

Indicator name			Version
NB3: Extent and condition of natural landscape connections: hedgerows and ponds			21/03/16
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 capacity to adapt	BD5 Species unable to track changing climate space	

At a glance
<ul style="list-style-type: none"> <li>• Species range shifts are already occurring in response to climate change</li> <li>• Habitat connectivity, via features such as hedgerows and ponds, enables species to disperse through the countryside</li> <li>• This is likely to become increasingly important in a changing climate, enabling species to track changing climate space</li> <li>• Hedgerows and ponds are Priority Habitats in the UK Biodiversity Action Plan and, as such, are the subject of conservation targets</li> <li>• This indicator assesses the extent and condition of hedgerows and ponds, enabling the status of natural landscape connections to be monitored</li> </ul>

Latest Figure	Trend
<p><b>(2007)</b>  <b>Hedgerows</b>  <i>Extent:</i> The length of managed hedgerows in Scotland was 21,200,000 km.</p> <p><i>Condition:</i> Species richness (No. of species per 10m by 1m Hedge Plot) was 14.7</p> <p><b>Ponds</b>  <i>Extent:</i> The estimated number of ponds in Scotland was 198,000.</p> <p><i>Condition:</i> Ponds supported an average of 9.6 wetland plant species (per pond). Just 9.9% of ponds met Priority Habitat status based on quality criteria for plants.</p>	<p><b>Hedgerows</b>  <i>Extent:</i> decrease of 7% (1998-2007)</p> <p><i>Condition:</i> decrease of 22% (1998 – 2007)</p> <p><b>Ponds</b>  <i>Extent:</i> increase of 6% (1998 - 2007)</p>

## Why is this indicator important?

Habitat connectivity is important for biodiversity, providing the means for species to move through the landscape between fragmented areas of suitable habitat. The ability of species to disperse is constrained by habitat fragmentation and loss, and it is likely to become increasingly important in a changing climate that may render their current habitat unsuitable. There is good evidence of species range shifts occurring already in response to climate change and this is projected to increase in future (Brown et al, 2012).

Linear landscape features such as hedgerows are ecologically valuable within enclosed farmland as habitats for plants and animals. They can act as 'corridors' enabling species to move between fragmented patches of suitable habitat. They also have a role in land demarcation, livestock control, reducing soil erosion and can be of aesthetic and historical importance.

Hedgerows are listed as a Priority Habitat in the UK Biodiversity Action Plan (BAP). This includes agreed conservation targets based on measures of the extent and condition of hedgerows over time. There is no statutory protection for Scottish hedges (Hedgerow Regulations 1997, which prohibit the removal of most hedges in England and Wales without permission, do not apply in Scotland).

Ponds, or lochans, are another important habitat in Scotland both functionally and aesthetically. They help to create 'stepping stones' to enable aquatic species to move between suitable patches of habitat. They also collect and transport sediments and nutrients. When in good condition they can support a wide range of plants and animals; some are listed in the UK Biodiversity Action Plan. Ponds are also listed as Priority Habitats. The broad habitat definition for ponds includes both open water and the vegetation along the water's edge.

This indicator considers both overall extent and condition of hedgerows and ponds, using the results of the 2007 Countryside Survey.

To assess hedgerow condition, various criteria including structural elements, the woody species composition of the hedge itself, vegetation species richness and management of the adjacent margins are utilised in the Countryside Survey (Norton et al, 2009). The primary focus within this indicator is on species richness, as the most relevant indicator for biodiversity value.

Pond condition is assessed against two plant Priority Habitat criteria; the presence of rare plant species and species-rich plant communities. All of the ponds that met Priority Habitat status did so based on the presence of rare plant species, and none based on species-richness (Norton et al, 2009).

Note: Where trends are described as 'significant' increases or decreases within this document, this refers to the sample-based Countryside Survey's Statistical Methodology; significant change requires  $p < 0.05$  (Norton et al, 2009).

### Related indicators:

NB7 Area of land under landscape scale conservation

NB16b Abundance and frequency of specialist and generalist species: butterflies

NA5 Trends in breeding farmland birds

NA9 Proportion of farmland under High Nature Value farming systems

NA12 Agricultural production methods which reduce erosion risk

## What is happening now?

### Hedgerows

**Extent**

In 2007 the length of hedgerows in Scotland was 21,200,000 km, a decrease of approximately 7% since 1998.

