Ireland's Environment
An Assessment






epa
Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

2012

Environmental Protection Agency

The Environmental Protection Agency (EPA) is a statutory body responsible for protecting the environment in Ireland. We regulate and police activities that might otherwise cause pollution. We ensure there is solid information on environmental trends so that necessary actions are taken. Our priorities are protecting the Irish environment and ensuring that development is sustainable.

The EPA is an independent public body established in July 1993 under the Environmental Protection Agency Act, 1992. Its sponsor in Government is the Department of the Environment, Community and Local Government.

OUR RESPONSIBILITIES

LICENSING

We license the following to ensure that their emissions do not endanger human health or harm the environment:

- waste facilities (e.g., landfills, incinerators, waste transfer stations);
- large scale industrial activities (e.g., pharmaceutical manufacturing, cement manufacturing, power plants);
- intensive agriculture;
- the contained use and controlled release of Genetically Modified Organisms (GMOs);
- large petrol storage facilities;
- waste water discharges.

NATIONAL ENVIRONMENTAL ENFORCEMENT

- Conducting over 2,000 audits and inspections of EPA licensed facilities every year.
- Overseeing local authorities' environmental protection responsibilities in the areas of – air, noise, waste, waste-water and water quality.
- Working with local authorities and the Gardaí to stamp out illegal waste activity by co-ordinating a national enforcement network, targeting offenders, conducting investigations and overseeing remediation.
- Prosecuting those who flout environmental law and damage the environment as a result of their actions.

MONITORING, ANALYSING AND REPORTING ON THE ENVIRONMENT

- Monitoring air quality and the quality of rivers, lakes, tidal waters and ground waters; measuring water levels and river flows.
- Independent reporting to inform decision making by national and local government.

REGULATING IRELAND'S GREENHOUSE GAS EMISSIONS

- Quantifying Ireland's emissions of greenhouse gases in the context of our Kyoto commitments.
- Implementing the Emissions Trading Directive, involving over 100 companies who are major generators of carbon dioxide in Ireland.

ENVIRONMENTAL RESEARCH AND DEVELOPMENT

- Co-ordinating research on environmental issues (including air and water quality, climate change, biodiversity, environmental technologies).

STRATEGIC ENVIRONMENTAL ASSESSMENT

- Assessing the impact of plans and programmes on the Irish environment (such as waste management and development plans).

ENVIRONMENTAL PLANNING, EDUCATION AND GUIDANCE

- Providing guidance to the public and to industry on various environmental topics (including licence applications, waste prevention and environmental regulations).
- Generating greater environmental awareness (through environmental television programmes and primary and secondary schools' resource packs).

PROACTIVE WASTE MANAGEMENT

- Promoting waste prevention and minimisation projects through the co-ordination of the National Waste Prevention Programme, including input into the implementation of Producer Responsibility Initiatives.
- Enforcing Regulations such as Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) and substances that deplete the ozone layer.
- Developing a National Hazardous Waste Management Plan to prevent and manage hazardous waste.

MANAGEMENT AND STRUCTURE OF THE EPA

The organisation is managed by a full time Board, consisting of a Director General and four Directors.

The work of the EPA is carried out across four offices:

- Office of Climate, Licensing and Resource Use
- Office of Environmental Enforcement
- Office of Environmental Assessment
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet several times a year to discuss issues of concern and offer advice to the Board.

Ireland's Environment 2012

- An Assessment

Editors

Mícheál Lehane and Barbara O'Leary

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June 2012
ISBN 978-1-84095-439-5
€20

IRELAND'S ENVIRONMENT 2012 - AN ASSESSMENT

Published by
Environmental Protection Agency, Ireland

Design
Clever Cat Design

Foreword

This fifth EPA State of Environment report provides an integrated assessment of the overall quality of Ireland's environment, the pressures being placed on it and the societal responses to current and emerging environmental issues. The EPA State of Environment reports are important milestones for Ireland, as they provide a snapshot of the environment at a particular point, as well as showing trends and changes in the environment over time. The reports also assess progress in meeting the main environmental challenges facing the country, evaluate how national policies are being implemented and if they are operating and delivering as intended. The evidence base and assessments provided by State of Environment reports facilitate policy makers and decision-makers across all sectors of the economy to review developments in their respective areas, so that changes to existing policies can be made if necessary, or new policies and approaches brought forward which take into account the main environmental priorities.

The overall finding of this report is that Ireland's environment is in a generally good condition overall. However, there is no room for complacency and the country faces tough challenges in the coming years to meet EU commitments and targets across a range of areas including water, waste, air quality and greenhouse gases to name but a few. The current recession has meant that levels of emissions and waste generation rates have paused and in some cases reduced. However, we must not assume that recession-induced reductions mean that environmental pressures are being managed in a sustainable way. We need to learn from the mistakes of the past and ensure that we do not repeat them in the future. Ultimately, Ireland needs to ensure that its economic renewal and recovery is based strongly on the principles of sustainable development, and that we decouple future economic growth from environmental pressures. In this context, the report has identified four key environmental challenges for Ireland: Valuing and protecting our natural environment; Building a resource-efficient, low-carbon economy; Implementing environmental legislation; and Putting the environment at the centre of our decision-making.

This current State of Environment report is being published at a time when the country is facing severe economic challenges and where the public finances are under considerable pressure. At times such as this, it may be tempting to view the protection and management of our environment as a luxury. However, it should be remembered that not only does Ireland's natural environment have an intrinsic value in its own right; it is also a key strategic asset for the country. For example, our valuable and abundant water resources are predicted to become of increasing strategic importance to the Irish economy and have the capacity to position Ireland well in terms of competitiveness. Similarly, Ireland's biodiversity is valued in excess of €2.6 billion per annum, from which the economy and society derive a variety of services including food production, and recreation. In addition, a healthy, protected and well managed environment underpins the development of our key economic sectors, such as tourism and agri-food industry which thrive on the clean and green image of Ireland.

Meeting the challenges that we have identified is important to preserve and protect this valuable national asset. By doing so, we can ensure that the natural resources and environmental conditions essential to the economic and social well-being of Ireland's future generations are protected and are not degraded or exhausted. This is fundamental to sustainable development to which we, as a country, should aspire. However, addressing the challenges will not be easy and nor can all of them be resolved in the short or even medium term. It will require concerted and determined action across a range of Government Departments, State agencies and local authorities, working together to tackle these complex, issues and implement the right policies and solutions. Such an approach is all the more pertinent now, given the pressure on resources across the public and civil service.

The responsibility of protecting and managing Ireland's environment lies not only with Government Departments and agencies; it is a shared responsibility involving all citizens of Ireland. Businesses, industry, farmers, and members of the public all have a role to play. We need to mobilise each of the more than four and a half million people living in Ireland and ensure that the environment is placed at the heart of our decisions and actions.

Clear, accurate and timely information is vital in raising awareness among the public and among key policy and decision makers. This report is an essential part of this process. The EPA has also developed an online environmental indicator-based resource to accompany this report to provide regularly updated information on key environmental indicators. This resource is available on the EPA's website at *www.epa.ie/irelandsenvironment*

Finally, a report of this nature would not be possible without the information provided through the expertise of the many people involved at local and national levels in the monitoring, research and assessment of Ireland's environment. I would like to express my thanks and appreciation to all those concerned.

Laura Burke *Director General*

Wexford, June 2012

Acknowledgements

The Environmental Protection Agency (EPA) wishes to express its appreciation to the following for their assistance in various ways towards the preparation of this report.

- Botanic Gardens
- Department of Agriculture, Food and the Marine
- Department of the Arts, Heritage and Gaeltacht
- Department of Communications, Energy and Natural Resources
- Department of the Environment, Community and Local Government
- Department of Transport, Tourism and Sport
- Economic and Social Research Institute
- Forest Service, Department of Agriculture, Food and the Marine
- Health Service Executive
- Marine Institute
- National Parks and Wildlife Service
- National Biodiversity Data Centre
- National Roads Authority
- Radiological Protection Institute of Ireland
- Teagasc

Special thanks are due to the following who provided material for the report or commented on specific aspects:

- Dr Olivia Crowe, Birdwatch Ireland
- Dr Matthew Jebb, Botanic Gardens
- Ms Nuala Bannon, Mr Darren Byrne, Mr Pat Duggan, Mr Kevin Greene, Mr Gary McGuinn, Mr John O'Neill, Ms Fiona Quinn, Mr Micheal Young, Mr David Walsh, Department of the Environment, Community and Local Government
- Dr Deirdre Lynn, Dr Ferdia Marnell, Dr Ciaran O'Keefe, National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht
- Professor Micheal Depledge, Department of Environment and Human Health, Peninsula College of Medicine and Dentistry, Universities of Exeter and Plymouth
- Dr John FitzGerald, Dr Sean Lyons, Dr Edgar Morgenroth, Economic and Social Research Institute
- Mr Liam Cashman, Mr Micheal Ó Brian, European Commission
- Ms Cliona O'Brien, Heritage Council
- Ms Breda Naddy, Health Research Board
- Dr Una Fallon, Dr Tessa Greally, Dr Ina Kelly, Dr Patricia McDonald, Dr Mary O'Mahony, Health Service Executive
- Mr John Evans, Marine Institute
- Dr Liam Lysaght, Dr Eugenie Regan, National Biodiversity Data Centre
- Mr David Dawson, Mr David Fenton, Radiological Protection Institute of Ireland
- Mr David O'Brien, South Dublin County Council
- Dr John Finn, Dr Rogier Schulte, Teagasc
- Dr Julian Aherne, Trent University, Ontario, Canada
- Dr Padraic Larkin, Former EPA Director

A number of EPA staff provided input to specific aspects of the report: Catherine Bradley, Regina Campbell, Colman Concannon, Niamh Connolly, Eimear Cotter, Matthew Craig, Karen Creed, John Curtis, Donal Daly, David Dodd, Kevin Delaney, Brian Donlon, Paul Duffy, Kieran Fahey, Andy Fanning, David Flynn, Nigel Hayes, Sandra Kavanagh, Odile Le Bolloch, Aoife Loughnane, John Lucey, Kevin Lydon, Ian Marnane, Patricia McCreesh, Tom McLoughlin, Sorcha Ní Longphuirt, Caoimhin Nolan, Kirsty Nolan, Shane O'Boyle, Marie O'Connor, Cian O'Mahony, Tadhg O'Mahony, Pol Ó Seasnáin, Brian Quirke, Leo Sweeney, Deirdre Tierney, Alice Wemaere, Suzanne Wylde.

The report was prepared under the direction of Mr Micheál Ó Cinnéide, Director, Office of Environmental Assessment. Advice and comment on the report were also received from the other Directors of the Agency: Ms Laura Burke (Director General), Dr Matt Crowe, Mr Dara Lynott and former Director General Dr Mary Kelly.

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The report was edited by Dr Mícheál Lehane and Ms Barbara O'Leary.

Production of the report was managed by Deirdre Murphy, Helen Bruen, Annmarie Tuohy, Eileen Monahan and Sarah Culleton.

Maps in this report were produced by Aisling McElwain and provided by other sources as acknowledged through the report.

EPA and former EPA personnel who provided photographs were: Dermot Burke, Regina Campbell, Ray Cullinane, Sarah Culleton, Jonathan Derham, David Dodd, John Doheny, Kieran Fahey, Gary Free, Donal Grant, Ger Hussey, Martin Kerr, Ruth Little, John Lucey, Cormac MacGearailt, Ian Marnane, Martin McGarrigle, George McHugh, Aidan O'Hanlon, Niamh O'Neill, Mary Sheehan, Larry Stapleton, Wayne Trodd, Robert Wilkes.

Other photographs were provided by:
Botanic Gardens
Golden Eagle Trust
Office of Public Works
and
Mary Falvey
Hannah Glynn
Inez Mahony

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Executive Summary

Summary and Main Challenges

Ireland's Environment 2012 – An Assessment, the Environmental Protection Agency's four-yearly state of the environment report, provides an evidence-based assessment of the current state of the environment in Ireland and the pressures being placed on it. It outlines the trends and changes in environmental quality as well as the socio-economic activities that are linked with these changes. Since the previous state of the environment assessment in 2008 there have been significant new policy and legislative advances in areas such as air and waste, and in the broader context of sustainable development.

The environment is a strategic and valuable asset for Ireland and as such it must be protected and proactively managed to ensure it forms the basis of Ireland's economic wellbeing and a healthy society. The overall finding of *Ireland's Environment 2012: An Assessment* is that Ireland's environment remains in a good condition, although there are a number of areas of concern, and Ireland faces a number of key challenges in the coming years. The recent period of economic recession has lowered pressure on the environment in areas such as waste generation and greenhouse gas (GHG) emissions. However, the overall challenge for Ireland is that as its economy and key sectors develop and recover, they do so in a sustainable way – decoupling economic growth

Figure 1 Main Environmental Challenges

from environmental pressures. This means ensuring that the natural resources and environmental conditions that are fundamental to the economic and social wellbeing of Ireland's future generations are protected and are not degraded or exhausted. In this context, *Ireland's Environment 2012: An Assessment* has identified four key environmental challenges for Ireland as illustrated in Figure 1, and outlined below:

Challenge 1: Valuing and Protecting our Natural Environment

A good environment is a critical component of high quality of life, with clean air and safe water being two of our most basic human needs. Abundant biodiversity and healthy soil are other aspects of our natural environment that are essential to humanity. Meeting the requirements of the Water Framework Directive (WFD) and protecting our water resources in a changing climate are pressing challenges for Ireland. Maintaining our clean air and healthy soil will also require continuing attention, as will protecting biodiversity and nature from further loss and damage. Ireland's natural environment and resources have a great intrinsic worth. It is critical to value these resources as key assets for the State and to protect this wealth to provide for future generations.

Challenge 2: Building a Resource-Efficient, Low-Carbon Economy

The recent economic downturn has curbed, for the present, the type of growth in Ireland that was unsustainable. There is now an opportunity to ensure that future development is based on highly efficient processes and improved resource efficiency. This concept is being driven by increasing scarcity and costs of fuels and resources. We need to learn from the mistakes of the Celtic Tiger years and transform our economy onto a resource-efficient path to bring increased competitiveness and new sources of growth through cost savings, commercialisation of innovations and better management of resources. From waste prevention to efficient and renewable energy, investment now in this area will position Ireland as a competitive economy into the future and help to provide protection from future economic shocks as well as allowing us to meet our targets under international climate change agreements. Meeting the 2020 targets on GHG emissions is a major task for Ireland. Domestic mitigation action is imperative, so that Ireland reduces greenhouse gases while also availing of the wider opportunities in terms of new and sustainable growth in the emerging global green economy.

Challenge 3: Implementing Environmental Legislation

In the coming years Ireland faces formidable challenges in meeting international obligations including for example on water quality, air quality, GHG emissions and waste management. Ireland also faces a number of EU infringement proceedings in relation to the transposition or implementation of a range of EU directives. It is important that Ireland complies with international commitments and ensures that legislation is implemented in a timely and appropriate manner. Similarly, the EPA and other regulators have an important role to play to ensure that a healthy, safe environment is delivered for Ireland through effective enforcement of environmental legislation at national and local levels. These actions are necessary not only to prevent avoidable environmental damage, but also to protect Ireland's reputation and green image, which is important to many of our economic sectors, in particular the agri-food and tourism sectors.

Challenge 4: Putting the Environment at the Centre of Our Decision Making

Achieving development and growth that is sustainable means that environmental considerations need to be placed at the centre of policy and decision making at national, regional and local levels. There is a shared responsibility for achieving and maintaining a healthy environment. Clear leadership and co-ordinated efforts from Government and public bodies are needed to ensure that existing and future activities maintain and improve the quality of the environment. Business and industry also play an important role in this area, by ensuring their activities do not cause pollution or create environmental liabilities for future generations – with a special responsibility resting on Ireland's farmers as guardians of our rural environment. Finally, all members of the public must play a part by taking action to avoid pollution and controlling our own environmental impacts.

Thematic Assessments

The current state of Ireland's environment for six key thematic areas is presented in Section II of the report. The assessment is based on the latest evidence and includes trends, policy developments and priority challenges.

Greenhouse Gases and Climate Change

There have been substantial reductions in Ireland's GHG emissions in recent years, due in significant part to the impact of the economic downturn. Ireland is on track to meet its Kyoto Protocol commitment for the 2008–2012 period. This is a first step in achieving a longer term goal of a low-carbon society and economy. The next key step is to meet the emissions reductions required under the EU 2008 Climate and Energy Package. The European Commission Roadmap for moving to a competitive low-carbon economy by 2050 points to EU-wide GHG emission reduction requirements of up to 80% by 2050. Within the EU, Ireland has an unusual emissions profile, with emissions from agriculture being proportionally higher than for most other Member States and projected to increase in the period to 2020. Projections by the EPA indicate that even in the best case scenario, Ireland will breach its annual obligations for GHG emissions under the EU 2020 target in 2017. Accordingly, further cost-effective actions need to be identified, assessed, adopted and implemented to reduce GHG emissions in the near term.

The impacts of climate change are already occurring in Ireland and are projected to intensify over the coming decades; this must be factored into future planning and investment choices. The vulnerability of existing systems and infrastructure should be assessed and a national framework for climate change adaptation prepared.

Air Quality and Transboundary Air Emissions

Air quality in Ireland is of a high standard across the country and is among the best in Europe, meeting all EU air quality standards in 2010. This is due largely to prevailing clean Atlantic air and a lack of large cities and heavy industry. However, in Dublin and Cork levels of nitrogen dioxide are close to the specified EU limit values for air quality in traffic-impacted areas. Over the past decade, levels of particulate matter have decreased in cities and large urban areas, arising principally from improvements in vehicle engine technology. This decrease is not seen in smaller towns, where domestic solid fuel emissions are more significant than traffic emissions. Many towns do not benefit from the ban on smoky coal, and often do not have access to cleaner fuel alternatives such as natural gas. Ireland also faces the challenge of meeting new air quality standards for $PM_{2.5}$ concentrations by 2020; this will require an integrated approach across a number of sectors including industrial, transport and residential emissions

With regard to air emissions, the strategies implemented to achieve compliance with the EU National Emissions Ceilings Directive have successfully controlled emissions of sulphur dioxide, ammonia and volatile organic compounds. Emissions of all three are expected to remain below the prescribed ceilings. However, levels of nitrogen oxides are expected to remain above Ireland's national emission ceiling in the short term due to sustained emissions from road transport.

For Ireland to comply with its international commitments on air quality and air emissions, industrial emissions of pollutants to air must continue to be rigorously controlled; policies must be implemented to increase the use of alternatives to the private car and improve efficiencies of motorised transport. Government departments, national agencies and local authorities must make air quality an integral part of their traffic management and planning processes. Households and businesses must use more efficient methods to burn fuel and shift from solid fuel to cleaner alternatives including gas.

Water

In comparison with other EU Member States, Ireland has better than average water quality. The principal cause of water pollution in Ireland is nutrient enrichment resulting in the eutrophication of rivers, lakes and tidal waters from agricultural run-off and discharges from municipal waste water treatment plants.

While there is evidence of an overall improvement in water quality, Ireland faces major challenges to achieve water quality targets set for 2015, 2021 and 2027 as required by the WFD. A recent key development has been the publication of the River Basin Management Plans, including the setting of objectives for waterbodies and the selection of Programmes of Measures to meet the objectives of the WFD. However, it is also clear the current governance and administrative arrangements for water management are not optimal or configured to ensure the delivery of WFD objectives in an efficient and effective manner. A review of water governance is currently under way to deliver more effective integration of roles and policies between the key government departments, the EPA and the lead local authorities.

Ensuring that Ireland's water resources are of good quality is vital for public health, the agri-food industry, tourism and inward investment. There is a particular challenge ahead to deliver the production increases planned under the *Food Harvest 2020* strategy in a manner that does not prevent Ireland from meeting its international obligations in relation to water.

Sustainable Resource Use, Consumption and Waste

Since 2008, there have been sharp decreases in Ireland in commercial and household waste volumes, in line with the downturn in consumption and economic growth. Waste volumes associated with the construction sector have collapsed by 81% since 2007. Industrial waste (including hazardous wastes) volumes are stable, reflecting the relative stability of Ireland's manufacturing industry, the main contributor to this waste stream.

Ireland has achieved its EU waste recycling and recovery targets for waste packaging; for waste electronic and electrical equipment; and for household waste paper, metals, plastic and glass. Ireland has also achieved the first target for diversion of biodegradable waste from landfill as required under the EU Landfill Directive. However, Ireland has failed to meet the EU re-use and recovery targets for end-of-life vehicles.

The waste collection sector has changed dramatically in the past four years, with the majority of local authorities exiting the domestic waste collection market. Moreover, as of 2012, virtually all households on a collection service are now offered at least a two-bin service (dry recyclables and residual), and 34% of serviced households are offered a three-bin collection (includes organics bin). Ireland's first merchant municipal waste incinerator commenced operation in 2011, and the use of waste-derived fuels in industrial energy plants has grown significantly. However, 15 of Ireland's 28 operational municipal landfills will run out of consented capacity in three years, and there is only 12 years' gross municipal landfill disposal capacity in the State. Ireland continues to export nearly half of its hazardous waste for treatment/disposal.

The recently transposed EU Waste Directive (98/2008/EU) will have a profound influence on waste management practices and policy for the foreseeable future. In addition, the increasing levy on disposal of waste to landfill is driving post-consumption management options up the waste hierarchy towards more sustainable behaviours.

Nature and Biodiversity

Humanity is dependent on nature for survival. Its protection is also of ethical and economic concern. Ireland's marine and terrestrial environment supports a wide variety of species and habitats, many of which are of international importance. While many species are doing well in conservation terms, there are a significant number of habitats and species that are not. Progress has been made in the designation of EU-protected areas in Ireland, but several areas of national importance remain undesignated, and significant aspects of biodiversity in Ireland are under considerable threat from unsustainable activities.

Ireland has international and legal obligations to protect biodiversity. These include a commitment to halt biodiversity loss by 2020. Protection of biodiversity within and outside protected areas is necessary and will require greater integration of biodiversity concerns in sectoral policy development and implementation, at local and national levels. Ireland's second National Biodiversity Plan (2011–2016) includes a programme of measures aimed at meeting Ireland's biodiversity obligations. Full implementation of the plan will help ensure the sustainable management of biological resources and protection of biodiversity for future generations.

Land and Soil

The rate and nature of land use changes indicate where future environmental pressures are likely to arise. By European standards, Ireland has experienced a relatively high rate of land use change since the early 1990s. Generally, Ireland's soils are considered to be in good condition, with the exception of peat areas, which are particularly vulnerable to external pressures. However, the information available on land and soil is currently not sufficient. It is vital to improve our evidence base, which is required in order to accurately assess and protect these vital resources and to provide information and guidance to policy and decision makers. The sustainable management of both land use and soils requires an integrated approach; a national landscape strategy and a national soil protection strategy for Ireland need to be prepared and fully implemented. While Ireland has fewer contaminated land problems than most other industrialised countries, an overall policy framework for the identification, management and remediation of contaminated land in Ireland is needed.

Managing and Protecting the Environment

Section III of *Ireland's Environment 2012: An Assessment* examines the importance of the environment with respect to two sectors: economy and health.

Environment and the Economy

The environment doesn't exist in isolation; it both affects and is affected by many aspects of our lives. Environmental resources and ecosystem services are direct inputs into the economy. Establishing a sustainable pattern of development is a key challenge for Ireland, and improving resource efficiency is a top priority to achieve this goal. Embracing resource efficiency offers a path to job creation and economic growth. Resource efficiency is also one of the key environmental priorities at EU level and is one of the seven flagship initiatives within the Europe 2020 Strategy. The challenge is to utilise resources in a sustainable manner throughout their life-cycle, avoiding over-exploitation and reducing the environmental and social impacts of their use.

Changing the consumption patterns of private and public purchasers will help drive resource efficiency and reduce waste with the potential to generate direct net cost savings. Sustainable management of our water and biodiversity resources is another aspect of resource efficiency. Policies supporting energy efficiency, sustainable transport and sustainable agriculture can bring benefits to both the environment and the economy.

Transforming the economy onto a resource-efficient path requires policies that recognise the interdependencies between the economy, wellbeing and natural capital and the removal of barriers to improved resource efficiency. To achieve a resource-efficient and green economy, there is a need to make a transition across all sectors of the economy and, in particular, the energy, agricultural and transport systems, as well as changing behaviours of producers and consumers.

Environment and Health

Environmental protection and health protection are inextricably linked. At a time of major concern about employment and economic issues, it is easy to overlook the truth in the maxim that health is wealth. Protecting the Irish environment plays an essential role in protecting the health of the population.

In Ireland the quality of drinking water from large public supplies is comparable to that in other EU countries, and the risks to health from all public supplies continue to reduce. Implementation of legislation on waste water treatment plants, industrial activities and septic tanks as well as good agricultural practice will further reduce the risks to drinking water quality and reduce water pollution generally.

Air quality, noise and odour pose little overall risk to public health in Ireland, although these issues can give rise to localised concerns and impacts. The continued implementation of relevant European and Irish legislation will maintain a healthy environment. Actions are required, however, to reduce the risk to health from high radon levels in some areas.

Maintaining and benefiting from a healthy environment requires coordinated efforts from many government and public bodies to ensure that existing and future activities maintain or improve the quality of the environment. Small, medium and large-scale businesses and industry also play an important role in this area by ensuring their activities do not cause pollution or create environmental liabilities for future generations, with a particular responsibility falling to farmers as guardians of the rural environment. Finally, the public play an important part by not polluting their local environment and by taking advantage of the tangible benefits to health that come from contact with a good-quality environment.

In Conclusion

Ireland's environment is a strategic asset for the State and this report shows that, overall, the quality of the environment in Ireland is generally high. However, Ireland faces a number of formidable challenges in the coming years to maintain a healthy and protected environment and to decouple future economic growth from environmental pressures. The challenges identified are significant and not all will be resolved in the short or even the medium term, but the benefits of addressing them are great. A protected environment provides a clean and safe place to live, while underpinning vibrant agri-food and tourism sectors and making Ireland an attractive place for inward investment.

Meeting our environmental goals will require clear leadership by Government to guide and empower people in making the changes needed in our lifestyles and consumption patterns to live within our (environmental) means. A cornerstone of sustainability is behaviour change and, in moving towards a sustainable future, individuals and businesses will have to engage willingly in a multitude of actions including waste reduction, water and energy efficiency and modal transportation shifts. The overarching goal for our future must be to ensure that as Ireland begins to work its way back to economic recovery, it goes in a sustainable direction.

Introduction

Chapter 1

Introduction & Socio-economic Context


SHAWS

Chapter 1
Introduction & Socio-economic Context

Ireland's Environment 2012 provides an evidence-based assessment of the current state of the environment in Ireland and the pressures being placed on it. It outlines the trends and changes in environmental quality as well as the socio-economic activities that are linked with these changes. Environmental policy and legislation in Ireland continues to be driven by European and global developments. Since the previous state of the environment assessment in 2008 there have been significant new policy and legislative advances in areas such as air and waste, and in the broader context of sustainable development. Future EU policy, in particular the seventh Environmental Action Programme, will continue to drive the agenda on environmental protection and management in Ireland in the coming years.

The recent period of economic recession has lowered pressure on the environment in areas such as waste generation and greenhouse gas emissions. However, the challenge for Ireland is that economic renewal be achieved in a more sustainable way than previously, and that Ireland transitions to a low-carbon, resource-efficient and climate-resilient economy. *Ireland's Environment 2012* is an important tool for policy and decision makers to assist in identifying and shaping future policy to support this transition.

Introduction

This State of the Environment report by the EPA, *Ireland's Environment 2012*, presents the most recent information on the quality of Ireland's environment. The report provides an outline of the socio-economic developments that have impacts and consequences for the environment, together with thematic assessments focusing on key trends, challenges and actions for climate change, air, water, waste, nature, and land and soil. The final section of the report provides a more in-depth integrated assessment of Ireland's environment within a broad socio-economic context, looking in particular at the environment and economy and the environment and health themes, and identifying the future challenges for Ireland's environment.

There are complex linkages between the environment and human activities. Changes to the environment can be fully appreciated only in the context of the activities and the driving forces that give rise to them. As such, actions aimed at environmental improvement must also recognise and understand these linkages. To highlight this 'cause and effect' chain, the report uses the **D**riving force–**P**ressure–**S**tate–**I**mpact–**R**esponse (DPSIR) framework as follows:

- ***D**riving Force* – Socio-economic and socio-cultural forces driving human activities, which increase or mitigate pressures on the environment, e.g. demographics, economics
- ***P**ressure* – Stresses that human activities place on the environment, e.g. emissions to air, land and water
- ***S**tate* – The current state of the environment
- ***I**mpact* – Effects of environmental degradation, e.g. biodiversity loss, economic damage
- ***R**esponse* – Responses by society to the environmental situation, e.g. legislation, policy and science.

The EPA produces a state of the environment report every four years. *Ireland's Environment 2012* is the fifth such report; previous reports were produced in 2008, 2004, 2000 and 1996. The EPA has also published environmental indicator reports in the middle of this four-year cycle, to provide a mid-term assessment of Ireland's environment. In 2010, the EPA developed a web-based indicators resource to facilitate access to key national indicators on the environment in Ireland. This state of the environment report is closely linked to the online resource (www.epa.ie/irelandsenvironment), where data and assessments on Ireland's environment are regularly updated. State of environment reports and environmental indicators are important tools to provide up-to-date data, knowledge and assessments to assist policy and decision makers, across all sectors of the economy, to manage and protect the environmental assets of the State.

Ireland is not unique in producing such reports – the majority of the other members of the European Union produce similar environmental assessments and/or indicators. The European Environment Agency (EEA) also produces periodic reports on the state of Europe's environment, the most recent being *The European Environment – State and Outlook 2010* (EEA, 2010). Following the same DPSIR assessment framework, the EEA concluded that global demands for natural resources to feed, clothe, house and transport people are accelerating. These mounting demands on natural capital are exerting increased pressure on ecosystems, economies and social cohesion in Europe and elsewhere. A complete shift to a resource-efficient green economy requires that all environmental resources be fully considered in production, consumption and global trade decisions. Other key findings of the assessment include the following.

- *Climate change:* The European Union has made progress in cutting emissions and expanding renewable energy. However, sectoral trends are not all positive. EU-27 emissions from transport rose by 24% between 1990 and 2008
- *Climate change adaptation:* Even if Europe meets all its emission reduction targets, it will still need to adapt to ongoing and expected climate change impacts
- *Biodiversity, ecosystems and people's health:* The Natura 2000 network of protected areas has helped protect endangered species. However, intensification of land use, loss of habitats and overfishing has prevented the EU from meeting its target of halting biodiversity loss by 2010
- *Integrated solutions with a global perspective:* Integrated actions across different policy areas can help deal with the pressing challenges, so as to deliver improvements more quickly and maximise co-benefits (e.g. mitigate climate change and improve air quality at the same time)
- *Resource efficiency:* Accounting and pricing that takes full account of resource use impacts are essential for steering business and consumers towards enhanced resource efficiency
- *Citizen involvement:* Policy alone cannot halt or reverse environmental trends. Europe needs to increase the number of citizens committed to reducing their impact on the environment by involving them in collecting data and through social media.

Environmental Policy Context

A broad range of European Union directives and regulations are in place that provide a framework for the management of the environment. These legally binding instruments and their implications for Ireland are outlined in more detail in each of the thematic assessments in the following chapters.

One of the key findings in the EEA's state of the environment report (EEA, 2010) was that existing EU environmental policy is effective in tackling the major environmental issues, but more needs to be done to implement policy fully across all Member States. Furthermore, it found that EU policy must be more adaptable and flexible to tackle today's more complex, systemic challenges in a global context.

The Sixth Environmental Action Programme (EAP), adopted by the European Parliament and Council in 2002, sets out the framework for environmental policy making in the European Union for the period 2002–2012 and outlines the actions that need to be taken to achieve them. It identifies four priority areas:

- climate change
- nature and biodiversity
- environment and health
- natural resources and waste.

The final assessment of the Sixth EAP was conducted by the European Commission and was adopted in August 2011. It found that the vast majority of actions set out in the Programme were, or are, in the process of being completed. However, it also found that progress was still required in implementing agreed EU objectives and rules and in improving biodiversity protection, soil and water quality. The assessment also showed that environmental policy would continue to benefit from a coherent overarching policy framework.

The European Commission is planning to publish a Seventh EAP in 2012, which will address a number of issues, including:

- the rapidly changing external conditions and the increasingly interlinked nature of environmental, economic and social challenges
- increased growth in the demand for natural resources and the impacts this has on the environment
- the enlargement of the EU and the increased diversity of national characteristics and circumstances
- pressure on ecosystems, biodiversity loss, waste generation and air quality in urban areas
- the uneven implementation of environmental law across Europe.

In March 2012, the European Commission published a consultation document on the proposed environmental policy priorities to 2020, which need to be included in the Seventh EAP, and on the most effective tools for the EU to employ in addressing the main environmental challenges facing Europe (EC, 2012).

A proposed blueprint to safeguard Europe's water, also due in 2012, will be based on an EU assessment of the river basin management plans in each Member State and will focus on water scarcity, drought and the effects of climate change. It will also focus on how to better integrate water into other policy areas such as the Common Agricultural Policy and will cover the time period up to 2050.

Environmental policy and legislation in Ireland continue to be driven by European and global developments. A brief synopsis of the main policy and legislative developments in Ireland in recent years is provided below, with more detailed information given in the thematic assessments in Section 2 of this report.

Climate Change

The EU has taken a lead role in global environmental negotiations, especially in the area of climate change. This has resulted in Member States being committed to legally binding targets for greenhouse gas (GHG) emissions. In November 2011, the Department of Environment, Community and Local Government (DECLG) published a Review of National Climate Policy in order to develop the necessary mix to support a national mitigation agenda. This will be based on a public consultation, an independent study to be carried out by the NESC (National Economic and Social Council) and sectoral mitigation progress, to be pursued through the Cabinet Committee on Climate Change and the Green Economy. The review also examined the progress made in reducing GHG emissions in recent years and outlined the challenges that lay ahead. It found that Ireland has clear and challenging GHG mitigation targets for the 2013–2020 period, which are binding under EU law and which must be addressed in the longer-term context of transition to a competitive low-carbon economy. The outcome of the review will strengthen the development of future climate policy in support of achieving the mitigation targets.

Air Quality

Ambient air quality monitoring and assessment in Ireland is carried out in accordance with the requirements of Directive 2008/50/EC on ambient air quality and cleaner air for Europe, also known as the CAFE Directive (EP and CEU, 2008a). The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. 180 of 2011), which revoked and replaced three earlier statutory instruments (S.I. 33 of 1999, S.I. 271 of 2002 and S.I. 53 of 2004).

These regulations set limit values/target values for a range of pollutants, including sulphur dioxide; nitrogen dioxide and oxides of nitrogen; particulate matter (PM_{10} and $PM_{2.5}$); lead; benzene; carbon monoxide; and ozone.

In 2011, the ban on bituminous coal in cities and towns was extended to four additional towns and a nationwide 0.7% limit on sulphur in bituminous coal was also introduced. New regulations further extending the ban are expected in the coming years.

Waste

Waste management is regarded as one of the most challenging areas of environmental management, and a comprehensive range of European and national policies are in place to address this challenge.

The revised EU Waste Directive (EP and CEU, 2008b) was transposed into Irish law in March 2011 by the European Communities (Waste Directive) Regulations 2011 (S.I. 126 of 2011). This legislation is very significant as it introduces many new obligations for public and private sector waste operations as well as for regulatory authorities.

In August 2011 the Government consulted on a new National Waste Strategy. The long-term aim of this strategy is to influence production and consumption behaviours to reduce waste, discourage disposal and to ensure an effective waste management market and infrastructure.

A wide range of specialist schemes have been introduced to deal with scheduled products, substances and wastes as required by EU Directives. These include schemes for Waste Electrical and Electronic Equipment (WEEE), batteries, packaging, end-of-life vehicles (ELVs) and tyres.

The first Green Public Procurement Action Plan, *Green Tenders*, was launched in January 2012. The overall objective of Green Tenders is to assist public authorities to plan and implement green public procurement successfully. Public procurement can shape production and consumption trends and generates significant demand for greener goods; it can thereby enlarge markets for environmentally friendly products and services.

Water

The Water Framework Directive (WFD) (EP and CEU, 2000) is a key initiative aimed at improving water quality throughout the EU. Its objectives are to protect all high-status waters, prevent further deterioration of all waters and restore degraded surface and ground waters to good status by 2015. It applies to rivers, lakes, groundwater and coastal waters. The Directive requires that management plans be prepared for each river basin and specifies a structured approach to developing those plans. In Ireland, River Basin Management Plans were finalised for each of the seven river basin districts in the country in July 2010. The plans set out the current status of our waters, the objectives to be achieved by 2015, 2021 and 2027, and the programme of measures to be implemented in order to achieve those objectives.

A consultation paper on the *Reform of the Water Sector in Ireland* (DECLG, 2012) highlighted the strategic importance of water to the Irish economy and the need to manage Ireland's water resources in a sustainable way to support economic growth and competitiveness. The paper outlined the Government's intention to take a national approach to water to improve cost efficiency associated with water provision. It also sought submissions on the proposed establishment of a public water utility and on a proposed approach to the introduction of water metering and charges for domestic water users. This is expected to be progressed further in the coming years.

Biodiversity

In the area of biodiversity, the National Biodiversity Plan 2011–2016 (DAHG, 2011) is the main vehicle by which Ireland seeks to meet its commitments under the Convention on Biological Diversity and the EU Biodiversity Strategy. The plan lists 102 actions that cover the conservation of biodiversity in the wider countryside and in the marine environment, both within and outside protected areas. The overarching target of the plan is 'that biodiversity loss and degradation of ecosystems are reduced by 2016 and progress is made towards substantial recovery by 2020'. Some specific key objectives are to mainstream biodiversity in the decision making process across all sectors and to strengthen the knowledge base for conservation, management and sustainable use of biodiversity.

Sustainable Development

The Draft Framework for Sustainable Development for Ireland (DECLG, 2011a) was published as a consultation document in December 2011. This overarching policy document recognises that economic, environmental and social progress go hand in hand. It also notes that there is a growing consensus that our systems of production and consumption cannot be sustained without posing a significant threat to the environment and to human health. Water scarcity, air and water pollution, climate change, resource depletion and irreversible biodiversity loss are problems that have to be tackled as a matter of priority.

The aim of the Framework is to provide for the integration of sustainability principles into key areas of policy, to put in place effective implementation mechanisms and deliver concrete measures to progress sustainable development.

Environmental Goals and Challenges

The focus of the EPA's *2020 Vision* strategy (EPA, 2007) is on the need for Ireland to deliver positive environmental outcomes. This means moving beyond the identification of environmental problems towards the active resolution of root causes. To this end the EPA has identified six key environmental goals to protect and improve Ireland's environment:

- *Limiting and adapting to climate change.* Ireland will achieve major reductions in GHG emissions and will be prepared for the unavoidable impact of climate change
- *Clean air.* Our air will be healthy and clean. Ireland's emissions to the atmosphere will meet all international and national targets
- *Protected water resources.* Our surface water and groundwater will not be depleted and will be of excellent quality, meeting all national and international standards
- *Protected soil and biodiversity.* The soil of Ireland will be protected from contamination and loss and will support dependent plants and animals. Our biodiversity will be protected and managed for future generations to enjoy
- *Sustainable use of resources.* The overall goal is a more efficient use of resources (water, energy and materials). Waste will be prevented and minimised, with the balance safely collected, recycled or recovered. Final disposal will be completed in a way that does not harm the environment

- *Integration and enforcement.* Environmental considerations will be at the heart of policy making and decision making. Responsible environmental behaviour will be the norm across all sectors of society, and those who flout environmental laws will be held to account.

The previous state of the environment report (*Ireland's Environment 2008*) found that while Ireland's environment is generally of good quality, it is subject to potentially damaging pressures from a range of activities and sectors.

It identified four priority challenges for the environment: limiting and adapting to climate change; reversing environmental degradation; mainstreaming environmental considerations; and complying with environmental legislation and agreements (Figure 1.1).

Progress towards these goals is considered in subsequent chapters of this report, and future challenges are outlined in Section 3.

Socio-economic Context

Pressure on the environment arises from social and economic developments that involve the exploitation of natural resources and the generation of waste. To reflect fully the DPSIR assessment framework and to place the state of the environment in context, this section considers some recent socio-economic trends that have a particular relevance for the environment.

Population

The report of the latest census (CSO, 2012) shows that the population of Ireland reached over 4.5 million in 2011. This represents an increase of 8.2% since 2006 (Table 1.1) and is the highest population recorded since 1871.

Ireland had the highest increase in population in the EU between 2000 and 2010, with a growth rate of almost five times the EU average (3.8%) over the 10-year period (CSO, 2011a) (Figure 1.2).

Ireland remains relatively sparsely populated compared to most other European countries, with just over 60 persons per square kilometre compared to an average figure of 116 persons in the European Union (Eurostat, 2011). However, the population in Ireland has become increasingly urbanised over recent decades, with consequent pressures on the environment and on the provision of environmental services.

Figure 1.1 Main Environmental Challenges

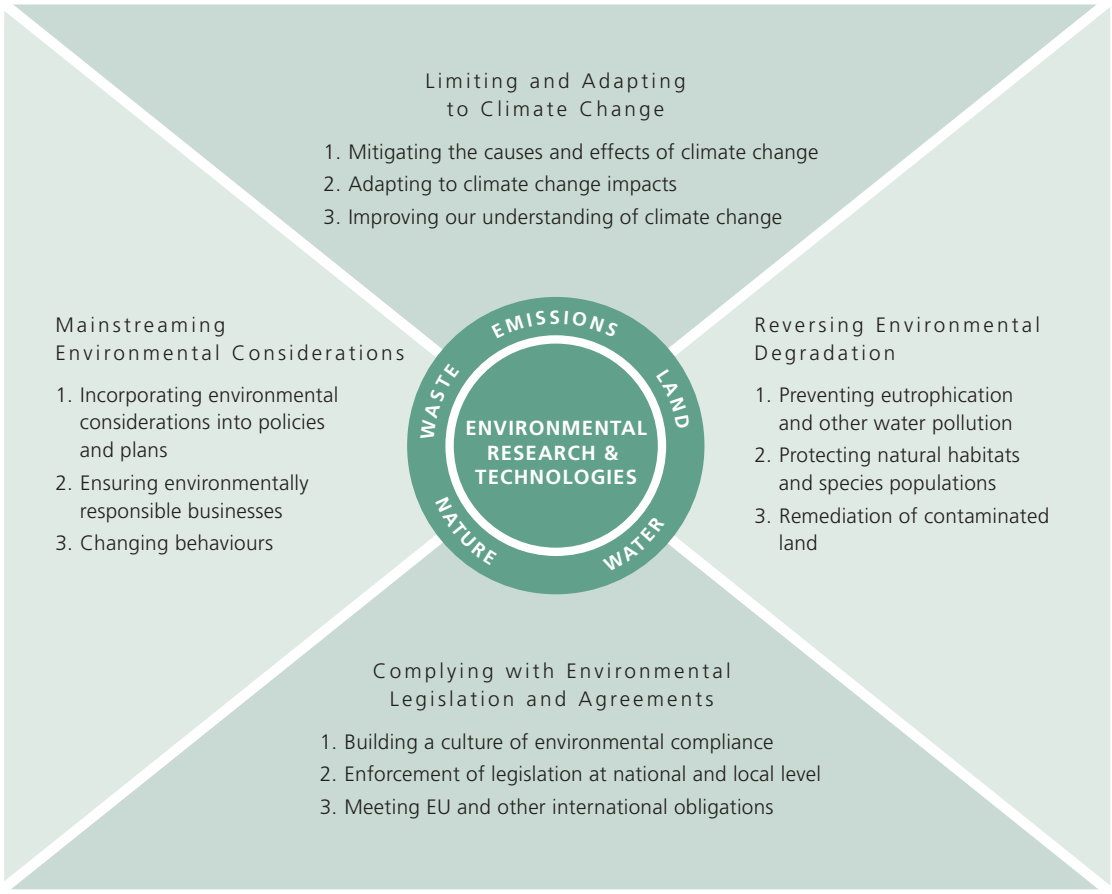
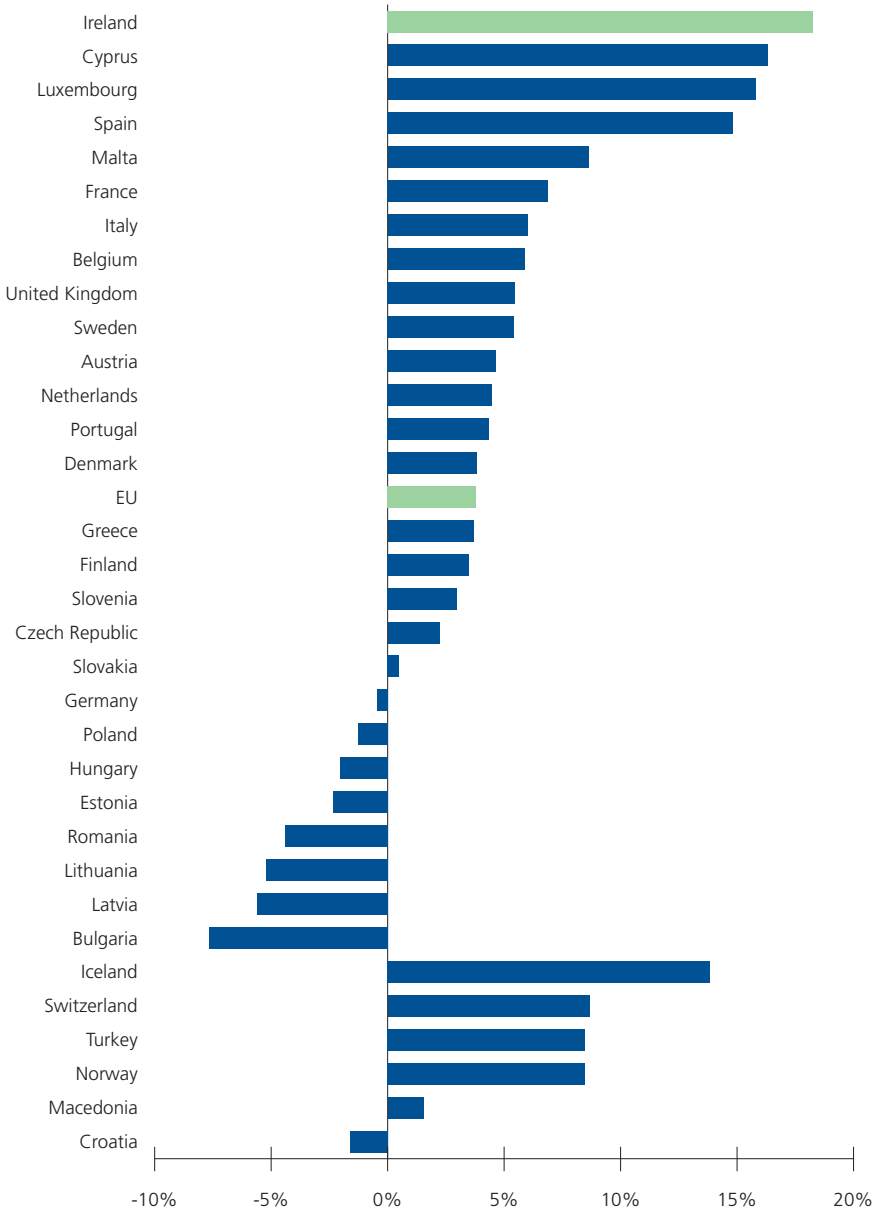


Table 1.1 Population by Province and Change in Population 2006–2011 (Source: CSO)

Province	Persons 2006 (million)	Persons 2011 (million)	Actual Change 2006–2011	% Change 2006–2011
Leinster	2.29	2.50	209,691	9.1
Munster	1.17	1.25	72,748	6.2
Connacht	0.50	0.54	38,426	7.6
Ulster (Part)	0.27	0.29	27,539	10.3
TOTAL	4.24	4.58	348,404	8.2

Figure 1.2 EU: Population Change, 2000–2010 (Source: CSO)



Households and Consumption

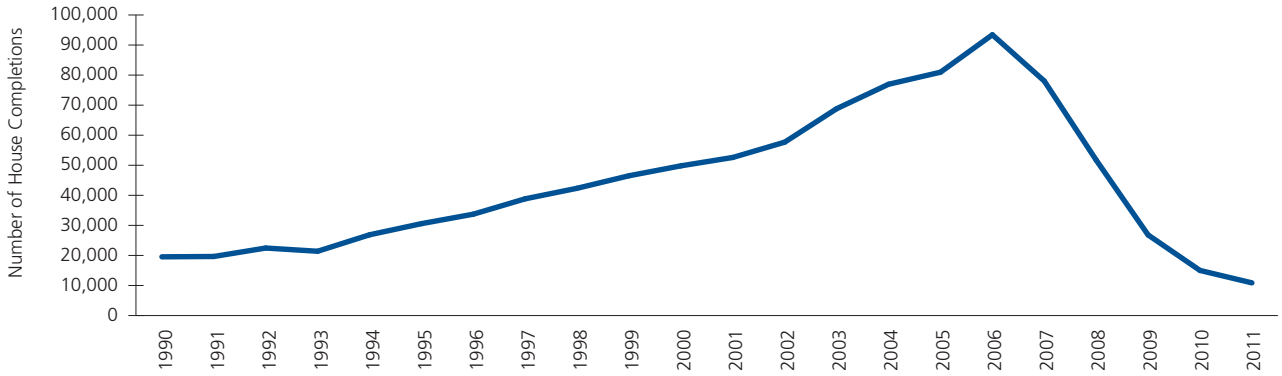
Between 2001 and 2010 the number of private households grew by 343,200 or 26.3%. In that period the average size of private households fell from 2.95 persons to 2.71, continuing a long-term downward trend (CSO, 2012) (Table 1.2). This trend of an increasing number of households and smaller household size has a significant impact on consumption patterns, including the demand for energy and household goods. It is estimated that one-person households consume, on average, 38% more products, generate 42% more packaging waste and use 55% more electricity per person than four-person households (EEA, 2010).

In the 10 years between 1996 and 2006 there was a remarkable increase in the number of house completions in Ireland, from an annual total of 33,000 in 1996 to a peak of over 93,000 in 2006. The collapse of the construction sector since then is clear from Figure 1.3, with only 10,500 houses completed in 2011 (DECLG, 2011b).

Table 1.2 Number of Households and Average Household Size, 2001–2010 (Source: CSO)

Year	Total Households (000's)	1 person household (000's)	2 person household (000's)	3 or more person household (000's)	Average household size (Persons)
2001	1,304.7	284.7	331.1	689.0	2.95
2002	1,348.1	298.0	345.9	704.1	2.91
2003	1,385.3	308.4	371.1	705.9	2.88
2004	1,409.3	297.6	386.4	725.2	2.88
2005	1,461.4	318.4	400.2	742.8	2.83
2006	1,492.6	325.8	411.6	755.2	2.84
2007	1,532.1	325.7	427.3	779.1	2.84
2008	1,581.9	334.6	462.0	785.2	2.80
2009	1,627.2	352.5	494.1	780.6	2.74
2010	1,647.9	376.5	493.4	778.1	2.71

Figure 1.3 House Completions in Ireland 1991–2011 (Source: DECLG)



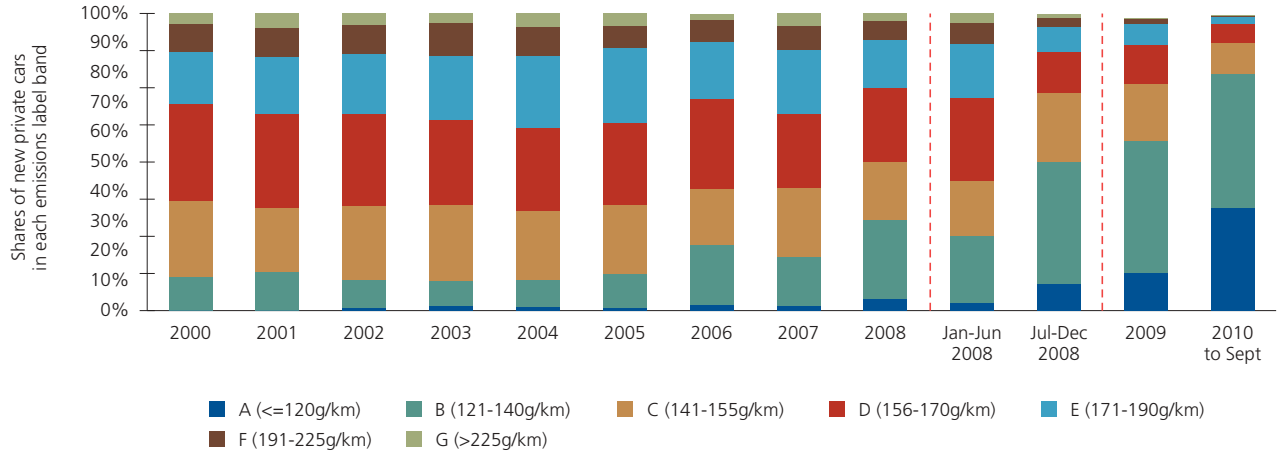
This construction collapse has led to the abandonment of housing estates at various levels of completion around the country. A survey carried out by the DECLG in 2010 found that there were 2,800 'ghost estates' in the country, comprising a total of 23,000 completed but unoccupied houses and apartments. There were a further 20,000 dwellings at various stages of construction. Apart from the unsightly nature of these estates they also pose potential environmental risks, as a result of inadequate or incomplete waste water treatment systems.

Transport Patterns

The transport sector is a significant source of GHGs and emissions to air (e.g. NO_X) in the State. Ireland remains heavily reliant on the car for its transport needs, with approximately three-quarters of all journeys made by private car (CSO, 2011b). The increase in population around the major cities has resulted in increased traffic flows, and congestion and long-distance commuting have become a feature of Irish life.

Car ownership in Ireland has changed significantly in the past decade, with the proportion of households with multiple vehicles increasing substantially up to 2008. There was also a continuing trend to purchase new cars with larger engine sizes over this time period. In 2009 the number of new cars licensed declined significantly, in line with the economic downturn. Since the introduction of a new system of Vehicle Registration Tax in mid 2008, car purchasing patterns have shifted significantly towards lower-emissions vehicles and those with

Figure 1.4 Shares of New Private Cars in each Emission Band 2000–2009 (+2010 to September) (Source: SEAI)



smaller engine sizes. This shift was also incentivised by a car scrappage scheme in 2010. Figure 1.4 shows the shares of new car sales between 2000 and September 2010 classified by emissions label band.

