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Illustration: Untertitel

Colourful Diversity

More grassland, more hedgerows, more maize? Land-use scenarios help us to understand how species diversity can be increased in Germany's agricultural landscapes. The necessary data is being gathered by monitoring ten bird species in their natural habitats.

Whatever happened to the skylark's song? Wasn't it only a few years ago that you could admire the lapwing's erratic flight in spring and hear the little owl in the evenings from the nearby orchard? Questions like these, relating to the birds of field and meadow, are often heard – and not without reason. According to an indicator report published by the Federal Statistical

Office in 2012 on sustainable development in Germany, bird populations are under threat, with the number of farmland birds, at least, having noticeably declined.

The reasons for the disappearance of farmland species are as varied as they are complex: the intensity of agricultural use, the abolition of EU-subsidised set-aside land, the increased break-up of grassland

and the growing cultivation of energy crops, particularly maize, are all posited as key causes. But does this mean that modern agriculture no longer offers suitable habitats for animals and plants? And what needs to change in order to achieve sustainable land use in Germany, providing wildlife habitats alongside the production of food and energy crops? Since 2010, these questions

have been studied by the DFG-funded project “Sustainable Land Use and Species Diversity”, based at the Institute of Animal Ecology at the University of Giessen and Rotenburg University of Applied Forest Sciences.

The cooperation partner in the transfer project is the Dachverband Deutscher Avifaunisten e.V. (DDA), an association of Germany’s national and regional ornithological societies. The DDA is coordinating a nationwide bird monitoring programme involving over 5000 ornithologists, most of whom participate on a voluntary basis. As a partner in the transfer project, the DDA is very interested in the results, which will reveal what kind of sustainable land use can contribute to growing bird populations as representative of species diversity.

In the research project, the sustainability of land-use practices is evaluated using the indicator of “species diversity and landscape quality”, drawn from the federal government’s National Sustainability Strategy. This indicator, of special relevance to conservation, is one of 21 key indicators covering economy, society and environment, designed to measure the effectiveness of sustainable actions. The Federal Statistical Office publishes regular reports presenting updated information.

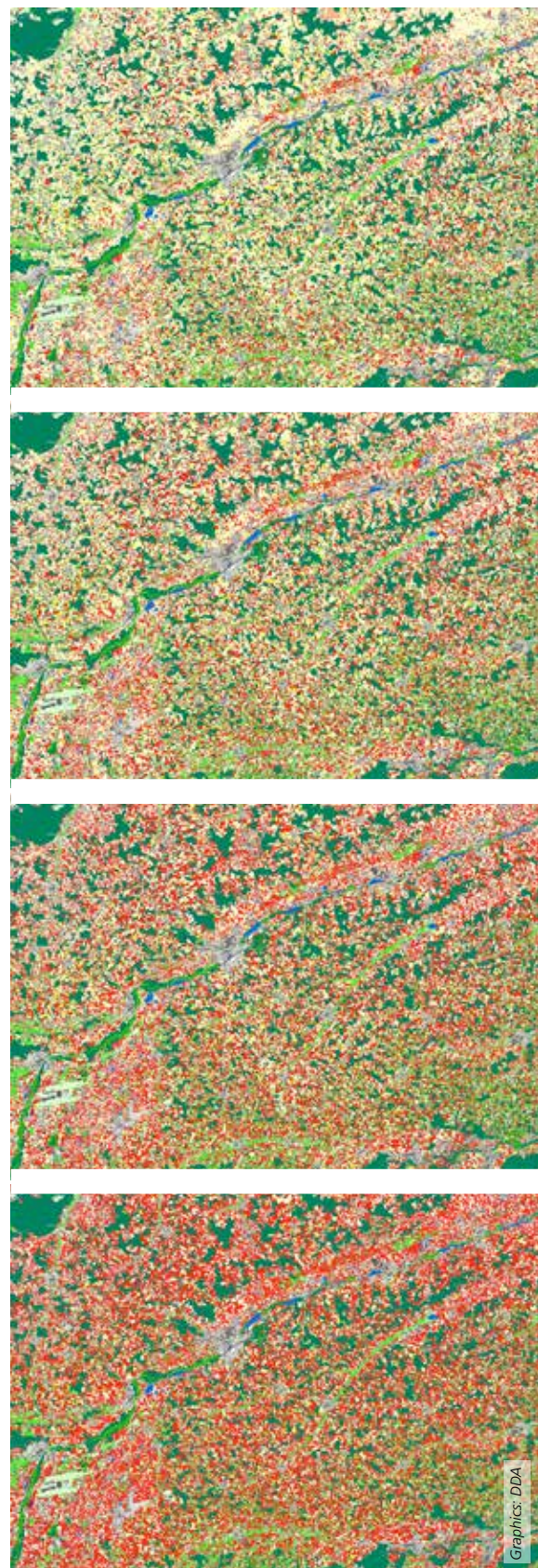
The indicator is calculated by studying trends in the breeding population of 59 bird species, which serve to represent the quality of the landscape as a habitat for many of Germany’s native species. The size of each population is compared with a defined species-specific target. In the case of the lapwing, for example, a panel of experts set a target of