**Condition**

In 2007 there were 14.7 vegetation species per Hedge Plot (the size of these plots is 10 metres by one metre) in Scotland. This is a statistically significant decrease of 22% between 1998 and 2007. There were corresponding decreases in the presence of species used for food by farmland birds and butterfly caterpillar food plants over the same period. Meanwhile there was an increase in grass species associated with shaded conditions.

Vegetation condition measures	Mean values for Scotland		Direction of significant changes
	1998	2007	
Species richness (No. of species per 10m by 1m Hedge Plot)	18.9	14.7	Decrease
No. of bird food species	10.1	7.9	Decrease
No. of butterfly food species	8.8	7.0	Decrease

**Table 1:** Hedgerow condition values and trends

In addition, in 2007:

- There were an average 2.2 woody species per 30m section of hedge, a statistically significant increase from 1.8 species in 1998;
- 36% of all managed hedges were in good structural condition
- Only 6% of managed hedges on arable land were in good structural condition with appropriately managed margins.

**Ponds****Extent**

In 2007 there were 198, 000 ponds in Scotland. This is a 6% increase in the number of ponds since 1998.

	Number of ponds ('000s)		Direction of significant changes 1998-2007
	1998	2007	
Scotland	187	198	Increase

**Table 2:** Trend in pond numbers

**Condition**

The 2007 Countryside Survey provides the baseline condition of ponds across Scotland, based on their plant communities. In 2007 Scottish ponds supported an average of 9.6 wetland plant species per pond. Only 9.9% of ponds met Priority Habitat status; all of those were based on the 'presence of rare plant species' quality criteria for plants. (To qualify for Priority Habit status based on the diversity of plant species, a pond has to support at least 30 wetland plant species (JNCC, 2008)).

## What has happened in the past?

### Hedgerows

**Extent**

The length of hedgerows has decreased by approximately 7% in Scotland between 1998 and 2007. There was also a decrease between 1984 and 1990. In the intervening period (1990-1998) there was a statistically non-significant increase in the length of hedgerow. This followed a long period, from the late 1940s to the 1980s, of reduction in boundary habitats, including hedgerows, associated with agricultural intensification.

	Length (000 km)				Direction of significant changes		
	1984	1990	1998	2007	1984-1990	1990-1998	1998-2007
<b>Scotland</b>	27.5	21.2	22.9	21.2	Decrease		Decrease

**Table 3:** Past changes in hedgerow extent

**Condition**

*Species richness:* between 1978 and 2007 there was a statistically non-significant decrease from 18.4 to 14.7 species. The increase in grassland species seen between 1998 and 2007 was also evident between 1978 and 2007. There is no long term trend available for woody species richness of hedgerows as Hedge Diversity Plots were not recorded before 1998.

**Ponds****Extent**

In the middle years of the 20<sup>th</sup> century ponds were lost due to agricultural intensification. New ponds may be helping to reverse these losses.

**Condition**

The 2007 Countryside Survey provided the baseline for pond condition i.e. there are not figures prior to 2007.

### What is projected to happen in the future?

**Hedges**

Future surveys may see improvements in hedgerow extent and/or quality due to the effect of incentives. The Scottish Rural Development Programme (SRDP) Management of Hedgerows Option was temporarily suspended in 2011, following contributions of over £32m to creation and management of 2,655km of hedgerows to benefit biodiversity.

SRDP Options for 2015-2020 are due for publication later in 2015. It is not expected that there will be substantive changes to the options available for Hedgerows; however they will be spatially restricted to the areas where they can achieve the highest impact in terms of biodiversity and water quality. It is therefore likely that funding will not be available in parts of the Highlands that have benefitted in the past.

**Ponds**

Recent environmental legislation imposes requirements to protect water bodies that will hopefully lead to improvements in pond condition. The UK Biodiversity Action plan (BAP) included ponds as a Priority Habitat in 2007 for the first time.

