UK National Ecosystem Assessment

Northern Ireland Summary

October 2011

UK National Ecosystem Assessment
Northern Ireland

Co-ordinating Lead Author
Susan J. Christie Northern Ireland Environment Link (NIEL).

Lead Authors
David McCann (NIEL; Co-ordinator and Researcher), Judith Annett (Northern Ireland Biodiversity Group; NIBG), Judith Bankhead (Rivers Agency), Diane Burgess (Agri-Food & Biosciences Institute; AFBI), Patrick Casement (Council for Nature Conservation & the Countryside; CNCC), Peter Christie (AFBI), Alan Cooper (University of Ulster; UU), John Griffin (Forest Service), Neil Halliday (NIEL), Hilary Kirkpatrick (UU), Cathy Maguire (Comhar Sustainable Development Commission/Queen's University Belfast; QUB), Jim McAdam (AFBI), Ronan McColgan (NIEL), Melina McMullan (Northern Ireland Environment Agency; NIEA), Julian Orford (QUB), Dave Schoeman (UU), Robert Scott (Belfast City Council), Roy Tomlinson (QUB-retired), Mark Wright (NIEA).

Contributing Authors
Peter Archdale (CNCC), Caroline Barry (NIEA), Tony Bazley (Earth Science Ireland Magazine), Martin Bradley (NIEA), Joe Breen (NIEA), Lee Bruce (Woodland Trust), Christine Butler (Department of Agriculture & Rural Development; DARD), Martin Carey (Mourne Heritage Trust), Patrick Cregg (Woodland Trust), Peter Cush (NIEA), Iain Davies (NIEA), Colum Delaney (Royal Society for the Protection of Birds; RSPB), Philip Downey (DARD), John Early (NIEA), Lindsay Easson (AFBI), Clifford Henry (NIEA-retired), Dermot Hughes (Ulster Wildlife Trust - retired; UWT), Crawford Jordan (AFBI), Eimear Kearney (Lough Neagh Partnership), Jonathan Kingham (NIEL), Lisa Kirkwood (WWF), Declan Lawlor (Loughs Agency), Aileen Lawson (Ulster Farmers Union), Christine Maggs (QUB), Orla Maguire (Belfast City Council), John Martin (RSPB), Marcus McAuley (Department of Culture, Arts & Leisure), Thomas McCann (UU), Neil McCulloch (NIEA), Damian McFerran (Centre for Environmental Data & Recording; CEDaR), Philip McMurray (Department of the Environment), Jonathan McNee (Planning Service), Arthur Mitchell (Rural Development Council), Alan Moore (NI Water), Stuart Morwood (Forest Service), Joan Moss (AFBI), Archie Murchie (AFBI), Ken Neill (NIEA), Geoff Nuttall (WWF), Julia Nunn (CEDaR), John O'Neill (Fisheries Division, DARD), Brian Poots (Northern Ireland Forest School Association), David Porter (Rivers Agency), Neil Reid (Quercus), Robert Rosell (AFBI), Diane Ruddock (National Trust), Richard Schaible (Forest Service), Matthew Service (AFBI), Maxime Sizaret (Causeway Coast & Glens Heritage Trust), Emily Smyth (UU), Jude Stephens (QUB), Andrew Upton (UWT), Claire Vincent (NIEA), Michael Young (Geological Survey NI).

Photography
Mike Hartwell (www.northern-eye.co.uk).

Table of Contents

Core Funded by:

environment link Northern Ireland

NIEA Northern Ireland Environment Agency www.ni-environment.gov.uk

An Agency within the Department of the Environment www.doeni.gov.uk

Esmée Fairbairn Foundation

UK National Ecosystem Assessment
Northern Ireland

The benefits derived from the natural world and its constituent ecosystems are critically important to human well-being and economic prosperity, but are consistently undervalued in economic analyses and decision making. Ecosystems and the services they provide underpin our existence. We depend upon them to produce our food, regulate our water and climate and provide a sense of identity.

This report is the first independent assessment of the services provided by Northern Ireland's environment. Part of the UK National Ecosystem Assessment, it has been prepared by over 70 scientists. It provides an analysis of the current state of our ecosystems, looks at changes over time, examines the factors driving current changes and provides recommendations on how Northern Ireland's land and sea can be managed to ensure delivery of a wide range of benefits to enhance well-being.








The UK NEA was funded by the Countryside Council for Wales; the Department for Environment, Food and Rural Affairs; the Economic and Social Research Council; the Natural Environment Research Council; the Northern Ireland Environment Agency; the Scottish Government; the United Nations Environment Programme and the Welsh Assembly Government. The UK NEA is an accredited project within the LIving with Environmental Change Partnership (LWEC).

UK National Ecosystem Assessment
Northern Ireland

The natural world is critical to our well-being and our economy, but it is often undervalued in decisions which impact upon its ability to deliver the goods and services upon which we depend. There have been major changes in the way land is managed over the past 60 years and these have impacted upon nature's ability to deliver a range of services and benefits. Although there have been recent improvements in some aspects, there are serious concerns about the continuing ability of natural and managed ecosystems to deliver the range of products and services upon which we all depend. Decisions now being made will have long-term impacts on our environment and this report identifies the factors which must be considered within these decisions. Putting a financial value on some aspects of the environment through the services which ecosystems deliver will enable improved decision-making, promoting an integrated approach to ecosystem management and delivering benefits for all of Northern Ireland's people.

The findings are diverse and wide ranging and impact upon every aspect of our lives and every facet of government. The report demonstrates how valuable our natural environment is and shows that this value is largely hidden in standard accounting, markets and decision-making. Putting a proper financial value on ecosystem services challenges us to deliver integrated resource management which optimises delivery of multiple ecosystem services.

The natural world provides many direct and indirect benefits to Northern Ireland's residents and visitors. In addition to food, clean water, cultural heritage and a sense of place, there are less tangible benefits such as flood control, carbon storage and providing resilience in the face of change (Figure 1). Assigning values to products is relatively easy, but assigning values to less tangible services is very difficult. Assigning value has typically only been done on a partial bases for individual services and the costs that would be required to deliver that service if it was not delivered 'naturally', for example the cost of pollinating crops in the absence of natural pollinators.

The Northern Ireland National Ecosystem Assessment (NI NEA) is the first analysis of Northern Ireland's natural environment in terms of the benefits it provides to society and to economic prosperity. If Northern Ireland's ecosystems are to be able to support our communities and economy they need to be healthy and resilient to change. The NI NEA provides an assessment of the extent and condition of Northern Ireland's natural and human-modified habitats. It looks at the ecosystem services they provide and, where possible, attempts to place a value on those services in economic, social and environmental terms. Information on trends in the ecosystems and in the services they deliver has been compiled and factors that will influence future changes have been identified. It also provides an introduction to the use of the ecosystem approach to inform policy development and management decisions which can maintain and improve the ecosystem services that provide a range of benefits to residents and visitors. This ecosystem assessment exercise forms the basis for making future management decisions which enhance ecosystem health, resilience and ability to deliver many diverse services which will ensure maximum contributions to human well-being and economic prosperity.

The NI NEA is a part of a UK-wide, two year project to assess the state of our ecosystems, what goods and services they deliver and the value they provide to human well-being and the economy. It is independent, interdisciplinary and peer reviewed. Over 70 scientists from government, academia, voluntary organisations and the private sector contributed to the Northern Ireland document which was funded by the Northern Ireland Environment Agency. The UK NEA has been funded by the UK and all devolved administrations and is part of the Living With Environmental Change initiative of the United Nations Environment Programme World Conservation Monitoring Centre. The report has been welcomed by the UK Government and devolved administrations and is recognised as a major contribution, demonstrating how the environment is critical to the economy and to personal and societal health and well-being.

Ecosystem Services

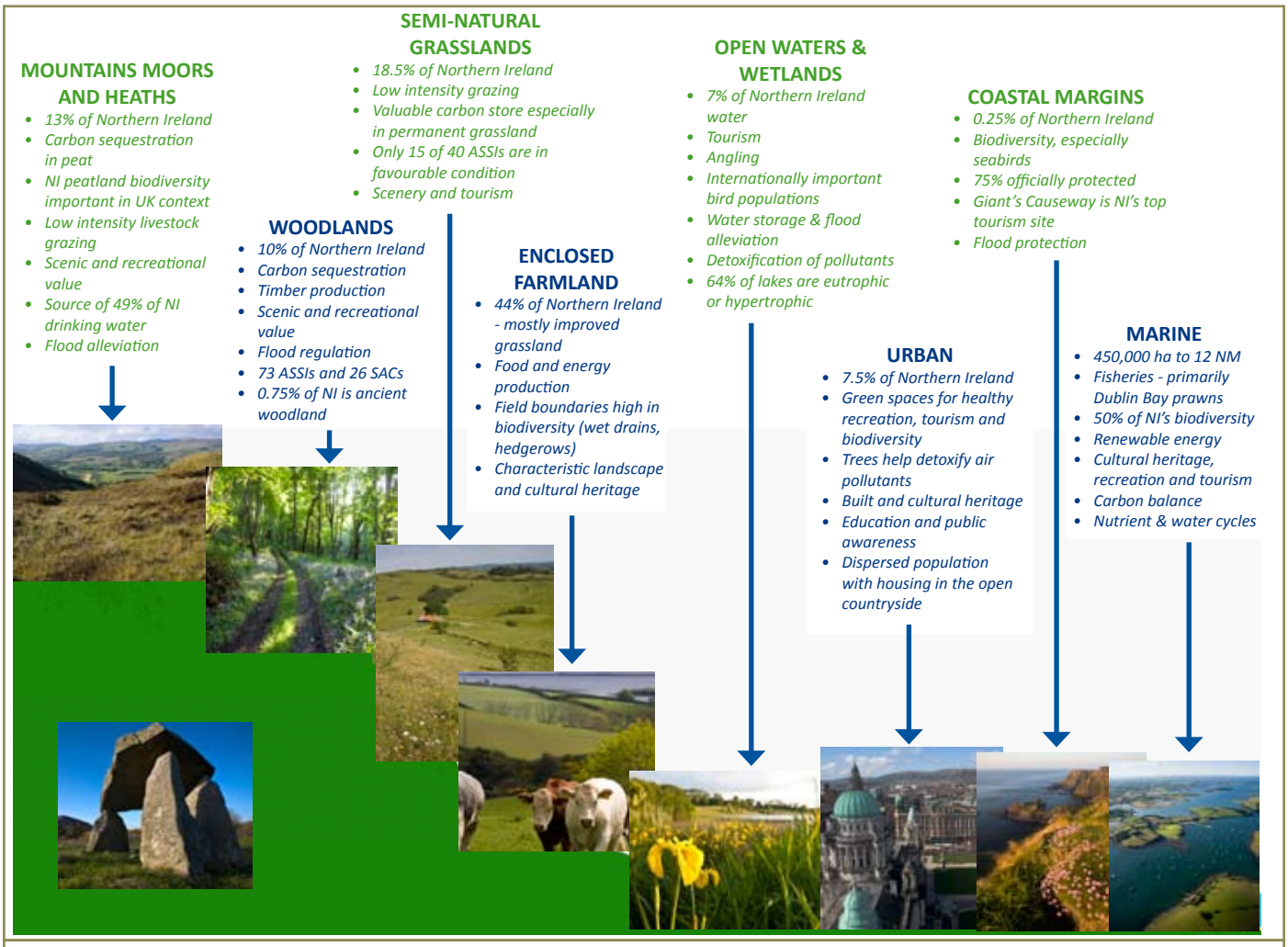


Figure 1. Delivery of services by Northern Ireland's ecosystems.

An ecosystem is an interdependent system of living things (plants, micro-organisms and animals including people) in their physical environment. A change in any one component of an ecosystem can impact on the entire ecosystem. Ecosystems can be terrestrial or marine, inland or coastal, rural or urban and can vary in size and over time. In many cases, ecosystems overlap and interact. A healthy ecosystem is one that is resilient: able to adapt to changes in the environment such as fires, flooding, insect population explosions, human activities and the introduction of exotic plant or animal species.

Ecosystem services are the benefits provided by ecosystems that contribute to making human life both possible and worth living. Ecosystem services are commonly grouped into four categories.

- **Provisioning**: the products obtained from ecosystems such as food, fibre and fresh water;
- **Regulating**: the benefits obtained from ecosystem processes such as pollination and control of the climate and water;
- **Cultural**: the non-material benefits obtained from ecosystems; for example through spiritual or religious enrichment, cultural heritage, recreation and tourism or other aesthetic experience; and,
- **Supporting**: ecosystem functions that are necessary for the production of all other ecosystem services, including soil formation and the cycling of nutrients and water.

Key Recommendations

1. **The Northern Ireland NEA should inform policy and decision-making** to ensure long-term sustainable management of ecosystems and delivery of their services. This requires legislation, guidelines, planning policies, designations, restrictions, fiscal drivers, education and awareness (Figure 2). Public, private and voluntary sectors benefit from and impact on ecosystems and their ability to deliver services.

2. **A fully integrated cross-departmental and inter-sectoral approach is needed**. Work of all central government departments and agencies and local government impact upon and are in turn dependent upon the environment. Although there has been a lack of integration of policies and their delivery in Northern Ireland, it is increasingly recognised that the principles of sustainable development are key to ensuring that ecosystem services are maintained and optimised in the long term, both on land and at sea.

3. **Greater understanding is required at public and political levels of ecosystem services;** what they are, what benefits society and individuals gain from them, why natural habitats are crucial for providing the resilience necessary for meeting global and local challenges including climate change and food security, and how to manage ecosystems to deliver multiple services.

4. **Further research, especially around establishing financial values for service delivery, is required**. There are currently limited data that demonstrate and value ecosystem services in the UK, especially in a Northern Ireland context. There are also issues around what data exist, their accessibility and their comparability with other data sets. Issues of different data collection methods, metrics and scales make comparisons and long-term monitoring and reporting difficult. Limited data exist in Northern Ireland on local habitats and ecosystem services. There is a need for comparable and repeatable methods across the EU, establishing ecosystem indicators and minimum baseline standards to which Northern Ireland data contribute. A variety of methods increases the information available, but mechanisms to compare data sets are crucial.

5. **Effective delivery of ecosystem services requires informed and integrated management across a range of habitats that supports high levels of biodiversity and ensures long-term resilience to changing circumstances**. Future challenges (weather, changing consumer preferences and political priorities, etc.) could place unanticipated demands on both natural and human-modified ecosystems. Resilient, biodiverse ecosystems underpin economic and social prosperity by providing a wide range of valuable services. Mechanisms that reflect this value in economic and policy decisions are required. Conserving ecosystem functionality can minimise the high costs associated with environmental degradation.

