Resource Use Efficiency in Grasslands. Article in Irish Farmers Monthly, May 2016.

T.V. outputs:

Eco Eye - season 18, episode 2. Aired 14th Jan 2020 RTE1.

Overview of the SmartGrass project and findings which was recorded in Ag House for dissemination as a video as part of the DAFM Science week 2017 initiative.

An overview of the SmartGrass project and findings was presented by the project team for episode 36 of Grassroots, broadcast by Irish TV in 2016.

5. Scientists trained by Project

Total Number of PhD theses: 2

Grace, C. (2018) The Potential of Multispecies Swards Compared to Perennial Ryegrass Only Swards on Dry Matter Yield, Chemical Composition and Animal Performance. PhD thesis submitted to National University of Ireland, University College Dublin.

Maloney, T. (2018) Multi-species swards for silage production. PhD thesis submitted to National University of Ireland, University College Dublin.
Associated PhD thesis:

Total Number of Masters theses: 0

6. Permanent Researchers

Institution Name	Number of Permanent staff contributing to project	Total Time contribution (person years)
University College Dublin	4	2.15
Teagasc	3	1.985
AFBI	2	0.424
Total	**9**	**4.559**

7. Researchers Funded by DAFM

Type of Researcher	Number	Total Time contribution (person years)
Post Doctorates/Contract Researchers	3	5.093
PhD students.	2	7.593
Masters students	0	0
Temporary researchers	0	0
Other	10	4.5
Total	**16**	**17.186**

8. Involvement in Agri Food Graduate Development Programme

Name of Postgraduate / contract researcher	Names and Dates of modules attended
N/A	

9. Project Expenditure

Total expenditure of the project: €603,046.34

Total Award by DAFM: €633,046.53

Other sources of funding including benefit in kind and/or cash contribution(specify): € N/A

Breakdown of Total Expenditure

Category	UCD	Teagasc	AFBI	Total
Contract staff	3915.55			3,915.55
Temporary staff				
Post doctorates	184,184.82			184,184.82
Post graduates	79,851.55	88,000		167,851.55
Consumables	46,058.20	43,617.22	1,465.45	91,140.87
Travel and subsistence	10,197.64	4,298.51	261.12	14,757.27
Sub total	324,206.91	135,915.73	1,726.57	461,850.06
Durable equipment	2,642.11			2,642.11
Other				
Overheads	97,262.33	40,774.72	517.97	138,555.02
Total	**424,111.35**	**176,690.45**	**2,244.54**	**603,047.19**

10. Leveraging

Summarise any additional resources'/funding leveraged by this award from other sources e.g. Additional Staff, National/EU funding secured, EI Commercialisation Fund, etc.

The findings from SmartGrass, lead to the establishment of UCD Lyons Farm Long Term Grazing Platform. This is a nationally and internationally unique research facility which is investigating the potential of multispecies swards, versus PRG & WC and PRG only swards under a dairy calf to beef system. This will further enhance and deepen our knowledge of the potential of multispecies swards under bovine grazing systems. The Long Term Grazing Platform is a participant site in the Global Farm Platform – a global network of research farms investigating ways to enhance the sustainability of livestock production systems.

In 2018, the Department of Agriculture, Food and the Marine awarded >€1.2 million funding for the SmartSward Project. This UCD lead project is a collaboration between UCD, AFBI, TU Dublin and Massey University New Zealand, together with industry partners Slaney Foods and Devenish Nutrition. This project is building on the findings of SmartGrass, to significantly further develop our knowledge regarding the establishment and management of multispecies swards, and to determine their impacts on animal performance. In addition, the Teagasc lead FaSTEN project, also funded by DAFM (in 2019) has strong links to the Long Term Grazing Platform. The research

currently being undertaken by a PhD student funded within this project will further enhance our knowledge and understanding of the impact of different the different sward types on the soil resource and GHG emissions.

Furthermore, a number of UCD SmartGrass academics are collaborating with Devenish Nutrition and Wageningen University on the EU Marie Curie ITN funded Heartland project based on the Devenish lands at Dowth, Co. Meath.

11. Future Strategies

As outlined above, findings from SmartGrass initiated the establishment and development of a globally unique research site, the UCD Lyons Long-term Grazing Platform to address many of the critical sustainability challenges facing livestock farmers.

Research currently ongoing at this site is further investigating the potential of multispecies swards compared to PRG and PRG & WC swards in terms of their agronomic performance and environmental impacts. Future plans include the monitoring of biodiversity, GHG emissions and water quality in response to sward type and associated management practices, while the long-term nature of the site will lend itself to tracking of changes in soil carbon in response to sward type, over time.