Indicators and trends

Monitoring climate change adaptation

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Indicator name				Version
NB23 Amount of natural regeneration in native woodlands				**29/04/16**
Indicator type:	**Risk/opportunity**	**Impact**	**Action**	
			X	

SCCAP Theme	SCCAP Objective	CCRA risk/opportunity
Natural environment	N2: Support a healthy and diverse natural environment with the capacity to adapt	FO5: Loss of biodiversity in native woodlands

At a glance

- Scotland's native woodlands are highly valued for their biodiversity
- They are under pressure from a number of stressors including climate change, habitat fragmentation and invasive non-native species
- Sufficient natural regeneration of native woodland is a vital part of developing its resilience to climate change and other pressures
- This indicator monitors the amount of natural regeneration in native woodlands, using results from the Native Woodland Survey of Scotland

Latest Figure

Year	Proportion of total cover in native woods in regeneration stages (visible and established)
2014	21%

Trend

No trend available

Why is this indicator important?

Scotland's native woodlands[1] are an important part of our 'natural capital' (Scottish Government, 2013). 'All types of native woodland are recognised as priority habitats for conservation action in Scottish Government policies and strategies for forestry and biodiversity' (Forestry Commission Scotland, 2014a, p.9). Providing habitat for many of Scotland's rare and threatened species, they are highly valued for their biodiversity.

Although there have been considerable efforts to protect and enhance native woodlands since the 1980s, they remain under pressure from multiple sources including non-native tree planting, habitat

[1] woodlands where over 50% of the canopy is composed of native species (Forestry Commission Scotland, 2014a)

fragmentation, invasive non-native plants and animals, plant pests and diseases and deer browsing. Climate change and atmospheric pollution are additional stressors (Forestry Commission Scotland, 2014a).

The resilience of native woodlands to climate change and other pressures depends on a number of factors including the extent of natural regeneration, which has a critical role in allowing genetic adaptation through natural selection in response to climate change and other environmental pressures. A sufficient level of diverse natural regeneration is important in establishing and maintaining resilient native woodland ecosystems (Forestry Commission Scotland, 2014a).

Semi-natural woodlands are created by natural regeneration from parent trees rather than by planting and are considered of greater conservation value due to their more natural structure and composition and also their greater genetic conservation value. The trees and shrubs that are present in a woodland landscape shape its character and are a major influence on ecosystem processes. This is important for biodiversity as the specialist species that are most threatened by environmental change are often adapted to specific native trees or shrubs, having co-existed over a long period of time. For example, birches, willows and oaks host numerous specialist insect species (Patterson, 1993, cited in Forestry Commission Scotland, 2014a).

Native woodland biodiversity value is usually greater when:

- a wide range of native trees and shrubs characteristic of the site-type are present, which will support a larger community of wildlife, more rare and specialist species and a wider range of ecosystem processes like decomposition and nutrient cycling;
- 'native species make up all or nearly all of the woodland' (Forestry Commission Scotland, 2014a, p. 31)

This indicator monitors the amount of natural regeneration in native woodlands. Regeneration is one of the prerequisites for healthy woodland and is likely to contribute to the ability of woodland to withstand climate change. The indicator draws on the Native Woodland Survey Scotland (NWSS) to report on the proportion of Scotland's native woodland that is in the regeneration stage. This includes:

- 'Visible regeneration: trees above the predominant field layer height but <1m tall and still susceptible to browsing damage'
- 'Established regeneration: trees >1m in height and <7cm DBH' (diameter at breast height), 'usually <5m in height but DBH overrides height' (Forestry Commission Scotland, 2014c)

Related Indicators:

NB37: Proportion of native woodland affected by invasive non-native plant species
NF14: Area of woodland with active, approved deer management plans

What is happening now?

21% of Scotland's native woodland is in the regeneration stage, comprising 17% established regeneration and 4% visible regeneration. 78% of native woodland cover is in the mature or pole immature stages while just over 1% is shrubs and less than 1% is veteran trees (Forestry Commission Scotland, 2014a). Forestry Commission Scotland (2014a) estimate that the minimum average cover of established regeneration needed to sustain our native woods at 15-35%. While the method is based on a number of assumptions and requires further refining, it indicates that the observed 17% of

established regeneration is insufficient to sustain native woods.

As well as the amount of regeneration, its distribution is important. This is shown in Fig. 1 below.

