The State of Birds in Switzerland

Special Issue on the Breeding Bird Atlas 2013–2016

vogelwarte.ch

Breeding Bird Atlas 2013–2016: Key findings

Specialists are in decline and generalists on the rise, increasing the potential for conflict with unpopular species.
➲ page 6

Many long-distance migrants have lost ground. Insectivores in particular are in steady decline.
➲ page 14

Several birds of prey have made a long-term recovery. These popular, iconic birds are well protected by law. ➲ page 16

The effects of global warming are clearly visible and have caused several species to move to higher ground. Many birds are at risk from climate change, but only few stand to benefit. ➲ page 18

Farmland birds have suffered the greatest losses. While the lowlands are most affected, pressure is increasing in the mountains as well. ➲ page 20

Several woodland species have increased in number. The growing forest area, nature-friendly forest management and more deadwood have given woodland birds a boost. ➲ page 24

Conservation action has become essential. Recovery measures have succeeded in reversing the trend for several threatened species. ➲ page 34

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Further information

Visit our website for a review of 2017, including population trends of breeding birds, results of the waterbird census and additional analyses: www.vogelwarte.ch/state

The atlas – a milestone

The 2018 report on «The State of Birds in Switzerland» is a very special one. For once, our report does not present the results of the latest annual counts of breeding birds and wintering waterbirds; rather, it summarises the key findings of the «Swiss Breeding Bird Atlas 2013–2016» and in doing so takes stock of the developments of the past 20 years.

For the next 20 years, the Swiss Breeding Bird Atlas 2013–2016 will be the standard work of reference when it comes to assessing the state of our native bird communities and how they are changing over time. Its findings paint a clear picture of how we impact our environment. For example, the atlas reveals that woodland birds (with some exceptions) are doing well. In contrast, birds that breed in farmland have suffered further dramatic declines, leading to the disappearance of some species at a regional scale or – in the case of the Woodchat Shrike – from all of Switzerland. We explain the reasons for the various trends and suggest ways to preserve and promote our native birdlife. Indeed, urgent action is called for to support our bird communities.

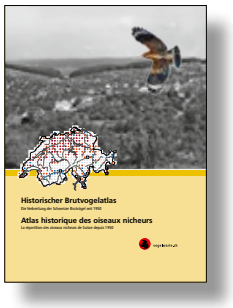
In Switzerland, breeding birds are the best monitored group of wild animals, thanks to the tireless, dedicated and often decade-long effort of more than 2000 volunteer collaborators in all parts of the country. This atlas, the fourth in a series of atlases published at 20-year intervals, again triggered a wave of enthusiasm among our volunteers, who responded with countless hours of skilled fieldwork. Their tremendous effort is acknowledged on pages 40–43.

But the Swiss Breeding Bird Atlas 2013–2016 is a momentous event for the Swiss Ornithological Institute as well: from planning and preparation to the printing of the book, the creation of the website and, finally, the publication of journal articles, the atlas will have kept us busy for almost ten years. Our atlas team set its goals high, figured out how to achieve them, directed the volunteer collaborators, prepared all the materials, checked the data, clarified uncertainties, sent annual progress reports to the observers in charge of the atlas squares, analysed the data, modelled distribution and the change in distribution, generated the maps, produced population estimates, wrote, edited and translated the texts so that the atlas could be made available in four languages. All of this was only possible thanks to a remarkable degree of commitment and enthusiasm for this collaborative project.

Last but not least, we are grateful to our numerous donors for their generous support, be it in the form of larger contributions from institutions or small and large amounts from individuals who sponsored a species account or expressed their recognition for this unique project in other ways.

We hope that the Swiss Breeding Bird Atlas 2013–2016 will not remain a simple documentation, but will give rise to targeted measures in support of our bird communities and, in turn, benefit nature and the environment.

Prof. Dr. Lukas Jenni
Chairman of the Board of Directors
and Scientific Director



1950–1959
Knaus et al. 2011

1972–1976
Schifferli et al. 1980

1993–1996
Schmid et al. 1998

2013–2016
Knaus et al. 2018

Documenting trends in bird communities in Switzerland is one of the Swiss Ornithological Institute's core missions. The 2013–2016 breeding bird atlas is a further milestone that has earned the institute international recognition.

The Chaffinch is the most common breeding bird in Switzerland, with about one million breeding pairs. Its density map shows that it occurs in high densities in wooded areas across the country.

The pressure of urbanisation and the Swiss preference for «tidy» landscapes: unfavourable conditions for many bird species with special requirements.

Birds reflect the state of the environment

Birds delight us with their colourful plumage, their song, their feats of flight and their behaviour. But they are also excellent bioindicators, meaning that they provide information on the state of the environment and our impact on nature. In some ways, birds resemble us: they share our living space and have similar requirements in terms of soil, water, air, vegetation and food. In fact, our kinship with birds has often served us well. Take, for example, the proverbial canary in the coal mine. Coal miners used to carry a canary into the mine. If there was any danger from toxic gasses, the canary would fall silent, warning the miners to leave the coal mine and make their way to safety.

The most sensitive creatures are the first to signal an imminent threat to the entire system. In the early 1970s, the collapse of Peregrine Falcon and Bald Eagle populations revealed the dangerous effects of the insecticide DDT before it could harm human health. Birds have drawn our attention to the environmental pollution caused by mercury from industrial waste and to other toxins, and observations of migrant birds arriving earlier in the season were among the first signs of global warming. Birds are therefore generally considered important indicators for the state of the environment. There are good reasons for this:

- Birds are easier to observe than most other animals: they are fairly large, quite prominent, mostly active during the day, can be identified from a distance, and the number of species is manageable.
- Therefore, birds are comparatively easy to monitor and count. We have

Peregrine Falcons are not only among the world's fastest animals, they are also top predators. Because many pesticides accumulate in the food chain, these birds are early indicators of environmental toxins.

The Common Cuckoo shows a marked decline below 1500 m asl, drawing our attention to the fact that butterflies are in great difficulty, as the Cuckoo is a specialist that feeds largely on caterpillars. Butterflies and Cuckoo need more tapered, semi-natural forest edges and adjacent flowery meadows.

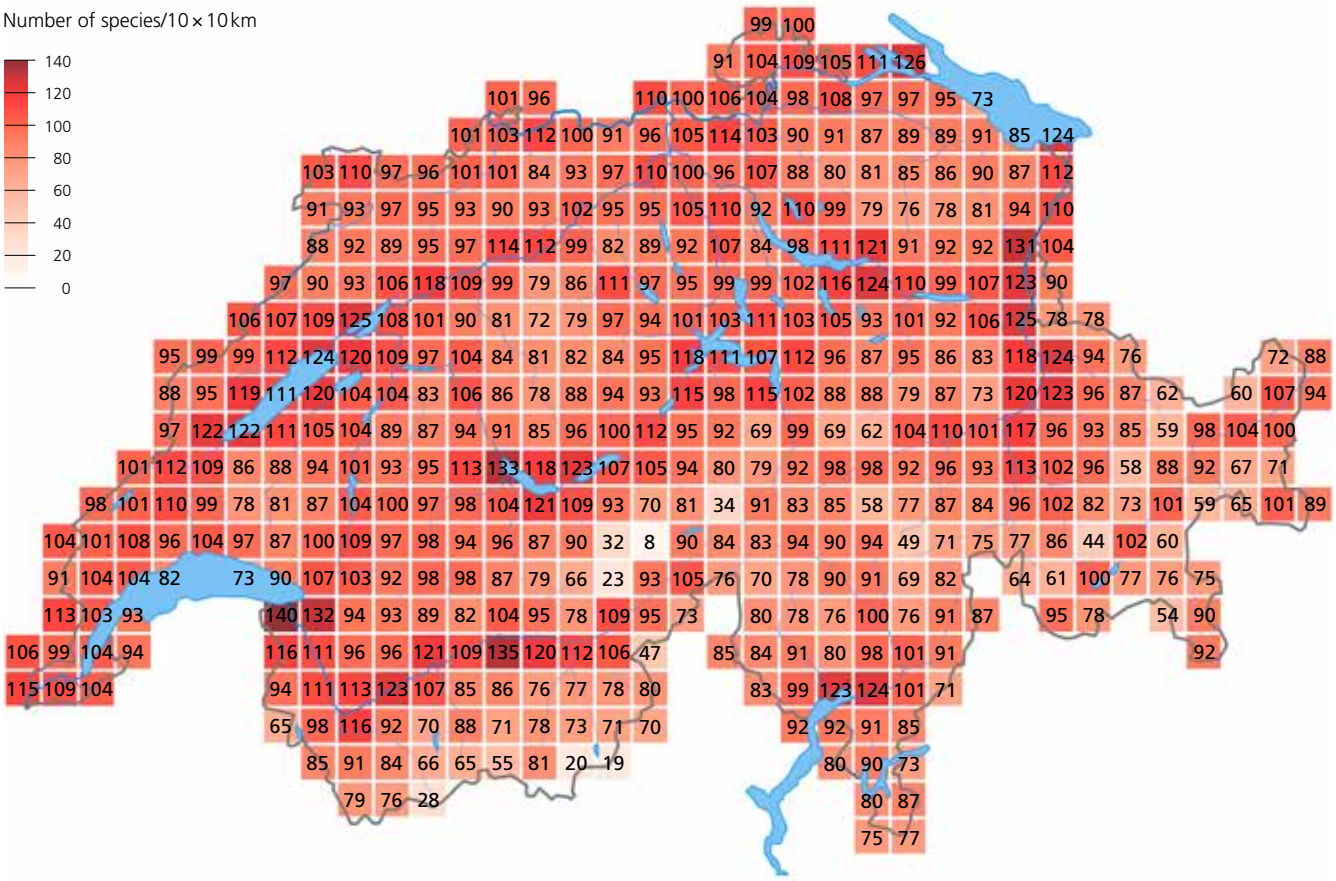
documented their distribution and abundance for decades and have excellent data that allow us to identify changes.

- Birds respond with sensitivity to changes in our shared environment. They are at the top of the food chain (just like us), where negative influences can accumulate.
- We know a lot more about birds than about most other groups of animals and plants. We know their life histories and their habitat requirements, which allows us to correctly interpret changes in bird communities.
- Birds occupy almost all habitats. Changes in the populations of different species point to changes taking place in their respective habitats.
- To a certain degree, birds are representative of other groups of organisms; moreover, they orient themselves at a spatial scale that is relevant in terms of our spatial planning.

In short, birds convey a detailed picture of the state of the environment and allow us to detect changes in habitat conditions at an early stage. Understanding birds allows us to read the signs of the times. Birds are a reliable measure of sustainability. Our future efforts in nature conservation and environmental protection should therefore not only be measured by the number of implemented management plans or the amount of money invested – though both these things are undoubtedly very important – but also by the state of bird communities. This will show us how hospitable landscapes and habitats are for animals and humans and where there is cause for alarm.

Further information
www.vogelwarte.ch/atlas

Habitat structures like hedges have been removed from our landscapes, and the land has been built up and overused, leaving less space for birds with particular requirements. Less specialised, highly adaptable species, so-called generalists, are the ones that benefit, such as Yellow-legged Gull, Rook and Common Woodpigeon. Their populations have grown since 1993–1996, and they increasingly occupy habitats in proximity to humans, increasing the risk of conflict.



2013–2016 breeding bird atlas: the number of recorded species per atlas square (10 × 10 km). The most species-rich squares are in areas where all important types of habitat occur, from lowland wetlands to Alpine habitats.

Swiss birdlife in numbers

The main objective of the 2013–2016 atlas is to document the current distribution and population numbers of breeding birds in Switzerland and Liechtenstein. Equally important is showing the changes in distribution over the past decades. The goals are therefore similar to those of the 1993–1996 atlas:

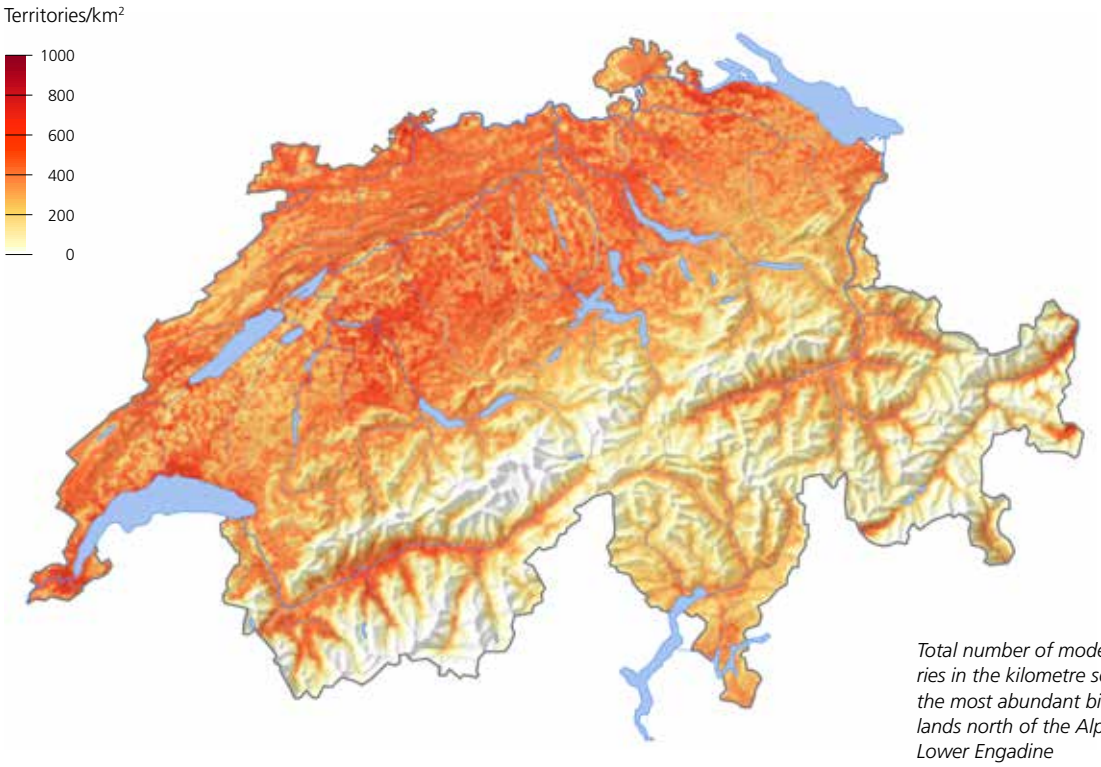
1. to document all breeding bird species present in each atlas square (10 × 10 km), as far as possible,
2. to determine the abundance of breeding birds using territory mapping surveys, and
3. to record rare and colonial species as comprehensively as possible.

Country-wide results

A total of 467 atlas squares measuring 10 × 10 km were surveyed in Switzerland and Liechtenstein as well as in areas just beyond the Swiss border. Within the atlas perimeter, 216 species of breeding birds were found in 2013–2016 (on Swiss territory: 204 as well as six non-native species), 13 more than during the last atlas surveys. However, four of these new species are not native to Switzerland. On average, 93 species were recorded per atlas square. The most species-rich atlas square was Vouvry VS with 140 species; only eight species were recorded in the atlas square in the Finsteraarhorn area BE/VS, due to the natural topography, making it the square with the smallest number of species.

Results in the kilometre squares

The territory mapping surveys in 2318 kilometre squares, which make up about 5 % of the total area within the atlas perimeter, provide a comprehensive and representative data set with a huge potential for analysis, especially of common and widespread species. On average, 239.6 territories of 35.4 species were counted per kilometre square. In total, 745 428 territories were detected during the surveys. The most abundant species is the Common Chaffinch, with an estimated 0.9–1.1 million breeding pairs. The Black Redstart remains our most universal bird: it was recorded in 94.7 % of all surveyed 1-km squares, making it the most widespread, though not the most abundant bird species. Woodland birds like Common Chaffinch, Eurasian Blackcap and Common Blackbird, present in forests at all altitude levels, are the ones with the largest populations. The number of species and territories decreases with increasing altitude: at 600 m asl, a kilometre square on average held 50 species with 396 territories; at 1200 m, 48 species with 351 territories were found, and 38 species with 209 territories at 1800 m.