A transport policy document, *Smarter Travel – A Sustainable Transport Future 2009–2020* (DoT, 2009) was published in 2009. This policy was designed to show how unsustainable transport and travel patterns can be reversed. It sets out the necessary steps to ensure that people choose more sustainable transport modes such as walking, cycling and public transport.

The Economy

Since the last state of the environment report was published in 2008 the economy has experienced a turbulent time. In 2009 the majority of world economies were in recession, thereby adversely affecting Ireland's open economy. The global recession together with the deflationary impact of the banking crisis caused the Irish economy to shrink by over 7% in that year. The consequent reduction in manufacturing, production and consumption lowered pressure on the environment in some areas e.g. waste generation and greenhouse gas emissions.

Table 1.3 shows the decline in Ireland's Gross Domestic Product between 2007 and 2010 and compares it to that of our main trading partners.

The impact of the recession on individual domestic sectors, and consequently on the environment, was not uniform. Important sectors are considered further in Table 1.4 (CSO, 2011c) using Gross Value Added (GVA). GVA is equal to the sum of the values of goods and services produced, including depreciation and subsidies on production but excluding taxes on production.

Agriculture, Forestry, Fishing

The agriculture, forestry and fishing sector accounted for approximately 2% of total GVA and 4.6% of total employment in 2011. The agriculture sector is in a period of transition, responding to increased demand and anticipating changes to the EU's Common Agriculture Policy (CAP) and to changes in milk quotas.

The longer-term outlook for the development of the agriculture sector, as outlined in the sectoral strategy document *Food Harvest 2020* (DAFF, 2010), is positive. The document states that Ireland must build on the strengths of its 'green' image and maintain its commitment

Table 1.3 Real GDP of Ireland's Major Trading (Export) Partners (Source: OECD, 2011)

	Percentage change from previous year				
	2007	2008	2009	2010	2011
Belgium	2.8	0.8	-2.7	2.1	2.4
France	2.3	0.1	-2.7	1.4	2.2
Germany	2.8	0.7	-4.7	3.5	3.4
Ireland	5.6	-3.6	-7.6	-1.0	0.0
Italy	1.4	-1.3	-5.2	1.2	1.1
Netherlands	3.9	1.9	-3.9	1.8	2.3
Spain	3.6	0.9	-3.7	-0.1	0.9
Switzerland	3.6	1.9	-1.9	2.6	2.7
United Kingdom	2.7	-0.1	-4.9	1.3	1.4
United States	1.9	0.0	-2.6	2.9	2.6
Euro Area	2.8	0.3	-4.1	1.7	2.0
Total OECD	2.7	0.3	-3.5	2.9	2.3

Table 1.4 Gross Value Added at Constant Factor Cost (Source: CSO)

	€ million				Annual Percentage Change			
Description	2007	2008	2009	2010[1]	2006–2007	2007–2008	2008–2009	2009–2010
Agriculture, forestry and fishing	3,103	3,099	3,011	3,032	1.4	-0.1	-2.8	0.7
Industry (including building)	45,405	44,009	42,236	44,420	3.6	-3.1	-4.0	5.2
Distribution, transport & communication	25,108	24,072	21,710	21,268	7.6	-4.1	-9.8	-2.0
Public administration and defence	5,939	6,199	5,954	5,793	4.9	4.4	-4.0	-2.7
Other services (including rent)	73,366	72,376	70,679	69,060	6.3	-1.3	-2.3	-2.3
Gross value added (constant factor cost)[2]	155,619	152,870	144,605	144,508	5.6	-1.8	-5.4	-0.1

1 Figures for 2010 are preliminary
2 Total GVA does not necessarily equal sum of component sectors

to sound agricultural practices. Ireland also needs to maximise the food production strengths that are key to the Irish agri-food and fisheries industry while recognising that environmental sustainability is an essential requirement for food production in the future.

The European Commission Joint Research Centre document *Evaluation of the Livestock Sector's Contribution to EU Greenhouse Gas Emissions* (EC JRC, 2010) shows that Ireland is among the most emission-efficient producers of food in the world. However, anticipated changes in milk quotas with a consequent significant increase in the national dairy herd will make it more challenging for Ireland to meet its EU commitments on greenhouse gases and on water.

At EU level, the EU CAP provides the main policy framework for development of the primary agriculture and agri-food industries to 2020 and thereafter. All farmers in receipt of direct payments from the EU are now subject to cross-compliance, which requires applicants to maintain their land in 'good agricultural and environmental condition' and to comply with statutory management requirements relating to the environment.

Industry

The industrial sector employs some 230,000 people and accounted for almost 13% of those in employment in 2011. The sector includes manufacturing, construction and utilities and saw declines in its GVA of 3–4% per annum in both 2008 and 2009, with a return to growth subsequently (see Table 1.4). Ireland's exports proved to be very resilient during this turbulent time. Exports of high-end-value goods led the way in 2010, with the pharmaceutical sector performing most strongly, but the recovery was quite broad-based and most of the traditional sectors of the economy also posted a solid return. Exports of food and drink and plastic and metal goods also gained momentum. In the services sector, ICT and financial services both recorded strong growth (DETI, 2010).

Industry sub-sectors vary considerably both in their relative economic performance and their potential impact on the environment. Some noteworthy sub-sectors are reviewed below.

Building and Construction

The effects of the recession and the property market collapse have been most acutely felt in the construction sector, where both GVA and employment have more than halved since 2007. The most noticeable environmental impact is the dramatic reduction in construction and demolition waste. Cement manufacture was also down, with consequent reductions in GHG emissions from that sector.

Chemicals/Pharmaceuticals

The pharmaceutical and biopharma industry accounted for over 50% of total Irish exports in 2010 and employed over 50,000 directly and indirectly. Following a decline in GVA in 2008 the sector has experienced annual growth rates of about 30% in the period 2009–2010. The sector has the potential to place significant pressures on the environment, due to the nature of the materials used and the wastes generated. For that reason all such manufacturing facilities are regulated under the EPA's Integrated Pollution Prevention and Control licensing regime.

Tourism and Hospitality

The Fáilte Ireland visitor surveys continue to confirm that Ireland is prized by overseas visitors for its clean, green image (Fáilte Ireland, 2010). In 2010, for example, 84% of visitors said they were attracted by the natural, unspoilt environment.

The Tourism Renewal Integration Group was established in 2010 and tasked with driving competitiveness for Ireland's tourist industry. TRIG identified that Ireland has a particular competitive advantage in the area of eco-tourism. Hence a clean environment is essential for the maintenance and growth of this important sector.

The Green Hospitality Programme (www.ghaward.ie), sponsored by the EPA through the National Waste Prevention Programme, is an internationally recognised environmental certification initiative that helps hospitality businesses to improve their environmental performance and enables them to market their business to an increasingly environmentally conscious customer. The programme has over 200 members and resulted in savings of €5.6m in 2010 through reductions in water and energy use and waste generated.

Energy

Ireland's energy requirement over the past two decades has increased significantly due to growth in energy consumption for transport, electricity and space heating. Fossil fuels accounted for 95% of all energy used in Ireland in 2009. Oil is by far the dominant energy source but natural gas use has also been increasing. Figure 1.5 shows the breakdown of Ireland's total primary energy requirement by fuel type.

Figure 1.5 Total Primary Energy Requirement by Fuel Type (Source: SEAI)

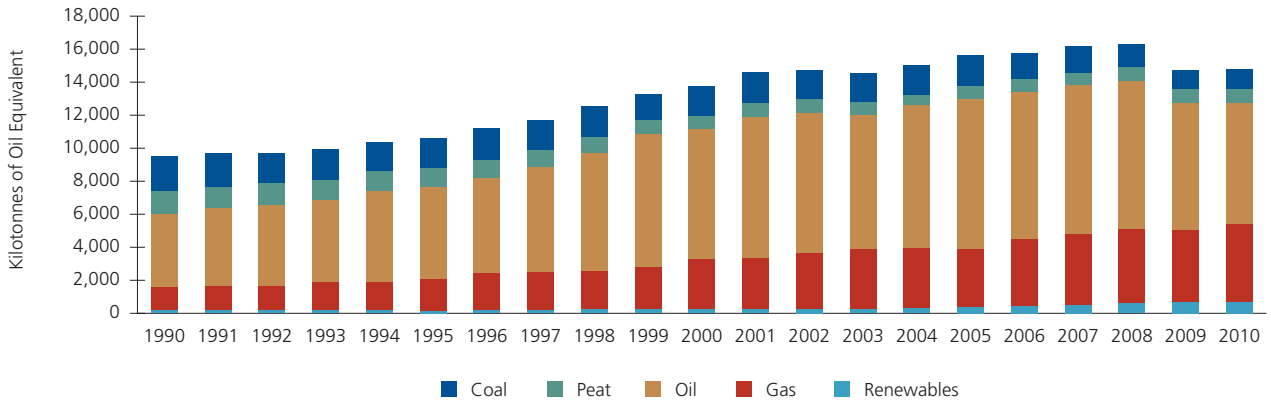
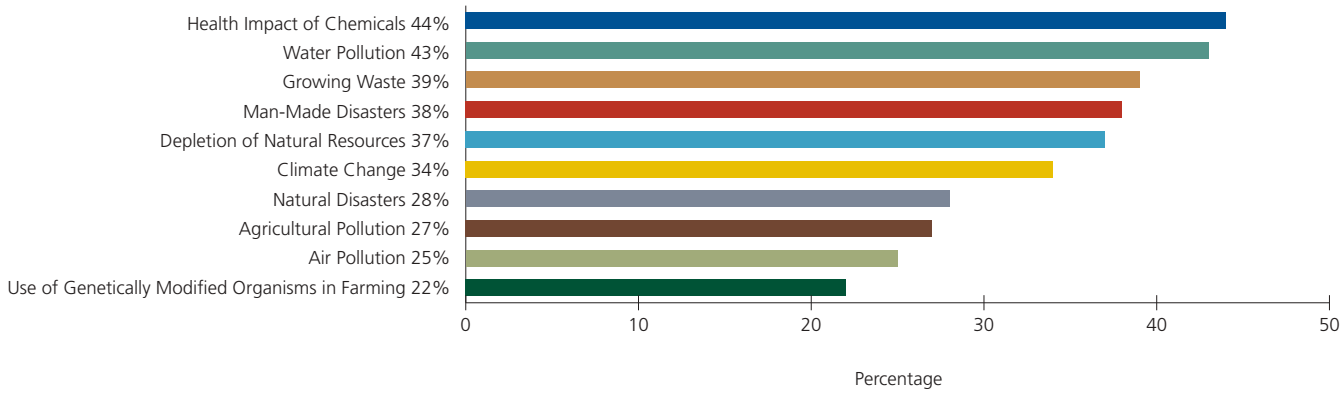


Figure 1.6 Environmental Issues of Most Concern to Irish Citizens (Source: EC)



Since 1990 renewable energy use has increased, but it still accounted for just 4.6% of the primary energy requirement in 2010. Ireland's target under the EU Renewable Energy Directive is a 16% share of gross final energy by 2020. Ireland has abundant renewable energy resources in wind, water, geothermal, solar and biomass. These sources offer sustainable alternatives to fossil fuels as well as reducing GHG emissions and our dependency on imported fuels. In 2010 Ireland imported 86% of its energy needs (SEAI, 2011).

It is envisaged that wind power will be the most significant contributor to national and international targets for green electricity over the coming years. According to a recent Wind Energy Roadmap from SEAI, Irish wind could contribute 2.5% of EU electricity demand, create 20,000 jobs and generate €15 billion for the Irish economy by 2050. At the end of June 2010, a total of 110 wind farms were metered in Ireland, bringing the total installed capacity for wind to 1,379 MW. In order to achieve national targets for renewable electricity (40%) by 2020, an estimated 5,500–6,000 MW of wind generation is required (SEAI, 2011).

Public Perceptions and the Environment

Despite the economic downturn, public interest in the environment remains high in Ireland. A Eurobarometer Survey, conducted by the European Commission in 2011 (EC, 2011b), found that the issue of most concern to Irish citizens was the impact on health of chemicals used in everyday products (Figure 1.6). Other environmental issues causing concern were water pollution, growing waste, and man-made disasters. The public also considered that the efficient use of natural resources and the protection of the environment were key to economic recovery and growth in the future.

Conclusion and Future Challenges

Environmental issues can no longer be considered in isolation. Increasingly these issues are broad-ranging and complex and are linked to a web of interdependent human activities. This means that understanding and responding to environmental challenges has become more complex for policy and decision makers across all areas of the economy.

Ireland's Environment 2012 provides an integrated assessment of the environment in Ireland, using the cause and effect chain of the DPSIR framework (Driving forces–Pressures–State–Impact–Response). In doing so, it looks at the interrelationship of recent socio-economic developments and the consequences these have on the environment. While the recent period of economic recession has reduced pressure on the environment in some areas, one of the major challenges now facing Ireland is the achievement of economic growth that is environmentally sustainable into the future.

A vital part of Ireland's economic renewal is the development of a green economy to take advantage of Ireland's exceptional resources in terms of natural and human capital. This requires the development of a clear vision as to how the transition can be made to becoming a low-carbon, resource-efficient and climate-resilient economy. This state of the environment report is an important tool to assist in identifying and shaping future policy to manage and protect Ireland's environment and to support this transition.

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II Thematic Assessments

Chapter 2
Greenhouse Gases and Climate Change

Chapter 3
Air Quality and Transboundary Air Emissions

Chapter 4
Water

Chapter 5
Sustainable Resource Use, Consumption and Waste

Chapter 6
Nature and Biodiversity

Chapter 7
Land and Soil

Chapter 2
Greenhouse Gases and Climate Change

Ireland is on track to meet its Kyoto greenhouse gas (GHG) emissions target for the 2008–2012 period. This is a first step in achieving a longer term goal of a low-emissions society and economy. The next key step is to meet the emissions reductions required under the EU Climate and Energy Package. Actions to address the 2020 challenge in the package are informed by longer term 2050 emissions goals. The European Commission Roadmap for moving to a competitive low-carbon economy by 2050 points to EU-wide GHG emission reduction requirements of up to 80% by 2050. Within the EU, Ireland has an unusual emissions profile, with emissions from agriculture being proportionally higher than for most other Member States and projected to increase in the period to 2020. This is in the context of an overall reduction target of 20% by 2020 (relative to 2005) for sectors that are not included in the EU Emissions Trading Scheme, under the EU Commission's Effort Sharing Decision (ESD). Current analysis from the EPA suggests that Ireland will exceed its annual limit under the ESD by 2017. Accordingly, further cost-effective actions need to be identified, assessed, adopted and implemented to reduce GHG emissions in the near-term. Climate change impacts are projected to increase over the coming decades. This reality must be factored into planning and investment choices. The vulnerability of existing systems and infrastructure must be assessed and the necessary measures, systems and tools to enable management of these impacts put in place. Overall, Ireland requires a long-term strategy and action in the near-term to enable a successful transition to a low-emissions, climate-resilient, sustainable economy.

Introduction

Increased atmospheric concentrations of greenhouse gases such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), released by human activities, trap additional energy in the Earth's climate system. This is known as 'global warming' and gives rise to a range of Earth system changes, broadly referred to as climate change. The resultant impacts include increasing global average temperature, loss of snow and ice cover, and global sea-level rise. If not addressed, the projected impacts of climate change present a very serious risk of dangerous global impacts. These would threaten global food production and natural ecosystems, and could cause irreversible flooding of low-lying coastal areas.

The causes and consequences of climate change pose an immense global challenge which is addressed at an international level under the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. At an EU level the *Climate and Energy Package* and the forthcoming *Adaptation Strategy* provide the context for actions in Ireland. However, Ireland must deal with its own unique conditions and circumstances that arise from its location, geography and economy, which provide a unique greenhouse gas emissions profile within the EU.

The Current Situation

Enhanced atmospheric concentrations of a range of long-life greenhouse gases (GHG) trap energy in the Earth's climate system. Figure 2.1 shows the increasing concentration of CO_2, the most important greenhouse gas, measured at Mace Head, Co. Galway, since 1991.

Similar observations are found at other sites around the world. Such direct observations are complemented by ice-core measurements which show that current atmospheric GHG levels far exceed the natural range that has existed for over 650,000 years (IPCC, 2007).

The effects of enhanced GHG levels are most evident in the long-term global temperature record. Most recent studies show that the average ambient temperature in Ireland increased by 0.7°C over the period 1890–2007. There is also evidence of a trend towards more intense and more frequent rainfall. These trends are reflected in ecosystem changes, with changes in, or lengthening of, the growing season and increasing

Figure 2.1 Atmospheric Carbon Dioxide Levels at Mace Head (Source: EPA/CNRS)

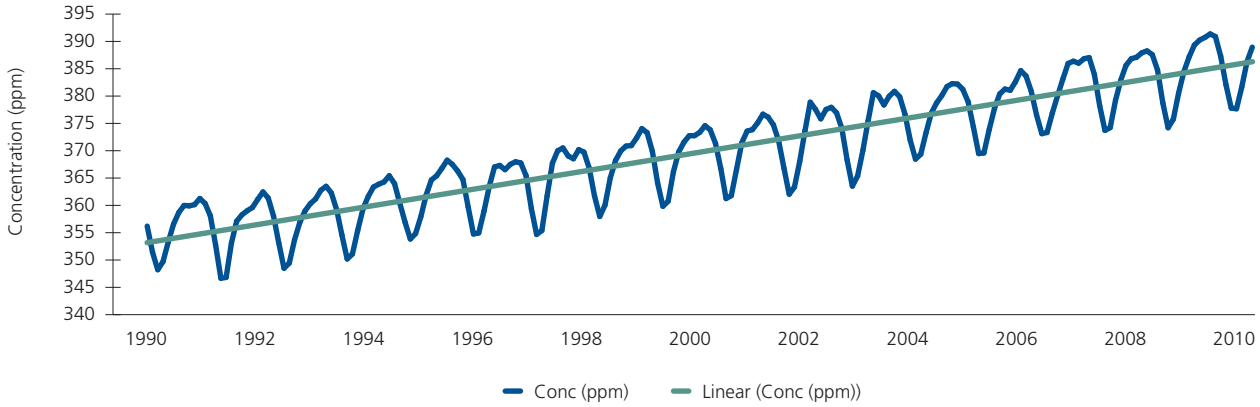


Figure 2.2 Greenhouse Gas Emissions – Distance to Ireland's Kyoto Limit (Source: EPA)

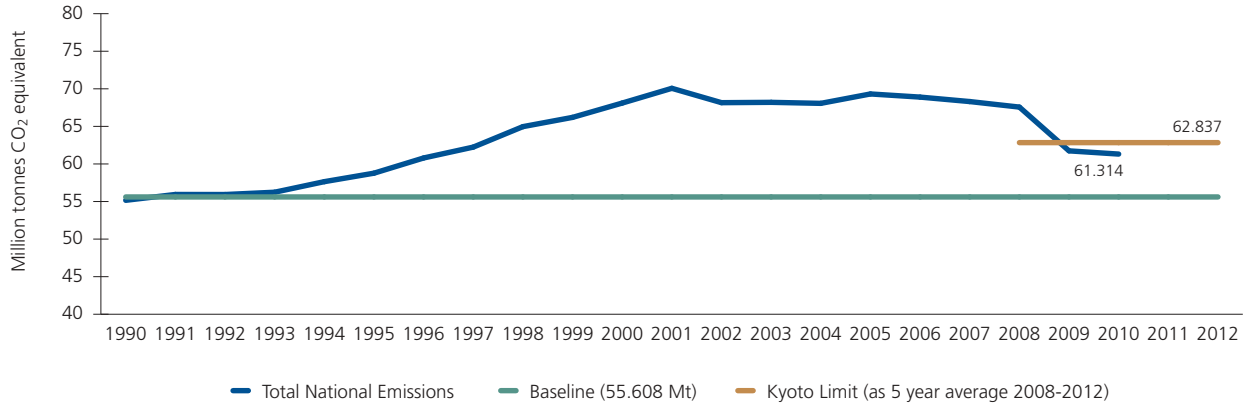
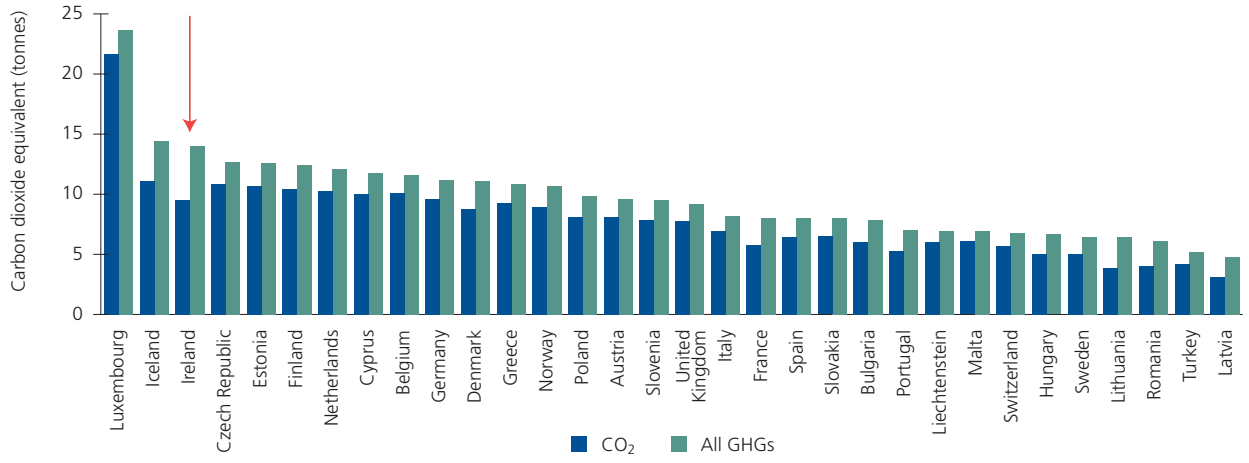


Figure 2.3 Total GHG Emissions and CO_2 Emissions as Tonnes CO_2 per Person by Country in 2009 (Source: EEA, 2012)



presence of warmer latitude flora and fauna in Ireland and its surrounding waters (EPA, CCRP, 2009; Marine Institute, 2009).

Projected impacts of climate change in Ireland include:

- increasing average temperatures
- more extreme weather conditions including rainfall events
- an increased likelihood of river and coastal flooding
- water shortages, particularly in the east of the country
- changes in the types and distribution of species
- the possible extinction of vulnerable species.

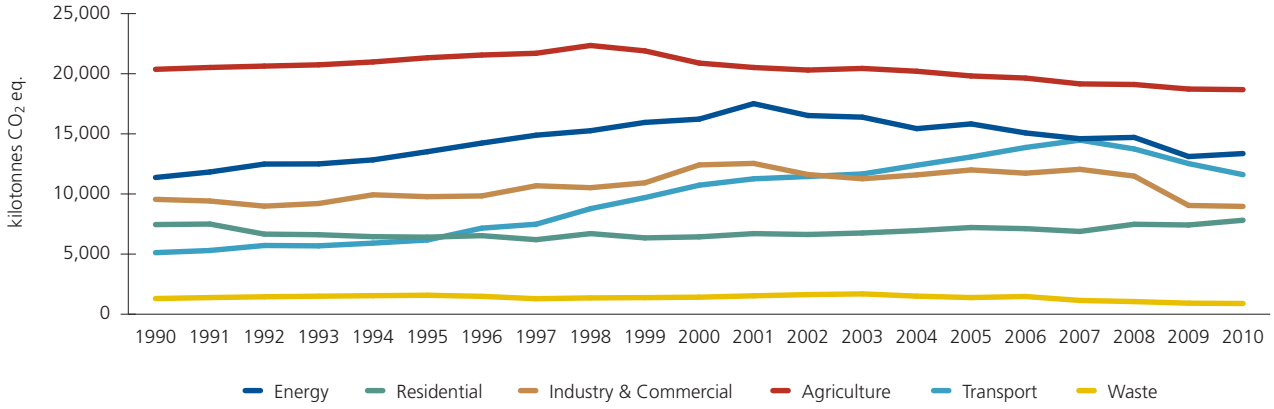
Drivers and Pressures

Ireland's GHG emissions and the Kyoto Protocol

Ireland's GHG emissions profile between 1990 and 2010 is shown in Figure 2.2. Emissions rose rapidly between 1990 and 2000, remained relatively stable up to 2008 and then show a sharp decline, due largely to the effects of the economic downturn (EPA, 2012a). Ireland's Kyoto Protocol limit which is equivalent to 62.8 Mt of CO_2 equivalents (CO_2eq) per annum in the period 2008–2012, is also shown in this figure. For compliance purposes the Kyoto Protocol limit is calculated as the total greenhouse gas emissions over the period 2008–2012. Ireland is on track to meet its Kyoto commitment either taking unused allowances from the EU Emissions Trading Scheme new entrants reserve into account, or by using credits already purchased by the State.

Figure 2.3 shows that while Ireland's per capita aggregate GHG emissions are the second highest in the EU, its CO_2 emissions per capita are the 10th highest. This reflects the fact that non-CO_2 GHGs, mainly methane and nitrous oxide from agriculture, make up a significant proportion of total emissions in Ireland.

Figure 2.4 Greenhouse Gas Emissions by Sector (Source: EPA)



Sectoral Sources of GHGs in Ireland

The sectoral breakdown of Ireland's GHG emissions between 1990 and 2010 is shown in Figure 2.4. The single largest contributor to overall emissions in Ireland is Agriculture at 30.5% of the total. Energy and Transport are the second and third largest contributors, at 21.8% and 18.9% respectively. The remainder is made up by Industry and Commercial at 14.6%, Residential at 12.7% and Waste at 1.4%.

Agriculture

Emissions from agriculture reached a peak in 1998 and have decreased to below their 1990 level in recent years. This reflects a long-term decline in cattle population and in fertiliser use, due largely to the EU Common Agricultural Policy (CAP). 2010 saw a substantial increase in nitrous oxide emissions due to increased fertiliser sales (up 18% on 2009). The increase in nitrous oxide emissions was offset by the continuing decline in total cattle and sheep numbers in 2010, while swine numbers have increased relative to 2009 levels. Ireland's position within the EU as the country with the highest national proportion of agriculture emissions will present major challenges in limiting emissions and meeting future targets.

Energy Generation

Power generation is the most significant source of energy sector emissions. Since the mid-1990s, Ireland's population growth has been significantly greater than the EU average. This growth and the consequent increase in the number of households placed greater demands on energy for heating and electricity, which to a large extent, are fossil-fuel-based. Since 2001 the efficiency of electricity generation has improved through the displacement of coal and oil with less carbon-intensive fuels such as natural gas, and the greater penetration of renewable energy. Emissions in 2010 were 1.9% higher than in 2009. While the overall trend has been towards increased renewable energy share in total electricity production, wind and hydro resources were less in 2010, which resulted in more electricity generation from coal and gas-fired power stations.

Transport

The transport sector was the fastest growing source of greenhouse gas emissions in Ireland over the period 1990–2007 with transport emissions 127% higher in 2007 compared with 1990. However, transport emissions have decreased by 20% since 2007. The decrease primarily reflects the impact of the economic downturn plus the changes in vehicle registration tax and road tax introduced in mid-2008. In addition, the Biofuels Obligation Scheme started operation in mid-2010, with biofuels displacing petrol and diesel use in the transport sector.

Industry

Emissions in 2010 from the *Industry and Commercial* sector were 0.8% lower than in 2009. There was a substantial increase in 2010 in CO_2, primarily from the alumina industry which was offset by the continuing decline in the production of cement. In particular, reports from the EU Emissions Trading Scheme show that emissions from the cement sector peaked in 2007 and have decreased by 55% between 2007 and 2010.

Responses

The National Climate Change Strategy (DEHLG, 2007), which updates the 2001 strategy, sets out a plan for how Ireland can meet its GHG emissions limitation under the Kyoto Protocol through action at the sector level. It also highlights the need to advance actions to adapt to adverse impacts of climate change. To date policies have focused on mitigation. A range of EPA funded research projects have looked at both mitigation and at climate

change impacts for Ireland and the identification of adaptation options. The EPA has recently launched two reports on climate change adaptation as discussed in the section on Climate Change Impacts and Adaptation below.

Climate-Change Legislation

The 2011 Programme for Government includes a commitment to publish climate legislation to give certainty and clarity in relation to the reduction in greenhouse gas emissions to be achieved by Ireland in line with EU targets. In November 2011, the Minister for Environment, Community and Local Government announced a review of National Climate Policy in order to develop the necessary policy mix to support an ambitious, but realistic national mitigation agenda based on a three-pronged approach:

1. a public consultation, initiated by the Minister in 2012, to enable all stakeholders to engage in the policy development process;
2. an independent study to be carried out by the secretariat to the National Economic and Social Council (NESC);
3. sectoral mitigation progress, to be pursued through the Cabinet Committee on Climate Change and the Green Economy, based on positive engagement with the relevant Government departments where progress must be made to meet legally-binding EU targets.

In January 2012, the Minister issued a work programme setting out the steps and milestones for the development of national climate policy and legislation. This programme includes the publication of the final report from the NESC secretariat and the heads of a Climate Bill by the end of 2012.

Mitigation of GHG Emissions

Ireland uses a range of policy instruments, both domestic and EU, to advance mitigation of GHGs across the main economic sectors. These include the EU Emissions Trading Scheme and CAP reform; a national carbon tax; and policies to promote the uptake of renewable energies and to advance low-emission transport options.

Emissions Trading Scheme

The Emissions Trading Scheme (ETS) is the EU's cornerstone climate change mitigation programme. The EPA is responsible for implementing the ETS in Ireland. The scheme works on a 'cap and trade' basis whereby companies must keep their emissions below the level of their allocated emissions cap or buy extra allowances on the market.

Figures 2.5 and 2.6 show that while CO_2 emissions for the EU25 (Bulgaria and Romania joined the ETS in 2008) as a whole increased over the first three years (2005–2007), the opposite occurred in Ireland. In the second three years (2008–2010) greenhouse gas emissions from installations covered by the scheme show significant decreases. It is as yet unclear whether the reduction in emissions is due solely to the impact of the recession, or whether the economic driver of the cost of allowances actually encouraged real reductions. Nonetheless the 'cap' on emissions under the EU Emissions Trading Scheme will progressively reduce over the next decade as set out under the EU Climate and

Figure 2.5 ETS Emissions and Allocations 2005–2010 for EU-25 (Source: EU Commission, 2012)

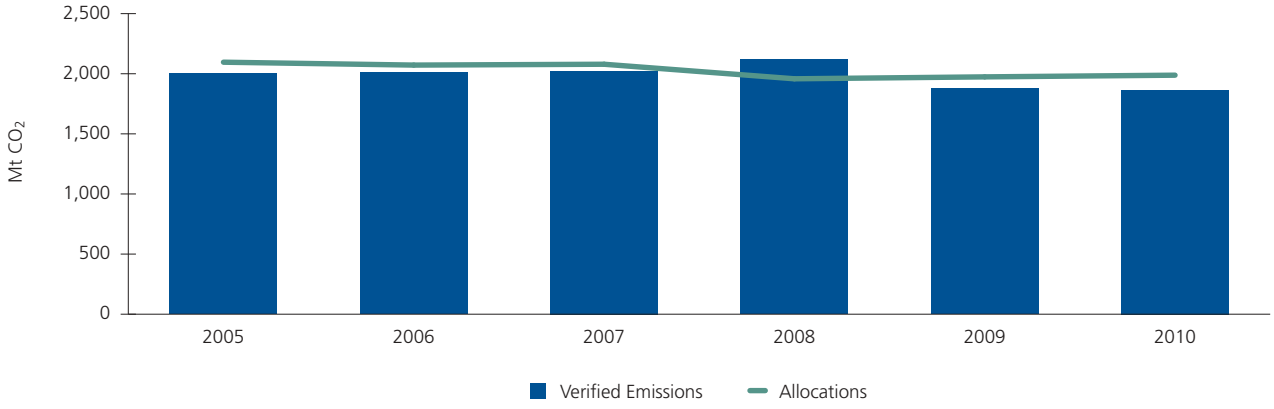
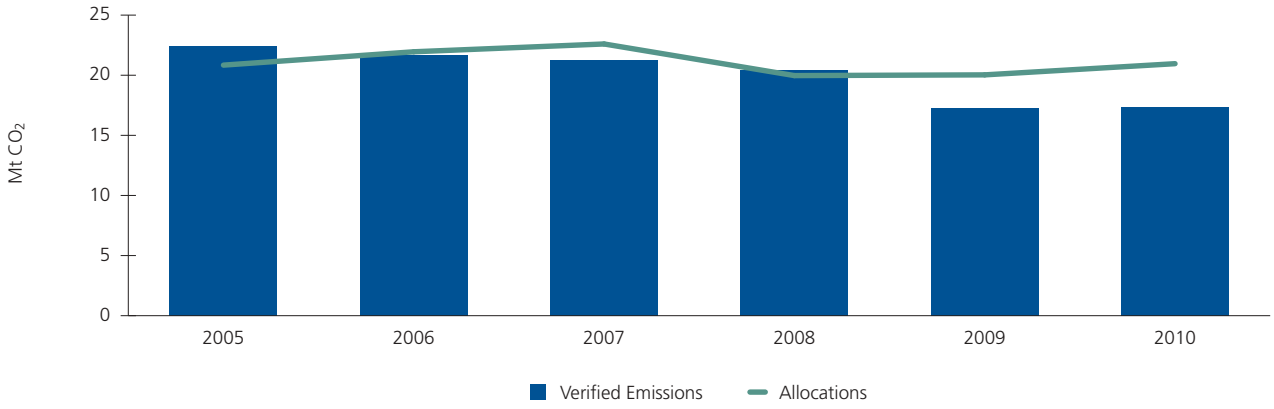


Figure 2.6 ETS Emissions and Allocations 2005–2010 for Ireland (Source: EU Commission, 2011)



Energy Package. In addition, the EU ETS delivers a carbon price signal across a wide range of industries which encourages investment in energy efficiency and low carbon alternatives. Since the beginning of 2012, the ETS scheme includes emissions from air flights to and from European airports.

Details for the 2005–2010 period showing the free emissions allowance allocation to companies and associated verified emissions are available from the EU Commission website (EC, 2011).

Renewable Energy

Developing renewable energy is an integral part of Ireland's climate change strategy. The renewable contribution to Ireland's gross final consumption was 2.3% in 1990, rising to 5.5% in 2010. Under the EU Directive on the Promotion of the Use of Energy from Renewable Sources (EP and CEU, 2009a), Ireland's overall target is 16% of gross final consumption to come from renewable sources in electricity generation (RES-E), transport (RES-T) and thermal energy (RES-H) by 2020. The share of electricity generated from renewable energy sources (RES-E) in 2010 was 14.8%, exceeding the interim EU target of 13.2% RES-E by 2010 and almost meeting the Government target of 15% of all electricity generation to be from renewable energy sources by 2010. Ireland is on track for the longer term Government target of 40% RES-E by 2020 (Table 2.1).

Heat from renewable energy sources (RES-H) has grown from 2.4% in 2000 to 4.4% in 2010 (mostly due to the use of wood waste as an energy source in the wood products and food sectors). The national target specified in the Government White Paper is 5% of all heat to come from renewable energy sources by 2010 and 12% by 2020.

In regard to RES-T, the White Paper target was to achieve 5.75% of road and rail transport energy from renewable sources by 2010 and 10% by 2020. In the consultation paper on the introduction of the Biofuels Obligation Scheme (DCENR, 2008), the Minister for Communications, Energy and Natural Resources proposed that the 2010 target be reduced from 5.75% to 3%.

Table 2.1 Renewable Energy: Progress to Targets (% of each target) (Source: SEAI, 2011)

Year	1990	1995	2000	2005	2006	2007	2008	2009	2010	2010 Target	2020 Target
RES-E (normalised)	5.3	4.6	4.8	7.2	8.7	9.9	11.1	13.7	14.8	15	40
RES-T	0.0	0.0	0.0	0.0	0.1	0.5	1.2	1.8	2.4	3	10
RES-H	2.6	2.1	2.4	3.5	3.6	3.7	3.6	4.3	4.4	5	12
Directive 2009/29/EC	2.3	1.9	1.9	2.8	3.1	3.5	4.0	5.0	5.5	–	16

The EU 2020 target of 10% by 2020 remains unchanged. Biofuels in transport have increased from 0.03% in 2005 to 2.4% in 2010 in energy terms.

Carbon Tax

A carbon tax of €15 per tonne of CO_2 emitted was announced in the 2010 Budget. The tax was applied to petrol and diesel with immediate effect from December 2009 and to non-transport fuels (i.e. kerosene, marked gas oil, liquid petroleum gas, fuel oil, natural gas and non-domestic coal) from May 2010. The tax was increased in Budget 2012 to €20 per tonne CO_2 for transport fuels (in Budget 2012) and for the other liquid and gaseous fuels from May 2012. The application of the tax to domestic solid fuels and to commercial peat will be subject to the provision of a mechanism to counter the sourcing of coal and peat from Northern Ireland.

Land Use and Forestry

The Kyoto Protocol (Article 3, paragraph 3) covers direct, human-induced, afforestation, reforestation and deforestation activities (ARD). Accounting of these activities is mandatory and Ireland must report on and account for emissions and removals for the commitment period (2008–2012) on lands on which these activities occur.

Reporting and accounting of these ARD activities contributes to Ireland meeting its commitments under the Kyoto Protocol. Reported net removals for the first three years of the commitment period (2008–2010) amounted to 8.5 Mt of CO_2 equivalents (CO_2eq).

The Kyoto Protocol also includes forest land management, cropland management, grazing land management and revegetation activities. Accounting of these activities for the first commitment period is optional and Ireland has not elected to report or account them. Research in Ireland, Europe and elsewhere, has increased the understanding of the extent and nature of carbon removals associated with different land uses and particularly the uptake of carbon in soil, where it can remain for long periods of time. This research shows that Irish grazing land could remove a significant amount of carbon from the atmosphere. However, carbon is emitted or lost from other land uses such as cropland and the drainage and use of peatland. Options to enhance current removals and reduce or eliminate carbon loss from soils are being explored. However, accurate determination of these

remains difficult and further work is required to understand the carbon dynamics of these land uses.

As carbon removals are likely to be important in achievement of future climate targets, the roles and potential contributions of managed land will come under increasing attention. Policy measures to preserve or enhance existing removals and reduce carbon losses will be required. These will need to be combined with robust measurement and verification systems, in order to meet international accounting standards.

Climate Change Impacts and Adaptation

A range of analyses of climate-change impacts for Ireland have been developed. These are based on climate modelling centred on Ireland and pan-European analyses. These analyses have been carried out in co-operation with other state agencies and funding bodies including Met Éireann, OPW and SEAI. The output from this work has included an analysis of potential impacts for Ireland, as summarised in the State of Knowledge Report (EPA, CCRP, 2009).

Research in this area is designed to support decision making to increase the climate resilience of key sectors and vulnerable regions and to provide input for the development of a National Climate Change Adaptation Framework. This can support sectoral and local level planning and decision making in the context of climate change. At a broader scale it also develops a basis for provision of future climate services as envisaged in the outcomes of the Third World Climate Conference (2009). It further contributes to the European Climate Change Adaptation Platform "Climate-Adapt" which was launched in 2012, and the proposed EU Adaptation Strategy, which is expected to be published in 2013.

Ongoing work includes:

- National vulnerability assessment
- Development of a pilot climate information system for Ireland
- Methodologies and guidelines for risk assessment and costing adaptation options.

Recently completed research includes the National Adaptive Capacity Assessment (EPA, CCRP, 2011), which shows that Ireland is in a good position to begin planning for climate change, with a number of sectors and local authorities integrating climate change issues into decision making. A national framework for adaptation is required to provide a strategic structure for the development of adaptation actions in Ireland. Such a framework is expected to be published by the DECLG in 2012. The National Climate Change Adaptation Framework is likely to flag the need for ongoing assessment and review of climate-change vulnerability at the local and sectoral level with a view to developing a climate-resilient Ireland.

Climate Change Research

The relatively recent identification of climate change as a key environmental and socio-economic challenge means that research plays a vital and essentially an operational role in the development of responses. At a global level this is reflected in the work of the Intergovernmental Panel on Climate Change (IPCC) which provides periodic authoritative assessment to world governments. Since 1988 its work has resulted in all major global actions to address climate change including formation of the UNFCCC.

In Ireland, the EPA established a national climate change research co-ordination committee in 2007. This group includes representatives of the main government departments and agencies with responsibility for climate change research. It is working to improve co-ordination of climate change research, sharing of data and communication of research outputs to policy makers and decision makers.

The EPA itself is funding climate change research which is directed at addressing specific knowledge gaps of direct relevance to the National Climate Change Strategy. The first call for research proposals was announced in June 2007. In the period 2007–2011, grant awards totalling €19m were made to a range of projects and fellowships on air and climate issues.

This programme is advanced via thematic research areas that support key elements of national actions on mitigation, adaptation and longer term strategic development:

Theme 1: Greenhouse Gas Emissions, Sinks and Management Systems

Work in this area has been instrumental in improving the national GHG inventory to ensure that data provided reflect conditions and activities in Ireland rather than regional or global default data and analysis. This work is highly focused on reducing uncertainties in the national inventory, many of which occur in the agriculture and land-use sectors, and identification of GHG mitigation and management options that can be accounted in the UNFCCC and EU systems.

Theme 2: Ireland and Future Climate, Impacts and Adaptation

Research in this area is focused on understanding how Ireland will experience climate change and enabling society and vulnerable sectors to adapt to anticipated impacts. This involves a range of activities from climate modelling to impacts analysis and provision of climate information services.

Theme 3: Socio-economic and Technological Climate Solutions and Transition Management

This area is focused on longer term issues and has a goal to identify pathways for achievement of a carbon-neutral Ireland by 2050. Research in this area has progressed the analysis of energy demand to 2050, and provided initial options to meet major emissions reductions requirements.

Reports published in each of the thematic areas are available for download from the EPA website.

Outlook

The future development of actions on climate change in Ireland needs to be aligned with developments within the UNFCCC and EU and to take account of:

- Ireland's current emissions profile and projections of future emissions based on socio-economic and sectoral analysis to 2020 and up to 2050
- projections of future climate conditions and analysis of ongoing changes associated with climate change
- opportunities for sustainable development and economic growth that will arise from global actions to address climate change.

The analysis of Ireland's emissions over the full Kyoto period (2008–2012) will not be completed until 2015 when compliance will be fully assessed at EU and UN levels. However, interim analysis and projections for this period indicates that Ireland will comply with its Kyoto obligations, without a requirement for any further purchase of credits. This is as a direct result of the current economic recession and economic outlook in the short term.

2013 will see the commencement of the second Kyoto Protocol Commitment period and the first year of compliance with emissions targets established under the EU 2008 Climate and Energy Package. The EU 2008 Climate and Energy Package commits its Member States to an overall reduction of GHG emissions by 20% by 2020 relative to 1990 emissions levels. The EU has also committed to raise this to a 30% emission reduction in the context of a global agreement involving comparable effort by other developed countries and major emitters.

Implementation of this Package is envisaged in two main strands:

(1) the EU ETS, which involves major industrial emitters and is implemented mainly by the EU Commission;

(2) limits under the *Effort Sharing Decision* for all other sectors, to be implemented by each Member State.

The 2020 EU Effort Sharing Decision (EP and CEU, 2009b) commits Ireland to reducing emissions from those sectors in Ireland that are not covered by the ETS (e.g. transport, agriculture, residential) to 20% below 2005 levels. This will result in a limit of approximately 38 Mt CO_2eq for Ireland's non-ETS emissions in 2020, together with annual binding limits for each year from 2013 to 2020.

Figure 2.7 shows projections of GHG emissions to 2020. Projections *'with measures'* represent a "business-as-usual" scenario where only policies and measures that have been already adopted or implemented are considered. Projections *'with additional measures'* represent a scenario where all the planned measures are considered to be fully implemented in a timely fashion.

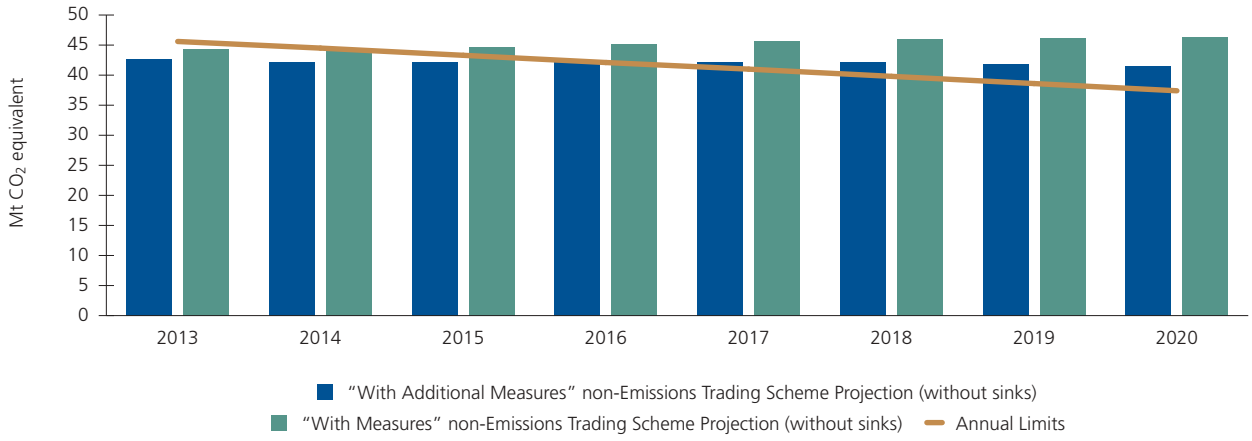
The EPA emissions projections indicate that even under the most optimistic scenario (*with additional measures*), Ireland will exceed its annual limit in 2017 and exceed its 2020 target. Under the with measures scenario, it is projected that Ireland will exceed its annual limit in 2015. The predicted cumulative exceedance over the 2013–2020 period is estimated to be between 2.0 and 20 Mt CO_2eq.

The projections under the most optimistic scenario are predicated on the assumption that Government policy targets, such as the 40% renewable energy target for electricity generation, are implemented and delivered in full. In addition, significantly reduced economic growth rates underpin the projections out to 2020. In order to meet future targets, Ireland must deliver and implement all planned policies and measures as well as identifying new policies and measures.

Transport and agriculture are the two key sectors in relation to the 2020 targets, accounting for 75% of non-ETS sector emissions in 2020. Efforts to reduce non-ETS sector emissions must therefore focus on these two sectors. Ireland faces considerable challenges in developing cost-effective and environmentally effective policies for transport and agriculture given their importance to the economy and the limited availability of low-cost solutions. Latest projections indicate that through full implementation of *all* foreseen mitigation measures, a small reduction in transport emissions is achievable by 2020. The agriculture sector is projected to expand under the *Food Harvest 2020* strategy, which further highlights the challenge that Ireland faces in meeting the 2020 non-ETS sector targets.

It is noteworthy that under current accounting rules for the EU 2020 limits, Ireland is not permitted to include the contribution from forest sinks, which is estimated to be 32 Mt of CO_2 equivalents over the 2013–2020 period. Ireland is contributing to discussions at international level that may alter this situation in the future.

Figure 2.7 GHG Emission Projections to 2020 (Source: EPA)



Conclusion and Future Challenges

Ireland requires action to reduce greenhouse gas emissions and to adapt to climate-change impacts. A long-term strategic plan for Ireland to transition to a low-emission, climate-resilient society and economy by 2050 is required, which encompasses key UN and EU goals such as the EU Commission's 2050 Roadmap. Ireland also needs to be at the forefront of adopting new approaches and low-carbon technologies, particularly in the transport and agriculture sectors, that will be effective in the national context.

In the short term Ireland must take appropriate actions to ensure that annual emissions targets over the period 2013–2020 are not exceeded. These actions include meeting existing sectoral targets and commitments, for example in *Delivering a Sustainable Energy Future for Ireland*; the National Bioenergy Action Plan; the National Energy Efficiency Action Plan; and Smarter Travel - A Sustainable Transport Future. It is of particular importance that the implementation of *Food Harvest 2020* takes place in a sustainable manner, to ensure that any increase in greenhouse gas emissions from the agriculture sector is addressed and does not overburden other key sectors.

It is also essential that Ireland reduce its dependence on fossil fuels while ensuring that significant increases are achieved in the use of alternative energy sources (wind, ocean, biomass and others). Considerable improvements in energy efficiency are also needed as envisaged in the *National Energy Efficiency Action Plan*. Due to the long investment cycles for major infrastructure, the role of research will be crucial in identifying cost-effective pathways to reduce greenhouse gas emissions from energy, agriculture and transport.

To avoid significant adverse climate-change impacts over the coming decades, a concerted approach involving both adaptation and mitigation is required, with mainstreaming of climate-change issues into future investment and planning decisions. Even if global GHG levels were reduced now, some impacts would be unavoidable due to the lifespan of certain GHGs in the atmosphere. National, local and regional development plans must be climate-proofed to minimise the unavoidable effects of climate-related impacts. Through its research programme the EPA is providing expert input to develop a National Adaptation Strategy for Ireland in conjunction with relevant Government departments, to identify the main risks posed and how best they can be managed.

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Chapter 3
Air Quality & Transboundary Air Emissions

Air quality in Ireland is of a high standard across the country and is among the best in Europe, meeting all EU air quality standards in 2010. This is due largely to prevailing clean Atlantic air and a lack of large cities and heavy industry. However, in Dublin and Cork levels of nitrogen dioxide are close to the specified EU limit values for air quality in traffic-impacted areas. Traffic emissions also contribute to high levels of particulate matter and polycyclic aromatic hydrocarbons. Levels of particulate matter in large towns without a smoky coal ban are higher than in towns where such a ban is in place. Ireland also faces future challenges to meet new air quality standards for $PM_{2.5}$ concentrations by 2020.

With regard to air emissions, Ireland has complied with the 2010 EU emission ceilings for sulphur dioxide, volatile organic compounds and ammonia. Ireland did not meet the prescribed 2010 ceiling for nitrogen oxides emissions due to sustained emissions from road transport.

For Ireland to comply with its international commitments on air quality and air emissions, industrial emissions of pollutants to air must continue to be rigorously controlled; policies must be implemented to increase the use of alternatives to the private car and improve efficiencies of motorised transport. Government departments, national agencies and local authorities must make air quality an integral part of their traffic management and planning processes. Households and businesses must use more efficient methods to burn fuel and shift from solid fuel to cleaner alternatives including gas.

Introduction

Air pollution is a major environmental health risk; poor air quality reduces human life expectancy by more than eight months on average and by more than two years in the most polluted cities and regions (EC, 2010). The World Health Organisation (WHO) states that outdoor air pollution is estimated to cause 1.3 million deaths worldwide per year (WHO, 2005). Poor air quality also has an adverse impact on the environment by contributing to acidification, eutrophication and crop damage. This chapter is concerned with outdoor air quality; information on indoor air quality is contained in Chapter 9, *Environment and Health*.

Since the 1970s the EU has introduced a number of legislative requirements with regard to air quality, which have become progressively more stringent. This led to a significant improvement in air quality since 1990; however, the improvement has stagnated in recent years and we currently face new challenges.

In order to protect our health, vegetation and ecosystems, EU Directives set down air quality standards for a wide variety of pollutants. The current standards are contained in the Clean Air for Europe (CAFE) Directive (EP & CEU, 2008) and the 4th Daughter Directive (EP & CEU, 2004). These Directives also include rules on how Member States should monitor, assess and manage ambient air quality.

The Directives require that Member States divide their territory into zones for the assessment and management of air quality. The zones adopted in Ireland are Zone A, the Dublin conurbation; Zone B, the Cork conurbation; Zone C, comprising 21 large towns in Ireland with a population >15,000; and Zone D, the remaining area of Ireland. A nationwide network of 29 monitoring stations, managed by the EPA, measures levels of air pollutants in each zone and delivers this information in real-time to the public.

Air pollution has a transboundary aspect, meaning that emissions in one country can cause pollution in a different country. These pollutants contribute to acidification, eutrophication and ozone formation. Emissions of transboundary pollutants are controlled by the 1999 UNECE Gothenburg Protocol under the Convention on Long-Range Transboundary Air Pollution (CLRTAP) and by the EU National Emissions Ceiling (NEC) Directive (EP and CEU, 2001a). The NEC directive prescribes national emissions ceilings for each EU country for four key

Figure 3.1 Annual Mean Nitrogen Dioxide Concentrations 2002–2010 (Source: EPA)

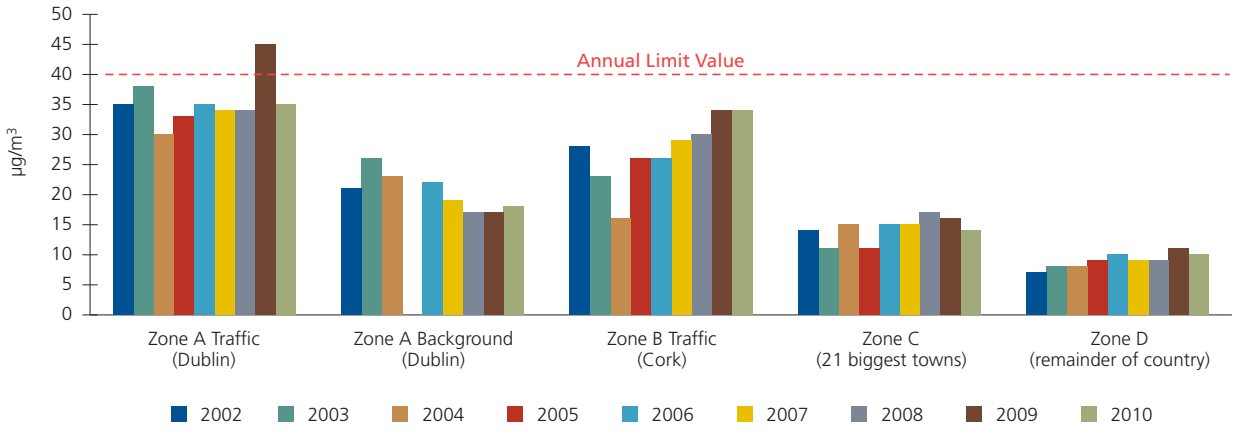
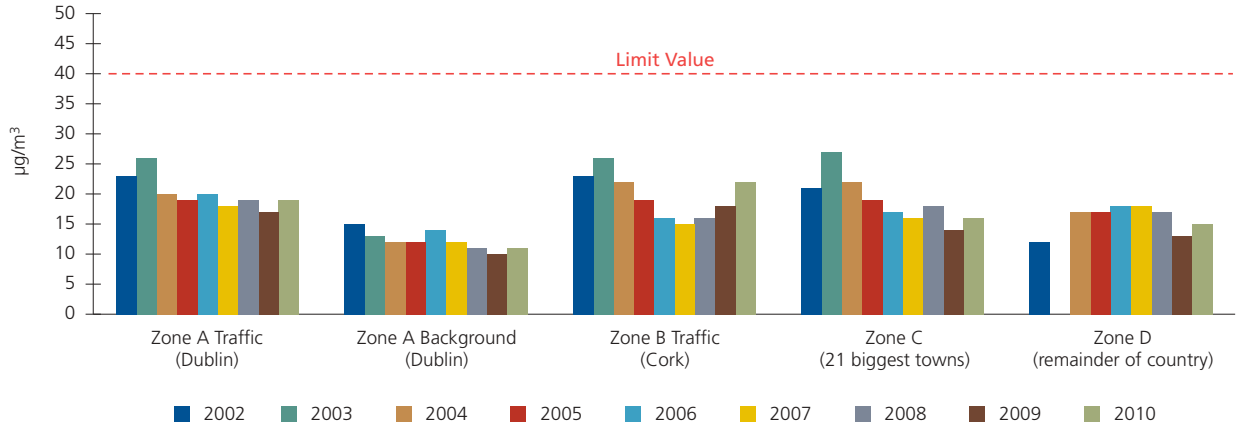


Figure 3.2 Annual Mean PM_{10} Concentrations 2002–2010 (Source: EPA)



transboundary pollutants: sulphur dioxide (SO_2), nitrogen oxides (NO_X), volatile organic compounds (VOCs) and ammonia (NH_3).

