Scotland's Biodiversity Progress to 2020 Aichi Targets

Interim Report 2017

Scottish Natural Heritage
Dualchas Nàdair na h-Alba
All of nature for all of Scotland
Nàdar air fad airson Alba air fad

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Acknowledgements

The preparation of this report was led by David O'Brien, Simon Foster and Debbie Bassett with considerable input from Sue Marrs, Claire McSorley and Kamila Fraser.

A wide range of contributors, shown in Annex 4, provided advice on each of the individual assessments.

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Introduction

This interim report presents an assessment of Scotland's current progress towards meeting the Global Aichi Targets[1].

The Convention on Biological Diversity (CBD) set 20 global targets, known as Aichi Targets, to be met by 2020. The *Scottish Biodiversity Strategy: 2020 Challenge for Scotland's Biodiversity*[2] sets the strategic priorities for Scotland and the Route Map to 2020 identifies the large-scale collaborative projects that are needed to contribute to these targets.

In 2016[3] an initial assessment of 13 Aichi Targets was published using recognised guidance and design standards. This report contains an assessment against all 20 Aichi Targets. The evidence base continues to be developed and we would hope that this interim assessment will attract interest and engagement towards developing a fuller account by the end of 2019.

Background

In October 2010 the UN Convention on Biological Diversity (CBD) agreed a Strategic Plan for Biodiversity 2011-2020[4] and set twenty international targets known as 'Aichi Targets'.

In 2010, SNH undertook a national assessment of biodiversity achievements in Scotland[5]. This assessment concluded the following.

- Progress for Scotland's biodiversity has been made by many people and organisations that care about Scotland's biodiversity. Biodiversity loss had been slowed where targeted action had been applied.

- However, Scotland's biodiversity indicators, the condition of notified habitats and species on protected areas, and progress towards meeting Scotland's biodiversity targets demonstrated that biodiversity loss had not yet been halted and would require renewed and sustained effort over a longer period.

The UK is a signatory to the CBD and will submit a full report in December 2018, which will include progress on each Aichi Target. In Scotland, the Scottish Government has also indicated that we should undertake a final assessment at the end of 2019.

Account development

The Aichi Targets are wide ranging and diverse in nature and present challenges both in terms of delivery and reporting. This is the first time we have attempted to report on all 20 targets in Scotland. The collation of data and information across such a wide range of areas from financial resource allocation to knowledge transfer and conserved genetic resources has presented considerable challenges. We have enlisted the collaboration, advice and support from many organisations including government, agencies, academics, NGOs and research institutes.

[1] https://www.cbd.int/sp/targets/
[2] http://www.gov.scot/Resource/0042/00425276.pdf
[3] https://www.snh.scot/sites/default/files/2017-11/Aichi-Targets-Interim-Report-September-2016-A2098126.pdf
[4] https://www.cbd.int/sp/elements/default.shtml
[5] http://www.snh.org.uk/pdfs/biodiversityreport2010.pdf

The accounts presented are composed of a combination of information and data, some available at Scottish level others are only collated at UK level. There are some generic issues with information and data that cut across all accounts and require some further work and coordination at UK level. This applies particularly to data derived from UK indicators, which either require updating or disaggregation for Scotland. We have also taken some account of Scotland's impact on biodiversity elsewhere in the world.

In order to ensure a consistent approach to account development and enable the data and subsequent analysis to contribute to UK reporting, the Convention for Biological Diversity (CBD) quick guides were used to scope the assessments, with reference to technical documentation and the Global Biodiversity Outlook 4 assessment (GBO4[6]).

We have adopted the five-point scoring system produced by the United Nation Convention on Biological Diversity as shown in figure 1 below to summarise progress against each target.

Figure 1. Five point scale of progress, adapted from Global Outlook 4.[7]

On track to exceed target (we expect to achieve this before its deadline)	On track to achieve target (if we continue on our current trajectory we expect to achieve the target by 2020)	Progress towards target but insufficient (unless we increase our efforts the target will not be met by its deadline)	No significant overall progress (overall, we are neither moving towards the target nor moving away from it)	Moving away from target (things are getting worse rather than better)

Following collation of information and data for each Aichi account, an assessment of status using the UN scale of progress shown above was assigned to each Aichi Target. This was undertaken by relevant experts within and out-with SNH. The Scottish Natural Heritage (SNH) Scientific Advisory Committee provided quality assurance and expert advice through-out Aichi target account development and assessment.

It is not suggested that this interim assessment is definitive. The results are presented for consideration and we are hoping to build capacity and wider engagement in the process of developing them further.

Summary of findings

An account of progress with each Aichi Target in Scotland is provided with a summary of the assessment of each target shown in Table 1. There are seven Aichi targets assessed as being on track. A further twelve are showing progress, but requiring additional action if we are to meet these targets by 2020. Only one of the twenty targets is moving away from target.

[6] https://www.cbd.int/gbo/gbo4/publication/gbo4-en.pdf
[7] https://www.cbd.int/doc/gbo/gbo2/cbd-gbo2-en.pdf

The Convention on Biological Diversity brigaded the Aichi Targets under five strategic goals covering; A) mainstreaming; B) direct pressures; C) biodiversity status; D) benefits to all; and E) enhanced implementation.

There are a number of areas where Scotland is progressing well with mainstreaming biodiversity, including work to increase public awareness and engagement and embedding biodiversity values through the development of policy and practice on natural capital; brigaded under Strategic Goal A. But there appears to be a time lag in terms of translating these ambitions into changes in practice and clearly influencing decision making across key sectors of government and society.

The areas of work that have proved most challenging is actions contributing to the Aichi Targets brigaded under the Strategic Goal B which relate to the direct pressures on biodiversity. Although positive changes in relation to sustainable management, pollution reduction and protection of ecosystems vulnerable to climate change are underway, there is still more to do. Development of improved metrics and focused action on a range of pressures are planned and being implemented.

There has been good progress in safeguarding biodiversity with the designation of marine and terrestrial protected areas now exceeding the international target. The development of Scotland's National Marine Plan and the reformed Common Fisheries Policy along with the Marine Strategy Framework are all helping to focus efforts towards sustainable management in the marine environment. Work will continue to 2020 to ensure management, representativeness, integration, and connectivity is improved. Further work is required to identify additional actions for certain species, including seabirds, waders, upland birds and specialist butterflies. The development of a Scotland priority species indicator and metrics for genetic diversity will contribute to this work.

The Aichi Targets relating to Strategic Goal D; benefits to all from biodiversity and ecosystem services have been progressed well. A suite of regulations are in place across the UK to ensure compliance with the Nagoya Protocol which safeguards the fair and equitable sharing of benefits arising out of the utilisation of genetic resources. The restoration of peatlands across Scotland is underway and the ecological status of freshwaters habitats is continuing to improve. Ambitious targets for native woodland planting and restoration have yet to be met though and further work is required on implementation of deer management plans. Both the ecological and wider social, economic and environmental benefits of these actions will take some time to realise. Much work is on-going and continues to be developed to ensure ecosystem services are safeguarded; such as the EcoServ GIS tool for Scotland and the application of the Ecological Coherence Protocol.

Finally, there is mixed progress on the Aichi Targets that comprise Strategic Goal E. The continued implementation of the Scottish Biodiversity Strategy and the Route Map to 2020 is regularly reported to the Scottish Parliament and Ministers. The 2nd annual progress report on the latter concludes that 3 targets have already been achieved and eight targets are progressing well track with only three targets not currently on track. The protection of traditional knowledge and the rights of communities are contributing positively to Scotland's biodiversity. The improved collation of data and data management are ensuring decisions are informed and information is shared and accessible. More work is required to address improved data recording, data analysis gaps and data relating to ecosystem functions. There has been a continued decline in public sector spending on the environment of 24% since 2010. However there are many other funding streams and non-monetary contributions to biodiversity conservation that are not currently accounted for in this target reporting There is work required to develop the metric for financial resources to ensure it better captures the investment in biodiversity across Scotland.

Table 1. Summary assessments of the 20 Aichi Targets

#	Aichi Target Name	Target assessment
Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society		
	**A1 Awareness increased** Biodiversity awareness in Scotland is currently measured at around 65%. There are a large number of organisations actively seeking to promote biodiversity and help raise the awareness of conservation and sustainable use of biodiversity.	
	**A2 Biodiversity values integrated** Scotland is a world leader in developing the concept of natural capital, and actively promotes biodiversity through strategies and policies. Whilst challenges remain to embed conservation and sustainable use in practice, biodiversity values have been integrated into the mainstream planning, policy and reporting frameworks.	
	**A3 Incentives reformed** In Scotland there are a wide range of incentives designed to support and encourage management for biodiversity. However there are incentives for activities which conflict with biodiversity leading to its deterioration and sometimes loss.	
	**A4 Sustainable consumption & production** Sustainability is an integral part to Scotland's economy and enshrined within the Government Economic Strategy. Scotland is committed to being a low carbon economy and has ambitious targets to achieve this. However, current indicators show we still have work to do to ensure the economy is operating within safe ecological limits.	

#	Aichi Target Name	Target assessment
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use		
	**B5 Habitat loss halved or reduced** Some of Scotland's habitats have suffered degradation and losses through changes in land use and management. Targeted restoration is underway on peatland, woodland and freshwater habitats. The Habitat Map of Scotland provides baseline habitat data and will enable us, in time, to look at changes in Scotland's habitats. The review of Priority Marine Features and ongoing work to implement fisheries management measures across the Scottish MPA network will also assist in reaching the target. The Ecosystem Health Indicators will improve our knowledge of habitat fragmentation.	
	**B6 Sustainable management – marine** Considerable progress has been made in ensuring fish, invertebrate and aquatic plants are harvested sustainably and in line with Scottish and European legal frameworks. The latest fishery stock assessments show that they are at Good Environmental Status (GES) for the Greater North Sea ecoregion. In the Celtic Seas ecoregion, a number of stocks have very low biomasses and are not sustainable. The development of Scotland's National Marine Plan, 1 and Aquaculture, Seaweed Harvesting and Fisheries Strategies along with the Marine Strategy Framework are all helping to focus efforts towards sustainable management in the marine environment.	
	**B7 Sustainable agriculture, aquaculture & forestry** Agriculture, aquaculture and forestry are important industries in Scotland. Considerable progress has been made in developing policies and strategies that will help achieve and support sustainability targets by 2020.	
	**B8 Pollution reduced** Improvements to air and water quality over recent decades, brought about by reduced pollution, have led to marked improvements in their status. However, much work remains to be done, with more challenging measures required to control air pollution and diffuse pollution, control marine litter, and better quantify the effects of pollution on Scotland's biodiversity and ecosystems.	
	**B9 Invasive species prevented and controlled** Action to control the most problematic non-native invasive species is underway and new information systems are being developed to inform rapid response. However, the spread of invasive non-native species and their impacts on biodiversity is a present and growing threat.	
	**B10 Pressures on vulnerable ecosystems reduced** In Scotland terrestrial ecosystems vulnerable to climate change include uplands, peatlands and oak woodland. Coastal habitats such as machair and saltmarsh as well as intertidal habitats are particularly vulnerable to sea-level rise and increased air and water temperature. Many marine habitats and species such as cold water corals, maerl beds, serpulid reefs, horse mussel and flame shell beds are considered vulnerable to various factors such as temperature increase and ocean acidification. Steps are being taken to identify pressures and to make ecosystems more resilient through protecting sites, voluntary codes and enacting legislation.	

#	Aichi Target Name	Target assessment
Strategic Goal C: Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity		
	**C11 Protected areas increased and improved** Species, habitats and geology of national and international importance in Scotland are safeguarded in a suite of protected areas, contributing to halting biodiversity loss. By August 2017 some 23% of terrestrial and inland water areas and 18% of marine areas had been brought under site protection, with over 80% of designated features in favourable (including recovering) condition. Although these percentages exceed the Aichi Target and meet the national target, more work is still required on management, representativeness, integration, and connectivity of sites.	
	**C12 Extinction prevented** In historical times, there has been only one case of a Scottish species going extinct worldwide: the great auk which went extinct in Scotland in 1840, and globally in 1844. From a biological viewpoint, in many cases it is appropriate to look at extinction risk across the British Isles as a whole, as well as the Scottish context. The UK Indicator shows some evidence of a slowing in the rate of decline in abundance of the UK's priority species. There is a mixed picture from Scotland's species indicators: with seabirds, waders, upland birds, and specialist butterflies in decline; generalist butterflies, woodland birds, and geese are increasing. Further work is required to develop a Scotland priority species indicator, and improvement of the taxonomical breadth of our GB-Red Lists, and indicator suite.	
	**C13 Genetic diversity maintained** There is no universally agreed metric of how genetic diversity should be measured and the subject itself is complex. Scotland is at the forefront of developing such metrics and is also a partner in UK-wide work to safeguard genetic diversity. Comprehensive reporting on Target 13 involves addressing several knowledge gaps/issues. Despite the progress on plant health and on individual species, such as the Scottish wildcat, until these gaps are understood, it would be premature to say we are on target.	

#	Aichi Target Name	Target assessment
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services.		
	**D14 Ecosystems & services safeguarded** Scotland has a variety of ecosystems which provide essential services for environmental, cultural, recreational and economic purposes. These include large rivers and lochs, woodlands along with an extensive coastline and marine area. The overall measure shows Scotland's natural capital deteriorated historically until the 1990s. Most habitat types were declining during this period, especially bogs and grassland. However, stocks have stabilised or slightly improved since 2000. Numerous policies, directives and legislation help us to safeguard these ecosystems. The biodiversity duty placed on all public sector bodies in Scotland further protects them. Clean drinking water is widely available with 99.91% of samples at point of use meeting EU Drinking Water Directive standards.	
	**D15 Ecosystems restored & resilience enhanced** Reversing ecosystem degradation, loss and fragmentation are key aims of the Scottish Biodiversity Strategy. Considerable efforts have been made on restoration of some of Scotland's most threatened habitats over the past few years. In particular peatlands and rivers have seen focused efforts which help towards Scotland's climate change targets. Rivers have seen continuous improvement in condition over the last 25 years. The area of woodland has more than trebled since 1900, though much of this is non-native commercial plantations.	
	**D16 Nagoya protocol in force & operational** The UK signed the Nagoya Protocol in 2011. Following public consultation in 2014 the Nagoya Protocol (User Compliance) Regulations 2015 were laid in the UK Parliament on 23 March 2015. Guidance on compliance and provision of an Access and Benefit-sharing (ABS) information platform provides a key tool for facilitating the implementation of the Nagoya Protocol.	

#	Aichi Target Name	Target assessment
Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building		
	**E17 NBS & AP adapted as policy instruments** The Scottish Biodiversity Strategy; 2020 Challenge for Scotland's Biodiversity was approved by the Scottish Cabinet and published in 2013. This document sets the strategic direction for biodiversity action in Scotland towards 2030. The Route Map to 2020, published in 2015, provides a clear focus for activity which will significantly contribute to the Scottish Biodiversity Strategy. Both documents represent the policy instruments for biodiversity in Scotland.	
	**E18 Traditional knowledge respected** Scotland's traditional languages and the knowledge held by their speakers have gained greater protection since 2005, following the Gaelic Language (Scotland) Act 2005. New research is safeguarding and sharing traditional knowledge. The rights of communities have been enhanced through several pieces of legislation, particularly since 2000. Traditional land management practices, such as crofting, benefit nationally and internationally important biodiversity.	
	**E19 Knowledge improved, shared and applied** Scotland has made significant efforts in data delivery and data management systems with The NBN Atlas Scotland, Scotland's Environment Web, and the Marine Scotland data publishing portal all contributing greatly to improving sharing and application of Scotland's knowledge. Volunteers and researchers make large contributions to the numbers of species and habitats records and the way we use them. More work is required to address data recording and analysis gaps. Improved information on the consequences in the loss, values, and functions of Scotland's biodiversity, could aid us in prioritising conservation action.	
	**E20 Financial resources increased** The UK indicator shows a long term increase in financial resources for biodiversity, but a recent short term decline. There is currently no Scottish indicator for this target. Total funding figures for most of the Scottish organisations that have some biodiversity remit have also declined in the last 5 years. Work is required to produce a Scotland indicator.	

Next steps

The accounts will continued to be developed during 2018, so as to contribute to the UK reporting on Aichi Targets to the Convention on Biological Diversity in December 2018. Further assessment of progress in Scotland will continue with a final assessment for Scotland published in December 2019.

In order to achieve this we will continue to build capacity and engage a wider audience in the assessment process. We would welcome feedback on the direction and pace of progress to-date, and views on further development of reporting against the Aichi Targets.

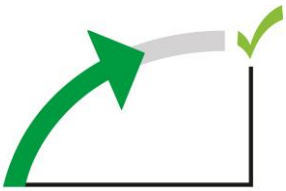
Aichi accounts

The 20 accounts are documented in the following section.

AICHI TARGET 1 – AWARENESS INCREASED

By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Biodiversity awareness in Scotland is currently measured at around 65%. There are a large number of organisations actively seeking to promote biodiversity and help raise the awareness of conservation and sustainable use of biodiversity.



Measuring biodiversity

We measure awareness of the values of biodiversity using a number of methods.[1] Since 2009, the Scottish Nature Omnibus Survey (SNO) has provided an insight into public awareness and engagement with SNH and its work. The SNO includes a number of questions about the public's views on biodiversity and their participation in activities which help look after the natural environment. Figures from the latest survey revealed around 65% of people were concerned about biodiversity.

The membership figures for environmental NGOs, and number of records submitted to various biological recording schemes also provide insight into awareness and involvement and we have used information from 35 environmental organisations that form Scottish Environment LINK.[2]

People throughout Scotland take part in a range of environmental activities, from large scale citizen science projects to focused species specific research. Figures from Scottish Environment LINK show that around 565,000 people were involved in these types of projects in 2015. Due to the complexities surrounding the membership figures, no allowance can be made for double counting across the 35 organisations that make up the LINK partnership.

The Open Air Laboratories (OPAL), the UK citizen science initiative that allows people of all ages and backgrounds to get hands-on with nature has been operating in Scotland since 2014. OPAL has reached 128,895 beneficiaries in Scotland, 24,836 of who were from disadvantaged backgrounds according to the Scottish Index of Multiple Deprivation (SIMD). For a full overview of OPAL engagement around the UK see the OPAL report 2016.[3]

Figure 1.1 Map showing locations of organisations that have worked with OPAL Scotland. Inlay shows Orkney and Shetland Isles. Each circle represents the denoted number of organisations OPAL Scotland has worked with in that area from 2014 until present.

AICHI TARGET 1 – AWARENESS INCREASED

Promoting biodiversity

Promoting biodiversity is a key aim of the Scottish Biodiversity Strategy.[4] Since its inception in 2004 there has been a range of initiatives rolled out across Scotland, targeting all areas and sectors. More recently in 2013, the 2020 Challenge for Scotland's Biodiversity[5] set out the major steps needed to improve the state of nature in Scotland. The work to deliver this is, however, complex and challenging. The Route Map to 2020 sets out how these six Big Steps for Nature can be delivered, through 12 priority projects. This includes three projects specifically focused on connecting people with nature.

Priority Project 5: More people experiencing and enjoying nature
Aim: Improve levels of regular participation in outdoor recreation, volunteering and learning by all of Scotland's people.
Target: Increase regular visits and active travel in greenspace through improved infrastructure, information, and campaigns, and the provision of activities and events.

Priority Project 6: Taking Learning Outdoors
Aim: Increase secondary and primary schools' access to greenspace and nature for outdoor learning as part of the wider 'Learning for Sustainability' agenda.
Target: 100 schools in the 20% most disadvantaged areas across Scotland have access to quality greenspace for outdoor learning.

Priority Project 7: Developing Scotland's natural health service
Aim: NHS Health Boards to promote health benefits from physical outdoors activity and contact with nature, with green exercise routinely prescribed by health professionals as part of the physical activity pathway.
Target: Improve greenspace quality and use on at least one hospital or health care facility in each NHS health board in mainland Scotland.

A duty to further the conservation of biodiversity was placed on all public sector bodies in Scotland in 2004. This biodiversity duty is about connecting people with the environment and managing biodiversity in the wider environment all around us, including protected sites. The Scottish Government Biodiversity Duty report 2012-2014 provides information regarding Scottish Government's contribution to the biodiversity duty.[6]

Priority Projects	Relevance	Status
PP5 – More people experiencing and enjoying nature	Increase regular visits and active travel in greenspace through improved infrastructure, information, and campaigns, and the provision of activities and events.	
PP6 – Taking learning outdoors	100 schools in the 20% most disadvantaged areas across Scotland have access to quality greenspace for outdoor learning.	
PP7 – Developing Scotland's natural health service	Improve greenspace quality and use on at least one hospital or health care facility in each NHS Health Board in mainland Scotland.	

