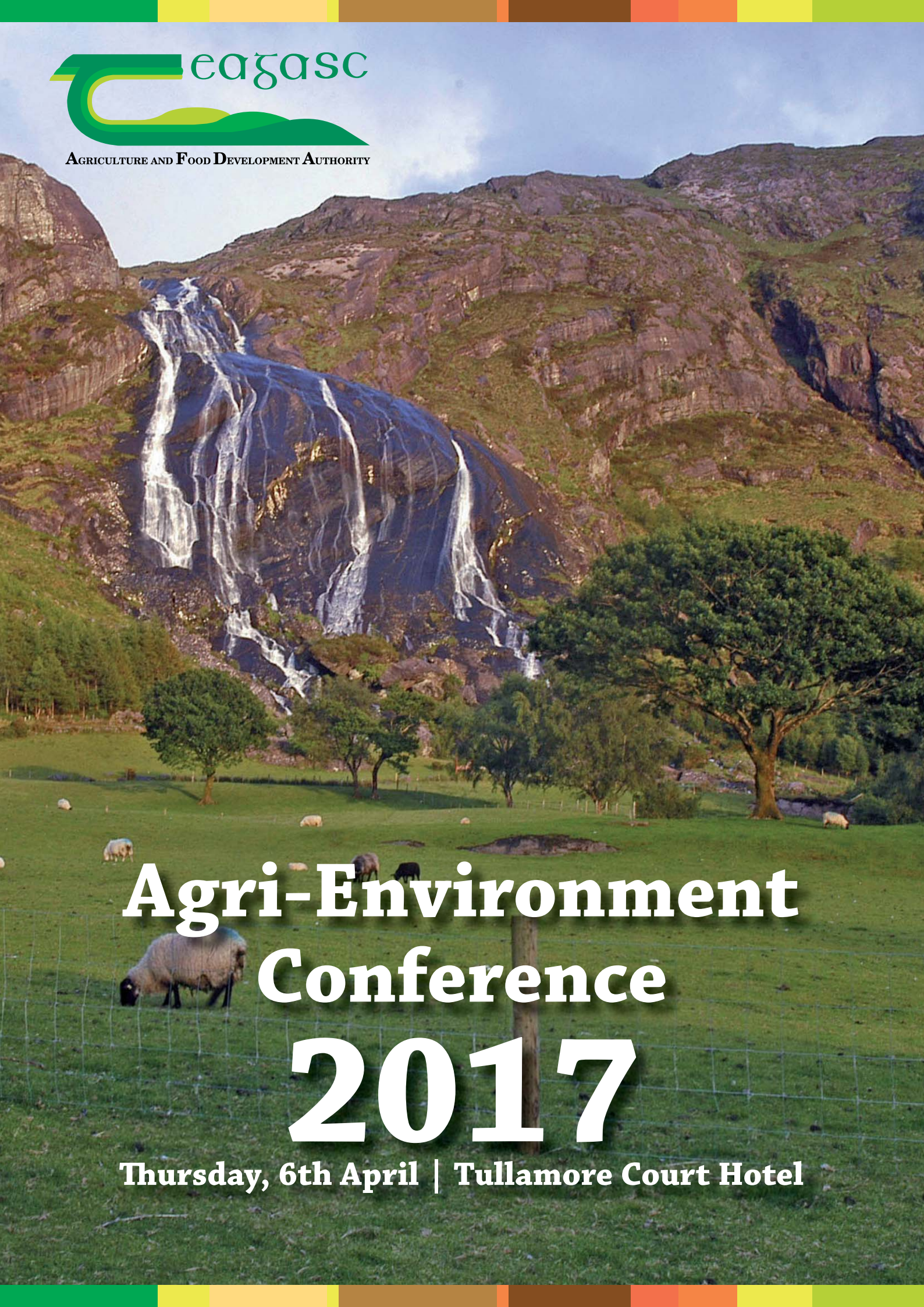
teagasc
Agriculture and Food Development Authority
Agri-Environment Conference
2017
Thursday, 6th April | Tullamore Court Hotel

9.30-9.50 ***Registration/complimentary tea and coffee on arrival.***

9.50-10.00 ***Conference Opening***
Dr. Noel Cawley, Chairman, Teagasc.

Session 1 Sustainability
10.00-11.30

10.00-10.20 **The Irish Dairy Industry Association (IDIA) Sustainability Project.**
Joe Crockett, Chairman of the Dairy Sustainability Working Group.

10.20-10.40 **How to Include Farmland Habitats in Sustainability Assessments?**
Dr. John Finn, Teagasc.

10.40-11.00 **Mitigating Greenhouse Gas and Ammonia in Irish Agriculture.**
Professor Gary Lanigan, Teagasc.

11.00-11.20 **Fertiliser Nitrogen Options: the Yield, Efficiency, Cost, Greenhouse Gas and Ammonia Emission Balancing Act.**
Dr. Patrick Forrestal, Teagasc.

11.20-11.30 **Panel Discussion/Questions.**

Session 2 GLAS
11.30-1.00

11.30-12.00 **Farming The Uplands – Where to From Here?**
Declan Byrne, Teagasc.

12.00-1.00 (5 x 10 min presentations)

Tree and Hedgerow Actions.
Kieran Kenny, Teagasc.

Grassland Actions.
Con Moloney, Teagasc.

Wild Bird Cover.
Colin Finnegan, Teagasc.

Campaign for Responsible Rodenticide Use.
John Lusby, CRRU Ireland TaskForce and BirdWatch Ireland.

NMP Online What's New.
Louis Kilcoyne, NMP Support Team.

1.00-1.45 **Lunch.**

Session 3 Research Updates
2.00-3.00

6 x 10 mins presentations

Farmer Attitudes in Relation to Participation in Agri Environment Schemes.
Paula Cullen, Teagasc.

Environmental Sustainability Indicators (*from The National Farm Survey Sustainability Report*).
Dr. John Lynch, Teagasc.

Use of Bio-Solids in Agriculture.
Professor Owen Fenton.

Water Quality and Biodiversity.
Dr. Daire O'Huallachain, Teagasc.

Assessing the Risk of Phosphorus Transfer in High Status Catchments: Integration of Nutrient Management and Soil Conditions.
Dr. Karen Daly, Teagasc.

***The Sky and the Ground:* Influence of Weather Change on Soil Nutrient Loss.**
Dr. Per-Erik Mellander, Teagasc.

Session 4 Water Quality
3.00-4.00

3.00-3.20 **MCPA and Other Pesticide Threats to Irish Agriculture.**
Dr. Aidan Moody, DAFM.

3.20-3.40 **Water Quality - How can we Achieve Improvement?**
Dr. Jenny Deakin, EPA.

3.40-3.50 **Panel Discussion/Questions.**

3.50-4.00 **Close of Conference.**

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Agri-Environment Conference 2017 – Foreword

You are welcome to the Teagasc Agri-Environment Conference in Tullamore. This conference has become a key opportunity for practitioners, be they advisors or farmers to have an interface with researchers and policy makers. On the one hand this is an opportunity to get sight of research that is going to have an impact on how farmers operate while at the same time providing an opportunity to have an input into the on-going development of policy and farming systems.

Developing a verifiably sustainable agri-food industry is our key challenge. Traditionally the main focus has been to meet legislative requirements in relation to water quality, GHG emissions and bio-diversity. However, the increasing demand from international buyers for products which can be demonstrated to be sustainable is becoming as important a driver as regulation and will in time determine whether Irish produce will be seen as a premium product with a premium price.

The biggest change going forward is a shift from complying with the provisions of regulation to achieving challenging targets in relation to water quality, gaseous emissions (ammonia and GHGs) and in protecting biodiversity. It is now accepted that regulation alone cannot deliver this outcome and that a focus on adoption of change through a combination of regulation and knowledge transfer is the way forward. Getting the right mix of regulation and support is a major challenge.

This conference aims to advance an understanding of some of the key changes emerging and to provide an opportunity to ensure that actions proposed are both practical and cost effective

Pat Murphy

Session 1

Sustainability

The Irish Dairy Industry Association (IDIA) Sustainability Project.

Joe Crockett
Chairman of the Dairy Sustainability Working Group.

Food Wise 2025 as the Govts policy framework for agriculture and agri-industry, sets out a vision of the sector continuing along a sustainable growth path as a strategically pivotal sector of the Irish economy.

On the key issue of sustainability, Food Wise 2025 outlines a new economic and market truth that environmental protection and economic competitiveness are equal and complementary: one will not be achieved at the expense of the other. Furthermore, international markets are now focussed more strongly than ever on environmental sustainability and there is increasing international market demand for environmentally sustainable products. The Irish Dairies Industry Association believes that this trend will accelerate and deepen. Agri environmental sustainability is now a major economic opportunity as well as a major social and statutory responsibility.

Accordingly, the dairy industry/sector has adopted a leadership position within the context and ambitions of Food Wise and Origin Green, and national and international regulatory requirements, to address and overcome sectoral economic and environmental expansion sustainability challenges and develop and implement new strategic approaches to achieve these ends.

In such context and with the foregoing objectives, the IDIA has established a Dairy Sustainability Initiative with pro-active partnership mechanisms which seek to incorporate whole of sector and whole of Govt perspectives and approaches, working with farmers/suppliers and with all stakeholders to develop and implement new approaches to on farm economic and environmental sustainability issues on a multi annual basis to achieve success for the sector and for society in the achievement of on farm environmental and economic sustainability.

The IDIA believes that the Dairy Sustainability Initiative will support and assist with the implementation of the Water Framework Directive (and within this support the Nitrates Action Programme/nitrates derogation negotiations), the Paris agreement on Climate change, the Bio-Diversity directive, and the clean air package as part of sustainable agri expansion as identified in Food Wise 2025 and as part of the evolution of the Bord Bia Origin Green Programme.

How to include farmland habitats in sustainability assessments?

John Finn
Teagasc, Environment Research Centre, Johnstown Castle, Wexford
John.finn@teagasc.ie

Estimating the distribution of High Nature Value farmland in Ireland

The Rural Development Measure of the CAP includes High Nature Value (HNV) farming and forestry systems as one of seven headline Environment indicators, and Member States are required to: identify areas with HNV farming practices in each Member State (by 2006); support and maintain HNV farming through Rural Development Programmes (by 2008), and; monitor changes to the HNV farmland area over time.

Within a Geographical Information System, used values of the following five indicators to estimate the nature value of each tetrad in the country (2 km × 2 km grid): semi-natural habitat cover, stocking density, hedgerow density, river and stream density, and soil diversity. We present the results at the scale of electoral districts (Fig. 1). For further details, see www.high-nature-value-farmland.ie.

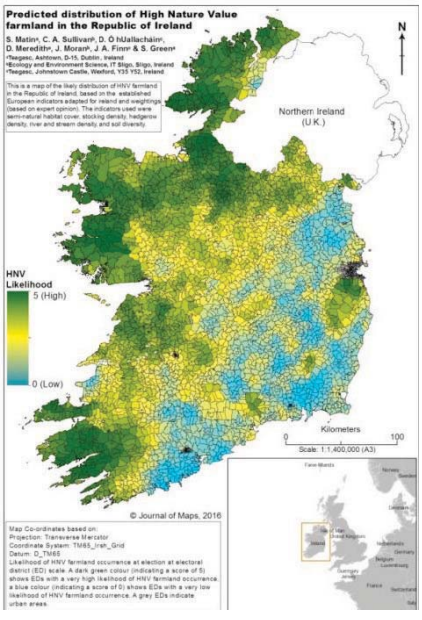

Figure 1. Likelihood of HNV farmland occurrence at electoral district (ED) scale. A dark green colour (indicating a score of 5) shows EDs with a very high likelihood of HNV farmland, a blue colour (indicating a score of 0) shows EDs with a very low likelihood of HNV farmland. A grey colour indicates urban areas. From Matin et al. (2016, Journal of Maps, available as Open Access).

