Annex A: Technical Annex to Chapter 2: Natural Environment Theme

1. Terrestrial species and habitats
2. Freshwater rivers and lochs
3. Marine and coastal ecosystems
4. Soils and agriculture
5. Forestry

Introduction

- This slide pack:
  - Is the technical annex to **Chapter 2: Natural environment** in the ASC's first statutory report to Parliament on the Scottish Climate Change Adaptation Programme, available at www.theccc.org.uk/publications
  - Provides the latest trend information on indicators of exposure, vulnerability, action and realised impacts that informed the ASC's assessment. Many of these were developed by ClimateXChange, which were published on their website: http://www.climatexchange.org.uk/adapting-to-climate-change/indicators-and-trends/
  - Will be updated periodically as new data becomes available.
  - Highlights indicators that would be useful but where the necessary datasets have not yet been identified.
  - Follows the structure of the natural environment chapter in the ASC's progress report, which is based on the 'adaptation priorities' the ASC identified for the natural environment.

Natural environment: scorecard

Adaptation priority	Is there a plan?	Are actions taking place?	Is progress being made?
1. Terrestrial habitats and species	Green	Amber	Amber
2. Freshwater rivers and lochs	Green	Amber	Amber
3. Marine and coastal ecosystems	Amber	Amber	Amber
4. Soils and agriculture	Amber	Green	Red
5. Forestry	Green	Green	Amber

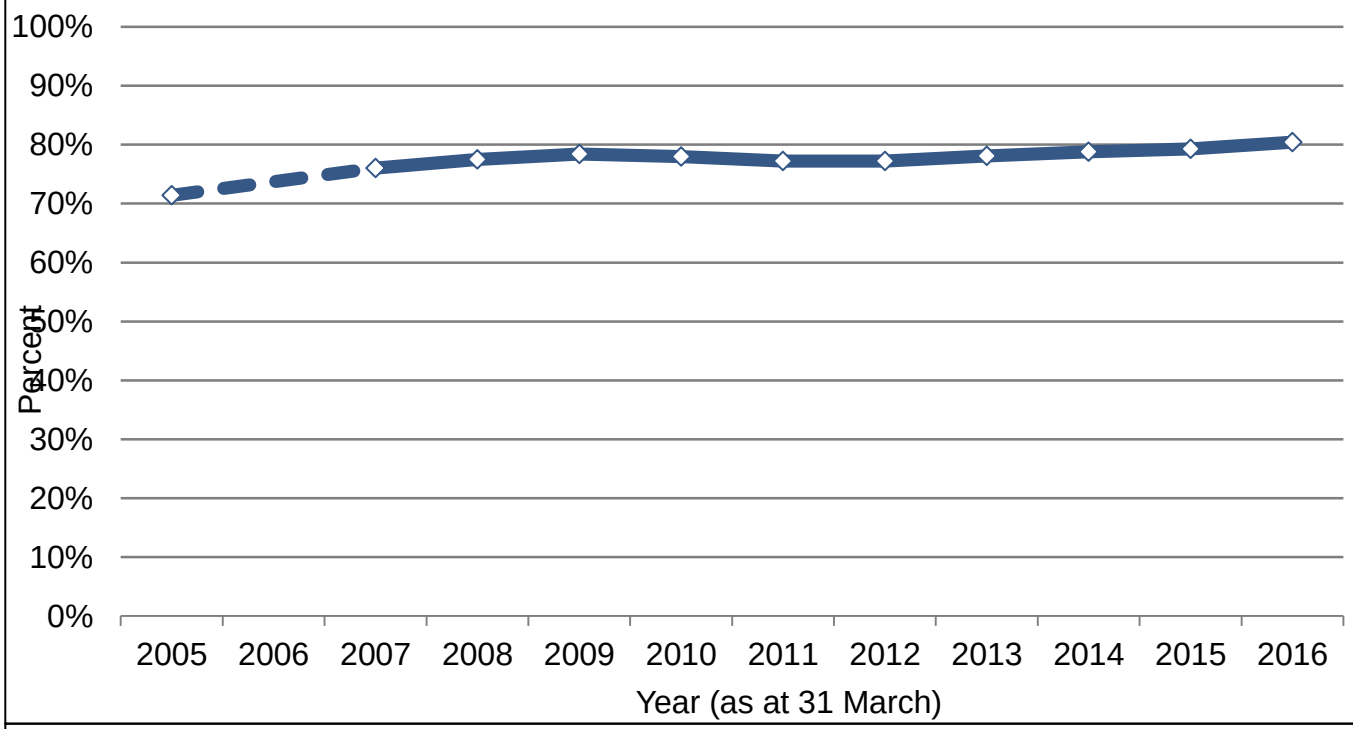
Red: plans and policies, delivery of actions, or progress in addressing vulnerabilities, are lacking.
Amber: adaptation priority has been partially addressed, some evidence of progress in some areas.
Green: plans are in place, actions are being delivered, progress is being made.
Grey: insufficient evidence to form a judgement.

1. Terrestrial species and habitats

Indicator	Data series	Source	Trend	Implication
Percentage of natural features on protected nature sites in favourable condition	2005-2016	SNH	⇧	Condition of designated sites and species is improving.
Abundance of terrestrial breeding birds	1994-2016	Scottish Government	⇧	Overall numbers have fluctuated, but are higher than in 1994.
Abundance of breeding farmland birds	1994-2013	SNH	⇩	Decline in abundance since mid-2000s
Abundance of wintering water birds	1974-2012	SNH	⇔	Numbers have been relatively stable, although fell below 1974 baseline in 2011/12
Abundance of specialist butterfly species	1979-2013	UKBMS	⇩	Decline in abundance of specialists since 1979, although rate of decline has lessened since 2004
Natural Capital Asset Index	2000-2010	SNH	⇔	Combined index has been broadly stable over the last decade, with improvements in some broad habitats and declines in others

1. Terrestrial species and habitats

Percentage of natural features on protected nature sites in favourable condition	⇧	Condition of designated sites and species is improving



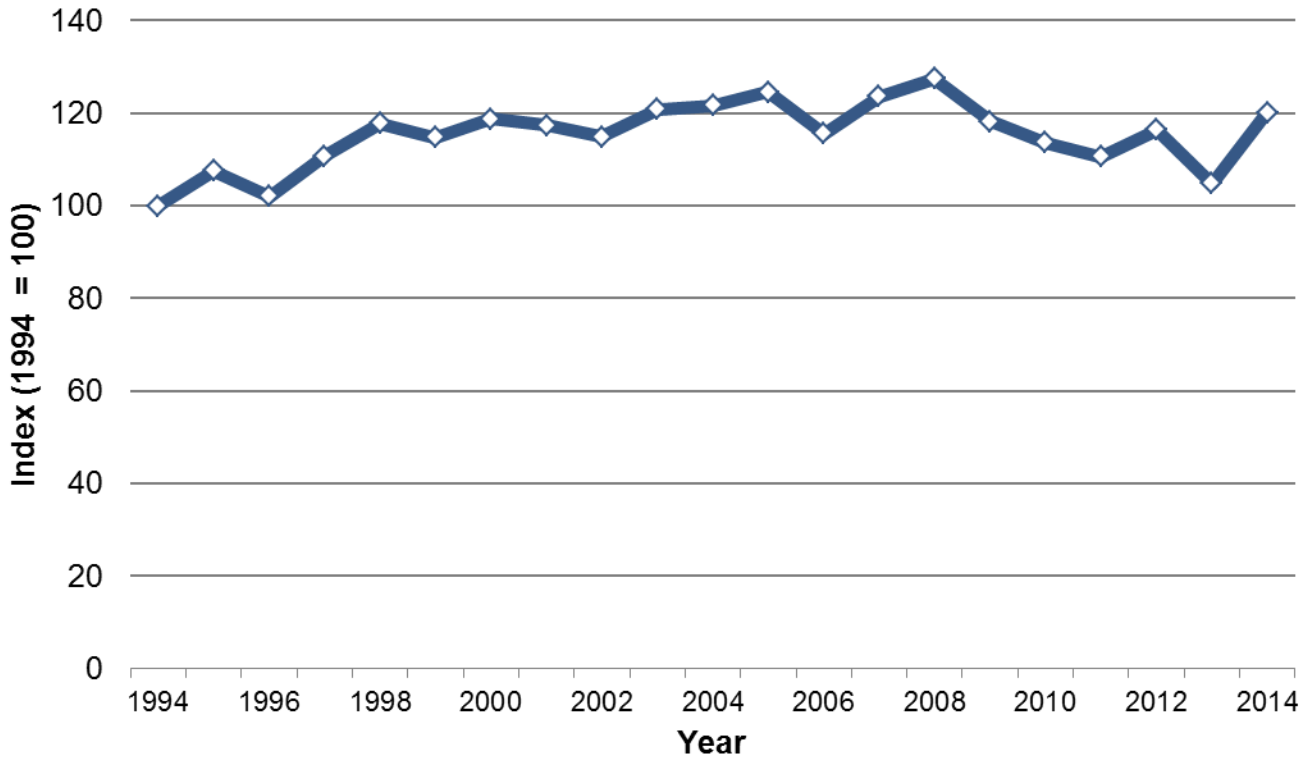
Notes: Proportion of notified habitat features in favourable condition based on SNH Site Condition Monitoring

- By March 2016, 80.4% of natural features on protected nature sites were assessed as being in favourable condition.
- This figure represents an increase of 1.1 percentage points from 2015 and has increased by 4.4 percentage points from 76.0% in 2007

Source: Scottish Government (2015) Scottish National Indicators.

1. Terrestrial species and habitats

Abundance of Terrestrial Breeding Birds	⇧	Overall numbers have fluctuated, but are higher than in 1994.



