Current Topics in

ANIMAL ECOLOGY

01

Photo by Paula Christoph

EUROPEAN MANTIS
Mantis religiosa


SAND LIZARD
Lacerta agilis

Imprint

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SEED MIXTURES

TOAD CONSERVATION

NOISE POLLUTION

RODENTICIDES

Fresh from the field: Spotlight on student theses

Each year, students in our working group dive into the wild world of animal ecology. Some of their latest findings are highlighted in the short news below.

Which flowers empower pollinators?

Pollinating insects are key players in ecosystems, yet many species are in decline. Urban areas, however, may offer new refuges - if planted wisely. In his Bachelor's thesis, Silas Kaufmann tested which seed mixtures best support pollinators in city environments. He compared three types in an experimental garden in Münster: one for agriculture, one from a hardware store, and one with native, Regio-certified wildflowers. Surprisingly, the hardware store mix attracted the most pollinators. It had the densest flower cover during the season, likely a key factor. Native plants were expected to perform best due to coevolution, but high bloom abundance seemed to outweigh this. The results were also influenced by "gatecrashers", unplanned plant species that colonized the plots. Still, the findings offer a practical takeaway: even readily available seed mixes from hardware stores It can provide valuable resources for urban pollinators.

Rodenticide applications impact rural songbird diversity

Anticoagulant rodenticides are widely used to control rats on liv livestock farms. But what are the unintended consequences for other animals? In her Master's thesis, Brit Anderle studied twelve farms near Münster to investigate how rat poison impacts songbirds. She recorded bird populations before, during, and after bait application and found fewer individuals during poisoning periods. While properly applied baits may not threaten entire species, their use clearly affects local bird abundance.

Interestingly, previous studies in regions like New Zealand showed the opposite effect: here, poison improved breeding success by reducing nest predation by rats.

This highlights how the impact of rodenticides depends heavily on ecological context and management goals. Anderle's study also revealed that farm structure played a bigger role than poison: more trees meant more birds, and even structural features like open barns helped support certain species. Bottom line: how and why rodenticides are used makes all the difference for farm bird communities.

A Little Bit of Chaos for the Natterjack Toad

The Ruhr area, shaped by rapid change and dense development, offers few natural habitats. Yet for the natterjack toad (*Epidalea calamita*), former industrial wastelands provide valuable secondary habitats that mimic the dynamic conditions of its original environment.

As part of her Master's thesis, Nadine Jöllenbeck created the first comprehensive register of the species across the Ruhr Metropolis. She documented 194 records, including 94 current occurrences but also found signs of a general decline.

Habitat loss, succession, and increasingly frequent droughts are taking their toll on the species. Interestingly, railway lines still act as migration corridors, supporting gene flow. The study shows that local habitat structures and water availability are more crucial than the surrounding urban landscape. To support the toad's survival, we may need to allow for a little more "chaos": by preserving wastelands, protecting railway networks, and managing habitats dynamically.

Can you hear me? Grasshoppers against traffic noise in Münster

Male grasshoppers produce sound by rubbing their hind legs against their wings - a vital tool for attracting mates and deter-ring rivals. But what happens when city noise drowns them out?
In her Master's thesis, Clara Holtmannspötter studied five grasshopper species to under-stand how urban noise influences their songs. She found clear differences between rural and urban sites: three species showed reduced singing activity in cities, while two, *Chorthippus dorsatus* and *C. brunneus,* were more active in urban areas. Song characteristics such as frequency, duration, and pauses also varied.

Interestingly, pause length increased with temperature, possibly intensified by the urban heat island effect. Only *Pseudochorthippus parallelus* raised its peak frequency in noisy areas, perhaps due to subtle morphological changes in its stridulation organ. The study suggests that grasshoppers adjust their songs to remain audible through anthropogenic noise. Even if all other habitat needs are met, urban soundscapes may still reduce habitat quality for acoustically active insects. As with many animals, not all grasshopper species respond alike, each reacts in its own way to the pressures of city life.

COMMON MOURNING BEE
Melecta albifrons

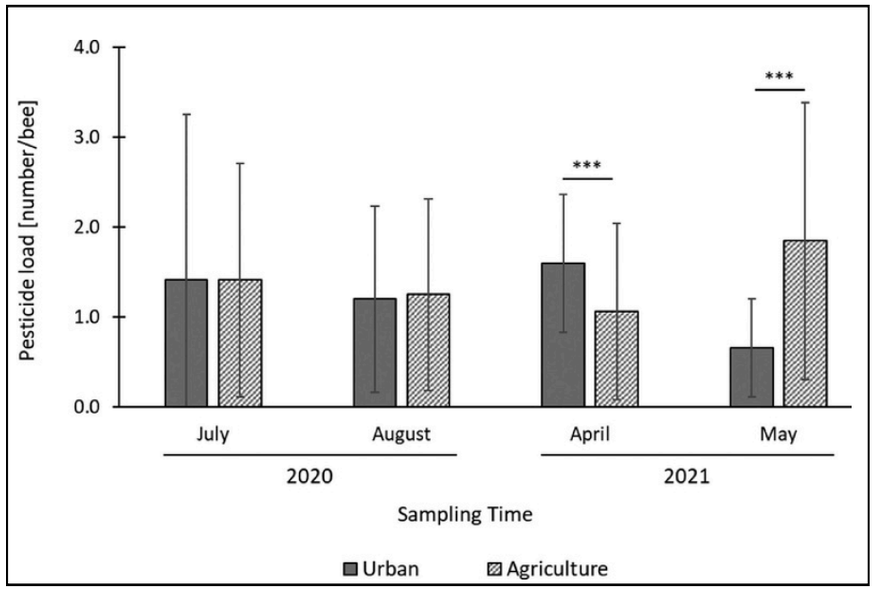
How you can save our bumblebees by reducing pesticide in your private garden