The Current Situation

Air Quality – Main Pollutants

Under the EU Directives, Ireland is required to monitor a number of air pollutants that have an impact on health and vegetation. These include NO_X, SO_2, carbon monoxide (CO), ground level ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), benzene, heavy metals and polycyclic aromatic hydrocarbons (PAHs). Across Europe the most problematic pollutants have consistently been NO_X, PM and O_3. Recently PAHs have also been identified as a pollutant of concern.

Oxides of Nitrogen (NO_X)

NO_X refers to the two pollutants nitric oxide (NO) and nitrogen dioxide (NO_2). The main sources of these pollutants are vehicle exhausts and combustion sources. Exposure to NO_2 is harmful to health, while NO_X contributes to the formation of ground-level ozone and acid rain.

NO_2 levels across Ireland have remained relatively static since 2002; however, an increasing trend at traffic-impacted sites in Dublin and Cork is emerging. These sites are approaching the 2010 limit value for NO_2 with one exceedance of the limit value recorded in 2009 at Winetavern Street, Dublin (EPA, 2010). This exceedance occurred before the limit value came into force on 1 January 2010. Figure 3.1 shows annual mean nitrogen dioxide concentrations from 2002 to 2010 for monitoring sites across Ireland.

Particulate Matter (PM_{10} and $PM_{2.5}$)

PM_{10} and $PM_{2.5}$ are particles with diameters less than 10 micrometres and less than 2.5 micrometres respectively. The health impacts of these small particles relate to their ability to penetrate deep into the respiratory tract. In Ireland the main sources are domestic use of solid fuel and vehicular traffic.

PM_{10} concentrations show a decreasing trend in cities and large urban areas since 2003. This is mainly due to the decreases in particulate emissions from traffic arising from improvements in vehicle engine emissions. However, this decrease is not seen in smaller towns, where domestic solid fuel emissions are more significant than traffic emissions. Many towns do not benefit from the ban on smoky coal, and often do not have access to cleaner fuel alternatives such as natural gas (EPA, 2011).

Under the CAFE Directive, Ireland requires a reduction in levels of $PM_{2.5}$ by 10% between 2012 and 2020. This reduction is challenging, as it will require an integrated approach across a number of sectors including industrial, transport and residential emissions. Figure 3.2 shows annual mean PM_{10} concentrations 2002–2010 for monitoring sites across Ireland.

Polycyclic Aromatic Hydrocarbons (PAHs)

The sources of PAHs include industry, traffic emissions and domestic use of solid fuels such as wood and coal. Long-term exposure to low levels of PAHs may cause a number of diseases including lung cancer.

PAHs were monitored in Ireland for the first time in 2009 at five monitoring stations. In 2010, levels at two of the stations were at the limit value of 1 ng/m^3. Reductions in emissions from traffic and from domestic use of solid fuel are required to reduce ambient levels of PAHs.

Ground-Level Ozone (O_3)

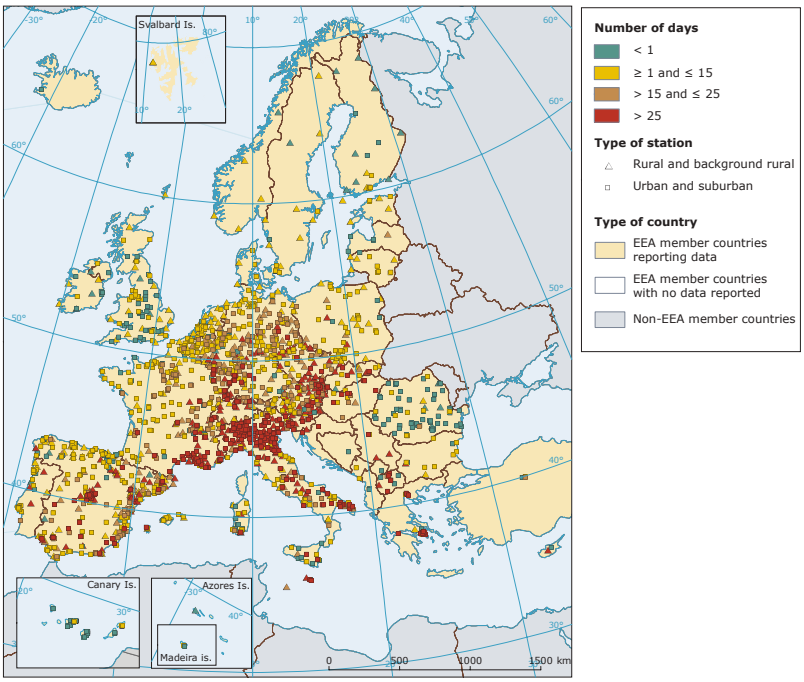
Ozone is a gas that is formed as a secondary pollutant at ground-level by the reaction of a mixture of other chemicals – NO_X, CO and VOCs – in the presence of sunlight. Ozone is a powerful oxidising agent and can affect health and vegetation.

Table 3.1 Emissions of the Four NEC Pollutants 1990–2010 (Source: EPA)

	1990 (kt)	1995 (kt)	2000 (kt)	2005 (kt)	2006 (kt)	2007 (kt)	2008 (kt)	2009 (kt)	2010 (kt)	2010 Emissions ceiling (kt)	Ceiling achieved?
SO_2	182.5	161.1	139.7	71.2	60.7	55.1	45.3	32.7	26	42.0	Yes
NO_X	129.2	129.5	125.1	116.6	113.4	113.0	106.2	88.8	72.6	65.0	No
VOCs	88.0	81.1	73.4	59.7	58.4	56.9	55.2	52.2	44.9	55.0	Yes
NH_3	105.5	112.9	120.9	113.3	112.4	107.6	107.4	107.8	106.2	116.0	Yes

Short acute ozone pollution episodes are infrequent in Ireland; however, they have happened in the past and will happen in the future. They are most likely to occur in summer months when there is a stable anti-cyclone over Ireland bringing settled, warm weather combined with transmission of polluted air masses from other European countries. Reducing ozone requires limiting emissions of its precursors locally, regionally and globally. The objectives of both the CLRTAP and NEC Directive include addressing ground-level ozone. Figure 3.3 shows ozone concentrations across Europe in 2011.

Figure 3.3 Number of Days on which Ozone Concentrations Exceeded the Long-Term Objective for the Protection of Human Health during the Summer of 2011 (Source: European Environment Agency)



Other Pollutants

The other health-relevant pollutants measured are SO_2, CO, benzene, lead, arsenic, cadmium, nickel and mercury. Levels of all these pollutants are low in Ireland and below all relevant limit and target values (EPA, 2011).

Emissions of Transboundary Pollutants

The four main contributory gases to transboundary pollution in Europe are SO_2, NO_X, VOCs and NH_3. This transboundary pollution usually manifests itself in the form of acidification, eutrophication and ground-level ozone formation. The emissions of these main acidifying air pollutants and ozone precursors have been declining in general throughout Europe since the 1990s. Substantial progress on emissions reduction in recent years has been driven by the 1999 UNECE Gothenburg Protocol under the Convention on Long-Range Transboundary Air Pollution (CLRTAP) and the EU National Emissions Ceiling (NEC) Directive (EP and CEU, 2001a).

The NEC Directive sets emissions ceilings for SO_2, NO_X, VOCs and NH_3 to be achieved in 2010. The current position in Ireland is shown in Table 3.1.

Figure 3.4 NO_X Emission Sources and Trends 1990–2010 (Source: EPA)

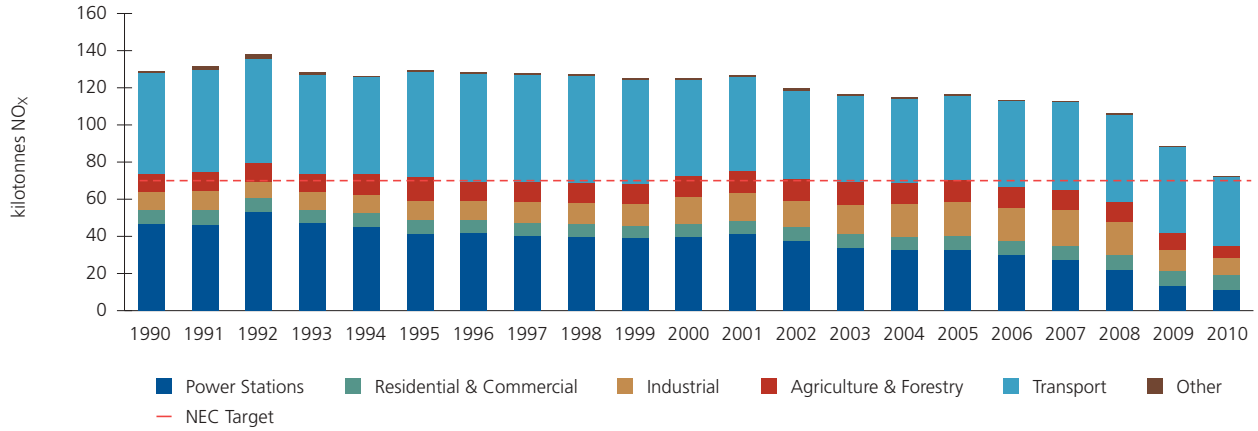
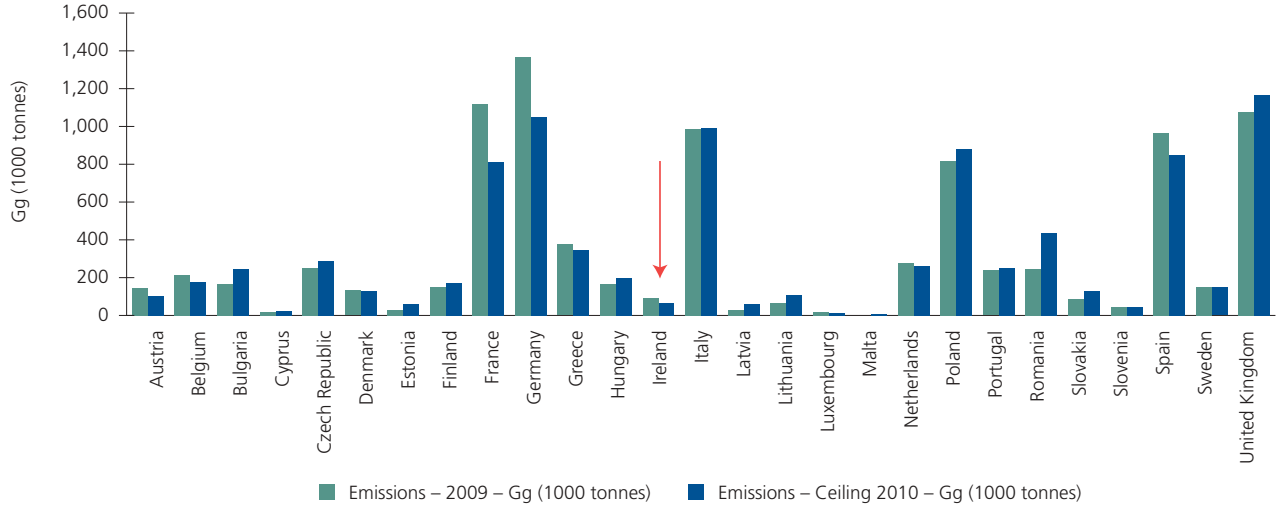


Figure 3.5 Total 2009 NO_X Emissions and 2010 NO_X National Emissions Ceiling for EU Member States (Source: EEA)



Sulphur Dioxide (SO_2)

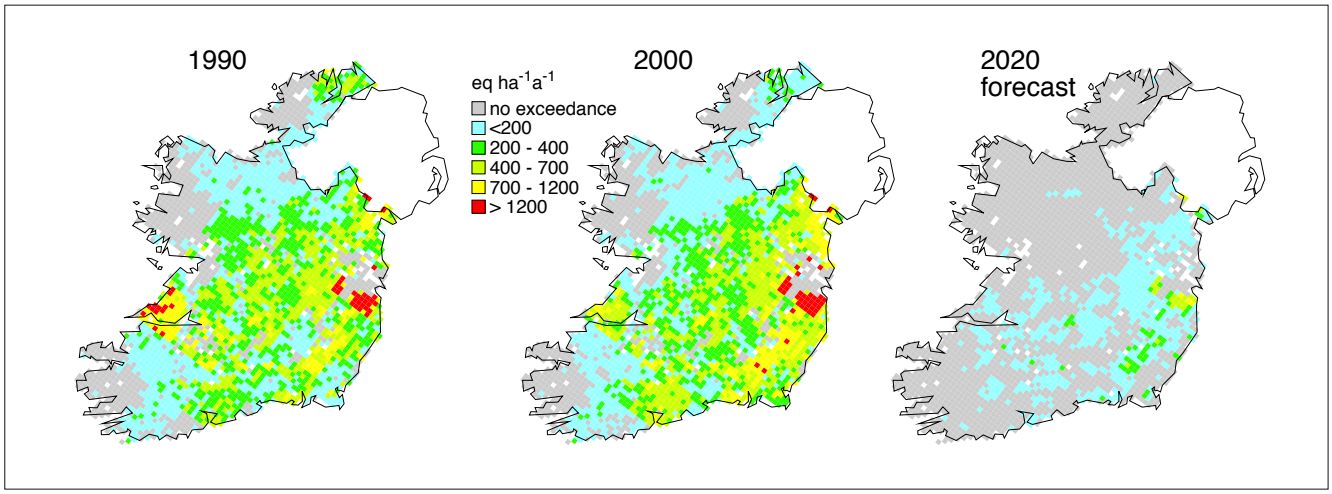
SO_2 is the major precursor to acid deposition, which is associated with the acidification of soils and surface waters. Ireland achieved the emission ceiling of 42 kilotonnes (kt) in 2009 due to the large decrease in SO_2 emissions in recent years. This is due to fuel switching, from solid and liquid fuels to natural gas, in the power generation and industry sectors; reductions in the sulphur content of fuel oil, gasoil, diesel and gasoline; and the decrease in coal and peat use for heating in Irish homes. The recent application of flue gas desulphurisation at the Moneypoint coal-fired power station led to a substantial reduction in SO_2 from this key point source.

Oxides of Nitrogen (NO_X)

Emissions of NO_X also contribute to acidification of soils and surface waters as well as ground-level ozone formation and nitrogen loading in terrestrial ecosystems. The main sources of NO_X emissions in Ireland are the transport, power generation and cement sectors. NO_X emissions from the electricity sector decreased substantially due to the implementation of the Large Combustion Plant (EP and CEU, 2001b) and Integrated Pollution Prevention and Control (IPPC) (CEU, 1996) Directives, but sustained NO_X emissions from road transport mean that Ireland failed to achieve the emissions ceiling of 65 kt by 2010. Figure 3.4 compares the emission trends for NO_X to the NEC target.

Ireland is one of the 11 EU Member States that did not meet their 2010 emission ceiling for NO_X. Figure 3.5 shows the total NO_X emissions for 2009 from all Member States compared with their NO_X national emission ceiling.

Figure 3.6 Average Accumulated Exceedance of Critical Loads of Acidification in 1990, 2000 and 2020 (Source: Posch et al., 2011)



Volatile Organic Compounds (VOCs)

Ireland's emission ceiling for VOCs is 55 kt and this was achieved in 2009. The main sources of VOC emissions are solvent use and transport. Catalyst controls and improved vapour abatement technologies in gasoline vehicles achieved large reductions in VOC emissions. The contribution from solvent use remains relatively constant in absolute terms even though drivers such as population, paint use and pharmachem industrial activity have increased in recent years.

Ammonia (NH_3)

NH_3 emissions are associated with acid deposition and the formation of secondary particulate matter. Ireland's emission ceiling for NH_3 is 116 kt and this was achieved in 2003 and remains below the target. The agriculture sector (cattle population) accounts for virtually all ammonia emissions in Ireland. NH_3 levels will rise and may become problematic if cattle numbers increase to their pre-2000 levels.

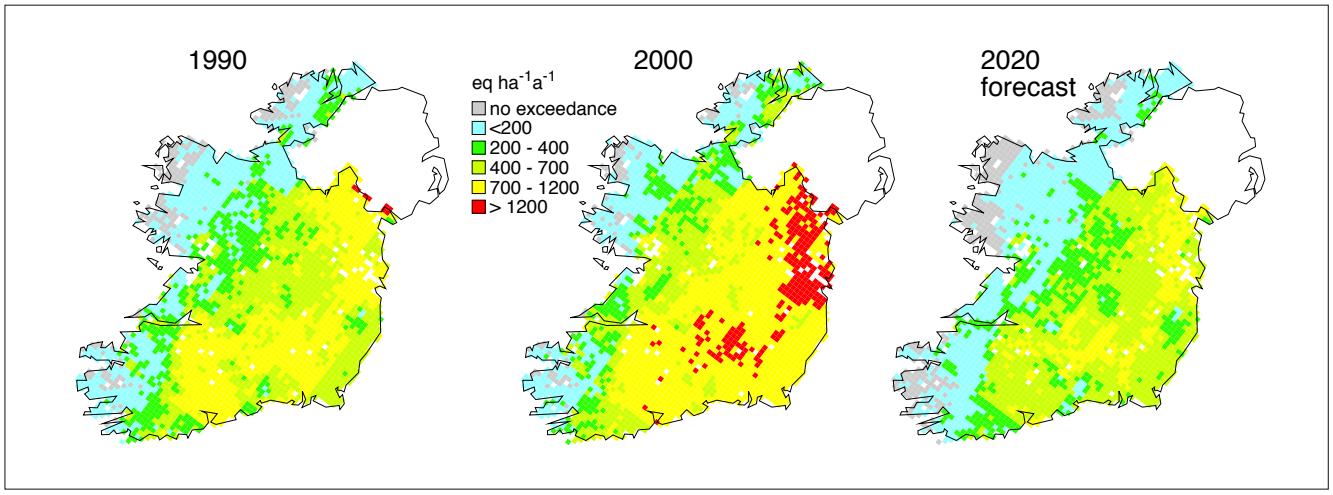
Other Transboundary Pollutants

Ireland also reports emission inventories annually for a significant range of pollutants under the Convention on Long-Range Transboundary Air Pollution. These inventories include heavy metals, particulate matter and persistent organic pollutants such as dioxins, PAHs, hexachlorobenzene and polychlorinated biphenyl. Historical data on these pollutants, along with Ireland's Inventory Report for 2011, can be obtained on the EMEP Centre on Emission Inventories and Projections website (CEIP, 2012).

Critical Loads of Acidification and Eutrophication

The concept of critical loads is used across Europe for assessment and management of ecosystems that are sensitive to atmospheric pollutant deposition which causes acidification or eutrophication. These are mainly sulphur and nitrogen species produced by industrial and agricultural activities and combustion. Environmental damage is inevitable if the critical load for an ecosystem is exceeded. Prevention of such damage is a key objective of the UNECE CLRTAP and EU NEC Directive.

Figure 3.7 Average Accumulated Exceedance of Critical Loads of Eutrophication in 1990, 2000 and 2020 (Source: Posch et al., 2011)



The critical load can be determined for specific ecosystems, e.g. fish species, surface waters and habitat types. Atmospheric deposition by rain or directly by gases and particulates in excess of the critical load is termed an exceedance. The EPA provides Ireland's data on critical loads to European analysis centres. These include data on forests, natural grassland, heathland and peatland (Posch et al., 2011). These data inform compliance and support the development of future UNECE and EU Strategies on Air Pollution.

The reduction of sulphur emission and associated acidification recovery over the past two decades is one of Europe's environmental success stories. Figure 3.6 shows the average accumulated exceedance of critical loads of acidification in Ireland modelled for the years 1990, 2000 and 2020. Future reductions are projected to further reduce the magnitude and extent of critical load exceedances.

However, nitrogen deposition and exceedance of nutrient nitrogen lead to eutrophication in ecosystems and remain problematic. Figure 3.7 shows the average accumulated exceedance of critical loads of eutrophication modelled for the years 1990, 2000 and 2020. There has been little change in exceedance of nutrient nitrogen since 1990 owing to the limited reductions in nitrogen emissions. This is leading to ecosystem changes including biodiversity loss and is a challenge for achievement of EU Habitats Directive goals. Consequently there is an increasing European focus on nutrient nitrogen critical loads. The development of combined soil-vegetation models is required to better assess these impacts, and further action on emissions is needed.

Responses

European Union Legislation

The EU Directives on ambient air quality (EP & CEU, 2004, 2008) set limits and target values for ambient concentrations of air pollutants harmful to human health and the environment. If any limits are exceeded, Member States must implement measures to ensure the air quality standards are met. The four Dublin local authorities have prepared an air quality management plan to address the 2009 exceedance in nitrogen dioxide in Dublin which was submitted to the EU in December 2011 as required.

A range of European Union legislation specific to sources, gases or fuels is contributing to progress to achieving NEC Directive ceilings (EP and CEU, 2001b, 2009; CEU, 1996, 1999; CEC, 1993).

Emissions from Industry

Emissions from industry and the power generation sectors are currently controlled by IPPC licensing and the implementation of the Large Combustion Plant Directive. These measures have achieved significant reductions in NO_X, SO_2 and PM emissions in Ireland in recent years.

Road Transport

While new standards for car emissions and the resultant cleaner technology have curbed emissions, this has been offset by the sustained level of use of private cars in particular. This trend must be addressed to reduce emissions and achieve compliance with the NEC Directive for NO_X, the CAFE Directive for NO_2 and the Fourth Daughter Directive for PAH. The actions set out in *Smarter Travel - A Sustainable Transport Future* (DOT, 2009) should be implemented to improve air quality. These include actions to reduce travel demand, increase alternatives to the private car and improve the efficiency of motorised transport.

Bituminous Coal Ban and Domestic Emissions

The ban on bituminous coal in large cities and towns greatly reduced levels of particulate matter pollution in these areas (EPA, 2011). A study on the effect of the bituminous coal ban found that that there were approximately 359 fewer cardiovascular and respiratory deaths per year in Dublin following the introduction of the ban (Clancy et al., 2002). In 2011 the ban was extended to four additional towns and a nationwide 0.7% limit on sulphur in bituminous coal was introduced (DECLG, 2011). New regulations further extending the ban are expected. These measures should decrease levels of particulate matter across the country. In addition the EPA is funding a research programme that is investigating potential links between the burning of bituminous coal, resulting high levels of PM_{10} and $PM_{2.5}$ and levels of PAHs.

Outlook

Overall, air quality in Ireland continues to be good and is among the best in Europe. This is due largely to the prevailing clean westerly air-flow from the Atlantic and the relative absence of large cities and heavy industry. However, Ireland faces a number of challenges in the near future when trying to meet obligations under EU legislation.

Levels of NO_X in traffic-impacted city centre areas will continue to be a problem due to the difficulty in achieving large-scale reductions in road traffic numbers. This should be addressed through policies to reduce car use; increase use of public transport; and reduce emissions from vehicles.

Under the CAFE Directive, Ireland is required to reduce levels of $PM_{2.5}$ by 10% between 2012 and 2020. This reduction will be challenging as it will require an integrated approach across a number of sectors including industrial, transport and residential emissions.

Emissions from domestic solid fuel use contribute to high levels of particulate matter and PAHs in villages, towns and cities. New regulations in 2011 reducing the sulphur content in coal and extending the ban on bituminous coal should bring improvements in air quality. Switching from solid fuel to gas or other low-emission fuels and the use of efficient stoves to burn solid fuel will further reduce domestic emissions of air pollution.

Increasing population and the demand for electricity, space heating fuels, construction materials and vehicle ownership are some of the principal drivers for air emissions in Ireland. Ireland also has a large agricultural and food export industry, a key driver for ammonia emissions. Expected growth in the agricultural sector as outlined in the *Food Harvest 2020* strategy (DAFF, 2010), along with the planned removal of milk production quotas within the European Union (CEU, 2009) will increase pressure on future emissions to air from this sector.

The EPA IPPC licensing regime and EU legislation will continue to control emissions to air from industry and power generation to ensure that these sectors will not impact on air emissions and air quality. The strategies to achieve compliance with the EU NEC Directive have successfully controlled emissions of sulphur dioxide, ammonia and VOCs. Emissions of all three are expected to remain below the prescribed ceilings. In contrast, levels of NO_X are expected to remain above Ireland's national emission ceiling in the short term.

Conclusion and Future Challenges

Ireland as a country must continue to be vigilant in order to maintain good air quality. Ireland must meet its international commitments on air quality and air emissions and ensure that industrial emissions of pollutants to air continue to be rigorously controlled. Ireland should also strive to ensure that its industrial sector continues to make use of clean technologies where possible.

The actions set out in *Smarter Travel - A Sustainable Transport Future* need to be implemented to arrest the increasing trend in NO_X levels in Ireland. These include policies to reduce travel demand, increase use of alternatives to the private car and improve the efficiency of motorised transport. This process will require joined-up action between Government departments, national agencies and local authorities. These bodies must make air quality an integral part of their traffic management and planning processes.

The shift from solid fuel to cleaner alternatives including gas must continue. This may need an extension of the natural gas network to include smaller towns and villages. Finally, the links between health and air quality must be better communicated by all public bodies involved in air quality assessment and management, to raise awareness of the critical issues with policy and decision makers and with the public.

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Chapter 4
Water

This chapter reviews the current status of surface waters and groundwaters in Ireland. The main drivers and pressures are identified and a prognosis on outcomes is presented with a path towards achieving the goals of the Water Framework Directive (WFD), which is now halfway through its first full implementation cycle.

In summary, the assessment of Ireland's water resources shows that:

- 71% of river channel is at high or good status
- 46.6% of lakes monitored are at high or good status
- 46% of transitional and coastal waters are at high or good status
- 85.6% of the area of groundwater aquifers is at good status.

Water quality in Ireland compares favourably with that in other EU countries. However, similar to many other EU countries, Ireland still faces considerable challenges to meet the objectives of the WFD within the required timeframes. The three main challenges for water quality management are to eliminate serious pollution associated with point sources; to tackle diffuse pollution; and to use the full range of legislative measures in an integrated way to achieve better water quality. A key aspect is that focusing measures on rivers, where monitoring has identified particular causes of pollution, will help reduce pollutant loading to lakes and coastal waters as well as improving river quality.

In addressing these challenges, improvements are also required in the governance and administrative systems for water management in Ireland to ensure that they are optimised to support the delivery of Ireland's obligations under the WFD and other water legislation.

Introduction

The WFD was introduced in 2000 as a European-wide law that brings a common approach to safeguarding all water and water-dependent ecosystems: groundwaters, rivers, lakes, transitional waters, coastal waters and wetlands. The main goals of WFD are:

- to maintain high- and good-status waters where they exist already
- to restore waters that do not support aquatic ecosystems adequately.

These are ambitious goals which all EU countries, including Ireland, must attain and they provide a vision and a target for the management and protection of water across the EU over the coming decades. The main unit of management for the WFD is the River Basin District (RBD), and Ireland has been divided into seven RBDs. River basin management plans for all seven RBDs were finalised in July 2010. This marked the culmination of many years of effort and significant expenditure in monitoring and assessing Ireland's surface waters and groundwaters; classifying the waters according to their quality status; and setting objectives with a view to protecting and improving these waters in accordance with objectives of the WFD.

The Current Situation

The WFD requires surface waters to be classified into high, good, moderate, poor and bad status. Groundwater is classified according to its chemical and quantitative status. The methods for classifying surface waters have been intercalibrated in a formal exercise required by the WFD. This is in order to ensure comparability across Europe. In addition, the former assessments of Irish waters, which have been conducted since the 1970s, have now been adapted to ensure they are compliant with the needs of the WFD and comparable with methods used in other countries.

Groundwater Quality

Groundwater is important as a source of drinking water in Ireland – providing approximately 25% of drinking water nationally. It also has significance in driving the ecology of many rivers, lakes and estuaries, especially during low-flow periods when groundwater forms a significant part of surface water flows.

Table 4.1 provides a summary of the status of groundwater bodies in each of the seven RBDs and nationally in terms of numbers of water bodies and area covered. It shows that the majority of Irish groundwater bodies (85%) achieve good status as required under the WFD.

The bulk of poor-status groundwater bodies, particularly in the Western and Shannon RBDs, are in areas where groundwater is contributing significant loads of phosphate to surface water bodies that are failing to meet their WFD objectives because of eutrophication from diffuse sources. A small number of water bodies are also at less than good status due to site-specific contamination, e.g. from historical mining in the Avoca catchment and at Silvermines.

Importantly, WFD criteria do not include microbiological elements in determining the assessment of ecological status. In 2010, 40% of all samples taken from the 285 wells and springs in the EPA national groundwater monitoring network were polluted by microbial pathogens, which can pose a threat to private water supplies in particular.

Table 4.1 River Basin District Summary of Status Classification Results for Groundwater Bodies (Source: EPA)

RBD	Good Status (No. of water bodies)	Good Status (% RBD Area)	Poor Status (No. of water bodies)	Poor Status (% RBD Area)
Eastern	67	89.7	8	10.3
Neagh Bann	26	95.3	2	4.7
North West	72	100	0	0
South East	146	97.8	5	2.2
Shannon	182	74.5	60	25.5
South West	77	96.8	7	3.2
Western	71	65.2	34	34.8
National	**641**	**85.6**	**116**	**14.4**

Figure 4.1 Trends in Nitrate Concentrations at Groundwater Monitoring Locations 1995–2010 (Source: EPA)

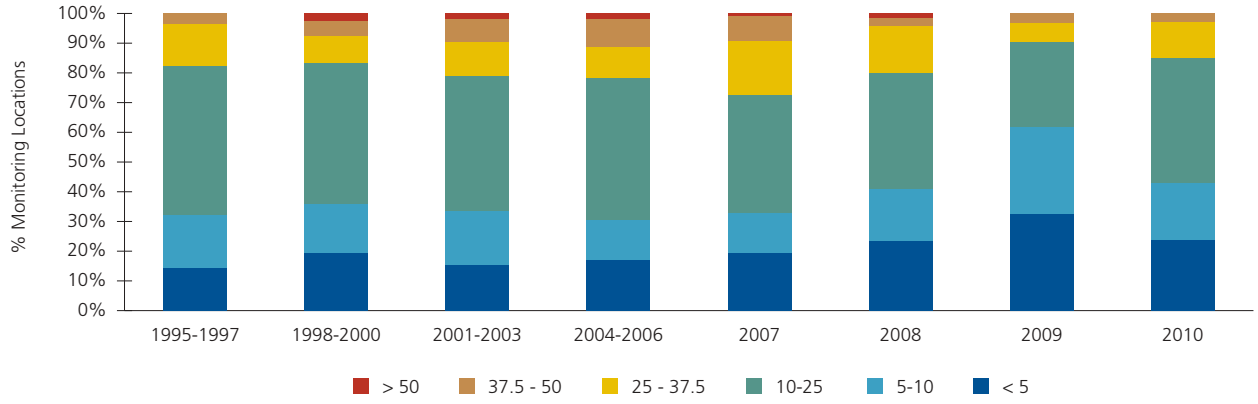
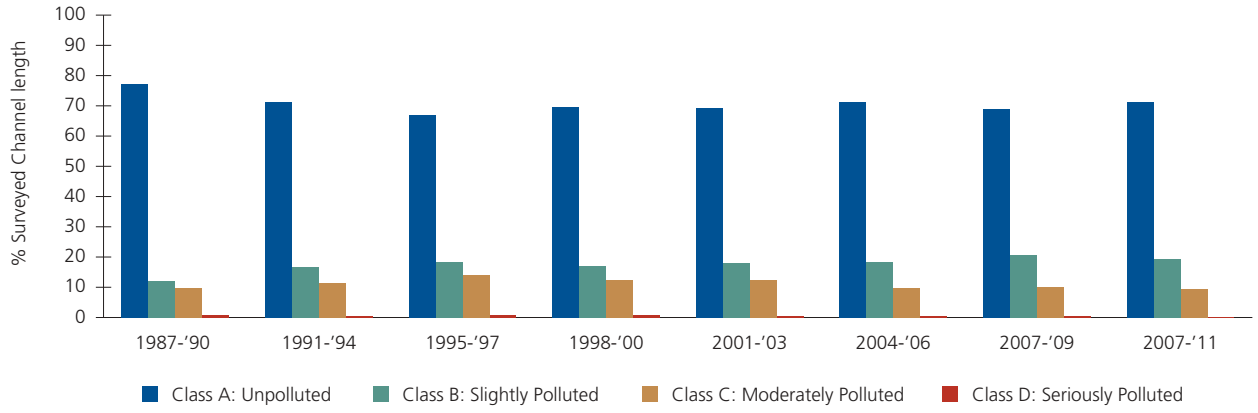


Figure 4.2 National Trends in the 13,188 km Baseline Showing the Percentage of Surveyed River Channel in the Four EPA Biological Quality Classes (Source: EPA)



Nitrate and Phosphate in Groundwater

Figure 4.1 illustrates trends in nitrate levels. In the period 2008–2009 there was a general reduction in nitrate concentrations compared with the previous period, which has been attributed to increased rainfall, reductions in inorganic fertiliser usage, improvements in organic fertiliser storage and the implementation of land-spreading restrictions. In comparison with 2009, the slight increases in nitrate concentrations that are observed in 2010 are attributed to reduced rainfall leading to less dilution of the nutrients in the water body (McGarrigle et al., 2010).

Elevated nitrate concentration in groundwater remains an issue, particularly in the southeast and south of the country. It may contribute to eutrophication of surface waters and impact on the quality of water abstracted for drinking water. Elevated phosphate concentrations in groundwater, resulting from diffuse pressures, can also be a cause of eutrophication of rivers and lakes where the source of phosphate is not attributed to point source discharges, especially at times of low flow. Previous EPA water quality reports (1994–2010) have reported diffuse agricultural pollution as a significant source of the elevated nitrate and phosphate concentrations in Irish groundwaters.

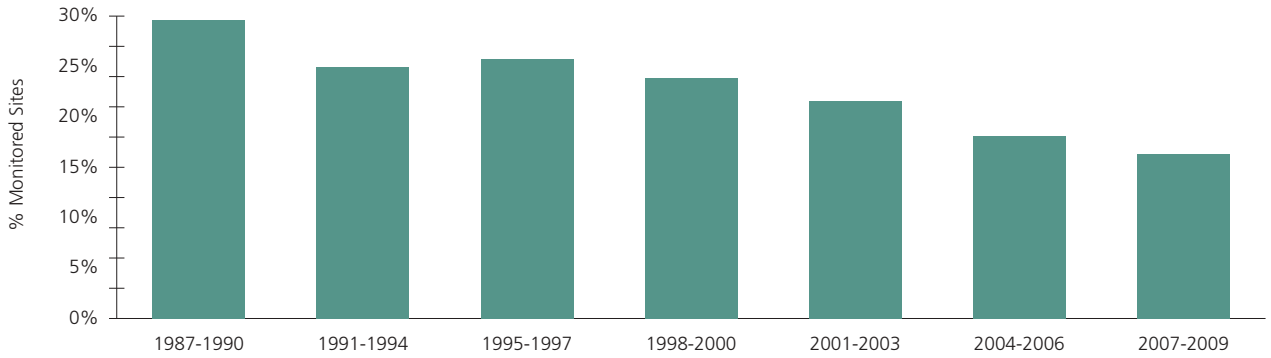
River Water Quality

Over 13,000 km of river channel is assessed by the EPA on an ongoing basis at over 2,500 sample points. The most recent assessments show that approximately 71% of river channel is classed as unpolluted in Ireland – achieving at least good ecological status. However, approximately 29% of monitored river channel length is polluted to some degree (Figure 4.2).

Long-term trends in river quality from 1987 to 2011 are shown in Figure 4.2. The main trends show that there has been:

- an overall decrease in the length of river channel that is classed as unpolluted, although there have been some improvements in recent years

Figure 4.3 Trends in the Number of River Sites at High Ecological Status 1987–2009 Shown as Percentage of the Total Number of Sites Monitored (Source: EPA)



- a decline in the length of seriously polluted channel
- an increase in the channel length affected by slight to moderate pollution – mainly due to eutrophication (over-enrichment of nutrients).

Monitoring for WFD purposes commenced in 2007. Table 4.2 shows the breakdown in terms of numbers of WFD water bodies and their WFD ecological status (as opposed to channel length, shown in Figure 4.2). The overall ecological status seems lower than that based on individual sites and quality elements. This is because the final ecological status of a water body is determined by the lowest status of the available quality elements at each site, and also by the lowest status of the monitored sites within the water body – there may be more than one monitoring station within each water body. The main success story over the past eight years has been the virtual elimination of seriously polluted (bad ecological status) river sites. The focus is now on the moderate- and poor-status sites and on the point and diffuse sources that cause the pollution.

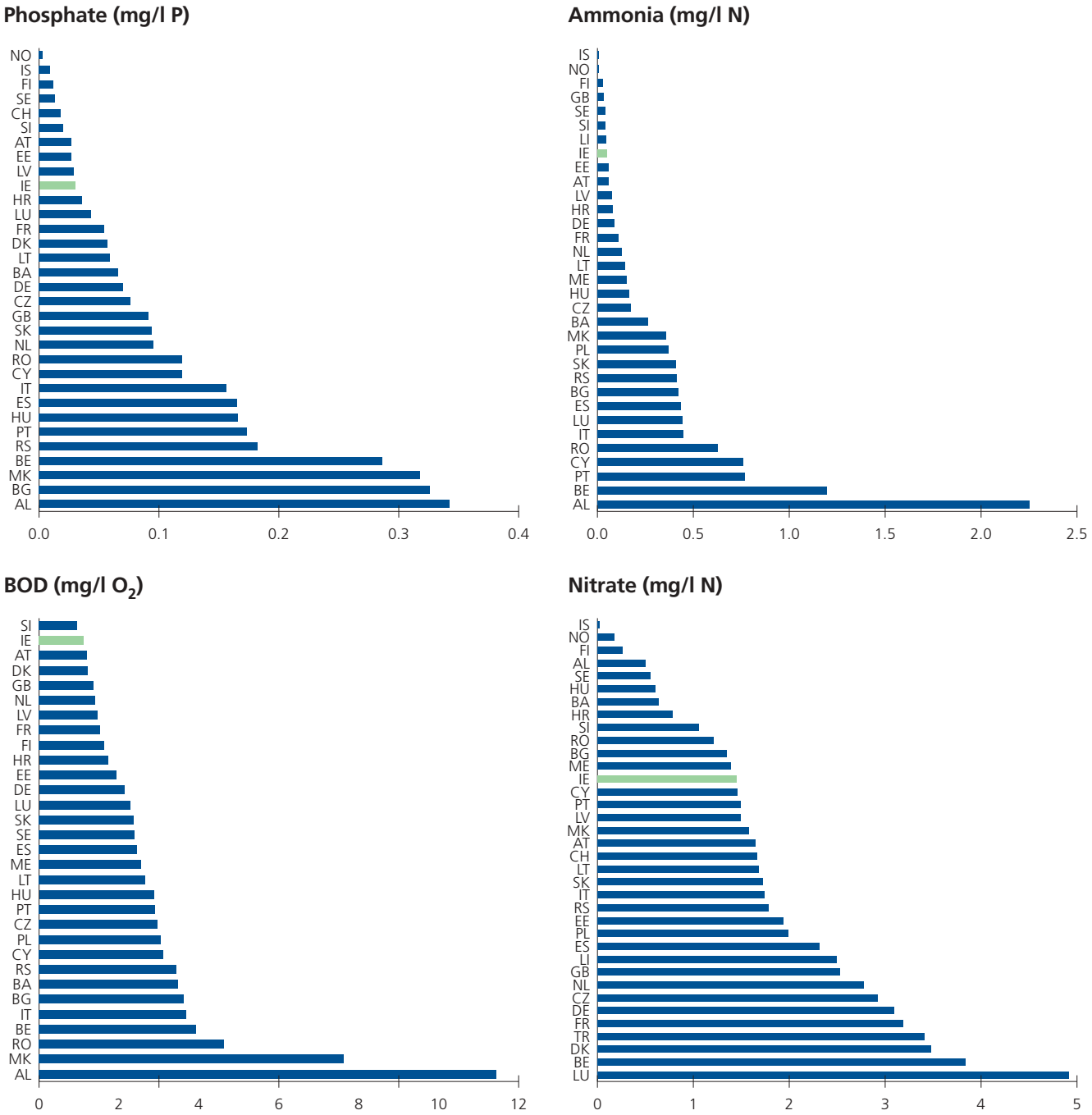
Table 4.2 River Water Quality in Ireland – Ecological Status 2007–2009 (Source: EPA)

Ecological Status	Number of Water Bodies	% of Water Bodies
High	204	13
Good	612	39
Moderate	435	28
Poor	295	19
Bad	18	1
Total	1,564	

High-status waters such as rivers with healthy populations of freshwater pearl mussel require very high standards of protection. However, the number of such high-status waters has declined significantly in recent decades (Figure 4.3). This decline is worrying, and site-specific, targeted interventions are needed in the catchments with high-status sites to prevent further loss.

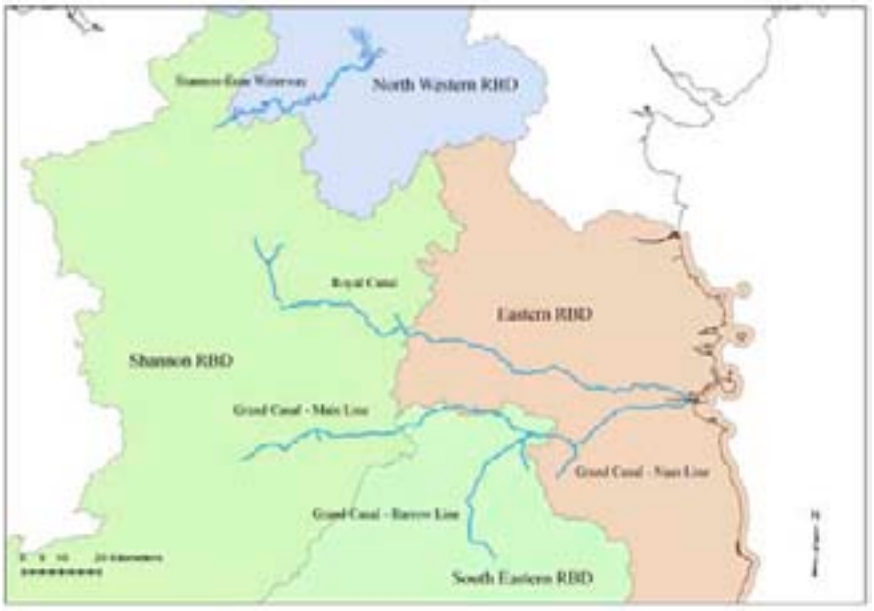
Irish river water quality can be compared directly with that of other European countries using the European Environment Agency's Waterbase database, which has a representative set of nutrient monitoring stations across Europe. Ireland's ranking for biochemical oxygen demand (BOD), ammonia,

Figure 4.4 Comparison of Ireland's River Water Quality with that of other European Countries 2007–2009 (Ireland is shown in green) (Source: EEA)



phosphate and nitrate is shown in Figure 4.4. This is based on a comparison of the reported concentrations in rivers across Europe in the period 2007–2009. Ireland's water quality compares very favourably with that of other EU countries, typically ranking in the top third of the 30+ assessed. However, there is no room for complacency as Ireland faces significant challenges in meeting the requirements of the WFD within the specified timeframes. These are the same as in most other EU countries. Pollution from nutrients and organic matter arising from sewage, agriculture and industrial sources is still the most common form of pollution across Europe. The WFD programmes of measures to address these sources are discussed further later.

Figure 4.5 Map showing Main Canal Systems Identified as Artificial Water Bodies (AWBs) under the Water Framework Directive (WFD). (Source: Waterways Ireland)



Canal Water Quality

The main canal systems (the Royal and Grand Canals) and sections of the Shannon-Erne Waterway have been identified as artificial water bodies (AWBs) under the WFD. They are required to achieve good ecological potential rather than ecological status. Ecological potential means that the water body is managed to achieve the biology that can be attained given its artificial nature. For classification purposes, the ecological potential can be maximum, good, moderate, poor or bad. The interim classification of ecological potential for Irish canals, based on chemical, biological and hydromorphological criteria, showed that 87% of the 332 km surveyed was at good ecological potential (Waterways Ireland and Central Fisheries Board, 2008).

Water-quality monitoring over the period 2007–2009 indicated generally good conditions in the Royal and Grand Canal systems and in the canalised section of the Shannon-Erne Waterway (Central Fisheries Board, 2008 and 2009). In 2010 and 2011 quality remained generally in good condition.

Lake Water Quality

In the period 2008–2010, ecological status was assigned to 208 lakes by the EPA, representing 981 km^2 of lake surface water covering 65% of the total lake surface area in Ireland (see Table 4.3).

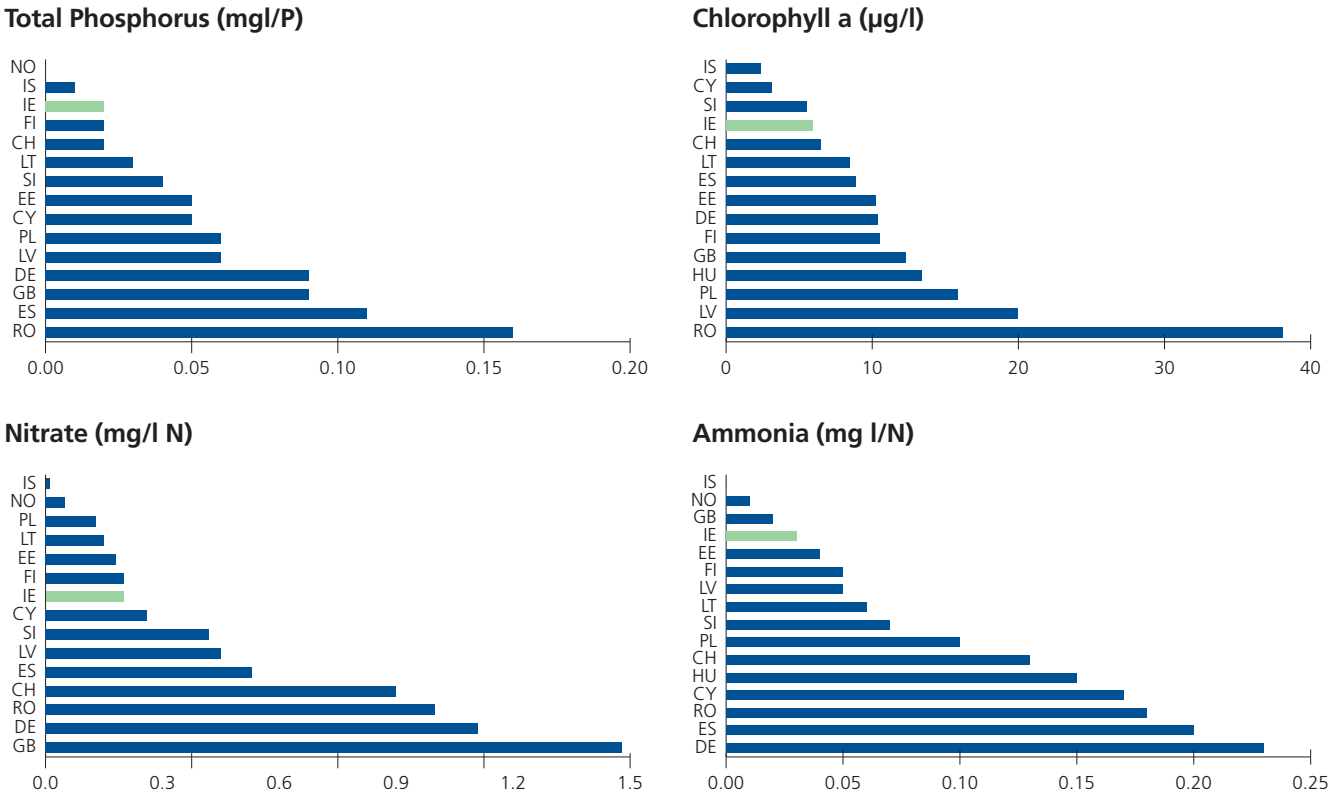
This shows that 97 (46.6%) lakes were of high or good status with the majority, 39%, in the latter category.

Ireland ranks very favourably in a comparison of nutrients and chlorophyll against other European countries. Figure 4.6 compares average concentrations of total phosphorus, chlorophyll, nitrate and ammonia in lakes over the period 2007–2009, which were the latest dates available at the time of writing. Ireland has the third lowest concentrations of total phosphorus; the 4th lowest concentrations of chlorophyll and ammonia; and the 7th lowest concentrations of nitrate or oxidised nitrogen in this representative network of lakes.

Table 4.3 Lake Water Quality in Ireland – Ecological Status 2008–2010 (Source: EPA)

Ecological Status	Number of Lakes	% of Lakes	Surface Area (km^2)	% Area
High	16	7.7	22.1	2.3
Good	81	38.9	412.0	42.0
Moderate	69	33.2	282.3	28.8
Poor	37	17.8	257.2	26.2
Bad	5	2.4	7.4	0.8

Figure 4.6 Comparison of Ireland's Lake-Water Quality with that of Selected Other European Countries (Ireland is shown in green) (Source: EEA)



As noted earlier with river quality, there is no room for complacency in terms of lake water quality, with only 46.6% of the monitored lakes achieving the targets of the WFD.

A reduction in the total amount of nutrients delivered to lakes via their tributary rivers is a key focus of the WFD programme of measures.

The EPA is working towards a set of phosphorus loading limits for individual lakes, based on an extensive new set of bathymetric measurements made over recent years that will allow volume and residence time of water in these lakes to be calculated and, thus, phosphorus loadings in terms of annual targets. Programmes of measures to achieve these new limits will need to be more focused than current measures, and to bring about further improvements in lake water quality. As with the rivers feeding into the lakes, these measures will focus on nutrient sources, both point source and diffuse.

Table 4.4 Transitional and Coastal Water Bodies Ecological Status 2007–2009 (Source: EPA)

	Number of Water Bodies	%	Area (km²)	%
High	19	16	1879	46
Good	36	30	729	18
Moderate	62	51	1500	36
Poor	4	3	5	<0.01
Bad	0	0	0	0
Total	121		4114	

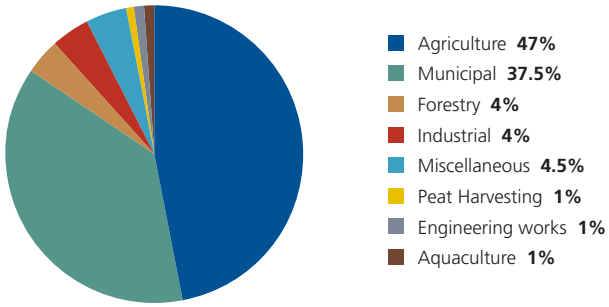
Transitional and Coastal Water Quality

A total of 121 transitional (estuaries) and coastal water bodies were assessed for the period 2007–2009 for WFD ecological status classification (Table 4.4). Of these 55 (46%) were classified as either high or good status with over 50% classed as moderate status and 3% assigned poor status.

In European terms, Ireland's transitional and coastal waters are relatively good – as might be expected from Ireland's western location on the North Atlantic. This is borne out by the OSPAR Commission assessments (OSPAR, 2009), which found that problem areas are confined to estuaries and the nearshore coastal zone. While transitional waters are under pressure due to the majority of Ireland's population living at or next to the coast, they still rank in the top five across Europe. For coastal waters, Ireland ranks at or close to the top in terms of proportion of water bodies meeting high status or high and good status. 70% of Irish coastal waters already reach this standard.

Urban wastewater treatment plants pose the biggest threat to transitional waters, but major improvements have been seen where new treatment plants have been installed (e.g. Sligo). Nitrate from agricultural sources is a particular issue in some estuaries such as the Argideen, near Courtmacsherry in Cork, where extensive sea lettuce growths have given rise to odour and nuisance problems. As with rivers and lakes, the reduction of nutrient inputs is the key to improving the status of Ireland's transitional and coastal waters.

Figure 4.7 Suspected Causes of Pollution at 953 Polluted River Sites Surveyed in 2007–2009 (from a total of over 2500 monitoring sites) (Source: EPA)



Drivers and Pressures

There is now a very good understanding of causes of water pollution in Ireland, based on long-term pollution-monitoring field work and supported by detailed risk assessments undertaken for the WFD, as well as international research. The pressures that impact on ecological status are clear and the corresponding remedies are also clear.

The EPA has identified the main suspected causes of pollution in water quality reports published over many years. The most recent overview for rivers is shown in Figure 4.7 (based on McGarrigle et al., 2010), in which 953 polluted river sites in catchments across Ireland – taken from a total monitoring programme of 2,500 sites – were analysed in terms of their catchments and observed sources of pollution in the field. These sites are all on rivers, but improving their water quality is also the key to improving water quality in lakes and transitional and coastal waters.

