



May 14, 2024

Diversity of bird communities and pressure from the recreational transformation

DOI

dx.doi.org/10.17504/protocols.io.eq2lyw7npvx9/v1



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Protocol Citation: Tatiana Shupova, Zarik Joy 2024. Diversity of bird communities and pressure from the recreational transformation. **protocols.io** <https://dx.doi.org/10.17504/protocols.io.eq2lyw7npvx9/v1>

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Protocol status: Working

We use this protocol and it's working

Created: May 14, 2024

Last Modified: May 14, 2024

Protocol Integer ID: 99747

Keywords: α - and β -diversity, bird communities, disturbances load, gradient: park – oak forest, recreational transformation, Ukraine, transformation of bird community, diversity of bird community, habitat conditions of bird, diversity of bird, bird communities during the transition, bird diversity, transformation of the forest ecosystem, magnitude of bird diversity, habitat condition, species composition of community, pair of bird community, biotopic distribution of bird, bird community, insignificant decrease in the species diversity, species diversity, more decrease in the bird community, habitat, wide ecological valence, forest ecosystem, ecosystem, species accumulation, elucidation of the species composition, species abundance, species composition, recreational transformation of riverbank tree biotope, habitats on the outskirts, nest, species, new environment, bird, greatest similarity of the species composition, many bird, new nesting site, large number of species, dominant species pressure, curves of species a

Abstract

Recreational activity leads to a complex transformation of the forest ecosystem. These disturbances taken together affect the habitat conditions of birds.

The transformation of bird communities under the pressure of negative impacts occurs in various ways. Due to the large number of species and wide ecological valence, many birds adapt to habitats in modified biotopes (Walther 2002;

Blinkova et al. 2020). Some colonize new nesting sites (Shupova et al. 2022); others move nests to safer tiers of the forest stand (Blinkova & Shupova 2018) or to greater depths when nesting in a burrow (Chen et al. 2011). Birds easily navigate a new environment (Nicolaus et al. 2019); develop new elements of behavior depending on living conditions, which improve the result of foraging (Jarjour et al. 2020), and the ability to engage in altruistic behavior increases offspring survival (Gómez-Serrano & López-López 2017).

The analysis was to understand how the species composition and diversity of birds changed along the sub-environment gradient: park, semi-natural (tourist bases) and natural (floodplain oak forest) habitats on the outskirts of the town. Observations were performed in June 2013 on the site of the left bank of Siverskyi Donets River from Svyatogirsk town (49°01'55.3"N 37°34'09.8"E) to Bogorodychne village (49°01'32.5"N 37°31'02.1"E).

To determine the anthropogenic impact gradient in the biotope, we took into account the share of the transformed territory, the share of the territory directly exposed to the uncontrolled impact of vacationers, the attendance of the site by people and domestic animals in the form of a sum of points. This was done according to the method described by us in the work of Shupova et al. (2023). The gradient of increasing anthropogenic impact forms the following series of biotopes compared by us: biotope 1 → biotope 2 → biotope 3, and expressed in the number of points: 116→237→259.

Elucidation of the species composition, abundance and biotopic distribution of birds was performed by the method of counting birds on routes (Bibbi et al. 2000).

We compare species diversity using data from samples of different sizes obtained with transects (sampling units) of unequal length, due to which observed species abundances can be biased. To eliminate errors in the interpretation of the analysis of diversity indices, there was a need for modeling to minimize the influence of disproportional sampling fractions. Our estimate of α -diversity is based on Shannon entropy, calculated by the method that links it to the species accumulation

curve proposed by A. Chao et al. (2013), and β -diversity indices, we calculated abundance-based (Chao et al. 2006).

The recreational transformation of riverbank tree biotopes negatively affects the species composition of communities and the magnitude of bird diversity along the sub-environment gradient: park, semi-natural (tourist bases) and natural (floodplain oak forest) habitats on the outskirts of the town.

The α -diversity index data showed a clear picture of recreational transformation impact on birds. The Shannon entropy index shows an insignificant decrease in the species diversity of bird communities during the transition from biotopes 1 and 2, and more decrease in the bird community during the transition between biotopes 2 and 3. The Berger-Parker index, which reveals the degree of dominant species pressure, is the largest in the biotope 2. The Pielou evenness index revealed that the bird community inhabiting biotope 2 is also the most unbalanced. This result emerged after modeling the weighted indices, it is consistent with the result shown by ranged curves of species abundance, which we consider next, and we recommend our method for working with the Berger-Parker and Pielou index. According to the Sørensen and Jaccard indices, the greatest similarity of the species composition between the bird communities inhabiting the biotopes 2 and 3, the smallest – in the pair of bird communities of the biotopes 1 and 3.

Attachments



[alpha-beta-diversity...](#)

672KB

Image Attribution

View of the study area from the right bank of the river (on the left are a floating oak forest, tourist bases, in the center is a park, in the background is Sviatohirsk Town. Ukraine)

Guidelines

We compare species diversity using data from samples of different sizes obtained with transects (sampling units) of unequal length, due to which observed species abundances can be biased. To eliminate errors in the interpretation of the analysis of diversity indices, there was a need for modeling to minimize the influence of disproportional sampling fractions.


Materials

The species of birds and the search for their nests in tree canopies visually were determined using binoculars Barska X-Trail 10×50 Reverse Porro. The audio definition of birds' voices (mp3) was used for the acoustic identification of species.



Troubleshooting

Safety warnings

 This work was supported by the National Academy of Sciences of Ukraine [theme: 'Assessment of the impact of military actions on the transformation of terrestrial natural ecosystems using model groups of bioindicator species and monitoring of alien species in flora and fauna as a component of ensuring the biological security of Ukraine', 0123U101039].



Ethics statement

In the study, visual and acoustic identification of birds was carried out, without contact with their body.

Before start

The our research is addition that examines the response of arboreal bird communities during the nesting period in the northern European Steppe Zone, based on empirical data.

Diversity of bird communities and pressure from the recreational transformation of riverbank tree biotopes of Siverskyi Donets River


- 1 Recreational activity leads to a complex transformation of the forest ecosystem. These disturbances taken together affect the habitat conditions of birds.
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3 **Key words:** α - and β -diversity, bird communities, disturbances load, gradient: park – oak forest, recreational transformation, Ukraine.

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