Lena Benner and her colleagues evaluated the use of pesticides in private gardens and on agricultural fields, showing that everyone needs to work together to use fewer pesticides to protect pollinators. Speaking of pollinators, research often refers to the honeybee, which results in frequently underrepresented other pollinators, for example the well-known bumblebee. Consequently, little do we know about contamination of bumblebees via pesticides which underlines the importance of this study. By Ina Heiduck

The problem: pollinator decline

Over the last few years, there has been a global insect and pollinator decline, even though the global economic value of pollination is estimated at 153 billion dollars annually. This decline is based on several reasons, for example, habitat loss and land-use change, as well as pathogens and exposure to chemicals. At the same time, pesticides are commonly used in agricultural or private areas to protect crops or plants from diseases and pests. But the exact consequences of

using those pesticides are rather unstudied, especially in non-Apis (honeybee) pollinators. Known is, that pollinators, for example, bumblebees, passively collect pesticides by visiting the flowers in search of nectar. When they bring back nectar to their hives, they also carry harmful pesticides into their colony and to their larvae, which negatively affects their development. In addition, pesticides could also interact with other pollutants such as lead, leading to more toxic effects and dying individuals.



© Benner et. al

The study: look, what the bumblebee´s dragged in

The authors investigated the pesticide contamination of bumblebees resulting from foraging in agricultural fields and urban environments. Three hives of buff-tailed bumblebees (*Bombus terrestris*) were placed at different fields (agricultural land use) and three hives at traffic roads (urban land use) in and around Aachen, Germany. By capturing the bumblebees returning to the hives, the researchers investigated which pesticides occur in the different landuse types and how frequently.

Findings: Bumblebees are loaded with pesticides

Pesticide occurrence was highly seasonal, and 73.3 % of bumblebees surveyed in urban or agricultural areas were contaminated with at least one of the target chemical substances. An alarming 33 % of bumblebees carried even more than one pesticide. The highest overall pesticide load was detected in agricultural land use, but the highest number of chemicals on one single individual was found in an urban habitat with seven pesticides. Since urban gardens are not treated with active ingredients, these must come from private areas.

What does it mean?

This study shows that bumblebees are a suitable model species to monitor pesticide contamination of pollinators to underline the importance of reducing these substances in our environment. Several pesticides were detected for the first time in bumblebees, indicating further investigation in future studies. Pesticides could also interact with other air and micro-pollutants, leading to consequences in the individual or the hive, which are not yet completely understood.

From these results, the authors strongly recommend future studies on this topic to protect our pollinators and to work against the actual insect decline. In addition, due to heavy pesticide load of pollinators in urban areas, there is a need to raise awareness among the population to reduce application of pesticides in private gardens.

Full citation of the article:

Benner, L., Coder, L., Reiter, A., Roß-Nickoll, M., Schäffer, A. (2023). Bumblebees under pollution pressure of pesticides in urban and agrarian landscapes. Journal of Hazardous Materials Advances. Volume 9, 100216. Online available: https://doi.org/10.1016/j.hazadv.2022.100216

Related:

Hooven, L. A., Chakrabarti, P., Harper, B. J., Sagili, R. R., Harper, S. L. (2019). Potential Risk to Pollinators from Nanotechnology-Based Pesticides.Molecules, 24 (24), 4458. Online available: https://doi.org/10.3390/molecules24244458.

Barraud, A., Vanderplanck, M., Nadarajah, S., Michez, D. (2020). The impact of pollen quality on the sensitivity of bumblebees to pesticides. Acta Oecologica, Volume 105, 103552. Online available: https://doi. org/10.1016/j.actao.2020.103552.

Karbassioon, A., Stanley, A. D. (2023). Exploring relationships between time of day and pollinator activity in the context of pesticide use. Basic and Applied Ecology. Online available: https://doi.org/10.1016/j.baae.2023.06.001.

BUFF-TAILED BUMBLEBEE
Bombus terrestris agg.

FEEDING NICHE

Maybe it’s not the honey-bee that we should worry about: How resources impact wild bees

The latest research by a team comprising Joan Casanelles-Abella, Simone Fontana, Bertrand Fournier, David Frey, and Marco Moretti evaluates how limited resources influence the foraging behavior of wild bees, thereby facilitating the coexistence of multiple species. This phenomenon is called feeding niche partitioning and refers to parceling food resources among different species to minimize competition and promote coexistence. The study focuses on the competition dynamics between honeybees and wild bees in various urban areas. The study aims to determine whether feeding resources, specifically high flower diversity, play a role in niche partitioning. The researchers assess whether an increase in honeybee hives correlates with a decrease in wild bees, as suggested by previous studies. By Alexandra Margraf

Save the bees!

Everyone recognizes the crucial role of bees as vital pollinators for agriculture, and it brings joy to witness the diligence of these tiny creatures. However, in recent years, a certain level of controversy has emerged regarding which bees to prioritize for support. The practice of urban beekeeping has experienced a significant upswing in numerous European cities, leading to a rise in honeybee population. Yet, concerns have been raised regarding the potential depletion of available floral resources by honeybees, thereby instigating competition between wild bees and honeybees. Honeybees are known for their generalist nature, as they can collect nectar from a wide range of plants and thrive in large colonies. In contrast, wild bees often lead solitary lives and primarily rely on pollen from a few selected plant species. Additionally, wild bees have a more limited flying range compared to honeybees. Therefore, it may seem that wild bees are unquestionably disadvantaged. However, is that truly the case?