AICHI TARGET 1 – AWARENESS INCREASED

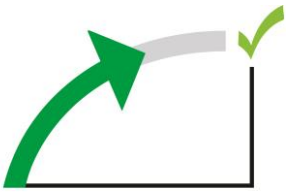
References end notes

1 http://www.snh.gov.uk/about-scotlands-nature/scotlands-biodiversity/snh-and-biodiversity/
2 http://www.scotlink.org/
3 http://www.imperial.ac.uk/opal/publications/
4 http://www.biodiversityscotland.gov.uk/
5 http://www.gov.scot/Resource/0048/00480289.pdf
6 http://www.gov.scot/Topics/Environment/Wildlife-Habitats/biodiversity/duty

AICHI TARGET 2 – BIODIVERSITY VALUES INTEGRATED

By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

Scotland is a world leader in developing the concept of natural capital, and actively promotes biodiversity through strategies and policies. Whilst challenges remain to embed conservation and sustainable use in practice, biodiversity values have been integrated into the mainstream planning, policy and reporting frameworks.



Ecosystem services

In 2011 Scotland became "the first country in the world to publish a detailed attempt to measure annual changes in its natural capital, based on an evaluation of ecosystem service potential." [1,2]

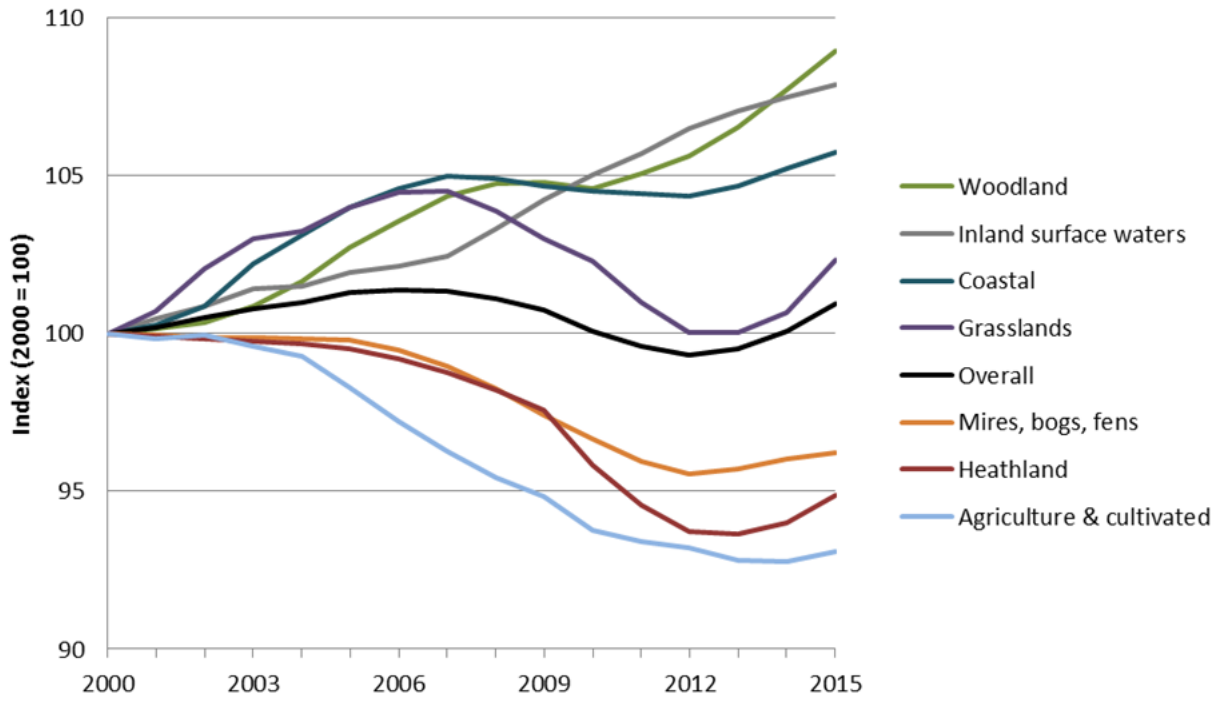


Figure 2.1 Scotland's Natural Capital Asset Index 2017.

Ecosystem services have been assessed by relative value,[3] such as forestry,[4] water[5] and coasts.[6] While there is inevitable uncertainty, these have informed weightings in the Natural Capital Asset Index, summarised in Table 2.1. Based on a survey of scientists, the Omnibus survey and the relative economic contribution of nature-based tourism, ecosystem service group weightings were derived, as 25% (provisioning), 50% (regulating/maintenance – split equally) and 25% (cultural). Specific services within each group were also weighted, for example, the Scotland-wide importance of carbon sequestration (weight 10) was estimated to be twice as important as the Freshwater quality regulation (weight 5).[7]

AICHI TARGET 2 – BIODIVERSITY VALUES INTEGRATED

McVittie *et al*. (2016)[8] state that "challenges remain in developing natural capital accounts. We need biophysical data that reflect changes in condition over time, and that can be linked to both management actions and benefits that can be valued." The latest assessment[9] shows a stabilisation of Scotland's natural capital following decades of decline until the 1990s. Habitats that continue to deteriorate include heaths and bogs but recovery of inland surface waters, which deliver a range of ecosystem services, contributes to the overall positive trend. The decline in cultural ecosystem services requires further analysis.

Table 2.1 The importance of each ecosystem service to Scotland.

Ecosystem Services/Goods	Scotland Weight
Food/fibre/water	25.0
Fresh water quality	5.0
Air pollution	2.1
Freshwater regulation	4.4
Carbon sequestration	10.0
Erosion control	3.5
Pollination	4.4
Genetic resources	3.2
Biodiversity	17.4
Recreation/well-being	9.3
Heritage/spiritual	9.3
Tourism	6.4

National policies & Strategies

All public bodies in Scotland have a biodiversity duty[10] and are required to publish their compliance with it.[11]

The Scottish Economic Strategy recognises the need for investment in natural resources. Scottish Planning Policy and the National Planning Framework (NPF3)[12] support four key outcomes: *A successful sustainable place; a resilient place*; *a low carbon place*; and a *more connected place*. These policies and frameworks operate at national and sub-national scales.

Scotland's National Marine Plan [13] provides a comprehensive overarching framework for all marine activity in Scotland's waters. It aims to enable sustainable development and use of marine areas in a way which will protect and enhance the marine environment whilst promoting both existing and emerging industries.

The Scottish Biodiversity Strategy states that biodiversity will be conserved for the health, enjoyment and wellbeing of the people of Scotland.[14] The Scottish Land Use Strategy has objectives relating to the economy, environment and communities; and the Principles for Sustainable Land Use to guide policy and decision making by Government and across the public sector.[15]

Green Infrastructure

Green infrastructure (GI) is a strategically planned network of high quality natural and semi-natural areas with other environmental features, which is designed and managed to deliver a wide range of ecosystem services and protect biodiversity, in both rural and urban settings.[16] Scotland uses European funding[17] to develop and improve green infrastructure. Access to urban greenspace has been shown to be linked to better health, particularly in areas of multiple deprivation.[18]

Other measures that can also help support biodiversity include: European LIFE funding, Heritage Lottery Funds, Scotland's Rural Development Programme and Land Use Strategy.

AICHI TARGET 2 – BIODIVERSITY VALUES INTEGRATED

Priority Projects	Relevance	Status
PP4 – Investment in natural capital	Businesses are more aware of their reliance on Scotland's natural capital, and more investment is being made in building natural capital.	

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17 Green Infrastructure – http://ec.europa.eu/environment/nature/ecosystems/index_en.htm

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AICHI TARGET 3 – INCENTIVES REFORMED

By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.

Incentives help to influence behaviour towards achieving a range of aims. They can encourage activity that can promote biodiversity. However, in Scotland some still conflict with biodiversity leading to its deterioration and sometimes loss.

Incentives in Scotland

In Scotland there is a range of subsidies and incentives available, some of which positively support and influence biodiversity, while others do not. Agricultural and forestry land use covers around 80% of Scotland, and the current support mechanism provides around £1.326 billion to land managers. Only a relatively small proportion (£125m) goes towards biodiversity, although Scotland's protected nature sites receive separate funding of some £30m.

Other subsidies exist, including tax incentives for oil and gas exploration and extraction, renewable energy, estate management, house-building and capital allowance. Further analysis is required to understand the implications of these on biodiversity. A stringent planning policy exists that considers biodiversity interests but the degree to which this restricts negative impacts is unknown.

Supporting farming

As part of the measures of support, Cross Compliance is a mandatory set of requirements and standards that land managers have to meet in order to receive support payments. With the reforms to the Common Agricultural Policy (CAP), all areas under receipt of payments have to meet mandatory criteria to ensure good agricultural and environmental condition (GAEC) is being maintained.[1] However, Positive and direct payment for agri-environment activity is a limited element within overall farm support.

Although the GAEC criteria should ensure no impacts, particularly for soils, habitats and landscape features on agricultural land, there are anomalies in the current system of funding. To claim funding for any farm, land managers are required to submit details of their land that is eligible for funding. Exclusions exist within this for some natural habitats such as marsh, rocks and scree, gorse, and bracken.[2] As a result of these exclusions, areas of natural habitat supporting biodiversity may be at risk of loss. A more thorough investigation on the scope of this activity is needed to fully understand the levels to which this occurs.

Bioenergy

The dedicated production of feed-stocks to supply bioenergy developments can require large areas of land, which would have otherwise been available for other purposes. This in turn increases pressure on land globally, leading to habitat loss. The Renewable Energy Directive has defined a set of sustainability criteria to ensure that the use of biofuels (used in transport) and bioliquids (used for electricity and heating) is done in a way that guarantees real carbon savings and protects biodiversity. Only biofuels and bioliquids that comply with

the criteria can receive government support or count towards national renewable energy targets.[3] Because the additional demand for land may cause displacement effects, Green House Gas (GHG) emissions that might be caused by indirect land-use change must be included in the reporting of fuel providers and EU countries. This policy framework helps limit risks but further assessments will be needed to judge its effectiveness in terms of protecting biodiversity.

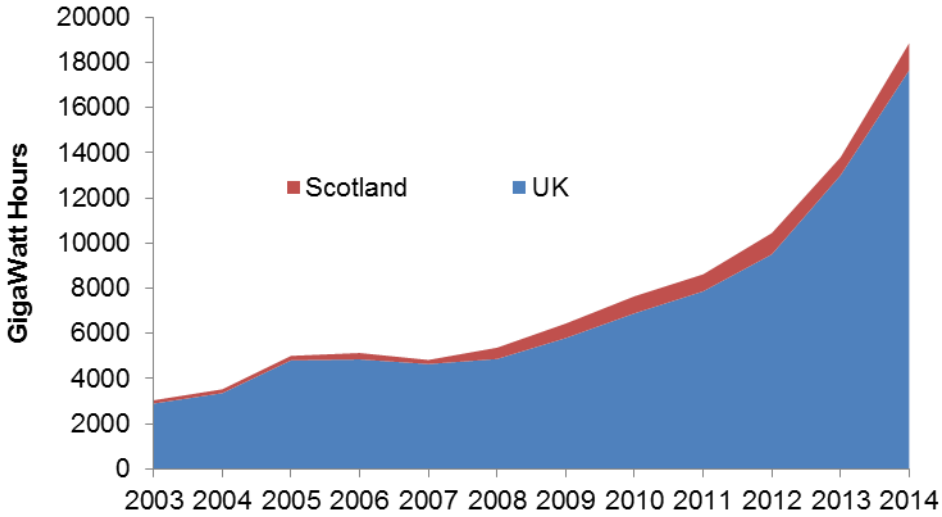

Figure 3.1 Biofuel Electricity Generation in Scotland and the UK. Source: Department of Energy & Climate Change.

There has been a rapid increase biofuel electricity generation (Figure 3.1), mainly as a result of subsidies aimed at meeting other targets such as reducing our reliance on fossil fuels.

Priority Project	Relevance	Status
PP4 – Investment in natural capital	Businesses are more aware of their reliance on Scotland's natural capital, and more investment is being made in building natural capital.	
PP11 – Sustainable land management	Promotion of measures to support biodiversity under CAP: sites demonstrating good practice aimed at supporting wildlife.	

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[1] https://www.ruralpayments.org/publicsite/futures/topics/inspections/all-inspections/cross-compliance/detailed-guidance/good-agricultural-and-environmental-conditions/

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AICHI TARGET 4 – SUSTAINABLE CONSUMPTION AND PRODUCTION

By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

Sustainability is an integral part of Scotland's economy and is enshrined within the Government Economic Strategy. Scotland is committed to being a low carbon economy and has ambitious targets to achieve this. However, not all indicators show confidently that we have achieved safe ecological limits.

The Government Economic Strategy is aimed at all production sectors, including agriculture, forestry, fisheries, oil and gas, and renewables, as well as other forms of production such as electronics, retail and marketing, construction and tourism.[1]

National Indicators measuring environmental impact

The Scottish Government National Performance Framework includes five key measures of sustainable production and consumption:[2]

Reduce Scotland's carbon footprint
Increase the proportion of journeys to work made by public or active transport
Reduce waste generated
Increase renewable electricity production
Improve the state of Scotland's marine environment

There has been reduction in Scotland's carbon footprint since a peak in 2007 when it was 115.3 million tonnes carbon dioxide equivalent ($MtCO_2e$). The latest figure of 94.8 $MtCO_2e$ for 2013 represents a slight rise over the previous year. An estimate of the ecological footprint was undertaken in 2006[3]. This was stable but above the target value.

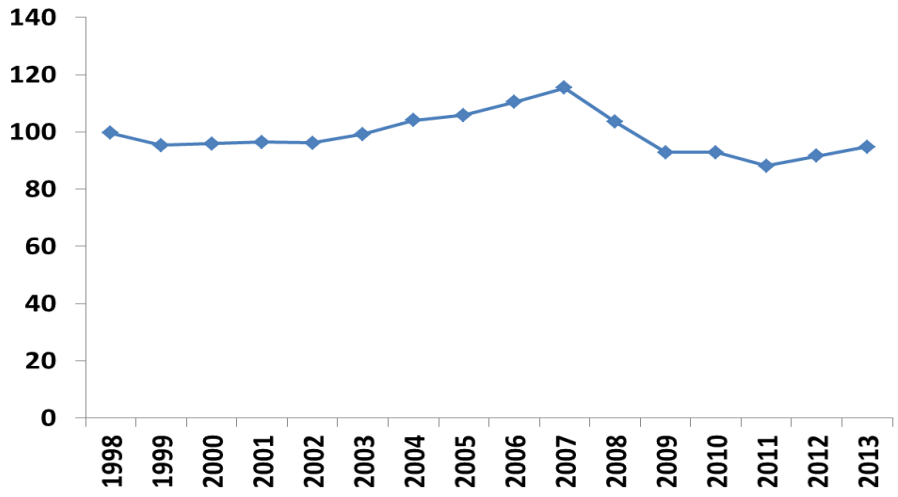

Figure 4.1 Scotland's Carbon Footprint, 1998-2013, Values in $MtCO_2e$. (Source: Scottish Government, 2017).

AICHI TARGET 4 – SUSTAINABLE CONSUMPTION AND PRODUCTION

A reduction in renewable energy production in the latest figures (2016) should be seen in the long-term context: it remains over three times the level at the end of 2006. Renewable electricity generation was equivalent to 54.0% of gross electricity consumption, a reduction of 5.4 percentage points compared with 59.4% in 2015. The reduction in renewable generation can be attributed to falls in both hydro and wind generation due to reduced rainfall and wind speeds in 2016.

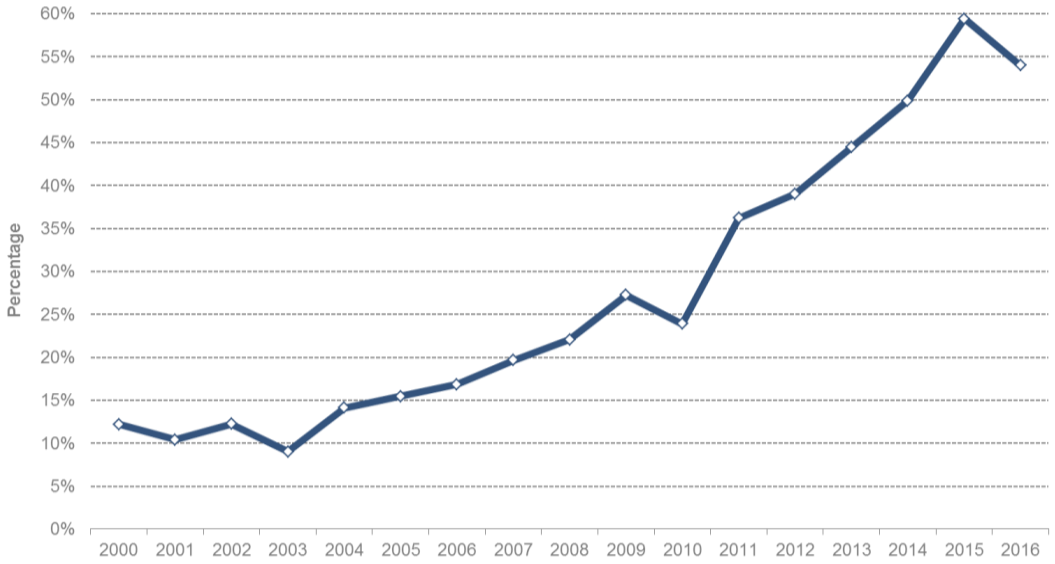

Figure 4.2 Electricity generated by renewables as a % of gross consumption, 2000-2016, (Source: Scottish Government, 2017)

Plans for sustainable consumption and production

A number of policies help guide action towards ensuring sustainability goals are being met. These include the Climate Change (Scotland) Act (2009),[4] the Zero Waste Plan (2010),[5] Low Carbon Scotland (2013)[6], Safeguarding Scotland's Resources (2013)[7], A Circular Economy Strategy for Scotland[8] and Scotland's National Marine Plan.[9]

Although the use of natural resources is mentioned within the economic strategy, it is unclear specifically what measures are being taken to ensure that impacts are being kept within safe ecological limits.

Project	Relevance	Status
PP4 – Investment in natural capital	Businesses are more aware of their reliance on Scotland's natural capital, and more investment is being made in building natural capital.	
PP11 – Sustainable land management	Promotion of measures to support biodiversity under CAP: sites demonstrating good practice aimed at supporting wildlife.	

AICHI TARGET 4 – SUSTAINABLE CONSUMPTION AND PRODUCTION

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2 http://www.gov.scot/About/Performance/scotPerforms/outcome/envImpact
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7 http://www.gov.scot/Resource/0043/00435308.pdf
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AICHI TARGET 5 – HABITAT LOSS HALVED OR REDUCED

By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

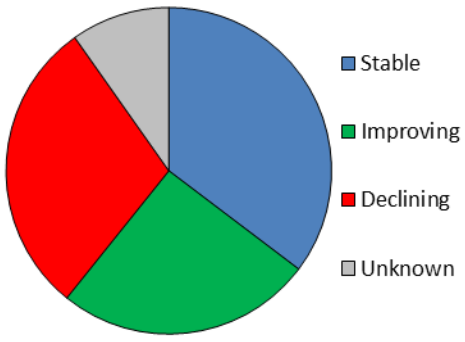
Some of Scotland's habitats have suffered degradation and losses through changes in land use and management. Targeted restoration is underway on peatland, woodland and freshwater habitats. The Habitat Map of Scotland provides baseline habitat data and will enable us, in time, to look at changes in Scotland's habitats. The review of Priority Marine Features and ongoing work to implement fisheries management measures across the Scottish MPA network will also assist in reaching the target. The Ecosystem Health Indicators will improve our knowledge of habitat fragmentation.

