FARMING FOR NATURE

THE ROLE OF RESULTS-BASED PAYMENTS

EDITED BY
EILEEN O'ROURKE & JOHN A. FINN

Agricultural habitats cover approximately half the European Union (EU) and an estimated 50% of all species and several habitats of conservation concern in the EU depend on agricultural management.

Reversing the loss of European biodiversity is clearly dependent on the conservation of farmland biodiversity.

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CONTRIBUTORS

Andy Bleasdale • Amanda Browne • Dolores Byrne

Padraig Cronin • Brendan Dunford • John A. Finn

Kathryn Finney • Caitriona Maher • Patrick McGurn

James Moran • Derek McLoughlin • Gráinne Ní Chonghaile

Richard O'Callaghan • Barry O'Donoghue

Eileen O'Rourke • Sharon Parr • Paul Phelan

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CONTRIBUTORS

Andy Bleasdale: Andy works in the Scientific Unit of the National Parks and Wildlife Service and has a particular interest in the potential of farming to enhance biodiversity in an Irish setting. He has had an active involvement in the commonage framework planning process, the NPWS farm plan scheme, BurrenLIFE and successor programmes, AranLIFE, RBAPS and INTERREG VA and he is an advocate of results-based approaches to incentivise farmers and to improve the status of habitats and species.

Amanda Browne was the Scientific and Technical Officer with the AranLIFE project since 2014 and is currently the Scientific and Technical Officer of Caomhnú Árann EIP. She is primarily responsible for developing the monitoring programme for assessing the effectiveness of the concrete actions of the project in improving the conservation status of the priority habitats. Prior to working on AranLIFE, Amanda was a Consultant Ecologist.

Dolores Byrne is a lecturer in the Institute of Technology, Sligo. She was the project ecologist on the Results-Based Agri-environment Payment Scheme project, based in County Leitrim where her work involved developing and testing the scoring assessments for species-rich grassland and marsh fritillary habitat. She is a technical scientific advisor to the Freshwater Pearl Mussel EIP and a member of the Inishowen Farmers EIP Operational Group, both of which are exploring the potential for results-based agri-environmental schemes within upland areas. She is part of the group of researchers in GMIT and IT Sligo currently working on agroecology, results-based approaches and high nature value farming systems and their interactions with the environment and community in which they sit.

Padraig Cronin is an agricultural and environmental specialist who graduated from the University of Wales Aberystwyth. He has worked on many conservation projects throughout the last 20 years with a specialisation in the development and demonstration of sustainable land use management techniques and practices. He worked as farm advisor on the KerryLIFE Project 2014-2019 and is now the Project Officer on the Hen Harrier Project for the south west region.

Brendan Dunford: From a farming background in Co. Waterford, Brendan has spent the past 20 years living and working in the Burren region. In 2001 he completed his doctorate on *The impact of Agricultural Practices on the Natural*

Heritage of the Burren, later published by Teagasc as *'Farming and the Burren'*. He led the award-winning BurrenLIFE Project and now manages its successor, the pioneering 'Burren Programme'. He is co-founder and secretary of the Burrenbeo Trust, a landscape charity dedicated to *'Connecting all of us to our places and our role in caring for them'* through a range of place-based learning and community stewardship initiatives. Brendan is a former board member of the Heritage Council and the Environmental Protection Agency (EPA) Advisory Committee, a former Director of the European Forum on Nature Conservation and Pastoralism, and is an Ashoka Fellow.

John A. Finn is an ecologist with Teagasc. He is a researcher on agricultural ecology and farmland wildlife, with a keen interest in the management of High Nature Value farming systems. He has been a journal editor and project evaluator for several funding agencies, as well as project leader in EU and Irish research projects. He has published multiple research articles, as well as several books and multiple popular articles for the farming community and the general public. He was project leader of IDEAL-HNV, a co-organiser of the CAP4Nature initiative, and a judge for Farming for Nature.

Kathryn Finney is the Irish Breeding Curlew EIP Project Manager. An agri-environment specialist, she joined BirdWatch Ireland in 2005 and has worked in breeding waders, scheme design, specialist advisory, habitat management and predator control. In addition to designing nationally adopted breeding wader schemes, she also worked on the RBAPS Pilot project to develop and trial results-based schemes. She has experience in predator proof fence design and habitat restoration for breeding waders. A graduate of Aberdeen University, she holds an MA degree in Countryside and Environmental Management. Kathryn believes passionately in working in co-operation with farmers to ensure a more sustainable future for Ireland's biodiversity.

Caitriona Maher did her PhD on the effects of farming practices and flood variables on the plant communities and insect assemblages of the Shannon Callows flood meadows in Ireland. Following this Caitriona worked with the successful Burren Programme (2013-2015) before working with the European Forum for Nature Conservation and Pastoralism on the Results-Based Agri-environmental Payment Scheme, RBAPS project (2015-2018). Caitriona is now lecturing in ecology and wildlife conservation in Liverpool John Moores University, where she continues her research in high-nature value farming and it's role in the delivery of ecosystem services.

Patrick McGurn was previously the project manager for the AranLIFE project and is now manager for a follow up project, Caomhnú Árann, working with farmers in the management of species rich grasslands. Patrick has a background in agriculture and ecology. After graduating in Agriculture from Queen's University Belfast, he went on to work in the agriculture advisory services for Department of Agriculture in Northern Ireland. Working with farmers within a HNV area in Fermanagh, led to an interest in semi-natural grasslands and he went on to complete a PhD on species rich grasslands in Fermanagh. He then went on to work for the European Forum on Nature Conservation and Pastoralism, looking at HNV farming Systems in Ireland and along with other stakeholders developed the EU LIFE application to address issues on designated farmland on the Aran Islands.

James Moran is a lecturer in Ecology and Biology at Galway Mayo Institute of Technology teaching on agriculture and environment related programmes. He leads the Agro-ecology and Rural Development (ARD) research group at GMIT. His research and outreach work concentrates on sustainable agricultural systems. Research areas include rural development; agri-environmental scheme design; High Nature Value farmland; biodiversity and ecosystem services; protected areas management; grazing ecology and wetland ecosystems. Outreach work focuses on improving agriculture policy and practice with a particular focus on the Common Agriculture Policy. He is a member of the National Biodiversity Forum; the National Rural Network sub-committee on Biodiversity, Environmental Challenges and LIFE Programmes; the Uplands Management Board of the Heritage Council; and board member of European Results Based Payments Network.

Derek McLoughlin is currently assistant project manager on the Pearl Mussel Project EIP, a €10M results-based project funded by the Department Agriculture Food and the Marine. This project uses many of the principles developed in the EU-funded Results Based Agri-environment Payment Scheme (RBAPS) project in Ireland and Spain, on which Derek was project coordinator with the European Forum for Nature Conservation and Pastoralism. He is based in Co. Mayo and has worked in a number of research and consulting capacities in High Nature Value landscape since 1999, including ecological monitoring of Ireland's current agri-environment scheme – Green, Low-carbon, Agri-environment Scheme (GLAS).

Gráinne Ní Chonghaile currently works as the Administration and Financial Officer of the Caomhnú Árann project, previously AranLIFE project. Having lived on the island for the majority of her life and the fact that she is a fluent native Irish speaker have allowed her to build a very good relationship with the participating farmers on the Caomhnú Árann and AranLIFE project and with the community in general.

Richard O'Callaghan Richard O'Callaghan is project manager of the KerryLIFE project, a partnership project co-funded by the EU's LIFE programme. The KerryLIFE project developed and implemented practical conservation measures with the farming and forestry communities to conserve

the critically endangered freshwater pearl mussel. Richard has a research background in lake littoral ecology and has worked in ecological consultancy focusing on the conservation of freshwater species and habitats.

Barry O'Donoghue is Head of Agri-Ecology with the National Parks and Wildlife Service (NPWS). Barry hails from the Kingdom of Kerry where he grew up in the Stack's Mountains with a combination of farming and nature interests. Barry did his undergrad at UCD on Agriculture and Environment, followed by a Research Master's on the Hen Harrier and a subsequent PhD on the ecology and conservation of Hen Harriers, while at the same time working as a Ranger with NPWS. Barry has a keen interest in sports, our coast and seas, farming, communities and nature. At the time of publication, the next CAP Strategic Plan, Curlew, Corncrake, raptor poisoning and persecution and the NPWS Farm Plan Scheme are just some of the various topics that the Agri-Ecology Unit of NPWS are working on.

Eileen O'Rourke is a lecturer and researcher in the Department of Geography, University College Cork. She has participated in a number of European research projects and was the Principal Investigator on a Science Foundation Ireland (SFI) funded project, studying the links between biodiversity change and farming systems on the Iveragh uplands, Co. Kerry. She lectures in Biogeography and Human Ecology. She researches and publishes in the general area of conservation, biodiversity, landscape, upland environments and High Nature Value farming.

Sharon Parr is a biologist who has worked on all iterations of "Farming for Conservation in the Burren", from BurrenLIFE to the current Burren Programme. She developed the Burren scoring systems that are used as the basis of payments to farmers for managing biodiversity.

Paul Phelan is the Scientific Officer for the KerryLIFE project (freshwater pearl mussel conservation - www.kerrylife.ie). Originally trained as an ecologist, he has worked on sustainable land management for over 12 years including the FORWATER project (impacts of forestry on surface water), the GLOWORM project (impacts of climate change on European grazing systems) and has a PhD on the grazing management of white clover in Irish grassland. In recent years, his work has increasingly focused more on sustainable woodland/forestry management and the implementation of conservation measures

GLOSSARY

AES – Agri-Environment Scheme

AEOS – Agri-Environment Options Scheme

BFCP – Burren Farming for Conservation Programme

BP – Burren Programme

BPS – Basic Payment Scheme

CAP – Common Agricultural Policy

DAFM – Department of Agriculture, Forestry and the Marine

EC - European Commission

EEC – European Economic Community

EIP – European Innovation Partnership

EU – European Union

GATT – General Agreement on Trade and Tarrifs

GLAS – Green Low-carbon Agri-environment Scheme

HNV – High Nature Value

HNVf – High Nature Value farmland

IUCN – International Union for Conservation of Nature

LLAES – Locally Led Results-based Approach

LLRBA – Locally Led Results-based Approach

LU – Livestock Unit (The grazing equivalent of one adult dairy cow)

MS – Member States

NPWS – National Parks and Wildlife Service

PES – Payment for Ecosystem Services

REPS – Rural Environment Protection Scheme

RBAPS- Results Based Agri-Environment Payment Scheme

RBPS – Results Based Payment Scheme

RDP – Rural Development Programme

SAC – Special Area of Conservation

SPA – Special Protection Area

Teagasc – The Agriculture and Food Development Authority

WTO – World Trade Organisation

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FARMING FOR NATURE: RESULT-BASED AGRI-ENVIRONMENT SCHEMES

EILEEN O'ROURKE & JOHN A. FINN

INTRODUCTION

Agricultural habitats cover approximately half the European Union (EU) territorial area and besides producing food and fibre, an estimated 50% of all species and several habitats of conservation concern in the European Union (EU) depend on agricultural management (Halada et al., 2011; Batárt et al., 2015). Given the long history of agrarian landscapes in Europe it is not surprising that many species of plants and animals have adapted to anthropogenic ecosystems that require the maintenance of traditional low-input agricultural practices. As a result of both intensification and abandonment, farmland biodiversity has been in steep decline since the second half of the 20th century (Stoate et al., 2009; Donald et al., 2006; ECA, 2015). The implementation of a number of European and United Nations conservation conventions, such as the Habitats and Birds Directives, and the UN Convention on Biological Diversity, along with the billions of Euros spent on EU agri-environment-climate programmes, have failed to halt this decline. Agricultural production is expected to greatly increase in the coming years with calls for a doubling in food supply by 2050, in order to meet the demands of an increasing human population and for biofuel production (Godfray et al., 2010; Tilman et al., 2011; Tscharntke et al., 2012; IAASTD, 2009; Foley at al., 2011). The demand for increased food production may be counterbalanced to some extent by a reduction in

food waste, improved crop genetics, increasing yields and dietary changes; however, global agricultural expansion and intensification to meet a net increase in demand for food, along with the abandonment of naturally disadvantaged farmland (often of high nature value), appears almost inevitable. How we meet the world's future food security and sustainability needs, while at the same time reducing agriculture's environmental footprint, is one of the greatest challenges of the 21st century.

Agri-environment schemes (AES), implemented under the Common Agricultural Policy (CAP) provide the policy framework for sustainable agriculture in Europe, as well as providing the largest source of funding for practical nature conservation in the EU. AES have been in existence in the EU for over thirty years, but their ecological performance and cost effectiveness to date has been very mixed (Kleijn and Sutherland, 2003; Finn et al., 2009). They have often been seen more as a source of farm income support rather than the means of delivering environmental goals. Conventional management, or action-oriented, AES schemes have been criticised for a number of reasons, including poor targeting, lack of payment differentiation, short-termism, inadequate monitoring and failure to inspire behavioural change among participating farmers (ECA, 2011; Burton and Schwarz, 2013). In more recent times, there has been a call to integrate an ecosystem services approach into agri-environment programmes, along with a shift in emphasis from an action-based to a result-based approach, which would link payments to delivery of a desirable environmental outcome.

Result-based AES schemes reframe conservation as a "new form of production" rather than a positive by-product of agriculture (Wynn-Jones, 2013:77). A result-based approach is also challenging, with gaps in the scientific knowledge that link agricultural practices to biodiversity and other ecosystem services outcomes at appropriate spatial scales, along with an increased risk for land managers. Improved scientific knowledge is only part of the solution; the delivery of cost effective agri-environment-climate programmes is also inherently social and political. Result-oriented AES require a cultural change in the way farmers view the environment and engage with policy on the ground, along with a governance structure that is participatory and capable of adaptive management. Major changes in the design, implementation and governance of AES are needed to shift from the currently dominant 'one-size-fits all' AES to incorporating local knowledge and the recognition that management practices, and to a certain extent ecological outcome, are specific to location. The formulation of clear

objectives, robust science, along with farmers' engagement and ability to innovate are central to the delivery of pre-defined results, and ultimately to the fate of farmland biodiversity in the long term. Many different types of result-based payment schemes have been implemented across Europe, mostly on a case-by-case basis. One can distinguish between measures aimed at biodiversity conservation targeted at species and habitats of conservation concern, such as species rich grasslands, and those aimed at ecosystem services provision, which are often common habitat generalists, occurring in a wide variety of environments (Ekroos et al., 2014).

The principal aim of this book is to document, present the findings of and lessons learnt from a collection of innovative case-studies of the best Irish locally led result-based agri-environment schemes to date. Many of these projects started out as demonstration European Life projects, with the Burren Programme (Chapter 3), going on to win the joint 'Best Ever European Life' project in 2017. The book aims to drill down into the actual practicalities of designing and delivering result-based agri-environment schemes, within the larger framework of 'farming for conservation'. The core of the book and its major contribution is the collection of case studies, which situate the farming systems and the local environmental assets, their level of priority and the threats they face. They provide sufficient detail to help others see how the general principles of a Locally Led Results-based Approach (LLRBA) were implemented in the case study areas: for example, by providing actual farm plans and scoring sheets, as well as detailing governance mechanisms, the role of advisory services, the choice of indicators, monitoring details and the relationship between results and payment. While acknowledging the specificity of place, the case-studies have wider applicability, especially within the European Union that shares a common model of agriculture and a common policy framework. We also acknowledge that the results are not confined solely to ecological parameters, because in the delivery of LLRBA and nature friendly farming, one needs to build links between farming systems and the social and economic lives of the communities embedded in these places. Much of European biodiversity and its cultural landscapes require active management.

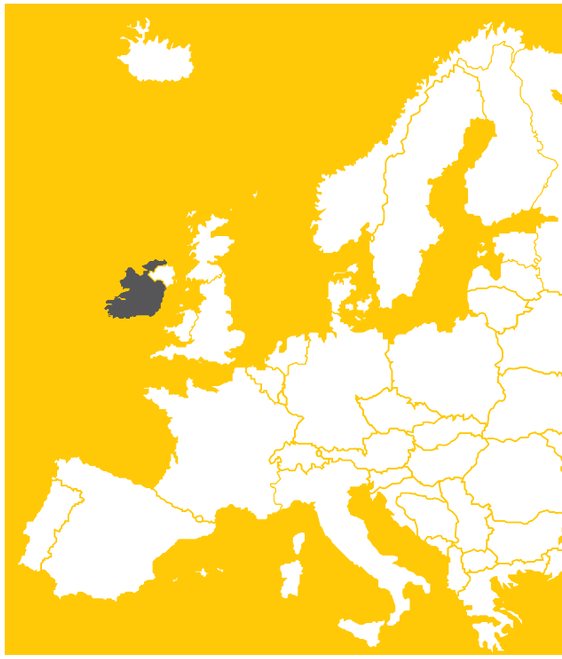
The book is intended for an international audience of agri-environmental practitioners; however, it is not a handbook or instruction manual. For example, it could be used by an NGO to support evidence for the feasibility of a locally led result-based approach; read by a policymaker to demonstrate examples and case studies; and used as a working example to assist a

practitioner in their own efforts to design a new LLRBA. The introductory chapter (Chapter 2), provides a critique of EU agri-environment policy and the closing chapters (Chapters 8 and 9) also consider the policy context and reflect on lessons learnt and where we go from here. Thus, they position the case studies within a larger academic and policy context. The book has clear research and policy relevance in the area of agriculture, environment, sustainability and rural development. It is born out of close collaboration between practitioners and academics.

The book offers a comprehensive overview of locally led result-based agri-environment case-studies, programmes and policies in operation in Ireland. It is largely structured around five case studies, and we invited the authors to reflect on the following themes in the presentation and discussion of their case study material:

- Why was your project needed, and how did it originate?
- How were the objectives identified and agreed upon?
- How were farmers selected for participation?
- How did you develop and use evidence-based, causal relationships, and how did you select and use indicators to represent these relationships?
- How did you develop suitable indicators linked to farming practices, and upon which result payments are based?
- Did the biodiversity targets for species rich grasslands require the maintenance of traditional management strategies and/or the development of major innovative practices? What management changes, if any, did the farmers make to their farming system? Did the project encourage innovation?
- How did the project/programme measure and monitor environmental performance?
- How did you calculate the payments to farmers, and how were payments related to results?
- Did the project have a reference or control site, i.e. what were the results measured against?
- Did you include a mixture of action-based and result-based approaches in your project or programme?

THE BOOK OFFERS A COMPREHENSIVE OVERVIEW OF LOCALLY LED RESULT-BASED AGRI-ENVIRONMENT CASE-STUDIES, PROGRAMMES AND POLICIES IN OPERATION IN IRELAND. IT IS LARGELY STRUCTURED AROUND FIVE CASE STUDIES ...



- What arrangements did you make to provide specialist advice for participant farmers?
- Has there been an increase in environmental awareness and motivation of farmers towards environmental protection? Has the project promoted long-term behavioural change among the farmers?
- What risks did the farmers perceive to be associated with the result-based agri-environment programmes, and how do they calculate transaction costs?
- Were participant farmers enrolled in other agri-environment schemes at the same time they were participating in your programme?
- What are the institutional arrangements for the roll-out of result-based agri-environment programmes?
- What were the social co-benefits of the project? And how did the project reinforce the social-capital around farming for conservation in the wider community?

THE STRUCTURE OF THE BOOK

In Chapter 2, Eileen O'Rourke provides a critical overview of European CAP agri-environment policies to date. She introduces the concept of public goods and ecosystem services, and goes on to debate the advantages and disadvantages of both action-based and results-based approaches to the design of agri-environment schemes.

Chapter 3, by Brendan Dunford and **Sharon Parr**, provides detail on the evolution and design of the first locally-led result-based agri-environment programme in Ireland – The Burren Programme. With over twenty years' experience on the ground, this is far more than just an agri-environment scheme. It is a highly adaptive pioneer programme that applies the concept of 'farming for conservation' in a very high nature value landscape - the Burren. Building on the research and lessons learnt from an initial PhD and subsequent European Life project, it now works with over 300 farmers and forms part of a national programme, funded under Ireland's Rural Development Plan. Not only does the programme prioritise 'payment by results' but it is also deeply social and emphasises its local embeddedness and the central role played by farmers in the management of their natural heritage. The objective is to give farmers a better sense of ownership of the conservation agenda, and to reward those who deliver clearly defined and ambitious environmental outputs. The chapter outlines the design and delivery of the Burren Programme – from habitat targeting and the development of farm plans to the field scoring system, monitoring of results, measuring impacts and payment calculations; to the role and training of farm advisors along with the scientific, technical and administrative support provided by the project team. It is clear that the principles underpinning the development and delivery of the Burren Programme can be applied elsewhere.

THE OBJECTIVE IS TO GIVE FARMERS A BETTER SENSE OF OWNERSHIP OF THE CONSERVATION AGENDA, AND TO REWARD THOSE WHO DELIVER CLEARLY DEFINED AND AMBITIOUS ENVIRONMENTAL OUTPUTS

Chapter 4, by Patrick McGurn, Amanda Browne and **Gráinne Ní Chonghaile**, leaves the mainland of Ireland and applies principles of farming for conservation and LLRBA to the Aran Islands. The objectives of AranLIFE may be similar to those of the Burren Programme, but the project's design is adapted to the specific challenges of the Aran context, with its small fragmented land holdings, scrubbed up access roads and widespread land abandonment. The project set out to respond to local farmers' identified issues in the management of the islands landscapes, species and habitats. The chapter provides scientific detail on the Aran habitats of priority conservation value and the linked farming practices, in particular grazing management, necessary for their maintenance. The project design, the choice of indicators, field scoring sheets, results validation and payment system are all clearly outlined. The project has also worked on increasing public awareness of the biological importance of the islands and the role that agriculture plays in maintaining it.

Chapter 5, by Richard O'Callaghan, Padraig Cronin and **Paul Phelan**, takes the 'farming for conservation' concept to the Kerry uplands within the context of the EU KerryLife project aimed at the conservation of the freshwater pearl mussel. The project developed a range of result-based and incentivised measures to better manage the lowland and upland portions of forty hill farms in the Blackwater and Caragh river catchments, necessary to support the conservation of the critically endangered freshwater pearl mussel. Measures related to drainage, riparian protection, stocking density, nutrient and forestry management. The design and lessons learnt for this pilot project will now be rolled out within the structure of the national Pearl Mussel Project EIP, which includes results-based payments.

Chapter 6, by Dolores Byrne, Derek McLoughlin, Caitriona Maher and Kathryn Finney, describes the RBAPS (Results-based Agri-Environment Payment Scheme) pilot project that developed and trialled results-based methods for five agriculture-dependent biodiversity targets in County Leitrim and the Shannon Callows in Ireland. These targets, including species-rich grasslands, breeding wader habitats and species-rich floodplain meadows, are all designated as conservation priorities at a national or international level. Scoring systems were developed using assessment indicators which reflect agricultural practices and determine the quality of the biodiversity. Management guidelines were provided to the thirty-

five farmers who participated in the project, to support biodiversity delivery. Payment rates were calculated to reward good ecological quality. Where farming practices alone didn't improve the biodiversity status, complementary actions were also introduced to increase the quality of the habitat. The key elements to the success of the results-based payments approach - such as selecting priorities and spatial targeting, robust assessment indicators and the necessity of farmer training and ecological advisory support, are among the important lessons from this ambitious and innovative pilot project.

Chapter 7, by Andy Bleasdale and **Barry O'Donoghue**, provides an excellent overview of the current National Parks and Wildlife Service Farm Plan Scheme. The main purpose of the scheme is to promote a focussed, targeted and innovative approach to farming for habitats and species of conservation concern in some of Ireland's most important biodiversity areas. Prescriptions are tailored for the habitats or species found on the farms in question, with flexible and adaptive solutions to maintain, create and enhance these habitats and species. Payment rates differ across the range of plan types. By trialling and enacting these innovative prescriptions, valuable lessons were learned which in turn informed advice to the Department of Agriculture, Forestry and the Marine (DAFM) on measures that could be delivered under national, co-financed Agri-Environment Scheme (GLAS). An overview of the different plan types and lessons learned is presented. The future of the scheme, in a broader national context, is also discussed.

In Chapter 8, James Moran, brings the discussion back to the policy environment within which results-based approaches are introduced. He considers the environmental priorities that need to be better addressed in international policymaking, and the role that agriculture can play in providing a range of ecosystem services and disservices. He reflects on the opportunities and challenges in developing efficient payments for an ecosystem services approach. He charts innovative solutions and a road map for the inclusion of locally adapted results-based payments in a more integrated approach to multifunctional agricultural land use in Ireland and the EU.

Chapter 9, by John Finn, is a synthesis chapter that collates and restates the key findings, lessons learnt and future challenges in operationalising a locally led results-based approach (LLRBA) within national and European contexts. Amidst the diversity of approaches that characterises LLRBA, John distils some of the common lessons across the multiple case studies, and illustrate general principles from the specific experiences. He consider some of the challenges associated with LLRBA, from the perspective of farmers, policymakers and ecologists involved in their design and monitoring. He discusses the complementarity that may be achieved between action-based and result-based hybrid approaches. In programmes characterised by innovative performance-related payments for biodiversity, he considers the different approaches to structuring the relationship between payment and performance. The social context of LLRBA is also very important, and the relevance of local engagement by communities and extension services is acknowledged. Most importantly, he asks - where do we go from here?

There is growing interest in and a strong policy imperative to develop results-based approaches to address the current climate and biodiversity challenge. We hope that this book provides practitioners and policymakers with insights and shared experiences that can inform the design, implementation and effectiveness of result-based agri-environment approaches to deal with this new reality.

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2
OVERVIEW OF EUROPEAN AGRI-ENVIRONMENT MEASURES WITH EMPHASIS ON A RESULT-BASED APPROACH

EILEEN O'ROURKE

INTRODUCTION

One of the greatest challenges facing humanity is the provision of and access to sufficient food to feed an expanding global population, while at the same time maintaining biodiversity and other ecosystem services (Adams, 2012; Benton et al., 2011; Tscharntke et al., 2012). Agricultural habitats constitute over 45% of European Union territorial area, and in words of McIntyre et al. (1992: 606), "The struggle to maintain biodiversity is going to be won or lost in agricultural ecosystems". It is estimated that 50% of all European species are dependent on farmland habitats and agricultural practices (Stoate et al., 2009), and their decline is well documented especially that of farmland bird communities which is commonly regarded as one of the best indicators of overall farmland biodiversity loss (Donald et al., 2001, 2006; Halada et al., 2011). The drivers of farmland biodiversity loss are relatively well understood. As a result of both land use intensification and abandonment, farmland biodiversity has been in decline throughout Europe since the second half of the twentieth century (Strohbach et al., 2015; Foley et al., 2011), resulting in species loss, habitat degradation and fragmentation, as well as excessive nutrient and pesticide loads (Plieninger et al., 2012; CBD, 2010). The decline of low input, high nature value farming systems has had a particularly detrimental impact on farmland biodiversity (Bignal and McCracken, 2000; Opperman et al., 2012; Kleijn et al.,

2008; Fischer et al., 2012). In the 2006 European Strategy for Sustainable Development member states, (MS) agreed to halt biodiversity loss by 2010. That target was not met, indeed the loss of biodiversity continues at an increased rate (Whittingham, 2011). A new declaration was signed in 2010 to halt biodiversity loss by 2020; once more it is highly unlikely that this target will be met.

Agri-environment schemes (AES), implemented under Pillar 2 of the European Common Agricultural Policy (CAP), represent the dominant policy instrument and largest source of funding for the practical conservation of nature and biodiversity in agricultural landscapes. A review of the monitoring evidence to date suggests that most agri-environment schemes provide only moderate or limited gains for biodiversity (Kleijn and Sunderland, 2003; Kleijn et al., 2006; Whittingham, 2007, 2011), and have failed to deliver the EU and Convention on Biological Diversity (CBD, 2010) targets of halting biodiversity loss. The prescriptive nature of AESs, generic rather than context-appropriate measures, poor targeting and monitoring, low priority put on actual results along with inflexible payment conditions have been identified as some of the key reasons for their poor performance (Burton and Schwarz, 2013; Batáry et al., 2015; Herzon et al., 2018). There is increasingly a call for a new approach to delivering biodiversity objectives on European farmland, prominent among which is a call for the integration of an ecosystem service approach (MEA, 2005) into agri-environment measures and a payment structure based on the delivery of results (results-oriented), rather than the existing prescribed management or action-oriented approach (Burton and Schwarz, 2013; Herzon et al., 2018; Keenleyside et al., 2014). As argued by Hanley et al. (2012), the supply of biodiversity and other ecosystem services typically goes unrewarded by market forces, owing to the "missing market" phenomenon. Private landowners usually receive no direct financial reward for enhancing or protecting biodiversity, rather, it typically comes at an opportunity cost to landowners.

The aim of this chapter is to provide a bibliographic review of European agri-environment schemes (AES), with particular emphasis on a result-based approach. It starts by positioning AES within the logic of European CAP policy. It introduces the concept of payment for ecosystems services. It goes on to outlines the advantages and disadvantages of both action and result-based approaches to AES. It also provides examples of a number of existing result-based AES schemes in the EU. This overview forms a backdrop to the subsequent empirical Irish case-studies, centred on what is still a novel approach to the provision of biodiversity and other ecosystem services within the context of locally-led results-based agri-environment schemes.

EUROPEAN COMMON AGRICULTURAL POLICY (CAP)

The European Common Agricultural Policy (CAP) constitutes the largest agricultural support system worldwide, with a budget of €362.8 billion for the 2014-2020 programme (Pe'er et al., 2014). It also provides the largest source of funding for nature conservation in Europe (Cooper et al., 2009; Keenleyside and Tucker, 2010). When the CAP was first established in the post-World War II era, its main objective was to feed Europe, maintain farm incomes and improve standards of living for farm families. Policy measures of the early CAP comprised mainly direct payments to farmers and commodity price guarantees. By the late 1980s the success of the programme resulted in the over-supply of food products, along with a significant intensification of agriculture, aligned with environmental deterioration and increased conflict with the World Trade Organisation (WTO), because of its distorting effect on world commodity prices.

The CAP represents around 40% of the total European Union (EU) budget and influences land management across 180 million hectares of its 28 (soon to be 27) member states (Reed et al., 2014). It consists of two funds, known as 'Pillars'. The European Agricultural Guaranteed Fund (EAGF), or Pillar I, provides direct payment to farmers (such as the Basic Payment Scheme), and other forms of market support. The smaller Pillar 2 – European Agricultural Fund for Rural Development (EAFRD), which receives about 20% of the CAP budget, is designed to support rural development within its member states. Agri-environment schemes come under Pillar 2, and account for a significant portion of its expenditure – 16.8% in 2019 (Arnott et al., 2019). However, overall less than 6% of the total CAP budget is spent on agri-environment measures. As previously stated CAP still constitutes by far the largest source of funding for practical nature conservation in Europe (Herzon et al., 2018; Batáry et al., 2015). Over the period 2007-2013 EU member states were allocated over €22 billion to cover AES payments (European Court of Auditors, 2011). Pillar 2 funding decreased in absolute terms by 18% from 2013-2020 (from €13.9

billion to €11.4 billion), compared to a 13% reduction in Pillar 1 budget (Pe'er et al., 2014). Funding for both Pillars is set to decrease further in the next CAP round 2021-2027, however, it is expected that environment and climate measures will be even more important, and so will value for money. Member States (MS) have to match Pillar 2 payments with national co-funding.

EVOLUTION OF AGRI-ENVIRONMENT POLICY

Agri-environment schemes (AES) can be traced back to the agricultural structural regulation of 1985 (EU Regulation 797/85), the so called Article 19 targeted scheme, to compensate farmers for loss of income associated with less intensive management of environmental sensitive areas. In 1992 the MacSharry CAP reform (followed by the Agenda 2000 reform), set out to curb the worst excesses of agricultural over-production and environmental degradation, with the introduction of compulsory agri-environment schemes under EU Regulation 2078/92, along with set-aside obligations, price reductions and farm income compensation. The CAP reform of 2003 introduced the 'decoupling' of payments from agricultural production and 'cross-compliance' by linking payments to obligatory minimum environmental and animal welfare standards (Plieninger et al., 2012). The latest CAP round 2014-2020, has gone beyond cross-compliance and other existing EU environmental legislation (e.g. Habitats and Birds Directive, Water Framework, Nitrates, and Sustainable Use of Pesticides Directives), by dedicating 30% of direct payments (Pillar I) to a 'greening component' to be part of everyday farming activities. The 'greening component' incorporates three mandatory principles: 1. Crop diversification; 2. Maintenance of permanent pasture; and 3. Establishment of Ecological Focus Areas (EFA) (Matthews, 2013).

The horizontal Green Direct Payments and its Ecological Focus Areas have been criticised as being too simplistic in their design and for ignoring the science of ecosystem services (Plieninger et al., 2012; Matthews, 2013). Similarly, the broad-brush management or action oriented agri-environment schemes, which currently cover approximately 25% of the EU territory, although positive outcomes have been documented (Primdhal et al., 2003; Hanley et al., 1999), have overall failed to deliver for farmland biodiversity and agro-ecosystems (Ribeiro et al., 2016; Kleijn et al., 2006; MEA, 2005; Ó hUallacháin et al., 2016; Bellebaum and Koffijerb, 2018). In general biodiversity declines exponentially with increased land use intensity (Kleijn et al., 2008; Bullock et al., 2011; Tscharntke et al., 2005). Research shows that it is extremely difficult to enhance the botanical diversity of intensively farmed agricultural fields (Berendse et al., 1992; Kleijn et al., 2008, 2011). It is also widely accepted that, conserving what is left is more ecologically effective and cost effective than getting back what was lost (Kleijn et al., 2011). These well-established findings feed into the ongoing debate on whether biodiversity conservation is better tackled by 'land sparing' - setting aside strictly protected areas combined with intensive agriculture outside these areas – or 'land sharing', the integration of agricultural production and biodiversity protection on the same land (Phalan et al., 2011; Grau et al., 2013; Fischer et al., 2008, 2014; Green et al., 2005). The latter, 'land sharing', has always been the EU policy and lies at the foundations of agri-environment programmes. European agricultural multifunctionalism rewards farmers for simultaneously providing commodities and fostering farmland biodiversity (Plieninger et al., 2012). Besides, the 'sustainable intensification' associated with 'land-sparing' requires the support of a raft of ecosystem services, from soil fertility and pollination to pest control.

Agri-environment measures decouple payments from agricultural output. They provide income transfer to farmers but, in deference to the Uruguay Round of the General Agreement on Tariffs and Trade (GATT), in a way that does not distort trade and world markets (Cooper et al., 2009; Matthews, 2002, 2013). They are categorised as 'Green Box' payments, to signify that they only support the production of non-commodity public goods. The GATT 1994, agreement stipulates that, "The amount of payment shall be limited to the exact cost or loss of income in complying with the government programme" (GATT, 1994:.63). These two criteria have governed AES since their inception. AES payments are calculated on the basis of the incurred costs and the income foregone, including opportunity costs – to generate alternative income, such as conversion to forestry. Agri-environment-climate measures also allow the EU to continue supporting the farming community at a time when direct agricultural subsidies are under pressure from the WTO.

The CAP has reached a critical point and calls for change in funding priorities have grown louder. There is an increasing imperative to target public money for agriculture directly to the provision of public goods and

ecosystem services. There are essentially two ways to pay for ecosystem services (ES) in agri-environment schemes – there is the currently dominant input-based system (with prescribed management actions), and output-based systems (also known as payment-by-results), which link payments to the delivery of ecosystem services. There are advantages and disadvantages to both approaches. I will briefly summarise issues with the dominant action-based approach before going on to discuss result-oriented AES in more detail.

LIMITATIONS TO ACTION-ORIENTED AGRI-ENVIRONMENT SCHEMES

The overwhelming majority of agri-environment schemes in the EU are management or action-based payment schemes. They relate to defined agricultural management requirements which must be carried out by the farmer or land manager (Keenleyside et al., 2014). They are a collection of schemes that vary markedly between countries and with different objectives, ranging from the conservation of species rich grasslands and hay meadows to reductions in agrochemicals. They generally consist of a set of measures, such as taking field margins out of production, or planting/maintaining hedgerows, erecting bird boxes or stipulating mowing dates. These for the most part horizontal schemes have been in operation for over thirty years and are well embedded within institutional and political structures. Compared to the level of spending, there has been very little scientific evaluation of their effectiveness, with acceptance and uptake used as indicators of effectiveness in EU reviews (Burton and Schwarz, 2013; Primdahl et al., 2010). However, the implementation of AES schemes does not guarantee that the stated objectives of the scheme will actually be meet. Furthermore, a review by Kleijn and Sutherland (2003) found that environmental and biodiversity objectives are rarely clearly defined at the outset, which hampers proper evaluation. Kleijn and Sunderland (2003) carried out a comprehensive evaluation of 62 AES in five EU countries and Switzerland, from studies in the published literature. They found that in the majority of studies the research design was inadequate to assess the effectiveness of the schemes. Ó hUallacháin and Finn (2016) came to a similar conclusion in relation to agri-environment conservation measures for grassland vegetation in Ireland.

Kleijn et al. (2006) measured the level of biodiversity (birds, bees, spiders, grasshoppers and crickets) on a random sample of 202 pairs of similar fields in five EU Countries, one with an agri-environment measure and the other one without. They found that the effects of agri-environment measures on biodiversity in the analysed countries was marginal to moderately positive. Overall they found that in all countries studied, except the Netherlands, some measures of biodiversity were higher on fields with AES compared to conventionally managed fields, but that the positive effects of AES on endangered farmland species was negligible, with the exception of birds in Spain. Not a single species from the IUCN Red Data Book was observed. This confirmed prior observations that contemporary farmland in N-W Europe hosts almost exclusively common wildlife species of both plants and animals (Kleijn and Sutherland, 2003; Kleijn et al., 2001, 2006). They concluded that schemes aiming to promote specific endangered species probably need to be much more tailored to the needs of those species (see also Bellebaum and Koffijerb, 2018). Along with other researchers, Kleijn et al. (2006, 2011) also highlight a major problem with respect to spatial scale, stating that local positive effects do not guarantee that biodiversity decline at the national or even regional level can be stopped (Berendse et al., 1992; Batáry et al., 2015; Tscharnthe et al., 2005). Most AES operate at the field or farm level, resulting in an erratic spatial distribution of fields in an otherwise intensively farmed landscape (Kleijn et al., 2006). Research by Batáry et al. (2015) found that AES schemes implemented after 2007 were not more efficient than schemes implemented before that date, with no sign of learning or improvement of effectiveness over time. Other researchers have also highlighted the fact that a learning process is rarely built into AES design (Finn et al., 2008, 2009; Primdahl et al., 2010). Kleijn et al. (2006) concluded that in order to make AES more effective for biodiversity, there is a need to formulate clear and quantifiable objectives at the start along with baseline data, and the compulsory evaluation of their ecological effects.

Along similar lines Feehan et al. (2005) conducted an evaluation of the Irish agri-environment Rural Environment Protection Scheme (REPS), and found that most species rich and species poor farms were all non-agreement farms, i.e not in REPS. The study concluded that the scheme did not significantly benefit the flora, fauna and beetle biodiversity surveyed. An evaluation of the status of Irish habitats under the Habitats Directive found that all grassland habitats had a 'poor or bad' conservation status in 2007, with no improvement by 2013 (NPWS, 2008, 2013). A study by Ó

hUallacháin et al. (2016) of the botanical composition of selected grassland habitats managed under the Irish Agri-Environment Options Scheme (a follow-on from REPS), found a large variation in results within different conservation measures, and that were not reflected in scheme payments. They called for increased prioritisation of targeting aimed at species and habitats that are of the highest conservation concern and an evidence-based approach linked with differentiated payment rates. Action-oriented AES have typically been seen as a source of income support, designed to facilitate the reliable distribution of funds to farmers' across the board, rather than targeting environmental objectives (Reed et al., 2014).

Potter and Wolf (2014: 402) summarised widespread consensus, when they stated that AES cannot be said to be "strongly anchored in scientific research". The scientific consensus since Kleijn and Sutherland's (2003) landmark paper, is that agri-environment measures have provided only marginal biodiversity gains. Despite major investments in action-oriented schemes across Europe, farmland biodiversity has continued to decline (Whittingham, 2011; Donald et al., 2006; Herzon et al., 2018; Davey et al., 2010).

Another major criticism of action-oriented AES, where farmers essentially select options from a menu-type template, is that they fail to influence farmer's attitudes to the environment or change their behaviour and are thus ineffective in the long term (Burton and Paragahawewa, 2011; Burton et al., 2008; de Snoo et al., 2013; Arnott et al., 2019). The actions are not embedded within farming culture as part of what Burton and Paragahawewa (2011) refer to as conventional 'good farming practice', central to the creation of cultural and social capital within farming communities. The voluntary five year contracts, that one can opt-out of at any time, do not necessarily require a deep personal involvement or a change in farm management strategy. The prescriptive nature of action-oriented AES does not even require farmers to learn anything about good conservation practices, neither does it encourage farmers to innovate (Burton and Schwarz, 2013)[1]. After the 5-year contract is up, there is no guarantee that the conservation measures will be continued, cancelling the ecological benefits accrued during the contract period. Furthermore, what Hanley et al. (1999) refer to as a 'halo effect' may develop where small parts of the farm operate under agri-environment schemes, while the majority of the farm remains intensive, restricting wildlife corridors or catchment performance. Farmers often select to participate in scheme prescriptions

that fit their farm situation, with low costs of compliance or minimum change to current farm practices (Morris and Potter 1995; Arnott et al., 2019). This bias in option uptake has been identified as a primary reason why AES may fail to deliver for biodiversity (Davey et al., 2010). There is also concern that the existing AES are not providing value for money (Armsworth et al., 2012; Hanley et al., 2012; Ansell et al., 2016; Matzdorf and Lorenze, 2010; Whittingham, 2011; ECA, 2011).

On a positive side, action-oriented agri-environment measures have shown good uptake and a willingness of the farming community to participate, as they generally involve little actual change to farming practice. Other advantages are the ease of management and monitoring – selection of options from a standardised menu, relatively low transaction costs, payments are predictable and can be incorporated within the farm planning budget. As previously stated they are politically embedded and do not contradict WTO trade and tariff agreements.

However, the rhetoric is changing, under budgetary constraints, WTO disquiet and the growing public scrutiny of agricultural subsidies, the EU is looking for more cost-effective and clearer outcome-based results, reflecting what Potter and Tilzey (2005) refer to as an increasing neoliberal ideology in EU policy. The European Court of Auditors (ECA, 2011) stated that agri-environment expenditure should be targeted more precisely, and that many current objectives are not specific enough to assess whether they have really been achieved. They also noted the lack of monitoring of the environmental impacts of agri-environment measures (ECA, 2011). We can conclude that both the ecological effectiveness and cost effectiveness of AES must be improved. The possibility of integrating the ecosystem services approach into AES is increasingly proposed, along with emphasis on measurable result outcomes (Herzon et al., 2018; Schroeder et al., 2013).

PAYMENT FOR ECOSYSTEM SERVICES (PES)

Before discussing the particularities of result-based agri-environment schemes, it is first necessary to position that debate within the broader framework of payment for ecosystem services (PES), which is ultimately the foundation on which result-based AES rests.

Ecosystem services (ES) are essentially the benefits people obtain from ecosystems. Although challenging, the concept has become what Redford

and Adams (2009: 785) referred to as "the central metaphor within which to express humanity's need for the rest of nature". The ecosystem services concept has become widely adopted, notably by the Millennium Ecosystem Assessment (MEA, 2005) which categorises services as: 1. Provisioning (e.g. timber / food), 2. Regulating (e.g. water / climate / carbon), 3. Supporting (e.g. pollinators / pest control) and 4. Cultural (e.g. wellbeing / recreation / landscape aesthetics). Many of these so called public goods and services are provided free of charge by agricultural landscapes, such as biodiversity, pollination, water, carbon capture, cultural heritage and scenery. As stated by Hasund (2013), if the agricultural management disappears or changes so will the public goods that are specific to agriculture. In essence, the ecosystem services approach strives to commodify environmental public goods in an attempt to counteract market failure, which currently classifies them simply as free 'externalities'. It positions conservation not as constraining the economy, but as protecting a source of direct economic value (Adams and Hodge, 2014; Hodge, 2013). It is a pragmatic neoliberal approach (based on the work of such ecological economists as Robert Constanza, 1997, Farley and Constanza, 2010), to put a monetary value on public goods. In 1997, Constanza et al. (1997) estimated ecosystem services worldwide to be worth an average $33 Trillion annually ($44 trillion in today's dollar), but updated estimates are substantially higher than that. Putting a market value on these services is quite complex, because the public goods and services have properties of non-rivalry and non-excludability; meaning there is no clear interaction between demand and supply, because their use by one agent doesn't necessarily reduce their availability for use by others, take for example clean air (Hodge and Reader, 2007; Arnott et al., 2019: Hanley et al., 2012). Consequently, standard market arrangements are ineffective. Given the difficulty associated with creating a working market for ecosystem services, the mediatory role of the State has been fundamental to act as a buyer on behalf of the diffuse public consumer (Wynn-Jones, 2013). In recent years a wide range of techniques have been developed to value ecosystem services, broadly based on the benefits perceived by those consuming them, rather than on the cost of provision (Reed et al., 2014). It marks a shift in policy from a Direct Payment Support System, to a 'Public Money for Public Goods' approach (Arnott et al., 2019). Ultimately, land managers should approach the production of ecosystem services and public goods, like they would any other marketable product.

In order to link ecosystem services with AES, policies must be informed by evidence on how ecosystem services and land management practices relate to each other (Whittingham, 2011). The cost of monitoring and verification of ecosystem services delivery, via payment by result-based agri-environment schemes, is considerably higher than the current prescriptive management schemes, and well outside the European Commission's recommendation of less than 4% of the total programme cost (Reed et al., 2014). It is also difficult to price individual services as they tend to work as a bundle within heterogeneous landscapes (Redford and Adams, 2009). Markets can change rapidly (e.g. carbon market), as do public preferences and 'willingness to pay'. For the PES approach to work, there needs to be a long term commitment to sustain a 'market' for public goods and ecosystem services, otherwise farm managers are not going to risk adapting their farm businesses to enhance ES. Competitive auctions that allocate contracts to those that can provide the highest ecosystem services benefits for the lowest cost, can be associated with result oriented agri-environment schemes (Groth, 2009). This approach is currently used in the US Conservation Research Program.

In terms of the shortcomings of the PES approach, many economists have questioned the ability of market valuation processes to capture the complexities of ecological systems and ensure parity of payments (Hodge and Reader, 2007). The difficulty of connecting disparate producer and consumer groups, along with the prohibitive costs of measuring goods and services supplied, means that most schemes end up as hybrids, i.e. with both a prescriptive management and result components. Others critique a neoliberal attempt to promote conservation through an expansion of capitalism, overlooking the intrinsic value of nature (Büscher et al., 2012). Norgaard (2010), argued that PES sustains rather than challenges the entrenched excesses of production and consumption. Others argue that PES may be a form of 'crisis remediation', and what CAP reform needs is for greater emphasis to be put on agro-ecological methods of production rather than continuing attempts to "remediate and maintain an unsustainable approach to agriculture" (Wynn-Jones, 2013: 84). In short, the market should conform to the logic of ecosystem services, rather than the other way around, which is arguably what PES is attempting to do. Finally, the WTO, GATT 1994 agreement and EU Regulation 1783/03, currently restrict the possibility of more direct CAP payment mechanisms, that explicitly cost the value of ecosystem services, rather than opportunity costs, i.e. the cost

of compliance (Schomers and Matzdorf, 2013; Hasund, 2013). Burton and Schwarz (2013: 638), argue that going forward we will need a more 'flexible interpretation of the WTO requirements', as we cannot logically design schemes to meet specific outcomes, and then set payment rates with reference to the costs of actions rather than the value of the outcomes. Potter and Wolf (2014) conclude that the PES landscape is currently highly fragmented and largely experimental, with PES-like approaches being piloted by a series of disparate case-studies.

RESULT-BASED AGRI-ENVIRONMENT MEASURES

There is no single agreed definition of what constitutes a 'result-based' agri-environment payment scheme (Herzon et al., 2018; Keenleyside et al., 2014). Other terms are used interchangeably, such as, 'payment-by-results', 'result-oriented', 'outcome focused schemes', 'payment for ecosystem services'. I will refer to them as 'result-based' payments to differentiate them from the currently dominant prescriptive management or action-based payment schemes, described above. Result-based agri-environment schemes pay land managers not for performing specific management actions (such as mowing on set dates), but for achieving set environmental outcomes, such as a species rich grassland or the promotion of an endangered species. There is a general belief that result-based approaches will be able to deliver better ecological outcomes than action-based approaches and can better integrate ecosystem services within agri-environment programmes. They are also believed to be more cost effective, as payments are directly linked to outcomes (Matzdorf and Lorenz, 2010). Within result-based payments the farmer or land manager is free to choose the most appropriate management to achieve the prescribed result, and payments should reflect the level of achievement. One of the frequently cited attractions of this approach is that it gives the farmer autonomy and the freedom to innovate. It allows them to use their existing knowledge that is necessarily more context specific than the generic prescribed measures that define action-based approaches. The removal of management restrictions and regulations is also likely to increase the attractiveness of schemes, and research to date indicates that the rate of uptake of result-based AES is very positive, despite the increased risk involved (Matzdorf and Lorenz, 2010; Fleury et al., 2015; Herzon et al., 2018; Maher et al., 2018). Linked with the freedom to innovate is what Burton and Schwarz (2013) refer to as the critically important long term attitudinal and behavioural change, whereby it is expected farmers will incorporate biodiversity and ecosystem services considerations into their concept of 'good farming practice'. It goes beyond the economic and ecological aspects of participating in AES to embrace the social and cultural co-benefits (de Snoo et al., 2013; Arnott et al., 2019).

The suitability of a result-based approach depends on a number of criteria (see Maher et al., 2018; Keenleyside et al., 2014; Herzon et al., 2018) including:

- The clear definition of the ecological objective (i.e. the outcome), based on strong ecological research and up to date baseline data.
- The biodiversity target should be a conservation priority, and be largely dependent on agricultural practices.
- There needs to be a clear, unambiguous link between the ecological objective and reliable indicators that act as proxy for achieving the ecological objectives, and upon which payments depend.
- The result indicators should not be easily achieved by means other than agricultural management. The indicators should be easily measurable, quantifiable and observable by farmers, and they should not be heavily dependent on factors external to the farm, for example, the weather (Uthes and Matzdorf, 2013).
- The existence of adequate expert knowledge on ecological requirements to inform best practice and knowledge transfer to farmers and farm advisors.
- An appropriate system for results verification, farm advisory service and dispute resolution needs to be in place.
- The objectives of the ecological results should be compatible with farmers production rationales and should not require excessive risk taking.
- Socio-economic factors need to be taken into account, including stakeholders' attitudes to innovation and risk taking, along with the existence of a culture of trust between the various actors – farmers, farm advisory service, evaluators and government institutions.
- Works well with a Locally-Led approach.

A lot of the literature on result-based AES has concentrated on the development of reliable indicators, but it must also be remembered that indicators may not be possible for all biodiversity objectives and in all locations (Uthes and Matzdorf, 2013; Kaiser et al., 2010). Thus, result-based schemes are restricted to cases where causal relationships are well established, and can be represented by indicators. Options for indicators range from the number of a single species to a composite indicator, as in the Burren Programme (see Chapter 3), combining species numbers and habitat attributes. When species are the biodiversity target, the ecological integrity of the supporting habitat needs to be considered. Maher et al. (2018: 21) advise that a habitat-based approach is the most effective to deliver a range of benefits and minimise trade-off between ecosystem services. Multiple indicator thresholds, aligned with corresponding payment levels, incentivises farmers to continually improve their ecosystem services outcomes. Setting an appropriate payment level that reflects the full cost of achieving the desired outcome, including time spent on training and possibly monitoring of results by farmers, while also keeping the scheme simple and cost effective is a challenge (Cooper et al., 2009; Herzon et al., 2018). Case studies, such as those from Germany, demonstrate that result-based payments can be achieved within the existing policy framework (Matzdorf and Lorenz, 2010).

Existing result-based AES mainly target the maintenance of threatened habitats or species of conservation priority rather than common farmland biodiversity. In general, they are better suited to the maintenance of existing habitats (where farmers can draw on their management experience), rather than the restoration or re-creation of habitats. These tend to be semi-natural habitats, which have for a long time been under low-input, often high nature value farming (HNVf) systems, with foremost priority going to Natura 2000 sites (O'Rourke and Kramm, 2009). Parallel research has been done on developing farm typologies that capture these farming systems, which could form a useful basis for targeting result-based AES (O'Sullivan et al., 2017; Ribeiro et al., 2016; O'Rourke et al., 2012). The targeting of

CASE STUDIES, SUCH AS THOSE FROM GERMANY, DEMONSTRATE THAT RESULT-BASED PAYMENTS CAN BE ACHIEVED WITHIN THE EXISTING POLICY FRAMEWORK

HNV farmland which tends to be found in naturally disadvantaged areas, means they would significantly benefit from the redistribution of funding associated with a result-based PES approach.

Keenleyside et al. (2014: 4), provide a good summary of the advantages of result-based agri-environment schemes to both farmers and managing authorities, which are summarised here:

- Much clearer link between payment and biodiversity achievements.
- Contracts with farmers simply specify the results required, rather than defining in detail the farm practices that should be carried out.
- The 'production' of biodiversity becomes an integral part of the farming system and farm business, not just another set of land management 'rules' to be followed.
- Farmers have the opportunity to use their management skills, professional judgement and knowledge of the farm and are rewarded for achieving the results of their entrepreneurial efforts.
- Farmers are encouraged to take responsibility for and own the biodiversity results, and this can lead to greater public recognition of farmers' role in supporting biodiversity objectives.
- Results-based schemes can more easily meet the EU requirements for verification of agri-environment-climate payments under the 2014-20 CAP.
- Results-based schemes are more easily targeted and budgets carry less 'deadweight' because there is a built-in incentive for farmers to select only the land where the biodiversity results are achievable.

Keenleyside et al. (2014: 4), also cite circumstances where a management-based approach may be more appropriate than a result–based AES:

- If it is not possible to design reliable indicators of biodiversity results and methods of measuring them on farms.
- Where the managing authority does not have access to the environmental information and expertise needed to set up and run a result-based scheme.
- If the farming community is unwilling to accept a result-based approach (end of citation, Keenleyside et al., 2014:4).

Result-based approaches also contribute to spreading environmental awareness and increasing the motivation of farmers towards environmental protection. Most result-based measures implemented to date have focussed on species rich grasslands, and aim for the conservation of plant rather than animal species; partly because mobile animals are more difficult to observe and they also depend on conditions in neighbouring fields, or in the case of migratory birds, different countries/continents (Russi et al., 2014).

RESULT-BASED AGRI-ENVIRONMENT SCHEMES: EXAMPLES FROM THE LITERATURE

The first experiments with result-based agri-environment schemes were carried out in the early 1990s, with one of the longest running and best known schemes being the MEKA ('Extensive grassland management') programme, introduced in 2000 and co-funded by CAP, focussing on species rich meadows in Baden-Württemberg and later in Lower Saxony in Germany. Within this scheme, farmers receive payments if they have 4 out of a list of 28 indicator plant species in their meadows (Matzdorf et al., 2008; Wittig et al., 2006; Russi et al., 2016). Farmers' received the result-based payment (of €50/ha., between 2000-2009, and €60/ha. between 2009-2014), in addition to an action-oriented basic payment for extensive grassland management, and it is thus a hybrid scheme. In the 2014-2020 RDP programme period a two level 'stand-alone' payment was introduced and is now €230/ha for four indicator species and €260/ha for six indicator species. But the result-based measure can no longer be combined with other management-based measures (as was the case prior to 2014), the de-facto additional payment in most cases is €80/ha (Russi et al., 2014). The MEKA programme essentially rewards existing practice and does not require any management adaptation except a ban on silage making. The programme initially had over 9,000 participating farmers and covered an area of 66,112 ha. In the 2007-2013 RDP period, participation levels fell to around 5,000 farmers, and the area covered decreased to around 41,539 ha, mainly due to low payment rates and the increased opportunity cost related to extensive grassland management (Russi et al., 2016). The increased payment in the current programme period was to incentivise farmers with higher opportunity costs. The majority (62%) of participants are part-time farmers, who as remarked by Russi et al. (2016:72) "tend to be less dependent on agricultural income than full-time farmers, and for this reason are ready to accept lower productivity and are thus more likely to maintain species rich grasslands".

Matzdorf and Lorenz (2010) interviewed 90 farmers' who participated in the Baden-Württemberg result-based AES. They found that 52% of interviewees continued to manage the grasslands without any change to their farming practices; 48% had adjusted their practices – the biggest change being ceasing silage production. They found that the maintenance of the species rich grasslands ranked very high in importance among 90% of the interviewees; firstly, because it produced good quality fodder (N=40), it contributed to nature conservation (N=38) and the preservation of the cultural landscape (N=29), and helps raise scenic beauty (N=10) (Matzdorf and Lorenz, 2010). The survey also found that many of the participating farmers already had a positive attitude towards nature conservation prior to joining the scheme, most were part-time farmers and over 70% of the interviewees identified all indicator species each year. All the participants mentioned the importance of well-defined indicators. They also found that risk-averse farmers were less likely to participate in the scheme (Matzdorf and Lorenz, 2010).

A review of the project by Russi et al. (2014) found that payments cover the opportunity costs of some categories of farmers (e.g. part-time farmers, less productive fields, hay producers, farmers with few animals), but not those of intensive cattle raisers and biogas producers. This is partly due to changing market conditions (e.g., the decreasing and fluctuating price of hay), and the increasing economic attractiveness and less labour requirements of more intensive management strategies (i.e. silage and biogas). Russi et al. (2014, 2016) argue that the scheme may not be sufficient in the long run to ensure a wide participation, as it does not fully compensate for the opportunity costs of all potentially involved farmers. Rather it acts as an incentive or reward to compensate management strategies that are dependent mainly on intrinsic (ethical) motivation, and in some cases also partly on extrinsic motivations (i.e payments). The increased payment level and differential thresholds introduced in the 2014-2020 programme period is an attempt to cover the opportunity costs of a larger share of farmers and improve the uptake of the measure (Russi et al., 2016). The authorities and scientists involved in the MEKA project believe it plays an important educational role as well as avoiding the abandonment or intensification of species-rich grasslands.

Other early examples of result-oriented schemes for the conservation of hay meadows and pasture land were implemented in the Peak District National Park in the UK, as part of a results element to the existing Higher Level Stewardship Scheme (Buckingham et al., 1998). Other programmes include a Swedish result-oriented scheme to encourage the reproduction of large carnivores (lynx and wolverines) on reindeer grazing land (Burton and Schwarz, 2013). In the Netherlands result-based payments targeted the improvement of breeding success of meadow bird species, using per clutch payments to preserve nesting Lapwings and Black-Tailed Godwits (Musters et al., 2001).

A flowering meadows result-based scheme was established in France in 2007, in the form of a 5-year contract between farmers and the State, and applies only within Natura 2000 zones (Fleury et al., 2015; de Sainte Marie, 2014). Like the Baden-Württemberg programme, farmers commit to ensuring that at least 4 plant species out of a reference list of 20 are present on their land. These species are chosen as indicators of meadows high ecological quality, and are for the most part easily identifiable plants with coloured flowers. Out of 39 participating farmers surveyed by Fleury et al. (2015), only 4 made technical changes, such as mowing later in the season, not mowing the centre section until last to allow flowers to seed, or diluting liquid manure. In practice farmers who signed up for the measure had already reached the target outcome, before they committed to the programme, so it was more a matter of maintaining these measures rather than achieving them. Overall, Fleury et al. (2015), found that the flowering meadows measure does promote a value change, and modifies how farmers view meadows and biodiversity. As in Baden-Württemberg, the French 'flowering meadows' farmers see biodiversity as a factor in forage quality. Again, the more risk-averse farmers tend not to get involved, or those who fear the scheme is too complicated, involving more work, more paperwork and too time consuming (Schroeder et al., 2013).

In the UK the Welsh Glastir scheme, using a whole farm approach, is a move towards a PES orientated scheme (Wynn-Jones, 2013). However, for the moment it is more a complement to the existing action-oriented AES rather than a 'pure' PES scheme, having hit some practical and political barriers in rolling out the scheme (Wynn-Jones, 2013). The former relate to an inability to link particular management specifications to the delivery of measurable ecosystem outputs (Potter and Wolf, 2014).