The methods

The study was conducted in 23 urban gardens in Zurich, Switzerland. These gardens were strategically chosen to represent various levels of urbanization and local management intensity. Over at least three days, for nine hours each day during sunny weather, bee specimens were collected from these gardens from 19 flowering pots with a given set of plants that were put there by the team. Additionally, the study considered six ecologically significant functional traits that could potentially influence the feeding niche partitioning alongside honeybees. So, are honeybees solely responsible for the decline in wild bee populations?

The study reveals that feeding niche partitioning is more pronounced in areas with limited food resources and a lower honeybee population. This could be attributed to heightened competition for scarce resources, resulting in the prevalence of oligolectic species: those exhibiting a narrow, specialized preference for pollen sources. Interestingly, the intensity of urban beekeeping has minimal to no impact on the diversity of wild bees or their niche partitioning. The authors propose that honeybees are not the primary concern, but availability of resources at different spatial scales plays a crucial role. Adequate resource availability may facilitate the coexistence of various species, even in the presence of a higher number of honeybees.

However, it is relevant to note that these results do not imply honeybees pose no threat to wild bees. The number of honeybee hives in urban areas is continuously rising, and the available food resources might not be increasing sufficiently to support both wild bees and honeybees. Nevertheless, there is a glimmer of hope that we can provide additional resources supporting all bee species. Let's be honest, it is hard to surpass the beauty of a flourishing garden teeming with buzzing bees.

Full citation of the article:

Casanelles-Abella, J., Fontana, S., Fournier, B., Frey, D., Moretti, M. (2022). Low resource availability drives feeding niche partitioning between wild bees and honeybees in a European city. Ecological Applications, Ecological Society of America. Online available: DOI: 10.1002/eap.2727

Related:

Gratzer K., Brodschneider R. (2023). Die Konkurrenz von Honigbienen und Wildbienen im kritischen Kontext und Lektionen für den deutschsprachigen Raum. Entomologica Austriaca 30: 247–285. Online available: https://bienen.ch/wp-content/uploads/2023/03/GratzerBrodschneiderDie-Konkurrenz-vonHonigbienen-und-Wildbienen-im-kritischen-Kontext-und-Lektionen-fuer-den-deutschsprachigenRaum2023.pdf.

Angelella, G. M., McCullough, C. T., O'Rourke, M. E. (2021). Honeybee hives decrease wild bee abundance, species richness, and fruit count on farms regardless of wildflower strips. Scientific Reports 11 (1), 3202. Online available: https://doi.10.1038/s41598-021-81967-1.

Steffan-Dewenter, I., Tscharntke, T. (2000). Resource Overlap and Possible Competition between Honey Bees and Wild Bees in Central Europe. Oecologia 122 (2), S. 288–296. Online available: https://www.jstor.org/stable/4222543.

The authors private collection of stunning animal pictures

On the following pages you can admire some of the adorable little creatures we, the authors of this journal, stumbled across this year. All these photos feature close encounters where we found these little fellas and joyfully decided to capture the moment and these wonderful animals.

Here we see the magnificent common heath (*Ematura atomaria*) sitting on common heather (*Calluna vulgaris*) one of the foodplant of the caterpillars of this species.

The second picture shows an adult male sand lizard (*Lacerta agilis*) basking on a boulder in a heathland.

The species of the Eurasian white admiral (*Limenitis camilla*) is enlisted as endangered on the red list in Germany.

The Picture of this magnificent lesser Capricorn Beetle (*Cerambyx scopolii*) on a field of gravel was taken during a hike in south Germany.

The name of the midwife toad (*Alytes obstetricans*) is based on the brood care behavior („spawning“) of the male.

This ruddy darter (*Sympetrum sanguineum*) just landed on purpleloose strife (*Lythrum salicaria*).

COMMON SAXTON BEETLE
Nicrophorus vespilloides

Burying beetles like this common saxton beetle (*Nicrophorus vespilloides*) are often found nearby dead carcasses.

These fledglings of the Eurasian curlew (*Numenius arquata)* just hatched from their eggs.

EURASIAN CURLEW
Numenius arquata

SILVER-STUDDED BLUES
Plebejus argus

Two mating silver-studded blues (*Plebejus argus*) sharing a plant. The picture above shows the top side of this majestic butterfly.

MOTTLED GRASSHOPPER
Myrmeleotettix maculatus

For such a great photo of a mottled grasshopper (*Myrmeleotettix maculatus*), you can even get your hands dirty.

NETTLE WEEVIL
Phyllobius pomaceus

The iridescent blue-green color of this nettle weevil (*Phyllobius pomaceus*) is a real eye-catcher!

ALEXANDRA MARGRAF

AZURE DAMSELFLIES
Coenagrion puella

Mating in perfect synch. These azure damselflies (*Coenagrion puella*) surely know how to charm the eye of every beholder.

The caterpillars of the common copper (*Lycaena phlaes*) almost exclusively rely on sorrels (*Rumex spec.*) as their foodplant.

COMMON COPPER
Lycaena phlaes

COMMON TOAD
Bufo bufo

About the lonesome toad croaking from the other side of the road and the last frog alone in the bog

The problem of habitat fragmentation for amphibians. By Bennet Künnemann

Amphibians are an essential component of ecosystems and food chains, regulating invertebrate populations and serving as prey for many birds and mammals. At the same time, amphibians are among the most endangered animal groups worldwide. One-third of all associated species are threatened with extinction. Amphibians are more endangered than any other vertebrate, and the causes of threats are manifold. One main reason for their global decline is that their habitats are dashed to shivers due to agriculture, logging, urbanization, and finally traffic infrastructure, a process known as fragmentation.