In broad terms approximately half of the 953 sites assessed are polluted due to what may be termed 'large point sources' such as municipal wastewater treatment plants. The other half are polluted as a result of diffuse sources, particularly agricultural activities, as well as a range of other activities such as forestry and peat harvesting.

Responses

Water Framework Directive

The seven River Basin Management Plans (RBMPs) submitted to the EU in 2010 include programmes of measures for the restoration or maintenance of the status of all water bodies by 2015, 2021 or 2027.

The programmes of measures described in the RBMPs are effectively the application of the generic measures, listed below, in various combinations to some 5,500 water bodies.

1. Controlling the inputs of phosphorus and nitrogen to waters.
2. Controlling inputs of oxygen-using matter (e.g. silage, milk waste, sewage).
3. Controlling pathogens in water.

Table 4.5 Percentage of River Water Bodies within Individual River Basin Districts Planned to Achieve at Least Good Status by 2015, 2021 or 2027

River Basin District	2009	2015	2021	2027
Eastern	40	~40	80	100
Neagh Bann	22	27	99	99
Northwestern	54	71	99	99.9
Southeastern	47	60	100	100
Shannon	42	61	99	99
Southwestern	67	84	99.7	100
Western	66	74	99.9	100

4. Complete elimination of dangerous substances (priority substances) and control of specific pollutants to protect aquatic communities and human health.
5. Ensuring that there is a sufficient volume of water in all our water bodies.
6. Controlling hydromorphological conditions (physical characteristics of the shape and boundaries of the water body) both in-stream and along riparian zones.

Reaching these goals of the WFD is the major task now facing Irish water managers (Table 4.5). The plans themselves may be seen as somewhat generic, but with prioritisation and breakdown to local level, together with on-the-ground actions, progress can be made. Examples of such progress already made are outlined in the topic boxes: 'Encouraging Results in Limerick' and 'Elimination of Serious Pollution'.

Between 2010 and 2012, the European Commission conducted a 'Fitness Check' of EU Freshwater Policy and an assessment of the RBMPs of the EU Member States. It found that there were weaknesses in the implementation of the current EU water legislation across Europe generally and that, in addition, there are conflicts between the EU's water policy and other sectoral policies' objectives (EC, 2012). In particular, the EC identified the need for improved coherence with the Common Agriculture Policy and with EU Regional Policy to ensure EU funds are better targeted at measures that deliver improvements to water and compliances with water legislation. Improved coherence is also needed with renewable energy and transport policy to ensure that measures adopted for climate mitigation do not cause unintended negative impacts on water. As part of a response to the challenges and to ensure the achievement of EU water policy objectives, the EC has proposed a *Blueprint to Safeguard Europe's Water Resources* (EC, 2012). The overall aim of the Blueprint is to ensure availability of good-quality water for sustainable and equitable water use in line with the WFD objectives. The time horizon of the Blueprint is 2020, as it is closely related to the EU Resource Efficiency Roadmap, and will in fact be the water milestone on that Roadmap.

The main focus of the proposed Blueprint is to:

- improve the implementation of current EU water policy
- foster the integration of water and other policies' objectives, with trade-offs managed on the basis of a better understanding of the costs and benefits of both economic activities and water resources management
- seek the completion of the EU water policy framework, especially in relation to water quantity, efficiency and adaptation to climate change.

Tackling Diffuse Pollution

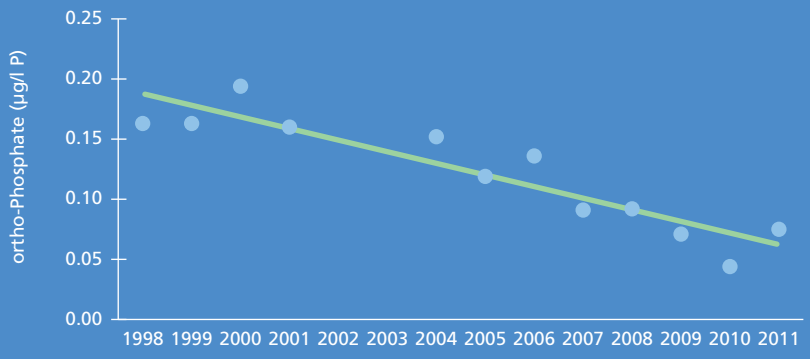
Agricultural activities associated with water pollution include land spreading of artificial fertilisers and animal manures in unsuitable climatic and ground conditions, silage effluent discharges, farmyard runoff, watering animals and poorly managed ring feeders.

A range of actions are available to control water pollution under existing legislation. The implementation and enforcement of the Nitrates Action Plan under the EU Nitrates Directive is the most important measure to address diffuse agricultural pollution of freshwaters. This includes a code

Encouraging Results in Limerick

Catchment surveys and intensive follow-up measures by the local authority focused on stemming diffuse pollution in the catchment of the River Deel in Co. Limerick have shown some dramatic improvements. Phosphate levels in the River Deel have dropped by a factor of three since 2002 (Figure 4.8) and ecological status had improved as a result (Goggin, 2011). The increase in concentration in 2011 is attributed to slurry spreading, at the start and end of the close period when conditions are at their wettest, causing runoff to water.

Figure 4.8 Decline in Phosphate Concentrations in the River Deel, at Askeaton Bridge, Co. Limerick (Source: Goggin, 2011)



of Good Agricultural Practice (GAP) which is mandatory for all farms. The Department of Agriculture, Food and the Marine (DAFM) undertakes approximately 3,500 farm surveys each year under cross-compliance rules. However, the GAP Regulations are unlikely to be sufficient to protect high-status water bodies in all cases, and special sub-basin plans have been prepared for freshwater pearl mussel catchments. In addition, DAFM and the EPA licensing and enforcement activities have important roles in the regulation of landspreading of slurry generated through intensive agricultural activities.

The measures for tackling pollution must also be also integrated with other measures, such as drinking water source protection or bathing and shellfish waters management. Surface water–groundwater interactions must be taken into account, and likewise river–lake and river–estuary interactions, to ensure that an holistic approach is taken to water management in Ireland. Finding sources of diffuse pollution can be difficult. New investigative tools such as the Small Stream Risk Score (developed during the first phase of the WFD implementation) allow sources of diffuse pollution to be pin-pointed by sampling small streams across a catchment upstream of a mainstem river site that is polluted.

Domestic Waste Water Treatment Systems

In most rural areas the majority of the population use on-site wastewater treatment systems such as septic tanks. If poorly sited and/or not properly maintained, these systems can pollute groundwater, surface water and drinking water supplies and impact on human health. The EPA has published a revised code of practice for wastewater treatment and disposal systems in unsewered areas (EPA, 2010) that is referenced in revised building regulations and will be applicable for all new builds. New legislation dealing with registration and inspection of septic tanks was passed in 2012 (Water Services (Amendment) Act 2012). This legislation is Ireland's response to a European Court of Justice (ECJ) ruling against Ireland in relation to on-site waste water treatment systems. The new legislation provides for the establishment of a registration system for domestic on-site waste water treatment plants and requires the EPA to put in place a national inspection plan in conjunction with the local authorities.

Forestry Issues

Afforestation on peat soils has the potential to cause significant nutrient and silt losses at the establishment and harvesting phases especially. Large areas of maturing conifers planted on upland peat soils are due to be harvested in the coming years. Residual phosphorus left behind can leach out into surface waters due to the low capacity of peat to bind phosphorus. Silt loss from harvesting operations can damage salmonid spawning beds or freshwater pearl mussel populations. Control of silt and nutrient losses is required to minimise the impact of forestry on water quality. The Forest Service's iFORIS GIS-based management system for forestry grants is being used to ensure that planting, felling and road building operations in forests are approved only following detailed environmental consultation with a range of public bodies and the general public.

Tackling Point Source Pollution

In some respects, point source pollution is easier to resolve than that from diffuse sources, because the location and pollutant load can be identified. In many cases, the large point sources of pollution will require investment and infrastructure upgrades, as indicated in the EPA's regular reports on urban waste water treatment. A key finding of the EPA's most recent assessment on urban waste water treatment plants (Monaghan et al., 2012) shows that discharges from 57 waste water works are causing pollution in rivers or bathing waters. The other main findings of this assessment are that:

- 93% of urban waste water discharges in Ireland received secondary treatment or higher (Figure 4.9)
- 11 large urban areas do not meet the Urban Waste Water Treatment Directive (UWWTD) requirement to have secondary treatment in place. These include, for example, Bray and Ringaskiddy, where the provision of treatment is now 10 years overdue; Clifden, where the old plant is impacting on bathing water; and Moville, where discharges are causing serious pollution to the River Bredagh
- Eight urban areas do not meet the UWWTD requirement to provide nutrient reduction in addition to secondary treatment for discharges to sensitive water areas by specified dates. These areas include the cities of Dublin, Cork and Kilkenny
- 46% of waste water treatment plants did not meet all waste water quality standards or EPA guidelines.

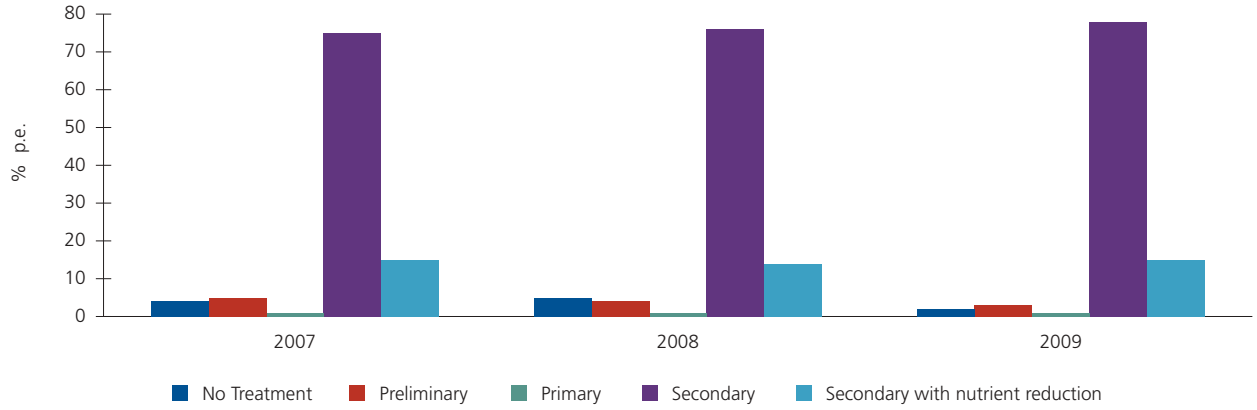
Perhaps one of the biggest changes since the publication of the last State of the Environment Report in 2008 was the introduction of a formal licensing system for municipal waste water treatment plants. The EPA is responsible for licensing waste water treatment plants for large towns, and for certification of treatment plants for smaller agglomerations. The EPA had granted 190 licences and 512 certificates by the end of 2011. Compliance with these licences and certificates will continue to drive improvements in waste water treatment and water quality in Ireland.

The EPA also regulates the discharges from many larger enterprises in Ireland through the Integrated Pollution Prevention and Control licensing regime. This has been partly responsible for the decline in the number of seriously polluted water bodies since 1993.

Elimination of Serious Pollution

The extent of serious pollution of rivers has been reduced significantly in recent years due to increased enforcement as part of a national programme coordinated by the EPA – the 'Red Dot programme'. In 2004–2006, 39 sites were categorised as seriously polluted, in 2007–2009 this had dropped to 20 sites and in 2011 there was a further significant reduction to 11 sites. Currently, approximately 18 km of river channel remains seriously polluted from a total length of 13,200 km surveyed under the WFD.

Figure 4.9 Level of Treatment in Irish Wastewater Treatment Plants 2007–2009 Based on Equivalent Number of Persons (Source: EPA)



Outlook

Over the years, water protection efforts have succeeded in reducing the extent of serious pollution in rivers from 174 km in 1971 to just 18 km in 2011. The main task now is to improve the status of some 4,000 km which is currently at less than good ecological status. With a focused programme, emphasising the same site-by-site approach, that has worked well with the seriously polluted sites, progress can be made in achieving the status targets set out in the RBMPs under the WFD.

Lake water quality has remained relatively static over recent decades, albeit with some dramatic reductions in chlorophyll levels due to the introduction of zebra mussels. Lakes will respond to measures to reduce nutrient inputs more slowly than rivers, but nonetheless the measures taken to address river pollution are also the key to improving lake water quality, as very few lakes have direct discharges into them.

Some improvements in the water quality of transitional and coastal waters have been noted due to the commissioning of new waste water treatment plants in coastal towns such as Sligo Bay and the Liffey estuary. There is still a significant lack of adequate treatment levels in many coastal towns, with 42 towns, important as tourist centres linked to water activities, without secondary treatment. The control of nutrient inputs from inland diffuse and point sources is also crucial in improving the water quality of estuaries and bays.

Groundwater status is heavily dependent on surface water status, and a good understanding of the linkages between surface water and groundwater is required in order to ensure success in improving groundwater quality. Overall, there is a continued need for improved protection of groundwater, especially in the context of achieving the WFD objective of good status for all waters by 2015. In some instances, it will not be feasible to meet this objective by this deadline, as it may take a number of years for the measures to bring about a reduction in concentrations of nutrients. This is because the nitrate and phosphate will require time to flush through the groundwater system. If all the basic and supplemental WFD measures are implemented, the objectives should be reached within the 2021 or 2027 extended deadlines. However, for a small number of water bodies (for example, with pollution from historic mining activities), it is likely that it will not be technically or economically feasible to achieve the WFD objective by 2027. These bodies will be candidates for less stringent objectives.

Special protection measures are needed to protect and restore high-status waterbodies of all types, as they are susceptible to degradation due to pressures such as field drainage and fertilisation, tree planting, tree felling, house-building, onsite waste water treatment plants, insecticide usage, road building and wind farm construction. The impacts of these pressures are not always easily controllable under current legislation.

The development strategy for the agriculture sector, *Food Harvest 2020* (DAFF, 2010) proposes a 50% increase in milk production by 2020. While environmental sustainability is a key underlying principle of *Food Harvest 2020*, the milk production targets will present a significant challenge to meeting WFD objectives. It is vital that future agricultural practices be developed and implemented to be fully sustainable, and not prevent Ireland from meeting its EU obligations in relation to water.

The paper on the Reform of the Water Sector in Ireland (DECLG, 2012) confirmed the strategic importance of Ireland's water resources and signalled the Government's intent to take a national approach to water with the aim of conserving water resources and increasing the cost efficiency associated with water provision. In April 2012, the Government announced the creation of Irish Water as an independent State-owned subsidiary within the Bord Gáis Éireann group. It is envisaged that Irish Water will take over the water investment programmes of the 34 county and city councils, with the key aim of supervising and accelerating the pace of delivery of planned investments needed to upgrade the water and sewerage networks.

Conclusion and Future Challenges

Overall, while water quality in Ireland is good relative to other EU countries, Ireland faces some considerable challenges in the coming years to meet the requirements of the WFD and other water directives.

The three main challenges for water quality management are to eliminate serious pollution associated with point sources (waste water treatment plants); to tackle diffuse pollution (pollution from agricultural activities and septic tanks); and to use the full range of legislative measures in an integrated way to achieve better water quality. There is a pressing need to develop site-by-site actions for the water bodies reported as being at less than good status. By prioritising a subset of these each year, improvements can be made in rivers in the short term (with a slightly longer recovery time for lakes and estuaries). In the longer term, the formal timelines set out in the RBMPs for improvements (Table 4.5) can be achieved even though they are quite ambitious, provided the necessary structures and resources are in place.

However, the current governance arrangements for the implementation of the Water Framework Directive are inadequate. The published River Basin Management Plans noted that:

"The current administrative systems are fragmented along administrative lines and do not facilitate analysis, identification and implementation of the most cost-effective solutions to manage water quality at river basin level. An RBD can cover the areas of responsibility of a large number of bodies e.g. 18 local authorities in the case of the Shannon RBD. Furthermore, the implementation of many of the measures necessary to achieve the objectives of the plans is the responsibility of national rather than local authorities."

Discussions to resolve this issue are ongoing between the DECLG, EPA, local authorities and other relevant bodies, and these are running in parallel with the development of the new model for management of national water services – Irish Water. The emerging consensus of a governance structure for the WFD is that it would consist of three interlocking levels with specific roles identified at each level, as follows.

Tier 1: National Management and Oversight: Led by the DECLG, the main emphasis would be on:

- preparation of policy and national regulations
- steering the WFD implementation at a national level
- addressing funding priorities, including integrating the Water Services Investment Programme and WFD programmes of measures
- national-level interaction with Irish Water
- planning and development coordination related to water-quality issues.

Tier 2: National Technical Implementation and Reporting: Led by the EPA, the activities would focus principally on:

- monitoring, assessment and reporting
- production of River Basin Management Plans
- evaluation and implementation of measures
- monitoring of enforcement tasks and environmental outcomes.

Tier 3: Regional Implementation via Water Networks: Led by the lead local authority within the RBD, this level would address:

- public awareness and participation
- implementation of Programmes of Measures by relevant public bodies, tracking and reporting, in consultation with EPA
- local authority monitoring, licensing and enforcement actions
- follow-up investigative monitoring aimed at pin-pointing sources of pollution.

As the key aims of the WFD are to maintain the existing satisfactory water status where present in surface waters and groundwater and to achieve good status where the status is currently unsatisfactory, the governance structures and administrative arrangements must support this in every way possible. As such, it is essential that the relevant Government departments, State agencies and local authorities work in close partnership to meet Ireland's obligations under the WFD in as efficient and effective a manner as possible.

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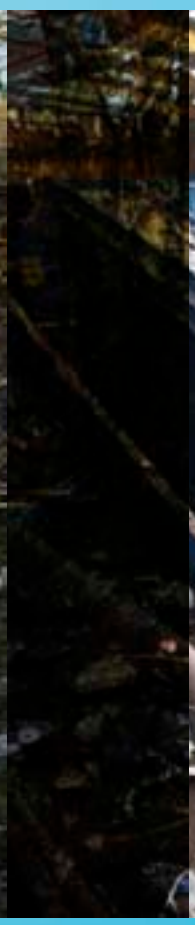


Chapter 5
Sustainable Resource Use, Consumption and Waste

Since 2008, there have been sharp decreases in Ireland in commercial and household waste volumes, in line with the downturn in consumption and economic growth. Waste volumes associated with the construction sector have collapsed by 81% since 2007. Industrial wastes (including hazardous wastes) are stable, reflecting the relative stability of manufacturing industry, the main contributor to this waste stream.

Ireland has achieved its EU waste recycling and recovery targets for waste packaging; for waste electrical and electronic equipment; and for household waste paper, metals, plastic and glass. Ireland has also achieved the first target for diversion of biodegradable waste from landfill as required under the EU Landfill Directive. However, Ireland has failed to meet the EU re-use and recovery targets for end-of-life vehicles.

The waste collection sector has changed dramatically in the past four years, with the majority of local authorities exiting the domestic waste collection market. Moreover, as of 2012, virtually all households on a collection service are now offered a two-bin service (dry recyclables and residual), and 34% of serviced households are offered a three-bin collection (includes organics bin).

Ireland's first merchant municipal waste incinerator commenced operation in 2011, and the use of waste-derived fuels in industrial energy plants has grown significantly. Fifteen of Ireland's 28 operational municipal landfills will run out of consented capacity in three years, and there is only 12 years gross municipal landfill disposal capacity in the State. Ireland continues to export nearly half of its hazardous waste for treatment/disposal.

The recently transposed EU Waste Directive will have a profound influence on waste management practices and policy for the foreseeable future. In addition, the increasing levy on disposal of waste to landfill is driving post-consumption management options up the waste hierarchy towards more sustainable behaviours.

Introduction

Waste management continues to be a central issue for policy makers in Ireland and the EU. Resource use and waste generation are at unsustainable levels throughout the EU (EEA, 2010). Raw material consumption in Europe is 16 t per person, with 6 t of this ending up as waste (EEA, 2010).

The past decade has seen significant changes in relation to how waste is managed in Ireland. The policy and regulatory regime developed in this period has yielded significant and measurable improvements. Ireland has moved quickly from a position of almost total reliance on landfill for managing waste to a system of sophisticated post-collection treatment, yielding higher levels of recovery of many recyclable waste materials.

Although the recent recession has impacted on generation of certain waste streams (e.g. commercial, construction and demolition), EU legislation and policy as implemented continues to be a primary driver of change in relation to waste management practices in Ireland: such policy deals with general issues of waste management, as well as permitting, enforcement and reporting. A second key driver is the landfill levy; its introduction in 2002 was mirrored by a downward trend in the percentage of municipal waste disposed. In addition, the EU has a range of both waste-stream and substance-specific producer/holder responsibility control frameworks, that have resulted in significant improvement in the management of certain recoverable or problematic wastes (e.g. packaging and waste electrical and electronic equipment (WEEE)).

Waste management has become hugely complex in recent years. The past five years has seen the introduction to the national waste management arrangements of a large number of collectors, intermediary processors, transfer and treatment activities. Waste generation and management in Ireland are reviewed annually in the EPA National Waste Reports. An update is published each year, with a full industrial waste survey being conducted every second year. Data for the national waste reporting come from thousands of returns and surveys of waste producers, handlers and disposal/recovery activities nationally and internationally, as well as from a range of compliance schemes.

The Current Situation

Economic Changes and Waste Generation

The Irish economy grew strongly between 2000 and 2007 but has contracted sharply since then. One macroeconomic measure of resource use – domestic material consumption (DMC) – peaked in 2007 at over 50 t per person in Ireland compared to an EU average of 16 t per person (EEA, 2010). This largely reflects the building boom at the time. Even allowing for the building boom, the data would suggest that Ireland has a considerable distance to go in relation to ensuring sustainable production and consumption patterns.

Figure 5.1 shows the most up-to-date information for the principal categories of waste arising in Ireland, which amounts to 11.8 million tonnes (EPA, 2009a, 2012a).

Figure 5.1 Principal Sources of Waste in Ireland (Source: EPA)

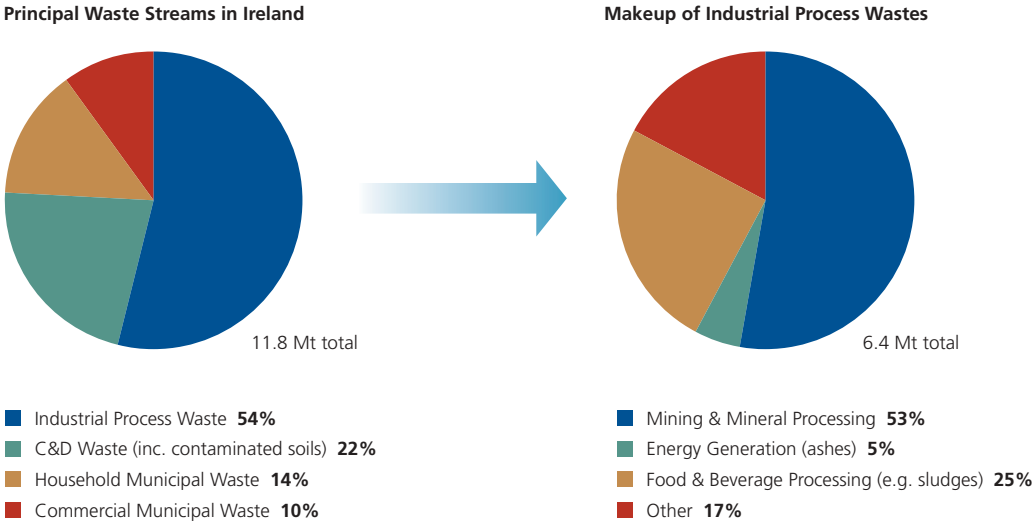
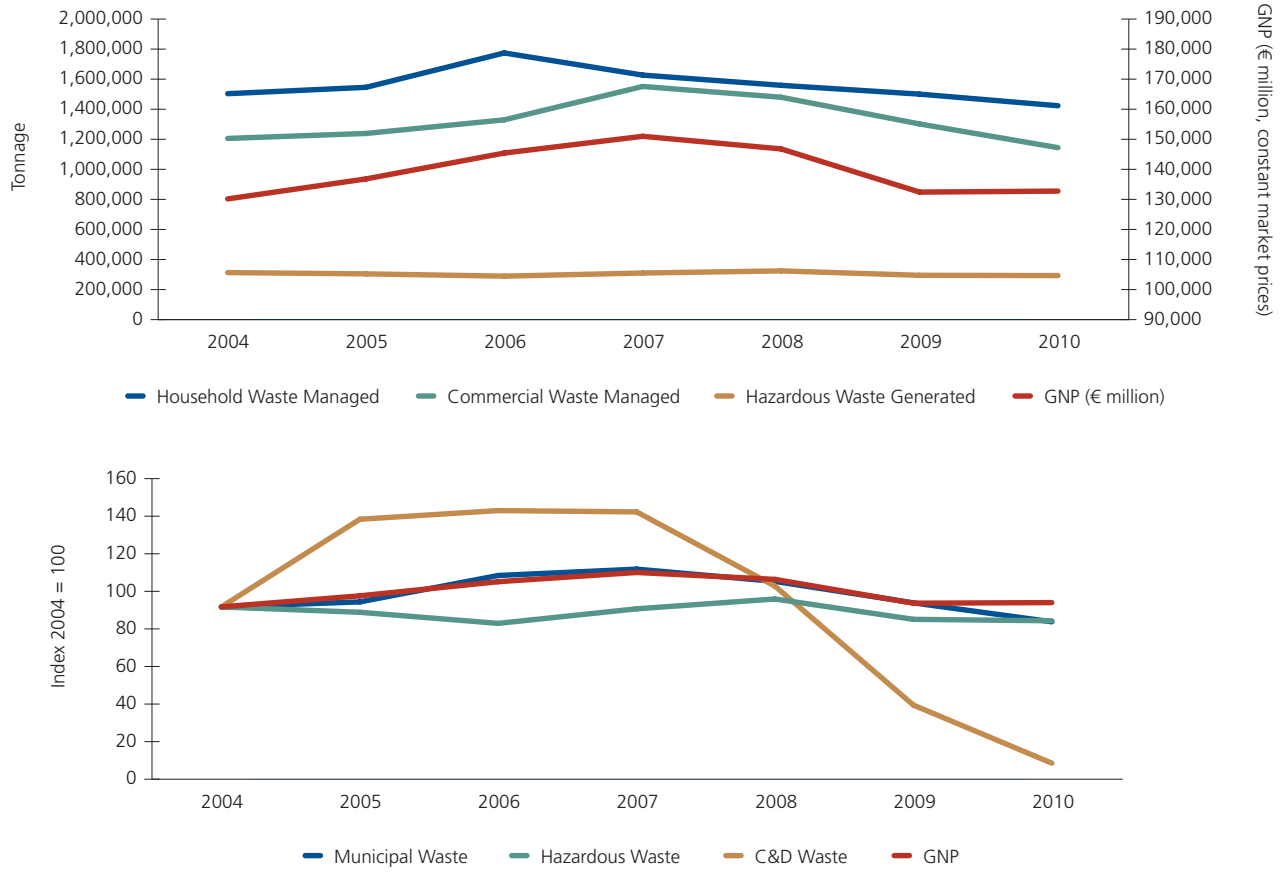


Figure 5.2 Waste Generation and Economic Performance (Source: EPA, CSO)



At 6.4 million tonnes, process industrial waste dominates the list, and is virtually unchanged since 2006. A substantial proportion of this 6.4 million tonnes of industrial process waste is mineral in nature (approximately 3.7 million tonnes) mainly as a result of Ireland's significant mining and ore processing activities (Figure 5.1).

The impact of the economic downturn is very marked in a number of the waste streams (Figure 5.2). Household waste was the first to respond to the economic pressures, followed by commercial waste: both streams remain in sharp decline despite a stabilising of GNP. Hazardous waste as a surrogate for industrial performance has remained stable, reflecting the performance of large manufacturing sectors. The collapse of the construction and demolition sector is very marked.

The challenge for Ireland is to ensure that waste generation does not increase at a matching rate to economic recovery and that the strong link between consumption and waste generation on one hand, and economic growth on the other, is broken.

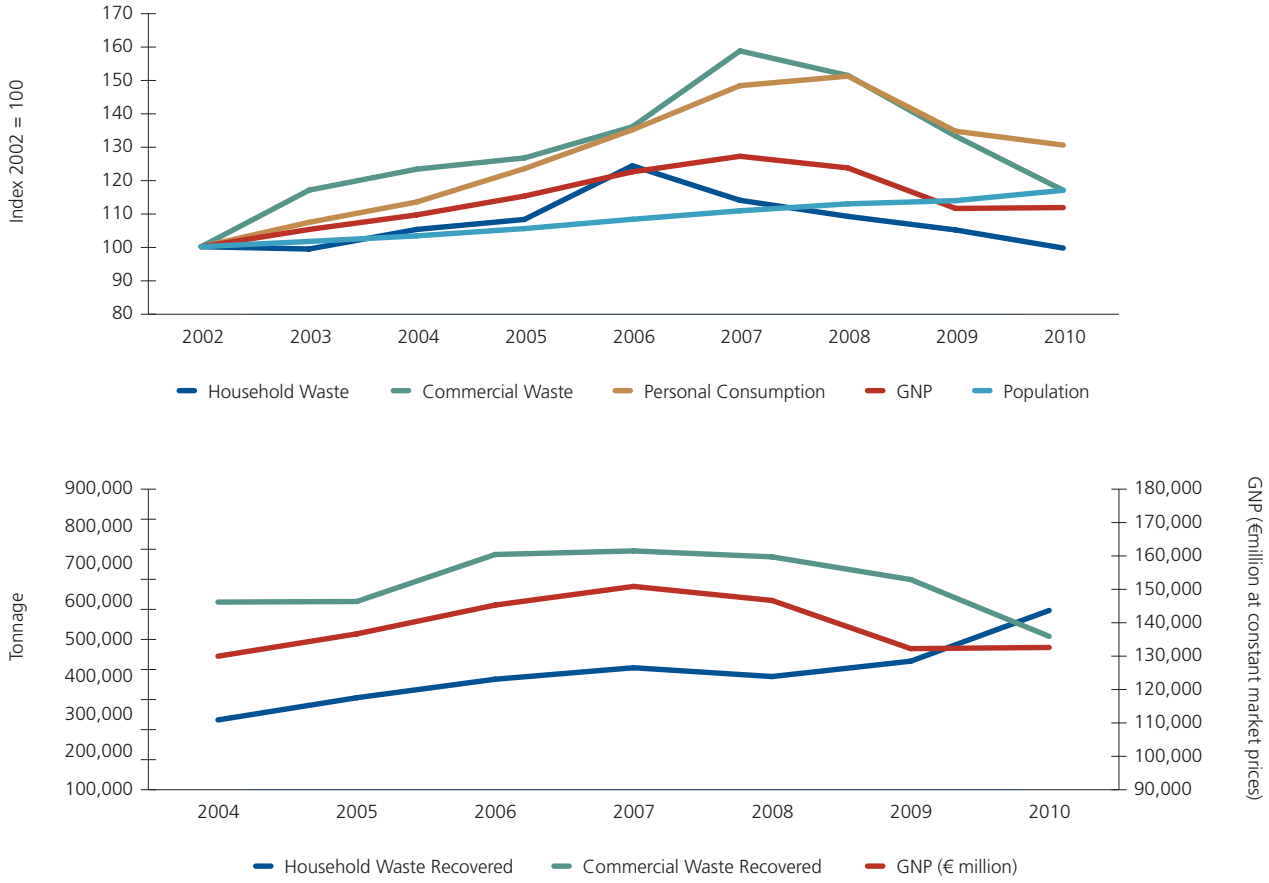
Municipal Waste Management

Municipal waste in Ireland is made up of household waste, commercial waste (including non-process industrial waste) and cleansing waste (e.g. street sweepings, municipal parks and maintenance waste). This stream and its component parts are given extended attention here as they are good indicators of the sustainability of consumption behaviours within society.

In 2010, municipal waste generated amounted to just over 2.85 million tonnes, a 16% reduction on the peak seen in 2007 (EPA, 2009b, 2012a). There is a strong correlation between the recent reductions in waste volumes and the abrupt fall in personal consumption even though population has continued to grow (Figure 5.3).

Municipal waste generation includes a provision for estimated uncollected household waste of 266,000 t. This tonnage equates to an estimated 16% of occupied houses in the State that do not avail of a waste collection service.

Figure 5.3 Trends in Generation of Municipal Waste, GNP, Population and Consumption (Source: EPA, CSO)



Municipal waste generated per person in 2010 amounted to 621 kg (800 kg in 2006) compared to an EU average of 513 kg (EuroStat, 2012; EPA, 2012). However, definitions of municipal waste vary widely across the EU, so the statistics are not definitively comparable. Nevertheless, a national reduction of 22% in municipal waste generation per person in four years (2006 to 2010) is a significant achievement. Recovery rates for municipal waste have been improving, reaching 42% in 2010 with the balance of 58% being landfilled. In 2010, Ireland's recycling rate (excluding energy recovery) was 38% (Figure 5.4), which is close to the EU average of 42% (EuroStat, 2012). Almost 77% of the recyclable municipal wastes were exported for material recovery.

Household Waste

Household waste generated per person in Ireland in 2010 amounted to 368 kg which is considerably less than the EU average of 444 kg (EuroStat, 2012; EPA, 2012a). It would appear that household waste generation is more strongly influenced by disposable income than by population changes. The proportion of household waste recycled has been increasing over the past few years despite the overall reduction in the amount generated (Figure 5.3). The challenging economic circumstances for households, together with the financial impact of the landfill levy and availability of source separate collections, have driven the rise in recovery in recent years. However, weight-based charging (especially for the residual or black bin) is not well developed across the State and therefore a major incentive for even stronger growth in household waste recovery achievement is largely absent.

Commercial Waste

Contrary to the trends in household waste recovery, recovery rates for commercial waste have been falling in line with economic trends and the overall decline in commercial waste generation (Figures 5.2 and 5.3). This is a difficult trend to explain, and it may be that commercial activities associated with high personal consumption were disproportionately contributing to recycling rates up to 2007 (e.g. retail, food and entertainment).

Figure 5.4 Municipal Waste Management: Ireland and EU 27 Average (Source: EPA, EuroStat)

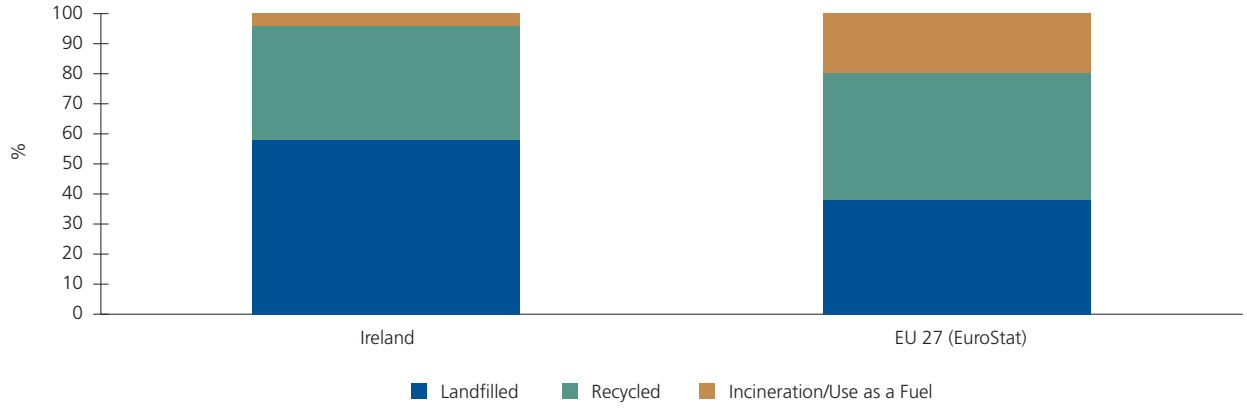
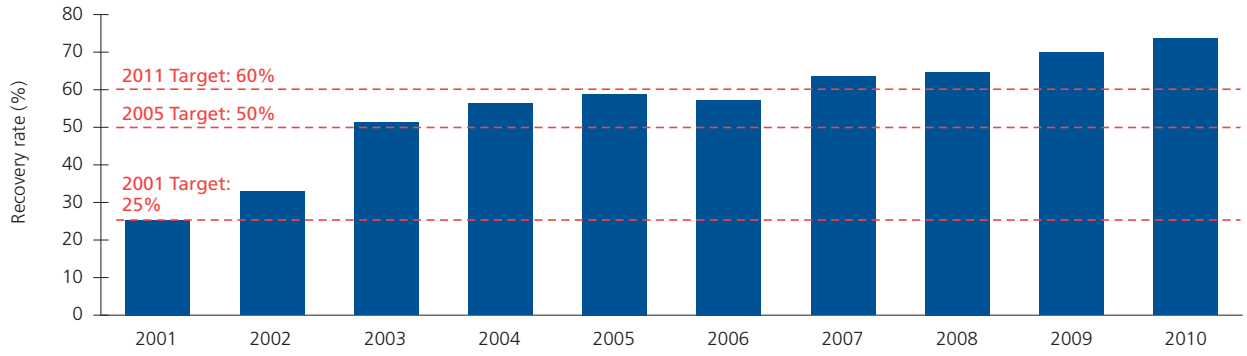


Figure 5.5 Recovery of Packaging Waste, 2001–2010, and Progress towards EU Targets (Source: EPA)



Biodegradable Municipal Waste

Biodegradable municipal waste (BMW) comprises those elements of the household, commercial and cleansing waste streams that will rot or degrade biologically. The main constituents of the biodegradable proportion of municipal waste are typically parks and garden waste, food waste, paper, card and textiles. The quantity of BMW generated in 2010 was 1.8 million tonnes, of which 0.86 million tonnes was disposed at landfill. This represents a 42% decrease on that landfilled since 2007. The fall in municipal waste generation; the increased home composting and kerbside collection for treatment of organic waste; and the ongoing diversion to recovery of paper and card are contributing to this excellent result. In 2010, 35% of houses on a kerbside collection service had an organics bin service (three bins). However, the availability of the third bin varies hugely across the State, with a 10% or less penetration in 15 Local Authority areas.

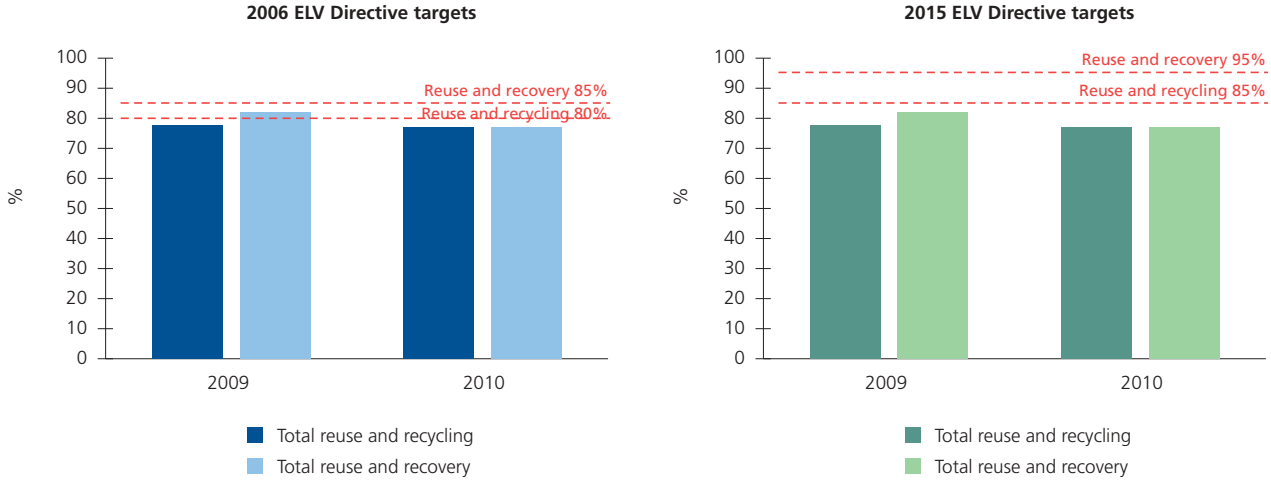
Ireland has met the July 2010 EU Landfill Directive target for diverting biodegradable waste from landfill. However, sustained effort will be required to ensure the 2013 and 2016 targets are met: Ireland is currently 250,000 t in excess of the 2013 limit of 610,000 t biodegradable waste disposed to landfill, and 433,000 t from the 2016 target of 427,000 t. It is anticipated that waste-to-energy incineration at merchant incinerators or at large energy units attached to industrial facilities (e.g. cement manufacture) will play a role in achieving these targets.

Producer Responsibility Initiatives

Ireland has met and surpassed all statutory packaging recovery targets set since 2001. A recovery rate of 74% is reported for packaging waste in 2010, surpassing the EU target of 60% due in 2011 (Figure 5.5). However, Ireland is failing to meet the 2006 EU targets for re-use/recycling/recovery of ELVs (Figure 5.6).

In 2010, a total of 45 thousand tonnes of WEEE was collected for recovery. This equates to 10 kg per capita, exceeding the modest EU target of 4 kg per capita and putting Ireland in the top five of European performers in this area. Ireland has exceeded the interim EU Directive target of collection for recycling of 25% of portable batteries placed on the market.

Figure 5.6 Progress towards EU ELV Recovery Targets (Source: EPA)



Hazardous Waste

Waste is classified as being hazardous when it displays properties that make it dangerous or potentially harmful to human health or the environment. Industry is the largest generator of hazardous waste in Ireland, though notable amounts are also generated by healthcare activities, households, educational facilities, small businesses and other organisations. The quantity of hazardous waste managed in 2010 decreased by less than 1% from 2009, to 288 thousand tonnes, and originated primarily from the pharmaceutical and chemical industries. Hazardous waste generation is a good surrogate for the economic performance of the manufacturing sector, and the modest decline in recent years confirms the stability of this sector despite the economic challenges.

Of the 288 thousand tonnes of hazardous waste reported in 2010, approximately 26% is treated on the site of production (e.g. distillation, on-site incineration and on-site landfill), and of the remainder, 143 thousand tonnes – or 50% – is exported for treatment. Four European countries take 91% of Ireland's hazardous waste exports (UK, Germany, Belgium and the Netherlands).

Figure 5.7 Distribution of Landfill Capacity in Ireland (Source: EPA)

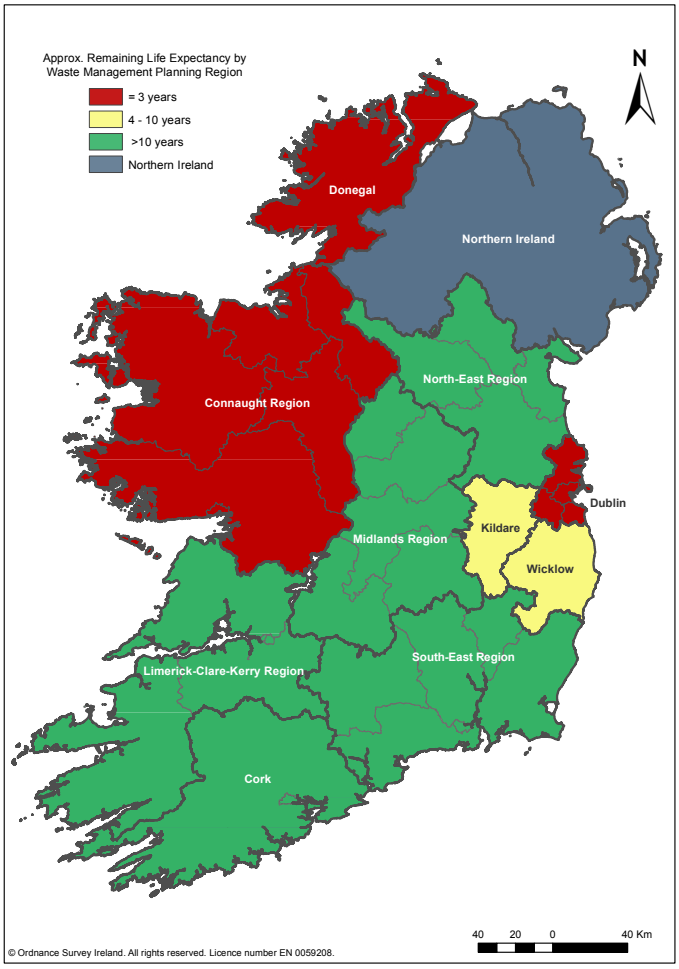


Table 5.1 Waste Infrastructure (Source, EPA)

Principal Infrastructure Capacities (in Ireland)	
Landfill	18Mt or 12 years at current fill rates
Merchant WtE Incineration	200,000 tpa
Refuse Derived Fuel Co-incineration (e.g. Cement Plants)**	343,000 tpa
Biological Treatment*	550,000 tpa
Bring Banks	1,922 facilities
Civic Amenity Sites	107 facilities

** Reported by Irish Waste Management Association*
*** Included proposed developments at Quinn Cement*

Waste Infrastructure

Relative to other EU Member States, Ireland's waste infrastructure has not been overly complex or comprehensive. This is changing rapidly, with more sophisticated infrastructure for pre-treatment and end-treatment of waste recently developed or currently under development. There is a continued reliance on landfill (58% in 2010), while for waste recovery/recycling, the greater part of candidate materials is exported, although some indigenous capacity is developing. A merchant municipal waste incinerator commenced operation in 2011, but no merchant hazardous waste incineration capacity is currently operational.

In recent years there has been a significant growth in the use of refuse-derived fuels in industrial boilers/furnaces (co-incineration) (Table 5.1). In 2008 a reported 88 thousand tonnes of waste was used as a fuel, which grew to 183 thousand tonnes in 2010. In 2008, the bulk of this refuse-derived fuel was timber, but in 2010, general municipal-waste-derived material was the dominant element (from processing of residual household and commercial bins) (EPA, 2009a, 2012a). There is now a national capacity to use over 340 thousand tonnes of municipal-waste-derived fuels in national cement kilns. Such use replaces fossil fuel use, reduces the land-take for waste disposal and assists compliance with EU landfill diversion targets.

Significant biological treatment capacity is available (Table 5.1), with more currently in the regulatory process. The main deficit is in relation to biological treatment facilities for the residual municipal waste stream prior to disposal to landfill.

In 2010, there were 28 EPA-licensed municipal waste landfills operating nationally. It is estimated that at current fill rates, 15 of the existing 28 municipal solid waste landfills will use up their consented capacity within three years. Significantly, landfill capacity is not distributed evenly throughout the State and some regions have very limited landfill capacity (Figure 5.7). National consented municipal waste landfill capacity currently stands at approximately 18 million tonnes which represents about 12 years' capacity at current fill rates. In national infrastructure planning terms this is not considered an appropriate level of availability, due to the lead-in time required for new facilities in terms of planning and licensing. 43% of the capacity is owned by just four private sector facilities.

In 2010, there was one civic amenity site per 43,000 persons, and one bring bank per 2,400 persons, in operation (Table 5.1). Nearly 20% of household waste is presented at civic amenity and bring centres, underlining their significant role in the national waste infrastructure, and essential role in waste collection universal service provision (household waste collection does not comprise just kerbside activities).

Drivers and Pressures

Consumption and Waste Generation

Consumption patterns are shaped dynamically by a variety of interacting social, cultural, political and economic influences in Ireland, Europe and the world. The natural assets or ecosystem services and resources available are limited and their current use is unsustainable (EEA, 2010). Consumption drives the whole resource use life-cycle. Household consumption is considered key, as consumer decisions are made daily about which products/services will be consumed. Industry is also a significant consumer of raw materials, only a fraction of which is derived from secondary resources (EPA, 2009a, 2012a). The increasing import of resources, including energy, into

Ireland and the EU is transferring the environmental impact of associated consumption to other parts of the world.

Resource Efficiency

Resource efficiency (also often referred to as eco-efficiency) comprises five elements:

- water conservation
- waste prevention
- energy efficiency
- clean technology
- eco-design.

Establishing a resource-efficient society is a complex matter that involves changing production and consumption activities and behaviours in our homes and in the workplace. A consumer's attachment to unsustainable products (e.g. less energy-efficient; difficult to repair, recycle) is environmentally damaging and a false economy for the household. The increasing demand from informed consumers and clients for 'green' and sustainable products and services provides new opportunities for enterprises to meet customer needs. In addition to new markets, companies are becoming increasingly aware of the financial savings and competitive advantage that arise from adopting an environmentally sustainable and resource-efficient approach to their own business. This advantage comes through awareness of, and action on, such key business pressures as energy costs, raw material costs and supply, and waste management costs.

Responses

EU Resource and Waste Policies

Changing consumption and production behaviours are considered central to the resource-efficiency challenge, as is the need to consider the whole life-cycle of the way resources are used. The implementation of the resource efficiency and waste prevention aspects of the EU Waste Framework Directive (EP & CEU, 2008) is an important policy intervention. Unsustainable consumption and use of resources in products has been the subject of EU policy in relation to Integrated Product Policy and Eco-design of Energy-using Products based on life-cycle thinking (EC, 2003, EP and CEU, 2009).

In 2011 the EU published a 'roadmap' on resource efficiency in Europe (EC, 2011) which sets out the EU ambitions and milestones in this topic area up to the year 2020. A number of the identified actions relate directly to waste (e.g. prevention, re-use, reduce hazardousness, consumption and production efficiency). The roadmap sets resource efficiency as key to this vision and establishes milestones and actions as well as a framework for how policies interrelate. The EC noted that resource efficiency will bring increased competitiveness and new sources of growth and jobs through cost savings from reduced raw material use, commercialisation of innovations and better management of resources over their whole life cycle.

National Policy and Implementation

The need for resource efficiency has been reflected in national policy over the past decade through emphasising the integration of waste management issues with a more sustainable production/consumption cycle in order to stabilise and reduce waste volumes. The 2011 Programme for Government states that policy will be developed adhering to the EU waste hierarchy – minimising landfill and maximising resources recovered.

The *National Reform Programme for Ireland* under the Europe 2020 strategy (Department of the Taoiseach, 2011) identified key linkages in the reform programme, one of which was 'decoupling economic growth from resource use while at the same time turning environmental challenges into growth and employment creation opportunities'. Similarly, the operation of resource-efficient practices supports policy statements in the *National Recovery Plan 2011–2014* (Department of Finance, 2010) relating to improving the efficiency and competitiveness of companies, through actions concerning energy use and waste generation.

In March 2011 the revised EU Waste Directive (EP and CEU, 2008) was transposed into Irish law by the European Communities (Waste Directive) Regulations 2011 (SI 126 of 2011). In terms of resource efficiency and waste management, this is a hugely significant piece of legislation which introduces many new obligations for public and private sector waste operations as well as for regulatory activities. This enhanced regulatory arrangement has established a firm and enduring platform that will permit Ireland to build towards a more resource-efficient, less wasteful and more sustainable society.

In August 2011 the Government consulted on a new National Waste Strategy that included a number of principles which are intended to inform how the State deals with waste in the coming decade. These include, for example, implementation of the waste hierarchy, investment, waste prevention and market intervention (including levies). The long-term aim is to influence production and consumption behaviours to reduce waste, discourage disposal, and ensure an effective waste management market and infrastructure (DECLG, 2011).

Many activities with significant waste-generating and polluting potential have been subjected to Integrated Pollution Prevention and Control licensing by the EPA. These licences are enforced by the EPA Office of Environmental Enforcement. Local Authorities regulate the movement of waste as well as smaller waste facilities. The implementation of the EPA waste pre-treatment obligations (prior to landfill or incineration) has had a significant impact on landfill diversion achievement (EPA, 2009b), by requiring that all waste be pre-treated in advance of landfilling to recover value from the residuals by producing refuse-derived fuel, extraction of metal, removing organics, etc. Since 2010 untreated waste cannot be accepted at a landfill.

The new National Waste Collection Permit Office (single body for issuing waste collection permits), established in 2012, will contribute significantly to more efficient regulation of national waste collection activities. Export of waste is regulated by the National Transfrontier Shipment of Waste Office in Dublin City Council (NTFSO). The Government – through NTFSO – has introduced significant efficiencies for businesses and Local Authorities through the electronic documentation of hazardous waste moved within, and exported from, the State.

A wide range of specialist schemes has also been introduced in Ireland to deal with scheduled products, substances and wastes as required by EU Directives. These include schemes for WEEE, batteries, packaging, ELVs, tyres, restriction of hazardous substances, deco-paints, persistent organic pollutants, polychlorinated biphenyls, ozone-depleting substances and fluorinated greenhouse gases (EPA, 2012b). Not all these producer-responsibility-type schemes are equally successful. Recent EU developments under the Waste Framework Directive are leading to the introduction of standards for secondary resources manufactured from former waste streams (so-called 'end of waste'). In addition, a range of national regulatory and market-based instruments have been utilised to achieve more sustainable waste management practices. These include significant increases in the landfill levy, as well as increases in the plastic bag levy and mandatory source separated collection of commercial biowaste.

Waste Management Planning

The current National Hazardous Waste Management Plan runs until the end of 2012 (EPA, 2008). This focuses on the prevention of hazardous waste and seeks to promote the safe collection and treatment of such waste. An interim implementation report has been published with a view to initiating consultations in relation to a new hazardous waste plan for 2013 and beyond (EPA, 2011b).

Indigenous infrastructural provision for hazardous and recyclable waste is limited, leaving Ireland reliant on waste export markets to treat hazardous and recyclable waste materials. The provision of indigenous facilities to deal with recyclable waste as well as the development of markets and standards for secondary material is being addressed by the *rx3* Market Development Programme, but outcomes here will be influenced by economics and the small size of the Irish waste market.

National Waste Prevention Programme

The National Waste Prevention Programme – now marketed under the BeGreen banner – was launched in 2004 and since then has developed a number of prevention initiatives. These have targeted business through sectoral approaches, e.g.:

- Green Business
- Green Hospitality
- Green Retail
- Packaging waste prevention
- Hospitals etc.
- Households
- Green Home – allied to Green School
- Stop Food Waste
- Local Authorities (Local Authority Prevention Network).

There are also prevention projects aimed at the general public including Greening Communities and Green Festivals. Re-use of products/materials is an important aspect of prevention, and projects here include the Community Re-use Network Ireland, SMILE Business Resource Exchange and the *www.freetradeireland* initiative. In 2011, €3 million was invested in NWPP projects, resulting in economic savings worth in excess of €12 million for the participant organisations through resource efficiency (EPA, 2012b).