In Ireland one of the best developed and longest running result-based AES is the Burren Programme which commenced in 2005 with twenty demonstration farms, farming 2,500 ha of priority habitat, and today has 328 farms covering an area of 23,000 ha of priority habitat. The Burren Programme is outlined in detail in Chapter 3. In 2015, Ireland's Department of Agriculture, Food and the Marine (DAFM) allocated some EU RDP funding towards the expansion of the Locally-Led Result-Based Approach (LLRBA), developed in the Burren Programme, to other areas under the auspices of European Innovation Partnership Pilot Projects (EIPs). All the above case-studies have had an important educational and awareness raising role.

Burton and Schwarz (2013) and Schwarz et al. (2008) provide a comprehensive literature review of result-based agri-environment programmes in Europe.

ISSUES WITH RESULT-BASED AGRI-ENVIRONMENT SCHEMES

Conventional action oriented agri-environment schemes have been criticised for a number of reasons: including poor targeting, lack of payment differentiation, short-termism, inadequate monitoring, moderate to poor ecological effectiveness, poor cost-effectiveness, inability to promote innovation and farmers long-term attitudinal and behavioural change (European Court of Auditors, 2011; Burton and Schwarz, 2013; Matzdorf and Lorenz, 2010; de Snoo et al., 2013; Finn and Ó hUallacháin, 2012). A focus on payment-by-results will address some of these issues, but as observed by Moxet and White (2014), it will not address all of them, and it does come with its own set of challenges.

Firstly, result-based AES are restricted to cases where causal relationships between farming practices and ecological objectives are well established and can be represented by single or composite indicators. Some agro-ecology interactions are very complex, operate within specific spatial and temporal scales, may vary over short distances, and not all biodiversity targets can be measured through indicators. Or as Wynne-Jones (2013: 82), put it, the 'limit of scientific knowledge', in terms of linking particular management specifications to the delivery of measurable ecosystem outputs can be a stumbling block, which may be improved on with further research. Habitat change may be slow to respond to changes in land management practices, due to lag times in ecosystem processes, and may not be picked up by

indicators for a long time. The 'time-lag' issue seems to suggest result-based AES may, as previously stated, be more appropriate for holding on to what one has rather than ecosystem restoration, reinforcing the advantage of targeting HNV farmland and designated areas like Natura 2000. The time-lags between management inputs and ecosystem outcomes can also complicate monitoring and payment regimes, making them less attractive to farmers (Reed et al., 2014).

The effectiveness of all agri-environment schemes are significantly impacted by the spatial scale of delivery. Biodiversity conservation is fundamentally a spatial practice. As argued by Kleijn et al. (2011:480), "it is imperative that biodiversity and ecosystem services are monitored within the context of land use within the wider countryside, and in such a way that effects can be scaled-up to national and continental trends, in order to assess what exactly is the impact on conservation strategy". Kleijn et al. (2011) found that only a few studies have linked local conservation efforts to national biodiversity trends, and it is therefore unknown how the EU agri-environment budget for conservation on farmland contributes to the policy objective to halt biodiversity decline. Currently all agri-environment schemes (management and result oriented), operate predominantly at the field and more rarely the farm scale, generally ignoring the critical landscape level (McKenzie et al., 2013; Tscharntke et al., 2005; Cumming et al., 2006). As remarked by Cumming et al. (2006), there is currently a mismatch between the scale at which ecosystem services are managed and the scale of the ecological processes that give rise to these services, and the scale at which most payments are made. The landscape scale requires linkages between separate land management units and attention to habitat matrixes to prevent species/habitat isolation and fragmentation (Donald and Evans, 2006). For example, to be successful AES measures for farmland birds must be embedded within landscape level habitat management to ensure suitable invertebrate food sources within easy reach and possibly to facilitate migration (Bellebaum and Koffijerb, 2018).

A number of researchers, including Burton and Schwarz (2013), Matzdorf and Lorenz (2010), have put a lot of emphasis on the fact that result-oriented AES create strong incentives for farmers' to innovate, and apply their context specific knowledge towards meeting biodiversity and other ecosystem services objectives, something 'rulebook' management-based AES stifle. They argue that this in turn leads to long term behavioural change and increases the social and cultural capital of farmers within their communities. However, as observed by Moxet and White (2014), farmers may lack the capacity to independently innovate with respect to the delivery of environmental outcomes. Given that environmental scientists themselves often express uncertainty about the complex ecological, spatial and temporal relationships between land management and ecology and hydrology, it is "unreasonable to expect scheme participants to know how specific environmental results can be achieved at low costs" (Moxet and White, 2014: 398). The ability of land managers to take advantage of the 'freedom to innovate' is strongly influenced by the availability of appropriate advisory support. This in turn raises issues about the role, training and skill-sets of farm advisors within result-based AES. How advisors are trained, technically supported, updated and funded is critically important. The Burren Programme is exemplary in providing local high end scientific support, training, up-dating and performance monitoring of farm advisors, however, it comes at a price. The higher training and transaction costs associated with result-based AES, means that keeping schemes both simple and cost-effective can be challenging (Cooper et al., 2009). Or perhaps the EU and National Governments have to accept that if we want agri-environment programmes that actually deliver for biodiversity and the environment, they have to pay more for them. Paying less for the delivery of management oriented schemes is a false economy and poor value for tax payers' money, if they do not reach their objectives. The higher transaction costs of result-based schemes, would arguably support employment and ultimately contribute to the often disadvantaged rural economies within which they are embedded. One could also envisage the distribution of transaction costs among public, private and semi-private providers.

Quantifying payment levels which reflect different levels of environmental outcome remains, according to Schwarz et al. (2008), one of the key challenges for the practical implementation of strongly result-oriented AES. The Burren Programme (Chapter 3), provides a good example of how to build this into a scheme and how to reward and incentivise high performance. Current result-based payments may be too low to motivate farmers and avoid both land abandonment and intensification (Russi et al., 2016; Wynn-Jones, 2013; Arnott et al., 2019). Russi et al. (2016) argued that the Baden-Württemberg programme acted more as a reward or incentive rather than a proper market based instrument as the payment level was too low to attract potentially interested farmers.

Result-based agri-environment schemes are also associated with increased private risks to farmers, as the outcome of land management practices may be dependent on factors outside the farmers control: such as the behaviour of neighbouring farmers along with many natural processes including - climatic conditions, pest invasion, disease, parasites, and the life cycle stages of mobile species may occur in different geographical locations. Thus, while action-oriented AES may provide a reliable source of funding (with risks transferred to the State), result-based schemes do not offer such security. We need to consider effective risk-management in the program design of result-based AES. A hybrid approach (as in Baden-Württemberg and the Burren Programme), including a base payment to compensate for actions and a bonus payment for outcomes, has been suggested as a means of reducing risks to farmers (Burton and Schwarz, 2013; Wynne-Jones, 2013). In a hybrid approach the State shares the cost of risk-bearing. Result-based AES also need a robust system of dispute resolution that is seen to be fair to both sides.

Potter and Wolf (2014: 406), have cited political concerns regarding "the privatisation of environmental management that could compromise the role of the State as a guardian of the public interest". They also acknowledge institutional and political resistance to change from the current broad-brush AES approach with its aligned vested interests, often within the farming community itself (see also Birge et al., 2017). Burton and Schwarz (2013: 638), conclude that "result-oriented schemes may be better viewed, not as the logical market based successor to action oriented approaches, but rather as part of a mix of agri-environment policy strategies to be targeted at particular situations rather than applied unilaterally". The empirical case-studies presented in this book appear to concur with that statement.

WAY FORWARD

The future of the Common Agricultural Policy (CAP), especially its agri-environment-climate programme, will shape the framework for biodiversity and nature conservation in Europe. As remarked by Arnott et al. (2019: 206), the current 'business-as-usual' action-based approach to agri-environment policy, "may maintain the status quo and stop further intensification and nutrient overload, but it is unlikely that it will deliver for biodiversity and ecosystem services at a landscape scale or promote long term behavioural

change". Under current and likely future RDP budgetary constraints and as specified by the European Court of Auditors (ECA, 2011), it is more important than ever that agri-environment-climate funding is targeted to actually deliver for the environment and society.

There is considerable potential to expand the use of a result-based approach within agri-environment schemes for the next CAP Rural Development Programme 2021-2027. Result-based payment schemes depend on setting clear objectives and result outcomes linked to agricultural practices, which can be measured by reliable (and self-monitoring) indicators. Or where this is not possible considering a hybrid approach - adding a more demanding result-based top-up to existing management based schemes. There are still technical and scientific issues to be ironed out, particularly in relation to indicators and spatial scale considerations, which may ultimately only be resolved by experimentation in a case by case approach. The spatial coordination of ecosystem services and public goods delivery across multiple farm holdings, along with collaboration among government departments and between public and private bodies remains challenging but, according to Hodge and Adams (2012), is not insurmountable. Perhaps, a good place to start is with a locally-led approach, which can effectively integrate and absorb a lot of the above complexity. The increasing EU devolution of responsibility to member states offers greater flexibility in the delivery of national agri-environment programmes, enabling a greater focus on outcomes and maximising cost-effectiveness. There is also a need for greater flexibility in the interpretation of WTO regulations. A true result-based approach should reward the achievements of actual results, above the cost of their delivery, comparable to the profit margin of producing a market product (Reed et al., 2014). The existing WTO 'direct costs and income foregone' calculations favour creation over maintenance, but logically effective habitat creation and restoration must result in a focus on maintenance (Finn et al., 2008). For example, it is currently financially more beneficial for a farmer to reinstate hedgerows which s/he had previously removed, than to maintain existing high quality hedgerows (Finn et al., 2008).

The environmental and public goods friendly discourse contained in EU and national policy documents is not reflected in reality when it comes to funding. To paraphrase Arnott et al. (2019: 203) "the first barrier to the success of agri-environment schemes and the delivery of Public Goods is that of economics". Agricultural subsidies are heavily skewed towards productivity, i.e. Pillar I, direct support payments, along with a very limited mandatory 'green' component. The substantially smaller Pillar 2 funding directed at agri-environment-climate regulation, aims to ameliorate rather than challenge the problems associated with intensive agriculture production. Ultimately we need to address the contradictions in agricultural policy, which appear to be moving towards a 'land sparing' scenario – with the oxymoronic 'sustainable intensification' on productive land and a payment for ecosystem services (PES) in areas of natural constraint. High productivity requires functioning ecosystems and all farmers want to produce, meaning agri-environment-climate schemes must work alongside their established farming practices (Lastra-Bravo et al., 2015; Fischer et al., 2012). Thus, all agriculture needs to be both productive and to operate within the limits of healthy ecosystems. The 'quality food' and 'quality environment' argument contradicts the current globalised neoliberal market economies and the 'food empires' that profit from a cheap food policy (Sage, 2012). Ultimately payment for ecosystem services must be positioned within a joined-up future vision for food, agriculture and the environment.

Endnotes

1 Recent research by McCracken et al. (2015) seems to contradict the common perception that prescriptive action based AES do not actively engage farmers or allow them to develop new environmental management skills. This research found a clear link between biodiversity outcomes, farmer's motivation and their experience, including the length of time and frequency with which they had been involved in agri-environment schemes. They concluded that farmers are not just carrying out prescribed tasks, but are also making decisions which impact on success.

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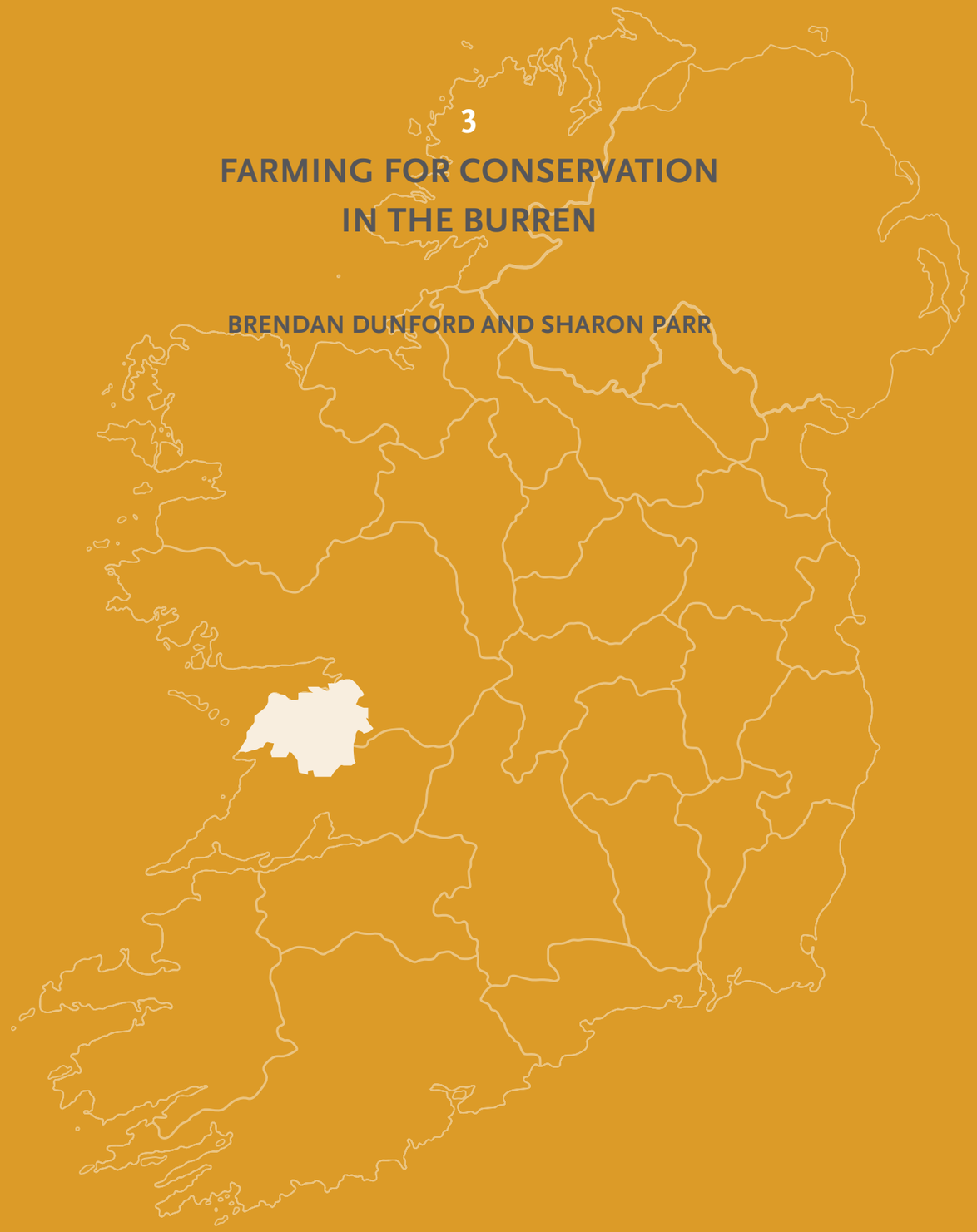


3

FARMING FOR CONSERVATION IN THE BURREN

BRENDAN DUNFORD AND SHARON PARR

THE BURREN, LAND OF PARADOX

The Burren, *An Bhoireann*, place of stone. Lunar landscape, fertile rock. A landscape abounding in contradictions: apparently barren, desolate hills that continue to sustain a rich and lengthy agricultural tradition; an inhospitable terrain that is saturated with evidence of 6,000 years of human activity; a region dominated by bare rock and whipped by Atlantic winds, yet one which provides refuge and sustenance for a wide diversity of plants, some of which are normally at home in regions as disparate as the Arctic, the Alps and the Mediterranean.

The paradoxical, and deceptively fertile, nature of the Burren has always captured the imagination: from 1317 AD we hear of the '*Burren's hilly grey expanse of jagged points and slippery steeps, nevertheless overflowing with milk and yielding luscious grass*' (O'Grady, 1929). In 1651 the Cromwellian soldier, General Ludlow (cited in Ó Dálaigh, 1998), famously noted:

> 'Of this barony it is said that it is a country where there is not water enough to drown a man, wood enough to hang one, nor earth enough to bury them. This last is so scarce that the inhabitants steal it from one another and yet their cattle are very fat. The grass grows in tufts of earth of two or three foot square which lies between the limestone rocks and is very sweet and nourishing'.

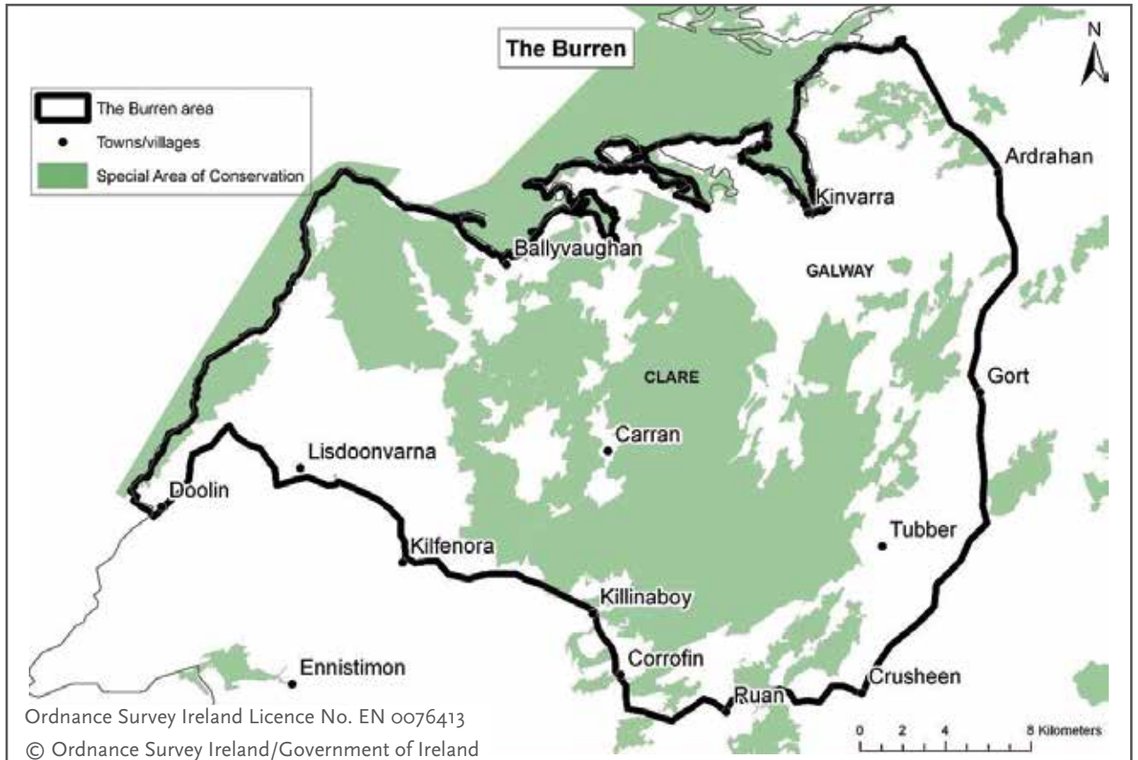


Figure 3.1
Location map of the Burren region (72,000 ha) with SAC designated areas in green

The Burren – extending over an estimated 72,000 ha of land in Counties Clare and Galway (Figure 3.1) – is defined by the presence of exposed limestone – the calcium-rich skeletal remains of marine organisms (e.g. sealilies, ammonites, urchins, corals and brachiopods) that populated the warm, shallow equatorial seas of the Carboniferous period, 340m years ago. Over time, these remains were compressed and elevated to reveal the massive, fossil-rich limestone terraces which we see today. These were shaped by a combination of water solution (creating macro 'karst' and micro 'karren' solutional features), tectonic forces and several periods of glaciation. While this stunning geological heritage (Figure 3.2) has recently been recognised through UNESCO Geopark Status, for farmers the limestone bedrock has always been valued for the 'dry lie' which it affords to outwintering cattle, akin to an underfloor heating system which keeps livestock warm, dry and sheltered.

Figure 3.2
Burren limestone pavements with clint-grike features

The story of farming in the Burren goes way back to 5,800 years ago when Poulnabrone Portal Tomb in the central Burren was built – now recognised as the oldest known structure built by farmers in Ireland. The entire landscape has been described as '*one vast memorial to bygone cultures*' – agrarian for the most part – by cartographer Tim Robinson (Robinson, 1999) with 6,500 years of human impact traceable through the region's extraordinary archaeological palimpsest (Figure 3.3). Farming and the Burren is an old story, but this story has been evolving very rapidly in recent years.

BOX 3.1
THE BURREN'S NATURAL HERITAGE

The natural wealth of the Burren includes over 70% of Ireland's native flora – the beauty, diversity and intrigue of which has been described in a wide array of publications, TV and radio programmes. A reflection of the quality and scale of this biodiversity is the designation of over 30,000 ha of the terrestrial Burren as Special Area of Conservation (SAC) under the EU Habitats and Species Directive (92/43/EEC) (see Figure 3.1) and an additional 2,000 ha designated as Special Protection Area under the Birds Directive (79/409/EEC).

The main Burren habitats protected include Semi-natural dry grasslands and scrubland facies on calcareous substrates (6210), Lowland hay meadows (6510), Limestone pavements (8240), Alpine and Boreal heaths (4060), Turloughs (3180), Calcareous fens (7210) and Petrifying springs (7220). This rich biodiversity hosted by these 'priority' habitats includes 23 of Ireland's 27 orchid species and regional specialities such as the Alpine *Gentiana verna*, the Arctic *Dryas octopetala* and the Mediterranean *Neotinea maculata* whose main British and Irish populations occur in the region. Other relatively common species - such as *Campanula rotundifolia, Antennaria diocia, Galium verum* and *Geranium sanguineum* are said to 'flourish so much more exuberantly in the Burren than elsewhere in Ireland' (Webb and Scannell, 1983), (see Figure 3.4)

The Burren is one of the best surviving areas for bumblebees in Ireland, it is home to at least half of the 570 macro-moths recorded in Ireland and 30 of Ireland's 34 butterfly species. Over 60 species of snail are found in the Burren, as are most of Ireland's native bat species. Ireland's only native reptile, the common lizard (*Zootoca vivipara*) and the introduced slow worm (*Anguis fragilis*) are frequently seen. Farmland birds such as Yellowhammer (*Emberiza citrinella*), Common Cuckoo (*Cuculus canorus*), Red-billed Chough (*Pyrrhocorax pyrrhocorax*), Eurasian Skylark (*Alauda arvensis*) and Common Linnet (*Carduelis cannabina*) are declining elsewhere but can still be found in suitable Burren habitats, as well as birds of prey such as the Peregrine Falcon (*Falco peregrinus*). Given the diversity, scale, connectivity and condition of the Burren's natural heritage, particularly at a time of 'biodiversity emergency' in Ireland, its value cannot be overstated, nor its continued presence taken for granted. Sustaining this biodiversity is the key objective of the Burren Programme.

A fascinating early insight into the diversity of habitats present in the Burren is offered by the Book of Survey and Distribution (Simington, 1641) which was, as the title suggests, a survey of all lands within various baronies (historical county subdivisions) with a view to their subsequent redistribution. Within the Barony of the Burren some 35 categories of land type are described, which in turn are broken down into 121 grades of different value. Under 'pasture' for instance, there are fourteen different classes, such as 'Dwarfwood pasture' and 'Rockie pasture'. These classes are further differentiated into 69 subdivisions based on profitability, such as 'Rockie pasture 1/3 profit', 'Rockie pasture 1/8 profit', etc. Today we rightly describe such areas as 'High Nature Value farmland' (HNVf).

Figure 3.3
A stone ringfort or caher, part of the Burren's rich archaeological heritage

A PERIOD OF UNPRECEDENTED CHANGE

During the decades following Ireland's accession to the EC in 1973, the relationship between Burren farmers and their landscape changed at a pace and scale that was totally unprecedented. For example, a study by Dunford (2001) estimated that stocking levels in Ballyvaughan Rural District (RD) in the north-west Burren increased from 0.38LU/ha in 1970 to 0.66LU/ha in 2000, a 73% jump over a period when the numbers employed in agriculture in the same RD fell by over 50%.

Figure 3.4
A species-rich Burren winterage pasture

During this time, it is estimated that approximately 30% of the Burren's archaeological sites were lost due to land reclamation (Hickie, cited in O'Rourke, 2005), which, by the mid-1990s had reached an estimated annual rate of 171 ha (Drew and Magee, 1994, Drew, 1996). The Irish Farmers Journal at the time carried a report on a trial to fertilise Aillwee hill in the Burren via helicopter. The expansion in the area of 'reclaimed' land, combined with increased fertiliser and slurry use, enabled a massive increase in stocking levels and winter fodder (mainly silage) production. Silage was fed liberally on winterages (Figure 3.5) to support the growing numbers of in-calf, continental-cross suckler cows which required nutritional inputs beyond what the Burren winterages could provide. Parts of the Burren effectively became outdoor slatted sheds, though grant aid for the subsequent widespread construction of actual slatted houses mitigated this somewhat. In either case, silage gradually replaced the naturally available forage of the winterage pastures, resulting in reduced levels of grazing which contributed to a loss of biodiversity and accelerated levels of scrub encroachment (Figure 3.6).

There were many factors driving these changes – social, economic,

cultural, political – and many, varied manifestations of them across the several hundred farms in the region. To generalise however, there was a growing polarisation of farming activity between fertile accessible lowlands which became very intensively managed with high levels of mechanical and chemical inputs, and extensive uplands where farming activity steadily declined, trends which still continue today. The environmental implications of this growing imbalance between farming and the landscape were generally very negative, particularly given the rate and scale of these changes.

Of course, this scenario was not limited to the Burren; all across Ireland and Europe there has been a growing polarisation of farming activity in recent decades – particularly an expansion in more intensive farming activity – with consequent biodiversity loss at farm and landscape level. Responding to public concern at this environmental degradation, EU policymakers introduced nature conservation directives and agri-environmental schemes which were in turn to have a major impact on the Burren, adding to the many changes of recent decades and creating a new context into which farming needed to fit.

Figure 3.5
Feeding silage on Burren winterages – a major source of groundwater pollution

Figure 3.6a
Scrub encroachment on the Burren- Image of Corkscrew Hill c. 1900 (Lawrence collection)

Figure 3.6b
Image of Corkskrew Hill in 2000 showing considerable scrub encroachment (compare with the exposed rock and stone walls above).

BOX 3.2
FARMING IN THE BURREN

Today, over 1,500 people in the Burren (from a population of c.15,000) describe themselves as farmers (Central Statistics Office (CSO), 2010). With c. 85% of the region's 72,000 ha farmed, the average farm size is 39.4 ha (CSO, 2010), though this varies widely. Census records show that the age profile of these farmers is increasing, with only 6.7% under 35 and almost 25% over 65.

Given the rocky nature of the Burren, it is a pastoral landscape where 'the cowman, rather than the ploughman is king' (Whelan, in Butler et al., 1985). Most Burren farmers are specialist producers of suckler beef, with a typical herd size of 30-40 cows, usually composed of a mixture of continental-cross (Charolais, Limousin and Simmental) animals. Typically, farmers sell the weanlings from these cows at local sales in autumn where generally good prices are made with many male calves destined for the export market and many of the females sold for breeding. A small number of dairy farms continue to operate in the region, while sheep farming persists mainly in parts of the east Burren. A few farms continue to use the Burren for 'store cattle' though far less so than previously. Very few farmers keep goats or horses, or practice tillage – again in contrast to previous generations when farming systems were more mixed and far less specialised than today.

A highly distinctive attribute of Burren farming systems is the traditional practice of winterage. The poor availability of water in summertime in the free-draining karst of the Burren must have been a factor in the adoption of this reverse form of 'transhumance', which has proven to be a significant factor in shaping the biodiversity and cultural heritage of the region. The thin soils and warm bedrock are ideal for livestock in winter, while the standing crop of herbs and grasses ('foggage') provide a good source of winter fodder. Stocking levels on these areas (usually stocked October-March) are generally low - as low as 0.1 LU/ha on poor ground but up to 0.56 LU/ha on stronger winterages. The cultural significance of Burren winterage was formally recognised in 2019 when it was included in Ireland's list of Intangible Cultural Heritage; it is also informally celebrated every year through a local festival.

Given the poor returns in the beef sector, and the difficulty in expanding or improving the farm holding, many Burren farm families need to supplement their income with an off-farm source – a far cry from the mixed farm systems which were able to support entire farm families in the not too distant past when farming was a relatively more rewarding profession. This off-farm employment has been a significant factor in pushing farmers to be more efficient in managing their extensive, fragmented holdings, often resulting in a shift in the focus of their activity to the more accessible, fertile lowland fields. As a consequence, the Burren's rockier 'upland' grasslands, home to such a stunning natural and cultural heritage, are increasingly under threat from scrub encroachment.

From palaeoecological and archaeological records (Watts, 1984; O'Connell, 1994; O'Connell and Jelicic, 1994) we know that farming activity in the Burren has ebbed and flowed for six millennia and the landscape has responded accordingly. But when we experience change at a scale, rate and nature (often involving heavy machinery) such as we have witnessed in Ireland since the early 1970s, the implications for the landscape – particularly the Burren's waterworn limestone pavement and stunning archaeological heritage - are much more profound and often irreversible. For a landscape of universal heritage significance such as the Burren (included on Ireland's list of tentative World Heritage Sites) such changes give cause for grave concern and urgent action.

EARLY ATTEMPTS TO MANAGE CHANGE

The EU Habitats Directive was transposed into Irish law in 1997 leading to the designation of Special Areas of Conservation (SACs) – 30,000 ha in the Burren alone, almost 50% of the entire region – a move which set out to, and succeeded in, halting a lot of land reclamation work. In 1994 the first national Agri-Environment Scheme (AES), known as REPS (Rural Environment Protection Scheme), was introduced which, among other things, compensated farmers for compliance with SAC restrictions. This represented a sea-change in Burren farming: – 'through REPS, for the first time ever, farmers are being asked to move beyond their production-orientated mentality and embrace measures that give conservation of the environment precedence over agricultural production. Such a radical shift in perspective will surely take time to sink in' (Dunford, 2002a).

SAC designations were not greeted positively by local farmers. A report by the Consultative Committee on the Heritage of the Burren (2000) found that farmers were 'bewildered and some angered by the lack of proper consultation before their lands were lumbered with SAC categorisation'. Similarly, with the introduction of REPS, Burren farmers were very frustrated at the one-size-fits all approach which, they felt, didn't sufficiently accommodate the unique agricultural or environmental circumstances of the Burren. A study by Bohnsac and Carrucane (1999) found that REPS was not sufficiently 'strict, specific and proactive to meet the legally-binding objectives of SAC-designated land, a purpose for which though it was not originally intended, it appears to be used'. As a result of these and other factors, it is reasonable to say that, by the late 1990s, there was deep concern, negativity and division regarding the Burren and its management.

Against this backdrop the Burren Irish Farmers Association (IFA) was established, a coming together of farmers from nine local parish branches of the IFA, initially in direct response to the perceived inappropriateness of the REPS guidelines in the Burren. The group, led by Michael Davoren, helped to successfully negotiate new 'Conditions for the Conservation of the Burren to be applied under REPS', which included a number of important concessions which made it possible and financially attractive, for Burren farmers to enrol in REPS. Part of the agreement was that research take place into 'the effects of REPS practices on member farms … and results should be used to modify the above-listed conditions' (Department of Agriculture and Food, 1995). Toward this end, a Teagasc Walsh Fellowship research project (in conjunction with University College Dublin) was initiated to explore '*The Impact of Agricultural Practices on the Natural Heritage of the Burren*'.

Significantly, the research was conducted by a locally 'embedded' student over a three-year period during which a great deal was experienced, and learnt, about the essence of the Burren and its farming community and their practices, acquiring knowledge and building relationships. This was particularly important when it came to farmer surveys. The slow, local approach allowed relationships of trust and respect to develop and encouraged farmers to have their say in a more open, honest and natural way than would have been possible through, for example, public meetings, anonymous surveys or time-constrained negotiations with public bodies.

The study culminated in 2001 with the submission of a PhD thesis (Dunford, 2001) which traced the evolution of the relationship between farming and the landscape of the Burren over the past six millennia, with a particular focus on more recent (1970 onwards) changes. Ecological and land management surveys were conducted to explore the impact of various grazing regimes on the region's grassland flora, while a survey of local farmers was carried out to elaborate on changes in farming systems and on attitudes to the land, its management, as well as views on SAC designation and REPS. Key research findings included:

- The central importance of traditional grazing practices, in particular winter grazing, in maintaining the biodiversity of the Burren, and an appreciation that such practices are complex and highly variable, thus requiring flexibility in their interpretation and application.
- The growing trend towards lowland intensification and upland extensification as the number of Burren farmers declined and as the need for off-farm income grew, resulting in a push for more efficient farming systems, many of which entailed negative environmental scenarios.
- The limitations of restriction-based SAC designations and national AESs in addressing the Burren's unique needs and, by implication, the need for proactive, locally-targeted, alternatives.

The PhD research findings were published in a user-friendly book form as *Farming and the Burren* (Dunford, 2002a), 'giving back' the story to those who contributed to it. This helped to address another interesting research finding - the degree to which local farmers felt excluded and disrespected when it came to the 'story' of the Burren and its future evolution.

BURRENLIFE – A BLUEPRINT FOR 'FARMING FOR CONSERVATION'

The PhD research, combined with the relationships and attitudes that began to flourish through the various publications and other initiatives such as Burrenbeo (see below), were the catalyst for a 2004 application to the EU LIFE Nature fund, a fund dedicated to the sustainable management of SACs across Europe. The project application's stated objective was to '*Develop a blueprint for the sustainable agricultural management of the Annex I habitats of the Burren*'. The proposed approach was simple: to implement a range of management interventions across a selection of twenty working farms covering 2,500 ha of SAC land in the Burren in order to address key environmental challenges identified in the PhD research project, and to monitor the agricultural, economic and environmental impact of these interventions.

Among the key environmental challenges identified were: land abandonment, undergrazing, pollution, supplementary feeding, inappropriate grazing regimes, reduced human intervention and loss of management knowledge. The funding application was successful, as indeed was the subsequent €2.23m BurrenLIFE Project (2005-2010), which was adjudged joint winner in 2017 of the Best LIFE Nature Project in the 25-year history of the fund. Fundamental to this success was the partnership approach, most notably the inclusion of farmers, and the clarity and originality of the proposal which built on the foundations provided by the previous PhD research project.

A team of four locally-based staff were appointed to run the project, some with extensive research experience in the Burren, which allowed the team, and the project, to get off on the right foot, with a good level of trust and credibility. The team was led by a Project Manager (Brendan Dunford) with direct experience of working with local farmers and engaging in scientific research. A Project Scientist (Sharon Parr) was employed to oversee project monitoring and advise on planned works, while a Project Administrator and Office Manager (Ruairí Ó Conchúir) was hired to deal with financial oversight, communications etc. A knowledge transfer and ecological research specialist (James Moran) was seconded from Teagasc for the duration. A former schoolhouse in the central Burren village of Carron was refurbished as a base for the project, placing it firmly in the heart of the Burren farming community. This refurbishment was co-funded by Leader and by local farmers, a testament to their commitment to the project.

BOX 3.3
CO-CREATING SOLUTIONS

The BurrenLIFE project appealed to farmers by striving to be innovative and progressive and not simply reverting to traditional practices: farmers, like most small business owners, like to feel that they are moving forward and not being static or restricted. The project respected farmer's ideas and their role in finding solutions: a good example of this was the issue of silage feeding on Burren winterages, a practice that was causing major direct and indirect environmental damage.

Farmers argued that suckler cows needed additional pre-calving nutrition that winterages could not provide. Testing of forage values across the Burren by the project team confirmed this to be the case. Dr. James Moran and colleagues from Teagasc then led the research to develop an alternative to silage; a supplementary Burren ration (concentrate feed) which met all of the cows' mineral requirements, as well as high protein levels to stimulate their appetite for, and enhance their ability to digest, the rough forage of the Burren. Feeding this at a recommended rate and time obviated the need for silage feeding, as long as there was enough available forage. This new feedstuff (the 'BurrenLIFE ration') was originally milled by Kerry foods; today, five companies produce this widely-used ration.

With the farmers' help in monitoring the impacts, the project team were soon able to show that this new feeding system maintained animal health and calving performance, was very cost-and-time efficient, made herding easier and improved the quality of the winterages through better grazing. This message was confirmed by the project farmers who tested the feed, leading them to reduce silage feeding levels by 61% over the course of the 5-year project, and convincing many of their peers to switch to this 'progressive' new feeding system. Environmentally, this new system reduced localised water pollution and soil erosion while increasing forage uptake and thus improving biodiversity.

Other innovations which helped convince farmers that 'farming for conservation' could be positive and progressive included the use of mechanical brush-cutters to control scrub and the use of solar and wind powered water pumps and fences. A 'Burren beef and lamb producers' group' was also established to try to capture a premium for local produce. This ultimately proved unsustainable given the limited amount of finished produce being generated in the Burren and also because of the distance from market and distribution costs. A broader label for meat from different landscapes or for a wider range of products and services from the Burren may be a more realistic future option.

The BurrenLIFE Project was essentially an exercise in 'learning by doing'; co-creating, with farmers, innovative solutions on actual farms. The project helped to demonstrate in real-time what 'conservation farming' looked like and proved that it can in fact improve agricultural efficiency and performance (e.g. reducing input costs and/or increasing stocking levels). This was a lesson that surprised some farmers and engaged many more.

As well as a large number of conservation works on the pilot farms, BurrenLIFE outputs included:

- A set of best practice conservation guidelines for use by farmers, on the themes of sustainable grazing regimes, feeding systems and the removal of invasive scrub.
- A costed 'menu' of conservation actions and equipment including: wall repair, water provision, scrub removal (using various techniques), gate installation and access provision.
- Monitoring data on the environmental, agricultural and economic impact of the project on the 20 monitor farms, of great relevance to the broader uptake of these actions elsewhere.
- Strong support from all stakeholders, in particular farmers, for the project and its findings as well as excellent working relationships and goodwill between all parties involved.

BurrenLIFE had a very positive impact, not least on the growing engagement and respect of the local farming community. This level of support and partnership, along with a tested, costed, blueprint for the expansion of the work made for a very compelling (low-risk, high impact) funding proposal. In 2010, the Department of Agriculture, Food and the Marine (DAFM) announced €3m funding over 3 years (from unspent Pillar 1 Single Farm Payment money) to expand the project's findings through the Burren Farming for Conservation Programme (BFCP). This ultimately ran from 2010-2015, bringing €6m in funding to the region, significantly improving the local environment on 160 farms and paving the way in 2016 for a further expansion across the entire Burren through the Burren Programme (BP) (2016-present). The development and roll-out of these (largely similar, though ever evolving) highly innovative programmes is now described.

MAKING THE LEAP: FROM RESEARCH TO ROLL-OUT

The stated aim of the BFCP was to conserve and support the heritage, environment and communities of the Burren, defined as an area of c.72,000 ha (Figure 3.1) with a population of approximately 500 target farmers. It had the great advantage of continuity, being able to build on the research findings and relationships that had grown from the PhD research and subsequent BurrenLIFE project. For example, the Project Manager and Scientist from the LIFE project were re-employed in the BFCP and they retained the same office. The new programme presented a wonderful creative opportunity as it entailed a 'blank page' approach to programme design. There was no ready precedent for such a locally targeted AES and the BFCP was small enough in scale, budget and timeframe to enable a more creative approach.

In designing the BFCP, there was one key challenge: for most farmers there was little or no financial incentive for them to manage upland areas beyond the minimum levels required for compliance which were way too low to sustain biodiversity. Clearly, an additional incentive was needed to sustain required management levels and it made sense to link or 'couple' this incentive to what the BFCP was ultimately trying to achieve – improved environmental performance.

The resultant programme design is best described as a 'hybrid' approach whereby farmers are rewarded annually for their environmental performance while also having access to a fund to carry out self-nominated 'conservation support actions (i.e. work)' to help improve this performance over time. So the typical 'action-led' approach to AES was enhanced in this case to encourage farmers to undertake conservation actions specifically designed to improve the environmental health of their farm, and so enhance their income through the new, complementary, results-based payment.

The resulting approach, as described below, was applied and continuously refined and adapted over its six years of operation (2010-2015) on c.160 farms covering c.14,500 ha of farmland. It proved very cost-effective, impactful and was well-regarded by farmers, scientists and policymakers. Testament to its success was the decision in 2015 to continue and further expand the programme, closely following the same successful format. Within Ireland's Rural Development Plan (2014-2020) a new Measure for Locally Led Agri Environment Schemes (LLAES) was included to provide '*support for a small number of projects identified centrally as being of critical environmental importance, namely the continuance and expansion of the existing Burren Farming for Conservation Project*' as well as other strategic projects such as those relating to the hen harrier and freshwater pearl mussel (DAFM, 2014). Moving from Pillar 1 to Pillar 2 funding, DAFM also agreed to fund a local management team, with National Parks and Wildlife Service (NPWS) covering the costs of the local office.

The new 'Burren Programme' (BP) commenced in April 2016, again with many of the same management team and located in the same office, providing further continuity. Its objectives relate to ensuring the sustainable agricultural management of HNV farmland in the Burren, improving water quality and usage, and supporting the landscape and cultural heritage of the region. It offers 5-year contracts to all participating farmers, with the last of the contracts set to expire in December 2022. With an outline budget of up to €15m, c. 328 farmers and c. 23,000 ha of target habitat, it represents a further, substantial expansion of the BFCP in terms of budget, area and timeframe. The 'hybrid' payment structure of the new BP is very similar to the BFCP whereby farmers are paid both for work undertaken and for environmental performance. However, under the BP farmers sign up to a five-year plan and are afforded even greater flexibility in undertaking conservation actions.

BOX 3.4
ENGAGEMENT

Complementing the work of the BFCP/BP, another crucial initiative in engaging and empowering Burren farmers was the establishment in 2002 of Burrenbeo (the 'living' Burren) Teoranta (later the Burrenbeo Trust), a local environmental NGO, which employed what was, at the time, 'new media' – a website www.burrenbeo.com – to tell the story of the 'living Burren' and in particular the role of farming. This was in response to the fact that 'many representatives of local, regional and state management bodies, visitors and even well intentioned 'conservationists' remain hopelessly oblivious to the important role that farmers play in protecting and contributing to the Burren's heritage, and of the constraints within which these farmers operate' (Dunford, 2002b).

Burrenbeo helped to address these issues and reshape the narrative around the Burren from a somewhat elitist, 'expert'-led perspective to a more inclusive one which also celebrated local people, place and tradition. This message was brought into local schools and communities through the Eco Beo (now Ait Bheo) programme, a ten-module course on local heritage and stewardship which has worked with over 1,700 young Burren people since its inception.

Burrenbeo also helped engage the broader community in a more nuanced perspective on the Burren and its management through monthly walks (many of them led by farmers, Figure 3.7) and talks, volunteering events and festivals, including 'Burren in Bloom' and the 'Burren Winterage Weekend' which is a unique celebration of the rich legacy of pastoral farming in the Burren.

The degree to which Burrenbeo Trust has complemented the farmer-focussed work of the Burren Programme cannot be underestimated, helping to align stakeholder's perspectives and form a 'community stewardship' approach to the conservation and care of the Burren's heritage. Most recently the Trust has been working to promote farmer-led walks as part of its 'learning landscape' initiative, as well as sharing lessons from the Burren's 'learning area' with other HNV landscapes across Europe (www.hnvlink.eu).

Figure 3.7
Burren walk led by farmers

HOW THE BURREN PROGRAMME WORKS – A HYBRID APPROACH

While the BP is relatively complex in terms of its technical and administrative requirements, every effort is made to keep the interface with participating farmers as simple, intuitive and responsive as possible. This is reflected, for example, in the simplicity of the farm plans and clarity of the payments (per score and per task) and is enabled by the high level of available support for the farmer from the local BP office and from the trained BP farm advisors. Entry to the BP was on a voluntary but competitive basis. All applications (on simple, one page forms) were rated according to criteria which were approved by the BP Steering Group, including the area and proportion of designated land on the holding, previous participation in AESs and the area of public land on the holding. All farmers who were offered places in the BP were invited to an induction meeting during which they were given the opportunity to find out more about the BP and how it might work for them, helping them to decide whether or not to accept their offer of a place.

A phased approach to farmer recruitment was adopted, with calls for applications made over 3 years (2016-18). Competition for places was

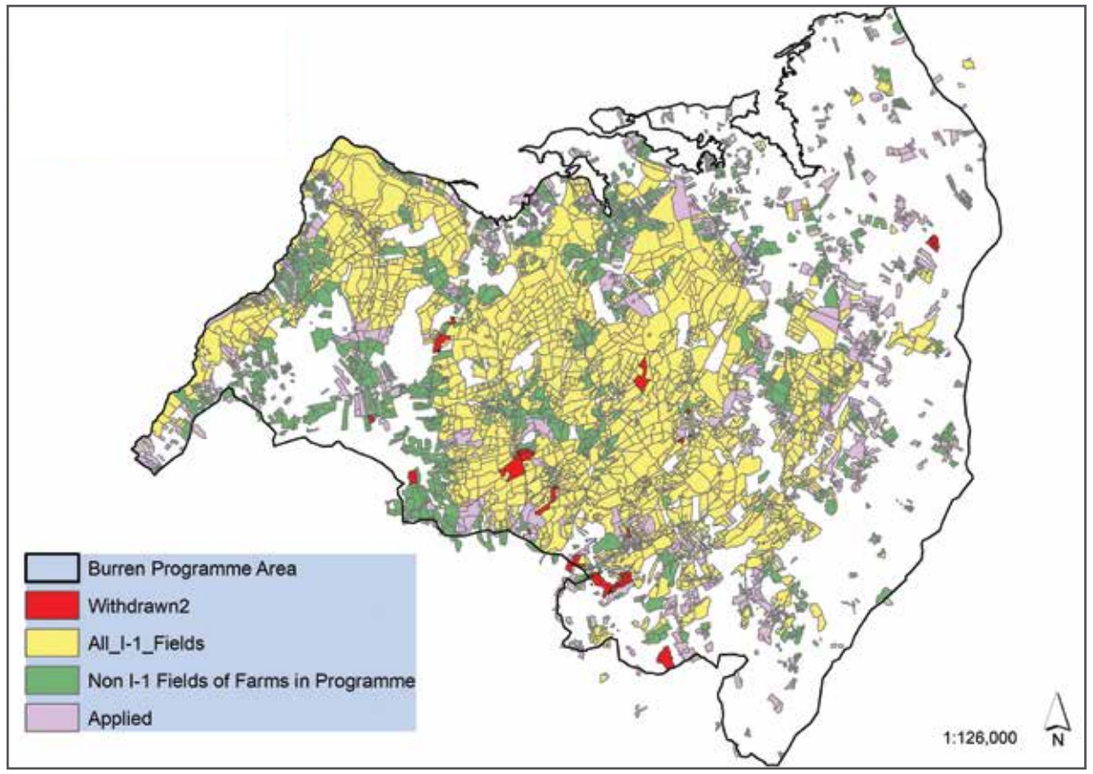


Figure 3.8
Overview of Burren Programme target area and uptake (2019)

initially strong – there were over 400 applications for the first call, with 194 places taken up (3 of whom later withdrew), and 147 of whom had previously been in the BFCP. In 2017 a second tranche of 80 farmers joined, followed by a third tranche of 57 in 2018, giving a total of 328 farmers. The area currently managed by these farmers is 23,191 ha, including 71% of the Burren's designated area (Figure 3.8). Much of the remaining non-BP area is accounted for by smaller farms, many of which receive Low Input Permanent Pasture (LIPP) and Traditional Hay Meadow (THM) payments through the Green Low-Carbon Agri-Environment Scheme (GLAS), and are thus excluded from the BP environmental performance payment. Most of these farms did not take up their place or 'withdrew' from the BP once payment details became clear to them (see purple and red shading in Figure 3.8).

All BP farmers were offered a 5-year contract with the DAFM. This contract takes the form of a simple 5-year plan outlining the baseline situation on the farm and suggested priority actions to improve the farm environment. By signing this 5-year plan the farmer agrees to abide by the BP Terms and Conditions. A set of procedure manuals translates these T&Cs into detailed procedures to be undertaken by the BP team, who are responsible for the successful delivery of the programme.

Within the BP, there are two key 'Interventions' – Intervention 1 (I-1) which rewards environmental performance, and Intervention 2 (I-2) which supports related conservation actions. The BP farm advisor conducts an annual summer assessment which results in an annual I-1 payment, and the BP advisor and farmer may also choose to produce up to five I-2 work plans within the BP contract (and within a stated budget). The I-2 plans are normally produced separately from the I-1 scoring.

The BP does not take a whole-farm approach: only species-rich areas are currently targeted although I-2 works may take place on species-poor areas to enable better management on target areas. While it is recognised that other parts of the farm may be critically important as conservation support-areas (for example, to hold cattle away from the species-rich pastures during the main flowering season in May-July), support for these areas is generally covered under the national Basic Payment Scheme (BPS) and national Agri Environmental Scheme (AES) measures, so funding these areas through the BP might raise concerns about the potential for double-payments. Future iterations of the BP may try to integrate these national and local AESs more seamlessly and thereby adopt a more holistic, whole-farm approach to environmental management.

INTERVENTION 1 (I-1) – REWARDING GOOD MANAGEMENT

Central to the success of the BP results-based approach to payments is the 'environmental health' assessment system developed by Programme Scientist Dr. Sharon Parr. This is based on the supposition that farm management plays a significant role in determining the ability of Burren pastures to achieve their potential in terms of their conservation status, diversity and abundance of plants present. It sets out to assess the management of each field in terms of both the actual management, the management that is needed to get it into the best condition for it to function as a species-rich limestone grassland/heath, and the ecological integrity of the grazed habitats present.

Detailed instructions, as well as all the required forms, for carrying out I-1 scoring are available on the BP website (www.burrenprogramme.com/burren-programme-resources/) for farmers, advisors and other interested parties. This scoring system is underpinned by evidence-based information built up over many years of field research and practice, and refined over several years' application under the BFCP, all of which helped create a very robust, detailed and objective system.

Within the I-1 scoring system, different approaches are used to assess the two main target habitats - Burren Winterage Pastures and Burren Lowland Grasslands (BLGs). Each qualifying field (species-rich SAC or undesignated Annex I habitat) is assessed annually (May-September) by a trained advisor. The advisor completes a 1-page, 10-point, field sheet for every qualifying field (see Appendices 1 and 2) and inputs this data into a simple Excel calculator which generates a field score ranging from 1 to 10. Scores for all qualifying fields are then transferred into an I-1 sheet which lists the field area, score, payment and management recommendations for each field (Appendix 3). The I-1 sheet is reviewed by the BP team before being submitted to DAFM for payment. Payment rates are presented in Appendix 4; the higher the score, the higher the payment. A high proportion (>50%) of I-1 scores are also validated on-site annually by BP staff to ensure that scoring is accurate and consistent across the BP's twelve trained advisors.

BURREN LOWLAND GRASSLAND (BLG)

For Burren Lowland Grasslands – usually small (c. 2.3 ha average), meadow-like fields, an ecological survey is undertaken by the BP team (every 3-5 years) to determine the 'conservation value' of the field. Using indicator plants from 5 different groups that reflect different levels of conservation value, from low to high (see Appendix 5), the grassland is categorised into one of 5 qualifying classes, with higher classes earning more points. This 'conservation value' score is combined, by the advisor, with scores from a number of other criteria (e.g. grazing management, undesirable species etc.) which reflects the suitability of the management regime. Points from all 10 criteria are tallied to yield an overall BLG field score that ranges from 1 to 10 (see Appendix 5: for further detail on the criterion 'Conservation Value and Ecological Integrity of Burren lowland grasslands').

BURREN WINTERAGE GRASSLANDS

Burren Winterage fields, in contrast to Burren Lowland Grasslands (BLG), are often very extensive (c.12 ha average), highly variable in terms of habitat type (Parr et al, 2009) and quality, and also management history. The use of indicator species would not work effectively in these areas, so the 'ecological integrity' is determined by a simple visual assessment (with reduced points, for example, for winterages which were previously fertilised or heavily summer grazed). This is combined with scores from 9 other criteria (slightly different from those in the BLG assessment) to give an overall field score (see Appendix 2).

All scoring criteria are carefully chosen based on previous research in the field and are weighted (positively and negatively) in accordance with their significance. For example, grazing has been shown to be the main driver of biodiversity in the Burren (Dunford, 2001), hence grazing (and litter) levels are assessed to evaluate whether the current grazing level equates to that needed to keep the grazing-dependant habitats in good ecological condition or, to restore them to such. Similarly, the condition of natural water sources and extent of bare ground reflects the suitability of management of the water and soil resources in the field. Invasive species which threaten biodiversity (and other heritage features) are scored negatively if present, and positively if not.

This performance-related scoring system is sensitive to changes in management so it sends an immediate (annual) signal to the farmer about the impact of his/her farming system, while also allowing for flexibility in approach/response. The scoring system rewards those who have managed their land well in the past but encourages all farmers to continue to improve their farming model.

In spite of initial concerns about the I-1 scoring system (that farmers would not accept the scores, that advisors would inflate scores, that scores will be unduly influenced by external factors, etc.), it has worked exceptionally well. The clarity of the scoring system along with the high levels of training and oversight, and the trust in the local team and advisors have been critical in this regard. If farmers are unhappy with their I-1 scores they are encouraged to query them with the BP team: this has rarely happened in over 8 years of operation across up to 1,700 fields scored annually.

BOX 3.5
THE INTERVENTION 1 PAYMENT SYSTEM: USING RESULTS-BASED PAYMENTS TO INCENTIVISE DELIVERY OF ECOLOGICAL BENEFITS

Once an advisor has carried out the annual I-1 assessment, all the data is transferred into a simple (Excel) I-1 calculator (one for BLGs and another for Winterages) to generate a field score of 0-10 (0 only applies where silage is fed, a negative activity which automatically results in a 0 score being applied). These scores are then transferred into an I-1 payment sheet (Appendix 3) where they are listed along with a management recommendation as to how the score might be improved.

Each score translates into a unit payment per ha (Appendix 4) e.g. a winterage score of 5 yields €60/ha, 6 yields €72/ha, 8 yields €96/ha, and this, multiplied by the I-1 area of that field (usually the BPS eligible area less any species-poor habitat) yields a corresponding payment per field. Higher rates are paid for lowland grasslands (up to €315/ha compared with €180 for winterages) given the higher 'opportunity cost' of not increasing productivity by reclaiming / improving these fields. BLGs, Winterages, Commonages and non-designated Annex I land are listed separately in the I-1 sheet.

Payments for winterage grasslands are banded (40 ha bands), with the payment rate halving for each successive band (the equivalent band for BLGs is 10 ha - see payment box, Appendix 4). This system, which is now also used in other AESs, takes account of some 'economies of scale' and supports smaller holdings.

The payment system (Appendix 4) contains a number of innovations designed to encourage an improvement in management and thus site condition, rather than settling for the *status quo*. For example, no payments are issued for scores less than 5, based on the assumption that this basic level of management is already covered under BPS and/or AES measures, and so a greater effort is required for payment under the Burren Programme. After 2 years in the BP, scores of 5 no longer receive payment, putting pressure on the farmer to improve his/her management on these fields. Also, the lowest scoring fields are listed first for payment; on larger farms (>40 ha) this means that the farmer is effectively losing more money on the lowest scoring fields (paid at the top-band rate) than is being gained on the highest scoring fields (which are paid at a (50%) lower rate). This offers a clear financial signal to the farmer to focus conservation activities on the lowest scoring fields which need most attention. On the other hand, a bonus of 25% and 50% is paid for scores of 9 and 10 respectively.

All payments are calculated and checked by the BP team before being submitted to DAFM for payment. Farmers receive an A3 copy of the I-1 sheet showing payments per field as well as management recommendations and an ortho-image showing the location of all fields. Farmers and/or their advisors have the chance to appeal any score before sign-off. The average I-1 payment is €2,617 per farmer (range €36-€9,347) or €75 per I-1 assessable ha (2019 figures). Payments are usually issued by DAFM to the farmer within the same calendar year as the I-1 assessment.

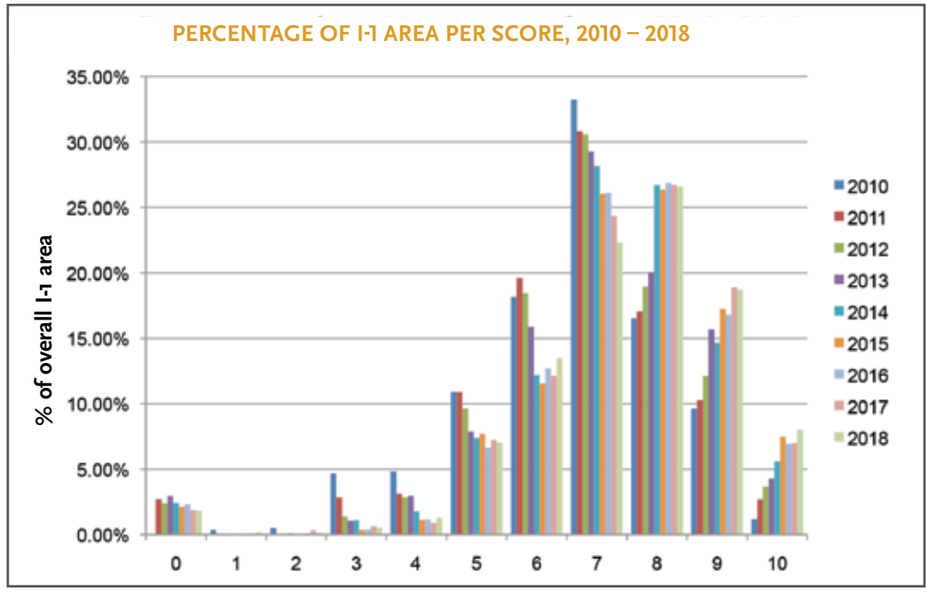


Figure 3.9
Percentage of area per I-1 Score, 2010 – 2018 (data from 147 farms, c.7,000 ha)

Over €4m has been paid to Burren farmers through this results-based approach and it has certainly had an impact. For instance, the average score from 147 farms (on over 1,000 fields covering 7,300 ha) which have been in the BFCP-BP since 2010 increased from 6.61 in 2010 to 7.4 in 2018. This increase may be seen in the shift in I-1 scores away from scores of 3-7 and towards scores of 8-10, as shown in the bar-chart above (Figure 3.9).

Similarly, looking at a subset of 574 fields which have been in the BFCP-BP since 2010, the average score (by area) increased from 6.81 (2010) to 7.56 (2018). This gradual but positive shift toward higher scores (and by implication improved environmental health) is shown below (Figure 3.10) and are visually represented at a landscape scale in Figure 3.11.