Analysing land-use sustainability in the scenario of increased maize cultivation – here between Freising and Landau in Bavaria. Images 1–4 show a maize cultivation area of 5% (current situation), 10%, 15% and 20% (simulations).

a doubling of the current breeding population to 150 000 pairs – assuming that the development objectives and measures outlined in the federal government’s sustainability strategy are fully implemented by 2015. If a habitat improves for one bird species – and the number of breeding pairs therefore increases – it may be assumed that other animal and plant species will benefit too, and that a more diverse landscape will emerge.

The transfer project uses the results and experience gained in the Collaborative Research Centre “Land-Use Options for Peripheral Regions” based at the University of Gießen (1997–2008) to formulate concrete application-based questions. What regional development objectives must be pursued in Germany to ensure a high degree of species diversity, and therefore achieve national targets for farmland birds, with the minimal outlay in terms of cost and complexity?

The intention is to identify positive examples of sustainable agriculture and nature-friendly landscape development. To do this, the impacts of different land-use patterns on bird populations are computer-simulated. Through the efforts of its volunteers, the DDA has contributed over 300 000 breeding bird records, while the agricultural departments of the state governments have supplied digital maps showing the geographical distribution of field crops.



Using this data, it was possible to create high-resolution habitat models for the indicator species for agricultural landscapes all over Germany. The information is processed by 25 x 25 m cells of 591 million pixels each, with data on land-use, topography and climate. In the next stage, with the help of various calculations, the research team will create different spatial land-use scenarios and assess their

impact on the bird populations in the model.

By changing parameters that affect species diversity, such as the proportional area of grassland or hedgerows, the researchers can evaluate their impact on species diversity and landscape quality. Achieving sustainable land use in an agricultural landscape means taking regional landscape and land-use factors into account. To take account

of these specific characteristics and differences, the country was divided into focus regions in which different landscape trends were simulated according to the predominant landscape type.

The reason for this approach is that farmland birds show different distributions depending on their habitat preferences. For example, the lapwing is not found in hedgerow landscapes, instead preferring open grassland or fields. Yellowhammers and red-backed shrikes, on the other hand, favour agricultural landscapes with hedges, bushes and trees.

Thanks to habitat models and up-to-date land-use data, it was observed that throughout Germany – with regional differences – the lapwing prefers low-vegetation maize and corn fields as a breeding habitat at the start of the breeding season. Grassland, fallow arable land and nearby water are also important factors in the choice of breeding site. In addition, conservation areas are of great importance. So far, the researchers have investigated the impacts of additional grassland in wetland regions, the expansion of conservation areas and an increase in maize cultivation on the German lapwing population.

The results of the simulations demonstrate that the lapwing prefers maize fields as a breeding habitat over other crops as long as there is sufficient grassland or water nearby. Fields of this type are attractive to lapwings because, unlike other crops, they have little vegetation cover in April when the breeding season begins. In vegetation-free fields, enemies are also easy to spot. Because maize fields offer little food or places to hide for the young at this time, en-



Illustration: Thorsten Klügel

Above: Field observation – a lapwing in Schwalmwiesen, Hesse. Below: Project team member Sophia Franke consolidates research results on the PC.

