Climate-Smart Agriculture
LEADERSHIP FORUM

A Climate-Smart Pathway for Irish Agricultural Development

Exploring the Leadership Opportunity

RDS

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'A Climate-Smart Pathway for Irish Agricultural Development

Exploring the Leadership Opportunity'

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Editorial input: Tom Kirley

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FOREWORD

On behalf of our respective organisations, the Royal Dublin Society (RDS) and the Institute of International and European Affairs (IIEA), we are pleased to introduce this report on 'A Climate-Smart Pathway for Irish Agricultural Development: Exploring the Leadership Opportunity". It is a product of a partnership between the RDS and the IIEA that stretched over eighteen months of fruitful collaboration.

Our mutual aim was to bring the strengths of our respective organisations to the partnership. Since its foundation in 1731, the RDS has been committed to improving standards within Irish agriculture and promoting economic and social development in rural Ireland. Since its establishment in 1991, the IIEA has facilitated analysis and produced policy recommendations on the key strategic issues at national, European and international level. When added together these strengths provide a unique analytical capability in dealing with an issue that covers science in its broadest sense, crosscutting policy making, public administration and the challenge of social change.

Simply expressed, the challenge we took up together was how to ensure global food and nutrition security while tackling climate change; without question this is one of the great issues of the century ahead. Ireland has specific national challenges in addressing these two issues: we are a significant exporter of high quality sustainable food and have a strong track record in contributing to global food and nutrition security. At the same time, we plan to expand our food production. For climate change policy-makers the significance of that development lies in the fact that our agriculture sector already accounts for a high proportion of national greenhouse gas (GHG) emissions; consequently, we confront formidable European and international targets to reduce emissions.

Nonetheless, we believe there is an opportunity here for Ireland arising from a unique set of circumstances. Due to EU climate targets in place since 2008, Ireland has already delivered considerable innovation that can be further built upon by developing a national strategy on climate-smart agriculture (CSA). The ambition should be to deliver a "triple win" of increasing agricultural productivity and income, building resilience to climate change and reducing GHG emissions.

As will be seen, the report proposes that Ireland should become a global pioneer in CSA and provide policy leadership at European and international level. In seeking to identify a practical agenda for such a role, we brought key stakeholders together, including government departments and state agencies, farm organisations, NGOs, the private sector and leading national and international experts. We embarked on a journey of listening and learning, on the basis of mutual respect for a diversity of views. The process was overseen by an IIEA/RDS Steering Committee, chaired by Tom Kirley, Chairman of the RDS, working closely with Tom Arnold, Director General, IIEA, Joseph Curtin, Senior Fellow for Climate Policy, IIEA, and Paul Farrelly, RDS. An Advisory Committee, consisting of representatives of the key stakeholders, played an important role in overseeing the development of the project.

We hope this report will help policy makers consider and frame the future. We believe that Irish leadership in the development of Climate Smart Agriculture can simultaneously serve our national economic interests while providing insights into dealing with a critical issue for our children and grandchildren.

Matt Dempsey
President, RDS

Brendan Halligan
Chairman, IIEA

ACKNOWLEDGEMENTS

The IIEA and RDS would like to thank all of those who have participated in the IIEA/RDS Leadership Forum on Climate Smart Agriculture over the past 18 months. In particular, we wish to thank the Department of Agriculture, Food and the Marine who have been supportive of this initiative from the outset. The then Minister for Agriculture, Food and the Marine, Simon Coveney, TD, officially launched the initiative in March 2015 and his successor, Michael Creed, TD, will launch this final report in July 2016. Officials in the Department have been a constant source of information and support throughout the project and provided substantial feedback on our research outputs throughout the course of our work.

Under the auspices of the Forum, we sought to explore the implications of Climate-Smart Agriculture for Ireland. We worked with stakeholders and experts to identify smart, ambitious and pragmatic solutions for Irish agriculture within the global context of the climate and food insecurity challenges. In particular we investigated the opportunity for Ireland to play a leadership role in addressing this nexus of challenges.

Our modus operandi has been to organise a series of events with national and international thought leaders and experts on related themes and topics. We undertook two substantial online surveys of opinion and we organised two in-depth workshops using the Delphi method. In so doing, we sought to inform this audience and to be informed by them. We also strived to build a spirit of collegiality and trust between stakeholders and experts from diverse backgrounds, including state agencies and government departments, independent researchers, the agri-food industry, the farming community and farmer representative organisations, and civil society organisations.

We established an Advisory Committee to guide the work of the Forum and to provide feedback on project outputs and to contribute their expertise. It was comprised of representatives from a wide and diverse range of organisations. These were:

Mike Magan, *Animal Health Ireland;* **Oonagh Duggan**, *Birdwatch Ireland;* **Padraig Brennan** & **Jim O'Toole**, *Bord Bia;* **Dominic MacSorley** & **Connell Foley**, *Concern Worldwide;* **Edmond Harty**, *Dairymaster;* **John Muldowney** & **Ronan Gleeson**, *Department of Agriculture, Food and the Marine;* **John O'Neill**, *Department of Environment, Heritage and Local Government;* **Hazel Chu**, *Diageo Ireland;* **John Gilliland** & **Gill Gallagher**, *Devenish Nutrition;* **Frank McGovern**, *EPA;* **Cara Agustenborg**, *Friends of the Earth;* **Audrey O'Shea**, *Glanbia;* **John Comer** & **John Enright**, *ICMSA;* **Thomas Ryan** & **Harold Kingston**, *IFA;* **Mags Gaynor** & **Ben Siddle**, *Irish Aid;* **Gerard Keenan**, *Keenans;* **Derry Dillon**, *Macra na Feirme;* **Larry O'Connell**, *NESC;* **Paul Farrelly**, *RDS;* **Eamon Meehan** & **Lorna Gold**, *Trocaire;* **Trevor Donnellan**, *Teagasc;* **Ray Bates**, *UCD;* and **Mick Hamell**, formerly *European Commission.*

We would like to thank all Advisory Committee members for their kind contribution of time and expertise, and for keeping the project on track. These are busy people whose time is in high demand, and we recognise the substantial contributions they made to our work. While this group helped us to develop our findings and recommendations and were supportive of our work, we did not seek endorsements from organisations or individuals for these recommendations. The views and opinions expressed in this report are those of the authors (IIEA and RDS) and do not necessarily reflect the official policy or position of any of the contributors.

The work of the Forum was supported by a number of generous sponsors. These were Bord Bia; Concern Worldwide; Dairymaster; the Department of Agriculture, Food and the Marine; Diageo; the Environmental Protection Agency; Glanbia; ICMSA; IFA; Irish Aid; Nestle; Trocaire; and Devenish Nutrition. We would like to thank all of our sponsors who made this project possible.

We would like to thank **Mary Robinson** and **Tara Shine**, the *Mary Robinson Foundation for Climate Justice*; **David Nabarro**, *UNDP*; **Juergen Voegele**, World Bank; **Joachim von Braun**, *University of Bonn*; and **Rajul Pandya-Lorch**, *IFPRI*, for comments and feedback received. We would also like to thank the IIEA's Director of Research, **Jill Donoghue**, and Creative Director, **Niall Matthews**, for their input into this report, as well as proof-readers **Cian McCarthy** and **Tim Costello**.

Finally, this project was, at its heart, a collaboration between the RDS and the IIEA. Through this project we have pooled our resources, collaborated and shared the burden of the commitment in various ways. While the IIEA took the lead on drafting this report, Tom Kirley, and others in the RDS, provided substantial editorial guidance and intellectual support. We would like to acknowledge each other's contributions in what was a mutually beneficial partnership.

Tom Arnold

Director General, IIEA

Tom Kirley

Chair, Agriculture & Rural Affairs Committee, RDS

EXECUTIVE SUMMARY

OVERVIEW

Ensuring food security for all and preventing dangerous climate change are two of the biggest challenges facing the human family in the 21st century. The scale of the transformation required in the agriculture and land use sector is comparable to the Agricultural Revolution of the 18th century.

This report follows an 18-month process overseen by the IIEA/RDS Leadership Forum on Climate-Smart Agriculture (CSA), under which we worked with stakeholders and experts to identify smart, ambitious and pragmatic solutions for Irish agriculture within this global context. It examines the role that Ireland can play by becoming ***a global leader in CSA.***

CSA is an integrative approach to agricultural and land use development that seeks to deliver a "triple win" of:

- **Increasing agricultural productivity and farm incomes**
- **Adapting and building resilience to the climate change impacts**
- **Reducing greenhouse gas (GHG) emissions (where possible*).**

THE GLOBAL PICTURE

Since the 2006 - 2008 ***food price crisis*** there has been a growing awareness around the twin challenges of achieving food and nutrition security while combating climate change globally, and of the need for an integrative "climate-smart" response to these challenges.

Without ***a dramatic global shift,*** food production and land use will account for an ever-increasing proportion of global emissions in the period to 2050. This would make achieving the global 2-degree climate target impossible, even assuming the rapid decarbonisation of energy sectors. The impacts of climate change will undermine productivity growth in agriculture, resulting in greater food price volatility, food insecurity, hunger, and malnutrition globally.

Improving productive efficiency, reducing food waste, promoting dietary changes, avoiding deforestation and increasing uptake of CO_2 in forests and soils can achieve reductions in agricultural GHGs. Irrespective of the successes of these measures, however, the world is ***locked into considerable climate change*** in the coming decades. Scaling up measures to build adaptive capacity and improve resilience, particularly in vulnerable regions, is therefore of high importance.

IRELAND'S CHALLENGE

Within this global context ***Ireland has*** a set of ***major challenges***. While a minor contributor to emissions in absolute terms, emissions per person are above the EU average. The beef and dairy sectors are relatively large for a developed country and are critically important to the rural economy, while there is substantially less land under forest than is the norm within the EU. The lifting of the EU's milk quotas creates an impetus for dairy sector expansion, but increasingly stringent emissions reduction targets could potentially constrain this growth.

The combined impact of these factors suggests that Ireland is in ***a unique position*** globally when it comes to agricultural emissions. In the absence of ambitious action to address emissions from agriculture, transport and buildings, significant compliance costs may arise in the period to 2030, which would be borne by the exchequer. The contribution of agriculture to Ireland's emissions suggests the sector will be increasingly under the spotlight.

THE FOUNDATIONS OF CSA LEADERSHIP

There is an opportunity arising from these unique circumstances. Due to demanding EU climate targets in place since 2008, Ireland has already delivered ***considerable innovation***. Measures have been deployed to promote greater productive efficiency and reduce inputs on farms, which are positive for farm income and reduce emissions. Ancillary supporting measures around knowledge transfer and R&D, including Origin Green and the Sustainable Dairy Assurance Scheme, are globally leading responses.

Progress has been made in developing increasingly sophisticated measurement and reporting approaches covering sources and sinks of emissions. Strategic policy development has recognised the multiple benefits arising from mainstreaming environmental concerns into agriculture. ***A progressive vision*** to work towards a ***"carbon neutral"*** agriculture and land use sector by 2050 has been proposed by Government, and has wide support from stakeholders and civil society. While the overall impacts of agricultural expansion plans on emissions have not been fully specified, the building blocks of future climate-smart leadership are clearly evident.

GLOBAL CSA LEADERSHIP THROUGH DOMESTIC ACTION

Building on these foundations, ***we recommend*** that Ireland strive for global CSA leadership. So doing would both establish Ireland as an exemplar for other countries to follow and complement existing initiatives that promote Irish food exports and agri-food expertise globally. In the process of striving for leadership, Ireland would continue to develop the techniques, technologies and expertise that will be required in years to come across the globe, and would manage the financial risk in relation to meeting EU climate targets.

This can be achieved by developing a management framework for agriculture, land use and climate change, with a clearly defined vision of either "global CSA leadership" and/or "carbon neutrality" at its heart. The three pillars of CSA are clearly crucial for the future development of Irish agriculture in light of pressure on farm incomes, the increasingly evident impacts of climate change such as flooding, and EU emissions targets.

A management framework would serve to further mainstream climate considerations into policy development and engender a more integrated approach to agriculture, land use and forestry planning. The transparent annual reporting of progress to meeting the agreed vision against key indicators would substantiate claims of leadership by providing hard evidence of progress over time. This would be of benefit to Ireland, both in communicating the efforts to EU partners and in building on Ireland's brand as a sustainability leader.

Measurement, reporting and verification of ***progress must occur*** in line with internationally agreed conventions, which Ireland is at the forefront of developing. New technologies and approaches to support and improve measurement of emissions from agriculture and land use, from farm level to global scales, are increasingly becoming available. ***We recommend*** that Ireland continue to research, pilot and test these new approaches so that on-farm improvements are captured in national inventories.

PROMOTING THE UPTAKE OF CLIMATE-SMART TECHNOLOGIES AND PRACTICES

The end of the milk quota era presents an opportunity for the expansion of dairy-beef enterprises, which are both climate-smart and economically beneficial for farmers. ***We recommend*** that incentives must be consistent and pushing in the same direction to ensure the climate-smart evolution of the national herd in this period of flux.

There are many climate-smart technologies and farming practices becoming available that save farmers money and maintain production, particularly in the area of fertilization. There are also considerable economic opportunities for farmers and rural communities from investing in renewables, and ***we recommend*** the introduction of financial incentives specifically targeting local citizens, based on international best practice.

There are many barriers to uptake of new technologies and practices that require policy intervention. A key challenge is access to land for CSA-pioneering young farmers. ***We recommend*** that this be addressed by ensuring that young farmers are eligible for EU and national incentives, and by promoting awareness of long-term leasing options for older farmers. There ***may also be a need to*** reconfigure extension services in light of new priorities and technologies that are now available for information sharing, and ***there is*** also ***a role for*** public-private partnerships in promoting uptake of new technologies and practices.

THE ROLE OF SINKS INCLUDING FORESTS

Without a substantial contribution from the carbon sinks, in particular forests, it is difficult to see Ireland's likely future EU targets being met. However, farmers remain unconvinced by the value proposition of forestry. ***We recommend*** that creative solutions to address financial and non-financial barriers be explored, including reconsideration of the replanting requirement to ensure that the land most suitable for forestry is planted. Building on existing good practices such as an increased focus on mixed planting, ***we recommend*** that biodiversity concerns associated with forestry be managed through greater integration of data on vulnerable species into planning.

CSA LEADERSHIP ON THE INTERNATIONAL STAGE

We propose that a domestic focus on CSA leadership be complemented with an approach to mainstreaming CSA into Ireland's outward facing diplomacy, building on the suite of existing activities. ***It is important*** within this context to clearly differentiate between the objectives of increasing food production and contributing to global food security; these are both valid, though clearly distinct, policy objectives.

To this end ***there is a case for*** greater definitional clarity of what we mean by CSA within the Irish context to ensure that a coordinated approach can be endorsed by stakeholders. ***We recommend*** a formulation that underpins the rights of smallholder farmers, safeguards human rights and emphasises gender equality.

Building on the existing commitment to spend 20% of the aid budget on nutrition and food security, ***we recommend*** that Government adopt a new target to spend 30% of the aid budget on nutrition, food security and CSA. Furthermore, we identify scope for the major Irish non-governmental organisations to build a strong programmatic and learning relationship with Irish Aid around CSA. The strengths of the private sector in CSA, particularly related to livestock efficiency, ***might be mobilised*** to use public-private partnership models focused on knowledge transfer.

Finally we acknowledge that Irish officials have worked to provide thought leadership at EU and international discussions on climate change and agriculture. ***There is*** now ***potential*** to bring a clear, distinct and coherent Irish narrative consistent with CSA leadership to these fora, and to enter into alliances with like-minded countries. The importance of the EU's Common Agricultural Policy (CAP) for Irish agriculture is underpinned in this report, as indeed is progress made integrating environmental considerations in CAP reforms. ***There is scope*** to build on this progress, and we recommend that the Irish Government play a leading role in advocating for CSA to be considered in the next round of CAP reform (2018-2019). We also ***identify the potential*** for CSA to play a prominent role in the ongoing UN climate change negotiations as well as those focused on implementing the Sustainable Development Goals.

A SOCIETAL VISION

CSA is not just a list of technologies and practices; it is also the process of engaging all stakeholders around a common vision. ***We recommend*** a strategic reorientation of Irish agriculture and food around the pillars of CSA, all three of which are of crucial importance to the future development of agriculture. Responsibility for this reorientation must be shared across the food system, focused on partnerships between processors and farmers, but also on reducing food waste and promoting healthy diets.

This proposed reorientation ***can*** only ***be achieved*** with buy-in for this vision at the highest levels of Government, across the administrative system, among key stakeholders, and particularly from the farming community. Taking action could deliver benefits within Ireland and provide leadership in the face of the global challenges of climate change and food insecurity.

*Some definitions of CSA include "where possible"1 because CSA is relevant for food insecure countries where mitigating greenhouse gas emissions may not a priority. Other definitions of CSA do not include "where possible".2

CHAPTER 1:
The Climate-Smart Leadership Opportunity

1. CLIMATE-SMART AGRICULTURE

Ensuring food security for all and avoiding dangerous climate change are two of the biggest challenges facing the human family in the 21st century. Avoiding the most negative future pathways – characterised by high levels of human hardship and suffering – requires urgent action and collaboration on a global scale.

The scale of the transformation required in the agriculture and land use sector is comparable to the Agricultural Revolution of the 18th century, or the "Green Revolution" of the 20th-century led by Norman Borlaug, which has been credited with saving over one billion people from starvation.

In working towards ensuring global food security, avoiding climate change and building resilience to its impacts, the idea of developing an integrative approach, climate-smart agriculture (CSA), to address these interlinked challenges has gained ground internationally. This culminated in the foundation of the Global Alliance for CSA (GACSA) in 2014. The founding members of the Alliance were 20 nation states, including Ireland, civil society organisations and international corporations.

CSA aims to achieve a "triple win" of:

1. Sustainably increasing agricultural productivity, to support equitable increases in farm incomes, food security and development

2. Adapting and building resilience of agricultural and food systems to climate change at multiple levels

3. Reducing greenhouse gas emissions from agriculture, including crops, livestock and fisheries (where possible).

The approach considers these objectives at different scales, from farm to landscape, at different levels, from local to global, and over short and long time horizons, taking into account national and local specificities and priorities. It relates to actions both on-farm and beyond the farm, and incorporates technologies, policies, institutions and investment.[3]

2. THE ROLE OF IRELAND

This report focuses on the role that Ireland, a small wealthy country, can play in meeting these global challenges. The IIEA/RDS Leadership Forum on CSA was established to examine how aspects of Irish climate-smart leadership could be collectively identified, disseminated and operationalised. We worked to identify smart, ambitious and pragmatic solutions for Irish agriculture, with a view to increasing the competitiveness of the sector while reducing its environmental footprint. Our modus operandi was to engage with and build a community of national leaders and stakeholders to this end (Section 3 below).

We acknowledge that, in absolute terms, Ireland cannot materially influence either global food security or the scale of climate change, given it contributes only 1.4% of total EU emissions per annum.[4] But it is at the intersection where these two issues of food security and climate change meet (Fig 1), that Ireland, through finding solutions to its own specific challenges, could provide policy and thought leadership internationally.

This intersection might be described as the climate-food-land nexus. It is clear that agriculture and land use are an important part of the climate change issue, both in terms of contributing to the problem and in providing solutions, but climate change also has profound implications for agriculture and land use (Chapter 2).

We do not believe at this point that there is an example of a country that has developed a fully coherent, whole-of-government position on how this climate-food-land nexus can comprehensively be addressed in a balanced manner, either in strategic policy development and formulation, or in implementation at farm level.

While many of the building blocks of an exemplar

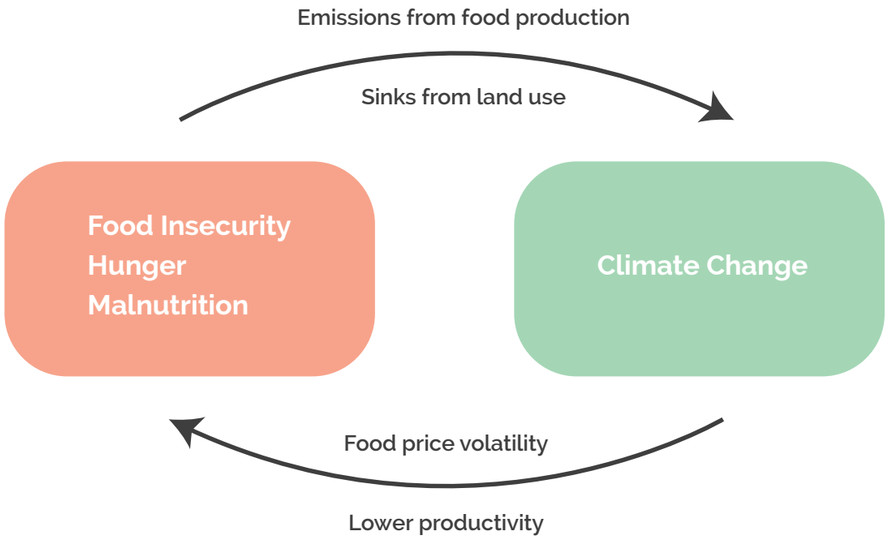


Fig. 1.1. The Climate-Land-Food Nexus

Source: IIEA/RDS

response are evident in the Irish case (Chapter 4), we believe these foundations can be built upon (Chapters 5 and 6), and that these individual strands of a strategic response can be brought together more explicitly into a coherent whole.