Improved knowledge of the distribution of HNV farmland will allow better evaluation of the extent to which it is being targeted for support, and being maintained or improved.

These data can be used to incorporate estimates of farmland nature value into national-scale models of the impacts on farmland biodiversity through, for example, land use change, climate change, or alternative scenarios for the agricultural sector.

How can farmers with wildlife habitats on their farm get sufficient credit for this in sustainability assessments?

Many sustainability assessments struggle to include and implement assessments of farmland biodiversity. This is despite farmland habitats (e.g. hedgerows, ponds, woodlands and species-rich grasslands) being quite common on Irish farmland (Sheridan et al., 2011, Sullivan et al. 2011), and biodiversity being an important pillar of environmental sustainability. In addition, many Irish agri-food companies are seeking environmental accreditation through benchmarking against internationally recognized standards e.g. Sustainability Assessment Initiative (SAI) Platform.

A common requirement of environmental accreditation standards that include biodiversity is the provision of a farm habitat map.

Traditionally, habitat surveys involve visits to individual farms, which is expensive and time-consuming. Teagasc has been working closely with Bord Bia on a pilot project to develop cost-effective and scalable methods to map farm habitats. Farmers were invited to participate in the project, with a total of 187 dairy, beef and arable farms. Those that accepted agreed to an ecological survey of their farmland. Three separate methods of habitat identification were conducted and compared: 1. the use of orthophotography, 2. the use of orthophotography coupled with farm-level photos, and 3. an on-the-ground habitat survey.

a) b)

Figure 2. (a) Aerial photography is an excellent starting point for identifying semi-natural wildlife habitats. (b) A habitat map was produced that is the starting point for a farm wildlife plan e.g. as required by SAI platform.

Once a habitat map (Fig. 2b) is generated, we can develop a short customised farm habitat plan that can satisfy the requirements of sustainability assessment criteria e.g. Sustainability Assessment Initiative (SAI) Platform. The farm habitat plan contains:

- a habitat map for a farm
- the area of each habitat type on the farm
- general information on the wildlife benefits and important management practices of the habitats that occur on an individual farm
- photos of the habitats that occur on the farm.

Acknowledgements

The IDEAL-HNV project was funded by an award from the Research Stimulus Fund (11/S/108) by the Department of Agriculture, Food and the Marine (DAFM) under the National Development Plan 2007 -2013. The work on farmland habitats was funded by Teagasc, and also supported by Bord Bia.

Mitigating Greenhouse Gas Emissions from Agriculture

Gary Lanigan
Patrick Forrestal
William Burchill
Owen Fenton
Karl Richards
Teagasc, Johnstown Castle, Wexford, Ireland

The **Food Wise 2025** Strategy, envisages substantial increases in agricultural production. Simultaneously national greenhouse gas (GHG) emission and air quality targets require curtailment of GHG and ammonia emissions by 30% and 5%, respectively Significantly, Ireland is unique among the EU countries in that one-third of national greenhouse gas (GHG) emissions originate from agriculture. Indeed, amongst the developed economies, only New Zealand has a higher proportion of national GHG emissions associated with agriculture. In addition, virtually all ammonia arises from the sector.

Agricultural greenhouse gas (GHG) emissions are dominated by methane (CH_4) and nitrous oxide (N_2O), which are 25 times and 298 times, respectively, more effective trapping heat compared to CO_2. Methane emissions are primarily due to livestock enteric fermentation and manure management, while N_2O emissions result from chemical/organic fertilizer application and animal deposition. Ammonia principally arises during the storage and land application of manures and from urea application.

Greenhouse Gas Mitigation

GHG and ammonia mitigation and the application of best management practices can provide some opportunities to optimise production efficiency. For example, ammonia emissions represent a loss of N that could otherwise be available for plant uptake, while methane emissions from enteric fermentation imply a loss of carbon and an unproductive use of energy. This greenhouse gas mitigation research can be placed into three main categories:

- Abatement strategies for reducing enteric methane production
- Mitigation of N_2O and ammonia production from housing systems and agricultural soils
- Carbon sequestration via land management or land-use change.

Abatement of enteric methane is focussed on improving efficiencies in terms of either the amount of production per head (i.e. less animals are required to meet production targets) or improving fertility (reducing the need for replacements). Improving dairy and beef EBI is a particular focus but also increased grazing, improved forage quality and reduced finishing times for beef will contribute to decreasing methane. Ammonia and N_2O mitigation is focussed on slurry additives during storage, efficient use of slurry both in terms of timing and application technique, novel fertiliser formulation, reducing farm N surplus, drainage of wet mineral soils and altering crude protein in animal diets. Greenhouse gas emissions can also be 'offset' by removal of a proportion of CO_2 *via* photosynthesis. Afforestation, optimal fertilisation, water table manipulation of organic soils and cover cropping can either increase soil C sequestration or reduce losses.

Fertiliser Nitrogen Options: The Yield, Efficiency, Cost, Greenhouse Gas and Ammonia Emission Balancing Act

Dr. Patrick J. Forrestal, Dr. Gary J. Lanigan, Dr. Karl G. Richards
Soils, Land Use and Environment Department, Teagasc, Johnstown Castle, Co. Wexford.

Ireland's growing agriculture industry is utilising our national soil and climate resources to produce high quality foods. The production of these foodstuffs underpins an export business worth €10.8 billion in 2015 (Bord Bia, 2016). The sustainability of our production systems is important for differentiating our exports from competitors through the efforts of the Bord Bia Origin Green programme for example. Fertiliser nitrogen is a cornerstone input of many of our production systems. However, fertiliser nitrogen application is associated with emissions of the greenhouse gas (GHG) nitrous oxide (N_2O) and the air pollutant ammonia (NH_3). Ireland has committed to making significant reductions in both of these gaseous emissions in the coming years. As agriculture accounts for ~33% of GHG emissions and ~98% of ammonia emissions it must play a role in efforts to meet reduction targets. Recent research from Johnstown Castle shows that the form of nitrogen fertiliser used on our farms has potential to decrease emissions without reduction of the fertiliser rates which underpin productivity.

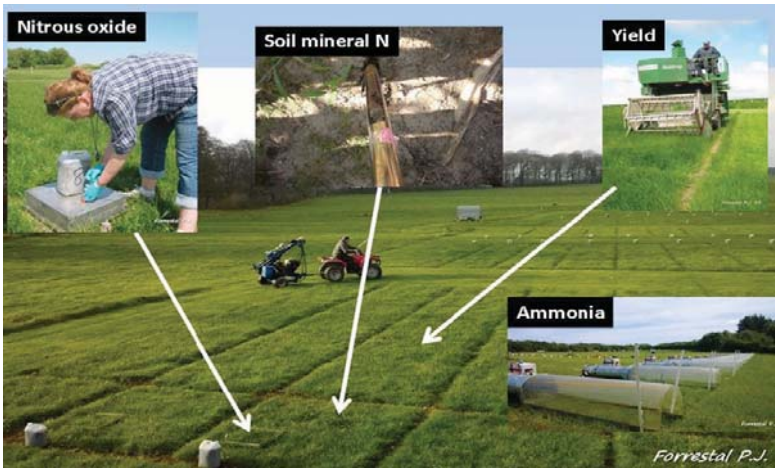

Figure 1. Measurement of the greenhouse gas nitrous oxide, soil mineral N, grass yield, grass nitrogen uptake efficiency and ammonia gas loss as affected by fertiliser nitrogen form (CAN, urea and urea protected with the urease inhibitor (NBPT)).

Yield:

When applied throughout the year CAN, urea and urea protected with the urease inhibitor NBPT gave comparable annual grass dry matter yields (Harty *et al.*, 2017). On average urea was a little better yielding than CAN for spring with 103.5% of the yield of CAN. In contrast, summer applied urea was a little poorer yielding than CAN with 98.9% of the yield of CAN (Forrestal *et al.*, 2017).

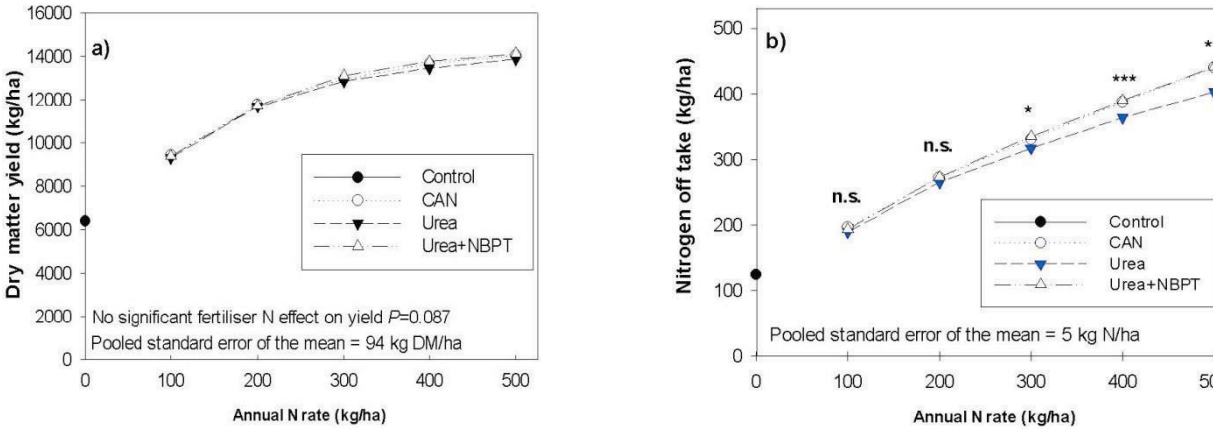

Figure 2. a) effect of fertiliser formulation on grass yield, b) nitrogen off-take efficiency. Based on data from six site-years and 30 individual applications (Forrestal *et al.*, 2017)

Fertiliser N recovery efficiency:

To improve production system sustainability use of fertiliser with high recovery efficiency is desirable. Unprotected urea had lower recovery efficiency compared to CAN and protected urea which had the highest N recovery efficiency (Figure 2b). At lower N application rates (<40 kg/ha/application) differences were non-significant, however as the N rates increased the efficiency gap between urea and the other two products widened (Figure 2b). The practical implications are that:

- Protected urea is consistently as efficient as CAN
- Urea is less efficient during the summer or at higher N rates, e.g. silage.

The greenhouse gas nitrous oxide:

When N fertiliser is applied to soil a portion of this N is lost as the very potent greenhouse gas (GHG) nitrous oxide. Nitrous oxide is c. 300 times as damaging as CO2 emitted from your car and c. 12 times more damaging than the methane emitted by dairy cows for example. Ireland has committed to reducing national greenhouse emissions and the agriculture sector, which is growing and accounts for ~1/3 of these emissions.

Recent research has shown that of the three fertiliser N options CAN has the highest and most variable GHG loss in Irish grassland conditions (Harty *et al.*, 2016). In comparison the urea based options reduce losses of the potent GHG by ~70%.