The EPA-coordinated NWPP is producing useful behavioural change guidance and other resources for households, communities, institutions and businesses, which are all available through its website (*www.epa.ie/whatwedo/resource/nwpp*)

There are currently 11 waste planning regions in Ireland. The waste market and national arrangement of infrastructure are such that this number of regions is not an efficient administrative arrangement. The Government is currently consulting with Local Authorities with a view to rationalisation of these regions. Recent legislative changes require an evaluation of regional waste plans by the end of 2012, and any decision on reconfiguration of regions will be reflected in the development of replacement plans.

Waste Prevention and Research

Prevention of waste is to be preferred to waste management and is at the highest point in the EU waste hierarchy. Reducing the inefficient and inappropriate use of raw materials and resources will reduce waste generation, energy/water use, transport impacts and all consequential environmental impacts.

Generally, waste prevention can be achieved either by reducing the overall demand for goods and services or by imposing production efficiency through using less – or at least less harmful – materials, to meet reasonable human needs. Prevention also seeks to reduce emissions and harmful substances in material streams and their dissipation. It seeks to improve resource efficiency throughout the life-cycle of a product or service. Prevention may require significant changes in the production and consumption cycle affecting product/service design, distribution, consumption and end-of-life activities.

There is currently no national resource efficiency programme; responsibility is divided among many actors (industry, State agencies and programmes, Local Authorities, etc.). In 2011, the EPA through the STRIVE research programme awarded funding to a research proposal in relation to informing the development of a national resource efficiency strategy.

The EPA-led National Waste Prevention Programme (NWPP) seeks to develop capacity for resource efficiency and waste prevention in homes, communities and businesses across Ireland (*www.nwpp.ie*). Enterprise Ireland and the Sustainable Energy Authority of Ireland (SEAI) also have resources and case studies on resource-efficient practices and opportunities.

In 2011 the EPA in association with the SEAI, IDA Ireland and Enterprise Ireland produced a guide for private and public enterprises on where to access State supports in relation to eco-efficiency initiatives (EPA, 2011c). Such 'joined-up' Government action is critical to the success of national resource efficiency ambitions.

Environmental research has also played an important role in informing waste management practices and policy. The EPA Cleaner Greener Production Programme has provided €2.13 million in grant aid to businesses operating in Ireland in the past five years for research and development of solutions to make their products and services more sustainable. This support has resulted in business innovation, marketing advantage, cost savings and patents, as well as significant environmental improvements.

Outlook

European requirements have altered and will continue to alter significantly how waste is managed in Ireland – leading to a greater diversion of resources to beneficial use, including energy recovery. The Economic and Social Research Institute (ESRI) has developed a Sustainable Development Model for Ireland (ISus) to forecast national environmental emissions and resource use up to 2025. This estimates that the total volume of municipal waste is likely to increase quite substantially within the coming decade, necessitating future investment in waste management infrastructure (Figure 5.8). The estimates are tied to the level of economic growth and the impact of proposed new waste policy measures.

It is anticipated that Local Authorities will continue to exit waste collection, and that most of the significant national waste infrastructure for waste recovery and disposal will be delivered and operated by the private sector. Waste planning regions will be reconfigured to a maximum of three regions, with better coordination between regions in relation to waste movement and strategic infrastructure.

Figure 5.8 Predicted Growth in Municipal Waste up to 2025 (Source: EPA, ESRI)

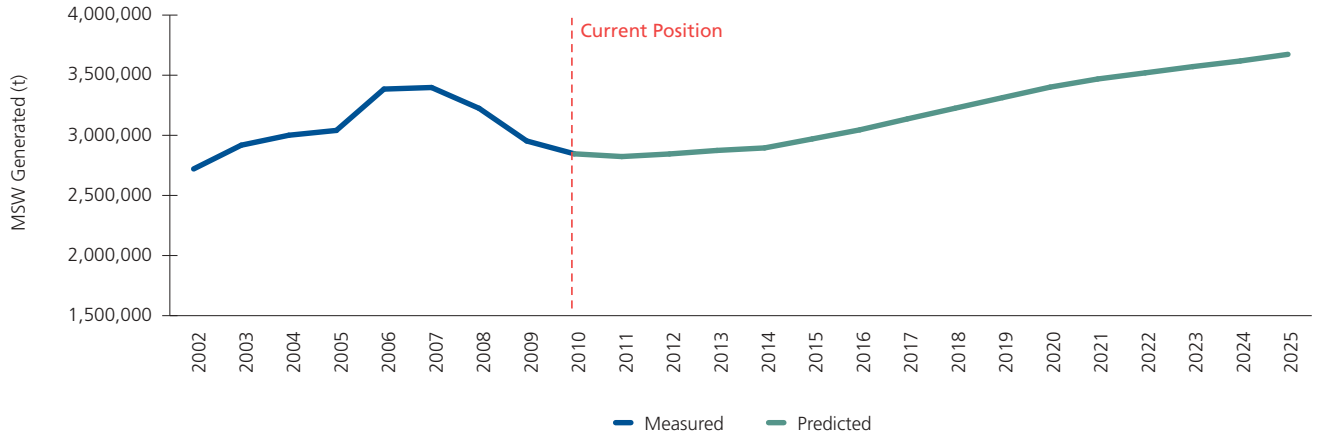


Table 5.2 Selected Waste Indicators (relative to most recent data – 2010) (Source: EPA)

Indicator		Current Position
Municipal Waste Managed	▼	21% decrease since 2007
Household Waste Recovery	▲	350% increase in recovery rate since 2002
Kerbside collection of household organic waste	▲	218% increase since 2004
Municipal Waste per person	▼	25% decrease since 2006
Commercial Waste Generated	▼	26% decrease since 2007
Landfill Rate for Municipal Waste	▼	33% decrease in disposal rate since 1995
Hazardous Waste (excl. soils)	▼	5.5% decrease since 2007
Industrial Manufacturing Waste	▼	1% decrease between 2006 and 2008
Construction & Demolition Waste Managed	▼	81% decrease since 2007
Number of Municipal Landfills	▼	65% decrease since 1998
Civic Amenity Sites	▲	250% increase since 1998
Number of Bottle Banks	▲	129% increase since 1998

Conclusion and Future Challenges

Waste management behaviours have changed significantly in recent years (Table 5.2), with the economic downturn impacting significantly on waste streams associated with construction and consumption.

Ireland has performed well against its EU Directive requirements for different waste streams (Table 5.3). Continued and expanded use of levies and other economic instruments must be introduced so as to disincentivise unsustainable products and poor waste management practices, and incentivise desirable behaviours in relation to key waste streams (e.g. battery recovery). The Producer Responsibility Initiatives (PRIs) currently operational in the State have had mixed performance success, with some not contributing effectively to their intended purpose (e.g. tyres and ELVs). The legislative arrangements for poorly performing PRIs would benefit from redesign. Moreover, there are a number of critical waste streams that should be considered for inclusion in a PRI-type scheme (e.g. paints, medicines, newspaper).

Good waste prevention and management practices must become commonplace in the home, at leisure or learning, in travel and the workplace. Undesirable activities, including fly-tipping, littering and fireplace/backyard burning of household waste, must remain an enforcement priority so as to ensure protection of health, the environment, and the amenity of the countryside. Such action also protects our national 'green' image,

so important for jobs in our tourism and agri-foods sectors.

Efficient resource use and management is a core goal of economic policy and jobs creation (OECD, 2011; DJEI, 2012). In order for Ireland to be sustainable, remain competitive and attract inward investment, it is necessary to ensure that resource efficiency techniques (including waste prevention) are embedded across the policy measures and production practices for all sectors of the economy. Resource efficiency allows the economy to create more with less, delivering greater value with less input, thereby using resources in a sustainable way and minimising impact on the environment. There is a need to develop a national Resource Efficiency Strategy that integrates all the existing programmes and maps future direction. Such a strategy would also be essential as a support tool for the EU's ambitions in relation to setting out a Critical Raw Materials Plan.

Industry will need to work towards ensuring that products are designed and marketed to minimise environmental impacts in their manufacture, use, and end of life – with producers taking responsibility for the end-of-life fate of products. Such life-cycle thinking is likely to become the industrial norm. Prices of goods must reflect all these costs, based on full global environmental impact. Research funding (e.g. EPA's STRIVE, IDA's CleanTech) for new technologies should continue, with additional opportunities identified and exploited to ensure cleaner, more efficient methods of production and service provision.

Development of essential waste infrastructure continues to be a challenge for the State. Facilities for the separate collection of waste, for materials recovery/recycling, for treatment of the biodegradable proportion of municipal waste, etc. are underdeveloped or absent in some regions. To tackle the high proportion of uncollected household waste, as well as reducing the substantial biodegradable municipal waste content of residual waste sent to landfill, further policy development (e.g. obligation to participate in a collection service, mandatory organics/brown bin for all urban area households, statutory defined BMW limits on landfill intake) is required to ensure higher recovery targets as well as to ensure compliance with EU obligations. Such initiatives will also reduce Ireland's climate burden and potential odour nuisance associated with landfills.

Table 5.3 Progress towards EU Recovery & Recycling Targets

	Directive	Progress to Targets
1994/62/EC	Packaging Directive	●
2002/96/EC	WEEE Directive	●
2000/53/EC	End of Life Vehicles Directive	●
1999/31/EC	Landfill Directive	●
2006/66/EC	Batteries Directive	●
2008/98/EC	New Waste Framework Directive	●

● Achieved

● Not Achieved

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Chapter 6
Nature and Biodiversity

Humanity is dependent on nature for survival. Its protection is also of ethical and economic concern. Ireland's marine and terrestrial environment supports a wide variety of species and habitats, many of which are of international importance. Many species are doing well in conservation terms, but there are a significant number of habitats and species that are not. While progress has been made in the designation of EU-protected areas in Ireland, several areas of national importance remain undesignated and significant aspects of biodiversity in Ireland are under considerable threat from unsustainable activities.

Ireland has international and legal obligations to protect biodiversity. These include a commitment to halt biodiversity loss by 2020. Protection of biodiversity within and outside protected areas is necessary and will require greater integration of biodiversity concerns in sectoral policy development and implementation, at local and national levels. Ireland's second National Biodiversity Plan (2011–2016) includes a programme of measures aimed at meeting Ireland's biodiversity obligations. Full implementation of the plan will help ensure the sustainable management of biological resources and protection of biodiversity for future generations.

Introduction

'Biodiversity' is a term used to describe the variety of life. It includes diversity within species, between species and of ecosystems. Biodiversity protects and nurtures people through providing an array of ecosystem services. These include provisioning services such as food, fuel and medicines; supporting services such as pollination and primary production; regulating services such as prevention of flooding and coastal erosion, climate regulation and pest regulation; and cultural services such as recreation.

Due to Ireland's geographical isolation and recent geological history it has a lower diversity of non-marine flora and fauna than is found on continental Europe. Nevertheless, Ireland's aquatic systems and wetlands support internationally significant populations of birds, fish and invertebrates and Ireland is relatively rich in bryophytes, algae and lichens. Ireland's marine environment is particularly biodiverse and is among Europe's richest for cetaceans (whales, dolphins and porpoises). It supports large seabird breeding colonies, a great range of invertebrate species, and its cold-water coral communities are of particular note, supporting a diverse array of associated fauna. In addition, Ireland has a significant number of internationally important habitats including limestone pavements, machair, turloughs and active peatlands.

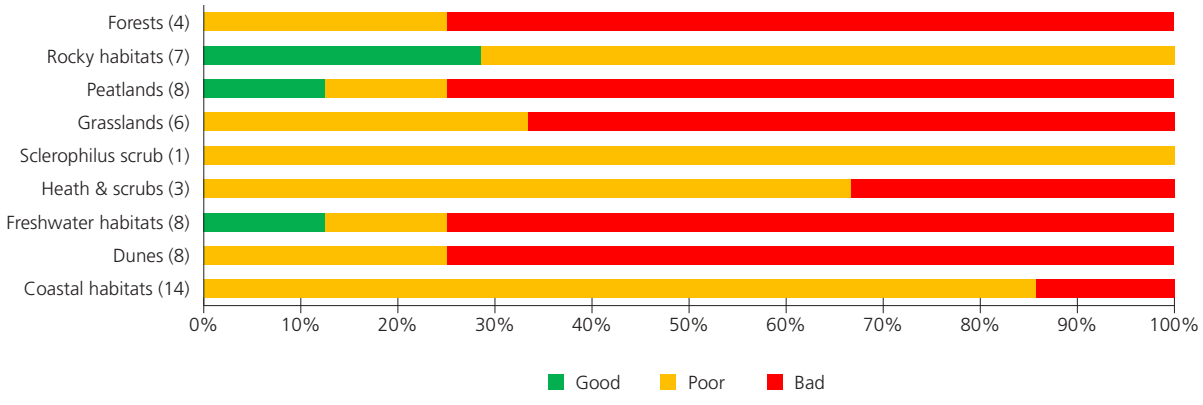
The Current Situation

Globally, species are currently being lost at up to 1,000 times faster than the natural rate, primarily as a result of human activities (MEA, 2005). It is estimated that in the EU, only 17% of habitats and 17% of species protected under the Habitats Directive (92/43/EEC) are in a favourable state (EEA, 2010). Recent evidence indicates that Ireland's biodiversity capital is still dwindling rapidly (EPA STRIVE, 2011).

Habitats

The majority of Ireland's habitats that are listed under the Habitats Directive are reported to be of poor or bad conservation status (Figure 6.1). Only 7% of listed habitats are considered to be in a favourable state (NPWS, 2008).

Figure 6.1 Overall Conservation Status of Habitats in Ireland Listed under the Habitats Directive by Broad Habitat Category (EC, 2009). (x) = number of occurrences



Species

In Ireland 39% of species listed under the Habitats Directive are in a favourable state (NPWS, 2008). These include bats, seals, certain cetaceans and plants (Figure 6.2). Other species, particularly of wetland and freshwater environments, are reported to be of poor or bad conservation status, including a number of species of fish (e.g. Atlantic salmon), molluscs (e.g. freshwater pearl mussel) and the natterjack toad.

Red Lists

Red lists aim at providing an objective assessment of species using the International Union for the Conservation of Nature (IUCN) categories and criteria. They identify those in most need of conservation interventions. The National Parks and Wildlife Service and the Northern Ireland Environment Agency co-ordinate red lists in Ireland.

Recent red lists indicate that more than a third of Irish bee species and non-marine mollusc species are threatened (Figure 6.3). In addition, over 15% of Irish water beetle species, butterfly species and dragonflies and damselflies are threatened. The red list on amphibians, reptiles and freshwater fish indicates that the European eel is critically endangered and the natterjack toad is endangered.

Most of Ireland's terrestrial mammal species are judged to be of least concern, with just one species, the black rat, judged to be vulnerable. This species is not prioritised for conservation action as it is considered a pest and vector of disease. Three mammal species, Leisler's bat, otter and red squirrel are considered near threatened. The *Irish Red Data Book* on vascular plants (Curtis and McGough, 1988) indicates that of the 159 species assessed, 10 species are thought to be extinct, six endangered, and 44 vulnerable.

The protection of bird species at EU level is provided for under the Birds Directive (2009/147/EC). A Birdwatch Ireland assessment of the population status of Ireland's birds indicates that of the 199 species assessed, 25 were placed on the red list (i.e. of most conservation concern).

Figure 6.2 Overall Conservation Status of Species in Ireland Listed under the Habitats Directive by Major Species Group (EC, 2009). (x) = number of occurrences

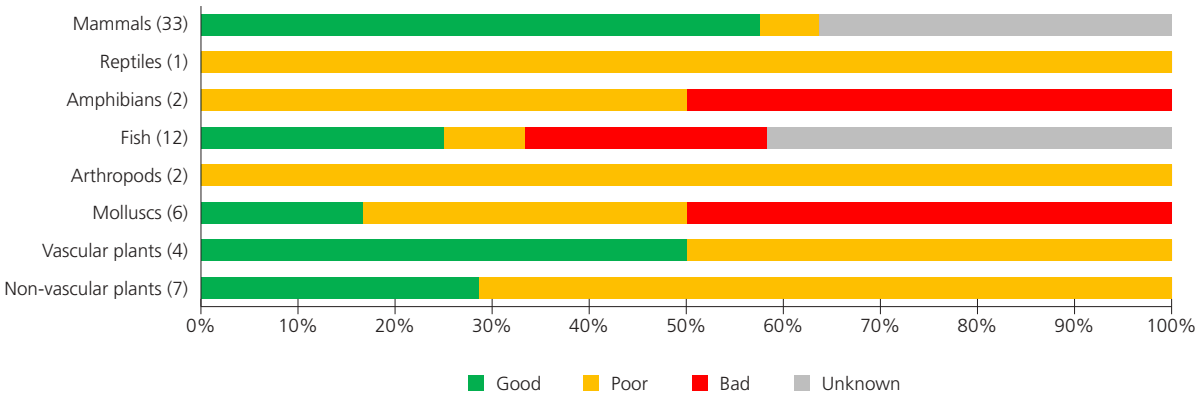
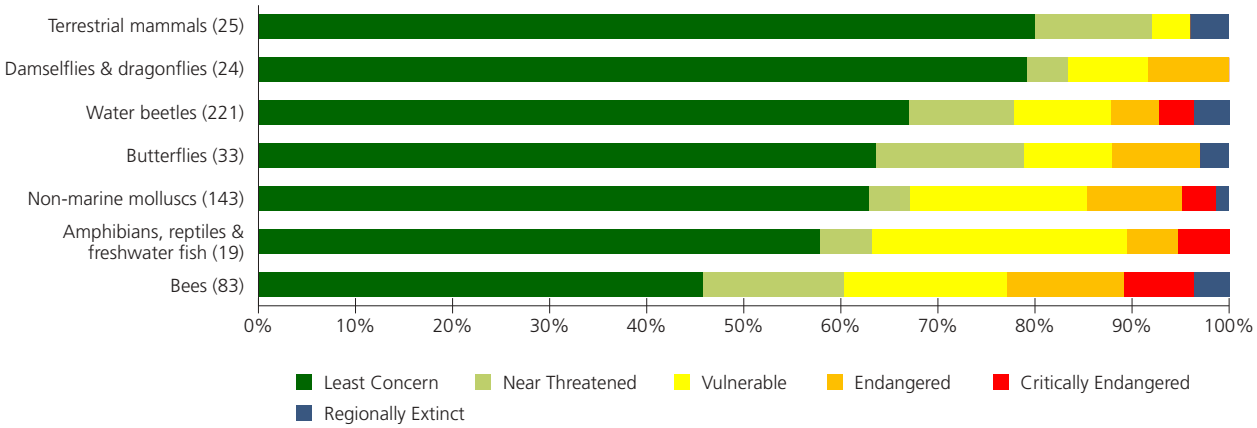


Figure 6.3 The Proportions of Species by Threat Category for Each of the Taxonomic Groups That Have Been Red Listed in Ireland Using the IUCN Methodology. (x) = number of species assessed in each group. (Source: NPWS)



Several red-listed bird species are believed to be on the brink of extinction as breeding birds in Ireland, including the common scoter, black-necked grebe, quail, red-necked phalarope and nightjar (Lynas et al., 2007).

Throughout Europe and in Ireland, certain farmland breeding bird populations suffered massive rates of decline in the 1970s and 1980s. There is evidence that some species are still undergoing significant declines (e.g. kestrel and skylark) or have become extinct in Ireland (corn bunting). However, it appears that many of the more common breeding birds in Ireland have fared quite well in recent years (Coombes et al., 2009). In addition, the populations of roseate tern and buzzard have increased significantly. The great spotted woodpecker established itself in Ireland in 2009 as a breeding species. Reintroduced golden eagles and red kites have bred successfully, and white-tailed eagles are likely to breed in the near future. A project to save the grey partridge at its one remaining location in Ireland has been successful and provides useful information to facilitate its range expansion on Irish farmland through targeted agri-environment measures (Buckley et al., 2011).

Drivers and Pressures

The key pressures on Ireland's habitats and species are direct habitat damage such as peat cutting, wetland drainage/reclamation and infrastructural development; overgrazing and undergrazing; water pollution particularly from nutrients and silt; unsustainable exploitation such as over-fishing and peat extraction; invasive alien species; and recreational pressure (NPWS, 2008). Indirect pressures such as population growth, limited awareness about biodiversity, and the fact that biodiversity's economic value is often not reflected in decision making are also threats to biodiversity. Climate change is likely to bring additional pressures on a number of species and habitats in Ireland (EPA CCRP, 2009).

Responses

Legislation

At EU level the Habitats Directive and Birds Directive create a comprehensive scheme of protection for wild species and habitats. While designation of protected areas in recent years has advanced substantially, the European Commission still considers Ireland's list of designated Natura 2000 sites as incomplete (EC, 2010). The full implementation of these Directives, along with other Directives including the Water Framework Directive (2000/60/EC) and the Marine Strategy Framework Directive (2008/56/EC), will contribute significantly to biodiversity protection.

The Environmental Impact Assessment Directive (85/337/EEC) and the Strategic Environmental Assessment (SEA) Directive (2001/42/EC) require the consideration of potential development impacts on biodiversity.

The most important pieces of national legislation on nature conservation are the Wildlife Act, 1976, the Wildlife (Amendment) Acts, 2000–2010, and the EU (Natural Habitats) Regulations, 1997–2011. Under the Wildlife Acts nearly all bird species and some 60 other animal species are afforded protected status, as are some 90 plant species. Substantial changes were made to the planning code in 2010, which included obligations on local authorities to ensure protection of Natura 2000 sites and species listed in the Habitats and Birds Directives.

Invasive Alien Species

Invasive alien species are species that have been introduced to Ireland, deliberately or accidentally, by humans and have a negative impact on the economy, wildlife or habitats. Examples of invasive species already established in our freshwaters are the curly leaved water weed and zebra mussel. The cost of alien invasive species in Europe is conservatively estimated to be €12.5 billion/year and may be over €20 billion/year (Kettunen et al., 2008). Invasive Species Ireland is a joint venture between the Northern Ireland Environment Agency (NIEA) and the National Parks and Wildlife Service (NPWS) to co-ordinate activities on invasive species issues. Some eradication efforts have been undertaken or are under way, for example the hottentot fig on Howth Head. In addition, the National Biodiversity Data Centre has developed an online invasive species database and an early warning system. Legislation controlling invasive species has been introduced in the Republic of Ireland (S.I. No. 477 of 2011) and the EU is planning legislation on invasive species in the coming years.

Biodiversity Planning

In 2011, the EU adopted its 2020 Biodiversity Strategy (EC, 2011) following recognition that the EU had missed its 2010 target of halting biodiversity loss. The EU strategy has six main targets which focus on: full implementation of EU nature legislation; better protection for ecosystems and more use of green infrastructure; more sustainable agriculture and forestry; more sustainable fisheries; tighter controls on invasive alien species; and a greater contribution to averting global biodiversity loss.

The National Biodiversity Plan 2011–2016 (DAHG, 2011) is the main tool by which Ireland seeks to meet its commitments under the Convention on Biological Diversity and the EU Biodiversity Strategy. Reviews of implementation of the previous National Biodiversity Plan have reported mixed success (DEHLG, 2005, 2010). Local and public authorities and Government departments were required under the previous plan to make local/sectoral biodiversity action plans. The EPA and Bord na Móna published biodiversity action plans in 2010 (Bord na Móna, 2010; EPA, 2012), and 26 local authority biodiversity action plans are complete or in the final stages of preparation.

As part of Ireland's response to a European Court of Justice ruling action/threat response plans have been published for 18 species of high conservation concern and a conservation plan for cetaceans has also been published.

Biodiversity in the Wider Countryside

Biodiversity is not evenly spread, and certain species are more at risk than others. Consequently EU and national approaches afford special attention to the protection of sites of highest nature value and species most at risk. However, they also recognise that much of our biodiversity lies outside protected areas and effective conservation and sustainable use of biodiversity and the maintenance of essential ecosystem services require action in the wider countryside.

The Agri-Environmental Options Scheme and the Natura 2000 Scheme, were launched in 2010. The objectives of the schemes are to promote biodiversity, especially in Natura 2000 sites, improve water quality and combat climate change. These schemes aim at building on the Rural Environment Protection

Scheme, which had been the principal agri-environment scheme since 1994 but which was closed to new entrants in July 2009. Achieving and evaluating the environmental effectiveness of agri-environment policy is becoming increasingly important. EPA-funded research, such as the Ag-Biota project, along with research by Teagasc, has provided information to facilitate and improve agri-environment policy evaluation.

The NPWS Farm Plan Scheme was launched in 2006 but curtailed in April 2010 due to budgetary constraints. To date 658 NPWS farm plans on Natura 2000 sites have been approved. NPWS farm plans include specifically targeted measures towards the conservation and enhancement of suitable ecological conditions for, among others, hen harrier, corncrake, chough, geese, eskers and upland commonages.

The single farm payment scheme applies to all farmers and, through mandatory cross-compliance, requires farmers to maintain their land in 'good agricultural and environmental condition' and to comply with 19 Statutory Management Requirements. These include requirements relating to birds, habitats, groundwater, sewage sludge and nitrates.

Green Infrastructure

Green Infrastructure is defined as *'an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations'* (Comhar, 2010). Such spaces include woodlands, coastlines, flood plains, hedgerows, city parks and street trees, and the benefits to humans they provide include water purification, flood control, carbon capture, food production and recreation. Incorporation of green infrastructure in spatial planning and sectoral decision making

helps to prevent biodiversity loss and fragmentation of ecosystems, thus restoring, maintaining and enhancing ecosystems and their services. It will improve resilience and adaptation to climate change and enable greater connectivity between ecosystems in protected areas and the wider countryside. The European Commission is to bring forward a strategy on green infrastructure in 2012, and some local authorities in Ireland are already incorporating this concept in their development planning (Fingal County Council, 2011). Due to its obligations under the European Landscape Convention, Ireland is preparing a National Landscape Strategy which will also have significant implications for biodiversity.

Knowledge Base

In order for Ireland to assess its contribution to preventing biodiversity loss, it is important that there is adequate knowledge of national biodiversity. Knowledge of the species occurring in Ireland has improved in recent years. Major surveys were carried out on terrestrial and marine habitats, and research is being carried out on many protected species and habitats. An online atlas of freshwater fish in Irish lakes was launched by the National Biodiversity Data Centre in 2010, and atlases are being compiled for Irish mammals and for birds.

The National Platform for Biodiversity Research, which is co-funded by the EPA and the NPWS, was re-established in 2009 to define national biodiversity research needs, to assist in the dissemination of biodiversity research in Ireland, and to improve the exchange of information between researchers and policy makers. Several large-scale biodiversity research projects were undertaken in recent years to inform biodiversity policy, including the EPA-funded Biochange project, which addressed the main drivers of biodiversity loss and made recommendations to improve biodiversity governance.

Outlook

Protected Areas and Species

Based on the bad conservation status of many important habitats and some species, considerable efforts and resources will be required to improve their status, both within and outside protected areas. Climate change may also exert additional pressure on a number of species and habitats.

Ireland has made progress in the designation of Natura 2000 sites, and the process of designating marine/coastal sites is due to be completed by 2014. Appropriate protection and management of Natura 2000 sites and of listed habitats and species is clearly paramount given recent conservation assessments. Management plans including site-specific conservation objectives need to be prepared for all areas designated for nature conservation as soon as possible.

There are some 630 proposed Natural Heritage Areas (pNHAs), comprising 65,000 ha, which were published on a non-statutory basis in 1995 but have not since been statutorily proposed or designated and therefore currently receive limited protection. It is imperative that undesignated nationally important sites of biodiversity significance be designated as NHAs by the NPWS as soon as possible to afford them better protection.

Biodiversity Planning and Conservation

Implementation of local authority biodiversity action plans will be crucial in ensuring that biodiversity and green infrastructure issues are taken account of in development planning. The network of local authority Heritage/Biodiversity Officers has made a valuable contribution to raising awareness of biodiversity, and should be maintained.

It is important that biodiversity protection objectives be incorporated into the forthcoming reform of the EU's Common Agricultural Policy and Common Fisheries Policy. Agri-environment, forestry, aquaculture and fisheries measures implemented nationally should be monitored and reported on to ensure that they bring about measurable improvements in the conservation status of species and habitats and in the provision of ecosystem services. Incentives harmful to biodiversity should be identified and addressed. The OECD has recommended that spending on agri-environment measures should match ecological needs, for example by placing more emphasis on measures in or near Natura 2000 sites (OECD, 2010). Sectoral initiatives, such as *Food Harvest 2020*, need to take full account of environmental/biodiversity concerns in their implementation. Sectoral plans, programmes and projects should be subject to SEA, EIA and Appropriate Assessment processes where required.

Information on the location and condition of natural habitats and species in Ireland is essential for good conservation management and for protection of essential ecosystem goods and services. The establishment of the National Biodiversity Data Centre in 2007 was a significant step forward in ensuring that data are available for improved decision making, with over 76 datasets of almost 2 million records now freely available through the Biodiversity Maps website.

Socio-economic Benefits

Research findings on the economic and social benefits of biodiversity in Ireland indicate a marginal value of at least €2.6 billion per annum (Bullock et al., 2008). Given the value of biodiversity to Ireland's economy, its protection is not just an ethical concern but an economic necessity. The international study on *The Economics of Ecosystems and Biodiversity* recommends that the economic value of biodiversity be factored into decision making, and reflected in national accounting and reporting systems, and it provides guidance on this for policy makers (TEEB, 2010).

Public Awareness

Eurobarometer results and findings from an Irish study on attitudes to biodiversity among the public (Heritage Council, 2010) indicate that knowledge of biodiversity in Ireland is well below the EU average and much more needs to be done to communicate issues relating to biodiversity to a wider audience. This will involve greater engagement with relevant sectors and greater incorporation of biodiversity/ecosystem services issues into relevant educational courses. The National Biodiversity Plan 2011–2016 aims at developing a suite of biodiversity indicators which would help to inform the public and policy makers on the state and trends in biodiversity, pressures on biodiversity and the effectiveness of key policy measures.

Conclusion and Future Challenges

Globally, the unprecedented and continuing loss of biodiversity is one of the greatest challenges facing humanity. In order to establish our credibility in tackling this challenge, Ireland must take appropriate measures to protect its own national biodiversity and ensure that our activities do not lead to biodiversity loss elsewhere. Ireland supports a wide variety of species and habitats, many of which are of international importance. However, significant aspects of biodiversity in Ireland are under threat from a range of unsustainable activities.

Addressing the challenges to protect biodiversity and to meet international commitments will require more concerted effort and greater integration of biodiversity across all sectors. Of particular importance is that the actions identified in the National Biodiversity Plan 2011–2016 be delivered by the relevant public bodies. Improved coherence is also required at national level between various plans and programmes affecting biodiversity. Sectoral initiatives to enhance biodiversity, such as agri-environment schemes, need to have clear and specific objectives that correspond to national biodiversity priorities and targets. The objectives and environmental performance of such initiatives should be monitored and reported. Similarly, decision-making at regional and local levels must also be consistent with high-level commitments and national targets. In support of this, local authorities should implement county biodiversity action plans to ensure protection of natural heritage and promotion of green infrastructure. Local communities should be encouraged to protect biodiversity through education and local initiatives.

Strategies and action plans are required to deal with high-priority issues including invasive alien species, conservation of peatland and protection of species of highest conservation value.

Improved information and indicators on biodiversity and protected areas and species are also needed to facilitate evidence-based decision-making on biodiversity issues at national and local levels. The full economic value of ecosystems and their services should be calculated to promote integration of these values into the national accounting and reporting systems.

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Chapter 7
Land and Soil

The rate and nature of land use changes indicate where future environmental pressures are likely to arise. By European standards, Ireland has experienced a relatively high rate of land use change since the early 1990s. Generally, Ireland's soils are considered to be in good condition, with the exception of peat areas, which are particularly vulnerable to external pressures. However, the information available on land and soil is currently not sufficient. It is vital to improve our evidence base, which is required in order to accurately assess and protect these vital resources, and to provide information and guidance to policy and decision makers. The sustainable management of both land use and soils requires an integrated approach; a national landscape strategy and a national soil protection strategy for Ireland need to be prepared and fully implemented. While Ireland has fewer contaminated land problems than most other industrialised countries, an overall policy framework for the identification, management and remediation of contaminated land in Ireland is needed.

Introduction

Land and soil can be considered as an integrated resource in the broadest sense of the term. It is a source of livelihood and enterprise; it is the landscape in which we engage with the world about us; it provides the food, fuel, water, and the basic materials for our wellbeing.

The Irish landscape is the direct result of many hundreds of years of human interventions and land use change. Many of these changes were driven by historical processes and events, such as the forest clearances prior to the 1700s, the Famine and the depopulation of rural Ireland from the 1850s through much of the last century (CSO, 1997). More recently the population growth of the late 20th and early 21st century led to an increase in the extent of built-up areas. However, the overall area of artificial surfaces remains low in comparison with other EU countries, and agriculture is still the predominant land use in Ireland.

The soil of Ireland is an immensely valuable national resource, which formed and evolved slowly over a very long period of time. The regenerative properties of soil are limited, therefore it is considered a finite resource. Soil is a biologically active, complex mixture of weathered minerals, organic matter, organisms, air and water that provides the foundation for life in terrestrial ecosystems. The general consensus is that soil quality in Ireland is good; however, this is based on limited information.

The Current Situation

Land Use and Land Cover

Land use and land cover (LULC) are the two main means of describing and studying the form and function of the national land surface. Land cover is the physical description of what is present on the surface of the land, e.g. artificial areas, forest, water bodies. Land use describes the terrestrial environment from the human perspective, focusing on its socio-economic usage, e.g. transport infrastructure, pastures and recreational areas. Land cover and land use are interdependent, and changes in one impact on the other.

The main source of national scale information on LULC in Ireland is the EEA/EPA Corine land cover data series, which delivered a 25 ha scale land cover/land use map of Ireland in 1990, 2000 and 2006, with the next map expected in 2014. Figure 7.1 shows the land cover in Ireland compared to that for Europe according to Corine 2006. The main land cover type in Ireland is agricultural land, which accounts for two-thirds of the national landmass. Most of this is permanent grassland pastures. Peatlands and wetlands are the second most widespread land cover type, covering almost one-fifth of the country, while forested areas

Figure 7.1 Land Cover in Ireland and Europe, 2006 (Source: EPA, EEA)

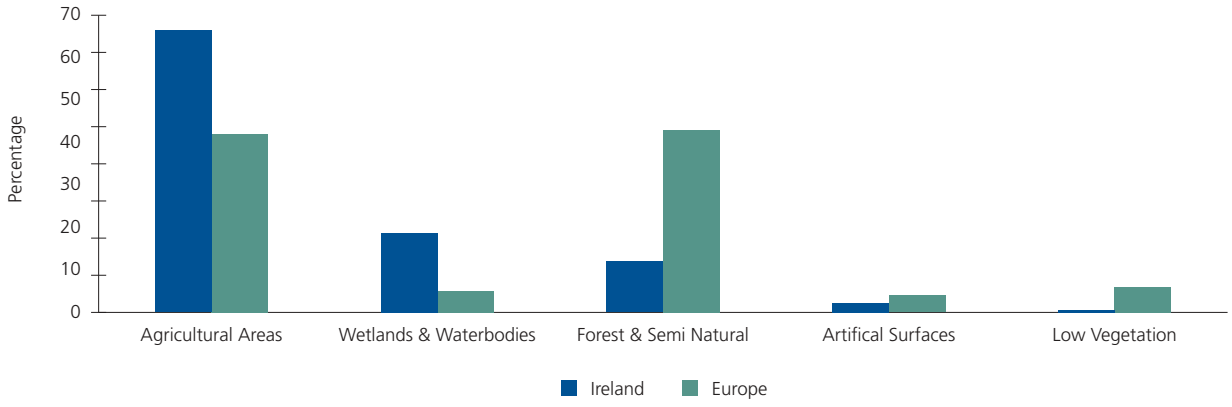


Figure 7.2 Percentage Land Use/Land Cover Change in Ireland 1990–2009 (Source: EPA)

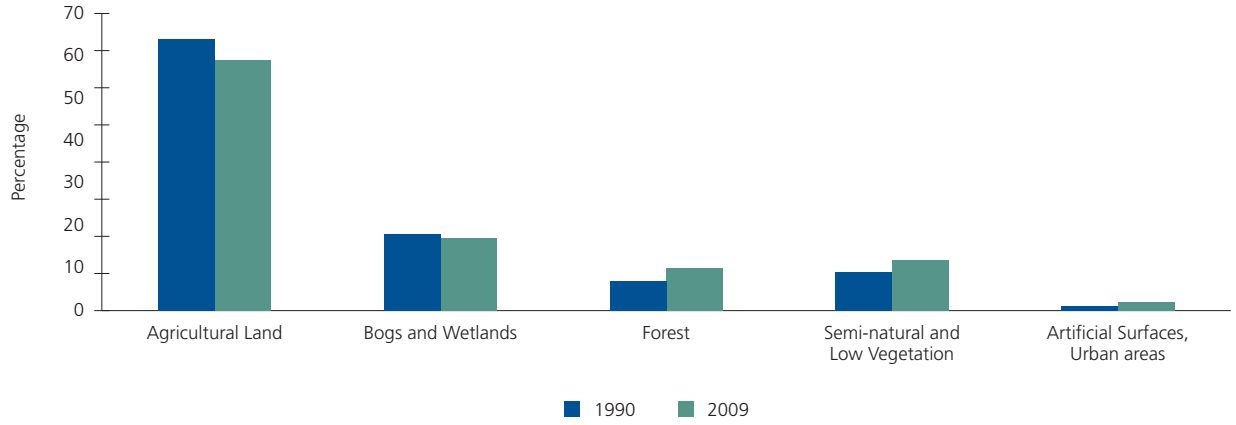
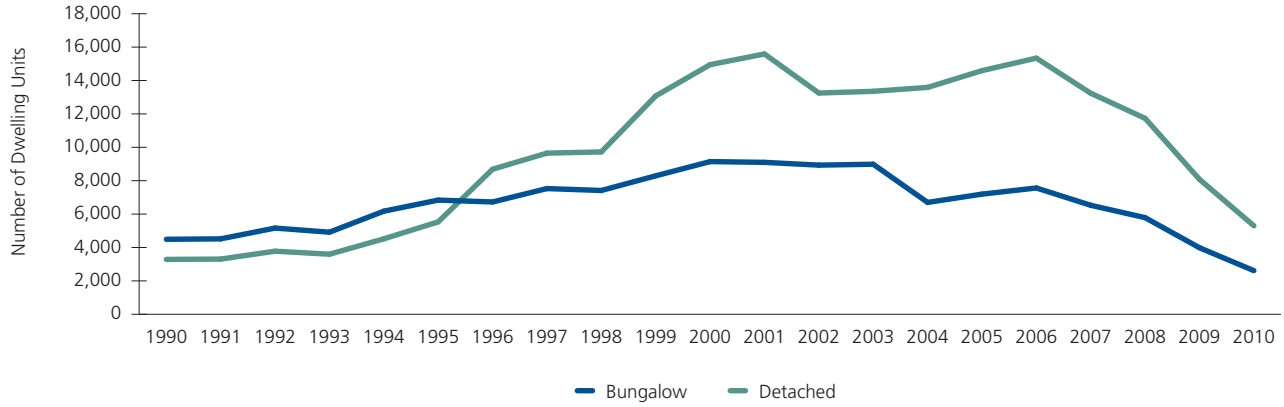


Figure 7.3 New Detached Houses and Bungalows Built in Ireland from 1990 to 2010 (Source: DECLG)



cover over one-tenth of the country. These figures show that despite rapid development in the past two decades, Ireland's landscape is predominantly rural and agricultural. Artificial surfaces account for 2% of the land surface, which is half the Europe-wide average of 4 per cent. Our agricultural land cover is far ahead of the European average of 42%, while the amount of land that is forested in Ireland is just one third of the European average of 35% (EEA, 2010).

Changes in LULC over time are key indicators of environmental change. Monitoring these changes is important to assess pressures on the Irish environment, allowing the development of strategies and policies to prevent irreversible damage. The Irish landscape has experienced continual land cover changes for centuries. The change in LULC since the early 1990s is shown in Figure 7.2; this is a relatively high rate of land use change by European standards.

The main changes have been an increase in the amount of forested lands and artificial areas and a decrease in the total amount of agricultural land and peatland. The area under forestry has increased from 7% to 11% of national land cover during this period, primarily due to the planting of peatland and pasture lands with coniferous plantations. The area under artificial surfaces increased by approximately 15% since 2000 to 2% of national land cover (EPA, 2011). This mainly occurred on former agricultural lands on the periphery of existing urban areas, including the suburbanisation of villages close to larger towns and cities.

There was also widespread construction of single rural dwellings in the countryside. Figure 7.3 shows the rate of construction of detached houses and bungalows in Ireland since 1990. It is assumed that a high proportion of bungalows and a lower proportion of detached houses are one-off rural constructions, many of which involved land-use change. Between 1990 and 2010, approximately 140,000 bungalows were built. This represents 32% of the estimated 440,000 dwellings with independent waste water treatment systems.

Under the Water Framework Directive, water quality sites of high status must be maintained. These sites are particularly sensitive to pressures and their high status can be lost from relatively low level (small area) changes in land use including reclamation of land, agricultural intensification and house building (see also Chapter 4). An EPA-funded research project is under way to provide information and guidance on protecting these high-status sites (EPA, 2012a).

A diverse range of providers contribute to the collation and analysis of land cover and land use data in Ireland; however, there is no clear mandated authority with overall responsibility for the task. It is challenging to present a consistent analysis of change across the entire landscape, and the need for improved coordination and integration of LULC mapping activities is widely recognised within the environmental sector. A study by the EPA in 2010 found that there is a pertinent need for a national high-resolution (1–5 ha scale) land cover dataset specially designed to characterise Irish LULC adequately.

Agriculture

Agriculture remains the largest use of land in Ireland, with two-thirds of land devoted to it. Most of this land is under grass for pasture, silage or rough grazing.

Food Harvest 2020 (DAFF, 2010) projects significant changes in production, particularly in the dairy sector, with a consequent increase in livestock. It is anticipated that much of this will be achieved through changing farm management and resource use with minimal changes to land cover. Nonetheless, integration of environmental considerations with the agricultural objectives must be carefully managed from the start to prevent negative impacts on soil quality and water quality.

Peatland

Almost one-fifth of land in Ireland is categorised as peatland; this includes raised bogs, blanket bogs and fens. They are important ecosystems sustaining a range of animal and plant species. The EPA STRIVE-funded BOGLAND study on sustainable management of peatland in Ireland (Renou-Wilson et al., 2011) found that up to 95% of all peatland exists in a degraded state, with the worst damage sustained in the 20th century. Peatland continues to be disturbed by domestic and industrial peat extraction, afforestation, wind farms, recreational activities and invasive species.

Natural peatland acts as a long-term carbon store; however, when peatland is damaged this function is reversed and carbon is released to the environment. Release of terrestrial carbon from soil and biomass is a major source of carbon dioxide (CO_2), the main contributor to climate change. Globally, it is estimated that 25% of the current elevated atmospheric concentration of CO_2 is due to historic land use change, primarily deforestation of land for agriculture. The BOGLAND study estimated that Irish peatland releases carbon at the rate of 9.66 Mt CO_2 equivalents per year.

The degradation of Irish peatland has caused a loss of biodiversity at both regional and national levels. The BOGLAND study found evidence of loss of species, loss of habitats and loss of entire ecosystems represented by the damage to almost all raised bogs and fens. In 2010 the European Commission began infringement proceedings against Ireland in relation to continued turf cutting on bogs designated as Special Areas of Conservation. The Government has banned turf cutting in these areas and offered compensation to those affected. Damage to peatland impacts on water quality due to silt release from mechanical peat harvesting, increased nutrient release from drained bogs and increased acidification from afforestation on bogs.

The industrial extraction of peat for energy and horticultural purposes is likely to decline over the next 15–20 years. This is due to the gradual harvesting and depletion of peat from existing industrial cutover bogs, and the limited scope for development of new peatland areas

for industrial extraction. Serious consideration is now being given by Bord Na Móna to the potential use of between 50 and 80 kha of cutaway peatlands as they leave production. This will represent a significant component of land cover and land use change, and may impact considerably on Ireland's carbon budget in this period.

The BOGLAND study highlights the importance of Ireland's peatlands, particularly in relation to climate change, biodiversity and water quality. In 2011, the Department of Arts, Heritage and the Gaeltacht (DAHG) launched a public consultation on the development of a National Peatlands Strategy. Such a strategy is urgently needed to prevent further damage and to ensure the sustainable management of peatlands in terms of enhancing, recovering and improving resilience.

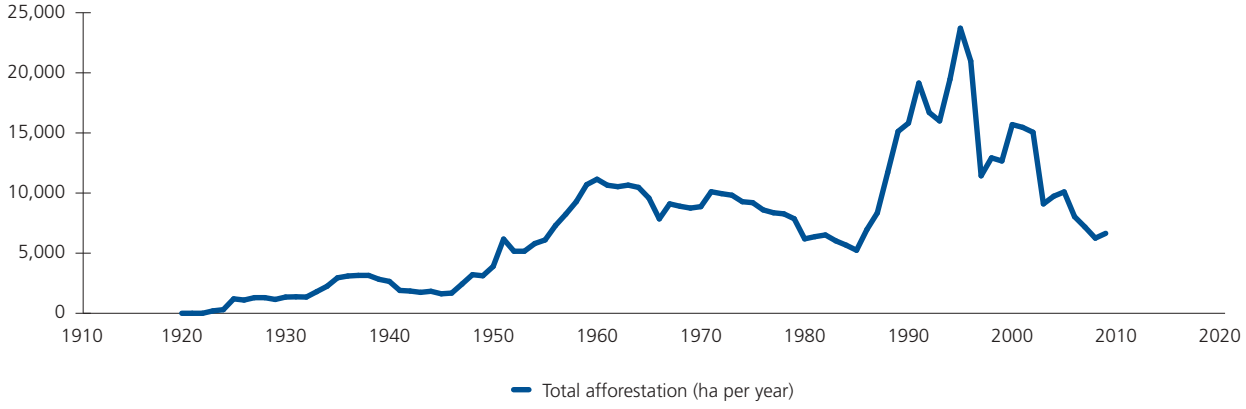
Forestry

Forestry accounts for 11% of land cover, which is low compared with a European average of 35%. Figure 7.4 shows historic afforestation in Ireland since 1920. Much of the forest in Ireland is young, with nearly 40% of total forest planted since 1990. This is significant from a climate change perspective, as the annual carbon store in any afforestation since 1990 can be used to offset emissions from other sectors, and helps Ireland attain greenhouse gas emissions reduction targets. The Programme for Government 2011–2016 sets a national planting rate target of 14,700 ha per annum, an increase on the rate in recent years.

Approximately 75% of the national forest estate is predominantly conifer, composed mainly of commercial timber species but also including some native species such as yew and Scots pine. Since 1997 policies have been in place to increase broadleaf planting, and the Rural Development Programme 2007–2013 sets a target of 30% annual broadleaf afforestation. This target has been reached (and exceeded) in recent years, primarily through a reduction in afforestation using coniferous trees rather than in an increase in planting of broadleaves.

The management of forest lands is challenging from an environmental perspective. The potential for adverse disturbance of vegetation, soils and landscape during afforestation and forest harvesting is large. These processes can also impact on water quality through acidification and nutrient mobilisation. Also of concern are the location and scale of forestry activities. Although Ireland has notably less forest than other European countries, the rate of afforestation in Ireland

Figure 7.4 Historic Afforestation in Ireland since 1920 (Source: DAFM)



has been relatively high. There is concern that a significant proportion of forest plantation in previous decades was undertaken without due consideration of the long-term potential environmental impacts. Coillte is currently undertaking research on the rehabilitation of inappropriately afforested lands to more sustainable ecosystem types (Coillte, 2012).

In recent years, there has been a trend towards plantation on more appropriate land and soil types driven primarily by the commercial requirements for reasonable productivity and easy access to forest sites, coupled with an appreciation of the potential environmental impact.

Soil

A healthy soil provides us with clean air, food and water. It supports the growth of both plant and animal life while providing foundations for human habitats and structures. This wide range of functions makes soil one of life's most important environmental media, and it should be afforded the same protection as air and water. Particular problems in Europe include loss of soil organic matter, loss of top-soil due to erosion or building activities, contamination and acidification. Historically, little attention has been paid to the conservation and protection of soils. There is relatively little legislation relating directly to soil and soil protection. In 2006, the EU published a Thematic Strategy for Soil Protection and introduced a proposed Soil Framework Directive; this has not yet been finalised. The 2011 Environmental Impact Assessment Regulations for On-Farm Development supports soil protection in Ireland through the requirements for environmental impact assessments for soil operations such as soil drainage.

The historic lack of attention to soil degradation can be seen not only in the paucity of legislation and soil protection targets, but also in the scarcity of data. Albeit that the degree of certainty is low, the general consensus is that soil quality in Ireland is good. The long growing season, absence of extreme temperatures, and frequent rainfall afforded by our temperate climate are beneficial to soil. The lack of heavy industry in Ireland means that our soils have not suffered from significant amounts of contamination. The large percentage of permanent pasture land has protected Ireland's soils from serious degradation, with the notable exception of peatlands. The production of a National Soils Database (EPA and Teagasc, 2007)

and the Historic Mine Sites project (Stanley et al., 2009) have provided much-needed baseline knowledge on soils in Ireland.

Soil Biodiversity

The immense biodiversity of our soils is the foundation of many ecosystems. The variety of species found beneath the earth's surface in our soils is vast, with an estimated one quarter of all living species on earth in our soils. These biota are the driving force that regulate soil. They have a crucial role in natural cycles, including regulation of the atmosphere, and water quantity and quality. Soil biodiversity provides significantly for human society in a variety of ways including food production, pollution control and development of new pharmaceuticals – the antibiotic penicillin originated from the soil fungus *Penicillium notatum*.

Estimates suggest that only 1% of soil micro-organisms are known today. The EPA-funded CréBeo research project (Schmidt et al., 2011) found species previously unrecorded in Ireland, including 13 predatory nematodes, an earthworm endemic to southern France, and a mite species potentially new to science. It is estimated that the improper management of soil biodiversity on a worldwide basis is equivalent to the loss of 1 trillion dollars per year (EC, 2010).

Soil Organic Matter

Ireland's soils are relatively rich in organic matter, especially our wetter soils and blanket peats. Soil organic matter has a key role in maintaining soil functionalities and water and air quality as well as a crucial function in the carbon cycle. A large amount of the global carbon concentration is stored in our soils. Correct land use management is essential to prevent release of this into the atmosphere, where it would contribute to climate change.

The EU Common Agricultural Policy encourages farming practices that maintain fertility and organic matter levels, thus improving soil characteristics. The Good Agriculture and Environmental Conditions standards are important in improving the relationship between agriculture and soil. The introduction of the Rural Environmental Protection Scheme (REPS) delivered payments to farmers for the provision of these agri-environmental measures; approximately 40% of farmed areas were involved in REPS (OECD, 2010). A holistic approach and good farming practices will maintain soil quality and counteract degradation.

Drivers and Pressures

Land Use

Land is subject to many competing demands. Current land use is the result of a sequence of past human interventions on the natural landscape. Policies related to forestry, renewable energy, agriculture, peatlands and the built environment have associated impacts on land use change and land resource management.

Population Growth

The principal causes of land use changes in urban areas have been the development of housing and associated commercial services built to cater for the increase in the population and consequent growth of suburbs, satellite towns and villages. This increase in artificial surfaces impacts on many aspects of the environment including climate, biodiversity, air quality and water quality.

The coastal zone is a popular residential location, with approximately 60% of the population living within 10 km of the coast. A high proportion of vulnerable ecosystems and priority infrastructures exist in these areas, thus coastal zone management remains a key concern.

Soil Degradation

The degradation of soils is a serious issue across much of Europe, and initiatives at EU level provide a timely incentive to assess critically the condition of soils in Ireland. The EU Commission set up the Thematic Group for Soil Strategy in 2004 to identify the potential threats to soil function. Its analysis identified six degradation processes that impact on soils: soil sealing, erosion, organic matter decline, compaction, salination and landslides. While a number of these processes are naturally occurring, human activity is an additional driver of degradation through poor land management.

Soil Contamination

Soil can be contaminated by a wide range of pollutants, through either point source contamination or diffuse contamination. Contamination from point sources can arise as a result of leakages and accidental spillages from industrial and commercial activities, e.g. petroleum storage tanks, old mine sites, old gas work sites, timber treatment or landfills. Diffuse contamination can arise from activities such as agriculture, forestry, horticulture and domestic septic tanks. The EPA is currently developing guidelines for the management of contaminated land and groundwater at EPA licensed facilities.

Figure 7.5 Volume of Contaminated Soil Sent for Remediation in Ireland 2006–2010 (Source: EPA)

The licensing by the EPA of both Integrated Pollution Prevention and Control (IPPC) and waste facilities covers soils in specific circumstances and where any incident of contamination is found. Figure 7.5 shows the volume of contaminated soil from Ireland sent for remediation from 2006 to 2010, and the fraction exported compared with that managed in Ireland. The overall tonnage of contaminated soil managed decreased significantly after 2008, probably reflecting the lack of land development/ redevelopment projects during the economic downturn (EPA, 2012b).

The 2009 inventory and assessment of historic mine sites (Stanley et al., 2009) concluded that of the 32 mining districts assessed, 22 districts will not require any interventions. Seven districts will require further monitoring and three districts (Tynagh, Silvermines and Avoca) will require additional site-specific risk assessment by the landowners. A comprehensive remediation project is currently under way at the Silvermines site, while a full assessment of the Avoca site, where the State is the landowner, has recently been completed. Similar assessments will be required at other sites; however, there is currently no legislative framework in place for this to be accomplished other than the Programme of Measures under the Water Framework Directive, where water quality is impacted.

Responses

Strategic Environmental Assessment

The EU Strategic Environmental Assessment (SEA) Directive became a legal requirement in Ireland in 2004. The main objective of SEA is to provide environmental protection and to implement environmental considerations into plans and programmes with the promotion of sustainable development. SEA is mandatory for certain plans/ programmes in the areas of agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications, tourism, town and country planning and land use.

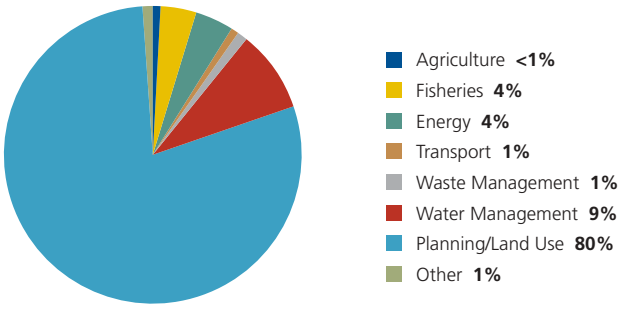
Almost 300 SEAs have commenced in Ireland since their introduction in 2004. Figure 7.6 shows the distribution of these per sector. Of the sectors specified in the Directive, land use planning has had the most significant take-up, accounting for approximately four-fifths of all SEAs undertaken. Water accounts for 9% while the energy and fisheries sectors each account for 4%. It is notable that a number of significant sectors, in particular the forestry, tourism, industry and telecommunications sectors, have yet to engage fully in the process.