Scotland's peatlands, mountain landscapes, coastal cliffs and seas, machair and some of our woodland ecosystems are exceptional by European standards[1]. However, degradation, losses and reduction of Scotland's native habitats has been – and is being – caused by many pressures including land use intensification and modification; habitat fragmentation; overexploitation; overgrazing;[2] invasive non-native species (e.g. rhododendron) [3] and wildlife diseases (e.g. Dutch elm disease). Climate change, particularly affecting montane, wetland and coastal habitats, and pollution have also impacted on our natural habitats[4,5]

Habitat changes

The overall condition of notified habitats on protected sites in Scotland is stable[6], with over 80% of all designated features in favourable or recovering condition (see Aichi Target 11). The area of land and sea under positive management for biodiversity conservation increased between 2010 and 2012.[7] In addition the area of sea with fisheries management measures has increased since 2012.[8]

Figure 5.1 2013 EU Habitats Directive Article 17 Scottish reporting – Scottish assessment of Overall trends in Conservation Status qualifier for 51 terrestrial and coastal habitats.



Trends in the conservation status of habitats of European importance in Scotland were 29% in decline, 25% improving, 35% stable and 10% unknown when last reported(Figure 5.1). Table 5.1 shows how five of the habitat groups had declining conservation status. The groups with the greatest proportion of declines were "Coastal sand dunes and continental dunes", "Marine, coastal and halophytic" and "Forests". Six groups showed improvements with "Natural and semi-natural grassland formations" and "Freshwater habitats" having the greatest number of improvements. The remainder of marine habitats in Scotland were reported on a UK scale.

AICHI TARGET 5 – HABITAT LOSS HALVED OR REDUCED

Table 5.1 2013 EU Habitats Directive Article 17 Scottish reporting - Scottish assessment of Overall trends in Conservation Status qualifier for 51 terrestrial and coastal habitats grouped by category (using JNCC categories).[9]

Habitat Group	Total	Declining	Improving	Stable	Unknown
Coastal sand dunes and continental dunes	9	5	2	0	2
Forests	5	5	0	0	0
Freshwater habitats	6	0	3	2	1
Marine, coastal and halophytic	5	2	0	2	1
Natural and semi-natural grassland formations	8	2	4	2	0
Raised bogs and mires and fens	8	1	2	4	1
Rocky habitats and caves	5	0	0	5	0
Sclerophyllous scrub (matorral)	1	0	1	0	0
Temperate heath and scrub	4	0	1	3	0

Whilst the extent of semi-natural features reduced by 17%[10] between 1947 and 1988, the assessment to 2007 was more positive, notably for expanding native woodland habitats.[11] Currently, Scotland uses a variety of data sources to review habitat extent; we have the Habitat Map of Scotland[12] which shows Level 1 EUNIS land cover[13] and a UK marine EUNIS map.[14] Work is continuing to produce higher level EUNIS maps for the Habitat Map of Scotland.[15]. These will provide current and up-to-date maps of the distribution of Scotland's terrestrial and marine habitats, against which, with time, change may be measured. Work is being carried out by JNCC on "Making Earth Observation work for UK biodiversity conservation."[16] The recently published Ecosystem Health Indicators quantify habitat connectivity.[17]

Scotland's habitats and biodiversity

Completion of the Habitat Map of Scotland enables us to better assess the extent and rate of change of habitats across Scotland. More information on habitat data may be found in Aichi Target 19 in this report.

Scotland's woodland area had declined to 4.5% by the beginning of the 20th century[18]. However, by the middle of the 20th century, Scotland's woodland had increased rapidly mainly through the planting of fast growing conifer species. By the 1990's more diverse woodland types were being planted[5]. Between 1900 and 2013 the proportion of Scotland covered by forest increased from 5%[19] to 18% of land area (1.4Mha).[5] Most of this area is dominated by introduced species, however, and the Native Woodland Survey of Scotland (NWSS) found that just over one fifth (0.3Mha, March 2011) of our woodland is native.[20] The NWSS showed that 50% of native woods on the National Forest Estate were in good condition (compared to 46% of all native woodland), but the remaining 50% were in unfavourable condition with the largest factor being excessive herbivore impacts.[2] Birds associated with woodlands show a long-term increase in abundance in Scotland,[21] which may be associated with both condition and extent However, all five of Scotland's Habitats Directive Annex I forest habitat types have an overall conservation status of inadequate / declining (Table 5.1). Although Scotland's State of the Environment Report, 2014 assessed the condition of our forests and woodlands for wildlife as "moderately good", and that this condition is likely to continue with sustainable management,[5] woodland habitats on protected sites have the second worst condition of all habitats with only 53% of protected woodland features being in favourable condition.[6] The 2006 Scottish Forestry Strategy[22] has enabled us to monitor change.

AICHI TARGET 5 – HABITAT LOSS HALVED OR REDUCED

Around 10% of Scotland's sea area is covered by Nature Conservation Marine Protected Areas.[23] The most recent assessment of Scotland's marine and coastal protected areas found that they are mainly in favourable condition at 98% and 82% respectively.[6] There have been declines in some inshore habitats with concerns for shallow and shelf subtidal sediments across Scotland.[24] UK implementation of the EU Marine Strategy Framework Directive and implementation of policies in Scotland's National Marine Plan (and in due course, Regional Marine Plans) are expected to contribute to better management of these areas. Many of our freshwater habitats are in relatively good condition,[5] however, there are some declines in our freshwater vascular plant diversity,[25] and invasive non-native species continue to negatively impact these habitats and remain extremely challenging to control.

Mountains and uplands define much of Scotland's landscape.[5] Upland breeding birds which depend on these habitats have shown a gradual long term decline in Scotland,[21] but remedial action on protected sites is improving condition of some upland habitats.[5] Peatlands cover more than 20% of Scotland's area; it is estimated that in Scotland 70% of blanket bog and 90% of raised bog have been damaged.[26] However, Scotland's National Peatland Plan (2015) is working towards improving their protection and condition. This is covered in more detail under target 15. Biodiversity hotspot analysis in the uplands has shown the importance of biodiversity habitat mapping to enable the spatial targeting of management options.[27] Grasslands have suffered declines in recent years: there have been significant declines in vascular plant diversity in grasslands;[25] and, 50% of grassland protected features are in unfavourable condition, the worst condition of all habitat features on protected sites.[6]

Ecosystem Services and Health & Wellbeing

When in a healthy condition Scottish habitats can provide ecosystem services such as water, food, fuel and energy, storm protection, carbon storage, minerals, and flood control.[5] Although Scotland's Natural Capital Asset Index is currently static overall, the natural capital in woodland, freshwater, coast, and urban greenspace broad habitats increased between 2000 and 2010, and declined in moorland, grassland, and cropland.[28] Scotland's Land Use Strategy will enable us to think more strategically about landuse, and provide a framework for decision making to ensure that our land delivers multiple benefits, results in partnerships with nature, and links people with the land.[29] A project in central Scotland is looking at the natural environment, climate change resilience and how these impact on our health and wellbeing, particularly in our more populated areas.[30]

AICHI TARGET 5 – HABITAT LOSS HALVED OR REDUCED

Project	Relevance	Status
PP1 – Restoration of peatlands	Ambitious peatland restoration programme underway, contributing to the EU15% degraded ecosystem restoration target	
PP2 – Restoration of native woodlands	Increase the amount of native woodland in good condition (upwards from 46% as identified by the *Native Woodland Survey of Scotland)*. 3,000 to 5,000 ha new native woodland creation per year. Restore approximately 10,000 ha of native woodland into satisfactory condition in partnership with private woodland owners through Deer Management Plans.	  
PP3 – Restoration of fresh waters	Achieve agreed ecological water quality objectives under the Water Framework Directive of river and lake water bodies and to contribute to meeting conservation objectives (including Natura 2000 sites) through scoping improvements to physical modifications.	
PP11 – Sustainable land management	Promotion of measures to support biodiversity under CAP: sites demonstrating good practice aimed at supporting wildlife.	

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AICHI TARGET 6 – SUSTAINABLE MANAGEMENT – MARINE

By 2020, all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

Considerable progress has been made in ensuring fish, invertebrate and aquatic plants are harvested sustainably and in line with Scottish and European legal frameworks. The latest fishery stock assessments show that they are at Good Environmental Status (GES) for the Greater North Sea ecoregion. In the Celtic Seas ecoregion, a number of stocks have very low biomasses and are not sustainable.
The development of Scotland's National Marine Plan, [1] and Aquaculture, Seaweed Harvesting and Fisheries Strategies along with the Marine Strategy Framework are all helping to focus efforts towards sustainable management in the marine environment.

Fishery catch statistics are collated annually by the International Council for the Exploration of the Seas (ICES). These provide a measure on sustainable use and inform fishery quotas and policy decisions. The latest fishery stock assessments show that many are being harvested at sustainable levels, with biomass increasing in the North Sea[2]. In the North Western Waters, the situation is less positive, with a number of stocks being harvested at unsustainable levels and having very low biomasses.

In 2016, of 19 'key' Scottish stocks 13 (70%) were fished at or very close to being fished at the Maximum Sustainable Yield (MSY); 5 in the North Sea, 6 in the west of Scotland and 2 Northern Shelf stocks. Biomass is also steadily improving with 14 of these stocks (74%) currently above biomass action points for fisheries management (MSY Btrigger). For comparison in 2015, 11 stocks were fished at or very near MSY (almost 60%). The setting of Total Allowable Catches (TAC) is done at an international level for fish stocks which are widely dispersed and often fished by many countries. As such Scotland does not have complete control over what is a very internationally managed process. An outcome of fisheries negotiations at the end of 2017 is that for 2018, nine of the thirteen stocks (69%) by which Scottish Government measures its sustainability performance have had their Total Allowable Catches (TACs) set in line with the maximum sustainable yield (MSY) for 2018 - an increase from 62% in 2017.

Levels of fishing in the past have meant that several fish species in both ecoregions are now on the OSPAR threatened and declining species list, including spurdog, the common skate complex, angel shark, porbeagle and some deep-water sharks. [3] Assessments by the OSPAR Commission in their Intermediate Assessment 2017[4] (across sea areas larger than Scotland (but including data from Scotland) indicate that fisheries management is starting to have a positive impact on fish communities, with for example the proportion of large fish (more susceptible to fishing mortality) in the demersal community improving and set to continue as long as current pressures, including wider environmental pressures, do not increase.

The fishery for Nephrops (known as Norway lobster, scampi, Dublin Bay prawn or langoustine) in Scottish waters has developed from landings of a few tonnes in the early 1960s to over 30,000 tonnes in the mid-2000s. Landings in 2014 of just over 20,000 tonnes had a first sale value of approximately £73 million making Nephrops the second most valuable species landed into Scotland[5]. The latest shellfish stock assessment for Scotland shows variation between the different fishing grounds. In some stocks abundance has declined to around the Maximum Sustainable Yield Biomass trigger, the level where management actions may be needed.[3]

Fisheries managers are also working to implement the commitment to end discarding in European waters which was in the reformed Common Fisheries Policy. This should lead to healthier fish stocks in the longer term as mortality from fishing can be more accurately controlled. Implementing this commitment does create significant management challenges for all EU Member States and will require substantial changes in the fishing operations which will be demanding to deliver within the timescales contained in the legislation.

Scotland's National Marine Plan[6] states "Achieving a sustainable economy, promoting good governance and using sound science responsibly are essential to the creation and maintenance of a strong, healthy and just society capable of living within environmental limits." The plan sets out strategic policies for the sustainable development of Scotland's marine resources. Aquaculture and fisheries have sustainable management strategies in place. While the strategies do not explicitly explain how they are linked to biodiversity, they do state that operations should have due regard to the environment.

The Marine Strategy Framework Directive (MSFD) places further emphasis on ensuring that Scotland's seas are healthy, productive and safeguarded for use by future generations.[7]

A new indicator for tracking the status of Scotland's commercial fish stocks is being developed which will be available for the final 2019 Aichi report. The proposed indicator will measure the extent to which the fishing mortality (i.e. rate of fish captured – landings plus discards) for different key commercial stocks is in line with sustainability thresholds as defined by relevant MSY reference points. The current policy objective, as required by the UN following the 2002 Johannesburg Declaration, is to reduce fishing mortality for each key commercial stock to a level below the respective MSY reference point.

AICHI TARGET 6 – SUSTAINABLE MANAGEMENT – MARINE

The Scottish Government Programme for Government[8] provides commitments to marine work including: a sustainable marine sector with commitments to clean, healthy, safe, productive and biologically diverse seas and coasts and the sustainable growth of key industries, including aquaculture, sea fisheries and seafood. It also pledges to protect the marine environment, and makes the following commitments:

- **Protecting our marine environment:** The seas around Scotland are a national asset that must be protected and cherished. In the year ahead [2018], we will:
  - consult on refreshing the National Marine Plan and improve the protection given to Priority Marine Features outside Marine Protected Areas
  - create a research programme on blue carbon and evaluate options to create a deep sea national marine reserve
  - create a research programme on blue carbon and evaluate options to create a deep sea national marine reserve
  - develop a dolphin and porpoise conservation strategy to maintain the species in favourable conservation status
  - host an international conference to discuss improving our marine environment and protecting our wildlife, focusing on marine plastics
  - commit £500,000 to begin to address litter sinks around the coast and to develop policy to address marine plastics, which will involve working with community groups

Priority Projects	Relevance	Status
PP12 – Increase environmental status of our seas	10% of Scotland's seas to be incorporated in nature conservation Marine Protected Areas.	

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AICHI TARGET 7 – SUSTAINABLE AGRICULTURE, AQUACULTURE AND FORESTRY

By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

Agriculture, aquaculture and forestry are important industries in Scotland. Considerable progress has been made in developing policies and strategies that will help achieve and support sustainability targets by 2020.

Agriculture, aquaculture and forestry are widespread land uses throughout Scotland. The Land Use Strategy for Scotland provides policies, proposals and a set of working principles which can be used to underpin decision making across all land use types, enabling well integrated, sustainable land use delivering multiple benefits for all in society.[1] Although primarily focussed on food and fibre production, farmland includes some of Scotland's most biodiverse areas. Aquaculture can be broadly split by marine and freshwater.[2] Marine aquaculture is largely sited along the west coast and Northern Isles where conditions are typically more favourable. Freshwater aquaculture shows a more widespread distribution across Scotland.

Sustainability Certification Schemes

Woodland

All woodlands owned and managed by Forestry Commission Scotland meet the UK Woodland Assurance Standard (UKWAS).[3] The UKWAS Steering Group works closely with the internationally recognised certification schemes Forest Stewardship Council (FSC) and Programme for the Endorsement of Forest Certification (PEFC) in the UK to ensure continued alignment of the UKWAS standard with their scheme requirements. In 2007 the working arrangements were formalised by the means of Concordats between the UKWAS Steering Group and FSC UK and PEFC UK setting out each party's respective role.[4] In addition to this timber and wood suppliers are encouraged to only use and promote products coming from FSC (or equivalent) sources.

Aquaculture

Alongside the existing sustainability drivers through the consent process, accreditation schemes that promote sustainable practices and are used currently by industry include the Aquaculture Sustainability Council (ASC), the Soil Association Organic Certification Scheme and the Marine Stewardship Council (MSC) certification scheme[5] .

Agriculture

Certification exists for some organic farms in Scotland. The Soil Association has an Organic Certification Scheme which encourages farmers to meet a set of standards.[6] In addition farms in receipt of the Single Farm Payment Subsidy must meet Cross Compliance Measures, though the degree that this meets with sustainable management for conservation of biodiversity is not currently known.

High Nature Value Farming and Forestry

High Nature Value (HNV) farming and forestry has been mapped for Scotland. This provides an indication of important areas for biodiversity. These are reported as an Official Statistic for Scotland. The findings show that the total area under HNV farming was

estimated at 2,432,000 hectares (44% of the utilised agricultural area). The Highlands made up the largest area for HNV farming. The area of woodland determined to be of HNV status was estimated to be 575,000 hectares.[7]

Fertilizer Use

Fertilizer use in Scotland has declined overall since 1986, and in particular from around 2000 suggesting improved agricultural practices. Fertilisers contain nutrients, such as nitrogen, phosphorus and potassium, which improve plant growth and crop yields. However, the inappropriate or mistimed use of fertilisers may cause nutrient enrichment and eutrophication of waters. The application rate of nitrogen fell from 127 kg/ha in 2001 to 89 kg/ha in 2015 and the application rate of potash fell from 49 kg/ha to 34 kg/ha over the same period. The phosphate application rate remained relatively stable at around 45 kg/ha until 1997, before declining steadily to 27 kg/ha in 2015.[8] The final version of this report will also include a review of pesticide use.

Breeding Birds

The Official Statistic for Terrestrial Breeding Birds provides a high level measure on biodiversity trends for Scotland. As of 2015 the trend of breeding woodland birds has increased significantly by 68% since 1994. Farmland birds have increased by 22%. Upland birds, in contrast declined by 14%.

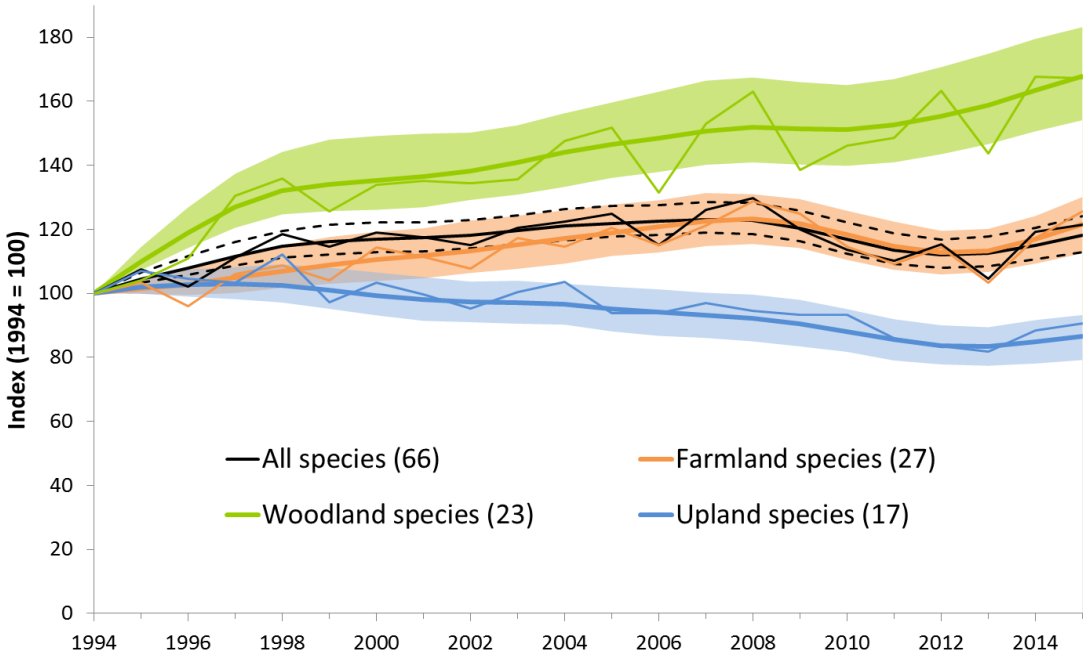

Figure 7.1 Trend in the Terrestrial Breeding Bird Index for Scotland: Source SNH Official Statistic 2017.[9]

Policies, Strategies and Industry Initiatives

A report by Marine Scotland[10] highlighted the benefits of aquaculture to Scotland. The report discussed the impacts of aquaculture production on the seabed and disease levels, and also considered climate and carbon footprint measures. At a local level, improvements are being made to reduce the impact of salmon farming.[11] Salmon farming requires harvest of some

lower trophic level fish from various parts of the world to manufacture aquafeeds, however, the composition of salmon feed today is dominated by protein and oil from plants rather than fishmeal and fish oil from forage fisheries. Work is ongoing to ensure the sustainable management of these fisheries, including the Peruvian anchoveta.[12] Reducing the 'export' of negative biodiversity impacts is seen as an important issue at both a Scottish and a European level.[13] In livestock farming, approximately 20% of the feed materials used in the UK are imported from outside the EU, principally soya beans and maize from North and South America.[14]

Scotland's National Marine Plan (NMP)[15] lays out Scotland's objectives and policies for aquaculture. The NMP sets targets to grow marine finfish and farmed shellfish by 2020 with due regard to the marine environment. Alongside existing regulatory controls including Environmental Impact Assessment, the NMP provides a framework which aims to minimise and mitigate the environmental impacts of developments through, among other things, appropriate siting of farms in relation to protected species and wider biodiversity interests.

Scotland has a legislative and regulatory framework in place that seeks to balance aquaculture growth and protecting the environment on which the sector depends. Marine and freshwater fish farms (both shellfish and fin fish) are authorised by local authorities who will give regard to the National Marine Plan (NMP) when considering applications. Prior to determining an application, the local authority will conduct a detailed assessment of the potential impacts of the proposal on the environment, including marine protected areas, and will seek advice from statutory consultees (including SEPA, SNH, the local district salmon fishery board and Marine Scotland).