In a recent study published in Global Ecology and Conservation, Andrew J. Hamer, Barbara Barta, Attila Bohus, Blanka Gál, and Dénes Schmera investigated how the presence of roads and railways, that form a barrier to other habitats, affects the abundance of amphibians in a peri-urban and agricultural landscape near Budapest in Hungary. They repeatedly dipped for amphibian larvae with nets in 30 freshwater ponds during the breeding season in 2020 and determined the type and number of species caught.

The authors found that the number of amphibian larvae in a pond connects strongly to the size and distance of the nearest road. Within a 1000 meter radius around a pond, the existence of a road had the highest (negative) impact on the quantity of all occurring amphibian species. The impact of roads in this radius was even greater than the quality of the surrounding habitat or the number of ponds in the immediate area.

This is of high importance due to the essential role of amphibians in food networks worldwide because they are crucial for ecosystem balance. We all live in this ecosystem and depend on it. Everybody should care more about the lonesome toad croaking from the other side of the road.

Just like we want our children to be safe around roads, we should care about all the little toads, frogs, newts, and salamanders, that die on our streets daily. But we, as humans, can mitigate many of the dangerous effects of our infrastructure. We simply need small bypasses and tunnels for these little fellows on busy amphibian pathways.

MOOR FROG
Rana arvalis

Full citation of the article:

Hamer, A., Barta, B., Bohus, A., Gál, B., & Schmera, D. (2021). Roads reduce amphibian abundance in ponds across a fragmented landscape. Global Ecology and Conservation, 28, e01663. Online available: https://doi.org/10.1016/j.gecco.2021.e01663.

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Lee, T., Randall, L., Kahal, N., Kinas, H., Carney, V., Rudd, H., Baker, T., Sanderson, K., Creed, I., Moehrenschlager, A., & Duke, D. (2022). A framework to identify priority wetland habitats and movement corridors for urban amphibian conservation. Ecological Solutions and Evidence, 3, e12139. Online available: https://doi.org/10.1002/2688-8319.12139.

Bolte, L., Goudarzi, F., Klenke, R., Steinfartz, S., Grimm-Seyfarth, A., & Henle, K. (2023). Habitat connectivity supports the local abundance of fire salamanders (*Salamandra salamandra*) but also the spread of *Batrachochytrium salamandrivorans*. Landscape Ecology, 38, 1537–1554. Online available: https://doi.org/10.1007/s10980-023-01636-8.

Johansson, M., Primmer, C. R., & Merilä, J. (2007). Does habitat fragmentation reduce fitness and adaptability? A case study of the common frog (*Rana temporaria*). Molecular Ecology, 16(13), 2693–2700. Online available: https://doi.org/ 10.1111/j.1365-294X.2007.03357.x.

Vos, C. C., & Chardon, J. P. (1998). Effects of habitat fragmentation and road density on the distribution pattern of the moor frog *Rana arvalis*. Journal of Applied Ecology, 35(1), 44–56. Online available: https://doi.org/ 10.1046/j.1365-2664.1998.00284.x

Renewable energy in marine habitats: How seabirds don’t lose to wind turbines

Conflict points of renewable energies explained. By Louisa Meyer

The challenge of meeting our future energy needs exclusively from renewables is global. The decisive point to further promote solar, water and wind energy is significantly reduced emissions. Nevertheless, visions of the future must also be viewed holistically. In the case of wind power, for example, it is worth looking at the creatures that, for evolutionary reasons, have always used the air for their own purposes: birds. Specifically for offshore wind energy development (OWED), there is a lack of data to assess the risk to marine birds. Marine birds are birds that feed in the marine environment. Issues that arise for the birds due to the siting and commissioning of wind turbines include flight path disruption, increased stress during the breeding season, and collision risk. Why you should know about upcoming threats to marine birds?

As already mentioned, OWED is a critical component of global renewable energy strategies to reduce carbon dioxide emissions. Worldwide, offshore wind energy projects produced more than 300 gigawatts by the end of 2021. In addition, many countries have set targets to significantly increase the share of sustainable energy in the electricity mix over the next few years. New technologies should continue to make it possible to tap previously unattainable offshore areas.

All this progress can adversely affect marine birds due to avoidance or habitat alteration or through direct mortality by collision. In this regard, bird protection is becoming increasingly necessary as OWED expands, since the cumulative effects of individual turbines or facilities alone can lead to population declines.

How to find individual solutions

The factors described (vulnerability, collision, and cumulative impacts) are critical to establish a framework for constructing OWE that is less harmful to marine birds. Individual adjustments of the factors can run through three different steps. Firstly, there should be monitoring to check the impact of factors over the long term and detect changes. The second presents modeling, which determines how the aspects are measured. Finally, mitigation for vulnerability and collision is determined.

The overall picture

The paper addresses several stressors associated with various wind energy developments. Technical and methodological approaches can help to improve impact assessment and mitigation in OWED. Thus, compensatory mitigation is a tool that can include the regulatory framework to alleviate impacts that cannot be avoided or minimized through locating decisions or changes to OWED infrastructure or operations.

The work shows a solution approach for current problems in upcoming sustainable wind energy generations. It demonstrates how new technologies integrate into the landscape in an environmentally compatible way. With the help of scientifically tested framework conditions, ecological problems such as the conflict with marine seabirds can defuse early.

