

Indicator name			Version
NB37 Proportion of native woodland affected by invasive non-native plant species			25/03/16
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 BD3: Risk of pests to biodiversity	

At a glance
<ul style="list-style-type: none"> • Scotland's native woodlands are highly valued both for biodiversity and the ecosystem services they provide, such as improved flood control • These woodlands face multiple pressures including invasive non-native species, excessive deer browsing and climate change • The impact of non-native invasive plant species leaves native woodlands more vulnerable to climate change • This indicator monitors the extent of natural woodland affected by INNS • Although INNS only cover 1.8% of the total native woodland, they are locally significant in some areas

Latest Figure			Trend
Year	% of polygons (surveyed woodland units) of native woodland with a presence of INNS	% of native woodland area affected by INNS	No trend available
2014	19	1.8	

Why is this indicator important?
<p>Scotland's native woodlands are an important part of our 'natural capital' (Scottish Government, 2013). Providing habitat for many of Scotland's rare and threatened species, they are highly valued for their biodiversity. They also supply a wide range of beneficial ecosystem services, including timber and other forest products, improved flood control, reduced soil erosion, improved air and water quality, shelter for livestock and carbon sequestration. Native woodlands constitute part of our</p>

cultural heritage. Today they provide a valuable resource for recreation and tourism, and offer opportunities for improving physical and mental wellbeing (Forestry Commission Scotland, 2014).

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, 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, 2014). The Scottish Government recognises the importance of restoring native woodland flora displaced by invasive species such as rhododendron (Scottish Government, 2013).

Invasive non-native species (INNS) refers here to non-native plant species that have been introduced to an area by various mechanisms and have proliferated to a problematic extent. INNS have the potential to threaten the biodiversity of native woodlands in Scotland. They can inhibit growth and suppress natural regeneration of native species, creating a pressure on native woodlands that, along with other potential stresses, may make them less able to cope with the effects of climate change. INNS are recognised as major factors contributing to the vulnerable state of some types of native woodland, including upland mixed ashwoods, upland oakwoods, native pine and lowland mixed deciduous woodland (where non-native trees are also an important factor).

This indicator monitors the extent of native woodlands affected by INNS in Scotland, providing a partial measure of the impact of invasive species in native woodlands and a proxy of their impact on biodiversity. It draws on data gathered in the Native Woodland Survey Scotland (NWSS), specifically the number of woodland units (polygons) surveyed where INNS were present.

Related Indicators:

NB23 Amount of natural regeneration in native woodlands

NF14 Area of woodland with active, approved deer management plans

What is happening now?

19% of the native woodland polygons (surveyed woodland units) included in the NWSS had INNS present. However, INNS covered only 1.8% of the total native woodland area. Of the native woodlands surveyed, 4% had either 10% or more INNS cover or at least 3 species of INNS present, meaning they fell below the desired INNS condition criteria for biodiversity.

Figure 1 shows the percent of woodland polygons with a presence of INNS for each priority woodland type. Lowland mixed deciduous woodland and upland oakwood are the priority woodland types which contain the most polygons with INNS present (30% each). Native pinewood contains the least polygons with INNS present (8%).

Data is categorised by species for the INNS most commonly found in native woodlands in Scotland. Other INNS are presented in a separate category, 'Other herbaceous invasive exotics'. Non-native tree species were not recorded as invasive species (however they were noted as part of the assessment of woodland species composition and structural diversity).