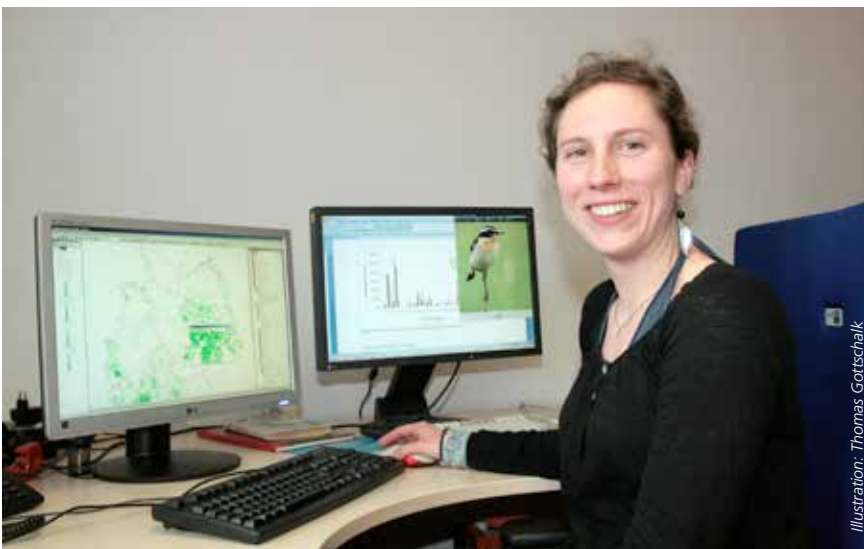
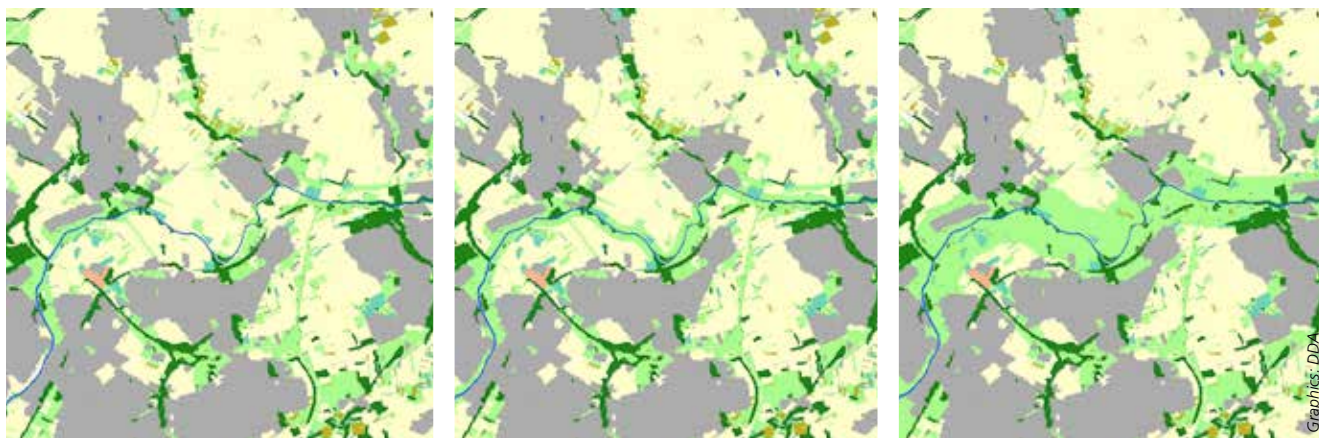


Illustration: Thomas Gottschalk



Simulations of increased grassland area with adjacent water (L to R): the situation today and with buffers of 100 m and 200 m.

ture lapwing families migrate into neighbouring marshes or pastures soon after the eggs have hatched. However, despite the fact that the total area under maize cultivation is increasing significantly, largely due to the use of maize in biogas plants, the national lapwing population is actually in decline. So additional research is needed into the bird's breeding success in the context of different crops and its mortality.

It was also discovered that the replacement of arable fields with intensively farmed grassland within floodplains has a negative impact on the lapwing breeding population. This initially surprising observation is easy to understand when the intensity of grassland exploitation is taken into account. Most grassland areas under agricultural management in Germany near a water source are unsuitable for the species due to intensive use (and large amounts of fertilisers), because on the thickly vegetated ground the ground bird cannot move around or spot enemies. Intensively used areas of grassland bordering wetland have no positive effects for the lapwing.

Conservation areas, on the other hand, do have a positive impact on the national lapwing population. Species-specific management measures such as extensive grazing and the creation of wet areas often provide the ideal breeding conditions for the lapwing.

While the lapwing prefers to breed in maize fields near suitable wet feeding areas, these areas do not present a suitable habitat for most of the other indicator bird species. The red kite, corn bunting and whinchat, for instance, prefer areas with grassland. It became apparent that a further expansion of maize cultivation would not ultimately represent a sustainable form of land use, but would instead lead to a dramatic loss in farmland bird populations.

Although the simulations revealed a few important measures for increasing the populations of the indicator species, the targets for many of these species have not yet been achieved using the models. The research team now intend to carry out further land-use simulations, for example by increasing the area of extensively used pastures or spring grain, always in conjunction

with the question of how the defined targets can be achieved.

The results are of considerable importance to the DDA, both on paper and in practical terms. The landscape simulations provide new data and contextual information on the interactions between landscape variables and landscape configuration, with reference to species diversity and sustainable land use in Germany.



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