BLACK-HEADED GULL
Chroicocephalus ridibundus

Full citation of the article:

Croll, D. A., Ellis, A. A., Adams, J., Cook, A. S. C. P., Garthe, S., Goodale, M. W., Hall, C. S., Hazen, E., Keitt, B. S., Kelsey, E. C., Leirness, J. B., Lyons, D. E., McKown, M. W., Potiek, A., Searle, K. R., Soudijn, F. H., Rockwood, R. C., Tershy, B. R., Tinker, M., ... Zilliacus, K. (2022). Framework for assessing and mitigating the impacts of offshore wind energy development on marine birds. Biological Conservation, 276(June), 109795. Online available: https://doi.org/10.1016/j.biocon.2022.109795

Related:

Baasch, D. M., Hegg, A. M., Dwyer, J. F., Caven, A. J., Taddicken, W. E., Worley, C. A., Medaries, A. H., Wagner, C. G., Dunbar, P. G., & Mittman, N. D. (2022). Mitigating avian collisions with power lines through illumination with ultraviolet light. Avian Conservation and Ecology, 17(2),9. Online available: https://doi.org/ 10.5751/ACE-02217-170209

Martin, G. R., & Banks, A. N. (2023). Marine birds: Vision-based wind turbine collision mitigation. Global Ecology and Conservation, 42, e02386. Online available: https://doi.org/10.1016/j.gecco.2023.e02386

Stenhouse, I. J., Berlin, A. M., Gilbert, A. T., Goodale, M. W., Gray, C. E., Montevecchi, W. A., Savoy, L., & Spiegel, C. S. (2020). Assessing the exposure of three diving bird species to offshore wind areas on the U.S. Atlantic Outer Continental Shelf using satellite telemetry. Diversity and Distributions, 26(12), 1703–1714. Online available: https://doi.org/10.1111/ddi.13168

Can frugivorous fauna help degraded urban forests to recover?

There are many ways to spread vegetation and promote habitat enrichment, one is called zoochory. In this case, the seed will be dispersed by animals who eat the fruit. During digestion, the seed will be transported throughout the habitat and excreted with the feces. Because of the anthropocentric defaunation this process is impaired. By Emily Brunner

The lower abundance of frugivores in degraded urban forest fragments affects the variability of the zoochoric plant composition and hence the community of plants and frugivores, which is essential to maintain a supporting ecosystem. Not only flora and fauna are at risk but also the surrounding human communities that depend on their services, for example for water supply and climate regulation. These services will be severely limited if habitat loss and the disappearance of green spaces continue - it's a vicious circle.

How to break that circle?

In their study „The resilient frugivorous fauna of an urban forest fragment and its potential role in vegetation enrichment" published in Urban Ecosystems in 2021, Eduardo Rigacci et al. investigated, whether frugivor-

ous (fruit eating) animals can by employed to restore a degraded urban ecosystem. Therefore, they kept 32 artificial feeding stations over the period of one year (between September 2017 to September 2018) distributed across the different successional stages of the urban forest fragment of Sao Paulo in Brazil. The feeders were placed in two heights to attract different frugivores and supplied weekly with a variable quantity of 27 zoochorous species of fresh, native fruit. A total of 36,000 hours of footage from camera traps was analyzed for which animals visited the feeders, how frequently, and whether the fruit was eaten.

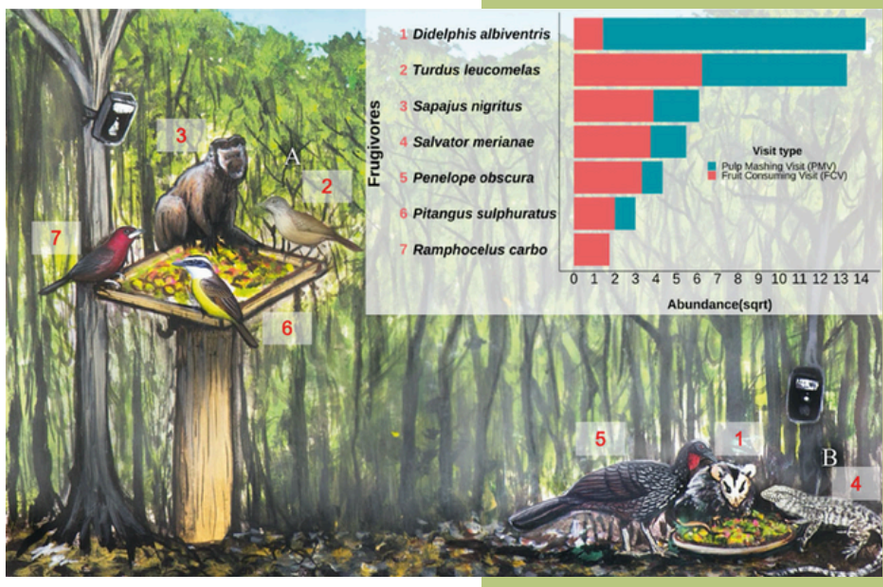


Illustration of the main fruit-consumers on the suspend feeder (a) and ground feeders (b). The bar graph indicates the proportion of Fruit-consuming and Pulp-mashing visits. Painting by Fernando Igor and Graph made in R Studio.

Visits and visitors

A total of 21 different species belonging to three different classes (Aves, Mammalia and Reptilia) were recorded to visit the feeders 768 times. Mammals and birds played a major role, especially the white-eared opossum (*Didelphis albiventis*) and the pale-breasted thrush (*Turdus Luecomelas*). By which criteria the animals decided to visit and/or consume the fruits depended greatly on the species.