INTERVENTION 2 – PAYING FOR CONSERVATION WORKS

The main focus of the BP is to improve I-1 scores, and farmers are encouraged to undertake I-2 conservation works to help achieve this. Without these capital works (non-productive investments), improving field scores would be much more difficult to achieve. Although farmers are given recommendations in their I-1 sheet as to how they might improve their field score, the choice of what to do and how to do it is determined by the farmer

Figure 3.10
Change in the average I-1 score 2010-2018 for all fields which were continuously in BFCP-BP since 2010 ('1' above) (574 fields, 4,567 ha)

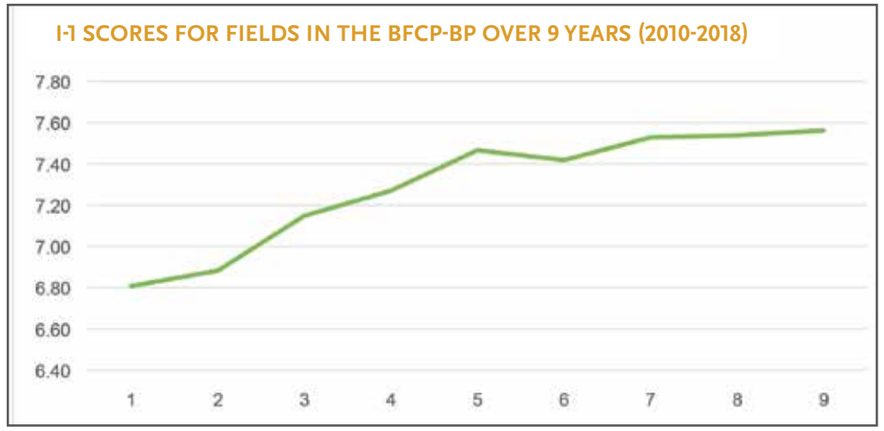
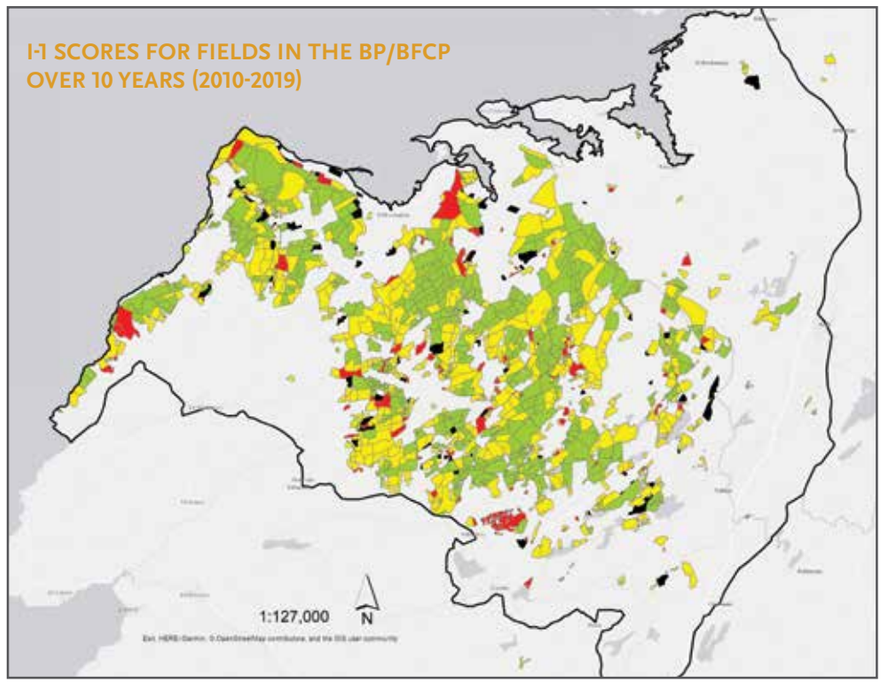


Figure 3.11
BP I-1 field scores in 2019 (grouped)



and his/her farm advisor. Up to five I-2 plans can be developed during the farmer's contract and the work approved in these plans can be completed at the farmer's convenience before payment is claimed. Some farmers may choose to use none, or part of, their I-2 works allowance – for instance between 2010-16 only 56% of the available I-2 budget was spent.

The I-2 process begins with the farmer and BP advisor together planning I-2 works. The advisor plots (using hand-held GPS devices/apps) the agreed works on each field and back in the office these are overlain onto an ortho map using a dedicated mapping system ('GLAMS' by DAFM). Each task is allocated a cost (see Box 3.6) and this information, along with a task description, is saved in the Excel planning template (the '*Intervention 2 Work Plan*') which is submitted to the local office for review and approval.

The BP team review all proposed tasks with a focus on establishing the environmental benefit, the optimal methodology, the cost and the need for permissions. This often entails a visit to the site and further discussions with the farmer and advisor. For some jobs, permissions must be sought from a number of authorities, e.g. National Monuments Service (NMS), National Parks and Wildlife Service (NPWS), Local Authority, etc. This is co-ordinated by the BP team using a set of agreed procedures; a service which relieves the farmer of a very significant and potentially costly bureaucratic burden. All calculations are carefully reviewed and validated before the draft plan is returned to the farmer and advisor for sign-off.

The final I-2 plan is printed in A3 (usually 1-2 pages) and the advisor meets the farmer to go through the plan before work can begin. Once some or all of the tasks have been completed, the farmer brings the plan to the BP office and indicates which jobs have been done, supplies any required receipts and signs off on a net payment claim approved by the BP team which is then communicated to the paying authority (DAFM), following detailed administrative payment checks by the local team. Payments are usually issued within a few weeks.

The BP team and DAFM inspect I-2 works on a regular basis to ensure compliance, which has generally been excellent. This is a reflection of the high level of oversight and support from the BP team and advisors, but also the buy-in and understanding of the BP farmers. Farmers appreciate the flexibility and trust and generally tend to respond positively and honestly. For example, if a farmer has planned work but later decides not to do it, he/she can simply declare this task 'not done' while claiming payment for whatever work has actually been done.

For farmers who are too busy or perhaps too elderly to undertake works, the BP office helps them to identify other local contractors (mostly farmers) to help with the work from a list of 80 such contractors. These contractors also receive training from the BP team. A list of mainly local suppliers for various products is also circulated, as are best practice guides for I-2 works, while innovations in best practice for I-2 work are shared at an annual 'Innovation Fair'.

BOX 3.6
THE INTERVENTION 2 (I-2) PAYMENT SYSTEM

All farmers are granted a certain allocation for I-2 work – €100 per annum for every digitised hectare of SAC and Additional Annex I habitat. Thus, for example, a farmer with 40 ha of SAC would be able to spend up to €20,000 on I-2 works over a 5-year contract (on up to 5 separate I-2 plans).

Every task proposed in the I-2 work plan is allocated a cost. The cost of each task is calculated using a detailed menu (Figure 3.12) which is updated annually, and, for scrub work, using a dedicated calculator. The scrub calculator uses the area of planned scrub removal, the proportion of scrub cover and the planned methodology to determine the overall cost of the task. The I-2 menu includes unit costs for wall repair and for access tracks – these costs, as with scrub control costs, were initially calculated during the BurrenLIFE project. Costs of water provision, feed equipment and gates are all based on the prices of these items at local stores, plus the labour cost (based on Targeted Agricultural Modernisation Scheme (TAMS) reference costs). This system greatly reduces the need for producing receipts as the cost per task is known and site visits certify that the task is complete.

All I-2 works are co-funded by the farmer based on their relative agricultural-environmental merit. Access tracks and cattle pens are funded at 25% by the BP, water provision and feed equipment are funded at 50% and wall repair and scrub removal are funded at 75%. Co-funding helps ensure that works tend to be carefully chosen and also ensures that the money is directed to those who do the most work, an approach that most farmers greatly appreciate.

Figure 3.12
Extract from I-2 'Reference costs'

Fencer Units	Unit	Detail	Actual €	Funding rate	Funded €
Solar fencer 12 V	Per fencer	High power (40-60 acre)	479.58	50%	239.79
Solar fencer 12 V	Per fencer	Regular (15 acre span)	257.42	50%	128.71
Electric fencer	Per fencer	High power (e.g. 40 km span)	191.40	50%	95.70
Electric fencer	Per fencer	Regular (e.g.	122.11	50%	61.06
Fencer - other	Per fencer	To be specified in I-2 plan	TBD	50%	TBD
Gates	**Unit**	**Detail**	**Actual €**	**Funding rate**	**Funded €**
Burren Gates & Posts	Per gate	All sizes of metal gate	354.00	75%	265.50
Burren gates - retrofit	Per gate	All sizes of metal gate	252.00	75%	189.00
Burren gatespost - fit	Per gate	All sizes of metal gate	62.00	75%	46.50
Burren Gate & RSJ posts	Per gate	All sizes of metal gate	178.33	50%	89.17
Field gate	Per gate	All sizes of metal gate	70.99	50%	35.50
Field gatepost- retrofit	Per gate	All sizes of metal gate	49.00	50%	24.50
B. Water Provision					
Water collection and Storage	**Unit**	**Capacity**	**Actual €**	**Funding rate**	**Funded €**
Plastic Storage tanks	Per tank	9000 L (1980 gal)	1138.00	50%	569.00
Plastic Storage tanks	Per tank	6000 L (1320gal)	1016.00	50%	508.00
Plastic Storage tanks	Per tank	3000 L (660 gal)	528.00	50%	264.00
Plastic Storage tanks	Per tank	1000 L (300 gal)	260.00	50%	130.00
Precast Concrete Storage tanks	Per tank	9464 L (2500 gal)	2545.00	50%	1272.50
Precast Concrete Storage tanks	Per tank	6814 L (1800 gal)	1463.00	50%	731.50
Precast Concrete Storage tanks	Per tank	4164 L (1100 gal)	1138.00	50%	569.00
Poured Concrete Storage tanks	Per tank	Various – estimate cost by formula	TBD	50%	TBD
Poured Concrete Storage tanks	Per tank	Various – estimate cost by quote	TBD	50%	TBD

During the period 2010-2015, €2.7m (total value €4.2m when farmers' contributions are taken into account) was spent by farmers to carry out 5,400 individually-costed conservation tasks which contributed to a much better conservation infrastructure in the region. These tasks included:

- 242 ha of invasive scrub removed to help restore Annex I priority grassland habitats (Figure 3.13);
- 163 km of pathways opened through areas of scrub to improve livestock and farmer access;
- 109 km of stone wall repaired (Figure 3.14), 32km of wire fencing erected to aid grazing and herding;
- 703 new gates installed (incl. 144 traditional Burren gates) to improve livestock management;
- 439 water troughs, 33 water pumps and 76 storage tanks installed to help protect water sources;
- 128 feed bins and 180 feed troughs purchased to help reduce silage feeding;
- 21 km of new track built, 32 km of existing track upgraded, to improve winterage access;
- 121 habitat restoration tasks – including bracken control, rubbish removal and water protection (Figure 3.15).

Figure 3.13
Removal of hazel scrub in order to restore grazing access to species-rich grassland

Figure 3.14
Wall repair to enable restoration of grazing

Figure 3.15
Demonstration event looking at ways to protect natural water sources

The completion of this work has contributed significantly to environmental improvement as reflected in the field scores, and has helped to future-proof management on some farms (e.g. by improving access and making it easier to herd and water stock).

INNOVATION IN DESIGN AND DELIVERY

The Burren Programme is clearly different in many respects from conventional action-based AES. Many of these differences arise from the farmer-centred approach adopted in programme design. Some of the key innovations which distinguish the BP approach from other AESs include:

Simplified farm plans and paperwork: Given its farmer-centred approach, the BP needed to engage farmers in a fuller understanding of the programme and how it works on their farm without burdening them with additional paperwork. Avoiding generic, jargon-and-text heavy plans, the BP developed streamlined I-1 and I-2 sheets which are concise (usually one page of information plus maps), visual (all work mapped on aerial images) and relevant (all jobs listed with a price and description for each one, all fields listed with their score and payment). To claim payment, the farmer has to fill out – usually just by signing it and ticking some boxes - one, simple, declaration form, and very few receipts are required for the vast majority of items (as prices are based on fixed costs). Permission requests to undertake work (a cumbersome undertaking) are organised by the BP team, resulting in very little paperwork for the farmer to complete and allowing him/her to focus on getting the work done.

Payment structure: The BP focusses on rewarding positive activity rather than compensating farmers to avoid negative activities. For farmers, the fairness and transparency of payments are almost as important as the amount. With I-2 works, all farmers are given a fair allowance but only tasks fully completed – and to a good standard - are paid upon. Every task is costed so farmers are clear on what they are being paid for. With I-1 scores, the payment structure is designed to reward those who make the effort to manage their land and livestock to deliver for the environment, thus rewarding farmers in an equitable and meaningful way. The payment structure is clearly explained to farmers; at annual training events, they gain a very good understanding of how field scores are arrived at and, most importantly, how they can be improved through targeted management.

Locally led: The research which underpins the BP is local, with farmers and scientists co-creating solutions to Burren problems on Burren farms (e.g. supplementary feeding systems). The BP is managed through a local

office and the staff present all live locally. Local suppliers and contractors are supported to provide the necessary products and services, from locally-made gates to local chainsaw crews. All training takes place in the Burren, mainly on the land and all resources (best practice guides, etc) are locally focussed. The scoring system is targeted specifically at Burren habitats and all management recommendations are locally relevant. As a result of this locally-led approach, the programme has a very strong local identity and benefits significantly from a sense of local pride and ownership.

Freedom to farm: Farmers decide what work they want to take on every year, also when and where they do it. Telling farmers what to do is usually not ideal; in contrast, asking them what needs to be done and to co-fund it, results in work being selected more carefully and strategically, being carried out to a higher standard and proving much more likely to have a positive, long term impact. Under the I-2 'allowance' (rather than fixed payment) system, the money goes to the farmers who want to do the work, not to those who don't. Under the results-based payment system, farmers get to decide how to graze their land and feed their livestock and are judged on the environmental impact resulting from this. For those farmers who need help in making management decisions, support is always available should they need it through their trained advisor and the local office. Enabling such freedom to farm results in a diversity of approaches and outcomes which is much better for our natural heritage than a uniform 'one size fits all' approach.

CHALLENGES

While the BP is often cited as a model for how locally-led results-based AESs should work, it is not without its challenges and limitations. It is still a work in progress – as indeed it needs to be if it is to continue to respond to changing circumstances and emerging challenges (e.g. around climate). Even among its 328 farmers, there remain those who are still not 'on board' and whose environmental performance remains largely unchanged – even negative in some cases - though such farmers earn much less than they might under other AESs as a result, while continuing to deliver something.

At a local level, ongoing challenges include keeping farmers on-board and motivated as the BP's 'novelty' wears off; ensuring standards are maintained on the ground as it expands; finding the right level of 'compromise' between farming and environmental needs – e.g. managing the limited but necessary, targeted use of chemicals and heavy machinery. Sourcing sufficient labour to undertake works on the ground is a growing issue for many farmers as much of the work is hard, dangerous and not very attractive e.g. removing encroaching scrub in remote locations.

Also of concern is the administrative burden that regrettably accumulates as such projects evolve. More focus on administration leaves less time for farmer engagement and on-site work which is to the long-term detriment of the programme. At an admin cost of <15% of projected spend, the BP isn't expensive to run, particularly considering the additional amount of technical support and monitoring work that the local team provide, while also dealing with the administration of payments. But it's important that such locally-led schemes don't become bureaucratically burdensome, particularly to the farmer. Currently the (necessary) complexity involved in the delivery of this programme is absorbed almost fully by the local team (and to some degree by the farm advisors), allowing a very simple interface for the farmer. To be successful, such programmes will need to be complex yet simple, so it is inevitable that a strong level of professional support will be needed. To attain long term success, it is essential for farmers' sons and daughters and others to aspire to deliver such services to their communities in future and earn a decent living by doing so.

A future challenge will be to integrate BP with other agri-environmental requirements and incentives that the farmer is engaged in. This is needed to simplify things for the farmer and reduce the risk of overlap (double-payments) for the paying authority. Future proofing to take on board issues around climate and declining rural populations etc. will only add to this challenge. Technological advances should help some activities, e.g. field scoring, works planning and monitoring.

Other ongoing challenges include managing the heightened expectations of funders, farmers and the public; securing continuity of funding without compromising programme structure; ensuring that other policies and programmes do not undermine, or overlap with, the BP; ensuring the BP delivers for evolving priorities such as climate change mitigation; strengthening and capturing the broader social and economic benefit of the programme itself. There is also the challenge of attracting and retaining experienced professional staff; the available pool of skilled staff is diminishing as other projects and opportunities (thankfully) emerge.

BOX 3.7:
ECONOMIC RETURNS TO FARMERS AND THE COMMUNITY

Since 2010, €8.5m has been paid to Burren farmers through the BFCP-BP. Given that all tasks are co-funded by farmers (in cash or through work, at rates of 25%, 50% or 75%), the actual value of the programme to the region has been close to €12m. The proportion of funding spent on 'results-based' payments (I-1) compared with 'conservation support measures' (I-2) in the BP's 'hybrid' approach varies from year to year but it is interesting to note that, from 2010-2015 there was a clear reduction over time in I-2 payments, while I-1 payments increased as the (I-2 funded) conservation infrastructure required for management was enhanced and began to deliver.

The average BP I-1 payment in 2018 was €2,617 while the average I-2 payment was €3,692. In most cases this payment is in addition to payments under GLAS agri-environment scheme (generally up to €4,000 per annum) so for the average Burren farmer, an average annual income of c. €10,000 is available through agri-environmental programmes. Given that average farm income for Irish farmers in the beef sector in 2018 was estimated at €8,300 (Teagasc, 2019) these environmental payments make a significant contribution to farm income, though not enough to make most of these farms economically viable – instead, the best that many can hope for is that they can become economically 'sustainable' by gaining off-farm employment or developing new business ideas.

Indirect economic benefits include employment opportunities for farm contractors; the BP maintains a database of 80 locals (mostly farmers) who are willing to do work on other farms, e.g. scrub removal and wall repair work. It also means more business for local products (e.g. gates, tools and water equipment) and service providers, such as plumbers and track machine operators. Additional funding has also been invested in the BP local office and management team. Several farmers have developed agri-businesses of their own including farmer-led farm tours and farm cafes, while a number of farmers act as farm advisors to other farmers.

Payments for ecosystem services such as the BP provides are no magic bullet but can make an important contribution to income and opportunities for farmers at a time when income from, and respect for, beef farming is eroding.

BOX 3.8
SOCIAL IMPACT

The Burren Programme has enabled farmers to come together to undertake meaningful work at a local level, while training days (6-8 events annually) are very well attended and provide farmers with the opportunity to exchange ideas and experiences for managing their land for themselves, the environment and the wider community. The broader social impact of the BP requires further research but, anecdotally it has helped improve respect for the work of Burren farmers and thus their professional self-esteem as custodians of one of Ireland's most extraordinary landscapes.

To reinforce the 'social capital' around farming for conservation, a series of annual prizes are awarded for the most improved farm, best pasture, best meadow, best standard of work and an overall prize for best 'conservation' farmer and best farm family in the Burren. These Bord Bia 'Origin Green' Awards – now expanded to a national level under the 'Farming for Nature' initiative (www.farmingfornature.ie) represent a powerful affirmation of the work of the best conservation farmers, who can act as role models for their peers within the farming community to emulate.

The work of the Burrenbeo Trust in creating social opportunities for farmers has been immense – monthly walks are often hosted by farmers, monthly talks are organised in local venues, events such as Burren in Bloom and the Burren Winterage Weekend entail a high level of farmer participation e.g. chairing conference sessions, hosting farm walks, hosting the cattle drove and doing promotional pieces for radio, TV and newspapers. Study visits have also been organised – to the UK and Northern Ireland - which are another important social and learning opportunity for farmers.

In terms of behavioural change among farmers, there is a wide spectrum of responses. Some farmers and/or their spouses have become very engaged in heritage conservation and in promoting sustainable farming, leading farm walks (Figure 3.16), taking part in public events, and continually liaising with the local team. Several others remain nonplussed, but the majority appear to have shifted slightly towards a more positive approach to nature conservation on their land, now seen as a more socially acceptable and a less risky part of the overall agricultural and economic future of local farm systems.

Figure 3.16
Burren farmer, Pat Nagle, outlining how the Burren Programme works on his farm

SUMMARY – KEY LESSONS LEARNED

Drawing lessons from the BP experience must come with something of a health warning given that the Burren region is so distinct and unique, as are the circumstances, timing and 'champions' involved in the development of the BP, as described above. Thus, not all of the BP learnings may be transferrable, nor should they be, given the diverse range of circumstances (geographies, farming systems and traditions, different environmental challenges, etc.) that exist in other regions.

However, it could equally be argued that if the BP approach can work in such an ecologically and agriculturally complex area as the Burren, it should be possible to adapt and apply its core principles elsewhere where conditions are likely to be far less complex. Indeed, evidence from other projects such as the 'Results Based Agri-environment Payment Scheme (RBAPS)' project, described in Chapter 6, and several of the new 'European Innovation Partnership (EIP)' projects, do seem to bear this out. The Burren, and these subsequent projects, have shown what can be done and a lot has been learnt in the process, knowledge that can hopefully help inform future projects. Some key learnings include:

The importance of local ownership, leadership and partnership: the initial stimulus for the BP came from local farmers who, feeling threatened by SAC designations and REPS conditions, decided to engage constructively with researchers and public authorities to find a way forward. The knowledge, support and willingness-to-engage of Burren farm leaders – particularly through the Burren IFA group - has been immense. This has helped inform the evolution of the BP, minimise conflict between stakeholders, reassure farmers around new developments and avoid the typical 'us versus them' scenario whereby locals feel that external agendas, values and ideas are being imposed upon them.

Taking a broad, inclusive approach to conservation: The initial PhD research phase (1998-2001) was, somewhat atypically, undertaken by a locally-based researcher over an extended period and adopted a very grounded approach, looking at a broad range of issues, social, botanical and agricultural. Such a holistic, ground-up approach to research worked very well in aligning perspectives – agriculturalist, scientist, policymaker, conservationist – towards a set of shared values and benefits. The subsequent 're-telling' of the Burren story in a more inclusive way helped to give farmers a greater sense of ownership of a story which they felt external 'experts' had appropriated. This 'ownership' remains a key element of the BP.

The value of practical, local, scientific research: BurrenLIFE afforded the luxury of sufficient time and resources to co-create, with farmers, a blueprint for the future of Burren farming and to overcome some key technical hurdles (e.g. developing alternative feeding systems). In a process which was local but inclusive, practical yet innovative, the research generated critical information on the cost and impact of various management options. It won the respect of local farmers who saw it as relevant and progressive, and cemented working relationships between partners. This research also gave a lot of reassurance to funders who could see the impact, cost and popularity of the programme locally.

Adopting a farmer-centered approach: The BP recognises farmers as the key group in delivering environmental improvements and caters to their key needs by being progressive and fair (payments, inspections, etc.), minimising bureaucracy, maximising flexibility and always being available to help and offer advice and encouragement. A 'pocket, head and heart' approach. Every effort is made to think like a farmer in terms of programme design and delivery, and this has been key to the high level of farmer engagement and compliance.

Paying for results: One of the key learnings of the BP has been the impact of its results-based payment system. Initially designed to provide an incentive for farmers to restore grazing on rough grasslands, it has yielded multiple benefits. For the farmer, it offers a clear and simple message about what the BP aims to achieve while allowing him/her flexibility in delivering it. It has also stimulated an appetite among farmers for information on 'farming for nature', encouraged innovation and the adoption of conservation actions which are more likely to deliver environmental benefits on the farm. For the funder, it guarantees better value for money and yields real-time information on the programme's impact.

Continuity, trust and respect: Within the farming community, relationships and trust tend to be built slowly over time. The continuity of funding, and of staff involved in the BP (some for 15 years) and of the local office has really

helped to build trust and to ensure that local learnings were translated into a workable programme. This trust has helped allay farmer's fears, including fears of additional restrictions and paperwork, increased risk of penalties and concerns about the fairness of the results-based approach (in particular how weather and disease events might impact on scores). Over time, fears about the BP have diminished with familiarity of the programme and as the relationship with the local team has grown closer. Farmers feel valued and respected and as a result are much more likely to engage positively.

Being responsive and adaptive: The BP started with a clean slate, and this allowed the local team to address key weaknesses of the former BurrenLIFE approach – such as the unwieldy farm plan and the failure to motivate farmers to improve grazing systems - by streamlining farm plan design and introducing a results-based measure. Equally the I-1 scoring system was refined for several years after its introduction to ensure that the weighted scores and guidelines achieved what they set out to achieve. This again highlights the importance of being able to continually adapt and improve with learnings gained, recognising that AESs, no matter how good, need to continually evolve if they are to continue to deliver.

Having a practical, environmental focus: The BP adopts a simple, practical approach to a quite complex set of environmental challenges. It is not a social programme, though it does deliver socio-economic benefits. It is very focussed on the delivery of clearly defined environmental outputs. Every element of the programme design - from farmer selection to technical evaluations to payment systems - is based on meeting this objective, in the knowledge that the BP will ultimately be judged on its environmental impact.

Institutional support : The BP has been fortunate to enjoy a lot of institutional support, often due to individual champions within Government Departments who worked 'up, down and across the line' to ensure 'top-down' support for the 'bottom up' initiative. Undoubtedly, challenges remain, with many of these stemming from the difficulty in accommodating the pioneering approach of the BP into the very rigid structures of an Article 28 funded programme. As with anything new, relationships between local teams and their funders take time to develop, and this can lead to a duplication in roles and reduced efficiency.

A strong advisory service: Ireland is fortunate to have such a strong public and private farm advisory service; unlike many other EU countries. The 12 BP farm advisors (who had to undertake a 5-day training course plus annual refresher training) provide a critical service, advising the farmer, carrying out I-1 scoring, planning I-2 works and liaising with the BP team. The quality of these advisors, and the trusted relationship they have with their clients (in most cases these advisors also handle the farmer's Basic Payment Scheme, Less Favoured Area and Agri-Environment Scheme returns), has been absolutely critical to the success and scaling of the BP and will be equally critical to the success of other such programmes.

LOOKING AHEAD

If the BP can continue to perform well and be allowed the flexibility to further adapt and improve, it can potentially reach a level at which it can unlock significant additional opportunities for the Burren. These might include: the branding and marketing of products and services; delivering greater local employment and training opportunities for local farmers (including professional roles within the BP); exploring new funding mechanisms such as private capital for delivering ecosystem services; bulk-ordering materials such as gates and feed to reduce costs; and piloting new technologies such as drones and scoring apps. The profile of the BP is already creating increasing opportunities for Burren farmers to share their knowledge of this 'learning landscape' through guided walks.

Ultimately the main success of the BP has been its positive impact on 23,000 ha (c. 71% of the designated area) of the Burren at a time when Ireland has declared a biodiversity emergency. This has been made possible by understanding, empowering and then motivating (a significant proportion of) Burren farmers to adopt a more multifaceted approach to managing their land. Although still in its infancy, this approach of viewing farmers as a conservation resource, trusting and investing in them, has worked well; it has encouraged a welcome diversity of responses at field and farm level while delivering a gradual but marked overall improvement in the environmental health of the Burren. Increasingly, local farmers are taking on roles of environmental leadership, offering a glimpse of a future where these farmers become independent, active stewards of, and spokespeople for their heritage.

The success of the RBAPS project and of the emergent EIPs show that the BP isn't a one-off, isolated success; instead, the principles underpinning the development and delivery of the BP can be applied elsewhere. These principles – locally-led, farmer-centred, results-based, and adaptable - can be applied to a wide range of landscapes, habitats and environmental challenges, which is not to say that a traditional action-based approach won't work better in some circumstances.

To ensure that this trend continues under future Common Agricultural Policies (CAPs), important institutional arrangements can enable this to happen, including a more flexible Rural Development Plan (RDP) Measure, more enabling Departmental structures, a strong farm advisory service and, where necessary, the presence of a local team. However, perhaps the most important factor of all will be an informed and enthused farming community who are prepared to fully engage with the opportunity that such programmes present for their farms, their families and their heritage.

APPENDIX 1A BLG FIELD SCORE SHEET A

I-1 Score Sheet for Burren Lowland Grasslands *Burren Programme v2 May 2017*

.Farm: _____ Field: _____ Surveyor: _____ Date: _____

Current Pasture Management (circle as appropriate)

Main Grazing Period:	Mowing / topping:
Mainly Winter	Never *or* rarely
Mainly Summer	Every 2-4 years
Year round *or* other	Most years

Feeding Management (circle as appropriate)

Silage/hay:
Not fed *or* Some fed loose, scattered
Fed as: Round bales (ring feeder or not)
or In/on Trailer

Concentrates: *If known
Not Fed* *or* unknown
or Fed in trough(s)
or Fed on ground*

SCORING (circle appropriate value)

A1. Sward management (grazing & mowing)?

Much too intense	Above optimum		Optimum	Below Optimum		Negligible
-10	-1	4	10	5	0	-5

Comments

A2. Impact of supplementary feeding?

Negligible	Low-Med	Medium	Med-High	High
10	5	0	-5	-10

A3. Impact on natural water sources? (*Note if no natural water present)*

None	Low	Medium	High
0	-7	-15	-20

A4. Presence of bare soil?

Insufficient	Optimum	Above Optimum	High
-3.5	5	-2.5	-10

B1. What is the level of immature, removable scrub? (% cover)

None	<2%	2 to 5%	6 to 10%	>10%
5	-2.5	-10	-15	-20

B2. What is the impact of / threat from, Bracken?

Negligible	Low	Medium	High
5	0	-5	-15

B3. What is the impact of / threat from, Purple Moor-grass (*Molinia*)?

Negligible	Low	Medium	High
0	-5	-10	-20

B4. What is the extent of 'weeds'?

Negligible	<2%	2-5%	6-10%	>10%
5	0	-5	-10	-15

C1. Conservation value (flora)? (Enter value provided by BP team)

A	B1	B2	C1	C2
60	50	40	25	15

C2. Additional conservation value (tick boxes as appropriate)

None	+ 1/2 class	+ 1 class
0	5	10

❑ Leaving agreed species-rich areas unmown ❑ High frequency of nectar sources (clovers, dandelions & dandelion-like flowers, thistle-type flowers, white umbellifers incl. hogweed ❑ High botanical diversity on field margins incl. grp 4&5 species ❑ Ant hills frequent ❑ Other(state in comments box).

C3. Have any of the habitats or archaeology present been damaged during past year? (circle/mark as appropriate)

No Yes

❑ Removal of established scrub ❑ Herbicide ❑ Reseeding ❑ Dumping (e.g. spoil, rubbish) ❑ Infilling or levelling of small banks, hollows (e.g. old quarry pits) or 'ponds' ❑ Removal of stone from built structures ❑ Other

Brief description & extent of damage - contact Burren Team asap for advice on how to adjust the field score.

Brief description/Comments (e.g. additional habitats present, actions needed & priority, quality of work done):

I-1 Score Sheet for Burren Lowland Grasslands

Burren Programme v2 May 2017

Gp	Code	1	2	3	4	5	6	7	8	9	10	Gp	Code	1	2	3	4	5	6	7	8	9	10
1	Cirs arv/vul											5	Ach ptar										
1	Hera sph											5	Ajug rep										
1	Sene jac											5	Alchem sp										
1	Tara off											5	Anem nem										
1	Trif rep											5	Anth vul										
												5	Blac per										
2	Ach mil											5	Botr lun										
2	Cirs pal											5	Bri med										
2	Crep/Leon*											5	Calt pal										
2	Medi lup											5	Camp rot										
2	Odo ver											5	Cent ery										
2	Plan lan											5	Cent scab										
2	Ran acr											5	Euph off										
2	Ran fic											5	Fili vul										
2	Rum acet											5	Gali ver										
2	Ver cham											5	Gent ver										
												5	Ger san										
3	Card prat											5	Geum riv										
3	Hypo rad											5	Heli pub										
3	Iris pseu											5	Hyac n-s										
3	Leuc vul											5	Hyper sp										
3	Luz camp											5	Knau arv										
3	Myo arv/dis											5	Koel mac										
3	Prun vul											5	Lath lini										
3	Ran bulb											5	Leon his										
3	Tri dub											5	Lin cath										
3	Tri pra											5	Lot corn										
3	Viola sp											5	Lych f-c										
												5	Ophi vul										
4	Agrimonia											5	Orchid										
4	Ange syl											5	Parn pal										
4	Carex sp											5	Pedi syl										
4	Cent nig											5	Pilo off										
4	Cono maj											5	Pimp sax										
4	Dauc car											5	Plan mar										
4	Fili ulm											5	Poly vul										
4	Lath pra											5	Prim ver										
4	Pot ere											5	Prim vul										
4	Rhin min											5	Sang min										
4	Stel gram											5	Ses caer										
4	Tris fla											5	Succ pra										
4	Vic crac/sep																						

* excl. L. hispidus (grp 5)

I1 Score Sheet for Winterage-type Pastures

Burren Programme v1.1 June 2016

Farm: _____ Field: _____ Surveyor: _____ Date: _____

Current Grazing Practice (circle as appropriate)

Winter Only | Winter & Light Summer | Year Round | Other

Feeding Management (circle as appropriate)

Silage/hay: Not fed or Some fed loose, scattered
Fed as: Round bales (ring feeder or not) or In/on Trailer

Concentrates: *where known: Not Fed* or Fed in trough(s) or Fed on ground*

SCORING (circle appropriate value)

A1. What is the grazing level?

Negligible	Below optimum			Optimum	Above optimum		V. High
-35	-25	-5	0 9	15	8	-6	-36

Comments

A2. What is the litter level? (% cover)

Low <10%	10-25%	>25-50%	>50-75%	High >75
20	14	8	2	0

A3. Is there damage around feed sites and/or water troughs?

Low	Low-Med	Medium	Med-High	High
15	11	7	2	-7

A4. Is there damage around natural water sources? (*Note if no natural water present*)

Low	Low-Med	Medium	Med-High	High
15	11	7	2	-7

A5. Is there bare soil and erosion?

Low	Low-Med	Medium	Med-High	High
5	1	-3	-10	-17

B1. What is the level of immature, removable scrub? (% cover) Use Nº in brackets if seedlings commonly seen or cover is borderline

≤2%	3 - 5%	6 - 10%	11 - 25%	>26%
15 (13)	9 (7)	3 (1)	-7 (-9)	-18

B2. What is the impact of / threat from, Bracken?

Low	Low-Med	Medium	Med-High	High
5	1	-3	-10	-17

B3. What is the impact of / threat from, Purple Moor-grass (*Molinia*)?

Low	Low-Med	Medium	Med-High	High
5	1	-3	-10	-17

B4. What is the extent of 'weeds' &/or agriculturally-favoured species present due to management practices?

Low	Low-Med	Medium	Med-High	High
10	6	2	-3	-12

C1. Does the field retain its ecological integrity (in terms of plant communities present)?

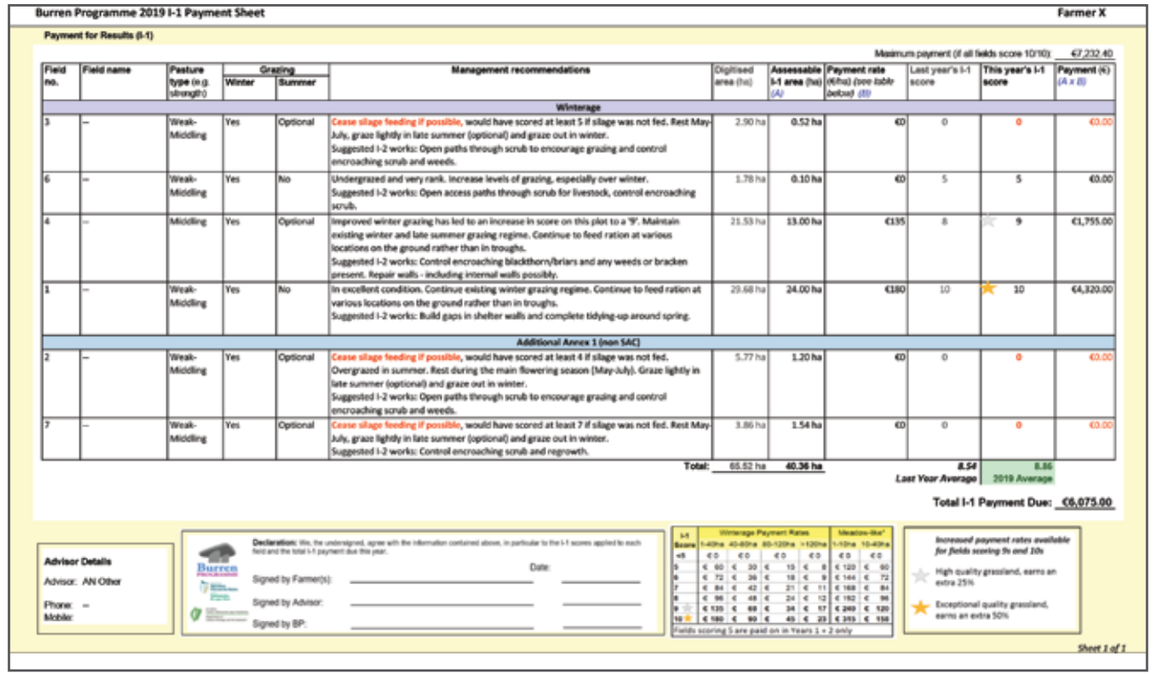
Vegetation Typical	Veg. slightly modified		Veg. moderately modified	Veg. significantly modified
5	0	-6	-17	-28

Have any of the habitats or archaeology present been damaged by unauthorised or careless activities during past year?

Note type & extent of damage and contact Burren Team asap for advice on whether and how to adjust the field score.

Comments (e.g. actions needed & priority, quality of work done, habitat type and pasture strength):

APPENDIX 3 EXAMPLE OF AN INTERVENTION 1 (I-1) PAYMENT SHEET



Burren Programme 2019 I-1 Payment Sheet — **Farmer X**

Payment for Results (I-1)

Maximum payment (if all fields score 10/10): €7,232.40

Field no.	Field name	Pasture type (e.g. strength)	Grazing: Winter	Grazing: Summer	Management recommendations	Digitised area (ha)	Assessable I-1 area (ha) (A)	Payment rate (€/ha) (see table below) (B)	Last year's I-1 score	This year's I-1 score	Payment (€) (A x B)
Winterage											
3	–	Weak-Middling	Yes	Optional	Cease silage feeding if possible, would have scored at least 5 if silage was not fed. Rest May-July, graze lightly in late summer (optional) and graze out in winter. Suggested I-2 works: Open paths through scrub to encourage grazing and control encroaching scrub and weeds.	2.90 ha	0.52 ha	€0	0	0	€0.00
6	–	Weak-Middling	Yes	No	Undergrazed and very rank. Increase levels of grazing, especially over winter. Suggested I-2 works: Open access paths through scrub for livestock, control encroaching scrub.	1.78 ha	0.10 ha	€0	5	5	€0.00
4	–	Middling	Yes	Optional	Improved winter grazing has led to an increase in score on this plot to a '9'. Maintain existing winter and late summer grazing regime. Continue to feed ration at various locations on the ground rather than in troughs. Suggested I-2 works: Control encroaching blackthorn/briars and any weeds or bracken present. Repair walls - including internal walls possibly.	21.53 ha	13.00 ha	€135	8	9	€1,755.00
1	–	Weak-Middling	Yes	No	In excellent condition. Continue existing winter grazing regime. Continue to feed ration at various locations on the ground rather than in troughs. Suggested I-2 works: Build gaps in shelter walls and complete tidying-up around spring.	29.68 ha	24.00 ha	€180	10	10	€4,320.00
Additional Annex 1 (non SAC)											
2	–	Weak-Middling	Yes	Optional	Cease silage feeding if possible, would have scored at least 4 if silage was not fed. Overgrazed in summer. Rest during the main flowering season (May-July). Graze lightly in late summer (optional) and graze out in winter. Suggested I-2 works: Open paths through scrub to encourage grazing and control encroaching scrub and weeds.	5.77 ha	1.20 ha	€0	0	0	€0.00
7	–	Weak-Middling	Yes	Optional	Cease silage feeding if possible, would have scored at least 7 if silage was not fed. Rest May-July, graze lightly in late summer (optional) and graze out in winter. Suggested I-2 works: Control encroaching scrub and regrowth.	3.86 ha	1.54 ha	€0	0	0	€0.00
					Total:	65.52 ha	40.36 ha		8.54 *Last Year Average*	8.86 2019 Average	

Total I-1 Payment Due: €6,075.00

Advisor Details
Advisor: AN Other
Phone: –
Mobile:

Declaration: We, the undersigned, agree with the information contained above, in particular to the I-1 scores applied to each field and the total I-1 payment due this year.
Signed by Farmer(s): Date:
Signed by Advisor:
Signed by BP:

I-1 Score	Winterage Payment Rates 1-40ha	40-80ha	80-120ha	>120ha	Meadow-like 1-10ha	10-40ha
<5	€0	€0	€0	€0	€0	€0
5	€ 60	€ 30	€ 15	€ 8	€ 120	€ 60
6	€ 72	€ 36	€ 18	€ 9	€ 144	€ 72
7	€ 84	€ 42	€ 21	€ 11	€ 168	€ 84
8	€ 96	€ 48	€ 24	€ 12	€ 192	€ 96
9 ☆	€ 135	€ 68	€ 34	€ 17	€ 240	€ 120
10 ★	€ 180	€ 90	€ 45	€ 23	€ 315	€ 158

Fields scoring 5 are paid on in Years 1 + 2 only.

Increased payment rates available for fields scoring 9s and 10s
☆ High quality grassland, earns an extra 25%
★ Exceptional quality grassland, earns an extra 50%

Sheet 1 of 1

APPENDIX 4 PAYMENT RATES FOR INTERVENTION 1 (I-1) SCORES

I-1 Score	Winterage Payment Rates 1-40ha	40-80ha	80-120ha	>120ha	Meadow-like 1-10ha	10-40ha
<5	€0	€0	€0	€0	€0	€0
5	€ 60	€ 30	€ 15	€ 8	€ 120	€ 60
6	€ 72	€ 36	€ 18	€ 9	€ 144	€ 72
7	€ 84	€ 42	€ 21	€ 11	€ 168	€ 84
8	€ 96	€ 48	€ 24	€ 12	€ 192	€ 96
9 ☆	**€ 135**	**€ 68**	**€ 34**	**€ 17**	**€ 240**	**€ 120**
10 ★	**€ 180**	**€ 90**	**€ 45**	**€ 23**	**€ 315**	**€ 158**
Fields Scoring 5 are paid on in Years 1 + 2 only.						

APPENDIX 5A DETAIL ON CONSERVATION VALUE AND ECOLOGICAL INTEGRITY OF BURREN LOWLAND GRASSLANDS

CONSERVATION VALUE - FLORA

When scoring BLGs, the criterion 'Conservation value – flora' has the highest weighting. As this value is slow to change under normal circumstances, it need only be calculated every 3-5 years unless there is reason to suspect an increase or decrease in the conservation value that would impact on the field score and hence payment. Here, we explain in more detail how it relates to the species composition of the targeted grasslands. Further details are available at: **www.burrenprogramme.com/burren-programme-resources/.**

To calculate the conservation value in terms of plant diversity, the field should be surveyed as follows:

- Generally, between four and ten recording stops should be made in the field, depending on its size, although more may be needed in particularly large fields. The stops should be representative of the vegetation of the body of the field i.e. avoid other habitats that might be present such as small flushes, and stay at least 5 m in from the field margins. The recording stops should be carried out at random (e.g. walk a pre-determined number of steps between stops so that there is no subliminal influence on stop location) when walking a zig zag route through the field.

- At each stop, record any of the listed species in groups 1-5 (Table 3.1) seen in an area of approximately 2 m radiating from the centre of the stop (i.e. circle with diameter of approx. 4 m) on the score sheet. Additional species of interest not on the sheet should also be recorded. The assessment is designed to be relatively quick, need not be exhaustive and should take a maximum of 15 minutes per stop (although it may take slightly longer depending on the condition of the sward). Where fields are obviously very species-rich, recording can be focused on species in groups 3-5 only.

- Enter the species data into the 'Cons val' sheet of the BLG calculator (in Excel) and it will calculate the conservation value (flora) automatically based on the frequency of occurrence of the recorded species. The frequency definitions are as follows:
  - Rare - found at 25% or fewer stops
  - Occasional – found at 26 to 50% of stops
  - Frequent – found at 51-75% of stops
  - Common – found at 76-100% of stops

Conservation values span a gradient of 5 qualifying classes (Table 3.2), a higher conservation class being assigned to an area with more frequent occurrence of the 'higher quality' indicator species. This gradient is reflected in the points (out of a maximum of 60) awarded for each of the 5 conservation classes as per the final column of Table 3.2. These points are input into the BLG Field Score Sheet (Appendix 1), and the resultant final field score in to the payment calculation (e.g. Appendix 3).

APPENDIX 5B DETAIL ON CONSERVATION VALUE AND ECOLOGICAL INTEGRITY OF BURREN LOWLAND GRASSLANDS

Table 3.1

INDICATOR SPECIES USED TO CALCULATE THE CONSERVATION VALUE OF BURREN LOWLAND GRASSLANDS. THE INDICATOR SPECIES REPRESENT AN INCREASE IN QUALITY AND HENCE CONSERVATION VALUE FROM GROUPS 1 TO 5.

GROUP 1 SPECIES (low 'quality')				
Cirsium arvense/ vulgare	Heracleum sphondylium	Senecio jacobaea	Taraxacum officinale	Trifolium repens
GROUP 2 SPECIES				
Achillea millefolium	Cirsium palustre	Crepis/Leontodon* sp.	Medicago lupulina	Odontites verna
Plantago lanceolata	Ranunculus acris	Ranunculus ficaria	Rumex acetosa	Veronica chamaedrys
*excluding L. hispidus (in grp 5)				
GROUP 3 SPECIES				
Cardamine pratensis	Hypochaeris radicata	Iris psuedacorus	Leucanthemum vulgare	Luzula campestris
Myosotis arvensis/ discolour	Prunella vulgaris	Ranunculus bulbosus	Trifolium dubium	Trifolium pratense
Viola sp.				
GROUP 4 SPECIES				
Agrimonia sp.	Angelica sylvestris	Carex sp.	Centaurea nigra	Conopodium majus
Daucus carota	Filipendula ulmaria	Lathyrus pratensis	Potentilla erecta	Rhinanthus minor
Stellaria graminea	Trisetum flavescens	Vicia cracca/sepium		
GROUP 5 SPECIES (high 'quality')				
Achillea ptarmica	Ajuga reptans	Alchemilla sp.	Anemone nemorosa	Anthylis vulneraria
Blackstonia perfoliata	Botrychium lunaria	Briza media	Caltha palustris	Campanula rotundifolia
Centaurium erythraea	Cantaurea Scabiosa	Euphrasia sp.	Filipendula vulgaris	Galium verum
Gentiana verna	Geranium sanguineum	Geum rivale	Helictotrichon pubescens	Hyacinthoides non-scripta
Hypericum sp.	Knautia arvensis	Koeleria maculata	Lathyrus linifolius	Leontodon hispidus
Linum catharticum	Lotus corniculatus	Lychnis flos-cuculi	Ophioglossum vulgare	Orchid1
Parnasia palustris	Pedicularis sylvatica	Pilosella officinarum	Pimpinella saxifraga	Plantago maritima
Polygala vulgaris	Primula veris	Primula vulgaris	Sanguinium minus	Sesleria caerulea
Succisa pratensis	1Note species at bottom of sheet if identified			

APPENDIX 5C DETAIL ON CONSERVATION VALUE AND ECOLOGICAL INTEGRITY OF BURREN LOWLAND GRASSLANDS

Table 3.2

ASSIGNING CONSERVATION VALUE

CLASS	DESCRIPTION	CALCULATION	POINTS
A	**VERY HIGH CONSERVATION VALUE** • High floral diversity, many plant species characteristic of the local conditions (e.g. wet or dry meadow) present • High number of Group 3, 4 & 5 'Quality' species that are occasional to common • High ratio of herbs to grass – usually in excess of 50:50	TOTAL SCORE FOR **GROUP 5 SPECIES ONLY > 30** Calculated by: • 5 pts for each Group 5 sp. that is frequent or common • 3 pts for each Group 5 sp. that is occasional	**60**
B1	**HIGH CONSERVATION VALUE** • Similar to above but fewer Group 5 species occasional to common • High ratio of herbs to grass – often in excess of 50:50	TOTAL SCORE FOR **GROUPS 4 & 5 SP. > 30** Calculated by: • 4 pts for each Group 4 sp. that is frequent or common • 2 pts for each Group 4 sp. that is occasional • Plus score for Group 5 sp. calculated as for Class A	**50**
B2	**GOOD CONSERVATION VALUE** • Fewer Group 4 & 5 species occasional to common • Ration of herbs to grass should be in excess of 30:70	TOTAL SCORE FOR **GROUPS 3, 4 & 5 SP. > 30** Calculated by: • 3 pts for each Group 3 sp. that is frequent or common • 1 pt for each Group 3 sp. that is occasional • Plus score for Groups 4 & 5 sp. calculated as for Class B1	**40**
C1	**LOWER CONSERVATION VALUE BUT HAS POTENTIAL** • Potential to increase conservation value with tweaking of management • Group 4 & 5 species if present tend to be restricted to field margins	TOTAL SCORE FOR **GROUPS 2, 3, 4 & 5 SP. > 30** Calculated by: • 2 pts for each Group 2 sp. that is frequent or common • 0 pt for each Group 2 sp. that is occasional • Plus score for Groups 3, 4 & 5 sp. calculated as for Class B2	**25**
C2	**LOWER CONSERVATION VALUE BUT HAS POTENTIAL** • Similar to above but with few or no Group 4 or 5 sp.	TOTAL SCORE FOR **GROUPS 2, 3, 4 & 5 SP. FROM 20 TO 30.** • Calculated as for Class C1	**15**
-	**INELIGIBLE**	TOTAL SCORE FOR **GROUPS 2, 3, 4 & 5 SP. <20**	**-**

APPENDIX 5D DETAIL ON CONSERVATION VALUE AND ECOLOGICAL INTEGRITY OF BURREN LOWLAND GRASSLANDS

ADDITIONAL CONSERVATION VALUE

Although botanical diversity is a good proxy, it can underestimate the true biodiversity value of some less flower-rich fields. We aimed to recognise this and to reward instances of positive management above and beyond that required. Thus, all fields, other than those with highest conservation value as determined botanically (i.e. Class A), can receive an additional 10 points which will increase the field score by 1. The following are examples of additional conservation management or biodiversity indicators that may qualify for the 10 point bonus:

- Leaving agreed flower-rich areas uncut at the time of mowing.
- Nectar sources that are important for pollinators, butterflies and moths relatively common in the field. For example:
  - Clovers.
  - Dandelions and other yellow dandelion-type flowers.
  - Thistle-type flowers (although classed as weeds, thistles have a high biodiversity value as a nectar source for pollinators, butterflies and moths, and their seeds form an important part of the diet of some birds (e.g. Goldfinch) later in the year).
  - White umbellifers including hogweed.
- Frequent ant hills.
- Higher botanical diversity on field margins e.g. more group 4 and 5 than in body of field.
- Presence of adjacent habitat (e.g. lake, wetland, woodland) whose invertebrates are supported by floral diversity of meadow.
- Participants can contact the Burren Team if they think that there are other examples of additional conservation value present.

OTHER NEGATIVE ACTIVITIES.

Any activity which leads to destruction or damage to all or part of the habitat and not covered elsewhere in the scoring system (e.g. indiscriminate herbicide use, ploughing, reseeding, or dumping of spoil or rubbish) is recorded and can be taken into account when calculating the field score. This can range from a deduction of 0 to 40 points from the overall score. The adjustment to the score will depend on the impact of the activity and is agreed by the farm advisor and the Burren Team.

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Aran, an incredible jigsaw puzzle of little fields where farmers clear their stoney patches and mark their every increasing subdivision of their holdings by building walls...

Tim Robinson *Stones of Aran* (1986)

The AranLIFE project area – The Aran Islands, located at the mouth of Galway Bay, on the west coast of Ireland.

FARMING FOR CONSERVATION ON THE ARAN ISLANDS

PATRICK MCGURN
AMANDA BROWNE
GRÁINNE NÍ CHONGHAILE

THE ARAN ISLANDS, HUMANS, FARMING AND WILDLIFE

INTRODUCTION

The Aran Islands consists of three islands, Inis Mór, Inis Meáin and Inis Oírr, located at the mouth of Galway Bay, on the west coast of Ireland approximately 43.3 km^2 or 4,330 ha in size. The islands' geology is mainly karst limestone dating from the Viséan age of the Lower Carboniferous, formed as sediments in a tropical sea approximately 350 million years ago. Human involvement with the Aran Islands dates to at least the Middle Stone Age (Mesolithic - between 6 and 10 thousand years ago) when they were visited by hunter-gatherer groups coming from the coast of Clare. Continuous inhabitancy and natural forces have all shaped the appearance of the islands to its present form, an agricultural landscape denuded of trees and subdivided into a mosaic of fields described by Tim Robinson in his book Stones of Aran (1986) as an "*incredible jigsaw puzzle of little fields where farmers clear their stoney patches and mark their every increasing subdivision of their holdings by building walls*".

The 2016 population was 762 people on Inis Mór, 281 on Inis Oírr and 185 on Inis Meáin (CSO, 2019). There are presently over 200 farm businesses on the islands, so agriculture is an important part of island life.

Figure 4.1
Facing page: Moving cattle on Inis Meáin, Aran Islands.

From left:
Figure 4.2
The AranLIFE project area – The Aran Islands, located at the mouth of Galway Bay, on the west coast of Ireland.

Figure 4.3
Winter grazing on Inis Mór, the grass is left ungrazed during growing season to supply a standing crop to graze during the winter

The agricultural system that has developed involves cattle grazing part of the farm during the growing season, and the remainder is left to allow excess grass to grow which is then grazed in the winter as a standing crop. The summer grazing tends to be on deeper soils closer to the dwelling houses and is grazed from calving time (March/April) to late Autumn/Early winter. The winter grazing is left ungrazed during this period to build up a bank of grass for grazing in the period November to March/April. Any excess grass on the summer grazing was traditionally made as hay, allowing some fodder supplementation in the winter, although this practice has declined as it is economically more favourable to purchase hay from the mainland.

This *winterage* practice was likely widespread in Ireland at one stage and in agricultural terms the standing crop is known as foggage, but this system has changed over the years because of the ascendancy of hay and then silage conservation. It is now mainly limited to the Aran Islands and the Burren, where the drier limestone grasslands and limestone pavement are less prone to poaching. It is an efficient farming system; no cattle housing or slurry storage is required and the system takes full advantage of compensatory growth (animal growth may be lower than expected for some months due to under-nutrition; later, the liveweight gain of the cattle will be greater than expected due to good nutrition in the available forage). However, associated

Figure 4.4
Summer grazing on Inis Oírr

with this system is a low stocking rate and high labour requirement which limits the financial returns from the land.

Although the system is similar to that practiced in the Burren, the Islands are much smaller in extent than the Burren and farm sizes are smaller with little recourse to more productive land as they have in the Burren. In addition, the dense network of field walls and highly fragmented farms mean the system is based on a rotational grazing system, in which the cattle are confined to a small area of land and moved regularly to different fields. The Burren approach is based more on set stocking, with cattle grazing over larger areas of land over a longer time period. The Aran's rotational grazing system means utilisation of grass is good but there is a high labour requirement particularly due to the high number of fields. For example, one 32-hectare farm on Inis Mór has 43 different parcels of land scattered across the island made up of 158 fields. Details of the average farm size and estimated stock numbers from the 2010 agricultural census are shown in Table 4.1. Based on these figures and using standard cow equivalent figures the average stocking rates for the island is 0.4 LU/ha. A more recent study by AranLIFE on a random selection of 25 farms found the average stocking of 0.44 LU/ha suggesting that the census stocking rate is an accurate reflection for the islands.

Table 4.1

AGRICULTURAL CENSUS FIGURES FOR THE ARAN ISLANDS

(CSO, 2010)

AGE STRUCTURE OF FARMERS				
Under 35	35 to 44	45 to 54	55 to 64	65 and over
8	9	53	56	99

FARM SIZE					
<10ha	10-20ha	20-30ha	30-50ha	50-100ha	>100ha
92	99	2	12	2	0

LIVESTOCK NUMBERS							
Bulls	Dairy cows	Other cows	Other cattle	Total cattle	Rams	Ewes	Horses
27	0	661	1027	1715	12	220	63

The farming economy of the Aran Islands was traditionally supplemented through fishing, and the sea was an important resource for fuel, food and fertilizer with traditional cropping systems, mainly potatoes, for home consumption. In more recent years, off-farm employment in the tourist industry has replaced fishing for many families as over 250,000 tourists visit the islands every year.

Sales of livestock vary on farms; some farms sell the calves at weanling stage in October only keeping an occasional replacement heifer while others keep the calves over winter and sell them in the following year. Cattle buyers (known locally as "cattle jobbers") come to the Islands and buy the cattle before exporting them to Ireland's mainland for finishing (O'Sullivan and Godwin, 1978). Cattle breeds also vary on farms. Shorthorn was the predominant breed but with a higher demand and financial return for continental cattle, breed type has switched to more continental types such as Charolais and Limousine.

With small farm size and low average stocking rate, sales of agricultural produce is limited. Based on the census figures, 40% of the farms are < 10 hectares and the average beef cow herd size is 3 cows. The islands have all the characteristics of High Nature Value (HNV) farming: low inputs of pesticides and fertilizers; limited cultivation; low stocking rates and; a high percentage of semi-natural vegetation (Albrecht et al., 2007; Bignal and McCracken, 2000; EEA, 2004). With low potential for livestock sales, there is a high reliance on subsidies on the farm. However, subsidy payments through Pillar 1 of the Common Agricultural Policy (CAP) are also low as they are based on historic claims. CAP support is generally much lower for HNV farms than other farms, where the historic Single Payment System is applied (Keenleyside et al., 2014). In 2014 the average Single Farm Payment for the three islands was €108 per hectare compared to a national average of approximately €270.

ISLAND ECOLOGY

The islands contain 17 different habitats types that are increasingly rare in Europe and listed in the EU Habitats Directive. These include Coastal lagoons (1150*), Fixed coastal dunes with herbaceous vegetation (grey dunes) (2130*), Machair (21AO*), Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (important orchid sites) (6210*) and Limestone pavement (8240*), Reefs (1170), Perennial vegetation of stony banks (1220), Vegetated sea cliffs of the Atlantic and Baltic coasts (1230), Embryonic shifting dunes (2110), Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) (2120), Dunes with *Salix repens* ssp. *argentea* (*Salix arenariae*) (2170), Humid dune slacks (2190), European dry heaths (4030), Alpine and Boreal heaths (4060), Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) (6510), Turloughs (3180*), Submerged or partly submerged sea caves (8330). Six of these habitats are classed as priority habitats (*).

Based on Halada et al. (2011) nine of the 17 habitat types are fully or partly dependent on agricultural management. This is reflected in the National Parks and Wildlife Service (NPWS) site synopsis that the islands are of 'major scientific importance owing to the range of outstanding karstic carboniferous limestone and coastal habitats, and the number of rare and threatened species found thereon. The cultural heritage of the islands (and in particular the continuation of traditional low-intensity farming practices) is intrinsically linked with its scientific interest' (NPWS, 1997). The main habitat types found are the Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (important orchid sites) (6210*) and Limestone pavement (8240*). These two habitat types form a mosaic across the islands and are the main focus of the farming system.

The farming system of winter and summer grazing conserves the biodiversity of the grasslands. The winter grazing produces a short turf and in the springtime, herbs such as *Gentiana verna* (Spring gentian), *Geranium sanguineum* (Bloody cranes bill), *Lotus corniculatus* (Birds foot trefoil) and *Galium verum* (Lady's bedstraw) flower and fill the fields full of colour. Free from grazing in the summer months, they then set seed and thus the seed bank and species-richness of the fields is conserved and enhanced.

As well as the diversity of plant species on the islands there are also interesting species that are frequently found on the islands but are rare or absent elsewhere. There are plants at their most northerly limit of their distribution and are more associated with Mediterranean regions of France and Spain e.g. *Neotinea maculata* (Dense flowered orchid), *Ophrys apifera* (Bee orchid), *Rubia peregrina* (Wild madder).

There are also Arctic-Alpine plants and plants with restricted distribution within Britain and Ireland, such as *Rhodiola rosea* (Roseroot), *Gentiana verna* (Spring gentian), *Euphrasia salisburgensis* (Salzburg eyebright) and *Saxifraga rosacea* (Irish saxifrage). These species are found in high-altitude meadows in mainland Europe but occur close to sea level here. An anomaly of the Aran Island flora is that these 'typical' arctic alpine plants may occur alongside plants typical of Mediterranean regions. There are species with a limited distribution in Ireland and Britain, e.g. *Ajuga pyramidalis* (Pyramidal bugle), *Helianthemum oelandicum* (Hoary rock rose), *Astragalus danicus* (Purple milk vetch) and *Allium ampeloprasum var. babingtonii* (Babington's leek). These species occur on the Aran Islands and few other places within the country, for example *Astragalus danicus* (Purple milk vetch) only occurs on the Aran Islands within Ireland. There are also some plant species that have died out elsewhere due to intensification of agricultural practise e.g. *Lolium temulentum* (Darnel) is a rare grass species that occurs as an arable weed in the rye crops on Inis Meáin.