Total number of modelled breeding bird territories in the kilometre squares. The habitats with the most abundant birdlife are found in the lowlands north of the Alps as well as in Valais and Lower Engadine

Overview of the 2013–2016 atlas data

Total number of records	3 169 412
of which records from territory mapping surveys	1 524 429
Number of kilometre squares with at least one record	36 002 (77 %*)
Surveyed kilometre squares	2318 (5 %*)

* = in percent of the entire survey area (46 202 km²)

Most abundant & widespread species

Species	Present in % of surveyed km²	Population size (territories)
Black Redstart	95 %	300 000–400 000
Common Chaffinch	88 %	900 000–1 100 000
Eurasian Blackcap	80 %	700 000–800 000
Common Blackbird	81 %	500 000–700 000
European Robin	81 %	450 000–650 000
Coal Tit	72 %	400 000–600 000

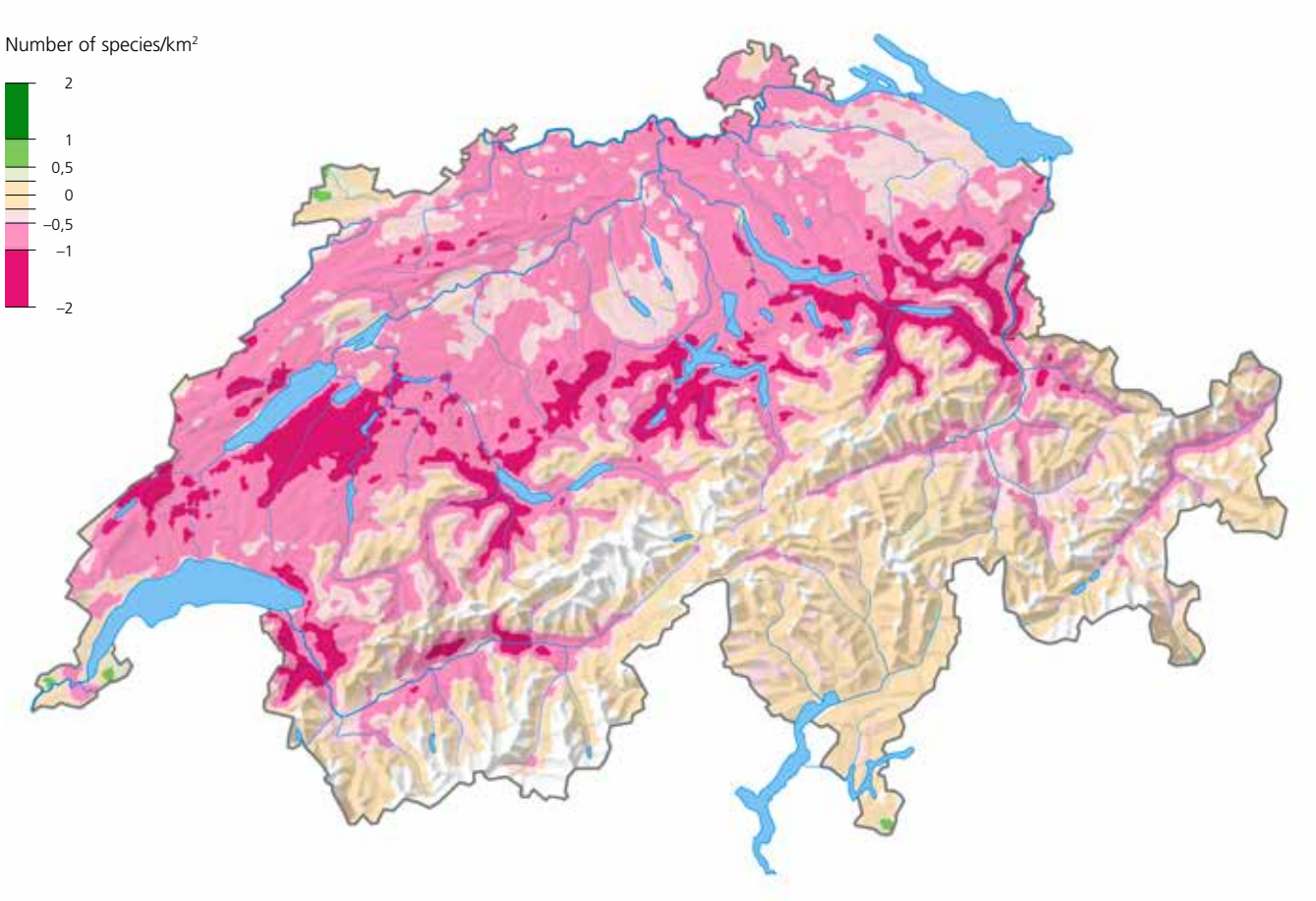
Surveys in kilometre squares

Average number of species	35.4
Min./max. number of species	2/69
Average number of territories	240
Min./max. number of territories	3/742
Total number of territories	745 428
Average survey time (per kilometre square)	10 h 49 min.
Number of survey visits	9095
Total survey effort	3.9 working years

Atlas squares with highest and lowest species richness

Vouvry (square 55/13)	140 species
Pfynwald (61/12)	135 species
Thun (61/17)	133 species
Leysin (56/13)	132 species
Sennwald (75/23)	131 species
.....	
Mattmark (64/9)	19 species
Finsteraarhorn (65/15)	8 species

The atlas square «Vouvry» at the eastern end of Lake Geneva accommodates diverse habitats and is therefore the most species-rich area.



Distribution change of Red-List species (2001/2010) since 1993–1996. The map combines the change maps of 27 species with sufficient data to model the occurrence probability for both atlas periods (most of the remaining 50 species are extremely rare).

Number of species remains constant, but...

To come straight to the point: the «bare figures» in the breeding bird atlas must be interpreted with great care. On the one hand, the number of observers increased from one atlas to the next, our level of knowledge has grown, the effort put into the surveys increased enormously, and mobility as well as the accessibility of many areas have changed fundamentally. On the other hand, the geographic scale of the maps plays a critical role: although many species that are moderately

	1910 – 1919	1920 – 1929	1930 – 1939	1940 – 1949	1950 – 1959	1960 – 1969	1970 – 1979	1980 – 1989	1990 – 1999	2000 – 2009	2010 – 2018
New breeders		Fieldfare Red-crested Pochard		Purple Heron Black-necked Grebe Western Yellow Wagtail	Eurasian Collared Dove Common Pochard Savi's Warbler Tufted Duck Gadwall Barred Warbler Tawny Pipit	Melodious Warbler Rook Mew Gull Yellow-legged Gull Mediterranean Gull	Bearded Reedling Cetti's Warbler	Common Rosefinch Common Eider Pallid Swift Bluethroat	European Bee-eater Common Shelduck White-backed Woodpecker	Great Cormorant Bearded Vulture	Short-toed Snake Eagle
Disappeared	Osprey	Common Redshank					Lesser Grey Shrike Crested Lark	Great Grey Shrike	Western Orphean Warbler	Eurasian Curlew Woodchat Shrike	Ortolan Bunting

Overview of species that have appeared in Switzerland since 1910 and have established themselves as breeders (top) and traditional breeding birds that have disappeared from Switzerland (bottom). The Bearded Vulture was reintroduced.

Swiss breeding bird communities are (too) dynamic

No more records: the Woodchat Shrike, once a widespread breeding bird, has disappeared from Switzerland.

Dwindling numbers: the Ortolan Bunting occupied 150–250 territories 20 years ago, but there have been no breeding records since 2014.

Brief appearance: a pair of Black-winged Stilts attempted to breed in 2013.

New breeder: the European Bee-eater has bred in Switzerland since 1991 and exceeded the threshold of 100 breeding pairs in 2017.

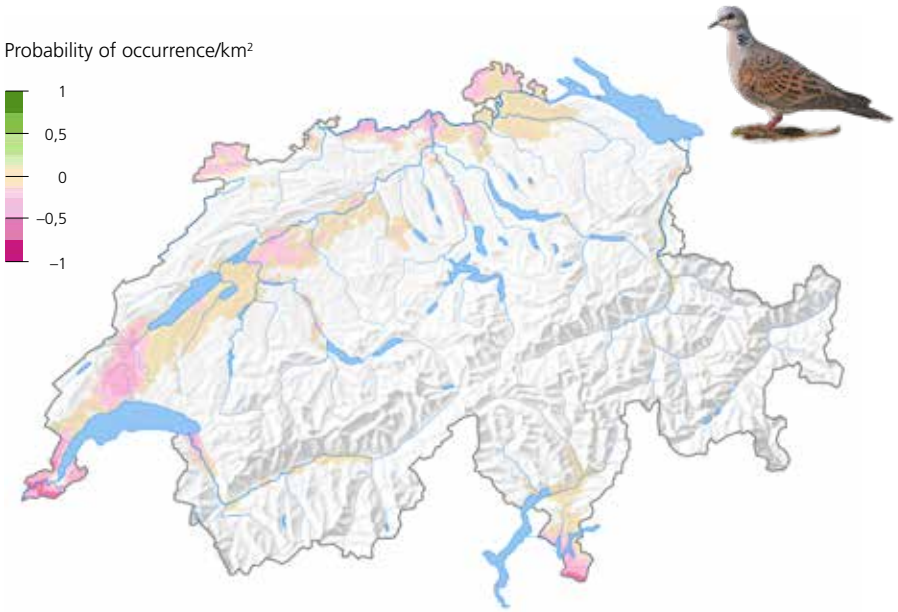
Gaining a foothold: following the first breeding record in 2012, 3–5 Short-toed Snake-eagle pairs have now become established.

Unwanted invasive species: the Ruddy Shelduck and more recently the Egyptian Goose (image) have established breeding populations.

common or scarce have decreased, this change is often not visible on the distribution maps at the 10 × 10 km scale. For example, if there used to be one hundred pairs in a given atlas square, but only one now remains, the atlas square will still appear as occupied on the map. For this reason, we decided not to publish the number of occupied atlas squares per atlas period for any species directly. Comparisons of the detailed results from those kilometre squares that were surveyed in both 1993–1996 and 2013–2016 are much more informative.

Homogenisation continues

The few species that bred in Switzerland for the first time – mostly concerning just a handful of pairs – produce a positive overall balance in the number of current breeding species in purely arithmetic terms. But the populations of many breeding birds in Switzerland are in marked decline and often show range contractions as well. Overall, we face a situation that is more unstable than necessary. The groups most affected by declines are wetland birds, birds that breed in low-intensity farmland, and/or long-distance migrants. Often, these species require larger habitats, are sensitive to human disturbance, rely on large insects for food, or are ground breeders exposed to the threats of farming machinery and predation. For many of them, conditions in Switzerland have become even more precarious since the last surveys in the 1990s. Most affected are those 40 % of our native breeding birds that are quite rare or whose populations are declining. For example, it is already clear that several species will have to be added to the new Red List when it is published in 2020.



No more dove talk? The results of the 2013–2016 atlas surveys do not bode well for the European Turtle-dove. Even in its former hotspots in Geneva, Vaud and Ticino, the species is in marked decline (red areas).

Population trend, status and population size of breeding birds in Switzerland in 1950–1959, 1972–1976, 1993–1996 and 2013–2016

Each of the following 216 species bred in Switzerland in at least one of the four atlas periods in the 1950s, 1970s, 1990s and/or the 2010s. ● = annually, ○ = irregularly, ♦ = exceptionally. (=) population largely constant or fluctuating, or no significant trend; ++ = strong increase, X = no trend could be calculated. Trends can only be determined for 174 species currently classed as regular breeders. The maximum decline is –100, while an increase can exceed +100.

Species	Trend 1990–2017	Trend 2008–2017	1950–1959	1972–1976	1993–1996	2013–2016	Population in 2013–2016 (territories/ pairs/broods)
Common Quail	(=)	(=)	●	●	●	●	500–2 000
Rock Partridge	–57	(=)	●	●	●	●	2 500–4 500
Common Pheasant	X	X	●	●	●	●	40–60
Grey Partridge	(=)	(=)	●	●	●	●	5–10
Hazel Grouse	(=)	26	●	●	●	●	3 000–5 500
Rock Ptarmigan	–33	(=)	●	●	●	●	12 000–18 000
Western Capercaillie	–35	(=)	●	●	●	●	360–470
Black Grouse	(=)	14	●	●	●	●	12 000–16 000
Mute Swan	X	X	●	●	●	●	590–720
Greylag Goose	X	X			●	●	45–60
Common Eider	X	X			●	●	1–5
Common Goldeneye	X	X	♦		♦		0
Red-breasted Merganser	X	X			♦	♦	0–2
Goosander	109	22	●	●	●	●	600–800
Egyptian Goose	X	X				●	8–13
Ruddy Shelduck	X	X			●	●	10–15
Common Shelduck	X	X			♦	●	1–4
Wood Duck	X	X			♦	♦	0–1
Mandarin Duck	X	X	♦	♦	●	●	10–20
Red-crested Pochard	973	65	●	●	●	●	210–300
Common Pochard	(=)	(=)	♦	●	●	●	6–9
Ferruginous Duck	X	X			♦	♦	0–1
Tufted Duck	78	(=)	♦	●	●	●	160–280
Garganey	X	X	♦	♦	♦	♦	0–1
Northern Shoveler	X	X	♦		♦	○	0–1
Gadwall	137	(=)	♦	♦	●	●	5–10
Common Teal	X	X	○	○	○	○	0–2
Mallard	24	(=)	●	●	●	●	20 000–30 000
Little Grebe	–19	(=)	●	●	●	●	800–1 300
Black-necked Grebe	(=)	405	○	○	○	○	3–4
Great Crested Grebe	–26	(=)	●	●	●	●	3 500–5 000
Feral Pigeon	X	X	●	●	●	●	20 000–35 000
Stock Dove	58	32	●	●	●	●	2 000–4 000
Common Woodpigeon	215	40	●	●	●	●	130 000–150 000
European Turtle-dove	–43	–29	●	●	●	●	150–400
Eurasian Collared-dove	50	(=)	●	●	●	●	15 000–25 000
European Nightjar	–18	–18	●	●	●	●	40–50
Alpine Swift	107	(=)	●	●	●	●	1 800–2 300
Pallid Swift	165	(=)			●	●	29–36
Common Swift	(=)	(=)	●	●	●	●	40 000–60 000
Common Cuckoo	(=)	(=)	●	●	●	●	15 000–25 000
Western Water Rail	(=)	(=)	●	●	●	●	500–800
Corncrake	205	(=)	●	●	●	●	15–40
Spotted Crake	(=)	(=)	●	●	●	●	10–20
Little Crake	X	X	●	●	●	●	1–5
Baillon's Crake	X	X	♦	♦		♦	0–1
Common Moorhen	(=)	46	●	●	●	●	1 000–2 000
Common Coot	31	26	●	●	●	●	5 000–8 000
White Stork	220	118	●	●	●	●	370–460
Common Little Bittern	(=)	(=)	●	●	●	●	90–120
Black-cr. Night Heron	X	X	♦	♦	♦		0–1