Ammonia gas:

Ireland has committed to reduce ammonia gas emissions by 5% by 2030. This is a significant challenge for a growing agricultural sector which produces ~98% of national ammonia emissions. When land applied, Urea based fertilisers emit ammonia gas. Urea protected with NBPT has been show to cut ammonia loss by 79% on average compared with untreated urea under Irish conditions (Forrestal *et al.*, 2016). The result is that ammonia loss from protected urea was not significantly different to CAN which has minimal ammonia gas loss.

Summary

Each fertiliser N option has strengths. However, based on research in Irish grassland conditions, across 3 contrasting soils and 2 years, protected urea fertiliser (urea + NBPT) is a very promising option for an agriculture industry seeking to grow sustainably.

	CAN	Urea	Urea + NBPT
Cost of N	★★★½	★★★★★	★★★★
Yield	★★★★★	★★★★½	★★★★★
N recovery efficiency	★★★★★	★★★½	★★★★★
Greenhouse gas	★★	★★★★★	★★★★★
Ammonia gas	★★★★★	★★	★★★★½

Acknowledgements

This research was supported under the National Development Plan through the Research Stimulus Fund administered by the Department of Agriculture, Food and the Marine (Grants RSF10-/RD/SC/716 and RSF11S138) and from the Department of Agriculture and Rural Development for Northern Ireland and by the Teagasc Walsh Fellowship Scheme.

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Session 2

GLAS

Information and photos used in the session on GLAS have been taken from GLAS Course material prepared in conjunction with BirdWatch Ireland, Bat Conservation Ireland, Irish Seed Savers Association, Woodlands of Ireland and the Native Woodland Trust

Farming the Uplands – Where to from here?

Declan Byrne[a], Catherine Keena[b], Fergal Maguire[c], Helen Sheridan[d] and Monica Gorman[e]
a Teagasc Adviser, Tinahely, Co Wicklow; b Teagasc Countryside Management Specialist, CELUP; c Teagasc, Navan, Co Meath; d,e University College Dublin, Belfield, Dublin 4.

Take Home Messages

- Timing of grazing and number of grazing days on uplands is critical to sustainable management
- Economic returns is the main driver for grazing the uplands
- Income from all schemes (BPS, ANC, Greening and GLAS) should be included when examining the economics of hill sheep, to advise and lead hill sheep farmers in the correct direction as these payments could become dependent on farmers grazing the uplands.
- Farming the uplands is the only way to manage the uplands to achieve the three pillars of sustainability - social, economic and environmental.
- Locally Led Agri-Environmental Schemes should be seen as an opportunity to trial new innovative ways of dealing with upland farmers and providing financial aid that will actually result in sustainable management on the uplands into the future.

Introduction

In 1975 the Less Favoured Areas (LFA) scheme was introduced in Ireland as part of the Common Agricultural Policy (CAP). Farmers in these areas were eligible to receive payments per head for livestock including cattle and sheep. The main aim of the scheme was to provide a reasonable level of income to farmers who farmed in areas with natural disadvantages (MacDonald et al., 2000). However, overgrazing in the upland regions became an issue in the early 1990s mainly as a consequence of increased stocking rates that ensued following the introduction of headage payments (Buckley et al., 2009; Acs et al., 2010).

Commonage Framework Plans (CFP) were introduced in 1998 in order to address the issue of overgrazing. Over 4,000 CFPs were drawn up and required all commonage farms to farm according to the specifications of the plans and to undertake compulsory destocking on all commonages (Buckley et al., 2009). In 2005 the introduction of decoupled payments under the Single Payment Scheme (SPS) also reduced the incentive to put sheep onto commonage land (Van Rensburg et al., 2009).

At present the traditional agricultural activity of hill sheep farming is in decline. Stock numbers on commonages have being falling significantly over the past 15 years and will continue to do so into the future if the current problems are

not addressed. Department of Agriculture Food and the Marine records show that currently only 8,500 commonage farmers have sheep and of those, only 6,000 actually have mountain breeds such as the Scottish Blackface or Wicklow Cheviot. While some cattle do graze commonage, there appears to be many farmers currently claiming direct payments on commonage under the Basic Payment Scheme (BPS) who are not grazing these areas. According to Monaghan (2015), 50% of farmers who declared commonage on their SPS applications never actually used it. In order to qualify for BPS, Greening, Green Low-Carbon Agri-Environment Scheme (GLAS) and Areas of Natural Constraint (ANC), these areas require the continuation of active farming and are likely to be deemed ineligible for future payments unless farming practices change, such that commonage land is maintained in Good Agricultural and Environmental Condition (GAEC). It is worth noting that farmers can receive BPS and Greening on commonage land even where they don't have sheep provided the land is maintained in GAEC. However it appears inevitable that vast tracts of commonage will become ineligible due to low levels of farming activity. This will financially affect both shareholders not using the commonage and also those who currently use it. Consequently, there is a danger that these areas will become completely abandoned because market returns from hill sheep production are not economically justifiable in the absence of income supports.

Wicklow Uplands Study

In 2015, Teagasc completed a study with farmers in the Wicklow Uplands to quantify what farmers were actually doing with their upland areas and the reasons why. From a potential population of 317 farmers who have access to commonage, selection of farmers was guided by those who had an existing relationship with Teagasc. Interviews of approximately one hour were conducted with 60 farmers at their residence. Table 1 gives the age profile of the farmers which does not differ significantly from the age profile of the general population of Irish farmers. However, the CSO (2010) found that 6.2% of farmers were under the age of 35 whereas in this study's population no farmers under the age of 45 were found.

Table1. Age of farmers who participated in the survey

Age	Number of respondents	% of respondents
Under 39	0	0%
40 – 49	10	17%
50-59	29	48%
60 – 69	16	27%
70+	5	8%

Of the 60 respondents, 57% were full time farmers with 43% operating their farms on a part time basis. A total of 60% of the farmers were in either the REPS or AEOS agri-environment scheme. Average commonage share was 51 ha on an average total commonage size of 305ha. The amount of private land owned averaged 32 ha. The number of shareholders on a commonage varied from two to 21 with an average number of eight.

Current levels of activity on the uplands

Table 2 shows that while all the farmers in the survey were declaring the land as forage area for payments, only 41% of the farmers in this study actually grazed any stock on it. This compared to 83% who were grazing it in 1999 (15 years earlier). Table 2 also shows that farmers are now grazing the uplands for a shorter period of the year, with only 18% of farmers grazing these areas for 6 months or more (compared to 70% in 1999). Six months (+) grazing would be regarded as traditional practice in the area and is now a requirement for participation within GLAS.

Table 2. Farmer use of the upland

Year	Farmers declaring upland for Agri schemes	Farmers actually grazing the upland area	Farmers grazing the upland up for 6 months or more
2014	100%	41%	18%
1999	100%	83%	70%

The study also found that between 1999 and 2014, 66% of the farmers had either reduced their numbers of sheep grazing the uplands or stopped grazing altogether, and a further 16% had done so in the 5-10 years previous to 2014. Table 3 shows the dramatic drop in sheep numbers grazing the uplands, but especially in the early summer and winter periods. This study shows that while there are fewer farmers using the uplands than in the past there has also been a very big decrease in the numbers of sheep and the length of time they spend grazing on the upland areas than just looking at farmer numbers alone would suggest.

Table 3. Sheep numbers grazing upland areas in 2014 and 1999 and % change

Time of year sheep spent on commonage	2014	1999	% change
Ewes and lambs on hill (May-July)	856	5082	-83%
Ewes on hill after weaning (Aug-Oct)	3822	8312	-54%
Ewes on hill after Mating (Dec-Feb)	1602	4832	-66%
Dry ewes and hoggets (February-July)	1238	2377	-47%

Reasons for reduction in sheep grazing the uplands

The next important question is why there are now fewer sheep grazing the uplands. Table 4 lists all the reasons given by the farmers in the survey (some similar answers were grouped together).

Table 4. Reasons given by farmers for, why they graze less sheep on the uplands.

Reason	% of farmers who mentioned this reason
Sheep losses on the uplands	43
Poor economic return	43
Reduced lamb performance	33
No market for light hill lambs	29
Smaller lamb crops	18
Hills are overgrown	18
Farmer was told to destock	15
Farmer keeping less stock & doesn't need the grazing	11
Labour issues	9
Age	4

The top five reasons quoted by farmers for putting fewer sheep to the uplands all relate either directly or indirectly to economic return. Age was not seen by the farmers themselves as a major reason for not putting sheep to the uplands. Similarly, labour was not regarded as an issue, but the study found a direct relationship between off-farm employment and grazing the uplands, with 58% of those with no off-farm employment putting sheep to the hill compared to just 27% of those with off-farm employment. There was no relationship between age, area of upland, area of enclosed holding or even being in an agri-environmental scheme (AEOS or REPS) and grazing the uplands.

Current levels of output from the uplands

Table 5 indicates that there are greater losses of ewes on farms that graze the uplands and there are a significantly lower number of lambs weaned. The study also found that the more time spent grazing the uplands, the lighter weight the lambs are sold at. This study did not examine costs or profitability on the farms, but Teagasc e-Profit Monitor results for 2015 show a gross margin from hill sheep €30 per ewe, and a net margin of €0.

Table5. Usage of commonage and lambs weaned per ewe

	No longer using Commonage	Only grazing ewes after weaning	Grazing ewes & lambs and weaned ewes
Ewe losses	3%	11%	11%
Lambs weaned per ewe	1.35	1.24	0.92

Condition of vegetation

Almost all of the respondents (93%) stated that heather had increased on their commonage in the last 15 years. The majority of farmers (63%) stated that bracken cover had increased on their commonage while 22% of respondents felt that the proportion of grassland had decreased on their commonage. Table 6 presents the reasons the farmers gave for the vegetation changes on the commonage (answers grouped under four main headings). Lack of burning was regarded as by far the biggest issue, with reduced grazing being the only other issue they raised.

Table 6. The factors that have led to commonage being in this condition

	% of Respondents
No burning of vegetation on commonage	89%
Less sheep grazing commonage throughout the year	58%
Less sheep in early summer grazing commonage	40%
Less sheep grazing on commonage in winter	14%

Where To From Here?

A guiding principle to meet sustainability goals within FoodWise 2025 will be that environmental protection and economic competitiveness be considered as equal and complimentary; one will not be achieved at the expense of the other. The three pillars of sustainability – social, economic and environmental – are equally important and carry commensurate weight. FoodWise 2025 Strategic Environmental Assessment Report recognises under-grazing as a threat to Natura 2000 sites. These lands offer key values in terms of quality and an opportunity for Ireland's agricultural produce to be linked to and marketed as a high-end environmentally sustainable product. Farmers with Natura uplands (Special Areas of Conservation) are obliged to maintain their uplands in Favourable Conservation Status. Article 6(2) of the Habitats Directive sets out the requirements of Member States, that within European sites, they maintain and restore those habitats to Favourable Conservation Status (FCS). While there are currently areas of undergrazing and overgrazing, overall the priority for the future must be to increase farming activity on the upland areas in order to keep these areas in a suitable agricultural and environmental condition. This will involve increasing numbers of grazing animals on the actual upland areas and vegetation rejuvenation in some areas.