We believe that it would be in Ireland's best interests to adopt global leadership as a stated policy objective and to identify and implement policy measures consistent with meeting these objectives across Government (Chapter 5). Adopting a leadership position would achieve three objectives:

First, Ireland could present itself internationally as an exemplar for other countries to follow, providing a template for how the policy objectives of agriculture and climate (often seen as inherently inconsistent or incompatible) can be married. Solutions to agricultural emissions will increasingly be required as energy sectors decarbonise (Chapter 2). In this sense Ireland's approach could have a true global impact.

Second, we believe that developing this leadership position is in Ireland's own best interests. Being seen as a leader will bolster Ireland's reputation, and would therefore help boost the value of Irish food exports and expertise globally. In the process of striving for leadership, Ireland would also develop the techniques, expertise and reputation internationally (many of which are already evident in the public and private sector) which will be required in years to come across the globe. Ireland could develop a first-mover advantage in sustainable food production and managing and reducing climate risk.

Finally, in developing global leadership, Ireland would help in managing the compliance risk it faces in relation to the greenhouse gas emissions from its agriculture sector, which faces a uniquely onerous regulatory environment by global comparison (Chapter 3).

3. REASONS IRELAND CAN LEAD ON CSA

Experts and stakeholders with whom we have worked (Section 4 below) have endorsed this concept of leadership and have worked with us to identify the following reasons and evidence that Ireland can become the leader.

First, *Ireland can lead because there is a growing focus internationally on how to address the climate-food-land nexus.*

Historically there has been insufficient policy or public attention paid to this nexus of issues, but in recent years we can identify a profound shift at EU level and globally (Chapter 2). There is a growing awareness of the importance of agriculture and land use as sinks and sources of emissions, the importance of reducing emissions for food security and hunger and the need for a coherent and consistent approach to addressing these issues. This opens an opportunity for Ireland to provide leadership by illustrating how a nation can develop a consistent, coherent, cross-government and exemplary response to this interrelated complex of concerns.

Second, *Ireland can lead because many of the competitive and institutional advantages, which are the building blocks of leadership, are already in place.*

Although a small country, Ireland is a big player in international food markets. It is the 4th largest beef exporter globally,[5] responsible for approximately 15% of the world's internationally traded infant formula, home to several global Irish food brands and has a reputation as an exporter of high quality, sustainable, carbon-efficient (Chapter 4) and safe food. The importance of the agriculture sector has resulted in the development of significant private and public sector resources that can be deployed in the direction of climate-smart leadership. Ireland also has a long-standing reputation for promoting climate-smart and agro-ecological approaches in developing economies through its aid programme and the work of several high-profile NGOs (Chapter 6). Finally, Ireland already has in place many building blocks of leadership such as a national sustainability programme for the Irish food and drink industry (Chapter 4). This is the only sustainability programme in the world that operates on a national scale, uniting government, the private sector and food producers, through An Bord Bia, the Irish Food Board (Chapter 4).

Third, *Ireland can lead because it is in a unique position with respect to the stringency of the emission reduction targets it faces.*

Ireland is unique among EU countries (and highly unusual among developed countries) in relation to the proportion of emissions arising from agriculture and the stringency of the emissions reduction obligations it faces (Chapter 3). While a huge challenge, the policy environment has created an impetus for innovation in many forms. This impetus for change is evident in institutional innovations; regulatory and policy innovation; innovation in analytical and research capacity and focus; innovations in measurement and advice to the farming community; and innovations in on-farm practices. The regulatory environment therefore poses strong pressure to develop solutions to problems that will increasingly become evident in other countries as energy sectors are decarbonised over the coming decades (Chapter 2).

Fourth, *Ireland can lead because it has achieved leadership in related fields in the past.*

The policy area of food security and nutrition provides a precedent where Ireland has established an internationally recognised leadership position,. A core element underpinning Ireland's leadership role in nutrition was a policy blueprint, represented by the report of the Irish Hunger Task Force (2008), which received high-level political support. A whole-of-government approach was taken to implementing its recommendations, and Irish development NGOs aligned their programmes accordingly. Ireland's international leadership role was reflected in the partnership with the US government in launching the Scaling up Nutrition (SUN) Movement in 2010, aimed at promoting improved nutrition. By 2016, 57 countries are members of the SUN Movement. The approaches used and lessons learned in achieving this leadership position underpin the contention that Ireland could also carve out a leadership role in CSA, and have thus influenced the direction of this project.

Fifth, *Ireland can lead because the experiences of our Northern European neighbours illustrate that small countries can lead in addressing climate change.*

The experiences of other small northern European countries in the climate arena, while not related to agriculture, give us confidence that small countries can be widely influential. These examples illustrate that ambitious action generates benefits and first mover advantages for the countries in question. Denmark, for example, has been a pioneer in the deployment of wind energy. When the 1973 oil crisis struck, more than 90% of all Danish energy supply was imported. This challenge was turned into an opportunity by first developing the technologies, techniques and practices; second, deploying them locally; and finally exporting globally. A strong national policy framework and consistently ambitious targets for wind energy have played an important role in wind energy deployment.[6] By

2015, wind power production reached nearly 42% of domestic electricity supply, and exports of Danish energy technology more than tripled from 1998 to 2008 and make up around 11% of total Danish goods exports. There is an analogous opportunity for Ireland to achieve something similar in CSA.

Sixth, *Ireland can lead because this vision of leadership is shared among many national experts and stakeholders.*

A final reason for thinking that Ireland can lead, and that there is a real opportunity from leadership, is the position of Ireland's leading experts and stakeholders, as elicited in a survey of over 1,500 experts (with a 14% response rate). The majority of respondents saw an opportunity from Irish leadership, with 76% agreeing or agreeing strongly that "Ireland's EU emissions targets present an opportunity for Ireland to become a leader in CSA". Furthermore, 86% of respondents "agree strongly" or "agree" that "establishing Irish leadership on CSA could offer benefits for the agri-food sector". These findings were consistent across all cohorts surveyed (farmers, agri-business, NGOs, independent researchers and policy makers) and were complemented by an international survey on CSA leadership, which found that no clear leader on this nexus of issues had emerged globally.

4. THE IIEA/RDS LEADERSHIP FORUM ON CSA

The Leadership Forum was established in April 2015, with IIEA and RDS forming a Steering Committee for the project. An Advisory Committee established to provide feedback on project outputs and to contribute expertise was comprised of the following organisations:

Birdwatch Ireland; An Bord Bia; Concern Worldwide; Department of Agriculture, Food and the Marine; Department of Environment, Heritage and Local Government; Diageo; Devenish Nutrition; EPA; Friends of the Earth; Glanbia; ICMSA; IFA; Irish Aid; Keenans; Macra na Feirme; NESC; Trocaire; Teagasc; UCD.

We sought to explore three dimensions of CSA leadership through the organisation of events and discussions with Irish and global experts, by undertaking on-line surveys, hosting expert and stakeholder workshops, and by producing research outputs, as per the project plan in Fig. 1.2 on the following page.

All outputs were disseminated via our digital hub: http://www.iiea.com/ClimateSmartAgriculture/index.html

This report is a synthesis of the findings of our project. It is structured as follows: the next chapter looks at the international context within which Ireland must act. We then look at the challenges faced by Ireland within this EU and global context, while Chapter 4 examines Ireland's policy response to date. On this basis, Chapters 5 and 6 set out policy options for consideration by Government in building a leadership position on CSA, looking at the national and international dimensions of leadership respectively.

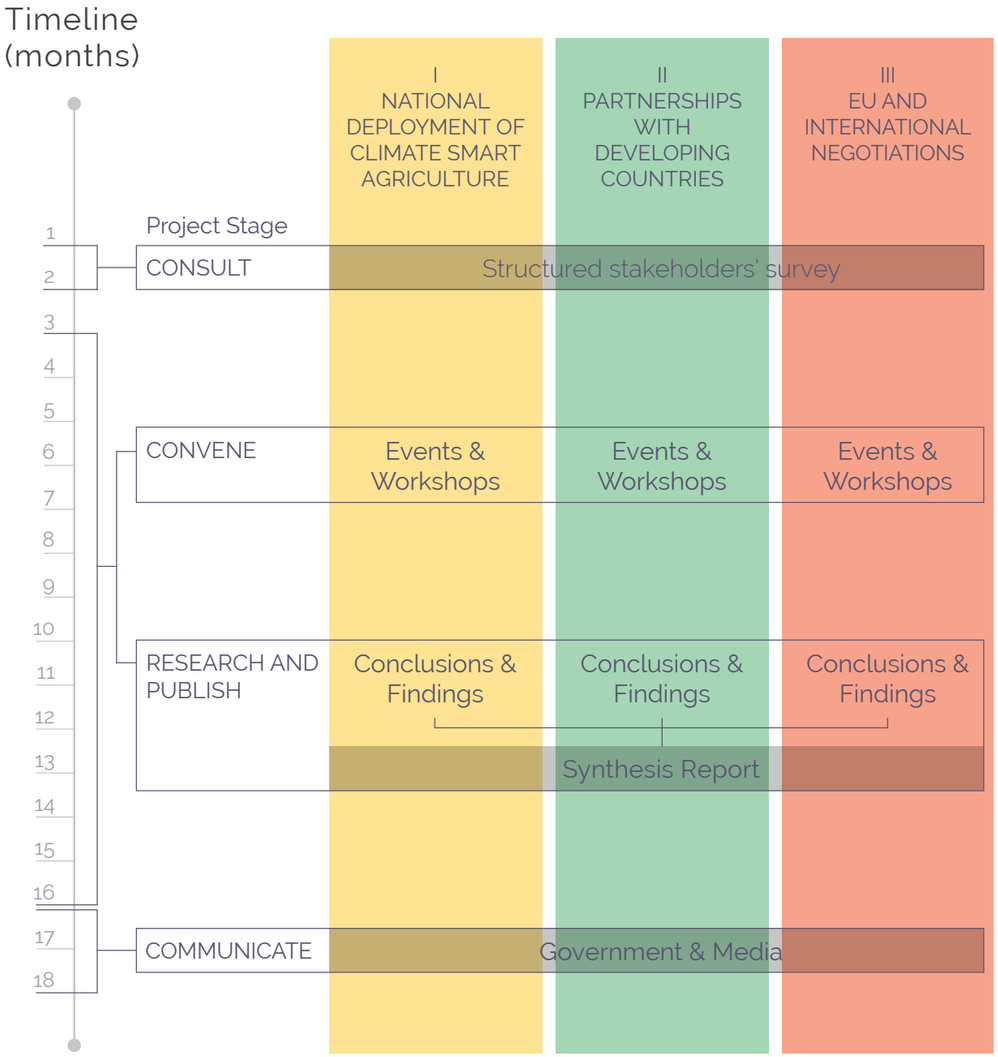


Fig 1.2. Project Plan

CHAPTER 2:
The Global Challenge

1. INTRODUCTION

The rapidly increasing demand for food from a growing and more affluent global population must be met in ways that are sustainable in the face of climate change, as well as other environmental challenges such as water stress and biodiversity. Solutions must also address economic and social challenges such as farmer income in both developed and developing countries, and more acutely, hunger and malnutrition, which continue to afflict the world's poorest people. Responding comprehensively requires evolution across the entire food system, in how food is produced, processed, stored, distributed, accessed and consumed.

This chapter deals with the scale and changing nature of the global food and nutrition security challenge within the context of climate change. It begins by defining what we mean by food and nutrition security and describes the changing dynamics in the global food economy over recent decades, and the consequent re-emergence of food and nutrition security as short-term and longer-term concerns.

It describes the scale of the challenge to achieve food and nutrition security within the context of climate change by 2050, and sets out the current knowledge on how food security and climate interact. This includes specifying the contribution of agriculture and land use to climate change; the potential impacts of climate change on food and nutrition security; approaches to mitigate emissions from agriculture and land use; and the necessity of building resilience within the agriculture sector to the impacts of climate change. Finally, the evolving international framework focused on taking a more integrative approach to addressing these challenges is discussed.

2. DEFINING FOOD AND NUTRITION SECURITY

The World Food Summit (1996) defined food security as existing 'when all people at all times have access to sufficient, safe nutritious food to maintain a healthy and active life'. This definition was based on three pillars – availability, access and use of food. In recent years, it has been recognised that, even when a country has an aggregate sufficiency of food, income distribution or other circumstances, such as lack of health services, may mean that individuals may not be nutritionally secure. It was on this basis that in 2013 the UN Standing Committee on Nutrition (SCN) stated that "food and nutrition security" exist when "all people at all times have physical, social and economic access to food, which is consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life".

3. THE CHANGING GLOBAL FOOD ECONOMY IN RECENT DECADES AND A 2050 PERSPECTIVE

For the three decades following the food price peaks in the early 1970s, the global food economy was characterised by falling real food prices. This was based on production somewhat outstripping demand, notwithstanding continuing population growth and changing food consumption patterns. Steady progress was made in reducing the proportion of the world's population classified as undernourished from nearly 30% in 1970 to slightly over 12% in 2015, a period during which world population more than doubled to reach 7.3 billion.

Progress notwithstanding, 795 million people were classified as chronically food insufficient in 2015. In addition 162 million children were stunted, and over 2 billion people suffer from one or more micronutrient deficiencies.

The first decade of the 21st century brought substantial changes in the global food economy. Severe weather events, subsidies to promote biofuels and the impact of the 1995 WTO Agreement (which reduced the capacity of major food

producers to subsidise exports to world markets) changed the dynamic of global food supply. Furthermore, growing demand for food was being driven by a steadily increasing world population, and in emerging economies, such as China, a desire for higher protein diets was driving increased meat and dairy demand.

These factors came together in the 2006-08 period, which saw rapid increases in food prices. In what was termed the 'food price crisis', food riots occurred in over thirty countries and pushed an additional 100 million into hunger. Following the crisis, food and nutrition security came back on the political agenda.

At the end of 2015, several further food crises were triggered by extreme weather events due to the El Nino phenomenon, but also linked to climate change. Severe droughts affected several countries in the Horn of Africa, southern Africa, eastern and southern Asia, Central America and the Caribbean. The impact of these droughts is forecast to continue through 2016, particularly in Southern Africa and in Southern and Central America. Combined with conflict and political unrest in Syria, the Middle East and parts of Africa, these factors have contributed to the significant flow of refugees to Europe since 2014.

At the other end of the spectrum, a growing number of people are suffering from over-nutrition: currently more than 2 billion people are overweight or obese. Moreover, under-nutrition and obesity increasingly coexist in the same households – what is termed the 'double burden'.

Arising from these developments there is an increasing recognition that the agricultural sector is both a contributor to and vulnerable to the impacts of climate change. This evolving understanding was captured by the UK Government's Foresight Study (2011),[7] which identified potential threats to food security as so great that 'they cannot be met by making changes piecemeal to parts of the food system'. It described addressing climate change and achieving a sustainable global food system as 'dual imperatives' and concluded that "a redesign of the whole food system to bring sustainability to the fore" was required.

Looking to the longer term, it is projected that world population will grow to 9.6 billion by 2050. Most of this growth will occur in developing countries. It is anticipated, in line with trends in recent decades, that an emerging middle class with growing wealth and purchasing power will increase their per capita food consumption, particularly for processed food, meat, dairy, and fish.[8]

This increasing demand will present market opportunities for a country like Ireland that produces and exports high quality, safe and sustainable food. But a significant proportion of the increased population will occur in poorer countries that currently experience relatively low agricultural yields and low per capita availability of food, with only a small percentage of caloric intake from animal products. The food security for these poorer countries can most effectively be enhanced by assisting them in increasing their own food production – and Ireland can also play an important role in this (Chapter 6).

4. THE CONTRIBUTION OF AGRICULTURE AND LAND USE TO CLIMATE CHANGE.

The increasingly important and complex interrelationship between food security and climate change will be critical to the evolution of the global food economy. Agriculture, forestry and other land use (AFOLU) combined contribute 24% of total GHG emissions globally, which is greater than the total contribution of the transport sector.

Emissions from the AFOLU sector increased by 20% between 1970 and 2010. While emissions from the sector are projected to grow, there is a wide range of uncertainty in relation to the speed of this growth. The Food and Agricultural Organisation FAO) estimates that emissions could increase by a further 30% by 2050 without greater mitigation efforts,[9] whereas other peer reviewed studies estimate that GHGs from food production could increase by up to 80% by 2050.[10] Drivers include increased human and animal numbers, an increase in food demand and per capita food availability, an increase in the area under agriculture and deforestation, and an increased use of fertilisers in all agricultural sectors.

A key driver of emissions is consumption of meat and dairy products, which is anticipated to rise by 76% and 65% respectively against a 2005–07 baseline, compared with 40% for cereals.[11] The FAO estimates that emissions from livestock supply chains alone represent 14.5% of all human induced emissions. In addition to its direct impacts, livestock production and demand for animal feed has a number of other indirect consequences, most notably deforestation and land degradation, which increase the concentration of greenhouse gases in the atmosphere.

Under these future projections for AFOLU emissions, it is highly unlikely that the universally agreed global 2-degree target will be met. This is because the resultant growth in agricultural emissions would leave insufficient space within the carbon budget for energy sectors, even assuming rapid decarbonisation within these sectors.[12] Feeding the population anticipated for 2050 while improving diets in developing countries would also require exploiting land and water beyond sustainable limits.[13]

It is clear that trends in agriculture and food consumption alone are making a major contribution to dangerous climate change. Even assuming rapid decarbonisation of other sectors, it will be impossible to stay within either a 1.5 or 2-degree C target without a transformation of the AFOLU sector.

5. BUILDING RESILIENCE TO POTENTIAL IMPACTS OF CLIMATE CHANGE

Irrespective of whether emissions are reduced or not, over the coming decades global temperatures are projected to increase along broadly similar pathways. That is to say that the world is locked into a certain amount of climate change and it is only in the second half of the 21st century and beyond that global temperature increases diverge across emissions scenarios.[14] As global emissions have continued to increase, this has inevitably brought an increasing focus on what the impacts will be for global agriculture, and on how resilience and adaptive capacity can be enhanced.

The Intergovernmental Panel on Climate Change's (IPCC) 5th Assessment Report asserted that the negative impacts of climate change will be particularly severe in developing countries, with all aspects of food security potentially affected, including food access, utilisation, and price stability. Climate and economic shocks increase the volatility of food prices. When prices are high or uncertain, consumers typically respond by protecting their intake of major staples and substitute other foods in their diet to make the most of their purchasing power.

In the future, climate change will likely bring greater temperature extremes that will be damaging and occasionally lethal to crops, and could cause drought, floods and tropical storms, which are all major drivers of food insecurity.

Impacts will be geographically differentiated (see Text Box 2.1 for an overview of potential impacts in Ireland). The African continent is particularly vulnerable to the impact of climate change. A temperature increase of 2 degrees would increase the frequency and severity of droughts, cause more erratic rainfalls, and shorten the growing season. Observed data and many studies indicate that a warming climate has a negative effect on crop production and generally reduces yields of staple cereals such as wheat, rice, and maize. Negative impacts will be felt on harvested aquatic species, both freshwater and marine. The reduced crop productivity associated with water, heat and drought stress brings a risk of strong adverse effects on regional, national and household food security.

Low-income agricultural dependent economies that are net food importers could therefore experience significant losses in food access through a double negative effect on reduced domestic agricultural production and increased food prices on global markets. For millions of farmers who own less than one hectare of land and live on less than $1 a day, food and nutrition security are at risk. By the year 2050, hunger and child malnutrition could increase by as much as 20% as a result of climate change.[15] Increases in productivity, it should be noted, could be experienced in some regions in certain scenarios.