Species	Trend 1990–2017	Trend 2008–2017	1950–1959	1972–1976	1993–1996	2013–2016	Population in 2013–2016 (territories/ pairs/broods)
Grey Heron	32	36	●	●	●	●	1 600–1 800
Purple Heron	++	++	●	●	♦	●	6–17
Great White Egret	X	X				♦	0–1
Little Egret	X	X				♦	0–1
Great Cormorant	++	462				●	1 200–2 100
Black-winged Stilt	X	X				♦	0–1
Eurasian Dotterel	X	X			♦	○	1–3
Little Ringed Plover	(=)	(=)	●	●	●	●	90–120
Northern Lapwing	–55	89	●	●	●	●	140–180
Eurasian Curlew	–97	X	●	●	●		0
Common Snipe	–93	X	●	●	○	♦	0–1
Eurasian Woodcock	–12	(=)	●	●	●	●	1 000–4 000
Common Sandpiper	(=)	73	●	●	●	●	70–90
Black-headed Gull	–62	(=)	●	●	●	●	560–800
Mediterranean Gull	++	(=)		♦	○	○	0–5
Mew Gull	(=)	–94		●	●	○	0–3
Yellow-legged Gull	++	54		●	●	●	1 240–1 430
Arctic Tern	X	X				♦	0–1
Common Tern	149	(=)	●	●	●	●	580–760
Common Barn-owl	–19	(=)	●	●	●	●	200–1 000
Eurasian Pygmy-owl	(=)	(=)	●	●	●	●	800–2 000
Little Owl	181	84	●	●	●	●	115–150
Boreal Owl	(=)	(=)	●	●	●	●	1 000–3 000
Eurasian Scops-owl	172	(=)	●	●	●	●	30–40
N. Long-eared Owl	15	(=)	●	●	●	●	2 000–3 000
Tawny Owl	(=)	(=)	●	●	●	●	6 000–8 000
Eurasian Eagle-owl	(=)	(=)	●	●	●	●	200–230
Europ. Honey-buzzard	20	(=)	●	●	●	●	500–1000
Bearded Vulture	++	433				●	9–15
Golden Eagle	16	(=)	●	●	●	●	350–360
Short-toed Snake-eagle	X	X				○	3–5
Western Marsh-harrier	X	X	○	♦		♦	0–3
Montagu's Harrier	X	X	○	♦			0
Eurasian Sparrowhawk	26	(=)	●	●	●	●	3 500–6 000
Northern Goshawk	(=)	17	●	●	●	●	1 300–1 700
Red Kite	552	64	●	●	●	●	2 800–3 500
Black Kite	112	(=)	●	●	●	●	2 000–3 000
Eurasian Buzzard	33	(=)	●	●	●	●	15 000–20 000
Common Hoopoe	56	(=)	●	●	●	●	180–260
European Bee-eater	++	414			●	●	53–72
Common Kingfisher	51	(=)	●	●	●	●	400–500
Eurasian Wryneck	(=)	42	●	●	●	●	1 000–2 500
Grey-faced Woodpecker	–73	–46	●	●	●	●	300–700
Eur. Green Woodpecker	75	(=)	●	●	●	●	10 000–17 000
Black Woodpecker	171	39	●	●	●	●	6 000–9 000
Three-toed Woodpecker	(=)	56	●	●	●	●	1 000–2 500
Middle Sp. Woodpecker	216	57	●	●	●	●	1 700–2 100
Lesser Sp. Woodpecker	21	26	●	●	●	●	1 500–3 000
White-b. Woodpecker	X	X			♦	●	20–30
Great Sp. Woodpecker	102	(=)	●	●	●	●	70 000–90 000
Common Kestrel	138	34	●	●	●	●	5 000–7 500

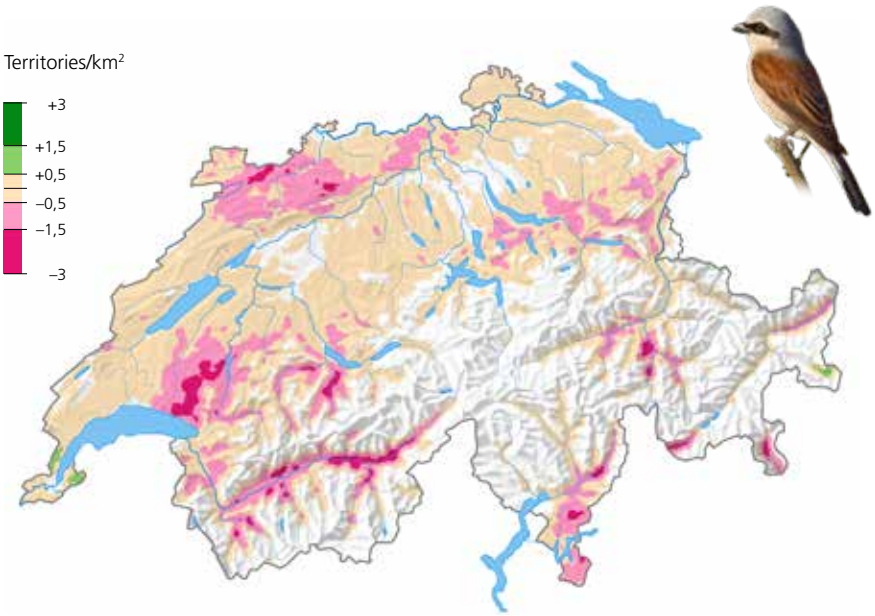
Species	Trend 1990–2017	Trend 2008–2017	1950–1959	1972–1976	1993–1996	2013–2016	Population in 2013–2016 (territories/ pairs/broods)
Eurasian Hobby	12	(=)	●	●	●	●	500–1 000
Peregrine Falcon	106	(=)	●	●	●	●	260–320
Eurasian Golden Oriole	50	(=)	●	●	●	●	3 000–4 500
Red-backed Shrike	–50	(=)	●	●	●	●	10 000–15 000
Lesser Grey Shrike	X	X	●	○			0
Great Grey Shrike	X	X	●	●			0
Woodchat Shrike	–100	(=)	●	●	●		0
Red-billed Chough	150	(=)	●	●	●	●	70–80
Yellow-billed Chough	(=)	(=)	●	●	●	●	11 000–21 000
Eurasian Jay	22	(=)	●	●	●	●	60 000–75 000
Eurasian Magpie	157	(=)	●	●	●	●	35 000–40 000
Northern Nutcracker	(=)	(=)	●	●	●	●	20 000–25 000
Eurasian Jackdaw	71	35	●	●	●	●	1 250–1 500
Rook	++	113		●	●	●	5 800–7 300
Common Raven	69	(=)	●	●	●	●	2 000–3 000
Carrion Crow	123	(=)	●	●	●	●	80 000–120 000
Hooded Crow	X	X	●	●	●	●	2 000–3 000
Coal Tit	530	(=)	●	●	●	●	400 000–600 000
Crested Tit	72	(=)	●	●	●	●	90 000–110 000
Marsh Tit	45	(=)	●	●	●	●	70 000–100 000
Alpine or Willow Tit	100	(=)	●	●	●	●	70 000–95 000
Eurasian Blue Tit	107	(=)	●	●	●	●	200 000–300 000
Great Tit	31	(=)	●	●	●	●	400 000–550 000
Eurasian Penduline-tit	X	X	○	○	○	♦	0–1
Woodlark	(=)	(=)	●	●	●	●	250–300
Eurasian Skylark	–43	–20	●	●	●	●	25 000–30 000
Crested Lark	X	X	●	○			0
Bearded Reedling	(=)	(=)		●	●	●	80–110
Zitting Cisticola	X	X		♦	♦	♦	0–2
Melodious Warbler	27	47	●	●	●	●	300–350
Icterine Warbler	–74	(=)	●	●	●	●	100–150
Moustached Warbler	X	X		♦		♦	0–1
Sedge Warbler	X	X		♦			0
Marsh Warbler	(=)	(=)	●	●	●	●	3 000–6 000
Common Reed-warbler	(=)	(=)	●	●	●	●	9 000–11 000
Great Reed-warbler	67	92	●	●	●	●	270–320
Savi's Warbler	49	(=)	●	●	●	●	280–310
C. Grasshopper-warbler	36	(=)	●	●	●	●	150–250
Northern House Martin	–29	(=)	●	●	●	●	70 000–90 000
Barn Swallow	(=)	23	●	●	●	●	70 000–90 000
Eurasian Crag Martin	55	51	●	●	●	●	7 000–9 000
Collared Sand Martin	–44	61	●	●	●	●	2 300–3 000
West. Bonelli's Warbler	110	38	●	●	●	●	40 000–60 000
Wood Warbler	–64	(=)	●	●	●	●	5 000–7 500
Willow Warbler	–67	–34	●	●	●	●	4 000–5 000
Common Chiffchaff	52	(=)	●	●	●	●	250 000–300 000
Greenish Warbler	X	X				♦	0–1
Cetti's Warbler	X	X		○	○	○	0–2
Long-tailed Tit	117	(=)	●	●	●	●	20 000–35 000
Eurasian Blackcap	65	19	●	●	●	●	700 000–800 000
Garden Warbler	–39	–24	●	●	●	●	35 000–50 000
Barred Warbler	–87	–87	●	●	●	●	0–5
West. Orphean Warbler	X	X	♦	○	○		0
Lesser Whitethroat	(=)	(=)	●	●	●	●	17 000–23 000
Subalpine Warbler	X	X			♦	♦	0–1
Greater Whitethroat	31	32	●	●	●	●	1 800–2 500
Short-toed Treecreeper	37	(=)	●	●	●	●	45 000–55 000
Eurasian Treecreeper	161	(=)	●	●	●	●	75 000–100 000
Eurasian Nuthatch	(=)	(=)	●	●	●	●	110 000–170 000

Species	Trend 1990–2017	Trend 2008–2017	1950–1959	1972–1976	1993–1996	2013–2016	Population in 2013–2016 (territories/ pairs/broods)
Wallcreeper	–33	(=)	●	●	●	●	1 000–2 500
Northern Wren	61	(=)	●	●	●	●	400 000–550 000
White-throated Dipper	36	(=)	●	●	●	●	6 000–8 000
Common Starling	(=)	(=)	●	●	●	●	120 000–140 000
Mistle Thrush	31	(=)	●	●	●	●	130 000–150 000
Song Thrush	40	49	●	●	●	●	300 000–350 000
Eurasian Blackbird	41	13	●	●	●	●	500 000–700 000
Fieldfare	–44	(=)	●	●	●	●	40 000–45 000
Ring Ouzel	–35	(=)	●	●	●	●	50 000–75 000
Spotted Flycatcher	–35	(=)	●	●	●	●	35 000–55 000
European Robin	38	20	●	●	●	●	450 000–650 000
Red-spotted Bluethroat	395	(=)		♦	●	●	5–12
Common Nightingale	58	33	●	●	●	●	1 700–2 200
Eur. Pied Flycatcher	49	(=)	●	●	●	●	17 000–22 000
Collared Flycatcher	X	X	●	●	●	●	15–25
Black Redstart	13	(=)	●	●	●	●	300 000–400 000
Common Redstart	(=)	(=)	●	●	●	●	12 000–18 000
Rufous-t. Rock-thrush	–28	36	●	●	●	●	2 000–3 000
Blue Rock-thrush	(=)	(=)	●	●	●	●	15–25
Whinchat	–56	–29	●	●	●	●	7 000–9 000
Common Stonechat	91	25	●	●	●	●	1 500–2 000
Northern Wheatear	31	(=)	●	●	●	●	40 000–60 000
Goldcrest	58	(=)	●	●	●	●	200 000–400 000
Common Firecrest	(=)	104	●	●	●	●	250 000–400 000
Alpine Accentor	(=)	(=)	●	●	●	●	25 000–40 000
Dunnock	20	22	●	●	●	●	200 000–250 000
House Sparrow	18	(=)	●	●	●	●	450 000–550 000
Italian Sparrow	X	X	●	●	●	●	20 000–25 000
Eurasian Tree Sparrow	66	(=)	●	●	●	●	80 000–95 000
White-w. Snowfinch	–12	(=)	●	●	●	●	6 000–9 000
Tree Pipit	–49	(=)	●	●	●	●	50 000–70 000
Meadow Pipit	–54	(=)	●	●	●	●	500–800
Water Pipit	(=)	(=)	●	●	●	●	150 000–200 000
Tawny Pipit	X	X	♦	♦	○	○	1–3
Western Yellow Wagtail	21	(=)	●	●	●	●	300–340
Grey Wagtail	(=)	(=)	●	●	●	●	17 000–20 000
White Wagtail	–11	–14	●	●	●	●	90 000–110 000
Common Chaffinch	31	(=)	●	●	●	●	900 000–1 100 000
Hawfinch	(=)	(=)	●	●	●	●	13 000–17 000
Common Rosefinch	(=)	173			●	●	50–70
Eurasian Bullfinch	(=)	(=)	●	●	●	●	40 000–75 000
European Greenfinch	(=)	–38	●	●	●	●	90 000–120 000
Common Linnet	(=)	(=)	●	●	●	●	25 000–30 000
Redpoll	(=)	(=)	●	●	●	●	15 000–20 000
Red Crossbill	123	(=)	●	●	●	●	25 000–35 000
European Goldfinch	–36	(=)	●	●	●	●	50 000–70 000
Citril Finch	–37	(=)	●	●	●	●	10 000–20 000
European Serin	–15	(=)	●	●	●	●	35 000–45 000
Eurasian Siskin	(=)	(=)	●	●	●	●	10 000–16 000
Corn Bunting	–39	(=)	●	●	●	●	80–110
Rock Bunting	(=)	(=)	●	●	●	●	7 000–10 000
Ortolan Bunting	–98	–90	●	●	●	○	1–5
Cirl Bunting	(=)	(=)	●	●	●	●	1 000–1 500
Yellowhammer	(=)	–16	●	●	●	●	65 000–75 000
Reed Bunting	–27	(=)	●	●	●	●	1 700–3 000

The Eurasian Wryneck inhabits open, light-flooded deciduous woods, gardens and traditional orchards and relies on sites with nutrient-poor soils and low, patchy ground vegetation. This is where it finds its favourite food, ants and their larvae and pupae, which it extracts from nests in the ground with a rapid extension of its tongue.

Long-distance migrants in decline

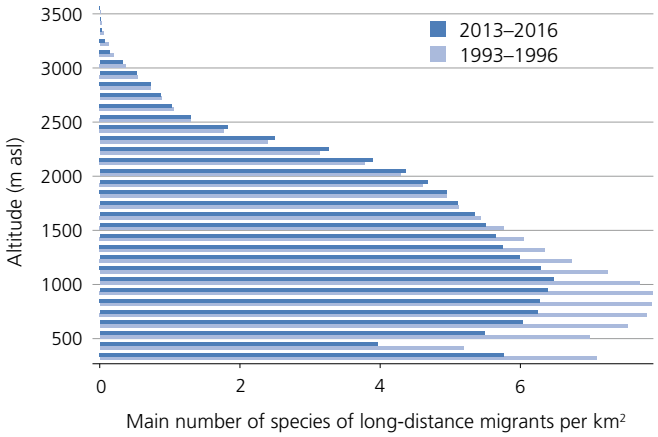
Overall, the numbers of long-distance migrants are declining, while those of short-distance migrants and residents appear to be increasing. Being more specialised, the former are more affected by habitat changes in the breeding and wintering grounds and therefore more vulnerable. In addition, insects are an important food source for many long-distance migrants. About 40 % of Swiss breeding bird species feed almost exclusively on insects. A further 25 % have a mixed diet, but rely mainly on insects to feed their young. Insectivores therefore need an ample supply of suitable insects that also have to be easy to catch. The steep decline of insects in farmland in particular is a major problem for our native breeding birds.



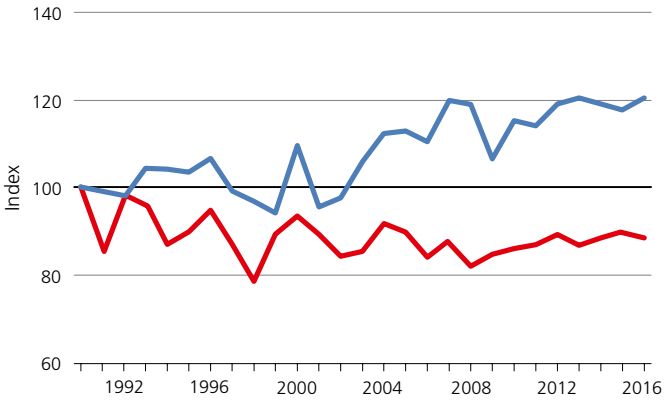
The Red-backed Shrike feeds mainly on large insects. While there were some local increases, e.g. near Geneva, the species has declined significantly in its former strongholds in the Jura, Valais and Ticino (red areas on the density change map, see p. 38 for more details on this map type).