The EPA commissioned an SEA Effectiveness Review in 2011 to examine how SEA has been implemented in Ireland since its introduction in 2004. The review found that SEA is clearly raising the profile of environmental issues in decision making at plan level among those sectors that have fulfilled their obligations under the Regulations. Overall, it was found that SEA was fulfilling its role and that considerable progress has been demonstrated in applying SEA in Ireland over a short seven years. The findings and recommendations of the review are considered further in Chapter 10.

National Landscape Strategy

The European Landscape Convention, adopted in 2000, emphasises the need to seek the right balance between management planning and protection of a landscape. The National Landscape Strategy Steering Group was established by the DAHG in 2011 to develop a National Landscape Strategy with the aim of sustainable management of change affecting landscape.

Figure 7.6 Distribution of SEA Plans/Programmes (Source: EPA)



Environmental Liability

The Environmental Liabilities Directive (ELD) was enacted in Ireland through the European Communities (Environmental Liability) Regulations (S.I. 547, 2008). The ELD establishes a framework for environmental liability based on the 'polluter pays' principle and aimed at preventing environmental damage to water resources, soil, fauna, flora and natural habitats. The central aim of the ELD is to hold operators whose activities have caused environmental damage financially liable for remedying this damage. In addition, the ELD holds those whose activities have caused an imminent threat of environmental damage liable for taking preventive actions. The EPA has been designated the competent authority in Ireland for the ELD and national regulations.

Investment in Research

The revival of a national effort on soils has been supported by significant investment since 2000 by the EPA Research Programme. Research in this area is intended to provide scientific knowledge to underpin the protection and sustainable use of soil. The National Soils Database (EPA and Teagasc, 2007) is the outcome of one project and provided Ireland with a baseline soil geochemical atlas. It provides data point and spatial distribution maps for 45 elements, including major nutrients such as phosphorus and potassium, as well as trace elements. A map of subsoils is now available from the Teagasc–EPA Soils and Subsoils project (EPA and Teagasc, 2009). The Irish Soil Information System aims to produce a national digital soil map at a 1:250,000 scale with the associated soil information system for Ireland by 2014. This important EPA and Teagasc initiative will address a significant gap in our knowledge of soils in Ireland.

The EPA-funded BOGLAND project provides valuable information on the importance of Irish peatlands to climate change, biodiversity and water quality. The study highlights the extent of the damage caused by antropogenic activities and makes recommendations for the development of a National Peatland Strategy. Land use and land change are a major pressure on water quality and biodiversity. Consequently research in these areas often considers LULC.

Conclusion and Future Challenges

The trend in the past decade towards the development of low-density residential development on the periphery of cities and the suburbanisation of satellite villages and towns has largely ended. Economic circumstances mean it is likely to be some years before there are pressures to convert a significant amount of land for development purposes. The main drivers of land use change over the coming decade will be the agricultural policies of afforestation and *Food Harvest 2020*. As highlighted elsewhere in this report, environmental considerations must be integrated in the implementation of these policies from the start to prevent unsustainable impacts on the environment.

The sustainable management of both land use and soils requires an integrated approach from the key statutory bodies. The proposed National Landscape Strategy for Ireland needs to be prepared and fully implemented. Similarly, a National Soil Protection Strategy, including the identification of soils at risk and addressing the need to establish a soil monitoring network, is required.

The information available on soil is currently not sufficient and it is vital to improve our evidence base to provide information and guidance to policy and decision makers. We can thus strengthen our assessment and understanding of threats and pressures and help identify the measures that are required to address priority issues. A national land use information and analysis capacity also needs to be developed to address the diverse range of information needs at local, regional and national levels. The EPA, NPWS, Teagasc, Heritage Council and OSi are currently working together to develop an integrated and shared approach to developing such a capacity.

Ireland's peatlands are of immense value and their degradation impacts on climate change, biodiversity and water quality. Inappropriate construction, unregulated extraction and site preparation at peatland sites have been shown to degrade peatland structural integrity over a wide area adjacent to some developments. It is important that these threats to ecosystem function and carbon stocks be minimised through robust and integrated planning, assessment, authorisation, enforcement and management processes. In this context the proposed National Peatland Strategy will be of considerable benefit.

The issues of spatial planning, land use and soil quality are intertwined and interdependent, and this should be reflected in integrated policies and plans at national, regional and local levels. The continued uptake of the SEA Directive across all economic sectors is important, and programme/plan makers across all sectors need to engage fully with the requirements of the SEA process.

While Ireland has fewer contaminated land problems than most other industrialised countries, there is no overall policy framework for the identification, management and remediation of contaminated land in Ireland. National legislation dealing specifically with soil contamination needs to be developed, including a mechanism for remediation of sites.

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III Managing and Protecting the Environment

Chapter 8
Environment and the Economy

Chapter 9
Environment and Health

Chapter 10
Future Challenges and Priorities


TESCO

Chapter 8
Environment and the Economy

Establishing a sustainable pattern of development is a key challenge for Ireland, and improving resource efficiency is a top priority to achieve this goal. Resource efficiency is also one of the key environmental priorities at EU level and is one of the seven flagship initiatives within the Europe 2020 Strategy. The challenge is to utilise resources in a sustainable manner throughout their life-cycle, avoiding over-exploitation and reducing the environmental and social impacts of their use.

Transforming the economy onto a resource-efficient path will bring increased competitiveness and new sources of growth, through cost savings from improved efficiency, commercialisation of innovations and better management of resources. This requires policies that recognise the interdependencies between the economy, wellbeing and natural capital and the removal of barriers to improved resource efficiency. To achieve a resource-efficient and green economy, there is a need to make a transition across all sectors of the economy and, in particular, the energy, agricultural and transport systems, as well as changing behaviours of producers and consumers.

Introduction

This chapter examines the interaction between economic activity, society and the environment and provides an integrated assessment of environmental quality, policies and initiatives. The environment doesn't exist in isolation; it both affects and is affected by many aspects of our lives. Environmental resources and ecosystem services are direct inputs into the economy. For example, clean water, air, soil, and vibrant biodiversity all contribute to a successful economy. While economic growth often receives political prioritisation, it goes hand in hand with social cohesion and environmental protection to deliver a high quality of life for citizens. The establishment of a sustainable pattern of development for Ireland is one of the key challenges of government and ultimately for society (DECLG, 2011). There is also a clear consensus at European and national levels that existing patterns of economic development must become more sustainable. The vision for the European economy is that by 2050 it will be competitive, inclusive and provide a high standard of living with much lower environmental impacts; that all resources are sustainably managed, while biodiversity and the ecosystem services it underpins will be protected and restored (EC, 2011a).

To help bring about this vision, resource efficiency has become one of the top environmental priorities and is one of the seven flagship initiatives within the Europe 2020 Strategy. The move to a resource-efficient EU economy fits within the context of worldwide efforts to achieve a transition to a green economy (OECD, 2011; UNEP, 2011).

Resource Efficiency and the Green Economy

In the EU today each person consumes 16 tonnes of materials annually, of which 6 tonnes is wasted, with half going to landfill (EC, 2011a). Globally over the 20th century, fossil fuel use increased by a factor of 12, while the extraction of material resources increased by a factor of 34. These are among the abundant examples of a profligate use of resources and an unsustainable growth path for both the economy and society. Continuing resource use at existing levels is not sustainable and will act as a barrier to future economic growth (OECD, 2011).

The European policy response is its roadmap to make Europe a resource-efficient economy (EC, 2011a). This flagship initiative aims at creating a framework for policies to support the shift towards a resource-efficient and low-carbon economy to:

- boost economic performance while reducing resource use
- identify and create new opportunities for economic growth and greater innovation and boost the EU's competitiveness
- ensure security of supply of essential resources
- fight against climate change and limit the environmental impacts of resource use.

The European Commission notes that to achieve a resource-efficient Europe, there is a need to make a transition in the energy, industrial, agricultural and transport systems, as well as making changes in behaviour as producers and consumers.

Embracing resource efficiency offers a path to job creation and economic growth. The challenge is to utilise resources in a sustainable manner throughout their life-cycle, avoiding over-exploitation and reducing the environmental and social impacts of their use. The European roadmap for resource efficiency is also linked with a world-wide effort to promote the concept of 'green growth' and the 'green economy'. This roadmap will be one of the key drivers for advancing the green economy agenda in the coming years. The EEA (2012a) defined the 'green' economy as one that establishes policies and innovations to enable society to use resources efficiently and enhance human wellbeing, while maintaining the natural systems that sustain us. At a basic level, the green economy is a clean energy economy, consisting primarily of four areas: renewable energy; green building and energy efficiency technology; energy-efficient infrastructure and transportation; and waste management (Chapple, 2008). But the green economy is not just about the ability to produce clean energy; it also includes technologies and activities that allow cleaner production and commercial processes that contribute to lowering of greenhouse gas (GHG) emissions and improving resource usage (DJEI, 2012).

The OECD (2011) has published a green growth strategy, which provides a framework for countries to achieve economic growth and development while preventing costly environmental degradation and the inefficient use of natural resources. Measures that are required for a transition to a green economy include a regulatory and policy framework that is adaptive, supportive and incentivises shifts away from traditional economic models. These include the wider introduction of user-charges and environmental taxes. User-charges for environmental resources should reflect the environmental cost and thereby incentivise use-efficiency. A shift to environmental taxes would enable the tax base to shift towards environmental pollutants and consumption and away from labour and production.

At a national level, the transition to a green economy is already Government policy (Department of the Taoiseach, 2008, 2010). A central plank of Ireland's economic recovery is the development of a green economy that recognises:

- the opportunities for investment and employment creation in sectors such as renewable energy, energy efficiency and waste and water management
- that a sustainable approach to economic development complements the core strength of our economy in the use of natural resources in the agriculture, forestry, fisheries, tourism and energy sectors.

The draft Framework for Sustainable Development for Ireland (DECLG, 2011) provides a means for advancing the green economy agenda in Ireland, taking account of the three pillars of sustainable development – economic, environmental and social. The Framework contains a range of measures to address the key challenges and priorities that will deliver change, and support the delivery of a broad sustainable development agenda. In relation to resource efficiency and the green economy, these measures include the following:

- Establishing an effective framework for transition to an innovative, low-carbon and resource-efficient society
- Identifying and adopting policies that can help achieve a shift towards greener growth
- Protecting and restoring our biodiversity and ecosystems so that benefits essential for all sectors of society will be delivered.

The Action Plan for Jobs (DJEI, 2012) underpins the need to develop the green economy in Ireland. It found that a range of drivers (such as increasing fossil fuel prices, renewable energy targets, emissions reductions targets, environmental legislation and consumer preferences) are creating significant opportunities for growth and jobs in green sectors. It estimates that in 2010, 19,000 people were employed directly in Ireland in key sub-sectors of the green economy and that through the adoption of appropriate policies, up to 10,000 additional jobs could be created by 2015. The longer-term job creation potential is even more significant, particularly in the area of renewable energy.

Ireland has a number of strengths that it can leverage to create employment and growth opportunities both for indigenous companies and for foreign investment in Ireland. These include the following (DJEI, 2012):

- Excellent renewable energy resources, which raise the prospect of Ireland becoming an exporter of clean energy to Europe
- A strong R&D base, including in the area of ICT, which is highly relevant to a number of green economy opportunities
- Strengths as a location to test and develop new technologies – in terms of both existing test-bed sites and taking advantage of Ireland's small size where new technologies can be tested for application to larger markets
- An outstanding natural environment and landscape to support 'green' tourism and activities
- An established international image as the 'Emerald Isle' that can be built upon to promote Ireland's 'green' offering.

The Action Plan sets as a key priority the publication and implementation of a new cross-Government plan for the green economy addressing the enterprise, energy, environment, transport, tourism and agri-food sectors. It also identifies a range of other actions, for example in relation to green public procurement; targeting FDI opportunities in the green economy; developing a brand to communicate Ireland's reputation for green goods and services; attracting a new range of 'green'-related financial products and services to Ireland; focusing public investment in research and development in areas of direct relevance to the green economy; and developing niche markets in green tourism and food, by promoting standards such as the EPA Green Hospitality Award.

Public authorities are major consumers, spending approximately €14 billion annually. Ireland's public

Table 8.1 Summary Data for a Selection of NWPP Resource Efficiency Programmes (EPA, 2011)

Programme	NWPP Investment (c. 2011)	Resource Efficiency	Actual and Potential Savings Identified (last 12 months)	Return on Investment (rounded)
Green Hospitality Award	€0.452M	6,400 t waste prevented 38,748,000 kWh energy saved 352,000,000 litres water saved 221 members 125 properties certified	€5.58M	12:1
Green Business Initiative	€0.374M	Water, energy & waste savings 479 active members 45 Resource Efficiency Assessments Typical savings of €40,000 per annum per company assessed	c.€4M	11:1
€co-Cert	€0.03M	50 members 31 certificates Average >€5,000 savings per certified member	€0.16M	5:1
Green Healthcare Project	€0.150M	2,700 t waste could be prevented €80,000 potential savings in water use in three hospitals	€1.6M	11:1
SMILE	€0.106M	658 waste 'matches' made 6,800 t waste potentially diverted Numerous services & logistics traded	€0.812M	8:1
Green Retail	€0.05M	265 cost saving actions in energy, water & waste for 10 participant stores	€0.142M	3:1
Green Home	€0.125M	11,000 participant households >40,000 visits to greenhome.ie website Est. €320 potential saving per high performing household	€0.8M	6:1

sector has considerable leverage to stimulate the marketplace to favour the provision of more resource-efficient, less polluting, goods and services. *Green Tenders: An Action Plan on Green Public Procurement* (GPP) (DPER & DECLG, 2012) is aimed at boosting the uptake of GPP, which is an important tool in advancing the green economy and resource efficiency agenda.

The Action Plan identifies eight areas of procurement as particularly suitable for GPP in the first instance: construction; energy; food and catering services; transport; ICT; cleaning products and services; paper; and uniforms and other textiles. It sets an indicative target to be achieved as soon as possible, that at least half of public procurement contracts will include GPP criteria.

A substantive element of the EPA-led National Waste Prevention Programme (NWPP) is focused on resource efficiency and dealing with production and consumption behavioural change. The NWPP is part of a national family of programmes, including those run by SEAI, Enterprise Ireland and IDA Ireland, which are designed to promote a more sustainable society and economy. In recent years the scope of the NWPP has been expanded to include wider resource use including water and energy. Projects include those aimed at householders (Green Homes), industry (Green Hospitality Award, Green Business) and local authorities. The most recent report of the NWPP (EPA, 2011) shows that in many cases the resource efficiency projects are resulting in significant commercial gains and savings for participants as well as positive outcomes for the environment (Table 8.1)

The remainder of this chapter reviews current progress and future challenges for development of the green economy. It broadly follows the thematic approach of the *EU Sustainable Development Strategy* and the draft *Framework for Sustainable Development for Ireland*. It considers the current initiatives, challenges and opportunities for the green economy and resource efficiency in the context of material consumption and waste; management and use of natural resources; clean and efficient energy; sustainable transport; and sustainable agriculture.

Material Consumption and Waste

The EC Roadmap for a resource-efficient Europe (EC, 2011a) noted that changing the consumption patterns of private and public purchasers will help drive resource efficiency and have the potential to generate direct net cost savings. The use of material resources in the EU as a whole peaked at 8.3 billion tonnes (measured as Domestic Material Consumption – DMC), declining to 7.3 billion tonnes in 2009 (EEA, 2012a). The European Commission (EC, 2011a) noted that through the use of efficient and cleaner production systems, this level of material use could be reduced, while boosting competitiveness. Furthermore, improving the re-use of raw materials through greater 'industrial symbiosis' (where the waste of some firms is used as a resource for others) could save €1.4bn a year and generate €1.6bn in sales across the EU.

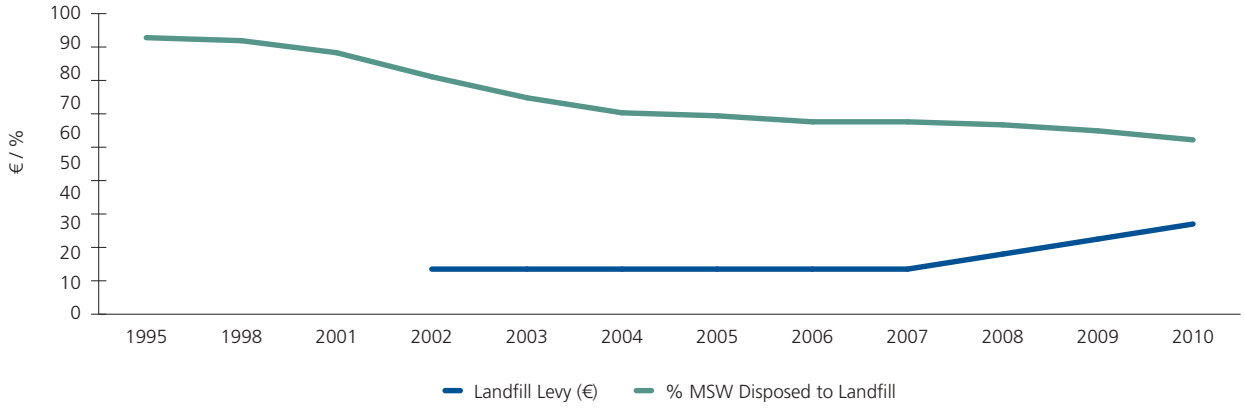
The use of resources and the generation of waste are different sides of the same coin. Each year in the European Union on average only 40% of solid waste is re-used or recycled, with the rest going to landfill or incineration. Improving waste management provides opportunities to improve the use of resources, open up new markets and jobs and at the same time reduce pressures on the environment. In 2010, almost 1.5 million tonnes of municipal waste was sent to landfill in Ireland. Much of this material has the potential to be re-used or recovered.

Ireland is legally obligated to improve its use of resources and waste management practices. The Waste Framework Directive incorporates a wide range of measures in waste prevention and recovery, as well as re-use of waste materials as a raw material substitute. It also requires Member States to take measures to encourage separate collection of the putrescible portion of biodegradable wastes, whereas the Landfill Directive places specific targets on the diversion of biodegradable municipal waste from landfill. The Packaging Directive, the WEEE Directive, the End of Life Vehicles Directive, and the Batteries Directive are among a host of EU legislative measures that obligate the management of waste materials in a more sustainable manner.

A range of other policy measures have also supported the sustainable use of resources. The plastic bag tax is a particularly good example of a financial incentive that changed behaviour. More recently, the Waste Management (Food Waste) Regulations 2009 (SI 508 of 2009) places obligations on major food establishments to segregate food waste for separate collection and processing, a policy that is intended to contribute to the targets on the diversion of biodegradable waste from landfill.

The landfill levy is a key national policy aimed at incentivising the diversion of all materials from landfill disposal. Since its introduction in 2002, it has been mirrored by a downward trend in the percentage of municipal waste disposed (Figure 8.1). In April 2011 the Minister for Environment, Community and Local Government outlined proposed landfill levy rates until 2013, as

Figure 8.1 Landfill Level and the Disposal of Municipal Solid Waste to Landfill (Source: EPA)



shown in Table 8.2. As noted in Chapter 5, the increasing levy together with the impact of the recession is driving post-consumption management options up the waste hierarchy towards more sustainable behaviours, with much improved waste recovery and recycling evident in recent years.

Table 8.2 Landfill Levy Rates 2002–2013

Effective Date	€/tonne
1 June 2002	15
1 July 2008	20
31 December 2009	25
1 February 2010	30
1 September 2011	50
July 2012	65
July 2013	75

Improved waste recycling and recovery decreases the amount of waste that is landfilled, while reducing the extraction and use of materials used in the economy (EEA, 2012a). The most recent national waste statistics reported by the EPA (EPA, 2012a) show that in 2010 approximately 71% of households in Ireland are serviced by a waste collection service. Of these households:

- 5% have a single-bin (residuals bin) service only
- 61% have a two-bin service only (residuals and dry recyclables)
- 34% have a three-bin service (residuals, dry recyclables and organics)

Extending the use of weight-based charging for the residuals bin would incentivise householders to increase the separation of waste at source.

The tonnage of future streams of waste is linked to the performance of the economy. Using the ISus model, it is possible to project future tonnages of municipal waste generation for the period up to 2025 depending on different economic recovery scenarios. For example, using a prediction of a growth rate not exceeding 1% per annum, it is anticipated that the total municipal waste generated could increase by c. 825,000 tonnes within the next 15 years (Figure 8.2) (EPA, 2012a). A similar pattern emerges for other waste streams. In the coming years it will be important that waste prevention and resource conservation become embedded across all sectors of the Irish economy, so as to assist in the decoupling of waste generation in Ireland from any future economic growth. The current recession affords the opportunity to introduce new technology and processes to improve the sustainability of waste management in advance of the forecasted growth in waste generation.

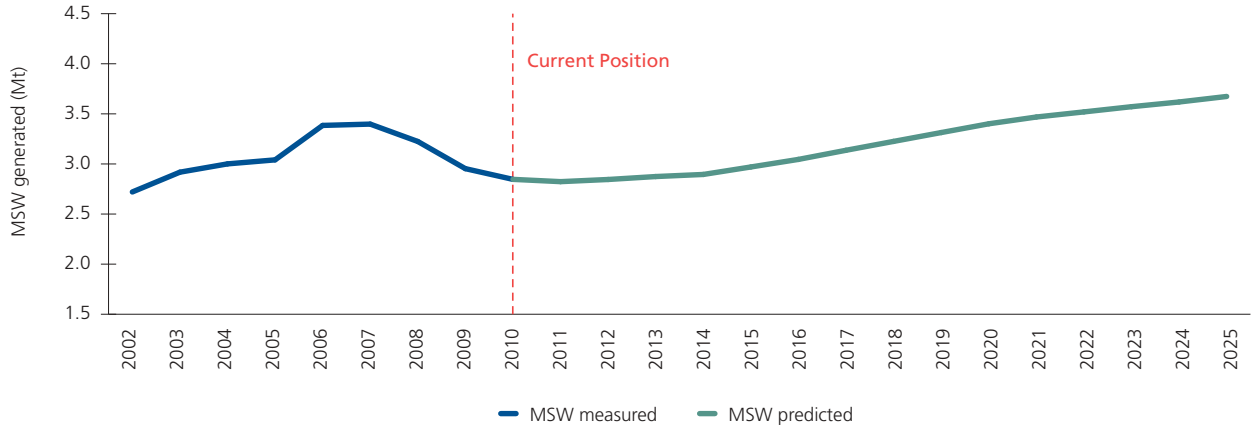
Management and Use of Natural Resources

Water

Efficient use of water resources is vital both for environmental growth and for environmental protection. As well as supplying household water requirements, economic sectors such as agriculture, energy, industry and tourism depend on reliable freshwater resources. A sustainable approach to water resource management requires that society conserve water and use it more efficiently (EEA, 2012a). It has been estimated that by 2007 at least 11% of Europe's population and 17% of its territory had been affected by water scarcity, putting the cost of droughts in Europe over the past 30 years at €100 billion. This situation is expected to deteriorate further if temperatures keep rising as a result of climate change (EC, 2012a)

The EC-proposed Blueprint to Safeguard Europe's Water Resources (EC, 2012a) has the long-term objective of ensuring availability of good-quality water for sustainable and equitable water use in line with

Figure 8.2 Predicted Growth in Municipal Solid Waste (MSW) Generation (ISus Model)



the Water Framework Objectives. The Blueprint is closely related to the EU 2020 Strategy and will be the water milestone on the EU's Resource Efficiency Roadmap. Its main focus will be to:

- improve the implementation of current EU water policy
- foster integration of water and other EU policy objects – managing trade-offs on the basis of a better understanding of the costs and benefits of both economic activities and water resource management
- seek the completion of the current policy framework, particularly in relation to water quantity, efficiency and adaptation to climate change.

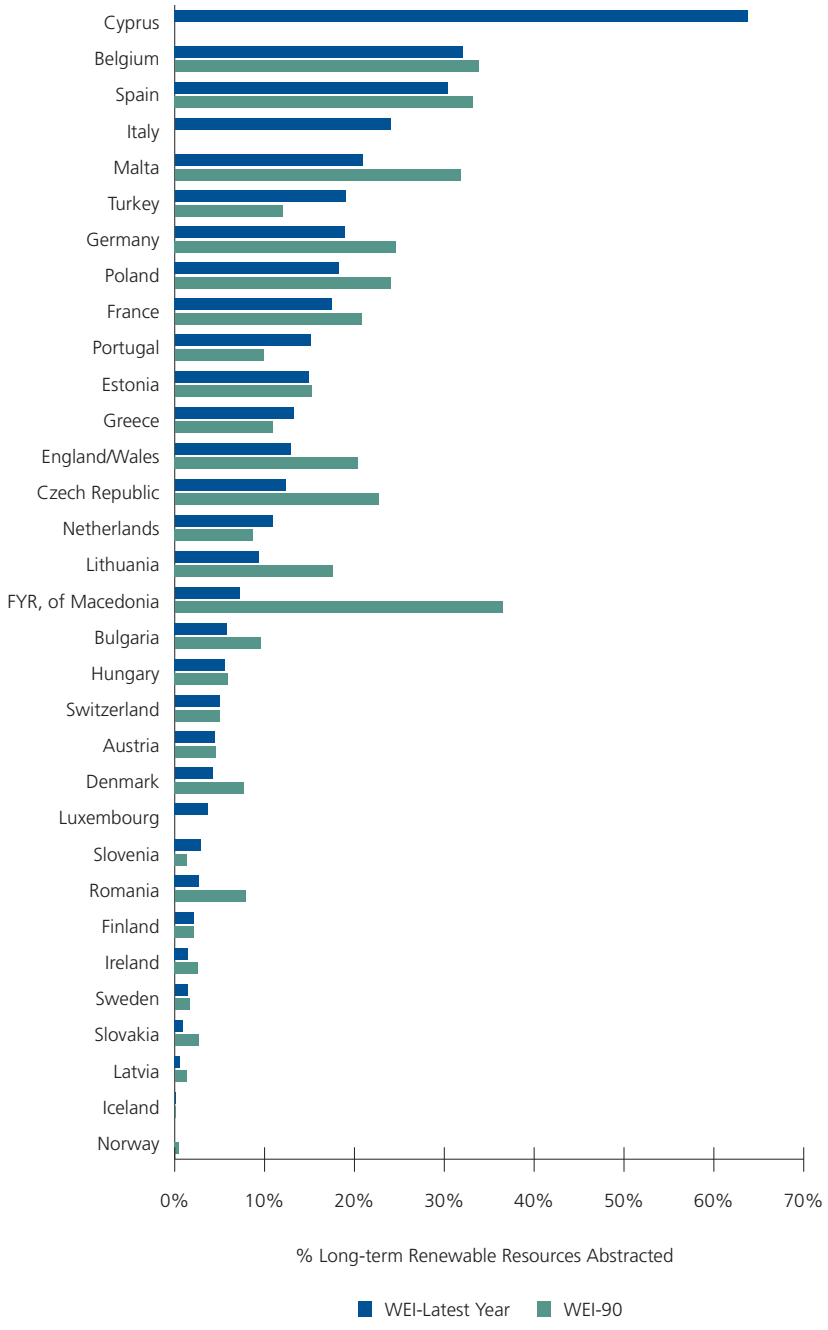
An indicator of resource efficiency for water is the water exploitation index (WEI). Over-abstraction and over-exploitation have a direct impact on the ecological health of aquatic ecosystems and can also reduce the capacity of the systems to absorb other pressures such as those from pollution. Figure 8.3 shows the water exploitation index for the majority of EU countries, and some other countries. It shows that accessible water is concentrated in some regions and in shorter supply elsewhere. As the value of water increases globally, it is anticipated that Ireland's valuable water resources will become of increasing strategic importance to the Irish economy and have the capacity to position Ireland well in terms of competitiveness (DECLG, 2012). As such, Ireland has the potential to exploit its competitive advantage and explore opportunities for using its water resources in a sustainable way to support economic growth. However, it should be noted that there is no comprehensive register of water abstractions in Ireland, and consequently, no definite figures on the current level of abstractions across the country. A regulatory system for the authorisation of water abstractions in the State is required to ensure adequate protection and strategic management of Ireland's water resources.

Ireland's Sustainable Development Model (ISus)

Ireland's Sustainable Development Model (ISus) is an environmental emissions projection model for the economy of Ireland. Essentially, ISus takes economic forecasts of ESRI's macroeconomic model, HERMES, and generates environmental accounts for future years to 2030. ISus models how the evolution of activity across the economy and society affects waste generation and emissions of potential pollutants. The model covers in excess of 70 substances and potential pollutants (to air, water and waste) emanating from 19 (NACE) productive sectors, as well as the residential sector.

The model was developed by the Economic and Social Research Institute (ESRI) and funded by the Environmental Protection Agency. Further information about the model is available at the ESRI's website at esri.ie/research/research_areas/environment/isus. A range of emissions projections presented in this chapter are from the ISus model.

Figure 8.3 Water Exploitation Index for some EU and Other Countries 1990 and 2010 (EEA, 2012b)



The Water Framework Directive includes a provision for Member States to take account of recovery of the costs of water services, and requires that, where implemented, water pricing policies should provide adequate incentives for users to use water efficiently. In Ireland, the provision of drinking water cost over €1.2 billion in 2010, with over 1.6 billion litres of water supplied by water services authorities on a daily basis. However, the DECLG has recognised that the current model of water provision, where unlimited quantities of an expensive product are provided at no charge, is not sustainable (DECLG, 2012). Ireland remains the only country in the OECD where households do not pay directly for the water they use. The OECD has found that pricing the use of environmental resources has proved to be a powerful tool for influencing consumer decisions (OECD, 2011). It found that households that are metered and pay for water consumption use approximately 20% less water than uncharged households.

The paper on the *Reform of the Water Sector in Ireland* (DECLG, 2012) signals the Government's intent to take a national approach to water with the aim to conserve water resources and increase the cost efficiency associated with water provision. In April 2012, the Government announced the creation of Irish Water as an independent State-owned subsidiary within the Bord Gáis Éireann group. It is intended that Irish Water will be established as a wholly owned public water utility that will manage the national investment and maintenance for Ireland's water and sewerage networks. The Government also plans to implement a universal water metering programme for users of public water supplies. This will facilitate moving to a charging system for domestic water users, based on usage above a free allowance.

Biodiversity

According to the United Nation's Food and Agriculture Organisation, at least 40% of the world's economy is based on the use of biological resources (DECLG, 2011). Ireland's biodiversity is valued in excess of €2.6 billion per annum (Bullock et al., 2008), from which the economy and society derive a variety of services including:

- provisioning services (e.g. production of food and water)
- regulating services (e.g. the control of climate and disease)

- supporting services (e.g. nutrient cycling and crop pollination)
- cultural services (e.g. recreational benefits).

There is a clear link between the protection of habitats, species and ecosystems and the direct benefit to society and economy. For instance, food production depends on pollination and nutrient cycling, whereas the tourism sector markets itself as a clean green destination. As noted in Chapter 1, visitors' surveys by Fáilte Ireland show that the majority of overseas visitors are attracted by the natural, unspoiled environment that Ireland offers.

In addition, Ireland is party to the Convention on Biological Diversity and has implemented several EU directives, such as the Birds Directive and the Habitats Directive, which aim to protect biodiversity. In 2011 a national biodiversity plan was published (DAHG, 2011). A key objective of the plan is to mainstream biodiversity in the decision-making process across all sectors. Getting all sectors to recognise their responsibility with regard to their impact on biodiversity and the environment is a necessary element in protecting biodiversity and the value it contributes to society and the economy.

Clean and Efficient Energy

Ireland is committed to a range of renewable energy and efficiency targets, many of which are being implemented as climate policy measures to reduce carbon emissions. At a European level, the '20/20/20' commitments agreed under the EU Climate Change and Energy Package set three new targets for 2020:

- a minimum 20% reduction in GHG emissions based on 1990 levels
- 20% of final energy consumption to be produced by renewable energy resources
- 20% reduction in primary energy use compared with projected levels to be achieved by improving energy efficiency.

Under the European Renewables Directive, the national 2020 target for Ireland is to source 16% of all energy consumed from renewable sources. In addition, Ireland must achieve a 10% share of renewable energy in transport consumption by 2020 (known as RES-T). Ireland's National Renewable Energy Action Plan (NREAP) details a pathway for Ireland to meet these binding commitments by setting national targets whereby renewable energy should comprise 12% of heat demand (known as RES-H) and 40% of electricity demand (known as RES-E). Large-scale development of renewable energy sources is envisaged over the next decade, particularly in the heat and transport sectors. The position in relation to these three targets in 2010 is as follows: RES-H was 4.4%, RES-T was 2.4% and RES-E was 14.8%. Ireland's progress in relation to the overall Renewable Energy Directive target was 5.5% in 2010 relative to a target of 16% to be met in 2020 (SEAI, 2011a). From an environmental perspective the expansion of renewable energy is welcome, particularly from a climate viewpoint.

Energy efficiency enables achievement of the same or improved performance with less energy which is positive from an energy and subsequently an emissions perspective. Energy efficiency lies at the heart of European energy policy and is fundamental to improving energy supply, reducing carbon emissions, fostering competitiveness and stimulating green technological development. The Energy Services Directive is the overarching framework within which energy efficiency policy is formulated. Ireland's National Energy Efficiency Action Plan (DCENR, 2009) sets out Ireland's strategy to meet energy efficiency obligations at national and EU levels. Ireland has a national target to deliver 20% improvement in energy efficiency savings in 2020. Government must take a lead role in this process and, accordingly, a higher target of 33% has been set for the public sector. While Ireland

has already achieved significant efficiency gains, namely a 50% reduction in the primary energy requirement per value of output between 1990 and 2010, the new policy target will be a major challenge.

A number of schemes to improve energy efficiency in recent years have had varying success. An initiative aimed at large energy users, the Large Industry Energy Network (LIEN), reported a 5.2% energy efficiency gain in 2008 (SEAI, 2009a). On the residential side the 'Home Energy Saving' scheme operated by SEAI was a success, with over 135,000 energy efficiency grants paid. The value of energy cost savings are anticipated to average at €450 per annum per participating home with an estimate of total emissions avoided at 2.4 million tonnes of CO_2 (SEAI, 2011a).

With high fossil fuel prices in recent years, there is evidence that households and businesses are switching to more cost-efficient (and carbon-efficient) energy sources (Cahill and Ó Gallachóir, 2011; Leahy and Tol, 2011). In 2011 the Better Energy programme was launched to supersede existing residential energy retrofitting subsidy programmes.

The carbon tax, introduced in 2009, is a policy instrument specifically designed to encourage and accelerate fuel switching away from carbon-intensive fuels, and was increased to €20/tonne in Budget 2012. However, two of the most carbon polluting fuels, peat and coal, continue to be exempt from this tax.

Improving energy efficiency is a difficult policy challenge. The empirical evidence suggests that financial incentives work, though programmes need to be closely monitored to ensure that they are cost-effective. At present there are a number of incentive schemes but the most effective incentive to improve energy efficiency may be the combination of carbon tax and high fuel prices. Public education about energy efficiency is also a necessary element to change behaviour. There is evidence that people utilise energy efficiency information in their decisions, with Alberini et al. (2012) finding that house buyers and renters utilise Building Energy Ratings (BER) and are willing to pay more for facilities with greater energy efficiency.

Sustainable Transport

Transport accounts for almost one-fifth of total GHG emissions and is an emission source that will require major action if Ireland is to meet its 2020 emissions obligations. Between 1990 and 2007, transport emissions grew considerably, with emissions in 2007 137% higher than in 1990. However, since 2007 transport emissions have decreased by 20% – due largely to the economic downturn and changes to the vehicle registration and road taxes. Given the strong relationship between growth in transport emissions and the economy, it is reasonable to assume that as the economy recovers, transport emissions will increase without sustained policy action and further intervention.

Sustainable transport is central to efforts to control GHG emissions, air pollution and environmental damage. The benefits of sustainable transport, however, extend beyond environmental considerations, delivering improvements in congestion, productivity, health and quality of life. Sustainable transport is central to European transport policy (EC, 2011b) and is in line with EU flagship initiatives on resource efficiency and energy efficiency. Transport is also an integral component of the proposed framework for sustainable development (DECLG, 2011).

Nationally, the Government's policy approach to sustainable transport is set out in 'Smarter Travel – a Sustainable Transport Future', which aims at reversing current unsustainable transport and travel patterns. Key goals of the strategy include improving economic competitiveness through maximising the efficiency of the transport system; alleviating congestion and infrastructural bottlenecks; minimising the negative impacts of transport on the local and global environments; reducing overall travel demand and commuting

distances travelled by private car; and improving security of energy supply by reducing dependency on imported fossil fuels. The strategy aims to bring forward actions to reduce the distance travelled by private car, to improve access to alternatives to the car, to improve fuel efficiency and to improve governance to deliver implementation of sustainable transport policy. The policy requires actions from a wide range of Government Departments, agencies and local authorities.

Investment in transport, and in particular in large-scale public transport projects such as Metro North, has seen a sharp fall in funding as a result of the economic recession. Government policy is now focused on a wide range of small-scale projects such as improving the existing network, cycling and pedestrianisation projects and the Smarter Travel Areas programme.

In 2012, Limerick City, Dungarvan and Westport were awarded a combined total funding of €23 million over a five-year period to transform into Smarter Travel Areas, promoting cycling and walking, the use of public transport, and reducing car travel. In broad terms, these Smarter Travel Area projects include provisions for:

- improved cycling ways, including safe routes to school and to key business and workplace zones
- secure cycle parking in town centres or at public transport nodes
- better walking facilities, including pedestrianisation
- lower speed limits in residential and town centre areas
- school and workplace travel planning
- e-working
- car clubs.

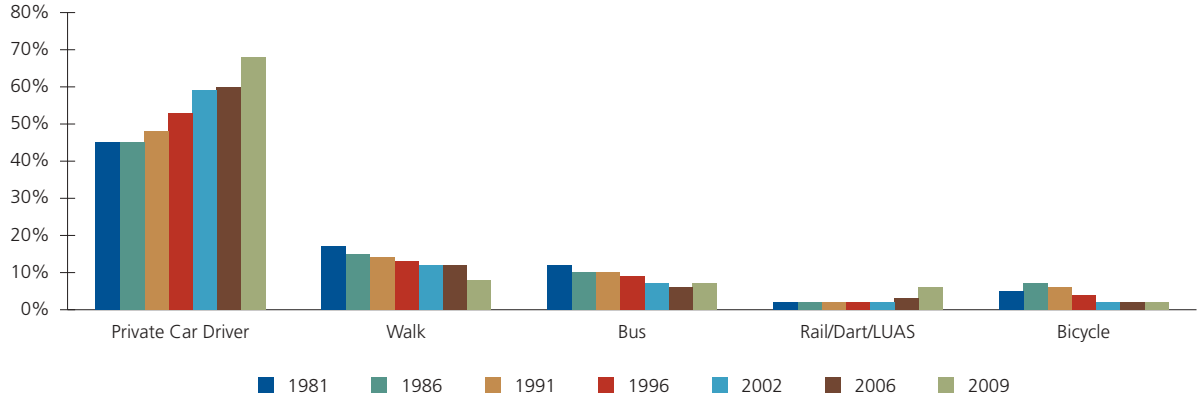
Alternative fuels and electric vehicles also comprise a significant element of Government policy to reduce transport emissions. Under the European Renewable Energy Directive, Ireland is obliged to deliver 10% of transport energy by renewable sources by 2020 – this is the RES-T target. The Biofuels Obligation Scheme 2010 and the rollout of electric vehicles underpin the achievement of this target. The electric vehicle target is for 200,000 electric vehicles in the national vehicle fleet by 2020. Electric vehicles are projected to account for one-tenth of the RES-T target by 2020, with biofuels contributing the remaining nine-tenths.

EPA emission projections (2012b) estimate that, under the most optimistic scenario, transport emissions will decrease by 1.4% over the period 2011–2020, returning transport emission to 2002 levels by 2020. In this scenario, it is assumed that renewable energy penetration is 10% by 2020 while more efficient road traffic movements and public transport efficiencies are also assumed to deliver savings. Achieving emissions reductions into the future in the transport sector remains a significant challenge – the EPA projections are predicated on the assumption that all policies and measures will deliver as anticipated and in full. Failure to deliver on these policies will result in higher emissions from this sector.

Research on Irish transport and policy initiatives further highlights the difficulty of moving to a more sustainable transport economy. Figure 8.4 shows that despite the economic downturn, the proportion of those travelling to work by private cars is still growing, while use of more sustainable travel modes is declining.

Switching vehicle taxation to emissions instead of engine size in 2008 was an attempt to incentivise more sustainable transport choices. The new car taxation system also highlights how environmental

Figure 8.4 Travel to Work Mode by Percentage (Source: CSO)



sustainability is interwoven with economic and financial (exchequer) sustainability. In the first year of the new emissions-based taxation system, average emissions of new cars fell by 13%, due to a significant switch to diesel cars, and estimated total emissions declined by 5.9 kt CO_2 (Rogan et al., 2011). This was a significant policy success and the consumer trend since then is towards emissions-efficient cars. The re-adjustment of tax band rates in Budget 2012 continues the incentive towards more emissions-efficient cars while maintaining Exchequer revenues.

Reducing reliance on the private car is a difficult policy target, particularly in a low-density, dispersed population such as Ireland's. Integrating spatial planning and transport investment is one of the most effective means of controlling emissions from road transport and reducing reliance on car use. A significant legacy of Ireland's rapidly growing economy in recent years has, however, been urban sprawl and low-density development, which has 'locked in' unsustainable travel patterns. Countering these established travel patterns and providing attractive and cost-effective public transport alternatives now presents a serious challenge given the limited public finances for investment in transport infrastructure.

Research suggests that two overriding issues are important in developing policies to reduce reliance on private cars. First, there is a strong persistence in car ownership in Ireland (Nolan, 2010), making the policy challenge to switch transport modes one not just of providing transport alternatives but also of aggressively tackling entrenched behaviours. The second issue is journey time (with the associated issue of frequency of service). While many factors are important, journey time is a particularly important factor influencing choice of mode of transport to work (Commins and Nolan, 2010). The policy challenge to switch transport modes is not just one of providing transport alternatives but of providing attractive alternatives.

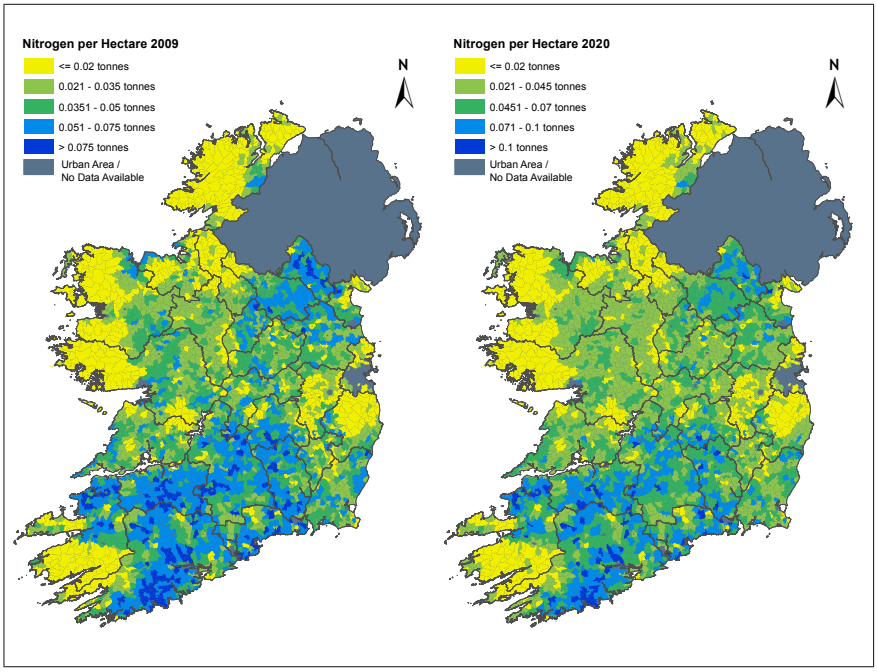
Sustainable Agriculture

In Ireland, the agri-food sector's contribution to the economy is large, generating an annual output of over €24 billion (DaFF, 2010). Government policy envisages the sector expanding, supplying foodstuffs to the world's growing population, as outlined in the sector's development strategy, *Food Harvest 2020*. The main goals of the strategy are as follows:

- Increase the value of primary output in the agriculture, fisheries and forestry sector by €1.5 billion (a 33% increase compared to the 2007–2009 average)
- Increase the value added in the agri-food, fisheries and wood products sector by €3 billion (a 40% increase compared to 2008)
- Achieve an export target of €12 billion for the sector (a 42% increase compared to the 2007–2009 average).

The strategy recognises that agriculture, fisheries and forestry activities can negatively impact on water, soil and air quality and on biodiversity. It stresses that meeting the ambitious growth targets for the agriculture sector will mean meeting these environmental challenges as well as reducing the carbon intensity of Irish agriculture. *Food Harvest 2020* explicitly recognises that environmental sustainability is an essential requirement for the food production systems of the 21st century and that there are significant marketing and trading advantages as a result of Ireland's 'green' image.

Map 8.1 Nitrogen Concentration Projections under *Food Harvest 2020*



Nonetheless, a key component of the strategy – that of increasing milk production by 50% with the removal of milk quotas – will pose serious challenges to achieving this environmental sustainability. As outlined in Chapter 2, agriculture is the single largest contributor to Ireland's overall GHG emissions, accounting for over 30% of the total. EPA emission projections (2012b) are that emissions from the agriculture sector will increase by 7% by 2020 on current levels as the removal of milk quota and the impacts of expansion under the *Food Harvest 2020* plan come into effect.

Ireland's emissions profile is unique among EU Member States, with the highest national proportion of agriculture emissions. This presents particular challenges for Ireland in meeting future GHG emission reduction targets. Ireland's production systems are already at the higher end of efficiencies in terms of efficiency per unit production, which highlights the challenges faced by the sector to identify further cost-effective measures to limit emissions.

For example, a recent EU study has shown that using a full life-cycle approach, Ireland's extensive grass-based systems produces the lowest GHG emissions in the EU for dairy animals and the fifth lowest for beef. In addition, Bord Bia has incorporated an assessment of sustainability on 32,000 beef farms into its Beef Quality Assurance Scheme, which led to accreditation by The Carbon Trust of a carbon footprint calculation for Irish beef production (DAFM, 2011).

The agriculture sector's approach to increasing production while limiting the growth in emissions is based on a 'sustainable intensification' model. This will include establishing farming practices and production methods that reflect the increasing concern for maximising efficiency and limiting emissions. While there are clearly benefits to be derived from, for example, optimising nutrient management and livestock management, such an approach is unlikely to deliver the deep emission reductions that are required to reduce overall national emissions.

It is vital that the implementation of *Food Harvest 2020* be undertaken in a manner that ensures that any increases in GHG emissions from the agriculture sector are addressed, and do not overburden the other key sectors, which would have to take on further emission reductions to make up for any shortfall from the agriculture sector.

Similarly, in the area of water quality, Ireland has international obligations under the Water Framework Directive and the Nitrates Directive. As outlined in Chapter 4, agriculture is one of the main sources of nitrates in groundwaters and of nutrient enrichment of surface waters. It is important that the proposed development of the agriculture sector does not prevent Ireland from meeting its international obligations. DAFM, in collaboration with the DECLG and the EPA, secured an extension of the Nitrates derogation to 2013, on foot of the satisfactory outcome of the first Nitrate Action Programme (NAP) and agreement on an enhanced second NAP. However, increasing milk production by 50% by 2020 will potentially increase total nitrogen generation from bovine livestock by as much as 14% between 2009 and 2020.

Map 8.1 shows that much of the increase in nitrogen generation will be concentrated in counties Limerick, Cork, Tipperary, and Waterford. With nitrogen and phosphate pollution already a significant problem, the expansion of the national dairy herd could compound this issue. The challenge for environmental sustainability of *Food Harvest 2020* is to ensure that nutrient management practices will be sufficient to prevent environmental damage to water bodies and that significant new mitigation measures will be developed and implemented to reduce emissions of GHGs.

Environmental Regulation

Although environmental regulation is sometimes perceived as a threat to competitiveness, it contributes a large dividend in terms of environmental improvements. The EC has indicated that implementation of EU environmental law will be a cornerstone of its forthcoming Seventh Environmental Action Programme (7 EAP). It cites that delayed or poor implementation can have negative consequences – not just for the environment, but also for the economy, by creating regulatory uncertainty for industry and distorting the Single Market (EC, 2012b).

The EC has also noted that the cost of inaction is greater than the cost associated with implementing legislation. For example, the clean-up of illegal waste sites and other contaminated land can outweigh the initial costs of prevention. The cost of not implementing the current EU environmental legislation is broadly estimated at €50 billion. This relates not only to environmental impacts, but also to human health impacts (e.g. as a result of breaches of air quality standards) (EC, 2012b).

Similarly, the EC has also estimated that the full implementation of EU waste legislation will generate 400,000 jobs and have net costs of €72 billion per year lower than the alternative scenario of non-implementation.

In a national context, between 2001 and 2007 the IPPC regulatory framework in Ireland is estimated to have contributed a 40% absolute reduction in direct pollution, and 45% pollution avoidance relative to a hypothetical non-IPPC regulatory scenario (Styles et al., 2009). Within the pharmaceutical sector the benefit of pollution avoided is estimated at over double the emission control cost incurred by the pharmaceutical companies (Styles and Jones, 2010).

Pollution/emissions abatement is generally the most cost-efficient approach to environmental protection. The evidence from the analysis of expenditures of industrial firms is that the implementation of the EPA's IPPC licensing regime is cost-effective, in that direct compliance costs borne by operators are considerably lower than the avoided external pollution costs.

Conclusion and Future Challenges

Before the current recession began the global economy was five times the size it had been 50 years ago and, if it had continued on that growth path, would be 80 times that size by 2100 (SDC, 2009). Such growth rates are unprecedented and they raise the fundamental question of how they can be sustained in a world of finite resources and fragile ecosystems. Continuing on the same path is clearly not sustainable.

The current economic recession provides an opportunity to break that cycle and follow an environmentally sustainable approach to production and consumption, with a focus on resource efficiency. The success of the EPA's National Waste Prevention Programme has demonstrated that well-targeted and well-designed resource efficiency initiatives can result in savings and gains to business and, at the same time, lead to positive environmental outcomes. In addition, EPA research has shown that the implementation of new technologies can reduce water and energy use, moderate waste and wastewater generation, as well as deliver significant financial returns (EPA, 2009, 2010). Investing in environmental technologies is good for the environment and does not impact negatively on competitiveness.

Equally in the policy arena there is an opportunity to learn from previous environmental policy successes, including the plastic bag tax, the realignment of vehicle registration tax (VRT), and the BER scheme. One important element of successful environmental policies is a wide consensus on the need for policy intervention. For example, Convery et al.'s (2007) analysis of the plastic bag tax shows that the popularity of the measure was due in part to the public belief that the tax was

introduced primarily to address the environmental problem rather than a measure to raise general Exchequer revenues. Transparency surrounding policy design and implementation, as well as public consultation, can be a critical element in successfully introducing environmental policies.

The polluter pays principle, which contends that the party responsible for environmental pollution should bear the cost of measures to reduce damage, underpins many environmental policies and laws, including for example Irish waste policy. Notwithstanding that principle, the distributional effects of policy measures are equally relevant, particularly if considered disproportionate or inequitable. The impact of environmental policies on households' expenditure is not always well understood, with indirect effects often dominating. An analysis by Callan et al. (2009) highlights the complexity of the distributional implications of a carbon tax in Ireland and shows how the tax weighs more heavily on rural than on urban households and hits smaller households harder. A greater understanding of the distributional implications of environmental policy measures will help design instruments that are considered proportionate and equitable and still create an incentive for environmental protection.

Establishing a sustainable pattern of development for Ireland is a key challenge of government (DECLG, 2011), and improving resource efficiency is a top priority to achieve this goal. The economic downturn, for the present, has curbed the growth in consumption of materials, natural resources and energy. As businesses and households adjust to the new economic climate, it is also an opportunity to change patterns of resource use, bringing the green economy to the fore. Transforming the economy onto a resource-efficient path can bring increased competitiveness and new sources of growth through cost savings from improved efficiency, commercialisation of innovations and better management of resources. This requires policies that recognise the interdependencies between the economy, wellbeing and natural capital and the removal of barriers to improved resource efficiency (EC, 2011a)

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Chapter 9
Environment and Health

Environmental protection and health protection are inextricably linked. At a time of major concern about employment and economic issues, it is easy to overlook the truth in the maxim that health is wealth. Protecting the Irish environment plays an essential role in protecting the health of the population.

In Ireland the quality of drinking water from large public supplies is comparable to that in other EU countries, and the risks to health from all public supplies continue to reduce. Implementation of legislation on waste water treatment plants, industrial activities and septic tanks as well as good agricultural practice will further reduce the risks to drinking water quality and reduce water pollution generally.

Air quality, noise and odour pose little overall risk to public health in Ireland, although these issues can give rise to localised concerns and impacts. The continued implementation of relevant European and Irish legislation will maintain a healthy environment. Actions are required, however, to reduce the risk to health from high radon levels in some areas.

Maintaining and benefiting from a healthy environment requires coordinated efforts from many government and public bodies to ensure that existing and future activities maintain or improve the quality of the environment. Small, medium and large-scale businesses and industry also play an important role in this area by ensuring their activities do not cause pollution or create environmental liabilities for future generations, with a particular responsibility falling to farmers as guardians of the rural environment. Finally, the public play an important part by not polluting their local environment and by taking advantage of the tangible benefits to health that come from contact with a good-quality environment.

Introduction

The World Health Organisation (WHO) defines health as complete physical, emotional and social wellbeing and not just the absence of disease; the environment impacts on all of these aspects. Clean air and water are essential to health, but physical activity, activities of daily living, transportation, urban design, community participation, food supply and nutrition also impact on health and are directly related to both the environment and wellbeing. When ecosystems are maintained in good condition they provide direct health benefits: a growing body of evidence demonstrates the value of contact with nature in the prevention/ treatment of conditions including stress, depression and obesity (Annerstedt and Währborg, 2011).