The importance of building resilience and adapting to these impacts has become a central issue in the work of developmental organizations such as the United Nations specialised agencies, bilateral donor institutions, and non-governmental organizations (NGOs).[16]

At the farm level, adaptation includes better use of seasonal forecasting, soil, water and nutrient management, conservation technologies and diversification of on- and off-farm activities. In many parts of sub-Saharan Africa, expanded access to irrigation is crucial because agriculture tends to be rain-fed, whereas in many parts of Asia, building resilience to flooding through improved seed varieties can be the priority. In all regions better soil management and building soil organic matter is crucial for building resistance to climate shocks, and there are synergies for mitigation. Insurance instruments are considered important for managing

shocks when they arise.

Efforts to adapt and build resilience need to be scaled-up, but insufficient finance is one of the main constraints. The costs of inaction, however, may be considerably higher: for every USD1 spent preparing for disasters, USD7 is saved in the cost of post-disaster recovery efforts.[17]

Text Box: The Potential Impacts of Climate Change in Ireland (2041-2060)

The most authoritative study on the potential impacts of climate change in Ireland was undertaken by the Irish Centre for High-End Computing and the Meteorology and Climate Centre, University College Dublin, in conjunction with Met Éireann and the Environmental Protection Agency. This study used Regional Climate Models to dynamically downscale coarse information from Global Climate Models, providing high-resolution information in Ireland. Simulations were run for a reference period (1981–2000), and a future period (2041–2060).

With respect to temperatures, projections suggest: an increase of 1–1.6˚C in mean annual temperatures; the largest increases in the east of the country; hot days will get warmer by 0.7-2.6˚C; cold nights will get warmer by 1.1-3.1˚C; the decline in the number of frost days by over 50%; and an increase in the length of the growing season of over 35 days per year.

With respect to rainfall and storm activity, projections suggest: significant decreases in rainfall during the spring and summer of up to 20% and a greater number of extended dry periods; up to a 20% increase in heavy rainfall events in winter and autumn; and an increase in the intensity of storms and risk of damage from storms, but a decrease in the overall number of storms. 18

6. REDUCING AGRICULTURAL AND LAND USE EMISSIONS ON THE SUPPLY AND DEMAND SIDE

In framing the debate on how to tackle the twin challenges of assuring global food and nutrition security and reducing GHG emissions, scientific research has focused on both the supply and demand sides. The consensus view from this research is that agricultural GHG emissions "cannot be addressed simply as a problem of inefficient production on the supply-side". Only a combination of sustainable intensification, food waste reductions, a shift towards healthier diets, and maximising sequestration, could result in sufficient level of emissions reduction.19 Together, these measures on the demand and supply sides could make a very substantial (over 50%) reduction in agricultural emissions by 2050. [20]

On the supply side, emissions from land-use change, land management and livestock management can be reduced, terrestrial carbon stocks can be increased by sequestration in soils and biomass and emissions from energy production can be saved through the substitution of fossil fuels by biomass. The scope to reduce emissions intensity (amount of GHGs emitted per unit of output produced) appears considerable given the large differences in emissions intensity between different regions of the world, particularly in the beef sector.[21]

It has been estimated that the emissions reduction potential of the agricultural sector through supply-based approaches is nearly 2 Gt CO_2-eq (approximately 3% of global emissions) per year by 2030 and, in most cases, these interventions would yield productivity gains and ought to be in the best interest of farmers and governments.22

Additionally, global carbon sequestration potential of between .7 and 1.6 Gt CO_2-eq per year by 2030 has also been identified, including the carbon sequestration in agricultural soils and above-ground biomass. There is uncertainty, however, around the level of potential, its permanence, and the impact of various measures. This is particularly the case in relation to soil carbon where the rates of sequestration are difficult to determine. Long-term management and preservation of soil carbon is also critical for agricultural productivity and maintaining soil organic matter is vital for farmers irrespective of climate change.

The IPCC found that the greatest potential for emissions reduction, however, exists from demand side measures.[23] Estimates vary, but between 2 and 3 Gt CO_2-eq[24] could be mitigated through changes in diets and reductions in food waste in 2030 compared with a business as usual scenario.

About 75% of this mitigation potential comes from changes in diet. Beef is the commodity with the highest emissions intensity, with an average of over 300 kg CO_2-eq per kg of protein (by comparison Irish production systems are considerably more carbon efficient, see Chapter 4, Section 2); followed by meat and milk from small ruminants, with averages of 165 and 112 kg CO_2-eq per kg of protein, respectively. Cow milk, chicken products and pork have lower global average emission intensities, all below 100 kg CO_2-eq per kg of edible protein.[25] Plant proteins tend to have carbon footprints many times smaller than animal proteins.[26]

The remaining 25% of demand-side mitigation potential arises from reducing food loss and waste. FAO estimates that each year, approximately one third of all food produced for human consumption in the world is lost or wasted.

There are, however, many barriers to implementation of cost-effective mitigation options, including accessibility to financing, poverty, institutional, ecological, technological development, diffusion and transfer barriers.[27] Encouraging changes in agricultural practices requires measures such as expanding extension capacity, expanding the availability of subsidised loans, providing financial incentives and working directly with producer groups.

Achieving a global transition would require mainstreaming of high productivity, low emissions agriculture across the globe into the daily business of actors across the sector. This includes a much greater focus on these issues from Governments, agribusinesses, financial institutions and donors, and reform of agricultural subsidies in major agricultural economies. 28

7. POLICIES LINKING FOOD AND CLIMATE

Notwithstanding their critical importance, efforts to establish a specific work programme on climate and food security issues (most recently at the Cancun Conference of Parties, 201029) were resisted until recent times. As a result, the COP climate change negotiations, as represented in COP-21 in Paris in December 2015, do not include a work programme for agriculture. By comparison, work programmes exist for similar areas, most notably reducing emissions from deforestation and forest degeneration (REED).

This situation is now changing. Since 2014, issues related to agriculture have been discussed in a parallel process under the Subsidiary Body for Scientific and Technological Advice (SBSTA). A report will be presented to the United Nations Framework Convention on Climate Change (UNFCCC) at the COP22 meeting in Morocco in November 2016, which will form the basis for a decision on agriculture, including the possibility of a work programme.

Furthermore, in 2015 two major international agreements were concluded: the Sustainable Development Goals (SDGs) in September and the Paris Agreement on Climate in December. Taken together, these agreements define the development and climate agendas for the coming decades and the climate-food-land nexus is recognized prominently in both.

A number of the SDGs and their indicators focus on hunger, responsible consumption and production, climate change and land use - in particular Goals 2, 12, 13 and 15. The Paris Agreement also brought a more prominent focus on agriculture than any earlier UN climate agreements. The preamble recognises "the fundamental priority of safeguarding food security and ending hunger, and the particular vulnerabilities of food production systems to the adverse impacts of climate change". Article 4.1 of the Agreement references the requirement "to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century", thereby underlining the importance of sinks (and land use) at the heart of the agreement. Agriculture also plays an important part in most countries' national pledges to reduce emissions.[30]

At EU level there has also been considerable focus on this nexus of concerns. The EU Council Conclusions in October 2014 placed a prominent focus on agriculture and land-use issues, noting the multiple objectives of the agriculture and land-use sector, and their "lower mitigation potential", and the need to ensure coherence between the EU's food security and climate change objectives (Chapter 3). In 2015, the EU adopted an initiative called Food 2030 aimed at achieving better research and innovation policy coherence on food and nutrition security. A key priority of Food 2030 is to build

climate and global change resilient food systems, both with respect to climate adaptation (e.g. drought resistant hybrid crops) and climate mitigation (e.g. reducing the GHG footprint of agriculture via soil carbon capture). At the Valetta Summit on Migration in November 2015, EU and African countries came together to find solutions to the political and economic challenges posed by migration flows. Among the decisions taken at the Summit was the creation of an Emergency Trust Fund of €1.8 billion aimed at addressing the root causes of forced displacement and irregular migration and supporting projects for food and nutrition security and environmental sustainability.

There is also a growing global understanding that this nexus of challenges must be addressed holistically. CSA has emerged as an analytical approach to achieve this objective. The GACSA, announced by world leaders at the Climate Summit in New York in September 2014, is part of a global response. The GACSA was formed by a diverse set of members including: governments; NGOs; farmers, fishers and forester organisations; intergovernmental organisations (including UN entities); research/ extension/education organisations, financing institutions and private sector actors. An African Alliance for CSA was also established in 2014 involving 26 African countries and five NGO members, including Concern Worldwide. These countries are participating on a voluntary basis with the objective of triggering policy changes and increasing investments that can transform Africa's agriculture in a changing climate.

Finally, a number of other discrete initiatives have been launched: a Global Research Alliance (GRA) on Agricultural Greenhouse Gasses was established in 2009 to find ways to reduce the emissions intensity of agricultural production while increasing food security; in 2009, the Consultative Group on International Agricultural Research (CGIAR) established a 10-year research initiative that seeks to overcome the threats to agriculture and food security in a changing climate; and at COP 21 (2015) the "4 per 1000" initiative was launched by the French Government with the objective of promoting carbon sequestration in the soil.

8. CONCLUSION

Since the 2006 – 2008 food price crisis, the challenges of achieving food and nutrition security while combating climate change have risen up the political agenda. There is a growing sense of urgency internationally in dealing with the climate-food-land use nexus of concerns as the impacts of climate change become increasingly apparent.

The short-term requirements to respond to immediate food and nutrition imperatives are compounded by worrying longer-term trends, in particular the potential negative impacts of climate change against a backdrop of a growing global population. Building more sustainable and resilient agricultural and food systems will be a key part of any solution.

On a business-as-usual approach, food production and land use will account for an ever-increasing proportion of global emissions in the period to 2050. If not addressed, emissions from these sectors make achieving the global 2-degree target impossible, even assuming rapid decarbonisation of other sectors. This in turn will undermine the productivity growth of the global agricultural system, resulting in greater global levels of food insecurity, hunger, and malnutrition.

These negative future scenarios can be mitigated or avoided through the adoption of a portfolio of approaches, including promoting the uptake of technologies and approaches to boost on-farm efficiencies, maximising sinks and supply side measures including dietary change and reducing food waste. In addition, efforts to build resilience to the future impacts of climate change, now inevitable, must be scaled up.

There has traditionally been an absence of efforts to address these challenges in an integrative manner. There are signs, however, of a growing global awareness that this nexus of challenges must be addressed holistically, and of a growing global willingness to address this nexus of concerns in an integrative manner. In particular we would point to an increased focus on deploying climate-smart approaches evident in the establishment of Global and African Alliances for CSA.

CHAPTER 3:
Ireland's Unique Characteristics

1. INTRODUCTION

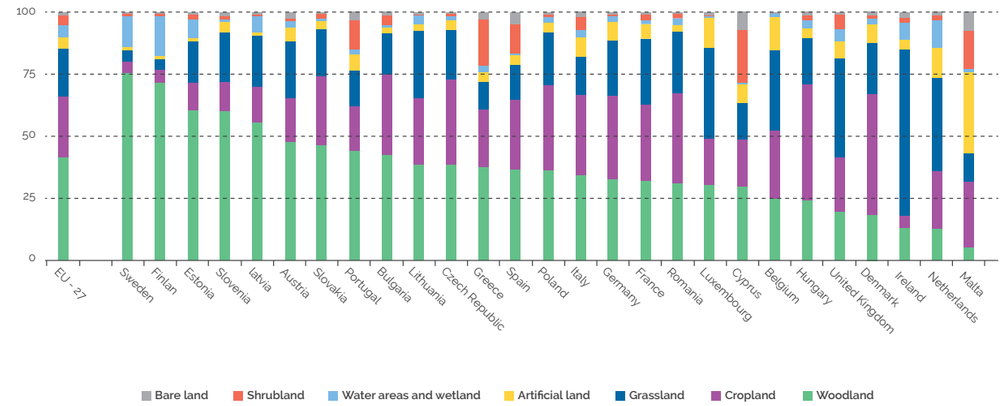
In this chapter we detail why Ireland finds itself with significant challenges due to traditional land-use patterns and the resulting greenhouse gas emissions profile.

We begin by describing Ireland's land-use patterns, the importance of the dairy and beef sectors to the Irish economy and the contribution of the agriculture and land-use sector to Ireland's greenhouse gas emissions. We detail Ireland's plans for agricultural development within the context of the EU's evolving CAP and in particular the lifting of EU milk quotas in 2015, highlighting the importance of the EU policy changes for the structure of Irish agriculture over the past and coming decades. We conclude that when these national and EU characteristics are considered, Ireland's circumstances are without comparison in relation to its emissions from agriculture and land use and we illustrate this point by way of compliance scenarios for 2030.

This chapter provides a foundation for understanding Ireland's policy responses to date and future policy responses that might be considered in pursuit of global CSA leadership, the subjects of the following two chapters.

2. IRISH AGRICULTURAL SECTOR LAND USE PROFILE AND EMISSIONS PROJECTIONS

In Ireland there is relatively more grassland and markedly less land under forest cover, arable crops and other land uses compared to the EU average (Fig 3.1.). Over 42% of the EU-28 land area is under forest cover and other wooded land,[31] compared to only 11% in Ireland. The current level of forest cover is an increase from 1% in 1900. Ireland's unusual land-use pattern can be attributed to the high levels of deforestation that occurred over previous centuries and to the natural suitability of soils and current climatic conditions to grassland-based agricultural systems.



(¹) Croatia: not available
Source: Eurostat (online data code: lan_lcv_ovw)

Fig 3.1. Main Land Cover By Land Type (EU 27, 2012)

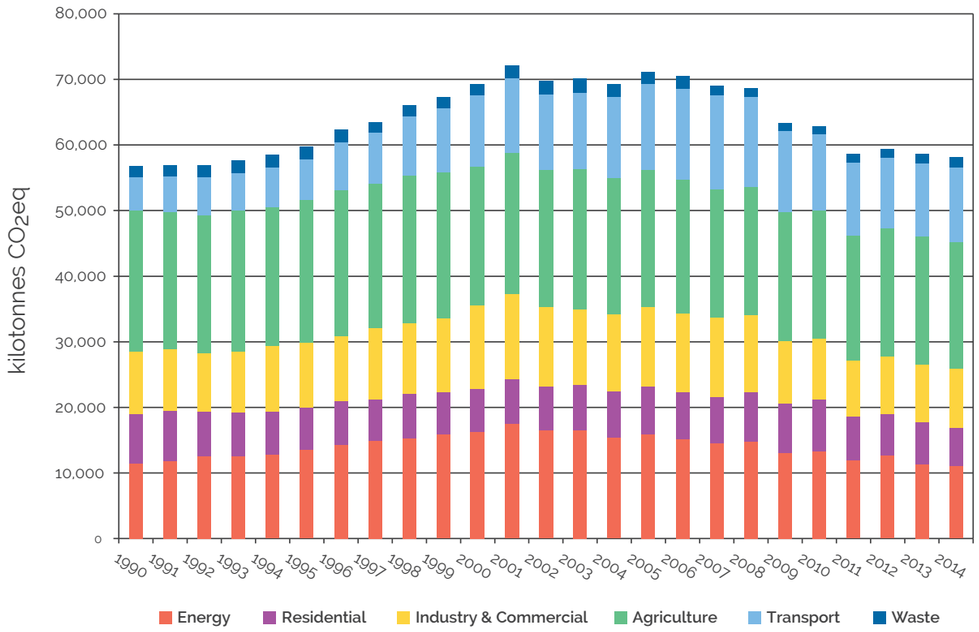


Fig 3.2. Ireland's Emissions Profile (1990-2014)

Source: EPA (2015)

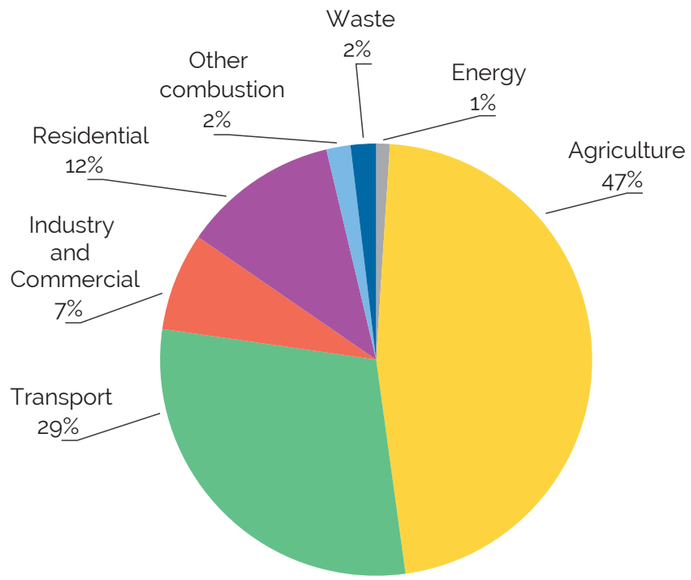


Fig 3.3. Project Non-ETS Emissions (2020)

Source: EPA (2016)

Agriculture is the largest indigenous sector in Ireland. According to the Department of Agriculture, Food and the Marine (DAFM), the agri-food sector generates 7.6% of gross value added, 10.8% of Ireland's exports and provides 8.5% of national employment.32 The dairy sector contributed 29.4% of gross agricultural output in 2015, while the cattle sector accounted for 39.3%. In 2015 there were almost 7 million cattle in the country.33 Agriculture is an important contributor to economic life in rural Ireland and to economically disadvantaged regions, where food production remains one of the most important economic activities. Indeed the dairy and beef sectors have become embedded in to the fabric of rural Ireland and into "the landscape, history and personality of the country". [38]

Ireland's GHG emissions were approximately 58 million tonnes in 2014. While only 1.4% of the EU total, on a per capita basis emissions were 13 tonnes, compared to an EU average of 9 tonnes.34 Agriculture is the largest contributing sector to Ireland's GHG emissions, accounting for one third of total emissions in 2014.

Having decreased on both a 2005 and 1990 baseline, emissions are projected to increase by up to 7% in the period 2014-2020, and by 2020 are projected to account for 47% or Ireland's emissions when the Emissions Trading Sector (see Section 6 below) is excluded.

The projected growth in emissions in the period to 2025 will be driven by increases in the dairy cowherd and an attendant increase in nitrogen fertiliser use. 35 These growth opportunities for the agriculture sector are set out in Government strategy for the agri-food sector, Food Wise 2025 (Chapter 4), and the preceding Food Harvest strategy. According to DAFM, these strategies have the potential to grow agri-exports significantly and could potentially create tens of thousands of jobs.

Significant afforestation has occurred since 1990, which may be available for compliance with emission reduction targets in the post 2020 period (Chapter 5) to mitigate some of this increase in emissions. In tandem with increasing agricultural output, Government set an objective of increasing the level of forest cover from 11 to 18% by 2046. Growth and development pathways for agriculture and forestry are subject to separate strategies (Chapter 5).

3. EU AGRICULTURE POLICY

The EU's CAP has been the most important single factor in determining the structure of Irish agriculture, and indeed is a key driver of its future direction. A series of reforms over the past 30 years has brought radical change to the CAP, moving from a system of price support for specific commodities to income support for farmers. These reforms also brought a greater focus on rural development, environmental considerations (through the linking of income payments to compliance with environmental schemes), and animal welfare. Since 2005, a direct subsidy has been provided to 130,000 Irish landowners under the CAP's Basic Payments. These payments have been fully decoupled from production of cattle, sheep and arable crops.

From 2015 onwards, the CAP introduced a new policy instrument in Pillar 1, the Green Direct Payment. This accounts for 30% of the national direct payment envelope and rewards farmers for respecting three obligatory agricultural practices, namely: maintenance of permanent grassland, ecological focus areas and crop diversification.

In addition, building on these compulsory elements, under CAP Pillar 2 Ireland's nationally determined Rural Development Programme (RDP 2014-2020) a significant proportion of measures are beneficial for the environment (with 20% cross-cutting climate change). According to DAFM, an estimated 87% of the Irish RDP is related to climate action.36 These include agri-environmental climate measures, organic farming, areas of natural constraints, Natura 2000 areas, forestry measures and investments. According to Teagasc, however, efficiency measures identified in their research that could reduce emissions in a cost effective manner[37] are presently excluded from supports under agri-environmental schemes.

These reforms have led to a growing awareness and understanding of environmental concerns on farms across the EU and in Ireland. Nevertheless, according to Teagasc, without a very fundamental change in the principles governing agri-environmental schemes "potential future schemes may have little prospect of incentivising further delivering significant outcomes."[38] There is a need, therefore, for innovative ways to work within this constraint and to influence EU policy design in a direction that better encourages innovation (Chapter 6).