Many dangers in many places

Long-distance migrants travel between several completely different locations, spending 4–5 months in the breeding grounds, two months on spring and autumn migration, and 5–6 months in the wintering sites. Certain species move considerable distances within their wintering range in a single season. Habitat changes at one of the sites frequented in the course of the year can quickly put them under pressure. They need to be in certain places at certain times, in keeping with their tight annual schedule. Moreover, many species face a high risk of mortality during migration.



Comparing the altitudinal distribution of long-distance migrants in 1993–1996 and 2013–2016 shows that significant losses only occurred below 1500 m, which suggests that many declines are «home-made».



The populations of long-distance migrants (red) are in marked decline, while short-distance migrants and residents (blue) are faring much better.

The fact that long-distance migrants have above all disappeared from the Swiss lowlands, where the impact of human activity is especially strong, is an indication that the decline is largely «home-made».

Causes of insect decline

Although data are scarce throughout central Europe, it is safe to say that fewer insects exist today than a few decades ago. This loss is documented for several areas in Germany, where insect biomass decreased by 75 % in the past 27 years. While there are no data from Switzerland, there are plenty of signs that indicate a similarly large loss. The reasons for the decline are diverse:

- Loss of habitats such as semi-dry and dry grassland, wetlands and semi-natural waterbodies.
- Farming methods that are hostile to insects: Semi-natural embankments are often mulched during the peak flowering period. Baled silage has become widespread right up to the sub-Alpine zone. Meadows are cut up to six times a year.
- Herbicides reduce the supply of plant food for many insects.
- Use of insecticides: beneficial organisms are decimated as well as harmful ones.
- Use of medication to control parasites in farm animals: The dung and manure of these animals attract significantly fewer insects.
- Use of pesticides in private gardens as well. Pesticide-free gardening would be an easy measure to implement.

Insects are poorly accessible

Many crops and meadows are much denser than they used to be. Sparse, low-nutrient meadows, for instance, declined by 20 % in the Engadine in only 20 years. The proportion of extremely dense meadows increased considerably during the same period. The wheat yield per hectare has tripled in Switzerland since 1940, thanks to heavy nitrogen fertilisation and closely spaced crop varieties. Insectivores like Eurasian Hoopoe, Eurasian Wryneck, Little Owl and Common Redstart are unable to forage in such densely vegetated meadows and fields.

The Barn Swallow is a familiar harbinger of spring. Its population has declined significantly in large parts of the country. During bad weather especially, the insufficient food supply can lead to brood loss. In addition, the decline of farms with livestock has caused breeding sites to disappear.

The Golden Eagle is present throughout the Swiss Alps; all suitable territories are occupied. The breeding success of the approximately 350 pairs is quite low, putting a natural limit on population growth. However, an increasing number of breeding attempts now fail due to disturbance by humans.

Recovery of raptor populations

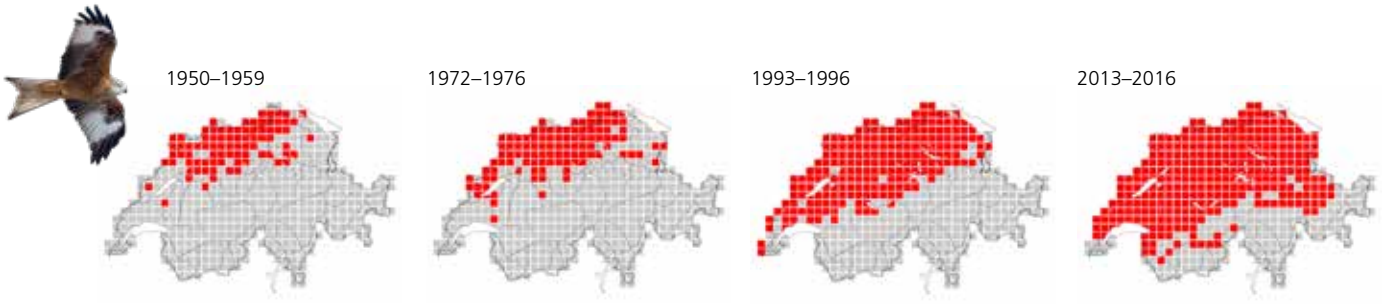
For centuries, raptors and owls were directly persecuted by humans. The last Bearded Vulture in the Alps was shot in 1913, and the last Osprey pair bred in Switzerland in 1911. The populations of Red Kite and Golden Eagle were severely depleted. Despite the ban on hunting introduced for several species in 1926, many raptor populations were slow to recover. Golden Eagle, Eurasian Hobby and Peregrine Falcon were not protected until 1953, Northern Goshawk and Eurasian Sparrowhawk not until 1963.

Fatal pesticides

Besides direct persecution, the use of pesticides such as DDT, put to large-scale use from 1940, was a severe threat. As it accumulates at the top of the food chain, it hit birds of prey particularly hard, causing them to produce eggs with thin shells. In consequence, only a single Peregrine Falcon pair bred successfully in Switzerland outside of the Alps in 1971. Following a ban on persistent chlorinated hydrocarbons (including DDT and PCB) in most western countries in the 1970s, the affected species started to recover. But poisoning by carbofuran, only banned in Switzerland in 2013, continued to occur regularly in farmland areas well into the 1990s, affecting Eurasian Buzzards and Red and Black Kites. The – intentional – decimation of insects also had serious consequences.

The reduced food supply affects many species, including raptors, the final links in the food chain, which either hunt insects themselves or prey on small, insectivorous mammals like shrews.

Various human activities have had a positive effect on certain species: intensively managed grassland, where grass is mowed several times a year, appears to benefit less specialised birds of prey, such as Red and Black Kite and Eurasian Buzzard. Targeted conservation measures have boosted the Red Kite population, for example,



In the Middle Ages, the Red Kite was a widespread and common species in central Europe. Its area of distribution shrank considerably with the spread of firearms and as a result of poisoning. The species has since recovered and extended its range far into the Alps.

The reintroduction of the Bearded Vulture in the Alps is a particularly notable success. The species has bred again in Switzerland since 2007 and occupied as many as 16 atlas squares in Switzerland in 2013–2016. Such reintroduction schemes require a huge effort and should remain an exceptional measure.

and nest boxes have helped the Common Kestrel.

Today, the populations of almost all birds of prey are comparatively large – in some cases, such as the Red Kite, numbers are probably higher than ever before. But several species are in decline once more. The Peregrine Falcon is a particularly critical case (due in part to illegal persecution), and Northern Goshawk and Eurasian Sparrowhawk populations appear to be unstable again.

Trends can easily reverse

Most raptors are long-lived, reach sexual maturity late and have a low reproductive rate. Therefore, even a small increase in adult mortality can affect the population trend. Current threats include habitat loss, increasing human disturbance, electrocution on power pylons, collisions with overhead power lines, cables, vehicles, trains and windows, pesticide contamination, lead poisoning from fragments of ammunition in the carcasses of game animals (affecting carrion eaters) and finally, illegal persecution.

Human leisure activities such as rock climbing, paragliding and nest photography also increasingly affect breeding success in several species, e.g. the Golden Eagle. The growth of wind energy will result in breeding birds disappearing from certain areas and also cause casualties among migrating raptors. Currently, collisions with wind turbines mostly occur in the raptors' southern migration and wintering grounds.

Need for action

Migratory raptors in particular, such as Red and Black Kite, European Honey-buzzard, harriers and falcons, are exposed to a number of threats, reaching from direct persecution to drought and rainforest deforestation. Many of these problems are hard to address. However, the replacement of dangerous power pylons in Switzerland is feasible and long overdue. We could also improve the protection of nest sites for sensitive cliff breeders. Timber should be harvested outside of the breeding season. To protect migrating birds, important migration routes such as mountain passes and ridges should remain unobstructed by infrastructure. Other desirable measures include the monitoring of breeding populations and breeding success, especially for secretive woodland species.

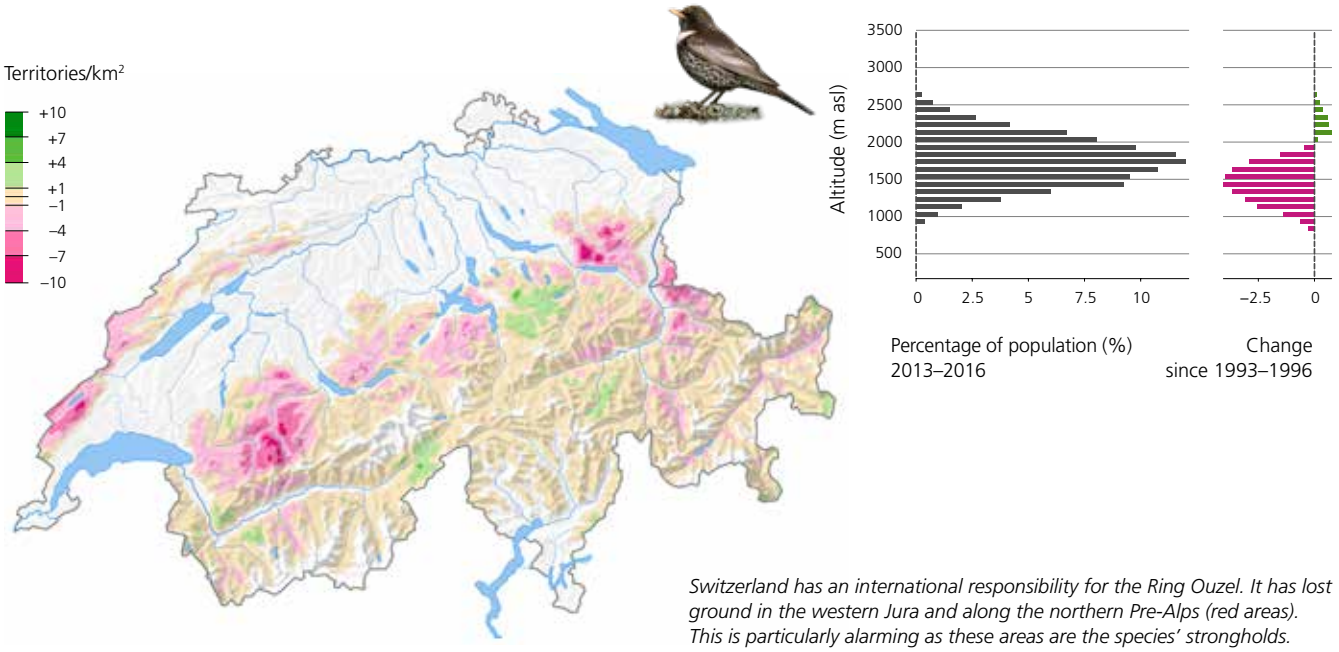
Clear positive trend: the Common Kestrel occurs in almost every atlas square. Numbers decreased significantly in the 1980s. Compared to the 1990s, populations have recovered throughout the lowlands.

Climate change forces birds upwards

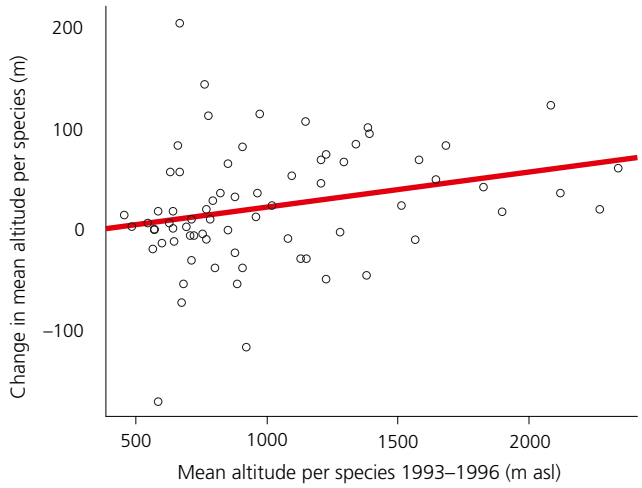
Not only are glaciers in retreat, but the vegetation cover around and above the tree line is also changing. As a result, many breeding birds of mountain forests and Alpine habitats move to higher ground while at the same time deserting the lower-lying regions.

Mediterranean species such as the Melodious Warbler, which reach their northern distribution limit in Switzerland, have increased since 1993–1996 and extended their ranges to the north. In contrast, central and northern European species whose western or southern range limit lies in Switzerland appear to be retreating northwards, among them Grey-faced Woodpecker and Willow Warbler. Climate warming is presumably a driving force behind these trends.

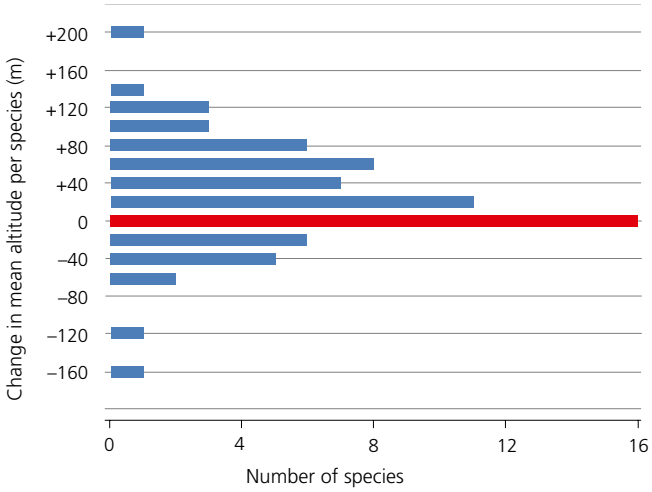
However, climate change in Switzerland affects the Alps first and foremost. The atlas results show how related environmental changes already impact breeding bird communities today, directly or indirectly.



Switzerland has an international responsibility for the Ring Ouzel. It has lost ground in the western Jura and along the northern Pre-Alps (red areas). This is particularly alarming as these areas are the species' strongholds.



Average altitudinal distribution per species between 1993–1996 and 2013–2016. Mountain birds have experienced a more pronounced upward shift than lowland species.



Between 1993–1996 and 2013–2016, 16 breeding species showed no change in average altitudinal distribution (red). 40 species shifted upwards (in some cases significantly), 15 species downwards.

Two thirds of common bird species move to higher altitude

Swiss breeding birds are distributed along an altitudinal gradient of more than 3000 m. The atlas data allows us to determine the shift in altitudinal distribution for 71 common species with density change maps for the period between 1993–1996 and 2013–2016; 40 of these are woodland birds. The average altitudinal distribution of all 71 species has shifted upwards by 24 m in the past 20 years. Almost two thirds of all species moved to higher altitude between the two atlas periods. Of the species whose average change in altitudinal distribution was more than 50 m, only four shifted downwards, while 22 species experienced an upward range shift.

A common pattern: losses down below, gains up high

Among the 47 species whose range has shifted upwards, 20 show a similar pattern: their populations have decreased at lower altitudes while increasing in the upper reaches of their distribution, independent of their ecological requirements and their average altitudinal distribution. The remaining 27 species either show only increases at higher altitudes or only losses in lower areas. Only in the case of four species did we find losses at high altitudes and gains in the lowlands.

The upward shift between the two atlas periods is particularly pronounced in species whose populations are concentrated at high altitude. The ten species with the highest altitudinal distribution in 1993–1996 experienced an average upward shift of 51 m.

Trends with various causes

Other reasons, such as changes in farming practices, probably also play a part. But we assume that climate change is the main reason for the upward range shift of breeding birds in Switzerland. Because climatic factors have a greater limiting influence on mountain birds than on lowland species, and because climate change is more pronounced at higher altitudes, climate change could also explain the above-average upward range shift of mountain birds

What does the future hold for our mountain birds?