Pollution in the environment can harm health. The WHO estimates that environmental hazards are responsible for as much as a quarter of the total burden of disease worldwide and that as many as 13 million deaths could be prevented every year by improving environmental quality (WHO, 2006). The causes of most of these deaths are air pollution, poor water quality and insufficient sanitation. These risks to human health are not confined to the developing world but also exist to a greater or lesser extent in all countries, including Ireland, as do risks posed by environmental chemicals, noise and waste. For this reason the protection of public health is a fundamental driver of environmental protection legislation and practice in Europe and Ireland. Vulnerable groups such as those on low incomes, children and the elderly may be disproportionately exposed to poor environmental conditions, giving rise to health inequalities. Sustainable management of the environment is fundamental to addressing health inequalities and achieving health for all.

As the preceding chapters have shown, the overall quality of the Irish environment is good and damage to health associated with environmental pollution in Ireland is likely to be far less than that caused by lifestyle factors such as poor diet, lack of exercise and tobacco use. To minimise future risks and capture benefits to health, protection of Ireland's high-quality environment is vital.

Ecosystem Services and Health

The environment offers a wealth of benefits to health and wellbeing. Natural ecosystems and the biodiversity that they support not only provide essential food but also help to break down waste, purify water, cleanse the air and even serve as a source of pharmaceutical drugs, many of which have been derived from micro-organisms, fungi, plants and animals. The global value of these ecosystem services has been estimated to be US$16–54 trillion (€12–40 trillion) per year (Costanza et al., 1997), while more recently for Ireland, ecosystem services were estimated to have a value of over €2.6 billion per annum (Bullock et al., 2008).

For over 200,000 years, humans have used the resources of forests and grasslands, rivers, lakes and the sea to ensure their survival and create prosperity. In the early 1800s a change began that has led to a complete transformation in the way in which people live. At the start of the industrial revolution, large numbers of people moved into towns and cities, leaving rural, outdoor lifestyles behind. Since that time, the world population has increased from 1 to 7 billion people, with 85% of Europeans now living in urban environments. Average lifespan has increased dramatically, from around 60 up to 80 years. This has been due, in part, to increased food availability, improved hygiene and medical advances.

National Loops Initiative

Since 2008, 200 looped walks have been developed throughout the country. Ranging from short strolls to long hikes, these well-marked trails offer walks that start and finish at the same trailhead and require little in the way of navigation skills. The walks are grouped under a number of themes including Nature, Island, Mountain and Coastal; all have strong linkages with their natural environments and with local heritage.

Each looped walk comes with a downloadable map and a detailed description of the route, including length, what the terrain is like and the difficulty level. In addition, each description includes details on wildlife that might cross the path or historical artefacts to look out for.

The walks were developed with support from Fáilte Ireland and other public bodies as well as local groups and landowners.

www.discoverireland.ie/things-to-do

One unexpected consequence of the transition to urban settings has been that many people have lost the intimate connection their ancestors had with nature. The newly adopted indoor lifestyles are often associated with reduced exercise; increasing rates of obesity, diabetes and heart disease; and higher incidence of depression. Recent figures for the UK indicate that adults now spend only 20% of their time outside, while for children the value is 9%. The health impact in terms of heart disease is comparable to that of smoking (Killoran et al., 2006). In fact, lack of physical activity accounts for about 1.9 million deaths worldwide annually (WHO, 2004).

Green Spaces and Health

The natural environment can play an important role in reducing this burden of chronic disease. Recent research published in *Nature* examined the protective effect of biodiversity and concluded that species loss in ecosystems such as forests and fields may lead to increases in disease incidence for humans and animals through increased pathogen transmission (Keesing et al., 2010). Motivating people to spend time participating in one or more of a range of outdoor activities in natural environments will help maintain good health. When people are outdoors they tend to be active, whether taking a gentle walk or a dip in the sea, gardening or participating in more vigorous activities such as surfing or long-distance running. The availability of high-quality green spaces (parks, woods, countryside) and blue spaces (ponds, river banks, lakeshores and seashores) helps to foster activity on the road to better health (UKDH, 2009). A survey conducted in eight European cities shows that people who live in areas with high levels of greenery are three times more likely to be active and 40% less likely to be overweight or obese (Ellaway et al., 2005).

An estimated 2,000 people die prematurely due to obesity-related illness in Ireland each year (National Taskforce on Obesity, 2005). While diet clearly has a large part to play in tackling this major threat to human health, good physical planning can also play an important part. There is growing evidence that well-designed built environments and public green spaces enhance physical activity patterns and reduce the risk of injuries. The planning authorities need to ensure that development enhances the quality of life in Irish communities. Houses and estates scattered around the country, poorly linked by public transport and dependent on private cars, militate against physical activity. In the Dublin region, 100,000 people drive 4 km or less to work and 45,000 drive just 2 km or less. At a national level 420,000 workers and students travel by car less than 4 km to their destination each day. Safe walking and cycling paths and accessible sports facilities have a major role to play in tackling this important public health problem. Urban and rural planning should include sufficient green spaces in towns and cities and adequate infrastructure to allow access to natural areas in the countryside. The objective of a healthier population living in a healthier and more sustainable environment is included in the Government's *Your Health Is Your Wealth* policy initiative (DOH, 2011).

Research has shown a positive impact on mental health from exposure to the natural environment (SDC, 2008). As well as tangible improvements in wellbeing, activity in green spaces has been linked to improvements in social networking, feelings of connectivity and companionship, an increased appreciation of nature and improvements in self-esteem. An additional benefit is that reconnecting with natural environments highlights their importance and why they need to be managed in a sustainable way.

Clean Water and Health

Drinking Water

Water is essential for life. Approximately 60% of the average adult human body, and 85% of the human brain, is water. If deprived of water, a person will die in a matter of days. A daily intake of one to two litres of water is recommended as part of a healthy diet.

Most tap water in Ireland is drawn from surface water sources (i.e. rivers and lakes), with the remainder originating from groundwater and springs. For the majority of people who live in urban areas the water is supplied by the local authority following extensive treatment. Smaller communities use private water schemes, while single houses in rural areas tend to rely on groundwater wells with little or no water treatment.

The EU Drinking Water Directive sets quality standards for water at the tap. The most important indicator for drinking water is the microbiological content, in particular the bacterium *Escherichia coli*. The presence of *E. coli* in drinking water provides a good indication that either the source of the water has become contaminated by faecal pollution or the treatment process at the water treatment plant is not operating adequately.

The incidence of *E. coli* in drinking water continues to decrease. In 2010 it was found in 0.01% of samples from larger public water supplies that serve a total of 3 million people (EPA, 2011a). This figure is in line with countries such as England and Wales, Scotland and the Netherlands. However, over 200,000 people are served by private group water schemes, where the microbiological quality remains inferior to public water supplies. Furthermore, little is known about the quality of the ~200,000 private wells used in rural areas as a source of drinking water (EPA, 2011a and GSI, 1999).

Any contamination of drinking water poses a health risk, especially to children, older people and those with compromised immune systems. In 2007, *Cryptosporidium* contamination of the water supply for Galway city led to widespread illness in the community. The outbreak highlighted the risks to health associated with the abstraction of surface waters for drinking from poorly protected reservoirs, and the need for modern and well-managed water treatment systems. Figure 9.1 shows the number of cases of cryptosporidiosis reported in Ireland between 2005 and 2010. Cryptosporidiosis is caused by the parasite *Cryptosporidium* and the disease can be contracted through contact with infected animals or humans or consumption of contaminated water or food. Ireland had the highest rate of cryptosporidiosis in the EU each year from 2005 to 2009; comparison figures for 2010 are not yet available (HPSC, 2009, 2010, 2011; ECDC, 2011).

To protect public health, the EPA adopts a risk-based and outcome-driven approach to the enforcement of the National Drinking Water Regulations, focusing on issues that present the greatest risk to health. Significant investment in recent years has resulted in increased treatment, storage capacity and continuous online monitoring for drinking water. That effort is reflected in the downward trend of public supplies showing evidence of *E. coli* contamination in recent years, as shown in Figure 9.2.

Compliance with chemical standards (the safe amount of different chemicals that can be allowed in drinking water) is generally very good in public water supplies, with 99.2% compliance in both 2009 and 2010. Trihalomethanes (THMs), an unwanted by-product of

Figure 9.1 Reported Cases of Cryptosporidiosis in Ireland 2005–2010 (Source: HPSC, 2009, 2010, 2011)

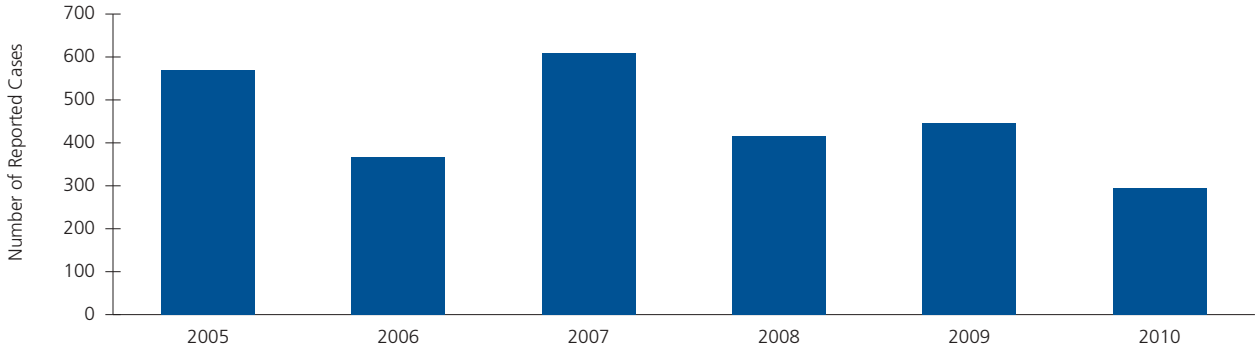
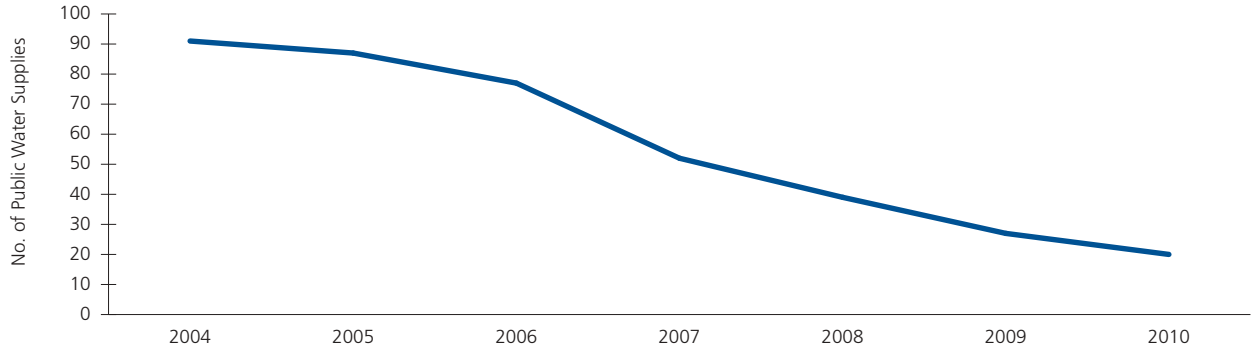


Figure 9.2 Number of Public Water Supplies in which *E. coli* Was Detected in Compliance Monitoring at Least Once from 2004 to 2010 (Source: EPA)



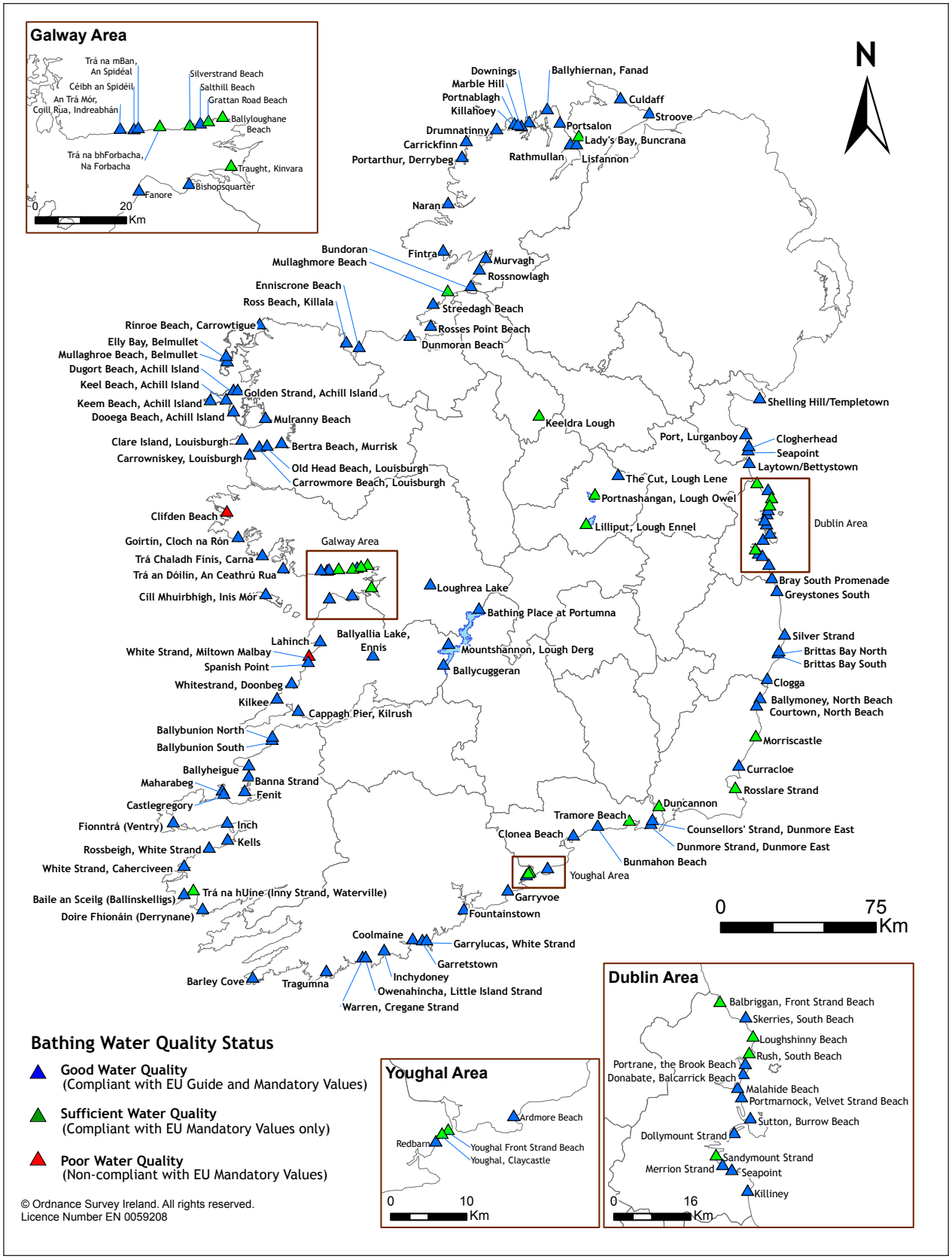
chlorination and a possible carcinogen, have been found at levels above the recommended standard in some supplies. The elimination of unsafe levels of THMs is a priority and all such supplies have been the subject of enforcement action by the EPA. This is expected to eliminate THM exceedances completely by 2014. There were also a small number of drinking water samples that exceeded nitrate and lead standards in 2010. In all such cases the risk to human health was minimal (EPA, 2011a).

Waste Water

Sewage and other waste waters contain microbiological and chemical substances that can harm health. Significant investment has gone into improving the water services infrastructure over the past decade, which has resulted in a dramatic improvement in the effectiveness of treatment of urban waste water. Despite these advances, sewage discharges comprise the main municipal pollution source of water and continue to pose a threat to human health and the environment in many areas (EPA, 2010). Pollution from municipal waste water treatment plants may arise where there is inadequate treatment, combined storm water overflows operating incorrectly or direct untreated discharges. Since 2007, local authorities are obliged to obtain a Waste Water Discharge Licence or Certificate of Authorisation from the EPA. The authorisation process provides for the EPA to place conditions on the operation of such discharges to ensure that potential effects on the receiving water bodies are strictly limited and controlled.

In rural areas most people use individual septic tanks that, if poorly sited and/or not properly maintained, can pollute groundwater, surface water and local drinking water supplies. In 2012 the Department of Environment, Community and Local Government published the Water Services (Amendment) Act to regulate wastewater discharges from all homes that are not connected to the public sewer network. Implementation and enforcement by local authorities and the EPA of this legislation regulating septic tanks will reduce the potential threat to public health.

Figure 9.3 Bathing Water Quality Map of Ireland (Source: EPA)



Bathing Water

There are 135 designated bathing areas in Ireland. Over the past 10 years the quality of water at these sites has remained high, with the vast majority meeting required EU standards. Figure 9.3 shows the quality of bathing water at the designated bathing areas in 2011. Various factors contribute to poor bathing water quality at the remaining locations, including inadequate sewage treatment, discharges from combined storm overflows and pump station failures.

The revised Bathing Water Directive (2006/7/EC) places greater emphasis on the protection of public health, on the proactive management of bathing water quality and on greater public participation. It establishes stricter microbiological standards for two new parameters, intestinal enterococci and *E. coli*, and establishes a new classification system for bathing water based on four classifications – poor, sufficient, good and excellent. Under EU law, improvements are required to bring all bathing waters to 'sufficient' by 2015.

Monitoring results indicate that there is little risk to bathers' health from pollution in designated bathing areas of the country. Occasional toxic algal blooms in inland lakes can pose a health threat to bathers, as blue-green algae are toxic to humans and animals. Bathers should avoid waters showing signs of an algal bloom. Members of the public can find out about bathing water quality on the EPA's SPLASH website (*www.bathingwater.ie*).

Shellfish

Irish coastal waters provide ideal conditions for shellfish growth. In order to support shellfish life and growth and to contribute to the high quality of directly edible shellfish products, the Shellfish Directive (2006/113/EC) and the Quality of Shellfish Waters Regulations (S.I. No. 268 of 2006) require the development of Pollution Reduction Programmes (PRPs) for designated shellfish areas. Shellfish PRPs relate to bivalve and gastropod molluscs, including oysters, mussels, cockles, scallops and clams. They do not cover shellfish crustaceans such as crabs, crayfish and lobsters.

The objectives of Shellfish PRPs are to:

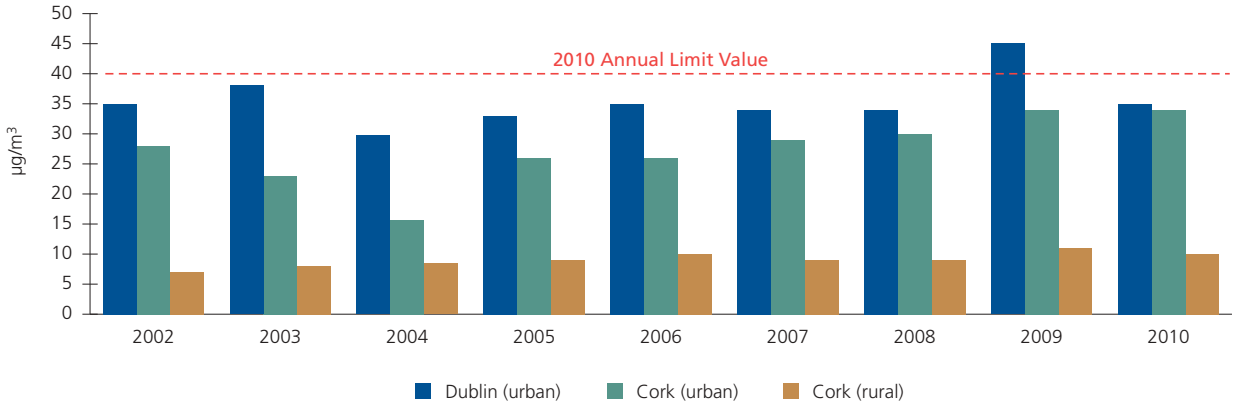
- protect or improve water quality in designated shellfish areas
- achieve compliance with water quality parameter values outlined in Annex I of the Shellfish Waters Directive (2006/113/EC) and Schedules 2 and 4 of the Quality of Shellfish Waters Regulations (S.I. No. 268 of 2006)
- determine the factors responsible for any non-compliances with the water quality parameter values
- ensure that implementation of the Shellfish PRPs does not lead, directly or indirectly, to increased pollution of coastal and brackish waters.

Occasionally the primary foodstuff of shellfish, phytoplankton (marine algae), produces algal toxins that may bioaccumulate in shellfish to such an extent that they cause illness to the consumer. To protect against such illness the Food Safety Authority of Ireland operates a strict shellfish monitoring regime, in cooperation with the Sea Fisheries Protection Authority and the Marine Institute, with shellfish samples being checked before harvesting is allowed. The controls are such that shellfish consumption poses little risk to public health.

Sea Lettuce

Nitrogen-rich waters allow opportunistic seaweed such as sea lettuce to thrive, and this increased growth of seaweeds is giving rise to accumulations of sea lettuce on beaches. In Brittany, France these accumulations decaying on beaches led to the death of animals and injury to humans in 2009. Studies by the French authorities concluded that a significant risk was posed to health from very high concentrations of hydrogen sulphide just above the piles of decaying seaweed when the crust was breached. The

Figure 9.4 Mean NO_2 Concentrations at Air Quality Stations 2002–2010 (Source: EPA)



Health Service Executive (HSE) has concluded that such accumulations can pose a potentially significant risk to both animal and human health. Due to the serious issues arising from this problem a multidisciplinary, multi-agency task force was established to investigate the issue and to advise on the management and control of the problem of sea lettuce. The Task Force reported in 2010 and identified that the problem related directly to the flow of nutrients into the affected waters from domestic, industrial and agricultural sources. In the short term the accumulations should be removed for use as an organic fertiliser; the longer term solution of reducing nutrient inputs should be addressed through the EU Water Framework Directive. Beach users should avoid such accumulations of sea lettuce and should prevent children, horses and dogs from breaking the surface crust.

Clean Air and Health

Harmful substances in the air can cause both immediate and long-term damage to health. They include natural materials and man-made pollutants as well as odour and noise. Protecting clean air is vital to human health.

Outdoor Air Quality

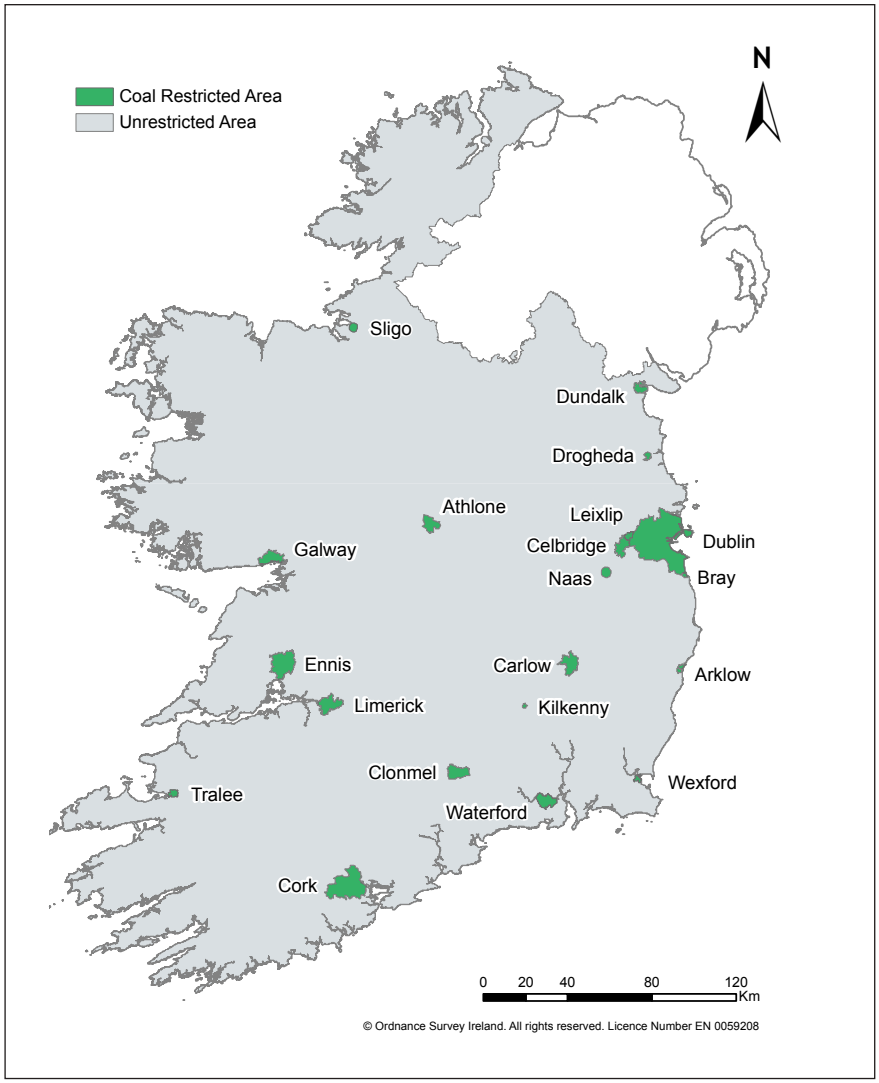
Outdoor air pollution is associated with a range of health problems and causes over 300,000 premature deaths in the EU every year (EC, 2005). Air pollutants can be transported over long distances. Monitoring indicates that some pollutants reaching Ireland originated in other countries, but most measured air pollutants of concern in Ireland are from local sources.

Air quality in Ireland is generally good and is among the best in Europe (EPA, 2011b). However, monitoring shows that levels of some pollutants in Ireland are at concentrations that may impact on health. The air quality index provides easily understandable hourly information on air quality and is available on the EPA website. It allows people sensitive to air pollution to take preventive actions that can minimise the health impact of poor ambient air quality.

Under the EU National Emission Ceilings Directive, Ireland is required to limit annual emissions of sulphur dioxide (SO_2), nitrogen oxides (NO_X), volatile organic compounds (VOCs) and ammonia (NH_3). EPA emission data have shown reductions in emissions of these air pollutants between 1990 and 2009, and Ireland is now in compliance with the 2010 limit for three of the four pollutants. Although NO_X emissions have been reduced by 31.3% between 1990 and 2009, these emissions continue to be above the limit. Concentrations of nitrogen dioxide (NO_2) and polycyclic aromatic hydrocarbons (PAHs) are close to their respective limit and target values at some traffic-impacted sites in Dublin and Cork. Figure 9.4 (EPA, 2011b) shows concentrations of NO_2 measured from 2002 to 2010 at urban stations in Dublin and Cork and at a rural station in Cork.

Traffic emissions will be reduced by introducing and implementing policies to reduce travel demand, to increase use of alternatives to the private car and to continue improving the efficiency of motorised transport. The actions set out in the Smarter Travel Policy for Sustainable Transport (DOT, 2009) should be implemented to improve air quality. The launch in 2012 of Smarter Travel Areas in Limerick City, Dungarvan and Westport aims to encourage a behavioural switch to more sustainable forms of transport. Through an investment of €23 million over five years, cycling and walking facilities will be enhanced with a view to reducing congestion and pollution, while improving people's health and fitness.

Figure 9.5 Smoky Coal Ban Areas (Source: EPA)



Levels of PM_{10} and $PM_{2.5}$, particulate matter with diameters less than 10 micrometres (μm) and 2.5 μm respectively, are also of concern due to the ability of these small particles to penetrate deep into the respiratory tract. In smaller towns, emissions from residential burning of solid fuel are the main source of particulate matter, while in cities traffic emissions dominate.

As seen in Chapter 3, the bituminous coal ban led to a significant drop in cardiovascular and respiratory deaths since its introduction in Dublin in 1990. This decrease clearly shows the link between outdoor air quality and human health. The ban has since been extended to other cities and large towns. Figure 9.5 shows the areas where the sale of bituminous coal is restricted. Switching from solid fuel to gas or other low-emission fuels effectively reduces domestic emissions of pollution. Increased access to the gas network would improve air quality across the country. Where solid fuel is used, it is important that it be burned efficiently; for example, in a modern, serviced stove rather than an open fire. Only suitable fuels should be used; burning of treated wood (e.g. MDF, chipboard) and household waste emits harmful pollutants and is illegal.

Indoor Air Quality

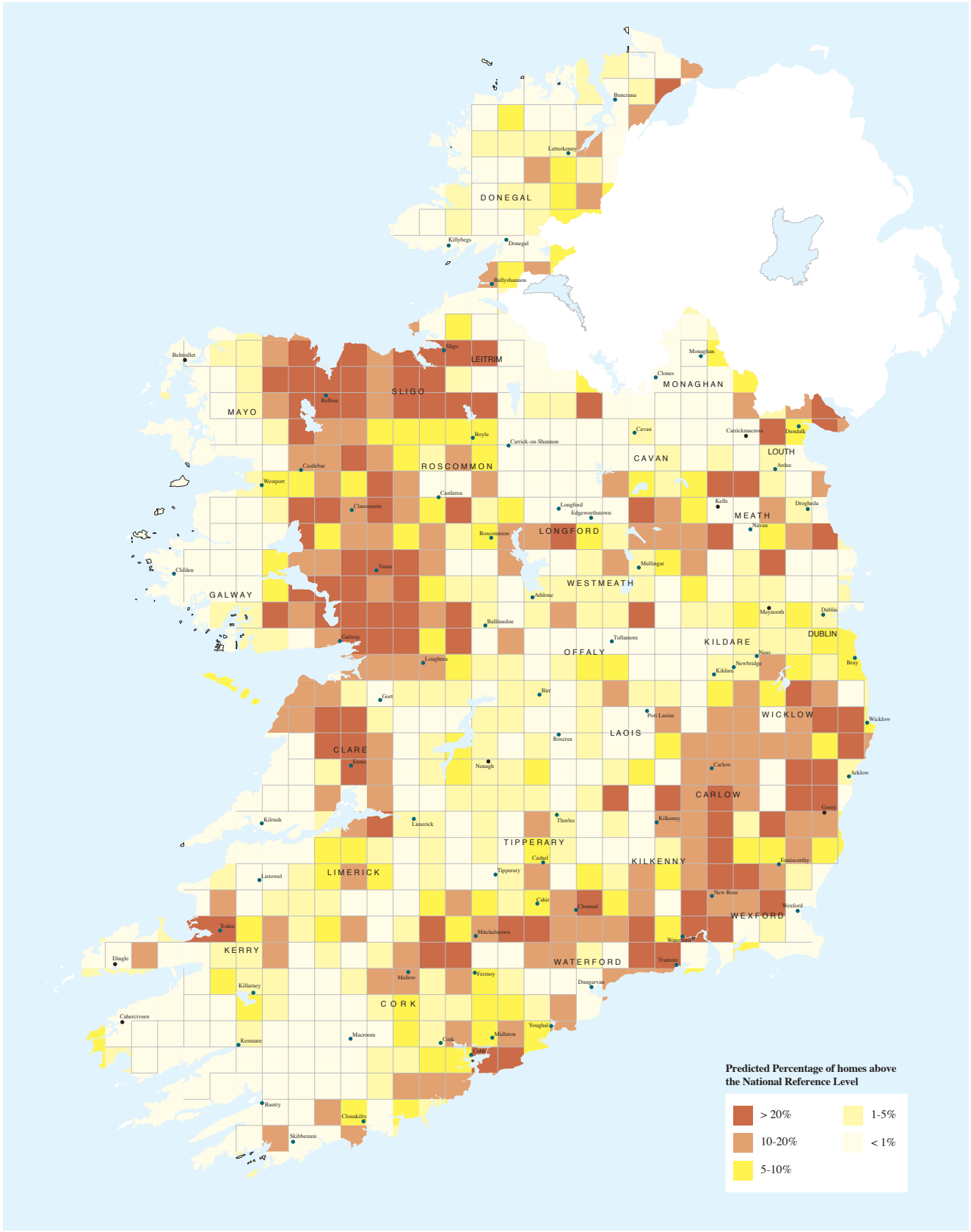
There are many sources of indoor air pollution in any building. These include:

- combustion sources such as oil, gas, kerosene, coal, peat, wood and tobacco products
- building materials and furnishings such as deteriorated, asbestos-containing insulation, wet or damp carpet, and cabinetry or furniture made of certain pressed wood products
- products for household cleaning and maintenance, personal care, or hobbies
- illegal burning of household waste in domestic fires.

The pollutants in indoor air of most concern from a health perspective are particulate matter, carbon monoxide, formaldehyde, benzene, naphthalene, PAHs, nitrogen dioxide, trichloroethylene and tetrachloroethylene. Radon gas in buildings also poses a significant threat to human health in some areas of the country and is discussed in the following section.

On a global scale the risks to health from polluted indoor air are high, with young children and older people the most vulnerable to this form of pollution as they spend most or all of the time indoors. The WHO estimates that nearly 2 million people die prematurely from illness attributable to poor indoor air quality arising from household solid fuel use each year (WHO, 2011). The biggest problems are seen in parts of the world where cooking is performed on open fires, but indoor air pollution is also an important health risk factor in high-income countries. For example, in Ireland, carbon monoxide poisoning in the home, caused by house fires, faulty heating or flue systems, is estimated to result in approximately 40 fatalities each year (Crowley et al., 2003). Preliminary results from

Figure 9.6 Radon Levels in Ireland (Source: RPII)



an EPA-funded research project on indoor air pollution and health in Ireland and Scotland indicate that indoor tobacco smoke posed by far the greatest health risk to the exposed population.

The Scientific Committee on Health and Environmental Risks examined indoor air quality at the request of the European Commission (SCHER, 2007). They concluded that the principles used in the EU for risk assessment of chemicals should also be applied to indoor air. They also found that more research and data are needed. In 2010 the WHO, recognising the importance of this issue, published guidelines to reduce the health risks from indoor exposure to air pollutants (WHO, 2010). These guidelines could form the basis of national policy on indoor air quality.

Radon

Radon is a naturally occurring, radioactive, colourless, odourless gas derived from uranium in rocks and in soil. It poses a threat to human health because when high concentrations of the gas are inhaled, it can cause lung cancer. While levels are too low outdoors to affect health, radon seeps into buildings from underground and can accumulate to reach high concentrations. It is estimated that between 150 and 200 deaths from lung cancer each year in Ireland are linked to radon, with smokers a particularly vulnerable group (RPII and HSE, 2010).

While high radon concentrations can be found in any part of the country, the Radiological Protection Institute of Ireland (RPII) has identified certain parts of the country, called High Radon Areas, as being more prone to radon (RPII, 2002). Approximately one-third of the country, mainly in the west and south east, is classified as a High Radon Area; this is shown in Figure 9.6. Of the 47,000 homes measured since the early 1990s by the RPII, some 5,600 were found to be above the national Reference Level of 200 Bq/m^3. This is just 6% of the 91,000 homes predicted to have high radon concentrations. The maximum value was 49,000 Bq/m^3 measured in a house near Castleisland, Co Kerry in 2003. In 2010, 743 homes were identified as having radon concentrations above 200 Bq/m^3. Of these, nine had extremely high levels of more than 10 times the Reference Level. These figures represent the highest number identified by the RPII in any period since its radon programme began some 20 years ago.

Reducing the health risk from radon involves a range of interventions that address both prevention in new buildings and identification and remediation of radon problems in existing buildings. This requires input from a range of organisations responsible for building science and technology, public health, health economics and national policy as well as radiation protection (RPII and HSE, 2010). A National Radon Strategy Group was established in 2011 by the Minister for Environment, Community and Local Government to formulate solutions to the radon problem in Ireland.

Ozone and Health

Ozone is a gas that is both beneficial and damaging to human health, depending on where it exists in the atmosphere. The 'ozone layer' is in the upper atmosphere (stratosphere), between 10 and 50 km above ground; here ozone plays the vital role of blocking dangerous ultraviolet (UV) radiation from reaching the earth. Excessive levels of UV lead to increased skin cancers and eye cataracts in humans. At ground level ozone is actually an air pollutant; it harms lung function and irritates the respiratory system in humans and animals and stunts the growth of many plants. It also reacts with other pollutants at ground level to create smog.

Stratospheric Ozone Depletion

Scientific measurements over the past 40 years have shown that the concentration of ozone in the stratosphere over the north and south poles decreases significantly in spring, forming a 'hole' in the ozone layer. The decrease is caused by a chemical reaction between ozone and a group of man-made chemicals including CFCs. Concern about this decrease led to a global agreement (Montreal Protocol) to ban the production of these ozone-depleting chemicals, and this ban is beginning to have an effect with the slow recovery of ozone concentrations.

It is estimated that full recovery of ozone levels over polar regions will take another 80 years. In Ireland the EPA is the competent authority for the implementation and enforcement of legislation dealing with ozone-depleting substances.

Ground-Level Ozone

The EPA monitors ground-level ozone at a number of locations around the country. The health information threshold for ozone is 180 µg/m^3, and any exceedance of this threshold must be notified to the public. The EPA has issued a small number of such public notifications in the past, but ozone pollution does not pose a significant risk to human health in Ireland. Ozone results, updated hourly, are available from the EPA website.

Odour

Some of the substances controlled under environmental regulations are malodorous at concentrations far below those at which toxic effects occur. The WHO notes that although odour annoyance cannot be regarded as an adverse health effect in a strict sense, it does affect the quality of life. Odours are by far the largest cause of complaints by the public to the EPA, with waste management facilities (including landfill sites), rendering facilities, composting activities and intensive agriculture (rearing of pigs and poultry) being typical sources of these complaints. Such odours constitute environmental pollution and may be unlawful, depending on a number of factors including the offensiveness and intensity of the odour, as well as frequency of occurrence. Health effects from exposure to odours include indirect responses such as stress and sleep disturbance through to more direct symptoms including nausea.

A study on odour nuisance by the Health Service Executive (HSE, 2010) found that persistent, offensive environmental odours were more than just a nuisance and had the potential to lead to short-term health effects and decreased quality of life. Waste landfills can be a major source of offensive odours because part of the waste is biodegradable and rots easily to generate landfill gas. The solution is to minimise generation of biodegradable waste, increase home-composting, divert biodegradable material away from landfill to fully enclosed composting or energy recovery facilities and ensure good odour management at all waste sites. The biodegradable fraction of landfill waste is decreasing as Ireland implements the EU Landfill Directive, which requires a significant reduction in the amount of biodegradable waste disposed of in landfills (see Chapter 5).

Bioaerosols

Bioaerosols are airborne biological particles consisting of a range of micro-organisms and organic constituents. Focus to date has been mostly on *Aspergillus fumigatus*, a fungus harmful to health that is associated with large-scale compost production. Aspergillosis is a lung condition caused by the fungus; most cases have occurred in immuno-compromised individuals and instances of aspergillosis in healthy individuals are rare. Bioaerosols do not currently pose a significant risk to human health in Ireland.

Noise

Excessive noise can seriously harm human health and interfere with people's daily activities at school, at work, at home and during leisure time. It is perceived by the public as a significant environmental problem. It can disturb sleep, cause cardiovascular and psychophysiological effects, reduce performance and provoke annoyance responses and changes in social behaviour. Research by the WHO and the Joint Research Centre of the EU shows that traffic-related noise may account for over 1 million healthy years of life lost annually in the EU Member States and other Western European countries (WHO and JRC, 2011).

The EU Environmental Noise Directive (END), relating to the assessment and management of environmental noise, aims to provide a common framework to avoid, prevent or reduce, on a prioritised basis, the harmful effects of exposure to environmental noise. The Directive was transposed in Ireland as the Environmental Noise Regulations 2006 (S.I. No. 140 of 2006). A range of organisations have responsibilities under the Regulations including the EPA, the National Roads Authority, local authorities, the airport authorities, Irish Rail and the Railway Procurement Agency.

The Directive sets out a two-stage process for addressing environmental noise.

- It requires Member States to establish the extent of the noise problem by preparing 'strategic noise maps' for major roads, railways, airports and agglomerations
- Based on the results of these maps, the competent authorities in each Member State are required to develop action plans to reduce the level of noise where necessary and to maintain environmental noise quality where it is good.

The process was completed for noise issued from sources over a specified major threshold. The second phase is currently under way for noise from sources at a lower threshold, and will be completed in 2013. The general public will be given an opportunity to participate in the preparation of action plans. Industrial and waste activities licensed by the EPA have noise restrictions, where relevant, to prevent local noise pollution. Licensees may be required to carry out a noise survey of operations at their respective industrial or waste site and where necessary produce a programme to reduce noise emissions.

Chemicals and Other Threats to Health in the Environment

Chemicals, both naturally occurring and manufactured, form the basis of our existence from the oxygen, carbon and nitrogen building blocks that make up our own bodies to exotic man-made materials used in personal care and medical products. While our lives and society derive great benefits from chemicals, it is well recognised that when particular chemicals reach the wrong place, in the wrong amounts, and at the wrong time, these powerful agents can damage both the environment and our health.

Environmental exposure to chemicals can occur through a number of routes including inhalation, ingestion through food/drink and by physical contact. The health effects of exposure to hazardous chemicals range from skin irritations and chemical burns to cancer and genetic damage. The nature of exposure to chemicals is generally categorised as either 'chronic', referring to ongoing exposure over an extended period (possibly over a lifetime), or 'acute', referring to a brief (or even single) exposure to a harmful substance. The effects of chronic exposure may not become evident for many years and the cause is often hard to identify. Perhaps the greatest concern regarding chemicals in the environment is whether they persist and accumulate, as this gives rise to concerns that humans are carrying a gradually increasing body burden of potentially toxic chemicals.

Some of the key regulatory instruments in controlling the use of chemicals are REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) and CLP (Regulation on classification, labelling and packaging of substances and mixtures). These EU-level regulations are implemented in Ireland by the Health and Safety Authority, EPA and other bodies.

Persistent Organic Pollutants (POPs)

Toxic chemicals that do not degrade easily and persist in the environment for long periods are classified as POPs. They are of particular concern because they can be concentrated through the food chain to levels that are dangerous to human health. They include pesticides, for example DDT; industrial chemicals, for example polychlorinated biphenyls (PCBs); and unintentional by-products, for example dioxins. Ireland is a party to the Stockholm Convention, a global treaty that aims to protect human health and the environment from 22 POPs by prohibiting or restricting their production and use and includes measures to reduce or eliminate releases. The EPA as competent authority is preparing a draft National Implementation Plan for POPs for Ireland in conjunction with other public bodies. Once finalised, the plan will be sent to the Secretariat of the Stockholm Convention.

Dioxins arise mainly as unintentional by-products of incomplete combustion and from certain chemical processes. A number of these dioxins are dangerous chemicals with very high toxicity including dermal effects, immunotoxicity and carcinogenicity, as well as reproductive and developmental toxicity. Similar effects are caused by some of the dioxin-like PCBs. The most recent EPA report on dioxin and PCB levels in the Irish environment shows that the levels in all of the samples tested were well below the relevant EU limits. The report is based on dioxin levels measured in cow's milk in a survey carried out in 2010. The report also shows that dioxin levels measured in this survey compare favourably with those taken from similar surveys in the EU and other countries. A 2010 study of dioxins in breastmilk

in Ireland found that levels were lower compared with a similar study in 2002 (Pratt et al., 2012).

Heavy Metals

Heavy metals occur naturally in the environment and low concentrations of some of these are essential to human health and wellbeing. However, elevated concentrations of many heavy metals are directly toxic to humans, animals and plants. Sources of heavy metals include materials such as paints, batteries and piping and industrial activities including mining and coal-burning electricity generation. A number of European regulatory controls are in place to limit heavy metal inputs to the environment; for example, the Restriction on Use of Certain Hazardous Substances (RoHS) Directive. Under this Directive only very low concentrations of six listed hazardous substances, including lead, mercury and cadmium, are allowed to be used in electrical and electronic equipment, and appropriate product waste management is required. Ongoing monitoring of water and air indicates that heavy metal pollution does not pose a significant threat to health in Ireland.

Endocrine Disruptors and Pharmaceuticals

The human endocrine system is responsible for controlling many body functions including the formation of hormones. Endocrine disruptors are a diverse group of chemicals that affect human hormonal function, for example through reduced sperm count. Substances with proven or suspected endocrine-disrupting effects include some pesticides, PCBs, dioxins and synthetic pharmaceuticals that are intended to be highly hormonally active; for example, the contraceptive pill. Effects on human hormones can range from minor to serious depending on the specific endocrine receptor and the amount of exposure. Research funded by the EPA on levels of endocrine disruptors in the Irish environment indicated that although some endocrine-disrupting compounds were detected, levels are generally low and not regarded as a significant risk. Implementation of EU legislation such as REACH, CLP and the Water Framework Directive should help protect against exposure to these chemicals. The issue is also receiving increased focus at international level, for example through the UN's *Strategic Approach to International Chemicals Management* initiative and by the EU through the *Community Strategy for Endocrine Disrupters*.

Pharmaceutical and Personal Care Products

The occurrence and effects of residues from pharmaceutical and personal care products (PPCPs), such as medicines, veterinary drugs, fragrances, sunscreen agents and cosmetics, discharging into the general environment is an emerging global concern. In particular, changes in society and medical practice have resulted in increased usage of non-prescription medication coupled with intensive therapeutic approaches to disease management. This has resulted in the use of large quantities of antimicrobial and other biologically active compounds that are not entirely absorbed by the human body and so are excreted to municipal sewage systems. Waste water treatment plants have variable levels of effectiveness in removing these compounds and so they can be discharged to water bodies. Similarly, veterinary products used routinely in agriculture eventually find their way to ground and surface waters and also pose a risk. Disposal of unwanted/out-of-date medicines via municipal rubbish collections or down the toilet also delivers these products into the environment, and improved procedures and public education on safe disposal are required.

The main concern with regard to the impacts of PPCPs is the development of antimicrobial resistance in bacteria, which is recognised as a major public health problem, but other toxicological and endocrine-disrupting effects are also possible. Preliminary results from EPA-funded research undertaken by the National University of Ireland Galway in collaboration with University College Dublin has found that antimicrobial residues are present in hospital effluent and in municipal sewage downstream from hospital effluent discharge points, at levels that could promote antimicrobial resistance formation. At this stage, further investigation is required but the research highlights an issue that is likely to become more significant in the future as a result of the ageing demographic and increasing pharmaceutical use.

Nanomaterials

Nanomaterials are a recent technology and offer great potential in a number of areas with environmental benefits such as improved energy efficiency in electronics; more precisely targeted medicines; and applications including water treatment and soil remediation. Nanotechnology generally refers to work performed with materials on a scale of less than 100 nanometres (nm) – for reference, a human hair is around 80,000 nm in diameter. A key feature of materials used in their nano-form is that their very small scale introduces new properties such as increased strength, chemical reactivity and electrical conductivity. They are already in use in hundreds of products including sunscreen, fuel additives and antibacterial clothing.

However, despite their beneficial properties, there is concern that certain nanomaterials are potentially

harmful to human health. Their tiny size means that they can pass through the skin and the blood–brain barrier, and may be able to reach internal organs not usually accessible to bulk materials. International bodies such as the EU Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) are working to assess the risks associated with nanomaterials and how best to manage their manufacture and use. Nanotechnology has been identified as a focus for future economic development in Ireland, therefore it is important that the potential health or environmental impacts of these materials be understood. Research is under way in University College Dublin with funding from EPA and other organisations to assess whether the unique properties of nanomaterials present additional concerns not yet addressed, and to develop strategies to address these concerns in a safe and responsible manner.

Electromagnetic Radiation

Electromagnetic (EM) radiation is a non-ionising form of energy generated by electrical charges or magnetic fields. Man-made EM fields are generated every time we turn on a light switch or use a mobile phone. Sources of EM radiation include domestic appliances, high-voltage power lines and mobile phone masts. As technology advances, there is a corresponding increase in the number of sources of EM radiation, leading to growing public concern that exposure could have adverse effects on health.

Given their widespread use, mobile phones are a particular area of public concern. The European Union has initiated the MOBI-KIDS project to assess the potential associations between use of communication devices and other environmental risk factors and brain tumours in young people. The EEA notes that although evidence of health effects from EM fields is insubstantial, there is disagreement in the scientific community. Using a precautionary approach, the EEA advises that people, especially children, should minimise time with a handset placed against the head and use hands-free devices and texting instead.

As a result, the Government appointed an expert group to examine the health effects of EM fields. This group concluded that no adverse short- or long-term health effects have been found from exposure to the EM radiation produced by mobile phones and base station transmitters (DCMNR, 2007). The World Health Organisation established the International EMF project to assess health and environmental effects of EM radiation. The results to date also showed no evidence that exposure to low-level EM fields is harmful to human health.

Waste

Many types of waste materials have the potential to affect human health adversely through direct toxic effects or through the spread of infectious disease. For this reason regulated systems of waste collection, treatment and disposal are in place throughout the country for municipal, industrial and clinical waste. In 2010, 288 thousand tonnes of hazardous waste was managed through recovery, disposal in Ireland or export for treatment in other countries. Overall, the amount of hazardous waste managed is static or declining, and amounts of unreported hazardous waste are very likely to have decreased due to implementation of legislation (on waste electrical and electronic equipment (WEEE), batteries and end-of-life vehicles), the increase in number of civic amenity sites and the effects of the economic downturn.

Some harmful waste materials do not change or degrade with time and thus pose a perpetual risk to human health. There are a number of sites around the country where asbestos, mining and other such industrial wastes were deposited. Facility operators, landowners and regulators (including local authorities and the EPA) need to identify and carefully manage these sites into the future to minimise the risk to health.

Although large generators of hazardous waste are regulated, households, small businesses and farms also generate quantities of hazardous waste such as batteries, WEEE, solvent-based paints, pesticides and waste oils. Inappropriate disposal of these materials with domestic waste or down the drain may pose a risk to human health.

Environmental Regulation and Public Health

There is considerable knowledge of the risks posed to human health by a variety of chemical and microbiological pollutants. For these pollutants, organisations such as the WHO have established levels in the environment that are considered safe. For some pollutants, for example coliform contamination of drinking water, this level is zero. Regulation of emissions to the environment is designed to ensure that levels of these pollutants in the ambient environment do not exceed those safe limits.

In Ireland, regulation of activities that pose a threat to human health and the environment is carried out by setting limits on all relevant emissions. These limits take account of ambient conditions and are based on the best scientific knowledge of what constitutes harm. Most standards are agreed within the EU, based on advice and guidelines from the WHO in many cases. In general, standards are set at levels that

protect the most vulnerable groups including children.

Where there is uncertainty as to the existence or extent of risks of serious or irreversible damage to the environment, or injury to human health, the precautionary principle dictates that adequate protective measures must be taken without having to wait until the reality and seriousness of those risks become fully apparent. This principle of precautionary action is now enshrined in environmental legislation and is designed to protect human health and the wider environment from unforeseen consequences of pollutants.

A review of the EPA in 2011 found that, of all the concerns about environmental matters, it is the potential for impacts on human health from emissions and environmental pollution that gives rise to most anxiety among the public. The review group recommended a strengthening of the Health Impact Assessment element of licensing by the EPA and the setting up of a statutory Advisory Committee to examine the overall issue of public health protection in environmental decision making.

Recognising that the health status of any individual or community is a complex issue, work is under way in the EPA to establish a Health Advisory Committee, including public health authorities, to advise the EPA in the carrying out of its functions, where there is an interaction between health and the environment. This development should build collaborative advantage in this important area of health and environmental protection.

Conclusion and Future Challenges

This chapter shows that environmental protection and health protection are inextricably linked. At a time of major concern about employment and economic issues it is easy to overlook the truth in the maxim that health is wealth. Protecting the Irish environment plays an essential role in protecting the health of the population.

Everyone should be encouraged to take full advantage of the tangible benefits to health that come from contact with a good-quality environment. Raising awareness of the value of green spaces and ensuring safe, convenient access to them will facilitate this. Planning authorities have a key role to play in this regard.

Ireland's clean air and improving water quality mean that risks to health from the environment are few. Continuing enforcement by the EPA and local authorities of new and recent legislation will further reduce the risk to health from water pollution. Successful implementation of existing and proposed strategies from Government departments that impact on health and the environment will reduce the risk further.

Emerging issues with the potential to impact adversely on health should be kept under review. These include nanotechnology and electromagnetic radiation. Further research is required to assess fully the risk of these technologies.

A combination of coordinated Government actions and public responsibility/participation is needed to deliver best outcomes for the environment and health.

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Chapter 10
Environmental Challenges and Priorities

Ireland's environment is a key strategic resource for the country and it must be managed and protected to ensure that it continues to be the foundation for our wellbeing and a sustainable economy. *Ireland's Environment 2012: An Assessment* provides a comprehensive, evidence-based assessment of the condition of the environment in Ireland and the pressures being placed on it. The overall finding of this assessment is that Ireland's environment is in a relatively good condition, although there are some areas of concern and there are a number of significant environmental challenges facing the country over the coming years. The four key challenges identified are: Valuing and protecting our natural environment; Building a resource-efficient, low-carbon economy; Implementing environmental legislation; and Putting the environment at the centre of decision making.

Within the concept of sustainable development, economic growth, social cohesion and environmental protection go hand in hand. Ultimately, what is required is that as Ireland's economy and key sectors develop and recover, that they will do so in a sustainable way and that economic development is decoupled from environmental pressures. This is vital to ensure that the natural resources and environmental conditions fundamental to the economic and social wellbeing of Ireland's future generations are preserved and not degraded or exhausted.

Meeting these environmental challenges will not be easy, nor is it only the responsibility of a few. Protecting and managing Ireland's environment involves Government and public bodies; businesses and industry; as well as members of the public, working in partnership and taking action to avoid pollution and controlling environmental impacts. The reward for this effort is clear; a productive landscape, an attractive location for tourism and investment and most importantly, a clean healthy environment in which to live and prosper.

Introduction

Ireland's environment is a key strategic resource and asset and it must be protected and managed to ensure that it continues to be the basis for our health, our wellbeing and a sustainable economy. Through regular State of the Environment reporting, the EPA provides evidence-based assessments of the quality of Ireland's environment and identifies current and future pressures. This most recent assessment has confirmed that although there are certainly issues of concern, Ireland's environment is of a generally high standard.

In 2007, the EPA set out a vision for Ireland's environment to the year 2020 and identified six key goals for environmental protection which are shown in Figure 10.1 (EPA, 2007) below. This chapter reviews the condition of Ireland's environment with respect to these goals as well as identifying a number of emerging environmental issues. It also examines how Ireland needs to adapt to a different development path, one that is sustainable and low-carbon, to address the key environmental challenges facing the country.