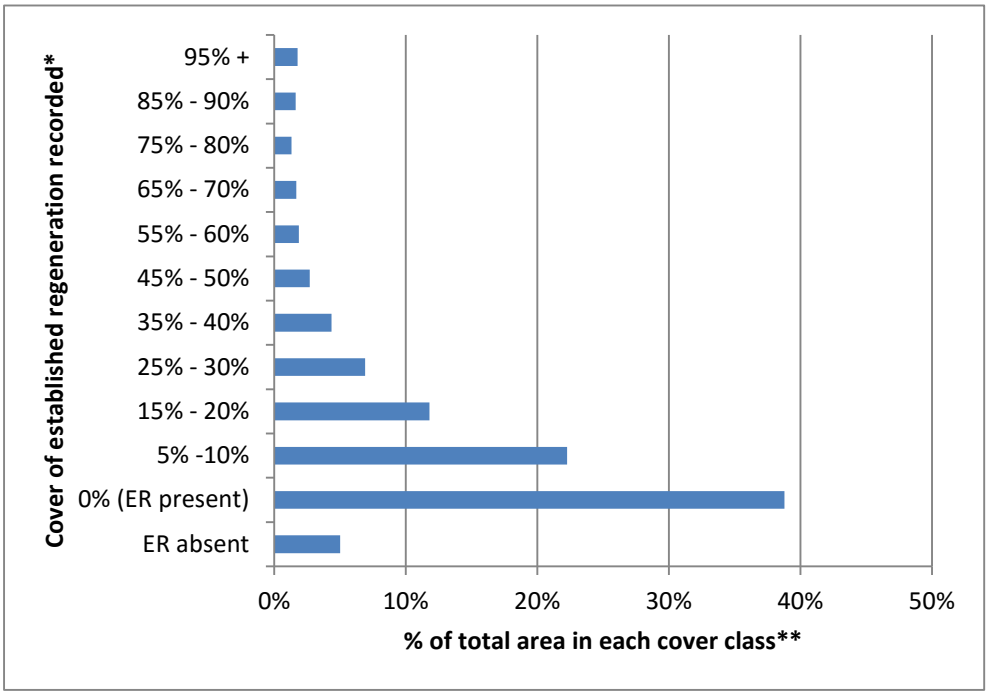

Figure 1 Frequency distribution of established regeneration cover classes for all native woodlands (Source: Forestry Commission Scotland, 2014a)
*Expressed as a % of total canopy cover
**Expressed as a % of total native woodland area

Fig. 1 shows the distribution of established natural regeneration (i.e. excluding planted woods) cover for native woodland. The distribution shows that of all native woodlands, only around a quarter have more than 20% cover of established natural regeneration.

Many native trees are only present in very limited areas of native woodland, as illustrated in Fig. 2. This is likely a result of previous woodland management practices, changes in land use, limited ranges of species suitability, and the impact of herbivore browsing on natural regeneration (Forestry Commission Scotland, 2014a).

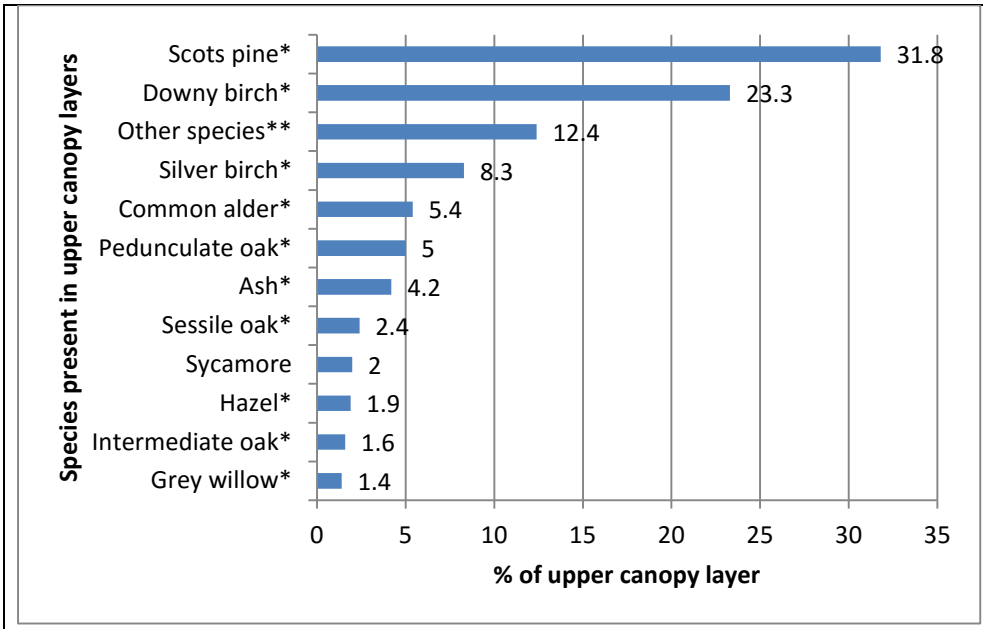

Figure 2. Species composition of upper canopy layer in native woodland
(Source: Forestry Commission Scotland, 2014a)

