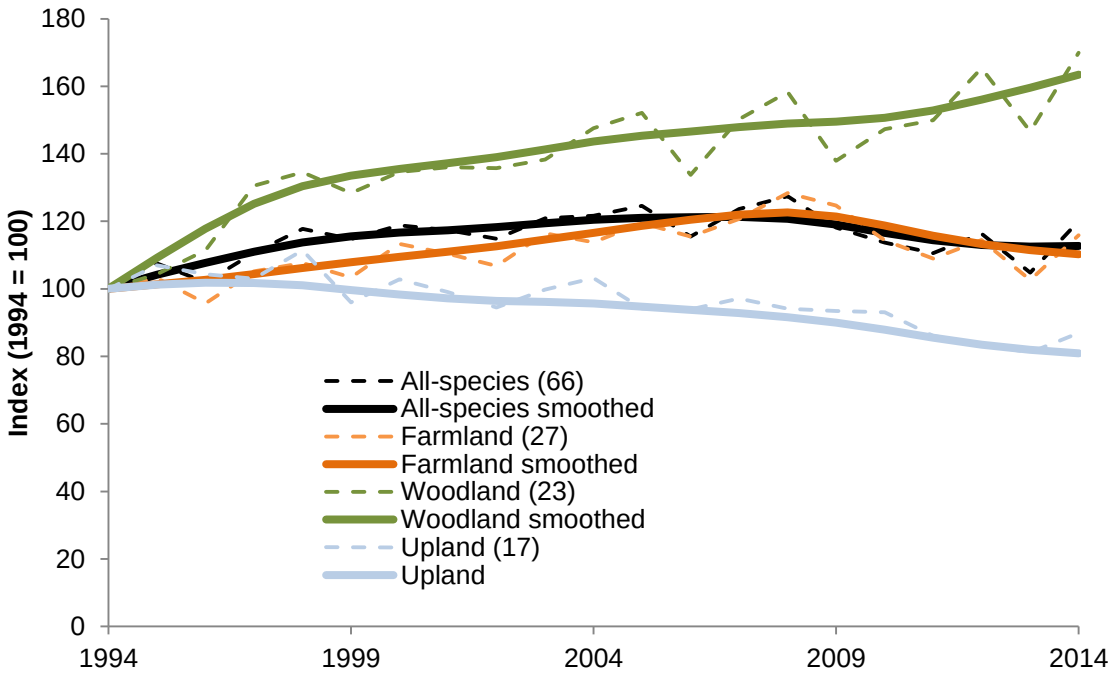
Index of Abundance for Scottish Terrestrial Breeding Birds, 1994 to 2014
An Official Statistics Publication for Scotland

Scotland's terrestrial breeding birds include those commonly associated with woodland, farmland and upland habitats. Some are found in one particular habitat, for example great-spotted woodpeckers are typical woodland birds. Others use a wider range of habitats such as dunnocks, which can be found in woodland and farmland. Birds can respond relatively quickly to change in habitat extent and condition through adaptive breeding success, survival or dispersal. Since most widespread and abundant species are relatively easy to identify and count, they can be used as indicators of environmental change.

Evidence

In Scotland, common terrestrial breeding birds are monitored primarily through the Breeding Bird Survey (BBS). Volunteers visit randomly located 1km survey squares twice in the breeding season (April to July). The squares are representative of farmland, woodland and upland habitats. Ten of the 66 species included here are assessed using targeted surveys, as they are either too scarce for reliable abundance estimation by the BBS or are better monitored by specialised surveys. A further 46 scarce terrestrial species regularly breed in Scotland but insufficient data are available to permit their inclusion in these indicators.