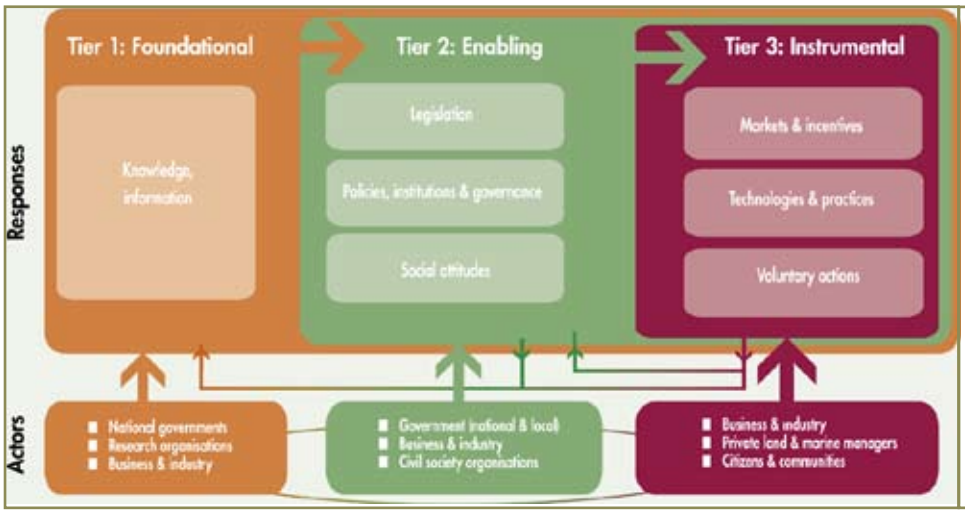


Figure 2. Cascade of responses. Knowledge (at a fundamental or 'Foundation' level) creates the context within which governments enact Legislation, adopt Policies, Institutions and Governance-based interventions, and influence Social Attitudes towards habitats and ecosystem services. These provide the 'Enabling' conditions within which actors undertake specific 'Instrumental' strategies that frequently involve the use of Markets and Incentives for action, the deployment of specific Technologies and Practices, or the adoption of Voluntary Approaches. The figure also shows the role that key actors play in the initiation and implementation of responses at each of these three tiers.

Key Recommendations

6. **The role of ecosystem services in mitigating the effects of human impacts, including climate change and biodiversity loss, should be considered in all decisions about the use of land and sea**. Increasing ecosystem resilience will reduce costs by retaining restoration ability in changing circumstances, including unanticipated events. While direct impacts of climate change may be lower in Northern Ireland than in many other parts of the world, impacts of unanticipated events (including severe weather) and changing weather patterns are already apparent. The multiple roles of habitats (for example, of wetlands and peatlands in water management, of woodlands and peatlands in carbon storage, of coasts and marine habitats in flood control, of enclosed farmland and semi-natural grasslands in providing food, and the potential for all habitats to provide renewable energy) need to be fully recognised as underpinning the ability of people to live safely and sustainably. The ability of ecosystems to buffer changes and of biodiversity to deliver ecosystem services needs to be given full value in policy decisions affecting the environment.

7. **Carbon management needs to be seen as an important part of management for multiple service delivery**. Carbon storage and sequestration are vital ecosystem services and are cost-effective ways to mitigate and adapt to climate change. Key aspects include soils, peatlands, permanent pasture and woodlands.

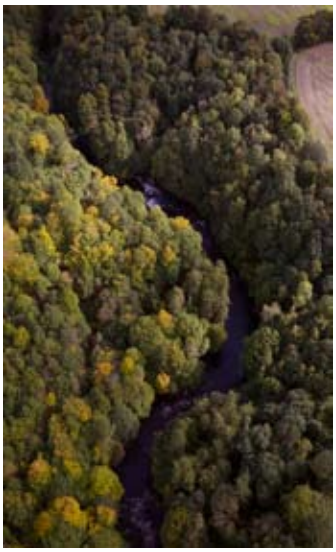
8. **The full value of sequestration in existing habitats must be factored into carbon and greenhouse gas budgets and targets and given weight when making decisions on land management regimes**. There is a significant opportunity due to the scale of the resource in Northern Ireland, including potential financial benefits through possible carbon credits and targeting new markets for low carbon livestock production.

9. **Planning and management policies need to be aligned with natural processes to maintain the capacity for multiple service delivery.** Management decisions need to be at a strategic level and sustainable, regarding tradeoffs between outputs, opportunities for multiple service delivery and addressing competing demands. Implementing these strategic decisions locally requires a mixture of incentives and regulations for land owners which put an economic value on the 'public goods' delivered by functioning ecosystems.

10. **A network of ecologically coherent sites should form a core for integrated management within the wider environment, delivering ecosystem services and minimising environmental degradation**. The unique and internationally important biodiversity of Northern Ireland requires specific management and protection measures in an overall context of land and sea management. UK policies need to be integrated and coherent, but cognisant of and flexible in their response to unique Northern Ireland conditions.

11. **The island of Ireland should be considered as a whole for ecosystem management**. An Ecosystem Assessment which incorporates the wider British Isles, the Republic of Ireland and the surrounding marine areas would be worthwhile. The international border raises issues of differential management, protection, legislation and funding within single ecosystems. Fiscal drivers can be particularly important in determining how people move, shop and spend their leisure time with regard to the border and the ecosystems which traverse it.



Ecosystems and People

The natural world and the services which ecosystems deliver underpin our existence. Nature is vital for human health and well-being, providing essentials such as food and fibre, pure water and clean air but also providing regulation of water and climate, breaking down waste products and defending against flooding. These aspects are less obvious, often taken for granted and seldom considered during policy making or practical management decisions. The financial value of nature to human well-being in total is difficult to calculate, especially as many benefits are intangible and difficult to price. For example, the natural environment has many positive effects on health; there are benefits derived from enjoyment of scenery and cultural heritage; soils and vegetation are important in purification of water and in flood defences. The value is clearly significant and needs to be considered in all decisions which impact on the natural world and the services it delivers. Assigning too little value or ignoring it entirely in cost-benefit analyses risks incurring significant costs in both finance and human well-being terms. Applying a monetary value to nature may be too simplistic (nature's value goes far beyond money), but providing broad estimates of the costs of environmental degradation and the benefits of nature's services can offer a powerful argument for environmental protection. It is important to realise that our health and well-being are dependent on not only the condition of Northern Ireland's environment but also the state of the global environment.

Putting a proper financial value on the benefits delivered by nature will enable better decision making, improve human well-being and provide new avenues for investment, jobs and land management. The benefits provided by Northern Ireland's environment (often referred to as 'natural capital') have been largely under-estimated in the past, and the UK-wide report begins the process of putting financial values on the different options for managing the natural environment. This allows rational, comprehensive policy decisions to be taken with full knowledge of the impacts that policies could have on the ability of the natural environment to deliver public goods such as water purification, carbon management, flood defences and soil productivity as well as direct goods such as food, timber and water.

By looking at the changes that have taken place in natural areas in the past 60 years it is possible to understand how natural systems function and to begin to quantify the value of the services they provide. Actions now will have impacts far into the future, and these consequences must be understood in order to make rational decisions today which do not incur unacceptable future costs.

Provisioning	Regulating	Cultural	Supporting
• Livestock	• Climate change mitigation	• Visitor attractions, scenery	• Peat deposition
• Drinking water	• Carbon storage	• Hill walking, outdoor pursuits	• Soil formation
• Renewable energy	• Water purification	• Archaeological heritage	• Nutrient cycling
• Timber	• Flood control	• Landscape and sense of place	• Water cycling

Figure 3. Ecosystem services provided by upland areas.

Sustainable Management

Sustainable management of our natural resources requires a mixture of regulations, technology, financial investment, fiscal incentives and education aimed at delivering changes in both individual and societal behaviour. An integrated approach, across sectors and across traditional governmental boundaries, is required to deliver ecosystem management to provide multiple benefits to society. The pressures on land and demands for services are constantly changing as a result of both societal preferences and environmental changes. Functioning ecosystems contribute billions of pounds to the UK economy, but without techniques for putting financial values on all of these benefits they can be undervalued and even lost as a consequence of inappropriate decisions based on partial information.

Consider for example what Northern Ireland's peatlands deliver; an iconic landscape highly valued for tourism and recreation, storage and purification of drinking water, an important source of renewable energy, areas of high biodiversity value, timber, livestock products and flood alleviation. They are also a major store of carbon whose release would add to global warming. Through careful management of all uplands it is possible to deliver all of these outputs, and in some places many can be delivered simultaneously.

Damage to natural systems can occur from many causes: fires, floods, storms, invasive species, climate change, wilful or accidental destruction, uncontrolled development or discharge of pollutants. Healthy systems can recover from small changes, however overwhelming damage to systems can reduce their ability to recover, and ultimately

Ecosystems and People

impairs the ability of these systems to deliver the range of products and services upon which people rely. Some of the damage to natural systems is apparent (e.g. through fires), but often the less noticed impacts can be of even greater importance to the functioning of the system. For example, long term damage to soil microbes, pollinating insects or water quality can lead to significant degradation in the ability of systems to function and provide services and human benefits. The cost of replacing these services (if they can be replaced at all) can be very high; imagine the task of pollinating Armagh's apples by hand if insects did not do the job. The loss of upland vegetation and damage to underlying peat in the April 2011 fires may impose signifcant additional costs to purify drinking water.

While it is easy to put a value on goods and services which are bought and sold, putting a value on others which are not traded in this way is difficult. In the past, this has resulted in ecosystem services being assigned a value that does not reflect their important role. This effectively ignores the positive benefits of these ecosystems and this can result in decisions based on incomplete information with unfortunate or unforeseen consequences. The ecosystem assessment approach attempts to redress this misunderstanding.

Ecosystems Approach

Adopting an ecosystem approach requires an understanding of what ecosystems are present in Northern Ireland, their current state and recent trends, and the services which they deliver. We must then refine our ability to assign values to all services, and develop ways to factor those values into policy decisions which impact upon those areas and services. The UK National Ecosystem Assessment is the first major step in this process. An analysis of the information available in 2010 for Northern Ireland's ecosystems forms a baseline and identifies areas where further knowledge is required. It identifies trends since the Second World War in habitats and services, looks at some key drivers of past and future change and compiles information and some figures on the benefits and services that ecosystems bring to human well-being. A number of recommendations are provided which will help embed the ecosystem services concept in decision making to help optimise the benefits that Northern Ireland's ecosystems can provide for its citizens.

The analysis shows that direct production of goods has increased, but that the overall health of ecosystems has suffered as a consequence. Some of this damage is being reversed, such as a decline in water pollution levels, but this is generally a long, complex and often costly process. Other damage is also increasing; invasive species (especially in and adjacent to freshwater) are becoming a significant cost and threats to honeybee populations are worrying.

There is good news for Northern Ireland. We have productive soils, huge carbon stores in peatlands and permanent grasslands, beautiful scenery and potential for cultural heritage tourism, generally good air quality, enormous potential for renewable energy and a developing network of protected sites.

However, all is not yet satisfactory. Most surface waters are overly nutrient rich, there is over-development in the countryside, many designated sites are in unfavourable condition, some habitats are declining in quantity or quality and invasive species and diseases are becoming major problems.

Recognising the importance of the environment for human health and well-being and economic growth is vital if Northern Ireland is to make strategic decisions which ensure continued and enhanced delivery of services from our countryside. Adopting the ecosystem approach allows us to optimise the ability of the environment to deliver a variety of benefits, to retain its resilience to human and natural perturbations and to provide many practical and less tangible benefits to the people of Northern Ireland.

Valuing Ecosystem Services

Ecosystems services and their impacts on human welfare must be recognised in all decisions which affect how land is used. This is most easily done where a financial value can be placed on the benefits accruing to society and the economy from Northern Ireland's natural environment.

Much international work is now being carried out in this area, including *The Economics of Ecosystems and Biodiversity (TEEB)* work. Assigning economic values to particular areas, ecosystems or species is difficult. Much of the TEEB work, as well as the information specifically available for Northern Ireland, concentrates on products, the costs of providing services if nature did not do so (pollination, water purification), the costs of ameliorating environmental damage (flooding, pollution, invasive species) and the economic benefits provided through tourism or recreation.

The value of ecosystem services goes far beyond the value of the products derived and in many cases the additional values can be much greater than those of the products themselves (Figure 4). The regulatory and supporting functions of intact natural environments are particularly hard to value, but can be extremely expensive or even impossible to replicate.

Considerable information is available on the state of Northern Ireland's habitats, but there is little work linking specific habitats to the delivery of ecosystem services, and understanding of the functioning of ecosystems as a whole is still incomplete. There are limited data on the consequences of changes to habitats and ecosystem services. Natural ecosystems provide considerable value to the people of Northern Ireland through a wide range of ecosystem services, but the specific services change over time. Some benefits such as carbon sequestration and hazard resilience are not currently recognised as having financial value, but this may well change. Data have been collected at differing scales, using different methodologies and for varying purposes. Changes to habitats, their current and past management, and the extent of knowledge concerning past trends all vary. In many cases, trends differ markedly between different sub-habitats and the direction of changes has shifted over the last 60 years. Much more work is required on valuation for Northern Ireland.

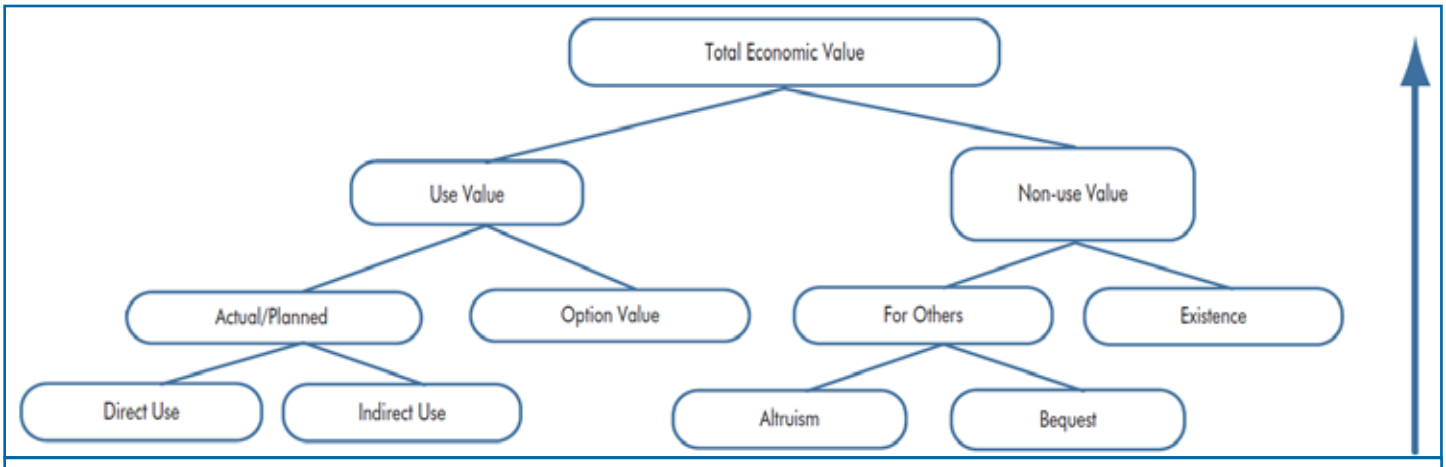
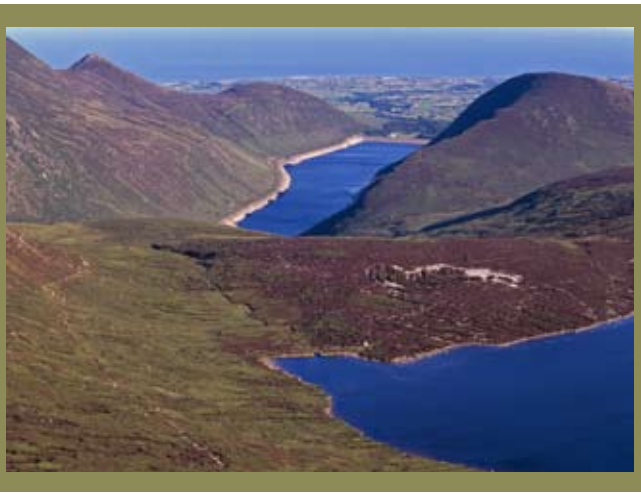


Figure 4. Total Economic Value Framework. Analysis of contributors to the total economic value.