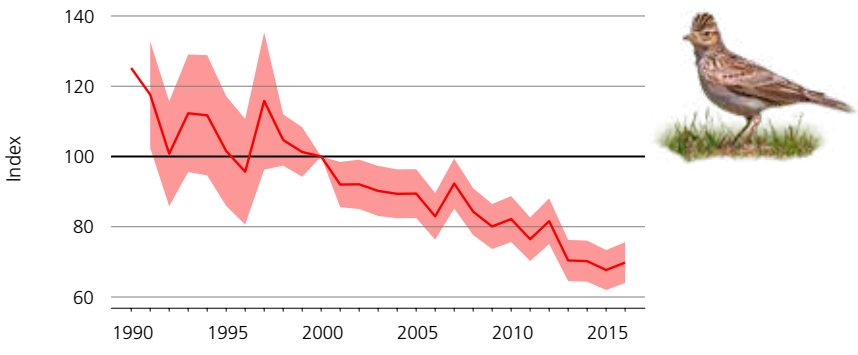
The changes in altitudinal distribution suggest that the Alps may serve as a refuge in the future, when even more pronounced environmental changes are expected to occur. But they will only be able to fulfil this function if biodiversity is taken into account in the development of tourist infrastructure or agriculture.

There are limits to this shift to higher ground. On the one hand, the surface area of suitable habitats decreases with increasing altitude simply due to topography. On the other hand, habitats respond to climate warming with a certain time lag, especially forests. How the resulting ecological imbalances will affect the species occupying these habitats is impossible to predict. One thing is clear: the Alps will play an even more critical role in the conservation of breeding birds in Switzerland than they have done so far. Unfortunately, it is also clear that the process underway will produce more losers than winners in the long term.

New techniques lead to increasingly intensive farming. For example, the large-scale use of protective fleece or plastic tunnels prevents farmland birds from breeding in their traditional habitats.

Monotonous farmland

The situation of farmland birds has worsened since the 1990s, in the mountains in particular. If you keep your eyes and ears open on a walk in the countryside, you will notice some ubiquitous species like the Carrion Crow but very few other birds. Where farming families used to cultivate a diverse mosaic of cornfields, flowery meadows, hedgerows and traditional orchards, agricultural land is now managed with industrial machinery. Farming practices have changed dramatically since 1950. Land consolidation, drainage of wetlands, the clearing of traditional orchards and hedgerows, mechanisation and the use of pesticides and artificial fertilisers have reduced the biological quality of farmland. In the last atlas published 20 years ago, the Swiss Ornithological Institute already concluded that many farmland birds were gradually being driven out by intensified land use.



The Eurasian Skylark, once a widespread and common species throughout Switzerland, has become a symbol for the decline of farmland birds. It has already disappeared from large parts of the country, and its population trend continues to decrease.

The federal government reacted by introducing policy instruments to stop the impoverishment of nature. In order to qualify for direct payments, farmers now have to provide «proof of ecological performance», one of the requirements being the creation of biodiversity promotion areas (BPA). The federal government also developed a system with measurable goals, presented in the report «Environmental Objectives in Agriculture (EOA)». But despite significant effort, none of these objectives has been achieved so far; on the contrary, the gap has actually widened. For example, the population size of EOA target species has declined by half since 1990.

Such results are frustrating – not only for conservationists, but also for the farmers that have shown genuine commitment and made a huge effort. So what are the reasons for the failure of our current agricultural policy, which is backed by more than 2.7 billion Swiss francs annually in the form of direct payments and other public funds? Since

the 1990s, the intensification of agriculture has continued to progress. The import of feed concentrates continues to grow, leading to the increased production of manure and slurry. Faster machinery means that larger expanses of land can be managed in less time. Modern harvesting and forage-conservation techniques (baled silage) resulted in the further rationalisation of intensive grassland management as many as 20 years ago. The amounts of pesticides have remained constant at a high level, but the substances used today are much more toxic. New livestock-fattening units are built and roads are constructed to access remote areas. Many of these ecologically harmful developments are supported by the federal government. Only about one fifth of the direct payments invested in agriculture target the promotion of biodiversity whereas the majority of the funds are used to further intensify production, promoting a form of agriculture that is harmful to the environment. Thus, agricultural policy thwarts its own efforts for more biodiversity. The system of direct payments needs to be greatly improved if agriculture is to be brought onto a more sustainable track. Only sustainable systems should receive support, but this support needs to be wholehearted.

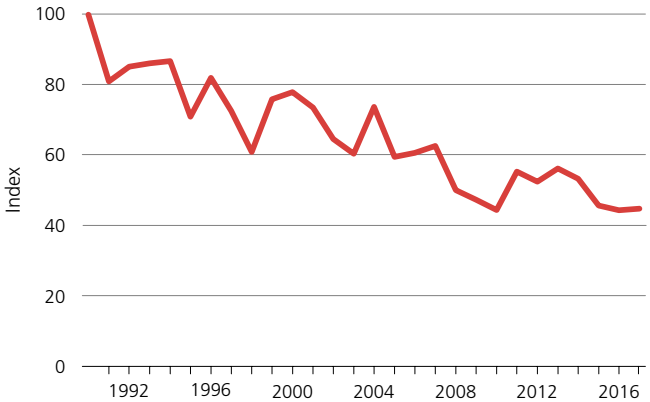
The most important single measure would involve the creation of sufficient high-quality biodiversity promotion areas (BPA). There is ample evidence that breeding birds, but also other animals and plants, benefit from such valuable areas. But only a part of BPA are of sufficient quality; in the valley and hill regions, high-quality BPA account for only 5.1 % of the total area of cultivated land. The situation is even worse on arable land, where wildflower strips and rotational fallows make up only 1.3 % of the area.

In the red: change map for species included in the «Environmental Objectives in Agriculture» (the map combines target and characteristic species).

Another critical measure would be the effective implementation of existing regulation. At present, numerous violations of existing laws go unsanctioned. Such practices not only harm nature, they also put those farmers that cultivate the land in an environment-friendly way at a disadvantage compared to those farming intensively.

Many farmers have a profound interest in nature. However, most of them are out of their depth when it comes to biodiversity-friendly practices and do not have the necessary knowledge to apply them. This is not surprising, as biodiversity and ecology are given far too little attention in education and training and in the existing advisory services for farmers. The Swiss Ornithological Institute was able to show that farmers who have benefited from advice and training implement more potent and more diverse measures, thus promoting biodiversity in an effective way.

The Corn Bunting inhabits richly structured farmland and the edges of wetlands, but has few special requirements. The fact that we have been unable to sustain even this species reflects the complete failure of our agricultural policy.



Way off target: the Swiss Bird Index SBI® «Target species EOA» shows an uninterrupted decline.

The bright green colours are a tell-tale sign: mountain farmland that is easily accessed with machinery receives large amounts of fertiliser and is used intensively. As a result, meadow birds barely stand a chance in this mountain valley in Grisons at 1700 m.

Intensification in the mountains

While farmland birds came under pressure on the Central Plateau several decades ago, many species continued to maintain substantial populations in mountain areas. The situation has worsened considerably since the 1990s. Due to the intensification of agriculture, many bird populations, especially ground breeders, have collapsed in mountain regions as well. In contrast, a decline in species richness due to the abandonment of farmland is only observed in relatively few areas.

Agriculture in the mountains has undergone major changes in the past decades. Mountain farmers are working increasingly large areas of land and as a consequence can use more powerful, faster and larger equipment. Small structures are an obstacle for these machines, so rocks and bushes are gradually removed and inclines are levelled. In general, such change is slow and goes almost unnoticed. Nevertheless, it leads to the loss of habitat for countless small animals as well as breeding sites for birds. A recent development is the use of stone crushers to transform large expanses of richly structured meadows into intensively used grassland, a process that completely destroys the value of the land as habitat for Woodlark, Northern Wheatear and Tree Pipit.

These two images from Gadmen BE are a striking illustration of the ongoing process of homogenisation in the mountains. On the left, an image from 1950, on the right, one from 2003. And yet this development goes largely unnoticed.

In the Jura too, farming methods have intensified. Areas levelled with stone-crushers in the Cantons of Berne and Solothurn.

Subsidies leading in the wrong direction

Between 2003 and 2016, the federal government spent more than 80 million francs per year on soil improvement and farm buildings. Two thirds of the expenditure have been allocated to mountain regions, triggering a substantial amount of additional investment. The funds were used to improve road access to cultivated land or finance irrigation systems in the central Alps, which in turn led to more intensive use of meadows. In the Engadine, the area of nutrient-poor grassland shrank by 20 % in just 25 years. On the other hand, the introduction of silage means that grass can be cut ever earlier in the year in favourable farming locations: between 1988 and 2002 alone, the date of the first mowing advanced by 20 days – which means that it now coincides with the breeding season of meadow birds in many mountain areas. Year after year, countless broods, and even incubating adults, are destroyed by mowing machinery. The high rate of brood loss causes populations to collapse.

Solutions exist

There is an urgent need for management practices that take into account the needs of meadow birds and other wildlife. Low-intensity meadows and pastures should make up about 20–40 % of the grassland area on the Central Plateau, 60 % in the mountains. This would be possible if livestock numbers were adjusted to match the grassland's natural potential for forage production. Farmers whose meadows and pastures are managed at low intensity receive compensation under the federal system of ecological direct payments.

Where meadow sage once bloomed, nutrient-rich and species-poor grassland now grows due to irrigation systems and fertilisation.

The nests of ground breeders like this Skylark brood are often destroyed through mowing.

Positive trends for woodland birds

Slightly larger forested area, increased growing stock and more deadwood: the Black Woodpecker and many other woodland species have benefited from the positive overall development of forests in Switzerland.

The trends of woodland birds are positive overall. The long-term monitoring scheme indicates that their populations have increased by about 20 % since 1990. In particular, widespread species that make their nests in tree trunks such as woodpeckers and the Eurasian Treecreeper have increased significantly. However, a few typical woodland species are also in decline, for example Western Capercaillie and Wood Warbler.

Distribution change since 1993–1996 of Eurasian Green, Black, Great Spotted, Middle Spotted, and Lesser Spotted Woodpecker, European Crested Tit, Willow Tit and Eurasian Treecreeper. Deadwood and old growth are critical for these typical woodland birds.

Continued increase in forest area and growing stock

Many woodland species have probably simply benefited from the increase in forest area and wood biomass. Between 1993–1995 and 2009–2013, forest area increased by 7 %. In the same time period, the growing stock increased by 3 %, reaching 352 m³/ha. On the Central Plateau, however, growing stock decreased by 11 %. Significant increases occurred in the central Alps (15 %) and southern Alps (30 %), mostly in areas above 1200 m. Here, the use of remote farmland was abandoned long ago, making way for the spread of forest. Another factor driving the increase in growing stock is declining timber exploitation in areas where access is difficult. Finally, climate warming stimulates the growth of trees in higher and less productive areas. Forest currently accounts for 31.3 % of Swiss territory and consists of about 535 million trees. Forests are the second largest type of habitat in terms of surface area after agricultural land.

More natural regeneration, deadwood and habitat trees

The practice of natural and site-adapted forest regeneration implemented throughout the country since the start of the millennium has reduced stands with a large proportion of conifer trees by one fifth, especially in the lowlands. The volume of deadwood more than doubled between 1993–1995 and 2009–2013, increasing from 11 to 26 m³/ha on average. However, the distribution of deadwood is unsatisfactory. In the more intensively used forests of the Jura and the Central Plateau, the amount of deadwood is still only half that of the Alps and Pre-Alps, where it is concentrated in the windthrow areas created by storm «Lothar». Many areas in the Jura and on the Central Plateau have not yet reached the federal target of 20 m³/ha, to be achieved by 2030.

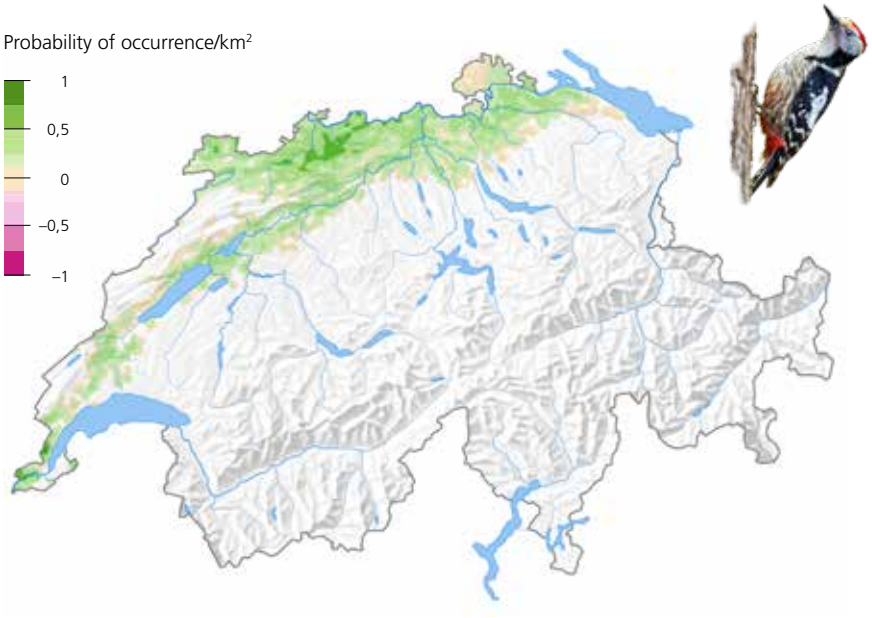
The promotion of biodiversity has also led to an increase in so-called

habitat trees compared to 1993–1995 (1.7 vs. 1.1 trees/ha). As they age and are exposed to external influences, large old trees often form rot, cracks, crevices, cavities as well as moss and lichen growth, offering habitats for a large range of organisms; these in turn serve as a food source for woodpeckers and treecreepers. But the number of habitat trees in our managed woods remains small: there are about 30 times as many such trees in the primeval beech forests of the Ukrainian Carpathians.

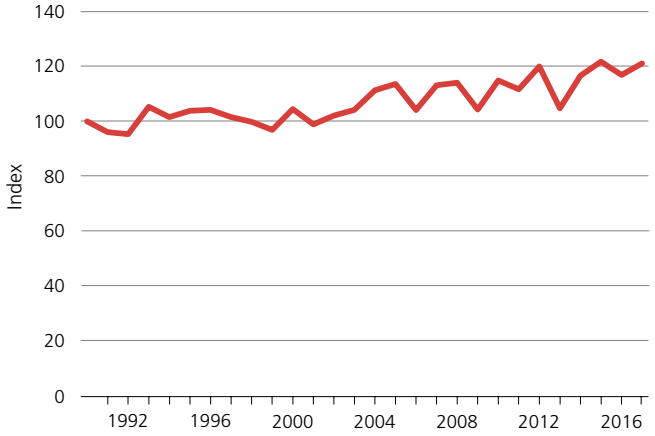
On the way to becoming an ecological hotspot?

The Forest Act of 1991 requires owners and foresters to use a close-to-nature approach to forest management. Thanks to this practice of nature-friendly silviculture and the fact that the total extent of forest area is protected by law, the ecological quality of woodlands is high compared to other habitats. As promising as the increasing use of biodiversity-friendly methods in forestry is, there have been other, more problematic trends in recent years: as the forest has grown, open, light-flooded types of woodland have become even scarcer. Moreover, the loss of forest edges as patches of forest grow together is undesirable in terms of overall species diversity. 84 % of forest edges still lack a sufficiently broad and well-structured shrub and herb belt.

Forests are also becoming more and more popular with leisure seekers, which affects game animals and birds sensitive to disturbance, such as Western Capercaillie. Finally, trends in forest management that involve ever larger wood-harvesting machinery and interventions at all times of the year – including during the breeding season – give cause for concern. Due to the increased use of wood for fuel, the proportion of deadwood and old growth could decline again in the future if no measures are taken to prevent this. For these reasons, we need to continue to pay close attention to the use of forests despite the overall positive trends in bird populations.



The Middle Spotted Woodpecker, a species that mainly occupies deciduous trees with furrowed bark, has gained a lot of ground in the past 20 years.



The Swiss Bird Index SBI® for woodland birds shows a growing long-term trend with annual fluctuations.