Agriculture and forestry have sustainable management strategies in place, however the links between how these ensure the conservation of biodiversity is not explicitly made within the strategies.
The recently published Pollinator Strategy[16] contains further measures that will help towards meeting sustainability goals in agriculture. This includes supporting mechanisms that increase the diversification of flower-rich, and other pollinator-friendly habitats across farmland, the countryside and urban areas.

Priority Projects	Relevance	Status
PP2 – Restoration of native woodlands	Increase the amount of native woodland in good condition (upwards from 46% as identified by the *Native Woodland Survey of Scotland)*. 3,000 to 5,000 ha new native woodland creation per year. Restore approximately 10,000 ha of native woodland into satisfactory condition in partnership with private woodland owners through Deer Management Plans.	
PP4 – Investment in natural capital	Businesses are more aware of their reliance on Scotland's natural capital, and more investment is being made in building natural capital..	
PP11 – Sustainable land management	Promotion of measures to support biodiversity under CAP: sites demonstrating good practice aimed at supporting wildlife.	

AICHI TARGET 7 – SUSTAINABLE AGRICULTURE, AQUACULTURE AND FORESTRY

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14 https://www.food.gov.uk/business-industry/farmingfood/animalfeed/what-farm-animals-eat
15 http://www.gov.scot/Publications/2015/03/6517
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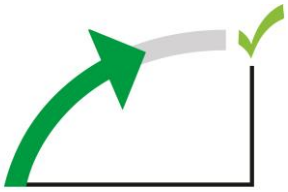
AICHI TARGET 8 – POLLUTION REDUCED

By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

Improvements to air and water quality over recent decades, brought about by reduced pollution, have led to marked improvements in their status. However, much work remains to be done, with more challenging measures required to control air pollution and diffuse pollution, control marine litter, and better quantify the effects of pollution on Scotland's biodiversity and ecosystems.



Our seas, freshwater, air, and soil are affected by pollutants. These include sulphurous oxides, nitrogen (oxides and ammonia), carbon oxides, phosphates, ozone, metals, halogens, volatile organic compounds, radioactive compounds, persistent organic pollutants, litter, organic matter, noise and light. Excess nutrients cause acidification and eutrophication of soils and waters resulting in the loss of biodiversity and effects on ecosystem functioning (such as primary production and decomposition); [1,2,3] they can cause excessive growth of aquatic algal mats that smother other organisms and remove oxygen from the water[4] creating "dead-zones".[5] Pollutants may be toxic to organisms and some persistent pollutants can accumulate in their bodies affecting normal functioning or can cause harm to wildlife by entanglement (e.g. discarded fishing equipment) or ingestion (e.g. plastic litter, microplastic beads). Pollutants can come from fertiliser and pesticide use, industrial emissions, urban development, animal and human waste, or natural events such as volcanic eruptions (atmospheric pollution as gases or particulates), and transport.

Trends in Pollution and Biodiversity

Over the last 20-25 years in Scotland, air pollutant emissions have declined,[6] bathing water quality has fluctuated and improved,[7] river water quality has improved but in the short term has fluctuated [8] and freshwater macroinvertebrate diversity in Scottish rivers has increased.[9] However, ground level ozone has fluctuated but frequently exceeds the Air Quality Strategy threshold.[10] The seas around Scotland are generally clean with mainly stable trends for e.g. eutrophication and algal toxins.[11] Across the UK, hazardous substances input to the marine environment has declined.[12] Habitats particularly sensitive to acidification and eutrophication cover 60% and 55% respectively of Scotland's land area and reducing the exposed area is beneficial to healthy ecosystems. For those sensitive habitats, the area that exceeded critical loads (Figure 8.1) of acidification fell from 68% to 31% between 1995-1997 and 2013-2015. Similarly, the area that exceeded the critical load for nutrient nitrogen in the

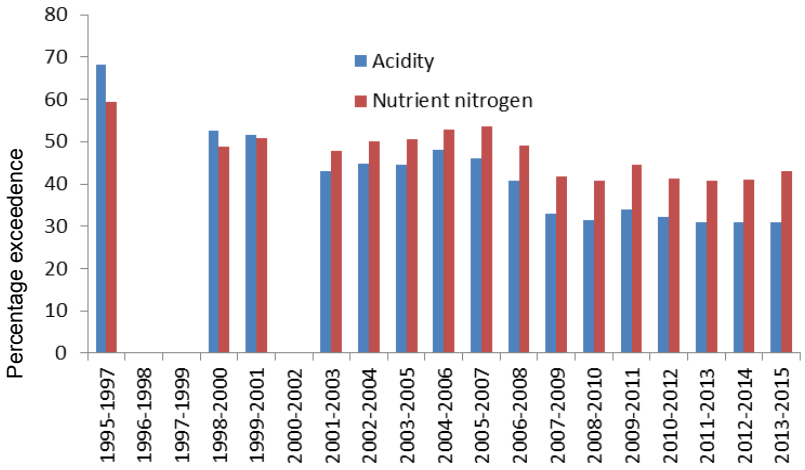


Figure 8.1 Sensitive Habitats Exceeding Critical Loads for Acidification and Eutrophication: 1995-1997 to 2013-2015. (Source: Scottish Government)[12]

same period fell from 59% to 43%.[12, 13] Nitrate Vulnerable Zones have been designated, covering 14% of Scotland's land area, where nitrate water pollution from agricultural sources is reduced through mandatory rules on farming practices.[14] The percentage of riverine sites with mean nitrate concentrations at natural background level (< 0.3 mg N/l) has increased from 25% in 2000 to 33% in 2013, and less than 3% have levels above 7.5 mg/l (down from 7% in 2000).

Other chemicals can impact on our biodiversity, including heavy metals like lead, cadmium and mercury, and complex organic compounds. The UK's pollinators, which play an important role in healthy functioning of the ecosystem, are in decline.[15] Scotland's Pollinator Strategy[16] says that pesticides such as neonicotinoids, in addition to habitat loss, climate change and disease are all likely pressures on these species. We require quantitative evidence on the degree to which pollinators are exposed (including likely pathways to exposure) and impacted by pesticides in Scotland.[16]

Pollution control

Pollution control measures have been put in place across Scotland *via* Acts of Parliament (UK and Scottish parliaments), and through associated regulations, including measures to regulate sludge disposal to land, waste management, water environment and industrial emissions.[17] EU Directives[18] including Water Framework Directive, Air Quality Directive, and Marine Strategy Framework Directive (MSFD)[19] require the assessment of the state of the environment. SEPA has guidance on pollution control mechanisms and regulations by industry *via* the Pollution Prevention and Control Regulations,[20] and also water regulations and licencing for controlled activities in our water environments.[21] Diffuse pollution is increasingly being controlled and regulated using Sustainable Drainage Systems (SuDS) in the urban environment, and General Binding Rules in the rural environment.[22] SEPA continues to work on its Diffuse Pollution Management Advisory Group implementation plan which includes prioritisation of fourteen catchments.[23] The Scottish Government have a Marine Litter Strategy for Scotland that "seeks to maximise opportunities and minimise threats in addressing the levels of litter"[24] in conjunction with the MSFD.

Work has been carried out on some protected sites impacted by pollution e.g. many loch sites require focus on chronic increases in nutrient export, and nutrient and slurry management.[25] The Route Map to 2020 contains a priority project on the restoration of freshwaters which includes: the Pearls in Peril LIFE project, including reducing diffuse pollution;[26] developing and implementing two river basin management plans;[27] and, plans to carry out work on measures for priority catchments for diffuse pollution to deliver biodiversity benefits.[28] The ENTRUST Landfill Community Fund in Scotland closed in 201529 and EU funding mechanisms such as LIFE currently support projects investigating biodiversity and pollution.[21]

Reporting Measures

In the air, freshwater and marine environments, Scotland collects and collates information underpinning reporting for EU Directives including information from the Air Quality Strategy, River Basin Management Plans, and the Marine Atlas. Although the Scottish Soil Monitoring Action Plan[26] and Scottish Soil Framework[27] describe pressures and measures to safeguard ecosystem health from e.g. acid critical load exceedance,[2] there is currently no EU Directive for soil,"... soil is not subject to a comprehensive and coherent set of rules in the Union".[28]

Scotland is making steady progress in decreasing pollution, with better integration of pollution control measures in incentives such as the Scottish Rural Development Programme

AICHI TARGET 8 – POLLUTION REDUCED

(SRDP) Agri-Environment Climate Scheme [33] and Greening guidance under the CAP Basic Payment Scheme.[34] More could be done on quantifying the effect of pollution on biodiversity and ecosystem function (e.g. pollinators) and also control of pollutants with particular regard to air pollution, diffuse pollution, and marine litter.

Priority Projects	Relevance	Status
PP3 – Restoration of fresh waters	Achieve agreed ecological water quality objectives under the Water Framework Directive of river and lake water bodies and to contribute to meeting conservation objectives (including Natura 2000 sites) through scoping improvements to physical modifications.	
PP11 – Sustainable land management	Promotion of measures to support biodiversity under CAP: sites demonstrating good practice aimed at supporting wildlife.	

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AICHI TARGET 9 – INVASIVE ALIEN SPECIES PREVENTED AND CONTROLLED

By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

Action to control the most problematic non-native invasive species is underway and new information systems are being developed to inform rapid response. However, the spread of invasive non-native species and their impacts on biodiversity is a present and growing threat.

More than 3,000 non-native species are recorded in Great Britain; of which 234 established species have a negative impact on biodiversity.[1] Among the 1,161 non-native species known to be established in Scotland, 183 (16%) have negative ecological impacts. The majority of invasive non-native species (INNS) are higher plants.

Information on INNS is collated by the GB Non-Native Species Secretariat through a partnership process involving many national experts.[2] Data on the recorded occurrence of species are available *via* the National Biodiversity Network (NBN) Atlas.[3] A priority list of 29 species has been developed.[4]

Distribution of INNS

The greatest number of INNS occurs in woodland and in urban habitats (Table 9.1). The UK National Ecosystem Assessment[5] shows continuing impact in semi-natural grasslands and moorlands, mountain and heaths. Elsewhere, in other habitats, the number of INNS and therefore their potential impact upon the habitats is increasing.

The Native Woodland Survey of Scotland cites INNS as a serious potential threat to the biodiversity of native and ancient woods. Nineteen percent of all native woodland polygons in Scotland contained INNS; lowland mixed deciduous and upland oak woodlands showed the highest recorded frequency both with 30% of all polygons affected. Rhododendron was recorded in 1.2% of the total woodland area.[6]

Impacts from INNS and their cost vary from species to species. Remedial action is prioritised on the basis of risk, as assessed by the Non-Native Risk Analysis Panel (NNRAP),[7] through an expert assessment and peer review. The socio-economic impacts of INNS are greatest in urban areas and intensively managed agricultural habitats. Weeds, and damage to crops and stored food by pests have greatest economic impacts. The rabbit is ranked as the most costly INNS, with an estimated annual cost of £96 million per annum in Scotland.[8] Japanese

Table 9.1 Distribution of established INNS by EUNIS habitat[1]

EUNIS Habitat	No species
Marine	12
Coastal habitats	25
Grasslands etc.	23
Heathland, hedgerow & scrub	13
Inland surface water	24
Mires, bogs and fens	11
Woodland and forest	30
Inland unveg. sparsely veg.	17
Urban habitats	30
Total (some species occupy more than one habitat)	**183**

knotweed costs around £4.4 million per annum, mainly in urban areas. The total annual cost of INNS to Scotland's economy in 2010 was estimated to be £245 million.[9]

The most effective way of managing INNS is by prevention, early detection and understanding distribution routes. The GB Non-native species secretariat currently has six species on high alert[10] as part of a rapid response protocol. A spatial application to track the change of occurrence in the number of known INNS is currently under development (Figure 9.1) and this will be used to focus and direct management.

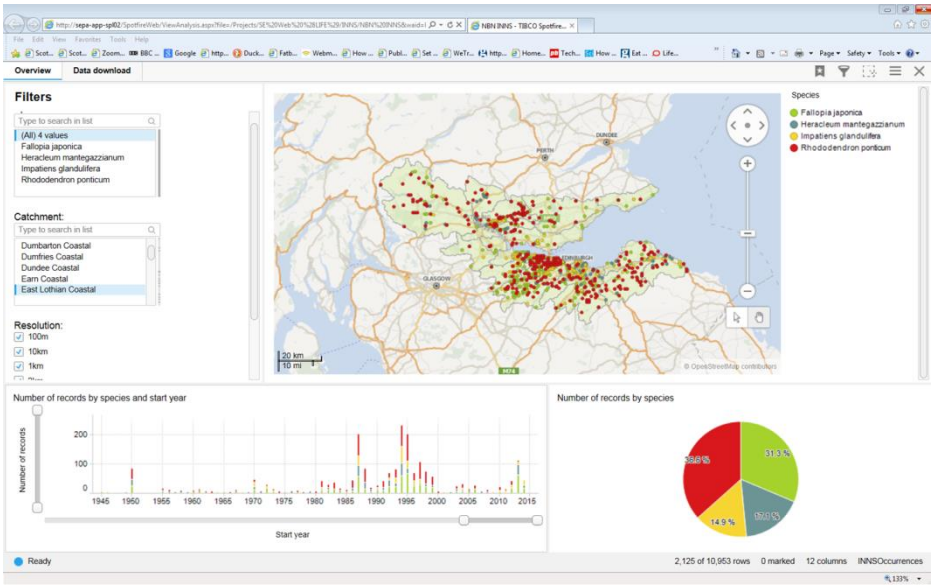
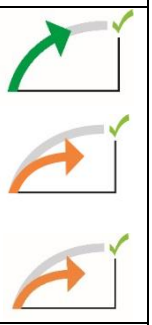


Figure 9.1 Invasive Non-Native Species on Scotland's Environment Web showing individual records, date record and number of records by species

Priority Projects	Relevance	Status
PP2 – Restoration of native woodlands	Increase the amount of native woodland in good condition (upwards from 46% as identified by the *Native Woodland Survey of Scotland)*. 3,000 to 5,000 ha new native woodland creation per year. Restore approximately 10,000 ha of native woodland into satisfactory condition in partnership with private woodland owners through Deer Management Plans.	
PP3 – Restoration of fresh waters	Achieve agreed ecological water quality objectives under the Water Framework Directive of river and lake water bodies and to contribute to meeting conservation objectives (including Natura 2000 sites) through scoping improvements to physical modifications.	
PP9 – Conservation of priority species	Deliver focussed action for priority species in Scotland.	
PP10 – Improving ecological connection	Improve connectivity between habitats and ecosystems	

AICHI TARGET 9 – INVASIVE ALIEN SPECIES PREVENTED AND CONTROLLED

References end notes

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7 http://www.nonnativespecies.org/index.cfm?pageid=51

8 CABI, 2010. The Economic Costs of Invasive Non-Native Species on Great Britain.

9 https://secure.fera.defra.gov.uk/nonnativespecies/downloadDocument.cfm?id=488

10 http://www.nonnativespecies.org/alerts/index.cfm

AICHI TARGET 10 – ECOSYSTEMS VULNERABLE TO CLIMATE CHANGE

By 2015, the multiple anthropogenic pressures on coral reefs, and other ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and function.

In Scotland terrestrial ecosystems vulnerable to climate change include uplands, peatlands and oak woodland. Coastal habitats such as machair and saltmarsh as well as intertidal habitats are particularly vulnerable to sea-level rise and increased air and water temperature. Many marine habitats and species such as cold water corals, maerl beds, serpulid reefs, horse mussel and flame shell beds are considered vulnerable to various factors such as temperature increase and ocean acidification. Steps are being taken to identify pressures and to make ecosystems more resilient through protecting sites, voluntary codes and enacting legislation.

Ecosystems on land

Changes in the nature and pattern of precipitation and rising temperatures will affect most, if not all, of our upland and peatland habitats to some degree. Peatlands (raised bogs, blanket bogs and fens) rely on a persistently shallow water table to maintain their species composition and function. Higher temperatures, particularly combined with dry periods, will promote deeper water tables. Occasional drying events will have little lasting effect, but if regular, or frequent, then changes in floristic composition are likely and the habitat may be more prone to wildfire damage. The capacity of these habitats to provide the same level of base-flow to neighbouring streams and rivers would also be diminished, as well as their ability to capture carbon.

Conversely, any increase in storm events with intense rainfall, particularly if following periods of relative drought, would be likely to increase the frequency of peatslides, resulting not only in loss and damage to peatland habitats, but potentially to property and other assets, including livestock, and any receiving water environment.

Dwarf shrub heaths, moss heaths and possibly to a lesser extent, grasslands in the uplands are also susceptible to change with a changing climate, again directly or indirectly. Climate warming is likely to reduce the frequency of snow fall and the duration of snow-lie. This will have most effect on assemblages of highly specialised species such as occur in 'snow beds'. However, it will also affect the relative growth rates of species differently, resulting in changes to habitat structure and composition. This may in turn influence management and management objectives.

Long-term surveys of vegetation in Scotland conducted by the James Hutton Institute (Birse & Robertson data set and the McVean & Ratcliffe data set) have revealed relationships between changes in drivers and changes in vegetation over the last *c*.40 years. One common finding throughout the studies has been the homogenisation of vegetation over time, with species richness increasing as a result of common species increasing and specialist species declining [1,2,3]). In the North-West Highlands species with an oceanic distribution increased at the expense of those with an arctic-montane distribution. Changes are consistent with the predicted impacts of climate change and acidification.[3]

AICHI TARGET 10 – ECOSYSTEMS VULNERABLE TO CLIMATE CHANGE

Additional Pressures on vulnerable ecosystems

Herbivore impacts over several centuries, particularly by deer and sheep, and diffuse pollution are key additional pressures. Changes in herbivore impacts are affecting upland and peatland habitats in ways which are not yet fully clear. Numbers of domestic livestock have generally declined in recent years. However, it has not been a simple, proportional decline. In some places, they have been removed entirely. Deer numbers are believed to have increased, their browsing altering the composition of woodland, particularly oak woodland, by eating more palatable species and leaving behind birch and alder.[4] In some areas, focussed management has taken place to reduce numbers, which in turn has allowed vegetation recovery to occur[5]. A decline in herbivore pressure may be beneficial to upland habitats, especially vulnerable habitats such as montane willow scrub.

Changing patterns of grazing management influence associated land management. Muirburn is an important tool capable of creating and maintaining high conservation value in plant, invertebrate and bird communities, though if badly managed it can lead to severe habitat damage, soil erosion and lowering of water-tables.[6] A best practice approach to muirburn has been developed between land-owners, NGOs and the Scottish Government in the Muirburn Code.[7]

Diffuse pollution mainly comes from burning fossil fuels and may result in nitrogen deposition in sensitive areas. Nitrogen is the limiting nutrient for plant growth in many ecosystems. Many plants in Scotland are adapted to nutrient-poor conditions, and can only survive or compete successfully on soils with low nitrogen availability. High nitrogen deposition leads to changes in vegetation composition and vegetation structure.

Development pressure, particularly wind farm construction, which is itself an important means of mitigating climate change, is also increasing, resulting in local loss and fragmentation of, and damage to, habitats. This is more amenable to influence and control than changes in herbivore densities, but the need to achieve renewables targets is clear.

Marine and coastal ecosystems

In the marine environment, all ecosystems are potentially vulnerable to climate change and ocean acidification acting alone or in combination. In the shorter term, it is probably habitats and species of more shallow water and intertidal zones that are most vulnerable to a whole range of factors including sea surface temperature changes, sea-level rise, changing salinity, changes in storm patterns, etc. Scotland sits at a boundary between southern and northern influences and consequently we are therefore most likely to see changes in those species that are already near or at the extremity of their ranges, either resulting in their range extending if they are southern species or their range receding if they are northern species. The species affected range throughout the food chain from particular plankton species (e.g. *Calanus* spp.), to various invertebrates and fish, birds such as kittiwake[8], and cetaceans. In terms of ocean acidification, it was originally believed the main threat was to those species with calcareous skeletons, and whilst this remains true it is becoming clearer that other species may also be adversely affected, especially during their developmental stages. At the same time it is likely that some species of seagrass and algae will benefit from the higher levels of carbon dioxide in the water.