The costs of widespread fires in 2011 are not yet available. However, in July 2004 a fire near the Silent Valley reservoir in the Mournes lasted a few days and burned an area of blanket bog of approximately 0.8 km^2. The fire had a considerable effect on the raw water quality (increase in colour and organic content) in the reservoir supplying Drumaroad Water Treatment Works which supplies water to over 15% of Northern Ireland's population. It was not until June 2006 that the raw water quality improved significantly. Operational changes to address this, including increased use of chemicals and power, cost circa £230,000.



Biodiversity

Biodiversity is the variety and abundance of all life – plants, animals, fungi and microbes. Ecosystems are composed of all the living things in the area, plus the physical features (soil, water, etc.) which support them. Biodiversity underpins the provision of all ecosystem services. Research on a range of taxa from algae to mammals shows that some Northern Ireland species have a unique genetic composition and that these differences are important and should be maintained.

Managing land in ways which maintain or increase natural biodiversity generally improves the delivery of all classes of ecosystem services, as well as improving the resilience of the area if it is subjected to stress (weather or climate changes, pollution, invasive species). Natural flood control, pollination, erosion control and pollution abatement are all areas where the natural biodiversity of an area can greatly improve its ability to deliver benefits to people. There are numerous examples where the decline of key species or the introduction of non-native invasive species has led directly to the decline of natural habitats and degradation of ecosystem service delivery; zebra mussels, Nuttall's pond weed and Rhododendron are but three examples where there are significant on-going costs required to deal with impacts.

Some recent mechanisms to protect biodiversity are having beneficial effects. As of the beginning of 2011 there were 51 Northern Ireland Priority Habitats and 481 Priority Species. However, the NI Biodiversity Group found that fewer than half of these for which data were available in 2009 were stable or increasing, a fact which caused them concern (Figures 5, 6 and 7). Biodiversity Action Plans, Biodiversity Implementation Plans, Biodiversity Delivery Groups and a Biodiversity Duty for public bodies to further the conservation of biodiversity are all positive steps, and the Biodiversity Strategy will be reviewed in 2012.

The principal threats to Northern Ireland's species diversity come from human activities such as agriculture, forestry, fisheries and building development which have all led to significant habitat damage or loss. The impacts of climate change have been noted through seasonal changes for both plants and animals and there have been notable weather events, such as a perceived increase in high-intensity rainstorms. Non-native invasive species have considerable localised impacts and are becoming a problem in many habitats. There has been some loss of native species and others are declining. Further information is required on trends in the conservation status of Priority Species and Habitats (that is, those species and habitats recognised as a priority for conservation through national and European designations).

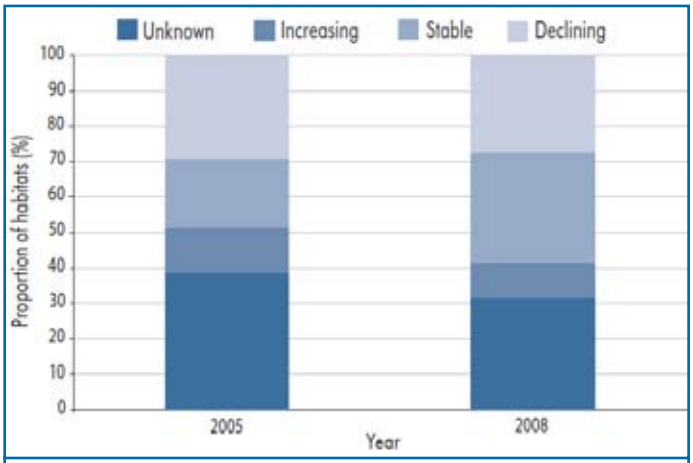


Figure 5. Status of Northern Ireland Priority Habitats in 2005 and 2008.

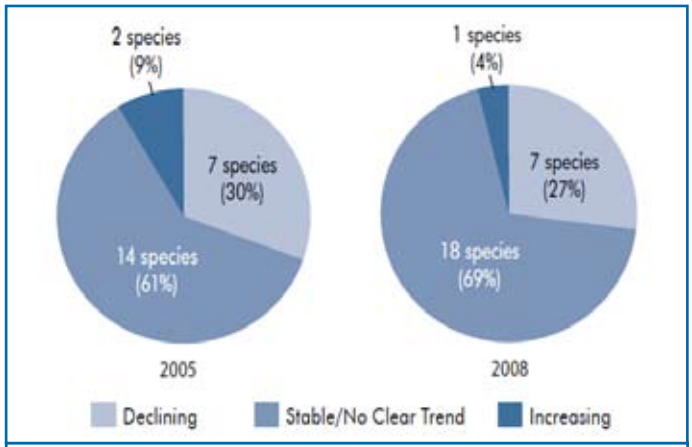


Figure 6. Status of Northern Ireland Priority Species in 2005 and 2008.

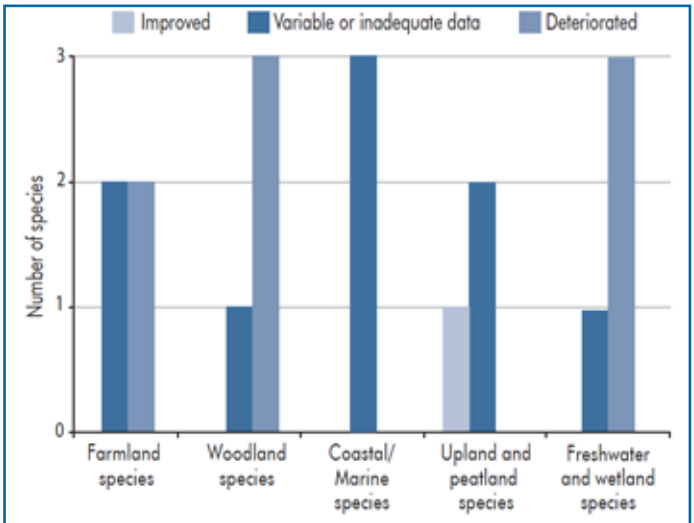


Figure 7. Status of Northern Ireland's biodiversity exemplar species.

Northern Ireland's Ecosystems

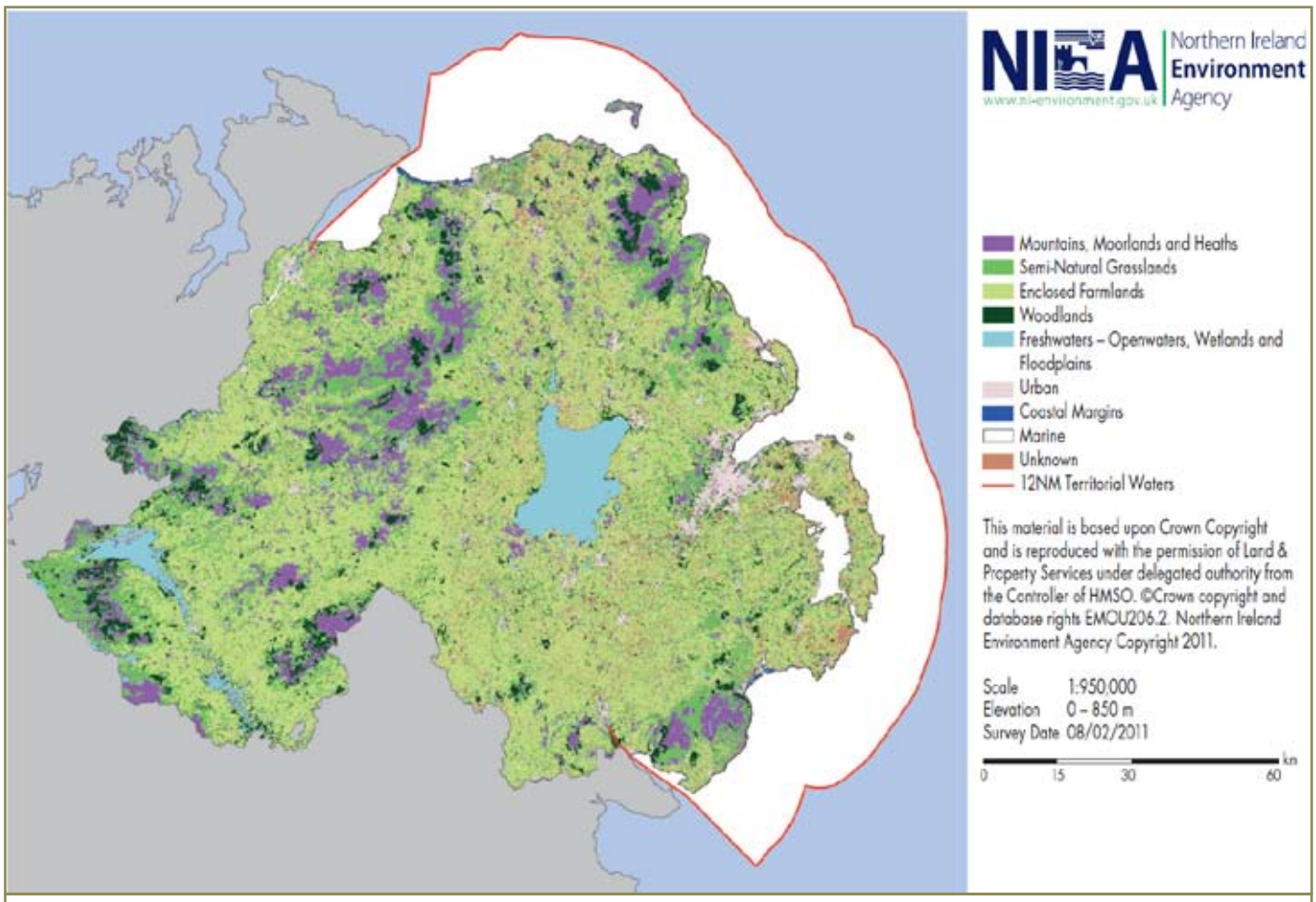


Figure 8. Distribution of Ecosystems in Northern Ireland.

The area and composition of different ecosystems in Northern Ireland have changed over time and contribute to the delivery of a range of ecosystem services. The Northern Ireland Countryside Survey provides the major source of information on habitat change since 1989. Key changes noted between 1989 and 2007 include increases in high yield grassland, built-up land and broadleaved woodland and decreases in arable crops, species-rich grassland and peatland (Figures 9, 10 and 11).

Eight broad categories of ecosystems were set at UK level. The current status, recent changes and key challenges were identified for each of these in Northern Ireland. This information provides the baseline for the analysis of ecosystems services.

Mountains, Moors and Heathlands cover 186,382 ha (13.1%) of Northern Ireland and contain the largest tracts of semi-natural habitats. Upland blanket bog is extensive (10%), with smaller areas of heath in the uplands and rush-dominated poor fen in the marginal uplands and some dense bracken. Although the overall area has been relatively stable over the past 20 years, changes in area and quality of some of the constituent habitats have occurred. Northern Ireland has a large proportion of the UK and EU blanket peat resource and, although most of the blanket bog has been physically modified (mostly by peat extraction over several centuries and drainage), the majority is still capable of forming peat (i.e. it is active peat). These habitats are used for low intensity livestock grazing and have high scenic and recreational value. Peatlands are important for carbon sequestration, water storage and flood alleviation.

Semi-Natural Grasslands cover 261,763 ha (18.5%) of Northern Ireland and consist largely of neutral grassland (16%), with smaller areas of species-rich wet grassland, acidic hill grassland, calcareous grassland and fen meadow. Some of the associated flora and fauna are very important in both a UK and an EU context. However, a high proportion of neutral grassland is highly productive agriculturally and

Northern Ireland's Ecosystems

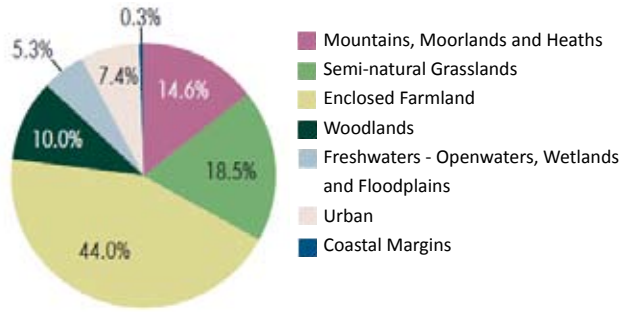


Figure 9. The percentage of Northern Ireland's land area (area to HWMMT, i.e. 1,416,047ha) covered by each UK NEA habitat category in 2007.

low in natural species diversity. Semi-natural grasslands have undergone a major decline in the past 60 years due to fragmentation and agricultural intensification and are now used primarily for low intensity livestock grazing. Management of grazing intensity is particularly important to avoid damage to soils and plants, maintain grassland biodiversity and halt scrub encroachment.

Enclosed Farmlands cover 623,092 ha (44%) of Northern Ireland and include lowland and marginal upland habitats, largely used for grass production (40% of Northern Ireland is improved grassland) and some cereal crop and other arable production. Small family farms predominate. Farms have changed markedly due to intensification, particularly since WW2, which has led to some loss of habitat and species diversity. There is an extensive system of hedge and earthbank field boundaries which are important for biodiversity. Since the 1950s many field boundaries have been removed, largely as a result of increased farm field sizes, but this trend is declining. The main agricultural outputs are livestock and livestock products, resulting in greenhouse gas emission and soil and water pollution issues. There has been a dramatic switch from hay to silage production since 1950, (Figure 25 pg 24) with most of the decline in hay in the last two decades. Arable production has also decreased over the past 70 years with shifts between the crops grown (Figure 12). There is a recent increase in the land used for energy production, although the total area remains small.

Woodlands cover 141,151 ha (10%) of Northern Ireland, of which 4% is planted coniferous woodland (predominantly Sitka spruce) and 6% is broadleaved and mixed woodland (including scrub). Woodlands are distributed across the uplands, marginal uplands and lowlands. There has been a large increase in total woodland cover since the 1950s, with the last ten years responsible for the major increase in broadleaf woodland, mainly due to planting in farmland and ecological succession in other habitats (e.g. colonisation of cut-over bogs). However, Northern Ireland remains one of the least wooded countries in the EU and only has a small amount of ancient woodland (0.04%). Woodlands provide many ecosystem services, often simultaneously, including timber production, carbon sequestration, biodiversity and recreational opportunities.

Open Waters and Wetlands cover 95,706 ha (6.8%) of Northern Ireland and are composed predominantly of loughs (Lough Neagh and Lough Erne being the largest), rivers and lowland raised bog, with smaller areas of streams, fen, swamp, reedbeds and water inundated vegetation. Northern Ireland is notable within the UK for the large area of freshwater habitats, their flow dynamics, nutrient characteristics and their biodiversity, including bird populations of international importance. Lowland raised bogs cover 1.5% of Northern Ireland and are important in a UK context and these and many other minor wetland habitats have decreased over the past ten years. Land drainage and flood defence engineering schemes since the 1950s resulted in large decreases in the area of wetland vegetation, but there has been little change from 1998 to 2007. Northern Ireland has the highest percentage of modified rivers in the UK with accompanying impacts on biodiversity. More recently, restoring riverine habitats and recognising their role in flood prevention have been prioritised. Open waters provide water, food, recreation and biodiversity benefits as well as helping to detoxify pollutants and contributing significantly to flood control.