4. MILK QUOTAS

Another key external driver of the size and structure of sub-sectors within agriculture has been the EU's milk quota regime. In the first decade of EU membership, from 1973 to 1982, Irish milk production expanded by about 50%. Dairy farming, which is labour and capital intensive, has been associated with larger, better-resourced, younger and more dynamic farmers, concentrated in areas with highly productive land. The milk quota regime introduced by the EU in 1984, which placed restrictions on Ireland's output, therefore constrained the growth of the most profitable sector of the rural economy.

The milk quotas had what has been described as a "corset effect",[39] by stimulating the expansion of alternative land uses, which tended to be less profitable at farm level.[40] Prior to the introduction of milk quotas, some 78% of the national cowherd was made up of dairy cows with 22% suckler cows (a cow used to breed and suckle calves for beef). By 2000, suckler cows made up just over half the national herd. The sucker herd accounted for approximately 1.1 million animals, kept on just under 80,000 farms (there are approximately 130,000 farm households in Ireland).

The lifting of milk quotas has led to an increase in dairy cow numbers and an immediate decrease in suckler cows, largely on dairy farms. While these points are returned to in Chapter 5, the importance of changing EU priorities on national farm activity is underlined by these developments.

5. EU CLIMATE POLICY

Irish climate policy objectives and targets are also highly influenced at EU level. Member States are responsible for reducing the proportion of their emissions not covered by the EU Emissions Trading Scheme (EU ETS). The EU ETS is a EU-wide instrument covering around 45% of the EU's greenhouse gas emissions in energy-using installations in the power generation and manufacturing industries.

In Ireland, the ETS sector accounted for 28% of overall emissions in 2013. The remainder of Ireland's emissions are made up almost entirely from the agriculture, transport and buildings[41] sectors. It is to these sectors that Ireland's national target for 2020, and future targets for 2030, will apply. Agriculture alone accounted for 44% of non-ETS emissions 2014, which makes Ireland an outlier within the EU(Table 3.5).

A further challenge relates to the demanding target Ireland received under the EU's 2008 Effort Sharing decision. The national legally binding target requires non-ETS emissions to be 20% below 2005 levels by 2020.[42] This is the most demanding of any EU Member State (along with Denmark and Luxembourg), and was twice the average emissions reduction required from non-ETS emissions across the EU.[43] The target was allocated on the basis of cost-optimality (arising from economic modelling) adjusted for "ability to pay", for which GDP per capita was used as a proxy.

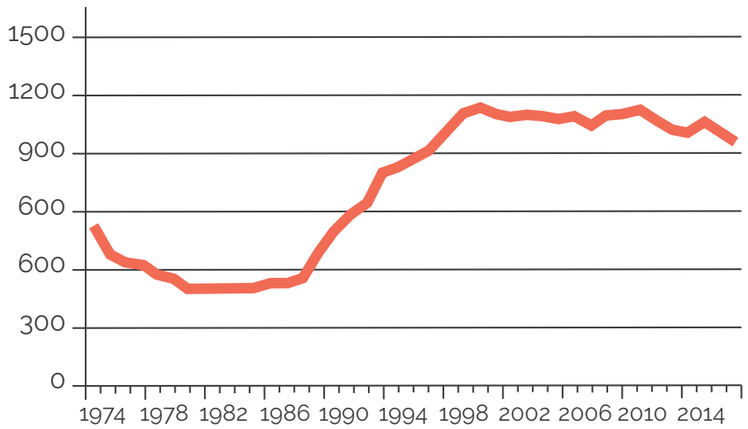


Fig 3.4. Suckler Herd Numbers 1980-2015

Source: CSO (2016)

Table 3.1. Agriculture emissions as a proportion of non-ETS emissions per EU Member State[42]
Source: Alan Matthews (2014)

Ireland	43
Lithuania	31
Denmark	29
Latvia	29
Romania	26
Bulgaria	25
Estonia	24
France	23
Hungary	21
Sweden	19
Greece	19
Spain	19
Finland	18
European Union	18
Poland	18
Cyprus	17
Portugal	17
Slovenia	17
Croatia	16
Austria	15
United Kingdom	15
Germany	14
Netherlands	14
Slovakia	14
Belgium	13
Czech Republic	17
Italy	13
Luxembourg	7
Malta	7

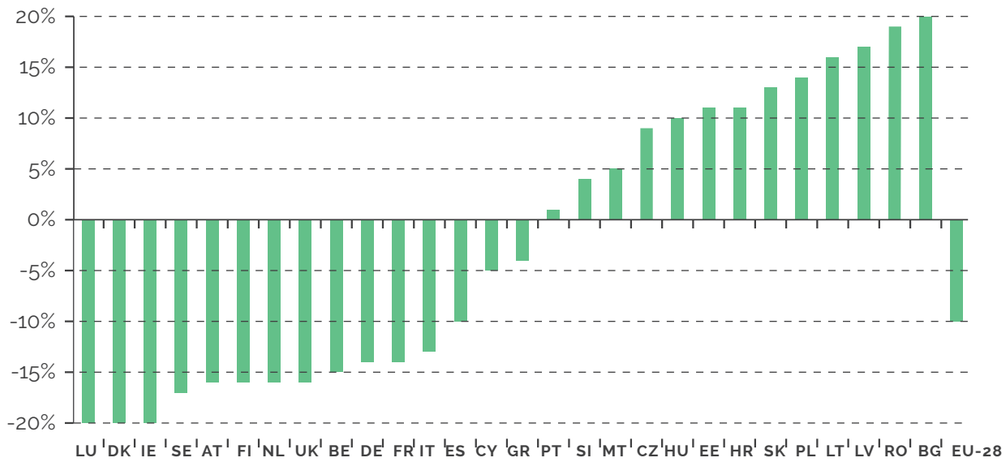


Fig 3.5. Member State greenhouse gas emission limits in 2020 compared to 2005 levels

Source: European Commission (2008)

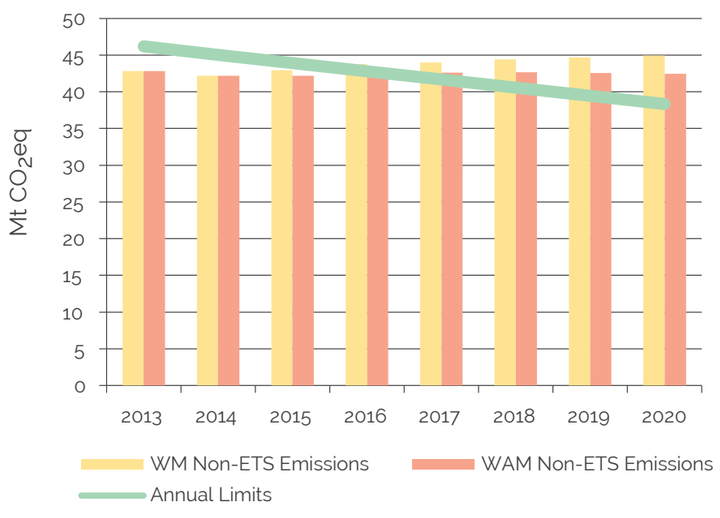


Fig 3.6. Projected targets and emissions to 2020 for the buildings transport and agriculture sectors

Source: EPA (2016)

The Irish Government has argued that this target was unreasonably demanding on the basis of analytical work, which suggests that the European Commission may have underestimated Ireland's cost of compliance.[44]

A third factor that exacerbates Ireland's difficulties relates to the land use, land-use change and forestry (LULUCF) sector. While in the previous compliance period (2008-2012) Member States were permitted to use forests for compliance purposes, this mechanism is not available under the current EU Effort Sharing Decision (2012 – 2020).

Looking forward to 2030, Europe's Heads of State (at the October European Council of 2014) agreed to a target to reduce EU domestic greenhouse gas emissions by "at least" 40% below the 1990 level by 2030. As part of this overall objective, the (non-ETS) agriculture, transport and buildings sectors are required to deliver an additional 30% reduction between 2020 and 2030.[45] Heads of State acknowledged the "multiple objectives" and "lower mitigation potential" of the agriculture and land-use sector, as well as the need to ensure coherence between the EU's food security and climate change objectives

European Heads of State also invited the European Commission to examine how the sequestration of emissions (including through afforestation) could be recognised within the EU's approach. In effect this means that it is likely that LULUCF sector will be included, but the accounting rules that will be used have to be agreed.

6. IRELAND'S PARTICULAR CHALLENGE

Considering the EU's policy and Ireland's legally binding targets therein, combined with Ireland's development plans, we conclude that Ireland is in an unusual position globally with respect to its emissions from agriculture and land use. While countries such as New Zealand (and Australia to a lesser extent) have an emissions profile comparable to Ireland's, these countries are not subject to legally binding targets to reduce emissions. We can see from the Intended Nationally Determined Contributions (INDCs) these countries submitted to the UN prior to the Climate Change Conference in Paris of December 2015 that neither country has credible plans to address emissions from agriculture in the period to 2030.[46] Ireland, on the other hand, has a highly challenging and legally binding reduction target for 2020 and an as-yet undetermined target for 2030.

While Ireland may not be faced with a very significant compliance burden by 2020,[47] this is attributable to reduced emissions in the early (2012 to 2015) years of the compliance period because of the severe economic recession. Under EU rules, over-compliance in the early years of the target can be "banked" and used to offset years in which the target is breached. As illustrated below, Ireland will breach its annual limits in 2016- 2017.

While a relatively modest aggregate gap to target (of up to 12 Mt CO_2-eq) may emerge by 2020, the overall trend is a cause for concern.

There will be new obligations, as yet undefined, for the years 2021- 2030. It is not possible at this point to guess how the European Commission will interpret the "limited mitigation potential" that was recognised for agriculture in the post-2020 period Even if a positive outcome is achieved, however, Ireland is likely to have a considerable challenge.

In order to illustrate the magnitude of this challenge Ireland faces in relation to its emissions from buildings, agriculture and transport, we provide three scenarios below based on the following assumptions:

- Ireland receives a target of 25%, 30% or 35% below 2005 levels by 2030
- On LULUCF we use two scenarios:
  - Ireland afforests 8,000 ha per year and this is allowable for compliance purposes under EU accounting rules, or
  - Ireland receives no credit for post-1990 afforestation [48]
- We use the EPA's existing measures scenario for future emissions, which in themselves contain a number of macro-economic and other assumptions, and which assume no new measures are brought forward to reduce emissions.

The annual distance to target based on these assumptions is given in the graphic below.

It should be noted that it is impossible to tell whether a potential gap to target should be met through the purchase of carbon credits, payment of fines or by some other compliance mechanism. There are therefore considerable uncertainties and these scenarios are provided for illustrative purposes.

We should emphasise that these are "do nothing" scenarios, and we use them to underscore the importance of taking action to reduce emissions from non-Emissions Trading System (ETS) sectors. It should also be noted that this compliance gap relates to the buildings, transport and agriculture

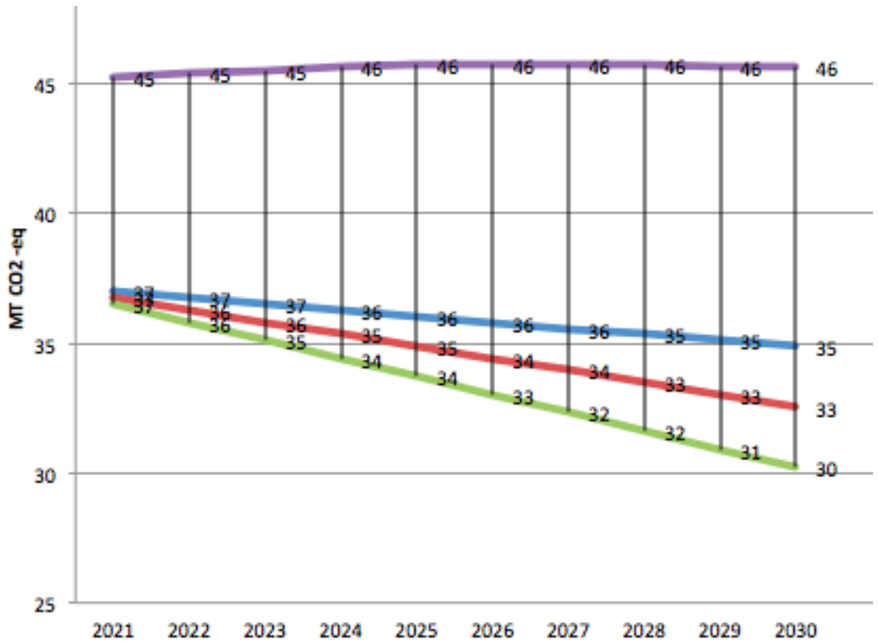


Fig 3.7. Annual distance to target (2020-2030) based on plausible 2030

Source: IIEA/RDS

sectors combined and it is a mistake to attribute this gap to the agriculture sector alone.

The importance of Ireland's on-going negotiations with its EU partners are underlined by this analysis, as is the importance of bringing forward measures in all sectors to reduce emissions and to begin managing the compliance risk.

7. CONCLUSION

Ruminant-based agriculture is of crucial importance to the Irish economy, and Ireland's land-use pattern is exceptional by EU comparison. Plans for the continued expansion of food output, focused in particular on the dairy sector, and increasingly stringent emissions reductions suggest a growing contradiction between Ireland's climate and agriculture policy objectives.[49]

Ireland could be faced by potentially significant compliance costs in the period to 2030. While the burden of compliance is not exclusive to agriculture, the sector will be required to make a contribution given the share of non-ETS emissions it represents. There is therefore a case for spending this money domestically to promote CSA-approaches that are positive for farm income and reduce emissions, whether this might involve improved technical efficiency or promoting optimal land-use choices (Chapter 5).

A key conclusion from this analysis is that Ireland can consider itself a test case for dealing with these issues. Over the coming decades emissions from agriculture and land use will increasingly become centre stage as other sectors of the global economy are decarbonised. While there are clearly risks to be managed, the solutions, technologies, techniques, practices and institutional and analytical innovations necessary to marry climate and agriculture policy objectives that are developed here will be required across the EU and globally in decades to come.

CHAPTER 4:
The Foundations Of CSA Leadership

1. INTRODUCTION

The objective of this chapter is to review what has been achieved in Ireland on managing the climate-food-land use nexus of challenges, which we argue provides strong foundations for future global CSA leadership (Chapters 5 and 6).

In order to understand Ireland's policy response, we first provide an overview of the debate in civil society on how agriculture and land use should contribute to meeting Ireland's climate objectives. This debate has been a prominent feature of the national discussion on climate change, in particular since the EU's climate targets for 2020 were agreed in 2008, arising from the importance of agriculture to Ireland's non-ETS emissions (Chapter 3).

We then move on to consider what has been achieved in establishing a leadership position with respect to agriculture's contribution to climate objectives. Early pressure to reduce emissions (Chapter 3) has prompted innovative approaches to mitigation and sequestering agricultural emissions using sinks. We review in turn the development of a "third way" vision for carbon neutrality; measures to encourage "sustainable intensification" and increased productive efficiency; and longer-term initiatives in the areas of R&D and knowledge transfer.

2. THE DEBATE IN CIVIL SOCIETY ON AGRICULTURE AND CLIMATE CHANGE

It is generally accepted by experts and stakeholders that decarbonisation of Ireland's non-ETS sector should focus at first on the transport and buildings sectors. This can be attributed to the results of techno-economic assessments that point to lower-cost abatement opportunities in these sectors.[50] There is a lower level of consensus, however, on the implications of this understanding for emissions from agriculture and land use.

A key insight from the IIEA/RDS expert workshops, surveys and other activities is that stakeholders and experts remain divided on whether the focus of Ireland's response should be primarily on increasing GHG-efficiency of agriculture, or whether reducing overall emissions from the sector should be expected. The two distinct competing perspectives for how agriculture should respond to the climate challenge, as we understand them, are detailed in Table 4.1 on the following page, along with common justifications for each position.

A key aspect of this debate relates to the efficiency of Ireland's beef and dairy outputs. The efficiency-based argument is for the most part based on an FAO (2010)[52] comparison of production systems at global level, and findings of a European Commission JRC Paper from 2010.[53] The latter employed Life Cycle Analysis to find that:

- Ireland (with Austria) has the lowest cow milk emissions per unit of product
- Ireland's emissions from beef were 5th lowest per unit of product in the EU.

It is worth noting, however, that according to the Origin Green Sustainability Report 2015, variance between the highest and lowest levels of efficiency is significant within Ireland, especially on beef farms where the range of carbon footprint results varies from 5kg to 25kg CO2e/kg. [54] Stakeholders, experts and the IIEA/RDS workshop on CSA recognised the importance of GHG-efficiency as an important indicator of progress, but noted a tendency to see carbon efficiency as a static indication of our "good standing", rather than as a potential yardstick to measure and drive future progress.[55]

We conclude from this debate that, while there is good science underpinning the efficiency-based arguments, there are also clear limitations, uncertainties and valid counter-arguments. In policy terms the challenge is therefore not to come down in favour of one side or another, but to seek to balance these competing perspectives.

It is clear that the challenge for the coming decades, both globally (Chapter 2) and within Ireland, is to find effective ways to decouple the observed historical

Table 4.1. Competing visions for how agriculture should respond to climate change

VISION 1	VISION 2
Agriculture output should be increased in the period to 2030 and while this might result in an increase in overall emissions, the GHG efficiency of output should be improved significantly.	Agriculture must play its part in contributing to Ireland's overall emissions reduction targets by delivering an absolute emissions reduction in the period to 2030.
JUSTIFICATION	
The agriculture sector must achieve multiple policy objectives including supporting rural livelihoods.	Wealthy countries like Ireland have responsibility (and legally binding targets) under the EU and UN agreements to reduce absolute levels of emissions in line with the principle of "common but differentiated responsibilities".
GHG-efficiency of Ireland's beef and dairy outputs is high by European and international comparison, and reducing output would result in "carbon leakage" and an increase in emissions globally.	Improving efficiency of agricultural production is insufficient to avoid dangerous climate change (Chapter 2), and it is total atmospheric concentrations of atmospheric GHGs that drive climate change.
Ireland should focus on producing food types that can be produced most efficiently in terms of their impact on resource usage and the environment, including beef and dairy products.	Ireland has high agricultural emissions on a per hectare basis. Efficiency-based mitigation strategies will not always result in a reduction of emissions. Well-known rebound effects may in fact result in more, rather than less, absolute GHG emissions (Chapter 2).
Reducing food output to meet climate objectives risks undermining global food security (Chapter 6).	Increasing food exports going to commodity markets does not necessarily improve food security for the most vulnerable.
Ireland's agriculture may not be as vulnerable to the impacts of climate change in comparison to other regions, and on this basis food production should be increased.	Climate justice: the impacts of Ireland's emissions will be felt most immediately in vulnerable countries.

trends, and to ensure that further efficiency gains lead to reduced absolute levels of emissions, so that legally binding obligations can be met. This will involve the consideration of additional complementary measures in tandem with efficiency-based approaches.[56] These are points we take up in the following Chapter 5.

3. THE OBJECTIVES OF POLICY

Policy has attempted to balance these competing understandings of what can and should be the delivered by the agriculture sector to meet Ireland's climate objectives. The current strategy, Food Wise 2025, published in 2015, acknowledges the substantial contribution of agriculture and forestry to global emissions and "the need to develop robust mitigation strategies that can lower emissions and deliver a low carbon future". A guiding principle for how the expansion is to be delivered is that "environmental protection and economic competitiveness will be considered as equal and complementary, one will not be achieved at the expense of the other." Food Wise 2025 established an Environmental Sustainability Committee to monitor, review and make recommendations as to how sustainability goals can be achieved. At its heart, however, is a plan to increase food output in the period to 2030, which would result in an increase in absolute gross levels of greenhouse gas emissions.

While the contribution of agriculture to Ireland's emissions objective are not specified in Food Wise 2025, an attempt to balance the competing understandings of what should be required of the agriculture sector has been developed in the Irish National Policy Position on Climate Change of 2014. This adopts an objective of delivering an 80% reduction in emissions from the heat, transport and power sectors, and: "in parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production". This vision corresponds with the stated objective of the December 2015 Paris Agreement, to achieve "global peaking of greenhouse gas emissions as soon as possible…so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases…"

Teagasc defines carbon neutrality as referring to a scenario in which "national GHG emissions from agriculture are fully offset by carbon sequestration by grassland soils, forestry and other land use".[57] They note that: "The concept of carbon-neutrality allows the agricultural sector to widen its horizons and to consider offsetting mechanisms such as carbon sequestration and fossil fuel displacement into its menu of options to reduce the impact of agriculture and land use on global GHG emissions."