A number of Priority Marine Features have been identified in Scotland's seas (Priority Marine Features[9]). These include the cold-water coral reef (*Lophelia pertusa*) and coral gardens. Whilst cold-water coral reefs are not susceptible to bleaching events they are vulnerable to

the effects of ocean acidification, and there is a growing body of evidence showing a possible weakening of the reefs may occur, leading to their ultimate collapse. [1011]

In Scotland, it likely that the low-lying west-facing coasts may be first affected, including our internationally recognised machair and important saline lagoons and saltmarsh. Machair is especially vulnerable to the impacts from increased storminess and flooding from changed rainfall patterns whilst saltmarsh and saline lagoons are threatened by sea-level rise. The marine and coastal environment also offers many ecosystem services that will be compromised by climate change. For example with ocean acidification many blue carbon stores in the form of calcium carbonate deposits will be more vulnerable, and increased turbidity and storminess may reduce kelp forest extent and thus the coastal protection they provide to low lying soft sediment coasts. Other industries such as aquaculture and fisheries will also be affected by changing conditions, and distribution of target species. Increased development of marine and coastal renewable energy generation, whilst helping to reduce Scotland's climate impacts, has been predicted to have an adverse effect on some species, particularly those that are long-lived.[12]

The Marine Strategy Framework Directive (MSFD)[13] aims to ensure sustainable use of marine waters in order to achieve Good Environmental Status (GES). In the UK, a programme of measures is in place to help fulfil the requirements of the MSFD in achieving GES. In line with the UK Marine Policy Statement, the UK Government and Devolved Administrations have already put in place, and have committed to taking many measures that will improve the state of the UK's marine environment as part of ensuring sustainable development, most notably through the Marine and Coastal Access Act 2009, the Marine (Scotland) Act 2010 and the Marine Act (Northern Ireland) 2013. Equally, measures taken as a result of existing EU legislation, such as the Water Framework Directive (WFD), the Birds and Habitats Directives and the newly reformed Common Fisheries Policy (CFP), also contribute to improving the state of the UK's marine and coastal environments. These existing and planned measures form the core of our proposed Programme of Measures (DEFRA, 2015[14]). Marine Protected Areas (MPA) help support our marine environment. Developing a network of MPAs in Scotland is part of a wider strategy to achieve the Government's commitment to a "clean, healthy, safe, productive and biologically diverse marine and coastal environment that meets the long term needs of people and nature".[15]

Work underway

Scotland is amongst the world leaders in meeting climate change targets. There has been considerable investment in restoring peatland and the development of an extensive Marine Protected Area suite, as well as existing Special Areas of Conservation and Special Protection Areas further strengthen Scotland's commitment to helping reduce the effects of climate change on vulnerable habitats. Further work is needed to determine the implications of climate change for particular species and therefore what can be done to reduce the stresses on these species to help them cope with climate change. There is also much more that is needed to be done to identify effective networks of protected sites to enhance the opportunities for organisms to move and recruit successfully in the face of climate change. Ultimately, however, without reductions in greenhouse gas emissions, and in particular carbon dioxide conditions in the marine environment will continue to deteriorate.

AICHI TARGET 10 – ECOSYSTEMS VULNERABLE TO CLIMATE CHANGE

Priority Projects	Relevance	Status
PP1 – Restoration of peatlands	Ambitious peatland restoration programme underway, contributing to the EU 15% degraded ecosystem restoration target.	
PP2 – Restoration of native woodlands	Increase the amount of native woodland in good condition (upwards from 46% as identified by the *Native Woodland Survey of Scotland)*. 3,000 to 5,000 ha new native woodland creation per year. Restore approximately 10,000 ha of native woodland into satisfactory condition in partnership with private woodland owners through Deer Management Plans.	  
PP3 – Restoration of fresh waters	Achieve agreed ecological water quality objectives under the Water Framework Directive of river and lake water bodies and to contribute to meeting conservation objectives (including Natura 2000 sites) through scoping improvements to physical modifications.	
PP12 – Increase environmental status of our seas	10% of Scotland's seas to be incorporated in nature conservation Marine Protected Areas.	

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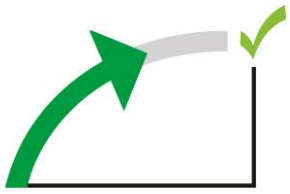
AICHI TARGET 11 – PROTECTED AREAS INCREASED AND IMPROVED

By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape.



Species, habitats and geology of national and international importance in Scotland are safeguarded in a suite of protected areas, contributing to halting biodiversity loss. By August 2017 some 23% of terrestrial and inland water areas and 18% of marine areas had been brought under site protection, with over 80% of designated features in favourable (including recovering) condition. Although these percentages exceed the Aichi Target and meet the national target, more work is still required on management, representativeness, integration, and connectivity of sites.

Scotland's protected areas

Protected areas contribute to safeguarding Scotland's biodiversity and are a key component of the Scottish Biodiversity Strategy.[1] By August 2017 the extent of protected areas[2] in Scotland's total area was: Terrestrial and Inland waters = 22.7%; Marine = 17.6%. The UK indicator shows long-term increases in the extent of UK nationally and internationally important marine and terrestrial protected areas.[3] In March 2017, 80.3% of natural habitat, geological and species features were in favourable or recovering condition,[4] meeting the national target.[5] This is an improvement since 2007 (Figure 11.1). Scotland's Environment Web holds up-to-date information on the status of features on protected sites.[6]

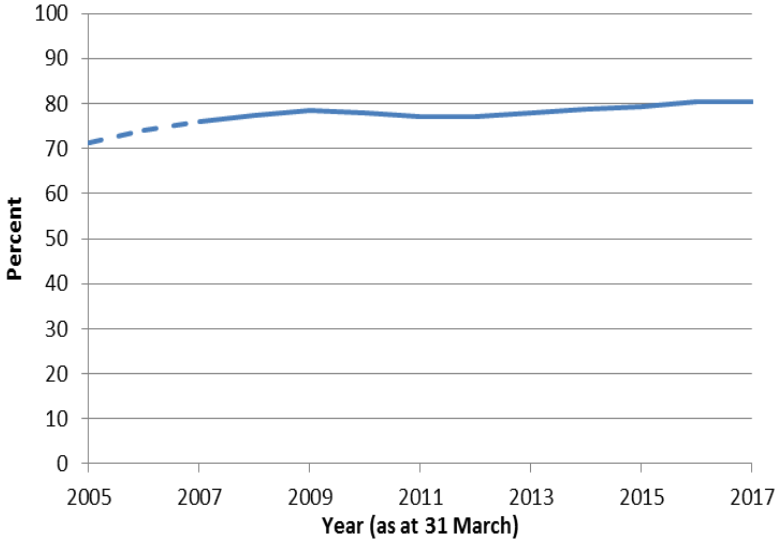


Figure 11.1 Percentage of natural features on protected nature sites found to be in favourable or recovering condition, as at 31 March, 2005, 2007-2017.[4]

Grassland and woodland habitats,[7] amphibians and reptiles, and marine mammals[8] have the greatest proportion of features in unfavourable condition. Marine and geological features, dragonflies and terrestrial mammals, have the greatest proportion of favourable features.

AICHI TARGET 11 – PROTECTED AREAS INCREASED AND IMPROVED

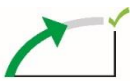
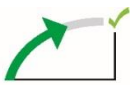
Representativeness, connectedness, and management

Scotland's SSSI, MPAs, SPAs and SACs are representative of their qualifying species and habitats, with consideration of important biodiversity areas, including Important Bird Areas, and Important Plant Areas.[9] The Scottish Protected Areas for Nature Review (PANR) looked at how the role and purpose of protected areas might be developed to better secure public benefits within the context of wider thinking on land use and ecosystem services.[10] The work is being taken forward as a Priority Project (PP9). Land use intensification has led to the isolation of some protected sites[10] making them less resilient to change or effective in protecting biodiversity.[1] A more ecologically coherent network in Scotland[1] could improve connectivity and reduce isolation of sites.[11] Connectivity of four key habitats (fen, marsh and swamp; heathland; semi-natural woodland; and semi-natural grassland), is reported through our Ecosystem Health Indicators.[12] The two most reported pressures on protected sites are invasive species (see target 9 for more detail) and over-grazing; pressures may be addressed by remedial management where possible.[13]

Ecosystem Services and Community Involvement

Guidance is available on how to apply an ecosystems approach to plans, policies and management of land.[14] By improving the condition of habitat features, we may also improve regulating ecosystem services (such as carbon sequestration by peatbogs)[15] within and beyond protected areas.[16] Some protected sites may deliver more in terms of regulating and cultural services than non-designated sites.[16] Scotland's Land Use Strategy objectives include: "Urban and rural communities better connected to the land, with more people enjoying the land and positively influencing land use",[17] with the PANR "suggesting exploring all opportunities to involve people in decisions about the establishment and management of protected areas".[10]

Biodiversity remains under threat[18] and protected areas alone may not be enough to safeguard biodiversity and ecosystem services.[19] We recognise the need to complement the protected areas approach with other measures that tackle pressures on biodiversity.

Priority Project	Relevance	Status
PP8 – Protected areas in good condition	Focus action on those sites that are in most need of effective conservation management Work towards improving the condition of protected sites in the longer term	
PP9 – Conservation of priority species	Deliver focussed action for priority species in Scotland.	
PP10 – Improving ecological connection	Improve connectivity between habitats and ecosystems.	
PP12 – Increase environmental status of our seas	Complete the suite of Marine Protected Areas and Natura sites	

AICHI TARGET 11 – PROTECTED AREAS INCREASED AND IMPROVED

References end notes

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AICHI TARGET 12 – EXTINCTION PREVENTED

By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

In historical times, there has been only one case of a Scottish species going extinct worldwide: the great auk which went extinct in Scotland in 1840, and globally in 1844.[1] From a biological viewpoint, in many cases it is appropriate to look at extinction risk across the British Isles as a whole, as well as the Scottish context. The UK Indicator shows some evidence of a slowing in the rate of decline in abundance of the UK's priority species. There is a mixed picture from Scotland's species indicators: with seabirds, waders, upland birds, and specialist butterflies in decline; generalist butterflies, woodland birds, and geese are increasing. Further work is required to develop a Scotland priority species indicator, and improvement of the taxonomical breadth of our GB-Red Lists, and indicator suite.

GB Red Listed Threatened Species found in Scotland

The Alliance for Zero Extinction (which uses the 2004 Red List for species information) "aims to prevent extinctions by identifying and safeguarding key sites, each one of which is the last remaining refuge of one or more Endangered or Critically Endangered species", and lists no key sites in Scotland where a species extinction is imminent globally.[2] However, Scotland's species are under threat from climate change;[3] land-use change; recreational, agricultural and forestry practices; non-native species, pollution and disease; and over exploitation.[4] The Scottish Biodiversity List (SBL),[5] a statutory list that contains 2105 terrestrial and marine species deemed "important" by Scottish Ministers, includes:

- 441 (21%) classed as threatened, and 222 (11%) as near threatened in GB[6] (for those species with a GB-IUCN Red List assessment);
- 70 of these threatened species are classed in the SBL as being in decline; and
- 70 endemic terrestrial species, sub species or races on the SBL with 34 endemic species being threatened; 24 of these endemic, threatened species are rare in Scotland making them of particular risk of extinction.

Indicators and Conservation

Currently, there is no Scotland indicator for threatened species. However, the UK indicator for priority species, based on country lists such as the SBL, shows that since 1970 there were significant long term (1970-2015) declines in the abundance (birds; butterflies; mammals; and moths, Figure 12.1)[7], by 68%. Many of these species were prioritised because they were already in decline.[8] The UK species abundance bar chart in Figure 12.1 shows that in the long term, there are 73% of species in decline, but 58% in the short term. A stable or significantly increasing index would provide a good indication that on average priority species are no longer in decline and therefore the UK are moving towards this Aichi target.[8]

A longer-term data set is needed to determine whether the rate of change of decline is reducing or stabilising. Analysis of Scotland only data underpinning both the abundance and the frequency indicators could provide a Scottish indicator of priority species. However, it should be noted that the priority indicators and bar charts include a broader list of species than those that are "threatened" and are not taxonomically representative. Our Scottish Biodiversity Strategy indicators show that the trends in some of

AICHI TARGET 12 – EXTINCTION PREVENTED

Scotland's species have been mixed: there is a long term stable trend for breeding birds, with evidence of a decline in upland birds and an increase in woodland birds;[9] our wintering waders and breeding seabirds show long term declines, however our wintering geese have benefitted from large, long term increases;[10,11] generalist butterflies show a long term increase, but specialist butterflies show a long term decrease, which has stabilised in the short term.[12] These changes may be due to factors including climate change, habitat loss, and factors affecting migratory species outside of Scotland. Only a limited range of species have appropriate data for analysis; even for well-studied taxa such as birds, data may be insufficient.

The proportion of species with a favourable conservation status on Scottish protected sites is 76.3%.[13] The five top reported pressures acting on those protected species features are (in decreasing order): recreation/disturbance, water management, invasive species, over-grazing, and "other" (including pressures such as climate change, air pollution, and wildlife crime).The 2013 UK Habitats Directive reporting showed that 42.5% of terrestrial Habitats Directive species (n=40) found in Scotland (on protected sites and the wider countryside) had an inadequate or bad UK overall assessment of Conservation Status conclusion. This takes into account a species range, population, habitat, and future prospects[14] with 10% being unknown.[15] The previous report[16] in 2007 showed 52.5% of the same 40 species found in Scotland having a bad or inadequate UK overall assessment of Conservation Status conclusion with 17.5% being unknown.

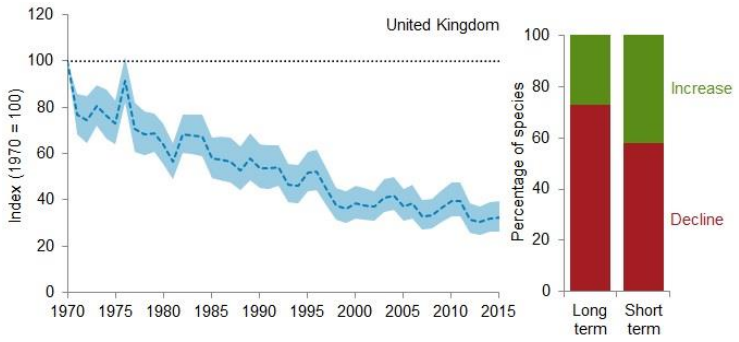


Figure 12.1 Changes in the relative abundance of priority species in the UK, 1970 to 2015.[6]

Notes:
1. Based on 215 species. The line graph shows the unsmoothed trend (dotted line) with its 95% confidence interval (shaded).
2. Bar chart shows the percentage of species increasing or declining over the long-term (1970 to 2015) and the short-term (2010 to 2015).
3. All species in the indicator are present on one or more of the country priority species lists (Natural Environmental and Rural Communities Act 2006 - Section 41 (England) and Section 42 (Wales), Northern Ireland Priority Species List, Scottish Biodiversity List).

There are opportunities in preventing species extinction including funding of biodiversity conservation *via* Scottish Rural Development Programme (SRDP), targeted projects,[17] and protected site management. SNH have collated a list of more than forty possible funders for Natural Heritage Projects.[18] SRDP is now targeted to those areas where greatest biodiversity benefit may be achieved,[19] we are continuing to carry out projects on priority species,[20,21] and effectively managing protected sites particularly through the Protected Sites for Nature Review.[22] The benefits that species deliver may be quantified in part through their contribution to healthy habitats; the Natural Capital Asset Index deteriorated historically from 1950s-1990s, followed by a stabilisation or slight improvement since 1990.[23] Constraints to prevent extinction would include: continued pressures such as disturbance, climate and land-use change, invasive non-natives species, pollution and land management. Long-term monitoring is essential and relies on funding for volunteer recruitment, training and data storage and mobilisation.[24] To address the data deficiency for rare, difficult to identify or cryptic species we may have to employ novel technologies[25] e.g. eDNA[26].

AICHI TARGET 12 – EXTINCTION PREVENTED

Issues, case studies, and knowledge gaps

Some SBL species are too rare and data deficient to assess their GB threat status e.g. *Euphrasia campbelliae*. There are large groups for which no assessments have yet been incorporated into the GB red lists.[27] The Scottish wildcat is one of Scotland's most endangered species and is currently in decline primarily through hybridisation with domestic cats. By 2019 SNH and Scottish Wildcat Conservation Action Group aim to have: secured five stable, wild populations; a better understanding of wildcat distribution, numbers, genetics and degree of hybridisation; and, raised local awareness of the threats to wildcats.[28] Recent surveys show that otter populations have largely recovered from historic lows.[29]

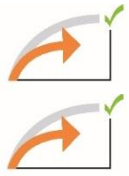
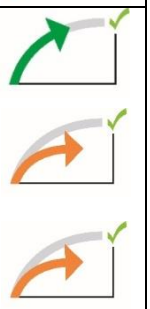
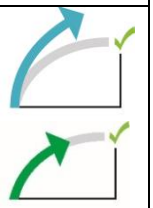
Scotland is internationally important for the richness of its non-vascular plant species, such as mosses and liverworts.[18] New information is still being discovered, such as the 2012 finding that northern prongwort (*Herbertus borealis*) is confined to one site globally, Beinn Eighe National Nature Reserve. This followed the identification using DNA analysis of a new liverwort, Viking prongwort, on Shetland and Norway.[30] The moss *Grimmia anodon*, an SBL species listed as being extinct in Scotland (based on GB-IUCN 2001 Red-list assessment), was re-found in 2005.[31] The new national plant monitoring scheme may help to improve our knowledge of trends, and thus the status of plants;[32] however, vascular plant diversity has declined in recent years.[33]

Several formerly locally extinct species have been successfully reintroduced under IUCN guidelines, including vendace, and white-tailed eagle. Capercaillie, reintroduced in the 1830s, has shown declines in recent years.[18] On-going work is being undertaken to conserve great yellow bumblebee,[34] freshwater pearl mussel, and red squirrels.[19] An action plan for hen harriers (Red listed) is currently on-going.[35] There is evidence of a UK wide decline in pollinator distributions[36]. The Pollinator Strategy for Scotland 2017-2027 sets out how Scotland can continue to be a place where pollinators thrive, along with actions that are needed to help achieve that objective[37].

Halting the decline in biodiversity and threat of extinction is a challenge to all countries across the globe. The global extinction of the great auk in the 1840s through overexploitation is a cautionary tale for highlighting human driven extinctions.[22] As the Indicators above show, there are some critical challenges to preventing extinction of Scotland's wildlife. Many of our most important groups of species are in decline such as seabirds, for which we hold internationally important numbers of some species; changes in sandeel availability are considered to be the most likely cause of declines in black legged kittiwakes, which may be affected by a combination of climate and fishing impacts.[11] It is only through concerted and coordinated action that we can halt declines in groups of species such as seabirds, waders, pollinators, upland birds and specialist butterflies, and tackle some of these cross border pressures such as global climate change, pollution and overexploitation.

In order to identify those species most in decline, we require better data and information on a Scotland scale on the rate of change and location of our highest priority species (e.g. to create a map of areas of most importance to our threatened species). This will allow us to assess the threat status of our species by improving the taxonomic spread of the GB-IUCN Red Lists. Much of our data are collected by volunteer recorders, so we have to ensure recording organisations are adequately funded and we continue to engage with citizen science initiatives.[38]

AICHI TARGET 12 – EXTINCTION PREVENTED

Priority Projects	Relevance	Status
PP1 – Restoration of peatlands	Peatland Action - store and sequestrate carbon through peatland management covering 5,100 ha. Flow Country Peatland Restoration - setting an international benchmark for good practice.	
PP2 – Restoration of native woodlands	Increase the amount of native woodland in good condition (upwards from 46% as identified by the *Native Woodland Survey of Scotland)*. 3,000 to 5,000 ha new native woodland creation per year. Restore approximately 10,000 ha of native woodland into satisfactory condition in partnership with private woodland owners through Deer Management Plans.	
PP3 – Restoration of freshwaters	Achieve agreed ecological water quality objectives under the Water Framework Directive of river and lake water bodies and to contribute to meeting conservation objectives (including Natura 2000 sites) through scoping improvements to physical modifications.	
PP8 – Protected areas in good condition	Focus action on those sites that are in most need of effective conservation management Work towards improving the condition of protected sites in the longer term	
PP9 – Conservation of priority species	Deliver focussed action for priority species in Scotland.	
PP11 – Sustainable land management	Promotion of measures to support biodiversity under CAP: sites demonstrating good practice aimed at supporting wildlife.	
PP12 – Increase environmental status of our seas	10% of Scotland's seas to be incorporated in nature conservation Marine Protected Areas.	