Along with the rich floral diversity, the Aran Islands also support a great variety of butterflies that feed and depend on the grassland plants. Twenty-one species of butterfly occur on the Aran Islands, a significant proportion of the national total of 31 species. These include *Cupido minimus* (Small blue butterfly) which is endangered nationally. The caterpillar of this butterfly feeds on the flowers of *Anthyllis vulneraria* (Kidney vetch) which occurs frequently on the islands. The caterpillar of the *Erynnis tages* (Dingy skipper), which is a near threatened species, feeds on *Lotus corniculatus*

Facing page, clockwise from top

Figure 4.5
Species rich Calcareous grassland with limestone pavement out crops on Inis Meáin

Figure 4.6
Astragalus danicus (Purple milk vetch) on Inis Meáin

Figure 4.7
Bombus muscorum, var *allenellus*, a form of the species which is unique to the Aran Islands

(Bird's-foot-trefoil). Wall brown, also an endangered species nationally, is common on the islands and its caterpillars feed on the native grasses.

The Aran Islands has its own variety of bumble bee, *Bombus muscorum*, var *allenellus*, that has only been recorded on these islands. Also found on the Machair grasslands is the rare snail, *Vertigo angustior* (Narrow-mouthed whorl snail). This species can occur on a wide variety of sites however the exact micro-climate that it requires is very strict and it is sensitive to drainage, changes in grazing and management. This species is on Annex II of the EU habitats Directive and is considered threatened within Europe.
The bird life associated with the farming system is also vibrant. *Vanellus vanellus* (Lapwing) a Red listed bird species are found nesting on Machair grassland on the islands whilst their numbers are declining elsewhere. Important numbers of terns (*Sterna paradisaea* (Arctic tern), *Thalasseus sandvicensis* (Sandwich tern) and *Sternula albifrons* (Little tern)) have been recorded breeding on the islands, these species over winter on Antarctic pack ice (*Sterna paradisaea*) and west coast of Africa (*Thalasseus sandvicensis* and *Sternula albifrons*) and return to the Aran Islands to breed in Summer. *Anthus pratensis* (Meadow pipit) and *Alauda arvensis* (Skylark) are also common throughout the islands. The grazing system is favourable for ground nesting birds which have suffered in other parts of Ireland. The winter grazing also leaves a favourable habitat for *Pyrrhocorax pyrrhocorax* (Chough), a member of the crow family with a distinctive red beak, as it requires short turf grazed grasslands to forage for insects and grubs. *Pyrrhocorax pyrrhocorax* is on Annex I of the EU Birds Directive and has been included in the Red List of Birds of Conservation Concern in Ireland (Newton et al., 1999).

ORIGINS OF THE ARANLIFE PROJECT

The poor economics of farming on the island is leading to changing practices that include both land abandonment and/or sub-optimal grazing. This lack of agricultural activity leads to an increase in scrub, particularly *Rubus fruticosus* agg. (Bramble), *Prunus spinosa* (Blackthorn), *Crataegus monogyna* (Hawthorn), *Corylus avellana* (Hazel) and *Pteridium aquilinum* (Bracken). The result is the development of species-poor grassland and/or scrub communities at the expense of the species-rich grasslands. This has caused a visual change in the island with not only grasslands disappearing but the iconic field structure being engulfed by the encroaching scrub. In the national survey of semi-natural grassland (Devaney et al., 2013), 6 of 7 site assessments on the Aran Islands indicated scrub encroachment as a threat causing a decline in their conservation status. For the islanders, there is a fear that scrub encroachment can also result in negative effects for the tourist industry which forms a major part of the islands economy. The farmers on the islands had seen how a project in the Burren (BurrenLIFE) developed with strong tangible benefits and felt the islands could develop their own plan. In late 2008, BurrenLIFE in conjunction with Teagasc held a series of information meetings on the islands followed by a visit to the Burren with a number of island farmers. The Heritage Council, (a public body that provides policy advice for government on heritage issues including High Nature Value (HNV) farming) commissioned a report in 2009 which recommended the development of agri-environmental schemes that specifically focus on HNV farmland to enhance conservation of the extensively farmed landscape. This aim would contribute to the biodiversity objectives under the CAP and other areas of EU policy, and could potentially contribute to Ireland's National Landscape Strategy (Smith et al., 2010). During that period, Kelly (2010) investigated the impact of the Irish agri-environment scheme REPS (Rural Environment Protection Scheme) on the Aran Islands. REPS was introduced under Council Regulation 2078/92 in order to encourage farmers to carry out their activities in a more extensive and environmentally friendly manner. Overall, the study found that REPS was a beneficial scheme to the Islands, because it increased awareness of the environment, improved knowledge of stonewall maintenance and generally tidied up the farming landscape of Aran. However, some important limitations of the scheme in the context of the Aran Islands were identified, especially in the lack of positive management of habitats. The study also found that specific conservation issues on the Islands (e.g. encroachment of roads in common ownership) were not being addressed by REPS. The report suggested that the concept of High Nature Value Farmland needed to be taken out of the policy arena and into a tangible reality where it ensures the viability of low intensity farming for conservation in areas such as the Aran Islands. The study suggested that future programmes should focus on the specific habitat, species and cultural conservation issues of the Aran Islands.

To develop the recommendations in the reports, The Heritage Council established a HNV Ireland working group made up of various stakeholders including government, local community groups and non-government

organisations. This work was supported by the 'European Forum for Nature Conservation and Pastoralism' (EFNCP) (a European organisation focusing on the maintenance of low-intensity livestock farming) and The Heritage Council, with additional help from the Institute of Technology, Sligo.

The approach taken was a "bottom-up approach". Workshops were held on the islands where the farmers were asked to describe the factors making it difficult for them to maintain their low-intensity agricultural activity and what did they feel needed to be incorporated into future programmes to address these issues. A total of 48 islanders attended the workshops, representing 25% of the farming community. At the meetings a number of farmers volunteered as contact points to assist with future developments with the project The outcome of the workshops was a list of issues and proposed solutions from which a specific agri-environment programme was developed as a discussion document among the group.

To develop the ideas, additional funding was required. Because 75% of the islands are designated under Natura 2000, LIFE (the EU's financial instrument for supporting environmental, nature conservation and climate action projects), was considered the most appropriate instrument. In addition, the main designated habitats on the islands, Calcareous grassland, Limestone Pavement and Machair are priority habitats so 75% funding was available under LIFE. Co-funding was required as well as an organisation to act as the co-ordinating beneficiary, which is an organisation that has sole, legal and financial responsibility to the Commission for the full implementation of a LIFE project. This proved to be the most difficult part in developing a project as whilst organisations were willing to contribute technical and financial help they were not in a position to take on the full requirements of the co-ordinating beneficiary. After consultations, the Department of Culture, Heritage and Gaeltacht (DCHG) agreed to take on the role with Teagasc as associated beneficiary and the Department of Agriculture, Food and Marine (DAFM), Fáilte Ireland, The Heritage Council and Galway County Council all acting as co-funders. Once this structure was in place an application was prepared and submitted to the EU Nature LIFE unit. The application was prepared by EFNCP in conjunction with the Institute of Technology Sligo and the HNV Ireland working group. The final result was the AranLIFE project entitled 'The sustainable management of the priority terrestrial Habitats Directive Annex 1 habitats of the Aran Islands'. The project was successfully funded to the tune of 2.4 million Euro, and ran from 2014 to 2018.

SPECIFICS OF FARMING FOR CONSERVATION ON THE ARAN ISLANDS

To look at the specifics of farming for conservation on the islands it is important to understand the historical and cultural influences on the islands' landscape to date. Farming has shaped this landscape for almost six thousand years. Neolithic farmers began by cutting down the original tree cover to expose the limestone rock and grasslands. Future generations of farmers carried sand and seaweed to make the very soil on which many of the species-rich grasslands now grow. Thousands of kilometres of stone wall were built to shelter their livestock from the harsh Atlantic winds, protect their grasslands, mark boundaries and sometimes just as a way of storing the stone gathered from the fields. Out of necessity an agricultural system developed. This system described earlier with the absence of fertilisers has resulted in a high species diversity of flora, intact historic landscapes and cultural heritage throughout the islands (O'Rourke, 2006). On an individual animal performance, it is an economically favourable system with low associated costs as there are no housing costs. In fact, the islands have been recognised as an important area for livestock production over the ages. In 1684 Ruaidhrí Ó Flaithbheartaigh the Irish historian and 'de jure Lord of Iar-Connacht' wrote in his book 'A Chorographical Description of West Or H-Iar Connaught':

> "The soil is almost paved over with stones, so as in some places nothing is to be seen but large stones with wide openings between them where cattle break their legs. Scarce any other stones there but lime stones and marble fit for tombstones, chimney mantle trees and high crosses. Among these stones is very sweet pasture so that beef and mutton are better and earlier in season here than elsewhere; and of late there is plenty of cheese & tillage" (O'Flaherty, 1684).

The change in agricultural policy and general move to intensification has made the economics of livestock farming on the islands less attractive and the nature of the landscape has limited the possibility for intensifications. The past practices have shaped the farm structure and as a result lead to highly fragmented farms. In the past the land division of the Aran Islands into *ceathrúna* is a direct consequence of the geology and ecology of the islands. Each *ceathrú* provides access to the full range of habitats available on each island: high, rocky limestone plateau, lower fertile grassland, Machair and

Figure 4.8a
The fragmented layout of fields is typical of farms on the islands

sandy shore (Laheen, 2007). Therefore, each *ceathrú* theoretically comprises a self-contained agricultural unit with access to summer and winter grazing, seashore, and other resources (Laheen, 2007).

The fragmented nature of the farms, poor access to some of the fields/ habitats and cost of water installation means that it is now easier for the farmer to concentrate livestock in parts of the farm with more productive soils and abandon the fragmented areas. Higher stocking rates can then be maintained with the application of inorganic fertiliser and herbicides to improve the agricultural condition of the sward. This intensification has a detrimental effect on priority habitats whilst at the same time the abandonment of grazing on the other areas leads to their ecological degradation. Alternatively, there may be grazing levels below the ecological optimum or even a total abandonment of farming.

Specific conservation measures to keep the island grasslands in favourable condition are based on the continuation of traditional grazing. The winter grazing produces a short turf grassland in the *winterages* which allows wildflowers to flourish in the growing season. For the summer grazing, the combination of low fertility, rotational grazing and low stocking rates also aid in maintaining species diversity, though often somewhat lower than in the *winterage*. Therefore, conservation measures for the island aim to ensure optimal grazing and maintain low soil fertility. To aid in this practice the main concrete actions implemented by the AranLIFE project were actions that aided in grazing management. These included:

Figure 4.8b
The fragmented layout of fields is typical of farms on the islands

IMPROVE ACCESS AND GRAZING MANAGEMENT

This was considered to be one of the most important recommendations to improve the island landscape and facilitate grazing on priority habitats by the island farmers. The fragmented nature of the farms on the island and the small parcel size means that the grazing period for a particular parcel of land may be short. Access to these small parcels of land is through a series of communal narrow *boreens* (laneways). Due to the current infrequency of use, they are prone to scrubbing up, mainly with *Rubus fruticosus* and *Prunus spinosa*, and eventually become impassable, and this is resulting in the cessation of grazing on the priority habitat they lead to. The agricultural return from clearing such scrub means it is uneconomic but the ecological return, in terms of increased biodiversity is high. The *boreens* need to be

kept open and clear of scrub to facilitate the movement of cattle so that the optimal grazing regime can be maintained.

Provision of water for grazing livestock

The achievement of optimal grazing requires livestock to have access to water in appropriate locations. In the absence of rivers or mains water on the islands, an appropriate water infrastructure is required to resume and continue grazing. Historically, this was through the use of a tank and slope, known as a rain catcher. The economic return from farming small units means that when these structures deteriorate, there is insufficient funding within the farm to justify the replacement of the water infrastructure. This means it is no longer possible to graze these fields, resulting in a decline in the conservation status of the habitat. Replacing the rain catchers and to ensure adequate water for livestock is therefore vital in the conservation of species rich grasslands.

Removal of encroaching scrub

As stated earlier a reduction or cessation of grazing has led to an increase in scrub, particularly *Rubus fruticosus* agg. (Bramble), *Prunus spinosa* (Blackthorn) and *Pteridium aquilinum* (Bracken). Therefore, initial removal of scrub and bracken is the first step in the restoration of the priority habitats. Once the scrub is removed, these areas can be further enhanced by optimal grazing regimes.

Correction of mineral imbalances in livestock

Healthy cattle are vital in any grazing management system and aid to the economic feasibility of the enterprise. The AranLIFE project monitored the nutrient contribution over two years. In general mineral levels are low in grazed forage throughout the year and without supplementation mineral deficiencies are likely particularly in Phosphorous, Copper, Cobalt and Selenium. Therefore, supplementation is required through use of mineral licks, concentrate supplementation or mineral boluses.

Ensure optimal grazing rates

Once the conditions limiting grazing are rectified, optimal grazing levels are then required to ensure favourable condition.

These conservation measures formed the basis of the AranLIFE project.

DETAILS OF THE DESIGN AND MONITORING OF THE ARANLIFE PROJECT

The Department of Culture, Heritage and Gaeltacht (DCHG) was responsible for the overall management of the project, and employed a dedicated team for its implementation. This team were not DCHG staff but hired as a specialised team who worked full time and were employed on fixed-term temporary whole-time contracts. The team consisted of a project manager (Patrick McGurn), a scientific and technical officer (Amanda Browne) and an administration and financial officer (Gráinne Ní Chonghaile). The project manager had experience in both agriculture and ecology and was responsible for the overall project operation and its day to day management, reporting directly to the DCHG. The main responsibilities included liaising between the project team, project participants, the project steering committee and advisory group; management of the project team; the formation of formal contract agreements with the participating farmers, overseeing implementation of all project actions, monitoring, dissemination and reporting activities. The main role of the scientific/technical officer, whose expertise was in ecology, was to ensure proper operation and monitoring of all conservation actions in line with project objectives and expected results and reporting of the results. The scientific/technical officer was aided by a PhD student (Louise Duignan) who carried out some of the monitoring actions. The project administration and financial officer came from an administration background and had responsibility for day to day operation of project administration and finances, including maintenance of up to date financial records for all project actions. The main responsibilities included administrative support to project manager and scientific/technical officer; general office administrative duties; application of necessary financial and system controls; preparation of monthly and annual financial reports for project manager; communications with stakeholders, and generating farm plans based on information supplied by the rest of the project team.

After the general administration associated with implementing a project, the next step was the selection of farmers interested in working with the project. First the project team invited all 225 farmers on the Islands to a meeting where details of the project were outlined, what it hoped to achieve and what would be required from farmers participating in it. Farmers were asked to submit an expression of interest in working with the project. Such expressions were not accepted on the night of the meetings to encourage

farmers to fully consider the project. A total of 98 expressions of interest were received which created difficulties as the project only had funding for 70 farmers. Therefore, the next step was to develop a selection criteria based on the suitability of each farm for the project. This was delivered by visiting each land parcel and assessing them based on a suitability score of 1 (highly suitable), 2 (moderately suitable) or 3 (marginally suitable) based on predetermined descriptions, which included levels of scrub encroachment, current grazing levels, access to water and presence of adjacent *boreens* (blocked by scrub or not).

Farms with higher areas of Score 1 were deemed to be more favourable for selection as they provided the best opportunity to improve conservation status of priority habitats and to achieve the AranLIFE's objectives. For each island the total area of land parcels with a score 1 was calculated per farm and used to rank the farms accordingly, thus prioritising farms in order of their suitability for the project. Ranking the farms in relation to the amount of area of the best suitable habitat for the demonstration of the management techniques was the best way to achieve the objectives of the project. It allowed a transparent procedure which could be justified and explained. It also allowed for a reserve list in case some of the selected farmers withdrew from the project. Using this procedure, 70 farms were selected, with a corresponding area of 1,126 ha of SAC. Letters of offer were issued to the farmers and 67 replied giving the target area of 1011 ha agreed under the LIFE application.

Each farm was visited by the project team and a farm management plan was developed with the farmer. The plan included a farm map which highlighted the location where each action needed to be undertaken and details on scrub control (such as area and density of scrub to be cleared), *boreens* for clearance, position of type of water infrastructure, grazing and management regimes for priority habitats, and the project team also gave the associated costings for the completion of the work. Costs for the work were based on trial works on the island prior to the AranLIFE project. The costs were then standardized to reflect the full cost of the work and no co-funding by the farmer was required. Farmers also recorded the time associated with actions, e.g. scrub clearance during the project to determine the accuracy of the costs. There was a strong positive correlation between the expected cost and the time recorded. The cost incurred by the farmer in the construction of raincatchers was higher in some cases due to the quality of the work and logistic issues getting materials to remote areas. A breakdown for the associated costs is detailed in Table 4.2. Specific works were based on actual hours e.g. where a wall needed rebuilding to aid access. In all calculations, the hourly rate was €15.

Table 4.2 **PAYMENT COSTS ASSOCIATED WITH FARM PLAN WORKS UNDER ARANLIFE**

	LIGHT	MEDIUM	HEAVY
Boreen clearance (€/m)	1.20	2.40	4.00
Scrub Control (€/ha)	3000	4500	6000
	NEW	**REBUILD**	
Rain catcher (€)	635	300	
	SCORE 3B	**SCORE 4**	**SCORE 5**
Grazing Payment (€/ha)	100	125	150

Along with the farm plan, the project team developed a set of 'Terms and Conditions' for the project signed by the participant and the project manager. The 'Terms and Conditions' outlined the legal status of the project, the obligations of the participant and the project team, and technical details on the work involved.

The farm plans were active throughout the term of the project, and were updated when required by the farmer or project team. The project held regular update meetings with the farmers and regular one-to-one meetings when amending farm plans or carrying out inspections for work completed.

KEY ELEMENTS OF AN ARANLIFE PLAN

The farm plans were developed by the project team and the farmers. In simple terms they were a contract between the project and the farmers which detailed the work to do in each field and the associated cost of the work. To achieve this, there were two main elements to the farm plan; first, the terms and conditions drawn up with legal expertise that detailed the obligations on each side, and; second, the plan element consisting of a farm map detailing the work and the associated costings for each action. Associated with this was a farm map (Figure 4.9) outlining the areas for clearing, site of water facility and the score for each field. Examples of a farm plan are detailed below.

Table 4.3
An example of the farm plan detailing scrub control in different land parcels

WORKS PLANNED for 2014 - 2018

Action C2:Scrub and Bracken control

Parcel No.	Name of field	Area (Ha)	Scrub Parcel	Scrub or bracken density	Area to clean (Ha)	Total Payments€
G1xxxxxxx		0.20	a	Heavy (76-100%)	0.10	600
G1xxxxxxx		0.60	b	Medium (41-75%)	0.20	900
G1xxxxxxx		2.20	c	Medium (41-75%)	0.12	540

Table 4.4
An example of the farm plan detailing water requirements in different land parcels

Action C3 Enhancement of livestock management facilities through the provision of a water infrastructure

Refer to associated maps for location of recommended water facilities:

Parcel No.	Field name	Code	New Water facility	Cost
G1xxxxxxx		1	Water management required	€635
G1xxxxxxx		2	Water management required	€635.00

Table 4.5
An example of the farm plan detailing the condition score for each land parcel

Action C4 Implementation of Optimal Grazing Plans

The grazing payment rate is based on the condition of the field where each field has a score from 1 to 5, where 5 is the indicative of best condition. Payment is restricted to grazed grassland with a score of 3 and above.

Land parcel	Field name	Area(Ha)	Updated area	Start score	Activities required	Grassland Payment/ ha	Parcel payment
G1xxxxxxx		1.0	1.0	3b	Graze, scrub and bracken control	€100.00	€100
G1xxxxxxx		1.0	1.0	4	Spring grazing to control molinia	€125.00	€125
G1xxxxxxx		2.0	2.0	5	Continue grazing levels	€150.00	€300.00

Figure 4.9
An aerial view of the farm outlining the areas of scrub to clear based on light (yellow), medium (orange) and dense (red) and the rain catchers for construction (1 and 2)

RESULTS-BASED COMPONENT FOR GRASSLAND CONDITION UNDER THE ARANLIFE PROJECT

To assess the optimal grazing action, the project developed a basic scoring system that reflected the quality of the habitat and level of grazing achieved. The purpose of this was twofold: first, it encouraged farmers to graze the land to a predetermined level, and; second, was an opportunity to trial a results based output which could be used in future agri-environment programmes after the project ended. On-site demonstration days with the farmers helped to improve the principles behind the scoring system so that the farmers understood how a score was allocated to a field.

A score of 1 to 5 was given to the land parcels to determine the condition of the habitat and relate it to grazing level. This was a visual assessment method, which was intuitive and quick to apply in the field and was associated with the scientific monitoring across the range of habitats.

Score 1: Non-priority habitat and therefore not covered by the LIFE project

Score 2: Semi-improved habitat with limited indicators of priority habitat, grass dominated, usually with higher levels of fertility or more recently made grasslands in an island context.

Score 3a Areas of priority habitat either not in agricultural use or where grazing is not occurring or where the grazing rate is so low there is a substantial build-up of grass.

Score 3b Priority habitat with reduced numbers of positive species indicators. Habitat is not optimally grazed and scrub encroachment may be an issue. Habitat may also support negative indicator species.

Score 4 Priority habitat with a high number of positive indicator species and an appropriate grazing regime (lacking indicators of undergrazing and overgrazing) but with scrub or bracken encroachment an issue.

Score 5: Priority habitat perceived to be very well managed, indicated by a high number of positive indicator species and an appropriate grazing regime (lacking indicators of undergrazing and overgrazing).

Figure 4.10
An example of a field with a Score 2

Figure 4.11
An example of a field with a Score 3a

Figure 4.12
An example of a field with a Score 3b

Figure 4.13
An example of a field with a Score 4

Figure 4.14
An example of a field with a Score 5

The fragmented nature of the farms on the islands usually means that the farm consists of a number of isolated parcels of land, with each land parcel made up of several small fields, usually managed as one block. The score given was based on these individual parcels. For parcels with a percentage of semi-improved/improved, where this area was less than 30% then the

dominant score was given to the whole area, but if the area was greater than 30%, the areas were scored as separate units. Semi-improved and improved grassland automatically received a score of 2 whilst areas of shoreline, lane ways etc., received a score of 1.

The area had to have clear signs of grazing visible from the condition of sward, these included areas cleared of vegetation or a range of vegetation height covers including tightly grazed patches, indications of livestock tracks, faecal material, lying areas. Encroaching scrub/bracken present in the area was also assessed and incorporated into the score as was an assessment of damage, such as excessive poaching, damage as a result of feeding troughs, excessive vehicle damage. Such attributes would reduce the score.

Sward condition was assessed using the presence and abundance of specific indicator species. This method also identified the presence of negative indicator species, areas of scrub/bracken and agricultural grasses. The procedure involved taking a line transect across the field diagonal and identifying the species located in an area of $1m^2$ in a total of 10 random points within the transect. For grazed areas of limestone pavement, the survey points were concentrated on the grazed outcrops within the limestone.

Where a field contained one or less positive indicator present in an area of one square metre at six out of ten random points in the area, it is likely to be a semi-improved or improved field with a grass dominant over herbs and so will have a score of 2.

A field having between two and four positive indicators present in an area of one square metre in at least six out of ten random points in the area is indicative of a moderately species-rich field and will have a score of 3. The presence or absence of grazing will determine if it is 3a or 3b.

Where four or more positive indicators are located in an area of one square metre at five out of ten random points in the field, it would have score of 4. The remaining five points will likely consist of scrub, course grass or semi-improved grassland.

If five or more positive indicators are located in an area of one square metre at eight out of ten random points in the field, then the area will have a score of 5. Fields with 5 indicator species at between 5 to 8 random points will have a score of 4 with the remaining random points likely to consist of scrub, course grass or semi-improved grassland.

Based on feedback from the demonstration days, AranLIFE produced brochures detailing the species found to help farmers identify plants on their own farm.

Above:
Figure 4.15
An example showing part of a flora brochure developed by the project to aid farmers in plant identification

Table 4.6
THE INPUT SHEET USED FOR SCORING GRASSLANDS IN THE ARANLIFE PROJECT

FIELD NO.	MAIN HABITAT	AGRIC. ACTIVITY Y/N	SCRUB > 10%	DAMAGE ASSESS-MENT	SWARD CONDI-TION	MANAGE-MENT ADVICE	SCORE

The final score given also reflected other variables, for example, a field could score highly under the Sward Condition but could include excessive damage, and in such cases the field would drop a score.

POSITIVE INDICATOR SPECIES

Determining positive and negative species was initially based on NPWS 2013 data for determining favourable condition and included forb, graminoids, positive indicator species, negative indicator species, scrub and bracken encroachment, sward height, litter cover, extent of bare ground, and grazing and disturbance levels (O'Neill et al., 2013). However, following the vegetation analysis of well managed areas of calcareous grassland within the project, additional indicators were added to reflect local conditions.

The following are the top species used in scoring at stops within the fields.

Table 4.7
SPECIES NOTED DURING SCORE ALLOCATION

	HIGHLY POSITIVE	POSITIVE
Briza media (Quaking grass)	★	
Geranium sanguineum (Bloody cranesbill)	★	
Anthyllis vulneraria (Kidney vetch)	★	
Primula veris (Cowslip)	★	
Carlina vulgaris (Carline thistle)	★	
Campanula rotundifolia (Harebell)	★	
Antennaria dioica (Cat's-foot, Mountain everlasting)	★	
Blackstonia perfoliata (Yellow-wort)	★	
Sanguisorba minor (Salad burnet)	★	
Linum catharticum (Fairy flax)		▲
Sesleria caerulea (Blue moor-grass)		▲
Lotus corniculatus (Bird's-foot-trefoil)		▲
Galium verum (Lady's bedstraw)		▲
Thymus praecox (Wild thyme)		
Carex species (Sedges)		
ORCHID SPECIES		
Euphrasia officinalis (Eyebright)		
Succisa pratensis (Devil's-bit scabious)		

PAYMENT BASED ON THE FIELD SCORE

Higher field scores resulted in higher payment levels (Table 4.8), and directly reflects a results-based approach. The payment was for adequate grazing levels, but the decision was taken early in the project to relate it to the quality of the habitat as an encouragement to complete some of the concrete actions required to improve grazing output.

The AranLIFE project investigated factors which contributed most to the production of high quality grasslands, and early indications showed that the amount of time invested in land parcels is the main driver. Additional time is required for maintenance of walls to control the extent of grazing, time in moving livestock across the farm, constant herding of cattle to ensure removal of vegetation, regular removal of encroaching scrub by hand cutting, and the supply of adequate water to meet the needs of the grazing livestock. This often involves bringing drums of water to livestock in periods of dry weather when raincatchers are no longer functional. Based on national data figures (Teagasc, 2008), the labour required for an out-wintered cow equates to 3.5 working days per year or 28 hours. Initial indications from the AranLIFE project, are that slightly higher stocking rates are required to achieve higher scores. The payment rates were based on the additional labour input required to achieve the higher scores. To ensure no dual funding with other agri-environment measures, the work involved had to be above the requirements of land under an agri-environment measure. Details of payment rates and their relation with agri-environment schemes, specifically the Low Input Permanent Pasture under the Green, Low-Carbon, Agri-Environment Scheme (GLAS) are detailed in Table 4.5. GLAS is the existing national agri-environment scheme and farmers under AranLIFE could also participate in GLAS. Under the Low Input Permanent Pasture action of GLAS, farmers selected a suitable pasture that contained a minimum of four grass species (excluding Ryegrasses) e.g. Cock's-foot (*Dactylis glomerata*), Timothy (*Phleum pratense*), Bentgrasses (genus *Agrostis*), Fescues (genus *Festuca*), Sweet vernal grass (*Anthoxanthum odoratum*), Yorkshire fog (*Holcus lanatus*), etc. and a minimum of three other non-grass plant species e.g. Plantain (genus *Plantago*), Chickweed (*Stellaria media*), Trefoils (genus *Lotus*) etc., and these must be reasonably dispersed throughout the field. There must be less than 30% Ryegrass cover (genus *Lolium*). The sward is then maintained by grazing with a maximum chemical nitrogen usage on the parcels of 40 kg/ha/annum of nitrogen.

Under AranLIFE, such management would be unsuitable to maintain the high species count found under a 4 or 5 score and therefore such scores need higher management requirements; thus, a farmer participating in GLAS could also receive the AranLIFE payment on scores 4 and 5 only.

Table 4.8

PAYMENT RATES UNDER ARANLIFE FOR DIFFERENT SCORES AND THE RELATIONSHIP WITH AGRI-ENVIRONMENT SCHEMES

SCORE	ELIGIBLE FOR GLAS	ARANLIFE	ARANLIFE PAYMENT /HA	DAFM POSITION
5	Yes	Yes	€150	Farmer paid both GLAS & AranLIFE
4	Yes	Yes	€125	Farmer paid both GLAS & AranLIFE
3	Yes	Yes	€100	Farmer only paid GLAS payment
2	Yes	No	€0	Farmer only paid GLAS payment
1	Yes	No	€0	Farmer only paid GLAS payment

For each scored parcel, advice was presented in the farm plan which gave the participant farmer some feedback on the score and what additional works were required to improve the score. A summary of the main advice for each score is detailed in Table 4.9.

Table 4.9

ADVISORY INFORMATION FOR EACH SCORE CATEGORY

LAND PARCEL SCORES FOR GRAZING ACTION	
SCORE	RATIONALE
5	Continuation of the existing management is main action required here, ensuring no increase or decrease in stocking levels. Maintain all water structures and access points to ensure stocking levels can be maintained. Small pockets of scrub control may still be required in some areas to prevent further encroachment.
4	Targeted Scrub removal will be main action required with follow up treatment. A small increase in stocking level may be required post scrub cutting. Ensure adequate water supplies.
3b	Increase current grazing levels, the main aim is to remove excess vegetation to allow species diversity. This may mean supplying adequate water facilities by either construction of new raincatcher/spring catchment or using facilities in adjacent fields. For winterage a flash grazing during the summer could be considered early enough to allow regrowth. Areas of encroaching scrub should be removed with retreatment as required. For fields with high levels of Molinia (Purple moor-grass), consider spring grazing when the grass is palatable to livestock. Remove any features that increase likelihood of damage, e.g. feeders.
3a	Reintroduction of adequate grazing is first step, best achieved through grazing with higher number of cattle over a short period. Areas of dead grass avoided by livestock should then be cut back along with the removal of areas of scrub. Ensure adequate water supplies for livestock which may mean construction of rain catcher.
2	Short term improvements in biodiversity unlikely. Determine whether semi-improved area is part of overall farming systems, supporting sensitive management of grazing areas elsewhere. If farmer is willing to improve species content, reduction of fertility levels is likely first step. Consider taking a hay crop from field, followed by grazing to reduce fertility. No inorganic or organic fertiliser to be applied.
1	Non-priority habitat and therefore not covered by the LIFE project.

AGRICULTURAL OUTPUT

AranLIFE also investigated the forage quality of Aran pastures and whether they meet the nutritional requirements of grazing livestock. A total of 369 forage samples were collected over 10 sampling occasions between March 2015 and January 2017. Samples were analysed for oven dry matter (DM), N (Dumas method), crude protein (CP) (N x 6.25), ash, acid detergent fibre (ADF), and neutral detergent fibre (NDF) (Van Soest analysis). In addition, 76 forage samples were analysed for dietary minerals, i.e. P, Mn, Ca, Na, K, Cl, Mg, Cu, Zn, Se, Co, I, during May 2015 and January 2016.

Overall, forages sampled from the less ecologically rich summer grazing areas were of a higher nutritional quality. Forage quality was highest in the pastures during the summer months and lowest on winterage during February and March. The winterage sward contains a high degree of scenesced plant material. Crude protein levels in forage are at an annual low

and fibre (i.e. NDF) content is high, indicating a low feeding value of the forage (i.e. energy content and digestibility is low). This is at a time when the daily energy demands of the suckler cow are highest due to rapid foetal growth during the third trimester of gestation (Duignan et al., 2018).

Mineral analyses data indicated that Aran forages are seasonally deficient throughout the year in P, Cu, Se, Co and Zn. Overall there were moderate to high levels of Ca, Mg, K, Mn and I. Very high levels of Na and Cl were recorded in Aran forages.

Therefore, to maximise the agricultural output may require some form of supplementation. Blood sample of grazing livestock reflected these deficiencies with the exception of phosphorous. Accurate sampling for phosphorous requires serum to be separated from the red/white blood cell clot within one to two hours of collection; however, this was not logistically possible for the project. Further investigation techniques are required but AranLIFE, working with the local veterinary surgeon developed mineral supplementation specifically suited to the islands' forage.

MONITORING WITHIN THE ARANLIFE PROJECT

Monitoring the impact of the project was an important element of the AranLIFE project. Many of the actions were designed using best available knowledge but were untested in the specific context of the Aran Islands. Therefore, a monitoring programme was developed to test effectiveness of the project actions and make recommendations that could be developed for other programmes in the Irish Rural Development Programme.

Monitoring of the impact of project actions on conservation status of the priority habitats involved baseline surveys prior to action implementation followed by the reassessment of monitoring locations later in the project by using $4m^2$ permanent quadrats or relevés to record change in percentage cover of species over time. A total of 350 relevés were recorded over the course of the project. The national methodologies for the assessment of limestone, coastal and grassland priority habitats, have derived indicators of condition and set targets that were used by the project to assess and monitor the conservation status of the habitats. These relevés were analysed as monitoring stops according to the criteria for assessing conservation status (Ryle et al., 2009; Devaney et al., 2013; Wilson and Fernández, 2013; O'Neill et al., 2013). Fixed point photographs were taken, and the following information was also recorded in the relevé: percentage cover of bare rock, bare soil, litter, of grass/sedge layer, broadleaf layer, bryophyte layer, woody layer and sward height.

To monitor the development of the scrub species and bracken following scrub control measures, transects were set up along cut areas within scrub patches and the frequency of the scrub species (number of stems or stalks of bracken, briar, blackthorn and hazel) was recorded within $1m^2$ quadrat at 5m intervals. Percentage cover of the scrub/bracken species was also estimated. A $4m^2$ relevé was also collected within the cleared area and was paired with a relevé recorded from adjacent optimal vegetation outside of the scrub patch. From this data the progression from scrub encroached habitat to optimal species-rich habitat following scrub control measures was assessed.

Relevés recorded within scrub patches before cutting were also used to monitor the effectiveness of scrub control measures. These relevés were resurveyed and analysed for changes in vegetation following scrub control actions and used to assess if the developing vegetation resembles priority habitat quality following scrub removal.

The effectiveness of the protocol for measuring the scoring system outlined previously was also monitored. Transects containing ten 1 m^2 plots were recorded within a land parcel or field to verify the optimal grazing scores given to these areas. A total of 39 transects (each with 10 x 1 m^2 plots) were recorded across the three islands. Locations of 1 m^2 plots were randomly selected in a diagonal across or in a 'W' if the diagonal of the field was less than 100 m. At each of the 10 stops or plots within the transect the presence of higher plants and dominant bryophytes was noted. The analysis of these transects helped to ascertain the indicators which distinguish the scores and refine the national species indicators to suit the Aran Island context.

COMPARISON OF LAND PARCEL SCORES FROM 2014 AND 2016

Year 1 vs year 3 scores

Despite the short time period, improvements in the quality habitat, reflected through the scoring system did show an improving trend with land parcels moving up the scoring system over time with the changes of management. Comparison of grazing scores from 2014 and 2016 on the three islands shows a significant increase in areas scoring 5 (Figure 4.16).

Figure 4.16

COMPARISON OF LAND PARCEL SCORES FROM 2014 AND 2016

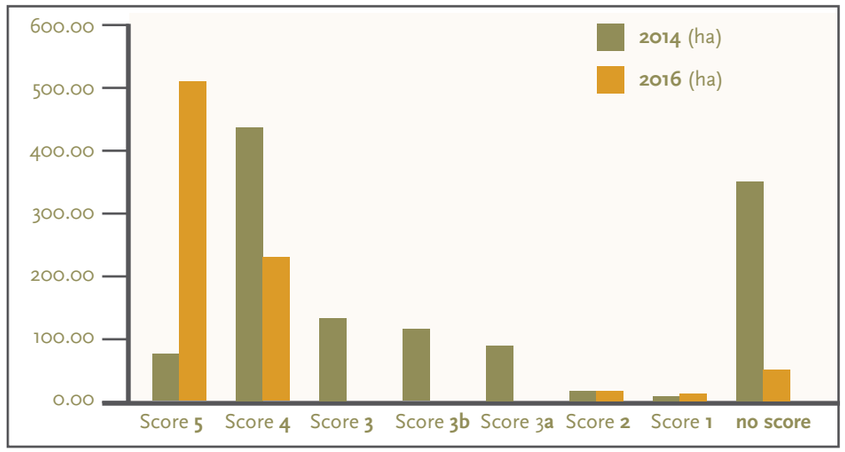


Figure 4.16. Total Area = 1016 ha. The change in grazing scores between year 1 of the project in 2014 and year 3 in 2016. Grazing score 3a was introduced in 2016 to take account of priority habitat that was not being grazed. Score 5 area increased by 315 ha from 2014 to 2016, and most of this improvement is from score 4 fields that had scrub removed and implemented optimal grazing.

As expected the results over a small time period tend to reflect that with changes in management there is a movement from habitat just below favourable condition (Score 4) to favourable condition (Score 5), whilst improved grazing and scrub control did move some areas with a Score 3b to 5. In generally a longer period of time is required to change the score at the lower end of the scale (Score 3b and 2).

In relation to scrub control, the monitoring programme demonstrated that for successful control, follow up treatments were required. With one cut of scrub and no follow up treatment, positive indicator species may increase over the short term, however scrub encroachment is still an issue. Further cutting, herbicide treatment or selective grazing with goats all helped control subsequent regrowth. Scrub cutting operations helped to increase the grazing score over most of the areas, even though the vegetation underlying the scrub patch may not be of high conservation value, unlike the vegetation throughout most of the field. Once the scrub had been cleared and adequate water provision supplied, fields could then be optimally grazed and attain a high grazing score.

COMMUNITY INVOLVEMENT

As detailed earlier the development of AranLIFE came from the island community who were concerned about the changing landscape due to changing farming practices. There was a strong recognition that the island landscape was linked with the tourist industry in terms of landscape character and biodiversity. So AranLIFE was not a project developed from government agencies and then rolled out on the islands, but was a combination of groups working together to meet the needs of the different stakeholders. Farmer involvement was critical to AranLIFE's development. Initially meetings with farmers outlined what work they felt was necessary. Trial works were then undertaken by farmers to aid in the costing of measures and at different stages of the process information was fed back through farmer meetings. This greatly aided in the delivery of the project as there was greater awareness of what the project was about and also the measures came from the farming community.

This stakeholder engagement continued throughout the duration of the project. To increase awareness of the work educational initiatives were developed, information days held, an island bioblitz (intense period of biological surveying) was carried out on Inis Mór and the project team facilitated a large number of outside group visits. These events explained the biodiversity of the islands, the role of farming in maintaining that biodiversity, as well as its significance at a national and international level. The main target groups were the islands' farmers and the local community, local school children (primary and secondary), universities and the wider public (visitors, service providers and farmers from other High Nature Value farmland areas in Ireland).

The use of information sheets, public notice boards and other beneficial materials informed people of the AranLIFE Project and the importance of Natura 2000 sites. To provide accessible information for participant farmers and the wider public, a range of pamphlets were produced. One was an information leaflet giving details of the project and was available in locations around the islands. Additional leaflets were produced as a series on wildlife on the farm and included colourful guides of plants on the farm, butterflies and birds found on the islands. Informative road signs were produced for each island.

KEY FINDINGS, LESSONS LEARNED AND THE WAY FORWARD

The main aims of the AranLIFE project were to demonstrate best management techniques to either maintain favourable condition, or restore sites to favourable condition by addressing the multiple threats of land abandonment, undergrazing, intensification, loss of traditional management systems and associated loss of knowledge. By doing so, the project aimed to improve the conservation status of 218 hectares of Limestone pavement (8240*), 78 hectares of Orchid rich calcareous grasslands (6210*), 686 hectares of Limestone pavement (8240*)/Orchid rich calcareous grasslands (6210*) mosaic and 29 hectares of Machair (21AO*). The project also aimed to enhance understanding, appreciation and engagement of all the key stakeholders with the conservation of priority habitats on the Aran Islands, and provide recommendations on appropriate support mechanisms for farming on the Aran Islands that will address the issues that threaten the status of the priority habitats of the islands.

The results-based approach was tried as it was a way of both encouraging work on the negative features, such as undergrazing, scrub control, and also it helped farmers to understand what the conservation status of habitats actually meant on the ground (McGurn and Moran, 2013). The AranLIFE approach has been successful. The main advantages of the approach taken were:

- an improvement in the condition of priority habitats and harnessing of knowledge regarding their management from both the farmers and other stakeholders.
- a specialised team with their own identity helped to foster a good working relationship with both the participant farmers and the islands' community.
- a Steering Committee and wider Advisory Group to oversee the project brought together the relevant statutory agencies, farming communities, and researchers, thereby improving communications between all stakeholders and gave the project team the necessary support when required.
- a farm plan approach was an efficient way of detailing works. From the farm plan, a farmer could clearly identify the work required and the costings involved. Once the work was complete the farmer could make a claim for payment. The plans were also a good way of recording all works completed.
- a high level of engagement between the project team and farmers simplified the project, with farmers willing to help out in different ways.
- a results-based model that could be used as a template for other High Nature Value farming areas within Europe which are currently not being served by existing agri-environment schemes.
- production of information guides on farming and biodiversity on the islands were popular with farmers and tourists.

AranLIFE was a LIFE project, the EU's funding instrument for the environment and climate action, aimed at specific habitats with a range of actions that include specific works to improve the quality of the habitat. The approach taken by AranLIFE was to incorporate payments for a range of actions, including scrub control, access improvements, and optimum grazing, with the latter being judged on a results-based approach. This approach allowed us to develop ideas for future results based agri-environmental measures that could be incorporated into future Rural Development Programmes, and so address the limitations of existing schemes in the management of habitats (as in Kelly, 2010). For the farmers, the AranLIFE work therefore had a range of payments for capital works, prescribed actions and results-based outcomes. For AranLIFE, this approach was beneficial because it enabled the farmer along with the project team to:

- address the conservation issues he/she had at a field level;
- supply the necessary funding to carry out actions;
- have a payment to ensure optimal grazing
- communicate the message across to the farming community of what the project was looking to achieve.

For AranLIFE, the results-based payments for grazing outcomes ranged from 0-€150 per hectare (Table 4.8), while the scrub control payment ranged from €3000-6000 per ha. Both payments are for the participants' time, and this can be a weakness in the blended approach, incorporating an action and results-based approach. Basically it can be more financially advantageous

for a farmer with high levels of corrective actions over a farmer with high-scoring land. In other words, the restoration of a habitat may attract more payments than its maintenance. This can create a perception in the farming community that the farmer who hadn't looked after their land was better rewarded in comparison to the farmer who has always maintained a high level of habitat quality. In an ideal results-based approach, the level of payment for the highest score should reflect the work involved in maintaining it. However, with high payments for specific actions needed to bring degraded habitat back to a favourable condition, this can be unrealistic.

On the other hand, although there may be more payments for restoration, the farmer must still conduct the works, and these works are required for the farmer to be in a position to maintain the habitat and get the smaller (but ongoing) payments for achieving high scores. While the intention is not to profit from non-productive investments, works involving a labour input from the farmer need to be set at a sufficient rate to incentivise the farmer. These can be seen as an additional income and favoured by the farmer.

THE FUTURE

Ireland's offshore islands have and will have greater uncertainty in the future due to: isolation, poor employment prospects, a very extensive agriculture system, less favourable economic justification for provision of services, and adverse climate conditions. Over the years there has been a continuous decline in the number of islands inhabited. However, the habited islands are important aspects of Ireland's cultural and natural capital. The AranLIFE project has been vital in highlighting the natural capital of the Islands, liaising with stakeholders, working with the islands farming and non-farming community, increasing the understanding of why agriculture is important to maintain these habitats and developing suitable policies to meet requirements. Compared to the value of the livestock produced, the additional services from this agricultural system are of greater value to the overall economy in terms of tourism and the genetic resource of the island. Disseminating this information is one of the important long term benefits both from an environmental, economic and social point of view, as without the AranLIFE Project there is a poor platform for highlighting such issues at a local and European level.

Widening the scope of AranLIFE may change the delivery mechanism and may involve the use of outside specialised planners or an expanded project team requiring training to fully understand the ecology and agricultural system on the islands. A follow-on project, Caomhnú Árann, an EIP (European Innovation Partnership)-Agri Operational Group co-funded by the Department of Agriculture, Food and the Marine and the EU, is investigating alternative ways of developing farm plans using remote sensing. This has potential to aid in the delivery of local led programmes whilst reducing the administration costs involved. This new project, which commenced in 2019, will build on the work of AranLIFE working with 127 farmers, including the majority of farmers who participated in AranLIFE over the three islands, with the idea that the approach could be rolled out as a large scale Results Based Agri-environment scheme. Caomhnú Árann will also investigate whether high scoring species rich grasslands can be used as a wildflower seed source, where seed is collected to meet a growing market for wildflower seed but with no negative effect on the overall grassland biodiversity. This is possibly a way of adding value to grassland outputs.
Recognising the high administration costs associated with the AranLIFE project and with a lot of other results based programmes, a central element of Caomhnú Árann is to look at remote sensing to aid in the delivery of farm plans and monitoring. The Caomhnú Árann project team of three people is working with farmers using existing ortho-imagery available and drone technology to see if habitat quality and encroaching scrub can be identified quickly and accurately, thus reducing the need for complete land survey work. Training farmers along with the project team will aid in this process. A full monitoring programme is in place within Caomhnú Árann to judge the efficiency of using such technology.

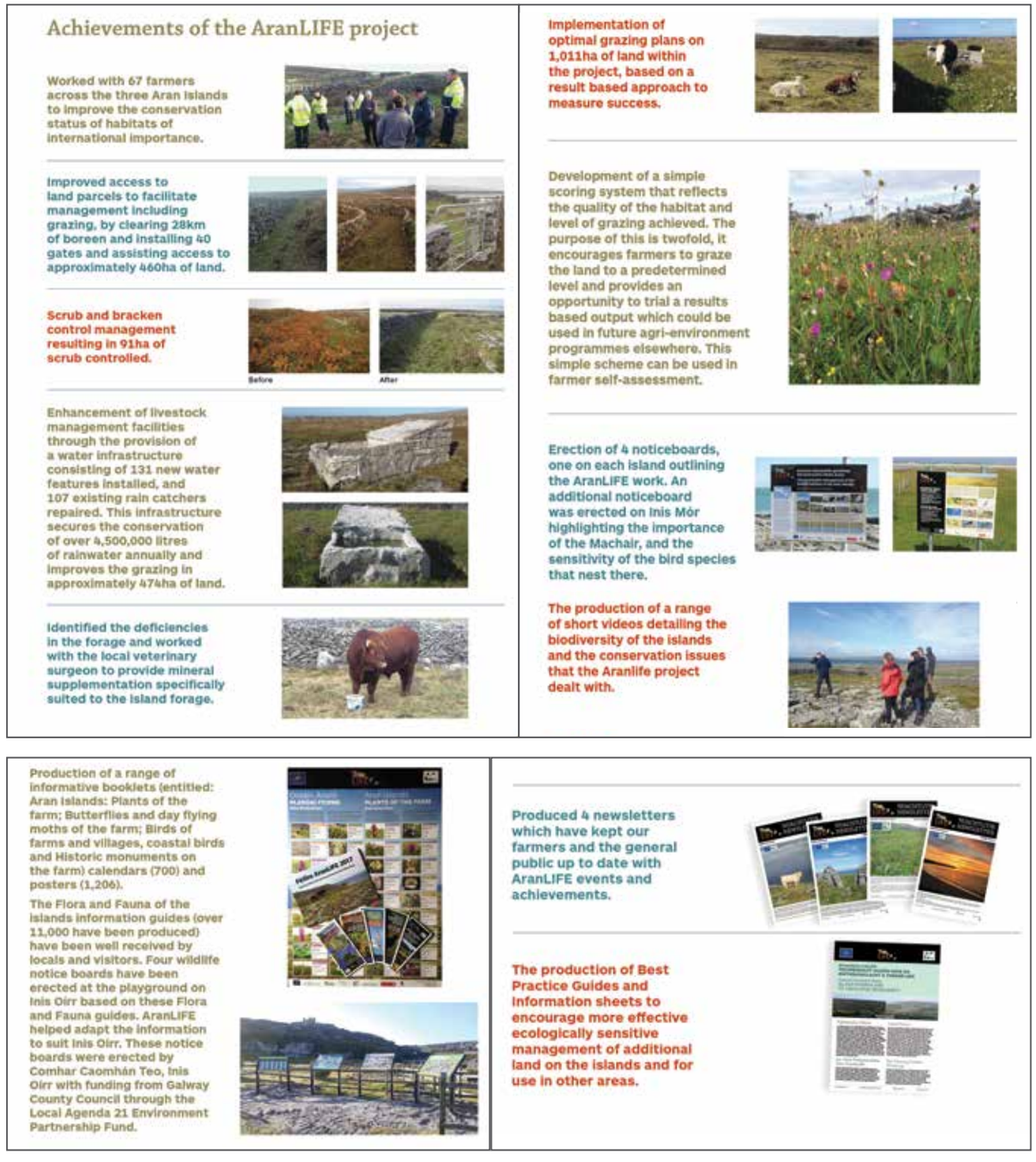
AranLIFE was a successful demonstration project contributing to the implementation of the objectives of the Habitats and Birds Directives. Stakeholders worked together to deliver a series of actions. Caomhnú Árann is the next step, it will look at how predetermined outputs can be delivered at a wider level using different processes to reduce administration costs when instigated over a higher number of farmers. Different approaches need to be incorporated in the development of national agri-environment schemes within Rural Development Plans. The history of direct payments within the CAP is based on historic entitlements, reflecting past stock numbers. Low stocking rates are and have been a feature on the islands and hence direct agricultural payments per ha are low. In the present structure there is no

allowance for other services such as biodiversity. Adding value to the cattle, possible with a quality label is one approach, but is difficult to achieve. The small number of farmers and low stocking rates limit the guarantee of supply that wholesalers, restaurants require. In addition, the feeding value of the Aran Island grasslands during the winter is poor, therefore finishing cattle would require a major change in the agricultural system with possible negative effects on biodiversity, the very selling point of the Aran Island beef. Greater co-ordination with beef finishers on the mainland may be a better option with the beef sold as sourced from the Aran Islands.

The results-based approach implemented by AranLIFE and now trialled under Caomhnú Árann is a step towards improving farm income based on the provision of ecosystem services. Farmers can then make the decisions on the path they would prefer to take. Some will continue trying to maximise the agricultural output through the sale of livestock, whilst other will favour the route of maximising payment for ecosystem services. Such programmes can be implemented independently and alongside existing agri-environment measures but, ideally, they should be incorporated into existing agri-environment schemes. AranLIFE implemented the measures the farming community felt were needed, coupled with additional technical expertise. Many of these actions were untested and the LIFE project was a source of innovative practice and demonstration. Incorporating results based payments into future agri-environment schemes will require a higher level of input, targeted areas, community involvement, and identification of indicator species, assessment procedures and payment structures. The projects funded under the EIP Agri measure, including Caomhnú Árann, are a good method to trial such ideas on a broad range of habitat types.

APPENDICES

Appendix 1 Outputs from AranLIFE – clockwise from top left; outputs 1,2,3 and 4



APPENDICES

Appendix 2 The AranLIFE scoring system

The AranLIFE scoring system

Score 5
Represents good quality priority habitat. It is well managed with an appropriate grazing regime, which usually involves grazing to a short turf in winter, but may also involve a flash grazing during the summer if grass growth is good.
A score 5 has a high-species diversity with frequent positive indicator species, producing a colourful array of flowers during the summer months, including an abundance of orchid species. No fertiliser is applied to this grassland as doing so would reduce the species diversity significantly. Since the grazing intensity is at an optimum level, scrub and bracken encroachment is not an issue or has been rectified by cutting.

Score 4
Is priority habitat that has a high-species diversity with frequently occurring positive indicator species. The grazing level is appropriate for the most part, however, scrub or bracken encroachment is an issue.

Score 3b
Is priority habitat with reduced number of positive indicator species. It has low species diversity due to sub-optimal grazing levels, which favour a dominance of rank tall grasses, and a higher sward height in summer which shades out the herbaceous species typical of calcareous grassland. Scrub or bracken is an issue in these fields, which is also a consequence of the sub-optimal grazing regime.

The AranLIFE scoring system

Score 3a
Is priority habitat either not in agricultural use, where grazing is not occurring or where the grazing rate is so low that there is a substantial build-up of grass.

Score 2
Is semi-improved grassland with limited indicators of priority habitat. The vegetation is grass dominated, with higher levels of fertility or more recently made grasslands.

Score 1
Is habitat that is not one of the habitats covered by the AranLIFE project.

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5

THE KERRYLIFE FRESHWATER PEARL MUSSEL CONSERVATION PROJECT

RICHARD O'CALLAGHAN, PADRAIG CRONIN & PAUL PHELAN

INTRODUCTION

The freshwater pearl mussel *Margaritifera margaritifera* (Linnaeus, 1758) is considered to be the most critically endangered invertebrate species that is protected in Ireland. The freshwater pearl mussel fulfils the criteria of "indictor", "flagship", "keystone" and "umbrella" species, making it an important target species for the conservation of oligotrophic stream ecosystems (Geist, 2010). It is a bivalve, a type of mollusc that is almost completely enclosed between a pair of shells (Figure 5.1). Individuals can grow to >150 mm, building up thick calcareous valves. In natural conditions, their lifespan can exceed over a hundred years. Mussels are benthic, largely sedentary animals with two-thirds of their shell length buried into the gravels of the river bed. For most of its life the mussel is a filter feeder and large quantities of water are pumped through the animal's siphons.

Pearl mussels have a complex life cycle, maturing between seven and 15 years of age. Following fertilisation within the female's brood chamber, the eggs develop into a larval glochidial stage, which are then released into the open water in high numbers in mid-to-late summer. The larval glochidia must encyst onto the gill of their salmonid fish host to continue growing (Österling and Larsen, 2013; Taeubert et al., 2010; Young, 1991), metamorphosing into a juvenile mussel before dropping off the following spring or summer. The few juveniles that survive bury into the river gravels where they will remain for the next 5-7 years until mature enough to withstand the flowing water conditions at the surface of the river bed.

Figure 5.1
Freshwater pearl mussels, *Margaritifera margaritifera* (L.) in the Caragh River.
© KerryLIFE Project

Freshwater pearl mussels have particularly stringent habitat requirements. The open water must be of high quality with oligotrophic conditions or very low nutrient concentrations, especially, phosphorus. They require stable cobble and gravel substrate stabilised by boulders. The substrate must also be free of excessive filamentous algae, rooted macrophages, inorganic silt, organic peat and detritus, to allow free water exchange between the open river and the water within the substrate.

Freshwater pearl mussels are particularly at risk from habitat disturbance during their long lives. The species is subject to pressures including agricultural intensification, clearfell forestry management, pollution, river engineering, and abstraction. These lead to the deterioration of the river bed, impaired flows and near-bed velocity, and water quality issues such as eutrophication (Bauer, 1988) and increased siltation (Denic and Geist, 2015; Geist and Auerswald, 2007; Moorkens and Killeen, 2014). Even slight alterations or short-term fluctuations of habitat condition can result in the loss of pearl mussels. Together these result in the continuous failure to produce new generations of mussels. The species is also negatively affected by a decline in their host salmonid fish populations and illegal exploitation by pearl fishers.

The best remaining pearl mussel populations are found in countries along the north Atlantic including Ireland, Scotland, Norway, Sweden, Finland and Russia. In Ireland, freshwater pearl mussels are widely distributed, occurring in more than 162 rivers in 104 catchments across 16 counties principally situated along the western sea board from Donegal to Cork and parts of the southeast (NPWS, 2019) (Figure 5.2). Four populations are recorded in Northern Ireland. Populations in Ireland can be divided between those with small relict populations with a few remaining elderly mussels that have not successfully recruited for many years and those with large adult numbers and some recent recruitment. The most important Irish populations and the ones of most international concern are those with populations of 500,000 and 3,000,000

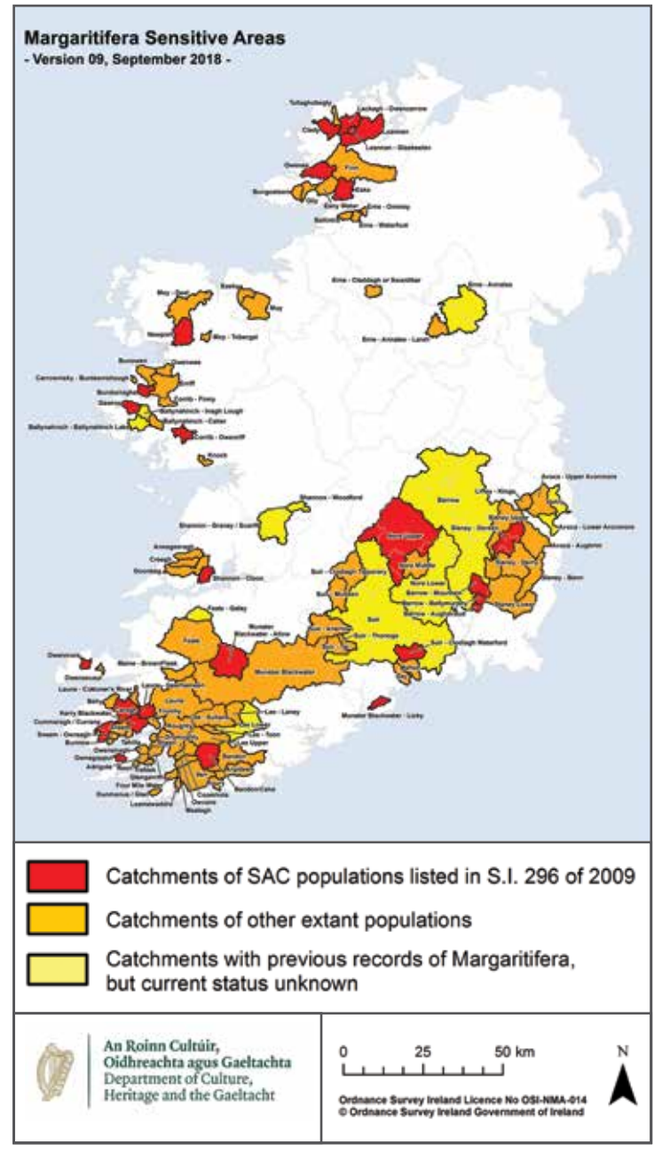

Figure 5.2
Map of the *Margaritifera* sensitive areas in Ireland

individuals. Population estimates based on number of adults visible at the bed surface was estimated to be 12,000,000 in 2006 (NPWS, 2008), 10,990,000 in 2013 (NPWS, 2013), with the 2019 estimate reported as 9,600,000 (NPWS, 2019). This represents an estimated decline of 3% per year.

The current monitoring results indicate that no Irish freshwater pearl mussel population is viable and therefore the population is assessed as Unfavourable Bad. The species is classified as 'Critically Endangered' within Europe by the International Union for Conservation of Nature (IUCN) (Moorkens, 2011) and on the Irish Red Data list (Byrne et al., 2009). It is protected under the Wildlife Act 1976-2000 throughout the state, and by the European Habitats Directive (Council Directive 92/43/EEC) in 19 Special Areas of Conservation containing 27 populations or 80% of the national population (Figure 5.2).

KERRYLIFE PROJECT

The KerryLIFE project was born partly out of Ireland's response to the European Court of Justice Case C-282/02 under the Dangerous Substance Directive and the conservation strategy for pearl mussels in Ireland (NPWS, 2011). There was a clear need to involve key stakeholders in nature conservancy, agriculture, forestry and the community. The National Parks and Wildlife Service of the Department of Culture, Heritage and the Gaeltacht coordinated the bid and commissioned a two-person part-time team to write the funding application. The Department of Agriculture, Food and the Marine, Teagasc, Forest Service, Coillte, Pobal and South Kerry Development Partnership (SKDP) were invited to join the project. Each respective partner contributed technical expertise to the development of the application. The project partners also recognised the critical role farmers and forest-owners play in managing the catchment, and public meetings targeted at farmers were held during the development of the application to take into account their suggestions. A field visit for farmers to the Burren Farming for Conservation Programme was arranged by South Kerry Development Partnership to allow farmers gain a better understanding of what a LIFE project was and how they operate. Farmers quickly realised the benefit of a project that would be designed to "work with their land" rather than for land elsewhere in the country.