Text Box: Northern Ireland

Northern Ireland is in a similar situation to the Republic of Ireland with respect to the importance of livestock-based agriculture to the economy and from an emissions perspective. In 2010, a Greenhouse Gas Stakeholder Group was established to identify a range of primary production-focused mitigation measures suitable for different farming systems based on available scientific evidence. The Phase One report of the project, published in 2014, showed that significant progress could be made in advancing production efficiencies and in reducing emissions through strong voluntary partnership between processor, producer and environmental interests, supported by official Government policy and agencies. The conclusions drawn from this report resulted in a Greenhouse Gas Reduction Strategy and Action Plan being published in 2014, which highlights promising measures and encourages their implementation on-farm through a variety of initiatives.

The adoption of this objective by Government can therefore be seen as an attempt to move beyond the dichotomous debate (Section 2 above) toward a third possible vision for the sector. The precise meaning of "carbon neutrality", however, was unclear to experts and stakeholders with whom the IIEA/RDS consulted, making it challenging to measure progress towards meeting this objective. Furthermore, some experts and stakeholders see carbon neutrality as a "direction of travel", while others see it as a hard objective. [58] These are points to which we return in Chapter 5.

4. MEASURES TAKEN TO REDUCE AND OFFSET EMISSIONS

According to DAFM,[59] a host of measures have been introduced to address GHG emissions in the agriculture sector. Many of these are contained within the Rural Development Programme (2014 to 2020), which has a budget of almost €4 billion over 7 years. [60]

Measures deployed have primarily aimed at increasing productive efficiency. According to DAFM, emissions intensity per calorie of food output in 2013 was approximately 14% below 2005. It is projected that by 2030 emissions intensity will 25% below the emissions intensity in 2005.[61]

A comprehensive list of measures deployed is detailed in DAFM's Discussion Document on the Potential for Greenhouse Gas Mitigation within the Agriculture and Forestry Sector. Examples of measures introduced include:

The Green Low-Carbon Agri-Environment Scheme (GLAS): promotes the retention of soil carbon stocks through the encouragement of climate friendly agricultural practices such as minimum tillage, green-cover establishment and low-emission manure spreading techniques.

The Beef Data and Genomics Programme (BDGP): provides support to farmers to take samples for genotyping from selected animals in their herds and to provide vital breeding data to support the development of a national cattle-breeding databank.

The Targeted Agricultural Modernisation Schemes II (TAMS II): assists farmers to establish or upgrade their facilities in areas such as efficient slurry spreading equipment.

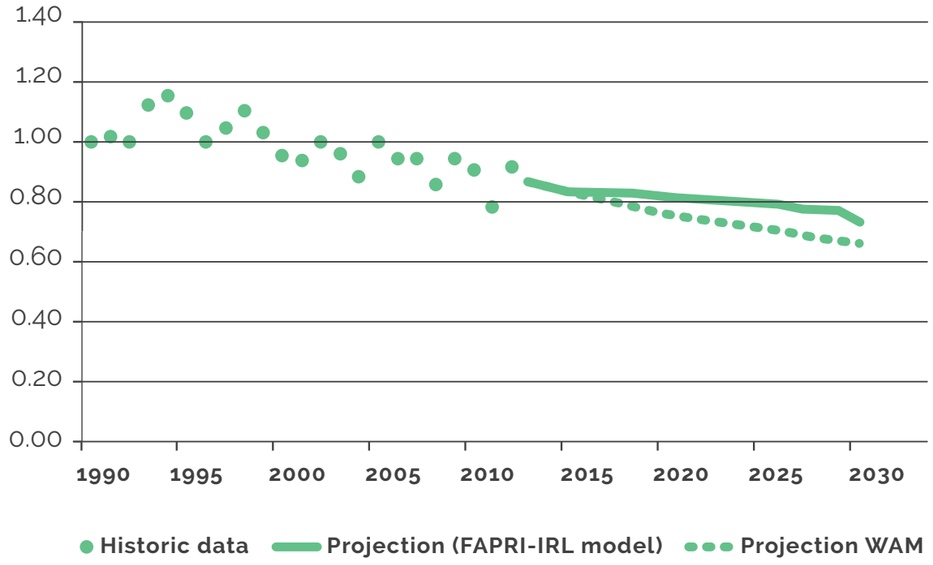


Fig 4.1. The Emissions Intensity of Irish Agriculture

Source: Teagasc (2014)

The National Afforestation Programme: incentivises farmers to plant forestry on their land (Chapter 5).

While these and other measures introduced will increase productive efficiency, the net impact on emissions and Ireland's GHG inventories needs further analysis in some cases. It is worth noting that both GLAS and BDGP will be subjected to an impact analysis. The contribution of other areas, such as afforestation, depends on accounting modalities under negotiation at EU level (Chapter 5).

5. THE BUILDING BLOCKS OF LEADERSHIP

In addition to taking measures to increase productive efficiency and to promote land-use change in the direction of greater afforestation, much has been done to develop the building blocks of an ambitious long-term approach to managing the interrelationships between climate change and agriculture. The key initiatives, detailed in turn below, together offer evidence of an emergent leadership approach.

5.1. Knowledge Transfer and Engagement

If CSA is to be implemented in scale in Ireland it will have to attract support from farming communities and their representative organisations on the basis that it makes sense from a business perspective. Farming communities have been engaged in various ways in decision making in fields related to environmental sustainability. For example, they participate in the functions of decentralised agencies and institutions to make services more responsive at local levels. One such example is the role that farmers play in the development of genetics and genetic selection in the Irish dairy and beef sector.

Another particularly noteworthy initiative in this respect is the Farm Carbon Navigator, which was developed as a joint venture between Teagasc and An Bord Bia. It is designed to assess the level of adoption of technologies that have been proven to reduce GHG emissions on farms, to communicate to farmers how they are performing and to give clear targets for improvement. The objective is to set emissions on a downward path rather than to accurately estimate them.[62]

Another initiative for engaging farmers in climate change is the Smart Farming Initiative, a peer-to-peer knowledge transfer programme. This initiative aims to improve farm returns with better resource management, focusing on such areas as soil fertility, energy, grassland, water and feed. The initiative is supported by nine participating organisations, including the IFA, and is delivered in conjunction with the EPA's national resource efficiency programme.

5.2. Research Capacity into Irish Agricultural Greenhouse Gas Research

As well as collaborating in international research initiatives DAFM, Teagasc and EPA have devoted an increasing amount of analytical capacity to climate change related research over the past decade. The Agricultural Greenhouse Gas Research Initiative for Ireland was established in 2011 to ensure a coordinated approach to this research. This is an organisational and collaborative framework designed to build a critical mass of scientific expertise in GHG research, to co-ordinate uniform measurement protocols and to address a specific set of research issues.

The objectives in relation to climate change include further work on nitrous oxide emissions, impacts of land-use management and carbon stocks, and technologies to reduce methane emissions. The work will build on the investment to date under the Agricultural Greenhouse Gas Research Initiative for Ireland.

5.3. Origin Green

Launched in 2012, Origin Green is the national sustainability programme for the Irish food and drink industry. It is the only sustainability programme in the world that operates on a national scale, uniting government, the private sector and food producers, through An Bord Bia, the Irish Food Board. Independently verified at every stage, Origin Green enables Ireland's farmers and food producers to set and achieve measurable sustainability targets, reduce environment impact and serve local communities more effectively.

The scope of Origin Green involves ongoing measurement throughout both food manufacturing and on the farm. Participating farms are assessed on various measures, including their carbon footprint, water, energy and biodiversity. At manufacturing level, companies develop multiannual sustainability plans, setting measurable targets in the area of raw material sourcing, manufacturing process and social sustainability.

The overall ambition of the Origin Green programme is to have every farm and every food manufacturing business demonstrate their commitment to operating in the most sustainable manner possible. This commitment is being certified and verified at every stage.

Origin Green currently has 164 verified members who account for between 85-90% of all Irish food and drink exports. At farm level some 40,000 assessments are conducted annually.

5.5. International leadership on carbon neutrality

Finally, Ireland has played a leadership role in promoting an integrated approach to agriculture and land-use issues, particularly at EU level. For example, it was a key proponent for a reference to the importance of including agriculture, land use, land-use change and forestry together in the EU's climate policy. This manifests itself most notably in paragraph 2.14 of the European Council conclusions of October 2014 (Chapter 3).

6. CONCLUSION

In civil society there has been a lack of consensus around how the agriculture and land-use sector should be treated in so far as meeting Ireland's climate objectives are concerned. We identify two competing interpretations of how the climate-food-land nexus could be dealt with, and detail the supporting evidence and underpinning arguments for each position. Overall we conclude that, looking forward, efforts need to be made to marry these competing approaches, both in Ireland and globally, to ensure that further efficiency gains can lead to reduced absolute emissions levels from agriculture.

Policy development in Ireland has made strides in marrying these competing visions, and Government strategies have sought to integrate and mainstream environmental considerations. While the overall impacts on emissions levels of agricultural development strategies are not clear, the development of a vision of carbon neutrality for the agriculture and land-use sector and the promotion of an integrated approach to agriculture and land use internationally, are notable achievements. Carbon neutrality has emerged as cogent vision for managing the climate-food-agriculture nexus of challenges.

Policies that have been implemented have sought to promote greater productive efficiency, and their impacts on overall levels of emissions need greater consideration in some cases. Through the adoption of ancillary supporting measures around knowledge transfer, research and development, including Origin Green, the building blocks of future climate-smart leadership are evident.

CHAPTER 5:
Achieving Global CSA Leadership Through Domestic Action

1. INTRODUCTION

From the "why?" questions of previous chapters, we now move on to consider the "how?" question, that is, how can Irish leadership in CSA be achieved? Our proposals are made within the context of insights derived from previous chapters, and build on the leadership initiatives that have already been introduced, as detailed in Chapter 4.

Taking ambitious action at home is the key building block of leadership, according to the great majority of Irish[63] and international64 stakeholders and experts who participated in workshops and surveys under the auspices of the IIEA/RDS leadership forum. Some 88% of stakeholders saw this as "very important" or "important". Furthermore, a majority of stakeholders saw an opportunity from leadership. Deploying CSA innovations at home can, it was considered, act as a springboard, both for the export of climate-smart food, but also for developing and exporting new techniques, technologies and practices that have been developed, tested and proven at home.

In this chapter we therefore focus first on the domestic and inward-looking dimension of CSA leadership, before turning to the external dimensions in Chapter 6. In turn we address the following issues:

1. The case for a CSA management framework to further mainstream climate change considerations into agricultural policy development

2. Promoting the adoption of greater on-farm efficiencies including climate-smart responses to the lifting of milk quotas

3. The case for land use optimisation focused on forestry and agro-forestry

4. The broader societal dimension, focusing on climate-smart food, labelling and reducing food waste.

2. AN INTEGRATED MANAGEMENT FRAMEWORK

In the previous chapters we identified a number of strengths associated with the Irish strategic policy response to the climate-food-land nexus of challenges. Ireland has emerged as a leader internationally in promoting an integrated approach to agriculture and land use, has developed a domestic vision of carbon neutrality for the sector, and introduced measures to promote land-use change and greater carbon efficiency of production.

Nevertheless, strategic policy development for the agriculture and forestry sectors, while aligned, is not fully integrated. The extent to which separate plans might overlap, affect and perhaps even contradict each other perhaps requires further consideration. Furthermore, the emissions costs and impacts of agricultural expansion plans are not fully integrated into policy planning. In some cases there is lack of clarity around the net emissions impact of proposed mitigation measures, making it challenging to assess their carbon costs. Finally, how climate change might affect agricultural expansion plans and the resilience of Irish agriculture to climate change is an underdeveloped theme, requiring further elaboration. Within this context we make observations on the further mainstreaming of climate change into agricultural strategy development below.

2.1. A management framework to achieve global leadership in CSA

In order to become a global leader in CSA we would propose the development of an integrated management framework comprising of a core vision, subsidiary measurable objectives, and annual progress reporting using key related indicators. Annual reporting against an agreed vision would substantiate claims of leadership by providing hard evidence of progress over time. This would be of benefit to Ireland, both in communicating its efforts to EU and global partners, and in terms of branding itself as a sustainability leader in international food

and agri-food technology markets. A key aspect of this approach would be to take an integrated approach to agriculture and land use (including forestry) development.

According to the OECD, a long-term vision is essential to deliver an investment grade policy framework for climate change.[65] A vision can help articulate and clarify exactly what it is that a country seeks to achieve in the long term, and can be a starting point for thinking about the process of change required to achieve this objective. It can guide a framework where necessary actions can be developed, prioritised, agreed, implemented, reviewed, and evaluated. In this way a management framework can also be a useful tool for transparently considering and managing trade-offs between different policy objectives where they arise. Generally a vision would lend itself to be translated into objectives, each of which in turn can be associated with key indicators.[66] Any proposed vision would require buy-in from across the agri-sector and society, and would therefore require a consultation exercise. It is not therefore for IIEA/RDS to be proscriptive in this respect. Nevertheless, in Table 5.1 below we propose two options for consideration, the first of which has already been adopted by Government (Chapter 4), while the second option arises from the focus in this report on CSA.

Table 5.1. Two options for Ireland's vision

1. To achieve a carbon neutral agriculture and land use by 2050	2. To become a global leader in CSA

In both cases, the key is for the vision to lend itself to identification of subsidiary objectives, and measurable indicators of progress, so that it could form the basis of a management framework.

2.1.1. Vision 1: Carbon Neutrality

If we take the currently agreed vision of achieving carbon neutrality (Chapter 4), this can be seen as an attempt to marry different positions on climate change in society (Table 5.2).

We would conclude, however, that a greater level of definitional clarity is required for this vision to be used to guide a management framework. For example, we would argue that Ireland's explicitly stated goal should be to seek to achieve carbon neutrality on the basis of whatever EU accounting rules are agreed between Member States in ongoing negotiations. These rules will likely open up opportunities for Ireland to sequester emissions from (scientifically verifiable) management practices in forests, grasslands, peatlands, and croplands.[67] A final issue for Ireland to determine is whether carbon credits (or, say, promoting the planting forestry abroad) could be used in meeting carbon neutrality.

While carbon neutrality may not be considered achievable by some stakeholders and experts on the basis of currently available technologies and approaches, we should not discount the prospect that new technologies will be uncovered in the decades ahead. Furthermore, Ireland can and is furthering its understanding of how the IPCC rules should be developed to support this goal (Text Box 5.1). Ireland should be a leader in terms of developing these rules, but should also be explicitly bound by them.

Depending on the decisional clarity, key indicators of progress could include: sources of emissions, scientifically verifiable sinks, efficiency of output in different sectors etc. Building on existing policy, the key proposed innovations are therefore a tighter definition of "carbon neutrality" and transparent annual reporting of progress to meet this vision.

Table 5.2. Carbon neutrality as the middle ground

Position 1 Ireland should increase production of highly efficient agricultural outputs and improve the GHG-efficiency of output	**A unifying vision** Ireland should aim to achieve "carbon neutrality" in agriculture by 2050 by balancing sources with sinks that are scientifically validated and accepted under EU/IPCC rules	**Position 2** Ireland should reduce absolute levels of GHG emissions from the national herd

2.1.2. Vision 2: Achieving Global Leadership in CSA

While endorsing the vision of achieving "carbon neutrality", a second option would be to adopt the broader vision of achieving global leadership in CSA. The three aspects of CSA are clearly crucial for the future development of climate agriculture: farm income and productivity; building resilience to the increasingly evident impacts of climate change such as flooding; and reducing emissions in light of EU obligations.

The objectives for meeting this vision could coincide with these three pillars of CSA. The mitigation objective of "carbon neutrality" outlined above could be integrated with considerations of farm income and productivity, building resilience to climate change, as well as broader supporting conditions for CSA (biodiversity and water quality, for example).

Indicators under farm income and productivity could include value-based output targets already included Food Wise 2025, but also a number of measurements from the annual National Farm Survey related to farm profitability. Indicators under the building resilience objective, on the other hand, could include measures of on-farm exposure to commodity price fluctuations, but also progress in managing and building resilience to future flooding, droughts and other climate impacts.[68]

For illustrative purposes we integrate these considerations into a Fig 5.1 below.

3. ADOPTING CSA ON IRISH FARMS

There is significant potential to deliver greater carbon-efficiency on Irish farms through delivering improvements and innovations in "feed, fertiliser and fertility." The cost-effective emissions abatement potential available is quite well understood, largely as a result of the work of the DAFM, Teagasc and

Vision	**Global leadership in cimate-smart agriculture**			
Objectives	Carbon Neutrality	Increasing productivity and farm income	Building Resilience	Supporting conditions
Indicators	Sinks	FW 2025 projections	Diversity of farm income	Farms carbon footprinted
	Sources	Farm income & profitability	Building Resilience	Supporting conditions
	Efficiency of output	Animal health	Other	Advisory services
	Grassland management	Other	Other	Other

Fig 5.1. Management framework for global CSA leadership

Source: IIEA/RDS

other state-funded research. For example, genetic improvement (EBI), prolonging the grazing season, improved methods and timing of spreading of animal manures, using clover to fix nitrogen, improving reproductive efficiency of the beef herd, and promoting greater efficiency of fertiliser application are cost effective options for reducing emissions,69 and these techniques are already being adopted on many farms.[70] Teagasc and Agri-Food and Biosciences Institute (AFBI) research published in June 2016 found that switching from CAN to urea with a urease inhibitor (NBPT) can reduce direct greenhouse gas emissions associated with fertiliser application by 73% on average in grassland, while maintaining yields and saving money on farms, illustrating the potential of new technologies.[71] A number of stakeholders emphasised in particular the importance of improving soil biology as a means of delivering the triple win of CSA. The advent of "precision farming" and the growing use of phone apps, GPS, micro-sensors, satellite imaging, and wireless networks also open up new avenues to recording and using real time on-farm data.

The key issues, however, relate to the changes to the national herd in the post-milk quota era and how barriers to greater uptake and adoption of adoption of new technologies can be addressed. We explore these issues in turn below.

3.1. Climate-smart evolution of the national herd in the post-milk quota era

As discussed (Chapter 3) lifting of milk quotas in 2015 means that the agriculture sector in Ireland, in particular dairying, is entering a period of growth. While a lower milk price may slow the expansion in dairying temporarily, it remains the more profitable option.

Uncertainties remain in relation to the implications of dairy's expansion for the remainder of the national herd, and indeed for land availability for forestry (Section 4 below). A key question is how farm incomes can be maximised and emissions minimised in response to these regulatory developments. In the post-milk quota era there is an opportunity for incentives to be thoroughly examined and realigned within the context of new policy priorities, particularly climate change.

Initial data indicates that the total number of beef cows has declined by 8% due largely to culling on dairy farms and their replacement by dairy animals. This, however, was a once off event and beef cow numbers stabilised in 2015.

As a consequence of the increase in dairy cow numbers, the availability of calves from the dairy herd has dramatically increased. Up to 400,000 additional calves will eventually become available for beef production on non dairy farms. A climate-smart response would be to incentivise an expansion of dairy calf to beef production. According to Teagasc, emissions from dairy-beef systems (Chapter 2) are almost 50% lower than suckler systems, and this outcome can be both economically attractive and carbon-efficient.

While there is currently interest from farmers in transitioning from suckler-based systems into dairy calf to beef systems, the numbers are small relative to the numbers of calves becoming available. The availability of suitable breeds at a competitive calf price would be required for these systems to be economically attractive to farmers. New technologies, such as sexed semen, open opportunities for dairy farmers to supply the necessary numbers of dairy-beef crosses, and there may be a case for promoting and incentivising the uptake of this technology.

There are also barriers in relation to access to finance, uncertainties in relation to profitability and the appropriateness of these systems on marginal land. A relearning of skills in intensive calf rearing will be necessary for many farmers. These barriers, however, must be overcome. In the absence of a well thought through response, a collapse in the price of calves from the dairy herd could result in potentially negative impacts and unintended consequences for the sector.

There is a need for incentives to be aligned for the most climate-smart and economically beneficial outcomes to be delivered. Under a Beef Data and Genomics Programme (BDGP), introduced in 2014, some 30,000 suckler beef producers with 560,000 beef cows are committed to a 6-year initiative aimed at improving the quality and efficiency of the national beef herd, for which they receive an additional income support. This has the potential to lower the carbon intensity on this group of farms and to contribute to climate-smart farming. We note in Chapter 4 the considerable potential for Irish beef farmers to reduce their carbon footprint. The impact of this programme requires careful monitoring.