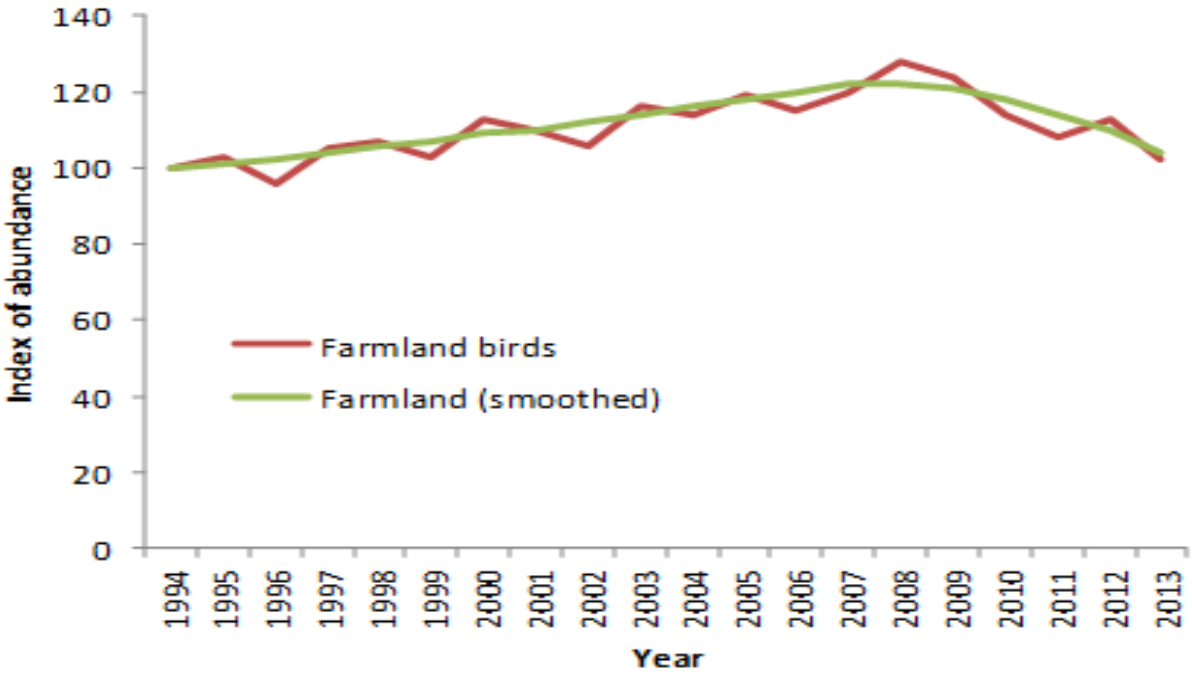
Notes: Terrestrial birds consists of resident and migratory garden, woodland, farmland and upland bird species.

- The index of abundance of terrestrial breeding birds was 120.1 in 2014 (against a value of 100 in 1994).
- This is 4% higher than the 2006 baseline, but 6% lower than the 2008 peak.
- The latest figures from 2014 show a increase of 15% from the 2013 figure.

Source: Scottish Government (2015) Scottish National Indicators.

1. Terrestrial species and habitats

Abundance of breeding farmland birds	⇩	Decline in abundance since mid-2000s



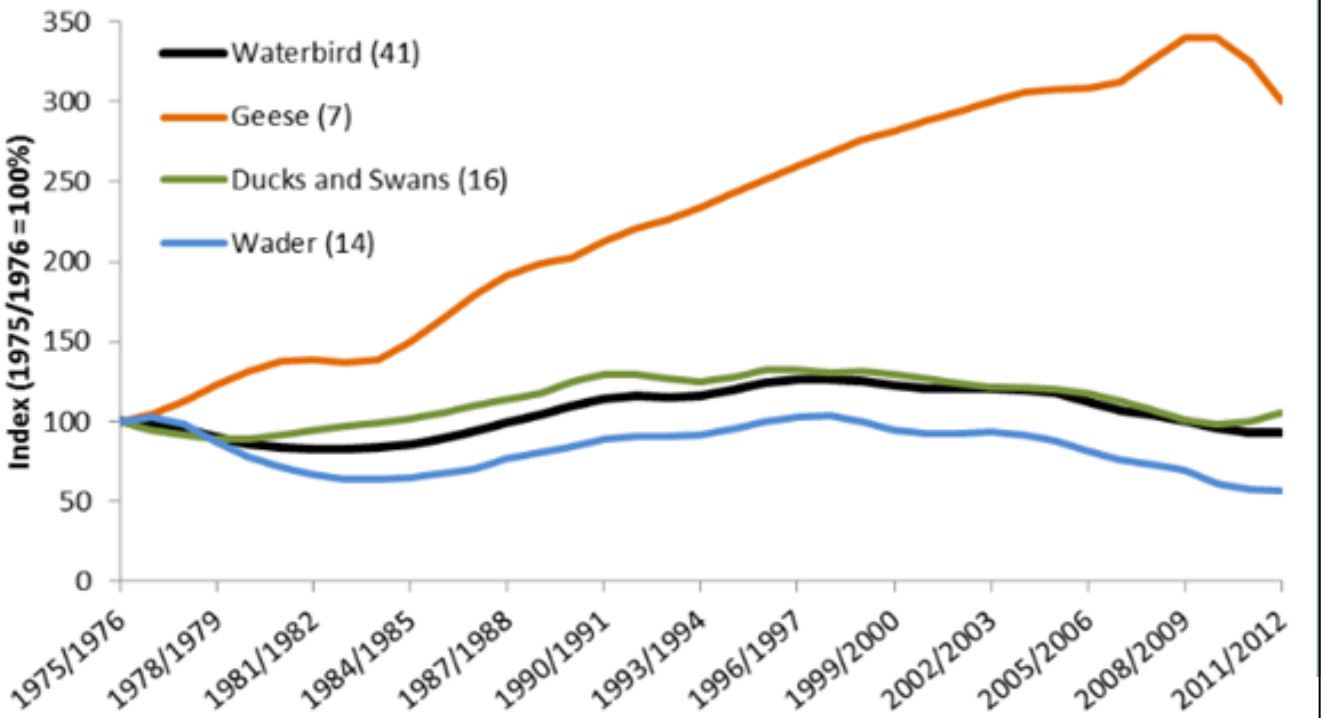
Notes: Primary data source is the Breeding Bird Survey (BBS) that has run since 1994, therefore 1994 is the base year used for the Index of Abundance.

- Smoothed trend shows steady increase up to late 2000s, followed by a decline, so that overall abundance is not significantly different in 2013 than in 1994.
- 15 species (out of 27 recorded species) increased in abundance. Five species remained stable and 7 decreased with long term decreases recorded for lapwing, greenfinch, linnet, skylark and kestrel.

Source: UKBMS for Scotland (SNH, 2015). From ClimateXChange indicator NA5

1. Terrestrial species and habitats

Abundance of wintering water birds	⇔	Numbers have been relatively stable, although fell below 1974 baseline in 2011/12.



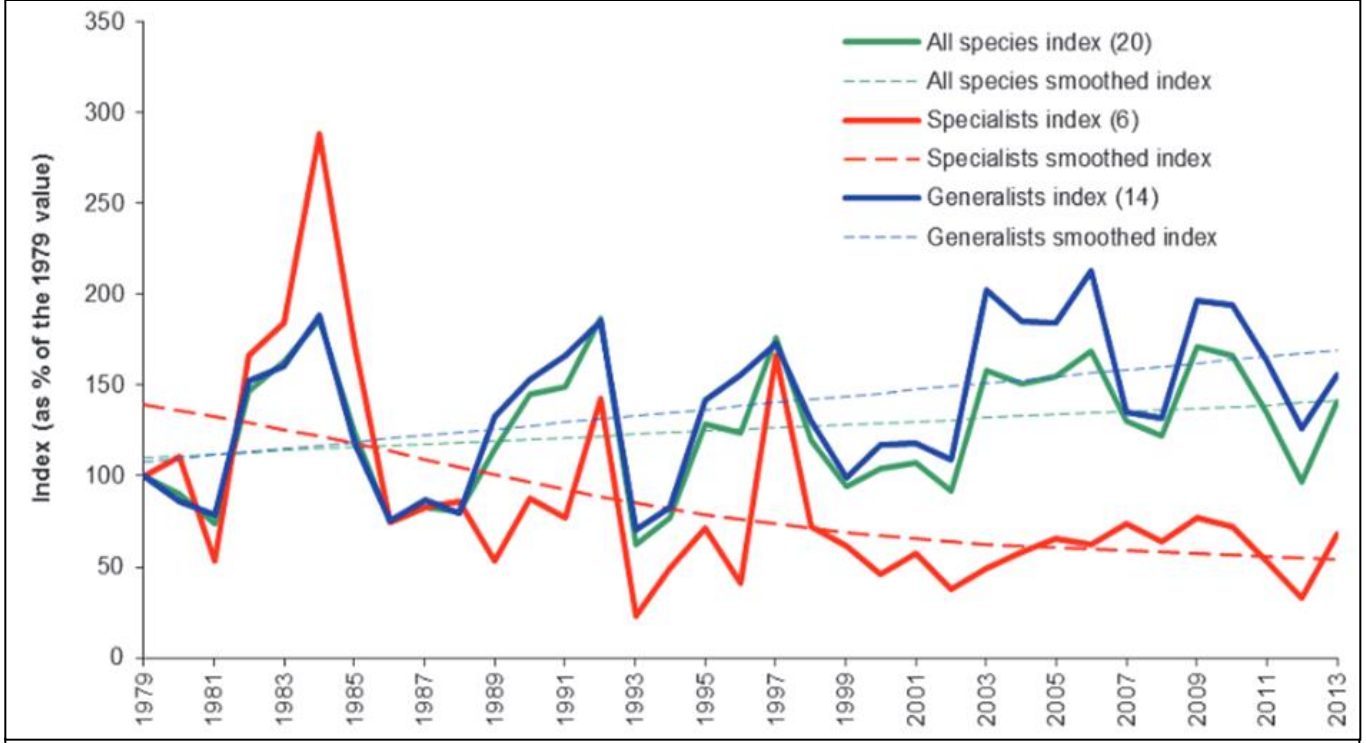
Notes:

- Numbers of geese overwintering have increased significantly, peaking at 340% of 1975/76 levels in 2009/10.
- Numbers of ducks and swans remained relatively stable through most of the period but dipped to 98% of baseline levels in 2009/10 before recovering to 105% in 2011/12.
- Wader numbers have declined since the mid-1990s and in 2011/12 were at 57% of the baseline level, an all-time low .