Management of the Uplands

Grazing uplands at a sustainable level is the ideal management for farming and biodiversity. Intervention to rejuvenate overgrown vegetation should only be considered if it is the plan to follow this with a sustainable grazing programme. A

combination of control options may be required. Consultation with the National Parks and Wildlife Service (NPWS) is necessary if carrying out work (Activities Requiring Consent) in Natura areas. A study to identify Best Management of Upland Habitats in County Wicklow was carried out by Tubridy et al (2013). Some of the plant species that may require control in upland areas, discussed in the study are outlined below. Teagasc organised two events in Wicklow in 2016 to demonstrate and discuss Prescribed Burning and Mechanical Management, engaging with all interested stakeholders.

Purple moor grass (*Molinia caerulea*)

Purple moor grass is often called white grass in Wicklow; fedget grass in parts of Kerry; meelic from its habitat marsh place or milic in Irish; and by its Irish name Fionán. It can dominate large areas of blanket bogs. The name purple moor grass comes from the purplish tinge of the plants early in the season. According to the Grasses of Ireland (2012), Molinia grasslands can be recognised by the shiny look of a mountain on a windy day and were considered valuable, compared to the reddish coloured vegetation that indicated a dominance of cotton-grass, which had a lower rental value.

Purple moor grass grows in tussocks and at the end of the growing season, an abscission layer at the base of the leaves similar to deciduous trees, results in the leaves breaking (Feehan *et al.,* 2012) Where grazing levels are low, the leaves shed in autumn build up producing a dense litter layer. This has the potential to smother out other species; hence it is important to prevent such a dense layer from building up. Cattle are more likely than sheep to eat purple moor grass. In addition to grazing levels, timing of grazing is critical for the sustainable management of this species. Purple moor grass has a high grazing value, but only in spring and early summer, whereafter digestibility drops off quickly. Dead material remaining over the winter has negligible nutritional value and is relatively indigestible. Good examples of Purple moor grass dominated habitat will contain other plant species, a habitat for the rare and protected marsh fritillary butterfly (Eurodryas aurinia) or potentially nesting sites for wading birds. Poor examples of this habitat will be dominated by purple moor grass to the exclusion of most other species. Abundance of this species tends to be associated with a reduction in cattle grazing or too frequent burning. As purple moor grass is a fire tolerant species, burning exacerbates the problem.

Bracken (*Pteridium aquilinum*)

Bracken dominated areas are poor for farming and biodiversity in general and tend to harbour ticks. Bracken is toxic to animals MAFF (1984), and spores contain carcinogens. The presence of bracken also increases the rate of soil or

peat erosion. A reduction in cattle grazing and particularly hot frequent fires can enhance the growth of bracken. Asulam (Asulox) is a selective herbicide for the control of bracken. Applied in mid-July to mid-August, it is very effective in killing bracken (average of 98% reduction). A follow up treatment in the second year may be required. Asulam kills all species of ferns and some other plants which may be of importance.

Asulam did not gain EU approval in 2011 and consequently DAFM (as well as the UK authorities) have issued an emergency approval each year since, for the control of bracken in upland areas, for a limited time period (120 days each year). This 120 day period usually commences around June. It is hoped that by 2018 a full (new) authorisation will be in place, when Asulam gets EU approval. Until then the only option is the emergency approval route.

Glyphosphate is a non-selective herbicide and therefore and kills all plants it contacts. It may be used with a weed wiper to target bracken early in summer before plants get too tall to operate in. A second application may be needed in order to control all the bracken plants, including those that were too small at the time of the first application. Cutting/crushing can be useful in getting rid of bracken. It needs to be carried out twice per year, in late June and in Early August, each year for 3 years. On upland sites, because of nesting birds, cutting is not allowed until after the 31st August, so this method alone will not be an option.

Burning in general, speeds up the spread of bracken as the rhizomes are better able to withstand fires than more shallow rooted plants such as heather. But burning does break the dormancy of the rhizome and removes the build-up of decaying bracken plants. This method should only be used as a pre-treatment to other methods such as herbicide application.

Heather (*Caluna vulgaris*)

Where heather is present, the ideal situation for farming and biodiversity is a mosaic of heather and grassland with a good distribution of heather of all ages. If the age distribution is too skewed towards old heather and all grassland areas are lost to a full stand of heather, this is not good for farming or biodiversity. Prescribed burning, in patches, of tall strong heather is recommended, in accordance with the DAFM Prescribed Burning Code. Burning is only recommended when followed with sustainable levels of livestock grazing. Mechanical cutting of heather can be used to make fire breaks and fire control lines for prescribed burning at a later date. For effective fire breaks, vegetation must be cut immediately prior to burning or the cut material removed before burning commences. Vegetation takes about eighteen months to rot down to be suitable as a fire break, if not removed. Cutting out lines of heather can facilitates the planning of patchwork burning.

Gorse / Furze / Whins (Ulex europaeus)

Mechanical control of grose involves the physical removal of the bushes with an excavator, including the roots. This removes existing plants, but others grow back from seed. Bushes are usually heaped in mounds and burned or left to rot. This causes a lot of disturbance to the soil and may not be desirable or allowed on upland or SAC areas. Follow-up treatment is often necessary. Mulching with either a tractor- or excavator-mounted machine chops the plants down to ground level, leaving stumps behind. There are no plants to dispose of, as they are mulched up, but regrowth from the stumps usually occurs, and plants also grow back from seed.

Cutting and stump treatment involves cutting the bushes as low as possible and painting the stumps with a suitable herbicide (Glyphosphate or Grazon 90) immediately to kill the roots. Cut plants have to be removed and heaped in mounds for rotting away or burning. Cutting is usually done using a chainsaw and is quite labour intensive, but may be an option on smaller areas of mature growth. There is no regrowth from treated stumps and with no ground disturbance, seed germination is minimised.

Herbicides can be used to kill mature gorse plants and there are a number of products available. Glyphosphate is non-selective and will kill all plants underneath, while selective products only kill gorse and allow other vegetation underneath to establish. There is still a lot of woody material left behind that takes a long time to rot away. Apply during active growth, generally early summer and ensure the entire plant is saturated. Use a suitable surfactant (wetting agent) to increase herbicide uptake. Herbicides can be used to control new regrowth following any control method. Regrowth is easier to kill and should be treated approximately 12 months after initial control. A selective herbicide for gorse should be used to avoid non-target competing plants.

Feehan, 2013 discusses the burning of gorse, which kills the above-ground stems and leaves entirely if sufficient heat is generated, though gorse seeds germinate with great ease in the bare ground under bushes that have been burnt. Burning is not recommended if the bushes are young as it will stimulate the growth of a forest of young shoots at ground level or from the bases of the stems. As gorse gets older the stems can be as much as 0.3 metre across, and it becomes less able to produce adventitious buds from the base if it is cut or burnt. Burning is a more effective way of clearing mature bushes over fifteen years old. Gorse regenerates prolifically from the seed bank after a fire, and ideally should be kept under control by grazing. The young fresh regrowth which follows burning is very sensitive to herbicides. Repeated burning without follow-up treatment can lead to a dense carpet-like infestation. The best time to burn is between September and November, avoiding the bird-nesting season and also avoiding January-February which results in increased seed germination.

Economic Returns

The main reasons given by farmers in the Wicklow study for reduced sheep grazing on the uplands related to economic returns, so that should be the first issue to be addressed. It has been suggested that there should be a price premium for lambs that were produced from the upland areas based on the environmental benefits to habitats/biodiversity, operated through local hill lamb schemes. This requires much work in setting up and marketing, but could definitely be a long-term option for increasing the profitability of hill sheep farming.

Teagasc profit monitor results for 2015 show hill sheep have a gross margin of €30/ewe, and a net margin of €0/ewe. However, when examining the income from hill ewes, all forms of income should be taken into account, including agricultural and agri-environmental payments received by farmers, i.e., BPS, Greening, GLAS and ANC. When the Single Farm Payment was replaced by the Basic Payment Scheme and the Greening Payment in 2015, entitlements are subject to convergence towards 90% of the 2019 national average. By 2019 all entitlements will have a minimum value of 60% of the national average value. This will result in large increases in money paid to farmers with upland areas, where payments were traditionally low. To put this into perspective and using the data from the farmers who were part of the Wicklow study is set out below. Average area of lowland was 32ha which is roughly the maximum area for payment under the ANC scheme, so it could be drawn down on the enclosed area alone without farming any upland area. The average area of upland/commonage was 51ha, and with an average the GLAS payment of €5,000 over the whole upland area, the average GLAS payment per hectare is of €98. For BPS and Greening, at 2019 rates, this is €150/ha. This gives a payment from BPS, Greening and GLAS on the upland area of €240 per ha.

DAFM Minimum Stocking Rate (SR) on upland areas varies according to the carrying capacity of the land and is available on the Commonage Container on DAFM website. Examples below calculate scheme payments per ewe for 2 hills with different carrying capabilities.

Scheme Payments on upland area = €240 per ha

- If DAFM Minimum SR is1.4 ewes/ha on the uplands – Scheme Payments = €171/ewe
- If DAFM Minimum SR is 2 ewes/ha on the uplands – Scheme Payments = €124/ewe

Because farmers have been receiving payments under BPS and agri-environment schemes on upland areas without putting stock there themselves (provided grazing by some stock occurred) they do not see these direct payments as income

from the hill sheep. If farmers must be actively farming the uplands to be eligible for BPS, ANC and GLAS, then this income can be attributed to ewes grazing on the upland area, which make them very profitable.

Collective Farming

Uplands are predominantly unenclosed, both commonage and privately owned land. Traditionally, farmers worked together herding sheep, gathering, burning, etc., and controlled the numbers of sheep grazing on the uplands in most areas. As farmers moved away from grazing the uplands, this co-operation has diminished. Previous agricultural and agri-environmental schemes have dealt with commonage farmers as individuals, despite the fact they do not farm in isolation from other shareholders. GLAS addresses uplands at commonage level, but deals with individual farmers subject to an overall commonage plan, and can have as little as 50% of the farmers on a commonage in the scheme. Dealing with farmers collectively is key to achieving long-term sustainability on the upland areas both for biodiversity and for farmers. In the Wicklow study, 82% of respondents indicated that setting up a commonage group to discuss management of the commonage would be beneficial to shareholders, with 47% felt that these groups could be used to join agri-environmental schemes in the future. Interestingly, 94% felt that inactive shareholders should also be members of these groups. The new Locally Led Agri-Environmental Schemes currently being developed are an opportunity to examine options for uplands specific to local areas rather than national options designed to target all.

Future Research / Demonstration

In the report on the review of Commonage Lands the Oireachtas Joint Committee on Agriculture, Food and the Marine (2013) recommended that studies be undertaken to assess the effect of changing farming methods, particularly the supplementary feeding of ewes and hoggets, on patterns of under and overgrazing. Tubridy et al. (2013) identified a need for research on grazing regimes to maximise productivity and benefit biodiversity in upland habitats. Applied research to develop advisory guidelines for farming in the hills on grazing, burning / swiping and the treatment of bracken and purple moor grass is also required. A blueprint for hill sheep farming which maximises the profitability and provides sustainable grazing levels is required. A proposal to investigate upland grazing practices through the Teagasc BETTER Sheep Farm programme is being developed. This will focus on management of the upland areas and how they are integrated into the whole farm.