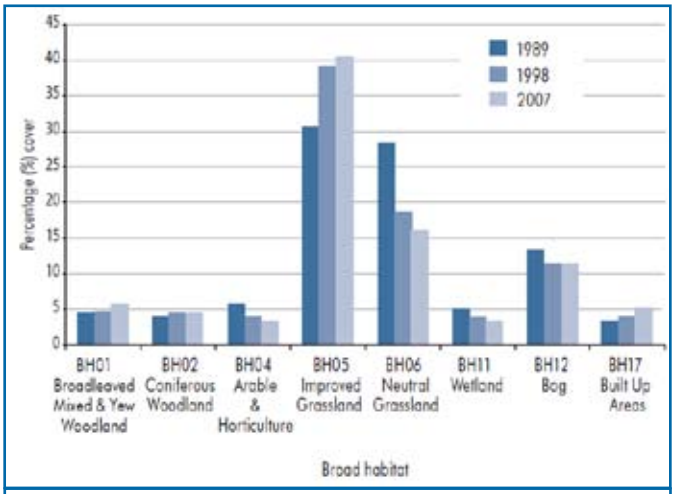


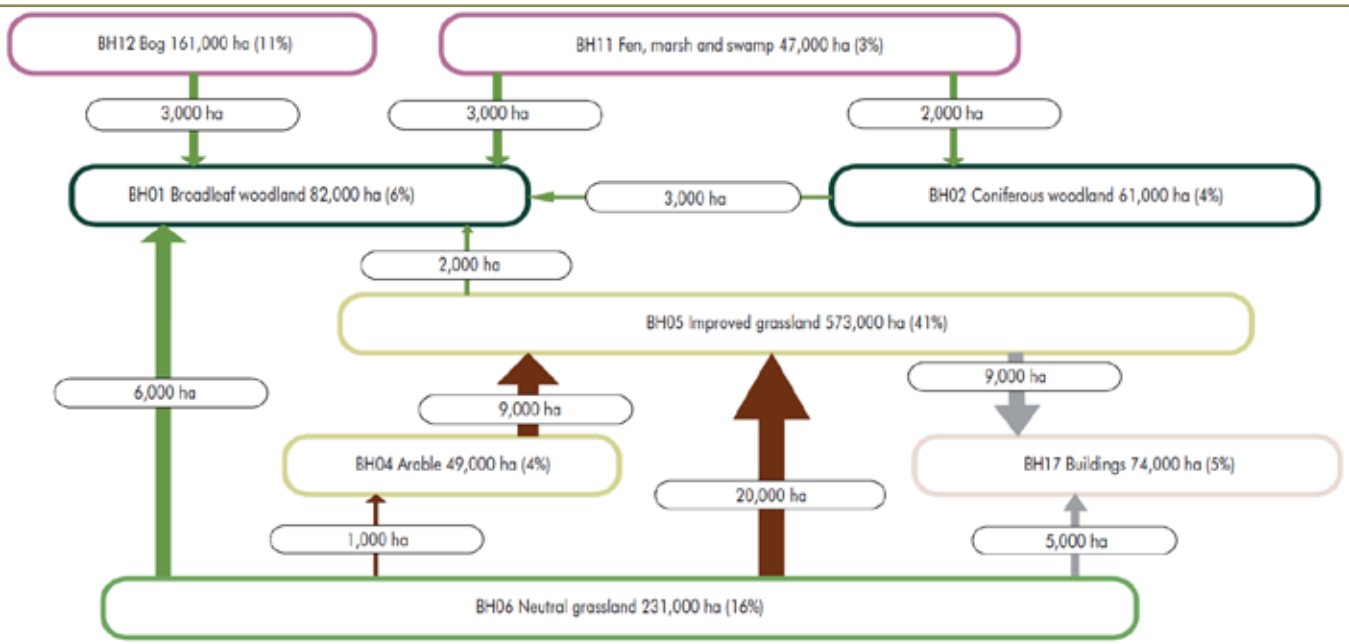
Figure 10. Change in the percentage cover of the main Northern Ireland Countryside Survey broad habitats between the baseline survey (1986-1991) and the resurveys in 1998 and 2007.

Northern Ireland's Ecosystems

Urban settlements (including rural buildings and roads) cover 105,049 ha (7.4%) of Northern Ireland, with a 22% increase between 1998 and 2007, mainly building on farmland and on the edges of existing built-up areas. There has been significant development in the countryside, principally of single dwellings, with attendant issues of infrastructure provision. Urban areas generally rely on the countryside to provide ecosystem services, including food, water, waste disposal and recreation. However, urban greenspace can provide opportunities for recreation and provide major health and well-being benefits to urban residents and help in flood and pollution control. There are some high conservation value sites within Northern Ireland's urban areas.

Coastal Margin habitats (sea cliffs, shingle, sand dunes, saltmarsh, coastal/saline lagoons) cover 3,576 ha (0.25%) of Northern Ireland. Their overall area has remained relatively stable over the past 20 years, however, the quality of individual sites and the amount of scientific knowledge available are highly variable. They generally have high biodiversity value, with important seabird populations and insect diversity from UK and Irish perspectives. As well as being important sites for biodiversity, they provide major recreation, cultural and tourism benefits and help to alleviate flooding.

Marine habitats for which Northern Ireland is responsible include both the intertidal zone covering an estimated 11,000 ha and the sub-tidal zone (to 12 Nautical Miles) covering an estimated 450,000 ha, including parts of the Irish Sea and Atlantic Ocean. Northern Ireland's marine environment contains around half of its overall biodiversity, with Strangford Lough and Rathlin Island together exhibiting 90% of its marine biodiversity. There is evidence of damage to habitats and deterioration of water quality, especially in coastal areas. Northern Ireland's fisheries are locally important, but catches of many finfish have decreased with prawns now being the main catch. The coast and marine environments are valued for cultural heritage, recreation and tourism and are a vital aspect of renewable energy, nutrient and water cycles with major roles in carbon balance.



The area of each broad habitat is for 2007. Arrows: brown = mainly agricultural conversion; green = mainly ecological succession or conversion to woodland; grey = building. Colour of box border denotes the predominant UK NEA Broad Habitats: light green = Seminatural Grasslands; yellow = Enclosed Farmland; light pink = Urban, dark green = Woodlands; pink = Mountains, Moorlands and Heaths.

Figure 11. Net transitions (of >1,000 ha) between Countryside Survey Broad Habitats between 1998 and 2007.

Ecosystem Services in Northern Ireland

All of Northern Ireland's ecosystems contribute to the four categories of services, but it is generally not possible to assign specific services to individual ecosystems; for example livestock is produced largely from enclosed farmland, wetland, semi-natural grassland and upland ecosystems, but also from coastal margins, woodlands and even from some urban areas. Data have been collected from a variety of sources and from different timescales and often differences in collection techniques or reported figures mean that it is difficult to make direct comparisons or to summarise results across areas.

Provisioning Services

- **Northern Ireland's primary agricultural outputs are livestock and dairy products, for both local consumption and export.** Although grain is produced, most is for livestock feed rather than human consumption. Over the past 150 years there has been a shift away from producing grain and potatoes to raising livestock; the total area of land in production (crops and pasture) in 2009 was slightly above that in 1959, but much lower than in 1859 and 1909. More livestock were produced in 2009 than in 1959 or before (Figures 12 and 13). In the past 30 years cattle have slightly and steadily increased, pigs have decreased and sheep have shown a moderate increase after a peak in the 1990s. Livestock (cattle, sheep and pigs) accounted for £407 million, the dairy industry for an additional £514 million and poultry and eggs for £218 million of output in 2008.

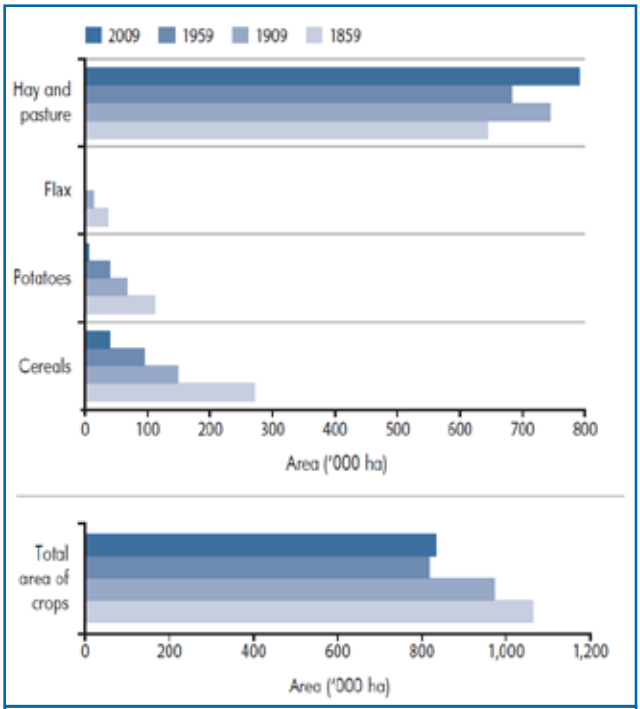


Figure 12. Area (in thousands of ha) of the main types of crop in Northern Ireland from 1859 to 2009.

- **Arable production** has continued to decline since 1981, with considerable change in the types of crops produced over the past 28 years. Potatoes, apples and mushrooms are the main crops for human use, with wheat, arable crop silage and other crops increasing in recent years.

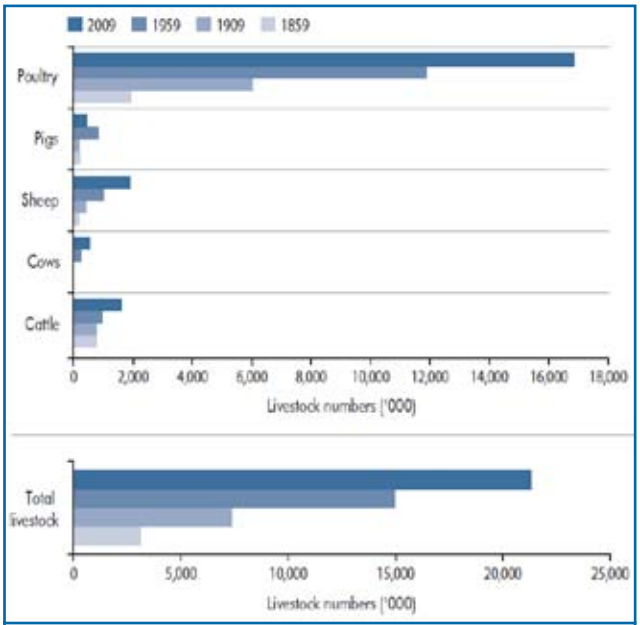


Figure 13. Livestock numbers (in thousands) in Northern Ireland from 1859 to 2009.

- **Agriculture and food processing** are major employers and significant contributors to the local economy. However, farm numbers and incomes have been declining in real terms for the past 28 years, while the value of farmland has been increasing rapidly since the mid-1990s to nearly £20,000/ha.

- **Marine fisheries** from Northern Ireland waters accounted for roughly £25 million in 2008 (4% of the UK catch) and have shown a shift from finfish to shellfish (primarily *Nephrops,* Dublin Bay Prawn) since about 2004. In 2008 the value of shellfish was nearly three times the value of finfish. There has been a decline in fish stocks over the past decade.

- **Freshwater fisheries** for salmon and eels have decreased significantly since 2000. The eel fishery in Lough Neagh accounted for roughly £2 million in 2008, down from £5 million, and has been declining since 1983. Salmon numbers have declined by about 85% since a peak in 1995, but the value (per kg) has increased (Figure 26 pg 24).

- **Aquaculture**, in the sea and freshwater, was valued at nearly £11 million in 2009, including mussels, oysters, salmonids and trout ova.

Ecosystem Services in Northern Ireland

- Most **forestry** consists of non-native conifers planted in upland areas, yielding timber used primarily for packaging, construction and fencing, and was valued at over £7 million in 2009. Annual production gradually increased to around 400,000m^3 from 50,000m^3 in the 1970s. In recent years there has been a shift to small-scale planting of broadleaved trees in lowlands with emphasis on the many benefits of mixed woodlands.

- Around 98% of **drinking water** is abstracted from rivers, lakes and reservoirs in Northern Ireland (in England and Wales 35% is extracted from groundwater). Annual costs for water and sewage treatment were over £186 million in 2007/8, an increase of one third since 2004, and high compared to Great Britain. Water quality of rivers and lakes has a direct relationship to the cost of water treatment. Historic under-investment in the infrastructure is being addressed to upgrade the system for piping, sewage treatment and drinking water treatment; capital investment over the five years to 2008 was over £1 billion. Low flow levels, particularly with possible climate change impacts, are a concern.

- **Peat** is a traditional energy source but extraction and usage are now low after significant extraction in the 1980s and 1990s. Extraction of this low-energy-yield fuel leads to major carbon losses from peatland. There is also continued extraction of peat for horticulture with an increase in area since 1990. Major lignite deposits have been considered for extraction.

- Upland areas are the main location for **windfarms**, an increasingly important source of electricity. Marine renewables have been identified as having significant potential for development (wind, tidal, wave) to meet renewable targets. Hydro-power is mostly small-scale, and short rotation coppice and anaerobic digestion are of increasing research and commercial importance. Renewable development has increased over the past ten years and is likely to continue to expand in order to meet government targets.

- There is a significant **quarry** industry with a total value of approximately £90 million in 2009, showing a gradual increase between 2000 and 2007 and a decrease since then. Stone and sand/gravel are used for building and road construction locally and road construction throughout the UK and in Europe.

Regulating Services

- The estimated stock of **carbon** (C) held in Northern Ireland's soils is 386 megatonnes. Although they only occupy 15% of the land area, peatlands contain 42% of the carbon stock and peaty soils account for a further 10% of the carbon stock, with the highest soil C densities (>5000t C/ha) in deep peat. Peat C stocks are reduced by extraction (Figure 14). Northern Ireland's soils have much higher carbon content on average (5%) than those in the rest of the UK (2-3%). Total vegetation stores of carbon are relatively higher in agricultural soils in Northern Ireland than in Great Britain (36% vs 10% of total carbon store) and lower in woodland (55% vs 80%) due to differences in land cover percentages. Land use changes have impacted upon these values over time.

- Agriculture accounted for 23% of **greenhouse gas emissions** in Northern Ireland in 2007, up slightly from 22% in 1990 and compared with 7% in the UK as a whole. Methane is emitted by ruminant livestock and organic manures. Nitrous oxide is emitted from soils following application of fertilisers and manures.

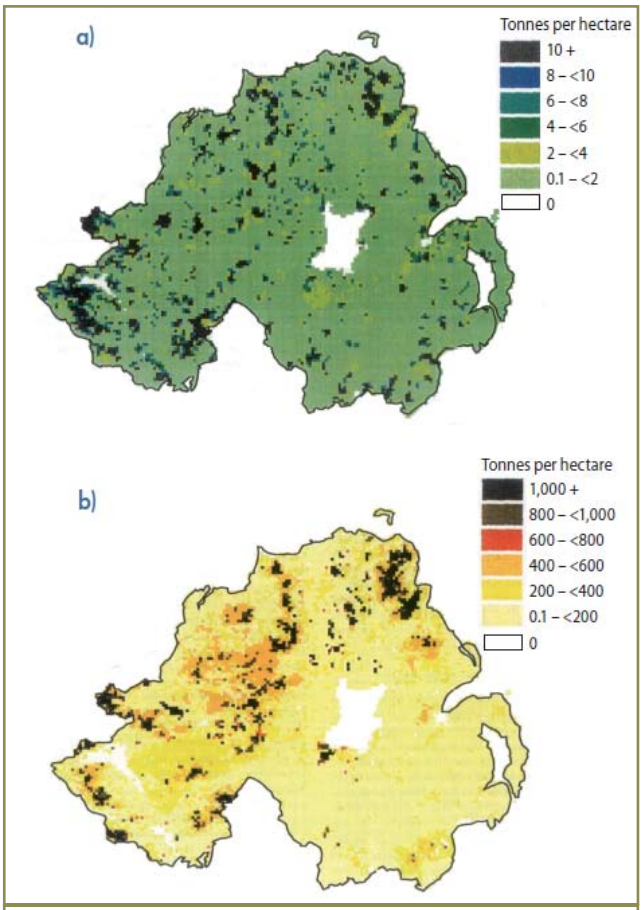


Figure 14. Carbon in vegetation and soils.