Index of Abundance for Scottish Terrestrial Breeding Birds, 1994 to 2014
Breeding Bird Survey and targeted survey scheme data for 66 breeding bird species



Assessment

Since the start of the time series in 1994 to the most recent estimate in 2014

- Of the 66 bird species, 39 increased in abundance, six were stable and 21 declined; the all-species (smoothed) index showed a steady increase up to the mid-2000s but has declined since. There is no significant difference between the 1994 and 2014 indices.
- The smoothed farmland bird index has shown a steady increase up to the late-2000s but has declined since, such that there is no significant difference between 1994 and 2014.
- The smoothed woodland bird index has increased significantly by 63% overall.
- The smoothed upland bird index has decreased significantly by 19% overall.
- The unsmoothed data show that, between 2013 and 2014, the upland bird index has increased by 7%. The farmland index has increased by 14%; the woodland index has increased by 16%; and the all-species index has increased by 15%.

All species change (2013 – 14)	**Increased**
All species long-term trend	**Stable**

Commentary

In this commentary, long-term refers to the period between 1994 and 2014 and short-term refers to the inter-annual change between 2013 and 2014. Longer-term changes since the 1970s analogous to those reported for the UK are not available for Scotland due to low monitoring coverage prior to the start of the BBS. Since 1994 the smoothed all-species index steadily increased to a maximum in 2007. In 2014 it was 13% above the baseline figure, but 7% below the 2007 figure. The farmland, woodland, upland and all-species unsmoothed indices all showed increases between 2013 and 2014. The reasons for these short-term changes may be partly attributed to weather conditions leading to differences in breeding success between years (Harris *et al*., 2015).

The trends for individual species (long-term and short-term) are assessed using the unsmoothed trend. Due to the variability in the individual species trends, a threshold for an increase or decrease is taken to be a long-term or short-term change of 5% or more. Individual species trends are shown in Table 1. For a number of species it is unclear what the main drivers of population change are; for others, available evidence is provided below to help understand possible reasons for change. Bird populations are affected by the environmental conditions in all parts of their natural range. For example, a migratory bird may be affected by the conditions in Scotland, *en route* to the migratory destination, or at the final destination.

Farmland Birds

The combined trend for farmland birds shows an increase followed by a decrease over the long-term. Individual trends reveal a mix of increasing and decreasing populations.

Birds that increased in the long-term include goldfinch, corncrake, whitethroat, reed bunting, and species that occupy the wood and edge habitats of farmland (e.g. song thrush, blackbird, dunnock and great tit). Other species that have fared less well include kestrel, lapwing and greenfinch. Goldfinch numbers have increased since 1994; attributed partly to their exploitation of other food sources, such as more regular feeding in gardens (Baillie *et al*., 2014), resulting in an improved annual survival. Long-distance migrants that winter in the Sahel region of Africa (such as whitethroat and sedge warbler) have shown positive responses to increased winter rainfall there (Ockendon *et al*., 2014). This is the most likely cause of upturns in long-distance migrant numbers between 2013 and 2014, as well as long-term increases in some of these species since severe droughts in this region several decades ago.

The kestrel continues to show the greatest overall decline of any index species since 1994. A study in France (Butet *et al*., 2010) implicated agricultural intensification as a factor contributing to declines there. Recent research on demographic factors suggests that in the UK, changes in first-year and particularly, adult survival are the primary contributors to population change (Robinson *et al*., 2014).

Farmland birds are known to have suffered in recent decades from many aspects of agricultural intensification (Chamberlain *et al*., 2000; Newton, 2004) including drainage of wetlands, loss of field margins, autumn sowing of cereals, and increased use of fertilizers and pesticides. Reductions in breeding performance (e.g. for linnet, lapwing and skylark) and overwinter survival (for seed-eating resident species) have also been implicated in these declines (e.g. Siriwardena *et al*., 1998; Siriwardena *et al*., 2000). Agri-environment schemes are one of the key mechanisms for addressing pressures on farmland birds. Although significant positive benefits of some key options have been demonstrated in England (see Baker *et al*., 2012), there is currently no strong evidence for their efficacy in Scotland. For ground-nesting farmland waders such as lapwing, new evidence is emerging of the potential benefits of patches of taller vegetation, presumed to support alternative prey for predators (Laidlaw *et al*., 2015). A study by McCallum *et al.* (2015) showed that lapwing distribution in upland areas is limited by the acidity of soils. Low intensity management may therefore not be enough on its own to benefit this species or others dependent on soil-dwelling invertebrates, which prefer higher pH. Other factors may play a role, with greenfinch declines linked to the widespread and continuing outbreak of trichomonosis that started in 2005 (Lawson *et al*., 2012).