The KerryLIFE project is a demonstration project aimed at the long-term delivery of sustainable land use practices that will restore and conserve the freshwater pearl mussel population within the Caragh and Blackwater freshwater pearl mussel catchments. There are four main objectives,

- Demonstrate effective conservation measures on farms and forests to restore the freshwater pearl mussel
- Enhance awareness and understanding of the mussel among stakeholders
- Demonstrate sustainable management techniques for farming and forestry in pearl mussel catchments
- Provide guidance for farming and forest practitioners to support the conservation of the freshwater pearl mussel.

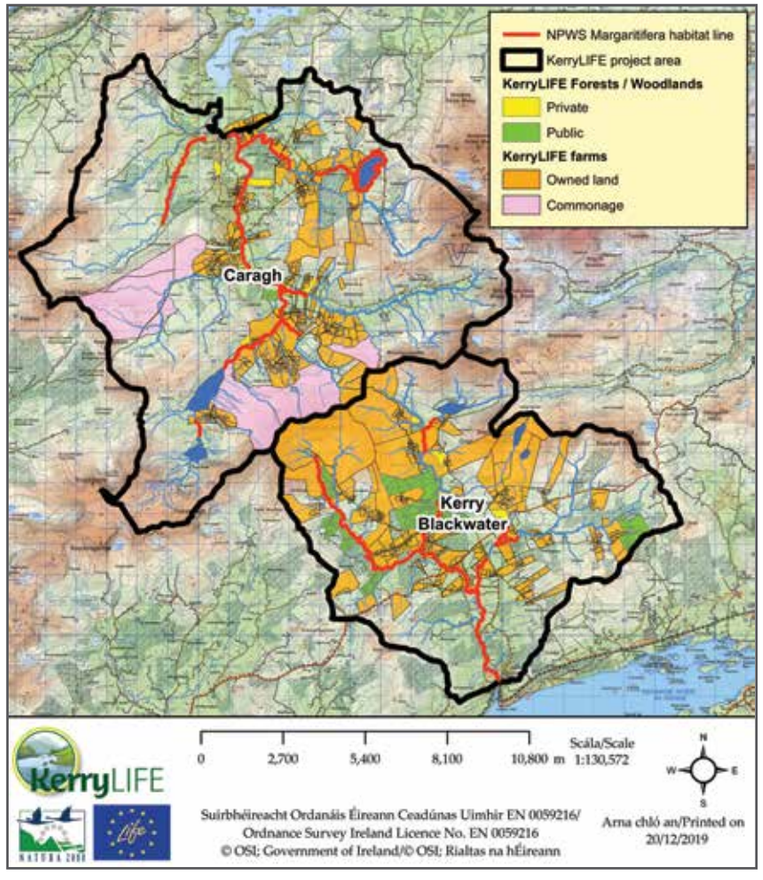

Figure 5.3
Map of KerryLIFE project area showing project farms and forest properties

Figure 5.4
Owenroe Tributary of the Caragh River with the MacGillycuddy Reeks Mountains in the background

The project specifically aims to improve the habitat quality for adults across 20% of the recorded habitat and improve 5% of the juvenile habitat through a reduction in siltation and eutrophication and an increased recruitment of juvenile mussels to the population to support the achievement of the favourable conservation condition.

The KerryLIFE project operates in the Blackwater and the Caragh catchments situated on the Iveragh Peninsula in Co. Kerry in south west Ireland (Figures 5.3 and 5.4). Both river systems support very large freshwater pearl mussel populations with a wide distribution within their respective river networks (Ross, 1999). It is estimated that the total population within the Caragh is approximately 2.8 million individuals, while the estimated total population within the Blackwater is approximately 2.75 million individuals (Ross, 1999).

The Caragh and Blackwater populations have a good distribution of mussel size classes, although the number of juveniles and younger mussels are below the required criteria (Table 5.1). Water quality within the Caragh failed three of the five Environmental Quality Objectives (EQOs) specified in Schedule 4 of the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations, S.I. 296 of 2009, while all five were failed in the Blackwater. Both rivers are in unfavourable conservation condition (Moorkens, 2019).

Table 5.1

CRITERIA FOR THE ASSESSMENT OF THE CONSERVATION STATUS OF FRESHWATER PEAR MUSSEL POPULATION AND THEIR HABITAT IN THE CARAGH AND BLACKWATER RIVERS 2019

CRITERIA	TARGET TO PASS	STATUS IN CARAGH	STATUS IN BLACKWATER
Number of live adults	No recent decline	Pass	Pass
Number of dead shells	<1% of population and scatted distribution)	Pass	Pass
Mussel shell length <65 mm	At least 20% of population ≤65 mm in length	12.77% Fail	19.47% Fail
Mussel shell length <30 mm	At least 5% of population ≤30 mm in length	3.04% Fail	2.83% Fail

ECOLOGICAL QUALITY OBJECTIVES FOR THE FRESHWATER PEAR MUSSEL HABITAT AND THE RESULTS FROM THE CARAGH AND BLACKWATER RIVER 2019

ELEMENT	OBJECTIVE	STATUS IN CARAGH	STATUS IN BLACKWATER
Macroinvertebrates	EQR ≥ 0.90	Pass	Fail
Filamentous algae	Absent or present <5%	Fail	Fail
Phytobenthos (Diatoms)	EQR ≥ 0.90	Fail	Fail
Macrophyte cover	Absent or present <5%	Pass	Fail
Siltation level	No artificially elevated levels of siltation	Pass	Pass

FARMING IN THE KERRYLIFE PROJECT AREA

Farming is dominated by extensive cattle and sheep rearing enterprises. The average farm size in the project is 131 ha ranging from 10 ha to 464 ha. While the holding is typically centred on the farm house, many farms also contain a number of separate land blocks, usually reflecting the inheritance of farms or amalgamation of adjoining or nearby farms.

Of the 40 farms participating in the KerryLIFE project, 32 are mixed cattle and sheep enterprises, 4 are sheep only farms and 4 are cattle only. The average number of cattle per farm is 21 animals (range 2 to 62). Larger continental or continental crosses such as Limousin, Charolais, and Simmental account for 71% of the cattle on project farms. Traditional breeds such as Hereford, Angus and Shorthorn accounted for 15%, 8% and 6% respectively. In the past, the herd was dominated by these smaller and hardier traditional breeds which would have been kept outdoors all year round except for the very worst of conditions.

Since the 1980's onwards there has been a shift towards specialised beef systems with larger continental breeds. This has lead simultaneously to the intensification of lowland portions of farms and an extensification and ultimately abandonment of upland and remote portions of farms across the catchments. The shift has been driven not only by competitive market conditions and increased mechanisation but also by a trend towards more off-farm work. The specialisation has been facilitated by the drainage of land in combination with the construction of animal housing units (i.e. slatted sheds), many of which were grant aided under various Department of Agriculture schemes. Today, the majority of KerryLIFE farmers house their animals for between 16 and 26 weeks, storing up nutrients that are spread on a small number of fields that would previously have been more evenly dispersed across a wider portion of the farm over the calendar year.

The presence of animal housing units with slurry storage in a catchment is generally regarded as a positive water quality protection measure; however there can be unforeseen consequences in high status water bodies such as freshwater pearl mussel catchments. This is largely explained by the limited availability of suitable land for the spreading of stored slurry on farms. In many cases the quantity of slurry has also driven farmers to create more land for spreading through land reclamation of semi-natural grassland and peatland habitats. In-field and surface drainage have been installed, the land ploughed and reseeded, or the bog would be turned over and topsoil imported. Despite this there is still relative little spreadland amounting to about 5-6% of the farmland.

In terms of feed, cattle graze on pasture or rough grazing. Silage is made from the improved grassland with farmers typically achieving a single cut of silage in mid to late summer. This is well below those of more intensive grazing systems. Fertiliser (organic and inorganic) is applied in spring and again following the cutting of silage. Some farms have also been restructured to create a single block of extensive farmland in which livestock are free to roam for the majority of the year. Only small areas of improved grassland are fenced to exclude cattle and sheep, except for lambing or silage production. This has resulted in some portions of the farm being overgrazed while other portions are under grazed with livestock loitering in preferred locations resulting in poaching and sediment mobilisation.

Sheep production systems are typically based on robust mountain breeds which can survive the harsh upland environment while grazing poorer quality herbage (Kilcline, 2018). The dominant sheep breed is the Scottish Blackface hill ewe which is a very hardy and resilient breed. The average flock size is 200 (range 20-600). Sheep are kept out all year round. They are brought down from the hills or commonage lands to the better ground for lambing in order to reduce casualty rates which can otherwise be high if lambed on the hill. Lambs are kept as replacements or are sold as store lambs from August onwards due to limited areas of improved grassland to profitably finish them without adversely affecting the performance of the breeding ewe flock. A significant proportion of the store lambs produced are sold to finishers in the midland and east of the country and finished on these lowland farms.

The Central Statistic Office's (CSO) Agricultural Census data for the Loughbrin, Caraghbeg and Lickeen electoral divisions which cover the KerryLIFE project area and adjoining areas, reveal a trend since 1991 of increasing farm size areas and decreasing labour availability (CSO, 2010). This is coupled with a trend of decreasing livestock numbers and a switch from rough grazing to pasture and silage crop areas. Farmers are not in a position to finish their animals, which are sold as weanlings after 6-8 months or as yearlings. Replacement heifers are bred on the farm and calving takes place throughout the year. Other than livestock output, these farms also produce a range of ecological services and public goods, including landscape management, preservation of biodiversity, traditional farming systems and cultural heritage (Plieninger et al., 2006), such as the tourist industry.

The major causes of the unfavourable conservation condition of both the Caragh and Blackwater freshwater pearl mussel populations are regarded as diffuse sediment, nutrient enrichment and hydro-morphological change. The Caragh and Blackwater Freshwater Pearl Mussel Sub-basin Management Plans (DEHLG, 2010a and b) identified the pressures impacting on the species in the two catchments and were used to provide the following detail on threats.

Restructuring and drainage of agricultural land is the most significant threat to the freshwater pearl mussel in the project area. Restructuring involves changing the layout of farms by removal of field boundaries (e.g. hedgerows), re-contouring of land (e.g. levelling off hills), clearance of vegetation (e.g. scrub) and commencing to use uncultivated land for agriculture. Land drainage is the excavation of drainage channels to decrease the capacity of land to retain water and to increase its productivity. These activities result in increased erosion and transport of sediment and nutrients from land to the river. Restructuring and reclamation have occurred on low-lying land close to the main rivers, around farmsteads and on the moderately steep uplands. Drainage is widespread throughout the catchments. These activities can have complex direct and indirect impacts on the freshwater pearl mussel, causing hydrological and morphological changes in rivers, increasing loads, providing a direct pathway for sediment and nutrients and resulting in siltation and nutrient enrichment of the mussel's habitat.

Riverbank erosion is the second most significant pressures in both catchments, and a significant contributor to siltation and erosion of the habitat of the freshwater pearl mussel and to direct damage on its habitat. Bank erosion is a natural process; however changes in land use intensity have acted to significantly increase the rate of erosion. It occurs along the main Caragh and Blackwater rivers and their tributaries. It is closely associated with land reclamation works and land drainage. It leads to direct and indirect impacts to freshwater pearl mussels, including erosion and loss of habitat and increased siltation of the river bed.

Changes to traditional farm practices have led to an increase in nutrient inputs to farms. There has been specialisation of farm enterprises, particularly grazing regimes, and movement from traditional mixed farm systems (relying on native breeds of sheep and cattle) to the (continental-cross dominated) suckler cow systems. Pregnant suckler cows are usually less mobile in the challenging hill terrain and require supplementary feeding. Nutrient inputs on farms have been concentrated in the low-lying areas that have been reclaimed. Typically, animal wastes (slurry) generated during housing are spread on these fields. Chemical fertiliser is also applied to achieve nutrient balance and increase productivity, particularly when re-seeding. Increased importation of chemical fertilisers onto farms, increased production of slurry and changing livestock management have resulted in increased losses of nutrients (nitrogen and especially phosphorus) in particulate and dissolved forms to rivers. These lead to damage to mussels from increased macroalgal and macrophyte production. The increased plant life also reduces oxygen levels during night time as plants respire.

Vegetation damage and soil erosion (i.e. poaching, tussocks, etc.) has resulted from changes in the livestock types and their management. Vegetation damage increases soil exposure and weathering, resulting in increased losses of sediment from land to rivers. Localised vegetation damage and soil erosion can occur on any part of the farm however, it is most strongly associated with supplementary feeding stations, access points and upland and peatland areas. Vegetation damage and soil erosion contribute significantly to siltation of freshwater pearl mussel habitat. They can also result in enrichment, through losses of soil-bound nutrients. Bare soil can generate faster runoff and contribute to hydrological and morphological changes in rivers.

Conifer plantations typically occur on peaty, erodible soils and often on steep slopes or close to rivers. These forests are managed under the clearfell silviculture system, with a crop cycle of approximately 40 years involving ground preparation, drainage, planting, fertiliser application, road construction, firebreak management, thinning, clearfell harvesting, further ground preparations and replanting. Many of these operations can result in significant sediment and/or nutrient losses. Erosion risks are especially high during drainage, ground preparations, crop establishment, road construction and clearfell harvesting, when soils are exposed or damaged. Nutrient losses are high at planting/reestablishment (fertiliser applications) and after harvesting (decay of brash-small diameter wood). Inappropriately sited conifer plantations are located throughout the catchments and can result in siltation and nutrient enrichment of freshwater pearl mussel habitat. They also contribute to hydrological and morphological changes in rivers.

In addition to the above, other threats include a lack of host fish for the larval glochidia; there is currently no evidence that a lack of host fish is a

threat to mussels in these rivers. Additional threats include non-agricultural/ forestry pollution sources namely peat-cutting, infrastructure and septic tanks.

FARMER ENGAGEMENT AND SELECTION, AND DRAFTING THE FARM MANAGEMENT PLANS

Early engagement with farmers at the outset of the project was crucial to securing their buy-in. This was achieved through requesting expressions of interest at public information meetings, advertisements in local media (radio shows, radio advertisements and newspaper advertisements), putting up posters in the project area, attendance at local livestock marts and calling to farm yards and houses. This latter approach was by far the most effective method and it aided the project team in making direct contact with the farmers. A total of 125 of 288 expressions of interests were received through the whole process. As the available spaces were over-subscribed, it was necessary to develop a selection process. This process aimed to balance the ability of the project to improve the condition of the freshwater pearl mussel population and habitat, and the ability to demonstrate the measures across the two catchments.

The selection process assumed that every farm in the catchment had the potential to positively contribute irrespective of the farm's position within the catchment. There were seven selection criteria, five of which were based on information available from existing sources (reflecting the area of land and proximity to pearl mussel watercourses, and a risk assessment), one criterion required a field survey and another was based on a farmer's interest in participating in the project.

The Caragh and Blackwater rivers contain approximately 45 km of freshwater pearl mussel habitat (NPWS Margaritifera Geodatabase) and the project committed to improving the condition of 20% or 10 km of freshwater pearl mussel habitat across the two river networks (Figure 5.5). Following a scientific review of the pearl mussel monitoring reports (Ross, 1999; Ross, 2004a and b; Ross, 2009a and b; Ross, 2011a and b; and Moorkens, 2014) and the Caragh and Blackwater Sub-basin Management Plans (DEHLG, 2010a and b) stretches of habitat were prioritised. In addition, important watercourses connected to this priority habitat were categorised as (i) large streams (streams equal or greater than Strahler Order 3) and (ii) small

Figure 5.5
Targeted freshwater pearl mussel habitat in the KerryLIFE project area, showing a) poached area with cattle access to stream, and high sediment load and b) the same stream after fencing, revegetation and control of sediment

streams feeding into pearl mussel habitat (streams of Strahler Order 1 or 2) as these have the greatest potential to influence the freshwater pearl mussel population.

Using GIS tools and available data on land use, watercourses, mussel habitats and farm distribution (with permissions) each farm was ranked according to the total area of land within (criterion 1) 200 m of priority pearl mussel habitat, (criterion 2) 200 m of other pearl mussel habitat, (criterion 3) 100 m of principal tributaries and (criterion 4) 50 m of low order streams.

A rapid catchment-level agricultural risk assessment (criterion 5) was conducted to identify potential pressures in the project area that posed a threat to the freshwater pearl mussel. Agricultural activities were identified through a desk study and field investigations and were related to Land Parcel Identification System (LPIS) parcels. A weighting based on the three key issues identified for freshwater pearl mussel conservation was assigned to each activity based on its potential to give rise to negative impacts if the activity was implemented inappropriately. The number of activities and their corresponding weightings were then summed for each farm.

As the project committed to demonstrating six broad types of conservation actions on farms, a qualitatively assessment based on farmer's interest in the types of measures and the potential to implement them on their farm was conducted (criterion 6). Farms were assigned a value of one for each conservation action and the results were summed to give a total for each farm.

With the above information, the following selection method best balanced the needs of the Kerry LIFE project:

- Each value within criteria 1 to 6 was normalised to a value between 0 and 1 by dividing it by the maximum value for that criteria. Farms were ranked according to the sum of normalised values.
- Any remaining farms that did not have LPIS land within 200 m of targeted FPM habitat were ranked according to potential for implementing a range of KerryLIFE conservation actions. Where more than one farm had the same value, random values were assigned to each farm and farms were thereby ranked randomly within values for this criteria.
- Farmers were then separated into two categories, those who expressed an interest in participating and those who did not (criterion 7). The highest ranking farmers from both catchments who had expressed an interest in participating in the project were then offered a place.

Allocation of places between the Blackwater and Caragh catchments was based on the relative size of the catchment (km^2). The Project Team wrote to all farmers who expressed interest in the project explaining the selection criteria and invited 50 farmers, 22 in Blackwater and 28 in Glencar to participate in the project. Once the farmer confirmed their continued interest the Project Team (Manager, Scientist, Farm Advisor and Administrator), commenced surveying farms. The preparation of the farm management plan involved documenting current farm management practices and carrying out comprehensive plot by plot surveys to conduct more detailed risk assessments and inform the best selection of management practices.

Current farm management practices were documented through a questionnaire. Information such as stocking rates, stock types, grazing periods, feeding regimes, forage utilisation patterns and fertiliser application were assessed. This assessment took into account relevant farm operations, such as silage production, animal housing infrastructure, slurry and fertiliser use, the availability of spread-lands, drainage history, drain maintenance and land reclamation works, e.g. ploughing, re-seeding and re-contouring. This gave an insight into how the farm was being managed before any management changes were proposed. A survey card ensured that information was collected in a standardised way.

A whole farm approach was used as the management of sediment and nutrients from critical source areas is dependent on the availability of support areas (e.g. alternative spread lands or grazing land) on other parts of the farm. The field survey was completed on a plot by plot basis designed to map sources of sediment, nutrients (soil sample analysis) and hydrology (streams, rivers, field drains, overland surface flows were mapped) on the farm. Source mapping identified critical source areas for sediment and nutrients on the farm and worked with the assumption that typically 80% of losses are associated with 20% of the area. Other potential sources not evident at the time of the field survey that were identified during the desk-based surveys were also incorporated into the risk assessment. In many cases the farmer accompanied the surveyor during the initial survey.

The source – pathway – receptor (S-P-R) model for environmental management was used to determine which pressures would be acted on. A source only becomes a pressure if the pollutant e.g. nutrients can reach the receptor i.e. the habitat with a freshwater pearl mussel population. The pathway is the link between the source of pollution and the receptor e.g. drains or overland run off. For each identified pressure, the risk was assessed taking into account the severity, scale, slope, soil type, presence of a pathway and proximity to pearl mussel habitat. Three categories of relative risk are used: low, moderate, and high. Measures were proposed in order of risk, starting with the high risk pressures that posed the highest risk to pearl mussels and their habitat.

Once the surveys were completed a farm management plan was drafted, which detailed the proposed concrete conservation actions to be implemented by the farmer. The conservation measures designed to support the conservation objectives for freshwater pearl mussel can be grouped into six broad measure types: drain management; stabilizing riparian sediments through broadleaf planting; buffers and hedgerows; grazing and livestock management; nutrient management planning, and; drinking water facilities for livestock. These are described in further detail below. Measures which had the greatest potential to deliver the desired improvement e.g. reduction of nutrients or sediment on a given farm were then proposed. For each of the measures, there were various alternatives, and associated payment rates. Details on selected examples only are provided here; full details are available on the KerryLIFE website http://kerrylife.ie/.

CONSERVATION MEASURES TO BE DEMONSTRATED

C1 Drain management. The project area has a dense network of field drains to improve productivity on wet soils and in an area of high precipitation. Agricultural drains are one of the most critical sources of sediment loss. The drainage systems accelerate the delivery of sediment and nutrients from land to watercourses, by acting as a preferential flow routes. Field drainage results in the soils and sub-soils of the drainage channels being opened up to erosion, increasing the load of fine and coarse sediments to surface waters. By causing changes to the hydrological regime, drainage also increases the erosive power of rivers, causing further changes in the hydrological regime. This leads to erosion of the freshwater pearl mussel habitat and of river banks, resulting in further sedimentation. Once installed, drains require on-going maintenance, including the removal of silt, vegetation and other obstructions, and the repair of damaged banks.

The KerryLIFE project used a series of measures to reduce the hydrological connectivity between source areas of sediment and freshwater pearl mussel populations, and minimise erosion and sedimentation in rivers. These include the re-vegetation of drains, the creation of effective and functioning buffers designed to reduce sediment losses to watercourses, and installation of peat plugs. The project has also worked to make farmers aware that much of the damage results from unnecessary maintenance which can inadvertently lead to the deepening and widening of drains. There is a perception that water must be seen flowing otherwise the drain is not functioning. This is often inaccurate and the hydrological function of vegetated drains is maintained.

C2 Stabilising riparian sediments using native broadleaf planting. Strategic, targeted tree planting at vulnerable locations along channels was proposed to reduce undercutting and slumping of the banks. The re-vegetation of riverbanks will help to dissipate the energy during moderate to high flow events, further reducing in-channel erosion. This action was delivered through the native woodland scheme funded by the Forest Service. The scope to implement small scale strategic planting through the scheme was challenging as in-built requirements of the scheme ruled out many locations e.g. set back distances from water-courses, minimum planting areas and minimum planting widths. Farmer's willingness to plant their more agriculturally productive land was also a factor in using trees to stabilise riparian sediments. In light of these the project adapted and instead identified larger sites (>6 ha) through the running of a demonstration event and trialled alternative planting scenarios, including birch pioneer woodland, together with measures to contribute to the restoration of the hydrology on site.

C3 In-field buffers and hedgerows. Restructuring of land for agriculture has created long paths for overland flow on farms. These increase the risk of sediment and nutrient transport to rivers, as well as contributing to negative hydrological changes. In-field grass buffers (€11.70 per m length for 5m wide buffers, and €24.65 for 30 m buffers) and hedgerows were proposed to intercept, interrupt and disperse overland flows and at the same time, promote infiltration in the soil. Division of the landscape into smaller constituent parcels will also aid livestock management on the farm and contribute to the implementation of grazing and supplementary feeding strategies. The opportunity to demonstrate the efficacy of the in-field buffers was limited due to the farms that ultimately participated in the project. However the project established over 3 km of hedgerows.

C4 Grazing and livestock management. Changes to traditional farm practices has, in particular, changed grazing regimes, from the traditionally diverse range of mixed farm systems (relying largely on native breeds of sheep and cattle) to the suckler cow based systems that prevail today (continental-cross dominated). The larger cattle breeds are usually less mobile, especially in the challenging terrain of the Caragh and Blackwater catchments. This has resulted in a concentration of more intensive farming activities in the relatively more fertile, low-lying parts of farms closest to the river.

The project implemented a wide range of measures including fencing of watercourse, installation of cattle crossing bridges, introduction of grazing strategies, conversion to traditional breeds of cattle and reducing stock number (Table 5.2). These continental crosses are also less hardy and require housing and/or supplementary feeding if out-wintered. Farmers were incentivised to reduce the number of cattle on their farm by payments for phosphorus reduction that offset the anticipated loss in margin from reduced cattle sales. The payment was linked to the quantity of phosphorus produced per animal type. The greater the reduction in phosphorus achieved by reducing or converting from continental to traditional breed of cattle, the higher the payment. The reduced level of stocking density could not

be increased for the lifetime of the project. In addition, the project also endeavoured to develop a beef initiative to add value to smaller traditional brands of cattle with the view that a premium price would be paid for environmentally friendly produced products

During the initial farm surveys, all farmland plots were risk assessed and assigned a condition score. Areas identified through the risk assessment were categorised as a critical source and transport areas for sediment and/or nutrients. These areas or plots were mapped and assessed using a five point objective scoring system (see Table 5.2) at the beginning of the project and each year during the farm plan. A farmer who reduced sediment losses (as estimated and assessed by percentage bare ground and/or maintained optimal condition) was paid when a score of 3 and above was achieved for land parcels. This results-based payment was implemented across 437 ha of farmland focusing on plots adjoining the main pearl mussel habitat.

Table 5.2

LIVESTOCK AND GRAZING MEASURES, UNITS AND PAYMENT RATES.

C4 MEASURE	UNIT	PRICE PER UNIT (€)
Critical source area score = 1 (>20% bare soil)	ha	0
Critical source area score = 2 (10 - 20% bare soil)	ha	0
Critical source area score = 3 (8 - 10% bare soil)	ha	50
Critical source area score = 4 (3 - 7% bare soil)	ha	80
Critical source area score = 5 (<3% bare soil)	ha	100
Fencing – stockproof	m	5.40
Fencing – single strand barbed wire	m	3.00
Fencing – double strand barbed wire	m	3.85
Fencing – electric	m	1.00
Fencing – A frame	m	8.40
Footbridge		50 - 100
Gates		120 - 180

Note the results-based payment for reduction of bare soil (associated with sediment and phosphorus transfer to watercourses) in critical source areas identified in the farm risk assessment

Figure 5.6
Example of a) critical source area with a score of 1 in Year 1 (2015) and b) score of 4 in Year 3 (2017)

'A'-FRAME FENCING: CASE-STUDY

Michael O'Neill farms along the bank of the Kealduff and Blackwater rivers adjoining some of the most important stretches of pearl mussel habitat. Before the project commenced there was evidence of cattle accessing the river for drinking and crossing to the opposite bank for grazing. This resulted in trampling of mussels and disturbance of the mussel's habitat. Cattle also defecated and urinated in the river.

The team proposed fencing the cattle out of the river and establishing a 10 m wide set back area. The standard fencing procedure for cattle involves driving timber posts 0.5 m into the ground with spacing between each post of 5 m. Wire is then put up along the full length. Due to the wetness of the site and sensitive location along mussel habitat, a standard stockproof fence was considered unsuitable mainly due to the potential for ground disturbance during installation or the risk of the stakes breaching the iron pan and releasing iron rich water which can give rise to iron bacteria colonies.

Michael was approached to come up with a solution and through discussions with the project team, it was decided to trial using A-frame fencing. Michael agreed to do this and visited the nearby Killarney National Park to see how a similar fence used for controlling deer in native woodland

was designed and constructed. Michael used strainer posts secured to the ground at both ends, where the fence changed direction and at either side of a gap. Light poles of 1.8 m in length were nailed in 'A' shape formation and stood on top of the ground every 5 m. Sheep wire was nailed to the timber posts and a single strand of thorny wire was run at the top to add tensile strength. The fence was priced at €8.40 per metre.

The erection of the fence has had multiple benefits. Cattle are excluded from the river which immediately stopped mussel trampling. The river bank vegetation at former cattle access points has recovered, reducing erosion and destabilisation of the bank. The protected riparian margin is dominated by rushes and sedges, and will supply detritus-rich water to the river for mussels to feed on. If a standard fence was used, approximately 50 posts would have been driven into the ground. The A-frame fence rests on the ground, is temporary, and can be moved by hand if necessary e.g. moved away from the river during flooding. A gap was retained to allow access for management and maintenance.

Figure 5.7
There were multiple benefits of cattle exclusion: A (facing page) innovative use of A-frame fence and 10 m wide buffer zone along the Kealduff river: B (left) cattle access point for drinking along river before erection of the fence and C (below) the same location three years after cattle were excluded.

C5 Nutrient management planning

Changes to traditional farm practices have led to specialisation of farm enterprises. This has been achieved through the re-cycling of organic fertilisers and the application of imported inorganic, chemical fertilisers on farmland. Investment in farm infrastructure (e.g. slatted houses) has facilitated intensification of farm management practices, generating increased volumes of animal waste from livestock housing. Nutrient loss from farmland is high owing to high rainfall and poor nutrient retention of many soils. A bespoke nutrient management planning system was developed specifically for the project. Many nutrient management plans calculate nutrients at a whole farm level; however in the KerryLIFE farms this is not appropriate as very little of the farm is suitable for the disposal of stored slurry due to wetness, slopes or trafficability of farm machinery. The net result is that the nutrients are applied on a very small proportion of the farm, 5-10 ha, therefore increasing the potential for run-off. Building on the work of Magette et al. (2007), the modified Phosphorus Risk Score (mPRS) risk assessment was adapted for the make-up of the farms and local conditions. In the first instance, measures to reduce the nutrient inputs (source) were adopted as intercepting nutrients along pathways is less effective. Measures included reduction in cattle numbers, conversion to smaller cattle breeds, switching to low or zero P concentration fertilisers and out-wintering period to reduce the quantity of stored slurry (Table 5.3). Secondly, measures aimed to reduce the risk of nutrient losses arising when the stored slurry was applied. This was achieved by: recommending the quantity to be applied for each plot; splitting nutrient applications across two applications to increase the potential uptake by the grass crop, and; changing the timing of applications to summer months with drier ground conditions.

Table 5.3
NUTRIENT MANAGEMENT MEASURES, UNITS AND RATES

ACTION	MEASURE	UNIT	PRICE (€)
C05	Annual Nutrient Management Plan	Farm	200
	Single application – summer only	ha	40
	Split applications – summer only	ha	80
	Split applications- spreading period	ha	80
	Reduction – suckler cow	per animal	400
	Reduction ->2 year old cattle	per animal	320
	Reduction – 1-2 year old cattle	per animal	250
	Conversion to Dexter	per animal	160
	Conversion to Shorthorn	per animal	100
	Conversion to Kerry cattle	per animal	100
	Conversion to Galloway	per animal	60
	Conversion to Aberdeen Angus	per animal	60
	Conversion to Hereford	per animal	40
	Conversion to Mountain ewe	per animal	25
	Conversion to Mountain hogget	per animal	15

C6 Alternative drinking water facilities. Livestock typically had access to rivers, streams and drains for drinking purposes on farms in the project area. Livestock (especially cattle) entering watercourses result in the destabilisation of the bank channel, bank collapse, fouling of water from animal excreta, trampling of freshwater pearl mussels and disturbance of their habitat. Alternative supplies were provided where livestock were excluded from the watercourses. To this end, the project trialled three main types of water troughs: gravity fed troughs, nosepumps and solar-pumps. Variations of the size and type (plastic or concrete) were used to adapt to the circumstances or preference of the farmer.

Working together to finalise and implement the farm management plans
Before the farmer was asked to sign up to the plan, the Farm Advisor walked each farm with the farmer, explaining to him/her the issues identified and the measures proposed to resolve them. These one-to-one farm walks proved invaluable, as the farmer was able to input into their farm plan, often offering alternative solutions to the Project Team in solving technical issues based on their knowledge of their own farm. The Farm Advisor updated the plan accordingly following the farm walk. The Manager reviewed it before it was finalised. The farmer was responsible for the implementation of the farm actions; however, several farmers worked together to implement a measure, while other farmers paid contractors do the work. The Farm Advisor provided technical information on how the measure was to be implemented while maintaining flexibility for the farmer to adapt the measure to suit their own circumstances or the local conditions. Each spring, the Farm Advisor carried

out the Annual Review to determine what measures had been completed, to score the critical source areas and to assess how the measures were working.

To best design the farm plan to communicate aims and be a useful tool to inform farm management, KerryLIFE built on the experience of the Burren Programme, AranLIFE and other projects. The farm plan comprised a series of maps and associated tables, containing information on the individual measures to be implemented. Farm plans contained three maps displaying the following:

1 **The farm overview map** displays the farm plots, the external farm boundary, the Special Area of Conservation and the freshwater pearl mussel habitat. A plot was defined as a field or recognisable management unit identified during the farm survey and utilised by the farmer. Plot was assigned in sequence with 1 attributed to the most north and western plot on the farm, moving eastwards, and then south with the highest number plot being the most south-easterly plot on the farm.

2 **The sediment and drain measures map** displays the location and extent of sediment reduction, drain management measures and the farmland woodland measures to be implemented on the farm as part of the farm plan. Measures were displayed as a point, polyline or polygon depending on the nature of the measure. Each measure was assigned a unique code e.g. 'C1a' comprised of the Action Number followed by a letter and each action was assigned a colour to help distinguish the measures in each action. The same colour was used on the associated tables. This resulted in a colour coding system which was repeated on the tables.

3 **The nutrient management plan map** displays the location and extent of nutrient measures to be implemented on the farm as part of the farm plan.

A series of tables accompany the farm maps. The first table lists the farmer details, the KerryLIFE farm plots, the associated Land Parcel Identification System (LPIS) and the Agri-environmental Option Scheme (AEOS) / Green Low-carbon Agri-environment Scheme (GLAS) plots, to avoid double payments.

There was one page per each of the six actions (C1-C6). All table followed the same format. At the top of each table a brief description of the action and the reason why it was been proposed was provided. Below this, there was a series of columns containing, the plot the measure was to be carried out, the measure code (e.g. C1a comprised of the Action code and letter), the number of units (length, area or number), a brief description of the measures, the total payment or the payment rate each the measure and the annual payment due each year. The final two pages of the plan provided a payment summary and the farmer's declaration. The farm plan was accompanied by a written contract which sets out all the relevant terms and conditions. An example of a complete farm plan (including payment rates and calculations is available from the KerryLIFE website: http://kerrylife.ie/destination/publications/.

PAYMENTS, IMPLEMENTATION AND ONGOING ADVICE

On signing their farm plan, each farmer was paid a pre-payment amounting to 30% of their first year payment. All subsequent payments were linked to the completion of the measures contained in their farm plan which was assessed during the Annual Review. At the end of the plan year, the second 70% payment was issued for completed works only. Each individual measure type had a fixed price. The core elements considered in the payment rate were the cost of any equipment or materials, the management cost, labour, income foregone, environmental benefit and an element of reward. The payment rate had to be acceptable to the farmers in order for them to see the benefit to them in undertaking the measure. Payment rates were realistic and broadly in line with payment rates associated with contemporary schemes. The payment rates were also driven in part by the project-scale commitments and the budget available in the project e.g. install drain measures at 1,000 locations, or implement nutrient measures across 375 ha.

KerryLIFE operated a hybrid payment model with a mixture of capital payments (non-productive investments), action-based payments and results-based payments. Capital costs included the erection of a fence to exclude livestock from freshwater pearl mussel habitat or the installation of a water trough. These measures accounted for 55% of the farm plan payments. Action-based payments (such as the split applications of slurry) accounted for 20% of farm plan payments. Result-based payments consisted of the achievement of improvements of habitat condition, and accounted for 25% of the payments. The high proportion of capital payments tend to be associated with one-off supporting actions that would not need to

Figure 5.8
Open door policy in action - KerryLIFE Farm Advisor leaning out of the office window to give advice to one of the project's participants

be undertaken in subsequent farm plan cycles; however, the maintenance of the capital works may need to be taken into account in future programmes.

As the total value of each farm plan was directly linked to the measures outlined in their farm plan there was a wide range of payments with the higher payments typically being made to the farmer who had the most measures to implement. The project did not set a minimum payment per plan but did apply a maximum payment. The average payment was very variable between farms ranging from €1,500 to €10,000 per annum over the 3½ year term of the farm plan.

The timing of the payment was important as the majority of farm payments e.g. Area of Natural Constraint, Basic Payment Scheme and Greening Payment, Young Farmers Scheme, AEOS, GLAS and the Beef Data and Genomics payment occur between September and December each year. This payment profile can present many farmers with unfavourable cash flow mid-way between the main payment periods. In recognition of this, the KerryLIFE payment was paid in June of each year following the Annual Review which was carried out in late spring.

Once the plans were in place, there was still a need to have a strong interaction with the farmers. In the first year, the Farm Advisor or Manager would call out to the farmers to ensure everything was going according to plan. These visits provided an excellent opportunity to troubleshoot with the farmer to solve a technical issue that might have arisen or which might be preventing a measure from being implemented. It also afforded the farmer an opportunity to discuss alternative approaches to those initially agreed. This informal learning between farmer and project team was very important as it highlighted practical considerations that can sometimes be overlooked or not clearly explained in the first instance. The meetings also allowed the project team to explain the importance of the measure, the benefit to the environment and the mussel and the benefit to the farmer. The on-going support available to the farmers was critical in underpinning the success of the project because it allowed time for trust to build between the farmer and the project team. In the initial stage of the farm planning process, the majority of farmers would have consulted their own independent Farm Advisor about what was proposed. As trust began to be developed, it became increasingly clear that the farmers would come direct to the project team with project issues (Figure 5.8).

KerryLIFE entered farm plan contracts with 40 farmer participants covering 3,658 ha or 27% of the Caragh catchment and 1,429 ha or 16% of the Blackwater catchment. Drainage measures have been implemented at 863 locations across the project farms, 341 locations in the Caragh and 522 locations in the Blackwater. These measures have commenced the process of re-wetting critical areas of the catchments to support the freshwater pearl mussels in the adjoining river reaches. Many of the drains have rapidly re-vegetated, intercepting sediment and increasing the retention of water in the catchment. Riparian buffers and/or set back areas have been implemented along approximately 5 km of freshwater pearl mussel habitat. Eliminating livestock access to the pearl mussel habitat prevents trampling of mussels that can cause mussel mortality, reduces bank destabilisation and erosion and protects fringing habitats. Implementation of grazing and livestock management in critical source areas covering 256 ha or 7% of KerryLIFE farmland in the Caragh and 181 ha or 12% of the KerryLIFE farmland in the Blackwater, has resulted in a reduction in the percentage of bare soil adjacent to freshwater pearl mussel habitat. The condition of the critical source areas in the two lowest scores (88 ha) decreased by 50% between year 1 and year 3 of the farm plans, while the area with the highest score increased from 36 ha to 229 ha in the same period (Figure 5.9).

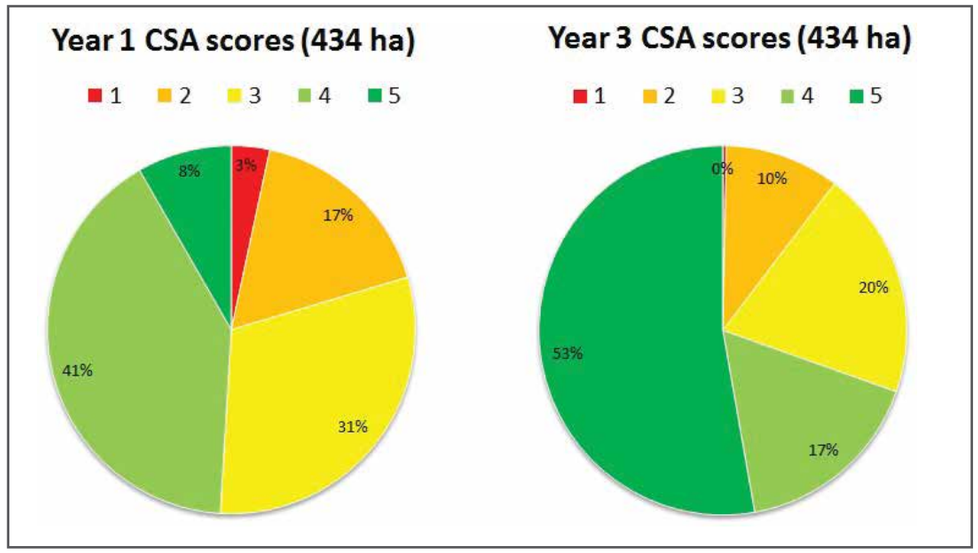

Figure 5.9
Changes in critical source and transport areas from year 1 to year 3 of implementation of the farm plans

Nutrient management planning has been implemented across 40 farms with measures implemented across 501 ha or 10% of KerryLIFE farmland. Farm level measures include stock reduction, conversion to traditional cattle breeds, switching to non-phosphorus containing chemical fertiliser and alteration of grazing patterns. Across the participating farms, 61 cattle have been removed from the herds for the duration of the project. This equates to an 18% reduction in slurry generated on farms. The switch away from phosphorus-containing compounds achieved an 83% reduction in phosphorus inputs at a farm level.

A total of 262 alternative drinking water facilities for livestock have been installed by the project. It is estimated that 1,040 cattle have been excluded from entering freshwater pearl mussel habitat or tributaries discharging to the watercourses. This measure has resulted in a 100% reduction in livestock damage to mussels and their habitat and a 100% reduction in cattle urination and defecation on pearl mussels in locations where the measure has been implemented.

KerryLIFE aimed to restructure 175 ha of commercial plantation to long-term retention woodland using several bespoke conservation measures including halo-thinning, a restructuring technique that aims to increase the proportion of broadleaf trees through manually felling or ring-barking conifer trees in a circle to release the broadleaf tree from competition from surround conifers; sensitive harvesting of conifer plantations and the demonstration of over 15 different mitigation measures designed to reduce sediment and nutrient losses associated with the harvesting. Novel measures such as sediment trapping 'in the dry' designed to intercept sediment before it reaches the main drains were trialled. High risk areas vulnerable to sediment and nutrient losses were seeded with Yorkshire fog (*Holcus lanatus*) and common bent (*Agrostis capilliaris*). Other measures included use of long-top (all woody material less than 7 cm in diameter) brash mats, brash removal from near watercourses, brash export from the catchment, drain management, log dams, pollarding, reduced timber product range (e.g. lengths of pulp wood, pallet wood, saw long etc.), and willow planting. A total of 90 ha of native broadleaf woodland was established or conserved on project forests.

The prospect of continuing the conservation measures after the lifetime of the project is very positive. In 2018, the Department of Agriculture, Food and the Marine (DAFM) funded a €10 million European Innovation Partnership (EIP) project called the Pearl Mussel Project under the Rural Development Programme 2014 – 2020. The measures developed and demonstrated in the KerryLIFE project have been incorporated into a whole farm results-based agri-environment programme that recognizes and financially rewards farmers for delivering environmental benefits. The Pearl Mussel Project operates in the two KerryLIFE catchment plus six other catchments located in Counties Donegal, Mayo, Galway, Kerry and Cork. KerryLIFE has worked closely with DAFM in the development of this EIP. Since the project has become operational, KerryLIFE participates on the Steering Group of the Pearl Mussel Project, has provided training to the Pearl Mussel Project team, supported the identification of pilot farmers, and provided technical specification for measures. The two projects have worked closely to ensure that the KerryLIFE participants transition across to the Pearl Mussel Project EIP.

Woodland sites created through the project will continue to be managed under a continuous cover forestry model, and the measures demonstrated by the project have direct relevance to operations throughout the forest cycle for the protection and conservation of freshwater pearl mussels and other high status water bodies.

Even in the very short lifetime of the project there has been a noticeable change in the behaviours of the participants. There was initially a low level of awareness of the freshwater pearl mussel or what role farmer's activities were having on the river and water quality. Farmers have become more aware of their role and the role of others in managing the environment. Some farmers question the value of their contribution if pressures arise elsewhere in the catchment from some of their neighbours who were not able to join the project or who didn't want to join. There is increased awareness of how vital it is that all farmers work together to deliver water quality improvements.

Farmers are also more willing to challenge certain aspects of their own farming practices that they previously took for granted. Many farmers are quick to explain that they are only doing what their parents did before them. They often overlook the reality that there have been significant advances in the mechanisation that is available to them today; when a drain was maintained in the past it was done by hand and was a relatively low-intensity operation. Today, the same operation would be done with a digger in a far shorter time and may inadvertently deepen and widen the drain. Farmers have begun to question why they are doing what they were doing over the years. For example, many farmers would have applied the same

amount of fertiliser every year, often in the absence of soil sample analysis results, as they believed it was necessary to achieve grass growth. As part of their nutrient management plans, soil samples showed that many of the soils were in excess of their nutrient requirements. Soil sampling results showed that the addition of expensive chemical fertiliser was not needed every year and, due to the very high rainfall together with low nutrient retention in peaty soils, much of the nutrients were being lost to the river or groundwater. As the project has progressed, farmers are slower now to apply fertiliser without soil testing, which is both more environmentally and financially beneficial.

KEY LESSONS

The experience of the KerryLIFE project provides some key lessons for the development and operation of an agri-environment scheme for a high nature value farming community, as follows:

Locally-led: The freshwater pearl mussel is the local priority for biodiversity conservation, and KerryLIFE addressed the local need to enhance conservation of this species. The Locally-led approach was evident in how the project consulted widely with local farmers and local stakeholders, and included them in the governance of the project. The prior knowledge from previous research projects and reports was a crucial support for the targeting of efforts and farmer selection criteria. The project works out of the local community centre, and the rental payment directly benefits the community. Having a local physical presence has been crucial in building trust between the project and the community.

On-going support: The access and availability of the project team to the farmers and forest-owners was essential in solving technical issues that might have arisen or which might be preventing a measure from being implemented. It also fostered continual dialogue and exchange of knowledge between the farmer and the team not only on aspects of farm management but also the history of the farm, the river and wider societal nuances. Annual monitoring of the condition of the CSA allowed farmers to track changes on their farm and encouraged adjustments to management to further improve their scores.

Figure 5.10
The 'Pearl Shield' challenge match was an enjoyable community event that also helped to build trust with the project team, and awareness about the project

Engagement: The project has been very proactive in engaging with not just the farmers but also the whole community. One of the more creative ways we embedded the project into the community was the setting up of the 'Pearl Shield' football competition which embraced the strong sporting tradition in the area (Figure 5.10). This event brings together the two communities that make up the project area but which play in separate divisions for an under 10s and 12s Gaelic Athletic Association football competition. The match also provided an excellent opportunity for the project team to meet the locals and explain the work they are doing and how it benefits the local environment.

Awareness and education: The project hosted public events to raise awareness of the freshwater pearl mussel, the very rare White Prominent Moth, and the Lesser Horseshoe Bat. The project has also worked with the community to develop two walking trails that benefit not only the local community but also visitors to the area.

Flexibility: The project enabled farmers to develop their own solutions to the pressures identified on their farms, which strongly aligns with a locally-led approach. This gave farmers ownership of their farm plan and farmer took pride in delivering their work to a very high standard. Another aspect of flexibility was the project's approach to the delivery timelines. While all farmers were asked to implement their full farm plan in the first year, this was not always possible. This may have been due to unsuitable weather, ill-health or limited availability of family members to help complete the

task. Payments associated with measures not completed by the time of the Annual Review were withheld until they were completed. When the measure was completed, the intervening payments were paid. This non-punitive approach proved very effective and the longer a measure went undone the greater the financial incentive there was for the farmer to undertake the outstanding measure.

Policy alignment: The project has endeavoured to work through a complex policy and legal framework that farmer and forest owners operate under. In complying with one policy, a farmer may run counter to another. It would benefit the farmers and the environmental outcomes to have greater alignment across policies and a clear hierarchy where two or more policies apply.

A whole catchment approach is really needed to achieve the very high requirements of the freshwater pearl mussel for water quality and habitat condition. As a pilot project, KerryLIFE worked with only 20% of the farmland and 20% forest land within the catchments. It is still too early to determine whether the project's actions have improved the conservation condition of the pearl mussel populations and their habitat in the Caragh and Blackwater catchments. Although some early signs of a recovery have been observed in the condition of farm habitats, riparian corridors and water quality, it may take a much higher rate of participation and time to detect the desired outcome in the pearl mussel populations.

Definitive improvements in habitat condition and water quality may take many years due to lag time (the time elapsed between adoption of management changes and the detection of measurable improvement in water quality in the target water body). The UK's Catchment Sensitive Farming predicted a best-case scenario of approximately 3 years if a programme of measures had an immediately beneficial effect (Environment Agency, 2019). A Belgian case study reported additional young pearl mussels as a consequence of improved water quality ten years after their project ended and through continued targeting of conservation efforts (Becerra, 2019). The freshwater pearl mussel is a long-lived, slow-growing species that requires clean sand/fine gravel throughout its whole life in addition to water quality improvements.

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6

THE RESULTS-BASED AGRI-ENVIRONMENT PAYMENT SCHEME (RBAPS) PILOT IN IRELAND: BACKGROUND TO THE RBAPS PILOT PROJECT

DOLORES BYRNE, DEREK MCLOUGHLIN, CAITRIONA MAHER, KATHRYN FINNEY

INTRODUCTION

Farming and nature are natural allies, a fact acknowledged by substantial European investment in agri-environment schemes (AES) over the past 30 years. However, as the condition of many habitats and species associated with agriculture continues to decline, especially important habitats and rare species, the efficacy of the conventional prescription-based model has come under scrutiny. Criticisms include the 'one-size-fits-all approach' where higher quality biodiversity is not recognised, lack of specific targeting, poor outcomes for the intended targets and inadequately resourced monitoring and evaluation.

An alternative is the results-based approach, where payments to farmers are directly linked to the quality of the biodiversity on their farms, thereby incentivising better biodiversity outcomes. Biodiversity quality is assessed through a scoring assessment which is specifically designed for the chosen biodiversity target. Because the biodiversity target must be present in order to deliver the outcome, results-based measures are in effect self-targeting and such schemes have the ability to fit local conditions and circumstances. Similar to prescription-based schemes, the results-based approach needs to be supported by farmer (and advisor/inspector) training, with advice on optimal delivery and tailored farm plans, along with appropriate scheme monitoring and evaluation. However, the farmer is free to choose the methods most suited to them and their farming conditions to deliver the desired result.

Results-based approaches should be the preferred method to incentivise delivery of higher quality biodiversity and associated ecosystem services from farmland. Assessing the ecological condition of the biodiversity target and making payments related to the condition is more reliable than broad prescriptions. Although there have been a number of European results-based schemes in operation over the past 25 years, widespread adoption of this approach (whether alone or in conjunction with an underlying prescription-based scheme), remains outside the norm in Member States. This reluctance to implement a wider roll-out of results-based approaches may be related to perceived barriers such as the assumption of higher costs than prescription-based schemes, that they only work in areas of very high quality or biodiversity importance and that they may be administratively burdensome to implement.

THE RBAPS PILOT PROJECT

To test how results-based agri-environment schemes could work over wider areas and in differing landscapes, the EU provided 70% funding for the **Results-based Agri-Environment Payment Scheme pilot (called RBAPS Pilot)** in Ireland and Spain, although this chapter focuses only on the Irish elements. The project ran from January 2015 to June 2018. Co-funding and support was provided by project partners, The Heritage Council, The Department of Agriculture, Food and the Marine, and Teagasc.

The specific objectives of the RBAPS Pilot project were to:

- Promote the design, development and use in rural areas of results-based remuneration schemes to conserve and enhance biodiversity;
- Increase the understanding of factors that contribute to the success or failure of such schemes;
- Identify opportunities and conditions for increasing the use of such schemes in the EU and in particular in the context of the Common Agricultural Policy (CAP);
- Explore the potential for such schemes to be applied widely in the rural countryside and beyond grasslands, *e.g.* for the protection and enhancement of pollinators, soil biodiversity;
- Demonstrate the potential of these schemes to have positive ecological outcomes by developing, testing and using widely applicable monitoring approaches;
- Promote and increase awareness and better understanding of the benefits of results-based remuneration schemes particularly within the rural community.

The project partnership was co-ordinated by the European Forum for Nature Conservation and Pastoralism (EFNCP), with the Institute of Technology Sligo, BirdWatch Ireland, the National Parks and Wildlife Service, High Nature Value Services Ltd. and Gestión Ambiental de Navarra. These partners have considerable expertise in high nature value farming and results-based schemes, including the Burren Programme, which currently has almost 400 enrolled farmers (Chapter 3).

The pilot regions were chosen in High Nature Value (HNV) farmland, and offered contrasting farming methods, climate and physical challenges. Each region focused on different biodiversity targets associated with grassland and perennial cropland, with the teams testing, monitoring and evaluating the developed scoring assessments (scorecards, guidance and methodologies) across the full spectrum of quality. The scoring assessments were also tested by the participating farmers, farm advisors and with the Department of Agricultural, Food and the Marine (DAFM). The two pilot regions in Ireland, County Leitrim and the Shannon Callows, (Figure 6.1) are summarised in this chapter.

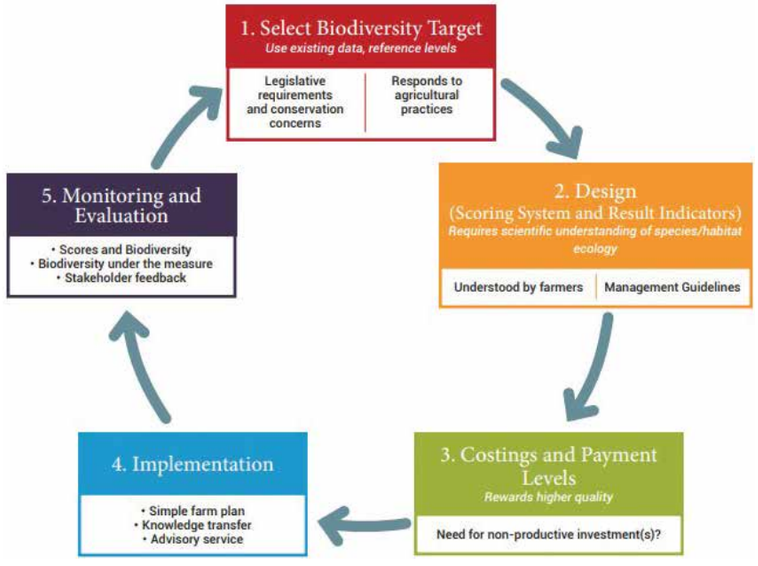
Figure 6.1
RBAPS Pilot study site locations in Leitrim and Shannon Callows

The RBAPS Pilot project was administered by locally-based teams and comprised four full-time staff members and a project co-ordinator from the EFNCP. The team members were ecologists with considerable experience of working with farmers in High Nature Value areas and had a strong level of experience in the local agricultural practices. Each team designed and implemented their respective scorecards (for assessment of ecosystem quality) and capital works programmes, and were responsible for administering payments to farmers in that pilot area.

Importantly, the project in each pilot area was also supported by the invaluable input and advice from local stakeholder advisory groups, which comprised local farmers, representatives from farming organisations, government bodies, and farm advisors. Thus, during the first year of the project, local farmers were instrumental in the design and development of the measures, which were then further refined during two years of farmer contracts; overall, this ensured that the measures were fully adapted to the pilot areas.

The RBAPS Pilot regional teams developed a five-stage approach (Figure 6.2) for the development, costing, implementation and monitoring of results-based agri-environment measures locally targeted to their region. This approach was applied to five selected biodiversity targets in Ireland and one in Navarra, Spain.

Figure 6.2
Five stages for the design and delivery of results-based agri-environment schemes



To facilitate testing of the developed measures, farmer contracts were implemented for two years in each pilot region, with associated advice and supports from the RBAPS Pilot teams. Payments to farmers were primarily based on the quality of the biodiversity targets. In the Shannon Callows, non-productive investment payments (sometimes called capital works or supporting actions) were also included in the available measures. These incentivised farmers to undertake works which lead to improvements in the biodiversity target, which otherwise would not be carried out under normal farm management.

Because this was a novel scheme for all participant farmers, their attitudes, understanding and criticisms of the approach were explored through a series of systematic questionnaires and interviews, providing valuable insight into how results-based approaches could appeal to the wider farming community.

SELECTION OF BIODIVERSITY TARGETS

The first step in the scheme design involved selection of the biodiversity targets, *i.e.* the ecological benefit for which farmers are incentivised to manage their farmland. This is a very important step as the scoring system will be developed to reflect the quality of delivery for the selected target. Locally applicable biodiversity targets in the pilot regions were selected to reflect legislative requirements and conservation concerns, and obviously they must respond to agricultural practices, as is the case with any agri-environment scheme. Targets selected for testing were also those which could potentially be supported under current and future Agri-environment Climate Measure (AECM) regulations.

County Leitrim is characterized by small family farms, with stocking rates, net farm incomes and direct payment receipts that are all below the national average. Farm habitats encompass primarily grasslands with field boundaries, wetlands, scrub and woodland and upland habitats, mainly peatlands. Designated sites tend to be concentrated in uplands meaning much of the lowlands, including extensive areas of semi-natural grassland, fall outside of Natura 2000 protection. Existing biodiversity datasets and consultation with experts in the relevant national and regional government conservation bodies were essential for identifying and refining the potential biodiversity targets in the undesignated County Leitrim HNV farmland. As a range of grassland quality and conservation value is present, supporting a

variety of biodiversity, this broad species-rich grassland target was selected for measure development and testing. Such a target would also be more widely applicable within wider high nature value farmland settings. Spatial targeting was informed by Ireland's national semi-natural grassland survey to ensure the measure was trialled on a number of soil types.

Available data also indicated that County Leitrim is a stronghold for the marsh fritillary butterfly and this invertebrate species is associated with extensive farming practices on wet ground. A separate measure was tested for grassland and mosaic habitat suitable for this butterfly species. However, the decision was made to concentrate on assessing habitat provision rather than the butterfly population as the latter is subject to natural fluctuations outside of individual farmers' control.

The Shannon Callows has by far the largest area of lowland semi-natural grassland and associated aquatic habitats in Ireland, and one in which there is least disturbance of natural wetland processes. The River Shannon Callows was selected as a pilot area as it has a dual Natura designation, including the River Shannon Callows Special Area of Conservation (SAC) and the Middle Shannon Callows Special Protection Area (SPA), and extensive areas of farmed land supporting a range of habitats and species of conservation importance.

Although the focus for biodiversity targets in the callows was on the qualifying interest (QI) special conservation interest (SCI) of the Natura 2000 sites, consideration was taken of their ability to be delivered through a results-based approach. The species-rich flood meadows along the callows are a QI which can be directly influenced by farming and for which results-based assessments could be trialled. Targeting of this measure in the pilot prioritised larger callow meadows to maximise uptake by participants for the purposes of developing quality assessments over as wide a range of meadows as feasible (Figure 6.3).

Corncrake is also listed as an SCI, but it is now functionally extinct in the area and was therefore not suitable for inclusion in the pilot. Looking outside of the SCI's, the selection of potential biodiversity targets was guided by the Prioritized Action Framework priority species, identifying breeding waders (snipe, lapwing, redshank and curlew) which are present in the callows. Spatial targeting for the Breeding Wader measure was based on the areas of highest concentrations of breeding pairs (using the most recent population data) (Figure 6.4). To be eligible for entry into the Breeding Wader measure, plots were required to be grazed by cattle during the breeding season machinery operations and inappropriate grazing intensities were not allowed and trees could not be planted. As part of the measure, non-productive investments could be undertaken by farmers (and paid for in addition to the per hectare payment), an example of a hybrid results-based scheme model.

As was the case for marsh fritillary in County Leitrim, available datasets for the callows indicated it is a national stronghold for breeding whinchat, which are associated with the species-rich flood meadows. Breeding curlew may also use these meadows. As these species were considered conservation priorities, a separate measure for ground-nesting birds was developed and provided as a top-up payment to the flood meadow measure, available to farmers where breeding was confirmed, and farmers complied with prescriptive mowing dates of after 15th July for curlew and after 26th July for whinchat - to take account of the different breeding periods of each species (Table 6.1).

Figure 6.3
High diversity of plant species is evident in the meadows of the Shannon Callows

Figure 6.4
The Shannon Callows system is of international importance for breeding waders, however numbers are in decline due to a variety of factors

Table 6.1.

SELECTED BIODIVERSITY TARGETS FOR THE RBAPS PILOT PROJECT

PILOT LOCATION	CHARACTERISTICS	SELECTED BIODIVERSITY TARGETS
County Leitrim, Ireland	Undesignated HNV farmland	Species-rich grasslands; Wet grassland and mosaic habitat suitable for the marsh fritillary butterfly *Euphydryas aurinia*
Shannon Callows, Ireland	Natura 2000 site (Special Area of Conservation & Special Protection Area)	Breeding wader bird habitat; Species-rich flood meadows; & Species-rich flood meadows with ground-nesting birds

DESIGN OF THE SCORING SYSTEM AND RESULTS INDICATORS

A common design approach was used to quantify the assessment of ecological quality across the two regions and five measures. The assessments relied on the use of results indicators which are proxies employed to quantify the quality of the biodiversity target. Measure specific result indicators were identified (either direct or indirect surrogates) and trialled for their fairness, robustness and reliability in assessing the quality of the farmland for the measure they were most suited to provide and to indicate general environmental condition. It was extremely important that the results indicators were both linked to the biodiversity target and feasible for the farmer to deliver.

