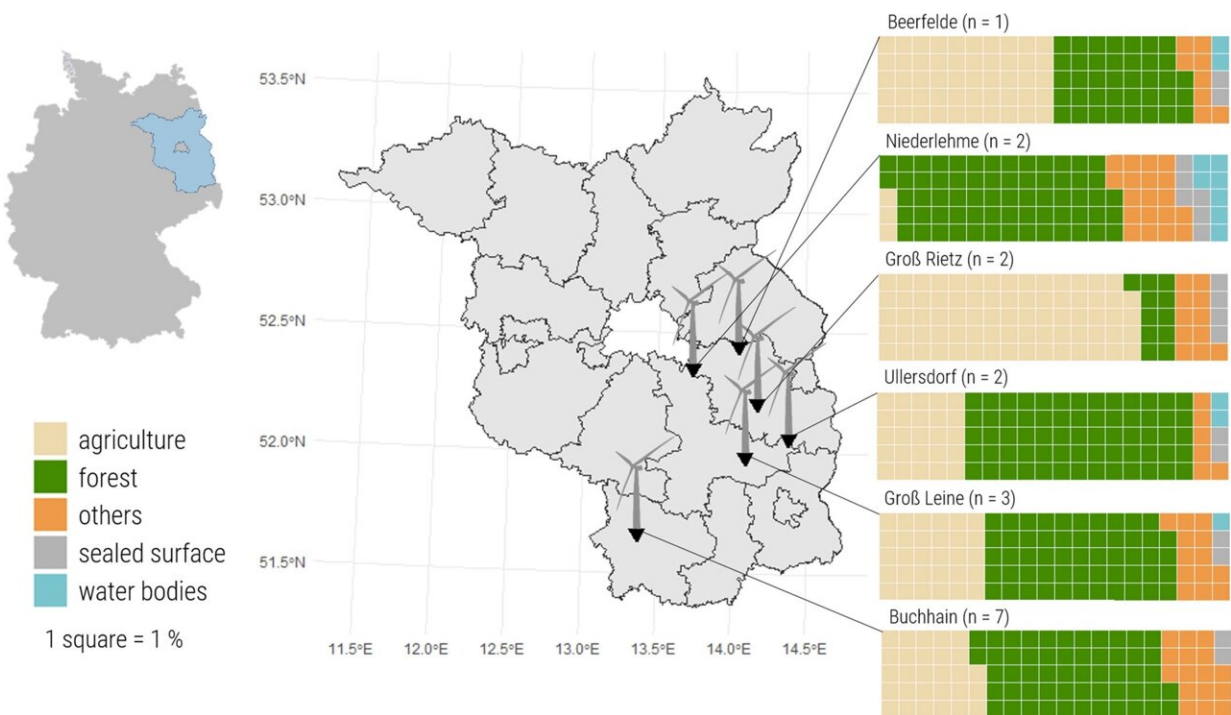


Death of bats at wind turbines interrupts natural food chains

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Sampling region in the federal state of Brandenburg in the Northeast of Germany. Black triangles on the Brandenburg map (middle) show the locations of those wind turbines where carcasses were collected. Charts on the right illustrate landscape composition of sampling areas within a 5.2 km radius (mean maximum flight distance of common noctule bats from roosts [Roeleke et al., 2020]) and number of bat carcasses found at each site (1 square = 1%). Credit: *Conservation Science and Practice* (2022). DOI: 10.1111/csp2.12744

The numerous casualties of bats at wind turbines (WT) have a negative impact on the populations of affected species and potentially far-reaching consequences for the biodiversity in rural areas. Until now, it could only be assumed that the death of bats had further consequences. Now, a team of scientists from the Leibniz Institute for Zoo and Wildlife Research (Leibniz-IZW) show in a paper in the scientific journal *Conservation Science and Practice* that natural food chains are interrupted, which can have far-reaching negative consequences for agriculture and forestry. The study demonstrates the extent to which the functional importance of bats for habitats has been underestimated so far.

