Targeted Activity of Local Organizers' Influences on Biodiversity Identification Within City Nature Challenge: The Experience of 2 Russian Megacities

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Chapter 19
Targeted Activity of Local Organizers' Influences on Biodiversity Identification Within City Nature Challenge: The Experience of 2 Russian Megacities

Nina Sadykova and Ivan A. Smorkalov

Abstract Using two Russian megacities, Moscow and Ekaterinburg, this study assesses how local organizer activity, specialization, and iNaturalist community traits influence biodiversity identification during the international City Nature Challenge (CNC). Data collected via iNaturalist from 2019 to 2024 were analyzed. Both cities are leaders in iNaturalist use in Russia: Ekaterinburg has participated since 2020, while Moscow was active from 2020 to 2022. Comparative analysis revealed that the presence of organizers, their specialization, and efforts to engage users significantly influence observation activity and taxonomic coverage. The results indicate a possible "founder effect" in the distribution of observations across taxonomic groups. Notably, when targeted organizer activities occur on CNC days, user engagement significantly increases, often leading to a focus on taxonomic groups that typically do not attract their interest. These findings highlight the role of professional organization in raising biodiversity awareness and community participation, providing valuable insights for further urban ecology research and public biodiversity monitoring projects.

Keywords City Nature Challenge · Urban Nature · Citizen Science · iNaturalist

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Introduction

iNaturalist is the main source of up-to-date data on biodiversity in cities. There is an emerging global trend to use iNaturalist data to develop solutions to meet the challenges of sustainable urban development (Palma et al. 2024). Open data collected by naturalists are beginning to be used to assess and model the cultural ecosystem services of urban ecosystems (Havinga et al. 2020), inventory and monitor biodiversity (Tiago et al. 2024), and identify the most species-rich areas (Callaghan et al. 2019). At the same time, it has been shown that biodiversity data generated by iNaturalist are highly opportunistic and depend on many subjective and local factors, the influence of which needs to be taken into account when analyzing and interpreting these data (Chozas et al. 2023; Ward 2014; Courter et al. 2013). It is therefore important to understand how and to what extent individual leaders and professionals can guide iNaturalist observers to better and more fully identify diversity at the scale of a large city.

In Russia, iNaturalist started to be actively used in 2019, with Moscow and Ekaterinburg in particular being the leaders of implementation.

The City Nature Challenge (CNC) is the largest citizen science event in the world, which varies greatly in the approaches used to organize the event in different cities and countries (Sakurai et al. 2022). However, we did not find any studies examining the impact of the local iNaturalist community's characteristics and the efforts of CNC organizers on the taxonomic coverage and quality of observations made during the CNC. In Ekaterinburg, CNC has been held since 2020, and in Moscow, it was held from 2020 to 2022. In 2024, 690 cities worldwide participated in the CNC, with only Ekaterinburg representing Russia (Current CNC results 2024). In different cities of the world CNC is organized by scientific, educational, environmental organizations, individual scientists, and activists; the action can be supported by local authorities, business, and mass media. In Ekaterinburg, the action is supervised by biologists—2 researchers from the Institute of Plant and Animal Ecology of the Ural Branch of the Russian Academy of Sciences, as well as the organizer of the local birdwatcher community "EkaterinBird," among them the authors of this article. In Moscow, the event was curated by botanist Alexey Seregin, curator of the largest project on iNaturalist "Flora of Russia" (https://www.inaturalist.org/projects/flora-rossii-i-kryma-flora-of-russia-and-the-crimea) and professor at Moscow State University.

The experience of using iNaturalist in Russian cities has not been studied so far, although only during the years of mass participation of Russian cities in CNC an impressive volume of observations has been obtained (more than 24 thousand in 2020, 54.5 thousand in 2021, and 58.5 thousand in 2022).

Purpose of the study—to analyze the experience of iNaturalist promotion and City Nature Challenge (CNC) organization in Ekaterinburg in comparison with Moscow from the point of view of the possibility to target iNaturalist users' behavior, composition, and quality of the data they collect.