The RBAPS Pilot scores were designed to reflect the variation in the quality of the selected biodiversity target which was assessed by totalling the points awarded for result indicators and translating into a scoring scale from 0 (very low) through to 10 (very high) (Table 6.2.) All RBAPS Pilot scorecards are available at www.rbaps.eu.

Table 6.2

THE 10-POINT SCORING SYSTEM USED IN RBAPS PILOT TO ASSESS THE QUALITY OF BIODIVERSITY TARGETS

BIODIVERSITY TARGET HEALTH RATING	LOW				MODERATE		GOOD		HIGH TO VERY HIGH		
RBAPS QUALITY SCORE	0	1	2	3	4	5	6	7	8	9	10

DESIGNING SCORING SYSTEMS WITH RESULTS INDICATORS FOR HABITATS

The scoring system developed for Species-rich Grassland and Species-rich Flood Meadow measures was divided into two sections: a) ecological integrity and b) threats and future prospects.

In both grassland measures, up to 60% of the available points were based on the number and cover of positive indicator plants (together termed 'ecological integrity'), as these species are considered to represent grasslands that benefit from environmentally sensitive farming and with high potential to support wider biodiversity. When selecting positive indicator plants, those in national or regional Annex I habitat assessments for Article 17 reporting offer a good place to begin, for both designated and undesignated grassland habitat.

The list of positive indicator plants did not include those that are too small (i.e. mosses) or difficult to identify, or plants which may be confused with non-positive indicator species. Species which looked similar were grouped together (provided they are all positive indicators), e.g. all orchid species. Additional positive indicator species may also need to be added to ensure a range of habitat quality is represented, i.e. positive indicators for HNV grasslands were also used in County Leitrim. The cover (and not just the presence) of positive indicator plants is also assessed as species may persist when reduced or declining in a habitat in response to less than optimal past and current management.

Ecological integrity also assessed the cover of negative indicator plants (agricultural weeds) which can indicate that the grassland has had less than optimal management.

In the second section of the scoring assessment, result indicators quantified threats to current habitat condition such as extent of bracken, scrub and any damaging activities, as relevant to each pilot region. These threat indicators also highlight to the farmer those features or practices that might result in future failure to deliver a high-quality biodiversity target.

An example of a (simplified) scoring assessment for two species-rich grassland fields is shown for County Leitrim in Box 6.1.

BOX 6.1:
EXAMPLE OF GRASSLAND QUALITY ASSESSMENT FROM THE COUNTY LEITRIM SPECIES-RICH GRASSLAND MEASURE

Each result indicator comprises categories (e.g. on a scale of good to bad) which reflect the extent to which each individual result indicator is achieved. The example below showcases how the scoring system can distinguish between the quality of species-rich grasslands of two fields, Field A and Field B, entered into the County Leitrim Species-rich Grassland measure (Figure 6.5).

SECTION A
ECOLOGICAL INTEGRITY

Positive indicator plants are an excellent surrogate for measuring habitat (plant community) quality and also indicating the potential of the grassland to support pollinators, invertebrates and other wildlife. The higher the number and cover of positive indicator plants the higher the marks and the payment to the farmer. Field B is a species-rich dry hay meadow, which has a high number (15-20) and cover of positive indicator plants. Field A is cattle grazed pasture which has become dominated by soft rush, resulting in lower number (5-10) and cover of positive indicators (Table 6.3).

Negative indicators such as ragwort and creeping thistle can indicate sub-optimal management. Field A has little to no cover of negative indicators and scored full marks for this indicator. However, in Field B, there was a medium cover of perennial rye-grass, which has spread from silage which is fed to cattle in this field. As feeding silage is not optimal in a species-rich grassland, it will be clear to the farmer why they have not achieved full marks for this indicator. Note that this hay meadow was surveyed in detail in 2010 and again in 2016 as part of the ongoing national assessment of high-quality (Annex) grasslands. The surveys showed a decline in quality of the grassland due to the spread of perennial ryegrass and demonstrates the importance of this result indicator in the scoring assessment (Table 6.3).

Figure 6.5a & b Facing page from top: Field A is a wet grassland with very low level of grazing, which is becoming dominated by soft rush. Field B is a species-rich dry hay meadow, which is starting to decline in quality due to silage feeding on the grassland in autumn and winter. (Credit: Dolores Byrne).

SECTION B
THREATS AND FUTURE PROSPECTS

Along with evaluating the current ecological integrity, it is also prudent to assess any activity that may impact on the future delivery of the biodiversity target (Table 6.4). Results indicators assessed vegetation structure, which is an indication of the level of management (grazing or mowing, levels of dead plant litter), cover of encroaching scrub, and damage to water, soil and vegetation. As it was undergrazed (low management level), the vegetation structure in Field A was not optimal for a range of biodiversity and had high levels of dead plant litter which will negatively affect the establishment of positive indicators in plants. Conversely, Field B is mown annually and vegetation structure/plant litter levels were in the optimal range. However, some damage was noted to the soils in the grassland around the location of a round feeder, and therefore the field was assessed as having 'some damaging activity' occurring.

The interaction of the results indicators is very important in establishing the 'true' ecological health of the grasslands. If the results indicators concentrate on ecological integrity alone, it limits the potential usefulness of the scoring system to bring about positive change in management practices which in the short or longer term will impact on the positive indicators, and hence on wider grassland biodiversity.

Table 6.3
EXAMPLES OF THREE RESULTS INDICATORS, THRESHOLDS AND POINTS, WHICH ARE SURROGATES FOR ECOLOGICAL INTEGRITY OF SPECIES-RICH GRASSLANDS

NUMBER OF POSITIVE INDICATOR PLANTS:		
5-10	10-15	15-20
10 marks	20 marks	30 marks
COVER OF POSITIVE INDICATOR PLANTS:		
Low	Medium	High
10 marks	20 marks	30 marks
COVER OF NEGATIVE INDICATOR PLANTS:		
High	Medium	Low
-10 marks	0 marks	15 marks

Table 6.4
EXAMPLES OF RESULTS INDICATORS, THRESHOLDS AND POINTS USED TO ASSESS FUTURE PROSPECTS AND THREATS IN SPECIES-RICH GRASSLANDS

CURRENT LEVEL OF MANAGEMENT:		
Too low (no signs of grazing and/or mowing)	Optimum	Too high (bare ground)
-10 marks	25 marks	-20 marks
ARE THERE ANY DAMAGING ACTIVITIES:		
High level of damage	Some damaging activity	None
-40 marks	-20 marks	0 marks

DESIGNING SCORING SYSTEMS WITH RESULTS INDICATORS FOR HABITATS WHICH SUPPORT BIODIVERSITY TARGET SPECIES

When species are the target of the measure, the result indicators need to reflect the habitat suitability for the species (e.g. vegetation structure for breeding waders) and spatial targeting of the measure needs to be based on the distribution of the species.

Previously developed habitat scoring assessments can be used as the basis of scoring assessments where habitat for a target species is the desired outcome. For example, in the Marsh Fritillary Habitat measure in County Leitrim, the Species-rich Grassland measure scorecard was adapted through refinement of the number and type of positive indicator plants and by the addition of a specific indicator that assessed habitat suitability for the larval stage of the marsh fritillary. It was targeted at areas where there were previous records of marsh fritillary and/or suitable habitat. The habitat quality rather than the population of marsh fritillary itself was selected as the biodiversity target, as the population is influenced by factors outside of farmers' control such as weather condition. Providing high quality habitat offers the opportunity for butterfly population maintenance and expansion, whilst also providing additional benefits for other associated grassland biodiversity (Figures 6.3).

Similarily, in the Shannon Callows, an additional measure for ground-nesting birds was offered to those farmers participating in the species-rich flood meadow measure, when the presence of curlew and/ or whinchat was confirmed (during monitoring) in that breeding season. Under this measure, the same scoring indicators were used as in the species-rich flood meadow measure. A delay of mowing dates until after 15th July for curlew and after 26th July for whinchat were prescribed under this measure, resulting in an additional payment to farmers above that which they could get for species-rich flood meadow alone. The measure for Species-rich Flood Meadow with Ground-nesting Birds aimed to reward farmers for both the protection of ground-nesting birds and the quality of species-rich meadows.

In the Breeding Waders measure, specific results indicators of habitat suitability and condition were developed as the wader species are faithful to their breeding sites. Therefore, the consistent provision of good quality habitat is a central element in achieving population stability or growth. Result indicators for the Shannon Callows breeding wader habitat assessed the vegetation structure, extent and suitability of feeding areas for chicks and presence of scrub and trees (which may provide habitat for predators).

Simplified examples of result indicators used for assessing the future prospects for ground-nesting wader bird habitat are provided in Table 6.5 and are based on proxies for assessing grazing intensity management and damaging activities.

Table 6.5

EXAMPLE OF RESULTS INDICATORS, THRESHOLDS AND POINTS USED TO ASSESS FUTURE PROSPECTS AND THREATS FOR BREEDING WADER BIRDS IN THE SHANNON CALLOWS

TUSSOCK STRUCTURE:	No Tussocks	Rare tussocks (suitable for nesting and chick cover)	Abundant tussocks (suitable for nesting and chick cover)
	0 marks	5 marks	15 marks
RUSH COVER:	High (> 50% of dense rush) no longer suitable for breeding	Medium (some dense rush, or a lot of sparse rush	Optimum (none, or few very sparse tussocks)
	-5 marks	5 marks	15 marks
CHICK FEEDING HABITAT:	Damaged / removed	Sufficient but plot could be improved by increasing the amount / quality	Ample features of appropriate slope, wetness and vegetative cover.
	-30 marks	10	15

DEVELOPING, COSTING AND SETTING PAYMENT RATES TO RECOGNISE AND REWARD QUALITY AND NON-PRODUCTIVE INVESTMENTS TO ACHIEVE HIGHER BIODIVERSITY TARGETS

In prescription-based schemes, participants typically receive a single payment rate for all land enrolled in a measure. The results-based approach links tiered payment levels to the quality of the biodiversity target, as assessed by the scoring system.

ESTABLISHING PAYMENT RATES

To establish payment rates, the principal threats to the biodiversity targets were considered (Table 6.6) and the associated cost (including income foregone and additional costs) of achieving the biodiversity target was calculated in line with World Trade Organisation and Common Agricultural Policy regulations. Up to 10% transaction costs were also included under each measure.

Table 6.6

SUMMARY OF THREATS IN EACH REGION

REGION	COUNTY LEITRIM	SHANNON CALLOWS
PRIMARY THREAT	Conversion to forestry	Intensification
SECONDARY THREAT	Intensification	Abandonment (rare)
TERTIARY THREAT	Abandonment	–

The payment structure (Table 6.7) aimed to achieve a balance between incentivising farmers to deliver the highest possible score in their particular farm setting, while giving a clear signal that the delivery of higher quality also results in a higher reward. In the pilot, payment rates for the low-medium quality scores were set at a level sufficient to cover costs of farmers' participation in the scheme, while creating payment increments to incentivise further progression towards delivery of higher quality outputs. Tiered payment levels provide a financial incentive to the farmer to deliver the highest quality environmental product in their particular farm setting.

Table 6.7

PAYMENT RATES (Euros per hectare) ACROSS EACH OF THE RBAPS PILOT MEASURES

BIODIVERSITY TARGET HEALTH RATING	SCORE	LEITRIM SPECIES-RICH GRASSLANDS	BREEDING WADER HABITAT	SPECIES-RICH FLOOD MEADOWS	SPECIES-RICH FLOOD MEADOW / GNB
Low	0	–	–	–	–
	1	–	€43	–	–
	2	–	€86	–	–
	3	–	€129	–	–
Moderate	4	–	€172	€100	
	5	€110	€215	€160	€210
Good	6	€170	€258	€220	€270
	7	€230	€301	€280	€330
High to very Good	8	€280	€344	€330	€380
	9	€320	€387	€370	€420
	10	€350	€434	€400	€450

DECIDING ON 'PURE' OR HYBRID MODELS

In some instances, in order to create, maintain or rehabilitate biodiversity features, an initial investment may be required to enhance the biodiversity outcome. This is a non-productive investment for actions over and above what is covered in the costing of annual results-based payments and their inclusion gave rise to blended/hybrid model of delivery rather than 'pure' results-based where payment is solely based on quality as assessed by the scoring system. Both types of RBAPS were trialled in the pilot.

For the Breeding Wader measure in the Shannon Callows, ongoing and 'normal' farm management was not sufficient to deliver high quality breeding habitat. For instance, wet features suitable for feeding chicks, may not be present in otherwise suitable breeding habitat. Therefore, a hybrid model was implemented as part of the breeding wader measure to co-fund non-productive investments that could be undertaken by farmers if/when necessary (and paid for in addition to the per hectare payment). Both the prescriptive management (i.e. restricted stocking rates and machinery operations during the breeding season) and non-productive investments complemented the results-based payments and together aimed to deliver high quality breeding habitat. Payments were partly linked to quality and partly to capital works and/or prescribed management that could enhance the biodiversity targets.

In Shannon Callows species-rich flood meadows, long-term fertiliser use has resulted in species-poor (low scoring) meadows with depleted seed bank. Adjusting the timing of the mowing of the meadow (or other annual management) is unlikely to benefit these meadows, particularly when they have been of poor quality for a number of years and the seed bank of the soil is also depleted. If the conservation importance is considered sufficient to justify the additional costs, substantial restorative, non-productive investment actions (such as spreading seeds or green hay) could be undertaken to increase the floral diversity of the meadow. In this instance, including the cost of this action in annual payments to all participants fails to adequately remunerate the (few) farmers needing to carry out the restoration works and needlessly increases the annual cost of the measure. Therefore, in this case, it works best as a separate, once-off non-productive investment payment with the aim of achieving higher biodiversity target outcomes.

In County Leitrim, the pilot tested a 'pure' results-based scheme which solely linked payments to the quality of biodiversity target, without payment

for complementary actions or any specific management as implementation of normal farming practices was considered sufficient to deliver the targets. However, it became obvious during the pilot that the very low grazing intensity which provides the highest quality marsh fritillary habitat is not sufficient for farmers to meet their obligations under cross compliance (e.g. with regards to encroaching scrub levels). The provision of funding for relevant and necessary non-productive investments may incentivise interest in a measure for species with specific habitat specifications, which may be more difficult to achieve under normal farming practices.

In conclusion, when considering whether a RBAPS measure should operate under a hybrid or pure results-based model, a cost-benefit analysis should be undertaken in each case, weighing any potential conservation benefit of non-productive investments against the costs of required actions. Additionally, the cost of non-productive investments in relation to the area based-payments, and the frequency with which it is necessary, are important to consider in order to produce an equitable and attractive measure, and it is important to keep separate the two types of cost in the payment structure. If non-productive investment payments are available, it is essential that the farmers fully understand when, where and why they may be appropriate and necessary so that best value for financial and time investment is achieved. Adequate advice and training need to be provided for the farmer and/or contractor in order to carry out the work appropriately and with regard to relevant legisalation, particularly within designated sites.

IMPLEMENTATION OF RBAPS PILOT

FARMER PARTICIPATION AND AREA UNDER AGREEMENT

For the purposes of the RBAPS Pilot, a call for participant farmers was made through various media sources (including local newspapers and radio) in selected areas where selected biodiversity targets were confidently expected to occur. Applicant farms were checked for suitability and for potential double payments with other agri-environment schemes (lands entered to other agri-environment schemes were excluded from entering the RBAPS Pilot). For the scheme, all participant farmers were required to be in receipt of Basic Payment.

A total of 35 farmers participated in the scheme in Ireland in 2017, entering over 260 hectares of land across 143 fields (including enclosed fields and unenclosed plots (see Table 6.8). Participant farmers represented the wider farmer demographic, with a mixture of ages, part and full-time farmers and farming enterprises commonly found in the surrounding landscape. For most of the measures being trialled, land parcels with a broad range of scores were included in the pilot.

Table 6.8

DETAILS OF PARTICIPANT NUMBERS AND AREAS UNDER AGREEMENTS IN 2017, WITH 2016 FIGURES IN BRACKETS

MEASURE / REGION	NUMBER OF FARMERS	AREA UNDER AGREEMENT (HECTARES)	NUMBER OF FIELDS/PLOTS	AVERAGE FIELD/ PLOT SIZE (HECTARES)
Species-rich grassland (SRG)	13 (13)	137.81 (121.26)	72 (62)	1.91 (1.96)
Marsh fritillary habitat and SRG	2 (2)	28.74 (14.39)	36 (20)	0.80 (0.72)
County Leitrim total/average	13 (13)	166.55 (135.65)	108 (82)	1.54 (1.65)
Breeding Wader Habitat	7 (5)	61.35 (29.55)	9 (5)	6.81 (5.91)
Species-rich Flood Meadow	13 (11)	23.94 (18.97)	18 (13)	1.33 (1.46)
SRFM with ground nesting birds	6 (7)	16.44 (13.54)	8 (9)	2.05 (1.05)
Shannon Callows total/average	22 (18)	101.73 (62.06)	35 (27)	2.9 (2.30)
Total	35 (31)	268.28 (197.71)	143 (109)	1.2 (1.16)

TRAINING AND GUIDANCE TO ACCOMPANY THE SCORING ASSESSMENTS

The provision of training and guidance is vital for the success of any agri-environmental scheme. In the RBAPS Pilot, annual training was offered by the project team to participating farmers over the two years of farmer contracts. A half-day classroom setting was used to present the scheme concept, its comparison with more familiar management-based schemes and the RBAPS Pilot scheme aims. For most participants, this was the first time that they received detailed insight into results-based agri-environment schemes, and so offered an opportunity to provide valuable feedback to the project team. Much of the interest and discussion tended towards future roll-out and the need for consistency from all those involved from farmers, agricultural advisors, inspectors/national departments through to auditors.

> "This is a new way of looking at the land. Success will depend on the level of training and whether it will be any good for the land. It is a more farmer-friendly approach because every farmer has a different way of managing his farm".
>
> Farmer at RBAPS Pilot training

The classroom session was followed by a half-day of field-training (preferred by farmers) for each measure which focused on the use and understanding of the scoring assessment, the rationale for the results indicators and discussion on optimal management to achieve the best possible outcome (and payment). Each result indicator was demonstrated and the thresholds and associated points explained. For example, as part of training for the Species-rich Grassland measure, the positive indicator plants (flowers and leaves) were shown to participants and the cover of these plants (high, medium, low etc.) in fields was described. It was important to ensure that training covered the range of quality (i.e. score range) and main scenarios which would be encountered. This allowed farmers to establish an idea of 'poor', 'medium' and 'good' biodiversity quality and importantly demonstrated what the best product (and payment) looks like (Figure 6.6).

Advice from the project team was also given to farmers on non-productive investments which could potentially help achieve optimal conditions for the type of biodiversity their land was best suited to deliver.

Figure 6.6
RBAPS Pilot project team member and farm advisors discussing the Species-rich Grassland measure, County Leitrim

Most farmers participated willingly at the farmer training events, with some requesting additional training as they found it both helpful and enjoyable. A very important element of the training days was the opportunity for farmers in the scheme to meet and share their views on participation in the pilot with each other. This 'farmer-to-farmer' interface is considered an important element in roll-out, whereby the knowledge of how to achieve the best scores can be shared.

Farmers were asked to self-score their land after training, but many were initially reluctant to do so ahead of payments due to both a lack of confidence in correctly assessing individual indicators (*e.g.* identifying plant species) and a concern that incorrectly scoring their site may negatively impact upon their payment rate. Most of the farmers that did score their fields under the RBAPS Pilot did not vary significantly from project team score. The process of self-scoring ensured that the farmers become more familiar with the result indicators and thus the ecological components of the habitat; thus self-scoring was considered an invaluable part of the process irrespective of how accurate the farmers' scores were. In addition, long-term behavioural change can be encouraged through better understanding of the result indicators and the relationship between management practices and ecological quality.

As it is envisaged that the roll out of any future RBAPS could be administered through a local farm advisory service, testing of the ecological assessment scoring system was undertaken with a number of agricultural advisors in each of the pilot areas. Primarily this was to determine how easy it is to understand and implement, and to identify any misunderstandings that may arise. This training was conducted as if the advisors were learning a 'normal' new RDP measure. This involved a one-day training session, similar to that held for farmers, with field- and classroom-based sessions, a second day when the farm advisors scored RBAPS Pilot sites using the relevant scorecards, followed by submission of a scheme evaluation. After their training, farm advisors were required to use the scoring assessments independently, in conjunction with the relevant RBAPS Pilot scoring guidance document. The farm advisors indicated that they found the scoring systems easy to understand but would need longer initial training, refresher courses and on-farm practice to feel more confident to assess such measures at field level. A minimum of one whole day per measure would be required on roll-out, and longer when the measure includes non-productive investments.

A range of guidance documents for farmers, farm advisors, external evaluators, auditors and anyone who needed to understand or use a measure were prepared to accompany the scorecards for each of the biodiversity measures. These documents, in addition to guidance to best practice management of the biodiversity targets are available on the RBAPS Pilot website (www.rbaps.eu).

BOX 6.2
FARMING IN THE SHANNON CALLOWS: FARMER PROFILE

BRENDAN AND MARETTI PILLION HAVE A BEEF AND SUCKLER FARM NEAR SHANNONBRIDGE, CO OFFALY IN THE SHANNON CALLOWS.

Nearly half of Brendan and Maretti's 78ha farm lies within the flood plain of the River Shannon. This land is known as 'Callow' land (derived from the Irish word *caladh* meaning river meadow), it floods regularly in winter and dries out in summer for use as pasture or hay. However, the land can be under water for up to six months of the year and flooding can occur anytime depending on weather conditions. Summer flooding has become more prevalent in recent years.

"Callow land is excellent grazing in summer, but you can never depend on it. It might flood and you could lose all your grass and hay

Brendan and Maretti participated in both the RBAPS Pilot Breeding Wader Habitat option and the Species Rich Flood Meadow Option. Brendan did have a full time off-farm business, however he only works part time at this now and concentrates more of his time on farming. He enjoys spending more time on his farm and likes to see the wildlife on his Callow land, even if *"it's not the most productive land"*. He sees schemes such as these as a way to support farming on this land, alleviating the drive to try and intensify and increase productivity.

Like most farmers in the Callows and other extensively farmed areas, when asked what they know or how they feel about the wildlife on their farm, they first appear not to have given it much thought. However, as conversation unfolds over a cup of tea, it is evident that not only do they know a lot, they also care deeply (lamenting its loss, where this has occurred). It appears the decades spent encouraging farmers to focus on productivity have led to an element of disconnection. That is why, in addition to providing support for biodiversity-rich areas, results-based agri-environment schemes are important for revaluing and reigniting the farmers' love of wildlife on their farms.

BOX 6.3
FARMING SPECIES-RICH GRASSLAND IN COUNTY LEITRIM: FARMER PROFILE

LILY AND TOMMY MCPARTLAN FARM SUCKLER CATTLE NEAR DRUMKEERAN, COUNTY LEITRIM.

With average yearly rainfall in the region of up to 1250mm and slow draining clay and peaty soils, the challenges of farming in County Leitrim are familiar to Lily and Tommy McPartlan.

Their small suckler beef farm is a mixture of wet grassland, broad-leaved woodland and heath. Extensive cattle grazing throughout the year makes the most of the grazing available, and also creates a mixture of vegetation heights which is perfect for birds, butterflies and insects. No fertiliser is added to the land, as it's too costly and doesn't suit the wet land. Supplementary feeding of concentrates and hay is carried out only when considered necessary.

Before taking part in the RBAPS Pilot Species-rich Grassland and Marsh Fritillary Habitat measures, Lily and Tommy were aware of wildlife they'd commonly see, such as squirrels, rabbits, hares and birds. They didn't know their farm supported the protected marsh fritillary butterfly. In fact, the project team found that the land is optimal for the fritillary and it holds one of the largest breeding populations in County Leitrim. From training provided as part of the RBAPS Pilot, Lily and Tommy are now able to recognise the butterfly and understand how their farm practices are providing shelter and food for this species.

As a consequence of low productivity and low farm incomes, some land in the local area has been afforested or has increased scrub cover up due to abandonment. Lily and Tommy feel that schemes such as RBAPS are vital to help farming communities and in particular to keep young farmers interested in farming.

CONTROL AND VERIFICATION OF BIODIVERSITY QUALITY

In the pilot project, scoring was undertaken by the project team, but it is envisaged that this would be performed by trained farm advisors or farmers on wider roll-out, with appropriate levels of verification on the ground. Independent verification of a sub-sample (10%) of the scoring systems was carried out during each of the two field seasons by HNVS Ltd., which operates the Burren Programme. The external evaluation examined the measures from both an ecological and administrative perspective, with particular emphasis on how it might be open to misinterpretation by farmers, advisors and auditors. These evaluations involved scoring plots under RBAPS Pilot agreements and evaluating the guidelines for administering the measures. This included extensive feedback on the structure of the scoring system and the associated guidelines. Where considered appropriate, scorecards and associated guidelines for scoring each measure were subsequently revised to incorporate the feedback received.

MONITORING AND EVALUATION

The monitoring stage had two main objectives. First, it served to assess the relationship between the RBAPS Pilot quality score and the associated result indicators, *i.e.* was there a significant positive correlation between the quality score and the chosen biodiversity target. Second, it assessed the impacts of the scheme on the biodiversity targets and in reaching the scheme objectives, although in the pilot project, this was constrained by the very short timeframe over which farmer contracts operated.

In all regions, positive correlations were found between the RBAPS Pilot quality score and the biodiversity target. Correlations were strongest where the result indicators were most directly linked to the biodiversity target, *e.g.* in the Shannon Callows Flood Meadow measure, the scoring assessment was mainly based on positive indicator plants, and had strong, positive and highly significant relationship with the target Annex I habitats supported by the flood meadows. Where the target is broader, *e.g.* species-rich grasslands in County Leitrim, some monitoring elements showed stronger correlations than others. It would also be expected that low correlations existed between some assessment indicators and the target biodiversity, such as indicators for damaging activities, as these are early warning systems that detect threats to the biodiversity targets.

Once the strength of relationship between the scoring assessment (and results indicators) and biodiversity target has been proven and confidence in the scoring system is established, it is possible to reduce the requirement for more detailed ecological monitoring as the annual quality scores are in themselves indicators of the status of biodiversity target. This makes results-based payment schemes easier to monitor compared to prescription-based measures.

Monitoring also showed that the scheme did have positive impacts on certain biodiversity targets compared to non-participant (control) farms, although caution is required in the interpretation due to the small sampling sizes available. In the Shannon Callows, positive impacts were noted for breeding wader populations, as the non-productive works and advisory support brought about tangible benefits for these species compared to sites where this was not in place. Very limited changes to biodiversity quality were noted in County Leitrim, as it takes longer for wet species-rich grasslands to respond to management changes. Declines in species-richness are difficult to reverse, which highlights the value of this scheme in identifying such grasslands and incentivising environmentally sensitive management.

FARMER ATTITUDES TOWARDS RESULTS-BASED APPROACH

Participating farmer views on the results-based approach were captured in interviews at the start and end of the pilot scheme. Across the pilot areas, farmer sentiment and outlook on results-based schemes was very positive after participation, with the majority agreeing the results-oriented approach was 'fair'. Farmers indicated they would enter a results-oriented scheme if it was available, including farmers who had never taken part in a national agri-environment scheme. Many of the farmers felt that this was the only agri-environment scheme which understood the challenging conditions and type of land that they farm. Furthermore, farmers considered that having a results-based scheme in place in the future might make the continuation of farming more attractive to those considering other opportunities.

Since the end of the pilot project in 2018, there has been no results-based scheme open to participant farmers although a small number of

Shannon Callow farmers are participating in the NPWS Breeding Wader Farm Plans (see chapter 7). In County Leitrim, farmers were hopeful that such an approach would be widely rolled-out in the future and with over 70% of their wider farm holdings comprising semi-natural grasslands, there is much scope for results-based schemes in Ireland's HNV farmland. The principal concern of farmers in both regions for roll-out was that there would be consistency of scoring between project assessors and government administrators (inspectors and auditors) and that schemes would cover all semi-natural habitats within their farm holdings.

> "One thing I didn't do was put on lick for rushes. I'd normally put it on each year to control the rushes, but when you [RBAPS Pilot team member] came to me about the scheme I said I wouldn't put it on as it might bring down my score and I didn't want to get a 3 [and not get paid]. I got enough information from what you were saying to make that decision and so I haven't used chemicals for 2 years now. I might keep it that way, you don't know what the chemicals are doing, it's more natural without them."
>
> County Leitrim farmer enrolled in RBAPS Pilot

Also of interest to farmers, agricultural advisors and future scheme administrators was an estimation of the time potentially required to implement a results-based scheme. The time for this pilot project totalled *c.* 2.4 days per farmer per year which included farmer engagement with specialist advice on achieving the biodiversity target and scoring of land parcels. Although a direct comparison of this time against management-based schemes was not possible, this level of time commitment appears to be broadly similar to that of farmers in the Burren Programme.

Long-term changes in environmental awareness or farm practices could not be formally captured because the farmer pilot phase operated over two years, although farmers anecdotally expressed opinions to the project team which indicated changes of attitude towards the environment and land management. The results-oriented European Innovation Partnership projects, particularly the Hen Harrier and Freshwater Pearl Mussel projects, which run for 5 years, can provide greater insight into farmer acceptance and interaction of such approaches.

DISSEMINATION AND COMMUNICATION

The project has been presented at conferences in Ireland, Spain, Belgium, Poland, Denmark, Italy and Cyprus by RBAPS Pilot team members and partners. The project website (www.rbaps.eu) was continually updated during the project and a project newsletter was produced in spring of each year. Regular meetings were held with local groups and project stakeholder advisory meetings were held annually in each pilot area. Numerous articles and interviews have been published or presented in local and national press/media to promote results-based schemes and showcase their value for HNV farmland and elements in the wider farming environment.

Importantly, the pilot has fed into emerging results-based approaches in Ireland and throughout Europe. Members of the RBAPS Pilot team have assisted European Environmental Innovation Partnership (EIP) Operational Groups in Ireland with results-based elements. The County Leitrim species-rich grassland scoring assessment has formed the basis for grassland scoring assessments that have been included in the Hen Harrier and Freshwater Pearl Mussel EIPs, which between them aim to enrol >1,500 farmers by the end of 2019. The Shannon Callows Breeding Wader option, has been rolled out and adapted where relevant as part of the Irish Breeding Curlew EIP.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE ROLL-OUT

The RBAPS Pilot study built on the evidence and success of existing and previous results-based schemes, particularly the Burren Programme. Robust scoring assessments were developed for a wide range of species and habitats associated with grasslands and traditional croplands. Monitoring results indicate that these assessments are capable of distinguishing between grasslands of varying quality and cropland of varying quality, providing a valid basis for the assessment and payment for those of higher ecological value.

The scoring assessment and result indicators developed for the RBAPS Pilot measures have been a useful 'starting point' from which a wide range of measures for high quality targets could be delivered through scaled-up implementation of such schemes. The scope of the pilot comprised the development of targeted scorecards for rare or endangered species and

habitats. This, however, is only a starting point from which other habitats that provide important functions in terms of connectivity and landscape-scale biodiversity should be incorporated. The next step is to roll-out a scheme across a whole farm with a range of scorecards available for all habitats and biodiversity occurring on the farm. Moving to a farm-level assessment will encourage greater understanding by farmers and authorities of the ability of farm holdings to produce high quality ecosystem services, as opposed to focusing payments for production on a small proportion of the farm holding. To support the whole-farm approach, a comprehensive set of scoring assessments should be available that encompass the whole farm setting and diversity of habitats and features supported which are suitable for results-based measures.

Tiered payment structures that link the quality to the payment rate can incentivise change in farmer attitudes and management and bring about benefits for biodiversity targets. Payment rates must reflect the value of the biodiversity being produced, the effort required to produce it and also the prevailing market concerns. For example, the current €450 per hectare ceiling for permanent grassland payments under agri-environment is approximately €200 lower than income foregone for the opportunity to afforest in Ireland; this upper limit needs to be re-examined to facilitate greater scheme flexibility in attracting and maintaining farmers in result-based schemes.

It is clear from farmer response to the pilot that they want agri-environment schemes which fit their land, their type of management and their ability to deliver high quality environment, something many feel the conventional action-based schemes fail to take into account. This pilot has found that farmers, on the whole, view the results-based approach as a fair mechanism for delivering agri-environment payments. They are however, aware that there are pitfalls and that the policy, administration, expertise and resources need to be in place in order to make any type of scheme (action- or result-based), work for them and their farmed environment.

Results-based payments for agri-environment may be more challenging to roll-out in regions with no comprehensive agri-environment advisory service available to farmers, which would be the case for any agri-environment scheme with higher level biodiversity targets. Similarly, for any scheme type, up-skilling of advisors or farm information authorities and participants will be a key aspect in supporting and delivering scheme objectives and ensuring success of the scheme. It is also vital that sufficient resources are placed into the appropriate design, monitoring and evaluation of agri-environment schemes, both prescription and results-based.

To facilitate more widespread Member State uptake of the results-based approach to agri-environment, we recommend a dedicated Article within the post-2020 Rural Development Regulation in CAP. Having this in place will provide administering organisations, farm organisations and farmers with confidence that the schemes and approaches under Pillar 1 will be integrated with other schemes under Pillar II.

7

THE NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) FARM PLAN SCHEME

ANDY BLEASDALE AND BARRY O'DONOGHUE

ABSTRACT

The National Parks and Wildlife Service (NPWS) Farm Plan Scheme was launched in 2006. The main purpose of the scheme is to promote a focussed, targeted and innovative approach to farming for habitats and species of conservation interest in some of Ireland's most important biodiversity areas. Measures are tailored for the habitats or species in question, employing flexible and adaptive approaches to maintain and enhance these habitats and species at farm level. By trialling and enacting these plans, valuable lessons are learned, which in turn informs advice to the Department of Agriculture, Food & the Marine (DAFM) on measures that could be delivered under national, co-financed agri-environment schemes (AES).

Almost 800 NPWS Farm plans have been approved since the scheme was launched. As commitments entered into by farmers in the scheme have varied, payments have also varied across the range of plan types. An overview of the different plan types and lessons learned are presented in this chapter. The future of the NPWS Farm Plan Scheme, in a broader national context, is discussed.

INTRODUCTION

The Irish landscape and the habitats within it are the product of thousands of years of interaction with agriculture. During this time our wildlife has evolved to exploit the niches that this interaction has created. This relationship has never been constant; agriculture has always been a dynamic industry and it has responded to changing social and economic conditions. These changes over time have impacted on the landscape and the wildlife within it.

Since Ireland's accession to the European Economic Community in 1973, policies have been progressed to support food production, rural communities and environmental responsibility, but not always in a coherent manner. Headage and premia payments in the 1970s and 1980s encouraged sheep numbers to increase to levels that were clearly unsustainable for the environment, with resultant damage to upland habitats, erosion and siltation of rivers (Bleasdale, 1995). The intensification and specialisation of farming practices has seen the widespread loss of farmland birds in terms of numbers and range and indeed extirpation or national extinction (McMahon, 2007). In an era of cheap food, small and mixed farming enterprises have found it increasingly difficult to maintain viability. Farm holdings have been consolidated or farming has ceased with the land abandoned or converted to commercial forestry, which for the most part has been non-native plantations. The amount and type of traditional or High Nature Value farming that was in Ireland in the early 1970s has shrunk to pockets of the country, of counties and of localities. This loss of biodiversity has also been experienced at farm level.

In Ireland, approximately 1 million hectares are designated as Special Areas of Conservation and Special Protection Areas (collectively referred to as Natura 2000 sites) and Natural Heritage Areas (NHAs). Approximately 13% of the terrestrial area of Ireland lies within the Natura network. It has been estimated that circa 60% of the land in Natura 2000 in Ireland is farmed by up to 35,000 farmers (unpublished NPWS analysis, 2012). However designation does not automatically ensure appropriate management by farmers and other land managers.

Ireland's 3rd assessment on the status of listed habitats and species was submitted to the European Commission in April 2019. A summary report has been published by the National Parks and Wildlife Service which provides an overview of the main findings of the assessments. 85% of habitats are reported as being in Unfavourable status, with 46% demonstrating ongoing declines. The main drivers of this decline are agricultural practices which are negatively impacting over 70% of habitats, particularly ecologically unsuitable grazing, abandonment and pollution (NPWS, 2019).

The Court of Justice of the European Union has found against Ireland in terms of protection of vulnerable habitats and species, including a ruling in 2002 pertaining to extensive damage in Irish uplands by overstocking of sheep from the 1980s onwards. The Commission closed this case in 2009 following the adoption of measures to restrict sheep numbers to environmentally sustainable levels on fragile peatlands soils. Agri-environmental schemes, including the NPWS Farm Plan Scheme, played a significant role in this. Arising from a case brought by the European Commission, the Court of Justice of the European Union delivered judgment in 2007 on Ireland's implementation of the Birds Directive. The Judgment referred to six separate complaints and gave a ruling in respect of each one. Again agri-environmental schemes played a significant part in the Programme of Measures aimed at addressing the rulings of the Court.

In 2015, the European Commission issued a letter of formal notice to Ireland for failing to, inter alia, adopt the necessary conservation measures required for the country's Special Areas of Conservation (SACs). This was followed by a Reasoned Opinion, which opens infringement proceedings against a Member State and is the basis on which the Commission grounds its case before the European Court of Justice. Naturally agri-environmental schemes will be central to the delivery of conservation measures to address the pressures and threats that are being experienced within the SAC network.

In parallel, there are many challenges facing agriculture and rural communities that can result in significant changes to land use patterns. While change is inevitable, an opportunity does exist to seek to manage change in order to preserve important habitats and species, while working in partnership with the farming community and other stakeholders.

THE NPWS FARM PLAN SCHEME

Since its establishment in 1979, NPWS has engaged in local management agreements with landowners. This was initially mainly on an *ad hoc* basis, as required. For example, fertiliser may have been purchased in the spring for a farmer who facilitated a flock of Whooper Swans or White-fronted Geese

over the winter months. This was, in essence, a locally-led approach. At the turn of the millennium however, it became apparent that there was a need for a structured mechanism of supports for targeted action and agreements between NPWS and local landowners and from this, the NPWS Farm Plan Scheme was developed.

The National Parks and Wildlife Service runs a Farm Plan Scheme (www.npws.ie/farmers-and-landowners/schemes/npws-farm-plan-scheme) to work with farmers to develop and deliver plans to create, maintain and enhance conditions for some of Ireland's most important habitats and species. Lessons learned, at what is a relatively small scale, can inform approaches to deliver on Ireland's biodiversity commitments (Bleasdale and O'Donoghue, 2015). The NPWS Farm Plan Scheme provides an important learning opportunity to test measures prior to national application, where appropriate, by the Department of Agriculture, Food and the Marine (DAFM) (Bleasdale and Dromey, 2011). In some cases, at certain scales and for more specific interventions, the NPWS Farm Plan Scheme may be the most suitable and responsive mechanism for incentivising conservation.

The NPWS Farm Plan Scheme was launched in 2006 after a period of planning and development involving NPWS officials, contracted agri-environmental planners and pilot farmers. The scheme is underpinned by a published set of Terms and Conditions, (www.npws.ie/sites/default/files/files/npws-farm-plan-scheme-terms-conditions-2017.pdf) that outline the various administrative protocols and parameters relating to farm plans, as well as the obligations of the plan participant, farm planner and NPWS administrators.

At farm level, measures are tailored towards the biodiversity and management requirements of particular fields or areas of conservation importance. In total, 779 NPWS farm plans have been approved. Plans are typically of five-year duration, with the participant free to leave at any time. To date, the NPWS Farm Plan Scheme has developed ten broad plan types (Table 7.1) across a wide geographical distribution (Figure 7.1). As different undertakings are required for different species or habitats, standard payment rates differ across the range of plan types (Table 7.1).

The NPWS Farm Plan Scheme has to date focussed predominantly on birds (Fig. 7.1), with more than 53% of plans targeted at Breeding Waders, Chough (*Pyrrhocorax pyrrhocorax*), Corncrake (*Crex crex*), Geese/Swans and Hen Harrier (*Circus cyaneus*). In addition, the commonage and Shannon Callows plans were initially driven by concern for bird species (primarily Red Grouse and Corncrake respectively). All of these species are listed as Birds of Conservation Concern in Ireland (Colhoun & Cummins, 2013) and all of the bird plans to date have been based in Special Protection Areas.

Between February 2006 and 2019, a total of approximately €28 million was spent in circa 23,000ha under the scheme. This average investment of approximately €2m per annum has provided an opportunity to develop appropriate methods of managing the targeted habitats and species and to receive feedback from farmers, ecologists and planners. This experience informed the NPWS advice to DAFM on measures for consideration under the Irish Rural Development Programme and CAP Strategic Plan. It also provided financial supports to farmers with High Nature Value (HNV) farmland across various parts of Ireland, primarily in designated areas.

Below:
Figure 7.1
Distribution of NPWS farm plans according to type and proportion

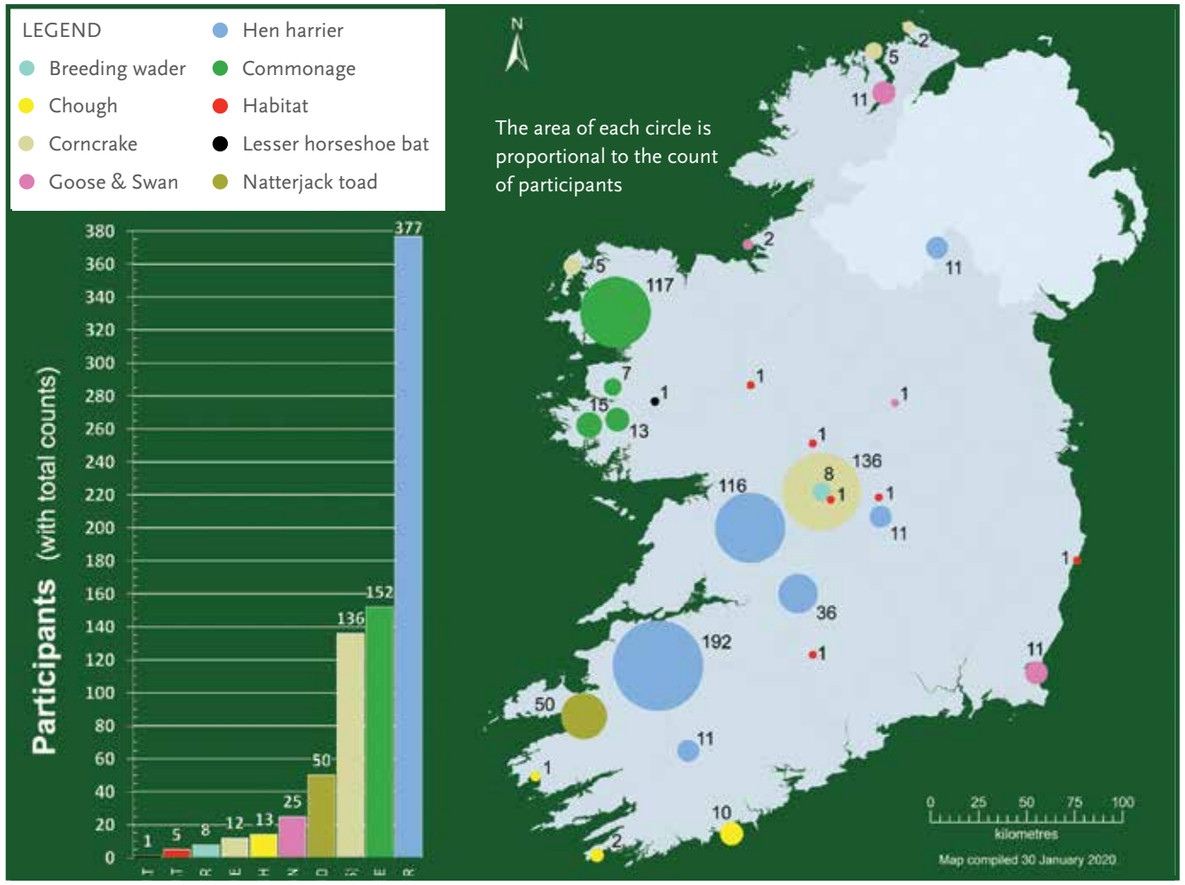


Table 7.1.

TYPES OF NPWS FARM PLANS, NUMBER OF PLANS AND MEDIAN PAYMENTS FOR THESE PLANS

PLAN TYPE (COMMENCEMENT DATE)	NUMBER OF PLANS	MEDIAN PAYMENT PER PARTICIPANT (€)
Commonage (2006)	186	N/A
Habitat plans – dune, fen, turlough, esker (various dates)	5	12,459
Geese and Swans (2006)	25	11,549
Shannon Callows (2008)	136	2,239
Corncrake – outside the Shannon Callows (2012)	12	5,460
Chough (2008)	13	4,195
Hen Harrier (2008)	377	7,347
Natterjack Toad (2008)	50	1,000
Lesser horseshoe bat (2017)	1	4,337
Breeding Wader (2014)	8	8,977

Farmers involved in the scheme have often commented that the interest shown in their farm *via* the NPWS Farm Plan Scheme gave them a sense of pride because the land that was heretofore termed 'marginal' was now at the centre of considerations for the NPWS and that their management of that land was important.

Payments for engaging in measures are based on costs incurred or income foregone and are roughly the same as payments for similar measures in, for example, the Green, Low-carbon Agri-environment Scheme (GLAS) implemented by DAFM. However there are some important differences, depending on the measure and the approach taken by either NPWS or DAFM. For example, there is not an overall individual cap on the amount a participant can receive in the NPWS Farm Plan Scheme (it is limited at €5,000/year per participant for GLAS and €2,000/year for GLAS+). Another point of difference is that payments for the creation of Early Late Cover in NPWS Corncrake farm plans are costed and paid separately from meadow payments, focussing attention and money on the component parts, whereas GLAS pays a flat per hectare payment. The NPWS Farm Plan Scheme for Corncrake also allows cutting if birds are not present, thereby being more adaptive and responsive. The NPWS Farm Plan Scheme is designed to be flexible and, subject to funding being made available, plans and new approaches could be further developed for a range of habitats or species.

The Prioritised Action Framework for Ireland (www.npws.ie/news/prioritised-action-framework-launch) prioritises the objectives and types of conservation measures, and where these measures will be delivered, as required by Article 8 of the Habitats Directive. In addition, plans are also considered where NPWS identify a requirement for delivering interventions that will (a) help a particular site, habitat or species achieve favourable conservation condition and/or (b) provide useful experience in managing for a habitat or species heretofore not catered for under the agri-environment schemes of the Rural Development Programme/CAP Strategic Plan. The scheme is not targeted according to geographic location, rather towards some of the most important conservation sites or sites in greatest need of intervention. In accordance with previous iterations of the NPWS Farm Plan Scheme, farm plans have occurred in Natura sites, although this is no longer a prerequisite for entry to the scheme.

Prior to budgetary constraints the Scheme was open for general entry for particular measures; however, selection and entry to the Scheme is now undertaken by the National Parks and Wildlife Service, rather than by general application. Because the scheme is acting predominantly as a test bed to trial new or particular approaches, farmers or sites with particular habitats or species are targeted. The Prioritised Action Framework informs decisions on what habitat or species targets are prioritised, or what farms are targeted for entry to the NPWS Farm Plan Scheme. The NPWS also considers: the return that can be gained from investing in a particular plan; the expected biodiversity outcome; the learnings that can be taken forward and the potential of the plan to inform future AES measures.

Farmers that are in other national AES are generally not eligible to join the NPWS Farm Plan Scheme, unless it can be clearly shown that measures undertaken in either scheme are entirely separate or complementary to avoid any risk of double-funding, i.e. paying for similar actions or outcomes on the same land.

OVERVIEW OF FARM PLAN SCHEME DELIVERED TO DATE

Commonage plans

The management of commonage land with respect to grazing has been a cause of significant concern since the early 1980s. Ireland committed to undertake a comprehensive assessment of the condition of commonages throughout the country and surveys commenced in 1999 and continued until 2006. The surveys were jointly administered by the Department

of Agriculture and the NPWS. Circa 440,000 ha of commonage was surveyed by 50 teams of trained planners resulting in the preparation of approximately 4,400 commonage framework plans (CFPs). The findings of the commonage plans were communicated to the relevant farmers with sheep quota in October 2002 by the Department of Agriculture. Sheep were destocked, where necessary, arising from the findings of the CFPs.

Subsequently NPWS co-ordinated a re-assessment of some large commonage blocks commencing in 2004 and 2005. The resurvey of commonage blocks continued until 2010. Two large blocks in Counties Mayo and Galway were deemed to not have demonstrated sufficient recovery and consequently further grazing interventions were required. These interventions commenced in the Owenduff/Nephin Complex SPA in November 2006, to run for a five year period. A similar intervention commenced in the Twelve Bens/Garraun and the Maumturk Mountain Complex SACs in November 2008 for a five year period. Farm plans were prepared that specified reduced stocking levels, as required, and off-wintering as mandatory on commonages. These interventions were co-ordinated by NPWS and operated across REPS, AEOS and NPWS Farm Plan schemes. REPS and AEOS farmers were paid €2,000 per annum for compliance with the additional grazing restrictions in the Co. Mayo and Co. Galway grazing restriction areas. Farmers in the NPWS farm plan were compensated for off-wintering and destocking, at agreed rates.

Arising from a second resurvey in the Owenduff/Nephin range in 2010, it was concluded that some areas were showing significant recovery but approximately half of the SPA had not recovered to a sufficient extent, and revised restrictions were necessary for a further two years. Both grazing interventions concluded in November 2013.

A separate evaluation of commonages (in 2008) which had a destocking greater than 50% showed that significant recovery had been delivered at a national level in the years since the original CFPs were prepared.

Geese and Swans

Ireland is of international importance in terms of the numbers of Greenland White-fronted Geese *(Anser albifrons flavirostris*) and Whooper Swans (*Cygnus cygnus*) that visit every winter. In recent decades these birds are mainly found on improved agricultural grassland, where they make use of the grass for feeding before they return to their breeding grounds in Greenland and Iceland respectively. This is an obvious imposition on the farmers who manage the fields these birds feed on, resulting in a reduced sward or "bank of grass", in addition to a "panned" or compacted field surface. The NPWS Farm Plan Scheme works with farmers to facilitate significant numbers of geese and swans in the winter period, by delivering a quality sward of c. 15cm on grassland and generally closing off from grazing of livestock and machinery operations from mid-October to March.

One of the first NPWS farm plans accommodated over 800 Greenland White-fronted Geese, over 1,500 Whooper Swans and over 1,200 Greylag Geese (*Anser anser*) in an intensive farm in an SPA in Donegal.

CASE STUDY
WEXFORD SLOBS

The Wexford Harbour and Slobs area in south east Ireland are of international importance for several species of waterbirds and support an average of close to 50,000 waterbirds each winter, making it one of the top three sites in the country for numbers and diversity of wintering birds. The combination of estuarine habitats, including shallow waters for grebes, diving duck and seaduck, and the farmland of the polders, which include freshwater drainage channels, provides optimum feeding and roost areas for a wide range of species. It is one of the two most important sites in the world for Greenland White-fronted Goose (close to 10,000 birds per annum). The geese feed almost entirely within the Slobs and roost at The Raven (a separate SPA). The site also has internationally important populations of Mute Swan (543), Light-bellied Brent Goose (1,469), Bar-tailed Godwit (1,696) and Black-tailed Godwit (790).

Obviously, this number of wildfowl, in particular geese and swans, has the potential to come into conflict with farming, given the birds will eat grass and crops as well as lead to panning of the surface and a lag in the growth of grass in the spring. The NPWS Farm Plan Scheme has been instrumental in maintaining positive relationships between farmers and conservation interests in the area. One of the most interesting features of the approach taken with these farm plans, of which there have been 11, covering some 1,338 ha, has been that they have effectively been managed as an overall unit, by one farm planner, enabling management at a landscape scale. The birds obviously do not operate on a farm by farm basis, rather take an overview of the landscape themselves and select the best places from day to day. The approach here has enabled coherent planning on a multiannual basis, to ensure that there is always a rotation of high quality habitat across the overall area. For example, spreading of slurry has been managed to ensure there is always a substantial area that is 'clean' and not recently treated, while reseeding of lands has similarly been undertaken on a rotational basis to ensure that there is always a substantial area of lush green growth available for the geese or swans.

Figure 7.2
Wexford Slobs © Alyn Walsh, NPWS

Chough

The Irish Chough population makes up approximately 60% of a geographically distinct and isolated northwest European population of circa 1,500 pairs. Chough is listed in Annex 1 of the Birds Directive and SPAs were designated in Counties Waterford, Cork, Kerry, Clare and Donegal and an NPWS farm plan prescription developed in tandem for interested farmers. This primarily entailed maintaining and enhancing habitats such as earthen or stone embankments, maritime turf and coastal heath and dry acid grassland. Areas of scrub were removed where appropriate, to allow increased foraging area. Silage cutting and grazing regimes were tailored to ensure that at least 40% of the target area was a "tight sward" of 2-3cm, which favours the Chough's requirement to feed on surface and soil invertebrates. Where farmers had to carry out dosing of livestock, plan participants were required to avoid ivermectins and use levamisoles and cypermectins.

Corncrake (including Shannon Callows)

The modernisation of agriculture has impacted negatively on traditional strongholds for Corncrake in Ireland. Since 1993, the NPWS have been proactively working with farmers to protect Corncrake adults, nests and chicks from mowing. A responsive or adaptive approach is required to conserve this species, given the nature of its ecology. The efforts for Corncrake in the NPWS Farm Plan Scheme were initially focussed in the Middle Shannon Callows SPA and subsequently efforts have been delivered in the other SPAs selected for Corncrake in accordance with a national policy framework (NPWS, 2014).

The Shannon Callows is one of the great floodplains in north-west Europe and is very important for biodiversity; it was previously also important for Corncrake. The NPWS Farm Plan Scheme attempted to manage cutting of meadows at farm and site level in a staggered way (i.e. varying dates) over the 5 years of the plan, and to deliver centre-out mowing to ensure the conservation of the species. The NPWS Farm Plan Scheme was delivered in parallel to REPS (Rural Environment Protection Scheme), and follow on AEOS (Agri Environment Options Scheme) plans for Corncrake in the SPA, and it was hoped that the integrated effort would serve to increase the breeding and hatching success of the species in the site. The measures for Corncrake in the NPWS Farm Plan Scheme were delivered in association with a prescription for traditional management of grazed lands, to maintain an extensively farmed system overall.

Although there are still NPWS farm plans and GLAS plans active in the Shannon Callows, the last Corncrake type plan under the NPWS Farm Plan Scheme expired in 2013. The conclusion of efforts for Corncrake in the site was as a result of the functional extinction of the species in the site, despite the specific conservation efforts described above. It is concluded that the frequency and duration of summer flooding in the site, as well as heavy predation rates resulted in the poor breeding and hatching of the species in the meadows on the Callows.

In 2013, a new approach to engaging with farmers for Corncrake conservation was piloted in the last remaining Corncrake strongholds. The main premise of this is to "forward plan"; to attract birds to particular fields that would be "set aside" for Corncrakes. Early and Late Cover (ELC) stands of vegetation (primarily nettle beds, although other options are available) are introduced within or adjacent to those fields, whereby these stands would be available and attractive before the general grassland area



would have grown in the summer. The farmer is paid to delay mowing, grazing and field operations until 15 July at the earliest. If the fields become 'active' (i.e. hold a calling male or breeding Corncrakes), mowing is held off until 20 August or 01 September and the farmer is paid accordingly. The creation of ELC entails significant field skills and dedication and is paid at an enhanced rate, compared to the delayed mowing element of the plan.

In addition to the NPWS Farm Plan Scheme in the SPAs, a separate Corncrake Grant Scheme (CGS) is operated by NPWS regional management to provide a means within and outside the SPA network to work with farmers to protect Corncrake. This 'toolbox approach' is necessary when dealing with species such as Corncrake.

Above from left to right

Figure 7.3
Species-rich meadow produced as part of an NPWS Corncrake farm plan © Barry O'Donoghue, NPWS

Figure 7.4
Creating a cover crops, including as early cover for Corncrake upon their arrival from Africa © Feargal Ó Cuinneagáin

Figure 7.5
The created nettle bed, which also serves as cover through the entire Corncrake breeding season © Feargal Ó Cuinneagáin

CASE STUDY

MULLET PENINSULA

It is fair to say that Feargal Ó Cuinneagáin is not a "typical farmer". He is a vet, who farms land for Corncrakes and for various other rare and common species, as well as producing crops of hay or silage for neighbouring farmers each year. Feargal bought a 10 hectare plot on the Mullet Peninsula in Co. Mayo with the sole purpose of helping Corncrake. The National Parks & Wildlife Service (NPWS) and Feargal entered an agreement under the NPWS Farm Plan Scheme in March 2016. The objective of the plan was to return Corncrakes to the farm, but also to take a holistic approach to supporting biodiversity including Twite (another 'red-list' bird), Chough, Barnacle Geese, pollinators, and habitats in their own right. The Agri-Ecology Unit of NPWS and Michael Martyn Agri-Environment Consultants worked closely with Feargal in designing and implementing a series of measures to convert what was a monoculture of grass to diverse hay meadows that would have been commonplace throughout the Irish countryside in previous generations.

Michael Martyn, the farm planner explains what changes have taken place, from the first turning of the sod:

> "It is said create the habitat and the species will come. On this farm the species rich meadows with abundant yellow rattle produce an open sward favoured by the Corncrake for nesting. But early in the season when the Corncrake arrives back from overwintering in Africa to begin the breeding cycle again, nesting cover and food source is in very short supply in this

Figure 7.6
A happy farm plan participant with results in the background © Feargal Ó Cuinneagáin

exposed coastal landscape. In response to this, the plan set about creating Early and Late cover (ELC) plots. If Corncrake arrive onsite, mowing is delayed until late summer. The centre-out mowing is used and a generous headland remains uncut and this and the ELC margin provide a refuge for broods to escape into cover safely. For Twite and other farmland birds, a cereal/brassica mix such as kale, mustard or radish and triticale was sown. This creates both a Summer/Autumn crop and a Winter crop producing bird seed of different sizes, insect food and cover while doing so in the 'hungry gap', the late Winter/ early Spring period. The plan adopts a holistic approach, creating the traditional agricultural habitat mosaic and restoring natural habitats on the farm."

Feargal, who has a great appreciation for wildlife, has been delighted with results delivered within a short few years.

"For me, entering the NPWS scheme has been a welcome boost due to the farming income I receive, as well as having advisory support. Since I joined, there has been a remarkable increase in the rare and threatened wildlife on my farm. Twite arrived in 2017 with at least twenty six birds feeding on the crop we created. There were no Corncrakes present when I joined, and in the summer of 2018 there were six calling males. In the winter, Barnacle Geese graze on the farm. The air is filled with the sound of Skylarks in the summer. A family of Chough have started to nest in a neighbouring derelict building, after I installed a nest box provided by the NPWS. I have also managed the hay meadow, specifically by focussing on Red Clover, as well as planting Phacelia and Kale, resulting in a benefit to the threatened Great Yellow Bumblebee."

Figure 7.7
Successful planting and establishment of a new fruit bearing hedgerow comprising native species, introduced as part of a Hen Harrier farm plan. © Barry O'Donoghue, NPWS

Hen Harrier

The Hen Harrier is an Annex I species that has seen significant declines in Ireland as a result of changes in the upland landscape. Afforestation (primarily with Sitka Spruce) of natural and semi-natural habitats including heather moorland and HNV farmland, has been a significant change in this landscape in recent decades, in association with other factors such as decoupling of farm payments, an ageing farming population, rural population decline, limited succession and increased predation. These factors have had consequences for the suite of open landscape and ground nesting bird species that once flourished in these areas including Skylark (*Alauda arvensis*), Meadow Pipit (*Anthus pratensis*), Red Grouse (*Lagopus lagopus*), Curlew (*Numenius arquata*), Snipe (*Gallinago gallinago*) etc. The Hen Harrier, being a bird of prey, is an indicator species and a decline from an estimated 250-300 breeding pairs in the 1970s to 108 confirmed breeding pairs in 2015 may reflect a wider decline in biodiversity and ecosystem health. The intensification of agriculture, including reclamation,

reseeding, removal of scrub habitat, unmanaged burning etc., have also had a negative effect. In 2007, in tandem with the designation of the SPAs, NPWS introduced a measure for Hen Harrier under the NPWS Farm Plan Scheme. The primary approach taken was to support and deliver a mosaic of habitats including tussocky vegetation, scrub, rush, hedgerows and wild bird cover, through appropriate grazing or capital works. There was significant interest in this scheme by farmers in the Hen Harrier SPAs.