In the short-term, from 2013 to 2014 there were declines for several species including woodpigeon, carrion crow, oystercatcher, chaffinch, and greenfinch. Increases were reported for several species including corncrake, whitethroat, reed bunting, buzzard, jackdaw, song thrush and skylark.

Woodland Birds

Woodland birds have shown the largest increases over the long-term, both in terms of the combined trend and individual species trends. Long-term increases have been noted for migrants including chiffchaff, blackcap and tree pipit. The reasons for these increases are not clear but could include improved conditions in the wintering areas (Amar *et al*., 2006) and woodland/scrub expansion in Scotland. Blackcaps have steadily increased throughout Europe. A recent study by Plummer *et al*. (2015) found that blackcaps have benefited from favourable weather during the winter and supplementary feeding, leading to changes in their migratory behaviour. Species such as willow warbler and tree pipit exhibit more positive population trends in the northern part of their UK range than in the south. Although climate change effects seem likely to play a role, local-scale habitat changes could also be important (Morrsion *et al*., 2010). Woodland creation, felling and stocking of managed forests and reductions in large herbivores in upland north-west Britain may have resulted in increased scrub and increasing abundances of bird species associated with this habitat (Calladine *et al*., 2015). Resident woodland birds that have increased include great-spotted woodpecker and great tits. Great-spotted woodpeckers have increased throughout Britain, in part due to increased breeding success, whereas great tit increases may be due to improved winter survival (Baillie *et al*., 2014).

Siskin have shown a short-term decline from 2013 to 2014. In contrast, marked increases between 2013 and 2014 were noted for resident species such as bullfinch, wren, lesser redpoll, song thrush and mistle thrush, as well as one migrant – tree pipit. Inter-annual changes in the abundance of woodland bird species may be reflective of changes in food supply. For example, Watson *et al*. (2009) highlighted that species that feed largely on conifer seeds track the considerable variation in the seed crop; beech mast and birch seed are also important.

Upland Birds

The combined trend for upland birds shows a long-term decline of 19%. Trends for the individual species are mixed; 10 declined by 10% or more and four increased. Cuckoo, raven and red grouse have shown the largest increases. Dotterel, curlew, black grouse, common sandpiper, golden plover, and hooded crow have shown the largest declines. Ravens have increased throughout Europe, possibly as a result of an increase in breeding success (Baillie *et al*., 2014). The trend for cuckoo in the uplands differs from woodland, with greater long-term increases in upland habitats than in woodland, but the reasons for this are not clear. Douglas *et al*. (2010) largely rule out the influence of host species' trends on cuckoo trends.

Curlew declines are likely to be linked to land use and predation pressure (Douglas *al*., 2014) as well as more direct impacts through reductions of the quality of foraging habitat in grasslands and trampling by cattle (Brown *et al*., 2015). Dotterel, an alpine specialist only found on a few mountain tops, have suffered declines. In their African wintering grounds, agricultural intensification and hunting pressure may have an impact (Whitfield *et al*., 1996). Another possible factor is that changes may reflect breeding distribution shifts on an international scale (Whitfield, 2002). Common sandpiper have declined across their range (Baillie *et al*., 2014); poor breeding success and over-winter survival are possible factors. A study by Pearce-Higgins *et al*. (2010) has shown a link between the abundance of cranefly larvae and golden plover populations.

Short-term trends showed that, from 2013 to 2014 ravens decreased. The largest increases were seen for hooded crow, dipper and red grouse between 2013 and 2014.