The remainder of the suckler beef herd are not covered by the scheme. The profitability and carbon efficiency of production in this sector are low. Given the optimal alignment of incentives, these are perhaps the farms that may consider switching to rearing dairy calves or indeed planting some of their farms in forestry (Section 4 below), with a view to improving and diversifying their incomes, while reducing carbon emissions.

Ultimately, if a carbon neutral agriculture and land-use sector is to be achieved, a mechanism to link dairy cow expansion to forestry and agro-forestry might be considered, perhaps in partnership with food processors.

3.2. On-farm renewables

Success in meeting emissions targets will require interventions broader than those that can reduce on-farm emissions directly. There are economic opportunities for farmers and the rural economy in the deployment of on-farm renewables, in particular wind energy, solar PV and bio-digesters. While the roll out of renewables has been dominated by traditional investors (utilities, professional project developers, and institutional investors) there is significant potential to mobilise local citizen investors, either individual farmers or rural community groups, in low-carbon transition. Doing so can create economic opportunity in economically disadvantaged regions, build support for low-carbon transition and build societal acceptability for renewable infrastructures, [72] which is perhaps the most important barrier to low-carbon transition in Ireland.

Mobilising rural communities as investors has become an important feature of low-carbon transition in countries such as Denmark, Germany, the UK and in Canadian states such as Ontario and Quebec. This has been achieved through the introduction of specifically tailored financial incentives, such as feed in targets or quota schemes. Feed in tariffs can be designed with "adders" or minimum reserve requirements specifically targeting rural communities. Quota schemes can also be designed in a manner favourable to community actors. Generally these incentives need to be supplemented by additional supports (such as grants) to cover specific additional barriers to investment faced by local citizen investors. In particular early stage project costs such as feasibility studies have been addressed by grants or soft loans in all cases. Furthermore, pilot initiatives and communication and information campaigns by trusted intermediaries are necessary to build awareness around the investment opportunities, and to disseminate positive experiences. Countries have also used voluntary (UK) or binding (Denmark) requirements on developers to provide equity investment opportunities to local citizens, or have set aside a specific proportion of feed in tariff contracts for community investors (Ontario). [73]

3.3. Barriers to adoption and uptake and knowledge transfer

There are many barriers to widespread adoption of climate-smart technologies, practices and innovations. The livestock sector is heterogeneous in nature and deploying technologies and approaches on farms raise challenges in terms of complexity, transaction costs and a lack of data. This makes identifying appropriate, context-specific strategies complicated, particularly where there may be distinct or competing objectives that could, for example, include economic development, biodiversity, providing products for the bio-economy, food security and water management alongside emissions reductions.

In the past, the availability of EU direct payments created less of an incentive to adopt best practice, and perhaps reduced technical proficiency in certain farming sectors.[74] The end of milk quotas and increasing exposure to market forces underlines the importance of adopting on-farm innovations and efficiencies, both for economic and environmental reasons.

As with land use change and forestry, the real question is how to encourage the adoption and uptake of new technologies, approaches and farming systems. This is particularly important in light of the different historical experiences of farmers with technology uptake. Within the context of past performance, it is important to consider how improved technology adoption can be delivered, to consider what a realistic level of technology adoption is, and indeed what kinds of messages will resonate with different types of farmers. Developing effective advisory access for part time or time-constrained farmers is an important policy challenge that must be met.

How can new technologies, techniques, and practices be diffused across the farming community, from "early adopters" to all farmers?[75] There are a number of policies (Chapter 4) that

are being deployed to address these barriers to adoption. Building on these measures we identify key additional areas below that merit greater focus.

3.3.1. Access to land for young farmers

Young farmers generally tend to have higher levels of formal education and greater openness to new approaches such as CSA, but access to land for these farmers is limited.[76] CSO figures show that only 6% of farmers are under 35 and 26% are over 65. Additionally only 0.3% of the total land area was put on the market in 2011, and the predominant land rent system is short-term and provides little security. [77] While many measures under the CAP and RDP are favourable towards young farmers, and progress has being made, supports under CAP target landowners who are not necessarily active farmers. This is a problem for young farmers, which is compounded by the fact that Ireland does not have an installation grant for young farmers under the Rural Development Programme. Additionally there is a tradition of late transfer of land that is impacting on current and future transfer patterns. There are therefore few opportunities for a young person to get established in farming outside of a family farm. Building on measures to encourage land mobility (including those introduced in Budget 2015), there is a need to ensure young farmers are eligible for EU and national schemes and incentives, and that they have access to finance, so that a career in farming becomes a more realistic option.

The shortage of exits, however, appears to be a greater problem than barriers to entry.[78] Studies have identified lack of awareness of the options available to exit farming among elderly farmers, particularly those without a succession plan, and the tax advantages of long-term leasing options, for example. These are issues that can only be addressed through concerted information provision activities, which might focus in particular on encouraging those without farming successors to consider the merits of long-term leasing. [79]

3.3.2. Limited funding and reach of advisory and extension services

Following the economic crash of 2009, Teagasc advisory staff numbers were reduced by 33%, placing pressure on advisory services. [80] This has restricted Government's ability to reach farmers though advisory services, and given the priority of mobilising the uptake of innovation and technology, as well as the Food Wise 2025 plan. This is an area of funding that perhaps merits revisiting.

There are, in addition, new opportunities for reaching famers that also need to be considered. Rapid advances in information and communications technology have opened the door for moving from "top-down, information push" models of advisory services based on print information and face to face meetings, to the more extensive use of digital platforms and management systems that use real time information, [81] targeting the growing cohort of farmers that have digital access. Digital platforms can provide personalized real-time and relevant information and reminders, and can store user specific data. Information can therefore be more targeted, timely and provided in a user-friendly format. This in turn opens up opportunities for the more effective use of information and resources that could complement existing extension services. In the rebuilding of the capacity of the advisory services it will be important to ensure that recruits have the skills to focus on climate-smart approaches and utilise the technological advances in advisory methodology.

The private sector also has a role in complementing the role of the advisory services by driving innovation in the right direction. The precedent of the public-private initiative Animal Health Ireland is worth considering in this respect. This organisation was established to address health-related issues and to disseminate best practice. Could a similar initiative be considered in CSA that would invest in the necessary technologies and ensure that they are widely adopted?

3.3.3. Peer-to-peer learning

Teagasc research has found that one of the barriers to technology adoption on farms is that farmers tend not to deviate from the routine developed (in relation to animal health in this case), and that farm-level routines change over time, in response to trial and error, learning and critical events.[82] This was a key point identified under the auspices of the IIEA/RDS Leadership Forum.

The conclusion in both cases was the importance of social influence and peer to-peer learning. From the perspective of farmers "if your neighbours are doing it you are more likely to do it". The importance of "learning by sharing" is endorsed by Teagasc research experiments. [83] Efforts to capture the importance of peer-to-peer learning, such as the IFA's Smart Farming initiative, can be built upon in order to drive higher levels of CSA adoption on farm level.

4. OPTIMAL LAND USE FOR CSA

In the Irish debate on reducing emissions from agriculture, there has been a strong analytical focus on identifying least-cost technical options to reduce emission through the development of so-called Marginal Abatement Cost Curves(MAC) (Section 3 above). The headline result from the MAC curve analysis is that there is limited cost-effective technical abatement available in Irish agriculture.

A focus on "carbon neutrality", however, implies a much greater focus on the questions of land use optimisation, or "functional land management".[84] These approaches consider what types of agricultural activities deliver the greatest benefits to farmers and to the environment on a particular type of land. The answer is often complicated, and can depend on soil and climatic conditions, local markets, commodity prices, environmental impacts and other factors.

When considering these questions, however, it is extremely important to note that farmers are entirely sovereign over which types of agricultural activities they choose. On the other hand, farm-level decisions have historically been greatly affected by policy incentives and regulatory decisions (Chapter 3), which in turn reflect evolving challenges and priorities.

In this section we therefore look at options for alternative land uses, focusing in particular on forestry and barriers to adoption and uptake of greater forestry in Ireland.

4.1. Forestry

Taking a land-use perspective shifts the focus to the economic and climate opportunities associated with forestry in Ireland. As noted in Chapter 3, there is markedly less land under forest in Ireland compared to the EU average.

Ireland has succeeded in achieving a considerable rate of afforestation since independence, involving both public and private sectors (Fig 5.2).[85] On the other hand, rates of afforestation have fallen short of meeting stated policy objectives, and indeed current targets for afforestation (7,300 ha per annum) are far

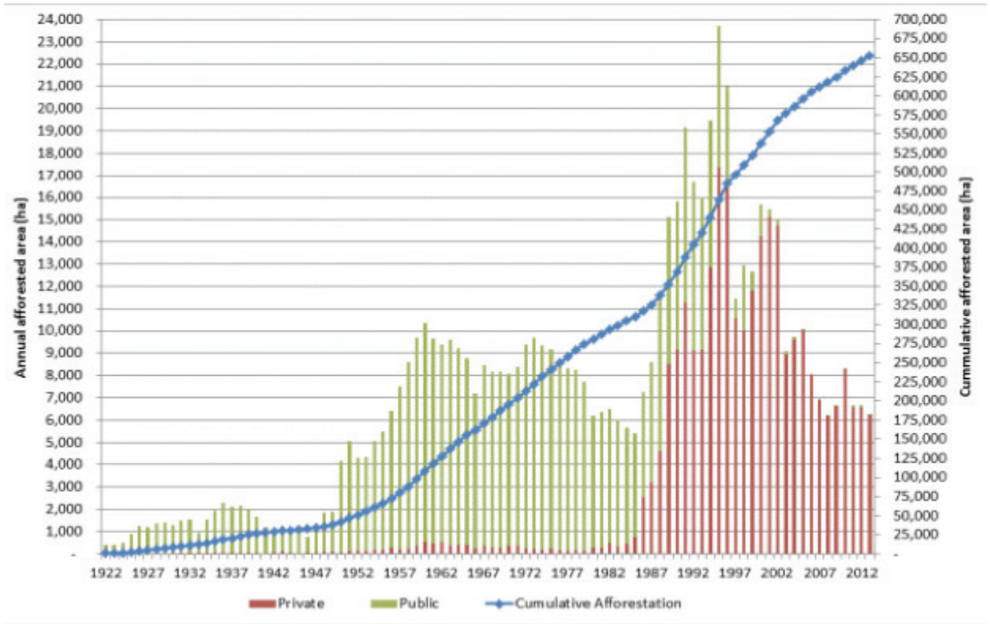


Fig 5.2. Public and Private Afforestation in Ireland

Source: IIEA/RDS

below the 16,000 hectares per annum that would be required to achieve the Government objective of 18% forest cover by 2046. Current plantings are 30% below the target for 2016.

Under the 2014-2020 Forestry Programme approximately 7,300 ha will be planted annually over the 6-year period to 2020. Under existing accounting methodologies (these methodologies are currently under negotiation at EU level and rules are likely to be revised) Ireland would receive a credit of over 4.5 C02 eq per annum between 2021 and 2030 for afforestation since 1990.[86] This is equal to almost 25% of overall emissions from agriculture.

Table 5.3. Sequestration Potential and Abatement Cost of Forestry (High Productivity Levels)
Source: Adapted from Schulte & Donnellan (2012)

	Medium	High
Planting rate (ha/year)	16,000	20,000
Emissions Dividend 1: Sequestered Carbon (Mt CO2)	7.7	9.5
Emissions Dividend 2: Fossil fuels displaced (Mt CO2)	1.6	1.9
Emissions Dividend 3: Reduced livestock emissions (Mt CO2)	?	?
Cost to Government (€/t/CO2)	28.9	26.3

As can be seen from Table 5.3, boosting the afforestation rate to a level in line with meeting Ireland's long-term objective (16,000 ha per annum) or beyond could deliver an even greater total emissions dividend (under current accounting rules) in the period to 2030. The authors note however, that results are highly sensitive to the degree to which planting rates can be accelerated, and yield classes can be increased. The output from forests (biomass) could additionally be used to displace a very significant amount of fossil fuels in heat and electricity generation.

It is also worth noting that a greater level of afforestation may have a third emissions dividend if land is taken out of marginal agricultural production. The impact of different rates of afforestation on beef and dairy farming is not currently well understood, and the extent to which greater levels of afforestation would result in a reduction in emissions from the national herd is an area requiring greater analytical attention.

Furthermore, failing to boost the current rate of afforestation would lead to a dramatic fall off in the overall sink contribution of forests in the post 2030 period (again, this is assuming current accounting rules), as per Fig 5.3.

Given higher rates of afforestation in the early to mid- 1990s, well exceeding 16,000ha per annum, we conclude that a higher rate of afforestation is technically and logistically feasible.[87] It should be noted, however, that higher afforestation rates from this period involved a strong contribution from both public and private sectors, and the public sector is not now involved in forestry for a number of reasons.

Within the context of Ireland's potentially high compliance cost with respect to 2030 EU targets (Chapter 3), one of the only large-scale opportunities for agriculture and land use to make a substantial contribution to mitigation (outside of dramatic reductions to the national herd) is to boost the rate of afforestation in line with meeting Ireland's long-term targets for 2046. Without finding solutions to promoting greater levels of afforestation it is highly unlikely that any plausible EU climate objectives can be met. It is vital for these long-term benefits to be integrated into short- and medium-term policy and development planning.

The wider case for more forestry is persuasive from a climate-smart perspective. In addition to reducing emissions, forestry can also:

1. **Boost farm income and the rural economy:** current afforestation programmes generally cover the full costs of establishing forestry, and provide an annual payment per hectare in the region of €440 to €615 for 15 years, which can be combined with the single farm payment.88 This compares favorable to an average loss of €244 on the least profitable third of suckler beef farms (the loss being somewhat offset by the Single Farm Payment under the CAP, among other income supports).[89] Planting a portion of a farm can additionally build resilience to commodity price shocks by providing farmers with diversified income streams.
2. **Build resilience to the impacts of climate change in particular flooding:** UK studies show that productive forests can build resilience to climate impacts such as flooding.[90] This is an area requiring more research in Ireland, especially given the apparent increased risk of flooding in the Shannon catchment area in recent years.

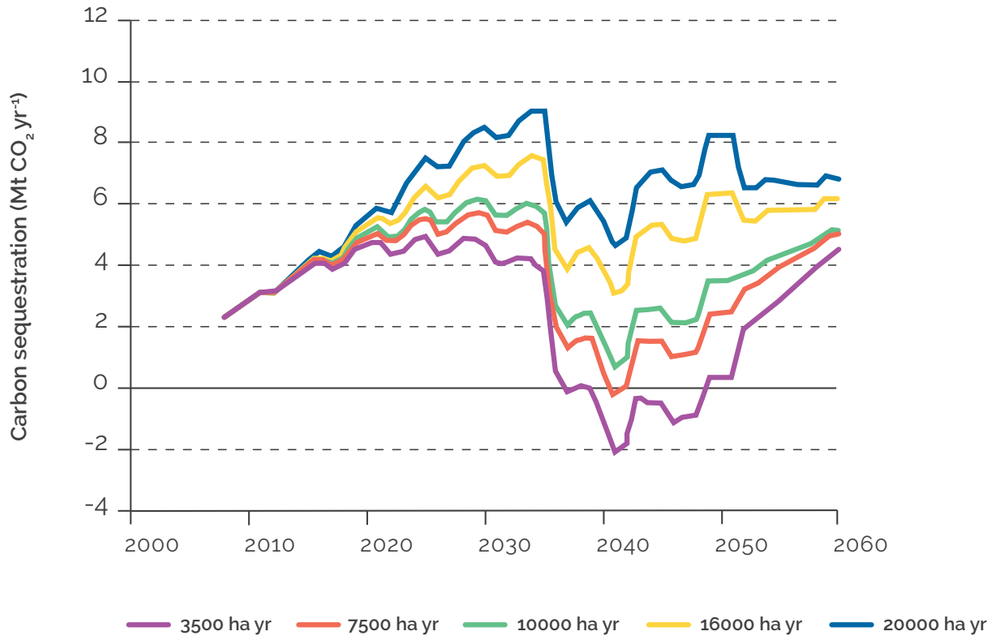


Fig 5.3. Contribution of Forests to sinks under different planting scenarios

Teagasc notes that there are other benefits of forestry such as raw material provision, water protection, recreation and job-creation in the bio economy. For example, and as noted above, the impact on fossil fuel displacement could be substantial, and it has been estimated that in order to meet Ireland's renewable objectives for 2020, gross demand for wood biomass will need to be doubled. It should not be forgotten that there is an important link to the buildings sector, where forestry outputs have a higher value than wood biomass. However, several major challenges must be addressed if afforestation rates are to be boosted.

4.2. AGROFORESTRY

While trees and agriculture can compete for land, they can also share land. Agroforestry offers a potential middle ground to the beef versus forestry debate, by combining food production and biomass for energy on the same piece of land. Agro-forestry systems have many potential advantages: they can prevent soil degradation and improve soil carbon, store carbon in biomass, provide land-owners with a renewable energy source,91 provide ecosystem services such as water retention, improve biodiversity and in many cases improve productivity.

Silvopasture in particular, a subset of agroforestry where trees are grown in grazed pasture in a regular or varied pattern, may have significant potential in Ireland. Experiments with silvopasture in Ireland have identified significant environmental improvements (enhancing the landscape, improving animal welfare benefits, building resilience to flooding, and providing shading for temperature extremes).

One of the challenges for silvopasture is that animals can damage trees. For this reason grazing by sheep

or young domestic stock is permitted only during spring and summer for the first six to eight years. Once trees are of a sufficient size larger stock can be re-introduced. For this reason, a new agro-frestry programme, provides a total grant of €4,450/ha for the duration of five years (compared to 15 years for forestry programmes).[92]

While the flexibility of agro-forestry could be very attractive to farmers, there are huge challenges to be overcome if it is to make a significant contribution to Ireland's emissions reduction targets. There is a lack of awareness of the benefits of agroforestry and landowners want more information. This is another challenge for researchers and extension workers.

There is, however, a lack hard data on the climate change mitigation level that can be achieved from agroforestry within an Irish context. Given its promise, the sequestration potential of agro-forestry requires greater analytical attention.

4.3. Land availability for forestry

In excess of half a million hectares of land would be required to meet targets in the period to 2046. Within the context of these ambitious afforestation plans, forestry must compete with other land uses.

To achieve this objective it may be necessary to reconsider certain land types that have been excluded from the afforestation programme due to site characteristics. A COFORD assessment of Land Availability for Afforestation found that 220,000 ha of land exists that is not currently in farming and is outside the main environmental constraint areas. However, much of this land is classified as "unenclosed", a somewhat out-dated classification for land that is considered unproductive. To be eligible for an afforestation grant, proposals must contain less than 20% of unenclosed land. For these reasons COFORD/Teagasc propose the use of a new system for classifying land availability for afforestation – Site Classification for Irish Forestry (SCIF). Incorporating SCIF into forestry assessment procedures, and reviewing grade and premium categories accordingly, could free up additional land for afforestation.

Ultimately, however, forestry will compete for land with other agricultural activities. According to a COFORD report, 1.8 million ha of land is classified as being "limited" for agriculture, and there is wider scope for afforestation compared to better quality land. On this land, however, forestry is competing with other land uses, in particular beef and sheep farming. If targets are to be met it will be necessary to incentivise greater numbers of farmers to consider planting some of their land.

4.4. Financial and non-financial incentives for forestry

An analysis of the farmers participating in the Teagasc National Farm Survey has shown that only 3% were considering planting forestry in the next three years. Despite financially attractive grants and annual payments, farmers would appear therefore to remain unconvinced by the forestry proposition, even within the context of the gross loss being made on much of the land used in directly competing activities. Research suggests that the barriers to afforestation are not, however, just economic. Deeply held values, including "a preference for a farming lifestyle, control over land, continuing a family farming tradition, meeting a challenge, to pride of ownership" can act against land being planted, notwithstanding the availability of strong economic incentives.

With respect to the financial incentives provided for forestry, we endorse recommendations 13 to 18 of the COFORD report93 which if implemented would go some way to making forestry more financially attractive. Some of these proposals are simple and sensible such as the removal of hassle factors, and others relate to improving the financial attractiveness of the grants, including improving tax treatment and allowing farmers access to higher premiums should they become available in the future.