The scientists at the Leibniz-IZW investigated the prey spectrum of the common noctule (*Nyctalus noctula*), a common bat species that frequently dies at wind turbines in Germany. By focusing on the insects consumed by the bats, they documented the extent to which their functional importance for habitats is lost.

Carolyn Scholz and Christian Voigt from the Leibniz-IZW investigated which insects common noctules consumed shortly before they died at wind turbines. For this purpose, they analyzed the stomach contents of 17 common noctules killed at wind turbines. Using PCR amplification and high-throughput sequencing, the scientists searched for the genetic barcodes of the insects consumed by the bats. These genetic barcodes provide information about the identity of the consumed species.

"We found DNA barcodes of 46 insect species from nine orders, most of them beetles and moths," says Scholz, first author of the study. "The insect species could be assigned to a variety of different habitats, from farmland and grassland to forests and wetlands." Twenty percent of the identified insect species are considered pests or a nuisance in agriculture and forestry, for example the chestnut weevil (*Curculio elephas*) or the chestnut fruit moth (*Cydia splendana*).

The scientists conclude that the loss of bats disrupts existing food chains and could therefore lead to higher numbers of pests and nuisance species, which might be compensated for by chemical pest control. The free ecosystem service of pest reduction by bats is reduced by wind turbines and therefore an emerging problem for agriculture and forestry.

Energy production from wind power undisputedly contributes to reducing CO₂ emissions. Ultimately, the space required for this is large and the ecological side-effects for affected animal groups such as bats and insects are massive. Recently, it was decided to double the [land area](#) used for wind [energy production](#) in Germany, particularly on [agricultural land](#) and in forest monocultures. These ecosystems are already characterized by reduced biodiversity, as they have undergone several waves of intensification over the past centuries, farmland was cleared and cultivation methods towards an increase in harvest optimized. The WTs that are now being installed as part of the energy transition in Germany drive a new wave of intensification.

"We do not know the consequences of this current land use intensification for biodiversity and the resilience of these habitats. This is all the more regrettable because this transformation is currently being carried out on a grand scale in our landscapes," reports Voigt, Head of the Department of Evolutionary Ecology. "We still need to understand in much greater detail which effects the energy transition has on the biological diversity in these habitats. There is no question that the installed wind turbines contribute to the protection of the global climate and thus also to the conservation of biodiversity."

On the other hand, it is well known that large numbers of bats die at wind turbines. "The loss of these individuals is often difficult for the populations to buffer, as the affected species have low reproduction rates. Unfortunately, not only do individuals disappear from the landscape, their interactions in complex food webs are also lost," says

Scholz.

Counts demonstrate that more than ten bats per year die at each conventionally run wind turbine. This sums to a six-digit number of annual bat fatalities at the 30,000 wind turbines on the mainland in Germany. Newly installed turbines are temporarily shut down during periods of high bat activity to prevent the bats from colliding with the rotor blades. This reduces bat mortality to one or two individuals per year and WT. Tragically, old WTs are still operated without such shutdown rules, and they comprise 75 % of all WTs in Germany.

"We have to reckon with more than 200,000 bats per year dying at WTs," says Voigt. "If we continue to tolerate this high number of victims at WTs, fewer and fewer insect pests will be consumed by bats," he concludes.

As predators, bats play an important role in the natural regulation of insect populations. The loss of bats and their role in food chains makes ecosystems more vulnerable to disturbances, Voigt and Scholz speculate. More in-depth scientific work is needed to understand the food-web links and the consequences of their disruption more precisely. An important first step towards the conservation of bats and their functional role in their habitats must be a mandatory shutdown of wind turbines during periods of high bat activity, Voigt and Scholz say. To this end, the approval practice for old [wind turbines](#) must be reconsidered. This is the only way to limit the negative consequences of the intensification of land use caused by the energy transition on our ecosystems to a minimum.

More information: Carolin Scholz et al, Diet analysis of bats killed at wind turbines suggests large-scale losses of trophic interactions, *Conservation Science and Practice* (2022). [DOI: 10.1111/csp2.12744](https://doi.org/10.1111/csp2.12744)

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