Figure 7.8
Conor and Eamonn McEvoy, continuing their family heritage of farming with nature. © Barry O'Donoghue, NPWS

CASE STUDY
SLIEVE BLOOMS

Conor McEvoy is a young farmer, bucking the trend of an ageing and declining farmer population managing High Nature Value farmland in the uplands. He inherited his father's farm in the Slieve Blooms in Co. Laois in 2017. This land has been in his family for generations. At the time when the farm plan came into place, Conor's father Eamonn was just about to completely plant the farm with forestry, predominantly Sitka Spruce.

> "The farm plan was effectively the first time that the State seemed to value our type of land" says Conor. "Until then, our generally wet and poor agricultural land was something we were conditioned into thinking was something to be ashamed of, certainly nothing to be proud of. I have often heard of this land being referred to as 'forestry land', that it was good for nothing else really. Many of our neighbours left farming when they opted for the large Government grants to plant their land. We very nearly went the same way. The farm plan valued the habitats and the species that shared the farm with our cattle. It gave us a sense of pride, that our farm and our management were very important for a magnificent bird called the Hen Harrier, which is rare in Ireland and across Europe. I am proud to continue to look after my family's heritage, but so too the natural heritage of the area."

This newfound sense of pride in their management and land inspired Conor and his father Eamonn to bring in particular types of stock, including highland cattle and ponies that would open up some of the areas that were being dominated by scrub. They created 'rides' through thick gorse to increase the surface area and linear habitats available for harriers to hunt and for passerines and small mammals to live. They trialled strip mowing of rushes, which was later applied in the national agri-environment scheme, GLAS. They created over 200m of new native hedgerow, including fruit bearing trees that would serve to feed small birds and small mammals over the winter. They cleaned up areas of the farm that had been damaged by supplementary feeding and they grew a hectare of wild bird cover, which hosts bird life and small mammals. This was the first trial of a results-based Hen Harrier farm plan, which has now been applied more widely by the Hen Harrier Project EIP (European Innovation Partnership). The habitat quality on the farm has improved over the years and sightings of hunting Hen Harriers are now commonplace each summer, a sign that the farm is obviously hosting significant numbers of other wildlife.

> **"The farm plan valued the habitats and the species that shared the farm with our cattle. It gave us a sense of pride, that our farm and our management were very important for a magnificent bird called the Hen Harrier, which is rare in Ireland and across Europe.**

from top:
Figure 7.9
Male and female Natterjack Toads in amplexus, with spawn strings.
© Barry O'Donoghue, NPWS

Figure 7.10
Natterjack Toad pond being created in County Kerry.
© Ferdia Marnell, NPWS

Natterjack Toad

The Natterjack Toad (*Epidalea calamita*) is Ireland's only native toad species and is listed on Annex IV of the Habitats Directive. The natural range of the Natterjack Toad in Ireland is confined to a small number of coastal sites on the Dingle and Iveragh peninsulas in Co. Kerry. This range has contracted substantially from what it once was and individual sites were becoming geographically isolated from one another, with risks of associated genetic bottlenecks and population unviability. In 2007, NPWS developed a measure to counter this by providing new ponds for the toads to breed in and to enhance the connectivity between sites. There has subsequently been good uptake, across approximately 50 farms, where 94 ponds were created. As the toad requires a short sward to physically chase its prey, but with tussocks to support invertebrate prey, grazing is a key consideration of these plans also. The most recent monitoring report found good evidence of the new ponds being colonised with successful spawning at some of those sites (Sweeney et al., 2013).

Breeding Waders

Breeding Waders are a particularly vulnerable group of ground nesting birds and farm plans were developed in cooperation with BirdWatch Ireland in the Shannon Callows for Lapwing (*Vanellus vanellus*), Snipe, Redshank (*Tringa totanus*) and Curlew as a group. The NPWS initially ran a "Breeding Wader Grant Scheme" from 2006 to 2015, with a set prescription including stocking rates and exclusion dates. In 2014, the first attempt at a results-based scheme for breeding waders in Ireland was trialled, with a scorecard developed and implemented. This was then further developed in the RBAPS project (https://rbaps.eu/; see Chapter 6) which was implemented in Ireland from 2015 to 2018.

Lesser Horseshoe Bat

The Lesser Horseshoe Bat (*Rhinolophus hipposideros*) is an Annex II species that is found in Ireland only in counties Cork, Kerry, Limerick, Clare, Galway and Mayo. It breeds mainly in old buildings such as farmhouses and outbuildings. It uses the farmed landscape primarily through the connectivity of hedgerows and is often associated with nearby native woodland. In 2017, NPWS introduced the first farm plan for Lesser Horseshoe Bat, focussing

on the connectivity foraging/commuting routes, provision of night roosts (away from the main roost), avoidance of ivermectins and the securing of a maternity roost, which was in danger of collapse. The plan is primarily driven by capital intervention in Year 1, with an annual payment thereafter for maintenance. The plan also serves a useful purpose as a trial for applying a results-based approach to planning for Lesser Horseshoe Bats, by monitoring the quality of habitat before and after intervention. It has been shown that such interventions have a positive effect, with increased bat numbers at roosts even within the first year after work.

Habitat-focussed plans

The NPWS farm plans targeted at commonage, dunes, eskers, fens, and turloughs could essentially be categorised as grazing type plans, whereby the NPWS Farm Planner worked out an appropriate stocking rate and grazing regime and provided a prescription for the plan participant to follow. In some cases, interventions are also required to manage scrub that may impact negatively on the habitat in question.

Other plans, measures and programmes

In addition to the NPWS Farm Plan Scheme, NPWS have also invested in the following types of agreements with landowners:

- Curlew Conservation Programme (https://www.npws.ie/farmers-and-landowners/schemes/curlew-conservation-programme)
- Corncrake Grant Scheme
- Land leasing/conacre

It is important to retain a range of tools in the farm planning toolkit, to suit particular requirements. For example, the Corncrake Grant Scheme is a very important facility to draw upon where Corncrake nest in fields that are not covered by existing NPWS or DAFM contracts with farmers and where the farmer is encouraged into an annual commitment to manage for Corncrake in the year in question.

ENGAGING FARM PLANNERS

Agri-environmental planners have been trained by NPWS on particular conservation issues and to enable farm plan preparation since the inception of the scheme. This included classroom sessions and field visits, with direction and leadership from respective experts on particular habitats or species. A panel of farm planners was formed for particular plan types, from which a prospective applicant can select a planner to prepare a farm plan. In certain cases, specialists were brought in as the farm planners, and no training was required i.e. they were fully competent on what was required in particular instances for particular species or habitats.

The farm planner is contracted by NPWS to identify the habitats and species on the farm, consider issues at field level, liaise with the landowner(s) and design actions that the plan participant is to follow in order to maintain, enhance, restore or create habitats. NPWS pay for the farm planner, to maintain independence from the plan participant and thus the integrity of the plan and annual compliance certification.

In addition, up to 10% of the plans are audited each year, to ensure that what is being paid for is what is being delivered in terms of habitat, and that all paperwork is in order, including the annual compliance certification of the farm planner. Farm planners are considered on probation for particular plan types until one of their first three plans has been audited and approved. If the standard of farm plan is at that stage deemed adequate, the planner receives approved planner status. If the standard of the audited plan is not deemed adequate by the NPWS, the planner will be allowed to produce one more plan. This plan will be audited, if it is deemed adequate the planner will receive approval. If this second audited plan is not deemed adequate the probationary approval will be revoked. There is regular engagement between NPWS and approved farm planners, with drafts of farm plans being discussed and developed in a collaborative manner. Throughout the lifetime of any plan, there is ongoing communication between the planner and NPWS and the plan participant, with a view to consolidating positive results and building towards progression.

PRESCRIPTION-BASED OR RESULTS-BASED NPWS FARM PLANS?

The main approach adopted by the NPWS Farm Plan Scheme since its introduction in 2006 has been a prescriptive one. These prescriptions were developed in tandem with habitat or species specialists and agri-environmental planners. While farming organisations would have been consulted at a general level, the prescriptions themselves were not informed by farmers. However, on the ground, NPWS farm plans have always maintained the flexibility to work with what makes best sense for the farmer, provided the intended results are achieved. Over the years, new ways of approaching the delivery of habitat condition have been informed by farmers, to varying degrees, largely dependent on how much the farmer 'bought into' the overall objectives of the scheme. The flexible approach of the NPWS Farm Plan Scheme allows new information, whether scientific or practical, to be brought into measures on the ground.

Looking at Article 12 (Birds Directive) or Article 17 (Habitats Directive) assessments for habitats or species relevant to the NPWS Farm Plan Scheme, it is difficult to translate national trends for a habitat or species to the outputs of a relatively limited NPWS Farm Plan Scheme operating in discrete geographical areas. While intuitively the NPWS plans have contributed positively to biodiversity, it is difficult to always make direct links between these interventions and the conservation status of habitats or species either locally or nationally. Results were largely measured in terms of whether the farm plan participant abided by his/her prescriptions or not e.g. were the rushes cut, was the pond created, was the hedgerow planted, the scrub cleared, the sheep off-wintered, the fence erected or the field reseeded, and so on.

NPWS has an ambition to better document the results of measures delivered in existing plans. Since 2015, NPWS have also moved towards measuring quality of habitat on an annual basis. The NPWS Farm Plan Scheme was the first to employ quality scoring for breeding wader, Hen Harrier and Lesser Horseshoe Bat. Since 2019, the Scheme is trialling scoring of farm plans for Esker and coastal grasslands and Corncrake habitat. Precisely determining the return for investments in agri-environment schemes across Europe has been an on-going issue. It is clear that close evaluation of impacts is needed (EU Commission, 2011) and that results-based payments offer a new approach to achieve results and measure impact (Maher et al., 2015). It is the intention of NPWS to have a clear results-based focus in all future NPWS farm plans. This is to ensure the Farm Plan Scheme can measure the impact of interventions and, in parallel, incentivise participants to strive to deliver the best condition habitat that they can. With the prescriptive approach that has been largely employed to date, participants were not encouraged to strive for optimal condition. At the same time, NPWS intend to retain what some refer to as a 'hybrid' approach, to pay for supporting measures to allow the plan participant to increase their score (and subsequently increase the value of the habitat or environment). Direct results have been observed for breeding waders from interventions such as predator-proof fences, scrub clearance or scrape creation that would not have been realised by scoring the quality of the habitat alone.

Scorecard for coastal sand dune habitats

Site: | Recorder: | Date:

Participant: | Field: | Score / Total Points

Habitats present: circle — Embryonic shifting dune (ESD); Shifting dune (SD); Fixed dune (FD); Machair (M); Humid dune slack (HDS); Semi-natural grassland (GS); Other:

A. Species composition

1 Average number of positive indicator plants (complete Table 1(a))

No. of plants	< 5 species	5-10 species	10-15 species	>15 species
	Bad	Poor	Fair	Very good
Points	0	5	15	20

2 Average cover of positive indicator plants (overall cover of those recorded on Table 1(a))

Cover	Low <25%	Med-Low 25-50%	Med-High 50-75%	High >75%
	Bad	Poor	Fair	Good
Points	0	5	15	20

3 Average cover of negative indicator plants (complete Table 2.) — Points

B. Physical attributes

4 Physical structure and function of dune system (signs of past sand extraction and dune levelling)

	Extensive damage to dune system	Some damage	not entirely intact	intact, as expected
	Bad	Poor	Fair	Good
Points	-20	-10	0	10

5 Vegetation structure (vegetation height [exclude Marram grass], & height of herbaceous flowering heads)

	Overgrazed, veg < 5cm, flowers suppressed OR scrubbing over	Heavily grazed, veg < 10cm, flowers suppressed OR rank veg. throughout	50% of area 5-20cm AND a) much of the rest <5cm OR b) much of the rest >20cm	50% of area 5-20cm; 25% >20cm; 25% < 5cm
	Bad	Poor	Fair	Good
Points	-10	0	10	20

6 a. Cover of bare sand on fixed dunes and machair (Record cover on Table 1(b))

% cover	>40%	10-40%	0-10%
	Bad	Poor	Good
Points	-20	-10	10

OR b. Cover of bare sand on fixed dunes and machair with *Petalophyllum*

% cover	>40%	15-40%	0-5%	5-15%
	Bad	Poor	Fair	Good
Points	-20	-10	10	20

C. Threats and pressures

7 Ongoing Site Management (assess: dung, tracks, poaching, fencing...) *(mis-management)*
Details: *Specify type and extent*

	Considerable issues over much of the site	Large proporion of the site affected	Minor problem	No issues
	Bad	Poor	Fair	Good
Points	-25	-10	5	20

8 Assessment of damaging activities (sand extraction, irrigation, dumping, burning, silage feeding...?) *(willfull damage)*
Details: *Specify type and extent*

	Large scale damage caused	Significant threat posed to habitat(s)	Minor problem(s)	No issues
	Bad	Poor	Fair	Good
Points	Not eligible for payment	-20	-10	0

Comments:

Figure 7.11
Example of a scorecard for coastal grassland to be used by the NPWS Farm Plan Scheme. Higher scores will result in higher payments, thereby incentivising a reduction in threats and pressures and an increase in habitat quality.

Scoring protocols have been designed for breeding waders (which were developed during the RBAPS project), Hen Harrier (which was subsequently developed by the EIP Hen Harrier Project (www.henharrierproject.ie), Lesser Horseshoe Bat and Esker. For Lesser Horseshoe Bat, habitat features and their condition were scored for quantity and quality, focussing on two main aspects of their ecology – shelter and feeding. There is a separate section on the scorecard for roost condition (how suitable it is and how stable it is), and an additional section for hunting habitat (quantity, type, connectivity and condition of hedgerow/woodland). Scores can be increased by supporting actions, paid for by the farm plan. Specifically for esker grassland, it is intended to adapt the RBAPS species-rich grassland scorecard. A scorecard for coastal grasslands is being trialled in 2019, as is a Corncrake habitat scorecard, focussing on early cover and meadow quality.

In addition to the positive ecological impact of NPWS farm plans, there was an obvious added-value in terms of knowledge exchange between the farmer, the farm planner and the administrators. It has been encouraging to see positive relations formed and maintained, which has fostered positivity amongst the participating farmers for biodiversity. Achieving farmer buy-in and understanding of the objectives of any farm plan is critical to delivering results (Burton and Schwarz, 2013; Cullen et al., 2018). The importance of good advisory supports and regular engagement and communication cannot be underestimated in terms of realising results.

Finally, and regardless of the types of farm plan being delivered or the delivery mechanism, learning from the experiences of others is important to ensure better outcomes from such interventions into the future (Ó hUallacháin and Finn, 2011).

SELECTED RESULTS OF THE NPWS FARM PLAN SCHEME

Commonage

A resurvey of the Red Grouse population within the Owenduff/Nephin Complex SPA was carried out in 2012, ten years after such a survey was previously carried out (Murray and O'Halloran, 2003). The reduction in grazing pressure and recovery in habitat, supported by the NPWS Farm Plan Scheme and coordinated by NPWS, facilitated an increase in Red Grouse numbers in the site. This survey (Murray et al., 2013) showed that Red Grouse numbers can recover quickly when habitat is managed appropriately. This survey estimated a population of 790 – 832 birds within the SPA, representing 3.08 – 3.25 individual birds per km². This represents an effective doubling of Red Grouse within the SPA within ten years. The off-wintering period started to take effect after 2006, and Red Grouse were seen in locations that they had not been recorded in prior to this measure. In the 2002 survey, six of the twelve 1 km² squares surveyed (50%) had no evidence whatsoever of Red Grouse, with eight of the twelve (66%) not having active pairs. The 2012 resurvey showed signs of Red Grouse in all twelve squares (100%), with active pairs also in all twelve squares (100%). Heather was estimated as having improved cover in eleven of the twelve squares (92%) in 2012 than in 2002, figures that compare favourably with Commonage monitoring data.

Similar results have been delivered elsewhere outside of the NPWS Farm Plan Scheme where active management has been undertaken. An annual survey of the Boleybrack Red Grouse Project in Co. Leitrim counted at least 85 grouse on Boleybrack Mountain in 2012. This compares to only three calling Red Grouse males encountered when the project first started in 2007. It is clear, however, that further management is required at landscape level to ensure improved management of habitats in Ireland for Red Grouse (Cummins et al., 2010, 2015)

The European Court of Justice case against Ireland, C-117/00, was closed in 2009 on foot of Irish commitments to continue interventions to resolve the serious overgrazing of hills in the grazing interventions areas in Counties Mayo and Galway, and in commonages across Ireland.

Corncrake

There were an estimated 4,000 Corncrake calling males in the early 1970s but numbers have reduced dramatically since then. While the population declines have somewhat stabilised since conservation efforts were enacted by the State in 1993 (O'Donoghue and Bleasdale, 2015), the geographical range of Corncrakes has reduced further. This includes the loss of the Corncrake population in the Shannon Callows, in spite of targeted agri-environmental measures delivered by NPWS and DAFM. Unfortunately, summer flooding during the 1990s and 2000s exacerbated the loss of the Corncrake from the Shannon Callows.

There have been some good success stories outside of the Callows where the NPWS Farm Plan Scheme assisted in creating early cover for the bird, particularly in areas where this resource is scarce. Where these early cover areas are successfully established, the birds will be attracted to them. This is

a particularly important result, as it also results in Corncrake being attracted away from the more intensive silage fields towards areas where there are commitments to delay mowing under a Farm Plan Scheme.

Hen Harrier

The measures implemented for Hen Harrier through the NPWS Farm Plan Scheme were central to securing thousands of hectares of farmed habitat to support the ecology of the species. The Scheme also helped promote positive relations between the NPWS and local landowners in the SPAs. However, approximately just 10% of landowners participated in the scheme due to the fact that many were at the time in REPS or AEOS and that the scheme was closed to general application in April 2010 due to budgetary curtailment. Nonetheless, and given the competing pressures and threats to the Hen Harrier (i.e. further afforestation, development of wind farms, increase in predator numbers, etc.), the efforts of the NPWS Farm Plan Scheme for Hen Harrier were important. The techniques and approaches delivered through the NPWS Farm Plan Scheme were instrumental in informing DAFM of prescriptions for GLAS and in progressing efforts for Hen Harrier under the European Innovation Partnership model.

Chough

For Chough, the population-scale impact of the scheme could be deduced with reasonable confidence, given that the farms involved in the Farm Plan Scheme were home to a significant proportion of the local population's habitat usage, and other land use change was not significant during the period of the plans. O'Donoghue et al. (2015) reported that over the duration of the Farm Plan Scheme for Chough in a discrete area, the breeding productivity of local Chough increased. In 2008, at the outset of the first Chough farm plans, a comprehensive survey of the Seven Heads SPA was undertaken by NPWS and BirdWatch Ireland (Trewby et al., 2010). This survey was repeated in 2012 and again in 2014. The main objectives of the surveys were to record breeding numbers, locations and productivity. The breeding productivity (young reared per attempt) of Chough in the SPA increased over the period of the Farm Plan Scheme from 1.08 in 2008 to 2.15 in 2012 and 2.50 in 2014.

Breeding waders

The provision of quality habitat structure and composition for breeding waders is obviously a key requirement of any agri-environmental measure aimed at securing their presence and breeding success at a site (Lauder and Donaghy, 2008). However, it is apparent that habitat alone is just one part of the equation and that (given the strength of meso-predator populations including fox, mink and hooded crow) predation control and nest protection is a fundamental requirement for breeding success. Sites protected with predator proof fencing have greater breeding productivity than those without (Malpas et al., 2013). Not all sites can have predator proof fencing, so direct predation control will be required in such areas. Agri-environmental measures focussed on breeding waders should always include reference to predator habitat and the need to manage it through non-productive investments.

LESSONS LEARNED

It is clear from the operation of the NPWS Farm Plan Scheme that a landscape approach is required for bird and bat species. Positive results have been realised for Greenland White-fronted Geese and Whooper Swans when actions have been planned across neighbouring farms that extend contiguously over hundreds of hectares. A piecemeal approach to breeding waders or Corncrake for example may not deliver sufficiently on a local or regional basis (for example if lands bordering a breeding wader farm plan are a haven for predators). In the absence of significantly enhanced funding, a landscape-scale approach will always be a challenge for the NPWS Farm Scheme. It is certainly something that should be encouraged in the schemes and projects such as GLAS, EIPs, INTERREG and dedicated LIFE projects, working in parallel to the NPWS farm plan scheme.

In future, it may be worth considering adopting geographical or landscape themes for Agri-Environment Schemes, rather than habitat or species themes. For example, an Agri-Environment Scheme for the Stack's Mountains of County Kerry could be an all-encompassing local programme for carbon, water, and biodiversity including Hen Harrier, Curlew, Red Grouse, Marsh Fritillary, species-rich grassland and so on.

It is clear that when operating with a limited budget, but almost unlimited demands, that it is important to strategically look at where funds are to be

directed. A deadline for applications each year would be required, to be assessed by a panel of NPWS specialists and senior management according to site specific and national needs, as well as value for money. For example, is the habitat or species already covered under another scheme, what is the conservation status of the habitat or species locally or nationally and could a new approach for a previously untargeted habitat or species be developed as an Agri-Environment Scheme through the NPWS Farm Plan Scheme?

The requirement for nest protection interventions (including direct predation control) has also been a learning point. Focussing on habitat is fundamental, but if there is a high risk of predation, enhancement of habitat is often not enough to stop that predator finding the nest and taking eggs or chicks or adults and thus rendering the time and money invested in habitat works redundant.

Non-productive investments have proven to be a vital tool in the toolbox for the NPWS Farm Plan Scheme to make immediate and telling interventions. Examples to date have included nest protection fences, wader scrapes, toad ponds, removal of scrub from threatened habitats, introduction of bird cover crops, hedgerows, securing of building structures, etc. When undertaken at an early stage in the plan, these interventions act as a springboard both in terms of actions to follow, in terms of landowner involvement and particularly in terms of ecological benefit.

In terms of participant buy-in and understanding, it is imperative that plans are clear and intuitive and not cluttered with too much information or background material. This can all be present and is often necessary, but the actions should be clearly summarised and displayed, ideally in the space of a couple of pages, with a map showing the plots and an associated table detailing what is to happen in each plot and when.

The lessons taken from the engagement on the ground in developing prescriptions for particular habitats and species have proven valuable in designing AES options and up-scaling under the Rural Development Programme. For example, all of the bird target species/groups trialled under the NPWS Farm Plan Scheme were prioritised under GLAS and some were taken forward under the European Innovation Partnerships.

In addition, lessons continue to be learned through engagement with other programmes and projects, such as the intervention being delivered at landscape scale in the Burren (Parr et al., 2010; see Chapter 3) and which is a source of inspiration both in Ireland and internationally.

Figure 7.12
Example of NPWS Farm Plan map and layout of actions for hen harrier.

PERCEPTIONS OF OTHERS

The NPWS Farm Plan Scheme is viewed by administrators, farmers, farming organisations, environmental Non-Governmental Organisations (eNGOs) and others as a valuable instrument for a number of reasons.

It provides a positive platform for engaging with farmers in some of the most important High Nature Value farmland areas of Ireland, including Natura and NHA sites. Participants in the scheme often comment that the engagement from NPWS Agri-Ecology Unit, local NPWS and the farm planner has provided them with an understanding of how important their fields are for particular habitats or species and that this in turn instilled a sense of pride and responsibility. On the other hand, it is fair to say that

a number of participants in designated areas viewed their farm plan as a form of 'compensation' for the restrictions associated with the designation. It should be borne in mind that the NPWS Farm Plan Scheme payments (as with any agri-environmental scheme) are based on participants going above their legal obligations. In the same way, local NPWS officials have commented that the NPWS Farm Plan Scheme has allowed greater and more positive communication with key farmers in their area.

The NPWS Farm Plan Scheme is generally seen as flexible and adaptable to work towards tailored solutions. A criticism however has been the capacity of the scheme to cater for as many plans as farming organisations, eNGOs or landowners would wish to see approved. In addition, and like RDP schemes, the plan duration of 5 years is seen as being too limited.

The Department of Agriculture, Food and the Marine has found the NPWS Farm Plan Scheme particularly useful in drawing upon experience of managing for particular habitats and species, prior to inclusion of measures for the same habitats and species under RDP schemes.

The NPWS recognise the importance of 'heart' in delivering sustainable conservation results. Many of the participants that have taken part in the NPWS Farm Plan Scheme have been inspired and equipped with the confidence to go above and beyond the prescriptions to create improved outcomes for the habitats and species found on their farm. This is of course chiefly due to the character of those people, but all that was needed was a recognition from the authorities of how important those individuals and the land held in their family for generations were on a local, national and international level. On a wider scale, it is important for the wider community to understand the importance of what these landowners are doing to safeguard and nurture what are becoming increasingly rare habitats and species of wildlife in Ireland. The NPWS Curlew Conservation Programme is a prime example of this. This much loved bird was once a common sound in the Irish countryside but has declined by 97% since the 1980s. Sites where the species is still surviving are a priority and what landowners do in those sites is obviously of immense importance, given that the Curlew is on the brink of extinction in Ireland and any loss from Ireland would reduce the international breeding range of the species. These landowners have been championed by the Curlew Conservation Programme and worked closely with it, in a positive and proactive way. The local communities have engaged in the conservation story, with on-going interaction and dialogue as to how important their locality is for Curlew and how proud they are

of this. This in turn leads to greater positivity around conservation efforts by NPWS. Indeed, most of those employed on the Curlew Conservation Programme are from the local areas themselves. It is hoped that in time, the narrative on conservation will be led by the local communities; that it is not about the Government or the EU wanting to protect Curlew, but that it is conservation by the community, because they want to keep their area special and retain the links to our natural and cultural heritage.

Figure 7.13
Some aspects of community engagement by the NPWS Curlew Conservation Programme. Children contributing art, education talks to local people, the Curlew Cup, and a Gaelic Football competition between local schools from Curlew areas

FUTURE POLICY CONTEXT

The NPWS Farm Plan Scheme will continue as an important scheme in the national context of;

- the Prioritised Action Framework for Ireland
- the National Biodiversity Action Plan and its contribution to the EU Biodiversity Strategy to 2020
- delivering direct interventions for nature conservation in a relatively quick and reactive and proactive way
- providing a learning opportunity for enhanced approaches to farm planning for particular habitats and species
- maintaining an interface between the NPWS, with primary responsibility for nature conservation, and those who manage the land on which the nature conservation priorities exist
- responding in a timely and proactive way to compliance cases against Ireland

NPWS has been and will continue to be involved in a number of other

initiatives to progress and shape agri-environmental policy at a national and European level. Examples to date include the Results Based Agri-environment Pilot Scheme (RBAPS), AranLIFE, KerryLIFE, the Burren Programme and LIFE Atlantic Crex.

The NPWS Farm Plan Scheme, while a national scheme, has adopted what may be considered a 'locally-led' approach. The case studies of the goose/swan in for Wexford and the Natterjack Toad plans in Kerry show how a coordinated and coherent approach can work to deliver at a landscape level necessary for the ecological requirements of the target habitats or species. The Corncrake case study shows how a plan ostensibly designed for Corncrake can grow to become something much more holistic; provided the one-to-one engagement and encouragement of an individual landowner. The Hen Harrier case study shows how one-to-one engagement can inspire a farmer to not alone continue farming, but to bring a new purpose and pride to the management of their land. Careful consideration will have to be given as to how the locally-led approach is rolled out across the country. The necessary knowledge, experience or expertise will need to be available locally or provided through appropriate supports and structures.

CONCLUSIONS

The NPWS Farm Plan Scheme has been entirely funded by the national exchequer since its inception, at a relatively small scale of operation, but nonetheless it provides an important function in the evolving agri-ecology policy space.

The NPWS seeks to engage with rural communities and farmers to ensure that habitats are enhanced and key species protected, in a way that involves the local people, provides support (both financially and in terms of advice) and is appropriate to the local level and ultimately delivers results. It provides a number of opportunities for supporting and promoting positive interaction between landowners and Ireland's natural heritage. Lessons learned through trialling innovative and bespoke measures for particular habitats and species allow better informed approaches to deliver on Ireland's biodiversity commitments. While in some cases the NPWS Farm Plan Scheme will provide an important learning opportunity for particular agri-environmental measures, in other cases it may be the most suitable and responsive mechanism for incentivising conservation. It is vital, in the overall context of agri-environmental schemes, to retain on a relatively small scale, the facility to experiment and learn, either from failures or successes.

The NPWS Farm Plan Scheme offers a mechanism for engaging with individuals in a joint conservation effort. Each party in this process has a role to play. Although the Scheme started out as a prescriptive, expert-led, top down, approach (and this is still necessary in many cases), it has over time evolved to be more landowner and community-involved and encourages feedback and ideas that are relevant to the plan, especially from the land managers.

The NPWS through the Agri–Ecology Unit will continue to provide vision, conservation guidelines, ensure consistency of approach and administer the scheme. The regional staff of the NPWS can provide local support and site based advice to planners and participants alike. Farm planners are the principal interface between the participant and the NPWS and their enthusiasm and professionalism serves to bring conservation interests and agricultural realities closer together in this joint enterprise. Of course, the key player in implementing the measures on the ground will always be the participant. The goodwill among the owners and managers of sites/lands that are important for biodiversity is the principal resource of the scheme.

The methods of the NPWS Farm Plan Scheme are not written in stone, never to change again. Like the scheme itself it is intended to evolve practices as lessons are learned and new challenges and indeed new opportunities are encountered.

ABOUT THE NATIONAL PARKS AND WILDLIFE SERVICE/ DEPARTMENT OF CULTURE, HERITAGE & THE GAELTACHT

The Department of Culture, Heritage and the Gaeltacht has a diverse portfolio. Its broad mandate is to promote and protect Ireland's culture and heritage; to advance the use of the Irish language; and to facilitate the sustainable development of the islands. The Department is the statutory authority for nature conservation in Ireland, with responsibility for implementing national and EU nature conservation law. The Department also has a number of statutory functions under planning law, in particular in relation to plans or developments which may impact on areas designated as Special Areas of Conservation (SACs), Special Protection Areas (SPAs)

and Natural Heritage Areas (NHAs). The National Parks & Wildlife Service (NPWS) of the Department is responsible for the formulation and implementation of policy and legislation relating to nature conservation and biodiversity. Within the NPWS, the Science and Biodiversity Section is responsible for the delivery of specialist scientific information and advice. Such advice pertains to the distribution of species, habitats and sites of conservation importance, their conservation status, the management of such sites, the selection of species, habitats and sites for statutory protection and the criteria for such protection, and other specialist advice as may be required from time to time.

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8

POLICY ENVIRONMENT ECOSYSTEM SERVICES AND THE ROLE OF RBPS IN INTEGRATED APPROACH TO AGRICULTURAL LAND USE

JAMES MORAN

INTRODUCTION

Results-based payments schemes (RBPS) in the European Union have evolved over the last 25 years as a method of improving the link between agri-environment scheme payments and achievement of environmental results. The prevailing approach to agri-environment schemes has been management- or action- based payments for which participants are paid for a prescribed list of management actions, which are expected to deliver the desired results. Action-based payment schemes have shown limited results in terms of delivering improvements in farmland biodiversity, apart from some geographically targeted, higher level schemes that have become increasing complex in terms of their design and implementation (Kleijn and Sutherland, 2003; Kleijn et al., 2006; Cullen et al., 2018; Dupraz and Guyomard, 2019). Hence, results-based payment schemes have received increasing attention over the last ten years (Matzdorf and Lorenz, 2010; Burton and Schwarz, 2013; Keenleyside et al., 2014; Herzon et al., 2018; Maher et al., 2018). Results-based payment schemes were first introduced in the early 1990s and early examples in the UK, Netherland and Germany focused on species-rich grassland and birds in grassland and arable areas. In general, they have been applied as higher tiered agri-environment measures targeted at specific geographic areas. A range of approaches have developed that vary from pure results-based to hybrid approaches that combine results-based payments with complementary actions (Herzon et al., 2018). The

main focus of RBPS to date has been on biodiversity targets but there is increasing interest in their application to a range of other ecosystem services including water quality, carbon storage and sequestration (Whittingham, 2011; Reed et al., 2014).

This chapter explores the policy environment where RBPS are emerging as a promising tool to meet societal demands for the delivery of biodiversity protection and associated ecosystem services. The chapter highlights how agriculture is both dependent on, and a supplier of a range of ecosystem services. The management of land and its condition influences ecosystem service provision. The international and national agricultural policy context in which RBPS are being introduced is summarised and the role of RBPS in a modern multifunctional agricultural system is outlined.

ECOSYSTEM SERVICES TRADE-OFFS AND SYNERGIES, AND NEED FOR INTEGRATED ECOSYSTEM APPROACH

Agriculture is the dominant land use in Ireland. Together with forestry, it is responsible for the management of 75% of the land area of Ireland. Our landscape has been shaped by millennia of agricultural production and today is made up of a diverse range of ecosystems which collectively provide society with a range of services termed ecosystem services. These include provisioning services such as food, fibre, bioenergy and biopharmaceuticals; regulation services such as regulation of climate, water quantity and quality; support services such as pollination and pest control; and cultural and aesthetic services. Agriculture is dependent on the services provided by its constituent ecosystems while also being a significant consumer of services (Power, 2010). For example, agricultural production is dependent on nutrient cycling and water provision within agroecosystems, but is also a significant consumer of nutrients and water.

The type, quantity and quality of ecosystem service provision from any one area is dependent on the ecosystem condition of that area. The balance between provisioning, regulatory and support services in agricultural areas depends on the capacity of the land to supply a particular service or bundle of services (Crouzat et al., 2015). This capacity is dependent on a range of biotic and abiotic factors e.g. geology, soils, hydrology, climate, vegetation composition and management. Ecosystem condition and diversity of agricultural ecosystems has deteriorated in recent decades in Ireland and

Considering that a climate and biodiversity crisis was declared by the Irish Government in 2019, then an integrated approach to land management is essential to mitigate climate change while preserving biodiversity and related ecosystem services. Collaboration between a wide range of disciplines: scientists, resource managers, economists, sociologists, policy makers, land owners, industrial and recreational users etc. is needed.

Europe, mainly as a result of multiple stressors including direct removal of habitats, pollution, inappropriate management relative to the capacity of the land resulting either from intensification or abandonment, and climate change (EPA, 2016; DCHG, 2019).

Agriculture can be responsible for a range of ecosystem disservices, including habitat loss, nutrient and sediment loss to water, soil erosion, flooding, net greenhouse gas emissions (Power, 2010). These disservices occur when the management intensity exceeds the capacity of the land or through mismanagement. Integrated and adaptive management approaches are required to manage the complex structure and interactions within our agricultural landscape in order to meet the needs of society for a range of ecosystem services. Integrated management needs to take into account the trade-offs and synergies between the potential services and disservices from agricultural production in any particular location.

Managing and sustaining ecosystems in a rapidly changing world requires adaptive management approaches that consider these ecosystems as interacting components at landscape scales – rather than focusing on single species or product/service. The integrated ecosystem approach considers the range of goods and services and manages them cognisant of their interactions and trade-offs. It takes into account the characteristics of the ecosystem and its political and social setting, integrating both social and economic information with biophysical information and explicitly considering the provision of human needs (Secretariat of the Convention on Biological Diversity, 2004).

Considering that a climate and biodiversity crisis was declared by the Irish Government in 2019, then an integrated approach to land management is essential to mitigate climate change (reduce emission and enhance

sequestration) while preserving biodiversity and related ecosystem services. Collaboration between a wide range of disciplines: scientists, resource managers, economists, sociologists, policy makers, land owners, industrial and recreational users etc. is needed. This collaborative approach brings a range of expertise and practical experience together to find solutions to pressing global challenges.

GLOBAL SUSTAINABLE DEVELOPMENT GOALS AND THE DEVELOPMENT OF CAP

Global agriculture has made significant gains in agricultural productivity in recent decades, but this has come at significant social and environmental costs that include water stress, soil degradation, biodiversity and increasing climate impacts that undermine our global food production potential (FAO, 2018). The response to these pressing global challenges resulting from ever-increasing pressures on natural resources has been the UN Agenda for Sustainable Development 2030 (United Nations General Assembly, 2015). This includes 17 sustainable development goals (SDGs) to which sustainable agriculture systems can make a significant contribution. Agriculture can be

Figure 8.1
Potential of CAP to contribute to meeting Sustainable Development Goals (SDGs). Source: European Commission

viewed as central to achieving the sustainable development goals and in a European context, future proposals on the Common Agricultural Policy recognise the potential of sustainable agriculture to contribute to 13 of the 17 SDGs (Figure 8.1) (EC, 2017).

FAO (2018) highlights that the 2030 vision for sustainable development is an integrated approach (addressed as one) to food and agriculture, people livelihoods and the management of natural resources in an environment where multiple actors (public and private) participate in the co-creation of solutions. The five key principles of sustainable agriculture (FAO, 2018) are:

1. Increase productivity, employment and value addition in the food systems
2. Protect and enhance natural resources
3. Improve livelihoods and foster inclusive economic growth
4. Enhance the resilience of people, communities and ecosystems
5. Adapt governance to new challenges

The challenges associated with managing the trade-offs and synergies between various policy goals is increasingly recognised (Fader et al., 2018; Nilsson et al., 2018) and there is an increasing need for decision makers to better understand and manage these trade-offs and synergies through improved alignment of objectives and incentives (FAO, 2018).

The Common Agricultural Policy (CAP) is the common policy governing the future direction of agriculture, forestry and rural development in the EU. It has its roots in the 1950s in Western Europe, when food supply and affordability were overriding concerns. However, as early as the 1980s, the intensification of agriculture had led to food surpluses and the impacts of CAP on the environment were becoming more evident. From the early 1990s, CAP was evolving towards a more multifunctional policy with the introduction of agri-environment payments to incentivise environmentally friendly farming practices. Successive reforms of the agricultural policy in the last two decades have seen continued decoupling of subsidies from production and increased linkages between incentives and environmental, public, animal and plant health requirements (Dupraz and Guyomard, 2019).

The current development of the post-2020 Common Agricultural Policy has highlighted the need for a new and simpler delivery model, with increased subsidiarity that can take into account the diversity of European

rural landscapes, together with a greater level of environmental ambition. There is a clear move towards a more results-orientated policy, aimed at achieving a range of objectives that meet a range of global challenges and the sustainable development goals (EC, 2018). Increased flexibility in the regulations has the potential to facilitate the development of more locally adapted and targeted policy interventions at regional and local levels, taking into account the heterogeneity in the European farmed landscape.

The potential contribution of the post-2020 CAP to Sustainable Development Goals is envisaged to be achieved through nine broad objectives which guide the formulation of Member States CAP strategic plans. Social, economic and environment themes are evident across the nine specific CAP objectives (Figure 8.2).

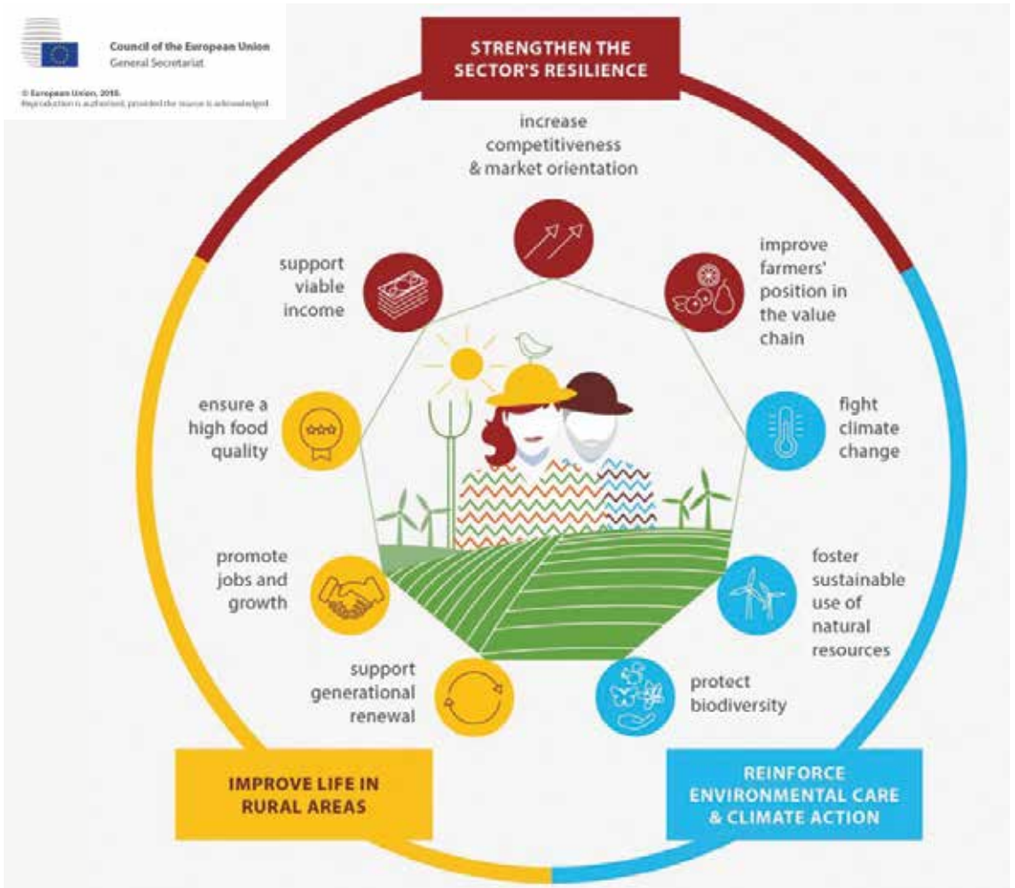

Figure 8.2
Specific objectives of the CAP. Source: European Union

There are clear opportunities in the proposed post 2020 CAP framework to realise a vision for agriculture that values people, nature and food in a more integrated approach to policy formulation. Under the proposed new delivery model, Member States have to draw up CAP strategic plans which cover both direct payments (Pillar I) and rural development (Pillar II) to meet quantified targets linked to the above nine objectives (McEldowney and Kelly, 2019). There is a clear need for a more integrated approach across both pillars of CAP. The main proposed changes to the CAP include more specific objectives with increased environmental ambition; introduction of enhanced baseline conditionality (replacing existing greening) related to climate, biodiversity, the wider environment, plant and animal health and eco-schemes in the direct payments architecture (Pillar I); and changes to priorities, budget allocations and a new delivery model focused on performance rather than compliance within the RDP (Pillar II) (Jongeneel, 2018).

A central part of the CAP strategic plans will be the Green architecture where there is a move towards a more results-orientated approach with greater ambition concerning resource efficiency and contribution to achievement of EU environmental and climate objectives (EC, 2017; EC, 2018). The new Green architecture covers both pillars and consists of three main components (Figure 8.3) including enhanced conditionality, eco-schemes and agri-environment climate measures.

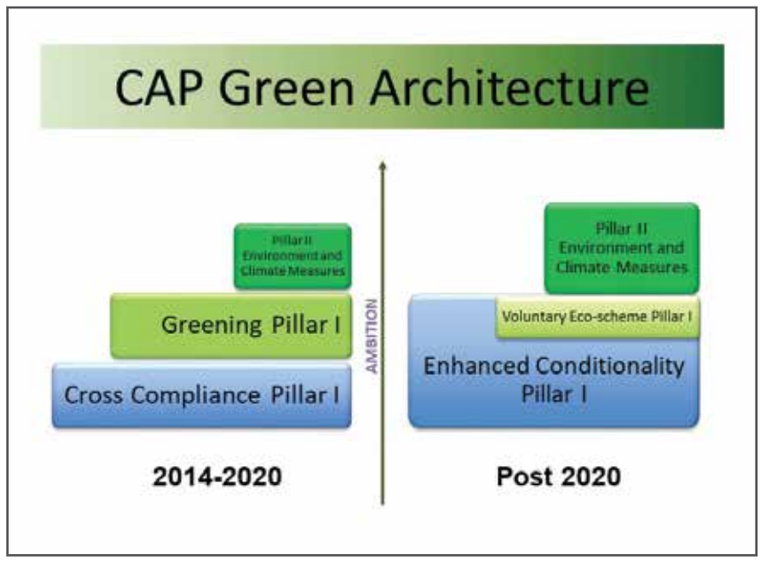

Figure 8.3
Comparison of the old and new CAP Green architecture

The enhanced conditionality replaces existing Greening and cross compliance. Under enhanced conditionality Member States must define minimum standards to keep agricultural land (including land no longer used for production) in good agricultural and environmental condition in line with overall objectives, and cognisant of the specific characteristics (e.g. soils and climate, farming systems, land use) of areas at national or regional level. There are 16 statutory management requirements (SMRs) and 10 mandatory standards for good agricultural and environmental condition (GAEC) included in the baseline conditionality. Statutory management requirements relate to legislation on climate and environment together with human, animal and plant health. Good agricultural and environmental condition standards include maintenance of permanent grassland, protection of peatland and wetlands, buffer strip, tools for sustainable management of nutrients, crop rotations, tillage management, retention of landscape features and minimum share of agricultural areas devoted to non-productive areas. The enhanced conditionality establishes a baseline with respect to climate, water, soil and biodiversity and both Pillar I eco-schemes and Pillar II agri-environment climate measures must go beyond this baseline.

Eco-schemes aimed at supporting practices beneficial to the environment and climate are obligatory for Member States but voluntary for farmers. These may be offered as entry level schemes which may be made a condition for entry into more ambitious agri-environment climate measures under pillar II. Eco-schemes can be paid as top-up payments, as a fixed amount per hectare, or linked to part or full compensation for income foregone and cost incurred related to specific agri-environment commitments. Eco-schemes could take the form of light green agri-environment schemes (such as entry level AE schemes in the UK) but also have the potential to be implemented as a results-based payments scheme (such as the proposed public goods bonus in Germany (Jongeneel, 2018; DVL n.d.). The theme of enhanced flexibility to Member States is followed through in relation to agri-environment climate measures where support under payments for management commitments may be granted in the form of locally-led, integrated or cooperative approaches and result-based intervention (recital 37) (EC, 2018). Furthermore commitments can be for an annual or pluri-annual period and can go beyond seven years where duly justified (recital 38) (EC, 2018).

It will be a significant challenge for Member States to realise a truly locally-adapted, results-orientated CAP Green architecture to meet the enhanced environmental ambitions of the post-2020 CAP.

POLICY OVERVIEW FOR IRELAND: SUSTAINABLE INTENSIFICATION VERSUS ECOLOGICAL INTENSIFICATION

In the Irish context, agriculture is the largest land use in the country with 70% of the land area devoted to agriculture, including approximately 61% grassland or pasture and 9% cropland (https://www.cso.ie/en/releasesandpublications/ep/p-eii/eii2016/lu/). The CAP is the main funding instrument that governs both land use and the implementation of agriculture-related land use policies. This includes food and agri-environment policy including the national agri-food strategy; biodiversity and nature conservation (Biodiversity Strategy and Natura 2000); Water Framework Directive; and agriculture related climate actions. The national strategy for the agri-food sector, set out in Food Wise 2025, is a 10 year vision for growth in the agri-food sector that acknowledges the role of the sector in maintaining the environment (DAFM, 2015). To achieve this, a sustainable intensification approach is advocated, where future food production systems must be equally focused on environmental protection and increasing production. Progress to date highlights the achievements in relation to production targets with growth in agri-food exports of 70% since 2009 (Government of Ireland, 2019). However, progress on environmental protection is less evident with increases in GHG emissions from agriculture over the duration of the strategy, with further increases projected in line with projected increases in production (EPA, 2019). Increases in production also coincide with deterioration in water quality (EPA, 2019) and ongoing deterioration in farmland biodiversity and habitat quality (DCHG, 2019). These results question the feasibility of the sustainable intensification model as currently implemented In Ireland.

Sustainable intensification i.e. achieving food security and protecting the environment is seen as a global challenge (Thomson et al., 2019; White et al., 2019). The current trend of intensification coupled with continued environment degradation is unsustainable. To a large extent sustainable intensification remains poorly defined and there is a need to move towards more explicit definitions (Wezel et al., 2015). Improved clarity in relation to the principles and practices that underpin sustainable intensification is also required. This may include de-intensification of high-input and high environmental impact systems, and improved efficiency of systems where increased production is attainable without adverse environmental impacts (Struik and Kuyper, 2017). There is a pressing need for improved

understanding of the trade-offs in food production and environment quality, which underpins future food security (Struik and Kuyper, 2017; Thomson et al., 2019). There is also an emerging focus on ecological intensification of agricultural systems which is more explicitly defined than sustainable intensification.

Ecological intensification focuses on increased use and understanding of ecological principles to improve the functioning of ecosystems. This is required to meet the range of ecosystem services (food, fibre and energy provision; plus regulatory, support, cultural and aesthetic services) needed by society, while also preserving access to these services for future generations (Tscharntke et al., 2012; Tittonell, 2014; Wezel et al., 2015; Struik and Kuyper, 2017; Kleijn et al., 2019). Application of an ecological intensification approach requires more integrated land use policy with explicit spatial targeting, matching the capacity of land to provide specific ecosystem services. This requires adaptive management to take account of the current knowledge gaps on the trade-offs between different services and to take account of new and emerging challenges.

Ireland's land base is made up of a diverse range of broad ecosystem types with potential to provide a range of ecosystem services. These range from ecosystems that are capable of producing high quantities of food (improved grasslands and arable crops) to semi-natural ecosystems dominated by semi-natural vegetation with varying food/fibre production capacities with potential for significant contributions to regulatory, support and cultural ecosystem services (carbon sequestration, water quality, pollination, pest control, flood alleviation, landscape quality etc.). There is an evident broad gradient in intensity of food production from the intensive dairy and arable area in the east and south-east of the country to the extensive food production area in the west and north-west. There are extensive uplands areas dotted around the east and south-east and similarly some intensive lowland areas on more fertile soils in the west and north west. This food production-intensity gradient is mirrored by a similar gradient in the nature value across the country (Matin et al., 2016; Matin et al., 2020).

In general, the areas with the highest proportion of natural/semi-natural vegetation have the highest nature value. This semi natural vegetation plays a major role in providing a range of non-provisioning ecosystem services. The proportion of semi-natural vegetation in Ireland has a good regional balance between semi-natural vegetation and provisioning of ecosystem services (food/fibre production), representing a multifunctional landscape that is capable of supplying both provisioning and regulatory/support services (García-Feced et al., 2015). However, the overall structure and configuration of the agricultural landscape, together with individual ecosystem structure and condition, determines how the area as a whole functions and its potential to provide ecosystem services to society (Fischer et al., 2006; Mitchell et al., 2013).

ROLE OF HNVF AND RBPS IN A MODERN MULTIFUNCTIONAL AGRICULTURAL SYSTEM

In an era where our food production systems need to adapt a multifunctional approach to provide a broad range of ecosystem services, there is a clear role for the diversity of land types within Ireland to be managed in a more integrated manner to meet the demand for multiple services.

High Nature Value (HNV) farmland is associated with areas where agriculture is the major land use and where low intensity agricultural systems support or are associated with high levels of semi-natural vegetation that support species and/or habitats of conservation concern (Beaufoy et al., 1994; Beaufoy, 2008). In Ireland, HNV farmland occurs across a broad range of landscape type (Jones et al., 2012), covering one third of the agricultural area (Matin et al., 2020) equating to approximately 1.5 million ha of agricultural land. These areas have natural constraints on food production related to soils, topography, climate and remoteness but are associated with high levels of biodiversity, landscape and socio-cultural values (Paracchini and Oppermann, 2012; Moran and Sullivan, 2017). In recognition of their high nature value, approximately 50% of these areas are part of the Natura 2000 network (Matin et al., 2020). Agriculture systems in Ireland range from intensive production on fertile land with high inputs, to very extensive production on marginal land with low inputs. To meet societal demands for food, fibre, climate and water regulation, and space for nature, we must target the service provision relative to capacity to produce. We essentially need complementary but contrasting approaches to low-input High Nature Value systems versus high-input intensive systems. In the former, we need to maintain ecosystem services and reduce threat of abandonment; in the latter, we need to reduce the impacts of intensification on the environment and promote ecological intensification where high

inputs are replaced by ecological enhancements and realise the benefits of same within the production system.

If we are to promote multifunctional models of agricultural production there must be a mechanism whereby farmers can realise value from the production of various goods and services. This value could be realised where there is market-driven adoption by rewarding production of a range of ecosystem services through enhanced market prices, or via policymakers supporting the implementation of measures such as agri-environment schemes that promote biodiversity and wider ecosystem services provision (Kleijn et al., 2019).

To date, agri-environment schemes have mainly focused on action-based approaches to agri-environment scheme design and their effectiveness has been questioned particularly in the absence of targeting, careful design, training and advice (Batáry et al., 2015). Results-based payments schemes (RBPS) have been advocated in recent decades as a means of improving the effectiveness of agri-environment schemes, in particular for biodiversity conservation. RBPS pay directly for the achievement of results linked to the provision of a biodiversity target or provision of ecosystem services. Results based payments were first introduced in agri-environment scheme design in the early 1990s coinciding with the introduction of mandatory agri-environment measures for Member States in the CAP. RBPS can be of particular interest where management actions are ineffective or the link between specific management actions and environment outcomes are unclear. They have generally been applied as 'higher tier' agri-environment measures that target specific geographic areas with higher environmental ambition than 'lower tier' entry level Management Based Payment Schemes (MBPS). Over the last 25 years, a range of approaches to RBPS design and implementation have emerged from pure results-based to hybrid approaches. In a hybrid approach the results-based payments are combined with payments for complementary management actions or prescriptions.

The relative advantages of the RBPS versus MBPS (Table 8.1) highlights the potential of RBPS as an important tool in well designed, targeted and results-orientated agri-environment measures. The main advantages of RBPS over MBPS include the clear link between payment rates and delivery of results. There has also been much criticism across the EU of the lack of sufficient monitoring of the effectiveness of MBPS when it comes to biodiversity targets (Finn and O'hUallacháin, 2012; Redhead et al., 2018), highlighting that there has been little follow up monitoring to verify if the desired results have actually been achieved from the prescribed actions. The flexibility in RBPS facilitates participants to innovate and use their skills and expertise to deliver results. RBPS have been highlighted as carrying higher risks for farmer when the results are not delivered despite work being undertaken. However, risks can be reduced with enhanced advisory support, training and knowledge sharing incorporated into scheme delivery as demonstrated in various initiatives in Ireland including the Burren Programme. Good design can also ensure that the measurement of the results takes into account factors outside the control of the farmer (see Chapter 9).

RBPS are often targeted at areas best placed, in terms of their land and farm system characteristics, to deliver specified results. Improved targeting

Table 8.1
RELATIVE ADVANTAGES/DISADVANTAGES OF RBPS AND MBPS APPROACHES

RBPS	MBPS
Clear link between payments and delivery of results	Payments linked to actions expected to deliver results
Flexibility for participant to innovate and use skills and expertise to deliver result	Participants must follow prescribed actions
Simple farm contracts specifying results and payments levels	Depending on design requires contracts with detailed definition of management actions required for various targets
Facilitate easy targeting where participants are incentivised to select land where results are achievable	Degree of targeting depends on design of measure i.e. lower tier broad scale approach or higher tier targeted approach
Builds improved knowledge of environmental targets and capacity among participants	Level of knowledge and capacity building depends on design i.e. higher versus lower tier
Easier to meet requirements for enhanced verification by EU due to inbuilt monitoring of results	Additional monitoring required to verify results have been achieved from prescribed actions
Higher administrative cost than lower tier AECM but similar to higher tier management based approach	Administrative support depends on design, lower tier versus higher tier i.e. level of targeting, number of actions available to farmer
Managing authorities generally unfamiliar with approach and requires adaption of administrative system	Management authorities familiar with approach and administrative system already set up
Requires specialist advisory support and training to ensure effectiveness	Requirements for specialist advisory support and training dependant on design i.e. higher versus lower tier
Higher level of risk for participant where results are not achieved	Where prescribed actions, terms and conditions are adhered to there is no risk of loss of payment to participant

where land use targets, including ecosystem service provision, matched to the capacity of a specific land/habitat type is one way of reducing the risk to the participant farmers. In the case of biodiversity, most current RBPS have been targeted at high nature value farmland areas (including Natura 2000 sites) and high nature value landscape features or field margins on intensive farmland.

To date, most RBPS have been implemented at a relatively small scale and focused on biodiversity, with limited experience of implementing these schemes at wider scale (Burton and Schwarz, 2013; Herzon et al., 2018). However, in recent years there has been increasing attention across the EU placed on understanding RBPS design and implementation, enabling expansion of the approach at a much wider scale in the next CAP programming period (Keenleyside et al., 2014; Herzon et al., 2018; Maher et al., 2018). There is increasing interest in their use beyond biodiversity targets, particularly where there is a relationship between higher biodiversity and other environmental targets e.g. water, landscape quality and carbon storage/sequestration. Recent studies have shown that there is high potential for biodiversity action to have multifunctional benefits, often contributing to soil and water quality objectives as well (Galler et al., 2015; Moran and Sullivan, 2017).

Extensively piloting of RBPS in Member States over the last 10 years (including EU Commission funded pilot projects in Ireland, Spain, The UK and Romania) have demonstrated that the RBPS approach can be successfully applied across diverse agricultural settings. These landscapes ranged from floodplain meadows in Ireland, arable crops in the UK, permanent crops in Spain to extensive grasslands in Romania (Maher et al., 2018; Chaplin et al., 2019). The RBPS pilots demonstrated that implementation and control can be simpler but that capacity and resources are needed for effective design. Guidance and training through a farm advisory system is crucial during the implementation phase. This helps build capacity and co-create solutions to deliver the results. RBPS essentially creates a market for environmental services/pubic goods and integrates environmental results into the farm production system. They could be viewed as a quality assurance element when implemented as part of a tool-box of measures to combat environmental challenges within the overall CAP green architecture.

Ireland has played a leading role in relation to innovative design of results-based agri-environment schemes through the Burren Programme (Chapter 3 in this issue), EU-funded pilot programme and more recently through

various European Innovation Partnership Operational Groups. RBPS initiatives in Ireland including the Burren Programme, Hen Harrier and Pearl Mussel EIPs have all been designed to deliver bundles of ecosystem services. The score cards are designed with results indicators aimed at improving biodiversity, soil and water quality in the one results-based scoring system. The indicators selected and used as the basis for payment reflect the overall ecosystem structure and condition and are related to the biodiversity and provision of a bundle of ecosystem services which have limited trade-offs with biodiversity e.g. soil quality, water quality and flow. They have adapted a common design approach that is locally-adapted, practical and results-focused. They seek to balance incentivising higher quality output, overall scheme complexity and aim to account for factors outside the farmer's control. A key to their success has been the hybrid approach where traditional action based payments are combined with results-based payments. The hybrid approach is often used where substantial initial investment and restorative actions (non-productive investments) are required to bring the target area to a minimum state where the result is achievable. The use of these complementary actions within the hybrid approach is very targeted and has been focused on areas where initial scores/results are low and where substantial restorative actions are required. These actions are essentially an investment to ensure that the green infrastructure essential to deliver the desired results is present on the farm. They are not included in the annual results-based payment as they are not required on an annual basis.

In the EU RBAPS pilots, farmers liked the principle that those producing higher quality environment products are rewarded with higher payments. They also highlighted how the approach made them more conscious of and positive towards environmental management. Above all, they felt that well-designed RBPS that are locally adapted to their farm context allowed them the flexibility to adjust their farming practices to the newly created environmental market. A key element for farmers is the opportunity for peer-to-peer learning where farmers can share knowledge on how best to achieve the results combined with locally targeted advice (Maher et al., 2018; Chaplin et al., 2019). The delivery of the results by the participant is facilitated by an advisory and administrative support infrastructure. This local advisory and knowledge information system helps to build trust and capacity enabling the co-creation of innovative solutions to deliver results.