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AICHI TARGET 13 – GENETIC DIVERSITY MAINTAINED

By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

There is no universally agreed metric of how genetic diversity should be measured and the subject itself is complex. Scotland is at the forefront of developing such metrics and is also a partner in UK-wide work to safeguard genetic diversity. Comprehensive reporting on Target 13 involves addressing several knowledge gaps/issues. Despite the progress on plant health and on individual species, such as the Scottish wildcat, until these gaps are understood, it would be premature to say we are on target.

Crop Plants

The botanical element of this target overlaps with Target 9 of the Global Strategy for Plant Conservation,[1] reporting for which is coordinated by Plant Link. Most reporting to date has been undertaken at a UK level. The UK Biodiversity indicator for plant genetic resources[2] reports on the genetic diversity of cultivated plants held in UK germplasm collections. The trend shows an increase in the numbers of accessions and is a measure of *ex situ* conservation of cultivated plants using methodology developed by the United Nations Food and Agriculture Organisation. The Millennium Seed Bank Project made the largest contribution to accessions since 2000 and, by 2014, accounted for just over 10% of the world's seed-bearing species. The Project aims to collect and store 25% of the world's flora by 2020, including all of those from the UK.

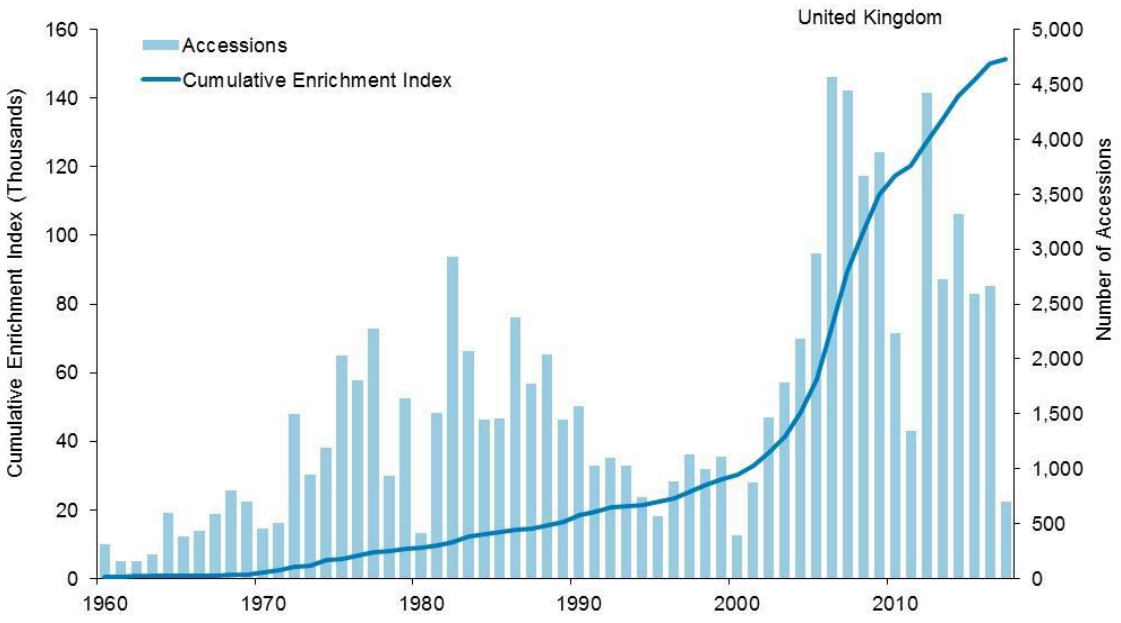


Figure 13.1 Number of flowering plant accessions added per year at UK holding institutes. (Source: EURISCO via JNCC UK biodiversity indicator C9b). The Cumulative Enrichment Index is a proxy measure of genetic diversity based on the number of species collected; the number of accessions collected; the number of countries collected from; and the area from which collection took place.

AICHI TARGET 13 – GENETIC DIVERSITY MAINTAINED

Fielder *et al*. (2016)[3] produced an inventory of 120 crop wild relatives in Scotland and have identified sites for their *in situ* conservation. Their paper provides a valuable assessment of the status of Crop Wild Relatives (CWR) in Scotland. The (draft) Scottish national inventory of priority CWR contains 102 species and 18 subspecies, approximately 10% of the 1259 CWR taxa present in Scotland. *Ex situ* accessions for only 11 of the priority CWR are available. Of the 40 accessions for Scottish priority CWR stored in gene banks, 23 are stored at the Genetic Resources Unit, IBERS at Aberystwyth University and the remaining 17 are stored at the Millennium Seed Bank, Kew.

The Scottish study found that approximately one third of priority CWR occurrence records are located within nature conservation sites. It was noted that although the Millennium Seed Bank, Kew aims to collect and store accessions for all native plants in the UK, the collection does not necessarily address populations across the UK. As a result accessions might be available for a species occurring in Scotland, but collected from another part of the UK. The report concludes that "conservation of priority CWR in Scotland is incomplete" and that accessions should be collected from all (120) priority CWR from Scotland.

Landraces are crops that have been traditionally grown without formal improvement and can have genetic, heritage and socioeconomic value. Science and Advice for Scottish Agriculture (SASA) holds collections of seven Scottish landraces,[4] most of which are from the North and Western Islands. The Scottish Landrace Protection Scheme has been set up to help identify and protect additional landraces as part of Scottish Government's commitment to conserve plant genetic resources.

Domesticated Mammals

The Rare Breeds Survival Trust compiles an annual watchlist of native breeds, based on the numbers of breeding females in the UK. Data are derived from over 130 breed societies.[5]

Table 13.1 Status of native domesticated mammals considered to be at risk 2015 – total numbers in each category for the UK and named breeds from Scotland

	Equine		**Cattle**		**Sheep**		**Goats**		**Pigs**	
Category	Scotland	UK	Scotland	UK	Scotland	UK	Scotland	UK	Scotland	UK
Critical	Eriskay	5	-	4	-	0	-	0	-	0
Endangered	-	2	Native Aberdeen Angus	2	-	1	-	1	-	0
Vulnerable	Clydesdale	1	-	2	Castlemilk moorit North Ronaldsay	7	-	0	-	6
At risk	Highland	3	Shetland	3	Soay	10	-	0	-	4
Minority	-	1	-	3	-	7	-	1	-	1

Other Scottish breeds are not of concern. SRDP has an option to encourage the farming of traditional or native cattle breeds on small units.[6] The UK indicator[7] tracks numbers of critically endangered breeds from 2000.

AICHI TARGET 13 – GENETIC DIVERSITY MAINTAINED

Wild Deer

There are two native wild species of deer in Scotland – red and roe – and two non-native wild species – sika and fallow.[8] Along with muntjac deer, another non-native species present in the UK, their distribution is mapped as one of the *Wild Deer a National Approach* indicators.[9] Past management practices of introducing non-native deer to improve shooting 'trophy' size has called into question the genetic make-up of Scotland's deer; however studies have shown this has had a limited impact especially in the Highlands.[10] Hybridization studies between the non-native sika and red deer have shown this not to be common.[11]

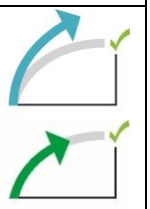
Issues and Knowledge Gaps

Comprehensive reporting on Target 13 involves addressing several knowledge gaps/issues. Firstly there is no universally agreed metric of how genetic diversity should be measured[12]. Secondly, the conservation of genetic diversity is itself a multi-faceted topic,[13] encompassing maintenance of genetic diversity and evolutionary processes *in situ,* the preservation of genetic diversity in *ex situ* collections, and a different relative importance of emphasis on genetic purity for domesticated taxa (e.g. livestock breeds) versus maximising genetic diversity for wild species.[14] A third challenge is determining which taxa to assess in the first place: the target refers to cultivated plants, farmed and domesticated animals and their wild relatives, as well as other culturally valuable species (e.g. species which are important for socioeconomic or cultural reasons, but which are not further defined).

Approaches and metrics for livestock and crop wild relatives are relatively well developed [3, 15]. Progress on the conservation of forest genetic resources has not previously been reported at the Scottish/UK level, but strategies for forest genetic resource for conservation are well understood in the UK[16] and well established in other European countries.[17] The major knowledge gap relates to the 'other species of socioeconomic/cultural value'
To further progress Target 13 in Scotland, a working group has been established, coordinated by the SEFARI Gateway group.[18] The primary aim of this group has been to develop a model strategy for tackling Target 13 designed for use in Scotland but applicable elsewhere, and which accommodates both the heterogeneous nature of the target and the heterogeneity of data availability to assess against the target. A major focus has involved integrating 'other species of socioeconomic/cultural value' into reporting. Progress to date has involved:

- Developing criteria for taxon inclusion (conservation value, cultural importance, ecosystem service provision, food/medicinal value, game species) and establishing an initial priority set of 32 species
- Developing a framework utilising variable information sources to undertake genetic risk assessments (encompassing both direct measures of genetic diversity and inferences from demographic/environmental data)
- Defining the primary generic genetic risks to *in situ* populations (lack of regeneration/turnover restricting evolutionary adaptation, loss of genetic diversity due to population size reductions or fragmentation, 'genetic pollution' due to elevated inter or intra-specific hybridisation)[19]
- Developing a framework for assessing the degree to which *ex situ conservation* collections are representative of the genetic diversity of the focal taxa (e.g. spatial and/or environmental coverage of extant range)

AICHI TARGET 13 – GENETIC DIVERSITY MAINTAINED

Priority Projects	Relevance	Status
PP9 – Conservation of priority species	Publication and implementation of a Plant Health Strategy Wildcat action plan	
PP11 – Sustainable land management	Targeted support for sustainable land management	

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[18] SEFARI stands for the Scottish Environment, Food and Agriculture Research Institutes, a collective research organisations responsible for the delivery of the Scottish Government's Strategic Research Programme. The Target 13 project is coordinated by the Royal Botanic Edinburgh, with input from SERARI institutes (James Hutton Institute, Scotland's Rural College, Biomathematics and Statistics Scotland, Moredun Research Institute), as well as the University of Edinburgh, Scottish Natural Heritage, Centre for Ecology and Hydrology, Royal Botanic Gardens Kew and Plant Heritage.
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AICHI TARGET 14 – ECOSYSTEMS & SERVICES SAFEGUARDED

By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

Scotland has a variety of ecosystems which provide essential services for environmental, cultural, recreational and economic purposes. These include large rivers and lochs, woodlands along with an extensive coastline and marine area. The overall measure shows Scotland's natural capital deteriorated historically until the 1990s. Most habitat types were declining during this period, especially bogs and grassland. However, stocks have stabilised or slightly improved since 2000. Numerous policies, directives and legislation help us to safeguard these ecosystems. The biodiversity duty placed on all public sector bodies in Scotland further protects them. Clean drinking water is widely available with 99.91% of samples at point of use meeting EU Drinking Water Directive standards.

The ecosystems found in Scotland, with their rich environmental and biological structures, and their variability, reflect the combined geography of climate, geology, and soils in Scotland, as well as a long history of human land-use and management.

The Natural Capital Asset Index (NCAI) helps us assess a vital part of Scotland's prosperity. Scotland's natural capital assets are the basis for our quality of life, so it is crucial that they are protected or enhanced to benefit the current and the next generation of people living in our country. Scotland's Economic Strategy recognises that investment in natural capital is, "fundamental to a healthy and resilient economy".[1]

The overall NCAI measure shows Scotland's natural capital deteriorated historically until the 1990s. Most habitat types were declining during this period, especially bogs and grassland. However, stocks have stabilised or slightly improved since 2000. Individual ecosystems show a mixed picture – woodland; coastal; inland surface waters; and grassland show increasing trends whereas there are marked decreases for mires, bogs, fens; heathland; and agriculture & cultivated.

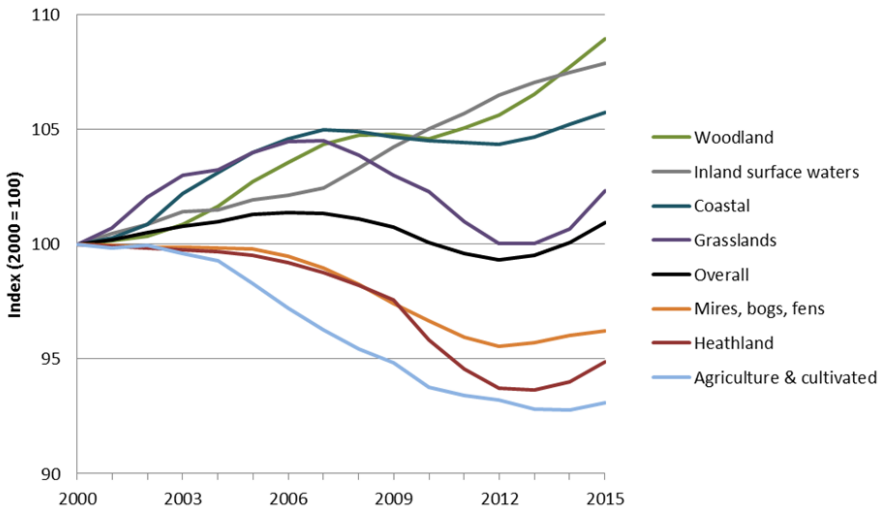

Figure 14.1 Scotland's Natural Capital Asset Index 2017.

AICHI TARGET 14 – ECOSYSTEMS & SERVICES SAFEGUARDED

Habitats in Scotland

Scottish Natural Heritage is developing a new, standardised, Habitat Map of Scotland, an objective of Scotland's 2020 Biodiversity Route Map. For the first time this brings together all useable habitat information for Scotland, classified to a common European standard. This provides a powerful tool for the management of our natural heritage. SNH will continue to update and refine the Habitat Map of Scotland to improve data resolution and so aid informed decision making.

Table. 14.1 EUNIS Level 1 habitats in Scotland mapped to mean low water spring.

EUNIS Level 1 Class	km^2	%
Heathland, scrub and tundra	20,001	25.0
Grasslands and lands dominated by forbs, mosses or lichens	18,874	23.6
Woodland, forest and other wooded land	14,245	17.8
Mires, bogs & fens	9,603	12.0
Regularly or recently cultivated agricultural, horticultural & domestic habitats	6,497	8.1
Constructed, industrial and other artificial habitats	3,345	4.2
Montane habitats	2,870	3.6
Inland surface waters	2,497	3.1
Marine habitats	1,171	1.5
Inland unvegetated or sparsely vegetated habitats	401	0.5
Coastal habitats	391	0.5
Habitat complexes	148	0.2
Total	**80,044**	**100**

Freshwater Ecosystems

Scotland has sizeable freshwater resources: 125,000 km of rivers, 27,000 lochs, over 198,000 ponds and 220 km of canals.[2]

Rivers, lochs, canals and ponds[3] cover about 2% of our land area. Together, they make up around 70% of the total surface area of freshwater, and contain 90% of the volume of freshwater in the UK.

We receive many benefits from freshwater ecosystems,[4] habitats and wildlife. Freshwater is used for drinking, irrigation, transport, fishing, recreation and food processing. Compliance with the standards set out in Scottish legislation and in the EU Drinking Water Directive in 2016 was 99.91%, demonstrating the continuing high quality of drinking water that consumers in Scotland receive. Standards have improved more or less continuously from levels of 99.14% in 2003. Microbial compliance in particular has improved [5] Clean water is a key ingredient in our greatest international export, whisky, which is responsible for over 13% of Scotland's exports by value.[6] Freshwater habitats can help control flooding, naturally treat or break down human and industrial waste, and support plant and animal life, including charismatic species like Atlantic salmon.[2]

Coastal and Marine Ecosystems

Scotland has around 19,000 km of coastline, which makes up 8% of Europe's coast (about 20% of the EU's coast). The area from the coast to our fishery limits (470,000 km^2) is around six times the size of the land area of Scotland. Scottish coastal and estuarine habitats are full of rich, diverse and fragile sea life that is under considerable pressure and shows signs of damage, but may be recovered through sustainable management. The main pressures come from fishing; aquaculture; litter; development; pollution; and non-native species.[7]

AICHI TARGET 14 – ECOSYSTEMS & SERVICES SAFEGUARDED

Land-based Ecosystems

Scotland's land is a fundamental asset. We grow food and timber on it; we build our houses and roads on it; much of our water filters through and is purified by it; it stores carbon and supports Scotland's range of habitats and species, some of which are internationally important.[8] Almost all of Scotland's land has been shaped by human activity, over many centuries.

By 2013, 17.8% of Scotland was covered by woodland – an increase from only 4.5% at the beginning of the 20th century.[7] As a result of human influence and climate change, no woodlands in Scotland can be considered truly natural. Likewise, most of the uplands have been modified through grazing, muir-burning, drainage, forest planting and deposition of pollutants from the atmosphere, and near-natural habitats are now rare.

Scotland's land is very important to the economy; agriculture, forestry and tourism based on the enjoyment of Scotland's landscapes and its historic environment make important contributions.[4] Agriculture is vital to our rural communities, providing much-needed jobs and contributing to the rural economy, although many agricultural activities are only economically viable because of external support payments.

In the last five years the biggest transformation of our landscapes has taken place through wind-farm development and gradual changes as a result of built development. Changes in farming and forestry practice are also altering our landscape, such as increased tree planting on farms.

AICHI TARGET 14 – ECOSYSTEMS & SERVICES SAFEGUARDED

Relevant policies, assessments and Strategies

The UK National Ecosystem Assessment Synthesis for Scotland provides an overview of Scotland's ecosystem services. There are over 40 policies and strategies applicable to ecosystems and services. These set the regulatory and policy framework for developing and implementing the Scottish Biodiversity Strategy.

Table 14.2 Policies and Strategies applicable to environmental systems in Scotland.

1. Air Quality Standards (Scotland) Regulations 2010[9]
2. The Scottish Animal Health and Welfare in the Livestock Industry: Strategy 2016-2021[10]
3. Bathing Waters (Scotland) Regulations 2008[11]
4. Biomass Action Plan for Scotland 2007[12]
5. Climate Change (Scotland) Act (2009)[13]
6. Climate Change Adaptation Framework (2009)[14]
7. Climate Change Delivery Plan (2009)[15]
8. Common Agricultural Policy Reform (2014)[16]
9. Animal Health and Welfare (Scotland) Act 2006[17]
10. EU Animal Health Law[18]
11. Water Framework Directive (2000) – Scotland regulations[19]
12. Action Programme for Nitrate Vulnerable Zones (Scotland) Regulations 2008[20]
13. Farming for a Better Climate Initiative (2009)[21]
14. Flood Risk Management (Scotland) Act (2009)[22]
15. Government Economic Strategy (2015)[23]
16. Healthy Eating, Active Living (2008)[24]
17. Healthy Weight Route Map: A Long term Obesity Strategy (2010)[25]
18. Getting The Best From Our Land: A Land Use Strategy For Scotland 2016 - 2021)[26]
19. National Planning Framework for Scotland (2015)[27]
20. OECD Rural Policy Review. Scotland, UK (2008)[28]
21. Understanding the Scottish Rural Economy (2018)[29]
22. Recipe for Success – The Scottish Food and Drink Policy (2009)[30]
23. National Food and Drink Policy; Becoming a Good Food Nation[31]
24. Reducing our ecological footprint (Scottish Government Performance Framework Indicator) [32]
25. Renewables Action Plan (2009)[33]
26. Scotland's Wildlife: An Assessment of Biodiversity in 2010[34]
27. Scotland Rural Development Programme 2007-2013 (2008)[35]
28. Scottish Biodiversity Strategy: 2020 Challenge for Scotland's Biodiversity (2013)[36]
29. Scottish biodiversity Strategy: Route Map to 2020[37]
30. Scottish Forestry Strategy (2006)[38]
31. Scottish Government Vision for Water Industry in Scotland (2010)[39]
32. The Scottish Soil Framework (2009)[40]
33. The Economics of Ecosystems and Biodiversity (2010)[41]
34. Other policy areas as appropriate to specific issues (e.g. Planning, Transport, Energy, Rural Housing)
35. EU Marine Strategy Framework Directive (2008)[42]
36. Scotland's National Marine Plan (2015)[43]
37. Scotland's Marine Nature Conservation Strategy (2011)[44]

AICHI TARGET 14 – ECOSYSTEMS & SERVICES SAFEGUARDED

Restoring Ecosystems

Peatland, woodland and fresh water are all Scottish Biodiversity Strategy Priority Project areas where focussed efforts to restore them are underway. For example, Peatland ACTION aims to restore more than 10,000 hectares of degraded peatlands.[9]

Green urban areas are also important for our health and well-being. The Green Infrastructure Strategic Intervention aims to improve Scotland's urban environment by increasing and enhancing greenspace in our towns and cities, especially close to areas of multiple deprivation. This will make these areas more attractive for people to live and work in, and therefore attract jobs, businesses and further investment.