Source: Wetland Bird Survey Results (WeBS)/SNH, 2014. From ClimateXChange indicator NB6b/NB17b

1. Terrestrial species and habitats

Abundance of specialist butterfly species	⇩	Decline in specialists species since 1979, although rate of decline has lessened since 2004



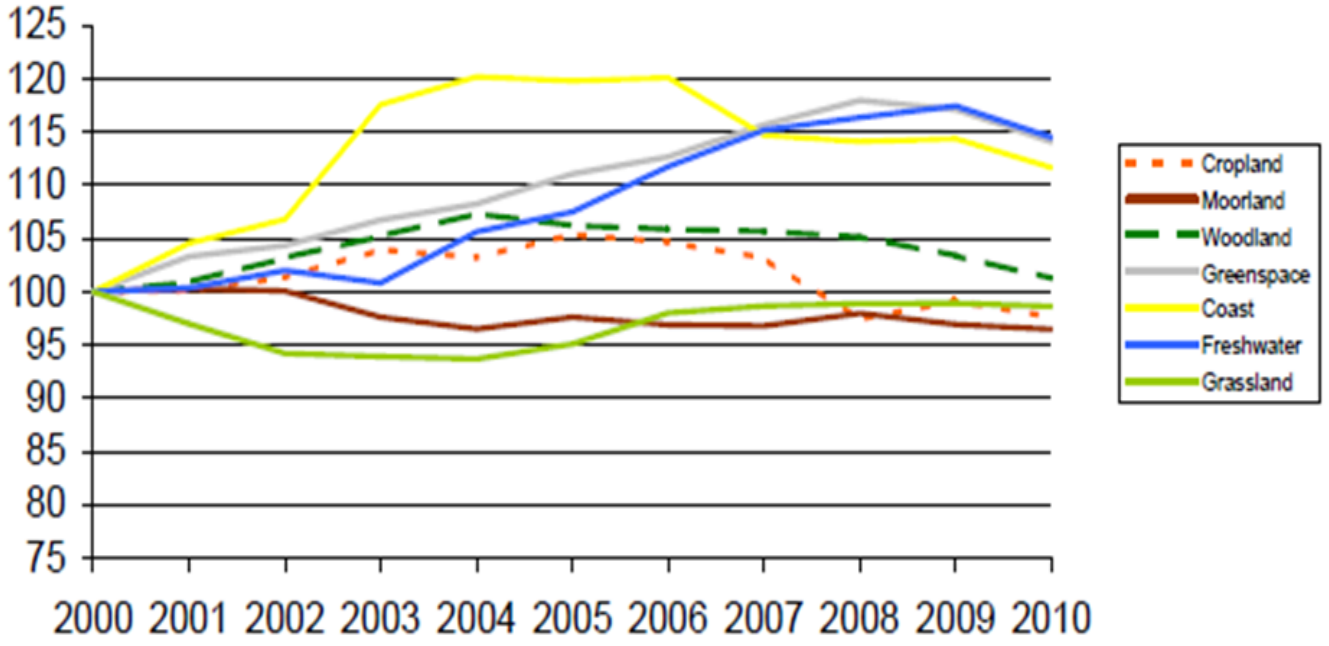
Notes: indicator describes trends in abundance for 20 of the 34 regularly occurring butterfly species in Scotland; insufficient data is available for the remaining 14 species. In the early years of the survey smaller numbers were surveyed therefore the data is less reliable than in recent years.

- During the period 1979 – 2013, the long-term (smoothed) trend for all species combined was stable.
- Generalist species increased significantly, by 57%. Specialist species have declined by 61%, with most of this decline occurring between 1979 and 1992.
- More recently, between 2004 and 2013, the decline is less pronounced and is not statistically significant
- Data limitations mean decline between 1979 and 1992 should be treated with caution. Therefore the trend for specialists is uncertain but appears to show a slight decline.
- Generalist species across the UK declined by 27%, compared to a 57% increase in Scotland

Source: UKBMS for Scotland (SNH, 2015). From ClimateXChange indicator NB16

1. Terrestrial species and habitats

Trends in Natural Capital Asset Index	⇔	Combined index has been broadly stable over the last decade, with improvements in some broad habitats and declines in others



Notes: The NCAI is an aggregate index produced from an analysis of the ecosystem area and ecosystem quality of seven broad habitats. SNH suggest that a change in the index of 5% or more, consistently over a period of a few years, should be interpreted as being significant i.e. a real change in natural capital.

- Three broad habitats (greenspace, coast and freshwater) showed clear improvements in NCAI, and woodland a slight increase
- Moorland showed a steady decline and cropland and grassland a slight decline.
- Overall, the combined NCAI index has been stable over the last decade . Although there was a slight increase in the mid part of the decade, a decline in recent years means overall there is no significant change in natural capital for the decade.

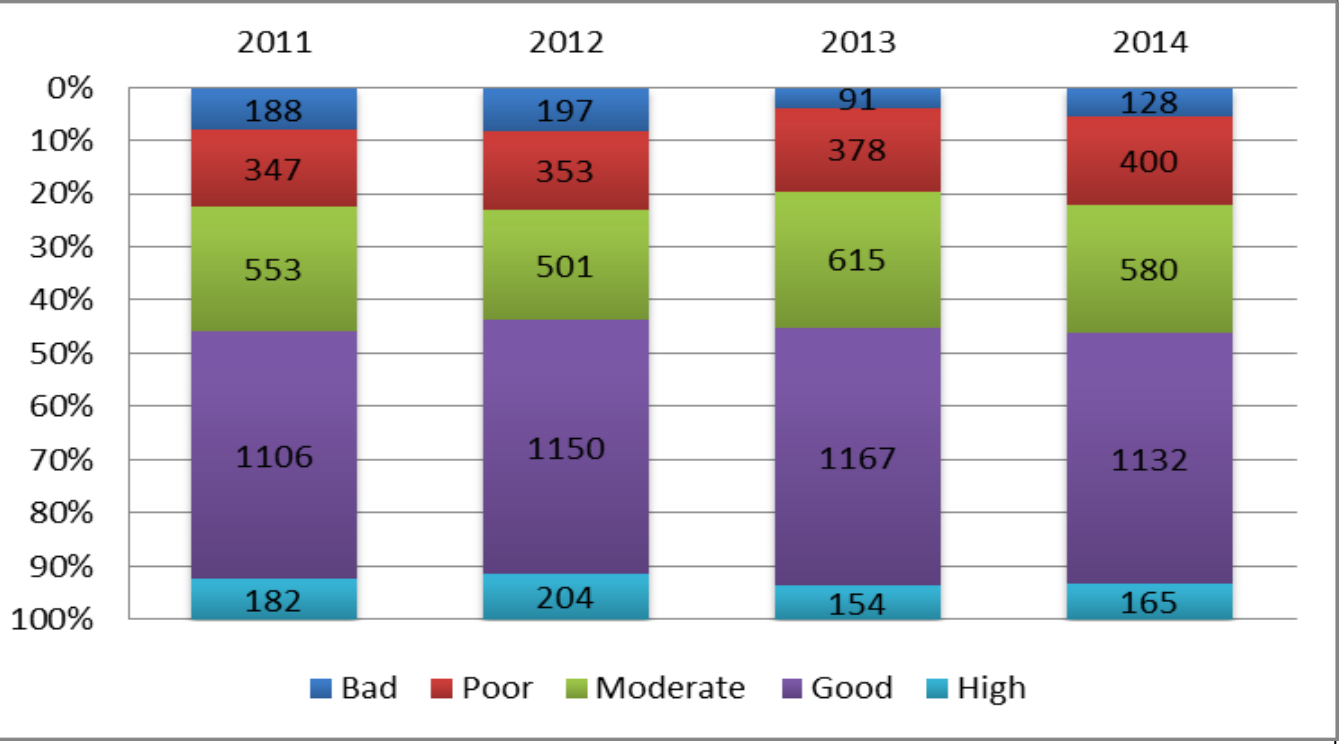
Source: SNH, 2012. From ClimateXChange indicator NB14

2. Freshwater rivers and lochs

Indicator	Data series	Source	Trend	Implication
Ecological status of rivers	2011-2014	SEPA	⇔	No significant change in proportion of rivers meeting good or high ecological status
Ecological status of lochs	2011-2014	SEPA	⇧	Proportion of lochs meeting good/high status has slightly increased.
Freshwater habitats with reported presence of key invasive non-native species (INNS)	2000-2014	SNH	⇧	Number of freshwater habitats being adversely affected by invasive non-native species has more than doubled in last ten years.

2. Freshwater rivers and lochs

Ecological status of rivers	⇔	No significant change in proportion of rivers meeting good/high status.



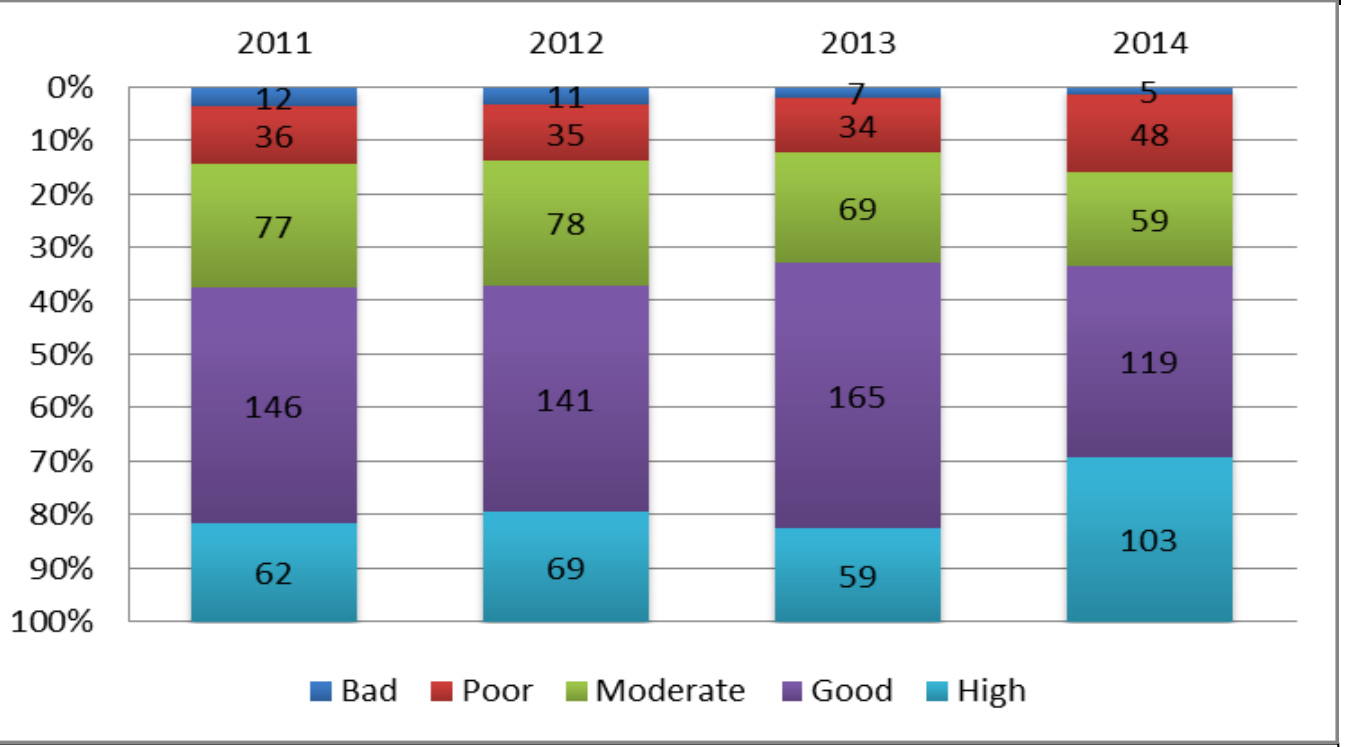
Notes: SEPA has been progressively improving the understanding of the state of the water environment in Scotland, and since 2009 a number of changes have occurred to the way data is collected and analysed. There are therefore some changes within the data over this period that reflect a change in understanding rather than an actual change in water body condition.