Relevance of Wicklow Upland Study to other areas

There is considerable variation between uplands throughout the country, with varying proportions of blanket bog, wet heath, dry heath and upland grasslands; as well as variations in farming system, farm size and socio-economic factors. In 2015, as part of Teagasc Commonage Management Planning In-Service Training for FRS advisers, discussions with farmers on the Comeragh Mountains in Waterford identified worrying trends similar to the Wicklow study of less ewes and lambs grazing the hill in early summer. While it is recognised that overgrazing is still an issue to be addressed in places, the current overriding concern is the threat of reducing farming activity in the uplands. Both undergrazing and overgrazing occurs in every upland region and often within the same commonage. The Take Home Messages from the Wicklow study have relevance for every upland region.

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Tree and Hedgerow Actions
Hedgerow Rejuvenation

Kieran Kenny
Teagasc.

Hedgerow Rejuvenation 1

Choose suitable Hedgerows

Escaped: suitable for rejuvenation

- Rejuvenate by laying or coppicing

or

- Allow grow into relict hedgerows

Dense Base: no need to rejuvenate - *if stockproof without wire*

- Trim from a wide base with sloping sides

- Leave occasional new whitethorn sapling

Relict hedgerows: unsuitable for rejuvenation

- Leave alone – high wild life value
- Too risky to rejuvenate
- Fence off stock from both sides to prevent deterioration by stock tramping through gaps.

Relict hedgerows

Hedgerow Rejuvenation 2

Laying

three-quarters through the stem.

- A downward angled cut near to ground level

- Use a billhook, axe or chainsaw

- A laid hedgerow must be secured against strong wind and livestock rubbing.

Hedgerow Rejuvenation 3

Coppicing

- Cut stems close to ground level to below 15cm

- Use a chainsaw or circular saw.

- Make a gentle sloping cut to allow water to run off.

- Fill in gaps with new plants – 4 per meter

- Consider livestock reach and future access for machine trimming, when positioning the fence.

- Control competing vegetation as necessary

- For the first few years after coppicing, cut back to 75mm above previous level of cut, gradually shaping into a triangular shape.

New growth comes from below the cut at ground level

Hedgerow Rejuvenation 4

GLAS Specifications

- Coppicing and laying can only take place between 1st September and the 28th February.
- Minimum of 10 m in a single continuous length
- Any plants that die must be replaced during the next dormant season
- All newly laid or coppiced hedges in a grass or tillage field must be fenced off and protected from livestock.
- Plants must be trimmed over the course of the contract to ensure a dense hedgerow develops.
- Grass and other competing vegetation must be controlled

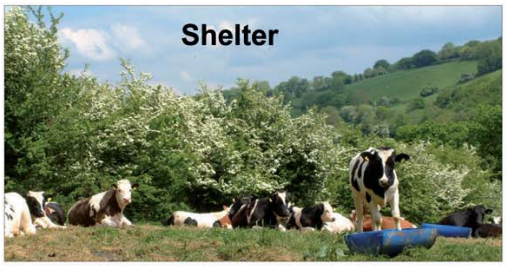
Long-term benefit of Rejuvenated hedgerows

- Stock control
- Shelter
- Wildlife – Cover, nest and hibernation sites

New Hedge Establishment 1

Why

Hedgerow Flora and Fauna



Planting

- Cultivation is essential for optimum growth
- Digging in well-rotted FYM encourages growth

- Protect roots from drying out during planting

- Plant to same depth as previously planted
- Firm in

New Hedge Establishment 2

GLAS Specification

- Double staggered row
- 6 plants per metre

330 mm between rows

330 mm between plants

e.g. 1200 plants in 200 meters

GLAS Hedgerow Species

Holly

Blackthorn

Whitethorn

Plants must be purchased from registered producers.

New Hedge Establishment 3

Pruning and Plastic

- Prune whitethorn to 75mm

Pruning produces multiple shoots

Good weed control allows dense growth at ground level

- Leave occasional whitethorn unpruned to grow up as individual whitethorn tree to flower and fruit – put on a tree guard
- Cut hole or slit plastic around holly and unpruned trees
- Weigh down plastic with inert gravel or press sides of plastic into ground with spade

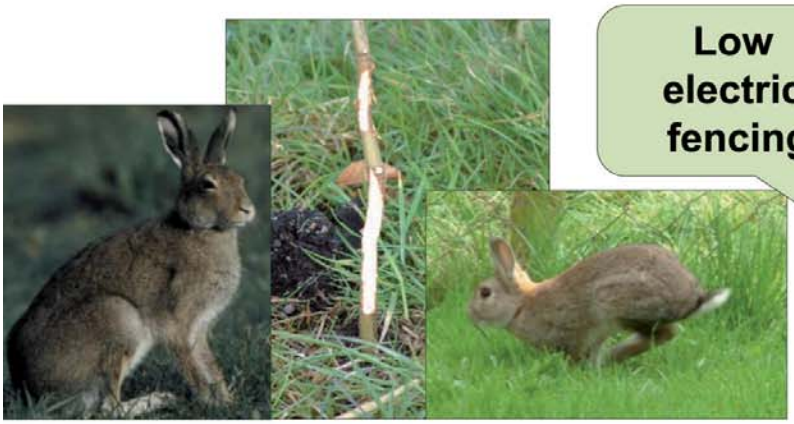
New Hedge Establishment 4

Fencing and ongoing management

- Fence from livestock *until* hedge becomes stockproof
- Fence
  - Stockproof
  - Fit for purpose

Sheep fencing if required

- Protect against hares and rabbits



Low electric fencing

- Cut annually for first few years - close above previous cuts

Plant a grove of trees 1

Biodiversity of a Grove of Trees

Flora

- Trees
- Flowering plants
- Ferns
- Mosses
- Liverworts
- Fungi
- Lichen

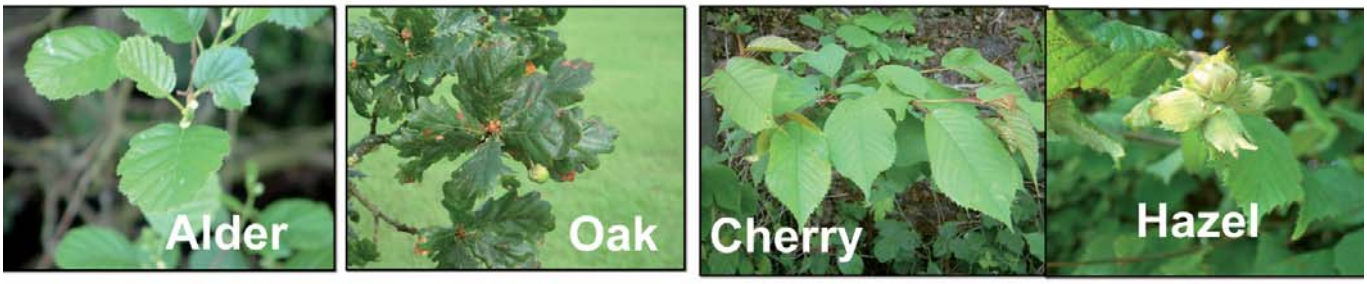
Fauna

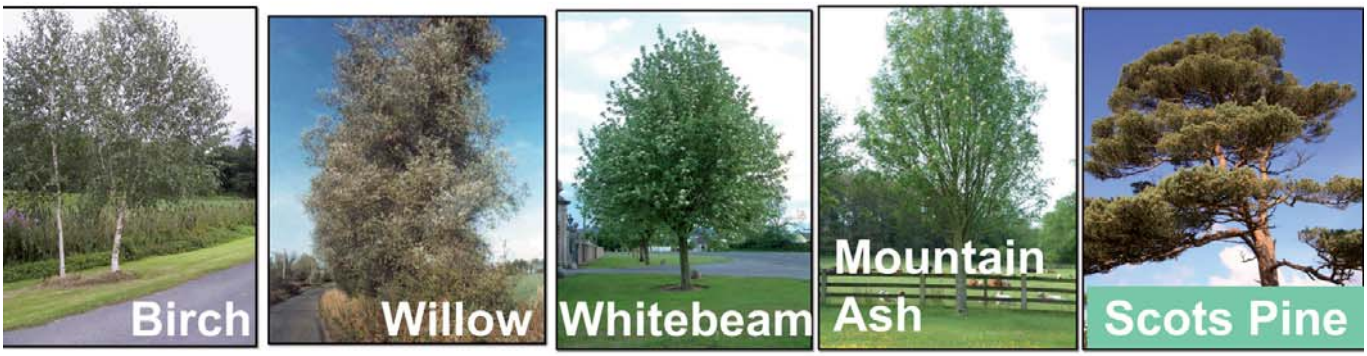
- Mammals
- Birds
- Invertebrates

Plant a grove of trees 2

Choose native trees

In GLAS choose at least 2 well matched species from the following trees;





Ash is not allowed because of Chalara disease

Most fertile sites, 2 major species:	Free draining, moderately fertile sites:	Free draining, poor infertile sites:	Wet sites:
Pedunculate Oak + Cherry	Scots Pine + Cherry	Sessile Oak + Scots Pine	Alder + Willow/Birch

- **Plant different species in discrete groups**
- **Keep smaller trees to the fringes of a grove**

Plant a grove of trees 3

Planting

➢ Line out rows with lime

➢ Dig trenches
2 m apart

➢ Use bare-rooted 2 year old whips
➢ Use trees of Irish provenance

➢ Protect whips from drying out during planting

➢ Plant trees :
- to correct depth (root collar)
- into elevated, vegetation –free mounds

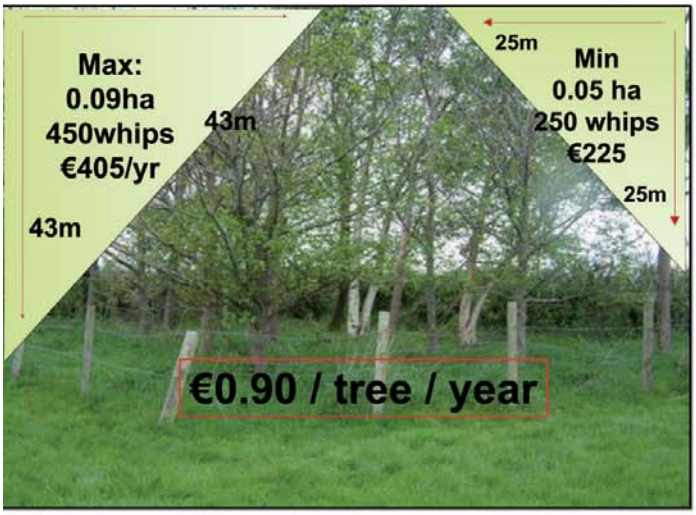
➢ Protect from rabbits and hares with tree guards

➢ Fence:
- Stockproof
- Fit for purpose

➢ Control competing vegetation

Plant a grove of trees 4

GLAS Specification

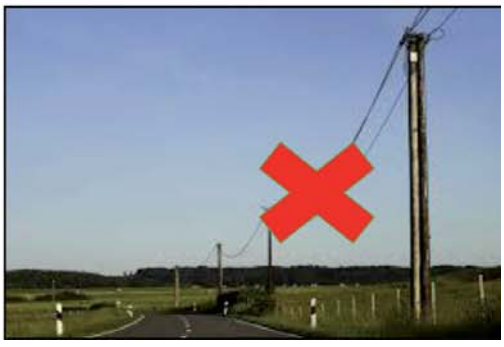


- One location only

- In rows 2 metres apart
- 1 metre between the plants within rows.