Methods

We used data from the iNaturalist portal for the period from January 1, 2019 to June 18, 2024. In total, the database contains 589,116 records (Fig. 19.1).

The cities differ significantly in many physiographic parameters and in absolute iNaturalist indicators (Fig. 19.1), but are close in relative "endowment" with naturalists (Table 19.1).

We divided the activities of local CNC organizers into general and targeting activities. To the general activity, we referred the actions to attract attention to the action. Within the framework of such activity of the organizers, we can note the following:

- In Moscow: Online presentations by Alexei Seregin, announcements of the action on the page of the Flora of Russia project and the Herbarium of MSU (Seregin 2019)

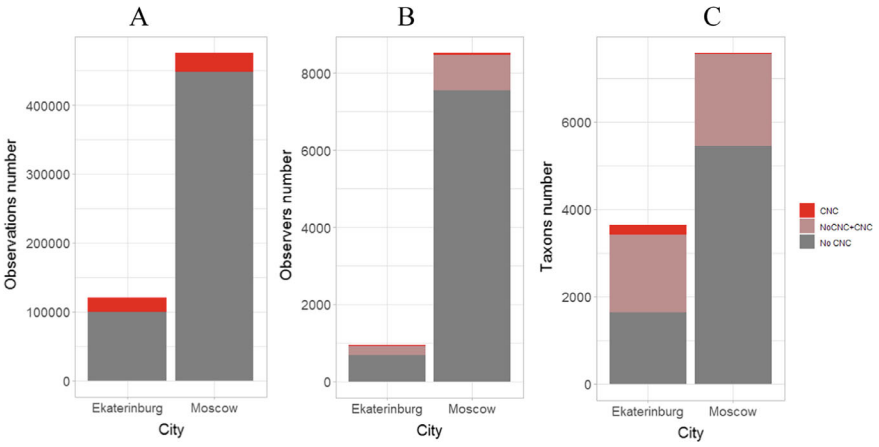

Fig. 19.1 Comparison of the used data for Ekaterinburg and Moscow according to the main iNaturalist indicators: number of A—observations, B—observers, and C—taxons; CNC, NoCNC, CNC + NoCNC means that values means that the data relate only to CNC days, only to the other days of the year, or both

Table 19.1 Comparison of some demographic and geographic characteristics of Moscow and Ekaterinburg

Parameter	Ekaterinburg	Moscow
Square, km^2	1110.7	2561
Population, 10^6	1.6	13.1
Climatic zone	Continental	Moder continental
Mean temperature, °C	3.3	6.3
Observers per 1000 population	0.53	0.63

- In Ekaterinburg: announcements on the "EkaterinBird" community page, appearances on the city radio, offline meetings in the city museum and central scientific library, and podcast recordings.

By targeting activity, we mean attracting attention to specific groups of organisms through posts and appeals in social networks, organizing special events (excursions) for all comers under the guidance of specialists in the relevant groups, and attracting specialists to more active participation in the action.

Data processing was performed in R Ver. 4.1.2. We took general activity as a binary factor: 1—activity is there if the city participates in CNC; 0—if the city does not participate in the action. Three-way ANOVA was used to assess the significance of the effect of general activity. All three parameters were used as the dependent variable: number of observers, observations, and identified species. The factors were "city," "year," and "participation/non-participation in CNC."

To assess the effect of targeting activity on the number of observations of organisms of individual groups, only data collected on CNC days and a four-way ANOVA (dependent variable—number of observations; factors: "Target activity" (yes/no for a specific group), "Year," "City," and "Group of organisms") were used.

To determine the list of the most active observers, the top 20 were selected separately in each city on CNC days and on normal days, and then summarized into combined top lists.

Results and Discussion

On CNC days, user activity can increase by more than an order of magnitude (in case the city takes part in the action) (Fig. 19.2a). If the general activity of the organizers stops, the difference between user activity on CNC days and on average during the year is completely leveled out within only two years. On CNC days, all activity parameters differ significantly ($p < 0.001$): number of observations per day ($F = 373.1$), number of observers ($F = 97.2$), and detected species per day ($F = 48.1$) (Fig. 19.2b). In Moscow, this difference becomes insignificant in 2023 and 2024.

Unfortunately, our analysis is limited to only 2 representative cities; an interesting task would be to compare it with the activity in cities in other countries that actively participated and then stopped participating in CNC.

Despite the fact that in both Ekaterinburg and Moscow plants rank first in the number of species identified (Fig. 19.3), the cities differ in the ratio of other groups of organisms. Thus, in Ekaterinburg during the CNC from 2020 to 2023, birds were in second place in the number of species detected, which did not correspond to the global trend—after plants, insect species were found the most. This "deviation" is explained by the fact that initially the active core of naturalists in Ekaterinburg was to a large extent birdwatchers. In addition, in 2020–2021, a significant proportion of all groups' observations were made by a single individual. Beginning in 2022, we, as CNC organizers in Ekaterinburg, began focusing on different groups of

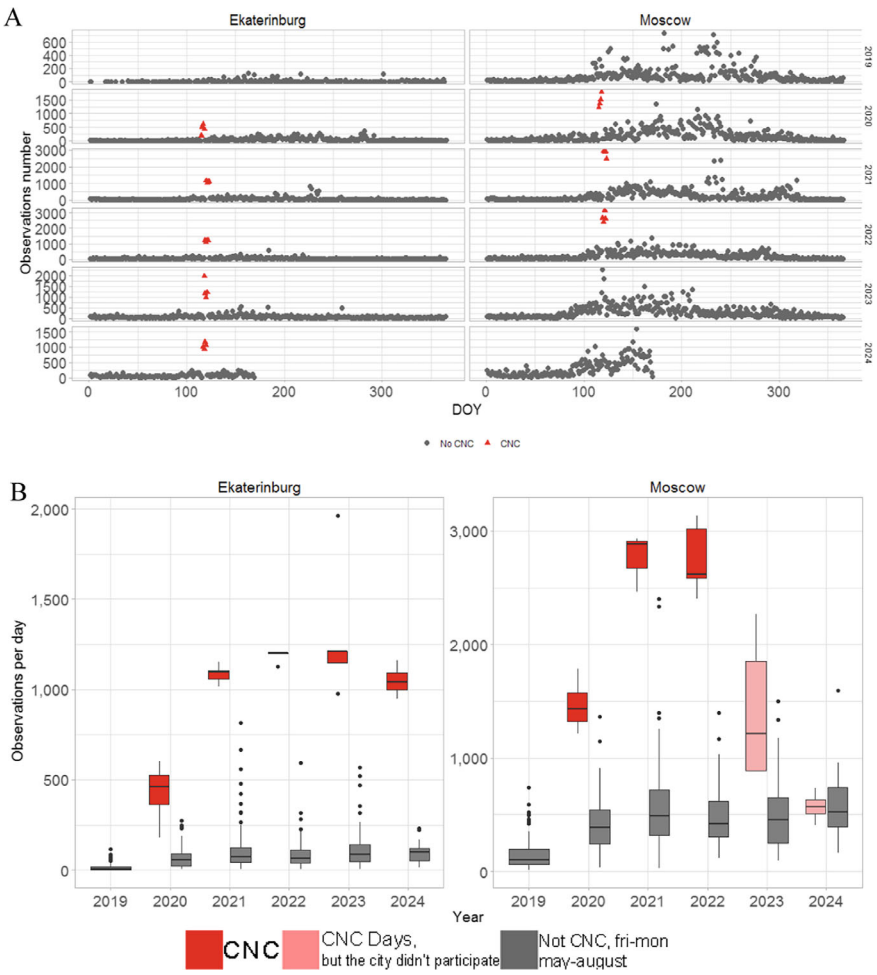

Fig. 19.2 Daily (**a**) and interannual (**b**) dynamics of observations in Ekaterinburg and Moscow

organisms. In 2022, we directed participants' attention to fungi and protozoa, which ultimately led to an increase in the number of species in the "Other" group. In 2024, after a purposeful shift of focus to insects, it was possible to double the number of species found during CNC. The effect of targeting activity on the number of observations of organisms of a specific group was statistically significant, although less than other factors (Table 19.2). This is quite understandable: firstly, we are dealing with minor groups poorly represented during the CNC, and secondly, the effect of targeting activity may be prolonged and operate in subsequent years (i.e., targeting activity is gone, but interest in the group remains at the same level (Fig. 19.3)). In Moscow, botanists were the organizers and the most active observers, so the focus on

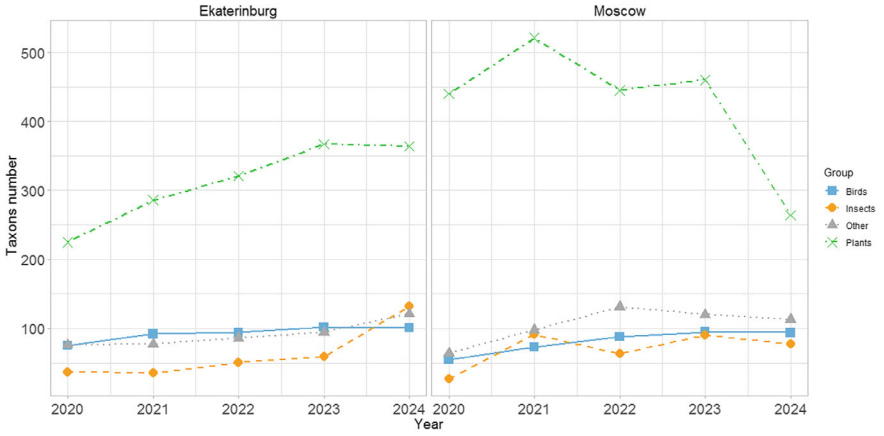

Fig. 19.3 Interannual dynamics of the number of taxa of different groups of organisms observed on CNC days

Table 19.2 The results of a four-way ANOVA for number of observations on CNC days

Source of variance	df_1	F	p
Target activity	1	5.49	0.02
Year	4	4.74	0.001
City	1	12.66	<0.001
Group of organisms	3	79.13	<0.001

plants during the CNC days (after Moscow stopped participating, the disproportion decreased).

Starting from 2021, the number of bird species detected on CNC days in Ekaterinburg remains practically unchanged, while in 2022 and 2023 almost the same number of plant species was detected. It is probably possible to say that the detectability of species of these groups within the CNC present in early May in Ekaterinburg has reached its limit (Fig. 19.3). In Moscow, the number of plant species detected during CNC days increased until 2022, decreased after the cessation of the campaign. The number of bird species detected increased until 2022, and then practically did not change despite the cessation of the campaign activity. At the same time, insects and some other groups of organisms remain a promising front for organizing targeted activity in the following years.

F is Fisher's test, p is the significance level, and df_1 is the number of degrees of freedom for the given factor.

Evaluation of the distribution of observations by users showed that only 10% of active iNaturalist users make 90% of observations (Fig. 19.4a). This proportion is similar in Ekaterinburg and Moscow, although the total number of users in these cities differs by an order of magnitude.

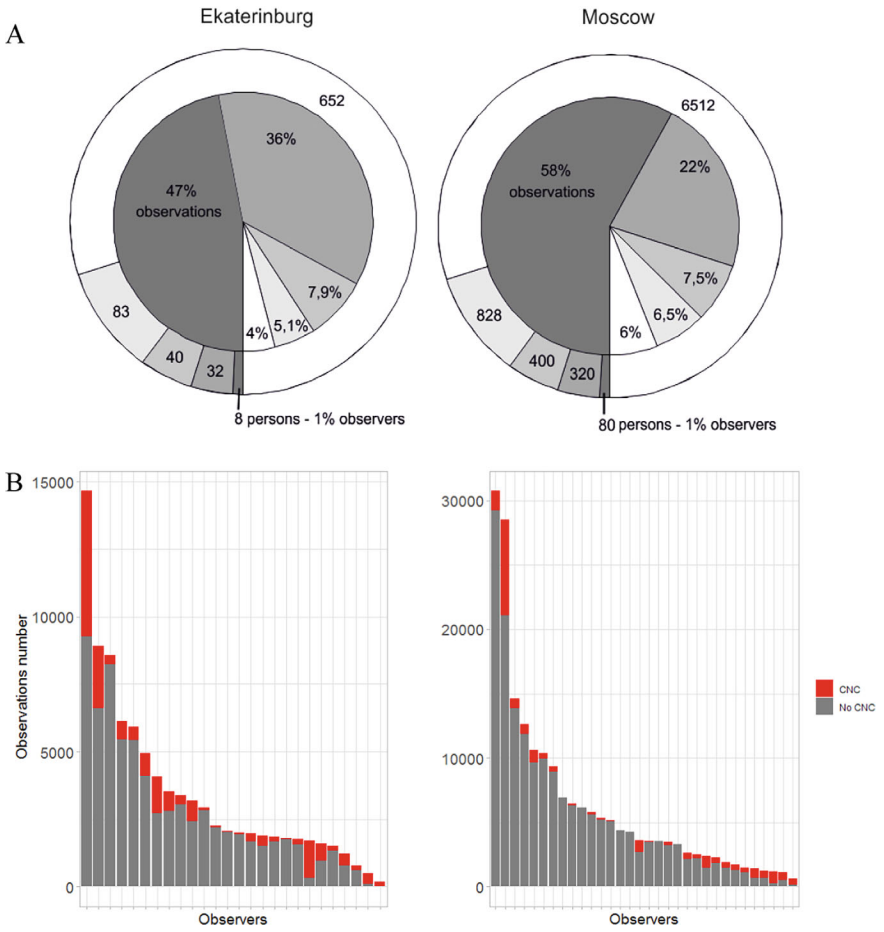

Fig. 19.4 Relative (**a**) and absolute (**b**) indicators of observer activity in Ekaterinburg and Moscow. **b** shows the combined ratings of the top 20 observers on CNC days and on "normal" days

Comparison of the top 20 observers by the number of observations in the city for all years and separately within the CNC (Fig. 19.4b) showed that both in Ekaterinburg (7 users) and Moscow (12 users) among iNaturalist users there are those who actively participate in the CNC, but are not very active during the rest of the time. According to some of them, this is due to the general activity of the organizers: they (observers) see the CNC announcement in social networks and participate to support their city in the competition, and the rest of the time they are not motivated to actively use iNaturalist. Therefore, it is important to combine the general activity associated with efforts to attract new users to iNaturalist while simultaneously targeting the most active user-leaders to collect better data and better identify species diversity. At the same time, for targeted detection of diversity of certain groups or in certain areas, it is most effective to attract participants from the active core of iNaturalist users in the

region—it is they who attend specialized events (excursions) and shift the focus of their "usual" activity on CNC days.

Conclusion

On the example of 2 megacities of Russia, it is considered how multidirectional activities of local CNC organizers influence user activity and identification of species diversity of different taxonomic groups in cities with an established community of naturalists.

Among iNaturalist users in the city an active core is formed; about 10% of active users provide 90% of observations. In the distribution of users' activity in observing different taxonomic groups, a "founder effect" can be observed; for example, in Ekaterinburg users during the year are more active in observing birds, because the spread of iNaturalist was associated with the activities of the Birdwatchers community, and in Moscow more attention is paid to plants, because in Moscow the spread of iNaturalist was largely associated with the activities of the MSU Herbarium and the Flora of Russia project.

It is shown that the general activity of CNC organizers can serve to engage new users in collecting data on urban biodiversity, and directed activity leads to a shift in the focus of attention of an active core of naturalists to discovering the diversity of previously poorly studied taxonomic groups.

The findings can be valuable for planning biodiversity inventory and monitoring programs in urbanized areas using the iNaturalist platform, as well as for developing educational programs aimed at introducing citizens to local urban biodiversity and engaging them in citizen science ecological monitoring. Such projects must include a preliminary analysis of the structure of the local iNaturalist community. To effectively identify the full species diversity of specific taxonomic groups and areas, it is essential to rely on the established core of active users. Attracting new users can help build and refresh this "active core," but on its own, it does not guarantee an increase in taxonomic coverage or the quality of biodiversity data collected.

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