- Overall proportion of rivers failing to meet good status did not change between 2008 and 2013, remaining at 46%.
- Of the 2,405 river water bodies in Scotland, the condition of 142 improved between 2013 and 2014, but 187 declined.

Source: SEPA through Environment Scotland. From ClimateXChange indicator NB24

2. Freshwater rivers and lochs

Ecological status of lochs	⇧	Proportion of lochs meeting good/high status has slightly increased.



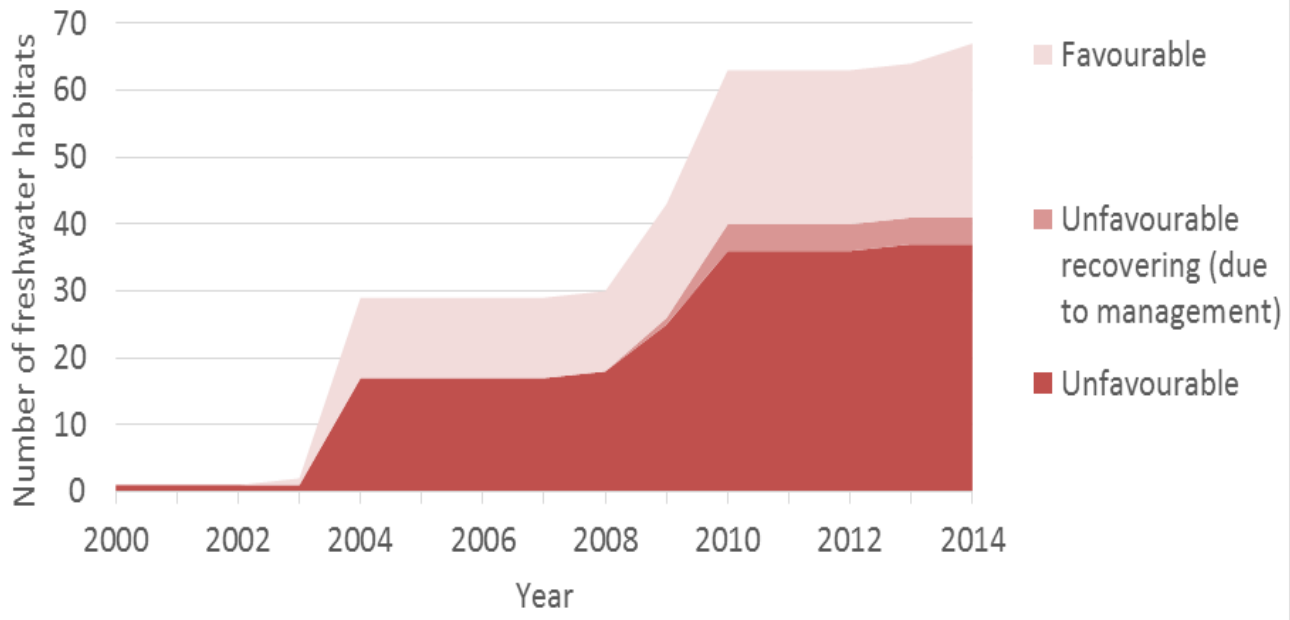
Notes: SEPA has been progressively improving the understanding of the state of the water environment in Scotland, and since 2009 a number of changes have occurred to the way data is collected and analysed. There are therefore some changes within the data over this period that reflect a change in understanding rather than an actual change in water body condition.

- Proportion of lochs failing to meet good status reduced from 37% in 2008 to 34% in 2014.
- More lochs improved in condition between 2013 and 2014 than were degraded (55 improving, 21 degrading).
- But increase in proportion of lochs classed as 'poor' is concerning.

Source: SEPA through Environment Scotland. From ClimateXChange indicator NB24

2. Freshwater rivers and lochs

Freshwater habitats with reported presence of key invasive non-native species (INNS)	⇧	Number of freshwater habitats being adversely affected by invasive non-native species has more than doubled in last ten years.



Notes: Accumulative number of notified freshwater habitats with invasive non-native species identified as a pressure during Site Condition Monitoring. Colours indicate latest (2014) reported overall status of the habitat. Not possible to determine if this is due to an increase in the number of sites included in later cycles of monitoring or an increase in sites under pressure per se.

- There are currently 67 freshwater notified habitat features with invasive non-native species as an identified pressure under Site Condition Monitoring. This represents 32% of all notified freshwater habitats in Scotland.
- The species which are seen to be causing the greatest threats to Scotland's freshwater bodies include North American signal crayfish, New Zealand pygmyweed, American mink, Ruffe, Canadian and Nuttall's pondweeds, Giant hogweed, Japanese knotweed, Parrot's feather, Himalayan balsam and Curly waterweed

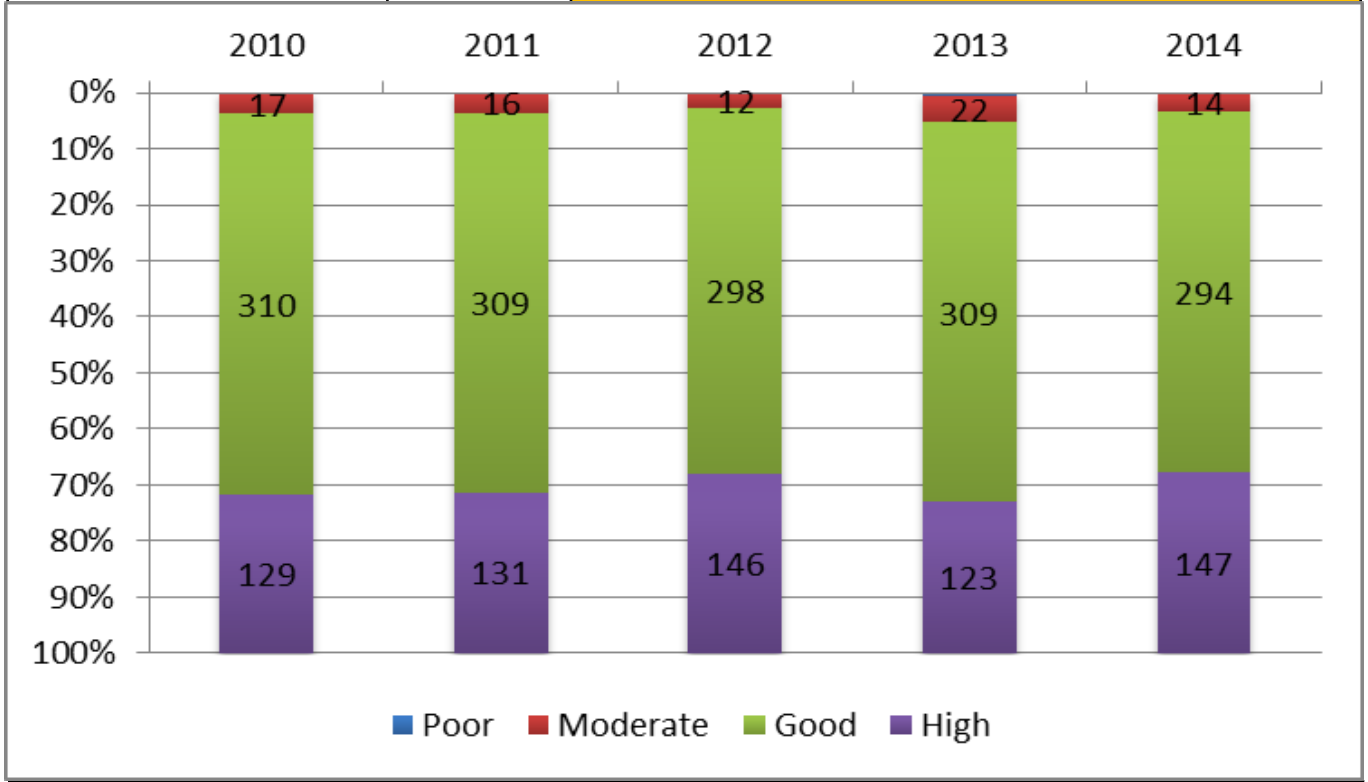
Source: SNH (2015) From ClimateXChange indicator NB39

3. Marine and coastal ecosystems

Indicator	Data series	Source	Trend	Implication
Ecological status of coastal waters	2010-2014	SEPA	⇔	Very little change in the ecological status of coastal water bodies
Ecological status of estuaries	2010-2014	SEPA	⇔	Very little change in the ecological status of estuarine water bodies
Input of hazardous substances (UK data)	1990-2012	Defra	⇩	Sustained reduction in hazardous substances being released to marine environment.
Key Scottish commercial species where TAC is consistent with scientific guidance	2000-2015	Scottish Government	⇔	Percentage has fluctuated since 2000 and has not met target since 2012.
Proportion of large fish by weight, in the NW North Sea	1983-2013	Defra	⇧	Fish size increasing since 2001 and has nearly recovered to 1980s levels
Abundance and productivity of breeding seabirds	1986-2011	SNH	⇩	Both seabird abundance and productivity are in long-term decline

3. Marine and coastal ecosystems

Ecological status of coastal waters	⇔	Very little change in the ecological status of coastal water bodies