LOCALLY LED AND RBPS

The application of the RBPS in Ireland to date has been highly targeted to specific ecosystems and local areas. The success of the Burren Programme has led to considerable interest in the locally-led approach to design and implementation of the RBPS. The Burren Programme is described as a locally-led approach that is farmer-centred, results-based, involving a local partnership that consists of farmers, advisors, scientists and government departments/agencies (Dunford, 2016). This has led to the development of innovative solutions to ongoing local challenges. At this stage, it is important to define what is meant by locally led in this very specific context and it also must be acknowledged that locally led is not an essential component of RBPS. However, the two approaches are very complementary and when they have been combined they have proven extremely effective in meeting environmental challenges. A factor in the success of combining the two approaches is the inherent flexibility in RBPS for the farmer with respect to land management. RBPS facilitates local adaption of management at the farm and field scale allowing the farmer to adapt their practices to meet specified targets/results.

Locally led is neither a top down nor a bottom up process but a combination of the two, marrying local knowledge and expertise with external specialist support. As highlighted by Dunford (2016), it builds on local knowledge to identify problems, causes and potential solutions. This is combined with research on local farms, trailing and testing solutions which are rolled out in programmes where as much as possible of the administration and support infrastructure are housed locally. This enables and encourages farmers to take ownership of the programme and become actively involved in its planning, monitoring and management. An adaptive approach has proven essential to the implementation of successful locally-led results-based schemes such as the Burren Programme. This ensures continued improvements and ongoing lessons from scheme implementation can be utilised to improve future design and implementation.

Ireland's current Rural Development Programme (DAFM, 2019) outlines how the government seeks to determine the applicability of the locally-led approach to the design, implementation and development of agri-environment schemes through the funding of EIP-Agri operational groups. The set up of EIP operational groups across the EU seeks to bring a diverse range of partners (farmers, advisors, scientists and the wider community) together to develop innovative solutions to specific problems or challenges (EC, n.d.). Further elaboration of the locally led approach to agri-environment scheme design and implementation can be seen in the EIP Operation group-locally led measure in the Irish RDP. In the case of the priority areas addressed by the Hen Harrier and Pearl Mussel Projects, locally-led refers to the delivery of locally adapted projects which are co-designed and implemented by a range of local and national actors including researchers, advisors, local farmers and other local stakeholders. It is clear from the RDP that the other locally-led environment and climate EIP operational group projects should be primarily driven by innovative ideas coming from the local area. However, there is also specific need to collaborate with a range of stakeholders including farmers, advisors, researchers, ecologists, NGOs, businesses, government departments and agencies. Locally-led can thus be defined as a local partnership approach, combining the experience and knowledge from a range of stakeholders both local and national with a specific geographical focus and with the aim of finding locally-adopted solutions to identified local challenges/needs.

THE NEED FOR A WHOLE-FARM AND LANDSCAPE-OR CATCHMENT-SCALE APPROACH?

To date the majority of RBPS have been applied at field or parcel-scale in Ireland, and have been specifically targeted at a habitat or ecosystem type. Where the design is driven by the requirements of a target species (e.g. the Hen harrier) whose requirements are only met by managing large contiguous areas across a range of ecosystems, then a wider landscape-scale approach is necessary. This is illustrated in the Hen Harrier RBPS project in Ireland (http://www.henharrierproject.ie/) where the project has targeted results-based payments at the range of semi-natural habitats required by the species during its breeding season. A range of score cards have been developed which include indicators of the provision of other ecosystem services besides habitat quality for hen harrier, including water quality, water storage and carbon storage delivering bundles of ecosystem services at a landscape scale. This is combined with an innovative bonus payment where additional payments are made to farmers conditional on successful fledging of Hen Harrier. In this landscape scale approach there can still be parts of the farm outside the RBPS system. As illustrated by the Pearl Mussel Project (https://

www.pearlmusselproject.ie/) this can be particularly problematic for certain biodiversity targets and for the provision of high status water bodies. The freshwater pearl mussel requires high status water bodies with low nutrient and no sediment loss to water within the catchments, accompanied by natural hydrological conditions. Similar to the Hen Harrier programme, score cards have been developed for all semi-natural habitats within the freshwater pearl mussel catchment that deliver appropriate ecosystem condition together with bundles of associated ecosystem services. However, in a RBPS targeted at individual fields, a farm could earn significant payments on most of the farm but still have substantial risk of nutrient or sediment loss from a field or part of a field. This could pose a significant threat to the receiving water and target species. The Pearl Mussel Project has devised an innovative whole farm assessment to resolve this issue. A simple scoring system is applied to the whole farm. This is used to calculate a weighting factor of poor (0.3 for high risk) to excellent (1.2 for low risk) which is applied to the total results-based payment. This clearly incentivises farmers to deal with any potential nutrient or sediment risks on their farm, and it is accompanied by a programme of complementary measures to assist farmers in addressing these issues. This is essentially a whole-farm, hybrid, results-based approach. Clearly the need for application of a RBPS measure at parcel-, farm- or landscape-/catchment-scale depends on the targets and specific objectives of the scheme.

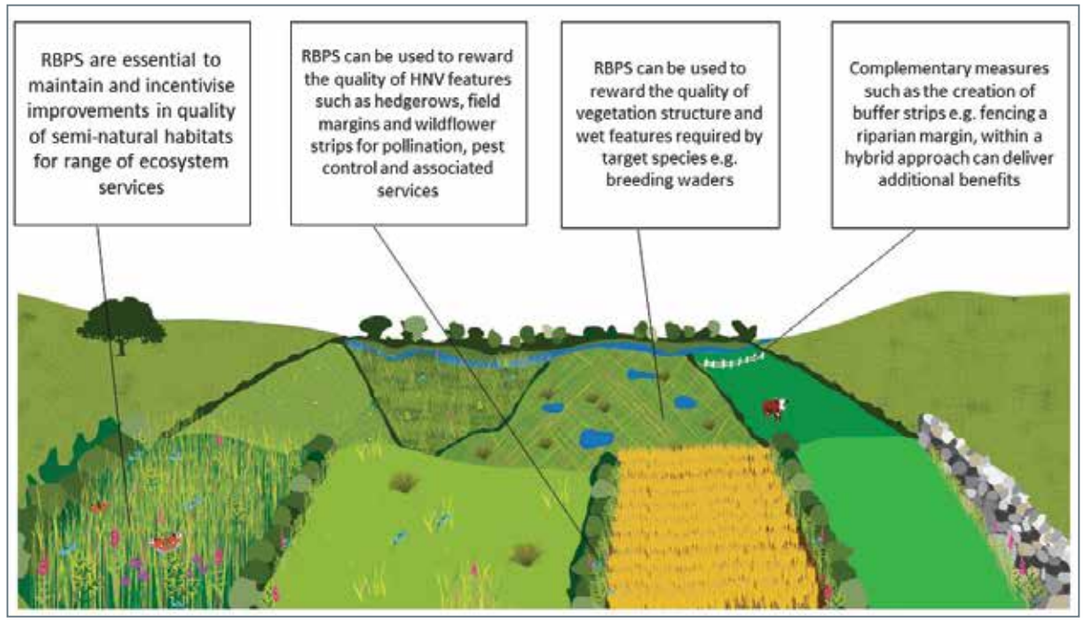

Figure 8.4
Illustrative example of an extensive livestock farm where the application of results-based payments is combined with complementary measures in a hybrid agri-environment scheme (Source for background image: Pearl Mussel Project)

CONCLUSIONS

Agriculture is dependent on the maintenance of healthy agro-ecosystems is both a supplier of and dependant on a range of ecosystem services. Ecosystem condition and the diversity of agricultural ecosystems has deteriorated in recent decades and the future of our food system is dependent on reversing this trend. RBPS have a clear role to play where the policy framework focuses on incentivising performance towards meeting environmental objectives as in the legislative proposals for the CAP post 2020. Clear objectives and targets are essential, together with long-term commitments to sustain this newly created market for ecosystem services. Short term or stop-start approaches to agri-environment schemes will increase the risk for participants and may limit their willingness to invest in the green infrastructure required to deliver the desired result. Initial investment in design of RBPS is essential. In Ireland in recent years, there has been considerable investments in pilot initiatives defining and testing indicators, training and capacity building, which can enable the wider roll out of RBPS post-2020. Familiarity with the RBPS approach among policy makers, administration, the farming community and wider advisory support services, still remains a major barrier to its wider implementation. Raising awareness and knowledge of the effectiveness of the approach in meeting environment challenges and the provision of essential ecosystem services is key to wider roll out of RBPS across Ireland and the EU.

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9

REFLECTIONS AND SYNTHESIS OF SELECTED RESULTS-BASED APPROACHES IN IRELAND

JOHN A. FINN

INTRODUCTION

The primary source of funding for biodiversity conservation and ecosystem services in the EU comes from agri-environment policies. It is clear, however, that the business-as-usual, 'one-size-fits-all' EU approach has failed to deliver the best biodiversity and ecosystem services outcomes, despite their considerable financial costs. Although EU agri-environment schemes have changed over time, they remain action-based, and there is a general acceptance among researchers and policymakers that agri-environment schemes need to be more focussed and better targeted to deliver verifiable results (ECA, 2011). The next stage in the development of such schemes is to incorporate results-based approaches and payments. The Irish programmes and case-studies described in this book provide applied research on how to achieve this. All the case-studies focus on areas of high nature value, many being Natura 2000 sites, and all are intimately linked with extensive farming systems.

Here, I identify and collate some common themes from these case studies, to share good practice and facilitate the broader adoption of results-based approaches in Ireland and, indeed, further afield. I outline some of the key features of locally-led results-based approaches that contribute to their environmental effectiveness. I explore some of the themes that may guide where results-based approaches, action-based approaches or a hybrid of the two may be most applicable. To this end, I discuss the various forms

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of targeting that are achieved through a locally-led approach, and which complements the results-based approach. I discuss the distinct features of the design, implementation and monitoring of results-based approaches, and the relative distribution of transaction costs. I conclude by considering the application of hybrid approaches that combine features of results- and action-based approaches.

OVERVIEW OF CASE STUDIES

In this section, I briefly review the case studies and select some key points and lessons from each in turn. The review of literature by Eileen O' Rourke (Chapter 2) established that:

- Biodiversity is widely threatened. Payments from EU DG Agriculture can play an essential role in supporting biodiversity if allocated appropriately. There is greater recognition of the role of public payments for environmental public goods;
- Current action-based agri-environment schemes are widely implemented. They also widely vary in the extent to which they are sufficiently monitored to assess the degree to which biodiversity objectives are achieved;
- There is limited evidence to show whether action-based schemes have had a strong effect on long-term farming behaviour and culture;
- Successful examples of results-based approaches are known, but are not yet widely implemented;
- Results-based approaches have their own set of pros and cons. In comparison to action-based programmes that have lower transaction costs (but are less likely to deliver the intended objectives), results-based approaches (that may have higher transaction costs in some cases) that deliver their objectives should therefore deliver overall better value-for-money.

In the first case study from the **Burren Programme** (Chapter 3), this long-running hybrid programme provides several key lessons:

- A results-based approach was successfully designed and implemented. It integrated the needs of participant farmers, scientists (who design, implement and monitor the programme), and policymakers (who need to deliver biodiversity objectives with a valid, compliant and verified programme);
- Scientifically validated indicator plants and scoring systems were developed, implemented and the farmer payments were related to scores;
- The succesful approach in the Burren Programme involved a hybrid model of results-based payments in combination with payments for capital works (non-productive investments). Interestingly, the capital works were co-funded both by the Programme and individual farmers through different co-funding rates that depended on the nature of the investment. The strategy helped increase the relevance and benefit of the investment;
- The programme delivered national-scale biodiversity objectives because of its focus on priority habitats that reflect vital objectives within the Irish Prioritised Action Framework;
- Regular and appropriate monitoring:
  - demonstrated to farmers and the wider community that their efforts can be effective and can justify their higher payments,
  - Informed scheme designers how to adapt to meet new challenges and facilitate iterative improvements over time,
  - demonstrated effectiveness and efficiency to scientists, policymakers and budget holders.
- Farmer and community engagement from the earliest time point is essential to achieve long-term commitment and effectiveness.

There are common highlights shared by both the **AranLIFE** and **KerryLIFE** projects that include:

- Successful use of an externally funded scoping study to collate information that informed the LIFE proposals and helped specify the objectives and target the actions;
- Focus on priority species/habitats that reflect key biodiversity concerns and objectives;
- Active engagement with the local community in the design phase;
- Adaptive learning throughout the project;
- Successful use of a mix of non-productive investments and results-based payments; (Definition: non-productive investments do not generate significant return, income or revenue, or increase significantly the value of the beneficiary's holding, but have a positive environmental impact);
- Provision of expertise for relevant ecological advice to farmers that contributes to the effectiveness of farm-scale implementation and actions.

The **RBAPS** project demonstrated the successful application of results-based approaches across several case study sites, and illustrated the following specific points:

- Because biodiversity priorities are highly spatially distributed, local adaptation of objectives and indicators contributed to effective biodiversity conservation;
- The involvement of farmers and specialists in defining objectives and targets can improve the process of local adaptation;
- Scorecards were developed to assess the quality of different ecological targets that ranged across species-rich grasslands, breeding waders, and habitat for a rare butterfly species. The scorecards were designed through ecological assessment, and were used to underpin results-based approaches;
- Appropriate guidance and advice from specialist advisors with ecological expertise was an important success factor;
- The optimal approach tended to involve a combination of non-productive investments and results-based payments;

- RBAPS developed and made publicly available a structure, tools and guidance notes that can allow more general adoption and customisation of the methodology.

Selected features of the **NPWS Farm Plan Scheme** include its:

- Focus on high-priority national biodiversity objectives (habitats and species) that are identified in the Irish Prioritised Action Framework;
- Translation of national priorities into locally-led approaches through engagement of local farmers by local NPWS staff, and working with farmers to develop plans, advice, implement and monitor effectiveness;
- Examples of co-ordinated landscape-scale implementation of conservation objectives and actions, which is typically quite rarely achieved;
- Use of non-productive investments and action-based payments, as well as a keen interest to roll out more results-based payments;
- High capacity to learn how to do better. There is widespread use of monitoring to very effectively assess progress toward results and respond accordingly;
- Ability to achieve and demonstrate effectiveness, which suggests very high value for money (although external factors may reduce effectiveness in some cases).

In Chapter 8, James Moran discusses the policy environment within which results-based approaches are being introduced. He considers the environmental priorities that need to be better addressed in international policymaking, and the role that agriculture can play in providing a range of ecosystem services and disservices. Results-based approaches seem to be an important policy instrument that is distinctly placed to most directly incentivise desired management and outcomes, given the dependence of ecosystem service supply on the management and ecological condition of ecosystems.

SYNTHESIS

In the remainder of this chapter, I outline some of the key features of locally-led results-based approaches that contribute to their environmental effectiveness. I also elaborate further on the lessons learned from these case studies, and explore the future implementation of results-based approaches.

THE 'LOCALLY-LED' NATURE OF CASE STUDIES CAN VARY IN APPROACH

The phrase "locally-led" is widely used. However, the case studies revealed different interpretations. 'Locally-led' does not necessarily mean that local people must lead the project or programme. Indeed, the experience across the case studies suggests that their greatest strength lies in combining the specialised skills across farmers, ecologists, advisors and project managers. In many cases, some of these skills are likely to be provided from outside of the local community. The priority is to ensure the most relevant skills are harnessed for the success of the project.

Some of the characteristics that contribute to the quality and efficacy of 'locally-led' include the presence of local champions and advocates, prior knowledge of the local agri-environmental context and farming system, and the specificity of objectives and targets. I discuss these as follows:

Locally-led by local champions

By definition, locally-led projects need to involve the local community. The presence of an appropriate champion at an early stage is vital to provide the link between external specialists and the local community. Locally-led projects tend to have local advocates and champions who are able to present a vision to the local community, and explain, encourage and often persuade local participation in the projects. It is very evident in the case studies from the Burren, KerryLIFE, AranLIFE, RBAPS and the NPWS initiatives. For example, the NPWS Curlew Conservation Programme has a specific 'Curlew Champion' role, which formalises the important contribution of local champions.

Typically, the most important function of the champion can be to identify: a problem, the need for a solution, who to approach to devise a solution, and who to work with to implement the solution. This information

"the most important function of the champion can be to: identify a problem, the need for a solution, who to approach to devise a solution, and who to work with to implement the solution ... The champion can be an individual, a group of individuals, or a local association. Whatever its identity, a locally-led approach requires a local leader.

is most likely to be provided through preparatory work before project development and is an important prerequisite for successful initiation of a project or proposal. Local champions typically encourage local participation and feedback, and this helps to build mutual trust and education, as well as improved design and delivery.

The champion can be an individual, a group of individuals, or a local association. Whatever its identity, a locally-led approach requires a local leader. The championing of a project or approach is not the same as representation which is also very important, of course. Representation is usually achieved on an ongoing basis through formal stakeholder groups and other informal stakeholder interactions.

Importance of locally-relevant prior knowledge

Typically, the effective conservation of a threatened species or habitat requires good understanding of: the current status and spatial distribution of the species, the relative priority of the threats to the species, the corrective actions needed and their likely effectiveness, feasibility and cost of actions.

The case studies generally represented projects that had substantial knowledge and understanding developed from ongoing monitoring and/or dedicated studies that preceded the project. The evidence collated is highly likely to be a strong success factor for both action- and result-based approaches. For example, KerryLIFE relied on a substantial body of national and local work on the distribution of freshwater pearl mussels, as well as catchment-scale assessments that identified priority threats. The RBAPS project benefited from prior knowledge and experience of the ecologists who formulated the proposal, and the work of previous surveys on e.g. the target location for species-rich grassland from the national Irish Semi-Natural Grasslands Survey.

High levels of local knowledge about an environmental issue facilitate the formulation of:

- specific objectives
- specific actions that are targeted at prioritised threats
- evidence-based actions that are highly likely to be effective
- actions that are feasible and cost-effective
- monitoring and evaluation programmes using targets and indicators that reflect performance and thereby confirm effectiveness, or guide learning how to do better.

Local specificity of objectives and targets

The setting of objectives is a critical aspect of any project or programme. The objectives dictate quantitative targets, the relevant actions and interventions that are intended to achieve the targets, as well as the quantitative indicators that are used to monitor effectiveness.

A defining feature of the case studies is the **clarity and focus of their objectives**. The latter are a direct outcome of the locally-led approach that integrates the experience of both specialists and local farmers and communities. Rather than having generic objectives such as 'restoring biodiversity', 'reinstating wildlife' or 'improving the countryside', they focus on quite specific biodiversity priorities for the local countryside. What is also impressive through all the case studies is the degree of shared ambition that was co-developed between specialists and the local participants. It is evidenced in the design and payment structures that seek to attain the highest levels of biodiversity provision.

There are multiple examples of conservation actions directed toward priority species and habitats featured in the Prioritised Action Framework in the NPWS Farm Plan Scheme. Similarly, the Burren Programme, AranLIFE and RBAPS projects directed their conservation efforts at nationally important species-rich grasslands. The KerryLIFE project was aimed at a critically endangered species.

What is also clear is that the local specificity in objectives occurred across multiple spatial scales. At the landscape-scale, projects set quantitative targets for named species/habitats while the locally-led ethos translated into farm-scale targets and actions.

IMPORTANCE OF FARM ADVICE

The important role played by farm advisors is another common theme running through the different case studies. They all relied on the provision of targeted ecological advice for individual farms, and stressed its importance. As one farmer put it, by having the right expertise available "you make the right decision before you make a mistake" (Norfolk farmer, RBAPS project). Typically, the advisor is the main link between the project and the participants, and the attitude and encouragement of the advisor can be very influential.

Targeted ecological advice and discussion is crucial for the drawing up of farm (and commonage) plans, in the verification of results, and in both advising – and learning from - farmers on how to achieve the targets. Traditionally, the training and recruitment of farm advisors and agricultural scientists in general has been strongly oriented towards more intensive agricultural systems. There is now a growing need for, and delivery of agri-environmental advice. To deliver biodiversity objectives, the case studies show a strong demand and need for advisory support with appropriate ecological expertise.

Without exception, all of the case studies considered training and education to be a crucial success factor. Given the importance of ecosystem health in achieving future CAP objectives, such an upgrading of the advisory capacity is a basic requirement and will be more evident in the future. Training and education (of advisors and farmers) is an important and substantial component of the public and private transaction costs of programmes/projects.

DESIGN OF INDICATORS

The careful design of indicators underpins the ability to conduct a feasible and reliable assessment of environmental quality that can be related to payment rates. It is only possible to define outcome indicators that reflect the range of environmental quality from low to high when there is clarity on the objectives and the desired environmental outcome. It is this differentiation that makes it possible to have result-based payments.

The case studies developed and implemented multiple examples of indicators, which showed considerable variation. An explicit contribution

of RBAPS was to focus on a variety of objectives and ecosystems; this variety demonstrated the capacity to design indicators that are appropriate for results-based approaches. In RBAPS, we see the use of composite indicators that included ecological quality (itself a composite of the number and cover of positive and negative indicator species), and an assessment of threats (level of management, and evidence of damaging activities). Proxy indicators were also used to represent attainment of the ultimate targets. RBAPS used habitat quality to represent conditions for marsh fritillary, and KerryLIFE used '% bare soil' in critical source areas as a proxy for the transfer of sediment and phosphorus to waterways. The appropriate selection and use of indicators (direct or proxy) is only possible through understanding of the underlying cause-and-effect relationships (Primdahl et al., 2010), and further reinforces the importance of relevant prior knowledge from scientific studies.

RAPID MONITORING OF EFFECTIVENESS, EVALUATION AND FEEDBACK

Here, I contrast the learning and feedback process in action- and result-based approaches. Action-based agri-environment schemes have *ex ante*, mid-term and *ex post* evaluations that are part of a seven-year policy cycle. In theory, the evaluation and policy cycle allow opportunity for monitoring of the outcomes that inform the assessment and demonstration of policy effectiveness , and/or facilitate lessons to be learned that improve future iterations. In practice, the approach appears mostly targeted at helping policymakers to learn (as opposed to farmers). The large effort involved in undertaking a programme-wide evaluation of the RDP usually means that the lessons learned are provided every seven years. The evaluation of environmental effectiveness in achieving biodiversity objectives in RDP evaluations has generally not been possible due to inadequate investment in monitoring (ECA, 2011). Overall, the widely applied action-based approaches have a relatively slow feedback cycle. In some cases, the data was not available with which to provide effective evaluation and feedback (ECA, 2011).

In contrast, an important feature of results-based approaches is the much more rapid feedback cycle. The aim of 'learning how to improve' includes the participant farmers as well as those implementing the project/programme. It occurs at the scale of farmers learning how to increase their provision of environmental services at the scale of individual fields, as well as across the whole farm. The feedback, directed at farmers, can derive from several sources. They include: self-assessment; advisors during farm visits and training events, and: other farmers as part of peer-to-peer learning and visits. There is also the formal scientific assessments of vegetation and/or indicator species. The scientific assessment can also be aggregated for the purpose of programme-level monitoring. Examples of programme-level evidence of environmental improvements from the case studies are shown in, for example, Figures 3.9 and 3.10 from the Burren Programme, and Figure 5.9 from the KerryLIFE project.

It is not surprising that farmers are proactive in wanting to learn how to perform better to attain the biodiversity targets with the associated financial reward to perform better, and the associated pride in achievement. It reinforces a virtuous cycle of positive performance often assisted by the availability of appropriate advice. This is an intended outcome of results-based programmes. Importantly, it adds to the credibility of result-based programmes or projects not only among participant farmers but also among the local community, policymakers and wider society.

DESIGN AND PAYMENT STRUCTURES TO DEAL WITH RISKS

Before discussing the risks associated with results based approaches, it is worth remembering that action-based agri-environment schemes also have significant risks. Multiple factors are involved in their intervention logic, and a failing in any one of these factors can compromise effectiveness (Finn et al., 2009; Primdahl et al., 2010). A number of risks (perceived or otherwise) are often associated with results-based approaches, and we discuss some of them here. These generally relate to the predictability of payments for farmers, the predictability of costs for implementing agencies and policymakers, and the governance of compliance, inspection, monitoring and evaluation by policymakers.

Risks related to farmers

Concern for farmers considering involvement in results-based approaches include the continuity of payments, their ability to increase the payments, and the impact of external factors on the payment levels. There will be other concerns as well, including the time and effort required to learn about a new type of scheme, and to undergo training and education.

Farmers' behaviour is typically risk-averse. Therefore, any successful results-based approach will need to reassure farmers considering participation. Clearly, results-based approaches need to consider effective risk management in programme design. Apart from obvious natural variables, such as climate, uncertainty in ecological responses to agricultural practices cannot be entirely removed, but can be limited by effective planning and use of prior agri-ecological research. Robust systems of dispute resolution, fair to both sides, will contribute to reducing the farmer (and project) risk.

Strategies can be adopted to increase the continuity and predictability of payments, and reduce risks, as well as the perception of risk once farmers have committed to participating. The choice of indicator can be important. In the RBAPS project, for example, the results-based approach for marsh fritillary used indicators of habitat quality, rather than more direct indicators such as the number of adult butterflies or larval webs. Habitat quality indicators are selected to reflect management more than weather. Therefore, the farmers' payments are buffered from year-to-year variation in butterfly numbers that are simply due to weather.

As another example, the payment rates can be adapted over time so that the standards required to achieve payment are less demanding at the start but increase over time as farmers have had sufficient time to learn to implement new actions (see Box 9.1). In addition, it is also possible to increase the standard of the ecological target. There is little or no risk for farms that already attain and maintain a high standard. This type of approach was adopted by the Burren Programme, which did not make payments for areas with a score of 5 or less; after two years in the programme, this threshold was increased to a score of 6.

BOX 9.1

Comparison of the distribution of payments in relation to level of outcome in action-based approaches (panel a) and results-based approaches (panels b and c) for an environmental context where a high level of quality is targeted. In typical action-based agri-environment schemes, the payment rate (y axis) is standard (horizontal dashed line in the left panel despite the large variation in the delivery of the ecosystem service represented by the distribution of dots).

In an example from results-based approaches, the exact same level of performance is supplied from the same farms in the left panel, but the payment rate is related to the supply of the ecosystem service. There is a threshold level of quality below which a low or no payment is made (panel b).

By varying the thresholds for payments over time to be less demanding initially (panel b), and increasing it over time (compare panel b and c), there is a reduction in risk for the farmer at the beginning, and an opportunity to increase performance over time (note the rightward shift in position of dots in panel c). In this scenario, some farms do not receive a results-based payment. From a scheme perspective, this may represent a form of targeting; however, these farms may participate in other more relevant schemes, or may receive non-productive investments that allow them to increase their score over time and receive payments.

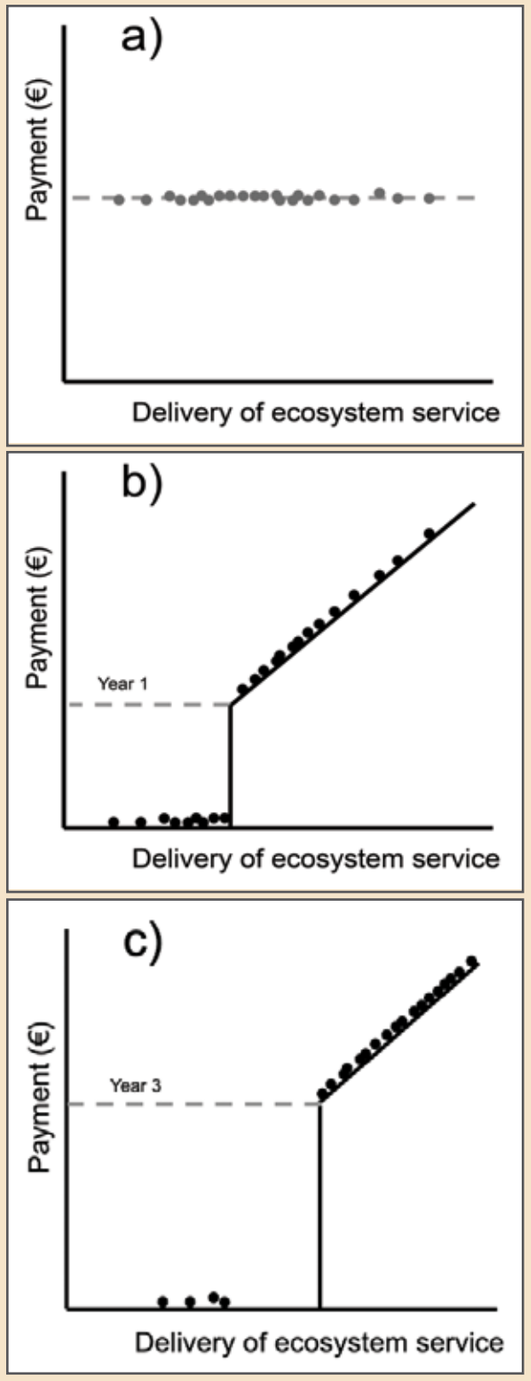

Figure 9.1
Comparison in the distribution of payments in relation to level of outcome in action (panel a) and results-based approaches (panels b and c).

In the Burren programme, there is a very practical approach to incentivising the progression from lower to higher ecological condition. As reported in Chapter 3, "the lowest scoring fields are listed first for payment - on larger farms (>40 ha) this means that the farmer is effectively losing more money on the lowest scoring fields (paid at the top-band rate) than is being gained on the highest scoring fields (which are paid at a (50% +) lower rate). It offers a clear financial signal to the farmer to focus on conservation activities on the lowest scoring fields which need most attention. On the other hand, a bonus of 25% and 50% is paid for scores of 9 and 10 respectively". The approach represents a risk-reduction strategy for the implementing agency to deliver on the environmental objectives and protect the reputation of the programme. It also fairly rewards farmers for their efforts. In effect, these 'banded' or grouped payments incentivise a progression that aims to "accentuate the positive, eliminate the negative". More generally, across case studies, many participant farmers clearly recognise the fairness associated with giving more payment to the participant who does more work or provides more of the environmental benefit. Similarly, participants also recognise the fairness in a lower payment going to a participant who does not deliver the environmental targets.

Generally, the way in which payments are related to the delivery of ecosystem quality can be adjusted to reflect exposure to risk (see Box 9.2).

A lesson from the case studies is that hybrid approaches (with some combination of action-based payments, non-productive investments, and results-based payments) are likely to be more widely implemented than pure results-based approaches. Hybrid approaches can also offer an opportunity to reduce the apparent risk for farmers (see Box 9.3). For example, there is a lesser reliance on action-based payments over time, with a corresponding increase in result-based payments. The approach might be appropriate for the introduction of a new results-based project. It allows time for training and knowledge transfer to occur and the delivery of higher ecosystem services over time.

BOX 9.2

Type 1: Strongly encourages delivery of a modest threshold level of environmental service, but relatively low reward for marginal improvement at the highest level of delivery. It can equally be seen as strongly penalising lowest levels of delivery. However, the payment levels are also very resistant to changes at the highest level of delivery, which buffers against environmental factors, e.g. weather/climate, that are outside of the farmers control.

Type 2: Equivalent reward per unit of environmental service delivered. It assumes equivalent costs per unit delivery of environmental service across the range of service provision. The marginal benefit from the per unit delivery of service at the highest levels is the same as that at lowest levels.

Type 3: Strongly encourages delivery of a high threshold level of environmental service and a relatively high reward for marginal improvement at top end of delivery of environmental series. This approach can also be seen as very strongly penalising low to medium levels of delivery. It might be very appropriate for maintenance and minor restoration of very high-quality habitats. This payment structure, however, would be riskier if external and unpredictable factors can have strong impacts on ecosystem service delivery.

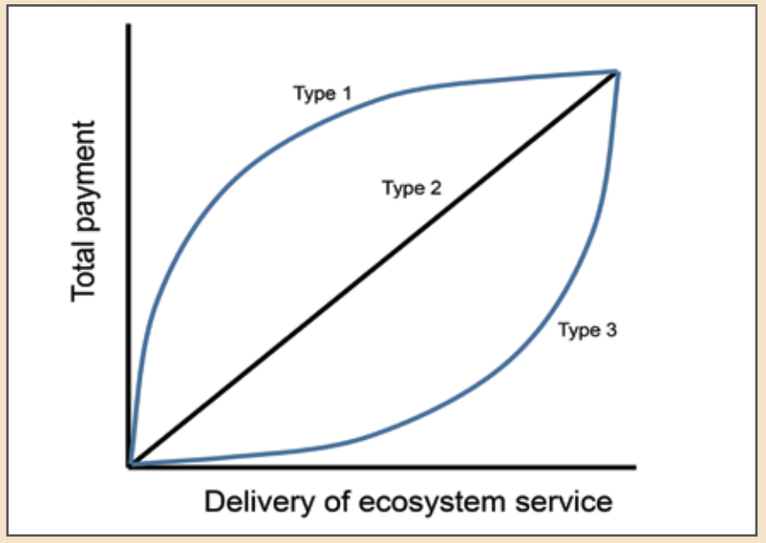

Figure 9.2
Illustration of different ways in which payments can be related to the delivery of an environmental service

BOX 9.3

In the first example, there is an action-based payment worth 75% of the maximum possible payment (line 1). Thus, 25% of the remaining payment is based on a result-based approach for delivery of the ecosystem service.

In the second example, there is an action-based payment worth 50% of the maximum possible payment (line 2). Thus, 50% of the remaining payment is based on a result-based approach for delivery of the ecosystem service.

In the first example (line 3), there is an action-based payment worth 25% of the maximum possible payment. Thus, 75% of the remaining payment is based on a result-based approach for delivery of the ecosystem service.

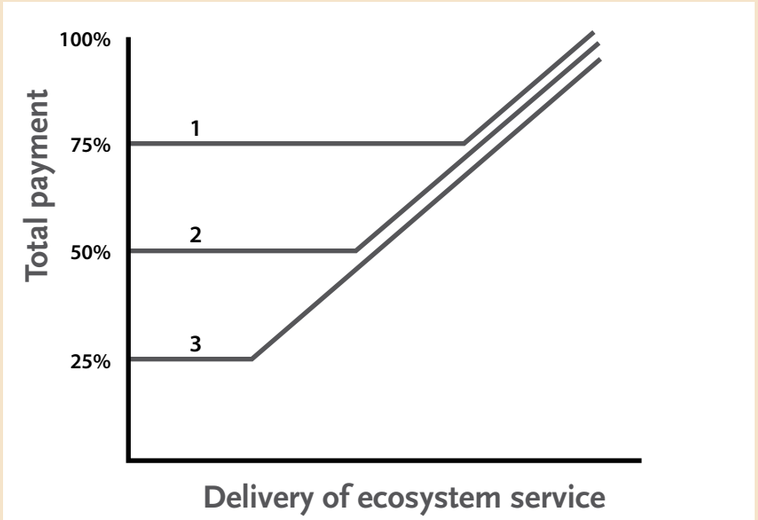

Figure 9.3
An illustration of different approaches to produce different hybrid result-based models by varying the relative contribution of action- and result-based payments.

The engagement with farmers, and resulting dialogue, training and knowledge exchange also help to: reduce risk perception through peer learning; identify ways to reduce real risks, and; identify and overcome the fear of income loss or disadvantage. Therefore, a range of results-based models are available to reduce risk perception among farmers and promote encouragement of positive practices.

Many of these approaches are already embedded in the case studies. They include: the example and encouragement by local champions, opportunity to contribute to programme design, peer learning (including visits to other areas and initiatives), use of demonstration activities, as well as effective training and knowledge sharing.

RISKS RELATED TO SYSTEM OF GOVERNANCE OF COMPLIANCE INSPECTION AND MONITORING

Policymakers have multiple responsibilities for the implementation of publicly-funded schemes. They include training, advice, compliance inspection, sanctions and penalties, monitoring, evaluation, and delivery of value-for-money. A comprehensive and complex administrative system for traditional action-based approaches has developed over time that addresses several of these issues. They are also known to be acceptable to the Commission.

A possible risk for policymakers may be the change in administration arrangements necessitated by the introduction of results-based approaches. Such a change may be an obstacle to implementation because of a combination of both the need to change administrative systems (a logistical challenge), as well as concern about the acceptability of the changed system to the Commission and, perhaps, stakeholders (a legal and political challenge).

A possible risk for policymakers may be uncertainty in the total budget for results-based approaches, given the relationship between payment and performance. However, the risk-reduction approaches highlighted above will also act to reduce unpredictability in budget demands. When hybrid approaches are used, the proportion of the total budget dependent on results-based approaches can be relatively modest. Traditional action-based approaches also have had uncertainty over budgets. It is evidenced by some measures requiring encouragement and incentivisation while others were over-subscribed.

In isolation, some of the individual components associated with results-based approaches may be a possible risk for policymakers. For example, can CAP regulations and administrative oversight be upheld and expenditure be justified based on self-assessment of performance by farmers? On its own, this would be a legitimate concern (even though farmers can be very conservative when conducting self-assessments). However, the RBAPS project and the Burren illustrate how a bundle of administrative actions are usually applied, and these can work together to result in a level of administrative oversight that is no less than that which is currently applied. For example, the education and training in self-assessment by farmers offers considerable benefits in communicating the targets, indicators and outcomes of a programme, and promoting a deep understanding of the programme objectives around ecosystem service delivery. The approach has the potential to result in an improved situation relative to traditional schemes.

The implementation of self-assessment by farmers collects information that can inform them on their progress towards the outcomes and higher payments. It also contributes to programme-level reporting. In addition to the self-assessment, scientific monitoring of randomly selected sites can contribute to validation of the self-assessment process, and provide independent scientific assessment of the level of achievement of the specific outcomes. A risk-based selection of farms for validation checks could be established that includes sites where there are unusually large increases in scores through either self-assessment and/or an advisor's declaration of scores. Certified advisors who are found to deviate from the scoring system could face sanctions that could escalate through e.g. more training, a warning and loss of certification to reduce this risk. It is also possible to assess broad changes in habitat extent and, perhaps, ecological quality with the developments in remote sensing technology. Collectively, the risk reduction strategies outlined above provide evidence that results-based approaches can deliver administrative governance to a standard that is equivalent to that of conventional action-based approaches.

A complex administrative process structure currently exists to assess compliance and verification within action-based agri-environment schemes. However, monitoring of outcomes is much less developed (ECA, 2011). Ultimately, the greatest risk lies in the CAP not achieving its stated environmental objectives (and see below). As CAP reform progresses, there will undoubtedly be further debate about the extent to which complete adherence to administrative requirements and avoidance of risk can be balanced with innovative approaches for more effective delivery of environmental outcomes that match the required level of ambition.

RELATIVE DISTRIBUTION OF TRANSACTION COSTS IN ACTION-BASED VERSUS RESULT-BASED APPROACHES

The public and private transaction costs associated with any policy instrument, including agri-environment schemes, are an important criterion for assessment of their cost-effectiveness.

Public transaction costs typically include the costs that arise for agencies that implement agri-environment schemes, for activities that include their design, *ex ante* evaluation, administration and support, provision of information, provision of training and education (for ministry staff, advisory services and farmers), compliance inspection, monitoring, *ex post* evaluation, and reporting. Private transaction costs are typically those borne by participants. They include the opportunity cost of information collection and processing when making a decision about whether to participate in a programme or not, as well as the costs of application, administration, implementation and training (following the decision to participate and implement actions).

Action-based approaches are perceived to have relatively low transaction costs (both public and private), as a percentage of the total budget. The perception arises because of their one-size-fits-all approach and lower information requirements for participants (who implement prescribed actions).

In contrast, results-based approaches are perceived to have relatively high transaction costs. The veracity of this perception is difficult to assess, for at least two reasons. First, given the complexity and scale of the transaction costs associated with action-based approaches, it is exceedingly difficult to ascertain their true public transaction costs; therefore, it is equally difficult to provide a fair comparison with results-based approaches. Second, most of the results-based approaches to date have been implemented as pilot projects. By definition, pilot projects are likely to have relatively high start-up costs and do not benefit from the economy of scale and per unit reduction in cost that would be expected from a programme-level roll-out with many more participants (see below).

Policy evaluation typically focuses on effectiveness (achievement of the stated objectives) and efficiency (whether least-cost methods are used to attain effectiveness). There has been significant CAP investment in action-based approaches for environmental public goods. Nevertheless, farmland biodiversity and habitat condition continue to decline despite numerous funding cycles that targeted farmland biodiversity. Even if action-based agri-environment have lower transaction costs (as a percentage of spend), there remains significant doubt about their effectiveness (e.g. ECA, 2011, and Chapter 2). In contrast, several of the case studies described/discussed earlier demonstrate that results-based approaches can effectively achieve their objectives for biodiversity improvements/ maintenance.

The delivery of action-based schemes, or indeed any type of scheme, is a false economy if they do not achieve their objectives. Therefore, results-based approaches that achieve their objectives can offer significant cost-effectiveness (value for money) even if their transaction costs may be higher

than results-based approaches (if that is indeed the case). The transaction costs are more likely to be locally targeted at activities that promote effective conservation practices and more specific objectives e.g. design of schemes, selection of effective actions, local consultations, training of specialist advisors, training of farmers, monitoring of performance, and rapid feedback on performance.

COMMUNITY ENGAGEMENT

Awareness-raising in the wider community is very important to highlight the central role played by high nature value farming systems as well as the farmers' knowledge and skills as landscape stewards. Most of the case studies promoted local engagement by establishing a local office with an open door policy, where farmers can drop-in, establish face-to-face relationships of trust, and receive administrative support and technical advice when necessary.

The Burren Programme identified the importance of instilling in its participating farmers a strong sense of identity, pride of place and programme ownership based on over twenty years' experience. Social events that bring the community together, such as the annual winterage weekend, education programmes in local schools, and 'Learning Landscape' workshops have been developed to achieve community engagement. This is to be expected from a long-established programme; however, it is also very impressive to note the strong community engagement achieved by the newer case studies. The building of social capital – networks, trust, information sharing, along with acquiring new skills, knowledge and awareness - is vital in the long-term change in behaviour, attitudes and values required for the delivery of ecosystem services. It is evidenced by the emerging combination of younger and older farmers in many of the case studies.

The bridging of ecological and sociological approaches highlights the potential social co-benefits of high nature value farming systems. Finance alone will not prevent land abandonment or intensification. Ultimately, farmers and the wider community will need to value a species-rich grassland, diverse hay meadow or intact peatland as much as (if not more than) a more intensive land use. Financial incentives can help, of course, but Dessart et al. (2019) highlight the importance and complexity of other aspects of farmers' behaviour that can enhance their commitment to sustainable farming practices. These include the wider promotion of environmental objectives as a norm for farming, environmental activities of neighbouring farmers, the social status associated with positive environmental outcomes and public recognition of farmers' efforts.

LOOKING TO THE FUTURE

What are the factors that guide the choice of pure action-based, pure result-based or hybrid approaches?

Although we clearly focus on results-based approaches in this book, this does not mean that there is no role for action-based schemes. There are likely to be some situations where results-based approaches are most appropriate, others where action-based approaches are most appropriate, and others again where some form of hybrid approach may be the best solution. A hybrid approach could comprise different combinations of:

- action-based payments
- non-productive investments
- results-based payments

Interestingly, all the case studies in this book adopted a hybrid approach, and offered a mix of results-based approaches, non-productive investments, and action-based approaches.

In the AranLIFE project, farmers were offered non-productive investments to pay for capital works for installation of water-catchers, which is a traditional solution for water storage and supply to the island cattle. The provision of water for cattle allowed cattle to graze areas at risk of undergrazing and scrub encroachment and restore the quality of species-rich grasslands. Similarly, the RBAPS, Burren programme, and KerryLIFE projects offered results-based payments, as well as non-productive investments e.g. improved access to facilitate cattle management and grazing or the installation of fencing along sensitive watercourses.

Locally-led non-productive investments can be very different in nature to nationally implemented non-productive investments that are implemented as one-size-fits-all approaches (e.g. hedgerow planting,

bird boxes and bat boxes). Importantly, the non-productive investments featured in the case studies were all highly targeted to resolve specific issues or limitations. They contributed to the infrastructure and capacity of the farmland to attain the higher results-based targets and payments. The nature of the non-productive investment is, therefore, strongly governed by the locally-led approach. Thus, the aims of the actions are aligned with the local environmental objectives, and designed and implemented in a way that contributes to achieving the delivery of targeted ecosystem services.

The important conclusions arising from the case studies in terms of guidance for future approaches include:

1. Action-based approaches that are locally-led or locally-adapted have the potential to offer higher environmental effectiveness compared to generic action-based approaches that do not have option for local adaptation. For example, the NPWS Farm Plan Scheme has been a highly targeted action-based approach (although it is adopting more results-based approaches), and an excellent example where "spatial targeting may be of greater importance than payment differentiation" (Hanley et al., 2012).
2. Results-based approaches can robustly complement and add value to action-based approaches.
3. The adoption of results-based and action-based approaches is not an either-or choice. Results-based approaches can be adapted to complement action-based approaches and both can be geographically targeted to situations where they are best suited.

The process of developing a results-based approach necessarily places a focus on the selection of specific objectives, quantifiable and reliable indicators, and specific targets and thresholds of performance. The clarity that is produced by this process represents good practice in policy design in general, including for action-based approaches. In addition, the clarity that arises from the systematic consideration of the local context will best inform what specific mix of results-based approaches, non-productive investments, or action-based approaches can best achieve the objectives.

HOW DO WE SCALE UP FROM INDIVIDUAL PROJECTS TO COUNTRYWIDE PROGRAMMES?

This collection of case studies provides proof-of-practice that results-based approaches can be successfully designed and implemented to achieve biodiversity objectives in high nature value farmland. These case studies, however, largely represent relatively small projects with numbers of farmers and areas that are relatively small compared to a nationally applicable agri-environment scheme.

Looking to the future, a key challenge is: how to upscale locally-led results based approaches? This is probably one of the most important challenges that need to be resolved if agri-environmental conservation efforts are to be implemented at a pace and scale that matches the corresponding threats.

Here, I draw attention to some of the issues and questions that need to be addressed in scaling up results-based approaches. I do not intend to resolve these issues here, and simply aim to identify and present some of the main ones, as follows:

Across several different environmental objectives, how will decision-making and governance mechanisms resolve the relative prioritisation of environmental objectives, and budget allocations?

Will governance issues arise as one attempts to fit results-based (and hybrid) approaches to the existing governance structures associated with public payment programmes?

Are results-based approaches a natural progression for the various agri-environment schemes that were initially more focused on the establishment of new practices and prescribed managements, and now need to maintain the natural capital arising from this?

Will it be possible for results-based approaches to achieve alignment with EU rules and regulations that were built for action-based approaches, or will some modification of those rules and regulations be necessary?

Can results-based approaches be used to better achieve landscape-scale programmes that achieve a critical mass and spatial distribution of participation that is sufficient to achieve biodiversity objectives (this is also an issue for traditional schemes)?

To what extent can the scaling up of results-based approaches contribute to an economy of scale in the associated transaction costs?

What kind of a national framework can achieve the scaling up of results-based (and hybrid) approaches, and also maintain their capacity for local adaptation? To scale up, do we have to compromise on locally-led aspects? If so, to what extent?

How best to design and implement hybrid approaches? How to decide on the best combination of pure action-based approaches, hybrid and pure results-based approaches?

What are the pros and cons of whole-farm or part-farm approaches to locally-led results-based (and hybrid) schemes?

Is there sufficient capacity in the advisory and knowledge transfer networks to implement an upscaling of locally-led results-based approaches? If not, how can this be addressed, and what is the potential role of other actors?

Are locally-led results-based approaches only appropriate for biodiversity? Can they also be applied to other ecosystem services such as water quality, soil health, greenhouse gas mitigation, and carbon retention?

Are locally-led results-based approaches only appropriate and feasible for High Nature Value farmland, or can they be implemented for the wider countryside as well?

Many of these questions can be resolved quite quickly and can be informed by current experiences within Ireland (and elsewhere in Europe). In addition, it can be expected that the scaling up of results-based approaches can itself be evaluated and improved over time. Here, I briefly discuss the two specific points raised about national frameworks and transaction costs. I also consider the potential for public-private partnerships in the delivery of environmental public goods.

NATIONAL FRAMEWORKS FOR THE INCORPORATION OF RESULTS-BASED APPROACHES

Several opportunities arise for the implementation of results-based approaches depending on the level of ambition and roll-out. Here, I focus on the articulation among the proposed eco-scheme, general agri-environment scheme, a higher tier agri-environment scheme, and separate (but complementary) results-based and hybrid approaches (see Box 9.4). I exclude consideration of the conditionality associated with Pillar 1.

Policymakers face such choices in the design of the new architecture of policy instruments of the CAP. One can also expect an evolution over time in the implementation of results-based approaches.

BOX 9.4

A) There is an increasing degree of incorporation of results-based approaches as one proceeds through more demanding environmental requirements of eco-schemes, general agri-environment schemes (AES), and higher tier AES.

B) Results-based approaches are only applied in selected objectives as part of an AES.

C) Results-based approaches are quite separate to the eco-scheme and AES.

There may be multiple large programmes that scale up hybrid approaches (that include results-based payments) to address specific objectives (e.g. similar to current examples such as Burren Programme, Hen Harrier EIP, and Pearl Mussel Project (EIP) in Ireland). These may also be complemented by smaller projects where other innovative approaches can be trialled for future scaling up. Of course, several of these features are not mutually exclusive.

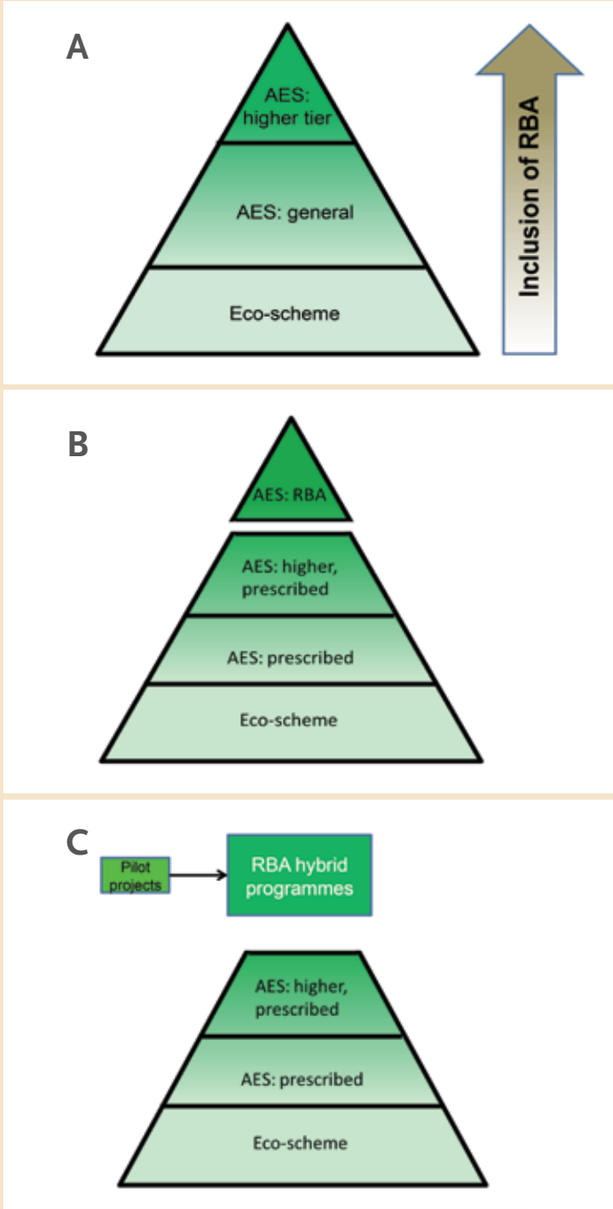

Figure 9.4.
Three scenarios for national frameworks for agri-environmental supports and incorporation of results-based approaches.

POTENTIAL FOR PUBLIC-PRIVATE PARTNERSHIPS?

The emergence of public-private partnerships for the provision of environmental public goods is one of the innovations that may arise through up-scaling of results-based approaches. To date, the prevailing view about agri-environment schemes has been dominated by the provision of environmental public goods being delivered through public payments from the national (or international) taxpayer. Such efforts were originally required because of market failure to internalise the negative/positive impacts of some types of production systems. The growing market awareness and reliance of food brands on sustainability standards represents an effort to internalise the environmental benefits of farming systems *i.e.* brands want to be associated with practices that are good for soil, water, climate and biodiversity (among other attributes). However, with this internalisation of the reputational benefits of sustainability standards also comes with it the possibility of internalisation of the costs of achieving these sustainability standards. There are several examples of this across Europe e.g. Pro Weideland programme in Germany. Might we see greater interest in public-private partnerships that result in some combination of public and private payments for environmental goods and services? If so, it is difficult to see such an approach that would not involve clear and verifiable delivery of the stated standards. Therefore, results-based approaches have a strong role in the delivery of public-private partnerships for delivery of ecosystem services.

TRANSACTION COSTS

A critical issue is whether an economy of scale can be achieved in the transaction costs, if results-based approaches are to be implemented more widely. Novel and innovative programmes generally have significant start-up costs as they learn to address initial obstacles for the first time. However, they can also be expected to reduce their per-participant transaction costs over time as they become more efficient, and increase the number of participants.

Having lower transaction costs (as a percentage of spend) for the delivery of any scheme is a false economy if the objectives are not attained.

Although we don't provide detailed economic analysis of the case studies presented here, some of the case studies can be used to indicate the scale of the transaction costs associated with large projects and programmes. For example, the Burren Programme has an administration budget that is capped at 15%. The administration costs were also capped at 15% for other similar results-based approaches introduced in Ireland recently, including the Hen Harrier Programme (€25 million over several years) and the Pearl Mussel Project (€10 million over several years). These administration fees include most, but not all, of the public transaction costs.

The on-going programmes and the new smaller EIP projects will provide the lessons and evidence to guide the development of results-based approaches in future new programmes so that they can effectively and efficiently achieve an economy of scale.

CONCLUDING COMMENTS

In conclusion, there is an extremely high demand for improved effectiveness of environmental payments to achieve environmental goals. There is a rapidly growing appreciation of the role of results-based approaches in meeting this requirement. It is very important to note, however, that results-based approaches do not displace the need for other agri-environmental measures and programmes (especially action-based payments and non-productive investments). In contrast, they can complement other approaches, and further increase environmental effectiveness. In this book, the evidence presented from the results-based approaches clearly shows its ability to reward farmers in areas with the greatest potential to deliver biodiversity and other ecosystem services in a way that is not constrained by a payment that is based on average conditions (Box 9.1).

In Ireland and the EU, most of the financial support for biodiversity and ecosystem conservation comes from agricultural policies. The future of ecosystem services, including biodiversity, is intimately tied with agricultural practice and support (Poláková et al., 2011). In view of the EU Parliament's enhanced ambition for the environmental and climate objectives of the CAP, the outcome of its reform for the post-2020 period has an ever greater significance. Meeting this ambition will require scaling up, development of capacity, and defining of appropriate CAP instruments for the incorporation of results-based approaches (among other approaches). Importantly, if it is to be properly integrated into policy, such planning and design of results-based approaches will need to be undertaken when general and broad agri-

environment measures are also being designed. This forward planning can help to better integrate these different instruments to ensure that both the environmental targets and payments of each are hierarchical. It in turn, will help to ensure additionality in effects, avoidance of double payment, and provide a progressive financial incentive for farmers to achieve higher payments for higher environmental performance.

Challenges remain to develop the operational details associated with the scaling up of results-based approaches to meet the EU's environmental ambitions. There have always been such challenges in policy formulation but the great societal benefits that need to be achieved provide a strong incentive for all stakeholders to quickly address them. The case studies presented here demonstrate the state of the art and success factors in the design, implementation and achievement of outcomes associated with results-based approaches in Ireland.

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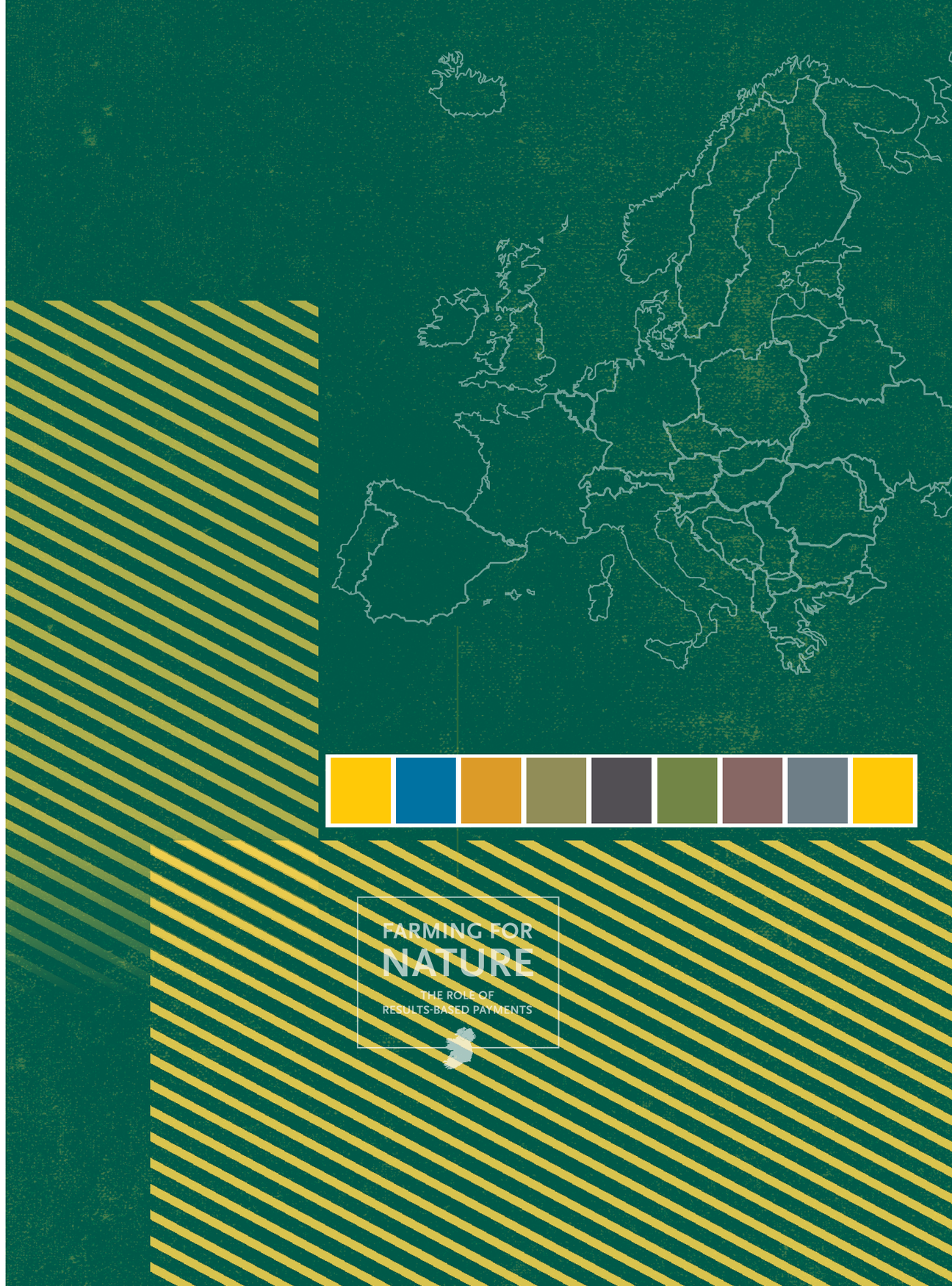

Agricultural habitats cover approximately half the European Union (EU) and an estimated 50% of all species and several habitats of conservation concern in the EU depend on agricultural management. Reversing the loss of European biodiversity is clearly dependent on the conservation of farmland biodiversity.

Results-based approaches are the focus of a growing discussion about improved biodiversity conservation and environmental performance of EU agri-environmental policies. This book outlines lessons learned from a collection of Irish case studies that have implemented results-based approaches and payments for the conservation of farmland habitats and species. The case studies include prominent projects and programmes: the Burren Programme, AranLIFE, KerryLIFE, the NPWS Farm Plan Scheme and Result-Based Agri-environmental Payment Schemes (RBAPS) project.

This work is intended for an international audience of practitioners, policymakers and academics interested in results-based approaches for the conservation of biodiversity and the provision of ecosystem services.

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