- Northern Ireland's territorial waters contribute to **cycling** of nitrogen- and sulphur-based greenhouse gases indirectly through the activities of marine algae and ocean temperatures. The marine environment receives and processes nutrient pollution from the land, some sewage, much litter and all of the wastes from marine aquaculture.

Ecosystem Services in Northern Ireland

- About 16 million tonnes of **waste** are generated each year in Northern Ireland, with 10 million tonnes from agriculture, which is largely disposed of on-farm with potential pollution implications. Recycling of municipal waste has increased by 68% over five years from 2004 to 33%, but this varies geographically. Most unrecycled municipal waste goes to landfill. Illegal waste disposal, including cross-border activity, has been an increasing problem. Most sewage sludge is incinerated with energy recovery, and mechanisms are being developed for producing energy while detoxifying agricultural wastes.

- Although overall **soil** degradation is low compared to Great Britain, many agricultural soils have elevated nitrogen and phosphorus levels and are a source of these nutrients to surface waters. The Nitrates Directive and the Water Framework Directive have encouraged increasing control of N and P inputs from agriculture, resulting in decreased fertiliser use. There have been improvements in soil phosphate levels in recent years, however there is still a major surplus in most soils, especially those under intensive grassland (Figures 15 and 16).

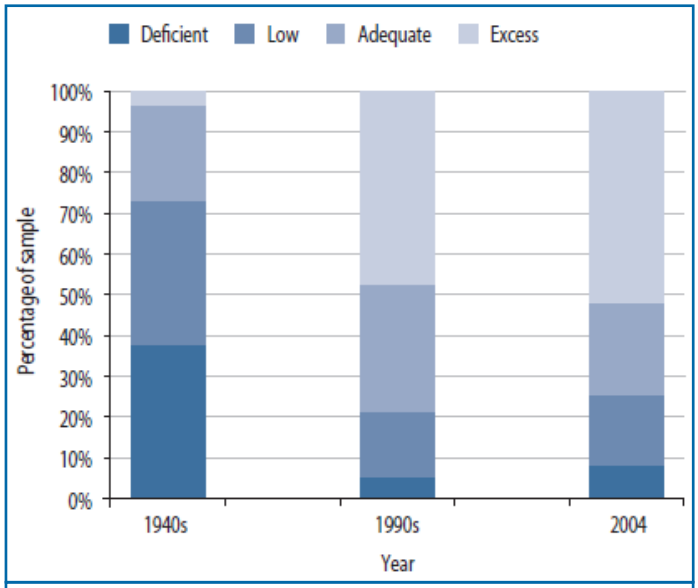


Figure 15. Soil phosphorus status for grass production in Northern Ireland in the 1940s, 1990s and 2004.

- **Water quality** problems in Northern Ireland are mostly due to diffuse nutrient pollution from agricultural rather than point sources; fewer than 6% of rivers show no nutrient enrichment. There have been improvements in nitrate and phosphate pollution levels in rivers since 1994. Despite these trends in the chemical quality of water, biological aspects of water quality have yet to show major improvements (Figure 28 pg 25). Between 2001 and 2008 river pollution incidences decreased in both number and average severity. Water courses have been affected by major drainage schemes and canalisation from the 1950s to the 1980s.

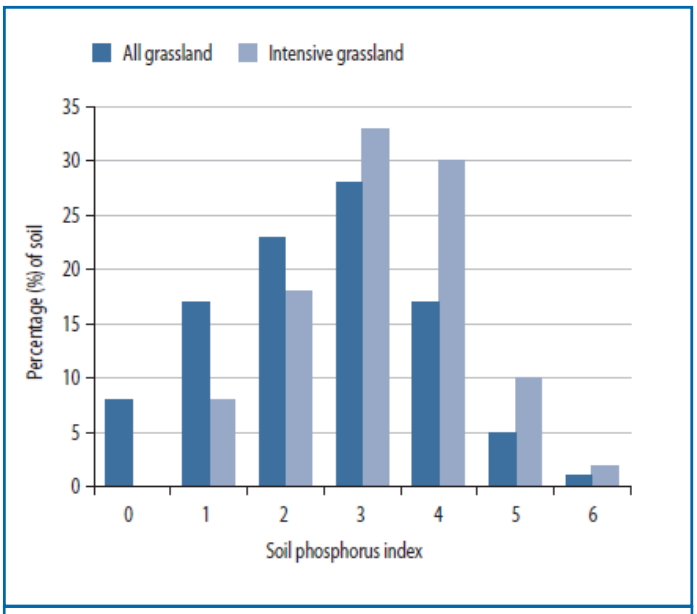


Figure 16. Soil phosphorus index of grassland soils. ADAS indices for extractable (Olsen) phosphorus 0=deficient, 2=normal (target), 6=excessive) in Northern Ireland in 2004/6.

- **Air quality** has improved in recent years and in general is good, with domestic heating and transport being the main sources of air pollution as there is relatively little industry. High levels of ammonia can occur in rural areas near intensive animal production facilities.

- The main crops **pollinated** by insects are apples and the market value of this pollination is over £7 million per annum, with about 80% by honeybees. Vegetables and soft fruit are also partially dependent on insect pollination worth an additional £100,000 per year. There is a range of agricultural pests and diseases with variable economic impacts of up to many millions of pounds per year (bovine TB, New Zealand flatworm, *Phytophthora ramorum*) but there are few data on control of these by natural systems.

- **Flooding** occurs sporadically in some parts of Northern Ireland and the cost can be high in human and financial terms. In urban areas it is usually from rainfall rather than from rivers and the investment in water and sewage infrastructure aims to address this but increasing levels of development contribute to flooding. Building development control is provided on floodplains via the planning system and flood maps to help identify areas at risk (including under changing climatic conditions) have been prepared. There are some coastal defences, most of which were developed in the mid-20th century, but increasingly emphasis is on managed retreat with recognition of the value of 'natural' flood defences for both coast and rivers. Woodlands and wetlands provide significant water storage capacity to help prevent flooding.

Ecosystem Services in Northern Ireland

Cultural Services

- **Public access** is largely restricted to lands in public or charitable ownership and access to open countryside is more restricted than in other parts of the UK. There is no public 'right to roam' in Northern Ireland. There are no National Parks. Membership of and volunteering for organisations that provide access to their properties are popular. Parks, play areas, allotments and community gardens are important and facilities are provided for cycling and walking which are encouraged as part of a healthy lifestyle.

- **Tourism** is increasingly important and is responsible for about 5% of the Northern Ireland economy, roughly £1.5 billion and 40,000 jobs. The history of violent conflict has restricted the willingness of tourists to visit Northern Ireland over the past 30 years; in 2009 there were 3.3 million visitors which is low compared to other countries in the UK (Figure 27 pg 24). There is scope for expanding this, especially in relation to unique and distinctive landscapes that are major attractions for visitors. The Giant's Causeway, a World Heritage Site, is the single most visited tourist destination and many popular tourism sites have an environmental component (Figure 17).

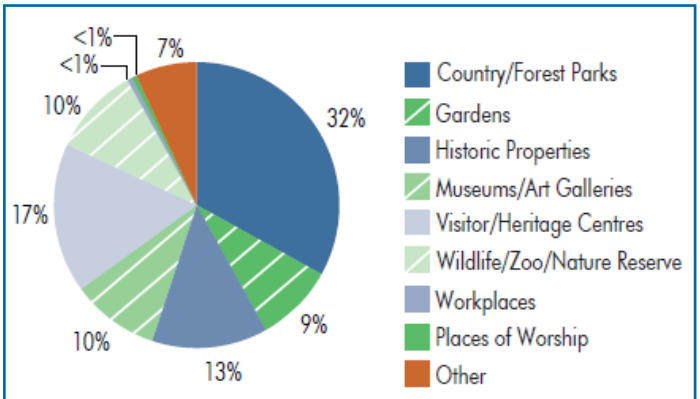


Figure 17. Market share of visitors to various attractions in Northern Ireland.

- Northern Ireland has a rich cultural and **archaeological heritage** and some unique landscapes. The archaeological heritage goes back 9,000 years, with nearly 2,000 scheduled monuments and over 8,000 listed buildings. Many of these are in State care or owned or managed by charities and are open to visitors. Protected sites are in significantly better condition than those without statutory protection.

- Coarse, game and sea/shore **angling** are popular among residents and visitors, with the former contributing about £40 million and the latter £3.5 million per annum to the local economy.

- There is a strong appreciation of the social value of **farming** in relation to the agricultural landscape. There are many small farms with part-time farming and many people have a family attachment to the land.

- Northern Ireland has a long history of **literature**, poetry, music and the visual arts and the landscapes have inspired many local artists. Religious traditions form an important part of local culture.

Supporting Services

- There is a wide variety of geological substrata and hence of **soil types**. Soil degradation is generally lower in Northern Ireland than in other parts of the UK, partly due to the cool and wet climate which slows down decomposition and results in soils that are high in organic matter and generally of good agricultural quality, but often require drainage (Figure 18).

- Climatic conditions ensure a good supply of **fresh water,** however levels of pollutants and changing patterns of temperature and rainfall are having impacts on water bodies.

- Basic **nutrient and water cycles** are generally functioning well, but human activities are having impacts on these in some areas.

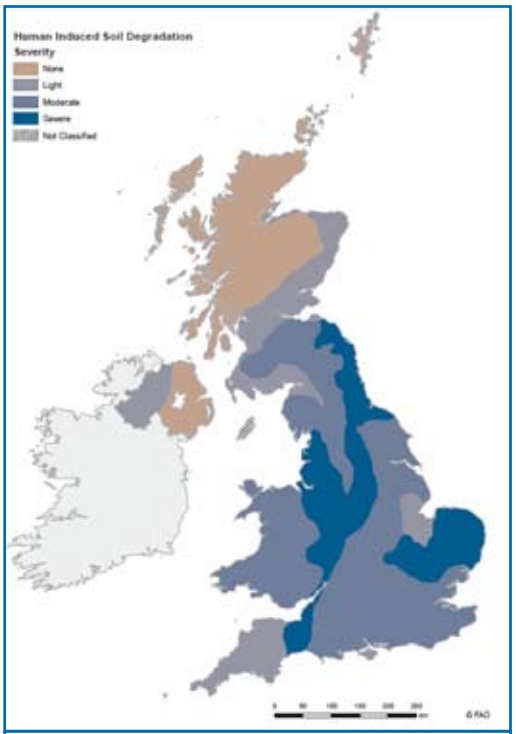


Figure 18. Severity of human induced soil degradation in the UK.

Dependence on External Ecosystems

Northern Ireland depends on external ecosystem services for basic food and many other commodities. There is a complex relationship between imports and exports and much further work would be required to deliver single, simple figures for our relative self-sufficiency with regard to any product.

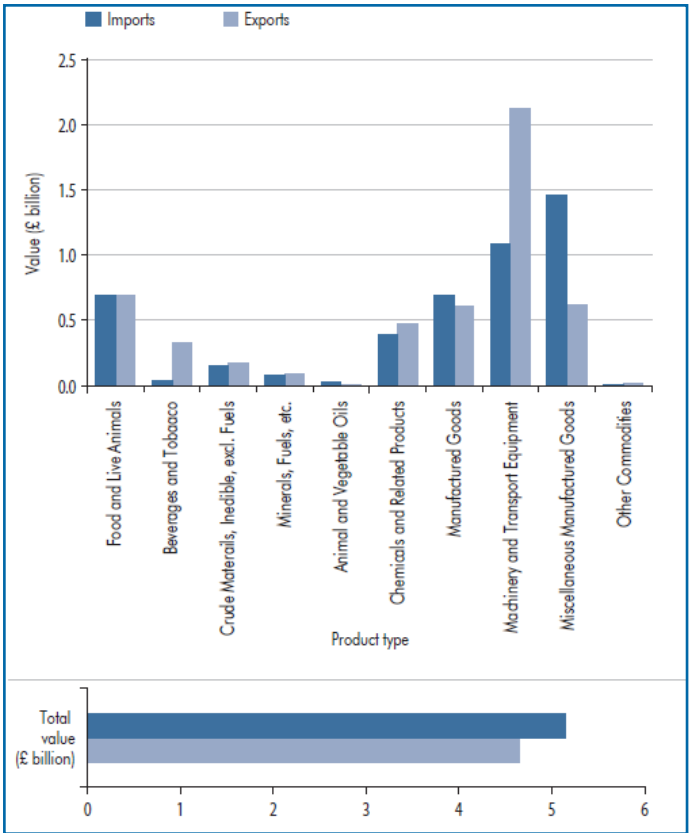
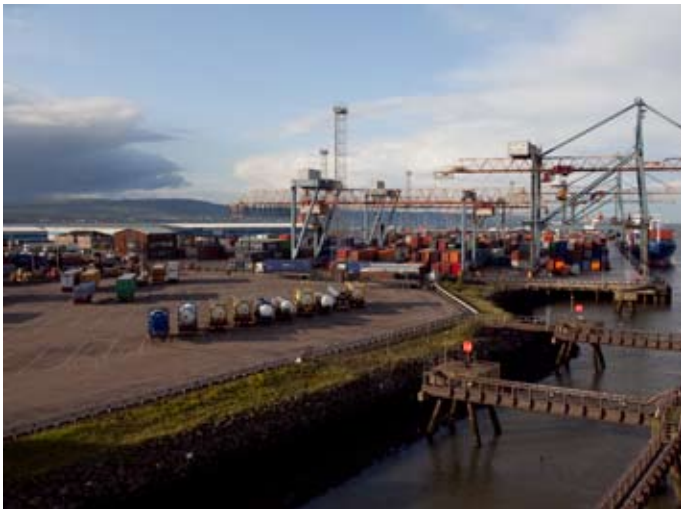


Figure 19. Northern Ireland import and export values in 2009.

Nearly 98% of Northern Ireland's energy comes from imported fossil fuel, and clearly we are far from self-sufficient in the types of food produced: while the values of food imports and exports are very similar (around £5 billion), the products differ markedly (Figure 19). Exports consist largely of milk and meat products, whereas most fruit and vegetables and many processed food products are imported. However, overall the exports of meat and live animals only slightly exceed imports, with this at least partially related to UK-wide movements by large retailers. Most exports are to other parts of the UK and the Republic of Ireland, with only milk, milk products and fish having significant markets further afield.



Imports of cereals, animal feeds and wood are noticeably high and relate obviously to local needs. The relatively large size of the Northern Ireland agricultural industry relies on imported feedstuff to sustain it, largely from the EU15, Eastern Europe and Latin America, leading to dependence on ecosystem services in these areas to sustain local socio-economic activity. In general Northern Ireland imports more biomass products per capita across all sectors than other parts of the UK; almost double that of England and over six times that of Wales.