Birds not specific to any of the habitats

Eight bird species are not included in the habitat-specific trends, either because they do not show a strong association to any of the habitats reported, or insufficient data were available to calculate a habitat-specific trend. Of these, long-term increases in Scotland have been noted for stonechat and grey wagtail as well as for house martin and house sparrow, which contrast with declining populations in England. However, stonechat populations are known to be vulnerable to severe winters; numbers in Scotland declined over the past five years following a long-term period of increase. Given that breeding output can be high when conditions are suitable, recorded stonechat numbers increased by 71% between 2013 and 2014. Long-term decreases were observed for swift. Results from BBS surveys elsewhere in the UK, show that swift populations have suffered steep declines. The decline may be related to the availability of suitable nest sites on buildings (Baillie *et al*., 2014) but a reduction in flying insects may also play a role.

Source data and updates

Data for 56 of the 66 species come from the Breeding Bird Survey (BBS) run jointly by British Trust for Ornithology (BTO), Joint Nature Conservation Committee (JNCC) and Royal Society for the Protection of Birds (RSPB) Breeding Bird Survey (BBS) (View map of BBS sites).

The data for BBS consist of annual counts made over a period of years at a series of sites. Generalised Linear Models are used to generate trends. To prevent short-term population variability and statistical error having an undue influence, trends are smoothed and long term trends assessed using techniques recommended by Fewster *et al*. (2000). The smoothed indices are used to assess the significance of long-term changes and the unsmoothed indices were used to assess the significance of short-term changes in the indices.

Details of the methods used to calculate the indices are available from http://www.bto.org/birdtrends2010/methodology.htm.

Trends for common sandpiper and dipper are derived from the BTO Waterways Bird Survey and the Waterways Breeding Bird Survey. Grey heron trends are derived from the Heronries Census. Trends for seven species (golden eagle, hen harrier, peregrine, dotterel, corncrake, black grouse and capercaillie) are estimated from single-species surveys carried out periodically, during the period 1994 to 2015 as part of the SCARABBS (Statutory Conservation Agency/RSPB Annual Breeding Bird Scheme) programme. A further 46 scarce to widespread terrestrial species (found in at least 100 10k squares in Bird Atlas 2007-11) are regular breeders in Scotland, but insufficient data are available through current monitoring schemes to permit inclusion in the indicators.

In Scotland, the production of multi-species indicators is limited to a start date in 1994 as this is when BBS was first implemented, and achieved broad-scale representative coverage of many terrestrial species in Scotland. Changes reported through these indicators therefore exclude any changes that occurred prior to 1994, which based on UK data suggest marked declines in many farmland and woodland species.

Results for the UK are available from https://www.gov.uk/government/statistics/wild-bird-populations-in-the-uk.

The index will be next updated in November 2016.

Official Statistics are produced by professionally independent statistical staff in accordance with the Code of Practice for Official Statistics.

References

Amar, A., Hewson, C.M., Thewlis, R.M. *et al*. 2006. What is happening to our woodland birds? Long-term changes in the populations of woodland birds. *RSPB Research Report* No. 19. RSPB, Sandy.

Baillie, S.R., Marchant, J.H., Leech, D.I. *et al*. 2014. BirdTrends 2014: trends in numbers, breeding success and survival for UK breeding birds. *BTO Research Report* No. 662. BTO, Thetford. http://www.bto.org/birdtrends

Baker, D.J., Freeman, S.N., Grice, P.V. & Siriwardena, G.M. 2012. Landscape scale responses of birds to agri-environment management: a test of the English Environmental Stewardship scheme. *Journal of Applied Ecology*, **49**, 871-882.

Brown, D., Wilson, J., Douglas, D. *et al*. 2015. The Eurasian Curlew – the most pressing bird conservation priority in the UK? *British Birds*, **108**, 660-668.

Butet, A., Michel, N., Rantier, Y. *et al*. 2010. Responses of common buzzard (*Buteo buteo*) and Eurasian kestrel (*Falco tinnunculus*) to land use changes in agricultural landscapes of Western France. *Agriculture, Ecosystems and Environment*, **138**, 152-159.