- Replace failed or dead trees

- Don't plant:
  - in the vicinity of overhead wires
  - within 20 m of railway line(s)
  - within 60 m of a dwelling house(s),
  - within 5 m of a watercourse



Traditional Orchard 1

Benefits

- Childhood Memories

- Home baking

- Genetic Resource: reservoir of rare alleles, possibly not present in modern cultivars

- Biodiversity

- Variety of distinctive tastes

Ard Cairn Russet
- Desert/eater
- Late flowering
- Late fruiting
- Cork

Ballyvaughin Seedling
- Culinary/cooker
- Late flowering
- Mid fruiting
- Clare

White Moss
- Cider
- Late flowering
- Mid fruiting
- Kilkenny

Widows Friend
- Desert/Eater
- Early flowering
- Early fruiting
- Armagh

Green Chisel
- Desert/Eater
- Late flowering
- Mid fruiting
- Tyrone & Donegal

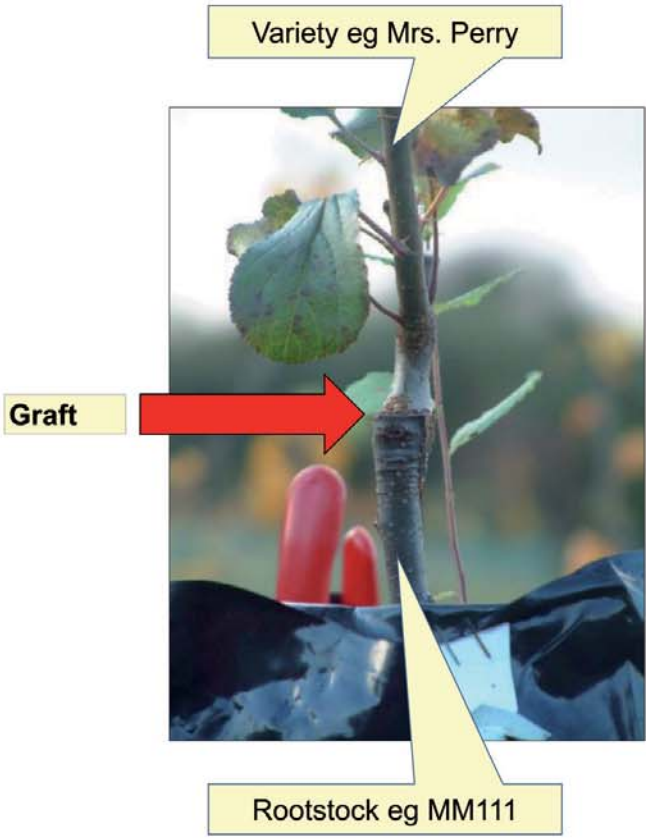
Traditional Orchard 2

Choosing Rootstock

- **MM26**
  - Tree grows up to 3m
  - Fruit within 2-3 years
  - Stake permanently.

- **MM106**
  - Tree grows to 4.5m
  - Stake for first three years
  - Fruit within 5 years

- **MM111**
  - Tree grows up to 5.5m
  - Fruit within 6-8 years
  - Can live up to 100 years



Choosing Varieties

- **Choose Varieties from Approved List**

- **Choose a mix of:**
  - Culinary/Cookers, Desert/eaters and cider
  - Early, middle and late flowering for pollination
  - Early, middle and late fruiting
  - Personal preference
    – variation in fruit size, taste, texture, etc.
  - Consider the county of origin of the tree

Traditional Orchard 3

Planting

- Plant 10 apple trees in the dormant season before the 31st March
- Minimum area: 0.05 ha
- Space tree 7m apart
- Warm, sunny site with free draining soil
- Dig a square hole and break up the bottom of the hole with a crowbar or fork
- Plant the tree to the depth previously planted, keeping the graft union above the ground
- Support trees with a stake and secure with a tie
- Protect with a tree guard

Orchard Care

- <u>Keep a 1m radius of each tree free from weeds for first five years to limit competition for the tree</u>
- Only apply pesticides to noxious and invasive weeds
- Monitor the orchard in wind and adjust tying and staking annually
- Check weekly for pests and disease
- Replace failed or dead trees
- Shape the tree each winter of juvenile stage
- Need little work in the mature stage

Grassland Actions

Con Moloney
Teagasc.

Extensive Grassland 2

Traditional Hay Meadow

- **Must have:**
  - At least 3 grass species (excluding ryegrass)
  - Less than 50% of sward ryegrass

Example Grasses

Low Input Permanent Pasture

- **Must have:**
  - At least 4 grass species (excluding ryegrass)
  - At least 3 non-grass species - reasonably dispersed
  - Less than 30% sward ryegrass

Sorrel

Example Non-Grass species

Lady's smock *or* Cuckoo flower

Not allowed on Derogation farms

Extensive Grassland 3

Management of Traditional Hay Meadow

Must be mown

- Graze before closing if possible
- Close from 15 April
- Cut on or after 1 July
- If bad weather occurs -
  silage can be made
  provided it is turned twice

- Do not top between 15 March and 1 July
- Do not reseed
- Control noxious weeds and rushes by
  - spot treatment
  - weed licking
- Fence
  - stock proof
  - fit for purpose

Nutrient Management

- Maximum chemical N allowed:
  40kg/ha/year (32 units / acre)
- P, K, lime and slurry allowed based on soil test results…….
  but may NOT be recommended

Extensive Grassland 4

Management of Low Input Permanent Pasture

- *Must be grazed*
- Must own livestock

- Do not top between 15 March and 15 July

- Allow plants to seed

- Do not cut silage or hay

- Control noxious weeds and rushes by spot treatment or weed licking
- Fence
  - stock proof
  - fit for purpose

Nutrient Management

- Max chemical N allowed: 40kg/ha/year (32 units / acre)
- P, K, lime and slurry allowed based on soil test results..
  but may NOT be recommended

Wild Bird Cover

Colin Finnegan
Teagasc.

Wild Bird Cover 1

Why? This unharvested crop is a giant bird table for seed eating birds and tillage flora and fauna

Seed eating birds

- in decline due to :
  - Intensification
  - Specialisation
  - Loss of tillage in many counties

Seed eating birds

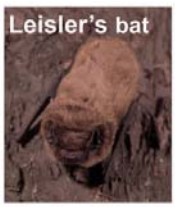
- need a variety of seeds:
  - Large cereal seeds - Yellowhammer
  - Small linseed or kale seeds - Linnet

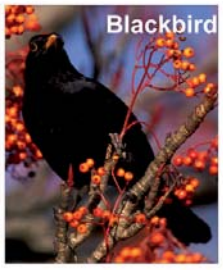
Flowers in Wild Bird Cover

- Attract pollinators and insects

Birds and Bats

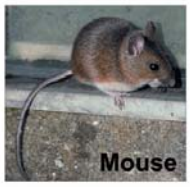
- Feed on insects and worms





Wild Bird Cover crops

- provide cover for small mammals



Birds of prey

- feed on small mammals

Wild Bird Cover 2

Oats & Linseed sown each year *Recommended*

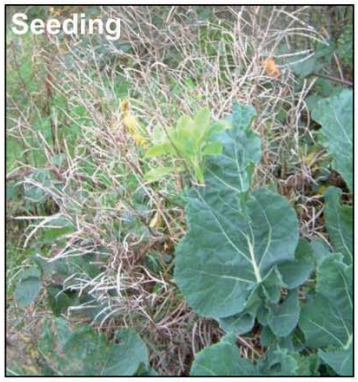
- Grow in all soil types (including heavy, acid)
- Tolerates a low pH

Oats and Linseed sown together

Kale

- Needs a high pH- lime important
- Fertiliser may be essential for establishment
- Club root risk (resistant varieties available)
- Biennial
  - Vegetative in year 1
  - Flowers and seeds in year 2
  - Remains in situ for 2 years
  - Sow every 2nd year
  - Establish half the plot in kale and other half cereal

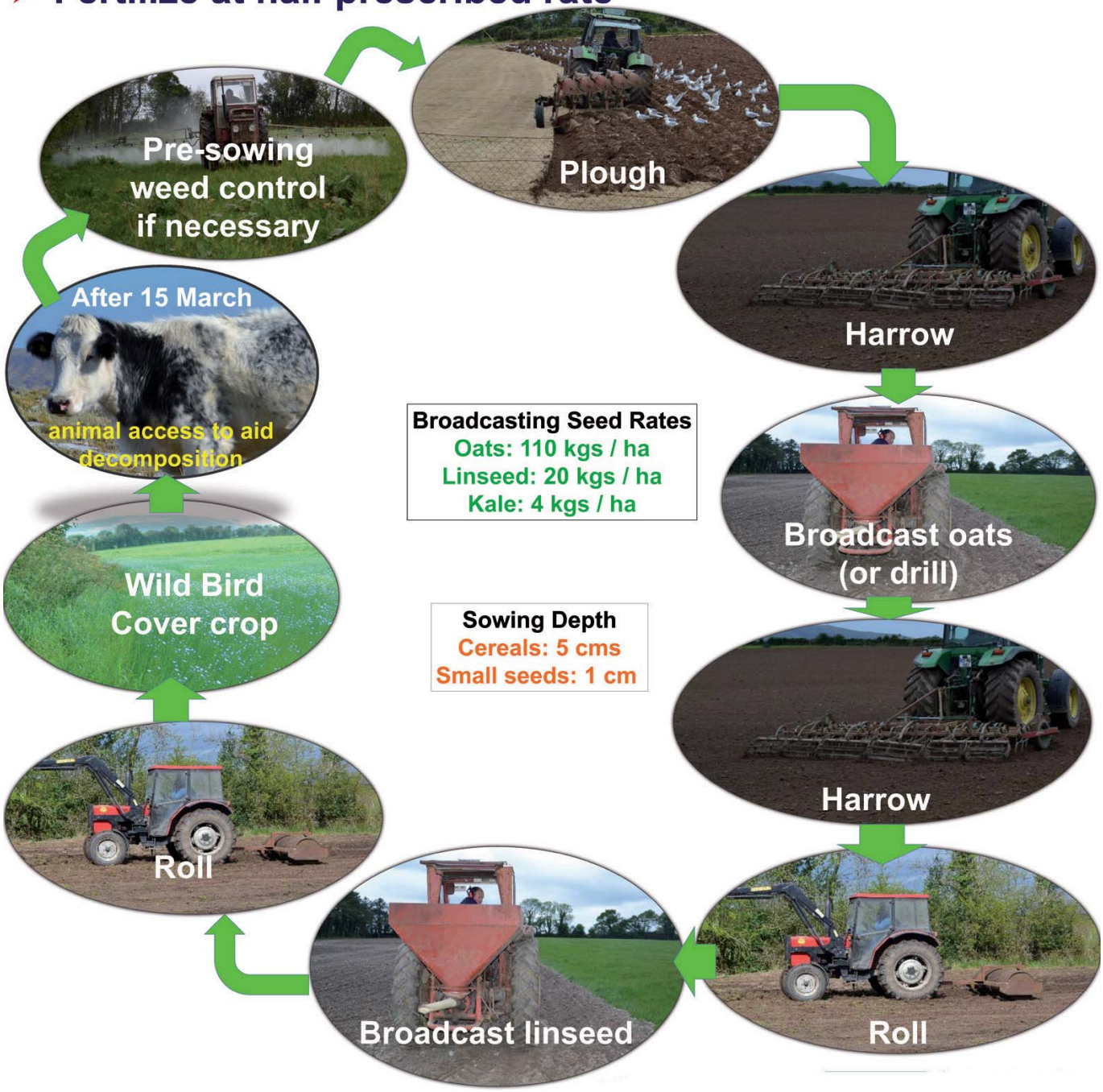
Year	Half Plot	Half Plot
1	Kale Yr 1	Cereal
2	Kale Yr 2	Cereal
3	Cereal	Kale Yr 1
4	Cereal	Kale Yr 2
5	Cereal	Cereal