Northern Ireland's ecological, carbon and greenhouse gas footprints are all slightly lower than the UK per capita average (Figure 20). The ecological footprint of Northern Ireland's food consumption in 2006 was 1.2 global ha/capita, making up some 28% of its residents' footprints, the largest contribution of any sector (Figure 21).

	Ecological footprint (global ha/capita)	Carbon footprint (tonnes of carbon dioxide/capita)	Greenhouse gas footprint (carbon dioxide equivalent/capita)
Northern Ireland	4.85	11.18	15.09
UK	5.30	12.08	16.34

Figure 20. Comparison of Northern Ireland's ecological carbon and greenhouse gas footprints with those of the UK in 2004.

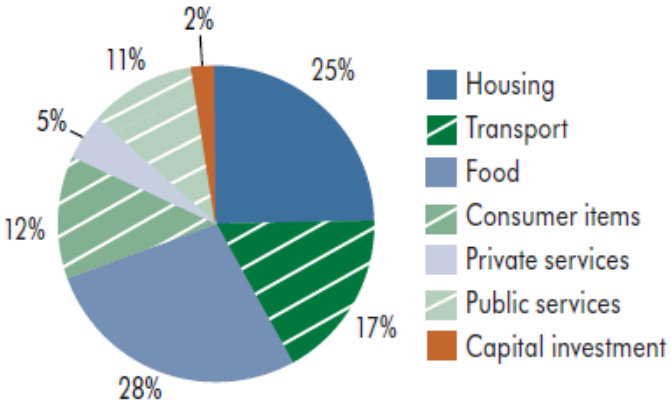


Figure 21. Northern Ireland's ecological footprint by sector in 2006.

Drivers of Change

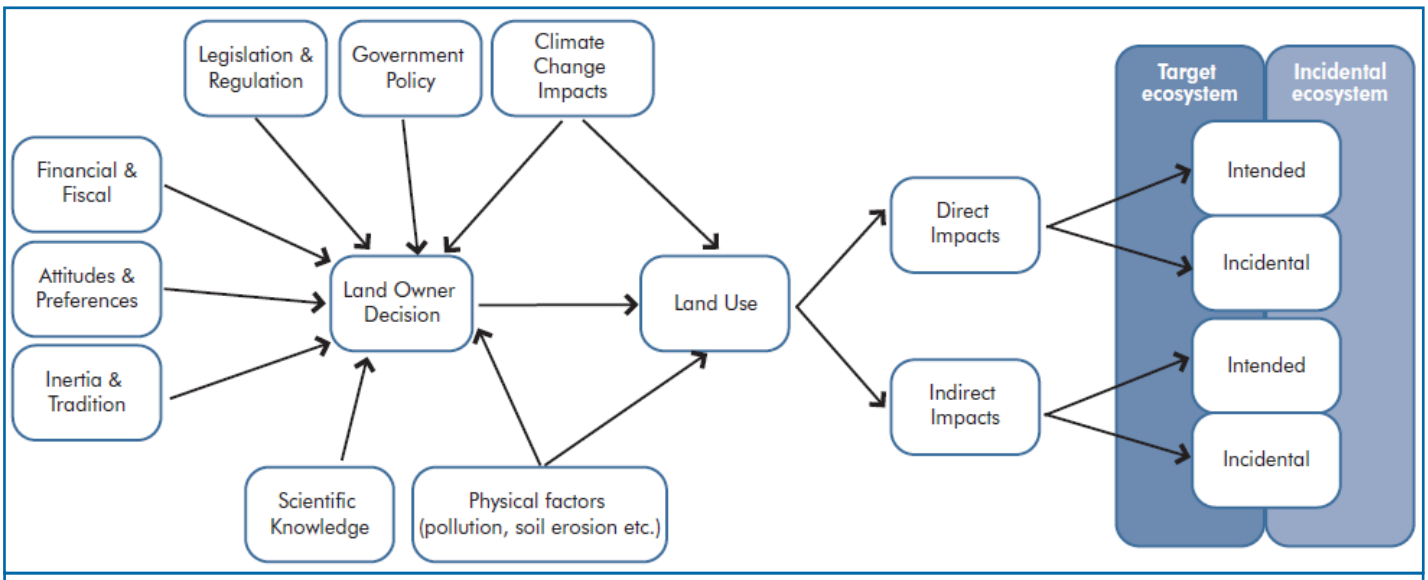


Figure 22. Summary of the factors impacting on land use and ecosystem service delivery.

There are many different factors that impact upon the environment, how it is used and what ecosystem services it can deliver (Figure 22). Some of the most significant impacts over the past decades are likely to continue into the future. The following policies and practices provide significant drivers for change in the countryside.

- The high profile and political emphasis ascribed to social and economic factors, as a result of Northern Ireland's history, have resulted in the environment historically being given a **low political priority**. There has been some improvement in this since the advent of the Northern Ireland Assembly in 2007.

- Transposing and complying with **EU legislation** and the possible financial consequences of not meeting targets set therein are major forces for environmental work. A large proportion of local environmental legislation is directly related to EU and UK legislation.

- Targets for designation, protection and management of sites and species have repeatedly been delayed, often due to **lack of adequate resources**.

- The **Programme for Government** focuses mainly on developing the economy, however the 2007-11 programme did have a stated goal of furthering sustainable development. The Programme for Government is supported by major strategies including those for Sustainable Development, Regional Development, Transport and Biodiversity, all with major impacts on land use.

- **Climate change, invasive alien species and plant and animal diseases** are having impacts which may increase in the future.

- **Consumer preferences, international trade, and costs and availability of commodities and energy** also have impacts on the demands made on land and sea resources.

- **The Common Agricultural Policy** has had significant impacts on land use, including through agri-environment schemes.

Northern Ireland is in a unique position within the UK since its legislation is decided by the Northern Ireland Assembly or UK Government, but it shares a land and sea border with another EU member state, the Republic of Ireland. The international border raises issues of differential management, protection, legislation and funding within single ecosystems. Work on River Basin Management and invasive alien species is proceeding on a cross-border basis and these are positive examples of how management of natural ecosystems benefits from international cooperation. Different fiscal policies can be particularly important in determining how people move, shop and spend their leisure time with regard to the border and the ecosystems which traverse it.

Sustainable Ecosystem Management

The sustainable management of ecosystems is supported primarily through designations, the planning system and financial incentives for agricultural land management. Together these mechanisms can enhance the delivery of ecosystem services from Northern Ireland's environment.

- The Northern Ireland government, agencies and charities **own over 100,000 ha (7% of Northern Ireland)**, much of it managed for conservation purposes. In addition, the Crown Estate manages land worth £10.9 million as well as the foreshore and seabed out to 12 NM. Most land, however, is owned by private landowners, primarily farmers (Figure 23). Land management is strongly influenced by government and EU policies and financial measures to support these objectives (specifically CAP measures).

- Land is subject to a complex system of **rights** including turbary (peat-cutting), fishing, shooting, mineral and water rights, which may or may not correspond to land ownership.

- Overall about 430,000 ha (approximately 30%) of Northern Ireland is **designated** for conservation purposes (including Areas of Outstanding Natural Beauty). Many sites have multiple designations.

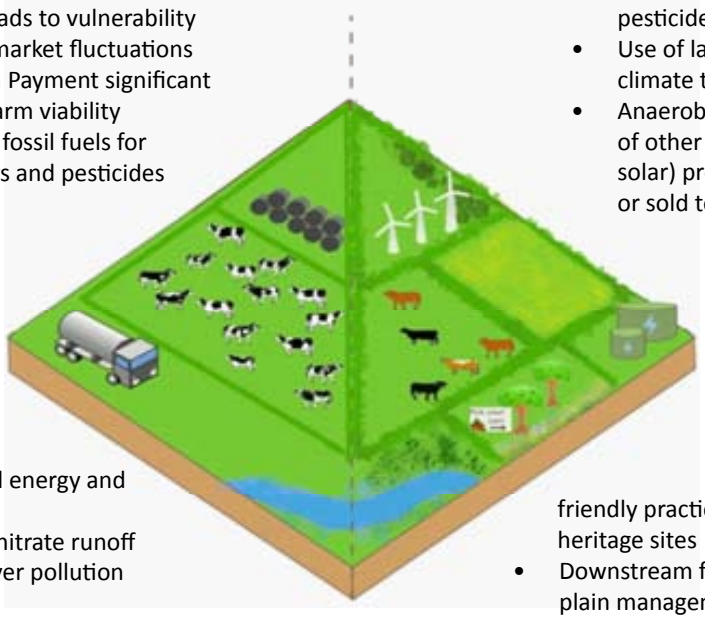
- The network of **Areas of Special Scientific Interest** (ASSIs) is still some years from completion; 304 sites (amounting to 7.1% of Northern Ireland) had been declared by the start of 2010. Designation as Areas of Special Scientific Interest forms the basis of terrestrial Natura 2000 sites, Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). There is one Marine Nature Reserve in Strangford Lough, and 10 of the 15 SPAs have a marine component. Some 75% of the coast is protected, much of it by multiple designations (Figure 24 pg 23).

- Designation alone does not ensure protection. By 2008, 916 features had been assessed on 195 ASSIs. The general results, focused on Natura 2000 sites, show that **condition** varied across habitats but overall fewer than half of the sites were in favourable condition, although a significant additional number were assessed as 'recovering' (Figure 29 pg 26).

- **Wider countryside** and landscape-scale conservation are largely through nine Areas of Outstanding Natural Beauty (AONBs) which cover 312,610 ha, about 22% of Northern Ireland, but powers are limited. Sites of Local Nature Conservation Importance (SLNCI), country parks, regional parks and forest parks also allow for sustainable management options.

Current farming approach:

- Specialisation - heavy reliance upon livestock producing meat or milk
- Intensive agriculture, driven by subsidy conditions
- Single output leads to vulnerability to disease and market fluctuations
- CAP Single Farm Payment significant determiner of farm viability
- Dependence on fossil fuels for energy, fertilisers and pesticides leaves farms vulnerable to price changes and security of supply
- Expensive management of animal wastes uses water and wastes potential energy and nutrients
- Phosphate and nitrate runoff contribute to river pollution



The ecosystems approach:

- Mixed farming - multiple outputs and goals
- Permanent pastureland acts as carbon store
- Crop rotation allows natural nutrient soil regeneration and reduces the need for pesticide application
- Use of land to store carbon helps to meet climate targets
- Anaerobic digestion of animal waste and use of other renewable energy sources (eg wind, solar) provides energy that can be used onsite or sold to the community
- Renewable generation provides energy, jobs and market drivers
- Alternative crops (eg oilseed rape, fruit) reduce reliance upon livestock as the single source of income
- Involvement in agri-environment schemes provides income to carry out environmentally friendly practices for archaeological or natural heritage sites
- Downstream flood risk minimised by river and flood plain management
- Wide hedgerows provide pollinators and natural pest control
- Income from providing access for recreation and tourism

Figure 23. Comparison of current and ecosystem services based approaches to farming.

Sustainable Ecosystem Management

		Area (ha)		Increase in area 98/99 - 07/08 (%)	No of Sites	Area (ha)	% Northern Ireland (1,415,000 ha)
		1999 (31/3/99)	2008 (31/3/08)		2010 (1/4/2010)		
Area of Special Scientific Interest (ASSI)	*Land identified by scientific survey as being of the highest conservation value.*	*83,535*	*95,555*	*14*	*304*	*100,474*	*710*
ASSI Features	*Earth Science*	*27,801*	*33,452*	*20*	*107*	*36,846*	*2.60*
	Habitats	*80,775*	*92,412*	*14*	*219*	*98,037*	*6.93*
	Species	*79,623*	*89,738*	*13*	*138*	*91,236*	*6.45*
Special Protection Area (SPA)	*Safeguard the habitats of migratory birds and certain particularly threatened birds.*	*71,035*	*108,607*	*53*	*17*	*114,402*	*N/A*
Special Area of Conservation (SAC)	*Protect the 220 habitats and approximately 1,000 species of European interest.*	*44,950*	*66,321*	*48*	*55*	*67,576*	*N/A*
Ramsar Site	*Conservation and wise use of wetland.*	*84,330*	*86,214*	*2*	*20*	*88,170*	*6.23*
Marine Nature Reserve	*Conserve marine flora and fauna and geological features of special interest.*	*16,500*	*16,500*	*0*	*1*	*16,500*	*N/A*
Area of Outstanding Natural Beauty (AONB)	*Protect and enhance the qualities of landscapes of distinctive character and special scenic value.*	*284,948*	*288,592*	*1*	*9*	*312,610*	*22.09*
Site of Local Nature Conservation Interest (SLNCI)	*Designated for their habitats, species and/or earth science, which make a contribution to the local natural heritage & contribute to National and European biodiversity.*	*N/A*	*N/A*	*N/A*	*911*	*36,092*	*2.55*
Country Parks	*Promote access to the countryside, encouraging a greater understanding and knowledge of the environment.*	*2,424*	*0*	*0*	*8*	*2,424*	*0.17*
National Nature Reserves	*Conserve terrestrial flora and fauna and geological features of special interest.*	*1,249*	*34*	*34*	*12*	*1,808*	*0.13*
Local Nature Reserves	*Areas set aside for biodiversity and where people can enjoy wildlife.*	*69*	*684*	*684*	*23*	*865*	*0.06*

Figure 24. Designations in Northern Ireland. Percentages cannot be calculated for designations that include marine areas. The percentage of Northern Ireland cannot be summed as many sites hold multiple designations.

- **Planning** is centralised but is scheduled to transfer to local authorities in 2015. A Regional Development Strategy, supported by a suite of Planning Policy Statements (PPSs) is delivered locally through Area Plans. Environmental Impact Assessments and Strategic Environmental Assessments are legal requirements for many major developments, plans and programmes.
- **River Basin Districts** (RBDs) serve as the administrative areas for coordinated water management. River Basin Management Plans use an integrated approach to the protection, improvement and sustainable use of the water environment.
- Almost 70% of farms in Northern Ireland are located on land designated as **Less Favoured Areas** (LFA).
- The **Northern Ireland Countryside Management Scheme** (NICMS) was introduced in 2008 in order to deliver on a wide range of targets and includes all previous agri-environment schemes. As of the end of 2010 the total area under agri-environment schemes had reached 468,000ha which is 42% of the agricultural land area.
- The **Woodland Grant Scheme** encourages the creation of new woodland to increase timber production, improve the landscape, promote woodland biodiversity and encourage the sustainable management of forests and woodlands. Since 1988 it has supported the planting of almost 12,000 ha.

Conclusions

1. **There is an overall trend of a decline in semi-natural ecosystems of high biodiversity with an increase in less biodiverse areas more heavily influenced by human activities. The last 70 years have seen changes in agricultural practices** such as a shift from hay to silage production (Figure 25) and a decrease in mixed and arable farming; a loss of peatlands, semi-natural grasslands and some wetland habitats due to a range of factors including conversion to intensive grassland; development; drainage; peat cutting; and planting of coniferous trees. Some of these trends have halted or even reversed in recent years in response to changing policies, fiscal measures and priorities (e.g. uplands previously often suffered from overgrazing, but undergrazing is now a threat to some semi-natural habitats). Urbanisation of the countryside is continuing, both on natural/semi-natural habitat and on agriculturally valuable land. The continuation of any positive changes will require supportive policy and financial encouragement.