### Patterns of change

**Hedgerows**

### **Extent**

Between 1984 and 2007, there was a decrease in the total length of hedgerows both in Scotland overall and in the Lowlands. Over the same period there was an apparent increase in hedgerow length in the Intermediate Uplands and Islands (which contain a very small proportion of the hedgerows in Scotland). Further investigation is needed to understand whether this represents a real increase or is an anomaly.

	Length (000 kms)				Direction of significant changes		
	1984	1990	1998	2007	1984-1990	1990-1998	1998-2007
<b>Scotland</b>	27.5	21.2	22.9	21.2	Decrease		Decrease
Lowlands	25.6	20.2	20.1	18.6	Decrease		Decrease
Intermediate Uplands and Islands	1.9	1.0	2.8	2.6	Decrease	Increase	
True Uplands	0	0	0	0			

**Table 4:** Changes in hedgerow extent by region

### **Condition**

There was declining species richness across Scotland, and in the Lowlands which accounted for 56 of the 60 hedge plots surveyed. Due to low sample sizes, species richness figures are not available for the Intermediate Uplands and Islands and True Uplands.

### **Ponds**

#### **Extent**

The increase in pond numbers seen in Scotland between 1998 and 2007 was evident in all regions and proportionately highest in the Lowlands.

	Number of ponds ('000s)		Direction of significant changes 1998-2007
	1998	2007	
<b>Scotland</b>	187	198	Increase
<b>Lowlands</b>	14	18	Increase
<b>Intermediate Uplands and Islands</b>	126	130	Increase
<b>True Uplands</b>	48	50	

**Table 5:** Changes in pond numbers by region

### **Condition**

Ponds in the Intermediate Uplands and Islands contained on average 9.4 wetland plant species per pond. There were not sufficient ponds surveyed in the Lowlands or True Uplands to report reliably on plant species richness in these zones.

## **Interpretation of indicator trends**

### **Hedgerows**

#### **Extent**

As farming intensified between the 1940s and 1980s many hedges were removed to create larger fields or were replaced by fencing. The use of pesticides and fertilisers in intensively farmed areas also contributed to a loss of biodiversity in boundary features (Norton et al, 2009). The percentage of newly planted hedges picked up in the survey is likely to be a reflection of the take-up of hedge

planting initiatives. However the overall decline in the extent of hedgerows may reduce species ability to track 'climate space' in a changing climate.

#### **Condition**

The increase in the mean number of woody species per 30m length of hedgerow between 1998 and 2007 probably results from agri-environment schemes that encouraged the planting of new species rich hedgerows, and also the Countryside Survey policy to sample new hedges in 2007 that resulted in a number of Hedge Diversity Plots being located on new hedges in Scotland (Norton et al, 2009). If the increasing number of woody species does reflect an improvement in hedgerow condition, this could indicate both that the hedgerows are more resilient to climate change and that species utilising them to move through the landscape are better able to disperse.

#### **Ponds**

##### **Extent**

In the middle years of the 20<sup>th</sup> century ponds were lost due to agricultural intensification and pollution. The increased number of ponds recorded in 2007 may in part be due to particularly wet conditions during the survey period that year. In the Lowlands some of the increase may be a result of pond creation in response to incentives. This increase might help reverse earlier losses and benefit biodiversity, provided their condition is good enough (Norton et al, 2009).

##### **Condition**

As pond condition data was not recorded prior to 2007, only baseline data is available. The average of 9.6 wetland plant species per pond recorded in 2007 is relatively low (for example, for Priority Habitat status the species richness criterion requires 30 or more wetland plant species). However, around two-thirds of all ponds, or lochans, surveyed are situated in the Intermediate Uplands and Islands. Lower diversity would be expected in many upland habitats which are low in nutrients (Norton et al, 2009). It is possible that both nutrient pollution from agricultural run-off and water body isolation due to earlier pond losses may still be negatively impacting pond condition (Norton et al, 2009).

#### **Limitations**

Sample sizes, definitions and classification of hedgerows changed in the 1998 survey. Data for 1990 has been adjusted for comparison.