Priority Projects	Relevance	Status
PP1 – Restoration of peatlands	Ambitious peatland restoration programme underway, contributing to the EU15% degraded ecosystem restoration target	
PP2 – Restoration of native woodlands	Increase the amount of native woodland in good condition (upwards from 46% as identified by the *Native Woodland Survey of Scotland)*. 3,000 to 5,000 ha new native woodland creation per year. Restore approximately 10,000 ha of native woodland into satisfactory condition in partnership with private woodland owners through Deer Management Plans.	  
PP3 – Restoration of fresh waters	Achieve agreed ecological water quality objectives under the Water Framework Directive of river and lake water bodies and to contribute to meeting conservation objectives (including Natura 2000 sites) through scoping improvements to physical modifications.	
PP4 – Investment in natural capital	Businesses are more aware of their reliance on Scotland's natural capital, and more investment is being made in building natural capital.	
PP10 – Improving ecological connection	Improve connectivity between habitats and ecosystems.	
PP11 – Sustainable land management	Promotion of measures to support biodiversity under CAP: sites demonstrating good practice aimed at supporting wildlife.	
PP12 – Increase environmental status of our seas	10% of Scotland's seas to be incorporated in nature conservation Marine Protected Areas.	

AICHI TARGET 14 – ECOSYSTEMS & SERVICES SAFEGUARDED

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4 http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx
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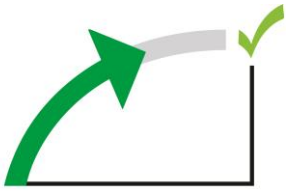
7 https://www.environment.gov.scot/media/1176/water-estuaries-and-coastal.pdf
8 https://www.environment.gov.scot/our-environment/state-of-the-environment/ecosystem-health-indicators/explore-ecosystem-health-indicators/
9 http://www.snh.gov.uk/climate-change/taking-action/carbon-management/peatland-action/

AICHI TARGET 15 – ECOSYSTEMS RESTORED & RESILIENCE ENHANCED

By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.



Reversing ecosystem degradation, loss and fragmentation are key aims of the Scottish Biodiversity Strategy. Considerable efforts have been made on restoration of some of Scotland's most threatened habitats over the past few years. In particular peatlands and rivers have seen focused efforts which help towards Scotland's climate change targets. Rivers have seen continuous improvement in condition over the last 25 years. The area of woodland has more than trebled since 1900, though much of this is non-native commercial plantations.

Ecosystem Restoration in Scotland

The Scottish Biodiversity Strategy; *2020 Challenge for Scotland's Biodiversity*[1] identifies peatlands, native woodlands, freshwaters and the sea as priority habitats for restoration; to support carbon capture and adaptation to climate change. Restoration is best achieved by working in partnership. There are a number of companies, organisations, groups, individuals, charities and volunteers involved in restoration projects. These are critical to the success and the long-term survival of restoration.

Peatland Restoration

Scotland's peatlands are of international importance. The estimated total area of peatland in Scotland is 2 million hectares[2] covering around 20% of the land area of Scotland.[3] Degradation and fragmentation have historically affected 80%[4] of peatland; with raised bog and blanket bog most damaged. By working with a range of stakeholders, efforts to restore these for the benefit of people and nature, and to help tackle the effects of climate change are underway.

Peatlands are an important carbon store, holding around 1.6 billion tonnes of carbon and rates of carbon sequestration for restored peatland are estimated at 2.45 t C/ha/year. As stores of carbon they are supremely important in helping to tackle climate change; as homes for nature they are special and unique; and as the raw ingredient of rural farming, tourism and crofting they are vital. Healthy peatlands[5] provide many benefits to us all. As part of SNH's vision for healthy peatlands in Scotland,

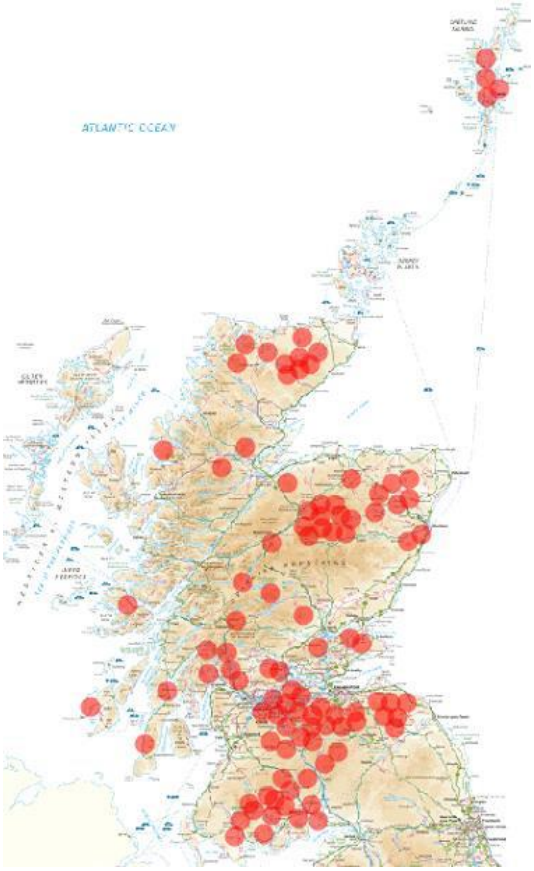


Figure 15.1 Peatland restoration sites 2012 -2014. (Source: Climate Exchange/James Hutton Institute)

the Peatland ACTION[6] project began in 2012. In 2015 Scotland's National Peatland Plan[7] was published to highlight the major contribution peatlands make to Scotland and foster working in partnership. Funding provided through the Scottish Government Green Stimulus programme of £5m enables restoration of 10,000ha of peatland. In 2017/18 additional funding of £8m was provided by Scottish Government available with a restoration target of 8,000 hectares.

Native Woodland Restoration

Scotland has a very low percentage of woodland cover compared with other countries in Europe, although it has increased over the last century. In 1900 only 5% of Scotland was covered in forest, but cover now totals around 18% (1.4 million ha) for woodland of all types. The vision of the Scottish Forestry Strategy[8] is that, by the second half of the 21st century, woodlands will have expanded to around 25% of Scotland's land area with native tree species comprising about 35% of the total area.

The Native Woodland Survey of Scotland (NWSS) was carried out between 2006-2013 to establish the first authoritative picture of Scotland's native woodlands.[9] A total of 311,153ha of native woodland (woods with 50% or more of the canopy made up of native species) were recorded. Upland birchwoods made up 29% and pinewoods 28% of the total area of native woodland.[10] Of the 87,599ha of native pinewoods around 20% are Caledonian pinewoods – the remnants of the large pine forest that once extended across Highland Scotland. Native woodland condition was recorded as moderate overall, with 46% of total area in satisfactory health for biodiversity. The largest single threat to native woodland health and survival is herbivore impact, with around a third of the total area of woodland affected. Deer were the most widespread type of herbivore recorded and are likely to be the major source of impacts.[10] Non-native species were the second largest adverse factor.

Some native woodlands have seen particularly focussed efforts, including ambitious restoration projects at Abernethy, Creag Meagaidh and Glen Feshie[11], and volunteer-led re-wilding projects such as at Carrifran Wildwood Project.[12] The Carrifran project has seen over 300 hectares of woodland planted in a bid to restore woodland. Trees for Life[13] is a charity working to restore Scotland's ancient Caledonian Forest and have purchased a 10,000 acre estate which will link up and expand the Caledonian Forest range. There are also numerous community-led local woodlands, providing multiple benefits for biodiversity and people.

Scotland's woodland sequestered a net total of 9.1 $MtCO_2$ equivalents in 2011. Without this, total Scottish net emissions would have been 18% higher. However, following a period of low historic rates of woodland planting, net carbon sequestration rates are currently reducing year-on-year due to the lower proportion of young trees in Scottish forests.[14]

Freshwater Restoration

Scotland has approximately 125,000km of rivers and 220km of canals.[15] Scotland has for the past 25 years focused effort towards helping protect and improve the quality of our waters through action to prevent and reduce pollution. There are ambitious targets to achieve further improvements over the coming years. The ultimate aim is for 96% of our rivers to be at good or high status/potential for habitats, water quality, flows and a reduction in the impacts from invasive non-native species by 2027.

Of the 25,000 km of rivers that are monitored and assessed, more than half are in good condition or better. This includes most of the rivers in the Highlands and Islands, where there are fewer pressures on the environment. Conditions in the Central Belt, and in more intensively farmed areas are improving but still are subject to further amelioration works.[16]

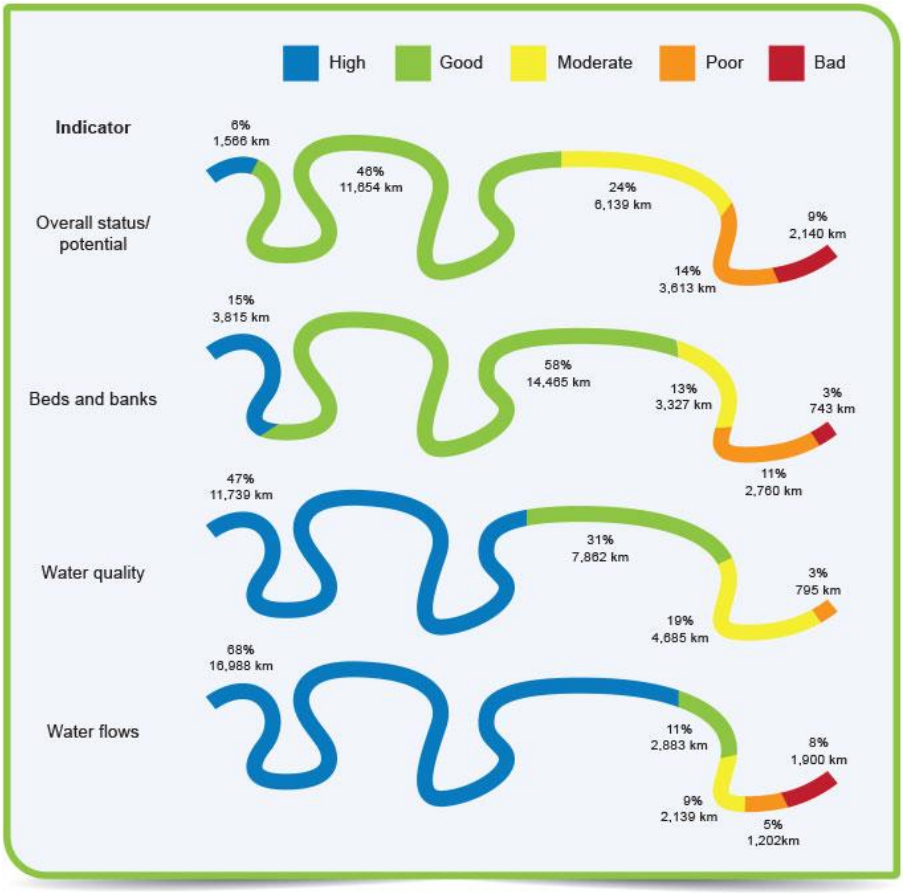


Figure 15.2 Status of Scotland's rivers and canals, 2012 data. (Source SEWeb)

Legislation is a significant driver to assist in the restoration of engineered river systems to bring them closer to their previously natural state and authorisation to undertake river engineering must now be obtained from the Scottish Environment Protection Agency (SEPA). There are also government-supported mechanisms in place. For example, the River Restoration Centre[17] is a focal point for the exchange of information and expertise relating to river restoration and enhancement in the UK and is supported by SNH. SEPA are responsible for administering the Water Environment Fund[18]. This funding from the Scottish Government seeks to restore the condition of Scotland's water environment and to support partnership projects with third parties. Information from the River Restoration Centre shows that nearly 200 restoration projects have been completed throughout Scotland.[19] These include large catchment scale projects such as the Tweed Forum – aiming to protect, enhance and restore the rich natural, built and cultural heritage of the River Tweed and its tributaries.[20] Good examples of smaller, locally led projects include the Dunglass River Restoration Project,[21] which successfully restored a new spawning channel on the Conon River in North Scotland.

Phase 3 of the IUCN river restoration[22] and biodiversity project is underway. The aim of Phase 3 is to establish a network of restoration sites across the UK and Republic of Ireland at which particular techniques may be trialled to illustrate the true benefits for biodiversity. Monitoring and appraisal will be key elements of the work. This project will gather enough evidence to present a compelling case for restoring rivers for biodiversity and so secure funding for restoration projects.

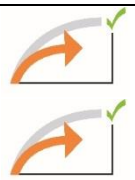
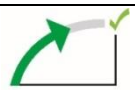
AICHI TARGET 15 – ECOSYSTEMS RESTORED & RESILIENCE ENHANCED

Marine

Scotland has around 470,000 square kilometres of seas in which more than 1,700 megatonnes of inorganic carbon, mainly in the form of calcium carbonate, are stored as non-living material such as mollusc and crab shells, and the skeletons of microscopic plants (phytoplankton) coral, and maerl.

So-called 'blue' carbon is captured and stored across a range of seabed types such as kelp forests, saltmarsh, seagrass beds, cold-water coral reefs, flame shell and mussel beds, and maerl that play a vital role in tackling climate change, much the same as onshore peatlands. But these habitats face challenges - maerl beds and coral reefs are subject to climate change and trawling, while seagrasses and saltmarsh can be affected by coastal erosion and various development activities. When damaged, these habitats cannot retain as much carbon and may become a source of greenhouse gases.

Many of these carbon storing habitats are Priority Marine features[23] and as such are covered by the National Marine Plan policies relating to safeguarding and enhancing these features. Controls are in place for some marine features, such as restricting damaging operations in areas known to contain flame-shells.[24] Typically improving marine environments is undertaken by reducing pressures such as through controlling activities such as trawling, dredging or mineral extraction. Scotland's National Marine Plan provides policies on ecosystem enhancement in relation to the natural heritage, natural coastal processes and blue carbon.[25]

Priority Projects	Relevance	Status
PP1 – Restoration of peatlands	Peatland Action - store and sequestrate carbon through peatland management covering 5,100 ha. Flow Country Peatland Restoration - setting an international benchmark for good practice.	
PP2 – Restoration of native woodlands	Increase the amount of native woodland in good condition (upwards from 46% as identified by the *Native Woodland Survey of Scotland)*. 3,000 to 5,000 ha new native woodland creation per year. Restore approximately 10,000 ha of native woodland into satisfactory condition in partnership with private woodland owners through Deer Management Plans.	
PP3 – restoration of freshwaters	Achieve agreed ecological water quality objectives under the Water Framework Directive of river and lake water bodies and to contribute to meeting conservation objectives (including Natura 2000 sites) through scoping improvements to physical modifications.	

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12 http://www.carrifran.org.uk/
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14 http://www.gov.scot/Publications/2013/06/6387/11
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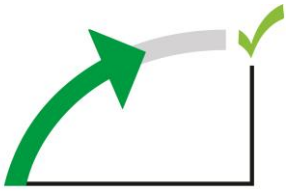
AICHI TARGET 16 – NAGOYA PROTOCOL IN FORCE & OPERATIONAL

By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

The UK signed the Nagoya Protocol in 2011. Following public consultation in 2014 the Nagoya Protocol (User Compliance) Regulations 2015 were laid before the UK Parliament on 23 March 2015. Guidance on compliance and provision of an Access and Benefit-sharing (ABS) information platform provides a key tool for facilitating the implementation of the Nagoya Protocol.



The Nagoya Protocol

The Nagoya protocol aims to promote the conservation and sustainable use of biodiversity by ensuring that any benefits derived from genetic research are fairly shared with the owners of those genetic resources.

The UK signed the protocol in June 2011 and it is now part of UK law under The Nagoya Protocol (Compliance) Regulations 2015.[1] This legislation applies, in the main, to a number of sectors including; food and beverage, pharmaceutical, cosmetic and personal care, animal breeding, plant breeding, biotechnology, bio-control and academia.

In order to support businesses and others working in these sectors the UK government undertook a consultation[2] on implementation of the Nagoya Protocol and has now developed guidance for stakeholders and policymakers.[3]

Sharing best practice

There are a number of platforms that support best practice, provide guidance[4] and provide legal clarity[5] for users including Access and Benefit-sharing Clearing-house (ABSCH) developed by the Convention on Biological Diversity.

AICHI TARGET 16 – NAGOYA PROTOCOL IN FORCE & OPERATIONAL

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[2] https://www.gov.uk/government/consultations/biodiversity-implementing-the-nagoya-protocol-in-the-uk

[3] http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=17827&FromSearch=Y&Publisher=1&SearchText=wc1016&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

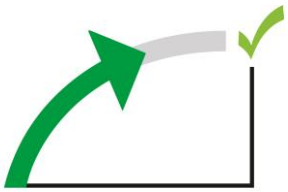
[4] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.C_.2016.313.01.0001.01.ENG&toc=OJ:C:2016:313:TOC

[5] https://absch.cbd.int/

AICHI TARGET 17 – NATIONAL BIODIVERSITY STRATEGY & ACTION PLAN

By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.

The *Scottish Biodiversity Strategy; 2020 Challenge for Scotland's Biodiversity* was approved by the Scottish Cabinet and published in 2013. This document sets the strategic direction for biodiversity action in Scotland towards 2030. The Route Map to 2020, published in 2015, provides a clear focus for activity which will significantly contribute to the Scottish Biodiversity Strategy. Both documents represent the policy instruments for biodiversity in Scotland.



Scottish Biodiversity Strategy

Following the publication by the Convention on Biological Diversity of the Strategic Plan for Biodiversity 2011-2020[1] the Scottish Biodiversity Strategy It's in Your Hands[2] (2004) was reviewed. In 2013 the Scottish Biodiversity Strategy; 2020 Challenge for Scotland's Biodiversity[3] was approved by the Scottish Cabinet n 2015 a Route Map to 2020 set out the large scale collaborative action that would significantly contribute to the strategy. Two progress reports have been published in 2016 and 2018.[4]

The Nature Conservation (Scotland) Act[5] 2004 requires the government to report on progress[6] with the biodiversity strategy every three years. The latest progress report was laid before Parliament in 2017.

UK biodiversity framework

In the UK the devolved administrations produce country level biodiversity strategies, each linked to the CBD Aichi targets. A UK Biodiversity Framework is in place to ensure reporting at UK level, and identify the activities needed to galvanise and complement country strategies in pursuit of the Aichi targets.

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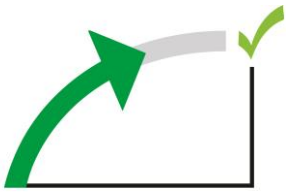
AICHI TARGET 18 –TRADITIONAL KNOWLEDGE RESPECTED

By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

Scotland's traditional languages and the knowledge held by their speakers have gained greater protection since 2005, following the Gaelic Language (Scotland) Act 2005. New research is safeguarding and sharing traditional knowledge. The rights of communities have been enhanced through several pieces of legislation, particularly since 2000. Traditional land management practices, such as crofting, benefit nationally and internationally important biodiversity.



Scotland was one of the birthplaces of the industrial revolution and has been at the forefront of modern thinking since the Scottish Enlightenment, beginning in the 18th Century. Despite accidental, and at times deliberate, suppression of traditional knowledge, local communities have preserved and continue to develop practices, customs and language.

Respect for indigenous language

The Gaelic Language (Scotland) Act 2005[1] was passed without opposition by the Scottish Parliament with a view to securing the status of the Gaelic language as an official language of Scotland commanding equal respect to the English language. At that time it was felt that the position of the language was extremely fragile and the declining numbers of those speaking Gaelic fluently or as a mother-tongue in the language's traditional heartlands threatened the survival of Gaelic as a living language in Scotland.

One of the key features of the 2005 Act is the provision enabling Bòrd na Gàidhlig (the Scottish Government's principal Gaelic development body) to require public bodies to prepare Gaelic Language Plans.[2] This provision was designed to ensure that the public sector in Scotland plays its part in creating a sustainable future for Gaelic by raising its status and profile and creating practical opportunities for its use. The Bòrd also publishes five-year National Gaelic Language Plans, the latest of which runs from 2017-2022.