Birds were more attracted by higher fruit abundance on the feeder, likely due to the greater visual attraction and signal of a safe resource as opposed to an offer of less or a single fruit. Because they fly, they can only consume smaller fruit and seeds but are able to disperse the seed during the flight, thereby connecting green patches and forest fragments and increasing the biodiversity and resilience for all fauna populations. Mammals decided which fruit to choose and to eat by the diameter, possibly because bigger fruit contain more nutrient-rich pulp. They provide larger-seeded tree dispersal, which are essential to maintain the diversity of the ecosystem services, such as climate mitigation, because these trees can store more carbon than small-seeded and abiotically dispersed species.

In general, the visitation rate was higher during the dry season between April and September with the highest rate in May (129 out of 768 visits). Due to the lower availability of natural resources the animals are taking more risk and longer ways to find food during this time period. This results in a larger spread of the seed than in rain season and therefore in a higher diversity and richness of the vegetation.

In conclusion, the scientists were able to proof, that employing frugivorous fauna and the interaction with native zoochoric plants with the aim of restoration represents a great opportunity to preserve and regenerate degraded urban forest fragments and their necessary ecosystem services to flora, fauna and human.

Full citation of the article:

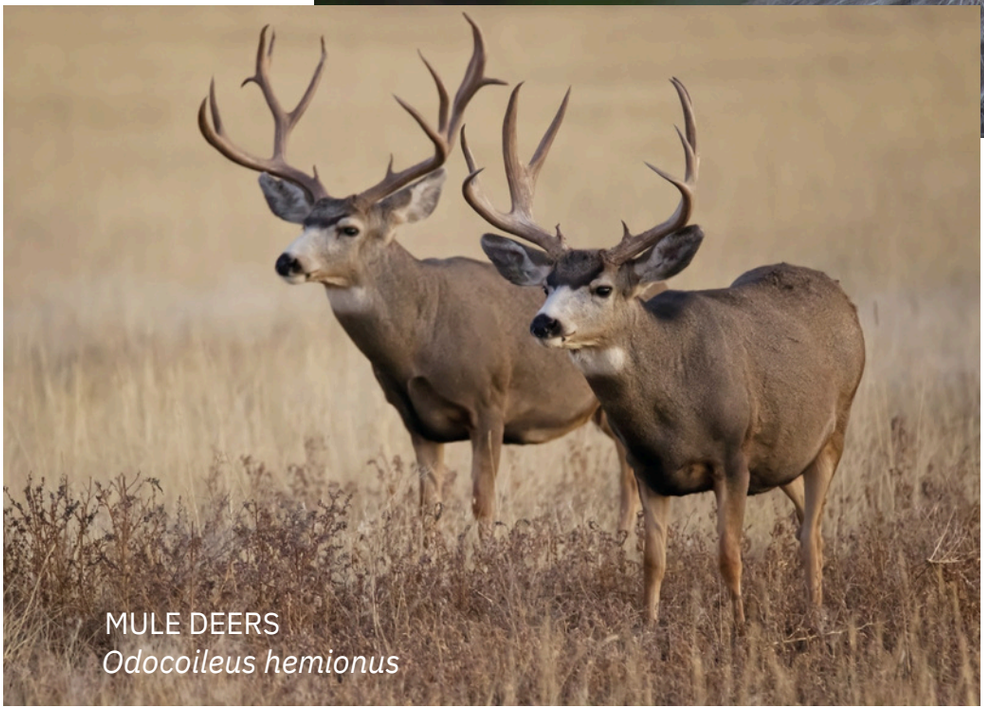
Rigacci, E.D.B., Paes, N.D., Félix, G.M. et al. (2021). The resilient frugivorous fauna of an urban forest fragment and its potential role in vegetation enrichment. Urban Ecosystems 24, 943–958. Online available: https://doi.org/10.1007/s11252-020-01080-5.

Related:

Catterall, C.P. (2018). Fauna as passengers and drivers in vegetation restoration: A synthesis of processes and evidence. Ecological Management and Restoration, 19: 54-62. Online available: https://doi.org/10.1111/emr.12306.

Cristescu, R.H., Rhodes, J., Frére, C. and Banks, P.B. (2013). Is restoring flora the same as restoring fauna? Lessons learned from koalas and mining rehabilitation. Journal of Applied Ecology, 50: 423-431. https://doi.org/10.1111/1365-2664.12046.

Crouzeilles R. et al. (2017). Ecological restoration success is higher for natural regeneration than for active restoration in tropical forests. Science Advances 3, e1701345. Online available: https://doi.org/10.1126/sciadv.1701345.

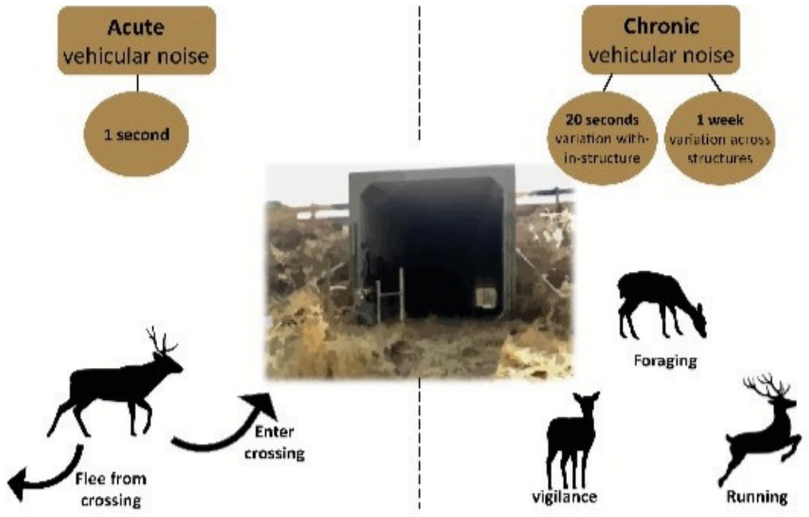


Which of these two mammals is more afraid of highway noise?