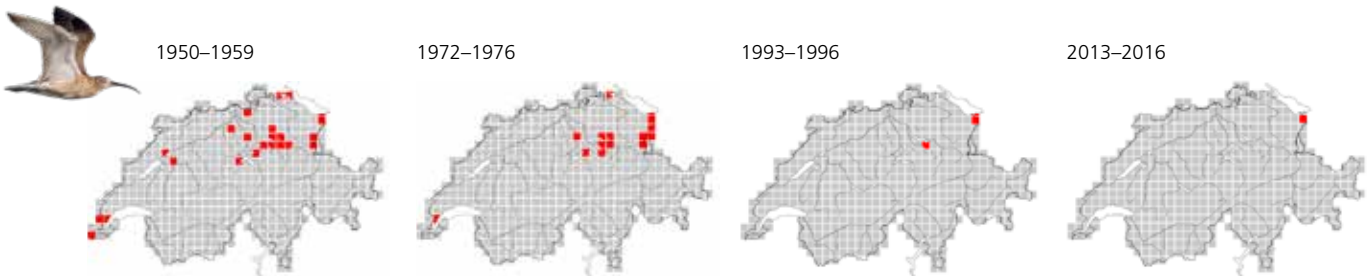
Old forests rich in deadwood are necessary to support specialised species, but are absent in many parts of the country, especially in easily accessible areas of the Central Plateau and Jura.

Overall, substantial amounts are invested in wetlands and lakes, for example in the Reuss delta UR, where structures typical for natural river deltas have been restored in the past 25 years. Nevertheless, their small size and geographic isolation continue to cause problems in many wetlands, along with recreation pressure, agriculture and insufficient water levels.

Wetlands under pressure

While the populations of several wetland birds have increased slightly since 1993–1996, many species continue to have small populations and are unable to compensate earlier losses. Most remaining wetlands today are small and isolated. Other problems include the human influence on hydrological regimes through water-level regulation and drainage as well as nutrient input and recreation pressure.

The large river regulation schemes and many smaller drainage projects have led to the loss of more than 90 % of mires in Switzerland since 1850. The most critical loss of area occurred in the large wetlands. Today, only few wetlands larger than 1 km^2 remain in our country, such as Les Grangettes VD, Pfäffikersee ZH, Bolle di Magadino TI and Neeracherried ZH. Even our largest wetland, the Grande Cariçaie on the southern shore of Lake Neuchâtel, covering about 30 km^2, is small in international comparison. The importance of the Grande Cariçaie is demonstrated by the fact that 41 of the 52 breeding bird species associated with wetlands in Switzerland were recorded there in 2013–2016. More than 50 % of Switzerland's Purple Herons, Savi's Warblers and Bearded Reedlings breed there, and more than 10 % of Red-crested



Good-bye Eurasian Curlew: once a traditional breeding bird in many of our marshes, the species' last remaining breeding sites are in Vorarlberg A. The Eurasian Curlew has thus become a symbol for the failure of Swiss nature conservation policy.

Pochards, Great Crested Grebes, Common Little Bitterns, Western Water Rails, Black-headed Gulls, Common Terns, Great Reed-warblers and Reed Buntings.

Small size and isolation are a problem

Large wetlands hold twice as many species as small ones, and some typical wetland species breed there in higher densities. This is most notably the case for species that breed in reedbeds, such as Western Water Rail, Common Reed-warbler, Savi's Warbler and Reed Bunting. Large wetlands are also more regularly occupied. Along with size, the isolation of wetlands also plays a role. Small and isolated wetlands are less frequently occupied by the Reed Bunting than large ones, and the species' breeding success is lower in small, fragmented habitats. The increasing fragmentation of areas that used to be continuous could be one reason for the decline of this species.

Poor habitat quality

The wetlands that remain today are not only much smaller, but also offer habitat of poorer quality for many birds owing to nutrient input, inadequate water levels and increasing human disturbance. Particularly alarming is the fact that many wetlands are drying up due to drainage of surrounding farmland and water-level regulation on lakes and rivers. Since the risk of flooding has increased, the water level of many lakes is lowered in spring as a preventive measure. With the exception of Lake Constance and Walensee, the outflow of all larger lakes in Switzerland is regulated.

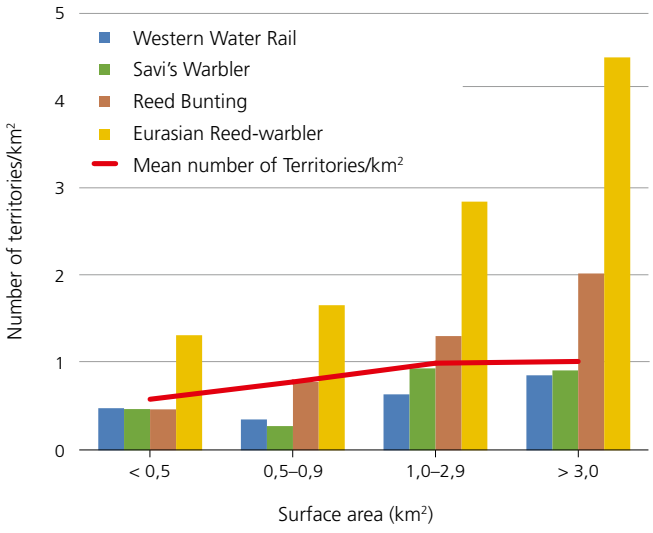
The peak water level is often not reached until late May or June; many nests are lost when water levels rise so late in the season. Wetland birds are adapted to fluctuations in the water level and losses caused by flooding are normal. However, the species are not adapted to artificial fluctuations that do not correspond with their phenology.

Winners and losers

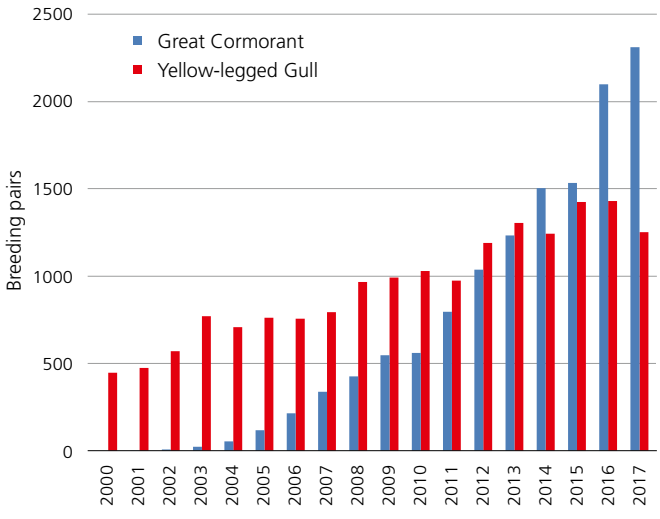
Among the «winners» are Red-crested Pochard, Yellow-legged Gull and Common Tern, whose populations at least doubled in number for various reasons. The Great Cormorant is a new breeder and reached a record high in 2017 with 2299 pairs in 12 colonies. After a long absence, the Purple Heron once again counts among our regular breeding birds. With the disappearance of the Eurasian Curlew as a breeder since the last atlas and only exceptional breeding records from the Common Snipe, we have lost two of our traditional breeding birds. Finally, a few breeding species that have always been rare in Switzerland bred only exceptionally in the recent atlas period.

Protection and management are key

The populations of several wetland species such as ducks, Common Tern and Great Reed-warbler have increased since 1993–1996. Wetlands are now under protection and management has improved in many areas. While management used to focus on preventing shrub encroachment by mowing large areas of reeds, more targeted and diverse measures are now used in an attempt to meet the requirements of various animals and plants. But the positive trends should not obscure the fact that populations of several species, e.g. rails, Common Little Bittern and Bearded Reedling, remain very small and therefore vulnerable. The fate of Eurasian Curlew and Common Snipe clearly shows that our wetlands need to be restored at a large scale to give these and other species a chance. There is also room for improvement when it comes to limiting human disturbance.



18 relatively common wetland birds reach higher densities in large wetlands. Data from 89 wetlands.



Rapid increases of Great Cormorant and Yellow-legged Gull show how dynamic some species can be.

The gravel bars of the heavily canalised Rhine between Trübbach SG and Rüthi SG accommodate the largest breeding population of Little Ringed Plovers in Switzerland. As the gravel bars are mostly accessible from the riverbank, recreation pressure is particularly high. They are also frequently flooded due to large variations in the water level.

Gravel-nesting birds in trouble

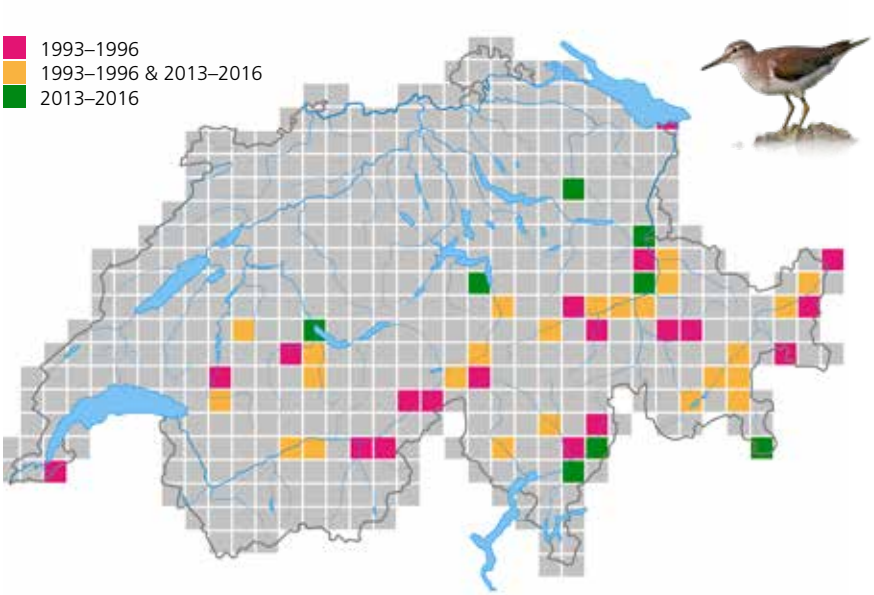
The birds of floodplains like Little Ringed Plover and Common Sandpiper face naturally difficult conditions on our rivers and streams. Most floodplains are quite small, and the high flow velocity often prevents suitable islands from forming. Heavy rainfall typical for June storms in the mountains is often exacerbated by the snow melt. This happens at a time that is crucial for the breeding success of gravel-nesting birds. Many nests are submerged by the rising water.

Human interventions

River regulations, gravel extraction and the construction of power stations and infrastructure add to the difficulties of the natural environment. Interventions on the riverbed are aggravated by the effects of hydropeaking. In some places, channels are flushed to remove trapped sediment. These sudden, massive changes in the water level pose an additional threat to breeding birds. Finally, gravel-nesting birds face frequent disturbance from human recreation.

Opportunities through restoration

Since the start of the millennium, many stretches of river have been restored in Switzerland, mainly for the purpose of flood protection. Further restorations will follow in the decades to come. Gravel-nesting birds have already been able to benefit from such restoration projects, for example on the rivers Inn, Moesa, Reuss, Kander and Rhone. But these are also areas popular with leisure seekers, and recreation pressure often leads to brood loss.



The situation of the Common Sandpiper is unstable. While it has recolonised certain revitalised rivers, it has disappeared from several other areas. In the 1970s, some populations still existed on the Central Plateau.

About 90–120 pairs of Little Ringed Plover breed in Switzerland. Many habitats are temporary and the species' breeding activity is disrupted by frequent human disturbance.

About 400 000 houses or blocks of flats have been built since 1991. In the majority of settlements, gardens are uniform and highly manicured, with few trees and hedges.

Inhospitable towns and cities

Settlements are among the fastest growing types of land use in Switzerland. Between 1985 and 2009, settlements grew by about 25 %, or 584 km^2. This corresponds to an area larger than Lake Murten every year. Based on the 2004–2009 land-use statistics, settlements and urban areas cover approximately 3079 km^2, which corresponds to 7.5 % of the surface area of Switzerland, or an area about twice the size of the Canton of Lucerne.

This development has consequences for bird communities. Species that want to survive in settlements face a host of challenges. Besides new competitors or predators, many non-native plants and a range of hazards (traffic,

Birds love this type of environment: an above-average number of birds inhabit settlements with plentiful green spaces and diverse, near-natural structures.

Changes in settlements

Species that typically inhabit settlements showed the following losses in kilometre squares surveyed in both 1993–1996 and 2013–2016:

Fieldfare	–231 squares (–29 %)
Garden Warbler	–226 squares (–26 %)
Northern House Martin	–85 squares (–19 %)
Common Redstart	–75 squares (–19 %)
Spotted Flycatcher	–126 squares (–19 %)
European Serin	–99 squares (–16 %)

A few common species recorded in settlements were found in more squares

Eurasian Crag Martin	+59 squares (+71 %)
Feral pigeon	+35 squares (+32 %)
Eurasian Magpie	+165 squares (+32 %)
Common Woodpigeon	+187 squares (+24 %)
Eur. Green Woodpecker	+129 squares (+20 %)
Eurasian Blue Tit	+110 squares (+13 %)

glass windows, cats), the direct and indirect disturbance caused by the permanent presence of humans (e.g. noise, light) is a particular challenge. Only a handful of highly adaptable species are able to colonise this new habitat, including Yellow-legged Gull, Common Woodpigeon and Rook.

A small number of species are largely or even completely dependent on buildings for nesting: Common, Pallid and Alpine Swift, Barn Swallow, Northern House Martin, House and Italian Sparrow. However, as a result of our modern «flawless» building design, these species find few nest sites on new or renovated buildings. Moreover, food in urban habitats is scarce, often too low in protein, or has to be transported over long distances. Birds that rely on buildings for nesting therefore face difficult conditions in many places – not least due to a lack of acceptance from humans.

For farmland birds, already under pressure from agricultural intensification, the spread of settlements generally means the loss of foraging and nesting sites. As a result, the birds disappear. This is particularly problematic because 89 % of new settlements were built on farmland. Grassland (32.8 %) and arable land (31.5 %) were most affected, but also orchards, vineyards and horticultural areas (13.5 %). In the transition zones between settlements and farmland especially, many ecologically valuable habitats have been lost to building development. Birds with a preference for this type of habitat, e.g. Eurasian Wryneck, Common Redstart and Spotted Flycatcher, have therefore become scarce in these areas.

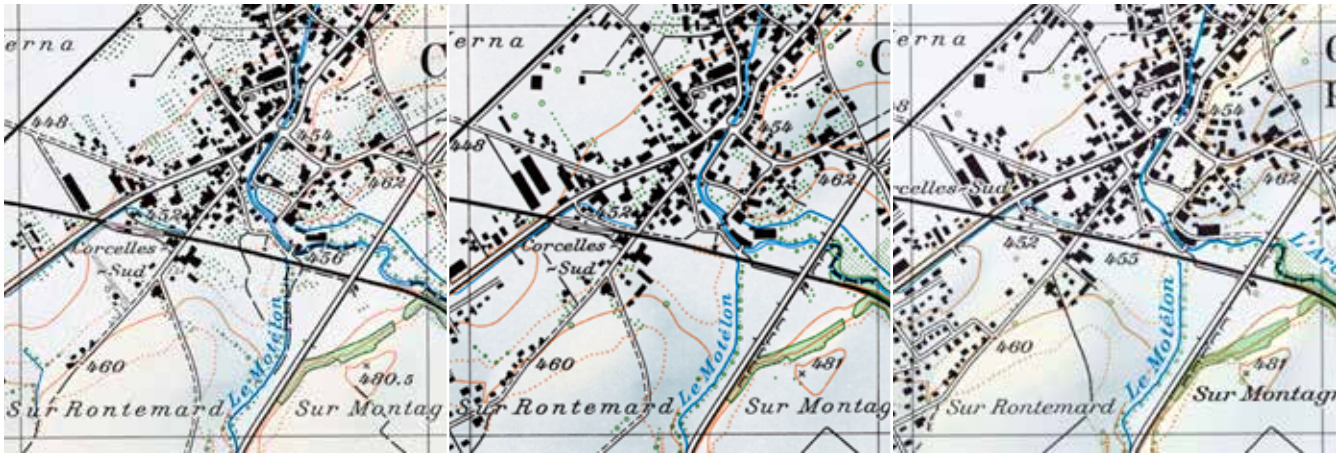
Woodland was less affected by construction, one reason being that forests benefit from better legal protection than farmland.