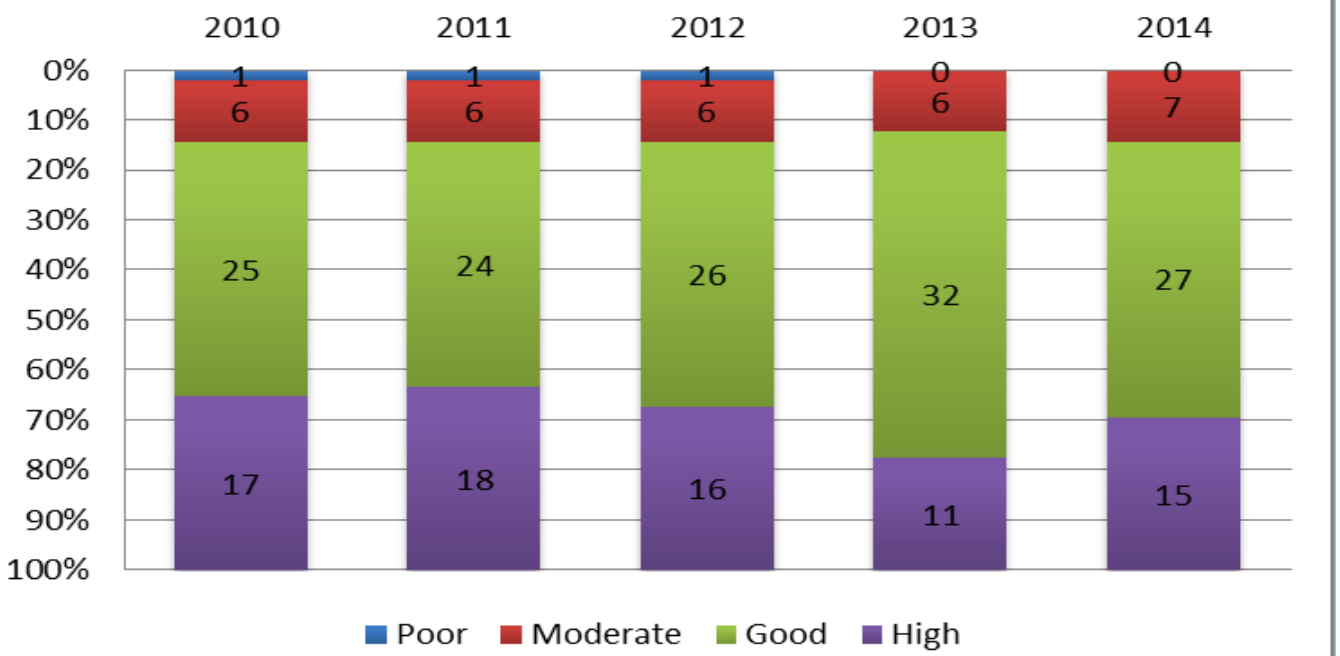
Notes: The environmental standards and methods used to produce the 2013 classification differ slightly from those used from 2007-2012 so any apparent changes between 2012 and 2013 should be treated with caution

- 3% of coastal water bodies are classified as having moderate status and 0.4% as poor in 2014.
- Two coastal water bodies in Scotland were classified as having poor status; in 2013 Leith Docks to Port Seton and Don Estuary to Souter Head (Aberdeen)
- Coastal waters are considered to be stable/declining overall

Source: SEPA through SEWEB http://www.sepa.org.uk/environment/water/classification/classification-results/

3. Marine and coastal ecosystems

Ecological status of estuaries	⇔	Very little change in the ecological status of estuarine water bodies



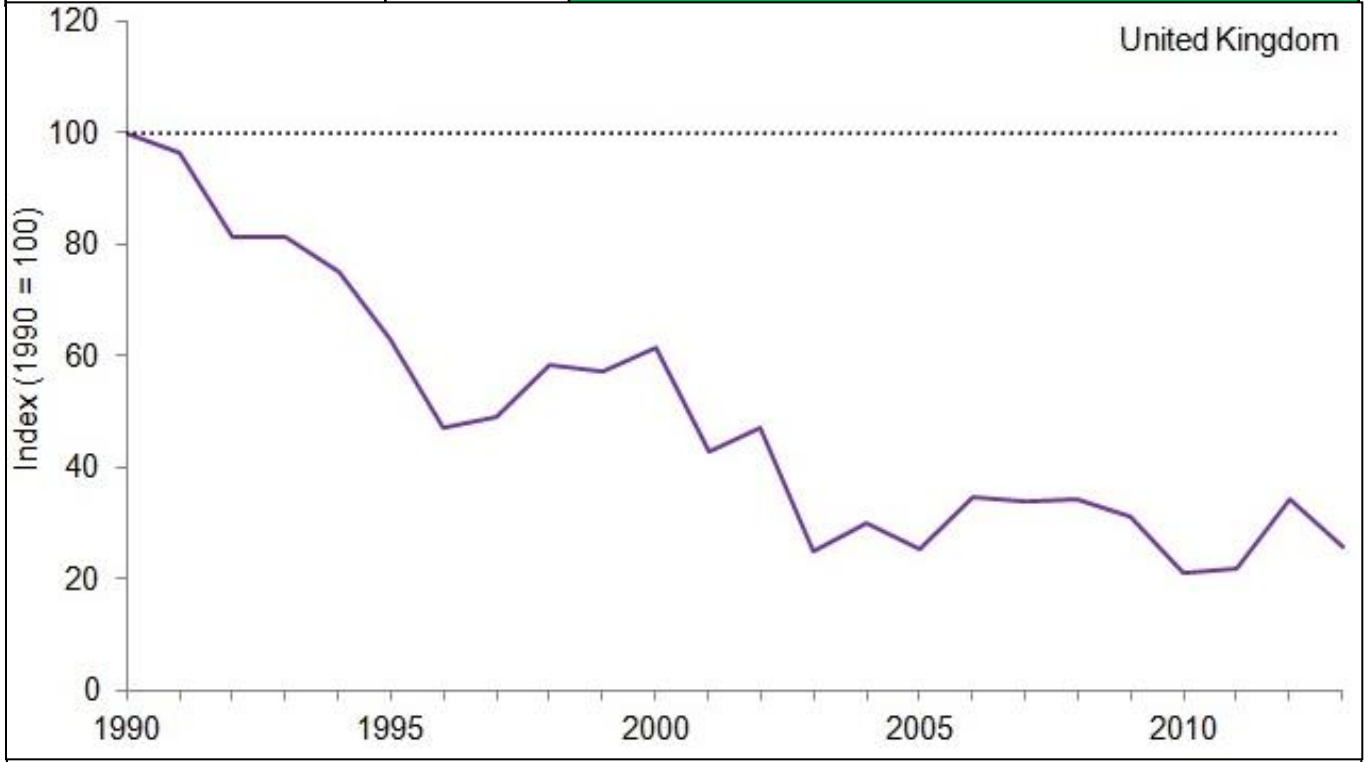
Notes: The environmental standards and methods used to produce the 2013 classification differ slightly from those used from 2007-2012 so any apparent changes between 2012 and 2013 should be treated with caution

- 14.3% of estuaries are classified a having moderate status and none as poor in 2014.
- Estuaries are considered to be improving overall , although the number classified as having high ecological status is lower than in 2010

Source: SEPA through SEWEB

3. Marine and coastal ecosystems

Input of hazardous substances	⇩	Sustained reduction in hazardous substances being released to marine environment.



Notes: Index shows changes in relative input of six of the most hazardous substance to the marine environment: cadmium., lead, mercury, copper, zinc and lindane.

- In 2013, the combined index was 74% lower than in 1990.
- In the short-term, the index was stable (2008-2013).
- Over this time, levels of fie of the six monitored substances declined whilst mercury remained stable.
- Inputs are estimated based on concentrations and flow rates from rivers. Flow rates are heavily affected by rainfall patterns, with high flows increasing inputs to the marine environment.

Source: Defra (2015) Biodiversity 2020: a strategy for England's wildlife and ecosystem services, Indicators

3. Marine and coastal ecosystems

Key Scottish commercial species where TAC is consistent with scientific guidance	⇔	Percentage has fluctuated since 2000 and has not met target since 2012.

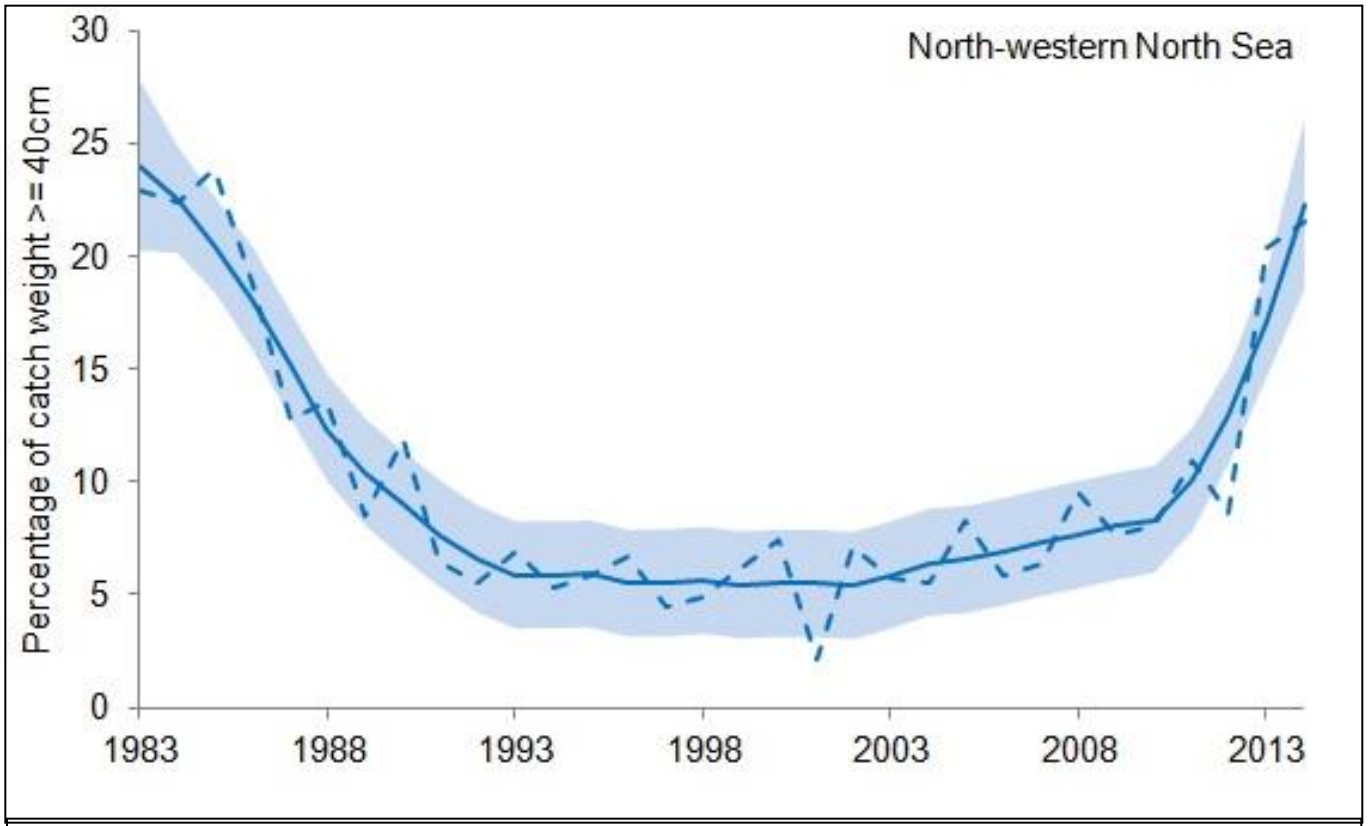
Notes: Calculated over a centred three year average. Data applies to species landed by Scottish fleet. TAC stands for Total Allowable Catch. The value of those fish stocks for which the TAC was set in line with scientific guidance is summed and this total is then divided by the total value of catch for all the stocks under consideration to yield the individual year percentage.