Amy C. Collins, T. Winston Vickers, and Fraser M. Shilling have researched how mammal wildlife responds to anthropogenic noise on highways. They found that the response to anthropogenic noise varies across species, temporal, spatial, and amplitude scales. Their results highlight the role of anthropogenic noise on predator-prey interactions. By Jonah Raymond Winkler

What is the problem?

We, as humans, dominate most of the earth's environment and put a lot of stress on wildlife by emitting noise. Human disturbances might trigger fear responses in animals. Just as human disturbance is heterogeneous, so can be the response of animals to different scales of noise. Understanding how we affect wildlife along highways through noise is crucial for wildlife conservation.



Schematic representing the range of spatial and temporal scales of noise sampled at crossing structures. © Collins et al.

What was the approach?

In California, this study examined the behavior of mule deer and coyotes at crossing structures, such as wildlife bridges or tunnels. The aim was to find out how acute and chronic noise affects animals. Behavior was classified using videos from multiple camera traps per crossing structure. Simultaneously, the cameras also recorded the noise at the crossing structures. With these data, it was then possible to understand how the animals behaved in the presence of acute noise or the presence of chronic noise.

Full citation of the article:

Collins, Amy C.; Vickers, T. Winston; Shilling, Fraser M. (2022). Behavioral responses to anthropogenic noise at highways vary across temporal scales. Frontiers in Ecology and Evolution. 10, 891595. Online available: https://doi.org/10.3389/fevo.2022.891595.

Related:

Duquette, C., Loss, S., Hovick, T. (2021). A meta-analysis of the influence of anthropogenic noise on terrestrial wildlife communication strategies. Journal of Applied Ecology 58, 1112–1121. Online available: https://doi.org/10.1111/1365-2664.13880.

Giordano, A., Hunninck, L., Sheriff, M. (2022). Prey responses to predation risk under chronic road noise. Journal of Zoology 317, 147-157. Online available: https://doi.org/10.1111/jzo.12968.

Kok, A., Berkhout, B., Carlson, N., Evans, N., Khan, N., Potvin, D., Radford, A., Sebire, M., Shafiei Sabet, S., Shannon, G., Wascher, C. (2023). How chronic anthropogenic noise can affect wildlife communities. Frontiers in Ecology and Evolution 11, 1130075. Online available: https://doi.org/10.3389fvo.2023.1130075.

What was found?

Both animals are more likely to flee from the crossing structure at higher acute noise levels. According to the risk disturbance hypothesis, acute noise forms a „landscape of fear".

However, when it comes to chronic noise, the behaviors diverge. Mule deer are more likely to forage when it is louder at crossing structures. Coyotes are more likely to run instead of walking, which is a stressed behavior similar to antipredator behavior.

What does this mean?

Escape behavior in the face of increasing acute noise potentially leads to interference with habitat connectivity, and thus to potential limitations in genetic exchange and access to resources. Chronic noise can provide a safe space from predators for some mammal species (human shield). Ultimately, both effects lead to a disturbance of predator-prey interactions.

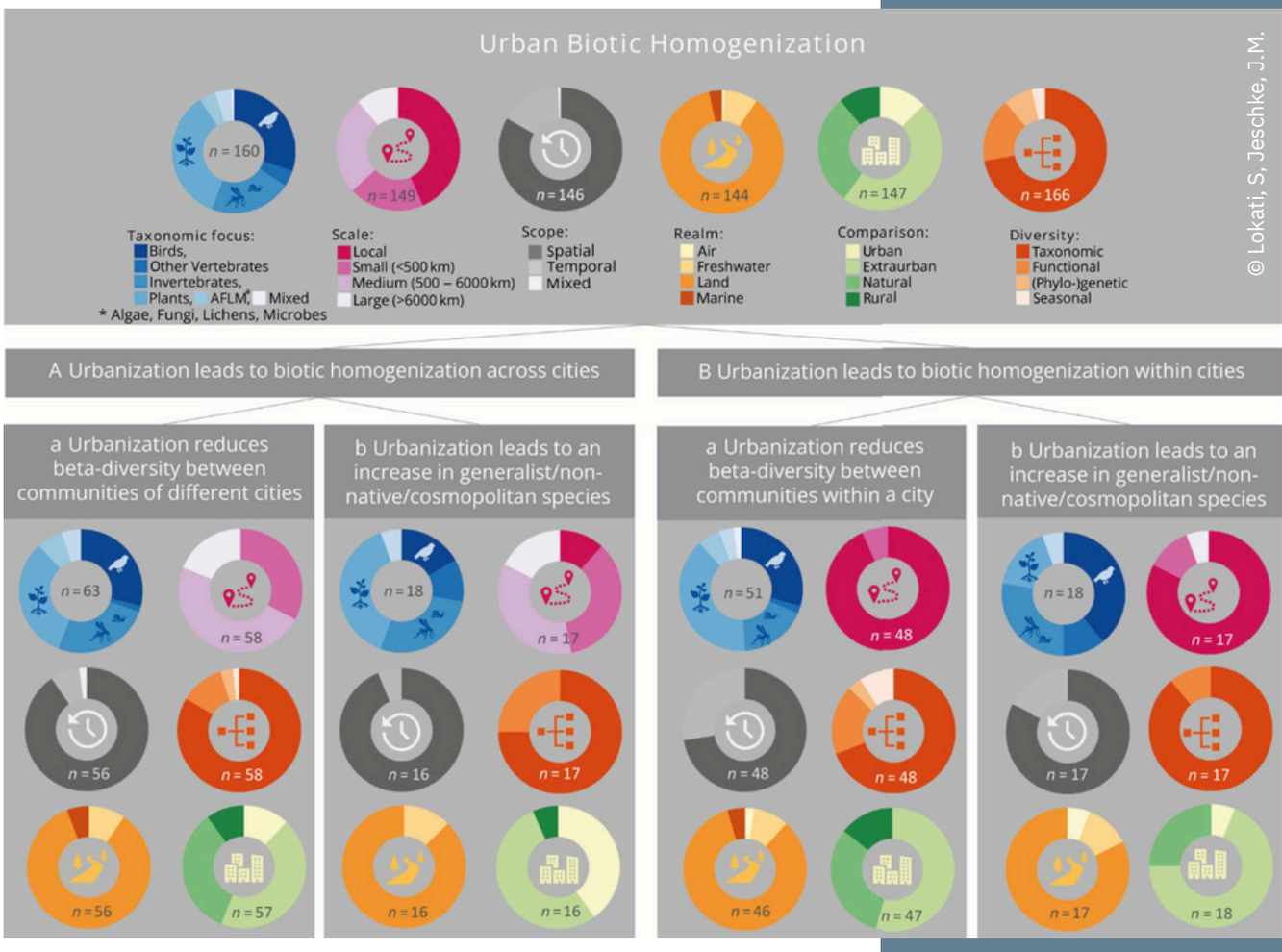
Will cities around the globe all secretly become the same?