Figure 10.1 Environmental Goals for Ireland

Limiting and Adapting to Climate Change

There have been substantial reductions in Ireland's greenhouse gas (GHG) emissions in recent years due in a significant part to the economic downturn. Ireland is on track to meet its Kyoto commitment; however, compliance comes with a cost, as this will require use of carbon credits already purchased by the State and/or taking unused allowances from the EU Emissions Trading Scheme (ETS) into account. Further targets under the EU's Effort Sharing Decision commit Ireland to a 20% reduction in greenhouse gas emissions by 2020 (relative to 2005 levels) for non-ETS sectors. However, projections by the EPA predict that even in the best case scenario, Ireland's non-ETS emissions will exceed annual obligations under the EU 2020 target by 2017. This best-case scenario includes ambitious assumptions on the full implementation of relevant Government policies on, for example, renewable energy and energy efficiency. Failure to deliver on the measures outlined in Government policies will result in higher emissions than currently predicted.

Transport and agriculture are the two key sectors, which are predicted to account for 75% of non-ETS sector emissions in 2020. Ireland faces considerable challenges in developing cost-effective and environmentally effective policies for these sectors given their importance to the economy and the limited availability of low-cost solutions. Latest projections indicate that through full implementation of all foreseen mitigation measures, a small reduction in transport emissions is achievable by 2020. However, Ireland's unique position within the EU as the country with the highest national proportion of agriculture emissions will present major challenges in meeting future emission reduction targets. In particular, under the ambitious targets of the *Food Harvest 2020* strategy (DAFF, 2010), emissions from the agriculture sector are projected to increase by 7% between 2010 and 2020. Teagasc have recently highlighted technical opportunities in the agriculture sector which would help mitigate against increasing emissions from agriculture (Teagasc, 2012). These measures include achieving improvements in nitrogen use efficiency, genetic improvements in livestock and extended grazing season. However, implementing these measures will require behavioural and cultural changes at farm level. Educational tools and advisory programmes will need to be established to realise the full potential of these measures.

Recent research on Ireland's national adaptive capacity shows that the country is in the early stages of the adaptation process (Shine & Desmond, 2011) and recommends concerted action to integrate climate change into policies, plans, programmes and projects at all levels of government and across all sectors. To achieve this, a national framework for adaptation is required to provide a strategic focus for the development of actions by various agencies and sectors.

Ireland cannot rely on recession to meet long term carbon reduction requirements and needs to refocus as a low-carbon economy while also ensuring that development is resilient to the impending consequences of climate change.

Clean Air

Air quality in Ireland continues to be good and remains among the best in Europe. This is due largely to prevailing clean Atlantic air and a lack of large cities and heavy industry. In 2010, measured values for key pollutants were below the limit and target values set out in the legislation. However, levels of particulate matter and nitrogen dioxide remain of concern; and polycyclic aromatic hydrocarbons may be a problem pollutant in the future. Over the past decade levels of particulate matter have decreased in cities and large urban areas, arising principally from improvements in vehicle engine technology. This decrease is not seen in smaller towns, where domestic solid fuel emissions are more significant than traffic emissions. Many towns do not benefit from the ban on smoky coal, and often do not have access to cleaner fuel alternatives such as natural gas.

Under the EU CAFE Directive, Ireland requires a reduction in levels of particulate matter ($PM_{2.5}$) by 10% between 2012 and 2020 and a national plan is required to achieve this. This reduction is challenging, as it will require an integrated approach across a number of sectors including industrial, transport and residential emissions.

The strategies implemented to achieve compliance with the EU National Emissions Ceilings Directive have successfully controlled emissions of sulphur dioxide, ammonia and volatile organic compounds. Emissions of all three are expected to remain below the prescribed ceilings. However, levels of NO_X are expected to remain above Ireland's national emission ceiling in the short term, due to sustained emissions from road transport.

For Ireland to comply with its international commitments on air quality and air emissions, industrial emissions of pollutants to air must continue to be rigorously controlled; policies implemented to increase the use of alternatives to the private car and improve efficiencies of motorised transport; and Government departments, national agencies and local authorities must make air quality an integral part of their traffic management and planning processes.

Protected Water Resources

In comparison with other EU Member States, Ireland has better than average water quality. The principal and most widespread cause of water pollution in Ireland is nutrient enrichment resulting in the eutrophication of rivers, lakes and tidal waters from agricultural run-off and discharges from municipal waste water treatment plants. Following the enactment of the Waste Water Discharge Regulations 2007, the EPA set up a licensing and certification regime for municipal waste water discharges, to reduce the pollution of waters from these sources. On the agricultural side, implementation of the Good Agricultural Practices Regulations and, in particular, the increase in farm storage for manure and slurry, and the reduced usage of inorganic fertilisers have had beneficial effects.

While there is evidence of an overall improvement in water quality, Ireland faces major challenges to achieve water quality targets set for 2015, 2021 and 2027 as required by the Water Framework Directive (WFD). A recent key development has been the publication of the River Basin Management Plans, including the setting of objectives for waterbodies and the selection of Programmes of Measures to meet the objectives of the WFD. However, it is also clear that the current governance and administrative arrangements for water management are not optimal or configured to ensure the delivery of WFD objectives in an efficient and effective manner. A review of water governance is currently underway to deliver more effective integration of roles and policies between the key government departments, the EPA and the lead local authorities.

Ensuring that Ireland's water resources are of good quality is vital for public health, the agri-food industry, tourism, and for inward investment. There is a particular challenge ahead to deliver the production increases planned under the *Food Harvest 2020* strategy in a manner that allows Ireland to meet its international obligations in relation to water.

Protected Soil and Biodiversity

The incentive to protect biodiversity does not simply arise from goodwill towards the natural world but also from the realisation that nature is a tangible, and quantifiable, asset to society. A high level of biodiversity ensures that we are supplied with 'ecosystem services' such as food production, air purification, fisheries, and nutrient cycling that are essential

to our well-being. Ecosystem services tend to be public goods with no markets and no prices, so their loss is often not detected by our economic systems. However, recent research has estimated that biodiversity and ecosystems contribute €2.6bn to the Irish economy each year (Bullock et al., 2008).

The status of many of our habitats and some of our species is judged to be poor or bad. While progress has been made in the designation of EU protected areas in Ireland, the European Commission still considers Ireland's list of designated Natura 2000 sites as incomplete. Addressing the challenges to protect biodiversity and to meet international commitments will require more concerted effort and greater integration of biodiversity across all sectors. Of particular importance is that the actions identified in the National Biodiversity Plan 2011–2016 be delivered by the relevant public bodies (DAHG, 2011). Strategies and action plans are also required to deal with high-priority issues including invasive alien species and protection of species of highest conservation value. Improved information, including indicators on biodiversity, is needed to facilitate evidence-based decision-making on biodiversity issues at national and local levels.

The soil of Ireland is an immensely valuable national resource which supports the growth of both plant and animal life while providing foundations for human habitats and structures. The general consensus is that soil quality in Ireland is good, although this is based on limited information. The large percentage of permanent pasture land has protected Ireland's soils from serious degradation, with the notable exception of peatlands. A National Soil Protection Strategy, including the identification of soils at risk and addressing the need to establish a soil monitoring network, is required to ensure the protection of this vital national resource. A joint EPA and Teagasc initiative is currently underway to develop an Irish Soil Information System including a national digital soil map. This will address significant knowledge gaps on soils in Ireland and support evidence-based assessments for policy and decision makers.

Agriculture remains the largest use of land in Ireland with two-thirds of land devoted to it. The majority of this land is under grass for pasture, silage or rough grazing. Forestry and food production are projected to be the main drivers of land use change over the coming decade and careful management will be required to prevent adverse impacts on the environment arising from expanded or increased production as envisaged under *Food Harvest 2020*. Almost one-fifth of land in Ireland is categorised as peatland; this includes raised bogs, blanket bogs and fens. Peatlands are Ireland's last great area of wilderness and must be protected.

Issues of spatial planning, land use and soil quality are intertwined and interdependent, and this should be reflected in integrated policies and plans at national, regional and local levels. The proposed National Landscape Strategy for Ireland and the proposed National Peatlands Strategy need to be prepared and fully implemented. The relative lack of heavy industry in Ireland means that Ireland has had fewer land contamination problems than most other EU countries. However, there is no overall national policy framework for the identification, management and remediation of contaminated land in Ireland. National legislation dealing specifically with soil contamination needs to be developed, including a mechanism for remediation of sites.

Sustainable Use of Resources

Resource efficiency is a powerful driver for mainstreaming environmental considerations across the range of economic sectors. By focusing on raw materials such as fuels, metals and biomass and also the air, water and soil ecosystems that support them, resource efficiency reduces inputs and minimises waste in economic activities while also addressing environmental objectives.

The EU's Europe 2020 strategy for smart, sustainable and inclusive growth sets out concrete targets to be achieved within the next decade in order to overcome the impact of the financial crisis and put Europe back on track for economic growth. A resource-efficient Europe is a key part of this strategy and aims to boost economic activity while also reducing greenhouse gas emissions and protecting ecological assets such as fisheries and agricultural soils.

The use of resources and the generation of waste are different sides of the same coin. Improving waste management provides opportunities to reduce the extraction and use of materials, open up new markets and at the same time lessen pressures on the environment. In addition to new markets, businesses are becoming increasingly aware of the financial savings and competitive advantage that arise from adopting an environmentally sustainable and resource-efficient approach to their own activities. This advantage comes by focusing on reducing energy costs, raw material costs and supply, and waste management costs. The EPA's National Waste Prevention Programme (NWPP) is part of a national family of programmes, including those run by SEAI, Enterprise Ireland and IDA Ireland, which are designed to promote

a more sustainable society and economy. The most recent report of the NWPP shows that in many cases the resource efficiency projects are resulting in significant commercial gains and savings for participants as well as positive outcomes for the environment.

Recent years have demonstrated some welcome developments in terms of waste and recycling and Ireland has made significant progress in meeting most of the EU waste recycling/recovery targets. However, Ireland is still over-reliant on landfill for the disposal of municipal waste and is also too dependent on external markets for disposal of hazardous wastes. In the coming years it will be important that waste prevention and resource efficiency are embedded across all sectors of the Irish economy, so as to assist in the decoupling of waste from future economic growth. To support this, there is a need to develop a national Resource Efficiency Strategy that integrates all the existing programmes and maps future direction for a resource-efficient Ireland.

Integration and Enforcement

Integration

Within the concept of sustainable development, it is widely accepted that economic growth, social cohesion and environmental protection go hand in hand. The underlying principle is that natural resources and environmental conditions fundamental to the economic and social well-being of future generations are not exhausted or degraded. The development of key economic sectors in Ireland, such as the agri-food and tourism industries, is strongly bound to the quality of our environment with marketing efforts centred on our clean, green image. However, It is important that this brand is reinforced by a high level of environmental quality in Ireland – to demonstrate 'substance' behind the image. It is vital therefore, that environmental priorities are fully considered in policy and decision-making across all economic sectors not just at government level but also within businesses and communities across Ireland.

Strategic Environmental Assessment (SEA) offers a formal systematic process for integrating environmental considerations into the preparation of plans and programmes across eleven broad-ranging sectors. Since the SEA Directive was implemented in Ireland in 2004, over 300 SEAs have commenced. The majority of these are in the land use sector, with SEA applied to Regional Planning Guidelines, county and town development plans and local area plans. The water and energy sectors comprise the bulk of the other SEAs undertaken. However, it is also clear that a number of other sectors, most notably the tourism and forestry sectors, have yet to meaningfully engage in the SEA process – a situation that was also reported in the previous State of Environment report in 2008.

The EPA, in cooperation with the other statutory environmental authorities for SEA – DECLG, DCENR, DAFM and DAHG (NPWS), has completed a comprehensive review of how effective the SEA process in Ireland has been to date. It is clear from this review that SEA is fulfilling its role and is providing a vital tool for environmental protection in Ireland. The SEA process is ensuring that environmental considerations are taken into account in policy development and implementation, and is raising the profile of environmental issues in decision making at plan level among those sectors applying SEA. However, a number of challenges have been identified which are acting as barriers to ensuring effective implementation across the board. These challenges are similar to those experienced in other EU Member States. In particular, as most plans have not been implemented for long enough and SEA related monitoring is not yet taking place, it remains unclear whether SEA is leading to widespread environmental improvements and preventing adverse environmental effects on the ground. The SEA statutory environmental authorities are currently formulating an agreed action plan for implementing the recommendations of the review and improving SEA effectiveness in Ireland.

Enforcement

Ireland is party to a large number of international agreements and treaties related to the environment. In a comprehensive review of Ireland's performance in this area, Cashman (2012) notes that Ireland has not had a good history of compliance with EU environmental laws. Starting from a first European Court of Justice (ECJ) judgement against Ireland in 1999, there have subsequently been numerous actions taken by the European Commission against the State. Some of these actions have resulted in further ECJ rulings against Ireland and others have been resolved prior to an ECJ court judgement.

In some respects, the full implementation of EU environmental legislation has clearly proved onerous for Ireland. However, as the EC has found, the cost of inaction can be greater than the cost associated with implementing legislation. For example, the evidence from the analysis of expenditures of industrial firms in Ireland is that the implementation of the EPA's IPPC licensing regime is cost-effective, in that direct compliance costs borne by operators are considerably lower

than the avoided external pollution costs. Furthermore, Cashman (2012) also notes that many positive outcomes for Ireland's environment can be traced to the implementation of EU legislation. These include:

- Improved air quality for Dublin
- Investment in waste-water treatment
- Establishment of protected nature sites and
- Better management of landfills.

Through prioritised and collaborative efforts across central and local government as well as with the European Commission, Ireland has significantly improved its environmental performance by resolving a substantial number of environmental infringement cases in the last few years. From a position at the start of 2010 with 32 open infringements, Ireland has more than halved the number of open cases with 14 cases open at the end of March 2012. The EC has indicated that implementation of environmental law will be a cornerstone of the forthcoming EU Seventh Environmental Action Programme.

OECD Environmental Performance Review of Ireland

The 2010 OECD review of Ireland's environmental performance examined progress since the previous review in 2000 and was broadly positive in its conclusions (OECD, 2010). The review noted that environmental policies had been improved and that environmental institutions had been strengthened. The OECD welcomed measures adopted to achieve an innovation-based, green, low-carbon economy and recognised significant investments that were made in environmentally-related infrastructure. Overall, Ireland was judged to have generally good air and water quality and an energy intensity (energy use per unit of GDP) that was the lowest among OECD countries.

Some significant challenges were identified however and the OECD recommended rapid action is necessary in three essential areas:

- *Ireland should strengthen its efforts to mitigate greenhouse gas emissions in transport, agriculture and in the commercial and residential sectors*
- *Ireland should provide better incentives for efficient use of water resources by charging households for the consumption of water*
- *Ireland should ratify the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters.*

A fundamental basis of environmental regulation is that activities or persons that cause environmental damage are held accountable for their actions. Environmental regulators in Ireland are responsible for in excess of 500 environmental protection functions contained within over 100 pieces of legislation. Many Government departments, authorities and agencies have a statutory role in protecting the environment in Ireland, with significant responsibilities for environmental protection vested with the EPA and the local authorities. There is a continued need to have a strong culture of compliance with environmental legislation, and to ensure that those who flout the laws are made to pay for their actions. This will require a continued emphasis on collaborative approaches between regulators, with prioritisation of available resources to deliver positive environmental outcomes.

The Role of Research in Environmental Protection

Environmental issues tend to be complex and influenced by a range of causal factors. Effective environmental policies therefore require robust and in-depth knowledge to underpin actions. Research and innovation play a pivotal role in environmental protection by providing information on and assessments of the current state of the environment, building environmental projections and trends, and developing new tools for environmental management. The EPA's Science, Technology, Research and Innovation for the Environment (STRIVE) Programme has been planned specifically to support environmental research activity in areas closely aligned to policy needs (Colgan & Donlon, 2010).

Sustainable development represents the most fundamental long-term challenge facing the world today. It raises profound problems for public policy-makers, businesses and civil society alike. It is increasingly recognised by international organisations (such as the UN and

the EU), many national governments and by important elements of the scientific community, that research has an essential role to play in helping to overcome these problems, by providing the intellectual foundations, analytical tools and empirical evidence upon which to build a more sustainable future.

The recent review of national research priorities led by Forfás recognised that research plays an important role in meeting policy objectives at minimum cost (Forfás, 2012). This exercise highlighted 'Climate Change and Related Environmental Issues' and 'Environmental Health' as two areas with strong policy-research needs. With specific regard to the EU-level policy processes that are so important in environmental protection, the report noted that high quality research directly informs Ireland's negotiating position with regard to shaping and implementing new obligations and regulations.

Emerging Issues

Emerging environmental issues are those issues that may be of concern in the future but where their full implications have not yet been generally recognised or understood.

Fracking

The exploitation of shale gas using hydraulic fracturing or 'fracking' has increased dramatically in the United States over the past twenty years and by 2010 dry shale gas production had risen to 23% of total dry gas production (US Energy Information Administration, 2011). There is increasing interest in the technique in other areas of the world and it is believed that, at least in the short term, shale gas could potentially have a strong impact on global energy markets.

However, this rapidly growing industry has attracted many critics because of the potential risks of new seismic activity and potential contamination of groundwater with methane or fracking fluids. The increased demand for water and the disposal options for the recovered fracking fluids as well as the overall carbon footprint of the fracking operation are also the object of increased debate. The environmental risks of fracking are not fully understood and research is ongoing to bridge this knowledge gap. The relevant public bodies in Ireland, including DCENR, the EPA, the Commission for Energy Regulation and An Bord Pleanála, as well as authorities in Northern Ireland are co-operating with a view to sharing knowledge and co-ordinating regulatory approaches.

Legacy of the Celtic Tiger

The Celtic Tiger years saw huge changes across Ireland. In some cases the changes can be expected to have enduring environmental benefits including extensive upgrading of Ireland's wastewater treatment plants and investment in public transport such as Dublin's LUAS tram network. In the backdrop of a strong growth in economic activity, many aspects of environmental performance improved, such as a dramatic increase in waste recycling rates and improved wastewater treatment, while GDP growth decoupled somewhat from environmental indicators.

However, there is also a negative environmental legacy to the Celtic Tiger years. Widespread development of one-off housing poses risks to water quality while incomplete housing projects (ghost estates) and over-zoning of land for development pose significant land-use challenges that will require resolution and remediation in some cases. A significant legacy has been urban sprawl and low-density development outside of towns and cities. In many cases this has led to unsustainable travel patterns and long journeys for those travelling to work or school, with the Central Statistics Office reporting that the average commute to work in Ireland is over 18km (CSO, 2011). Countering these travel patterns and providing attractive and cost-effective public transport alternatives now presents a serious

challenge given the limited public finances for investment in transport infrastructure.

Marine Environment

The protection of Ireland's marine environment is an emerging issue, both from the scientific and from the policy perspective. Ireland needs to move forward with concerted actions to meet its EU obligations under the Marine Strategy Framework Directive 2008/56/EC, which requires an integrated assessment of the quality of our marine environment.

Some of the pressing issues in the area of the marine environment are the loss of marine biodiversity, marine litter, the risks from overfishing and acidification. Acidification of oceanic waters is an emerging threat to the marine environment (Ní Longphuirt et al., 2010). The world's oceans have absorbed more than a third of net CO_2 emissions since the industrial revolution resulting in a decrease in the pH of the ocean (Sabine et al., 2004). Ocean acidification is increasing at a rate which is one hundred times faster than any previous change for millions of years, with the greatest pH effects occurring at high latitudes. This may limit the habitable depth for calcifying organisms, such as cold-water corals, which are found in deeper offshore waters to the west of Ireland. In addition, commercial shellfish and the species and ecosystems which underpin and provide habitats for commercial fisheries are at risk. While the rate of ocean acidification can be predicted with a high degree of certainty, the ecological consequences are less certain and the potential impacts are only just beginning to emerge. The extent of the impact on the marine ecosystem will depend on the ability of species to adapt to this rapid change.

A Sustainable Ireland

In 2005, the UN Millennium Ecosystem Assessment concluded that over the past half-century

> *"humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fibre, and fuel"* (MEA, 2005).

This rapid growth places stresses on the environment and if not managed and controlled, these stresses can overwhelm the ecosystem and damage the natural resources it provides. Sustainable Development is a term used to describe efforts to transform the way that society approaches growth and the attendant pressure on the environment. Perhaps the most frequently cited definition of sustainable development is the so-called *Brundtland Definition* (WCED, 1987):

> *"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*

Over the last thirty years, the concept of sustainable development has come to be recognised as a central principle of good governance and public policy at local, national and international levels. At a global level, the United Nations has taken a strong interest in Sustainable Development since the 1992 Conference on Environment and Development in Rio de Janeiro. At a European level, there are several policies and strategies looking at how the EU can be made more sustainable in the future. One of the most important of these is the Europe 2020 strategy which aims to build a low-carbon knowledge economy in Europe.

The Green Economy and Sustainable Growth for Ireland

The green economy is a phrase which is used to categorise a wide range of economic activities which contribute to lower greenhouse gas emissions and better resource usage while also functioning as commercial businesses. There are a number of key sectors which are usually identified with the green economy overall. These include: renewable energies; energy efficient products and services for buildings; lower carbon transport; water/ wastewater treatment; waste management; and green tourism. On a global scale, this sector of the overall economy is projected to grow strongly into the future providing opportunities for Irish-based companies to export relevant goods and services and also for Ireland to attract growing volumes of foreign investment. Ireland has a number of strengths which it can leverage to create employment and growth opportunities both for indigenous companies and for foreign investment in Ireland. These include excellent renewable energy and water resources; strengths in key sectors such engineering & ICT goods and a strong R&D base.

A central plank of Ireland's economic recovery will centre on the development of a green economy that recognises the opportunities for investment and employment creation in sectors such as renewable energy, energy efficiency and waste and water management, and how this sustainable approach to economic development can complement the core strengths of the economy in the use of natural resources (DECLG, 2011).

An economic model for Ireland based on sustainable growth will provide the following advantages:

- freeing up resources for household spending and productive investment by reducing energy and material costs
- reducing reliance on imports and exposure to the fragile geopolitics of energy supply
- providing a boost to jobs in the expanding 'environmental industries' sector
- making progress towards the demanding carbon emission reduction targets needed to stabilise the global climate
- protecting valuable ecological assets and improving the quality of Ireland's living environment for generations to come.

Clean energy from renewable sources will be a critical pillar of the green economy. In 2011 the Sustainable Energy Authority of Ireland (SEAI) unveiled three energy roadmaps to 2050 focusing on the potential benefits of Ireland moving to a future energy system where electricity, managed via a smart-grid, and increasingly generated by wind, meets more of the country's energy needs, in particular for heat and transport (SEAI 2011a; 2011b; 2011c).

When the hydroelectric scheme at Ardnacrusha on the Shannon was developed in the 1920s (the largest hydroelectric scheme in the world at that time) the new Irish state was striving for energy independence using renewable resources. Today the station generates less than one per cent of the country's energy needs. Now, 90 years later, the resources, technology and expertise exist to gain energy independence through a major investment in renewable energy generation. Such a step would put the Irish economy on a more sustainable footing into the future.

In parallel with developing sustainable energy sources, a successful green economy will require a more environmentally sustainable approach to production and consumption, with a major focus on resource efficiency. It is necessary to ensure that resource efficiency is embedded across all sectors of the economy in Ireland. This would allow the economy to create more with less, deliver greater value with less input, and utilise resources in a way that minimises pressures on the environment.

Terms such as 'Eco-Innovation' and 'Green Business' refer to the production and delivery of high-quality goods and services at a competitive price, without compromising the environment. By embracing these principles, businesses can generate real savings in terms of energy consumption, water usage and waste generation and so deliver a win-win in terms of a competitive economy and a reduced environmental impact.

Figure 10.2 Main Environmental Challenges

Conclusion and Future Challenges

Building a Sustainable Ireland

The environment is a strategic and valuable asset for Ireland and as such it must be protected and proactively managed to ensure it forms the basis of Ireland's economic well-being and a healthy society. The overall finding of *Ireland's Environment 2012: An Assessment* is that Ireland's environment remains in a good condition, although there are a number of areas of concern, and Ireland faces a number of key challenges in the coming years. The current recession has meant that levels of emissions and waste generation rates have paused and in some cases reduced. However, care must be taken not to interpret recession-induced reductions as a sign that environmental pressures are being managed. What is required is that, as Ireland's economy and key sectors develop and recover, they do so in a sustainable way – decoupling economic growth from environmental pressures. This means ensuring that the natural resources and environmental conditions that are fundamental to the economic and social well-being of Ireland's future generations are protected and are not degraded or exhausted. In this context, *Ireland's Environment 2012: An Assessment* has identified four key environmental challenges for Ireland as illustrated in Figure 10.2 and outlined below:

Challenge 1: Valuing and Protecting our Natural Environment

The environment is our life support system, with clean air and safe water being some of our most basic human needs. As the source of our food, abundant biodiversity and healthy, functioning soils are other aspects of our natural environment that are essential to humanity. The monetary value of the environment is significant and while the immense worth of ecosystem services to Ireland has been quantified, it is not always appreciated. Other 'values' are more fundamental and concern the pleasure inherent in experiencing nature in all its forms, from the solitude of wilderness walks to families enjoying a busy day at a clean beach. More recently, evidence is being gathered on the tangible

health benefits associated with contact with a clean environment while equally, the potential negative impacts on health from a polluted environment are well recognised.

Ireland's natural environment has a great intrinsic worth and like any resource, it requires careful and well-informed management to maximise benefits. Meeting the requirements of the Water Framework Directive is an important challenge that will deliver benefits in terms of enhancing our rivers, lakes, wetlands and coasts and protect this strategic resource for future generations. Like other countries, Ireland must also work to reduce greenhouse gas emissions and adapt to the effects of a changing climate. Maintaining our clean air and healthy soil will also require continuing attention as will protecting biodiversity and nature from further loss and damage. Addressing these issues will take time and money, so it is critical to fully value and recognise our environment as a key national asset and accordingly, to invest wisely in protecting this wealth for future generations.

Challenge 2: Building a Resource-Efficient, Low-Carbon Economy

The second challenge relates to building a resource-efficient, low-carbon economy for Ireland. The severe economic downturn halted a type of growth in Ireland that was unsustainable and ultimately doomed to fail. There is now an opportunity to ensure that future development is based on highly efficient processes and improved resource efficiency. More than just a desirable idea, this shift is being pushed by increasing scarcity and costs of fuels and resources. We need to learn from the mistakes of the Celtic Tiger years. Transforming our economy onto a resource-efficient path can bring increased competitiveness and new sources of growth through cost savings, better management of resources and commercialisation of innovations. As businesses and households adjust to the new economic climate, it is also an opportunity to change patterns of resource use, bringing the green economy to the fore. Countries that take a pro-active role in developing a sustainable green economy are likely to be successful in the future global economy. From waste prevention to efficient and renewable energy, investment now in this area will position Ireland as a competitive economy into the future and help to provide protection from future economic shocks as well as allow us to meet our targets under international climate change agreements.

Ireland's 2020 target for greenhouse gas emissions presents real challenges for Ireland. Domestic mitigation action is imperative so that Ireland plays its part in reducing GHG emissions while also availing of the wider opportunities in terms of new and sustainable growth in the emerging global green economy. The purchase of carbon credits from outside Ireland is a valid and potentially useful policy option; however, the primary focus in Ireland must be to achieve emissions reductions domestically. Such action will shape our transition to a low-carbon economy in the context of deeper emission reductions that will be required out to 2050. It will also provide a credible long-term policy signal for investment and demonstrate a commitment to Ireland's clean, green and sustainable image.

Challenge 3: Implementing Environmental Legislation

Arising from national and international policies there is now a substantial and diverse range of environmental legislation in force aimed at improving the quality of the environment and thereby protecting public health and the ecosystem. The European Commission 7th Environmental Action Programme, to be published in 2012, will set out an environmental vision for Europe placing particular emphasis on better implementation of environmental legislation at all levels across the EU (EC, 2012). Over the coming years Ireland faces formidable challenges in meeting international obligations, for example, in relation to the Water Framework Directive; reducing greenhouse gas emissions; reducing levels of particulate matter in air; and achieving tougher waste recovery targets. In addition, Ireland also faces ongoing EU infringement proceedings in relation to the transposition or implementation of a number of other EU directives, including the Birds Directive; Habitats Directive; and the Environmental Impact Assessment Directive. It is important that Ireland complies with the international commitments and ensures that legislation is implemented in a timely and appropriate manner. Ireland is proud to proclaim a clean environment and to reap the benefits in terms of tourism and agri-food marketing. It is critical that this image is not then undermined by perceived poor environmental performance.

At a national level, the EPA and other regulators have an important role to play to ensure that a healthy safe environment is delivered for Ireland's population through effective implementation and enforcement of environmental legislation at national and local level. Through co-operative working, this network of environmental regulators (including the EPA) has succeeded across a range of enforcement areas though issues remain, such as odour emissions from waste facilities.

Given current constraints on government spending, there is a possibility that resources may be directed away from environmental enforcement activities with delayed

implementation of legislation requiring additional funding for environmental protection measures. Such an approach carries a strong risk of significant future cost in terms of fines for failing to implement legislation, remediation costs to clean up avoidable environmental damage and a reputational cost that would impact on our national green branding – the costs of inaction.

Challenge 4: Putting the Environment at the Centre of Decision Making

All human activities have an influence on the environment through both personal behaviours and in the daily operations of businesses and organisations across the country. The concept of thinking globally and acting locally has probably never been more relevant as we confront biodiversity loss and climate change. In line with the aims of the UN's Rio+20 process, it is critical that we participate in a transition to living within the long-term limits of our planet. This final challenge is focused on mainstreaming environmental priorities and ensuring that they are fully integrated into policy and decision-making at national, regional and local levels. By incorporating environmental considerations into new policies and developments, we can save future costs, particularly where there are decisions to be made in the short-term about long-life assets such as housing, transport infrastructure, energy infrastructure, water supply infrastructure and investments such as in coastal and flood defences.

There is a shared responsibility for achieving and maintaining a healthy environment. Clear leadership and co-ordinated efforts from Government and public bodies is needed to maintain and improve the quality of the environment. Business and industry also play an important role by ensuring their activities do not cause pollution or create environmental liabilities for future generations – with a special responsibility resting with Ireland's farmers as guardians of our rural environment. Finally, all members of the public must play a part by taking actions to avoid pollution and controlling our personal environmental impacts. Recent impressive responses to waste recycling show how changes can occur, it is now time to build on this and work to mainstream the environment in our daily lives.

An Idea from Sweden

Sweden has set an overall aim for environmental policy to pass on to the next generation a society in which all the major environmental problems have been solved. To ensure that the country stays on track to meet this aim, the Swedish parliament adopted into law 16 environmental quality objectives relating to the quality of Sweden's environment (MSDS, 2006). By taking a similar approach, Ireland would be making a strong commitment to environmental protection which would underpin our important agri-food and tourism markets while driving efforts to deliver a clean environment for current and future generations of Irish citizens.

Meeting the Challenges to Build a Sustainable Ireland

Ireland has a tremendously valuable asset in its environment. Though this report has shown that the quality of the environment is generally high, there are clear pressures which must be confronted and managed to set our nation and people on a sustainable path. The challenges here are significant and not all will be resolved in the short or even medium term, however the benefits of achieving this vision are great. A protected environment provides a clean and safe place to live; while also underpinning vibrant agri-food and tourism sectors, and making Ireland an attractive place for inward investment.

In a wide ranging paper on future sustainability, the Blue Planet Laureates noted that transitioning to a more sustainable future will require simultaneously redesigning the economic system, a technological revolution, and, above all, behavioural change (Brundtland et al., 2012). In this context there is a real opportunity to re-examine Ireland's priorities and direction.

Meeting our environmental goals will require clear leadership by Government, to guide and empower people in making the changes needed in our lifestyles and consumption patterns to live within our (environmental) means. A cornerstone of sustainability is therefore behaviour change and so to move toward a sustainable future, individuals and businesses will have to willingly engage in a multitude of actions including waste reduction, water and energy efficiency and modal transportation shifts. The overarching goal for our future must be to ensure that as Ireland begins to work its way back to economic recovery, it goes in a sustainable direction.

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Acronyms / Abbreviations

AWB	artificial water body
BER	Building Energy Ratings
BMW	biodegradable municipal waste
BOD	biochemical oxygen demand
CAFE	Clean Air for Europe (EU Directive)
CAP	Common Agricultural Policy
C&D	construction and demolition
CCRP	Climate Change Research Programme
CEC	Council of the European Communities
CEU	Council of the European Union
CFC	chlorofluorocarbon
CH_4	methane
CLRTAP	Convention on Long-Range Transboundary Air Pollution
CO	carbon monoxide
CO_2	carbon dioxide
CO_2eq	carbon dioxide equivalent
CORINE	Coordination of Information on the Environment
CSO	Central Statistics Office
Cu	copper
DAFF	Department of Agriculture, Fisheries and Food
DAFM	Department of Agriculture, Food and the Marine
DAHG	Department of Arts, Heritage and the Gaeltacht
DCENR	Department of Communications, Energy and Natural Resources
DDT	dichlorodiphenyltrichloroethane
DECLG	Department of the Environment, Community and Local Government
DEHLG	Department of the Environment, Heritage and Local Government
DETI	Department of Enterprise, Trade and Innovation
DJEI	Department of Jobs, Enterprise and Innovation
DMC	domestic material consumption
DO	dissolved oxygen
DOH	Department of Health
DOT	Department of Transport
DPER	Department of Public Expenditure and Reform
DPSIR	driving forces-pressures-state-impact-response
DTTS	Department of Transport, Tourism and Sport
EAP	Environmental Action Programme
EC	European Commission
ECJ	European Court of Justice
EEA	European Environment Agency
EIA	Environmental Impact Assessment
ELD	Environmental Liabilities Directive
ELV	end-of-life vehicle
EP	European Parliament
EPA	Environmental Protection Agency
eq	equivalent
EQS	Environmental Quality Standard
ESRI	Economic and Social Research Institute
ETS	Emissions Trading Scheme
EU	European Union
FDI	foreign direct investment
GAP	Good Agricultural Practice
GDP	Gross Domestic Product
GHG	greenhouse gas
GNP	Gross National Product
GPP	Green Public Procurement
GSI	Geological Survey of Ireland
GVA	Gross Value Added
HSE	Health Services Executive

ICT	information and communications technology
IDA	Industrial Development Authority
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated Pollution Prevention and Control
ISus	Irish Sustainable Development Model
IUCN	International Union for the Conservation of Nature
JRC	Directorate General Joint Research Centre, European Commission
kt	kilotonne
LIEN	Large Industry Energy Network
LULC	land use and land cover
MSW	municipal solid waste
Mt	megatonne
NACE	European Classification of Economic Activities
NAP	Nitrate Action Programme
NESC	National Economic and Social Council
NEC	National Emissions Ceiling (EU Directive)
NGO	non-governmental organisation
NHA	Natural Heritage Area
NH_3	ammonia
NIEA	Northern Ireland Environment Agency
Ni	nickel
NO	nitric oxide
NO_2	nitrogen dioxide
N_2O	nitrous oxide
NO_3	nitrate
NO_X	nitrogen oxides
NRA	National Roads Authority
NPWS	National Parks and Wildlife Service
NREAP	National Renewable Energy Action Plan
NSDB	National Soil Database
NTFSO	National Trans-frontier Shipment of Waste Office (Dublin City Council)
NWPP	National Waste Prevention Programme
O_3	ozone
ODS	ozone depleting substance
OECD	Organisation for Economic Co-operation and Development
OEE	Office of Environmental Enforcement (EPA)
OSi	Ordnance Survey Ireland
P	phosphorus
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PM	particulate matter
pNHA	proposed Natural Heritage Area
POP	persistent organic pollutant
PPCP	pharmaceutical and personal care product
ppm	parts per million
PRP	Pollution Reduction Programme
R&D	research and development
RBD	River Basin District
RBMP	River Basin Management Plan
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals (EU Directive)
REPS	Rural Environment Protection Scheme
RES-E	renewable energy in electricity generation
RES-H	renewable energy in heat
RES-T	renewable energy in transport
RPII	Radiological Protection Institute of Ireland
SEA	Strategic Environmental Assessment
SEAI	Sustainable Energy Authority of Ireland
S.I.	Statutory Instrument
SO_2	sulphur dioxide
STRIVE	Science, Technology, Research and Innovation for the Environment
t	tonne
TEEB	The Economics of Ecosystems and Biodiversity
THM	trihalomethane
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
UWWTD	Urban Waste Water Treatment Directive
VOC	volatile organic compound
VRT	Vehicle Registration Tax
WEEE	Waste Electrical and Electronic Equipment
WEI	water exploitation index
WFD	Water Framework Directive
WHO	World Health Organisation
WSIP	Water Services Investment Programme
WWTP	wastewater treatment plant
µg/l	micrograms per litre
$\mu g/m^3$	micrograms per cubic metre
µm	micrometre

Glossary

Acidification

Continuing loss of capacity to neutralise acid inputs indicated by declining alkalinity and increasing hydrogen ion concentration (i.e. the decrease in pH of water or soil resulting from increases in acidic anion inputs such as sulphate).

Afforestation

Establishment of a new forest by planting of non-forested land.

Agri-Environmental Options Scheme (AEOS)

A scheme launched in 2010 and aiming to build on the Rural Environment Protection Scheme (REPS) in order to promote biodiversity, improve water quality and combat climate change.

Ammonia (NH_3)

A simple compound of nitrogen primarily originating in waste discharges. It can be toxic to fish under certain circumstances and is a source of nitrogen for plants and algae.

Anthropogenic

Produced as a result of human activities.

Appropriate assessment

The study of the potential or negative effects of a plan or project, in combination with other plans or projects, on a Natura 2000 site.

Assessment threshold

Level defined by legislation that is used to classify air quality for the purpose of determining the monitoring needed.

Attenuation

The reduction in magnitude/intensity/concentration of a substance dispersed in a gaseous or liquid medium.

Benzene

Carcinogenic volatile organic compound which is a component of unleaded petrol.

Bioaccumulative substance

A substance that builds up in tissue of living organisms as a result of direct exposure to polluted water, air or soil, or through consumption of contaminated food.

Bioaerosols

An airborne biological particle consisting of a range of micro-organisms and organic constituents.

Biochemical oxygen demand (BOD)

A measure of the potential oxygen consumption of decaying organic matter in water. It is a widely used measure of organic pollution in rivers and in effluents discharged to water.

Biodegradable municipal waste

Biodegradable municipal waste is municipal waste (see definition below) that can undergo biological decomposition. It is typically composed of food and garden waste, wood, paper, cardboard and textiles.

Biodiversity

Word commonly used for biological diversity and defined as assemblage of living organisms from all habitats including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part.

Biomass

Renewable organic materials, such as wood, agricultural crops of organic wastes used as a source of fuel or energy. Biomass can be solid, liquid or gaseous.

Biota

The flora and fauna of an area.

Bituminous coal

Type of coal that typically has a medium to high sulphur content.

Blanket bog

An area, often very extensive, of acid peatland, found in constantly wet climates, characteristic of broad flat upland areas, which develops where drainage is impeded and the soil is acid.

Carbon dioxide (CO_2)

A naturally occurring gas which is also a by-product of burning fossil fuels and biomass, land-use changes and industrial processes. It is the principal anthropogenic greenhouse gas that affects the earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and therefore has a Global Warming Potential of 1.

Carbon monoxide (CO)

Colourless gas emitted by road traffic. It is harmful to human health above specified limits.

Carbon tax

A policy instrument introduced in 2009 and designed to encourage and accelerate fuel switching away from carbon-intensive fuels

Carcinogen

A substance that causes or is believed to cause cancer in humans.

Climate change

A range of earth system changes caused by global warming.

Commercial waste

The waste that is produced from a number of diverse sources, including shops, offices and commercial premises, and consists of materials such as paper and cardboard, plastics, organics and glass.

Construction and demolition (C&D) waste

All waste that arises from construction, renovation and demolition activities and all wastes mentioned in Chapter 17 of the European Waste Catalogue (EWC).

Critical load

Level of a pollutant above which environmental damage is inevitable

Cryptosporidium

A coccidian protozoan parasite that infects vertebrates such as sheep and cattle. It can infect humans and is a particularly dangerous parasite when its oocysts enter public water supply systems due to, for example, cattle slurry contamination.

Daughter Directive

EU directive associated with a parent 'framework directive'. For air, the framework directive sets out the general approach and the daughter directive specifies the limit values for each pollutant.

Deforestation

The removal of trees in an area.

Diffuse source pollution

Pollution that arises from diffuse areas in a catchment such as septic tanks from rural housing or fields adjacent to a river or stream during heavy rainfall when surface runoff occurs.

Dioxins

A collective name given to a group of 75 closely related chemical compounds known as polychlorinated dibenzodioxins (PCDDs). Dioxins can form during combustion of organic materials containing chlorine, as undesirable by-products during chemical manufacture and bleaching operations.

Ecology

The study of the relationship among organisms and between those organisms and their non-living environment.

Ecosystem

A community of interdependent organisms together with the environment they inhabit and with which they interact, and which is distinct from adjacent communities and environments.

Ecosystem Services

Benefits people obtain from ecosystems, for example, provision of food and shelter, breaking down waste and purifying water.

Eco-tourism

Responsible travel to natural areas that conserves the environment and improves the well-being of local people.

Effluent

Liquid wastes.

Effort Sharing Decision

An EU initiative aimed at reducing emissions from sectors in Ireland that are not covered by the Emissions Trading Scheme.

Electromagnetic Radiation

A non-ionising form of energy generated by electrical charges or magnetic fields.

Emissions Trading Scheme

The EU's cornerstone climate-change mitigation programme, implemented in Ireland by the EPA.

Endocrine Disruptor

A substance which either mimics or blocks the effect of hormones which regulate various bodily functions.

Endocrine System

A system of glands, each of which secretes a type of hormone to regulate various bodily functions.

Energy efficiency

Achievement of the same or improved performance with less energy.

Erosion

Wearing away of earth or rock by the effects of rain, wind, sea or rivers or by the action of toxic substances.

Eutrophication

The enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned.

Fen

An area of waterlogged peat, which, unlike bog, is alkaline or only slightly acid.

Ghost estate

An unfinished or unoccupied housing estate.

Global warming

The trapping of additional energy in the earth's climate system caused by increased atmospheric concentrations of greenhouse gases such as CO_2, CH_4 and N_2O, released by human activities.

Green economy

Policies and innovations to enable society to use resources efficiently and enhance the economy and human wellbeing, while maintaining the natural systems that sustain us.

Green infrastructure

An interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations.

Green Tenders

An action plan, launched in January 2012, to assist public authorities to plan and implement green public procurement (GPP) successfully

Greenhouse gases

Gaseous constituents of the atmosphere that absorb/trap infrared (thermal) radiation which is mainly emitted by the earth's surface, and thereby influence the earth's temperature.

Groundwater

Water that occupies pores and crevices in rock and soil, below the surface and above a layer of impermeable material.

Habitat

The dwelling place of a species or community, providing a particular set of environmental conditions (e.g. forest floor, sea shore).

Hazardous waste

Waste displaying properties that make it hazardous to human health or the environment.

Heavy metals

Elements such as mercury, cadmium and lead that occur naturally in the environment but can be toxic to humans, animals and plants at elevated concentrations.

Hydraulic fracturing (fracking)

The forcing open of fissures in subterranean rocks by introducing liquid at high pressure, especially to extract oil or gas.

Household waste

Waste produced within the curtilage of a building or self-contained part of a building used for living accommodation.

Hydromorphological pressures

Physical disturbances of water such as impoundments and other water regulation structures.

Industrial waste

Waste produced by industrial activity such as that of factories, mills and mines.

Invasive alien species

Species that have been introduced to Ireland (deliberately or accidentally) by humans and have a negative impact on its economy, wildlife or habitats.

Invertebrate

An animal that does not possess a backbone.

Ireland's Sustainable Development Model (ISus)

An environmental emissions projection model for the economy of Ireland.

Kyoto Protocol

The 1997 protocol to the Convention on Climate Change under which industrialised countries commit to reducing their combined greenhouse gas emissions.

Limit value

A level fixed on the basis of scientific knowledge, with the aim of avoiding, preventing or reducing harmful effects on human health and/or the environment as a whole, to be attained within a given period and not to be exceeded once attained.

Municipal waste

Comprises household waste as well as commercial, industrial and street cleansing waste, which because of its nature and composition is similar to household waste.

Nanomaterials

Materials of extremely small scale, with applications in electronics and elsewhere, which may be potentially harmful to human health.

Natura 2000

EU-wide network of nature protection areas established under the Habitats Directive.

Nitrate (NO_3)

A salt of nitric acid (HNO_3).

Nitrogen oxides (NO_X)

A gas that usually includes the pollutants nitric oxide (NO) and nitrogen dioxide (NO_2), produced by high-temperature combustion and some natural processes. Nitrogen dioxide is harmful to human health above specified limits.

Nutrient

Element or chemical essential for growth, e.g. phosphorus, nitrogen, silica, oxygen, carbon.

Ozone (O_3)

A secondary pollutant in which the molecule of oxygen consists of three atoms rather than the more usual two.

Ozone precursor

A substance that contributes to the formation of ground-level (tropospheric) ozone.

Particulate matter

Air pollutant comprising fine solid particles (dust) and liquid droplets.

Pathogens

Biologically hazardous organisms such as viruses, bacteria or parasites that may give rise to illness in humans or animals.

Persistent organic pollutants (POPs)

Substances such as dioxins, polycyclic aromatic hydrocarbons, hexachlorobenzene and polychlorinated biphenyl that can resist degradation and accumulate in the environment.

Pesticide

A general term for any chemical agent used to kill unwanted plants ('weeds'), animal pests, or disease-causing fungi.

Phosphate (PO4)

The commonly occurring form of phosphorus taken up by plants in the aquatic environment and essential for their growth.

$PM_{2.5}$

Particulate matter measuring less than 2.5 µm in diameter.

PM_{10}

Particulate matter measuring less than 10 µm in diameter.

Point source pollution

Pollution that arises from a well-defined point, typically the end of a discharge pipe, but may include farmyard sources.

Polychlorinated biphenyls (PCBs)

Long-lived toxic chemicals formerly used in heavy industry.

Polycyclic aromatic hydrocarbons (PAHs)

Complex organic molecules found in soot, tar, vehicle exhausts and combustion products of fuels.

Radon

A naturally occurring radioactive, colourless, odourless gas derived from uranium in rocks and in soil.

Raised bog

An area of ombrogenous (i.e. originating as a result of wet climates) acid peatland with a convex profile.

Reforestation

Replanting of forests on lands that have recently been harvested.

Renewable resource

A resource that can be exploited without depletion because it is constantly replenished, e.g. solar radiation and wind.

River Basin District

A river basin/catchment is an area of land from which all surface run-off flows through a series of streams, rivers and possibly lakes into the sea at a single river mouth or estuary. A River Basin District comprises one or more neighbouring river basins together with their associated wetlands, groundwaters and coastal waters.

Secondary pollutant

A pollutant not directly emitted but formed from the reaction of other pollutants.

Stratosphere

Layer of the atmosphere between approximately 10 km and 50 km above the surface of the earth.

Sulphur dioxide (SO_2)

A colourless gas produced mainly by oxidation of the sulphur in fossil fuels through combustion. It is harmful to human health above specified limits.

Sustainable development

Defined by the Brundtland Commission (1987) as 'development that meets the needs of the present without compromising the ability of the future generations to meet their own needs'.

Taxonomic

Referring to 'taxon' (plural taxa) or taxonomic unit; a name designating an organism or a group of organisms.

Transboundary pollution

Pollution emitted in one country and transported naturally to other countries.

Troposphere

The lowest layer of the atmosphere, extending from the surface of the earth to 12–15 km above the earth.

UV radiation

Ultraviolet radiation, with wavelength between 4 and 380 nm.

Vascular plants

Plants with leaves, roots and stems containing tissues (vascular tissues) for transporting water and nutrients throughout the plant.

Volatile organic compounds (VOCs)

Organic compounds that evaporate readily and contribute to air pollution mainly through the production of secondary pollutants such as ozone.

Waste Electrical and Electronic Equipment (WEEE) scheme

A scheme introduced to deal with Waste Electrical and Electronic Equipment as required by EU Directives.

Water Framework Directive

An EU-wide law introduced in 2000 to bring a common approach to safeguarding all Community waterbodies and water-dependent ecosystems.

Wetland

An area covered permanently, occasionally, or periodically by fresh or salt water (e.g. flooded pasture land, marshland, inland lakes, rivers and their estuaries); also includes bogs.

An Ghníomhaireacht um Chaomhnú Comhshaoil

Is í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) comhlachta reachtúil a chosnaíonn an comhshaol do mhuintir na tíre go léir. Rialaímid agus déanaimid maoirsiú ar ghníomhaíochtaí a d'fhéadfadh truailliú a chruthú murach sin. Cinntímid go bhfuil eolas cruinn ann ar threochtaí comhshaoil ionas go nglactar aon chéim is gá. Is iad na príomhnithe a bhfuilimid gníomhach leo ná comhshaol na hÉireann a chosaint agus cinntiú go bhfuil forbairt inbhuanaithe.

Is comhlacht poiblí neamhspleách í an Ghníomhaireacht um Chaomhnú Comhshaoil (EPA) a bunaíodh i mí Iúil 1993 faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil 1992. Ó thaobh an Rialtais, is í an Roinn Comhshaoil, Pobal agus Rialtais Áitiúil.

ÁR bhFREAGRACHTAÍ

CEADÚNÚ

Bíonn ceadúnais á n-eisiúint againn i gcomhair na nithe seo a leanas chun a chinntiú nach mbíonn astuithe uathu ag cur sláinte an phobail ná an comhshaol i mbaol:

- áiseanna dramhaíola (m.sh., líonadh talún, loisceoirí, stáisiúin aistrithe dramhaíola);
- gníomhaíochtaí tionsclaíocha ar scála mór (m.sh., déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta);
- diantalmhaíocht;
- úsáid faoi shrian agus scaoileadh smachtaithe Orgánach Géinathraithe (GMO);
- mór-áiseanna stórais peitreail;
- scardadh dramhuisce.

FEIDHMIÚ COMHSHAOIL NÁISIÚNTA

- Stiúradh os cionn 2,000 iniúchadh agus cigireacht de áiseanna a fuair ceadúnas ón nGníomhaireacht gach bliain.
- Maoirsiú freagrachtaí cosanta comhshaoil údarás áitiúla thar sé earnáil – aer, fuaim, dramhaíl, dramhuisce agus caighdeán uisce.
- Obair le húdaráis áitiúla agus leis na Gardaí chun stop a chur le gníomhaíocht mhídhleathach dramhaíola trí comhordú a dhéanamh ar líonra forfheidhmithe náisiúnta, díriú isteach ar chiontóirí, stiúradh fiosrúcháin agus maoirsiú leigheas na bhfadhbanna.
- An dlí a chur orthu siúd a bhriseann dlí comhshaoil agus a dhéanann dochar don chomhshaol mar thoradh ar a ngníomhaíochtaí.

MONATÓIREACHT, ANAILÍS AGUS TUAIRISCIÚ AR AN GCOMHSHAOL

- Monatóireacht ar chaighdeán aeir agus caighdeáin aibhneacha, locha, uiscí taoide agus uiscí talaimh; leibhéil agus sruth aibhneacha a thomhas.
- Tuairisciú neamhspleách chun cabhrú le rialtais náisiúnta agus áitiúla cinntí a dhéanamh.

RIALÚ ASTUITHE GÁIS CEAPTHA TEASA NA HÉIREANN

- Cainníochtú astuithe gáis ceaptha teasa na hÉireann i gcomhthéacs ár dtiomantas Kyoto.
- Cur i bhfeidhm na Treorach um Thrádáil Astuithe, a bhfuil baint aige le hos cionn 100 cuideachta atá ina mór-ghineadóirí dé-ocsaíd charbóin in Éirinn.

TAIGHDE AGUS FORBAIRT COMHSHAOIL

- Taighde ar shaincheisteanna comhshaoil a chomhordú (cosúil le caighdéan aeir agus uisce, athrú aeráide, bithéagsúlacht, teicneolaíochtaí comhshaoil).

MEASÚNÚ STRAITÉISEACH COMHSHAOIL

- Ag déanamh measúnú ar thionchar phleananna agus chláracha ar chomhshaol na hÉireann (cosúil le pleananna bainistíochta dramhaíola agus forbartha).

PLEANÁIL, OIDEACHAS AGUS TREOIR CHOMHSHAOIL

- Treoir a thabhairt don phobal agus do thionscal ar cheisteanna comhshaoil éagsúla (m.sh., iarratais ar cheadúnais, seachaint dramhaíola agus rialacháin chomhshaoil).
- Eolas níos fearr ar an gcomhshaol a scaipeadh (trí cláracha teilifíse comhshaoil agus pacáistí acmhainne do bhunscoileanna agus do mheánscoileanna).

BAINISTÍOCHT DRAMHAÍOLA FHORGHNÍOMHACH

- Cur chun cinn seachaint agus laghdú dramhaíola trí chomhordú An Chláir Náisiúnta um Chosc Dramhaíola, lena n-áirítear cur i bhfeidhm na dTionscnamh Freagrachta Táirgeoirí.
- Cur i bhfeidhm Rialachán ar nós na treoracha maidir le Trealamh Leictreach agus Leictreonach Caite agus le Srianadh Substaintí Guaiseacha agus substaintí a dhéanann ídiú ar an gcrios ózóin.
- Plean Náisiúnta Bainistíochta um Dramhaíl Ghuaiseach a fhorbairt chun dramhaíl ghuaiseach a sheachaint agus a bhainistiú.

STRUCHTÚR NA GNÍOMHAIREACHTA

Bunaíodh an Ghníomhaireacht i 1993 chun comhshaol na hÉireann a chosaint. Tá an eagraíocht á bhainistiú ag Bord lánaimseartha, ar a bhfuil Príomhstiúrthóir agus ceithre Stiúrthóir.

Tá obair na Gníomhaireachta ar siúl trí ceithre Oifig:

- An Oifig Aeráide, Ceadúnaithe agus Úsáide Acmhainní
- An Oifig um Fhorfheidhmiúchán Comhshaoil
- An Oifig um Measúnacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáide

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag ball air agus tagann siad le chéile cúpla uair in aghaidh na bliana le plé a dhéanamh ar cheisteanna ar ábhar imní iad agus le comhairle a thabhairt don Bhord.

ENVIRONMENTAL PROTECTION AGENCY

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