- The proportion (calculated as a three-year moving average) of Scotland's key commercial fish stocks where the quota was set in line with scientific guidance currently stands at 57%
- This is below the 2006 level of 60% and 13% below the 2015 target level.
- Between 2014 and 2015, there was an increase of 17%.

Source: Scottish Government (2015) Scottish National Indicators.

3. Marine and coastal ecosystems

Proportion of large fish by weight, in the NW North Sea	⇧	Fish size increasing since 2001 and has nearly recovered to 1980s levels



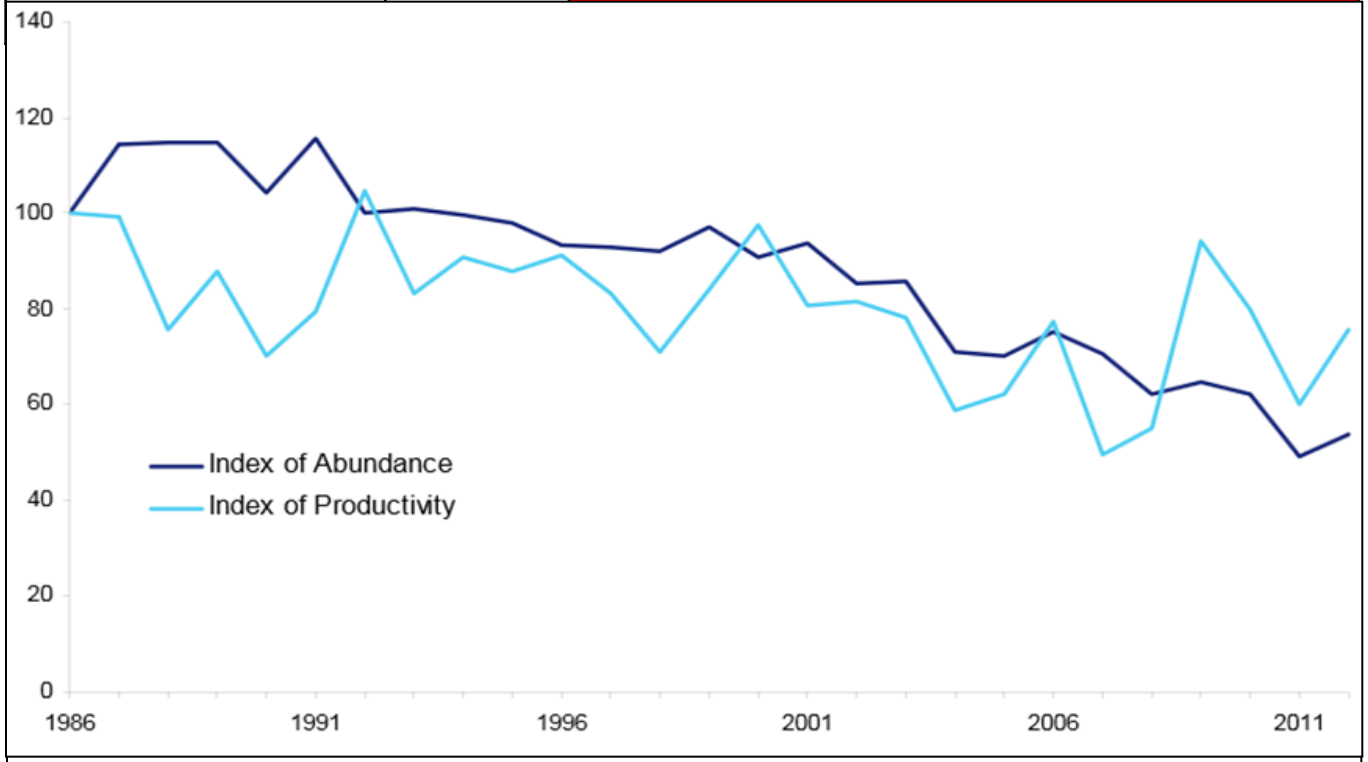
Notes: Large fish are those over 40cm

- Large fish in 2014 made up around 22% of the catch weight, this is comparable to the 23% in 1983.
- From a considerable drop in species size from the 1983 to the 1993 the trend is now increasing.
- The rate of increase has been quicker than the rate of decline.

Source: Defra (2015) Biodiversity 2020: a strategy for England's wildlife and ecosystem services, Indicators

3. Marine and coastal ecosystems

Abundance and productivity of breeding seabirds	⇩	Both seabird abundance and productivity are in long-term declines



Notes: Trends in abundance are available for 11 of 24 species, and productivity trends for 13 species

- Between 1986 and 2012 mean seabird abundance declined by 46% and mean productivity by 24%.
- Mean abundance in 2012 was 54% of the 1986 baseline. Mean productivity was 76% of the baseline,
- Sustained declines were recorded for nine of the eleven species . The species that declined most were Arctic skua (80%), Arctic tern (72%) and black-legged kittiwake (68%). Abundance of black guillemot and common gull remained stable over the period
- Except for the black guillemot, all species have declined more rapidly in Scotland than in the UK overall
- There is significant regional variation across Scotland, with the Northern Isles seeing the most serious declines.

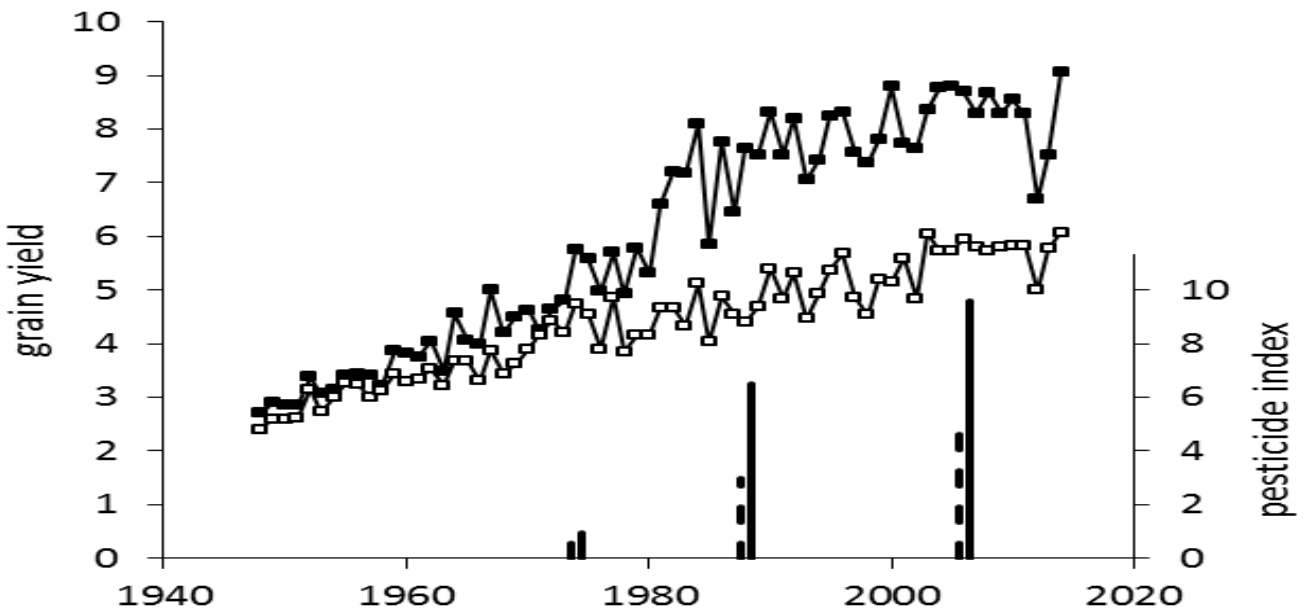
Source: SNH (2013). From ClimateXChange indicators NB6a/NB17a

4. Soils and agriculture

Indicator	Data series	Source	Trend	Implication
Crop yields	1960-2014	Squire et al	⇔	Yields have generally been stable since mid-1990s
Proportion of farmland under High Nature Value farming systems	2009-2012	Scottish Government	⇔	Area under High Nature Value farming has remained broadly stable .
Agricultural production methods which reduce erosion risk	2009-2013	Scottish Government	⇩	Slight increase in area of arable land left bare and so at high risk of soil erosion and a reduction in autumn/winter crops
Number of potato blight outbreaks	2003-2014	ADHB	⇧	Slight increase in average number of outbreaks across GB since 2003.

4. Soils and agriculture

Trends in crop yields	⇔	Yields have generally been stable since mid-1990s



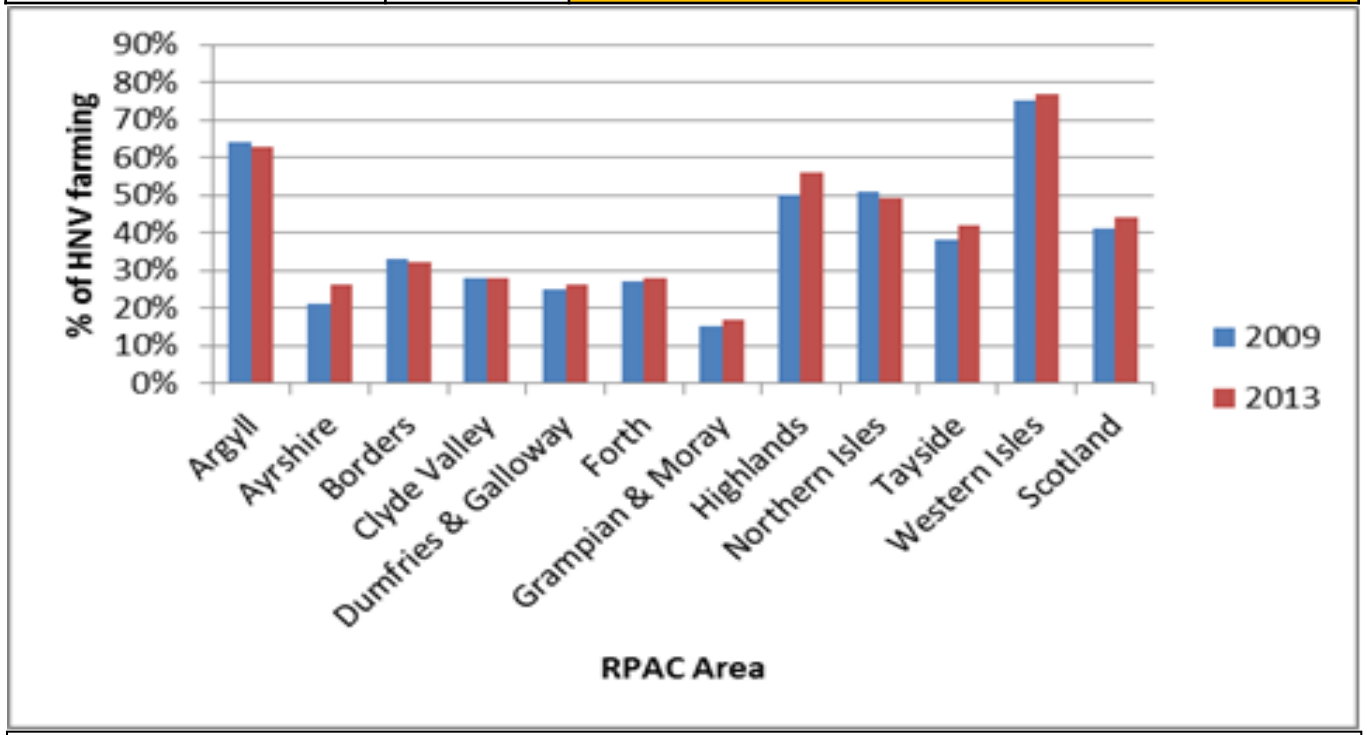
Notes: Trends in grain yield (t ha-1) and pesticide area index for wheat, mainly winter varieties (closed square, solid line) and spring barley (open square, dashed line).