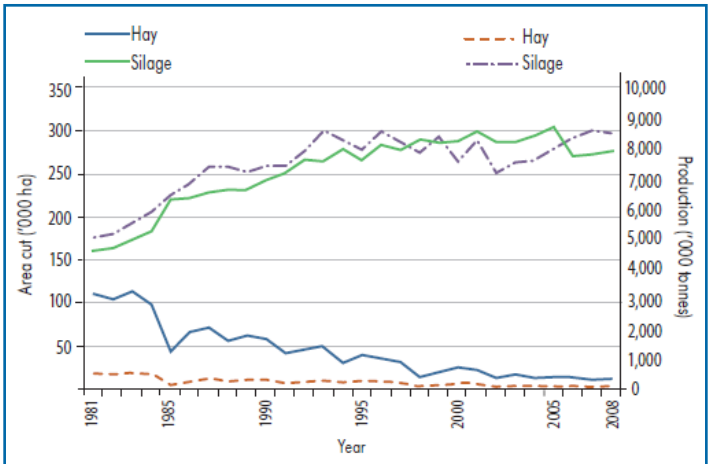


Figure 25. Hay and silage area cut (solid lines) and production (dashed lines) from 1981 to 2009.

- **Direct ecosystem outputs include the provision of food, wood, fuel and water. The outputs have changed over time**. There is now less peat harvesting, a shift from hay to silage production, a higher proportion of land used for grazing compared to arable crops and increasing reliance on *Nephrops* and aquaculture compared to wild-caught finfish. Northern Ireland is a net exporter of meat and dairy products, but relies on imports of energy, many foodstuffs and other commodities. Major export markets are the Republic of Ireland and Great Britain.

Figure 26. Commercial salmon catch in Northern Ireland by weight and value from 1994 to 2007.

- **Farming in Northern Ireland currently is centred around improved grassland producing meat and dairy products for both local use and export.** With appropriate management, farmland also has potential to contribute to greenhouse gas reduction targets through sequestering carbon in perennial vegetation and storing carbon in the soil. With suitable management farmland can also enhance biodiversity, ameliorate flooding and address waste management and pollution issues.

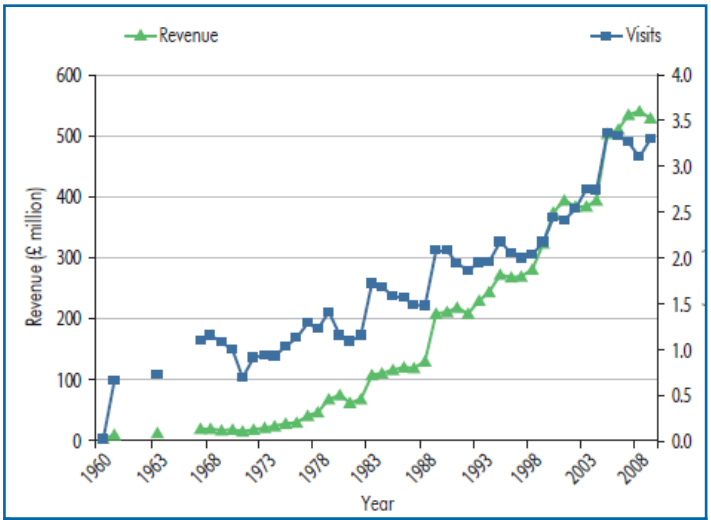


Figure 27. Tourism in Northern Ireland from 1959 to 2009.

- **Marine and coastal ecosystems are highly diverse and productive**, with areas such as Strangford Lough of international importance for biodiversity and important for tourism and recreation. Indeed, Strangford Lough could exemplify the need for a holistic ecosystems approach so that its unique habitats and species can be protected whilst providing living space, employment, recreation opportunities and tourism.

- **The abundant freshwater ecosystems, many internationally important for wildfowl, migrant wetland birds and fish, also provide most of Northern Ireland's drinking water and are of value for recreation and tourism**. However, most large lakes are eutrophic or hypertrophic as a result of human activity and this has environmental impacts and imposes a direct financial cost for water treatment.

2. **The complexities of ecosystem services and their interactions are becoming better understood by ecologists. However, this knowledge and understanding needs wider dissemination and promotion to facilitate its incorporation in government decision-making processes**. Much scientific information is not accessible in Northern Ireland as it has been gathered by government departments and agencies but not been published. Many of the data which do exist are descriptive. Valuation data based on ecosystem services are scarce but these are required to make the case for the integrated ecosystem approach to land and sea management. Recent work on River Basin Management Plans offers the potential to deliver more integrated valuation and quantification of benefits and threats.

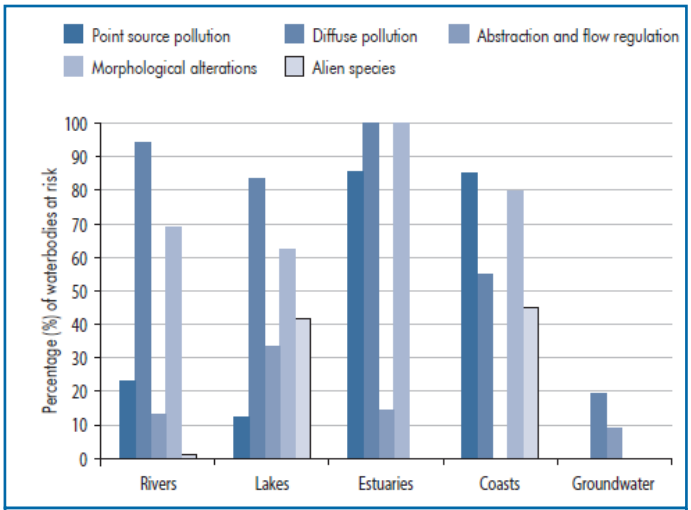


Figure 28. Percentage (%) of different types of waterbodies at risk of not meeting Good Ecological Status in 2015 without appropriate management action under the Water Framework Directive 2004.

3. **Northern Ireland has many policies and legislation that impact directly and indirectly on ecosystems and their service delivery**, including the responsibility to ensure local compliance with UK and EU legislation. The funding needed to deliver positively on these policies is limited and unlikely to increase. The competition for scarce government funding means environmental protection, aimed at enabling long-term delivery of ecosystem services, may not receive the necessary financial support.

4. **The true value of the countryside and marine ecosystems is not fully recognised** due to the difficulty of externalising and quantifying the many values and services ecosystems provide. Managing land primarily for provisioning services (from which landowners receive direct payments and/or subsidies) impacts upon all other ecosystem services, for example regulating services through purification and detoxification. Beneficiaries of these services include Northern Ireland residents, visiting tourists, people elsewhere consuming exported goods, and in the case of carbon sequestration/storage, the global population. Land can also be managed to deliver more general societal benefits (termed 'public goods', including scenery, biodiversity, flood regulation, avoidance of pollution) if policies and fiscal drivers encourage this. However, many people are not fully aware of the benefits they derive from ecosystem services and hence may not value rural areas highly. Similarly, ecosystem services provided in urban areas (and the potential for expanding delivery of these) are not widely recognised.

5. **The ability to place an economic and social value on the maintenance and enhancement of natural systems will be crucial to secure funding to promote integrated environmental management**. Valuation of ecosystem services is still at an early stage. Taking an ecosystem service view of land and sea offers the potential to put a value on delivery of services which are currently undervalued or even assigned no value at all in standard economic assessments. Valuation of ecosystem services could lead to a radically different approach to ecosystems and their use. The concept of 'public goods' and of providing financial support to people to deliver these through appropriate land management (in addition to or in some cases instead of traditional outputs of livestock, crops and fisheries) could become more widespread. The value of ecosystem services must be included in the overall assessment of all policies and practice.

6. **In the future there may be opportunities for management of habitats to deliver different ecosystem services** and possible changes in what food and other outputs are produced and how this is done. These changes will impact on individuals whose livelihoods directly depend on ecosystems and on all citizens through the use of the products and the wealth they create. Farming practices and products have changed over time in response to market forces, policy and fiscal drivers, for example the decline in arable farming since World War II and the increase in improved grassland. Dealing with competing land and sea use for food and renewable energy production, recreation and tourism, carbon sequestration and flood control is likely to become an important issue.

Conclusions

7. **An ecosystem-based approach will conserve the biodiversity and countryside** for people to enjoy, but will also assist water management, flood control and carbon sequestration and storage, and provide the economic goods derived from these provisioning, regulating and cultural services. In particular, Northern Ireland has abundant peatlands, some unique in their biodiversity, which are valuable as carbon stores in a UK and an EU context.

8. **Recognising the potential for multiple ecosystem outputs and establishing the importance of resilient natural systems to mitigate against unexpected natural and human impacts** can deliver a highly valuable service. Some systems and habitats are currently robust, but others are partially degraded and require positive management to maximise their potential. Delivery of the major 'public goods' for the benefit of the wider community will need to be through landowners and managers, but to do so they require knowledge, skills and financial support. There is a need for a framework within which landowners and managers can operate a vision for the wider environment and improved understanding of its potential for improving human well-being.

9. **Identification and delivery of multiple outputs from single ecosystems is still in its early stages in Northern Ireland**. Traditionally land was viewed as having a single purpose: farmland to produce food, forests to produce timber, or peatland to provide fuel. In recent decades this view has been changing, in particular with the tourism, recreation and leisure aspects of ecosystems such as uplands, coasts and forests being identified and promoted. Some multiple service delivery models are being developed, for example woodland to deliver biodiversity and recreation services in addition to timber provision, and the potential of short rotation willow coppice to produce fuel and detoxify sewage or farm waste. Opportunities for multiple service delivery exist for almost all habitats and encouragement of decision-makers to think more broadly in terms of multiple delivery is beginning to be seen in government policy and funding packages. There is considerable opportunity to increase this multiple delivery model by taking an ecosystem service perspective when looking at policies and fiscal incentives for land and sea management.

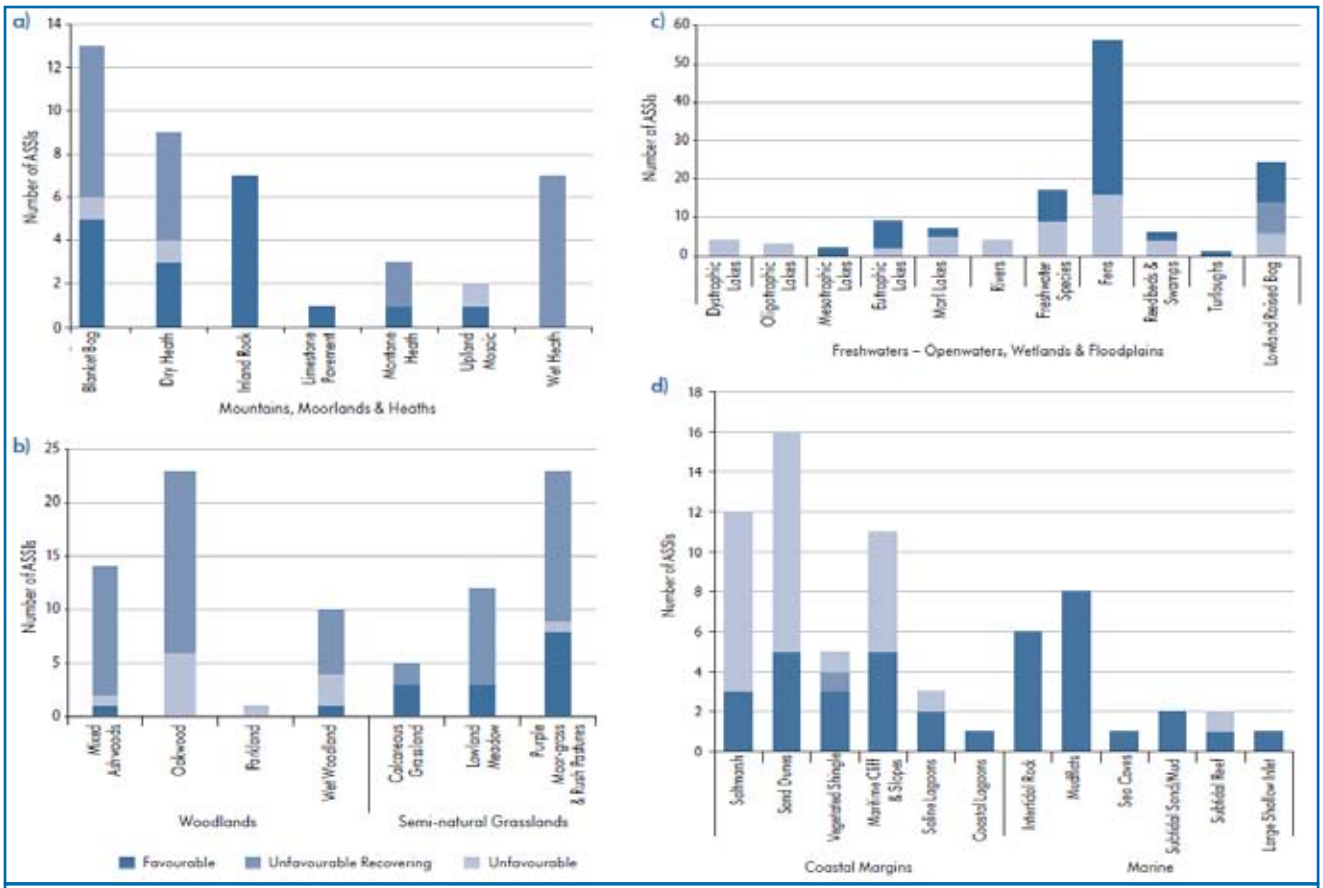


Figure 29. Condition of features within Areas of Special Scientific Interest for the six-year rolling period ending March 2008.

Knowledge Gaps

- **A coherent baseline is required on the state of and impacts on Northern Ireland's ecosystems and their services. The baseline should include economic valuation and how ecosystems relate to the remainder of the UK and the Republic of Ireland.** The **NI NEA project is a valuable starting point**, but **much more work is required**. Further data exist, although not always readily available and it is anticipated more will be made available in the coming months. An ongoing mechanism to add data to this work should be developed to ensure that it is progressed in a coherent fashion.

- **Research is needed on how to maintain and enhance ecosystems and identify threats, values and roles**. In particular, there is a lack of knowledge in terms of the ecosystem services provided by the marine environment and a need for better understanding of system boundaries and interactions.

- **Data and research issues centre around whether data exist, their accessibility and their comparability.** There is an increasing problem of data being seen as 'intellectual property' and therefore not being publicly accessible. Also, many data exist as unpublished reports or in difficult to access formats. There have been a number of positive developments, including Inspire and Freedom of Information. Government departments and agencies should continue to improve accessibility, particularly in times of financial restraint.

- **Integration across scientific and social disciplines is needed to improve communication and promote understanding of ecosystems and ecosystem services.** Work is also needed to determine how people engage with, are affected by and use the environment and from that to understand how to promote the need for environmental protection.

- **An agreed set of standardised indicators and definitions is needed across the UK and Ireland.** This will allow progress to be easily monitored and compared across regions. Examination of the available information for the NI NEA has identified a lack of standardisation of methodology, terminology and scale of reporting which makes comparison difficult.

- **A strategic plan for environmental management and resource use which identifies key ecosystem services and the most appropriate sites for future development and other changes in usage is required.** Many decisions impacting on the environment are taken within focused and isolated policy and practical perspectives. The value of ecosystem services transcends the interests or remits of any individual department or agency and can only be fully recognised and valued when viewed from a broader, integrated perspective. Integration across government and sectors is required for effective ecosystem service delivery.