Calladine, J., Bray, J., Broome, A. & Fuller, R.J. 2105. Comparison of breeding bird assemblages in conifer plantations managed by continuous cover forestry and clear-felling. *Forest Ecology and Management*, **344**, 20-29.

Chamberlain, D.E., Fuller R.J., Bunce, R.G.H., Duckworth, J.C. & Shrubb, M. 2000. Changes in the abundance of farmland birds in relation to the timing of agricultural intensification in England and Wales. *Journal of Applied Ecology*, **37**, 771-788.

Douglas, D.J.T., Newson, S.E., Leech, D.I., Noble, D.G. & Robinson, R.A. 2010. How important are climate-induced changes in host availability for population processes in an obligate brood parasite, the European cuckoo? *Oikos*, **119**, 1834-1840.

Douglas, D.J.T., Bellamy, P.E., Stephen, L.S. *et al*. 2014. Upland land use predicts population decline in a globally near-threatened wader. *Journal of Applied Ecology*, **51**, 194-203.

Fewster, R.M., Buckland, S.T., Siriwardena, G.M., Baillie, S.R. & Wilson, J.D. 2000. Analysis of population trends for farmland birds using generalized additive models. *Ecology*, **81**, 1970-1984.

Harris, S.J., Massimino, D., Newson, S.E. *et al*. 2015. The Breeding Bird Survey 2014: *BTO Research Report* No. 673. BTO, Thetford.

Laidlaw, R.A., Smart, J., Smart, M.A. & Gill, J.A. 2015. The influence of landscape features on nest predation rates of grassland-breeding waders*. Ibis*, **157**, 700-712.

Lawson, B., Robinson, R.A., Colvile, K.M. *et al*. 2012. The emergence and spread of finch *trichomonosis* in the British Isles. *Philosophical Transactions of the Royal Society B*, **367**, 2852-2863.

McCallum, H.M., Park, K.J., O'brien, M.G. *et al*. 2015. Soil pH and organic matter content add explanatory power to Northern Lapwing *Vanellus vanellus* distribution models and suggest soil amendment as a conservation measure on upland farmland*. Ibis*, **157**, 677-687.

Morrison, C.A., Robinson, R.A., Clark, J.A. & Gill, J.A. 2010. Spatial and temporal variation in population trends in a long-distance migratory bird. *Diversity and Distributions*, **16**, 620-627.

Newton, I. 2004. The recent declines of farmland bird populations in Britain: an appraisal of causal factors and conservation actions. *Ibis*, **146**, 579-600.

Ockendon, N., Johnston, A. & Baillie, S. 2014. Rainfall on wintering grounds affects population change in many species of Afro-Palaearctic migrants. *Journal of Ornithology*, **155**, 905-917.

Pearce-Higgins, J.W., Dennis, P., Whittingham, M.J. & Yalden, D.W. 2010. Impacts of climate on prey abundance account for fluctuations in a population of a northern wader at the southern edge of its range. *Global Change Biology*, **16**, 12-23.

Plummer, K.E., Siriwardena, G.M., Conway, G.J., Risely, K.E. & Toms, M.P. 2015. Is supplementary feeding in gardens a driver of evolutionary change in a migratory bird species? *Global Change Biology*, **21**, 4353-4363.

Robinson, R.A., Morrison, C.A. & Baillie, S.R. 2014. Integrating demographic data: towards a framework for monitoring wildlife populations at large spatial scales. *Methods in Ecology and Evolution*, **5**, 1361-1372.

Siriwardena, G.M., Baillie, S.R. & Wilson, J.D. 1998. Variation in the survival rates of British passerines with respect to their population trends on farmland. *Bird Study*, **45**, 276-292.

Siriwardena, G.M., Baillie, S.R., Crick, H.Q.P. & Wilson, J.D. 2000. The importance of variation in the breeding performance of seed-eating birds for their population trends on farmland. *Journal of Applied Ecology*, **37**, 128-148.