- The greatest changes occurred over about fifteen years between the late 1970s and early 1990s. This was due to intensification of agriculture, by increasing input and mechanisation.
- After the 1990s, the grain yields, as well as some of the input such as nitrogen fertiliser, stabilised.
- However, other input continued to increase, particularly the number and types of pesticide applications.
- Two notable weather-related changes in yield occurred in 2012 and 2014.
- In 2012, the particularly wet season caused wheat yield to drop by about 30%;
- In 2014, the combination of a high solar income and relatively little water stress facilitated an increased yield.

Source: ClimateXChange indicator NA3a/b

4. Soils and agriculture

Area of farmland under High Nature Value farming	⇔	Area under High Nature Value farming has remained broadly stable.



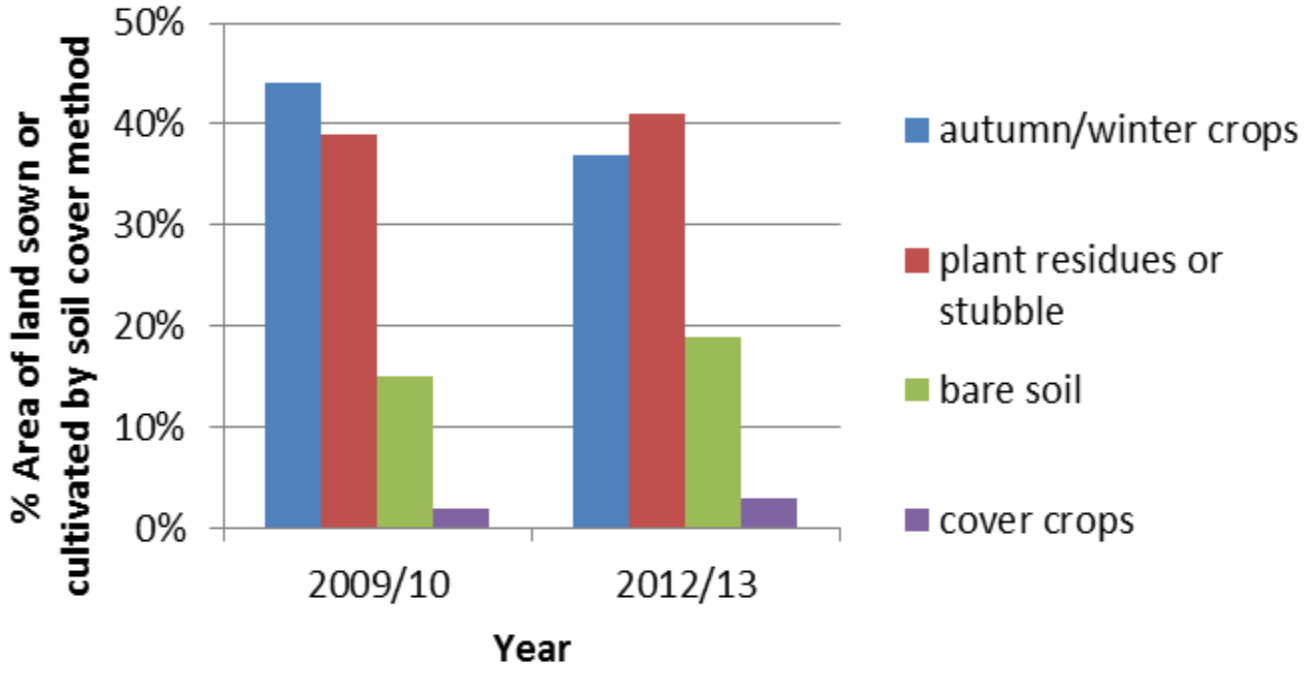
Note: A change to the classification of farm types in the 2013 June Agricultural Census means that figures from 2009-2012 cannot be directly compared with 2013 figures. Between 2009 and 2012 the percentage of UAA estimated to be HNV farming remained stable at 41-42%.

- High Nature Value (HNV) farming systems are important for the environmental benefits they provide, including support for a range of habitats and species
- In 2013, 44% of the total agricultural land in Scotland was estimated to be under HNV farming, an area of 2,432,000 ha

Source: From ClimateXChange indicator NA9

4. Soils and agriculture

Uptake of soil conservation measures	⇩	Slight increase in area of arable land left bare and so at high risk of soil erosion and a reduction in autumn/winter crops



Notes: Data is expressed as a percentage of the total cultivated land area in Scotland, which was about 1.02 million hectares in 2012/13

- Soil cover is typically provided by plant residues or stubble, autumn or winter crops or cover crops
- Majority (81%) of arable land in Scotland had some form of soil cover in 2012/13
- Area of bare soils increased from 15% in 2009/10 to 19% in 2012/13
- Reduced tillage covered11% of arable land in 2012/13. A further 8% of arable land was under zero tillage. The remaining 81% of arable land is under conventional tillage.

Source: EU Farm Structure and Methods Survey, 2013. From ClimateXChange indicator NA12

4. Resilience of agriculture

Number of potato blight outbreaks	⇧	Slight increase in average number of outbreaks across GB since 2003.

Notes: Late blight activity is monitored as part of a Great Britain (GB)-wide network sponsored by AHDB-Potatoes in their Blightwatch and Fight Against Blight (FAB) schemes

- Potato late blight is a devastating disease capable of destroying crops in 7-10 days
- Across Great Britain 267 potato blight outbreaks were reported in 2014
- Disease incidence and severity are strongly driven by weather conditions with even short periods of optimal weather driving explosive epidemics at a single field to regional scales.

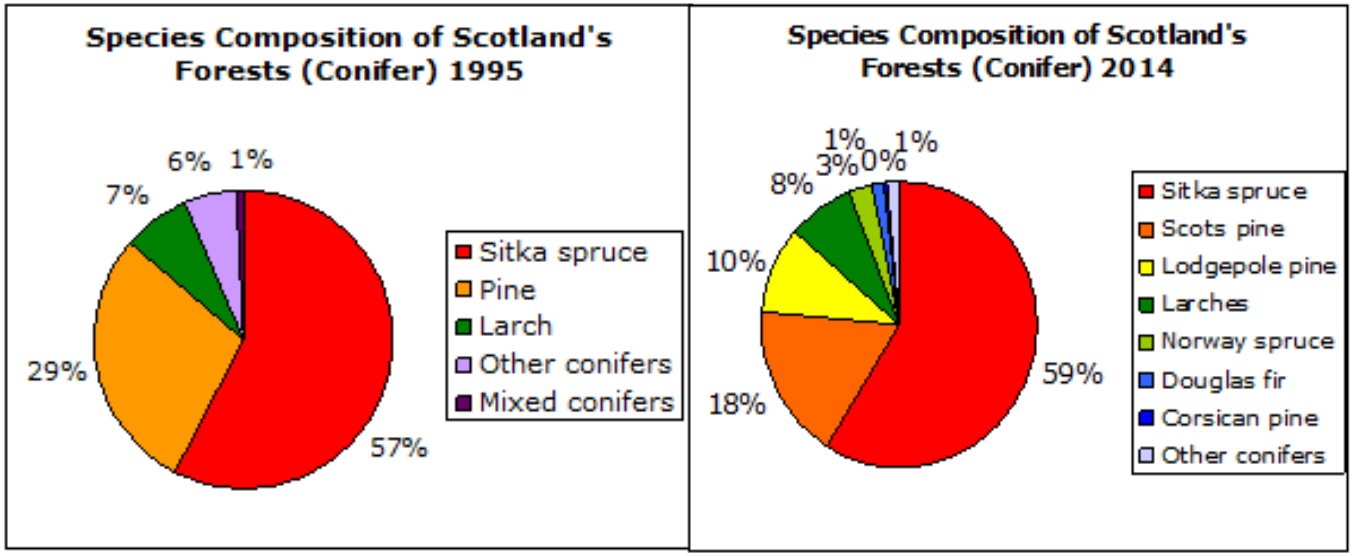
Source: ADHB. From ClimateXChange indicator NA25

5. Forestry

Indicator	Data series	Source	Trend	Implication
Planted forest tree species diversity index	1995 and 2014	Forestry Commission Scotland	⇔	Tree species diversity has improved slightly over the last 18 years, with an increase in broadleaf forest area. Conifer diversity has not changed.
Number of users of the Ecological Site Classification (ESC) decision support tool	2008 - 2012	Forestry Commission	⇧	Number of users of ESC in Great Britain has steadily increased
Number of users of the ForestGALES decision support tool	2008 - 2012	Forestry Commission	⇧	Number of uses of ForestGALES in Great Britain has steadily increased
Area of woodland with active, approved deer management plans	2007-2013	Forestry Commission Scotland	⇧	Overall increase in the area of woodland under active deer management since 2007

5. Forestry

Tree species diversity	⇔	Tree species diversity has improved slightly over the last 18 years, with an increase in broadleaf forest area. Conifer diversity has not changed.