Numbers of speakers of indigenous languages

In the latest census, just over one per cent (1.1 per cent or 58,000 people) of the population aged 3 and over in Scotland were able to speak Gaelic, a slight fall from 1.2 per cent (59,000) in 2001, with around 25,000 using the language at home. Over 1.5 million people reported that they could speak Scots (not recorded in 2001), though only 56,000 said they used the language at home.

AICHI TARGET 18 – TRADITIONAL KNOWLEDGE RESPECTED

Schools

The latest figures for the language in Scotland are for 2016-17,[3] with 2006-07 figures in parentheses. 1,039 (701) children in Scotland attended a Gaelic nursery, 3,145 (2,092) pupils were enrolled in Gaelic Medium primary education and 1,272 (945) secondary school pupils were studying Gàidhlig for fluent speakers and/or other subjects in high school through the medium of Gaelic. There are five primary schools (one with secondary provision) are Gaelic Medium only: Edinburgh, Glasgow (two), Inverness and Fort William, with a sixth, Portree, about to open during 2017-18.

Traditional knowledge safeguarded

Scotland's traditional biodiversity knowledge is probably better documented than most countries. However new technology is being applied to ensure it is not lost. SNH have led a project to compile a lexicon of biodiversity terms[4] and have recently published an on-line database of ferns and their traditional and modern Gaelic names. The aim of this project is to maintain people's links to biodiversity, keeping it at the heart of our culture.

Crofting is a traditional land use in Scotland, in recent years the numbers of individuals involved in crofting has declined. Crofting is vital in creating much of Scotland's landscape, such as machair, an internationally important habitat rich in biodiversity. The Crofting Commission[5] is a Non-Departmental Public Body (NDPB) which operates on a day-to-day basis independently of the government, but for which Scottish Ministers are ultimately responsible. The Crofting Commission's principal function is regulating crofting, re-organising crofting, promoting the interests of crofting and keeping under review matters relating to crofting. Protecting crofting is being assisted with projects such as Crofting Connections,[6] this will help ensure that many of the traditional methods and knowledge are captured for future generations

Community Empowerment in biodiversity decision making

Scottish Government and non-departmental public bodies such as SEPA and Scottish Natural Heritage consult with stakeholders to get their views on proposed new work. This applies to biodiversity and the environment as well as other topics. Recent examples include: the Climate Change Bill,[7] marine protected areas[8] and wild land[9]. More examples can be found on the following websites:

https://consult.scotland.gov.uk/
http://www.snh.gov.uk/consultations/our-consultations/

At a less formal level, Scottish Government and its agencies also work with communities on topics that will affect them, whether through fora such as the Moorland Forum[10] or the Tweed Forum,[11] or through direct contact. This has enabled the development of practices which combine the best of traditional knowledge with up-to-date scientific understanding such as the Muirburn Code.[12] This approach benefits both communities and biodiversity.

The rights of communities have been enhanced through several pieces of legislation, in particular the Abolition of Feudal Tenure etc. (Scotland) Act 2000,[13] the Land Reform (Scotland) Act 2003,[14] the Community Empowerment (Scotland) Act 2015[15] and the Land Reform (Scotland) Act 2016.[16]

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11 http://www.tweedforum.org/
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AICHI TARGET 19 – KNOWLEDGE IMPROVED, SHARED AND APPLIED

By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

Scotland has made significant efforts in data delivery and data management systems with The NBN Atlas Scotland, Scotland's Environment Web, and the Marine Scotland data publishing portal all contributing greatly to improving sharing and application of Scotland's knowledge. Volunteers and researchers make large contributions to the numbers of species and habitats records and the way we use them. More work is required to address data recording and analysis gaps. Improved information on the consequences in the loss, values, and functions of Scotland's biodiversity, could aid us in prioritising conservation action. [1]

Sharing and application of Scotland's biodiversity knowledge

Much of Scotland's biodiversity information is publically available through web-portals such as National Biodiversity Network Atlas (NBN Atlas Scotland) launched in 2017;[2] tNational Marine Plan interactive,[3] [4] and Scotland's Environment Web[5] (SEWeb). The NBN Trust is committed to NBN Atlas data being open access by default (with sensitive species data access caveats)[6]. SEWeb aims to be the gateway to Scotland's environment information and data, including the Habitat Map of Scotland.[7] Scottish Government's commitment to sharing data was shown in the establishment of a Co-ordinated Agenda for Marine, Environment and Rural Affairs Science (CAMERAS) in 2011; its scope includes "monitoring and surveillance, knowledge exchange and the more effective use of existing data and information".[8] In 2009, the EU INSPIRE Directive (2007) was transposed into Scottish law by the formation of the INSPIRE (Scotland) Regulations, to ensure that spatial data are shared to the benefit of society and environmental policy.[9]

Species and habitat data are collected by many different groups: our national schemes and societies, charities, and local records centres;[10] statutory agencies such as SNH and SEPA; Scotland's National Parks and local authorities; industry and developers; academic/research[11] institutions and, by the general public through citizen science initiatives,[12] such as OPAL, Wildlife Counts, iSpot, and iRecord. The Scottish Biodiversity Forum (SBIF)[13] is a community-led forum bringing together stakeholders from organisations involved in the collection, management, sharing or use of species or habitat data (the data flow system) both in the terrestrial and marine environment. The aims of SBIF will be to collectively identify the key challenges relating to the flow of biodiversity data in Scotland and then to tackle them.

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Baseline information, trends and indicators are generated where data allow. This can be on a Scotland scale (for example, Scotland's National Performance Indicators,[14] our Marine Atlas,[15] and Scottish Natural Heritage's Trends and Indicators[16]), and on a UK scale (for example, the UK Biodiversity Indicators[17] and the Biological Records Centre work programme including development of data analytical tools and new technologies[18]). The suite of Ecosystems Health Indicators is mainly based on a river catchment level and some data can be accessed at an even more local level.[19] Data, knowledge, and trends are used to inform policy and underpin advice. For example, they have been used in protecting,

restoring and securing freshwater pearl mussel populations on SACs,[20] and in spatial targeting of SRDP measures.[21] Ongoing or repeat surveys and research, for example by national schemes and societies such as the UK's National Plant Monitoring Scheme,[22] and BTO-led schemes for birds,[23] are required to ensure we can determine habitats' and species' status and trends. This information is required for e.g. Habitats and Birds Directives reporting and Aichi Target reporting, and improves our understanding of vital ecosystem functioning, and values.[24]

These trends and indicators show we have some good evidence of how our nature is changing in Scotland and the UK. The value we place on biodiversity forms part of our Natural Capital Asset Index (data on the area and quality of broad habitats are used to help assess the sustainability of Scotland's economic growth).[25] There are still gaps in our knowledge of the values and functioning of biodiversity that we are working to fill, however. The Scottish Government Rural Affairs Food and Environment (RAFE) Biodiversity and Ecosystems work package, has identified key knowledge gaps and "will deliver improved understanding of the processes contributing to the functioning and resilience of our natural assets, in particular biodiversity"[26]. This has shaped the Ecosystem Health Indicators[27], the Scottish Pollinator Strategy,[28] and ongoing Scottish Biodiversity Strategy priority projects (see table below) including peatland restoration.

The involvement of recorders and recording schemes across Scotland is crucial in collecting relevant data to underpin such strategies and work. There is some recent scientific evidence based on records from 18 national recording schemes, of declining resilience of ecosystem functions with the loss of the UK's biodiversity. The paper shows declining trends in the UK's species that provide pest control, pollination and cultural values, but that those species trends providing decomposition and carbon sequestration "remain relatively stable".[29]

Habitats Information

Habitat surveys (conducted by observers or remotely) provide data in a range of classification systems including; NVC, Phase 1, EUNIS/Annex 1/Priority Marine Feature, and Marine Habitat Classification. There are made available through several large databases containing habitat data including: Standing water database, Native woodland survey of Scotland, Land cover map of Scotland, National Marine Plan interactive. We currently publish a Habitat Map of Scotland, based on the EUNIS land cover classification system[30], with more work being undertaken to produce higher level maps[31] and a manual of terrestrial EUNIS habitats was published in 2015.[32] There is also a UK marine EUNIS map.[33] We have some good habitat data on protected sites and features but more needs to be collected in the wider countryside and marine; the gaps include lowland, grassland, lowland wetland, some upland areas, and the deep sea. Information on habitat trends and the rate of habitat loss is currently limited, but required for our statutory EU Habitats Directives reporting and for Aichi Target 05 reporting.

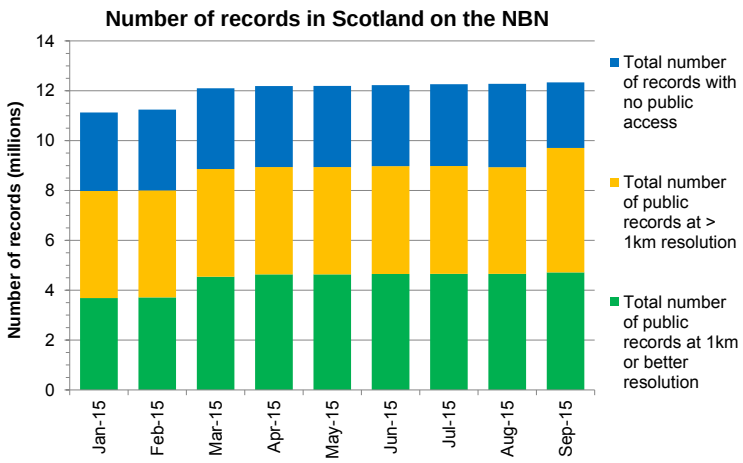

Figure 19.1 The number of Scottish records on the NBN.

AICHI TARGET 19 – KNOWLEDGE IMPROVED, SHARED AND APPLIED

Species information

Up to September 2015 the NBN held 12.3M records from Scotland, with 9.7M of these being publically available (Figure 19.1). This increasing trend in data accessibility is set to continue and is mirrored in the UK indicator (2004-2014),[34] and also in a Scotland indicator (2000 – 2007).[35] The migration of records from the old NBN Gateway to the NBN Atlas will make this information easier to access and allows members of the public to look at local records and even carry out their own analyses. There are geographic and taxonomic gaps[36] in species records as many terrestrial records are collected by volunteer recorders in preferred localities; remote and also offshore areas are often under-recorded. Although there is a coordinated plan of survey activity through the Scottish MPA Monitoring Strategy, there is not a coordinated approach to improving coverage in the terrestrial environment. More work is required to enable organisations to mobilise their data; for example, INSPIRE compliance and mobilisation has been applied in the UK through MEDIN[37] with data being collated by accredited Data Archive Centres. However further work is required to ensure better flow of data from all marine sectors. Work by NBN to mobilise more data from consultants[38] is ongoing. Improved taxonomic spread of the GB-IUCN Red Lists would enable us to assess the value and loss of our species.

Collecting data

There are many programmes to generate biodiversity information, including citizen science projects;[16, 39] statutory monitoring programmes and projects, e.g. site condition monitoring;[40] and the Marine Protected Areas Monitoring Strategy;[41] fisheries management; as well as national partnership projects such as the Habitat Map of Scotland.[31] The increase in citizen science, combined with the development of novel technologies (including eDNA, smartphone apps, earth observation satellite imagery[42], and camera traps), better data management, and analyses[43] have all contributed to improved biodiversity knowledge access and exchange.[44] To build on these foundations, we need the engagement and support of volunteers and communities. This means we need to continue to improve communication and coordination between different commissioners and users of information. Adequate funding for organisations involved in the collection, collation, management and analyses of biological records, is key to ensuring we continue to produce high quality biodiversity information.

Priority Project	Relevance	Status
PP1 – Restoration of peatlands	Ambitious peatland restoration programme underway, contributing to the EU 15% degraded ecosystem restoration target.	
PP9 – Conservation of priority species	Deliver focussed action for priority species in Scotland.	
PP11 – Sustainable land management	Promotion of measures to support biodiversity under CAP: sites demonstrating good practice aimed at supporting wildlife.	

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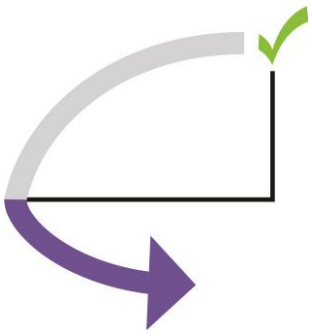
AICHI TARGET 20 – FINANCIAL RESOURCES FROM ALL SOURCES INCREASED

By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.

The UK indicator shows a long term increase in financial resources for biodiversity, but a recent short term decline. There is currently no Scottish indicator for this target. Total funding figures for most of the Scottish organisations that have some biodiversity remit have also declined in the last 5 years.



Currently there is no Scottish indicator for financial expenditure on Biodiversity; however, the UK indicator[1] (Figure 20.1) shows £453M of UK public sector funding being spent on UK biodiversity in 2015/16 with a long term increase of 71% in real terms (2000/01–2015/16). However, between 2010/11 and 2015/16 there was a short term decline in spending of 24%. The most recent data point in 2015/16 is roughly similar to the 2005/06 value, but with fluctuations between these years. Public sector spending as a percentage of GDP has fluctuated with the actual expenditure, with a gradual decline to its current level of 0.024%. In the most recent year of the time series (2014/15), NGOs spent £236M on biodiversity or nature focus work. Due to insufficient data it is not possible to report further on these; more data should enable an assessment. Figure 20.1 includes spending provided solely for the protection and promotion of biodiversity, generally excluding operational costs. The UK data could be disaggregated to Scotland in time but further work is required on: standardisation of biodiversity expenditure definitions; and, comprehensive collation and separation of public and non-public body information. There have been short and long term increases in public sector expenditure on international biodiversity.[1]

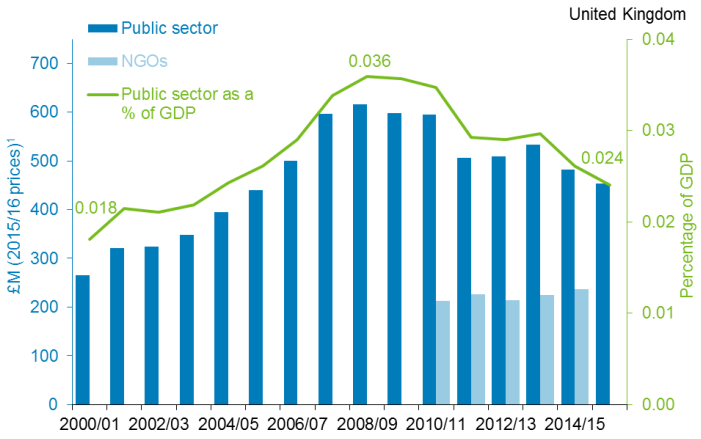


Figure 20.1 Expenditure on biodiversity in the UK, 2000-01 to 2015-16. (Source Defra, Her Majesty's Treasury[1])

Notes:
1. Deflated using UK Gross Domestic Product Deflator.
2. Non-governmental spend is net of government funding.
3. Small revisions to past data series as a result of improved estimation methodology can mean the indicator does not show exactly the same pattern between years.

Source: Defra, Her Majesty's Treasury.

An EU Indicator (1995-2006),[2] which reported only on LIFE Nature projects provides some indication that although LIFE expenditure as a proportion of total EU expenditure has fluctuated in the past, it has “now levelled out and is set to increase”. The EU Life contribution to the UK totalled approximately EUR11 million across a total of 18 UK projects

between 2000-2006, averaging EUR2.2 million per year during the period, making it the highest average contribution across all EU countries (although there was no call in 2001).

Mobilisation of financial resources in Scotland

Figure 20.2 has information on Scottish Government (SG) budgets[3] for six organisations that have some biodiversity element to their work. However, not all of the functions of these organisations are related to biodiversity. Figure 20.2 shows that over the last five years (2012-13 to 2017-18) SG funding (including this year's draft funding) for SNH[4] (SG's nature conservation agency) will have declined by 20% (26% in real terms, allowing for inflation) and SEPA[5] (SG's principal environment regulator) and the National Parks Authorities[6] will have both declined by over 5% (11% in real terms). Marine Scotland[7] (SG's body responsible for the integrated management of Scotland's seas) has seen an upswing in draft budget for 2017-2018, bringing it close to 2012/13 levels. For RBGE[8] (funding for "maintaining its National Collections and its contributions to environmental and biodiversity change, sustainable agro-forestry, and improving rural livelihoods in very poor areas of the world"), funding will have remained quite stable, with a 5-year change below 5%. For FCS, data are only reported since 2013-14 due to a change in the way they are reported by SG; however, there is a decline in its funding of 8% from 2013-14 to 2017/18. This is mostly due to a drop in funding for Forestry Enterprise. The Funding for all six of these organisations is due to decline in the most recent year; however, this is based on draft data. The Scottish Government's RACCE Committee noted concerns about the trend of budget cuts to SNH and the NPs, and also that research institutions have to raise non-Government funding to "sustain their standards of excellence".[9]

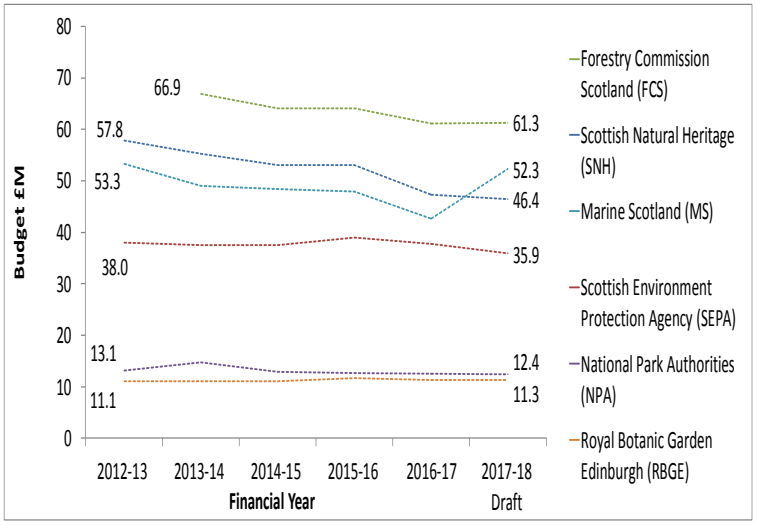


Figure 20.2 Scottish Government actual (solid line) and draft funding (dashed line) for the last five years for organisations with a biodiversity remit.

Notes:
1. From Chapter sections on "Research Analysis and Other Services", "Marine and Fisheries", "Environmental and Rural Services", and "Forestry Commission ". 2. Not all of the functions of these organisations are related to biodiversity.
Source: Extracted from Scottish Government's Scottish Draft Budgets 2013-14, 2014-15, 2015-16 and 2016-17).

The Scottish Rural Development Programme[10] (SRDP) delivers Pillar 2 of the EU Common Agricultural Policy (CAP). It is one of the main sources of biodiversity funding in Scotland. To April 2014 *c*. £434m has been committed: on the principal regional priorities that address biodiversity (regional priorities 8,9,10,11)[11] (*c.* £216M); and for forestry (all biodiversity woodland and forestry) options (*c*. £218M).[12] Between 1992 and 2014 the area of Scotland under higher-level agri-environment schemes (Environment Sensitive Areas, Countryside Premium, Rural Stewardship, Rural Priorities) has increased from 0.12 to 1.21 million hectares.[13] From 2010 to 2012 there was evidence of an increasing trend in the area of land

under positive management in Scotland (including tenure, management agreements, nature conservation and planning policies), with 5,181Mha (66%) of Scotland under positive management by 2012. In the same period, the area at sea remained static; with the recent inclusion of the marine protected areas, this Scottish trend is due to increase.

The Scottish Government has awarded £8.8 million of ERDF funding to SNH to deliver phase 1 of the Green Infrastructure Strategic Intervention by 2019. A decision on a second phase of funding on a similar scale is expected by early 2018.

Since 2004 all public sector bodies in Scotland have a duty to further the conservation of biodiversity, and since 2012 are required to report on their compliance with this duty;[14] so, in time, could potentially contribute to biodiversity projects and thus to a Scotland biodiversity funding indicator through their reporting.

Other funding sources

There are many sources of funding for biodiversity projects including Scottish Government's Strategic Research Programme,[15] the Heritage Lottery Fund, Scottish Rural Development Programme, EU's LIFE Nature and Biodiversity, SNH Grants, the Central Scotland Green Network Development Fund, City Region Deals and others[16] Additional funding for biodiversity could come from businesses, NGOs, and research institutions and bodies. Efficiencies could be derived from more collaborative working.[17]

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References end notes

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