While improving the financial attractiveness of farming is no doubt important, we note two important caveats. First, if the attractiveness of other competing activities is simultaneously increased through the provision of income supports, the net impact on behaviour change for the increased Government spend is zero. The extent to which income supports provided under the Rural Development Programme undermine the attractiveness of forestry needs to be carefully considered.

In order to address non-financial barriers, there is a need for an educational and promotional programme to improve the attractiveness of forestry for farmers, and indeed to explain how forestry can provide an income to current and future generations, building on already-existing initiatives such as knowledge transfer groups, and various advisory and training schemes for foresters.

Key additional barriers relate to the requirement for forested land to be replanted and the long-term nature of the investment.[94] Creative solutions to the replanting requirement, which makes replanting forestry after harvest mandatory, need to be found. This is perceived as a serious disincentive in that it locks land into forest "forever" and reduces the value of land. In practice, in the vast majority of cases, there may be no other viable use for this land other than to re-afforest it and the requirement may therefore have little value added. The requirement precludes a decision that might therefore never be taken.

The potential of a "carbon buy back" mechanism or a "buy out" provision could be envisaged in cases where a landowner wishes to take land back out of forestry in the future. This may go some way to alleviating the concern of farmers when considering switching some proportion of their farm to forestry.

4.5. Impact on biodiversity

Carefully planned woodlands can have a positive impact on biodiversity. All afforestation in Ireland requires consent from the Forest Service. Safeguards are in place in to avoid afforestation of environmentally unsuitable sites, and to ensure that afforestation takes into account environmental sensitivities. These include, inter alia, habitats and species (including NATURA sites, Freshwater Pearl Mussel and Hen Harrier sites), water quality (including fisheries sensitive areas, waterbody status, acid sensitive areas), archaeology and landscape.

The new Forestry Programme 2014-2020, which has been approved under State Aid, takes into account the aims and objectives of the EU's Biodiversity Strategy. It proposes:

- An overall 30% broadleaf target has been set for the Afforestation and Creation of Woodland Measure, plus a minimum of 10% broadleaves in all afforestation projects.
- Support for Forest Management Plans to private forest owners. Plans must adhere to the principles of Sustainable Forest Management.
- All measures supported under the Forestry Programme will incorporate the protection of Freshwater Pearl Mussel and its habitat.
- A Native Woodland Scheme (NWS) that aims at protecting and expanding Ireland's native woodland resource.

Notwithstanding these safeguards, the impact of productive forests on biodiversity has been the focus of considerable debate in Ireland and abroad, and there are concerns that afforestation may pose a threat to some bird species.

Scientific evidence suggests that the impacts of afforestation on biodiversity are influenced by many factors including planted tree species, management intensity and preceding land-use. Where plantation forests replace natural or semi-natural ecosystems, negative impacts on biodiversity are typically documented but plantations established on former agricultural (or otherwise ecologically degraded) land may offer considerable opportunities for biodiversity conservation.[95]

In Ireland, there has been considerable overlap between afforested areas with areas that are home to birds of high conservation concern. Afforestation may represent a threat to birds that rely on grasslands, and indeed plantation forests may already be having a negative effect on some endangered species. [96]

It is vitally important, given these concerns, that afforestation is planned and managed appropriately at a landscape scale, considering factors such as forest patch size and shape, [97] to ensure so that bird communities can be protected and enhanced.[98] The importance of considering preceding habitat type in the selection of sites for afforestation is underlined in many studies.[99]

It is important also that in the face of uncertainty the precautionary principle be respected. Due to specific concerns in relation to the hen harrier, Bird Watch Ireland and other NGOs have called for a halt to afforestation in areas which are important to this species outside of the Special Protection Area (SPA) network. They note that the proportion of breeding hen harriers occurring outside the SPA network increased from 39% in 2005 to over 50% in 2015.

On the basis of these concerns, the development of a bird forestry sensitivity map, which would aim to identify areas of particular sensitivity for birds where there are future afforestation plans might be considered.

Text Box: Measurement, Reporting and Verifying Agricultural Emissions

Livestock, fertiliser use and drainage of organic soils are the main contributors to GHG emissions from the agriculture sector. Emissions can also be removed from the atmosphere (or sequestered) in soils and above ground biomass. The ability to accurately measure, report and verify (MRV) these emissions is central to action to address climate change. There are, however, particular challenges associated MRV of emissions and their removals from this sector.

The IPCC has provided detailed Good Practice Guidelines on MRV for all sectors including agriculture, land use and forestry. These guidelines have been adopted for reporting and accounting under the UNFCCC and Kyoto Protocol (KP). Under the KP, Parties have to account for certain land use categories such as afforestation. Others such as grazing and cropland are only included if Parties volunteer to do so. Ireland has included grazing and cropland under its 2nd Commitment period to the KP (2013 – 2020).

For the most part the EU's reporting rules are consistent with those agreed under the UNFCCC and KP. However, sinks are currently not included in the EU accounting rules for the 2013 – 2020 period, closing off a potentially significant area of activity for Ireland.

There is ongoing consideration of this sink and how it may be accounted for at EU level post-2020. New rules could open up opportunities for Ireland to sequester carbon through afforestation, forestry management, grazing and cropland management. In the future, the rewetting and/or restoration of degraded wetlands and peatlands may also provide similar opportunities.

Factors such as inter-annual variability of weather systems, soil characteristics, and natural disturbance can pose challenges for MRV of emissions and removals from this sector, and are the subjects of continuing scientific study.

Specific on-farm efficiency improvements may in some cases be challenging to reflect in national inventories unless captured at sufficient scale for inclusion. Improving the genetic merit of cattle, for example, may result in a reduction in emissions, but will be reflected in inventories if it can be captured in the management/activity data. Inventories in this area can be improved through herd profiling, better management data and increased knowledge of fertiliser use. Farm scale analysis may be warranted in certain circumstance depending on the costs-benefit profile.

Management practices that result in enhanced uptake of carbon in soils and biomass can also be encouraged, but MRV systems need to be improved. New technologies such as LiDAR and SAR are capable of measuring increases in above ground biomass against a given baseline. These technologies, which have been piloted on Irish farms,102 open up possibilities to accurately capture improvements in a cost-effective manner. Soils pose a particular challenge and further research is needed to address this.

The dichotomy between what is happening on an individual farm level and what Ireland can gain credit for in national inventories creates a number of challenges. First, from a policy perspective, there is limited benefit from incentivising up-take of measures for which Ireland cannot receive accreditation. Second, it can create a communication challenge: the farming community may feel that they are not receiving credit for adoption of best-practice, especially in circumstances where long established and traditional management practices are actually consistent with long term sustainable production.

Inventories are becoming increasingly sophisticated over time, and Teagasc research illustrates that there are potential gains for Ireland in moving from default values to more sophisticated inventories (e.g. higher tier N2O values).103 A key objective of policy is to close the gap between on-farm practices and what can be reflected in inventories. Further research is required to achieve this policy objective, and funding relevant research is consistent with CSA leadership aspirations.

It should be noted that native woodlands and riparian woodland may be established within environmentally sensitive areas, and can contribute to biodiversity conservation and water quality and flood risk reduction objectives.[100]

4.6. Funding

Forestry costs the Government money. For example, a total of €173 million will be invested in afforestation in the 2014 to 2020 period. Schulte and Donnelan (2012) estimate that the costs of incentivising afforestation in the region of €30 per tonne of CO2eq by 2020,[101] though these costs may change significantly depending on accounting rules which are agreed for the 2020 to 2030 period. On the other hand, it should be noted that this cost estimate does not take account of reductions to bovine emissions that may arise indirectly from afforestation. Nor do these figures account for the many co-benefits provided by afforestation discussed above.

While afforestation therefore implies a significant cost for Government, and boosting afforestation rates further would incur even greater costs, these need to be considered within the context of Ireland's distance to target for 2030 and the potential compliance costs arising therein (Chapter 3).

5. A SOCIETAL APPROACH

Farmers, processors and retailers capture much of the value from agricultural production and expansion. Responsibility for implemeting CSA, therefore, must be shared across the food system, particularly focusing on partnerships between processors and farmers (Section 3.1 above), but also in society's relationship to food.

It is clear from Chapter 2 that without exploring solutions on both the supply and demand side, global agricultural emissions will continue to grow. For this reason in this section we explore options on the supply side to promote a greater awareness of the importance of climate-smart food, looking at food labelling, dietary change, and food waste.

5.1. Labelling and dietary change

It is clear from international research, including IPCC AR5, that dietary change in the direction of less carbon-intensive foods is one of the main opportunities to significantly reduce greenhouse gas emissions from agriculture and land use (Chapter 2). The majority of Irish produce, however, is exported, and promoting dietary change is therefore seen by some Irish stakeholders as something for consideration at EU level, if at all. Other stakeholders saw demand-side measures promoting dietary change to be of key importance.[104]

There was agreement among stakeholders that there is an opportunity to "leverage what we have developed" in Origin Green, and that this could perhaps be turned into a consumer brand, with a view to promoting more environmentally friendly food purchasing decisions, initially in Ireland but with the potential for extension into selected export markets. An Bord Bia is in fact already considering how Origin Green might be turned into a consumer brand.

Questions of dietary change fall primarily within the remit of government policy on health and well being, at national and international level. The growth in obesity levels is a significant policy challenge for public health and public finances. While obesity cannot be linked to one food source, it has been associated with excessive meat consumption in some studies. [105] A study by the High Level Panel of Experts of the Committee on World Food Security acknowledges that increasing consumption of animal sourced food (ASF) in emerging and developing countries has the potential to significantly improve food and nutrition security in many cases.

The study further states that:

> *"The consensus of expert medical advice is that, in developed and some emerging countries, people should reduce their consumption of a number of ASF, in particular of red and processed meats. If there were to be a significant reduction of overall ASF in richer areas, it would have important implications on production levels and practices, on land use, and on the geographical distribution of livestock production. In general, consumption levels of some ASF need to contract in some cases and/or some populations, while increasing in others. Such a shift would allow a greater convergence of consumption at the global level".*

The study also concludes that resource efficiency in livestock production is a key area for action (Chapter 2). It recognises that the livestock sector has huge potential for improvement if the existing best practices in a given system and region can be shared and learned from more widely. This is the wider global context against which an Irish

capacity to demonstrate its relative efficiency and sustainable practices in livestock production could serve as a key competitive advantage, in both food products and technology.

Tackling obesity and promoting healthier diets is a considerable policy challenge with few successful examples from international best practice to point to. The Lancet series on obesity (2015) found that "today's food environments exploit people's biological, physiological, social and economic vulnerabilities, making it easier for them to eat unhealthy food. Regulatory actions from governments and increased efforts from industry and civil society will be necessary to break this vicious cycle".

The HSE document 'Healthy Ireland - A Framework for Improved Health and Wellbeing' (2013) provides a public health framework for improved health and wellbeing of the population. An 'Obesity Policy Consultation Report' (September 2015) provides the basis for a National Obesity Policy and Action Plan, due to be published in 2016. The distinctive approach in each of these documents is the combination of a set of regulatory interventions (food safely, labelling, calories on menus, portion size) with approaches aimed at securing community engagement and responsibility in working towards better personal and community health outcomes.

If these policies are properly implemented, funded, monitored and reported upon, Ireland could, over relatively few years, develop some important evidence in policy development in dealing with obesity and public health. This approach would be entirely consistent with the overall approach of investing in sustainable food systems, which is at the heart of the approach advocated in this report.

5.2. Reducing Food Waste

Another opportunity relates to reducing food waste at various stages along the food chain, including on-farm, in transit, retail, food service and domestic. The OECD notes that reducing food losses and food waste is attracting growing public attention at the international, regional, and national levels, and is widely acknowledged to contribute to abating interlinked sustainability challenges such as food security, climate change, and water shortage.[106] As noted in Chapter 2, FAO estimates that food which is not eaten results in 3.3 billion tonnes of CO_2 eq emissions per year.

According to the EPA, in Ireland there is over one million tonnes of food waste disposed of each year. Around one third of this comes from households. 60% of this is categorised as "avoidable" food waste, while another 20% is categorised as "potentially avoidable", whereas 20% is considered "unavoidable".[107] Awareness raising campaigns such as the EPA's Stop Food Waste have been put in place. With respect to a CSA strategy, the question of what additional policies and practices could be considered arises.

There are a growing number of initiatives around the world that focus on reducing food waste that Ireland could learn from. According to the UN, one common feature is a focus on "gathering public and private actors, in a multi-stakeholder setting, often with a significant engagement of the private sector". Accordingly, the UN makes a number of recommendations to states in seeking to reduce food waste, including the convening of "an inclusive process to identify hotspots, causes of losses and waste at different levels, potential solutions and levels of intervention" with a view to determine a plan of action in a manner that includes all stakeholders, including those that stand to benefit or loose, and those that can provide solutions.[108]

The UN also notes that some governments have defined specific targets for food loss and waste reduction, and indeed the 2011 European Commission Resource Efficiency Roadmap sets a milestone of halving the disposal of edible food waste by 2020 (EU Commission, 2011).

6. CONCLUSION

This chapter outlines measures that might be considered in order for Ireland to emerge as a leader in CSA, building on the foundations of leadership that are already in place (Chapter 4). We believe that it would be in Ireland's best interests to differentiate itself further from other countries and to adopt global CSA leadership as a stated policy objective, and to identify and implement policy measures consistent with meeting these objectives across Government.

To achieve this objective we propose the adoption of a management framework for agriculture, land use and climate change, with a clearly defined vision of either "global CSA leadership" or "carbon neutrality" at its heart. A key aspect of this approach would be to take a fully integrated approach to agriculture and forestry development. Transparent annual reporting to meeting the agreed vision against key indicators, and using internationally agreed standards for MRV, would substantiate claims of leadership by providing hard evidence of progress over time. This would be of benefit to Ireland, both in communicating the efforts it is making to its EU partners, and in terms of branding itself as a sustainability leader in international food and agri-food technology markets. Such an approach would have implications for future iterations of agricultural strategy, ensuring the integrating of international climate commitments.

Action could be focused on the climate-smart evolution of the national herd arising from regulatory changes. The end of the milk-quota era presents an opportunity for the expansion of dairy-beef enterprises, which are both climate smart and economically beneficial for farmers. In order to overcome barriers to adoption, various incentives must be aligned and push in the same direction, and there may be a role for a carbon offsetting mechanism to promote optimal land used, supported by processors.

There are, however, many barriers to the uptake of new technologies and farming practices, not least access to land for young farmers. We outline approaches to overcoming these barriers, including ensuring that young farmers are eligible for EU and national incentives, and promoting awareness of long-term leasing options for older farmers. The may be a need to reconfigure extension services in light of new priorities and technologies and there is a potential role for public-private partnerships in promoting uptake of new technologies and approaches.

Promoting climate-smart approaches implies a greater focus on opportunities for optimising land use and building carbon sinks, in line with achieving carbon neutrality. There are economic and environmental advantages associated with greater uptake of forestry and agro-forestry - without a substantial contribution from the carbon sinks they provide, it is difficult to see Ireland's likely future EU targets being met. However, farmers remain unconvinced by the value proposition of forestry and there are considerable barriers to land use change Creative solutions to address these financial and non-financial barriers need to be explored including the possibility of a carbon trading mechanism that would ensure that the land most suitable for forestry is planted and an end to the replanting requirement. Building on existing good practices, biodiversity concerns associated with forestry can be managed through greater integration of data on vulnerable species into planning.

Finally, CSA is not just a list of technologies or practices. It is also the process of engaging all stakeholders around a common vision. We argue that addressing emissions from agriculture and land use is a societal challenge, and solutions need to be introduced across the food chain, focusing on climate-smart food. A greater emphasis on information and labelling and reducing food waste is required as part of a comprehensive CSA strategy.

CHAPTER 6:
CSA Leadership on the International Stage

1. INTRODUCTION

There is a perceived tension between responding to food security and addressing climate change: while climate change poses serious threats, poorly considered policy responses can undermine food security. For this reason, there is a growing recognition globally that the climate-land-food nexus of challenges must be addressed holistically. Most notably, this is reflected in the texts of October 2014 European Council Conclusions and the December 2015 Paris Agreement (Chapter 2). Within Ireland, it is reflected the policy objective of achieving "carbon neutrality" in a manner that "does not compromise capacity for sustainable food production" (Chapter 4).

In the previous chapter we explored policies and practices that might be considered as part of a credible and coherent domestic policy response consistent with CSA leadership. In this chapter we explore the importance of the outward facing aspects of CSA.

To begin we provide context by discussing the relationship between the policy objectives of boosting exports and enhancing global "food security", and provide a brief resume of Ireland's efforts in these domains. We then explore how Ireland could:

1. Mainstream CSA considerations into development assistance work and international research partnerships;

2. Boost CSA "knowledge transfer" initiatives involving public and private sector actors; and

3. Promote CSA in Ireland's participation at international and EU fora.

2. DISTINGUISHING BETWEEN FOOD PRODUCTION AND FOOD SECURITY

A key theme within the Irish debate on CSA is Ireland's contribution to global "food security" within the context of climate change, which is often associated with food production.

Irish engagement with the global food economy has developed in recent decades with a steady growth in the volume and value of food and drink exports. In 2015, Irish food and drink exports amounted to €10.8 billion, with the major export markets being the UK (41%), other EU (31%) and international markets (28%). The Irish food industry has been transformed into a high value added sector mainly supplying wealthy customers; the old commodity-based sector selling into third world markets with EU subsidies is long gone. This broad strategy of continuing to move up the value chain, service the core demand in the UK and EU, and target the more attractive international markets will be the industry's strategy over the coming years. Growing global food demand is a key economic opportunity for the sector and serving this market is a legitimate objective.

It is important, however, to distinguish between meeting these commercial objectives for Irish food outputs from aspirations to contribute to global food security, which relates to boosting access to food for the most vulnerable. In Chapter 2 we traced the evolving definition of food security – based on the three pillars of availability, access and use of food – and how, since 2013, there is a widely accepted definition of what constitutes 'food and nutrition security'. A significant minority of the world population is at risk of malnutrition, and this is the cohort that might be targeted by efforts to improve "food security".

The remaining world population are not in any short- or long-term risk of food and nutrition insecurity: these represent that part of the population who have increasing and more diverse food needs, with food safety and sustainability being among their key demands. It is to these markets that Irish food production outputs will be increasingly targeted.

3. IRELAND'S RECORD IN ADDRESSING GLOBAL FOOD SECURITY

Even if the bulk of Irish food exports are meeting the market demands of an increasingly affluent global population, Ireland has a strong track record of contributing to improving food and nutrition security in many of the world's poorer countries. Improving food and nutrition security has been a central focus of Ireland's humanitarian and development assistance programme over many years. The 2008 Irish Hunger Task Force report recommended that 20% of aid funding should be devoted to hunger and food security projects. It also recommended that there should be an increasing focus on maternal and early childhood nutrition and that Ireland should seek to play a leadership role at international level in advocating for improved nutrition and food security globally (Chapter 2).

Irish Aid delivered on the commitment to spend 20% of the aid budget on nutrition and food security. Irish NGOs, working in support of Irish Aid, aligned their own programmes with the recommendations. The net effect has been a shared learning on nutrition and food security between Irish Aid and NGOs leading to more programme impact and policy coherence. There has been international recognition of the success of this approach. The OECD Development Assistance Committee (DAC) 2014 report on the Irish Aid programme concluded that:

> *"Ireland's successful efforts internationally on hunger and nutrition shows how it rallies a range of actors behind a common objective. It is a founding-member of the Scaling Up Nutrition Movement and initiated a high level partnership with the United States focusing on the first 1,000 days of a child's life. In 2013, Ireland worked with the UK to get G8 leaders to endorse the Global Nutrition for Growth Compact. During its Presidency of the European Union it facilitated an EU approach to resilience".*

The DAC report goes on to recommend that:

> *"In light of these advances….Ireland might consider playing a stronger role – at home and internationally – in raising the perspective of development in agricultural policy making. For example, its Agri-Food sector is growing while it needs to reduce its CO2 emissions in line with EU targets for 2020".*

This DAC report provides a strong endorsement of the proposition (Chapter 1) that Ireland has attained an international leadership position in the area of nutrition and food security, based on a policy blueprint, high level political support, a whole-of-government approach to implementation and broad-based support from civil society.

4. CSA DEVELOPMENT ASSISTANCE AND RESEARCH PARTNERSHIPS

Drawing on this DAC endorsement, we recommend that a similarly coherent approach in the nutrition/food security area should be applied to CSA. We recommend that a key starting point should be the mainstreaming of CSA considerations into Ireland's development assistance programmes and international research activities.