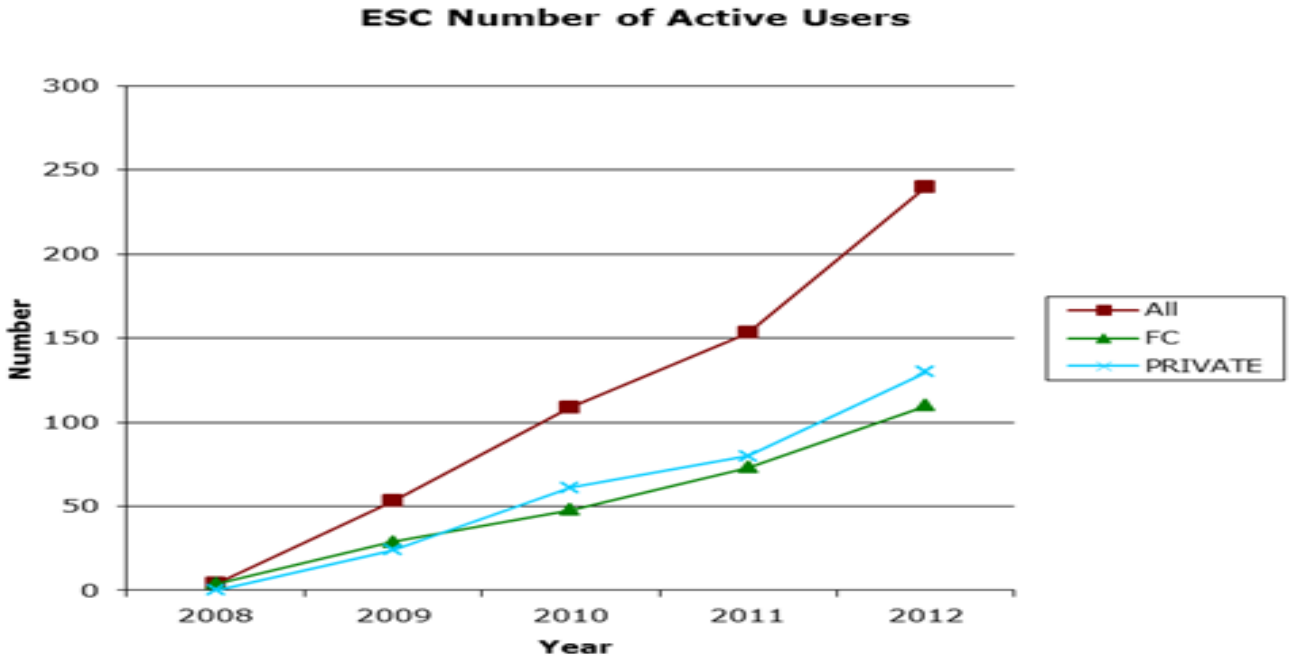
Notes: Species composition of Scotland's forests (privately owned and National Forest Estate) as surveyed in 1995 (left) and 2014 (right) for conifer species

- Sitka spruce is the dominant conifer species accounting for 43% of total forest area. Scots pine accounts for13% total forest area
- Overall proportion of conifer forest has decreased, from 81.6% in 1995 to 74.6% in 2014, and broadleaf forest has increased, from 18.4% in 1995 to 25.4% in 2014
- Proportion of Sitka spruce is similar in 1995 and 2014 at 57% and 59% and the proportion of pines is similar at 29% and 28% respectively

Source: Forestry Commission Scotland (2001 and 2015). From ClimateXChange indicator NF 5

5. Forestry

Users of forestry decision-support tools	⇧	Number of uses of ESC in Great Britain has steadily increased



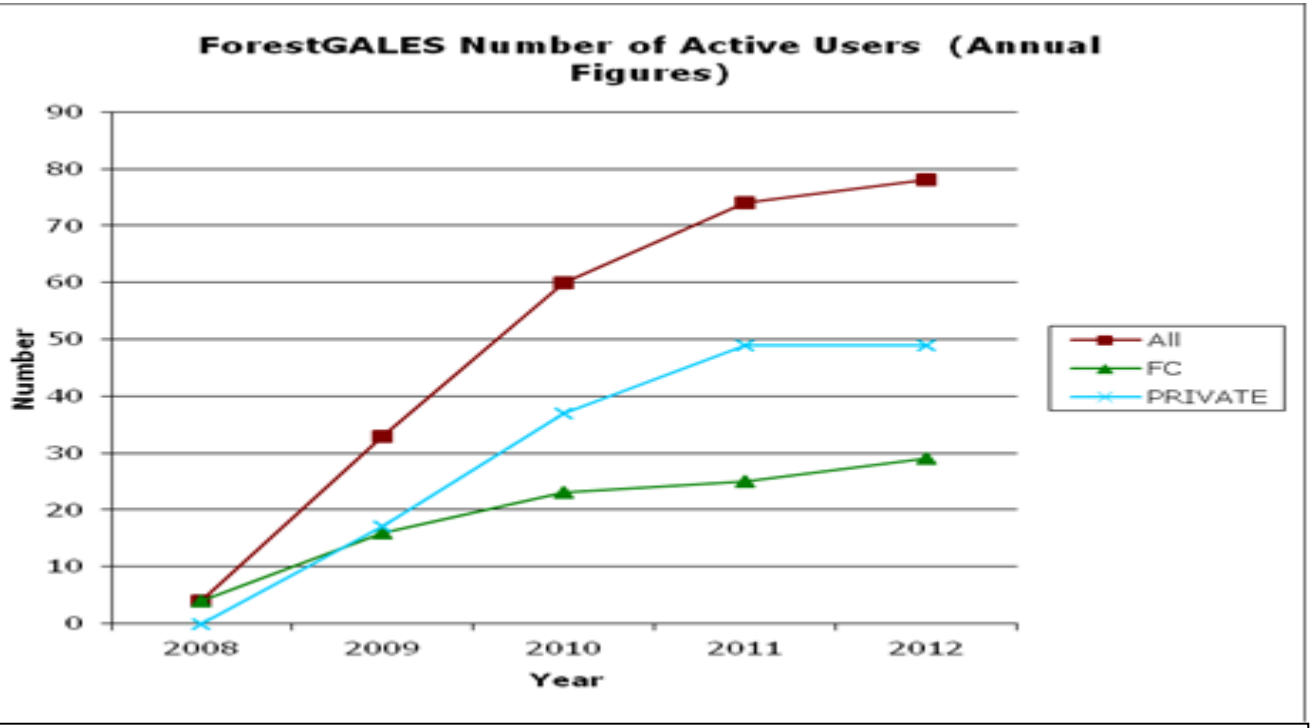
Notes: The Ecological Site Classification Decision Support System (ESC-DSS) is a PC-based system that aims to guide forest managers in deciding the most appropriate species to plant, given site and soil characteristics

- Since mid-2008 ESC has incorporated future climate change projections. for the 2050 and 2080 low and high scenarios of UKCIP02
- In 2012 ESC had 1012 uses, 240 active users and 151 new users registering.
- The number of uses of ESC in Great Britain has steadily increased from 131 uses in 2009 to 1012 in 2012.

Source: Forestry Commission. From ClimateXChange indicator NF 6

5. Forestry

Users of forestry decision support tools	⇧	Number of uses of ForestGALES in Great Britain has steadily increased



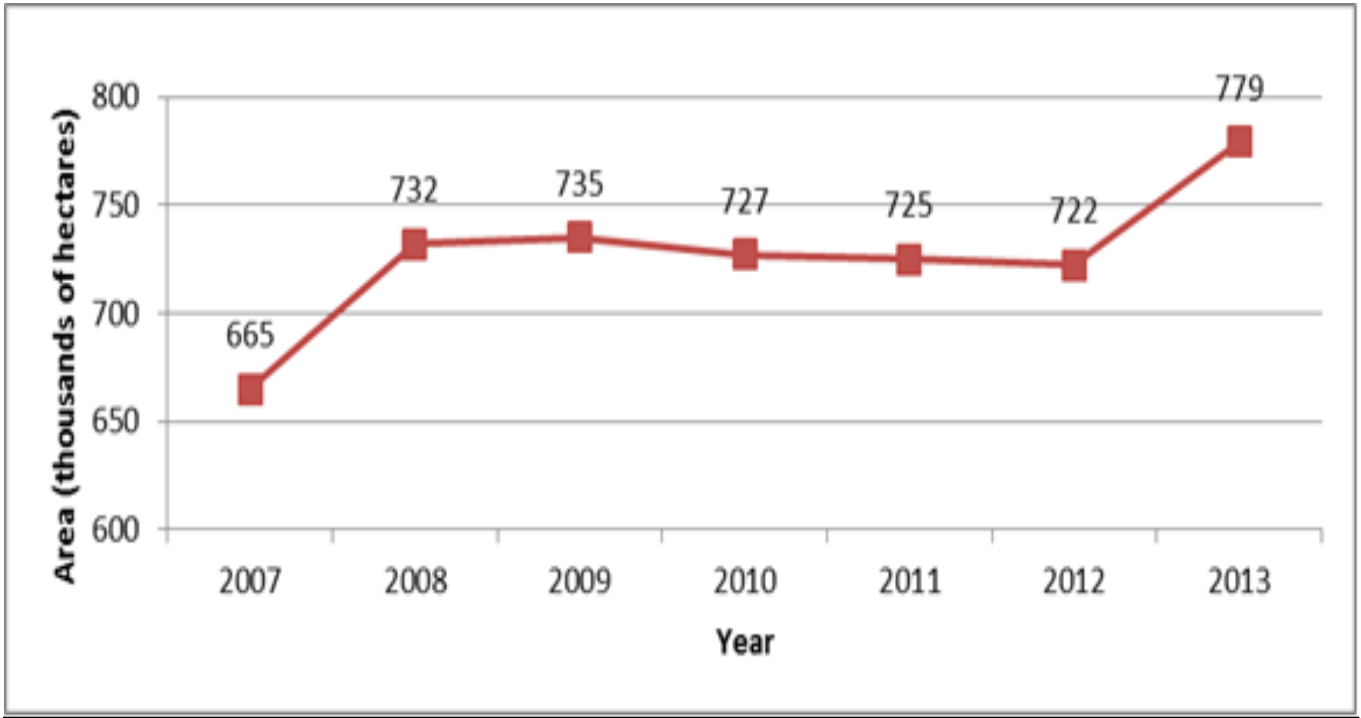
Notes: ForestGALES is a decision support tool which aims to assist forest managers in their decisions about how to plant forest stands to minimise windthrow.

- Over the last 4 years the use of ForestGALES in Great Britain has steadily increased. It had 124 uses in 2012, compared to 55 in 2009

Source: Forestry Commission. From ClimateXChange indicator NF21

5. Forestry

Area of woodland with active deer management	⇧	Overall increase in the area of woodland under active deer management from 50% in 2007 to 55% in 2013



Notes: measures areas of woodland, including any associated open areas, where specific deer management plans are in place

- In 2013, 55% (779,000 hectares) of woodlands in Scotland had active approved deer management plans
- The area has increased by 17% from 665,000 (50% of total woodland area) in 2007

Source: Forestry Commission Scotland (2014b) *The Scottish Forestry Strategy: Implementation Plan (2014-17) and Progress Report (2013-14)*. From ClimateXChange indicator NF14

Adaptation Sub-Committee

http://www.theccc.org.uk

@theCCCuk