Wild Bird Cover 3

Sowing & Management

- Fine, firm seedbed essential
- Any cultivation method allowed provided successful crop establishment
- Pre-sowing weed control may be necessary
- Plough, harrow and roll as necessary
- Drill or broadcast - if drilling, reduce seed rate
- Fertilize at half prescribed rate



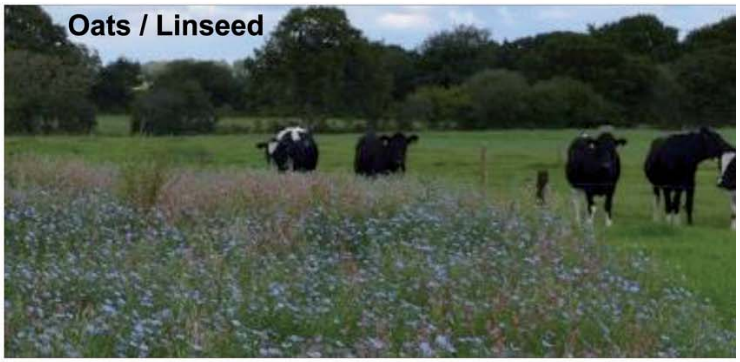
Wild Bird Cover 4

GLAS Requirements

- Sow by 31 May
  - each year for cereals,
  - every second year for kale
- Do not apply pesticides after sowing
- Spot treat noxious weeds and invasive species

- Fence
  - stock proof
  - fit for purpose

- Do not harvest
- Leave in situ until 15 March the following year (2 seasons for kale)
- Before replanting, livestock may enter from 15 March to aid decomposition of trash



Campaign for Responsible Rodenticide Use

John Lusby
CRRU Ireland TaskForce and BirdWatch Ireland.

Campaign for Responsible Rodenticide Use:

Demands of consumers for high quality and safe food mean that there is a requirement for high standards in all stages of food production, including strict quality assurance requirements from buyers, such as supermarkets and food processing companies. Among these requirements is the need for the effective control of rodents, which pose significant economic and health related risks, as they can consume and contaminate food stuffs, damage property and transmit disease. Control of rodent populations is therefore essential in many agricultural and urban environments and is principally achieved through the use of anticoagulant rodenticides.

Although rodenticides can be effective in controlling Brown Rat and House Mouse populations for which they are the targeted, their mode of action is not species-specific and their use can also result in the unintended exposure of non-target wildlife. Contamination can occur when a non-target species consumes bait directly (primary exposure), or when a predator or scavenger consumes an animal which has been previously exposed (secondary exposure). Exposure in significant proportions of avian and mammalian predators has been documented throughout Europe and North America. Small mammal predators are considered to be at greatest risk of secondary poisoning, however there is increasing evidence of exposure in other non-target predators which do not routinely feed on rodents, indicating that the toxins may be entering the food chain through pathways other than rodents.

There is a requirement to ensure better stewardship and best practice use of rodenticides to reduce and prevent wildlife exposure. The Campaign for Responsible Rodenticide Use in Ireland (CRRU Ireland) was established to meet this requirement. Under the banner "Think Wildlife", CRRU Ireland promotes best practice and responsible rodent control, to reduce wildlife from rodenticide exposure. As rodenticide products are authorized following the EU approval of their active substances, compliance with the Best Practice Requirements will be required for the mitigation of the risks for human health and the environment associated with their use. Risk mitigation measures and practices required for

the authorization of rodenticide products, will be specified on product labels. Accordingly, compliance with the Best Practice Requirements, will be an essential requirement for the use of authorised rodenticide products.

NMP Online An integrated tool for Nutrient Management Planning

Pat Murphy, Tim Hyde, Louis Kilcoyne & Avril Rothwell
Crops, Environment & Land Use Programme (CELUP)

Nutrient management planning has become a key skill for farmers, one which is essential in the achievement of a balance between high output and protection of the environment. Environmental regulation and the increase in price of fertiliser have become important factors for change in Nutrient Management Planning (NMP). NMP On-line is an effective nutrient management planning tool which is now entering its second year of use and meets both regulatory limits, and facilitates farmers in implementing those plans at farm and field levels. NMP Online has been developed to meet this need.

NMP On-line – Current functionality

NMP Online is a professional user system which combines nutrient advice from the Teagasc Green Book with regulatory planning for cross compliance, schemes and derogation. To improve comprehension of nutrient management planning it includes map based outputs for farmers to complement the normal tabular outputs.

The System has 250 Registered Agency's on the system, with over 800 registered users. To date 37,500 Nutrient Management Plans have been inputted on the system:-

✓ 35,000 Glas Tranche 1&2 NMP's
✓ 2,500 Derogation plans in 2017, 5000 in 2018

It is expected that there will be 50,000 farmers with NMP's by the end of 2017.

Phase 2 - Future Developments

NMP online provides a platform for the future inclusion of additional services and features designed to improve the value of the system to the end users. These include

- Additional Mapping Features
  - Farm Layout Maps
  - Paddocks, Roadways, Piped Water, Buildings Yards

- Integration of outputs into third party systems – Farm management software and APPS
  - E.g. Farmer in field can see fertiliser plan on App based on GPS
- Linkage to Pasture Base
  - Link Fertiliser planning to grassland management
  - Grass10 – soil fertility, sward composition and reseeding, grassland management and grazing infrastructure.
- Online submission of Derogation NMP's, farmyard sketches and soil maps
- Provide a format for tillage farmers that will allow crop specific advice based on different chemical fertilizer splits
- Linkage to soil laboratories to allow automatic download of results from all soil analysis laboratories to improve efficiency of use
- Improved farmer communication tools including automated time critical text messages to farmers on:-
  - Closed period dates, fertilizer usage
  - Lime for Year
  - Soil Samples required for Derogation/GLAS
  - Weather related timing of fertiliser application

Conclusion

The target of phase 1 of NMP online was to satisfy two basic requirements. Firstly, to provide a plan to the farmer in a comprehensive format that will act as a guide to the application of organic and chemical fertiliser and which will support the achievement of a good soil fertility status and targeted crop output for the farm. The second requirement was to enable professional users/planners to efficiently provide a plan to show compliance with regulation and to be in a format required by the statutory authorities. This is now complete.

Moving onto phase 2 will now become priority. How we can further enhance the system so that key messages are communicated to farmers effectively. Teagasc will work closely with advisors from across the country to ensure that the system is developed further to suit both advisor and client. The addition of extra facilities of the mapping system within NMP will ensure that this online system will become a tool which advisors require every day to go about their jobs.

Session3

Research Updates

Farmer Attitudes in Relation to Participation in Agri-Environment Schemes

Paula Cullen
Teagasc

Decisions made by farmers have a significant impact on the environment. Influencing farmers into making positive environmental decisions is a goal of policy makers. Agri-environment schemes (AESs) are one method of doing this, however, participation is voluntary. It is important we understand the decision to participate to ensure schemes and other agri-environment measures are created to maximise their scale and meet goals. Unfortunately, farmers are not all the same and will respond differently to different policy features. Hence, to understand the decisions made by farmers we must try to understand the differences between them. We have identified, through a representative survey of 1000 Irish farmers, seven broad attitude categories that farmers fall into. Attitudes to the environment, farming and the benefits and drawbacks of AESs were surveyed. Further analysis has shown that these attitudes are significant in the participation decision of AESs, but also in the adoption of other agri-environment measures including those related to water quality and mitigating greenhouse gas emissions.

The two strongest attitude groups resulting from our analysis relate to responses to statements regarding the benefits and drawbacks of AESs. Those farmers who fall into the category "Benefits Conscious" recognise the upsides of participating more than other farmers. The strongest agreement was to statements that the farmyard and countryside looked much better, that AES schemes were a valuable income source and slurry was better managed. Farmers also appreciated the environmental knowledge gained from courses and more areas for wildlife on the farm. Farmers who strongly recognise the downside of schemes were classed as "Drawbacks conscious". The highest level of agreement of farmers to the drawbacks of AESs were to statements that high adviser/ consultant cost of entering schemes, that there was greater risk of inspection and productive land is lost to measures.

While recognition of the benefits and drawbacks of AESs are the strongest attitudes that came across in our analysis, five other broad categories were

revealed. These attitude categories relate to farmer attitudes to farming and the environment. The names of each of these categories best reflects the statements mostly strongly associated with each group. Farmers displaying an "Innovative Orientation" believe in the importance of new technology and finding information to keep their businesses running in the future. Farmers who are focused on making a profit regardless of the environmental consequences are said to have a "Financial Orientation". "Positive environmental farmers" have a positive attitude to farming and believe that farmers are having a positive impact on the environment. Farmers with a "Conservative Orientation" are risk adverse and cautious about new ideas, they also find importance in the respect of other farmers. Finally, "Agricultural Optimists" are optimistic about the economic potential of farming and feel that agricultural land is underutilised.

Determining the broad categories of attitudes that farmers' display enables us to have a stronger understanding of their decisions. This deeper understanding can be used to assist in the creation of more successful agri-environment policies in terms of both participation and outputs. Each group of farmers is driven by different motivations. The next key steps are to examine which policy levers will affect each of the groups. This analysis also makes clear that changing farmers' attitudes towards the environment and agri-environment measures will have a significant effect on the scale and outcomes.

Environmental Sustainability Indicators

Dr. John Lynch
Teagasc.

The sustainability of agriculture, and particularly its effect on the environment, is increasingly recognised as an important issue. In order to assess the environmental impact of farming, and appraise progress towards improved performance, environmental sustainability metrics must be derived for a large number of farms across a number of years. The Teagasc National Farm Survey (NFS) provides a reliable annual data source across a nationally representative sample of farms from which these environmental metrics can be developed.

Two key environmental metrics are described here: greenhouse gas emissions and nitrogen balance. Greenhouse gas emissions are estimated by applying IPCC methodologies at individual farm levels. Livestock based methane and nitrous oxide emissions as a result of enteric fermentation and manure management are estimated through livestock inventories, while further nitrous oxide emissions are estimated based on fertiliser application to agricultural soils. Energy based emissions carbon dioxide emissions are estimate based on farm fuel and electricity usage. Farm nitrogen (N) balance is estimated via a farm gate level accounting of N inputs (e.g. fertilisers, purchased feed and livestock) and outputs (e.g. crops, livestock and livestock products).

Applying the methodologies described above to NFS farms provides an overview of the current environmental performance of farms, allowing us to compare different farm types, or explore variation in the environmental footprint of similar farms. As the NFS also collects detailed farm management accounts information, we can also contrast profitability with environmental performance, demonstrating that there is a general trend for more profitable farms to be more efficient, with lower greenhouse gas emissions per unit of agricultural output, and more production gained for the amount of surplus N applied. The considerable variation in environmental performance between similar farms may also suggest opportunities for some farms to improve management and reduce environmental impacts. Viewing trends in these metrics over time shows some progress towards increased environmental performance, but also highlights the impact of prevailing meteorological and economic circumstances, such as the fodder crisis in 2012 and 2013.