*Native species

** Other species include: grey willow*, rowan*, beech, birch*, goat willow*, Sitka spruce, hawthorn*, European larch, wych elm*, Norway spruce, lodgepole pine, hybrid larch, gean*, aspen*, bird cherry* and Japanese larch.

Scotland's total area of native woods is recorded at 311,200 hectares (Forestry Commission Scotland, 2014b). Just under half (46%) of native woods are considered to be in satisfactory condition for biodiversity (Forestry Commission Scotland, 2014a). Upland mixed ashwoods and upland oakwoods, both of which have especially high biodiversity value, are the rarest types of native woodland. They are both considered threatened, lack of regeneration being the main threat to upland oakwoods (Forestry Commission Scotland, 2014b).

What has happened in the past?

There is a lack of comparable data to enable an assessment of past trends. The NWSS is the most complete survey of its kind, identifying the location and types of all native woodlands in Scotland. Previous surveys have focussed on regions of Scotland, specific types of woodland, or woodlands at a larger scale, thus excluding some small but important native woodland habitats. Differences in the way that information was collected make it difficult to compare the results.

What is projected to happen in the future?

It is estimated that 15-35% is the minimum average cover of established regeneration required to sustain native woodlands (Forestry Commission Scotland, 2014a), therefore the current average cover of 17% established regeneration is likely to be too low.

Patterns of change

Across different types of woodland, regeneration cover (including both natural and planted regeneration) ranges between 11% in upland oakwoods to 26% in wet woodland (Forestry Commission Scotland, 2014a).

Interpretation of indicator trends

The NWSS report concludes that 'although a lot has recently been done to plant and restore native woodlands, the current amount and distribution of regeneration is not yet enough to sustain all of our current native woodland resource in the long term.' (Forestry Commission Scotland, 2014a, p.5)

Taking into account predicted survival and growth rates of young trees, the estimated minimum average cover of established regeneration needed to sustain native woods is 15-35%, indicating that the current average rate of 17% is insufficient to sustain our native woodlands. Furthermore, when planted trees are excluded (see Fig. 1) just a quarter of native woodlands contain 20% or more of established natural regeneration (Forestry Commission Scotland, 2014a).

The level of natural regeneration is particularly low for:

- upland oakwoods, at around 7%
- seminatural pinewoods, 9%
- lowland mixed deciduous woodland, around 11% (Forestry Commission Scotland, 2014a).

The impact of browsing and grazing by herbivores, particularly deer, is considered the single most widespread threat to native woodlands (Forestry Commission Scotland, 2014a). Deer play an important role in woodland ecosystems, with some grazing and browsing activity helping influence the composition and structure of woodland and therefore the biodiversity it supports. However sustained heavy browsing inhibits natural regeneration. The NWSS found that a third of native woodlands currently have high or very high levels of herbivore impact, a level that is 'likely to prevent the successful regeneration of most species' (Forestry Commission Scotland, 2014a) and slightly over a half of native woodlands suffer medium level impacts that are liable to suppress regeneration of some more vulnerable species leading to reduced overall levels of regeneration and reduced species diversity (Forestry Commission Scotland, 2014a).

The presence of Invasive Non-Native Species (INNS) is also likely to affect the amount of natural regeneration. Invasive species such as *Rhododendron ponticum* can suppress regeneration of native vegetation. Although INNS cover only around 2% of Scotland's native woodland area, they are present in 19% of the native woodland polygons used in the NWSS (Forestry Commission Scotland, 2014a) and are more significant in particular localities (Forestry Commission Scotland, 2014a).

The Indicators 'NB37: Area of native woodland affected by non-native invasive plant species' and 'NF14: Area of woodland with active approved deer management plans' provide further information.

Limitations

The NWSS is the most complete survey of its kind, identifying the location and types of all native woodlands in Scotland. It involved six years of continuous field survey, covering an area of 848,000 hectares and providing comprehensive data for every area of native woodland over 0.5 ha in area (Forestry Commission Scotland, 2014b). A quality assurance process was put in place for the survey which included data validation, post survey data checking, benchmarking of returned data and minimising variation between surveyors. For more information on the field survey quality assurance procedure see http://scotland.forestry.gov.uk/images/corporate/pdf/RSFSarticleonNWSSQA.pdf For more information on the survey method see Forestry Commission Scotland (2014a).

This indicator utilises the results of the NWSS. The identification of trends and future updates are

dependent on repeat surveys being carried out in future.

References

Forestry Commission Scotland (2014a) *Scotland's Native Woodlands – results from the native woodland survey of Scotland*. http://scotland.forestry.gov.uk/supporting/strategy-policy-guidance/native-woodland-survey-of-scotland-nwss (accessed January 2015).

Forestry Commission Scotland (2014b) *The Scottish Forestry Strategy: 2014-2017 Implementation Plan & 2013-2014 Progress Report.* Forestry Commission, Edinburgh.

http://scotland.forestry.gov.uk/images/corporate/pdf/sfs-implementation-plan-2014-2015.pdf

Forestry Commission Scotland (2014c) *NWSS - Glossary of Terms*. Forestry Commission, Edinburgh.

http://scotland.forestry.gov.uk/supporting/strategy-policy-guidance/native-woodland-survey-of-scotland-nwss/glossary (accessed Feb 2015).

Scottish Government (2013). *2020 Challenge for Scotland's Biodiversity*. Scottish Government, Edinburgh. http://www.scotland.gov.uk/Resource/0042/00425276.pdf

Further information

Background information and links to further detail on the Native Woodland Survey Scotland: http://scotland.forestry.gov.uk/supporting/strategy-policy-guidance/native-woodland-survey-of-scotland-nwss

Acknowledgements

Forestry Commission Scotland

Suzanne Martin (RBGE) contributed to this indicator.

Appendix One: Indicator metadata and methodology

Table 1: Indicator metadata

	Metadata
Title of the indicator	Amount of natural regeneration in native woodlands
Indicator contact: Organisation or individual/s responsible for the indicator	Ruth Monfries (Royal Botanic Garden Edinburgh/CXC)
Indicator data source	Native Woodland Survey Scotland (NWSS)
Data link: URL for retrieving the indicator primary indicator data.	http://scotland.forestry.gov.uk/supporting/strategy-policy-guidance/native-woodland-survey-of-scotland-nwss

Table 2: Indicator data

	Indicator data
Temporal coverage: Start and end dates, identifying any significant data gaps.	2014
Frequency of updates: Planned or potential updates	Potentially 10-15 years
Spatial coverage: Maximum area for which data is available	Scotland
Uncertainties: Uncertainty issues arising from e.g. data collection, aggregation of data, data gaps	The NWSS is the most complete survey of its kind, identifying the location and types of all native woodlands in Scotland. It involved six years of continuous field survey, covering an area of 848,000 hectares and providing comprehensive data for every area of native woodland over 0.5 ha in area (Forestry Commission Scotland, 2014b). A quality assurance process was put in place for the survey which included data validation, post survey data checking, benchmarking of returned data and minimising variation between surveyors.
Spatial resolution: Scale/unit for which data is collected	0.5 ha
Categorical resolution: Potential for disaggregation of	Local authority, priority woodland type.

data into categories	
Data accessibility: Restrictions on usage, relevant terms & conditions	Publically accessible and free.

Table 3 Contributing data sources

Contributing data sources Data sets used to create the indicator data, the organisation responsible for them and any URLs which provide access to the data.
Native Woodland Survey Scotland. Forestry Commission Scotland. http://scotland.forestry.gov.uk/supporting/strategy-policy-guidance/native-woodland-survey-of-scotland-nwss

Table 4 Indicator methodology

Indicator methodology The methodology used to create the indicator data
The Native Woodland Survey of Scotland (NWSS) was a field-based survey carried out from 2006-2012. It identified the location, type, extent, composition and condition of all native and nearly native woods, as well as woods planted on ancient woodland sites (PAWS), of at least 0.5 ha in area. Data about INNS was collected from the shrub and field layer of woodlands. Native woods were classified into six main habitat types which are recognised as UK priorities for conservation. Some subdivisions of these native woodland types are also recognised as priority habitats under the European Union Habitats and Species Directive. Surveyors subdivided and mapped the woodlands into polygons (discrete areas) of identifiable priority woodland types, each of which was at least 0.5 ha in size, then recorded the attribute data separately for each polygon. For further details of the methodology see http://scotland.forestry.gov.uk/supporting/strategy-policy-guidance/native-woodland-survey-of-scotland-nwss