It is probable that more of the surveyed ponds would qualify for Priority Habitat status if additional criteria, such as the presence of invertebrates and amphibians were also assessed. This means that the current Countryside Survey only provides a minimum estimate of the number of Priority Habitat Ponds in Scotland and a baseline for comparison with future surveys.

Hedgerow Diversity Plots were not recorded before 1998. The majority (56/60) of Hedge Plots are within the Lowlands region.

#### **References**

Brown, I et al (2012) Climate Change Risk Assessment for the biodiversity and ecosystem services sector. UK CCRA <https://www.gov.uk/government/policies/adapting-to-climate-change>  
Carey, P.D., Wallis, S., Emmett, B.A., Maskell, L.C., Murphy, J., Norton, L.R., Simpson, I.C., Smart, S.M. (2008) *Countryside Survey: UK Headline Messages from 2007*. NERC/Centre for Ecology & Hydrology,

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Williams, P., Biggs, J., Crowe, A., Murphy, J., Nicolet, P., Weatherby, A., Dunbar, M. (2010) *Countryside Survey: Ponds Report from 2007. Technical Report No. 7/07* Pond Conservation and NERC/Centre for Ecology & Hydrology, 77pp. (CEH Project Number: C03259).

JNCC (2008) *UK Biodiversity Action Plan Priority Habitat Descriptions: Ponds*. Available at: <http://jncc.defra.gov.uk/page-5706> (accessed March 2015)

#### Further information

Countryside Survey (2007) *Reports from UK in 2007*.  
<http://www.countrysidesurvey.org.uk/outputs/uk-results-2007> (accessed February 2015)

#### Acknowledgements

All the information in this indicator is from the Countryside Survey 2007.

Suzanne Martin (RBGE/CXC) contributed content to this indicator.

## Appendix One: Indicator metadata and methodology

**Table 1: Indicator metadata**

	Metadata
<b>Title of the indicator</b>	Extent and condition of natural landscape connections: hedgerows and ponds
<b>Indicator contact:</b> Organisation or individual/s responsible for the indicator	Ruth Monfries (Royal Botanic Garden Edinburgh/ClimateXChange)
<b>Indicator data source</b>	Countryside Survey (Scotland) (2007)
<b>Data link:</b> URL for retrieving the indicator primary indicator data.	<a href="http://www.countrysidesurvey.org.uk/outputs/scotland-results-2007">www.countrysidesurvey.org.uk/outputs/scotland-results-2007</a>

**Table 2: Indicator data**

	Indicator data
<b>Temporal coverage:</b> Start and end dates, identifying any significant data gaps.	2014 (1990 – 2007)
<b>Frequency of updates:</b> Planned or potential updates	6 - 9 year intervals
<b>Spatial coverage:</b> Maximum area for which data is available	Scotland (UK)
<b>Uncertainties:</b> Uncertainty issues arising from e.g. data collection, aggregation of data, data gaps	Data are provided as national estimates from the use of a well-founded sample based approach.  All data is subject to a QA exercise, reported as part of CS outputs.  Data are directly comparable between years.
<b>Spatial resolution:</b> Scale/unit for which data is collected	195 randomly chosen 1km x 1km squares in Scotland.
<b>Categorical resolution:</b> Potential for disaggregation of data into categories	Three regions covering Scotland.
<b>Data accessibility:</b> Restrictions on usage, relevant terms & conditions	Publicly available. Free of charge.

**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.

Countryside Survey 2007

**Table 4 Indicator methodology****Indicator methodology**

The methodology used to create the indicator data

Data are provided as national estimates from the use of a well-founded sample based approach. All data is subject to a QA exercise, reported as part of CS outputs.

The Countryside Survey 2007 recorded the stock and condition of terrestrial and freshwater habitats, as well as key linear landscape features such as walls and hedges for 195 randomly chosen 1km x 1km squares in Scotland. Data were collected on both the lengths of different feature types and their structural conditions. For further information see Norton et al.

Hedgerow condition: Numbers and types of plots have been increased in subsequent Countryside Surveys to provide information on specific feature types in addition to the original Boundary Plots. These include: Hedge Plots in which vegetation forming the hedge and also along the hedge bottom were recorded; and Hedge Diversity Plots, which provide information about the woody species within hedges.