- **Scenarios work is needed for Northern Ireland** comparable to that conducted for the UK NEA.

UK National Ecosystem Assessment Summary

This groundbreaking study has identified many key factors relating to all UK ecosystems and the services they provide which have profound implications for the management of land and sea throughout the UK, including in Northern Ireland. These general findings provide the framework within which the specific findings from the Northern Ireland study need to be considered when making policy and practical decisions which impact on our natural environment.

The UK, its people and its ecosystems

- The benefits that we derive from the natural world and its constituent ecosystems are critically important to human well-being and economic prosperity, but are consistently undervalued in economic analyses and decision making.
- Ecosystem and ecosystem services are constantly changing, driven by societal changes – demographic, economic, socio-political, technological and behavioural – which influence demand for goods and services and the way we manage our natural resources.

Changes in the past 60 years

- Ecosystems and their services have been directly affected by conversion of natural habitats, pollution of air, land and water, exploitation of terrestrial, marine and freshwater resources, invasive species and climate change.
- From the late 1940s onwards, emphasis in the UK was placed on maximising production of goods to meet human needs for food, fibre, timber, energy and water.
- While productivity increased, there was an initial decline in the delivery of a range of other ecosystem services, particularly those relating to biodiversity and air, water and soil quality.
- Changes in national policy and legislation, latterly often driven by European Union policy, along with technological developments and changing attitudes and behaviour, have led to improvements in some ecosystem services, particularly in the past 10–20 years.

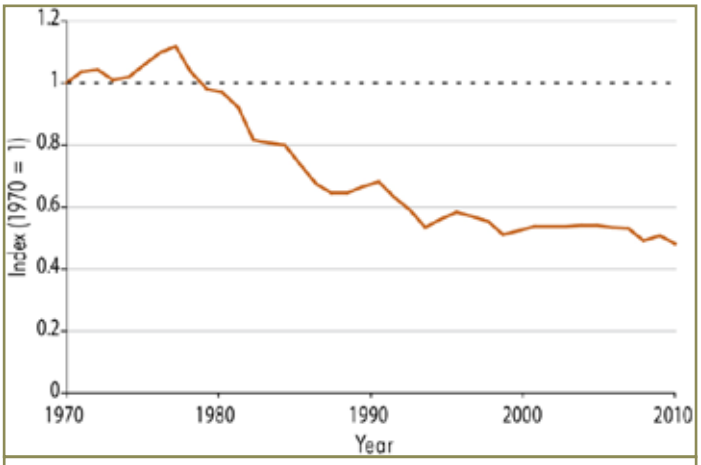


Figure 30. The UK Farmland Bird Index, 1970 to 2009, calculated on data from 19 individual farmland bird species.

Figure 31. Average yield of wheat in the UK from 1945 to 2010.

Present challenges and the future outlook

- Despite improvements, many ecosystem services are still far below their full potential – often as a consequence of long-term declines in habitat extent or condition, or both – and some continue to deteriorate, with adverse impacts on human well-being.
- A growing population and the increasing impacts of climate change mean that the future is likely to bring more challenges.
- The UK will remain an active trading nation, with substantial flows of biomass across its borders, generating a substantial ecological 'footprint' overseas while simultaneously being affected by social, economic and ecological changes elsewhere.

Responding to the challenges

- A move to sustainable development will require changes in individual and societal behaviour and adoption of a more integrated approach to ecosystem management.
- This will require an appropriate enabling environment of a mix of regulations, technology, financial investment and education, and the involvement of a wide range of different actors, including government, the private sector, voluntary organisations and civil society at large.
- We already have enough information to start managing our ecosystems more sustainably and good evidence of the benefits of doing so.
- Reversing declines in ecosystem services will require the adoption of more resilient ways of managing ecosystems, and a better balance between production and other ecosystem services – one of the major challenges is to increase food production, but with a smaller environmental footprint through sustainable intensification.
- Ecosystem services are critically important to our well-being and economic prosperity, but are consistently undervalued in conventional economic analyses and decision making. Contemporary economic and participatory techniques allow us to take into account the monetary and non-monetary values of a wide range of ecosystem services. These techniques need to be adopted in everyday decision-making practice.
- Failure to include the valuation of non-market goods in decision making results in a less efficient resource allocation, with negative consequences for social well-being. Recognising the value of ecosystem services would allow the UK to move towards a more sustainable future, in which the benefits of ecosystem services are better realised and more equitably distributed.
- Exploring some of the plausible futures open to us shows that there is a huge range of potential outcomes for the state of the nation, its people and its ecosystems in the coming decades. Decisions that we all make now and in the immediate future will have a major impact on these outcomes.

Figure 32. Schematic of the relative proportion of each UK NEA Broad Habitat found in the UK and its constituent countries. The size of each country chart is relative to the total area of land and sea (within 12 nautical miles) of the UK.

UK National Ecosystem Assessment Key Messages

The natural world, its biodiversity and its constituent ecosystems are critically important to our well-being and economic prosperity, but are consistently undervalued in conventional economic analyses and decision making. Ecosystems and the services they deliver underpin our very existence. We depend on them to produce our food, regulate water supplies and climate, and breakdown waste products. We also value them in less obvious ways: contact with nature gives pleasure, provides recreation and is known to have a positive impact on long-term health and happiness.

Ecosystems and ecosystem services, and the ways people benefit from them, have changed markedly in the past 60 years, driven by changes in society. During the second half of the 20th Century, the UK's population grew by roughly a quarter to nearly 62 million, living standards greatly increased and technological developments and globalisation had major effects on behaviour and consumption patterns. The production of food from agriculture increased dramatically, but many other ecosystem services, particularly those related to air, water and soil quality, declined.

The UK's ecosystems are currently delivering some services well, but others are still in long-term decline. Of the range of services delivered in the UK by eight broad aquatic and terrestrial habitat types and their constituent biodiversity, about 30% have been assessed as currently declining. Many others are in a reduced or degraded state, including marine fisheries, wild species diversity and some of the services provided by soils. Reductions in ecosystem services are associated with declines in habitat extent or condition and changes in biodiversity, although the exact relationship between biodiversity and the ecosystem services it underpins is still incompletely understood.

The UK population will continue to grow, and its demands and expectations continue to evolve. This is likely to increase pressures on ecosystem services in a future where climate change will have an accelerating impact both here and in the world at large. The UK's population is predicted to grow by nearly 10 million in the next 20 years. Climate change is expected to lead to more frequent severe weather events and alter rainfall patterns, with implications for agriculture, flood control and many other services. One major challenge is sustainable intensification of agriculture: increasing food production while decreasing the environmental footprint.

Actions taken and decisions made now will have consequences far into the future for ecosystems, ecosystem services and human well-being. It is important that these are understood, so that we can make the best possible choices, not just for society now but also for future generations. Contemporary economic and participatory techniques allow us to estimate values for a wide range of ecosystem services. Applying these to scenarios of plausible futures shows that allowing decisions to be guided by market prices alone forgoes opportunities for major enhancements in ecosystem services, with negative consequences for social well-being. Recognising the value of ecosystem services more fully would allow the UK to move towards a more sustainable future, in which the benefits of ecosystem services are better realised and more equitably distributed.

A move to sustainable development will require an appropriate mixture of regulations, technology, financial investment and education, as well as changes in individual and societal behaviour and adoption of a more integrated, rather than conventional sectoral, approach to ecosystem management. This will need the involvement of a range of different actors – government, the private sector, voluntary organisations and civil society at large – in processes that are open and transparent enough to facilitate dialogue and collaboration and allow necessary trade-offs to be understood and agreed on when making decisions.

Figures and Photos

Figure Sources

Figure 1 - Summarised from UKNEA Northern Ireland Chapter.
Figure 2 - Reproduced from UKNEA Synthesis of the key findings. Adapted from the Millennium Ecosystem Assessment 2005.
Figure 3 - Summarised from UKNEA Northern Ireland Chapter.
Figure 4 - Reproduced from UKNEA Northern Ireland Chapter. Data from Defra 2007.
Figure 5 - Reproduced from NIEA 2011.
Figure 6 - Reproduced from DOE & NISRA 2010.
Figure 7 - Reproduced from NIBG 2009.
Figure 8 - NIEA unpublished data.
Figure 9 - Data from Cooper & McCann 2010 and NIEA 2010h.
Figure 10 - Data from Cooper et al. 2002 and Cooper et al. 2009.
Figure 11 - Data from Cooper et al. 2009.
Figure 12 - Reproduced from DARD 2009.
Figure 13 - Reproduced from DARD 2009.
Figure 14 - Reproduced from Cruickshank et al. 1998.
Figure 15 - Reproduced from Foy & Jordan 2011.
Figure 16 - Reproduced from Foy & Jordan 2011.
Figure 17 - Data from NITB 2010.
Figure 18 - Reproduced with permission from FAO 2005. Copyright FAO AGL 2005.
Figure 19 - Reproduced from HM Revenue & Customs 2010.
Figure 20 - Reproduced from Stockholm Environment Institute 2009.
Figure 21 - Reproduced from Stockholm Environment Institute 2009.
Figure 22 - Reproduced from UKNEA Northern Ireland Chapter.
Figure 23 - Summarised from UKNEA Northern Ireland Chapter.
Figure 24 - Reproduced from UKNEA Northern Ireland Chapter.
Figure 25 - Data from DARD 2010.
Figure 26 - Data from DCAL 2008.
Figure 27 - Data from NITB 2010.
Figure 28 - Reproduced from NIEA 2008.
Figure 29 - Reproduced from NIEA 2008.
Figure 30 - Reproduced from UKNEA Synthesis of the key findings. RSPB, BTO, JNCC, Defra 2010.
Figure 31 - Reproduced from UKNEA Synthesis of the key findings. Defra 2010. Crown Copyright 2010.
Figure 32 - Reproduced from UKNEA Synthesis of the key findings.
Back cover - Reproduced from UKNEA Northern Ireland Chapter. Data from NIEA.

Disclaimer

Photo Descriptions

Front cover
Bog cotton adorns a pool near Altataggart Mountain, Western Mournes, Co Down

Pg 3 *Upland bog with bog cotton near Gortin, Co Tyrone*
Islandmore and Ringhaddy Sound, Strangford Lough
Cattle near Killinchy, Co Down
Bluebell wood, Co Down
Thrift on cliffs above Giant's Causeway, Co Antrim
Farm meadow at Monawilkin, Co Fermanagh
City Hall, Belfast
Flag iris, Ballydugan Lough, Co Down

Pg 4 *Irish hare, Monawilkin ASSI, Co Fermanagh*
Brent geese flying near Scrabo Tower, Co Down

Pg 5 *NIEA and National Trust staff, Divis Mountain, Belfast*
The Giant's Causeway, Co Antrim
Moorhen nesting
Rape field, Killyleagh, Co Down
Spring Squill
Whitepark Bay, Co Antrim
Farmland below Slieve Binnion, Mournes, Co Down

Pg 6 *Hawthorn on the Marlbank at Cuilcagh Mountain Park, Co Fermanagh*

Pg 7 *Causeway coast, near Ballintoy, Co Antrim*
Mossy log in bluebell wood, Co Down
Conly Island, Strangford Lough, Co Down
Mixed woodland, Roe Valley, Co Londonderry

Pg 8 *Cyclists, Lagan towpath, Belfast*

Pg 9 *Upland bog with bog cotton near Gortin, Co Tyrone*

Pg 10 *Cavehill Country Park, Belfast*
Kayaking on Quoile River, Co Down

Pg 11 *Lough Shannagh and the Silent Valley resevoir, Co Down*

Pg 13 *Upland bog with bog cotton near Gortin, Co Tyrone*
Farm meadow at Monawilkin, Co Fermanagh

Pg 14 *Cattle near Killinchy, Co Down*
Bluebell wood, Co Down
Flag iris, Ballydugan Lough, Co Down

Pg 15 *City Hall, Belfast*
Causeway Coast wild flowers - thrift, Co Antrim
Island and Ringhaddy Sound, Strangford Lough, Co Down
The Garron Plateau from Cushendall, Co Antrim

Pg 16 *Sheep near Trassey, Mournes, Co Down*

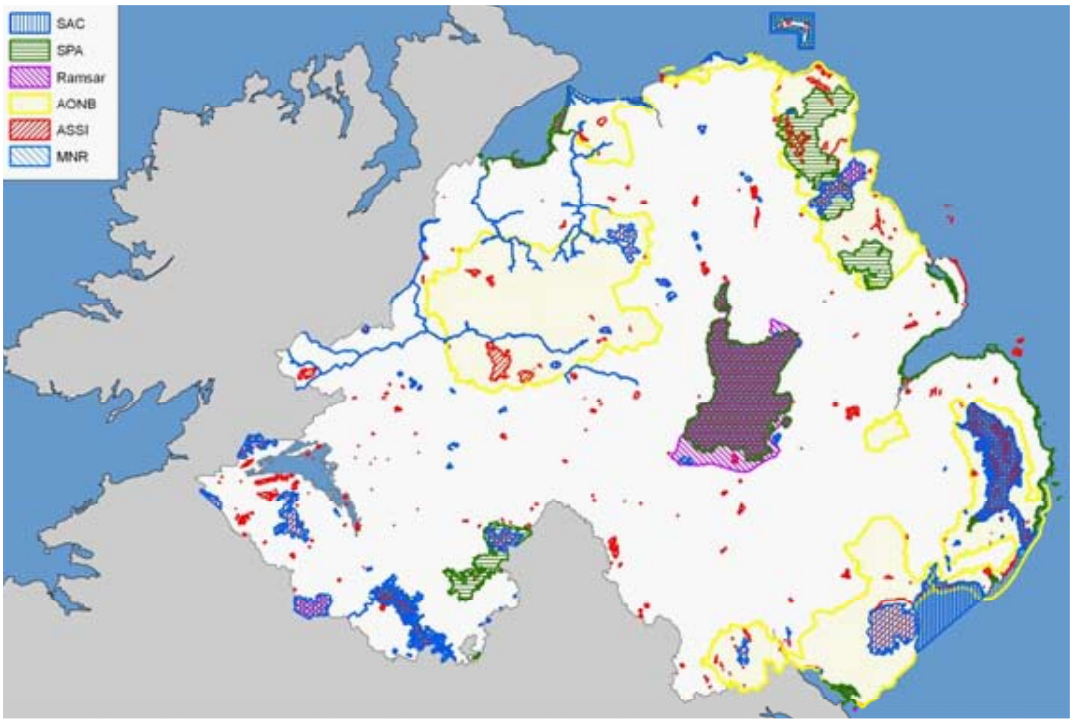
Pg 17 *Clea Lough, Co Down*

Pg 19 *Walker above Lough Shannagh, Mournes, Co Down*
Fields near Killyleagh, Co Down

Pg 20 *Container shipping in Belfast Harbour*

Pg 21 *Windfarm on peatland near Dungiven, Co Londonderry*

Pg 27 *Drumlins near Killinchy, Co Down*
Burnet moth
Thrift, Causeway Coast, Co Antrim
Ploughed fields, Bushmills, Co Antrim



Areas designated for conservation purposes in Northern Ireland.

The NI NEA is part of the UK Ecosystem Assessment and follows on from the global Millennium Ecosystem Assessment (2005). The full reports are available at http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx. The full Northern Ireland report and this summary are available at http://www.nienvironmentlink.org/publications/nea.php

Printed on recycled paper