The example of Corcelles-près-Payerne VD

The situation described below is typical for many settlements and urban areas in our country: the two municipalities Corcelles-près-Payerne VD and Payerne VD have expanded considerably over the past 20 years and have now practically grown together. The population of the two towns increased by 39 % and 28 %, respectively, between 1995 and 2015. A new residential area was built during this time period in the surveyed kilometre square, and many old trees, copses and hedges were lost. The gardens in the new housing developments are young, small and offer few near-natural structures, only attracting species with simple habitat requirements. The atlas survey in 2015 recorded 31 species of breeding birds – 17 fewer than in 1995. Among the lost species are many birds of open landscapes and near-natural habitats such as Eurasian Skylark, Common Nightingale, Red-backed Shrike, Garden Warbler, Greater Whitethroat, Marsh Warbler, Common Chiffchaff and Spotted Flycatcher. The Yellowhammer was able to hold a single territory out of ten recorded in the 1990s.

Losses in Corcelles-près-Payerne

Breeding pairs	**1995**	**2015**
Eurasian Skylark	4	0
Common Nightingale	4	0
Red-backed Shrike	2	0
Garden Warbler	6	0
Greater Whitethroat	5	0
Marsh Warbler	4	0
Common Chiffchaff	5	0
Spotted Flycatcher	5	0
Yellowhammer	10	1
Total breeding species	**48**	**31**



Corcelles-près-Payerne VD in 1972 (left), 1996 (centre) and 2013 (right). In the lower left corner, a whole new neighbourhood was built, with construction mainly taking place between 1996 and 2013. The expansion of built-up area led to the loss of trees, copses and hedges. Reproduced with permission of swisstopo (BA180142).

Nature as a leisure park

Is Switzerland the land of opportunity for leisure seekers? Go out into the country on a fine Sunday and see for yourself!

Many habitats occupied by birds are also used by recreation seekers and sports enthusiasts – and the trend is growing. These human activities cause varying degrees of disturbance that can lead to a decline in certain bird populations. Densely populated Switzerland is home to a vast number of outdoor recreation seekers, so species sensitive to disturbance are particularly vulnerable.

Disturbance refers to an event that leads to sudden changes in behaviour and/or metabolism. Signs of disturbance that are observed in the field include escape flights, alarm calls, increased vigilance, or distraction displays near the nest. But disturbance is not always easily recognised. Birds that react to human activities by remaining motionless may nevertheless be affected. Studies of grouse have shown that such situations cause the release of stress hormones and an increased pulse, but no striking changes in behaviour.

A combination of factors is often at play (e.g. disturbance and habitat changes), so that it can be difficult to isolate the effects of disturbance.

Many mountain-bike trails lead straight through typical Black Grouse habitats.

However, there is no question that disturbance can cause birds to abandon certain areas or reduce an individual's life span or reproductive rate, leading to a decline in population size in the long run. Along with habitat loss, human disturbance is now thought to be the main reason for decline in several bird species. The disappearance of Western Capercaillie and Black Grouse from the Napf region BE/LU, a popular leisure destination, presumably falls into this category.

Panels placed along the ski runs explain the purpose of quiet zones for Black Grouse. Not all visitors comply with them yet...

When is disturbance especially problematic?

Birds are particularly sensitive to disturbance during territory establishment, which for most species occurs in spring, as this is when they select a suitable site for breeding. But disturbance has a huge impact during the actual breeding season as well, when it affects the future generation as well as the current one. Disturbance not only affects Western Capercaillie, Golden Eagle and other large birds. Less spectacular species and even those living in proximity to humans are vulnerable too: dogs on a leash and other forms of minor disturbance can reduce the density of a population and even species richness, while major disturbance can cause birds to abandon their brood. Moderate and short-term stress can also affect the quality of the offspring, as stress hormones released during egg formation are deposited in the egg, affecting the traits of the chicks.

For grouse, the breeding season is not the only sensitive time of year; in winter, these birds operate on a low-energy budget. In addition, the available habitat is significantly diminished by human recreation. Off-piste winter sports in particular intrude into the wintering habitats of

Black Grouse, Western Capercaillie and Rock Ptarmigan. The flushing of Black Grouse and Capercaillie leads to extra energy expenditure and higher stress-hormone levels. But mass tourism on the slopes has negative effects as well: the number of displaying Black Grouse is lower in ski resorts than in other areas. In the Valais, only one fourth of the Black Grouse's wintering grounds is unaffected by winter sports.

Outdoor activities – anytime, anywhere

Leisure activities in nature are popular, and outdoor sports have increased significantly since the 1993–1996 atlas. Visitors are penetrating further and further into the remote habitats of many bird species. An example of an outdoor activity that has recently gained popularity is geocaching, a kind of treasure hunt. It can cause considerable disruptions, especially around cliffs where sensitive species have their nests, as the search for «caches» can go on for hours in otherwise undisturbed areas. Another new trend is stand-up paddling. Paddlers often fail to keep the required distance to protected zones, causing waterbirds to take flight. This happens mostly out of ignorance and often goes unnoticed by the paddlers themselves.

Stand-up paddlers cause a lot of additional disturbance on many lakes.

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Solutions and possible measures

To eliminate disturbance from human recreation and its negative impact, the needs of birds and humans need to be separated through spatial or temporal restrictions. This can be achieved by requiring visitors to stay on the trails and introducing protected zones. To be effective, such protected zones must be clearly marked and compliance regularly monitored. Switzerland still has a lot of work to do in this respect. Publishing recommendations for visitors can dramatically reduce the threat to birds in unprotected areas as well. The campaign «Respect to protect» succeeded in lessening disturbance in many areas to the benefit of wildlife. It is crucial that the campaign be continued and extended to the summer season. The precautionary principle requires us to create temporal or spatial refuges for birds. Only when visitors accept quiet zones and times and keep to the paths and slopes is the long-term conservation of sensitive species in such a densely populated country possible.

Rock Ptarmigans spend a lot of time in burrows dug into the snow. If they are disturbed and forced to flee, they deplete their energy reserves.

Off-piste skiing is popular and causes disturbance across large areas, even in places without ski lifts, like in the Furka region shown here.

Today, more than 80 % of Swiss Alpine Swifts nest in buildings. Renovations regularly put breeding sites at risk. However, many sites have been preserved and improved thanks to the collaboration with architects and building owners, resulting in an increase in population size of about 50 % since 1995.

Species conservation is worth the effort

Fifty of our regular breeding birds are dependent on recovery measures. The Swiss Species Recovery Programme for Birds, launched in 2003 by BirdLife Switzerland and the Swiss Ornithological Institute in collaboration with the Federal Office for the Environment FOEN, develops conservation measures for these so-called priority species and supports their implementation together with several partners. The results show that the efforts have paid off.

Many rare and threatened species now only occur in small, often isolated populations. Measures are needed to preserve populations and boost numbers if possible. The recolonisation of potential areas should also be a target. Recovery schemes enter the picture when habitat conservation and protected sites are not enough to secure a species' survival. To eliminate the factors limiting population growth, customised measures are implemented for each species.

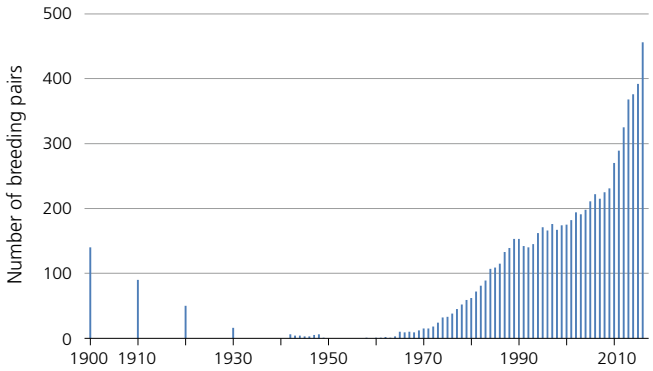
Species conservation goes beyond installing nest boxes

The traditional and simplest conservation measure involves increasing the availability of suitable nest sites as well as improving and maintaining the sites. This is an effective measure where sufficient habitat exists but nest sites are few. Nest boxes are provided for Common Barn-owl, Common Hoopoe, Common Swift, Northern House Martin, Eurasian Jackdaw, and others. Rafts, platforms and gravel islands benefit Common Tern and Black-headed Gull, and many places provide nest platforms for the White Stork.

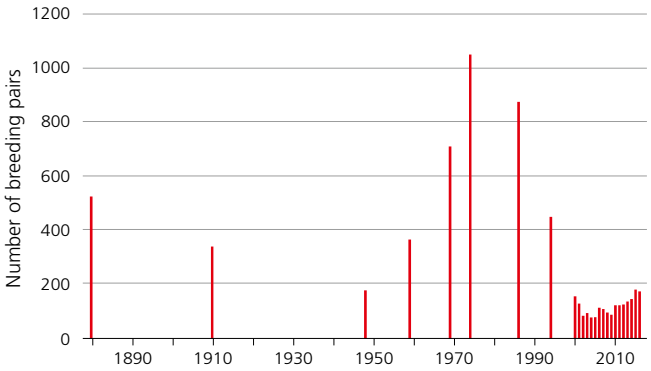
However, habitat quality is often inadequate. Targeted measures are necessary to improve the habitats of many priority species. To protect ground breeders, for example, large flower meadows cut late in the season need to be preserved. In collaboration with the cantons Valais and Grisons, core areas have been designated as special protection sites for ground-nesting birds.

The Northern Lapwing lacks suitable breeding sites in farmland, and predation and intensive farming practices reduce breeding success. Thanks to conservation measures in various regions, the Lapwing population has been recovering since 2009. For typical orchard birds such as Little Owl, Eurasian Wryneck and Common Redstart, the problem is often not a lack of trees but of low-nutrient, insect-rich meadows. Patches of bare ground between the trees make it easier for the birds to catch insects. Several projects exist to promote these types of habitat.

The Western Capercaillie requires open, undisturbed mountain forests with dwarf shrubs, while the Middle Spotted Woodpecker relies on forests with large oaks and other trees with furrowed bark as well as standing deadwood. Action plans for these two species involve forestry



White Stork numbers are soaring – thanks to decades of conservation work by the White Stork conservation society «Storch Schweiz», but also thanks to the species' adaptability.



Trend reversal for the Northern Lapwing: since reaching a low point in the early 2000s, the population has doubled to about 180 pairs. This was only possible thanks to effective conservation measures. They will continue to be necessary in the future.

interventions and the designation of special forest reserves to promote suitable habitat in priority areas. Refuge zones for Western Capercaillie protect the species from disturbance, at least in winter.

Partnerships are crucial

Species conservation has become an established part of nature conservation policy in Switzerland. The cantons have defined priorities based on the national strategies. For example, Valais and Ticino have developed cantonal species recovery schemes together with the Swiss Ornithological Institute and BirdLife Switzerland. Other cantons have implemented species-specific cantonal action plans, often in collaboration with partners from agriculture and forestry.

A central pillar of species conservation are the many volunteers and local organisations that contribute their expertise and show great commitment. The regional integration of recovery projects via people, institutions and authorities is a key success factor.

Future challenges

To date, national action plans for seven breeding bird species have been published in the context of the Swiss species recovery programme. Hopefully, these action plans will reinforce the commitment to species conservation on the part of the cantons and other partners.

The results of the 2013–2016 atlas clearly show that species conservation will continue to play an important role in nature conservation in Switzerland. Birds that breed in farmland and on natural rivers have experienced especially steep declines. Despite important achievements in the recovery of Capercaillie, Lapwing, Little Owl, Hoopoe and other species, their populations remain vulnerable. In future, other birds will have to be included in the species recovery programme, as they meet the inclusion criteria following substantial population declines. Species conservation is specified as an important immediate measure in the action plan for the Swiss Biodiversity Strategy. Meeting these challenges requires adequate funding but also mutual understanding and close collaboration between authorities, conservationists, land owners and land users. Successful species conservation takes time and resources, so recovery programmes must be planned carefully and include strategies for monitoring success.

Further information
www.conservation-oiseaux.ch

Benefits from grasshopper conservation and nest boxes: Eurasian Scops-owl.

Benefits from nature-friendly management of army training grounds and vineyards: Woodlark.

Benefits from river restorations and the creation of small waterbodies: Common Kingfisher.

Not for late risers and wimps: surveys began at the break of dawn – often following a long hike or a night under the stars. The volunteer observers were rewarded with stunning views and unforgettable experiences of nature in places they would never normally visit.

Atlas: the making-of

More than 200 bird species breed in Switzerland – depending on their occurrence, abundance and biology, they require different survey methods. To achieve comparability with the 1993–1996 atlas, but also in an effort to optimise the fieldwork process, we grouped the species into five categories that in turn defined the survey methods. The minimal goal was to record each species at least once per atlas square.

Major data collection effort

Fieldwork was carried out in the four breeding seasons of 2013 to 2016. One of the core elements were the territory mapping surveys in 2318 kilometre squares, conducted following the procedure used in the common breeding bird monitoring scheme. After the survey visits, the ornithologists digitised their records on the «Terrimap online» platform and defined the territories.

Review of territory mapping surveys and individual records

Experienced fieldworkers from the Swiss Ornithological Institute reviewed the survey results according to pre-defined guidelines, made corrections and provided individual feedback. The atlas team checked new entries on ornitho.ch on a weekly basis. Records of species that had not been detected in a given atlas square before were checked especially carefully. We required additional breeding evidence for observations outside of the known breeding range, e.g. a record of the Eurasian Golden Oriole in the Alps.

Producing the maps and altitude charts

For most species, we show the distribution in 2013–2016 as well as the change in distribution since 1993–1996.

5 species categories – 5 methods

Widespread species (93 species)	• territory mapping in selected kilometre squares • if the species was absent in the 1 × 1 km square, the rest of the atlas square was searched
Rare species (126)	• all observations were recorded with the exact location • records in several kilometre squares if possible
Rare species Central Plateau / Jura (9)	• same as «rare species» • Central Plateau and Jura only
Colonial species (10)	• detailed count • in the whole atlas square
Colonial species in settlements (2)	• survey of colonies with at least ten pairs • in the whole atlas square

Enormous survey effort

Upon conclusion of the four fieldwork seasons, the level of coverage was extremely satisfactory in all 467 atlas squares. The number of observers that contributed more than 100 records was 1527. Territory mapping surveys in the 2318 kilometre squares were conducted by 753 people. We estimate that volunteer observers spent a total of about 3.9 working years on fieldwork and travelled 46438 km.

467 atlas squares at a scale of 10 × 10 km were surveyed (light grey). In 13 atlas squares along the Swiss border, only the areas on Swiss territory were visited (squares outlined in green). Red kilometre squares were surveyed in both 1993–1996 and 2013–2016, blue ones in 2013–2016 only.

Special attention was paid to instruction and feedback: for example, the responsible observers repeatedly received maps of their area showing the records collected so far for each species.

However, because the data sets differ from one species to the next, we put a lot of effort into developing meaningful, informative maps. In the case of widespread species, for example, we calculated density maps based on the newest modelling methods, incorporating 16 environmental variables. We also took into account the detection probability of each species. On this basis, we were able to generate maps documenting the change in density since 1993–1996 (see the following pages). The altitude charts show the proportion of the total population at each altitude level. These charts also illustrate the shifts that have taken place in the past 20 years.

Population estimates – a real challenge

Estimating the population size of breeding birds is a challenging task. Complete counts are only possible for comparatively few species. In most cases, extrapolations were necessary; we used four different procedures, taking into account a diverse range of factors. We then selected the estimate that best represented the situation of the species in question. When interpreting these estimates, it is important to account for a degree of uncertainty.