Watson, A., Marquiss, M. & Summers, R. 2009. Abundance of crossbills, siskins and cone-crops. *Ornis Fennica*, **86**, 38-40.

Whitfield, D.P. 2002. Status of breeding dotterel *Charadrius morinellus* in Britain in 1999. *Bird Study*, **49**, 237-249.

Whitfield, D.P., Duncan, K., Pullan, D. & Smith, R. 1996. Recoveries of Scottish-ringed Dotterel *Charadrius morniellus* in the non-breeding season: Evidence for seasonal shifts in wintering distribution. *Ringing & Migration*, **17**, 105-110.

Table 1. Percentage changes in abundance for the Scottish Terrestrial Breeding Birds, 1994-2014 and 2013-2014, species listed in order of overall change 1994 to 2014

Summarised trends for individual species and their habitat associations from 1994 to 2014, and the most recent year of change. A blank entry denotes that the species did not show a strong association to that habitat, or that insufficient data were available to calculate a habitat-specific trend.

Species name	All species		Woodland		Farmland		Upland	
	94-14	13-14	94-14	13-14	94-14	13-14	94-14	13-14
Great Spotted Woodpecker	603	5	603	5				
Chiffchaff	587	16	587	16				
Blackcap	355	27	305	8				
House Martin	242	40						
Corncrake	196	41			196	41		
Whitethroat	181	61			181	61		
Tree Pipit	179	47	179	47				
Goldfinch	161	5			277	16		
Bullfinch	122	55	122	55				
Wren	95	51	95	51				
Cuckoo	94	34	14	15			131	15
Great Tit	94	0	97	-4	142	0		
Raven	92	-11					92	-11
Reed Bunting	71	48			71	48		
Dunnock	65	3	103	0	26	3		
Lesser Redpoll	64	56	64	56				
Treecreeper	58	5	58	5				
Willow Warbler	56	16	56	16				
Grey Wagtail	55	180						
Goldcrest	55	17	55	17				
House Sparrow	53	13						
Stonechat	48	71						
Buzzard	48	20	22	12	52	36		
Yellowhammer	45	10			45	10		
Siskin	43	-7	43	-7				
Magpie	34	-3			55	16		
Jackdaw	34	22			31	27		
Sedge Warbler	32	12			32	12		
Blackbird	30	8	21	3	47	9		
Song Thrush	29	32	42	47	55	39		
Mistle Thrush	29	55	29	55				
Pied Wagtail	25	25			25	25		
Blue Tit	23	10	9	11	44	18		
Robin	23	13	32	1				
Willow/Red Grouse	22	43					22	43
Swallow	21	9			21	9		
Snipe	21	7					21	7
Collared Dove	10	5						
Chaffinch	6	-4	10	-1	6	-7		
Mallard	4	20						
Golden Eagle	4	0					4	0
Coal Tit	4	9	4	9				
Woodpigeon	0	-4			-7	-10		
Carrion Crow	0	-6			4	-11		
Wheatear	-4	7					-4	7
Grey Heron	-5	-20						
Hen Harrier	-7	-4					-7	-4
Meadow Pipit	-11	15					-11	15

Species name	All species		Woodland		Farmland		Upland	
	94-14	13-14	94-14	13-14	94-14	13-14	94-14	13-14
Starling	-13	3			4	3		
Dipper	-18	21					-18	21
Peregrine	-20	-1					-20	-1
Skylark	-24	13			-25	36	-12	10
Oystercatcher	-32	-10			-32	-10		
Rook	-32	9			-32	9		
Hooded Crow	-32	33					-32	33
Golden Plover	-33	-6					-33	-6
Linnet	-37	3			-37	3		
Common Sandpiper	-41	0					-41	0
Black Grouse	-47	-3					-47	-3
Curlew	-49	17					-49	17
Greenfinch	-52	-8			-50	-8		
Swift	-53	13						
Capercaillie	-53	-8	-53	-8				
Lapwing	-58	-2			-58	-2		
Dotterel	-60	-7					-60	-7
Kestrel	-77	18			-77	18		