Use of Bio-Solids in Agriculture

Owen Fenton* & Mark G. Healy**
**Teagasc, Johnstown Castle, Wexford, Ireland*
***NUIGalway*

In the EU, implementation of directives and other legislative measures in recent decades concerning the collection, treatment and discharge of wastewater, as well as technological advances in the upgrading and development of wastewater treatment plants (WWTPs), has resulted in a rise in the number of households connected to sewers, which has increased the loadings on WWTPs. Production of untreated sewage sludge (the by-product of wastewater treatment plants) across the EU has increased from 5.5 million tonnes of dry matter in 1992 to an estimated 10 million tonnes in 2010 with production expected to increase further to 13 million tonnes in all EU Member States by 2020. Recycling to land is currently considered the most economical and beneficial method of municipal sewage sludge management. However, before this can occur, it must be treated to prevent harmful effects on soil, vegetation, animals and humans. Chemical, thermal or biological treatments, which may include composting, aerobic and anaerobic digestion, thermal drying, or lime stabilisation (LS), produce a stabilised organic material frequently referred to as "biosolids". The current project was funded by the EPA (collaborators UCD (Enda Cummins, Rachel Clarke), NUIG (Martin Cormican, Ger Fleming, Liam Morrison) and Teagasc).

Outcomes of the research

While current EU and international regulations govern certain priority metal pollutants and bioessential elements, other emerging contaminants that are potentially harmful to human health are omitted from the regulations. This means that, potentially, a number of emerging contaminants are being applied to land without regulation. As metals are relatively easy to measure using the techniques detailed in this study, it is recommended that the regulations governing the values for metal concentrations in biosolids for recycling in agriculture are extended to cover more metals. The measurement of pharmaceuticals is more problematic as it is very costly to measure these numerous parameters. In the first instance, it is recommended to test biosolids for triclocarban and triclosan, as these parameters are of the greatest concern internationally. WWTPs may also be upgraded or retrofitted to include treatment of these emerging contaminants. 2. On the basis of the parameters measured in this study, legislation governing livestock

exclusion rates from land after biosolids application are overly strict. However, a short period of withdrawal (e.g. 3 weeks) seems reasonable to reduce the risk of biosolids ingestion by the animals (as would be the case with cattle slurries). Any further restrictions may be overly strict for a single application to land at compliant application rates. 3. Currently, there is a knowledge gap concerning the effectiveness of LS in adhering to the pH and temperature requirements of the Codes of Good Practice. There is a need for research into the LS process and its effectiveness to minimise food safety concerns. This research should result in the introduction of mandatory standards governing LS methodologies.

The full Report No. 200 and author list is available on-line **http://www.epa.ie/pubs/reports/research/land/EPA%20RR%20200_web%20Essentra.pdf**

Sediment and freshwater ecology: identifying source, mitigating pressure

Dr. Daire O'Huallachain,
Teagasc.

Although a natural phenomenon, excessive transfer of sediment in rivers may have environmental and economic impacts. Siltation of river gravels can cause local deoxygenation and result in the degradation of important habitat types that support native salmonid and freshwater pearl mussel populations (protected under the Habitats Directive). The impact may manifest from source to sea and have consequences for many years following immediate impacts. In the United States for example, excessive sediment inputs are considered the most substantial pollutant affecting freshwater systems.

Teagasc research is addressing the lack of catchment scale studies on sediment in Ireland and has employed novel methodologies to quantify the amount of sediment leaving a catchment and relate this to the source of the sediment and to specific areas and land uses.

Results from two poorly drained agricultural catchments indicate variability in the dominant source of sediment, with sources being influenced by parameters such as soil type and land-use. For example, results from a grassland-dominated catchment indicate that channels (eroding channels and ditch banks) were the dominant sediment sources and accounted for 70% of the suspended sediment load. In an arable-dominated catchment, the results indicate that field topsoils were the primary sediment sources, accounting for 74% of the total suspended sediment load, with 17% attributed to channels and 9% to roads. It should be noted that average suspended yield in both catchments were 25 t km-2 yr-1 and 24 t km-2 yr-1 respectively, and were considerably lower than similar studies in the UK or Europe.

The results derived from the studies play an important role in assessing critical source areas and pathways for sediment and in-turn influencing the design and development of appropriate cost-effective mitigation measures and schemes as required under national and international legislation (e.g. for Freshwater Pearl Mussel conservation).

Assessing the risk of phosphorus transfer in high status catchments: Integration of nutrient management and soil conditions

Dr. Karen Daly
Teagasc

Agriculture has been implicated in the loss of pristine conditions and ecology at river sites classified as at 'high ecological status' across Europe. Although the exact causes remain unclear, diffuse phosphorus (P) transfer warrants consideration because of its wider importance for the ecological quality of rivers. This study assessed the risk of P loss at field scale from farms under contrasting soil conditions within three case-study catchments upstream of near-pristine river sites. Data from 39 farms showed P surpluses were common on extensive farm enterprises despite a lower P requirement and level of intensity. At field scale, data from 520 fields showed that Histic topsoils with elevated organic matter contents had low P reserves due to poor sorption capacities, and received applications of P in excess of recommended rates. On this soil type 67 % of fields recorded a field P surplus of between 1 and 31 kg ha-1, accounting for 46 % of fields surveyed across 10 farms in a pressured high status catchment. A P risk assessment combined nutrient management, soil biogeochemical and hydrological data at field scale, across 3 catchments and the relative risks of P transfer were highest when fertilizer quantities that exceeded current recommendations on soils with a high risk of mobilization and high risk of transport as indicated by topographic wetness index values. This situation occurred on 21 % of fields surveyed in the least intensively managed catchment with no on-farm nutrient management planning and soil testing. In contrast, the two intensively managed catchments presented a risk of P transfer in only 3 % and 1 % of fields surveyed across 29 farms. Future agri-environmental measures should be administered at field scale, not farm scale, and based on soil analysis that is inclusive of OM values on a field-by-field basis.

The Sky and the Ground: *Influence of Weather Change on Soil Nutrient Loss*

Dr. Per-Erik Mellander
Teagasc

There are overriding climate and weather pressures on nutrient losses to water. Measures to mitigate phosphorus and nitrogen losses from land to water are susceptible to influences by large-scale Atlantic weather systems. This presentation describes simplified concepts of catchments components, such as soil chemistry and soil drainage, and how changes in weather may influence phosphorus and nitrogen concentration and loads from rivers differently in different settings. The influence of weather has implications for expectations of change and reviews of agri-environmental measures. These may be potentially more beneficial in some years and less so in others. A key message from this presentation is that full appraisal of how measures are influencing agri-environmental management and impact from source to stream is required and these should not be assessed in isolation.

Session 4

Water Quality

MCPA and Other Pesticide Threats to Irish Agriculture

Aidan Moody
Pesticide Registration Division, DAFM

Abstract

Current regulatory issues of interest in relation to pesticides are considered in a number of areas, with the main focus on MCPA and drinking water quality.

There has been an increased trend of detections of grassland herbicides, particularly the active substance MCPA, in drinking water sources in recent years. This is partly due to more thorough monitoring that is now required but also reflects widespread use of these substances and frequent use of MCPA for rush control. The 2015 drinking water report published by the EPA records that 61 public supplies were affected by exceedances of the permissible limit for pesticides (0.1 ppb - parts per billion), compared to 28 supplies in 2014, with MCPA being detected in 41 supplies. Although none of the exceedances gave rise to any health concern, they represent breaches of a statutory limit that must be complied with for treated water and also for untreated water in sources used for the supply of drinking water.

The legal limit for any pesticide in drinking water (0.1 ppb) is not a health-based standard but does represent a political will that pesticide residues in European drinking water should be as close to zero as possible. Compliance is a considerable challenge, particularly in raw water used for the supply of drinking water. A single drop of pesticide would be enough to cause an exceedance along 30 km of a typical small stream.

The issue is being addressed through a range of actions, overseen by a recently established action group comprising a wide range of stakeholders and chaired by DAFM. Advice and information on best practice measures to protect water has been developed and widely disseminated and new regulatory measures to curtail use of some MCPA products were implemented in 2016. Measures to control the use of pesticides, implemented under the Sustainable Use Directive, also play an important role. These include training of pesticide users, distributors and advisors, inspection and certification of pesticide application equipment, and safeguard zones around drinking water abstraction points.

Other pertinent regulatory issues are considered in respect of glyphosate, neonicotinoid insecticides, and criteria for identification of endocrine disrupting

substances under pesticides legislation. Current regulatory developments are presented in each case and some implications of possible outcomes are highlighted.

Water quality – how can we achieve improvement?

Jenny Deakin
Catchment Science and Management Unit, EPA.

The national water quality monitoring data shows that 45% of rivers, 54% of lakes, 68% of estuaries, 24% of coastal waters and 8% of groundwaters that were monitored had unsatisfactory water quality in the most recent period 2013-2015 (DHPCLG, 2017). When all water bodies, including those that are not monitored, are included, the data show that approximately one third of water bodies are At Risk of not achieving their Water Framework Directive objectives. This equates to 1360 river and lake water bodies.

The key issue in freshwaters is excess phosphorus leading to eutrophication of our waterways, although there are also excess sediment issues arising in places. An intensive assessment process conducted by the EPA with support from RPS consultants, local authorities and Inland Fisheries Ireland, has shown that agriculture is a significant pressure in approximately 60% of impacted rivers and lakes, followed by urban discharge, hydromorphology (pressures causing impacts on the physical integrity of the aquatic habitat), forestry, peat cutting and domestic waste water. The next step is to conduct a series of investigative assessments or stream walks, to narrow down precisely where and what the problems are in the catchment areas of each water body that is At Risk, with the specific aim of figuring out how best to address them. Resources are currently being sought from the Department (DHPCLG) to enable this to be carried out. Community and stakeholder engagement will also play an important role in the process and is being facilitated by the new Waters and Community Office (http://watersandcommunities.ie). The philosophy is that to see water quality improvements we need to invest in identifying and implementing 'the right measure in the right place', and to support local communities in playing an active role in protecting their water resources.

With such a large number of At Risk water bodies to address, a process for prioritising action is required. The draft River Basin Management Plan proposes a number key priorities:

- Ensure full compliance with relevant EU legislation.
- Prevent deterioration.
- Meet the water related objectives for designated protected areas.

- Protect high status waters.
- Implement targeted actions and pilot schemes in focus subcatchments aimed at i) targeting water bodies close to meeting their objective and ii) addressing more complex issues which will build knowledge for the third cycle.

The Waters and Communities Office and the EPA are currently working through a series of regional catchment workshops for public agencies, where each water body that is At Risk is considered in turn, in terms of its issues, its priority for action under the draft plan, and the feasibility of getting improvements. A number of priority project areas are being considered for targeted action under the current river basin management plan, i.e. until 2021. It is only by carrying out this kind of targeted and focussed action, in the areas that need it most, that adequate water quality improvements are likely to be made to support and develop our 'clean green' marketing advantage. In our view agricultural advisors have a very significant role to play, but the mechanisms for how this can or should happen are not yet clear.

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