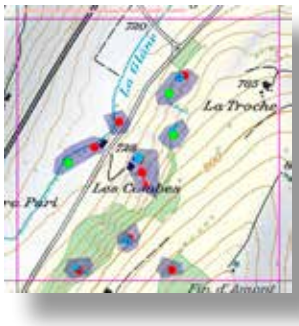
The atlas team began work in 2011 and now looks back on busy years. (from left to right: Jérôme Guélat, Thomas Sattler, Samuel Wechsler, Peter Knaus, Marc Kéry, Nicolas Strebel, Sylvain Antoniazza).

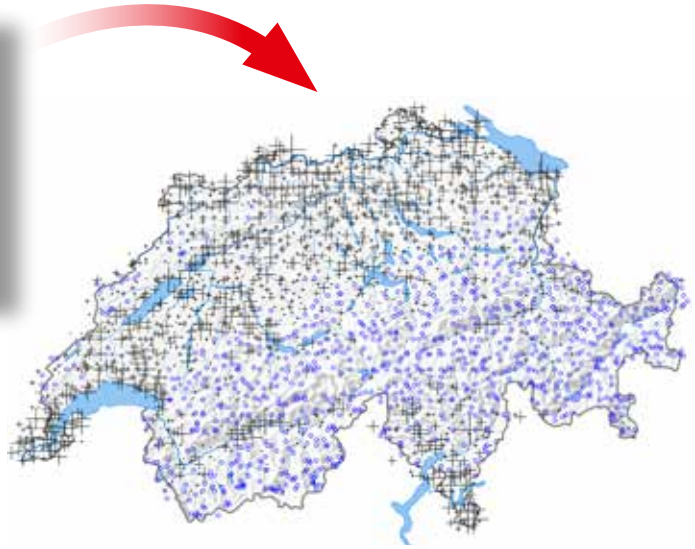
ornitho.ch as data centre

The online platform ornitho.ch played a central role in collecting records for the breeding bird atlas. It allowed users to view the current status of the surveys and helped to avoid unnecessary search effort. This national online platform was launched in 2007 under the auspices of Ala, Nos Oiseaux, Ficedula and the Swiss Ornithological Institute and developed by Biolovision S.à.r.l., Ardon. Up until 2018, about 15 million records had been entered on ornitho.ch; three million of these were used for the breeding bird atlas.

From field surveys to density change map

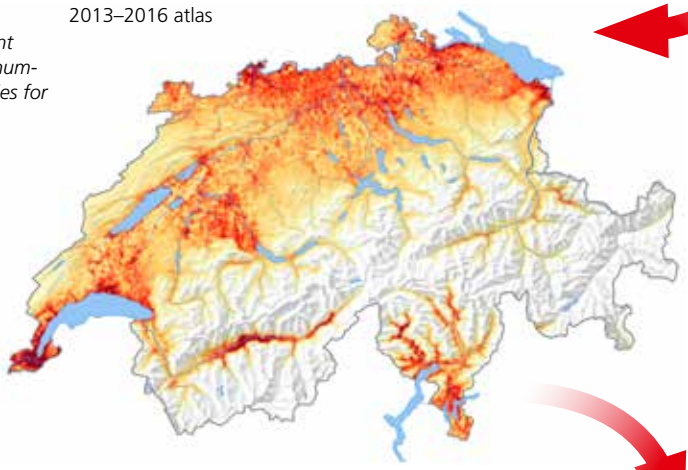
Thanks to the surveys in 2318 kilometre squares, quantitative data was collected on the occurrence of more widespread species on about 5 % of Swiss territory. This sample allows us to show an accurate representation of geographic and altitudinal distribution. Comparing the data with the survey results from the 1990s allows us to quantify the changes that have occurred since then.





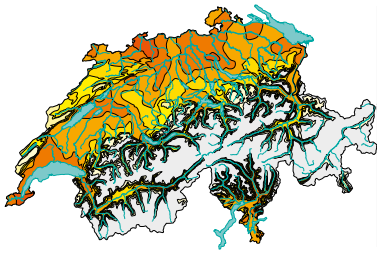
The black crosses represent the number of Blue Tit territories found during the territory mapping surveys (example in the small image on the left). The larger the cross, the greater the number of territories. Blue dots show survey squares in which the Blue Tit was absent.

2013–2016 atlas



The yellow-red gradient shows the estimated number of Blue Tit territories for all of Switzerland and Liechtenstein.

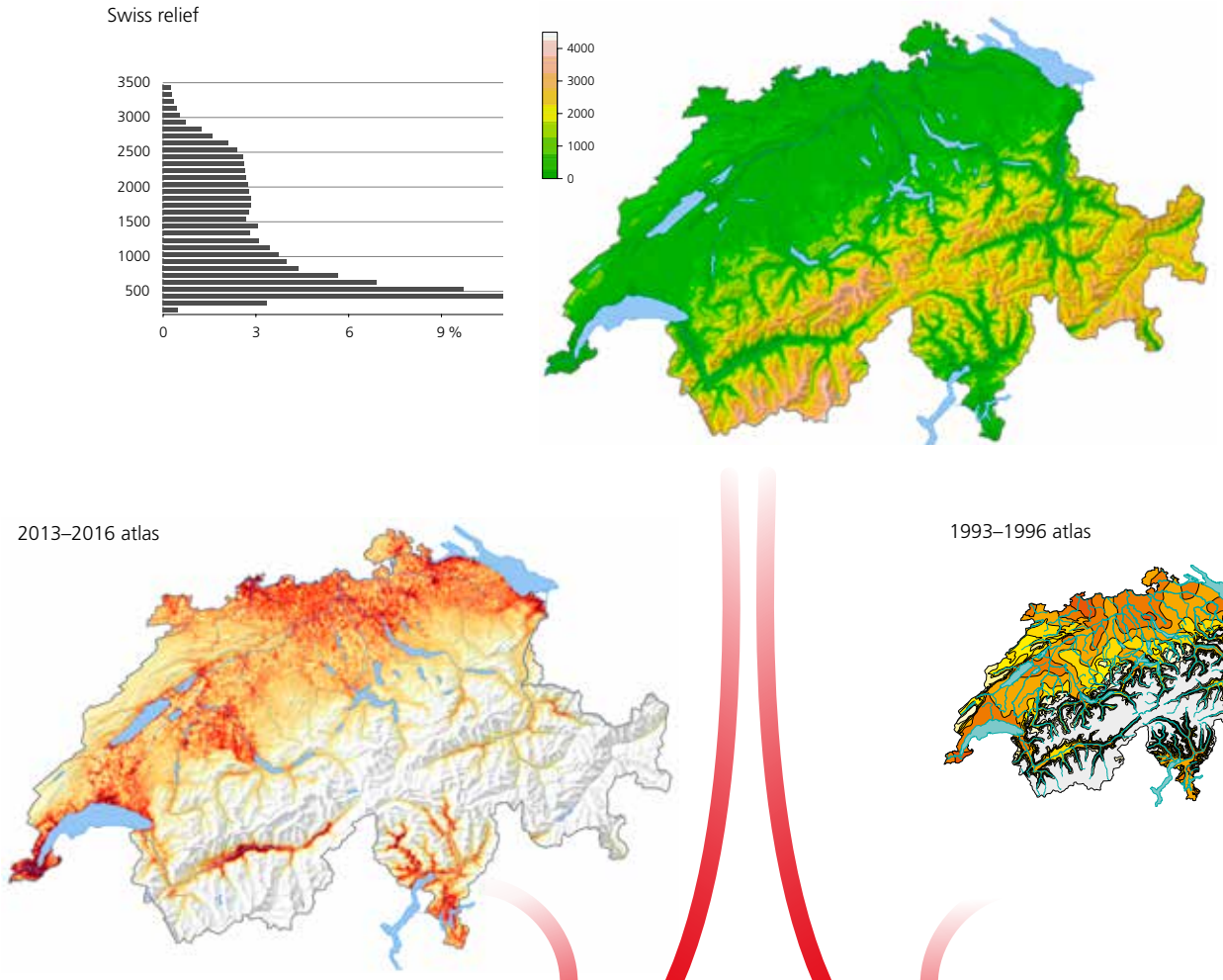
1993–1996 atlas



Calculating the difference between the 1993–1996 density map (new calculations, small map above) and the 2013–2016 map yields the estimated change in the number of territories per kilometre square, the so-called density change map. Beige represents areas where the Blue Tit occurred in one of the two atlas periods, but where change was less than one territory per kilometre square. The light grey areas (relief) are those in which the Blue Tit does not occur, or only very rarely.

From density maps to change in altitudinal distribution

Based on the territory mapping surveys in the kilometre squares, we can represent the altitudinal distribution in detail, either for the whole country or for selected regions. Here, too, the comparison with the 1993–1996 surveys allows us to show the percentage change in altitudinal distribution.



Adding the densities for the average altitude of each kilometre square yields a pattern that reflects altitudinal distribution, shown on the left for the Eurasian Blue Tit per 100-m altitude band in 2013–2016. Almost 25 % of the Blue Tit breeding population occupies the altitude level between 400 and 500 m asl. The proportion of Swiss territory covered by each altitude level and the Swiss relief are shown in the top.

The difference between the values for 1993–1996 and 2013–2016 gives us the increase or decline at each altitude level (green and/or red). In the case of the Blue Tit, the population growth between 400 and 500 m alone accounts for almost 10 % of the current population.

Tremendous support

Countless individuals, organisations and institutions contributed to the success of the 2013–2016 breeding bird atlas in a number of ways. Special thanks goes to all field ornithologists who collected the data used in the production of the atlas.

Data collection

With great enthusiasm and persistence, the following persons on civilian service duty, interns and experts helped us to conduct fieldwork in difficult terrain or poorly surveyed areas, digitise new territory mapping results or those from 1993–1996, establish routes prior to fieldwork, and/or verify and process data: Pascal Aeby, Joël Anliker, Lukas Arn, Nicolas Auchli, Elias Bader, Hansruedi Batzli, Frederik Baumgarten, Jean-Luc Ferrière, Bastien Guibert, Dominik Hagist, Marco Hammel, Isabelle Henry, Dominik Henseler, Merlin Hochreutener, Simon Hohl, Isabelle Kaiser, Alessio Martinoli, Julien Mazenauer, Corentin Morvan, Valentin Moser, Nikolai Orgland, Joël Piaget, Yann Rime, Christian Rogenmoser, Martin Roost, Luca Schenardi, Martin Spiess, Simon Stricker, Katarina Varga, Chris Venetz, Philine von Hirschheydt, Johannes Wahl, Lucas Wolfer, Andy Wyss and Stephanie Zihlmann.

The following organisations, companies and individuals provided us with observation data collected within the scope of their own projects: Abteilung Natur und Landschaft des Kantons Zug, Abteilung Umwelt und Energie der Stadt Zug, Ala – Schweizerische Gesellschaft für Vogelkunde und Vogelschutz, Amt für Raumentwicklung Kanton Thurgau, Aqua Terra, Association de la Grande Cariçaie, Auenschutzpark Aargau, BINA Engineering SA, BirdLife Aargau, BirdLife-Naturzentrum Neeracherried, BirdLife Austria, BirdLife Switzerland, BirdLife Zürich, British Trust for Ornithology (BTO), Centre Suisse de Cartographie de la Faune (CSCF), Centro Italiano Studi Ornitologici (CISCO), Cornell Lab of Ornithology, Dachverband Deutscher Avifaunisten (DDA), EBN Italia, Fondation des Grangettes, Fondazione Bolle di Magadino, Groupe Broyard de Recherches Ornithologiques (GBRO), Groupe d'Étude sur les Rapaces Nocturnes de l'Ouest Vaudois (GERNOV), Groupe Ornithologique de Baulmes et Environs (GOBE), Hintermann & Weber AG, coordination team for the European Breeding Bird Atlas 2 (EBBA2), Lega italiana protezione uccelli (LIPU), Ligue pour la protection des oiseaux (LPO) Ain, Ligue pour la protection des oiseaux (LPO) Franche-Comté, Ligue pour la protection des oiseaux (LPO) Haute-Savoie, Naturzentrum Glarnerland, Observation International, Office des Données Naturalistes du Grand Est (Odonat), Theiler Landschaft ecological consultants, Orniplan AG, Ornithologische Arbeitsgemeinschaft Bodensee (OAB), Ornithologische Arbeitsgruppe Reusstal (OAR), Ornithologischer Verein der Stadt Zug, Pro Natura Vaud, Réseau Gypaète Suisse occidentale (RGSO), Swiss Bird Ringing Scheme, Swiss National Park, Société des Amis des Chouettes et Hiboux des Endroits Montagneux (SACHEM), Stadt Aarau, Stiftung Lauerzersee, Stiftung Pro Bartgeier, Storch Schweiz, Verein Hopp Hase, Vulture Conservation Foundation (VCF), game wardens of the cantons of Bern, Grisons, St. Gallen and Ticino, Zürichsee Landschaftsschutz ZSL as well as Gaby Banderet, Pierre Beaud, Simon Birrer, Jost Bühlmann, Valentin Bütler, Walter Christen, Serge Denis, Arthur

The atlas surveys, conducted in all corners of the country, were a lonely job. Nevertheless, a sense of community developed among the more than 2000 volunteers. The various national and regional meetings – the image shows one in Ticino – were always well attended.

Egloff, Sepp Frei, Pierre Henrioux, Roger Hodel, Denis Horisberger, Andreas Jaun, Thomas Leu, Roland Luder, Lionel Maumary, Lukas Merkelbach, Erich Mühlethaler, Gilberto Pasinelli, Livio Rey, Marianne Richter-Bütler, Willi and Regula Schlosser, Daniel Studler, Thomas Troxler, François Turrian, Laurent Willenegger, Jean-Lou Zimmermann and Jean-Luc Zollinger.

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Our launching and closing events were held at the University of Fribourg. The University of Fribourg provided the venue and Jacques Roubaty organised food and drink.

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Atlas launch with around 300 participants on 1 December 2012 in Fribourg.

Developing the methodology

The 2013–2016 atlas builds largely on the methods used in the 1993–1996 atlas. Valuable advice on methodology came from Beat Naef-Daenzer, Hans Schmid and Niklaus Zbinden. We thank Gaëtan Delaloye and the Biolovision S.à.r.l. team for adding a special atlas tool to www.ornitho.ch. Pirmin Kalberer (Sourcepole AG) and Guido Häfliger developed «Terrimap online». The technology for modelling the density maps in the atlas was developed within the scope of Jérôme Guélat's

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Geodata sets and maps

To generate the field maps, the variables for the models, and the atlas maps, we were able to use geodata from Swisstopo (VECTOR 25, Topographical Landscape Model, aerial images, pixel maps), the Federal Statistical Office (land-use statistics), the Office of Construction and Infrastructure of the Principality of Liechtenstein (land-use statistics), Meteotest/Federal Office for the Environment (nitrogen deposition) and the European Environment Agency (CORINE land cover). Geodata on woodland habitats were made available in an exchange with the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL).

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Learn more!

The Swiss Breeding Bird Atlas can be ordered from mid-November 2018 in German, French or Italian in the Swiss Ornithological Institute's shop (CHF 88 plus postage). From January 2019, it will be available online in English as well as in German, French and Italian: www.vogelwarte.ch/atlas

Unremarkable, but successful: in absolute numbers, the Eurasian Blackcap has achieved the greatest increase and become the third-most abundant breeding species.

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Authors
Hans Schmid, Matthias Kestenholz, Peter Knaus, Livio Rey, Thomas Sattler

With the collaboration of
Sylvain Antoniazza, Raffael Ayé, Simon Birrer, Marcel Burkhardt, Jérôme Guélat, Lukas Jenni, Isabelle Kaiser, Verena Keller, Matthias Kestenholz, Tabea Kölliker, Markus Jenny, Pierre Mollet, Claudia Müller, Michael Schaad, Reto Spaar, Nicolas Strebel, Katarina Varga, Samuel Wechsler

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