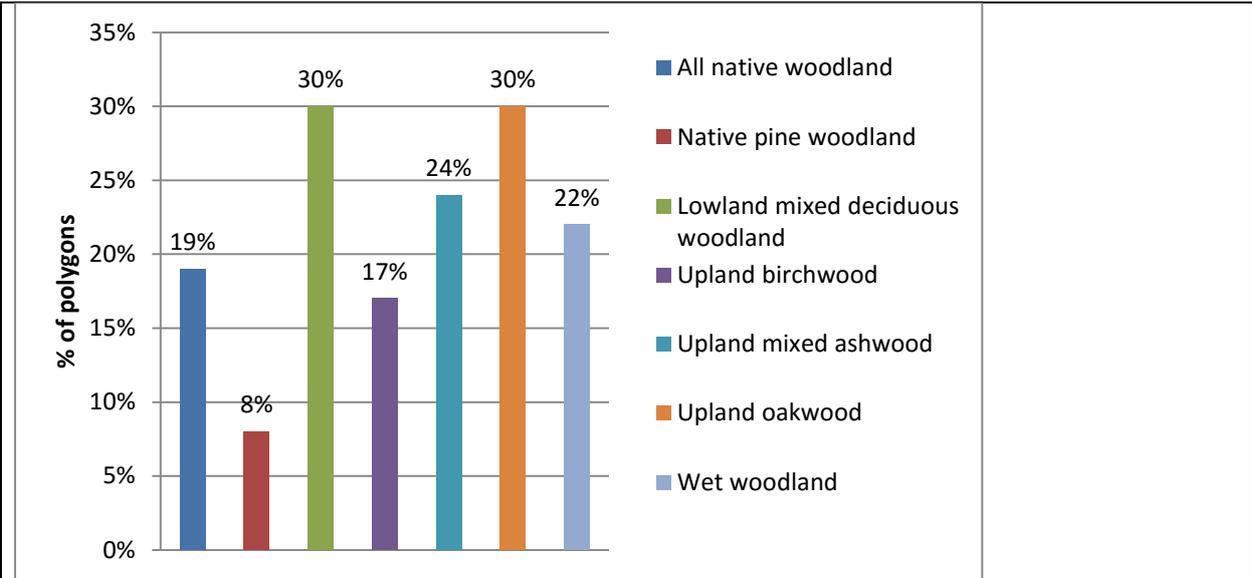


Figure 1: Extent of presence of invasive non-native species for each priority woodland type
 Source: NWSS (Forestry Commission Scotland, 2014).

Figure 2 shows the extent of particular INNS frequently found in native woodlands. *Rhododendron ponticum* is the most widely established of the INNS assessed.

Species	Area of invasives (ha)	%	% total native woodland area
<i>Rhododendron ponticum</i>	3,691	65	1.2
Other herbaceous invasive exotics	1,468	26	0.5
Himalayan balsam	240	4	0.1
Japanese knotweed	113	2	<0.1
Giant hogweed	96	2	<0.1
Snowberry	46	1	<0.1
Total	5,654	100%	1.8

Figure 2: Extent of recorded invasive non-native shrub and field layer species in native woods
 Source: NWSS (Forestry Commission Scotland, 2014)

Legislative support for controlling INNS is provided by The Wildlife & Natural Environment (Scotland) Act (2011), which makes it an offence to ‘plant or cause any non-native plant species to grow in the wild’ (Parrott & MacKenzie, 2013).

What has happened in the past?

Non-native invasive plant species can be imported by various mechanisms such as transportation of agricultural products, trading in exotic plants, freight and movement of travellers. Most plant INNS in Scotland have escaped from gardens. Once they become established in the wild, they are spread by soil and water movements and also on clothing and equipment (SNH, 2012).

Rhododendron ponticum is recognised as ‘the most damaging and widespread non-native terrestrial plant in Britain’ (Parrott & MacKenzie, 2013). The rhododendron, native to south-west Europe and south-west Asia, was introduced to the UK in the late 18th century (NNSS, 2015).

Concern about negative impacts including ecological damage, restricted access and damage to commercial plantations grew in the 1930s and various control methods were tried. Some control programmes started in the 1930s are still ongoing and no control programme has recorded complete eradication of rhododendron at a landscape scale (Parrott & MacKenzie, 2013).

Since the mid-1990s there has been a significant increase in the scale of rhododendron clearance efforts, helped by targeted funding through EU LIFE Nature Programme¹, EU Objective 1²/European Regional Development Fund³, Scottish Forestry Grants Scheme⁴/Scottish Rural Development Programme⁵ and Scottish Natural Heritage discretionary funds⁶. The LIFE project was targeted specifically at restoring Atlantic oakwoods and included a 6 year control programme at Sunart and Loch Maree. There is particular concern over Rhododendron as it can harbour the *Phytophthora* disease organism which threatens woodland (Parrott & MacKenzie, 2013). It is also a particular threat to the internationally important bryophyte and lichen floras of Scotland's Atlantic oakwoods (Long & Williams, 2007, cited in Parrott & MacKenzie, 2013).

Japanese knotweed *Fallopia japonica*, native to Japan, was introduced to Britain as an ornamental plant in the 19th century. It is a tall herbaceous perennial that tends to grow in dense thickets. It spreads in the wild by fragments of root or stem, and also is spread by human activity (NNSS, 2015).

Giant Hogweed *Heracleum mantegazzianum*, native to south-west Asia, was also introduced as an ornamental plant and was recorded in the wild in the UK in the early 19th century. It spreads only by seed, through deliberate planting, wind and water dispersal. It tends to form dense stands, crowding out native flora (NNSS, 2015).