In so doing, a challenge is to come to a common understanding of what is considered "climate-smart". Building on the FAO definition (Chapter 1), one of the findings of this project is that the emphasis of CSA will generally change according to context.[109] Several Irish and overseas NGOs would question some approaches labelled as CSA.

Greater definitional clarity of what we mean by CSA within an Irish context might therefore be required. There would likely to be a strong consensus among NGOs that initiatives which support small scale farmers to increase output while reducing emissions by using and recycling resources and restoring degraded soils which places small holders, especially women, at the heart of decision-making,[110] could be supported.

A portfolio of practices would need to be tested before being scaled, and the potential role for government in ensuring the availability of good "scientific assessment" would also be of importance. [111]

4.1. Irish Aid

Within the Irish aid programme, we recommend a prioritization of CSA, alongside the continuing prioritisation of nutrition and food security. Building on the existing commitment that 20% of Irish Aid funds are committed to nutrition and food security, we recommend that 30% of total funds could be committed to the combined programme efforts relating to nutrition, food security and CSA. This would provide a signal of the political and policy importance of taking a holistic and integrated approach to these related topics, and would also encourage innovative and creative programming linking them. Given that environment/cimate change and gender equality are both priority issues within the Irish Aid programme, it could furthermore be envisaged that the aid programme should build in a specific gender dimension under the nutrition/food security/CSA prioritisation recommended.

A further potential area of focus for Irish Aid could revolve around sharing experiences on mainstreaming climate change into agricultural and nutritional strategies, an area where Ireland is developing considerable expertise (Chapter 4). Finally, the value of an effective inter-departmental committee in dealing with the nutrition/food security issues was commented upon by the OECD DAC, and a similar structure could be established for CSA, including participation from key state agencies.

4.2. Development NGOs

There is a particular scope for the major Irish NGOs to build a strong programmatic and learning relationship with Irish Aid around CSA, taking into account the varying definitions and approaches of different agencies, as was achieved in relation to nutrition/food security. Such learning can connect to important external initiatives. For example, Concern Worldwide is one of five major NGOs who are members of the African Alliance for Climate Smart Agriculture (AACSA), which is committed to empowering 6 million smallholder farmers in sub-Saharan Africa by 2021. Trocaire have also developed a number of programmes promoting the transition to agro-ecological approaches to increase resilience of communities to the impacts of climate change.

4.3. International research alliances

There is a need for more research, data and evidence that explores the impact of climate change on food/nutrition security, so that appropriate and effective interventions can be designed and implemented.

Irish Aid has been a long-term supporter of international agricultural research operated by the CGIAR. One supported area has been the research programme on Climate Change Agriculture and Food Security (CCAFS), a programme addressing agriculture in the context of climate variability, climate change and uncertainty about future climate conditions. This programme is increasingly focusing on CSA, and therefore could be targeted for increasing support over time.

The Global Research Alliance (GRA) on Agricultural Greenhouse Gases (Chapter 2) was established in 2009 to focus on research, development and extension of technologies and practices that will deliver more food (and more climate-resilient food systems) without increasing greenhouse gas emissions. Ireland has been an active member of the GRA from the outset and could continue to deepen its research collaboration with a number of key country members of the GRA, including New Zealand. Based on this model, Ireland should look to identify a limited number of CSA issues to forge leadership coalitions with like-minded countries with corresponding interests and strengths. These coalitions could take the form of research collaborations, best practice exchanges or targeted policy advocacy opportunities.

4.4. An all-island approach to CSA.

In Chapter 4 we set out the progress already made in implementing CSA in the Republic and in Northern Ireland (Text Box 4.1). There is an opportunity to build on this progress by putting in place official and informal arrangements for collaboration, research and shared learning to explore innovative approaches to CSA implementation, for which European research support could be forthcoming.

We recommend the establishment of a standing committee of representatives of the Irish Government and the Northern Ireland Executive to explore the potential for and strategic direction of an all-island approach to CSA, building on existing shared initiatives.

5. KNOWLEDGE AND TECHNOLOGY TRANSFER

Many developing countries urgently need to substantially invest in developing their own food and nutrition capability within the context of climate change. As well as a growing focus on CSA approaches, this can be achieved through a greater focus on sustainable intensification, building national capacity for environmental services,[112] and by a greater recognition of the role of food systems in improving health and nutrition.[113]

Irish enterprise can play an important role in building

capacity in these countries. A number of existing Irish companies are already serving markets in animal nutrition systems, dairy production, smart technologies, robotics and biotechnology, which are potentially relevant in enhancing food and nutritional security.[114] One particular area of expertise that has been developed in Ireland is around livestock efficiency. There are considerable climate gains available in promoting greater livestock efficiency globally (Chapter 2). Whereas the main focus of Irish Aid programmes to date have been on small-scale crop productivity (cereals, legumes, vegetables etc.), public-private partnerships and collaborations could potentially focus on promoting greater livestock efficiency.

A particularly interesting example of potential is the service offered by Sustainable Food Systems Ireland (SFSI), a consortium of the largest Government – sponsored public agencies responsible for the agriculture and food sectors in Ireland. SFSI can point to robust and integrated systems covering food safety, traceability, animal health and welfare, productivity, breeding, sustainability and innovation.

The importance of ensuring that private sector involvement has a clear purpose, benefit and value added to the local community would be paramount. The can be achieved by adhering to the UN Guiding Principles on Business and Human Rights. Ireland has committed to developing a National Action Plan to implement the UN Guiding Principles on Business and Human Rights,[115] the results of which could be used to inform the design of a CSA knowledge transfer initiative involving public and private sector actors.

6. PROMOTING CSA AT INTERNATIONAL FORA

A final aspect of the external facing CSA leadership concerns Ireland's participation and role at international fora. Survey work undertaken by IIEA/RDS indicated that stakeholders and experts consider EU fora to be of most importance for Ireland when it comes to CSA. This reflects the importance of the EU's 2030 framework for climate and energy negotiations (Chapter 3), and in particular on-going "burden sharing" negotiations for the future development of Irish agriculture.

Talks on the next round of EU CAP reforms are scheduled to begin in 2018. This opens up further avenues for perusing a greater focus on CSA (Chapter 3). Reform of the CAP, particularly from 1992 onwards, has involved an increasing emphasis on agri-environmental measures (Chapter 3). The next round of CAP reform provides an opportunity to build further 'greening' policy instruments into the CAP.

Ireland should furthermore be fully supportive of the EU's Food 2030 initiative (Chapter 2), which seeks to prioritise research into building climate-resilient food systems. Food 2030 also supports the EU/African Union High Level Policy Dialogue on Food, Nutrition and Sustainable Agriculture.

The conclusions of the SDGs and the Paris Climate Agreement (Chapter 2) will provide the basis for ongoing climate, development and sustainability negotiations in the coming years. The linkage between these two major agreements is made through the Agenda 2030 project, led at UN level by Dr David Nabarro, Special Adviser to the UN Secretary General. The Irish Government, which played a major role in securing international agreement for the SDGs, should also aim to play a positive and proactive role in these negotiations, promoting a prominent focus on CSA. A key short-term objective might be to push for a specific work programme for the agriculture-climate-food nexus at the COP 22 in Marrakesh in November 2016.

Overall, the objective should be to bring a distinct and coherent Irish narrative to these international talks and negotiations consistent with CSA leadership.

7. CONCLUSION

A domestic focus on CSA leadership should be complemented with an approach to mainstreaming CSA into Ireland's outward facing diplomacy. This can build on the suite of existing activities, and should be based on how Ireland attained international leadership in the nutrition/food security area. It is important within this context to clearly differentiate between the objectives of increasing food production and contributing to global food security; these are both valid, though clearly distinct, policy objectives.

To this end there is a case for greater definitional clarity of what we mean by CSA within the Irish context to ensure that a coordinated approach can be endorsed by stakeholders. We propose a formulation underpinning the rights of smallholder farmers, and safeguarding human rights and gender equality.

Building on the existing commitment to spend 20% of the aid budget on nutrition and food security, we recommend a commitment of 30% of total aid funds to the combined programme efforts relating to nutrition, food security and CSA. Furthermore, we identify scope for the major Irish NGOs to build a strong programmatic and learning relationship with Irish Aid around CSA. The strengths of the private sector in CSA, particularly related to livestock efficiency, might be mobilised to using public/private partnership models focused on knowledge transfer.

Finally there is potential to bring a distinct and coherent Irish narrative consistent with CSA leadership to international talks and negotiations on climate change and agriculture. The importance of the EU's CAP for Irish agriculture is underpinned in this report. To become a better vehicle it must be reshaped around the three pillars of CSA in the next round of reforms, which will take shape by end of 2018. We also identify the potential for CSA to play a prominent role in the ongoing UN climate change negotiations as well as those focused on implementing the Sustainable Development Goals.

CHAPTER 7:
Conclusion

This report explores the climate-food-land nexus of challenges facing humanity in the 21st century, and the role that a small country like Ireland can play in addressing these challenges. It follows an 18-month process overseen by the IIEA/RDS Leadership Forum on CSA, which provided a venue where elements of Irish leadership could be collectively identified, disseminated and operationalised. We worked with key stakeholders and experts to identify smart, ambitious and pragmatic solutions for Irish agriculture, through a series of events, workshops and national and international surveys.

THE GLOBAL PICTURE

Since the 2006 – 2008 food price crisis, the twin challenges of achieving food and nutrition security while combating climate change have risen up the political agenda, and addressing the urgent need to address these issues holistically has been underlined. The short-term requirements to respond to immediate food and nutrition imperatives are compounded by worrying longer-term trends, in particular, the potential negative impacts of climate change on food production against a backdrop of a growing global population. Building more sustainable and resilient agricultural and food systems will be a key part of any solution.

Agriculture, forestry and other land uses contribute 24% of total global GHG emissions. These emissions could increase by at least 30% by 2050 without radical change. This means that – even assuming rapid decarbonisation of energy – trends in agriculture and land use emissions alone would make dangerous climate change inevitable. These non-energy related GHG emissions will account for a growing share of global GHGs over the coming decades.

While advances have been made in developing and deploying sustainable energy solutions globally, awareness of the impact of agriculture on climate change and the mainstreaming of climate change into agricultural development is lagging by comparison.

Major reductions in agricultural GHGs can be achieved by improving the productive efficiency of agriculture globally. Nevertheless, it is clear that supply side efficiency gains will not yield anything close to the levels of mitigation required from agriculture. International scientific assessments emphasise the importance of a portfolio approach, including maximising the potential of sinks in forests, grasslands, peat lands etc. and demand side responses, in particular reducing food waste and dietary changes.

No matter how ambitious and immediate action is, however, the world is locked in to considerable climate change in the coming decades. A warming planet and more climate extremes will contribute to global food insecurity by eroding agricultural productivity and contributing to food price volatility. Building adaptive capacity and improving resilience, particularly in vulnerable regions, is therefore of high importance.

There has historically been an absence of efforts to address these challenges in an integrative manner. There are signs, however, of a growing global awareness that this nexus of challenges must be addressed holistically, and of a growing global willingness to address this nexus of concerns in an integrative manner. This is evident in the two major international agreements of 2015: the agreement of Sustainable Development Goals and the Paris Climate Agreement. It is also evident in the establishment of Global and African Alliances for CSA.

IRELAND'S UNIQUE CHALLENGE

The beef and dairy sectors are relatively large for a developed economy and are critically important to the Irish economy, especially in rural Ireland. Ireland also has substantially less land under forest than is the norm across the EU. The case of Ireland illustrates that climate and agriculture objectives are increasingly at odds at national and EU levels, in a manner that will become apparent to other EU Member States over the coming decade. This is

because the EU's CAP and the lifting of milk quotas create an impetus for dairy sector expansion. On the other hand, the increasingly stringent emissions reductions targets that face Ireland in the non-ETS sector have the potential to constrain this growth.[116]

These unique characteristics combined with the challenging regulatory environment suggest that Ireland's circumstances are sui generis among developed economies globally. Indeed, Ireland could be faced by potentially significant compliance costs in the period to 2030 for emissions associated with agriculture, transport and buildings should solutions not be found to reduce emissions significantly.

A key conclusion from this analysis is that Ireland can consider itself a test case for dealing with these issues. Over the coming decades emissions from agriculture and land use will come increasingly centre stage as other sectors of the global economy are decarbonised. While there are clearly risks to be managed, the solutions, technologies, techniques, practices and institutional and analytical innovations necessary to marry climate and agriculture policy objectives that are developed here will be required across the EU and globally in decades to come.

THE FOUNDATIONS OF CSA LEADERSHIP

Much has already been achieved in Ireland to deliver an ambitious long-term approach to managing the interrelationships between climate change and agriculture and many of the foundations of a leadership approach are in place.

In civil society there has been a lack of consensus around how the agriculture sectors should be treated in so far as meeting Ireland's climate objectives are concerned. Overall we conclude that, looking forward, efforts need to be made to marry these competing approaches, both in Ireland and globally, to ensure that carbon efficiency improvements are combined with other measures to reduce absolute emissions levels from agriculture and land use.

Indeed, policy development in Ireland has already made considerable progress in marrying these competing perspectives. The development of a vision for a "carbon neutral" agriculture and land use sector is a notable achievement. This has emerged as a cogent vision for managing the climate-food-agriculture nexus of challenges domestically and has achieved considerable buy-in from stakeholders. While the overall emissions impacts of agricultural expansion are not clear, the promotion of an integrated approach to agriculture and land use internationally and the mainstreaming of environmental concerns into policy development are further examples of best practice.

Policies that have been implemented have sought to promote greater productive efficiency, though their impacts on overall levels of emissions need further assessment in some cases. Through the adoption of ancillary supporting measures around knowledge transfer and R&D, including Origin Green, the building blocks of future climate-smart leadership are clearly evident.

A MANAGEMENT FRAMEWORK FOR CSA

Building on these foundations, we believe that it would be in Ireland's best interests to differentiate itself further from other countries and to adopt global CSA leadership as a stated policy objective. The three aspects of CSA are clearly crucial for the future development of Irish agriculture: farm income and productivity; building resilience to the increasingly evident impacts of climate change such as flooding; and reducing emissions in light of EU obligations. Policy measures consistent with meeting these objectives could be identified across Government and implemented.

So doing would establish Ireland as an exemplar for other countries to follow, would bolster Ireland's reputation, and would therefore help boost the value of Irish food exports and expertise globally. In the process of striving for leadership Ireland would also inevitably develop the techniques, expertise and reputation internationally (many of which are already evident in the public and private sector) which will be required in years to come across the globe. It will also help manage the compliance challenge in relation to the GHG emissions.

To achieve this objective we propose the adoption of a management framework for agriculture, land use and climate change, with a clearly defined vision of "global CSA leadership" and/or "carbon neutrality" at its heart. Transparent annual reporting of progress to meeting the agreed vision against key indicators, using internationally agreed MRV standards, would substantiate claims of leadership by providing hard evidence of progress over time. This would be of benefit to Ireland, both in communicating the efforts it is making to its EU partners, and in terms of branding itself as a sustainability leader in international food and agri-food technology markets.

PROMOTING THE UPTAKE OF CLIMATE-SMART TECHNOLOGIES AND PRACTICES

The lifting of EU milk quotas has resulted in a period of flux in the national herd. The post-milk quota era presents an opportunity for the expansion of dairy-beef enterprises, which are both climate smart and economically beneficial for farmers. In order to overcome barriers to adoption, incentive schemes must be aligned and pushing in the same direction.

There are also considerable economic opportunities for farmers and rural communities from investing in renewables, and we recommend the introduction of financial incentives specifically targeting local citizens in rural communities, based on international best practice.

There are, however, many barriers to the uptake of new technologies and farming practices, not least access to land for young farmers. We outline approaches to overcoming these barriers, including ensuring that young farmers are eligible for EU and national incentives and promoting awareness of long-term leasing options for older farmers. The may be a need to reconfigure extension services in light of new priorities and technologies and there is a potential role for public-private partnerships in promoting uptake of new technologies and approaches.

OPTIMISING LAND USE AND FORESTRY

Promoting climate-smart approaches implies a greater focus on opportunities for optimising land use and building carbon sinks, in line with achieving carbon neutrality. There are economic and environmental advantages associated with greater uptake of forestry and agro-forestry. Without a substantial contribution from the carbon sinks they provide, it is difficult to see Ireland's likely future EU targets being met.

However, farmers remain unconvinced by the value proposition of forestry and barriers to land use change prevail. Creative solutions to address these financial and non-financial barriers need to be explored to ensure the land most suitable for forestry is planted, including reconsideration of the replanting requirement. Building on existing good practices, biodiversity concerns associated with forestry can be managed through greater integration of data on vulnerable species into planning.

Finally, we argue that addressing emissions from agriculture and land use is a societal challenge and solutions need to be introduced across the food chain focusing on climate-smart food. A greater emphasis on information and labelling and reducing food waste is required as part of a comprehensive CSA strategy.

CSA LEADERSHIP ON THE INTERNATIONAL STAGE

A domestic focus on CSA leadership should be complemented with an approach to mainstreaming CSA into Ireland's outward facing diplomacy. This should build on the suite of existing activities, and the example of how Ireland attained international leadership in the nutrition/food security area. Efforts to enhance global food security need primarily to target promoting access to food for the most vulnerable. It would be helpful within the context of the Irish debate, therefore, to differentiate between the objectives of increasing food production and contributing to global food security (both valid objectives in themselves). Facilitating and assisting the growth of food output in a sustainable way in vulnerable regions must be at the core of efforts to play a leadership role in CSA internationally.

There is a case for greater definitional clarity of what we mean by CSA to ensure that a coordinated approach can be endorsed by stakeholders. We propose a formulation underpinning the rights of smallholder farmers, and safeguarding human rights and gender equality.

Building on the existing commitment to spend 20% of the aid budget on nutrition and food security, the potential of committing 30% of total funds to the combined programme efforts relating to nutrition, food security and CSA might be explored. Furthermore, we identify scope for the major Irish NGOs to build a strong programmatic and learning relationship with Irish Aid around CSA. The strengths of the private sector in CSA, particularly related to livestock efficiency, might be mobilised to using

public-private partnership models focused on knowledge transfer.

Finally there is potential to bring a distinct and coherent Irish narrative consistent with CSA leadership to international talks and negotiations on climate change and agriculture. The importance of the EU's CAP for Irish agriculture is underpinned in this report. To become a better vehicle it must be reshaped around the three pillars of CSA in the next round of reforms, which will take shape by the end of 2018. We also identify the potential for CSA to play a prominent role in the ongoing UN climate change negotiations, as well as those focused on implementing the Sustainable Development Goals.

A STRATEGIC RE-ORIENTATION AROUND CSA

We present here proposals for a strategic reorientation of agriculture around the principles of CSA. This could only be achieved with buy-in for this vision at the highest levels of Government, the administrative system, and among key stakeholders. The debate on agriculture, climate change and food security has been at times an acrimonious one in Ireland, and the strategic reorientation has the potential not only to deliver benefits within Ireland, but to provide global leadership in the face of the considerable challenges of climate change and food security that the world faces in the coming decades.

While the Department of Agriculture, Food and the Marine would necessarily lead the strategic reorientation of the sector as outlined in this summary, it is clear that what is required is an integrated whole-of-Government approach. The elements of such a strategic reorientation would involve at its core the active engagement, buy-in and participation from the all relevant Government departments, including inter alia: the Department of Agriculture, Food and Marine; the Department of Communications Climate Action and Environment; the Department of Health; the Department of Public Expenditure and Reform; the Department of Foreign Affairs and Trade; and Irish Aid.

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48 It has been pointed out that LULUCG use using current rules would undermine the overall level of the EU's 40% emissions reduction target for 2030 by between 3 and 6.4%, and would therefore erode the environmental integrity of the EU's climate package. While negotiations are ongoing, we would speculate that accounting rules will change meaning that Ireland will not achieve the full credits for all post-1990 forests. See: (Fern/IFOAM, 2015) Impacts on the EU 2030 climate target of including LULUCF in the climate and energy policy framework.

49 This is particularly the case within the context of Ireland's draft Climate Action and Low Carbon Development Bill 2015, which adopts the objective of "transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050". See: http://www.oireachtas.ie/documents/bills28/bills/2015/215/b215d.pdf

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72 See, for example: Bolton, R., & Foxon, T. J. (2015). A socio-technical perspective on low carbon investment challenges – Insights for UK energy policy. Environmental Innovation and Societal Transitions, 14(0), 165-181; Devine-Wright, P. (2014). Renewable Energy and the Public: from NIMBY to Participation. London: Routledge.

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