Urbanization is a fast driver of global change. Whole ecosystems become restructured to suit one species: us humans. Humans seem to love living in cities. That is why researchers became aware that cities across the globe and also cities within themselves might become more and more similar not only in structure but also in biotic composition.
By Maximilian Schneider

That is how the so-called Urban Biotic Homogenization hypothesis came up. Lokatis & Jeschke (2022) made their way through all papers published about this topic to this date, trying to get a research overview of the variety of the scales, taxonomic groups, ecosystems, and regions of the different studies.

They found that 55 % of studies supported the hypothesis while 23 % had questioning and 22 % mixed findings. The authors especially revealed that study designs in this field have huge biases in different kinds of ways and are hardly comparable, bringing to light large knowledge gaps. What is most interesting about it: there are barely studies that run over several years or long-term. Consequently, it is common practice to substitute time for space. That means, you take a reference site outside the city and compare it with your urban area you are testing for bio tic homogenization. This approach is sometimes problematic because reference sites can be degraded, too, which may reduce the probability of detecting homogenization in your urban area. Especially in agricultural landscapes a similar biotic homogenization effect is said to be happening. And this makes sense, simply looking at the structure similarity of intensified modern agriculture landscapes across the globe.

What should be mentioned as well, is that many parts of the earth, e.g., the global south, where urbanization pressure is especially high, aren not covered at all. Studies took almost exclusively place in Europe, North America and other research hotspots. So, there is a strong geographic bias towards the northern temperate climate. In addition, the vast majority of study objects were plants and birds, almost neglecting species-rich taxonomic groups like



insects or aquatic life in general. Also, most studies put a classic focus on taxonomic diversity and barely on functio-nal, phylognetic, or evolutionary diversity.

To get through this jungle of study designs and to obtain a research overview, the authors first divided and grouped studies by the factor scale. There are study designs that look at biotic homogenization across cities and some within cities. They then further categorized each of the investigations into whether the researchers were looking for an increase in community similarity (beta diversity approach) versus whether urbanization leads to an increase in generalist, cosmopolitan, or non-native species or to a decrease of rare, endemic or specialist species. This approach in clustering study designs or rather hypotheses is called the hierarchy-of-hypotheses.

Combining this hierarchy with data about what methodical approaches were used (e.g., which taxons, scales, realms, etc.) and how support for the hypothesis turned out, leads to an evidence map demonstrating the distribution and amount of available evidence for different methodical approaches.

This overview about the study situation regarding urban biotic homogenization can be used as orientation for future research, for example, which knowledge gaps need to be filled and which study approaches are available including their pros and cons.

Full citation of the article:

Lokatis, S. & Jeschke, J. M. (2022). Urban biotic homogenization: Approaches and knowledge gaps. Ecological Applications, 32 (8), e2703. Online available: https://doi.org/10.1002/eap.2703.

Related:

Lososová, Z., Chytrý, M., Danihelka, J., Tichý, L. & Ricotta, C. (2016). Biotic homogenization of urban floras by alien species: the role of species turnover and richness differences. Journal of Vegetation Science, 27 (3), 452–459. Online available: https://doi.org/10.1111/jvs.12381.

Blouin, D., Pellerin, S. & Poulin, M. (2019). Increase in non-native species richness leads to biotic homogenization in vacant lots of a highly urbanized landscape. Urban Ecosystems, 22 (5), 879–892. Online available: https://doi.org/10.1007/s11252-019- 00863-9.

Banaszak-Cibicka, W. & Żmihorski, M. (2020). Are cities hotspots for bees? local and regional diversity patterns lead to different conclusions. Urban Ecosystems, 23 (4), 713–722. Online available: https://doi.org/10.1007/s11252-020-00972-w.

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