Himalayan balsam *Impatiens glandulifera*, a native of the west and central Himalaya, was introduced as a garden plant in the early 19th century and rapidly spread to the wild. It spreads by seed, which are easily dispersed either by wind or water. It out-competes natives especially along river banks. Growing densely along river banks it increases flood risk during high rainfall events when it impedes flow (NNSS, 2015). It may also divert pollinating insects away from native flowers (SNH, 2012).

Snowberry *Symphoricarpos albus* is a native of western North America introduced to Great Britain in the early 19th century by gardeners. Later in the 19th century it was used to provide cover for game. It spreads locally through suckering and is naturalised throughout Britain, except the north of Scotland. A vigorously growing, dense invasive shrub, it shades out most native species (NNSS, 2015).

Japanese knotweed, giant hogweed and Himalayan balsam are all dispersed by water and often grow alongside rivers and streams. Their impact on ecosystems and on habitat structure can restrict access and have a direct impact on salmonid fisheries (NNSS, 2015).

What is projected to happen in the future?

The NWSS identifies for the first time the location and extent of INNS across Scotland's native woodlands, enabling effective targeting of remedial action in local, regional and national planning. It

¹ <http://ec.europa.eu/environment/life/about/>

² http://europa.eu/legislation_summaries/regional_policy/provisions_and_instruments/g24203_en.htm

³ http://ec.europa.eu/regional_policy/index.cfm/en/funding/erdf/

⁴ <http://scotland.forestry.gov.uk/supporting/grants-and-regulations/legacy-grant-schemes/scottish-forest-grant-scheme>

⁵ <http://www.snh.gov.uk/land-and-sea/srdp/>

⁶ <http://www.snh.gov.uk/funding/>

provides an authoritative baseline against which future trends can be monitored. (Forestry Commission Scotland, 2014).

Rhododendron ponticum currently does particularly well in the milder, wetter climate in western Scotland. However, warmer, wetter winters in the east resulting from climate change may lead to increasingly vigorous growth there (Niinemets *et al*, 2003, cited in Parrott & MacKenzie, 2013). Historical experience of control efforts indicates that, to eradicate rhododendron, control programmes will have to be ‘carried out diligently, coordinated at a population scale and maintained over a period of many years’ (Parrott & MacKenzie, 2013).

Patterns of change

Interpretation of indicator trends

No historic data are available to allow trends to be identified; however the NWSS provides an authoritative baseline against which future trends in the presence of INNS can be monitored.

Whilst INNS are a locally important threat in certain areas, the threat to woodlands from herbivores and the resultant impacts on natural regeneration are currently of greater concern in relation to their impact on the ability of native woodlands to cope with climate change. However, as 19% of all surveyed native woodlands had INNS present, there is a widespread source of plant material, suggesting continued remedial action is necessary to reduce the risk of further spread.

Limitations

References

Forestry Commission Scotland (2014) *Scotland’s Native Woodlands – results from the native woodland survey of Scotland*. Forestry Commission Scotland, Edinburgh. <http://scotland.forestry.gov.uk/supporting/strategy-policy-guidance/native-woodland-survey-of-scotland-nwss/national-nwss-report>

NNSS (2015). GB Non-native species secretariat. <http://www.nonnativespecies.org/factsheet/index.cfm> (accessed January 2015)

Parrott, J. and MacKenzie, N. (2013) *A critical review of work undertaken to control invasive rhododendron in Scotland*. Coille Alba for Forestry Commission Scotland and SNH. <http://scotland.forestry.gov.uk/images/corporate/pdf/rhododendron-control-review-2013.pdf>

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

SNH (2012) *Non-Native species – Scotland changes its laws* <http://www.snh.gov.uk/docs/B1113471.pdf> (accessed December 2014)

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>

Further information on non-native species from the GB non-native species secretariat <http://www.nonnativespecies.org//home/index.cfm>

Acknowledgements

Suzanne Martin (RBGE) contributed to this indicator.

Appendix One: Indicator metadata and methodology

Table 1: Indicator metadata

	Metadata
Title of the indicator	Proportion of native woodland affected by invasive non-native plant species
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	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. The survey was carried out by highly trained field surveyors over seven years.
Spatial resolution: Scale/unit for which data is collected	0.5 ha
Categorical resolution: Potential for disaggregation of data into categories	Local authority, priority woodland type.
Data accessibility: Restrictions on usage, relevant terms & conditions	Available free of charge, online or to download

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), a field-based survey carried out from 2006-2012, is the most complete survey of its kind in Scotland. 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 6 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 Directive⁷.

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>

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>

⁷ http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm