"Flora of Russia" on iNaturalist: a dataset

Alexey P. Seregin†, Dmitriy A. Bochkov‡, Julia V. Shner‡, Eduard V. Garin§, Igor N. Pospelov‖, Vadim E. Prokhorov¶, Pavel V. Golyakov‖, Sergey R. Mayorov¶, Sergey A. Svirin‖, Alexander N. Khimin³, Marina S. Gorbunova*, Ekaterina S. Kashirina*, Olga P. Kuryakova*, Boris V. Bolshakov, Aleksandr L. Ebei⁴, Anatoliy A. Khapugin,⁵, Maxim M. Mallaliev⁴, Sergey V. Mirvoda⁴, Sergey A. Lednev⁴, Dina V. Nesterkova⁵, Nadezhda P. Zelenova⁶, Svetlana A. Nesterova⁷, Viktoria N. Zelenkova⁷, Georgy M. Vinogradov⁷, Olga V. Biryukova⁸, Alla V. Verkhozina⁸, Alexey P. Zyrinov⁹, Sergey V. Gerasimov⁹, Ramazan A. Murtazaliev⁹, Yuri M. Basov⁹, Kira Yu. Marchenkova⁹, Dmitry R. Vladimirov⁹, Dina B. Safina⁹, Sergey V. Dudov⁹, Nikolai I. Degtyarev⁹, Diana V. Tretyakova⁹, Daba G. Chimitov⁹, Evgeniy A. Sklyarev*, Alesya N. Kandaurova*, Svetlana A. Bogdanovich*, Alexander V. Dubynin**, Instructor, Olga A. Chernyagina**, Aleksandr V. Lebedev**, Mikhail S. Knyazev**, Irina Yu. Mitjushina**, Nina V. Filippova**, Kseniia V. Dudova*, Igor V. Kuzmin*, Tatjana Yu. Svetasheva*, Vladimir P. Zakharov**, Vladimir P. Travin**, Yaroslav O. Magazov**, Vladimir Yu. Teploukhov, NN, Andrey N. Efremov**, Olesya V. Deineko**, Viktor V. Stepanov**, Eugene S. Popov**, Dmitry V. Kuzmenckin*, Tatjana L. Strus**, Tatjana V. Zarubot**, Konstantin V. Romanov*, Alexei L. Ebel*, Denis V. Tishin*, Vladimir Yu. Arkhipov**, Vladimir N. Korotkov**, Svetlana B. Kutuev**, Vladimir V. Gostev**, Mikhail M. Krivosheev**, Natalia S. Gamova**, Veronica A. Belova**, Oleg E. Kosterin****, Sergey V. Prokopenko***, Rinat R. Sultanov**, Irina A. Kobuzeva**, Nikolay V. Dorofeev*, Alexander A. Yakovlev**, Yuriy V. Danilevsky**, Irina B. Zolotukhina**, Damir A. Yumagulov**, Valerii A. Glazunov**, Alexander A. Bakutov**, Andrey V. Danilin****, Igor V. Pavlov**, Elena S. Pushay****, Elena V. Tikhonova**, Konstantin V. Samodurov**, Dmitri V. Epikhin**, Tatjana B. Silaeva**, Andrei I. Pyak**, Yulia A. Fedorova**, Evgeniy S. Samarin****, Denis S. Shilov**, Valentina P. Borodulina**, Ekaterina V. Kropochevat**, Gennadiy L. Kosenkov***, Uladzimir V. Bury**, Anna E. Mitroshenkova**, Tatjana A. Karpenko**, Ruslan M. Osmanov**, Maria V. Kozlova**, Tatjana M. Gavrilova*, Stepan A. Serafimov*****, Maxim I. Khomutovskiy**, Eugene A. Borovichev**, Ilya V. Filippov**, Serguei V. Ponomarenko**, Elena A. Shumikhina**, Dmitry F. Lyskov*, Evgeny A. Belyakov*, Mikhail N. Kozhin**, Leonid S. Poryadin**, Artem V. Leostrov**

† Lomonosov Moscow State University, Moscow, Russia
‡ Papanin Institute for Biology of Inland Waters, BAS, Borok, Yaroslavl Oblast, Russia
§ Savetsky Institute of Ecology and Evolution, BAS, Moscow, Russia
¶ Kazan Federal University, Kazan, Russia
|| Targiak State Reserve, Barnaul, Russia
*** Lomonosov Moscow State University, Sevastopol, Russia
** «Pavlovsk Secondary School #2, Pavlovsk, Voronezh Oblast, Russia
*** Independent Researcher, Korolyov, Moscow Oblast, Russia
†† Independent Researcher, Korolyov, Moscow Oblast, Russia
‡‡ Independent Researcher, Petropavlovsk-Kamchatsky, Russia
§§ Independent Researcher, Petropavlovsk-Kamchatsky, Russia
¶¶ Independent Researcher, Petropavlovsk-Kamchatsky, Russia
‖‖ Independent Researcher, Petropavlovsk-Kamchatsky, Russia
§§§ Independent Researcher, Petropavlovsk-Kamchatsky, Russia
|||| Independent Researcher, Petropavlovsk-Kamchatsky, Russia
 bluff, Yaroslavl Oblast, Russia

© Seregin A et al. This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Biodiversity Data Journal 8: e59249
doi: 10.3897/BDJ.8.e59249
Tyumen State University, Tyumen, Russia
Mountain Botanical Garden, Dagestan Federal Research Centre, RAS, Makhachkala, Russia
Belorechenskoye Agricultural Public Joint Stock Company, Belorechensky, Irkutsk Oblast, Russia
Institute of Plant and Animal Ecology, Ural Branch, RAS, Ekaterinburg, Russia
Independent Researcher, Kaliningrad, Russia
Independent Researcher, Kostroma, Russia
Belgorod National Research University, Belgorod, Russia
Shirshov Institute of Oceanology, RAS, Moscow, Russia
Lobachevsky State University, Nizhny Novgorod, Russia
Siberian Institute of Plant Physiology and Biochemistry, SB RAS, Irkutsk, Russia
Independent Researcher, Novosibirsk, Russia
Republican Children’s Ecological and Biological Center of Bashkortostan, Ufa, Russia
Dagestan State Medical University, Makhachkala, Russia
Independent Researcher, Tyumen, Russia
Independent Researcher, Bryansk, Russia
Voronezh State University, Voronezh, Russia
Central Chernozem Reserve, Kursk Oblast, Russia
Institute of General and Experimental Biology, RAS, Ulan-Ude, Russia
Independent Researcher, Kursk, Russia
Independent Researcher, Saratov, Russia
Independent Researcher, Alushta, Russia
Open Laboratory of Conservation Biology, Novosibirsk, Russia
Novosibirsk State University, Novosibirsk, Russia
Kamchatka State University, Petropavlovsk-Kamchatsky, Russia
Kamchatka Branch of the Pacific Geographical Institute, FEB RAS, Petropavlovsk-Kamchatsky, Russia
Russian State Agrarian University - Moscow Timiryazev Agricultural Academy, Moscow, Russia
Institute Botanic Garden, Ural Branch, RAS, Ekaterinburg, Russia
Directorate of Protected Areas, Vladimir, Russia
Yugra State University, Khanty-Mansiysk, Russia
Tula State Lev Tolstoy Pedagogical University, Tula, Russia
Independent Researcher, Likino-Dulyovo, Moscow Oblast, Russia
Independent Researcher, Samara, Russia
Chelyabinsk and Youth Camping Trip Centre "Kosmos", Chelyabinsk, Russia
Independent Researcher, Omsk, Russia
Ulyanovsk State Pedagogical University, Ulyanovsk, Russia
Independent Researcher, Vladimir, Russia
Komarov Botanical Institute, RAS, Saint Petersburg, Russia
Independent Researcher, Khanty-Mansiysk, Russia
Independent Researcher, Nizhny Novgorod, Russia
Altai State University, Barnaul, Russia
Institute of Theoretical and Experimental Biophysics, RAS, Pushchino, Russia
Izrael Institute of Global Climate and Ecology, Moscow, Russia
Rybinsk State Historical, Architectural and Art Museum Preserve, Rybinsk, Yaroslavl Oblast, Russia
Bashkir State University, Ufa, Russia
Baikalsky State Nature Biosphere Reserve, Tankhoy, Buryat Republic, Russia
Irkutsk State University, Irkutsk, Russia
Institute of Cytology and Genetics, SB RAS, Novosibirsk, Russia
Federal Scientific Center of the East Asia Terrestrial Biodiversity, FEB RAS, Vladivostok, Russia
Independent Researcher, Moscow, Russia
Independent Researcher, Cheboksary, Russia
Independent Researcher, Ust-Labinsk, Krasnodar Krai, Russia
Independent Researcher, Ufa, Russia
Institute of the Problems of Northern Development, Tyumen Scientific Centre SB RAS, Tyumen, Russia
Independent Researcher, Volzhsk, Mari El Republic, Russia
NUST MISIS, Moscow, Russia
Independent Researcher, Perm Krai, Russia
Tver State University, Tver, Russia
Center for Forest Ecology and Productivity, RAS, Moscow, Russia
Independent Researcher, Asino, Tomsk Oblast, Russia
Vernadsky Crimean Federal University, Simferopol, Russia
Ogarev Mordovia State University, Saransk, Russia
Abstract

Background

The "Flora of Russia" project on iNaturalist brought together professional scientists and amateur naturalists from all over the country. Over 10,000 people were involved in the data collection.

New information

Within 20 months, the participants accumulated 750,143 photo observations of 6,857 species of the Russian flora. This constitutes the largest dataset of open spatial data on the country's biodiversity and a leading source of data on the current state of the national
flora. About 87% of all project data, i.e. 652,285 observations, are available under free licences (CC0, CC-BY, CC-BY-NC) and can be freely used in scientific, educational and environmental activities.

Introduction

Since 2008, iNaturalist (https://www.inaturalist.org/) has been crowdsourcing biodiversity observations made by citizen scientists, as well as their taxonomic identifications. Hundreds of publications have already taken into account iNaturalist data for use in research, conservation and policy (e.g. Ocampo-Peñaüela et al. 2016, Chandler et al. 2017, Heberling and Isaac 2018). There are three key themes that iNaturalist embraces: social interaction; shareability of data, tools and code; and scalability of the platform and community (Seltzer 2019).

The advent of large, technology-based resources allows ecologists and biologists to work at spatio-temporal scales previously unimaginable (White et al. 2015). With 50M observations accompanied by photo or audio evidence, the global iNaturalist dataset is one of the largest online collections of biodiversity data. It is partially represented in the GBIF, with the exclusion of observations which remain unidentified or have unconfirmed or missing licence information. Nonetheless, the GBIF export tools provide excellent data usability and the resulting exports come with a DOI which one can use for citation in publications. The GBIF data usage counter shows that iNaturalist GBIF-mediated data gained 781 citations (as of 11 Sep 2020) making it one of the most commonly-used datasets amongst the GBIF (Ueda 2020).

Many research papers focus on the employment of iNaturalist data as a primary source (Heberling and Isaac 2018, Seregin et al. 2020). For instance, iNaturalist includes dozens of metadata fields for every observation and was employed as a case study in the theory of long-tailed datasets (Cui et al. 2019). Observations from the iNaturalist Challenge at FGVC 2017 with links to 675,000 licensed images of 5,089 species have been widely used in computer vision training (Cui et al. 2018; Van Horn et al. 2018; Zheng et al. 2019). iNaturalist observations and images have been been employed as a data source in classical taxonomy of tracheophytes (Svoboda and Harris 2018), studies of the distribution of gecko clones (Lapwong and Juthong 2018), plant phenology (Barve et al. 2020) and fish infections on a continental scale (Happel 2019). Moreover, Skejo et al. (2020) recently published a description of a new species, based on photos from iNaturalist in addition to scarce museum material. The platform has been suggested as a suitable agent for storage of photo vouchers associated with museum specimens (Heberling and Isaac 2018).

Biodiversity documentation, by the means of aggregation of individual observations, is the main goal of iNaturalist. Consistent with this are the many examples of papers dealing with new noteworthy records of either alien (Vendetti et al. 2018; Hiller and Haelewaters 2019; Liebgold 2019) or native organisms (Rosenberg 2018; Schuette et al. 2018) made by amateur naturalists. Further accumulation of data made possible precise documentation of alien species distribution on a nationwide scale (Ciceoi et al. 2017), their expansion
process (Oficialdegui et al. 2020), routine monitoring of invasive species (Larson et al. 2020), documentation of at-risk species beyond the boundaries of protected areas (Young et al. 2019) and a global assessment of species’ extinction risk with the inclusion of citizen science data (Gardiner and Bachman 2016). Spatial data from iNaturalist have been employed in studies of bird collisions with windows (Winton et al. 2018), global snakebite mortality (Longbottom et al. 2018) and the search for environmental triggers in orchids (Lori et al. 2018).

It has recently been shown that iNaturalist serves as a tool indispensable for avoiding biases in urban biodiversity data (Li et al. 2019), for making decisions related to the urban management of red foxes and coyotes (Mueller et al. 2019) and for testing urban biotic homogenisation with the use of data generated by the participants of the City Nature Challenge (Leong and Trautwein 2019). There are positive examples of iNaturalist usage in data accumulation by researchers (Ocampo-Peñuela et al. 2016), as well as the citizen community helping scientists with a supply of data (Brown et al. 2019). In addition, there are examples of iNaturalist usage during university courses of classical zoology and botany together with standard field guides and keys (Unger et al. 2020).

The iNaturalist dataset at various taxonomic and/or geographical extents has been checked for completeness of data against complete literature data (Goldstein et al. 2018), expert-based range maps (Fourcade 2016), museum collections (Spear et al. 2017) and available inventories within protected areas (Jacobs and Zipf 2017). Vahidi et al. (2017) performed a general quality assessment of iNaturalist data which made possible the revealing of the majority of attribute and positional errors amongst the crowd-sourced biodiversity observations. Borzée et al. (2019) published a case study on cross-verification of iNaturalist observations against published georeferenced molecular data, whereas Maritz and Maritz (2020) compared Facebook versus iNaturalist as data sources in the assessment of trophic interactions. Prudic et al. (2018) verified the completeness of iNaturalist data with various field techniques of butterfly data collection.

The project "Flora of Russia", which includes all verified ("research-grade") observations of vascular plants from the country, was launched by the Moscow University team on 9 Jan 2019 to support data collection for the "Atlas of the Russian flora" (Seregin et al. 2020). During the first 20 months, the number of identified and verified iNaturalist observations of vascular plants from Russia increased 68-fold and the number of involved users increased 10-fold. Here, we present the characteristics of the dataset as for 9 Sep 2020, soon after the project reached two notable milestones of 750,000 verified observations and 10,000 observers (Fig. 1, Fig. 2 and Fig. 3).

Fig. 3 shows both the number of observers and project members. Since the collection projects on iNaturalist are working as filters, all RG observations of vascular plants from Russia are covered by the project giving an impressive figure of 10K observers. As of 13 Sep 2020, 1,736 members of iNaturalist have formally joined the "Flora of Russia" project by pressing the "Join" button. As a result, they clearly affiliate their data with the project by an automatically-generated logo on every observation page and receive notifications on project updates and journal posts. Those observers who are not members of the project
still get benefits in the form of identifications, because experts are inspecting all observations available on iNaturalist.

Figure 1. Dynamics of identified and verified ("research-grade") observations of the "Flora of Russia" project since the inception. Blue dots represent the research grade observations and red dots correspond to unverified observations from the project's backlog. About 11K observations were deleted from iNaturalist by a single "mega-observer" on 25 Feb 2020.

Figure 2. The "Flora of Russia" project species number dynamics since the inception on 9 Jan 2019. From 31 Jul 2020, the number of species stabilised due to ongoing expert data cleaning activity.
General description

Purpose: For a number of years, Russian professional and amateur biologists were using Internet-based national networking systems of the georeferenced data collection for birds, invertebrates and plants. For instance, Plantarium is the most popular Russian-language resource for collecting plant and lichen photographs from around the world with emphasis on Russia and adjacent regions. However, unlike iNaturalist, it does not allow data export nor is these data included in the GBIF, since photos and other data lack licence indications. In addition, contributing observations to Plantarium requires more effort from the members.

After digitisation of the nation’s second largest herbarium (Seregin 2018), the Moscow University team launched a public awareness campaign to support community-generated data collection for plants. We decided not to spend budget on our own crowd-sourcing system, but to use and promote the international iNaturalist platform as suitable for data collection in Russia with a number of efficient tools and a global community.

Russia on iNaturalist: By late 2018, Russia was the 18th country on iNaturalist in terms of the number of verifiable observations (47,888). After 20 months of the project activity, we can see drastic changes in the biodiversity data coverage across Russia with a strong emphasis on tracheophytes.

Currently, Russia holds fifth place amongst countries represented on iNaturalist in terms of the number of verifiable observations of all groups of organisms and the third place by observations of vascular plants in particular (Table 1).
Amongst the top ten countries, Russia has the highest proportion of tracheophyte observations of all uploaded to iNaturalist (62.2%). A community of birdwatchers is also quite active when compared to other top countries, whereas other groups of organisms are still lacking much attention (Table 2). Birds are the primary object of attention for at least eight co-authors of this paper, whereas three of us are focused on fungi.

| Rank | Country     | All groups | Tracheophytes | Proportion of tracheophytes amongst all groups |
|------|-------------|------------|---------------|-----------------------------------------------|
| 1    | USA         | 25,896,649 | 10,937,966    | 42.2                                          |
| 2    | Canada      | 3,606,976  | 1,401,370     | 38.9                                          |
| 3    | Mexico      | 2,305,831  | 721,168       | 31.3                                          |
| 4    | Australia   | 1,366,788  | 298,223       | 21.8                                          |
| 5    | Russia      | 1,329,399  | 826,949       | 62.2                                          |
| 6    | UK          | 1,150,580  | 512,311       | 44.5                                          |
| 7    | South Africa| 972,158    | 548,997       | 56.5                                          |
| 8    | New Zealand | 821,308    | 376,942       | 45.9                                          |
| 9    | Italy       | 705,192    | 243,265       | 34.5                                          |
| 10   | Germany     | 689,644    | 247,961       | 36.0                                          |
|      | WORLD       | 48,612,707 | 19,308,096    | 39.7                                          |

Table 1.
The top ten countries by the number of verifiable observations on iNaturalist (as of 5 Sep 2020). In Tables 1-6 of this section, Russia is presented within the borders on 1 Jan 2014 (so called "standard places" on iNaturalist), i.e. excluding the Republic of Crimea and the City of Sevastopol claimed by Ukraine.

| Rank | Country        | Tracheophytes | Birds | Insects | Other groups |
|------|----------------|---------------|-------|---------|--------------|
| 1    | Russia         | 62            | 15    | 13      | 10           |
| 2    | South Africa   | 56            | 11    | 15      | 18           |
| 3    | New Zealand    | 46            | 11    | 17      | 27           |
| 4    | UK             | 45            | 11    | 28      | 17           |
| 5    | USA            | 42            | 13    | 24      | 22           |
| 6    | Canada         | 39            | 13    | 28      | 20           |
| 7    | Germany        | 36            | 15    | 34      | 15           |

Table 2.
The proportion of popular taxonomic groups amongst verifiable observations for the top ten countries on iNaturalist (5 Sep 2020)
Russia has the highest proportion of vascular plants amongst identified and confirmed observations which are classified as "research grade" on iNaturalist (Table 3). Moreover, Russia is the leading country on iNaturalist amongst the top ten with regard to the proportion of confirmed observations amongst all tracheophyte records. As we showed in 2019 (Seregin et al. 2020), the number of unconfirmed plant observations in Russia usually rapidly increases from May to August and decreases from September to April, when experts most intensively work with the backlog of unprocessed observations.

Table 3.
Identified and verified ("research grade", RG) observations for the top ten countries on iNaturalist (as of 5 Sep 2020)

| Rank | Country     | All groups | Tracheophytes | Proportion of tracheophytes in RG observations | Proportion of RG observations in tracheophytes |
|------|-------------|------------|---------------|-----------------------------------------------|-----------------------------------------------|
| 1    | USA         | 15,359,670 | 6,023,579     | 39.2                                          | 55.1                                          |
| 2    | Canada      | 2,264,736  | 886,530       | 39.1                                          | 63.3                                          |
| 3    | Mexico      | 1,472,829  | 437,017       | 29.7                                          | 60.6                                          |
| 4    | Russia      | 1,049,298  | 704,273       | 67.1                                          | 85.2                                          |
| 5    | Australia   | 864,251    | 173,741       | 20.1                                          | 58.3                                          |
| 6    | UK          | 704,083    | 285,639       | 40.6                                          | 55.8                                          |
| 7    | South Africa| 630,269    | 360,377       | 57.2                                          | 65.6                                          |
| 8    | New Zealand | 589,106    | 311,365       | 52.9                                          | 82.6                                          |
| 9    | Italy       | 459,868    | 142,800       | 31.1                                          | 58.7                                          |
| 10   | Germany     | 455,542    | 171,487       | 37.6                                          | 69.2                                          |
|      | WORLD       | 29,184,780 | 11,091,055    | 38.0                                          | 57.4                                          |
3) CC-BY-NC (http://creativecommons.org/licenses/by-nc/4.0/) for their observations. We do this on a regular basis in the form of the project's journal posts available to every member of our community. As a result of this activity, 83.8% of all observations on iNaturalist from Russia (and as many as 85.3% in tracheophytes) are freely licensed, making Russia the leader in open-access biodiversity data on iNaturalist (Table 4).

| Rank | Country    | All groups | Proportion of observations with free licences | Tracheophytes | Proportion of observations with free licences |
|------|------------|------------|---------------------------------------------|---------------|---------------------------------------------|
| 1    | USA        | 15,566,609 | 60.1                                        | 6,568,148     | 60.0                                        |
| 2    | Canada     | 2,483,532  | 68.9                                        | 965,480       | 68.9                                        |
| 3    | Mexico     | 1,264,041  | 54.8                                        | 375,607       | 52.1                                        |
| 4    | Russia     | 1,114,574  | 83.8                                        | 705,631       | 85.3                                        |
| 5    | Australia  | 772,926    | 56.6                                        | 183,410       | 61.5                                        |
| 6    | UK         | 729,997    | 63.4                                        | 322,184       | 62.9                                        |
| 7    | South Africa | 620,335   | 63.8                                        | 335,863       | 61.2                                        |
| 8    | New Zealand| 608,534    | 74.1                                        | 285,092       | 75.6                                        |
| 9    | Germany    | 494,927    | 71.8                                        | 162,607       | 65.6                                        |
| 10   | Italy      | 387,866    | 55.0                                        | 139,812       | 57.5                                        |
|      | WORLD      | 29,540,093 | 60.8                                        | 11,797,509    | 61.1                                        |

As a result of intense expert activity and the promotion of free licensing, 73.8% of tracheophyte records from Russia have become available in the GBIF (Table 5) which is the highest proportion amongst the leading countries in iNaturalist. Since 2020, the iNaturalist dataset has become the largest source of data on the Russian biodiversity available through the GBIF.

| Rank | Country    | All groups | Proportion of GBIF records | Tracheophytes | Proportion of GBIF records |
|------|------------|------------|-----------------------------|---------------|-----------------------------|
| 1    | USA        | 10,286,645 | 39.7                         | 3,947,962     | 36.1                        |
| 2    | Canada     | 1,651,249  | 45.8                         | 638,998       | 45.6                        |
The number of observers with at least a single verifiable observation is not so high in Russia, equalling just 14K (Table 6). Nonetheless, the average productivity of the members of the community is extremely high. On average, 93 verifiable observations have been created by each observer across all groups of organisms, while, with regard to vascular plants, the number is 73 "research-grade" observations per observer, which makes the highest level of observer activity amongst the top ten countries on iNaturalist.

Russia is globally unique taking into account the active growth of data within the "Flora of Russia" project. Amongst the top ten countries on iNaturalist, Russia has achieved:

1. the highest proportion of tracheophytes amongst all observations;
2. the highest proportion of identified and verified ("research-grade") observations amongst tracheophytes;
3. the highest proportion of both free licences (CC0, CC-BY & CC-BY-NC) and GBIF records;
4. the highest number of observations per observer.

**Project description**

**Title:** "Flora of Russia" project on iNaturalist

**Personnel:** As of 13 Sep 2020, 1,736 members of iNaturalist have joined the project (see also Fig. 3). The core of the project team is formed by 129 people, who are listed simultaneously amongst the top 200 identifiers and top 500 observers of the project, including 15 project members affiliated with the Lomonosov Moscow State University. Of the 129 members, 112 confirmed their formal contribution to this data paper (see the "Author contributions" section and the "Community coverage" section for additional information). Dr. Alexey P. Seregin is the founder and an administrator of the project.
### Table 6.
Observers and their average productivity for the top ten countries on iNaturalist (as of 5 Sep 2020)

| Rank | Country      | All groups (observers with at least one verifiable observation) | Observations per observer | Tracheophytes (observers with at least one "research-grade" observation) | Observations per observer |
|------|--------------|-----------------------------------------------------------------|---------------------------|---------------------------------------------------------------------|---------------------------|
| 1    | USA          | 706,531                                                         | 37                        | 321,154                                                             | 19                        |
| 2    | Canada       | 87,559                                                          | 41                        | 40,415                                                              | 22                        |
| 3    | Mexico       | 53,150                                                          | 43                        | 19,244                                                              | 23                        |
| 4    | UK           | 49,955                                                          | 23                        | 22,228                                                              | 13                        |
| 5    | Italy        | 25,331                                                          | 28                        | 8,839                                                               | 16                        |
| 6    | Australia    | 23,679                                                          | 58                        | 7,098                                                               | 24                        |
| 7    | Germany      | 17,278                                                          | 40                        | 7,691                                                               | 22                        |
| 8    | New Zealand  | 16,535                                                          | 50                        | 7,095                                                               | 44                        |
| 9    | Russia       | 14,328                                                          | 93                        | 9,602                                                               | 73                        |
| 10   | South Africa | 11,031                                                          | 88                        | 5,466                                                               | 66                        |
|      | WORLD        | 1,282,002                                                       | 38                        | 546,182                                                             | 20                        |

**Study area description:** The project covers the territory of the Russian Federation as defined by the national legislation, i.e. including the Republic of Crimea and the City of Sevastopol claimed by Ukraine.

**Design description:** Main features of iNaturalist as a data collection platform

Any user can register as an "observer" on iNaturalist. Users may upload observations of organisms through their account using the website [https://www.inaturalist.org/](https://www.inaturalist.org/) or the free mobile applications "iNaturalist" and "Seek". A total of 1.28M observers are involved in the work of the platform, including 14.3K observers with at least one observation from Russia (Table 6).

In order to meet the minimum requirements for further scientific use, an observation needs to have: (1) a date; (2) a georeference; (3) a photograph/series of photographs or (for animals) an audio recording(s) of the object's sounds, created by the observer; (4) the organism needs to be recorded in the wild. Provided that these requirements are fulfilled, the observation is marked as "needs ID", regardless of whether the author identified the organism or not. Once an observation receives identical identifications by more than two thirds of the iNaturalist users at the level of species (in some cases of genus), it becomes "research-grade", a category for verified observations. A supporting identification by a second user makes an observation "research-grade" while identification by a single user is
not enough. Disagreeing identifications may once again exclude an observation from this category. Low-quality photos or photos of plants accurate identification of which requires a study of some micromorphological, anatomical or genetic traits usually do not reach the "research grade" or, in the latter cases, remain identified and verified only at the level of genus.

The observers may choose a licence allowing further re-use of the data. Observations licensed with three Creative Commons Licences (CC0, CC-BY, CC-BY-NC) and of "research-grade" quality are automatically exported to the GBIF. As of 5 Sep 2020, the iNaturalist database contained 48.6M observations that have met the minimum quality requirements (Table 1), of which 29.2M have achieved "research-grade" (Table 3). Unfortunately, only 19.7M observations have been exported to the GBIF due to copyright restrictions (Table 5).

The implementation of artificial intelligence (AI) for identification is a key feature of iNaturalist (Van Horn et al. 2018, Cui et al. 2018). It gives the users a suggestion about the most similar species after analysing the photos ("visually similar") and taking into account the geographical distribution of other records ("seen nearby"). Initially, the portal's AI compared the newly-uploaded photos with a basic set of images, which, in 2017, comprised 859,000 photos of more than 5,000 species. The images of varying quality had been collected using different types of cameras, but their identifications have been double-checked. Primary results showed that modern AI methods, at that time, gave an accurate identification for 67% of observations, which well illustrates the complexity of the dataset (Van Horn et al. 2018). In 2018, most images of plants and animals from any part of the world were likely to receive from the system an identification of species inhabiting North America. Over the course of 2019 and 2020, AI has almost stopped suggesting incorrect identifications for plants within European Russia (Seregin et al. 2020). It still works somewhat worse with photos from Asian Russia and the Caucasus. Millions of new photos reviewed by the expert community and constantly added to the library of standard images allow AI to improve the performance. Its capabilities are, however, still inferior to expert assessments with regard to certain groups of organisms or certain geographic territories. Nevertheless, the system's general awareness of the world flora is many times larger than that of an individual botanist. In many ways, this particular feature of iNaturalist attracts both amateurs and professionals. The success of iNaturalist has made possible the further use of AI for species recognition by photograph for millions of images in the GBIF database (Robertson et al. 2019).

**Portal on the flora of Russia**

To collect data on the plant distribution in the City of Moscow, the Moscow University team initially organised the "Flora of Moscow" project on iNaturalist on 29 Dec 2018. An immediate positive feedback from users and a surge of interest forced us to create 85 more regional projects with a uniform ideology in early January 2019 and organise them as part of the "Flora of Russia" umbrella project. Each regional portal automatically includes observations of vascular plants uploaded on iNaturalist which have achieved "research-
grade" and found within the administrative boundaries of a specific federal territory. The home page of each regional portal displays its statistics and basic information.

The "Flora of Russia" homepage (Fig. 4) includes a "scoreboard" with a ranking of regional projects (ordered by the number of observations, species and observers), basic statistics, a list of the latest observations, news from the project journal and a general map of all data. There are links leading to the project description, the project journal, the rankings of the top observers (ordered by the number of observations and species), top identifiers, most often recorded species and detailed statistical reports. Thus, both regional projects and the all-Russian portal are organised in the form of ranking tables, stimulating both individual and team activity of observers in accordance with the gamification paradigm (Bowser et al. 2013).

The experts (most of whom are the authors of this paper) review the unverified and unnamed observations to suggest the correct name which may either confirm or disprove the opinion of the observer. Typically, most clear photographs from European Russia and the Russian Far East are identified within a couple days after uploading.

Funding: The project is functioning on a voluntary basis. Although being created in the Lomonosov Moscow State University, it does not have formal institutional funding. Members of the project search for their own budget for field trips and online activity. Some grants of the co-authors are acknowledged in this paper.
Sampling methods

**Sampling description:** The standard procedure of sampling is described on iNaturalist in the form of 17 paragraphs in the "Observations" section of the help page (last revised 8 Sep 2020 by Sam Kieschnick).

**Quality control:** Data quality control is necessary for maintaining a high quality of records within a dataset. In the "Flora of Russia" project description, there is a well-structured, detailed and constantly improving section with recommendations for users in Russian. Apart from the general information (including short videos about iNaturalist and a description of available research tools of the portal), there are two particularly important sections, i.e. "Recommendations for new users" and "Recommendations for event curators". Both sections provide detailed instructions for the user on what, how and where to create a good-quality observation on iNaturalist. However, many users are not familiar with these guidelines. This imposes a certain responsibility on the identifiers and the project curators, who act as data stewards. The most important and/or frequently occurring issues are listed below.

For each project on iNaturalist, at least one or two curators should be assigned to review the uploaded observations and make comments, if necessary. The most frequent mistakes are:

1. low-quality or wrong-angle photos,
2. observations of cultivated plants without a relevant indication,
3. either unintentional or intentional duplication of the same observation,
4. unintentional merging of numerous observations into a single one,
5. lack of date or location of an observation,
6. lack of any original identification (at least a coarse one),
7. upload of copyright media.

In some cases, an inaccurate location for an observation shows up automatically, caused by specific GPS settings on the smartphone or camera. We report these issues to observers for further manual correction or mark such observations as "location is not accurate". We highly recommend georeferencing using the "GPS only" mode instead of either "GPS plus mobile networks" and "mobile networks only". The latter two options may shift the observation's georeference to the nearest mobile tower instead of the actual observer's location. Additionally, all records with positional accuracy exceeding 50,000 m were marked as having inaccurate location on 25 Sep 2020 and reported to users in the project journal post. Suspicious positional accuracy of 0, 1 or 2 metres recorded in thousands of observations is an artifact set up automatically during the uploading of observations by the devices.

Another difficult and common problem is the separation of cultivated plants from garden escapes (naturalised or casual). Cultivated plants may be well recognisable and could reach "research grade" rapidly. We ask experts and project curators to double-check "research-grade" observations to detect plants growing only in cultivation.
A well-designed and useful feature in iNaturalist is the possibility to call for attention of a specific user using the "@" prefix (for example, @krestov). This is very important for maintaining the appropriate quality as experts may respond and help in identification.

Undoubtedly, the data quality depends on the quality of the uploaded photographs and field experience of the users. We ask project curators to post links to regional checklists, field guides and illustrated atlases for interested naturalists in the project description.

Constant quality control is especially important during various events such as bioblitzes or mandatory student practices. As their numerous participants mostly lack experience in collecting biodiversity data through iNaturalist, the work of curators and teachers should be constant during the whole period of these events.

**Geographic coverage**

**Description**: Russia is a large country with an area of over 17 million km$^2$ and an unevenly distributed human population. For instance, in Chukotka, the population density is only 0.07 people per 1 km$^2$, whereas in the City of Moscow, it is 4,925 people per 1 km$^2$ (Table 7). The geographic coverage of the dataset is characterised by significant spatial disparities in the presented data for all indexes, including the number of observations, species and observers (Fig. 5).

| Regional project                          | Area (area) | Rank (area) | Proportion in Russia’s area | Population (population) | Rank (population) | Proportion in Russia’s population | Population density | Rank (population density) |
|-------------------------------------------|-------------|-------------|----------------------------|-------------------------|-------------------|---------------------------------|--------------------|---------------------------|
| Flora of Yakutia                          | 3,083,523   | 1           | 18.01                      | 967,009                 | 56                | 0.66                            | 0.31               | 82                        |
| Krasnoyarsk Krai Flora                    | 2,366,797   | 2           | 13.82                      | 2,874,026               | 13                | 1.96                            | 1.21               | 79                        |
| Khabarovsk Krai Flora                     | 787,633     | 3           | 4.6                        | 1,321,473               | 35                | 0.9                             | 1.68               | 78                        |
| Irkutsk Oblast Flora                      | 774,846     | 4           | 4.52                       | 2,397,763               | 20                | 1.63                            | 3.09               | 70                        |
| Flora of Yamalo-Nenets Autonomous Okrug   | 769,250     | 5           | 4.49                       | 541,479                 | 71                | 0.37                            | 0.7                | 80                        |

Table 7. Human population and area of the regions of Russia (official data)
| Regional project                                      | Area  | Rank (area) | Proportion in Russia's area | Population | Rank (population) | Proportion in Russia's population | Population density | Rank (population density) |
|------------------------------------------------------|-------|-------------|-----------------------------|------------|-------------------|-----------------------------------|-------------------|---------------------------|
| Flora of Chukotka                                   | 721,481 | 6           | 4.21                        | 49,663     | 84                | 0.03                              | 0.07              | 85                        |
| Flora of Khanty-Mansi Autonomous Okrug               | 534,801 | 7           | 3.12                        | 1,663,795  | 28                | 1.13                              | 3.11              | 69                        |
| Kamchatka Flora                                     | 464,275 | 8           | 2.71                        | 314,723    | 79                | 0.21                              | 0.68              | 81                        |
| Magadan Oblast Flora                                | 462,464 | 9           | 2.7                         | 141,234    | 83                | 0.1                               | 0.31              | 83                        |
| Zabaykalsky Krai Flora                              | 431,892 | 10          | 2.52                        | 1,065,785  | 49                | 0.73                              | 2.47              | 73                        |
| Komi Republic Flora                                 | 416,774 | 11          | 2.43                        | 830,235    | 60                | 0.57                              | 1.99              | 76                        |
| Arkhangelsk Oblast Flora                            | 413,103 | 12          | 2.41                        | 1,100,290  | 47                | 0.75                              | 2.66              | 72                        |
| Amur Oblast Flora                                   | 361,908 | 13          | 2.11                        | 793,194    | 62                | 0.54                              | 2.19              | 75                        |
| Buryat Republic Flora                               | 351,334 | 14          | 2.05                        | 983,273    | 55                | 0.67                              | 2.8               | 71                        |
| Tomsk Oblast Flora                                  | 314,391 | 15          | 1.84                        | 1,077,442  | 48                | 0.73                              | 3.43              | 67                        |
| Sverdlovsk Oblast Flora                             | 194,307 | 16          | 1.13                        | 4,315,699  | 5                 | 2.94                              | 22.21             | 43                        |
| Flora of Karelia                                    | 180,520 | 17          | 1.05                        | 618,056    | 69                | 0.42                              | 3.42              | 68                        |
| Novosibirsk Oblast Flora                            | 177,756 | 18          | 1.04                        | 2,793,384  | 15                | 1.9                               | 15.71             | 50                        |
| Flora of Nenets Autonomous Okrug                    | 176,810 | 19          | 1.03                        | 43,829     | 85                | 0.03                              | 0.25              | 84                        |
| Regional project | Area (area) | Rank (area) | Proportion in Russia's area | Population | Rank (population) | Proportion in Russia's population | Population density | Rank (population density) |
|------------------|------------|------------|-----------------------------|------------|------------------|-----------------------------------|-------------------|--------------------------|
| Tyva Republic Flora | 168,804 | 20         | 0.98                        | 324,423    | 78               | 0.22                              | 1.92              | 77                       |
| Altai Krai Flora  | 167,996   | 21         | 0.98                        | 2,332,813  | 21               | 1.59                              | 13.89             | 52                       |
| Primorsky Krai Flora | 164,673  | 22         | 0.96                        | 1,902,718  | 26               | 1.3                               | 11.55             | 55                       |
| Perm Krai Flora   | 160,236   | 23         | 0.94                        | 2,610,800  | 17               | 1.78                              | 16.29             | 48                       |
| Tyumen Oblast Flora | 160,122  | 24         | 0.94                        | 1,518,695  | 30               | 1.03                              | 9.48              | 60                       |
| Murmansk Oblast Flora | 144,902 | 25         | 0.85                        | 748,056    | 63               | 0.51                              | 5.16              | 64                       |
| Vologda Oblast Flora | 144,527  | 26         | 0.84                        | 1,167,713  | 43               | 0.8                               | 8.08              | 62                       |
| Bashkortostan Flora | 142,947  | 27         | 0.83                        | 4,051,005  | 7                | 2.76                              | 28.34             | 39                       |
| Omsk Oblast Flora | 141,140   | 28         | 0.82                        | 1,944,195  | 24               | 1.32                              | 13.77             | 53                       |
| Orenburg Oblast Flora | 123,702  | 29         | 0.72                        | 1,963,007  | 23               | 1.34                              | 15.87             | 49                       |
| Kirov Oblast Flora | 120,374   | 30         | 0.7                         | 1,272,109  | 37               | 0.87                              | 10.57             | 59                       |
| Volgograd Oblast Flora | 112,877  | 31         | 0.66                        | 2,507,509  | 18               | 1.71                              | 22.21             | 44                       |
| Saratov Oblast Flora | 101,240  | 32         | 0.59                        | 2,440,815  | 19               | 1.66                              | 24.11             | 42                       |
| Rostov Oblast Flora | 100,967   | 33         | 0.59                        | 4,202,320  | 6                | 2.86                              | 41.62             | 25                       |
| Kemerovo Oblast Flora | 95,725   | 34         | 0.56                        | 2,674,256  | 16               | 1.82                              | 27.94             | 41                       |
| Altai Republic Flora | 92,903   | 35         | 0.54                        | 218,866    | 81               | 0.15                              | 2.36              | 74                       |
| Regional project               | Area  | Rank (area) | Proportion in Russia's area | Population | Rank (population) | Proportion in Russia's population | Population density | Rank (population density) |
|-------------------------------|-------|-------------|----------------------------|------------|-------------------|----------------------------------|--------------------|----------------------------|
| Chelyabinsk Oblast Flora      | 88,529| 36          | 0.52                       | 3,475,753  | 9                 | 2.37                             | 39.26              | 26                         |
| Sakhalin Oblast Flora         | 87,101| 37          | 0.51                       | 489,638    | 74                | 0.33                             | 5.62               | 63                         |
| Tver Oblast Flora             | 84,201| 38          | 0.49                       | 1,269,636  | 38                | 0.86                             | 15.08              | 51                         |
| Leningrad Oblast Flora        | 83,908| 39          | 0.49                       | 1,847,867  | 27                | 1.26                             | 22.02              | 45                         |
| Nizhny Novgorod Oblast Flora  | 76,624| 40          | 0.45                       | 3,214,623  | 10                | 2.19                             | 41.95              | 24                         |
| Flora of Kalmykia             | 75,485| 41          | 0.44                       | 5,648,235  | 3                 | 3.85                             | 74.83              | 8                          |
| Kurgan Oblast Flora           | 74,731| 42          | 0.44                       | 272,647    | 80                | 0.19                             | 3.65               | 66                         |
| Kostroma Oblast Flora         | 71,488| 43          | 0.42                       | 834,701    | 59                | 0.57                             | 11.68              | 54                         |
| Tatarstan Flora               | 67,847| 44          | 0.4                        | 3,898,628  | 8                 | 2.66                             | 57.46              | 17                         |
| Stavropol Krai Flora          | 66,160| 45          | 0.39                       | 2,795,243  | 14                | 1.9                              | 42.25              | 23                         |
| Flora of Khakassia            | 61,569| 46          | 0.36                       | 536,167    | 72                | 0.37                             | 8.71               | 61                         |
| Kostroma Oblast Flora         | 60,211| 47          | 0.35                       | 637,267    | 67                | 0.43                             | 10.58              | 58                         |
| Pskov Oblast Flora            | 55,399| 48          | 0.32                       | 629,651    | 68                | 0.43                             | 11.37              | 56                         |
| Novgorod Oblast Flora         | 54,501| 49          | 0.32                       | 600,296    | 70                | 0.41                             | 11.01              | 57                         |
| Samara Oblast Flora           | 53,565| 50          | 0.31                       | 3,183,038  | 11                | 2.17                             | 59.42              | 14                         |
| Voronezh Oblast Flora         | 52,216| 51          | 0.3                        | 2,327,821  | 22                | 1.59                             | 44.58              | 22                         |
| Regional project                      | Area    | Rank (area) | Proportion in Russia's area | Population Rank (population) | Proportion in Russia's population | Population density Rank (population density) |
|--------------------------------------|---------|-------------|----------------------------|-------------------------------|----------------------------------|---------------------------------------------|
| Dagestan Flora                       | 50,270  | 52          | 0.29                       | 12                            | 2.1                              | 61.39                                       |
| Smolensk Oblast Flora                | 49,779  | 53          | 0.29                       | 57                            | 0.64                             | 18.93                                       |
| Astrakhan Oblast Flora               | 49,024  | 54          | 0.29                       | 51                            | 0.69                             | 20.69                                       |
| Moscow Oblast Flora                  | 44,329  | 55          | 0.26                       | 2                             | 5.18                             | 171.44                                      |
| Penza Oblast Flora                   | 43,352  | 56          | 0.25                       | 36                            | 0.9                              | 30.4                                        |
| Udmurt Republic Flora                | 42,061  | 57          | 0.25                       | 31                            | 1.03                             | 35.84                                       |
| Ryazan Oblast Flora                  | 39,605  | 58          | 0.23                       | 45                            | 0.76                             | 28.13                                       |
| Ulyanovsk Oblast Flora               | 37,181  | 59          | 0.22                       | 40                            | 0.84                             | 33.31                                       |
| Flora of Jewish Autonomous Oblast    | 36,271  | 60          | 0.21                       | 82                            | 0.11                             | 4.41                                        |
| Yaroslavl Oblast Flora               | 36,177  | 61          | 0.21                       | 39                            | 0.86                             | 34.82                                       |
| Bryansk Oblast Flora                 | 34,857  | 62          | 0.2                        | 42                            | 0.82                             | 34.43                                       |
| Tambov Oblast Flora                  | 34,462  | 63          | 0.2                        | 50                            | 0.69                             | 29.48                                       |
| Kursk Oblast Flora                   | 29,997  | 64          | 0.18                       | 46                            | 0.75                             | 36.9                                        |
| Kaluga Oblast Flora                  | 29,777  | 65          | 0.17                       | 52                            | 0.69                             | 33.9                                        |
| Vladimir Oblast Flora                | 29,084  | 66          | 0.17                       | 34                            | 0.93                             | 46.96                                       |
| Regional project                  | Area  | Rank (area) | Proportion in Russia's area | Population | Rank (population) | Proportion in Russia's population | Population density | Rank (population density) |
|----------------------------------|-------|-------------|----------------------------|------------|-------------------|----------------------------------|-------------------|---------------------------|
| Belgorod Oblast Flora            | 27,134| 67          | 0.16                       | 1,547,418  | 29                | 1.05                             | 57.03             | 18                        |
| Flora of Mordovia                | 26,128| 68          | 0.15                       | 795,504    | 61                | 0.54                             | 30.45             | 34                        |
| Flora of the Crimea              | 26,081| 69          | 0.15                       | 1,911,818  | 25                | 1.3                              | 73.3              | 9                         |
| Tula Oblast Flora                | 25,679| 70          | 0.15                       | 1,478,818  | 32                | 1.01                             | 57.59             | 16                        |
| Oryol Oblast Flora               | 24,652| 71          | 0.14                       | 739,467    | 64                | 0.5                              | 30                | 36                        |
| Lipetsk Oblast Flora             | 24,047| 72          | 0.14                       | 1,144,035  | 44                | 0.78                             | 47.57             | 19                        |
| Mari El Flora                    | 23,375| 73          | 0.14                       | 680,380    | 66                | 0.46                             | 29.11             | 38                        |
| Ivanovo Oblast Flora             | 21,437| 74          | 0.13                       | 1,004,180  | 53                | 0.68                             | 46.84             | 21                        |
| Chuvash Republic Flora           | 18,343| 75          | 0.11                       | 1,223,395  | 41                | 0.83                             | 66.7              | 11                        |
| Chechen Republic Flora           | 15,647| 76          | 0.09                       | 1,456,951  | 33                | 0.99                             | 93.11             | 6                         |
| Kaliningrad Oblast Flora         | 15,125| 77          | 0.09                       | 1,002,187  | 54                | 0.68                             | 66.26             | 12                        |
| Flora of Karachay-Cherkessia     | 14,277| 78          | 0.08                       | 465,563    | 75                | 0.32                             | 32.61             | 33                        |
| Flora of Kabardino-Balkaria      | 12,470| 79          | 0.07                       | 866,219    | 58                | 0.59                             | 69.45             | 10                        |
| Flora of North Ossetia           | 7,987 | 80          | 0.05                       | 699,253    | 65                | 0.48                             | 87.55             | 7                         |
| Flora of Adygea                  | 7,792 | 81          | 0.05                       | 454,744    | 76                | 0.31                             | 58.36             | 15                        |
Regional project | Area | Rank (area) | Proportion in Russia's area | Population | Rank (population) | Proportion in Russia's population | Population density | Rank (population density)
--- | --- | --- | --- | --- | --- | --- | --- | ---
Flora of Ingushetia | 3,628 | 82 | 0.02 | 497,393 | 73 | 0.34 | 137.1 | 5
Flora of Moscow | 2,561 | 83 | 0.01 | 12,615,279 | 1 | 8.59 | 4,925.92 | 1
St Petersburg Flora | 1,403 | 84 | 0.01 | 5,383,890 | 4 | 3.67 | 3,837.41 | 2
Sevastopol Flora | 864 | 85 | 0.01 | 443,212 | 77 | 0.3 | 512.98 | 3

**Figure 5.** A map of 750K observations from the "Flora of Russia" project showing an extreme disproportion in data coverage (source: iNaturalist.org).

**Number of observations.** The key index of the "Flora of Russia" project is the number of uploaded observations (Fig. 1). The project reached **750,000 observations** of "research-grade" quality on **7 Sep 2020**, whereas ca. 135,000 unverified observations make the project's backlog, which is not included in the dataset. The stable snapshot of the dataset produced on 8 Sep 2020 contains 750,143 records (see "Data resources" section).

The City of Moscow topped the project by the number of observations from 18 Aug 2019 to 15 Jun 2020, when Moscow Oblast, the region with the largest community of observers, took the lead (Table 8). Other regions of Central Russia - Bryansk, Tula, Nizhny Novgorod and Kursk Oblasts - hold the third to sixth places in the ranking.
| Regional project               | Observations | Rank (observations) | Per 1K capita | Rank (per 1K capita) | Per 1,000 km² | Rank (per 1,000 km²) | Per recorded species | Rank (per recorded species) |
|-------------------------------|--------------|---------------------|---------------|----------------------|---------------|----------------------|----------------------|--------------------------|
| Moscow Oblast Flora           | 73,271       | 1                   | 9.64          | 14                   | 1,652.9       | 4                    | 65.1                 | 1                        |
| Flora of Moscow               | 66,227       | 2                   | 5.25          | 29                   | 25,859.8      | 1                    | 60.9                 | 2                        |
| Bryansk Oblast Flora          | 34,913       | 3                   | 29.09         | 3                    | 1,001.6       | 7                    | 31.1                 | 3                        |
| Tula Oblast Flora             | 27,456       | 4                   | 18.57         | 8                    | 1,069.2       | 5                    | 29.0                 | 4                        |
| Nizhny Novgorod Oblast Flora  | 26,667       | 5                   | 8.30          | 17                   | 348.0         | 14                   | 26.5                 | 5                        |
| Kursk Oblast Flora            | 26,340       | 6                   | 23.79         | 4                    | 878.1         | 8                    | 22.8                 | 8                        |
| Novosibirsk Oblast Flora     | 22,914       | 7                   | 8.20          | 18                   | 128.9         | 24                   | 24.4                 | 7                        |
| Sevastopol Flora              | 21,986       | 8                   | 49.61         | 1                    | 25,446.8      | 2                    | 16.0                 | 19                       |
| Altai Krai Flora              | 21,283       | 9                   | 9.12          | 15                   | 126.7         | 26                   | 18.3                 | 12                       |
| Omsk Oblast Flora             | 19,749       | 10                  | 10.16         | 13                   | 139.9         | 23                   | 25.4                 | 6                        |
| Irkutsk Oblast Flora          | 19,658       | 11                  | 8.20          | 19                   | 25.4          | 56                   | 18.1                 | 13                       |
| Sverdlovsk Oblast Flora       | 18,595       | 12                  | 4.31          | 34                   | 95.7          | 34                   | 17.0                 | 15                       |
| Chuvash Republic Flora        | 18,502       | 13                  | 15.12         | 10                   | 1,008.7       | 6                    | 22.4                 | 9                        |
| Tatarstan Flora               | 17,725       | 14                  | 4.55          | 32                   | 261.2         | 16                   | 17.0                 | 14                       |
| Voronezh Oblast Flora         | 17,401       | 15                  | 7.48          | 22                   | 333.3         | 15                   | 15.4                 | 20                       |
| Flora of Mordovia             | 16,654       | 16                  | 20.94         | 5                    | 637.4         | 9                    | 19.7                 | 10                       |
| Flora of the Crimea           | 16,562       | 17                  | 8.66          | 16                   | 635.0         | 10                   | 10.5                 | 31                       |
| Bashkortostan Flora           | 16,023       | 18                  | 3.96          | 38                   | 112.1         | 32                   | 16.5                 | 17                       |
| Regional project                        | Observations | Rank (observations) | Per 1K capita | Rank (per 1K capita) | Per 1,000 km² | Rank (per 1,000 km²) | Per recorded species | Rank (per recorded species) |
|-----------------------------------------|--------------|---------------------|---------------|----------------------|--------------|----------------------|----------------------|------------------------|
| Yaroslavl Oblast Flora                  | 15,091       | 19                  | 11.98         | 11                   | 417.1        | 13                   | 18.4                 | 11                     |
| Vladimir Oblast Flora                   | 14,529       | 20                  | 10.64         | 12                   | 499.6        | 12                   | 17.0                 | 16                     |
| Kamchatka Flora                         | 13,975       | 21                  | 44.40         | 2                    | 30.1         | 53                   | 16.3                 | 18                     |
| Kostroma Oblast Flora                   | 12,728       | 22                  | 19.97         | 6                    | 211.4        | 19                   | 15.0                 | 21                     |
| Chelyabinsk Oblast Flora                | 10,214       | 23                  | 2.94          | 45                   | 115.4        | 29                   | 14.2                 | 23                     |
| Leningrad Oblast Flora                  | 9,860        | 24                  | 5.34          | 28                   | 117.5        | 28                   | 13.7                 | 24                     |
| Tver Oblast Flora                       | 9,607        | 25                  | 7.57          | 21                   | 114.1        | 30                   | 12.7                 | 26                     |
| St Petersburg Flora                     | 9,164        | 26                  | 1.70          | 60                   | 6,531.7      | 3                    | 14.7                 | 22                     |
| Krasnodar Krai Flora                    | 8,546        | 27                  | 1.51          | 64                   | 113.2        | 31                   | 6.7                  | 40                     |
| Samara Oblast Flora                     | 8,520        | 28                  | 2.68          | 48                   | 159.1        | 21                   | 11.1                 | 29                     |
| Krasnoyarsk Krai Flora                  | 8,395        | 29                  | 2.92          | 46                   | 3.5          | 74                   | 7.7                  | 37                     |
| Flora of Khanty-Mansi Autonomous Okrug  | 8,031        | 30                  | 4.83          | 30                   | 15.0         | 65                   | 13.2                 | 25                     |
| Primorsky Krai Flora                    | 7,792        | 31                  | 4.10          | 36                   | 47.3         | 40                   | 5.4                  | 44                     |
| Kaliningrad Oblast Flora                | 7,700        | 32                  | 7.68          | 20                   | 509.1        | 11                   | 11.2                 | 27                     |
| Dagestan Flora                          | 7,588        | 33                  | 2.46          | 51                   | 150.9        | 22                   | 3.9                  | 58                     |
| Kaluga Oblast Flora                     | 7,404        | 34                  | 7.34          | 23                   | 248.6        | 17                   | 10.9                 | 30                     |
| Tyumen Oblast Flora                     | 7,002        | 35                  | 4.61          | 31                   | 43.7         | 42                   | 11.2                 | 28                     |
| Regional project          | Observations | Rank (observations) | Per 1K capita | Rank (per 1K capita) | Per 1,000 km² | Rank (per 1,000 km²) | Per recorded species | Rank (per recorded species) |
|---------------------------|--------------|---------------------|--------------|----------------------|--------------|----------------------|----------------------|--------------------------|
| Belgorod Oblast Flora     | 6,271        | 36                  | 4.05         | 37                   | 231.1        | 18                   | 8.1                  | 34                       |
| Perm Krai Flora           | 5,832        | 37                  | 2.23         | 53                   | 36.4         | 47                   | 8.5                  | 32                       |
| Tomsk Oblast Flora        | 5,762        | 38                  | 5.35         | 27                   | 18.3         | 61                   | 7.7                  | 35                       |
| Kirov Oblast Flora        | 5,278        | 39                  | 4.15         | 35                   | 43.8         | 41                   | 8.4                  | 33                       |
| Udmurt Republic Flora     | 4,025        | 40                  | 2.67         | 49                   | 95.7         | 35                   | 6.9                  | 39                       |
| Buryat Republic Flora     | 3,644        | 41                  | 3.71         | 40                   | 10.4         | 68                   | 4.3                  | 52                       |
| Altai Republic Flora      | 3,571        | 42                  | 16.32        | 9                    | 38.4         | 45                   | 4.6                  | 50                       |
| Flora of Karelia          | 3,517        | 43                  | 5.69         | 25                   | 19.5         | 59                   | 7.7                  | 36                       |
| Volgograd Oblast Flora    | 3,512        | 44                  | 1.40         | 65                   | 31.1         | 51                   | 4.7                  | 49                       |
| Murmansk Oblast Flora     | 3,370        | 45                  | 4.51         | 33                   | 23.3         | 57                   | 7.1                  | 38                       |
| Saratov Oblast Flora      | 3,358        | 46                  | 1.38         | 66                   | 33.2         | 50                   | 5.7                  | 42                       |
| Ryazan Oblast Flora       | 3,319        | 47                  | 2.98         | 44                   | 83.8         | 36                   | 5.8                  | 41                       |
| Kemerovo Oblast Flora     | 3,305        | 48                  | 1.24         | 67                   | 34.5         | 48                   | 5.0                  | 45                       |
| Sakhalin Oblast Flora     | 3,198        | 49                  | 6.53         | 24                   | 36.7         | 46                   | 4.2                  | 54                       |
| Lipetsk Oblast Flora      | 3,087        | 50                  | 2.70         | 47                   | 128.4        | 25                   | 5.6                  | 43                       |
| Rostov Oblast Flora       | 2,920        | 51                  | 0.69         | 73                   | 28.9         | 54                   | 3.7                  | 59                       |
| Arkhangelsk Oblast Flora  | 2,822        | 52                  | 2.56         | 50                   | 6.8          | 73                   | 4.0                  | 57                       |
| Flora of Karachay-Cherkessia | 2,642      | 53                  | 5.67         | 26                   | 185.1        | 20                   | 3.6                  | 60                       |
| Regional project                  | Observations | Rank (observations) | Per 1K capita | Rank (per 1K capita) | Per 1,000 km² | Rank (per 1,000 km²) | Per recorded species | Rank (per recorded species) |
|----------------------------------|--------------|---------------------|---------------|----------------------|---------------|---------------------|----------------------|------------------------|
| Amur Oblast Flora               | 2,601        | 54                  | 3.28          | 42                   | 7.2           | 72                  | 3.5                  | 63                     |
| Ulyanovsk Oblast Flora          | 2,415        | 55                  | 1.95          | 57                   | 65.0          | 37                  | 4.8                  | 46                     |
| Pskov Oblast Flora              | 2,398        | 56                  | 3.81          | 39                   | 43.3          | 43                  | 4.2                  | 53                     |
| Ivanovo Oblast Flora            | 2,131        | 57                  | 2.12          | 54                   | 99.4          | 33                  | 4.7                  | 48                     |
| Penza Oblast Flora              | 2,067        | 58                  | 1.57          | 62                   | 47.7          | 39                  | 3.6                  | 61                     |
| Kurgan Oblast Flora             | 1,970        | 59                  | 2.36          | 52                   | 27.6          | 55                  | 4.6                  | 51                     |
| Flora of Yamalo-Nenets Autonomous Okrug | 1,944        | 60                  | 3.59          | 41                   | 2.5           | 76                  | 4.7                  | 47                     |
| Vologda Oblast Flora            | 1,943        | 61                  | 1.66          | 61                   | 13.4          | 66                  | 4.1                  | 56                     |
| Novgorod Oblast Flora           | 1,832        | 62                  | 3.05          | 43                   | 33.6          | 49                  | 4.1                  | 55                     |
| Mari El Flora                   | 1,207        | 63                  | 1.77          | 59                   | 51.6          | 38                  | 2.7                  | 67                     |
| Orenburg Oblast Flora           | 1,179        | 64                  | 0.60          | 76                   | 9.5           | 69                  | 2.7                  | 66                     |
| Stavropol Krai Flora            | 1,149        | 65                  | 0.41          | 81                   | 17.4          | 62                  | 2.6                  | 68                     |
| Flora of Khakassia              | 1,135        | 66                  | 2.12          | 56                   | 18.4          | 60                  | 2.8                  | 65                     |
| Tambov Oblast Flora             | 1,069        | 67                  | 1.05          | 68                   | 31.0          | 52                  | 3.6                  | 62                     |
| Zabaykalsky Krai Flora          | 1,024        | 68                  | 0.96          | 69                   | 2.4           | 77                  | 2.3                  | 72                     |
| Flora of Adygea                 | 965          | 69                  | 2.12          | 55                   | 123.8         | 27                  | 2.1                  | 74                     |
| Flora of Chukotka               | 928          | 70                  | 18.69         | 7                    | 1.3           | 79                  | 3.3                  | 64                     |
| Smolensk Oblast Flora           | 856          | 71                  | 0.91          | 70                   | 17.2          | 63                  | 2.5                  | 70                     |
| Regional project                      | Observations | Rank (observations) | Per 1K capita | Rank (per 1K capita) | Per 1,000 km² | Rank (per 1,000 km²) | Per recorded species | Rank (per recorded species) |
|--------------------------------------|--------------|---------------------|---------------|----------------------|---------------|---------------------|----------------------|--------------------------|
| Komi Republic Flora                  | 739          | 72                  | 0.89          | 71                   | 1.8           | 78                  | 2.4                  | 71                       |
| Khabarovsk Krai Flora                | 609          | 73                  | 0.46          | 79                   | 0.8           | 81                  | 2.0                  | 75                       |
| Oryol Oblast Flora                   | 570          | 74                  | 0.77          | 72                   | 23.1          | 58                  | 2.2                  | 73                       |
| Flora of Yakutia                     | 525          | 75                  | 0.54          | 78                   | 0.2           | 85                  | 1.7                  | 78                       |
| Flora of Kabardino-Balkaria          | 487          | 76                  | 0.56          | 77                   | 39.1          | 44                  | 1.8                  | 77                       |
| Astrakhan Oblast Flora               | 467          | 77                  | 0.46          | 80                   | 9.5           | 70                  | 2.5                  | 69                       |
| Magadan Oblast Flora                 | 221          | 78                  | 1.56          | 63                   | 0.5           | 83                  | 1.9                  | 76                       |
| Tyva Republic Flora                  | 205          | 79                  | 0.63          | 75                   | 1.2           | 80                  | 1.3                  | 83                       |
| Chechen Republic Flora               | 175          | 80                  | 0.12          | 84                   | 11.2          | 67                  | 1.3                  | 82                       |
| Flora of North Ossetia               | 128          | 81                  | 0.18          | 82                   | 16.0          | 64                  | 1.2                  | 84                       |
| Flora of Jewish Autonomous Oblast    | 110          | 82                  | 0.69          | 74                   | 3.0           | 75                  | 1.6                  | 80                       |
| Flora of Nenets Autonomous Okrug     | 81           | 83                  | 1.85          | 58                   | 0.5           | 84                  | 1.5                  | 81                       |
| Flora of Kalmykia                    | 48           | 84                  | 0.18          | 83                   | 0.6           | 82                  | 1.6                  | 79                       |
| Flora of Ingushetia                  | 32           | 85                  | 0.06          | 85                   | 8.8           | 71                  | 1.0                  | 85                       |

The top 10 regional projects contribute 45.4% of observations of the entire project and this proportion is constantly decreasing due to the growth of the communities in other regions. For instance, the proportion of observations made in the top ten regions was 55.5% on 9 Jan 2020. However, the disproportion in the spatial coverage is obvious even within the leading regions (Fig. 6).
Less than 500 observations have been made within each of the four regions of the Caucasian biodiversity hotspot (Kabardino-Balkaria, Chechen Republic, North Ossetia, Ingushetia), desert regions (Astrakhan Oblast, Kalmykia), as well as in Magadan Oblast, Tyva Republic, Jewish Autonomous Oblast and Nenets Autonomous Okrug.

**Observations per capita.** If we normalise the number of observations per 1,000 inhabitants, it turns out that the two most active communities are in the City of Sevastopol and Kamchatka, followed by Bryansk Oblast, Kursk Oblast, Mordovia, Kostroma Oblast and, unexpectedly, Chukotka, a vast region with a very small population. In general, this index best reflects both the involvement of the local residents in the "Flora of Russia" project and the activity of this particular region's community.
Observation density. Spatial sampling is best characterised by the density of observations per a standard area (for example, per 1,000 km$^2$). The three federal cities are far ahead: Moscow (26K observations), Sevastopol (25K) and St. Petersburg (7K), here, a large urban population is concentrated on a small area. Federal cities are followed by four regions of Central Russia with a relatively small area and active local iNaturalist communities, i.e. Moscow Oblast, Tula Oblast, Chuvashia and Bryansk Oblast.

Observations per recorded species. The number of observations per recorded species is the integrated index which best characterises both the data density and species representation. The gradual accumulation of observations leads to consequent revealing of all known species or, at least, of regularly observed plants. When recording a new species becomes a rare event and an active community still posts many new photos, the average number of observations per species begins to grow rapidly. According to this index, the leaders are Moscow Oblast (65), City of Moscow (61), Bryansk Oblast (31), Tula Oblast (29), Nizhny Novgorod Oblast (27) and Omsk Oblast (25). Regions with rich floras (for example, montainous areas) outperform the relatively-poor plains because more observations need to be made there to record numerous rare species.

Coordinates: 41 and 82 Latitude; 19.5 and -169 Longitude.

Taxonomic coverage

Description: As of 7 Sep 2020, the "Flora of Russia" project included observations of 6,857 species of vascular plants (Fig. 2). Plants of the World Online (POWO) serves as a taxonomic backbone for tracheophytes on iNaturalist. There are some tools used for automatic, semi-automatic and manual addition of new taxa and modification of the taxonomic information. Reasonable deviations from POWO could be accepted on iNaturalist by the curators after community discussions. The taxonomic opinion of an observer, if necessary, may be recorded in the description section of an individual observation.

Unfortunately, Russia lacks both a modern checklist of vascular plants and a standard flora. Therefore, we could assume that the project covers ca. 55% of the Russian plant diversity out of 12,500 species estimated by Kamelin (2007). That is quite a satisfactory figure since the Russian flora includes many species which require collection and proper identification of herbarium specimens (Hieracium, Alchemilla, Crataegus, some Poaceae and Cyperaceae etc.). There are also many rare endemics in hardly accessible mountain areas and quite a few insufficiently-known species recorded from scattered localities.

The list of the most recorded species of the project includes species which are widespread, easily recognisable and identifiable during all seasons (Table 9). These are mostly perennial herbs tolerant to intensive human activity, but also some common trees. Since the observations are concentrated in European Russia (Fig. 5), top-observed species of the project perfectly match the most common plants of temperate Europe, based on
frequency of occurrences in the national grid mapping projects (Seregin 2011). The five most observed species have more than 5,000 observations each.

| Rank | Species                              | Number of observations |
|------|--------------------------------------|------------------------|
| 1    | Urtica dioica                        | 5,788                  |
| 2    | Achillea millefolium                 | 5,536                  |
| 3    | Pinus sylvestris                     | 5,375                  |
| 4    | Taraxacum aggr. officinale           | 5,327                  |
| 5    | Cirsium arvense                      | 4,994                  |
| 6    | Acer negundo                         | 4,874                  |
| 7    | Tanacetum vulgare                    | 4,417                  |
| 8    | Artemisia vulgaris                   | 4,404                  |
| 9    | Trifolium pratense                   | 4,392                  |
| 10   | Tussilago farfara                    | 4,293                  |
| 11   | Chelidonium majus                    | 4,213                  |
| 12   | Tripleurospermum inodorum            | 4,183                  |
| 13   | Plantago major                       | 4,184                  |
| 14   | Cichorium intybus                    | 4,135                  |
| 15   | Chamaenerion angustifolium           | 4,109                  |
| 16   | Trifolium repens                     | 3,797                  |
| 17   | Sorbus aucuparia                     | 3,751                  |
| 18   | Glechoma hederacea                   | 3,750                  |
| 19   | Aegopodium podagraria                | 3,727                  |
| 20   | Veronica chamaedrys                  | 3,530                  |

Table 9.
The top 20 species of the "Flora of Russia" project ordered by the number of observations

There are 1215 unique observations in the project. They include:

- 994 species,
- 19 nothospecies (hybrids),
- 133 heterotypic infraspecific taxa,
- 36 homotypic infraspecific taxa,
- 33 genera lacking chance for finer identification.
The following users have created the greatest number of unique species and nothospecies records: R.A. Murtazaliev (195 observations), V.S. Volkotrub (81), M.M. Mallaliev (40), S.A. Nesterova (32), A.I. Pyak (32), S.R. Mayorov (31), S.A. Svirin (27), I.N. Pospelov (25), Aleksandr L. Ebel (23), D.A. Bochkov (23), D.G. Chimitov (19), M.S. Knyazev (17), A.P. Seregin (17), E.S. Kashirina (16), A.V. Popov (13), O.A. Chernyagina (13), E.A. Razina (12) and N.S. Liakosakova (12). Altogether, 224 observers were lucky to contribute at least one unique observation of a species or a hybrid.

To assess the regional representation of our data, we have compiled a table on the regional diversity of the Russian flora with necessary references (Table 10). The numbers of known species across the regions are not always perfectly comparable, since the authors of regional floras, guides and checklists used various species concepts which were either "splitters" or "lumpers". The overestimate for Volgograd Oblast (Sagalaev 2008) is especially notable.

Table 10.
Number of known species across the first-level administrative units of Russia with references.

| Rank | Regional project         | Number of known species | Reference                              |
|------|--------------------------|-------------------------|----------------------------------------|
| 1    | Dagestan Flora           | 3,380                   | Murtazaliev (2016)                     |
| 2    | Volgograd Oblast Flora   | 2,970                   | Sagalaev (2008), overestimate          |
| 3    | Primorsky Krai Flora     | 2,750                   | Kozhevnikov and Kozhevnikova (2014)    |
| 4    | Krasnodar Krai Flora     | 2,600                   | Zernov (2006)                          |
| 5    | Flora of the Crimea      | 2,573                   | Yena (2018)                            |
| 6    | Khabarovsky Krai Flora   | 2,516                   | Shlotgauer et al. (2001)               |
| 7    | Flora of Kabardino-Balkaria | 2,350               | Shkhagapsoev (2015)                    |
| 8    | Flora of North Ossetia   | 2,306                   | Komzha (2000)                          |
| 9    | Irkutsk Oblast Flora     | 2,295                   | Chepinoga et al. (2008)                |
| Rank | Regional project      | Number of known species | Reference                                                                 |
|------|-----------------------|-------------------------|---------------------------------------------------------------------------|
| 10   | Chechen Republic Flora | 2,295                   | Taysumov and Omarkhadzhieva (2012)                                       |
| 11   | Altai Krai Flora      | 2,264                   | Silantieva (2013)                                                         |
| 12   | Stavropol Krai Flora  | 2,257                   | Ivanov (2005)                                                             |
| 13   | Krasnoyarsk Krai Flora| 2,200                   | counts based on Krasnoborov (1988), Krasnoborov (1997), Krasnoborov and Malyshev (1988), Malyshev (1997), Malyshev and Peshkova (1987), Malyshev and Peshkova (1990), Malyshev and Peshkova (1993a), Malyshev and Peshkova (1993b), Malyshev et al. (2003), Peshkova (1996), Peshkova and Malyshev (1990), Polozhy and Malyshev (1994a), Polozhy and Malyshev (1994b), Polozhy and Peshkova (1996) |
| 14   | Buryat Republic Flora | 2,161                   | Anenkhonov (2001)                                                        |
| 15   | Altai Republic Flora  | 2,136                   | Krasnoborov and Artemov (2012)                                           |
| 16   | Udmurt Republic Flora | 2,073                   | Baranova and Puzyrev (2012)                                              |
| 17   | Tyva Republic Flora   | 2,066                   | Shaulo (2007)                                                            |
| 18   | Amur Oblast Flora     | 2,024                   | Starchenko (2008)                                                       |
| 19   | Sakhalin Oblast Flora | 2,000                   | Eremin (2005)                                                            |
| 20   | Moscow Oblast Flora   | 2,000                   | Varlygina et al. (2008)                                                 |
| 21   | Flora of Karachay-Cherkessia | 2,000 | Zernov et al. (2015)                                                  |
| 22   | Flora of Adygea       | 2,000                   | Zamotailov (2012)                                                       |
| 23   | Flora of Yakutia      | 1,987                   | Kuznetsova and Zakharova (2012)                                          |
| 24   | Rostov Oblast Flora   | 1,982                   | Fedyaeva (2014)                                                          |
| 25   | Voronezh Oblast Flora | 1,954                   | A.V. Shcherbakov (personal communication)                               |
| 26   | Flora of Moscow       | 1,908                   | Shcherbakov and Lyubeznova (2018)                                        |
| Rank | Regional project | Number of known species | Reference |
|------|------------------|-------------------------|-----------|
| 27   | Samara Oblast Flora | 1,900                  | Senator and Saksonov (2017) |
| 28   | Orenburg Oblast Flora | 1,870                  | Ryabinina and Knyazev (2009); M.S. Knyazev (personal communication) |
| 29   | Sevastopol Flora | 1,859                  | Seregin et al. (2015) |
| 30   | Flora of Khakassia | 1,850                  | Aleksandr L. Ebel (personal communication) |
| 31   | Flora of Karelia | 1,814                  | Kravchenko (2007) |
| 32   | Tver Oblast Flora | 1,798                  | Notov et al. (2014) |
| 33   | Ulyanovsk Oblast Flora | 1,760                  | Rakov et al. (2014) |
| 34   | Kemerovo Oblast Flora | 1,753                  | Sheremetova et al. (2011) |
| 35   | Bashkortostan Flora | 1,730                  | Naumova et al. (2011) |
| 36   | Sverdlovsk Oblast Flora | 1,715                  | Knyazev et al. (2019) |
| 37   | Penza Oblast Flora | 1,700                  | Vasyukov and Saksonov (2020) |
| 38   | Zabaykalsky Krai Flora | 1,700                  | Popova (2017) |
| 39   | Chelyabinsk Oblast Flora | 1,680                  | Kulikov (2005) |
| 40   | Belgorod Oblast Flora | 1,680                  | N.M. Reshetnikova (personal communication) |
| 41   | Lipetsk Oblast Flora | 1,669                  | A.V. Shcherbakov (personal communication) |
| 42   | Perm Krai Flora | 1,658                  | Ovesnov (2007) |
| 43   | Tatarstan Flora | 1,610                  | Bakin et al. (2000) |
| 44   | Tambov Oblast Flora | 1,605                  | A.V. Shcherbakov (personal communication) (1478 species recorded by Sukhorukov (2010)) |
| 45   | Oryol Oblast Flora | 1,605                  | Kiseleva et al. (2012) |
| Rank | Regional project                        | Number of known species | Reference                                      |
|------|-----------------------------------------|-------------------------|------------------------------------------------|
| 46   | Leningrad Oblast Flora                  | 1,600                   | Tzvelev (2000)                                 |
| 47   | Chuvash Republic Flora                  | 1,586                   | Gafurova (2014)                                |
| 48   | Kaluga Oblast Flora                     | 1,542                   | Reshetnikova (2016)                            |
| 49   | Flora of Ingushetia                     | 1,531                   | Dakieva (2003)                                 |
| 50   | Yaroslavl Oblast Flora                  | 1,500                   | estimate (previous number of species by Tikhomirov (1986) is out of date) |
| 51   | Saratov Oblast Flora                    | 1,492                   | Bulany (2010)                                  |
| 52   | Ryazan Oblast Flora                     | 1,475                   | Kazakova and Shcherbakov (2017)                |
| 53   | Kirov Oblast Flora                      | 1,470                   | Tarasova (2007)                                |
| 54   | Tula Oblast Flora                       | 1,465                   | A.V. Shcherbakov (personal communication)      |
| 55   | Magadan Oblast Flora                    | 1,457                   | Berkutenko (2010)                              |
| 56   | Bryansk Oblast Flora                    | 1,451                   | Bulokhov et al. (2005)                         |
| 57   | Vologda Oblast Flora                    | 1,450                   | Konechnaya and Suslova (2004)                  |
| 58   | Flora of Jewish Autonomous Oblast       | 1,443                   | Rubtsova (2019)                                |
| 59   | Kaliningrad Oblast Flora                | 1,436                   | Gubareva et al. (1999)                         |
| 60   | Ivanovo Oblast Flora                    | 1,418                   | A.V. Shcherbakov (personal communication)      |
| 61   | Kursk Oblast Flora                      | 1,409                   | Poluyanov (2005)                               |
| 62   | Flora of Mordovia                       | 1,401                   | Silaeva et al. (2010)                          |
| 63   | Vladimir Oblast Flora                   | 1,399                   | Seregin (2014)                                 |
| Rank | Regional project                              | Number of known species | Reference                                                                                  |
|------|-----------------------------------------------|-------------------------|-------------------------------------------------------------------------------------------|
| 64   | Tyumen Oblast Flora                          | 1,395                   | Kuzmin (2018)                                                                              |
| 65   | Novosibirsk Oblast Flora                     | 1,379                   | Klescheva (2011)                                                                           |
| 66   | Murmansk Oblast Flora                         | 1,357                   | Konstantinova et al. (2014)                                                               |
| 67   | Smolensk Oblast Flora                         | 1,310                   | Reshetnikova (2004); N.M. Reshetnikova (personal communication)                           |
| 68   | Kamchatka Flora                               | 1,300                   | Chernyagina (2018)                                                                         |
| 69   | Kurgan Oblast Flora                           | 1,300                   | Bolshakov (2012)                                                                           |
| 70   | Nizhny Novgorod Oblast Flora                  | 1,290                   | Bakka and Kiseleva (2008)                                                                  |
| 71   | Mari El Flora                                 | 1,259                   | Abramov (1995)                                                                             |
| 72   | Astrakhan Oblast Flora                        | 1,253                   | Laktionov (2009)                                                                           |
| 73   | Pskov Oblast Flora                            | 1,248                   | Konechnaya and Efimov (2018)                                                              |
| 74   | Flora of Khanty-Mansi Autonomous Okrug        | 1,175                   | Nazarenko and Pasechnyuk (2019) based on monograph by Krasnoborov (2006)                   |
| 75   | Novgorod Oblast Flora                         | 1,174                   | Yurova et al. (2009)                                                                       |
| 76   | Tomsk Oblast Flora                            | 1,170                   | Revushkin (2014)                                                                           |
| 77   | Omsk Oblast Flora                             | 1,161                   | Bekisheva (1999); A.N. Efremov (personal communication)                                    |
| 78   | Komi Republic Flora                           | 1,158                   | Taskaev (2009)                                                                             |
| 79   | Kostroma Oblast Flora                         | 1,130                   | Leostrin and Efimova (2018)                                                                |
| 80   | Arkhangelsk Oblast Flora                      | 1,098                   | Schmidt (2005)                                                                             |
Table 10 gives a good overview of plant diversity across the country with notable hotspots revealed earlier by Malyschev for standard areas (Malyshev 1975, Malyshev 1992):

1. Caucasus (Dagestan, Krasnodar Krai, Kabardino-Balkaria, North Ossetia, Chechen Republic, Stavropol Krai etc.);
2. Russian Far East (Primorsky Krai, Khabarovsk Krai);
3. Southern Siberia (Irkutsk Oblast, Altai Krai, part of Krasnoyarsk Krai etc.);
4. Crimea.

Additionally, the Caucasus is listed as the only biodiversity - and especially tracheophyte diversity - hotspot of global importance in Russia (Myers et al. 2000, Barthlott et al. 2007).

We present data on the taxonomic diversity of vascular plants within the regions (Table 11) using two indexes, i.e. (1) the number of the recorded species and (2) the number of the lowest-rank taxa of the taxonomic tree with "research grade". The second index includes varieties, subspecies, species and those genera which cannot be accurately identified to species rank by uploaded photos (for instance, *Alchemilla*, *Pilosella*, *Hieracium*, *Euphrasia* and some genera requiring specific features not always captured by observers, like *Melilotus* and *Epilobium* without flowers etc.). The number of the recorded species is more suitable for the further taxonomic analysis.

The community has observed the highest number of plant species in Dagestan (1,927 species), which is the richest region of Russia in terms of the number of known species (Table 10). However, the rich flora of Dagestan is still represented here by only 57.0% of known species (Murtazaliev 2016). It is followed by other six territories of the Russian Federation from the above mentioned plant diversity hotspots — the Caucasus (represented by Krasnodar Krai), the Crimean Peninsula (the Republic of Crimea and the City of Sevastopol), the southern part of the Russian Far East (Primorsky Krai) and the mountains of Southern Siberia (Altai Krai). Four well-represented regions of Central Russia
(Kursk, Voronezh, Moscow and Bryansk Oblasts) form the next group with a good proportion of flora detection ranging from 56.3% to 81.8%.

| Regional project           | Recorded species | Rank (recorded species) | Recorded taxa of the lowest rank | Species known in the region | Proportion of recorded species | Rank (proportion of recorded species) |
|----------------------------|------------------|-------------------------|---------------------------------|-----------------------------|-------------------------------|--------------------------------------|
| Dagestan Flora             | 1,927            | 1                       | 1,960                           | 3,380                       | 57.0                          | 19                                   |
| Flora of the Crimea        | 1,570            | 2                       | 1,643                           | 2,573                       | 61.0                          | 15                                   |
| Primorsky Krai Flora       | 1,430            | 3                       | 1,491                           | 2,750                       | 52.0                          | 25                                   |
| Sevastopol Flora           | 1,378            | 4                       | 1,405                           | 1,859                       | 74.1                          | 5                                    |
| Krasnodar Krai Flora       | 1,278            | 5                       | 1,302                           | 2,600                       | 49.2                          | 29                                   |
| Altai Krai Flora           | 1,161            | 6                       | 1,217                           | 2,264                       | 51.3                          | 27                                   |
| Kursk Oblast Flora         | 1,153            | 7                       | 1,185                           | 1,409                       | 81.8                          | 1                                    |
| Voronezh Oblast Flora      | 1,131            | 8                       | 1,187                           | 1,954                       | 57.9                          | 17                                   |
| Moscow Oblast Flora        | 1,126            | 9                       | 1,213                           | 2,000                       | 56.3                          | 21                                   |
| Bryansk Oblast Flora       | 1,121            | 10                      | 1,214                           | 1,451                       | 77.3                          | 3                                    |
| Sverdlovsk Oblast Flora    | 1,095            | 11                      | 1,146                           | 1,715                       | 63.8                          | 12                                   |
| Krasnoyarsk Krai Flora     | 1,094            | 12                      | 1,131                           | 2,200                       | 49.7                          | 28                                   |
| Irkutsk Oblast Flora       | 1,089            | 13                      | 1,130                           | 2,295                       | 47.5                          | 31                                   |
| Flora of Moscow            | 1,087            | 14                      | 1,176                           | 1,908                       | 57.0                          | 20                                   |
| Tatarstan Flora            | 1,041            | 15                      | 1,074                           | 1,610                       | 64.7                          | 11                                   |
| Nizhny Novgorod Oblast Flora| 1,006          | 16                      | 1,008                           | 1,290                       | 78.0                          | 2                                    |
| Bashkortostan Flora        | 970              | 17                      | 1,014                           | 1,730                       | 56.1                          | 22                                   |
| Regional project                | Recorded species | Rank (recorded species) | Recorded taxa of the lowest rank | Species known in the region | Proportion of recorded species | Rank (proportion of recorded species) |
|--------------------------------|------------------|-------------------------|----------------------------------|------------------------------|-------------------------------|--------------------------------------|
| Tula Oblast Flora             | 948              | 18                      | 991                              | 1,465                        | 64.7                          | 10                                   |
| Novosibirsk Oblast Flora      | 940              | 19                      | 975                              | 1,379                        | 68.2                          | 6                                    |
| Vladimir Oblast Flora         | 856              | 20                      | 907                              | 1,399                        | 61.2                          | 14                                   |
| Kamchatka Flora               | 856              | 21                      | 898                              | 1,300                        | 65.8                          | 8                                    |
| Kostroma Oblast Flora         | 846              | 22                      | 898                              | 1,130                        | 74.9                          | 4                                    |
| Flora of Mordovia             | 845              | 23                      | 844                              | 1,401                        | 60.3                          | 16                                   |
| Buryat Republic Flora         | 838              | 24                      | 852                              | 2,161                        | 38.8                          | 45                                   |
| Chuvash Republic Flora        | 827              | 25                      | 850                              | 1,586                        | 52.1                          | 24                                   |
| Yaroslavl Oblast Flora        | 818              | 26                      | 876                              | 1,500                        | 54.5                          | 23                                   |
| Rostov Oblast Flora           | 797              | 27                      | 820                              | 1,982                        | 40.2                          | 42                                   |
| Omsk Oblast Flora             | 777              | 28                      | 814                              | 1,161                        | 66.9                          | 7                                    |
| Altai Republic Flora          | 777              | 29                      | 802                              | 2,136                        | 36.4                          | 52                                   |
| Belgorod Oblast Flora         | 776              | 30                      | 808                              | 1,680                        | 46.2                          | 32                                   |
| Samara Oblast Flora           | 769              | 31                      | 795                              | 1,900                        | 40.5                          | 41                                   |
| Tver Oblast Flora             | 757              | 32                      | 797                              | 1,798                        | 42.1                          | 39                                   |
| Sakhalin Oblast Flora         | 755              | 33                      | 771                              | 2,000                        | 37.8                          | 49                                   |
| Volgograd Oblast Flora        | 744              | 34                      | 747                              | 2,970                        | 25.1                          | 67                                   |
| Tomsk Oblast Flora            | 744              | 35                      | 768                              | 1,170                        | 63.6                          | 13                                   |
| Amur Oblast Flora             | 737              | 36                      | 765                              | 2,024                        | 36.4                          | 51                                   |
| Flora of Karachay-Cherkessia  | 731              | 37                      | 753                              | 2,000                        | 36.6                          | 50                                   |
| Regional project                        | Recorded species | Rank (recorded species) | Recorded taxa of the lowest rank | Species known in the region | Proportion of recorded species | Rank (proportion of recorded species) |
|----------------------------------------|------------------|-------------------------|----------------------------------|-----------------------------|-------------------------------|---------------------------------------|
| Chelyabinsk Oblast Flora               | 720              | 38                      | 738                              | 1,680                       | 42.9                          | 37                                    |
| Leningrad Oblast Flora                 | 718              | 39                      | 714                              | 1,600                       | 44.9                          | 34                                    |
| Arkhangelsk Oblast Flora               | 714              | 40                      | 728                              | 1,098                       | 65.0                          | 9                                     |
| Perm Krai Flora                        | 689              | 41                      | 702                              | 1,658                       | 41.6                          | 40                                    |
| Kaliningrad Oblast Flora               | 685              | 42                      | 714                              | 1,436                       | 47.7                          | 30                                    |
| Kaluga Oblast Flora                    | 678              | 43                      | 708                              | 1,542                       | 44.0                          | 36                                    |
| Kemerovo Oblast Flora                  | 665              | 44                      | 695                              | 1,753                       | 37.9                          | 47                                    |
| Kirov Oblast Flora                     | 628              | 45                      | 654                              | 1,470                       | 42.7                          | 38                                    |
| Tyumen Oblast Flora                    | 625              | 46                      | 642                              | 1,395                       | 44.8                          | 35                                    |
| St Petersburg Flora                    | 624              | 47                      | 623                              | 1,088                       | 57.4                          | 18                                    |
| Flora of Khanty-Mansi Autonomous Okrug | 610              | 48                      | 631                              | 1,175                       | 51.9                          | 26                                    |
| Saratov Oblast Flora                   | 591              | 49                      | 601                              | 1,492                       | 39.6                          | 43                                    |
| Udmurt Republic Flora                  | 581              | 50                      | 595                              | 2,073                       | 28.0                          | 62                                    |
| Penza Oblast Flora                     | 579              | 51                      | 593                              | 1,700                       | 34.1                          | 55                                    |
| Ryazan Oblast Flora                    | 575              | 52                      | 591                              | 1,475                       | 39.0                          | 44                                    |
| Pskov Oblast Flora                     | 565              | 53                      | 578                              | 1,248                       | 45.3                          | 33                                    |
| Lipetsk Oblast Flora                   | 554              | 54                      | 568                              | 1,669                       | 33.2                          | 56                                    |
| Ulyanovsk Oblast Flora                 | 503              | 55                      | 516                              | 1,760                       | 28.6                          | 61                                    |
| Regional project                        | Recorded species | Rank (recorded species) | Recorded taxa of the lowest rank | Species known in the region | Proportion of recorded species | Rank (proportion of recorded species) |
|----------------------------------------|------------------|-------------------------|----------------------------------|-----------------------------|-------------------------------|---------------------------------------|
| Murmansk Oblast Flora                 | 475              | 56                      | 497                              | 1,357                       | 35.0                          | 54                                    |
| Vologda Oblast Flora                  | 472              | 57                      | 486                              | 1,450                       | 32.6                          | 58                                    |
| Flora of Karelia                      | 457              | 58                      | 474                              | 1,814                       | 25.2                          | 66                                    |
| Flora of Adygea                       | 453              | 59                      | 454                              | 2,000                       | 22.7                          | 69                                    |
| Ivanovo Oblast Flora                  | 451              | 60                      | 461                              | 1,418                       | 31.8                          | 59                                    |
| Mari El Flora                         | 450              | 61                      | 459                              | 1,259                       | 35.7                          | 53                                    |
| Zabaykalsky Krai Flora                | 449              | 62                      | 455                              | 1,700                       | 26.4                          | 63                                    |
| Novgorod Oblast Flora                 | 445              | 63                      | 459                              | 1,174                       | 37.9                          | 48                                    |
| Stavropol Krai Flora                  | 441              | 64                      | 444                              | 2,257                       | 19.5                          | 71                                    |
| Orenburg Oblast Flora                 | 434              | 65                      | 439                              | 1,870                       | 23.2                          | 68                                    |
| Kurgan Oblast Flora                   | 430              | 66                      | 436                              | 1,300                       | 33.1                          | 57                                    |
| Flora of Yamalo-Nenets Autonomous Okrug | 410          | 67                      | 424                              | 1,073                       | 38.2                          | 46                                    |
| Flora of Khakassia                    | 401              | 68                      | 417                              | 1,850                       | 21.7                          | 70                                    |
| Smolensk Oblast Flora                 | 343              | 69                      | 355                              | 1,310                       | 26.2                          | 64                                    |
| Flora of Yakutia                      | 303              | 70                      | 305                              | 1,987                       | 15.2                          | 74                                    |
| Komi Republic Flora                   | 302              | 71                      | 304                              | 1,158                       | 26.1                          | 65                                    |
| Tambov Oblast Flora                   | 300              | 72                      | 308                              | 1,605                       | 18.7                          | 72                                    |
| Khabarovsk Krai Flora                 | 299              | 73                      | 301                              | 2,516                       | 11.9                          | 76                                    |
If we consider the number of species known from each region, Kursk Oblast is the leader in terms of the proportion of observed species (81.8% out of 1,409 known species). Nizhny Novgorod Oblast, Bryansk Oblast, Kostroma Oblast and the City of Sevastopol also have over 70% of known species already represented on iNaturalist, although Nizhny Novgorod Oblast lacks a modern flora checklist, since the number of taxa for the region published by Bakka and Kiseleva (2008) is out of date.

In regional lists, 53 species are counted as the leaders of the scoreboards (Table 12). This list includes some notable invasive species like *Acer negundo* (a leader in five regions), *Heracleum sosnowskyi* (two regions), *Ambrosia artemisiifolia*, *Erigeron annuus*, *Hordeum jubatum*, *Impatiens glandulifera*, and *Lupinus polyphyllus* (one region each). Usually, this high performance of invasive alien species is a result of intentional recording in line with a regional assessment of aliens performed by the project members.

| Regional project                        | Recorded species | Rank (recorded species) | Recorded taxa of the lowest rank | Species known in the region | Proportion of recorded species | Rank (proportion of recorded species) |
|-----------------------------------------|------------------|-------------------------|----------------------------------|-----------------------------|-----------------------------|--------------------------------------|
| Flora of Chukotka                       | 285              | 74                      | 289                              | 936                         | 30.4                        | 60                                    |
| Flora of Kabardino-Balkaria             | 268              | 75                      | 271                              | 2,350                       | 11.4                        | 77                                    |
| Oryol Oblast Flora                     | 258              | 76                      | 255                              | 1,605                       | 16.1                        | 73                                    |
| Astrakhan Oblast Flora                  | 187              | 77                      | 190                              | 1,253                       | 14.9                        | 75                                    |
| Tyva Republic Flora                     | 164              | 78                      | 165                              | 2,066                       | 7.9                         | 78                                    |
| Chechen Republic Flora                  | 140              | 79                      | 140                              | 2,295                       | 6.1                         | 81                                    |
| Magadan Oblast Flora                   | 114              | 80                      | 114                              | 1,457                       | 7.8                         | 79                                    |
| Flora of North Ossetia                  | 111              | 81                      | 111                              | 2,306                       | 4.8                         | 83                                    |
| Flora of Jewish Autonomous Oblast      | 70               | 82                      | 70                               | 1,443                       | 4.9                         | 82                                    |
| Flora of Nenets Autonomous Okrug       | 54               | 83                      | 55                               | 720                         | 7.5                         | 80                                    |
| Flora of Ingushetia                    | 31               | 84                      | 31                               | 1,531                       | 2.0                         | 85                                    |
| Flora of Kalmykia                      | 30               | 85                      | 30                               | 994                         | 3.0                         | 84                                    |
Table 12.
The most recorded species in the regional projects (as of 9-10 Sep 2020)

| Species               | Number of observations in the regional project | Regional project                          |
|-----------------------|------------------------------------------------|-------------------------------------------|
| Acer negundo          | 109                                            | Tyumen Oblast Flora                      |
| Acer negundo          | 174                                            | Tomsk Oblast Flora                       |
| Acer negundo          | 279                                            | Altai Krai Flora                         |
| Acer negundo          | 399                                            | Bryansk Oblast Flora                     |
| Acer negundo          | 633                                            | Tatarstan Flora                          |
| Achillea millefolium  | 3                                               | Chechen Republic Flora                   |
| Achillea millefolium  | 27                                             | Penza Oblast Flora                       |
| Achillea millefolium  | 41                                             | Saratov Oblast Flora                     |
| Achillea millefolium  | 192                                            | Bashkortostan Flora                      |
| Achillea millefolium  | 265                                            | Nizhny Novgorod Oblast Flora             |
| Ambrosia artemisiifolia| 19                                             | Stavropol Krai Flora                     |
| Artemisia vulgaris    | 116                                            | Flora of Khanty-Mansi Autonomous Okrug   |
| Asplenium scolopendrium| 75                                             | Krasnodar Krai Flora                     |
| Betonica macrantha    | 18                                             | Flora of Adygea                          |
| Campanula patula      | 35                                             | Udmurt Republic Flora                    |
| Centaurea scabiosa    | 60                                             | Perm Krai Flora                          |
| Chamaenerion angustifolium | 10                          | Flora of Yakutia                         |
| Chamaenerion angustifolium | 155                        | Sverdlovsk Oblast Flora                 |
| Chamaenerion angustifolium | 177                        | Leningrad Oblast Flora                  |
| Chelidonium majus     | 43                                             | Tambov Oblast Flora                      |
| Cichorium intybus     | 19                                             | Orenburg Oblast Flora                    |
| Cichorium intybus     | 34                                             | Volgograd Oblast Flora                   |
| Cirsium arvense       | 162                                            | Chelyabinsk Oblast Flora                 |
| Cornus suecica        | 7                                              | Magadan Oblast Flora                     |
| Cornus suecica        | 80                                             | Murmansk Oblast Flora                    |
| Species                        | Number of observations in the regional project | Regional project               |
|-------------------------------|-----------------------------------------------|--------------------------------|
| Cypripedium macranthos        | 308                                           | Novosibirsk Oblast Flora       |
| Dactylorhiza euxina           | 3                                             | Flora of North Ossetia         |
| Delphinium grandiflorum      | 19                                            | Flora of Khakassia             |
| Diplotaxis tenuifolia         | 117                                           | Flora of the Crimea            |
| Echium vulgare                | 29                                            | Rostov Oblast Flora            |
| Echium vulgare                | 166                                           | Voronezh Oblast Flora          |
| Erigeron annuus               | 11                                            | Flora of Kabardino-Balkaria    |
| Erythronium sibiricum         | 28                                            | Kemerovo Oblast Flora          |
| Fragaria viridis              | 27                                            | Kurgan Oblast Flora            |
| Fritillaria camschatensis     | 149                                           | Kamchatka Flora                |
| Gentianaalgida                | 5                                             | Tyva Republic Flora            |
| Gentiana septemfida           | 25                                            | Flora of Karachay-Cherkessia   |
| Heracleum sosnowskyi          | 312                                           | Tver Oblast Flora              |
| Heracleum sosnowskyi          | 304                                           | Kursk Oblast Flora             |
| Hordeum jubatum               | 195                                           | Irkutsk Oblast Flora           |
| Impatiens glandulifera        | 30                                            | Primorsky Krai Flora           |
| Juniperus deltoides           | 154                                           | Sevastopol Flora               |
| Larix gmelinii                | 51                                            | Amur Oblast Flora              |
| Larix gmelinii                | 44                                            | Sakhalin Oblast Flora          |
| Leonurus quinquelobatus       | 775                                           | Moscow Oblast Flora            |
| Lupinus polyphyllus           | 73                                            | Kaliningrad Oblast Flora       |
| Melampyrum nemorosum          | 74                                            | Kaluga Oblast Flora            |
| Orostachys spinosa            | 67                                            | Altai Republic Flora           |
| Oxytropis myriophylla         | 15                                            | Zabaykalsky Krai Flora         |
| Papaver pulvinatum            | 124                                           | Krasnoyarsk Krai Flora         |
| Phragmites australis          | 14                                            | Astrakhan Oblast Flora         |
| Picea obovata                 | 25                                            | Komi Republic Flora            |
| Pinus sibirica                | 445                                           | Omsk Oblast Flora              |
| Pinus sylvestris              | 2                                             | Flora of Ingushetia            |
| Pinus sylvestris              | 12                                            | Mari El Flora                  |
| Species                  | Number of observations in the regional project | Regional project                  |
|--------------------------|-----------------------------------------------|------------------------------------|
| *Pinus sylvestris*       | 24                                            | Pskov Oblast Flora                 |
| *Pinus sylvestris*       | 26                                            | Dagestan Flora                     |
| *Pinus sylvestris*       | 26                                            | Novgorod Oblast Flora              |
| *Pinus sylvestris*       | 31                                            | Ivanovo Oblast Flora               |
| *Pinus sylvestris*       | 95                                            | Flora of Karelia                   |
| *Pinus sylvestris*       | 103                                           | Ulyanovsk Oblast Flora             |
| *Pinus sylvestris*       | 293                                           | Vladimir Oblast Flora              |
| *Pinus sylvestris*       | 293                                           | Flora of Mordovia                  |
| *Populus tremula*        | 3                                             | Flora of Jewish Autonomous Oblast  |
| *Rhodiola rosea*         | 5                                             | Flora of Nenets Autonomous Okrug   |
| *Rhodiola rosea*         | 16                                            | Flora of Chukotka                  |
| *Rubus chamaemorus*      | 54                                            | Flora of Yamalo-Nenets Autonomous Okrug |
| *Salix myrsinifolia*     | 80                                            | Arkhangelsk Oblast Flora           |
| *Securigera varia*       | 66                                            | Belgorod Oblast Flora              |
| *Spiraea salicifolia*    | 14                                            | Khabarovsky Krai Flora             |
| *Tanacetum vulgare*      | 50                                            | Lipetsk Oblast Flora               |
| *Tanacetum vulgare*      | 122                                           | Kostroma Oblast Flora              |
| *Taraxacum aggr. officinale* | 122               | Samara Oblast Flora               |
| *Taraxacum aggr. officinale* | 169       | St Petersburg Flora               |
| *Taraxacum aggr. officinale* | 1,064          | Flora of Moscow                   |
| *Trifolium repens*       | 11                                            | Oryol Oblast Flora                 |
| *Tulipa suaveolens*      | 7                                             | Flora of Kalmykia                  |
| *Tussilago farfara*      | 86                                            | Ryazan Oblast Flora                |
| *Urtica dioica*          | 28                                            | Vologda Oblast Flora               |
| *Urtica dioica*          | 187                                           | Yaroslavl Oblast Flora             |
| *Urtica dioica*          | 204                                           | Chuvash Republic Flora             |
| *Urtica dioica*          | 223                                           | Tula Oblast Flora                  |
| *Vaccinium vitis-idaea*  | 24                                            | Buryat Republic Flora              |
| *Vaccinium vitis-idaea*  | 59                                            | Kirov Oblast Flora                 |
Conifers, which could be observed during the whole year, provide another example of the most observed species across regions. For instance, *Pinus sylvestris* is a top species in ten regions as well as *Larix gmelinii* (two regions), *Picea obovata*, *Pinus sibirica* and *Juniperus deltoides* (one region).

Other examples include common plants of meadows and urban lawns (e.g. *Achillea millefolium*, *Taraxacum aggr. officinale*, *Tanacetum vulgare*, *Artemisia vulgaris*, *Cirsium arvense*, *Cichorium intybus*), common tundra plants in Arctic regions (*Cornus suecica*, *Papaver pulvinatum*, *Rubus chamaemorus*), species abundant in the taiga zone (*Vaccinium vitis-idaea*, *Chamaenerion angustifolium*) or common plants of dry grasslands (*Tulipa suaveolens*, *Fragaria viridis*, *Cichorium intybus*). There are exceptional cases of over-recording of orchids (*Cypripedium macranthos*, *Dactylorhiza euxina*).

### Temporal coverage

**Notes: Uploading date**

The project started on 9 Jan 2019 with 11,000 "research-grade" observations of the Russian flora. As of 8 Sep 2020, observations uploaded to iNaturalist in 2018 and earlier, account for only 1.4% of all the project data (Table 13). The number of observations uploaded in the eight months of 2020 exceeds threefold the data uploaded in 2019. The backlog of unidentified observations from 2019 is much smaller than the proportion of unprocessed records made in 2020.

| Year       | "Research grade" observations | Needs ID observations | All verifiable observations | "Research grade" (%) | Needs ID (%) | All verifiable (%) |
|------------|-------------------------------|-----------------------|----------------------------|----------------------|--------------|--------------------|
| 2018 and before | 10,841                        | 607                   | 11,448                     | 1.4                  | 0.4          | 1.3                |
| 2019       | 212,662                       | 19,075                | 231,737                    | 28.3                 | 14.0         | 26.1               |
| 2020       | 527,713                       | 116,862               | 644,575                    | 70.2                 | 85.6         | 72.6               |
| TOTAL      | 751,216                       | 136,544               | 887,760                    | 100.0                | 100.0        | 100.0              |
Observation date

Many participants of the "Flora of Russia" project hold large photo archives and continue to post them on iNaturalist retrospectively. Therefore, at least 14.9% of the observations were made before 31 Dec 2018 (Table 14). Since the project requires a photo of the organism, the most important limiting factor of the temporal coverage is the time of spreading of digital cameras. Apparently, their appearance in Russia, judging by the data, is dated 2002-2003. Amongst the earlier observations, there are both scanned photographs and transparencies, as well as later photographs of preserved specimens.

We have analysed the data on the basis of dates of observation for 2019 (21.5% of all data on plants in Russia) and the eight months of 2020 from January to August (64.6%). Two graphs given below have the same scale bar.

Table 14.
Observations of vascular plants of Russia ordered by the year of record (as of 7 Sep 2020)

| Year         | “Research grade” observations | Needs ID observations | All verifiable observations | “Research grade” (%) | Needs ID (%) | All verifiable (%) |
|--------------|-------------------------------|-----------------------|-----------------------------|----------------------|--------------|-------------------|
| 2001 and before | 642                           | 110                   | 752                         | 0.0                  | 0.0          | 0.0               |
| 2002         | 341                           | 24                    | 365                         | 0.0                  | 0.0          | 0.0               |
| 2003         | 662                           | 52                    | 714                         | 0.1                  | 0.0          | 0.1               |
| 2004         | 1,011                         | 96                    | 1,107                       | 0.1                  | 0.1          | 0.1               |
| 2005         | 2,146                         | 161                   | 2,307                       | 0.3                  | 0.1          | 0.3               |
| 2006         | 2,570                         | 199                   | 2,769                       | 0.3                  | 0.1          | 0.3               |
| 2007         | 4,625                         | 528                   | 5,153                       | 0.6                  | 0.4          | 0.6               |
| 2008         | 5,803                         | 451                   | 6,254                       | 0.8                  | 0.3          | 0.7               |
| 2009         | 5,637                         | 548                   | 6,185                       | 0.8                  | 0.4          | 0.7               |
| 2010         | 7,967                         | 1,603                 | 9,570                       | 1.1                  | 1.2          | 1.1               |
| 2011         | 6,029                         | 600                   | 6,629                       | 0.8                  | 0.4          | 0.7               |
| 2012         | 7,059                         | 793                   | 7,852                       | 0.9                  | 0.6          | 0.9               |
| 2013         | 8,262                         | 875                   | 9,137                       | 1.1                  | 0.6          | 1.0               |
| 2014         | 6,371                         | 649                   | 7,020                       | 0.8                  | 0.5          | 0.8               |
| 2015         | 9,576                         | 822                   | 10,398                      | 1.3                  | 0.6          | 1.2               |
| 2016         | 11,404                        | 1,008                 | 12,412                      | 1.5                  | 0.7          | 1.4               |
| 2017         | 13,622                        | 1,101                 | 14,723                      | 1.8                  | 0.8          | 1.7               |
| Year | "Research grade" observations | Needs ID observations | All verifiable observations | "Research grade" (%) | Needs ID (%) | All verifiable (%) |
|------|--------------------------------|-----------------------|----------------------------|----------------------|-------------|-------------------|
| 2018 | 18,490                         | 2,028                 | 20,518                     | 2.5                  | 1.5         | 2.3               |
| 2019 | 173,247                        | 17,496                | 190,743                    | 23.1                 | 12.8        | 21.5              |
| 2020 | 465,752                        | 107,400               | 573,152                    | 62.0                 | 78.7        | 64.6              |
| TOTAL| 751,216                        | 136,544               | 887,760                    | 100.0                | 100.0       | 100.0             |

In 2019, the most productive days were the first two days of the Team Cup final, when its participants made 3,027 (11 Aug 2019) and 2,602 (10 Aug 2019) observations of vascular plants (Fig. 7). This was mainly caused by the fact that we organised the final as a bioblitz, while in the early stages, it was possible to upload archived photos. However, the 2019 Cup overall did not attract much interest amongst the participants. For example, the third richest day by the number of observations was 17 Jun 2019, on which 2,514 observations of vascular plants were made, including 555 observations from the field trip of Lomonosov Moscow State University students to Voronezh Oblast.

In 2020, on the contrary, all the six stages of the Cup are clearly visible as prominent peaks of observation numbers. Namely, on 30 May 2020, 10,780 observations of vascular plants were made during 1/8 of the Cup (16 teams) and during the first and second days of the semi-finals 10,724 and 10,734 observations were made by four regional teams (Fig. 8).
From the 1/8 of the Cup onwards, the rounds were held in the format of a three-day bioblitz from Saturday to Monday.

International competitions like the City Nature Challenge (CNC) and the International Biodiversity Championship (IBC) did not generate peak user interest across Russia in 2020. However, both events also made a significant contribution to our data, since they lasted four days each. During the four CNC days (24-27 Apr 2020), 20,965 observations of vascular plants were made and 20,429 observations were recorded during the four IBC days (3-6 Aug 2020). We actively promoted both events amongst the participants of the "Flora of Russia" project.

It is worth mentioning that the COVID-19 restrictions of the spring of 2020 caused, for example, a low level of participation in CNC, which was made up for in the summer by off-campus student practices and events for high school students which all used iNaturalist this year.

Summing up, all Russian projects on student practices over the three summer months of 2020 (the common time for them in Russia) shows that 54,186 "research grade" observations by more than 750 observers meet the requirements of the "Flora of Russia" project. This makes a modest 17.4% contribution to the summer observations of the project. In 2020, practices in the form of independent work of students supervised remotely by teachers were held in fourteen Russian universities: Moscow State University, Bashkir State University, Irkutsk State University, State University of Nizhny Novgorod, Voronezh State University, Ural Federal University, Mordovia State University, Kazan Federal University, Kazan Federal University, Volgograd State University, Bashkir State University, State University of Nizhny Novgorod, Voronezh State University, and Ural Federal University.
University, Tver State University, Kirov State University, Pushchino State Institute of Natural Science, Ivanovo State University and Tomsk State University.

Another notable income of the summer data flow was the Herbarium 2.0 project, organised by Valentina Borodulina. Being initially designed for high school students, it attracted the attention of schoolteachers and teachers of out-of-school education. Of the 44,087 observations of this project (1 Jun - 31 Aug 2020), 36,307 observations were made in Russia and reached "research-grade". This contributes to 11.0% of our summer data and the most active observers involved in the project rapidly became notable participants of the "Flora of Russia" project.

Usage licence

Usage licence: Other

Data resources

Data package title: Flora of Russia on iNaturalist backup 8 Sep 2020 (750K + 136K records)

Resource link: http://doi.org/10.5281/zenodo.4061848, "Flora of Russia" backup (Zenodo), a stable snapshot of the dataset performed at 9 Sep 2020.

Alternative identifiers: Other endpoints for the same stable snapshot of the dataset performed at 9 Sep 2020: https://zenodo.org/record/4061848#.X3afWe1n1PZ, "Flora of Russia" backup (alternative Zenodo identifier); https://doi.org/10.15468/ab3s5x, alternative identifier of complete iNaturalist dataset in GBIF; https://doi.org/10.13140/RG.2.2.17886.87362/1, "Flora of Russia" backup (Research Gate); https://www.researchgate.net/publication/344174058_Flora_of_Russia_on_iNaturalist_backup_2020_Sep_08_750K_136K_records, alternative Research Gate identifier. Links to updated dynamic resources: https://www.inaturalist.org/observations/export?projects=flora-of-russia, permanently updated csv-export of the "Flora of Russia" data (link to iNaturalist export tool); http://www.inaturalist.org/observations/gbif-observations-dwca.zip, complete iNaturalist dataset in GBIF (Ueda 2020); https://www.gbif.org/dataset/50c9509d-22c7-4a22-a47d-8c48425ef4a7, alternative identifier of complete iNaturalist dataset in GBIF.

Number of data sets: 1

Data set name: Flora of Russia on iNaturalist backup 8 Sep 2020 (750K + 136K records)

Download URL: https://zenodo.org/record/4061848/files/flora-of-russia%26d1%3D1970-09-01%26d2%3D2019-06-30.xlsx?download=1;
https://zenodo.org/record/4061848/files/flora-of-russia%26d1%3D2019-07-01%26d2%3D2020-05-20.xlsx?download=1;
https://zenodo.org/record/4061848/files/flora-of-russia%26d1%3D2020-05-21%26d2%
Data format: xlsx

Description: "Flora of Russia" on iNaturalist backup for 8 Sep 2020 (886K records in total - 750K confirmed photo observations on 6,857 species and additional 136K unverified photo observations). Contains metadata only and hyperlinks to photos in csv format. The backup was exported from iNaturalist.org using the "Export Observations" tool. We are using 27 columns for further processing out of 66 available columns, since the whole iNaturalist dataset in long-tailed.

We amended the dataset on 25 Sep 2020 after a data audit performed by Dr Robert Mesibov (https://www.datafix.com.au) in line with preparation of the data paper. All records with positional accuracy exceeding 50,000 m were marked as having inaccurate location and reported to users. Altogether, we excluded 1,106 observations from the project's data and 587 observations from the backlog from the backup on this ground.

The “research-grade” observations with free licences (CC0, CC-BY and CC-BY-NC) are fully available in GBIF within “iNaturalist Research-grade Observations” occurrence dataset (https://doi.org/10.15468/ab3s5x). We added the last column "gbif_id" to all csv files of our dataset with URLs of GBIF records using GBIF Occurrence Download https://doi.org/10.15468/dl.msfxkn performed on 28 Sep 2020.

Five amended csv-files with 750,143 observations from the project “Flora of Russia” ("research-grade" records) and 136,023 observations the project’s backlog ("needs-id" records) represent the stable project backup (https://doi.org/10.5281/zenodo.4061848).

The following abbreviations are used in column descriptions:

- A - automatically generated data (usually from exif files of photos);
- M - manually inserted data;
- AM - both options are possible (automatically generated data which could be manually edited).

| Column label          | Column description                  |
|-----------------------|-------------------------------------|
| id                    | Unique identifier for the observation (A) |
| observed_on_string    | Date/time as entered by the observer (AM) |
| observed_on           | Normalised date of observation (A) |
| time_observed_at      | Normalised date/time of observation (A) |
| time_zone             | Time zone of observation (AM) |
| Field                  | Description                                                                 |
|-----------------------|-----------------------------------------------------------------------------|
| user_id               | Unique identifier for the observer (A)                                      |
| user_login            | Username of the observer (A)                                               |
| created_at            | Date/time observation was created (A)                                       |
| updated_at            | Date/time observation was last updated (A)                                 |
| quality_grade         | Quality grade of this observation; "research grade" only for the "Flora of Russia" project and "needs ID" only for the project's backlog (A) |
| licence               | Licence the observer has chosen for the media file supporting this observation (AM) |
| url                   | URL for the observation (A)                                                |
| image_url             | URL for the default image (A)                                               |
| oauth_application_id  | Which application was used to post the observation (A)                     |
| latitude              | Publicly visible latitude (AM)                                             |
| longitude             | Publicly visible longitude (AM)                                            |
| positional_accuracy   | Accuracy estimate in metres (AM)                                           |
| private_latitude      | Private latitude, set if observation private or obscured (AM)              |
| private_longitude     | Private longitude, set if observation private or obscured (AM)             |
| private_positional_accuracy | Coordinate precision, set if observation private or obscured (AM)              |
| geoprivacy            | Whether or not the observer has chosen to obscure or hide the coordinates (AM) |
| taxon_geoprivacy      | Most conservative geoprivacy applied due to the conservation statuses of taxa in current identification (A) |
| coordinates_obscured  | Whether or not the coordinates have been obscured, either because of geoprivacy or because of a threatened taxon (A) |
| positioning_device    | Device used to determine coordinates (A)                                    |
| positioning_method    | How coordinates were determined (A)                                        |
| scientific_name       | Scientific name of the observed taxon according to iNaturalist taxonomic backbone (AM) |
| taxon_id              | Unique identifier for the observed taxon (A)                               |
| gbif_id               | URL for the corresponding GBIF record (A)                                  |

**Additional information**

**Community Coverage**

**Number of observers.** The project reached a milestone of **10,000 observers** with at least a single "research grade" observation **7 Sep 2020.**
The maximum number of observers is concentrated in the largest cities of Russia and their metropolitan areas - Moscow with Moscow Oblast and St. Petersburg with Leningrad Oblast (Table 15), followed by Krasnodar Krai and the Crimea, two resort regions on the Black Sea coast, which attract millions of tourists. Large communities have also formed in other major cities of Russia, for example, Nizhny Novgorod and Ekaterinburg (Sverdlovsk Oblast). Despite the geographic proximity of Moscow Oblast and the City of Moscow, they have two different communities, which overlap only by 33.4%. A similar situation is observed in St. Petersburg and Sevastopol. The communities of observers in St. Petersburg and Leningrad Oblast overlap by 37.0%, whereas in the Crimea and Sevastopol by 32.0%.

Table 15. Community of the "Flora of Russia" project across regional projects

| Regional project | Observers | Rank (observers) | Regional project members | Rank (regional project members) | Observers per 1M capita | Rank (observers per 1,000 km²) | Observations per observer | Rank (observations per observer) |
|------------------|----------|-----------------|--------------------------|-------------------------------|------------------------|-------------------------------|-----------------------------|-------------------------------|
| Moscow Oblast Flora | 1,910 | 1 | 88 | 2 | 251 | 9 | 43.1 | 4 | 38.4 | 41 |
| Flora of Moscow | 1,623 | 2 | 122 | 1 | 129 | 25 | 633.7 | 1 | 40.8 | 38 |
| St Petersburg Flora | 677 | 3 | 20 | 21 | 126 | 26 | 482.5 | 2 | 13.5 | 71 |
| Leningrad Oblast Flora | 642 | 4 | 23 | 17 | 347 | 4 | 7.7 | 11 | 15.4 | 69 |
| Krasnodar Krai Flora | 508 | 5 | 42 | 7 | 90 | 37 | 6.7 | 12 | 16.8 | 66 |
| Flora of the Crimea | 428 | 6 | 59 | 4 | 224 | 12 | 16.4 | 5 | 38.7 | 39 |
| Nizhny Novgorod Oblast Flora | 366 | 7 | 21 | 20 | 114 | 31 | 4.8 | 19 | 72.9 | 16 |
| Sverdlovsk Oblast Flora | 345 | 8 | 41 | 10 | 80 | 40 | 1.8 | 34 | 53.9 | 31 |
| Tula Oblast Flora | 333 | 9 | 64 | 3 | 225 | 11 | 13.0 | 6 | 82.5 | 14 |
| Regional project | Observers | Rank (observers) | Regional project members | Rank (regional project members) | Observers per 1M capita | Rank (per 1M capita) | Observers per 1,000 km² | Rank (observers per 1,000 km²) | Observations per observer | Rank (observations per observer) |
|------------------|-----------|-----------------|--------------------------|--------------------------------|------------------------|----------------------|------------------------|--------------------------------|----------------------------|-------------------------------|
| Irkutsk Oblast Flora | 313 | 10 | 19 | 23 | 131 | 24 | 0.4 | 65 | 62.8 | 25 |
| Novosibirsk Oblast Flora | 304 | 11 | 45 | 5 | 109 | 32 | 1.7 | 36 | 75.4 | 15 |
| Bashkortostan Flora | 302 | 12 | 19 | 22 | 75 | 44 | 2.1 | 31 | 53.1 | 32 |
| Tver Oblast Flora | 290 | 13 | 25 | 15 | 228 | 10 | 3.4 | 24 | 33.1 | 46 |
| Tatarstan Flora | 276 | 14 | 22 | 19 | 71 | 48 | 4.1 | 22 | 64.2 | 22 |
| Kaluga Oblast Flora | 260 | 15 | 25 | 14 | 258 | 8 | 8.7 | 9 | 28.5 | 52 |
| Voronezh Oblast Flora | 240 | 16 | 16 | 32 | 103 | 33 | 4.6 | 20 | 72.5 | 17 |
| Vladimir Oblast Flora | 234 | 17 | 30 | 12 | 171 | 14 | 8.0 | 10 | 62.1 | 26 |
| Altai Krai Flora | 226 | 18 | 41 | 9 | 97 | 35 | 1.3 | 45 | 94.2 | 11 |
| Chelyabinsk Oblast Flora | 215 | 19 | 24 | 16 | 62 | 55 | 2.4 | 30 | 47.5 | 35 |
| Flora of Karelia | 211 | 20 | 11 | 52 | 341 | 5 | 1.2 | 47 | 16.7 | 67 |
| Sevastopol Flora | 199 | 21 | 41 | 8 | 449 | 2 | 230.3 | 3 | 110.5 | 9 |
| Bryansk Oblast Flora | 175 | 22 | 44 | 6 | 146 | 20 | 5.0 | 15 | 199.5 | 4 |
| Yaroslavl Oblast Flora | 175 | 23 | 14 | 39 | 139 | 22 | 4.8 | 16 | 86.2 | 13 |
| Samara Oblast Flora | 170 | 24 | 22 | 18 | 53 | 58 | 3.2 | 26 | 50.1 | 34 |
| Kaliningrad Oblast Flora | 163 | 25 | 12 | 47 | 163 | 16 | 10.8 | 7 | 47.2 | 36 |
| Altai Republic Flora | 153 | 26 | 16 | 31 | 699 | 1 | 1.6 | 39 | 23.3 | 61 |
| Regional project          | Observers | Rank (observers) | Regional project members | Rank (regional project members) | Observers per 1M capita | Rank (per 1M capita) | Observers per 1,000 km² | Rank (observers per 1,000 km²) | Observations per observer | Rank (observations per observer) |
|--------------------------|-----------|------------------|--------------------------|---------------------------------|-------------------------|----------------------|--------------------------|-----------------------------|---------------------------|-------------------------------|
| Murmansk Oblast Flora    | 142       | 27               | 15                       | 34                              | 190                     | 13                   | 1.0                      | 52                          | 23.7                      | 60                            |
| Krasnoyarsk Krai Flora   | 140       | 28               | 16                       | 30                              | 49                      | 63                   | 0.1                      | 82                          | 60.0                      | 27                            |
| Primorsky Krai Flora     | 138       | 29               | 14                       | 38                              | 73                      | 45                   | 0.8                      | 56                          | 56.5                      | 29                            |
| Ryazan Oblast Flora      | 129       | 30               | 15                       | 33                              | 116                     | 30                   | 3.3                      | 25                          | 25.7                      | 55                            |
| Flora of Khanty-Mansi Autonomous Okrug | 126       | 31               | 18                       | 25                              | 76                      | 43                   | 0.2                      | 71                          | 63.7                      | 23                            |
| Flora of Mordovia        | 125       | 32               | 17                       | 27                              | 157                     | 17                   | 4.8                      | 18                          | 133.2                     | 7                             |
| Buryat Republic Flora    | 121       | 33               | 16                       | 29                              | 123                     | 27                   | 0.3                      | 68                          | 30.1                      | 51                            |
| Kamchatka Flora          | 117       | 34               | 36                       | 11                              | 372                     | 3                    | 0.3                      | 70                          | 119.4                     | 8                             |
| Rostov Oblast Flora      | 117       | 35               | 10                       | 57                              | 28                      | 81                   | 1.2                      | 48                          | 25.0                      | 59                            |
| Chuvash Republic Flora   | 115       | 36               | 25                       | 13                              | 94                      | 36                   | 6.3                      | 13                          | 160.9                     | 5                             |
| Perm Krai Flora          | 114       | 37               | 16                       | 28                              | 44                      | 67                   | 0.7                      | 57                          | 51.2                      | 33                            |
| Stavropol Krai Flora     | 110       | 38               | 8                        | 68                              | 39                      | 72                   | 1.7                      | 38                          | 10.4                      | 79                            |
| Volgograd Oblast Flora   | 107       | 39               | 12                       | 46                              | 43                      | 68                   | 0.9                      | 53                          | 32.8                      | 47                            |
| Ivanovo Oblast Flora     | 103       | 40               | 10                       | 56                              | 103                     | 34                   | 4.8                      | 17                          | 20.7                      | 63                            |
| Kemerovo Oblast Flora    | 101       | 41               | 13                       | 42                              | 38                      | 74                   | 1.1                      | 49                          | 32.7                      | 48                            |
| Regional project                  | Observers | Rank (observers) | Regional project members | Rank (regional project members) | Observers per 1M capita | Rank (observers per 1M capita) | Observations per 1,000 km² | Rank (observations per observer) | Observers per 1,000 km² | Rank (observers per 1,000 km²) | Observers per observer | Rank (observations per observer) |
|----------------------------------|-----------|------------------|--------------------------|-------------------------------|------------------------|-------------------------------|----------------------------|-----------------------------|------------------------|----------------------------|-----------------------|----------------------------|
| Belgorod Oblast Flora            | 97        | 42               | 18                       | 24                            | 63                     | 54                            | 3.6                        | 23                          | 64.6                   | 21                         | 64.6                  | 21                        |
| Pskov Oblast Flora               | 96        | 43               | 9                        | 62                            | 152                    | 19                            | 1.7                        | 35                          | 25.0                   | 58                         | 25.0                  | 58                        |
| Novgorod Oblast Flora            | 87        | 44               | 9                        | 61                            | 145                    | 21                            | 1.6                        | 40                          | 21.1                   | 62                         | 21.1                  | 62                        |
| Saratov Oblast Flora             | 87        | 45               | 13                       | 41                            | 36                     | 77                            | 0.9                        | 55                          | 38.6                   | 40                         | 38.6                  | 40                        |
| Tomsk Oblast Flora               | 87        | 46               | 14                       | 37                            | 81                     | 39                            | 0.3                        | 69                          | 66.2                   | 20                         | 66.2                  | 20                        |
| Arkhangelsk Oblast Flora         | 78        | 47               | 8                        | 67                            | 71                     | 47                            | 0.2                        | 73                          | 36.2                   | 43                         | 36.2                  | 43                        |
| Flora of Karachay-Cherkessia     | 77        | 48               | 6                        | 74                            | 165                    | 15                            | 5.4                        | 14                          | 34.3                   | 44                         | 34.3                  | 44                        |
| Kursk Oblast Flora               | 77        | 49               | 12                       | 45                            | 70                     | 51                            | 2.6                        | 29                          | 342.1                  | 2                          | 342.1                 | 2                         |
| Kirov Oblast Flora               | 75        | 50               | 13                       | 40                            | 59                     | 56                            | 0.6                        | 60                          | 70.4                   | 18                         | 70.4                  | 18                        |
| Lipetsk Oblast Flora             | 74        | 51               | 4                        | 83                            | 65                     | 52                            | 3.1                        | 28                          | 41.7                   | 37                         | 41.7                  | 37                        |
| Flora of Yamalo-Nenets Autonomous Okrug | 71    | 52               | 17                       | 26                            | 131                    | 23                            | 0.1                        | 77                          | 27.4                   | 54                         | 27.4                  | 54                        |
| Flora of Adygea                  | 70        | 53               | 10                       | 55                            | 154                    | 18                            | 9.0                        | 8                           | 13.8                   | 70                         | 13.8                  | 70                        |
| Tyumen Oblast Flora              | 69        | 54               | 9                        | 60                            | 45                     | 65                            | 0.4                        | 63                          | 101.5                  | 10                         | 101.5                 | 10                        |
| Smolensk Oblast Flora            | 67        | 55               | 6                        | 73                            | 71                     | 46                            | 1.3                        | 44                          | 12.8                   | 74                         | 12.8                  | 74                        |
| Regional project                  | Observers | Rank (observers) | Regional project members | Rank (regional project members) | Observers per 1M capita | Rank (per 1M capita) | Observers per 1,000 km² | Rank (observers per 1,000 km²) | Observations per observer | Rank (observations per observer) |
|----------------------------------|-----------|-----------------|--------------------------|-------------------------------|-------------------------|---------------------|--------------------------|-----------------------------|--------------------------|-------------------------------|
| Orenburg Oblast Flora            | 65        | 56              | 8                        | 66                            | 33                      | 79                  | 0.5                      | 62                          | 18.1                     | 65                            |
| Penza Oblast Flora               | 64        | 57              | 12                       | 44                            | 49                      | 64                  | 1.5                      | 42                          | 32.3                     | 49                            |
| Udmurt Republic Flora            | 64        | 58              | 8                        | 65                            | 42                      | 69                  | 1.5                      | 41                          | 62.9                     | 24                            |
| Komi Republic Flora              | 63        | 59              | 3                        | 84                            | 76                      | 42                  | 0.2                      | 75                          | 11.7                     | 76                            |
| Ulyanovsk Oblast Flora           | 63        | 60              | 11                       | 51                            | 51                      | 60                  | 1.7                      | 37                          | 38.3                     | 42                            |
| Vologda Oblast Flora             | 58        | 61              | 11                       | 49                            | 50                      | 62                  | 0.4                      | 66                          | 33.5                     | 45                            |
| Sakhalin Oblast Flora            | 58        | 62              | 11                       | 50                            | 118                     | 29                  | 0.7                      | 59                          | 55.1                     | 30                            |
| Kostroma Oblast Flora            | 57        | 63              | 14                       | 36                            | 89                      | 38                  | 0.9                      | 54                          | 223.3                    | 3                             |
| Flora of Kabardino-Balkaria      | 56        | 64              | 7                        | 70                            | 65                      | 53                  | 4.5                      | 21                          | 8.7                      | 81                            |
| Dagestan Flora                   | 52        | 65              | 9                        | 59                            | 17                      | 83                  | 1.0                      | 51                          | 145.9                    | 6                             |
| Oryol Oblast Flora               | 52        | 66              | 4                        | 82                            | 70                      | 50                  | 2.1                      | 32                          | 11.0                     | 78                            |
| Astrakhan Oblast Flora           | 51        | 67              | 10                       | 54                            | 50                      | 61                  | 1.0                      | 50                          | 9.2                      | 80                            |
| Omsk Oblast Flora                | 51        | 68              | 14                       | 35                            | 26                      | 82                  | 0.4                      | 67                          | 387.2                    | 1                             |
| Mari El Flora                    | 48        | 69              | 7                        | 69                            | 71                      | 49                  | 2.1                      | 33                          | 25.1                     | 57                            |
| Khabarovsky Krai Flora           | 48        | 70              | 6                        | 72                            | 36                      | 75                  | 0.1                      | 81                          | 12.7                     | 75                            |
| Tambov Oblast Flora              | 42        | 71              | 5                        | 78                            | 41                      | 71                  | 1.2                      | 46                          | 25.5                     | 56                            |
| Regional project                     | Observers | Rank (observers) | Regional project members | Rank (regional project members) | Observers per 1M capita | Rank (per 1M capita) | Observers per 1,000 km² | Rank (observers per 1,000 km²) | Observations per observer | Rank (observations per observer) |
|-------------------------------------|-----------|-----------------|--------------------------|---------------------------------|------------------------|----------------------|--------------------------|--------------------------------|-------------------------------|-------------------------------|
| Flora of Khakassia                 | 41        | 72              | 11                       | 48                              | 76                     | 41                   | 0.7                      | 58                             | 27.7                          | 53                            |
| Flora of Yakutia                   | 41        | 73              | 10                       | 53                              | 42                     | 70                   | 0.0                      | 85                             | 12.8                          | 73                            |
| Zabaykalsky Krai Flora             | 33        | 74              | 8                        | 64                              | 31                     | 80                   | 0.1                      | 79                             | 31.0                          | 50                            |
| Amur Oblast Flora                  | 30        | 75              | 9                        | 58                              | 38                     | 73                   | 0.1                      | 78                             | 86.7                          | 12                            |
| Kurgan Oblast Flora                | 29        | 76              | 12                       | 43                              | 35                     | 78                   | 0.4                      | 64                             | 67.9                          | 19                            |
| Flora of North Ossetia             | 25        | 77              | 5                        | 77                              | 36                     | 76                   | 3.1                      | 27                             | 5.1                           | 84                            |
| Tyva Republic Flora                | 18        | 78              | 6                        | 71                              | 55                     | 57                   | 0.1                      | 76                             | 11.4                          | 77                            |
| Magadan Oblast Flora               | 17        | 79              | 5                        | 76                              | 120                    | 28                   | 0.0                      | 83                             | 13.0                          | 72                            |
| Flora of Chukotka                  | 16        | 80              | 8                        | 63                              | 322                    | 6                    | 0.0                      | 84                             | 58.0                          | 28                            |
| Flora of Kalmykia                  | 14        | 81              | 2                        | 85                              | 51                     | 59                   | 0.2                      | 74                             | 3.4                           | 85                            |
| Flora of Nenets Autonomous Okrug   | 12        | 82              | 4                        | 81                              | 274                    | 7                    | 0.1                      | 80                             | 6.8                           | 82                            |
| Chechen Republic Flora             | 9         | 83              | 4                        | 80                              | 6                      | 85                   | 0.6                      | 61                             | 19.4                          | 64                            |
| Flora of Jewish Autonomous Oblast  | 7         | 84              | 4                        | 79                              | 44                     | 66                   | 0.2                      | 72                             | 15.7                          | 68                            |
| Flora of Ingushetia                | 5         | 85              | 5                        | 75                              | 10                     | 84                   | 1.4                      | 43                             | 6.4                           | 83                            |

**Number of members (subscribers) of regional projects.** The largest regional community of formal members is in the City of Moscow (122 participants) and Moscow.
Oblast (88 participants). Membership in a regional project allows a member to follow news and to affiliate their observations with a specific region on the observation page. More than 40 participants joined the projects of Tula Oblast, Crimea, Novosibirsk Oblast, Bryansk Oblast, Krasnodar Krai, Sevastopol, Altai Krai and Sverdlovsk Oblast. In Kamchatka, 30.8% of observers are subscribers to the regional project, while in St. Petersburg, on the contrary, only 3.0% have subscribed to the regional project. The number of subscribers is a result of an active curation of the regional project journal.

**Number of observers per 1M capita.** The number of observers per 1M of the regional population shows how actively the local residents are involved in the work of the "Flora of Russia" project. However, a top list, with a few exceptions, includes regions with a small population and sites specifically noteworthy for naturalists. Due to tourist activity, a relatively high number of observers has been noted in Altai Republic, Kamchatka, Leningrad Oblast, Karelia, Chukotka, Nenets Autonomous Okrug and Kaluga Oblast. Communities mostly formed by local residents include Sevastopol, Moscow Oblast and Tver Oblast.

**Number of observers per 1,000 km².** This index helps assess areas with a high density of observers. The federal cities of Moscow, St. Petersburg and Sevastopol are undoubtedly in the lead here (200-700 observers per 1,000 km²). This number is reduced to 43 observers in Moscow Oblast, followed by the Crimea (16), Tula Oblast (13) and Kaliningrad Oblast (11).

**Productivity (number of observations per observer).** This index clearly demonstrates the regions with a fairly modest community, where data are received mainly from a few of the most active participants ("mega-observers") (Table 16). Such active individuals greatly helped Omsk Oblast, Kursk Oblast, Kostroma Oblast, Bryansk Oblast, Chuvashia, Dagestan, Mordovia, Kamchatka, Sevastopol and Tyumen Oblast to rise high in the index.

| Regional project          | Top observer (observations) | Number of observations | Top observer (species) | Number of species |
|--------------------------|-----------------------------|------------------------|------------------------|------------------|
| Flora of Moscow          | A.P. Seregin (apseregin), a | 14,900                 | A.P. Seregin (apseregin), a | 791              |
| Bryansk Oblast Flora     | N.N. Panasenko (panasenkon), c | 13,348                 | N.N. Panasenko (panasenkon), c | 1,010            |
| Kursk Oblast Flora       | N.I. Degtyarev (dni_catipo), a | 10,966                 | N.I. Degtyarev (dni_catipo), a | 841              |
| Chuvash Republic Flora   | S.M. Appolonov (velibortravoved), c | 10,676                 | S.M. Appolonov (velibortravoved), c | 577              |
| Omsk Oblast Flora        | V.I. Teplouhov (vladimir_teplouhov), a | 9,894                  | V.I. Teplouhov (vladimir_teplouhov), a | 492              |

**Table 16.**
Top observers of the regional projects (a - author, c - contributor)
| Regional project          | Top observer (observations)               | Number of observations | Top observer (species)               | Number of species |
|--------------------------|------------------------------------------|------------------------|--------------------------------------|-------------------|
| Sevastopol Flora         | E.S. Kashirina (katerina_kashirina), a    | 8,830                  | S.A. Svirin (sapsan), a              | 1,050             |
| Yaroslavl Oblast Flora   | E.V. Garin (eduard_garin), a              | 6,351                  | E.V. Garin (eduard_garin), a         | 669               |
| Altai Krai Flora         | P.V. Golyakov (pavel_golyakov), a         | 6,285                  | P.V. Golyakov (pavel_golyakov), a    | 829               |
| Moscow Oblast Flora      | N.V. Ivanova (dryomys)                   | 6,235                  | V.Y. Arkhipov (vladimirarkhipov), a  | 561               |
| Krasnoyarsk Krai Flora   | I.N. Pospelov (taimyr), a                | 5,608                  | I.N. Pospelov (taimyr), a           | 659               |
| Kaliningrad Oblast Flora | N.P. Zelenova (npz), a                    | 5,539                  | N.P. Zelenova (npz), a              | 543               |
| Kamchatka Flora          | O.P. Kuryakova (olga2019kuryakova), a     | 5,154                  | B.V. Bolshakov (borisbolshakov), a   | 553               |
| Tatarstan Flora          | V.E. Prokhorov (vadim_prokhorov), a       | 5,001                  | V.E. Prokhorov (vadim_prokhorov), a | 822               |
| Nizhny Novgorod Oblast Flora | T.V. Zarubo (tatyanaazarubo), a      | 4,573                  | T.V. Zarubo (tatyanaazarubo), a     | 591               |
| Kostroma Oblast Flora    | S.A. Nesterova (ledum), a                 | 4,385                  | S.A. Nesterova (ledum), a           | 719               |
| Novosibirsk Oblast Flora| A.P. Zyrianov (alzov), a                  | 4,268                  | K.V. Romanov (kildor), a            | 566               |
| Irkutsk Oblast Flora     | S.V. Mirvoda (smsergey), a                | 4,222                  | A.V. Verkhozina (allaverkhozina), a | 627               |
| Chelyabinsk Oblast Flora | Y.O. Magazov (yaroslavmagazov), a         | 4,027                  | Y.O. Magazov (yaroslavmagazov), a   | 387               |
| Voronezh Oblast Flora    | A.N. Khimin (aleks-khimin), a             | 3,782                  | A.N. Khimin (aleks-khimin), a       | 626               |
| Tomsk Oblast Flora       | A.L. Ebel (aleksandrebel), a              | 3,579                  | A.L. Ebel (aleksandrebel), a        | 643               |
| Dagestan Flora           | M.M. Mallaliev (mallaliev), a             | 3,508                  | R.A. Murtazaliev (ramazan_murtazaliev), a | 1,594           |
| Samara Oblast Flora      | D.V. Tretyakova (divitre), a              | 3,424                  | D.V. Tretyakova (divitre), a        | 469               |
| Tyumen Oblast Flora      | Y.M. Basov (yurii_basov), a              | 3,384                  | Y.M. Basov (yurii_basov), a         | 469               |
| Regional project | Top observer (observations) | Number of observations | Top observer (species) | Number of species |
|------------------|----------------------------|------------------------|------------------------|------------------|
| Flora of Mordovia | A.A. Khapugin (hapugin88), a | 3,322                  | A.A. Khapugin (hapugin88), a | 536              |
| Sverdlovsk Oblast Flora | D.V. Nesterkova (dinanesterkova), a | 3,151                  | M.S. Knjazev (mihail13), a | 661              |
| Primorsky Krai Flora | V.S. Volkotrub (vvvolkotrub), c | 3,052                  | V.S. Volkotrub (vvvolkotrub), c | 1,238          |
| Bashkortostan Flora | E. Ishmukhametova (evelina_ishmukhametova) | 2,952                  | E. Ishmukhametova (evelina_ishmukhametova) | 467              |
| Belgorod Oblast Flora | V.N. Zelenkova (sesquicentennial), a | 2,784                  | V.N. Zelenkova (sesquicentennial), a | 645              |
| Flora of the Crimea | E.A. Razina (lenatara) | 2,648                  | E.A. Razina (lenatara) | 983              |
| Flora of Khanty-Mansi Autonomous Okrug | N.V. Filippova (ninacourlee), a | 2,579                  | N.V. Filippova (ninacourlee), a | 352              |
| Vladimir Oblast Flora | V.V. Stepanov (vist), a | 2,357                  | A.P. Seregin (apseregin), a | 609              |
| Sakhalin Oblast Flora | S.A. Nesterova (ledum), a | 2,094                  | S.A. Nesterova (ledum), a | 574              |
| Saratov Oblast Flora | A.N. Kandaurova (cava), a | 1,964                  | A.N. Kandaurova (cava), a | 483              |
| Perm Krai Flora | M.E. Trubinova (mashat), c | 1,843                  | I.V. Pavlov (pavloviv), a | 337              |
| Leningrad Oblast Flora | M.I. Ismaylov (maxim_ismaylov), c | 1,667                  | A. Kondratieva (alina_kondratieva) | 407              |
| Kirov Oblast Flora | V. Bryukhov (woodmen19), c | 1,624                  | V. Bryukhov (woodmen19), c | 450              |
| St Petersburg Flora | M.I. Ismaylov (maxim_ismaylov), c | 1,552                  | A. Kondratieva (alina_kondratieva) | 359              |
| Buryat Republic Flora | D.G. Chimitov (daba), a | 1,547                  | D.G. Chimitov (daba), a | 506              |
| Kaluga Oblast Flora | A.A. Malutkin (sansan_94) | 1,429                  | N.V. Ivanova (dryomys) | 335              |
| Flora of Karachay-Cherkessia | D.A. Bochkov (convallaria1128), a | 1,362                  | D.A. Bochkov (convallaria1128), a | 599              |
| Arkhangelsk Oblast Flora | G. Okatov (gen_ok) | 1,314                  | G. Okatov (gen_ok) | 660              |
| Rostov Oblast Flora | S.R. Mayorov (phlomis_2019), a | 1,301                  | S.R. Mayorov (phlomis_2019), a | 510              |
| Regional project               | Top observer (observations) | Number of observations | Top observer (species)   | Number of species |
|------------------------------|----------------------------|------------------------|--------------------------|-------------------|
| Tula Oblast Flora            | T.Y. Svetasheva (tsvetasheva), a | 1,294                  | T.Y. Svetasheva (tsvetasheva), a | 529               |
| Tver Oblast Flora            | E.S. Pushay (pushai), a           | 1,108                  | A.P. Seregin (apseregin), a | 370               |
| Amur Oblast Flora            | A.P. Seregin (apseregin), a         | 1,052                  | S.A. Nesterova (ledum), a | 367               |
| Udmurt Republic Flora        | S. Seleznev (sergejseleznev)       | 1,006                  | S. Seleznev (sergejseleznev) | 367               |
| Kemerovo Oblast Flora        | E.E. Perfilev (gyng), c         | 970                    | E.E. Perfilev (gyng), c | 410               |
| Ryazan Oblast Flora          | P.Y. Likhacheva (polinalikhacheva), c | 948                    | P.Y. Likhacheva (polinalikhacheva), c | 267               |
| Kurgan Oblast Flora          | Y.M. Basov (yurii_basov), a       | 936                    | Y.M. Basov (yurii_basov), a | 250               |
| Ulyanovsk Oblast Flora       | A.V. Korobkov (korobkov)         | 777                    | R. Anashkina (rimma_anashkina) | 333               |
| Vologda Oblast Flora         | D.A. Filippov (dmitriy_filippov), c | 754                    | D.A. Filippov (dmitriy_filippov), c | 279               |
| Krasnodar Krai Flora         | A.P. Seregin (apseregin), a       | 712                    | Y.V. Danilevsky (yuridanilevsky), a | 339               |
| Pskov Oblast Flora           | E.S. Popov (epopov), a           | 641                    | E.S. Popov (epopov), a | 386               |
| Flora of Karelia             | anonymous (plrays)               | 626                    | anonymous (plrays) | 234               |
| Lipetsk Oblast Flora         | S.Y. Korovaiacev (mrsalento), c  | 617                    | A.P. Seregin (apseregin), a | 355               |
| Murmansk Oblast Flora        | D.A. Bochkov (convallaria1128), a | 593                    | D.A. Bochkov (convallaria1128), a | 242               |
| Penza Oblast Flora           | D. Polikanin (zemleved)          | 576                    | D. Polikanin (zemleved) | 345               |
| Volgograd Oblast Flora       | A.P. Seregin (apseregin), a       | 555                    | A.P. Seregin (apseregin), a | 334               |
| Mari El Flora                | V.A. Bakutov (vladimirbakutov), a | 553                    | V.A. Bakutov (vladimirbakutov), a | 359               |
| Tambov Oblast Flora          | E. Yarova (hln_m_t)              | 524                    | E. Yarova (hln_m_t) | 196               |
| Flora of Chukotka            | I.N. Pospelov (taimyr), a         | 469                    | I.N. Pospelov (taimyr), a | 159               |
| Altai Republic Flora         | N.V. Filippova (ninacourlee), a   | 430                    | K.V. Romanov (kidor), a | 170               |
| Flora of Khakassia           | A.L. Ebel (aleksandrebel), a      | 353                    | A.L. Ebel (aleksandrebel), a | 209               |
| Ivanovo Oblast Flora         | anonymous (olia27)               | 309                    | E. Voinova (ekaterinavoinova) | 205               |
| Regional project                                      | Top observer (observations) | Number of observations | Top observer (species) | Number of species |
|-------------------------------------------------------|-----------------------------|------------------------|------------------------|-------------------|
| Novgorod Oblast Flora                                | N. Zouieva (nat_zouieva)    | 302                    | A. Nikanorova (feanaro)| 166               |
| Zabaykalsky Krai Flora                               | D.G. Chimitov (daba), a     | 281                    | D.G. Chimitov (daba), a| 165               |
| Flora of Yamalo-Nenets Autonomous Okrug              | I.N. Pospelov (taimyr), a   | 252                    | I.N. Pospelov (taimyr), a| 136               |
| Stavropol Krai Flora                                 | M.A. Orlov (naturalist16000), c | 237 | M.A. Orlov (naturalist16000), c | 140               |
| Astrakhan Oblast Flora                               | A. Golovchenko (alena_golovchenko) | 224 | A. Golovchenko (alena_golovchenko) | 93               |
| Flora of Adygea                                       | E. Shaw (ed_shaw)           | 163                    | E. Shaw (ed_shaw)       | 110               |
| Komi Republic Flora                                  | E. Shubnitsina (elena_sh)   | 156                    | E. Shubnitsina (elena_sh)| 89               |
| Flora of Yakutia                                      | C. Rixen (christianrixen)   | 134                    | C. Rixen (christianrixen)| 106               |
| Flora of Kabardino-Balkaria                          | M.P. Shashkov (max_carabus) | 134                    | M.P. Shashkov (max_carabus)| 70               |
| Orenburg Oblast Flora                                | V.P. Travkin (vladimirtravkin), a | 131 | V.P. Travkin (vladimirtravkin), a | 87               |
| Smolensk Oblast Flora                                | D. Kulakova (daria_kulakova) | 124 | D. Kulakova (daria_kulakova) | 112               |
| Oryol Oblast Flora                                   | M. Frolenkova (frolenkovamar) | 108 | M. Frolenkova (frolenkovamar) | 66               |
| Tyva Republic Flora                                  | A.I. Pyak (pyakai), a       | 100                    | A.I. Pyak (pyakai), a   | 95                |
| Khabarovsky Krai Flora                               | A. Sukhinina (sukhinina-a)  | 86                     | V.A. Belova (veronika_belova), a | 65               |
| Flora of Jewish Autonomous Oblast                    | V.A. Belova (veronika_belova), a | 62 | V.A. Belova (veronika_belova), a | 51               |
| Chechen Republic Flora                                | T.A. Avtaeva (tomaavtaeva)  | 60                     | T.A. Avtaeva (tomaavtaeva) | 56               |
| Magadan Oblast Flora                                 | I.N. Pospelov (taimyr), a   | 42                     | E. Yusupova (ekaterina_yusupova) | 36               |
| Flora of Nenets Autonomous Okrug                     | D.G. Ivanov (ivanovdg19), c | 32                     | D.G. Ivanov (ivanovdg19), c | 25               |
| Flora of North Ossetia                               | V.N. Korotkov (vladimir_korotkov), a | 23 | V.N. Korotkov (vladimir_korotkov), a | 22               |
Regional project | Top observer (observations) | Number of observations | Top observer (species) | Number of species
--- | --- | --- | --- | ---
Flora of Ingushetia | R.A. Murtazaliev (ramazan_murtazaliev), a | 19 | R.A. Murtazaliev (ramazan_murtazaliev), a | 19
Flora of Kalmykia | V.E. Prokhorov (vadim_prokhorov), a | 12 | V.E. Prokhorov (vadim_prokhorov), a | 11

Data Usage

The project’s data were cited in a number of research papers dealing with documentation and verification of new regional records (Prokopenko et al. 2019; Verkhozina et al. 2019; Leostrin and Efimova 2020; Seregin 2020b; Verkhozina et al. 2019Verkhozina et al. 2020).

Other examples of dataset usage include papers on distribution of noteworthy alien plants (Mayorov et al. 2020; Zarubo and Mayorov 2020), floristic inventories of protected areas (Seregin 2020a) and phenology of plants during the extremely warm winter of 2019/2020 (Vinogradov 2020).

Several papers on orchids of Russia employed our data to a various extent since this showy group attracts special attention of the observers (Efimov and Legchenko 2020; Efimov 2020; Popovich et al. 2020).

Acknowledgements

More than 10K people and about 4K identifiers have participated in the data collection and curation within this dataset. We would like to thank other active observers and identifiers from iNaturalist: afid, alchemillist, alexander_baransky, alina_kondratieva, almantas, arslan_tatamov, bobwardell, dakileno, davydovbotany, dryomys, evelina-ishmukhametova, evgeniy_benikhanov, fedor_kondrachuk, frontova, fylatra, fyodorkhomenko, gen_ok, ggularijants, hln_m_t, igor_olshanskyi, kai_schablewski, karavan-altay, kemper, korobkov, kosienkov_konstantin, laukines_pievos, lenatara, liila_rakitianskaia, margosha, marioendistel, marina-privalova, max_carabus, mitchella_1, mobbini, natalya1406, naturalist19164, naturalist25051, naturalist31744, naturalist7664, nellysemenova, ocanire, olegdavydov, pavel_yeveseyenkov, prays, plectroniaceae, ppllaannttss_, roman_romanov, roman-evseev, sansan_94, schneider414, sergejseleznev, sergii_kudlaenko, sergilus, skuch, snergeeenvna, sokolkov2002, stepangrebnev2005, stephen54, thilokrueger, tiggrx, tmmaximo, trichocereus, ulrichs, valeria_reshehtnikova, vikaryabkova, viktoria, viktoriaf, vikula_bludov, v-lad, waldeamarzeja, wojciech, wojtest, wolfgangb, yayemaster, yriysokolov73, zdekanovkov and zemleved. This list includes (1) members of the project who decided to be neither contributors nor co-authors of the data paper (or left a proposal unanswered); (2) schoolchildren; (3) naturalists who either did not join or left our community. Their contribution and expertise are highly appreciated.
Funding

**State assignments:** AAAA-A16-116021660039-1 for Lomonosov Moscow State University (S.V. Dudov, K.V. Dudova, N.S. Gamova & A.P. Seregin), AAAA-A17-117011810036-3 for Institute of General and Experimental Biology, SB RAS (D.G. Chimitov), AAAA-A17-117050400146-5 for Institute of the Problems of Northern Development, Tyumen Scientific Centre SB RAS (V.A. Glazunov), AAAA-A18-118012690099-2 for Papanin Institute for Biology of Inland Waters, RAS (E.V. Garin), AAAA-A18-118021490070-5 for Institute of North Industrial Ecology Problems, Kola Science Centre RAS (E.A. Borovichev), AAAA-A18-118022090078-2 (E.S. Popov) & AAAA-A19-119031290052-1 (A.V. Leostrin) for Komarov Botanical Institute, RAS, AAAA-A18-118052590019-7 for Center for Forest Ecology and Productivity, RAS (E.V. Tikhonova), AAAA-A19-119020890099-4 for Mountain Botanical Garden, Dagestan Federal Research Centre RAS (M.M. Mallaliev), AAAA-A19-119051390034-4 for Tula State Lev Tolstoy Pedagogical University (T.Y. Svetasheva), AAAA-A20-120031890003-3 for Institute of Cytology & Genetics, SB RAS (O.E. Kosterin), AAAA-A20-120021490040-3 for Tyumen State University (A.A. Khapugin, I.V. Kuzmin).

**Grants from Russian Foundation for Basic Research:** 20-35-70066 (S.A. Lednev), 19-04-00799 (T.M. Gavriloa), 19-04-00658 & 19-29-05205 (R.A. Murtazaliev), 20-04-00544 (M.I. Khomutovskiy), 19-04-00370 (J.V. Shner), 18-44-860017 (N.V. Filippova), 19-54-53014 (S.V. Dudov), 18-44-030025 & 19-54-53015 (D.G. Chimitov), 19-44-710002 (T.Y. Svetasheva & A.P. Seregin), 19-34-70018 (S.V. Dudov, K.V. Dudova & A.P. Seregin), 20-44-420007 (A.L. Ebel & A.P. Seregin), 19-44-233012 (E.G. Kashirina, N.S. Gamova, S.V. Dudov & A.P. Seregin), 20-45-380009 (V.A. Belova), 20-416-380004 (N.V. Dorofeev).

**Other grants:** 20-67-46018 (A.I. Pyak) & 19-77-00025 (M.N. Kozhin) from Russian Science Foundation; grant 075-15-2020-787 in the form of a subsidy for a Major project in priority areas from the Ministry of Science and Higher Education of Russia (A.V. Verkhozina); grant 37/2020-P from Russian Geographic Society (R.A. Murtazaliev); grant 13-01-20/39 from the Yugra State University for the development of scientific schools (N.V. Filippova); grant "Providing Equipment for Digitizing Herbarium Collection of UUH and Materials for further Processing Plant Specimens" from the International Association of Plant Taxonomy (D.G. Chimitov).

Author contributions

Each co-author of the paper simultaneously fulfilled three criteria being (1) a top-500 observer with 180+ observations, (2) a top-200 identifier with 320+ identifications and (3) a formal member (a subscriber) of the "Flora of Russia" project on iNaturalist as of 8 Sep 2020. The following contribution was made by the authors:
• A - checking data quality (flagging cultivated plants, inspecting metadata of photos, checking copyright, monitoring the accuracy of georeferencing, giving advice to newcomers etc.);
• B - identification of someone's observations;
• C - confirmation someone's observations;
• D - promotion of iNaturalist (media and social networks, work with students and schoolchildren, organising biooblitzes etc.);
• E - curation of the regional projects of "Flora of Russia";
• F - active management of another project, the content of which overlaps (partially or entirely) with the "Flora of Russia" project;
• G - field inspection of interesting observations of other users.

Details of contribution of the authors (in alphabetic order):

• V.Y. Arkhipov (vladimirarkhipov) - ABCDG and field work mainly in Moscow Oblast;
• V.A. Bakutov (vladimirbakutov) - B and field work mainly in Mari El Republic;
• Y.M. Basov (yurii_basov) - ABC and field work mainly in Tyumen Oblast;
• V.A. Belova (veronika_belova) - ABCG and field work mainly in Irkutsk Oblast;
• E.A. Belyakov (evgeniib) - BCFG and field work mainly in Yaroslavl Oblast;
• O.V. Biryukova (beerolha) - ABCDEG and field work mainly in Nizhny Novgorod Oblast;
• D.A. Bochkov (convallaria1128) - ABCG and field work mainly in City of Moscow;
• S.A. Bogdanovich (svetlana-bogdanovich) - ABCDG and field work mainly in Crimea;
• B.V. Bolshakov (borisbolshakov) - ABCDG and field work mainly in Kamchatka Krai;
• V.P. Borodulina (valentinaborodulina) - ABCDF and field work mainly in Moscow Oblast;
• E.A. Borovichev (borovicheveugene) - BCDG and field work mainly in Murmansk Oblast;
• U.V. Bury (vlbury) - BCD and field work mainly in Kamchatka Krai;
• O.A. Chernyagina (olga_chernyagina) - ABCDEFG and field work mainly in Kamchatka Krai;
• D.G. Chimitov (daba) - BCDG and field work mainly in Buryatia;
• Y.V. Danilevsky (yuriydanilevsky) - ABC and field work mainly in Krasnodar Krai;
• A.V. Danilin (daniilinav) - AB and field work mainly in Moscow Oblast;
• N.I. Degtyarev (dni_catipo) - ABCDFG and field work mainly in Kursk Oblast;
• O.V. Deineko (lex_deineko) - C and field work mainly in Kursk Oblast;
• N.V. Dorofeev (nikolaydorofeev) - BCG and field work mainly in Irkutsk Oblast;
• A.V. Dubynin (alexanderdubynin) - ABCDEFG and field work mainly in Novosibirsk Oblast;
• S.V. Dudov (svdudov) - ABC and field work mainly in Karachay-Cherkessia;
• K.V. Dudova (antennaria) - ABDG and field work mainly in Vladimir Oblast;
• Alexei L. Ebel (alexieiebel) - ACDF and field work mainly in Altai Krai;
• Aleksandr L. Ebel (aleksandrebel) - BCFG and field work mainly in Tomsk Oblast;
• A.N. Efremov (andreyeefremov) - BCG and field work mainly in Amur Oblast;
• D.V. Epikhin (epikhin) - ABC and field work mainly in Crimea;
• Y.A. Fedorova (jules_f) - ABC and field work mainly in Bashkortostan;
• I.V. Filippov (bolotoved) - ABC and field work mainly in Khanty Mansi Autonomous Okrug;
• N.V. Filippova (ninacourlee) - ABCDEFG and field work mainly in Khanty Mansi Autonomous Okrug;
• N.S. Gamova (natalia_gamova) - ABC and field work mainly in Buryatia;
• E.V. Garin (eduard_garin) - ABCD and field work in City of Moscow;
• S.V. Gerasimov (sVg52) - BCDG and field work mainly in Bashkortostan;
• V.A. Glazunov (vaglazunov) - ABCG and field work mainly in Tyumen Oblast;
• P.V. Golyakov (pavel_golyakov) - ABCDG and field work mainly in Altai Krai;
• M.S. Gorbunova (melodi_96) - ABCDEF and field work mainly in Moscow Oblast;
• V.V. Gostev (v199rus) - ABCD and field work mainly in Moscow Oblast;
• T.A. Karpenko (tatiana_karpenko) - BCDF and field work mainly in Sevastopol;
• E.S. Kashirina (katerina_kashirina) - ABCDEG and field work mainly in Sevastopol;
• A.A. Khaustov (hapugin88) - ABCDEFG and field work mainly in Mordovia;
• A.N. Khim (aleks-khim) - BCDFG and field work mainly in Voronezh Oblast;
• M.I. Khomutovskiy (khomax) - BCG and field work mainly in Karachay-Cherkessia;
• V.N. Korotkov (vladimir_korotkov) - ABC and field work mainly in City of Moscow;
• M.N. Kuzhin (mkozhin) - ABCDFG and field work mainly in Murmansk Oblast;
• M.V. Kozlova (mitrula_paludosa) - ABCG and field work mainly in City of Moscow;
• M.M. Krivosheev (krivosheev) - BCDG and field work mainly in Bashkortostan;
• E.V. Kropocheva (naturalist6941) - BCF and field work mainly in Krasnodar Krai;
• O.P. Kuryakova (olga2019kuryakova) - ABC and field work mainly in Kamchatka Krai;
• S.B. Kutueva (svetlanakutueva) - BCD and field work mainly in Saratov Oblast;
• S.V. Mirvoda (smsergey) - BCE and field work mainly in Irkutsk Oblast;
• I.Y. Mitjushina (zefirka) - ABCF and field work mainly in Vladimir Oblast;
- A.E. Mitroshenkova (naturalist38499) - BCDG and field work mainly in Samara Oblast;
- R.A. Murtazeliev (ramazan_murtazaliev) - ABC and field work mainly in Dagestan;
- D.V. Nesterkova (dinanesterkova) - ABCEG and field work mainly in Sverdlovsk Oblast;
- S.A. Nesterova (ledum) - ABCE and field work mainly in Kostroma Oblast;
- R.M. Osmanov (ru_osmanov) - CG and field work mainly in Dagestan;
- I.V. Pavlov (pavloviv) - BC and field work mainly in Perm Krai;
- S.V. Ponomarenko (serguei_ponomarenko) - ABC and field work mainly in Moscow Oblast;
- E.S. Popov (epopov) - BC and field work mainly in Pskov Oblast;
- L.S. Poryadin (leoporyadin) - CG and field work mainly in Moscow Oblast;
- I.N. Pospelov (taimyr) - ABCG and field work mainly in Krasnoyarsk Krai;
- V.E. Prokhorov (yadim_prokhorov) - ABCDFG and field work mainly in Tatarstan;
- S.V. Prokopenko (sergeyprokopenko) - BC and field work mainly in Primorsky Krai;
- E.S. Pushay (pushai) - ABCDEFG and field work mainly in Tver Oblast;
- A.I. Pyak (pyakai) - BCG and field work mainly in Altai Republic;
- K.V. Romanov (kildor) - ABCDEG and field work mainly in Novosibirsk Oblast;
- D.B. Safina (dinasafina) - CG and field work mainly in Crimea;
- E.S. Samarin (brodaga59) - AC and field work mainly in Bashkortostan;
- K.V. Samodurov (konstantinsamodurov) - BC and field work mainly in Tomsk Oblast;
- S.A. Senator (stsenator) - ABCDG and field work mainly in Samara Oblast;
- A.P. Seregin (apseregin) - ABCDE and field work mainly in City of Moscow;
- D.S. Shilov (denis_shilov) - ABCD and field work mainly in Sverdlovsk Oblast;
- J.V. Shner (julia_shner) - ABCG and field work mainly in City of Moscow;
- E.A. Shumikhina (eashumikhina) - ABC and field work mainly in Tyumen Oblast;
- T.B. Silaeva (tbsilaeva) - BC and field work mainly in Mordovia;
- E.A. Sklyar (ev_sklyar) - ACDE and field work mainly in Kursk Oblast;
- V.V. Stepanov (vist) - ABCDEFG and field work mainly in Vladimir Oblast;
- T.L. Strus (naturalist10224) - BCDF and field work mainly in Khanty Mansi Autonomous Okrug;
- R.R. Sultanov (sultanov-rinat) - BCG and field work mainly in Novosibirsk Oblast;
- T.Y. Svetasheva (tsvetasheva) - ABCDG and field work mainly in Tula Oblast;
- S.A. Svirin (sapsan) - BCG and field work mainly in Sevastopol;
- V.I. Teplouhov (vladimir_teplouhov) - BC and field work mainly in Omsk Oblast;
- E.V. Tikhonova (elena_tikhonova) - BC and field work mainly in City of Moscow;
- D.V. Tishin (denis_tishin) - BCDEFG and field work mainly in Tatarstan;
- V.P. Travkin (vladimirtravkin) - ABCEF and field work mainly in Samara Oblast;
- D.V. Tretyakova (divitre) - ABCD and field work mainly in Samara Oblast;
- A.V. Verkhozina (allaverkhozina) - ABCDEFG and field work mainly in Irkutsk Oblast;
- G.M. Vinogradov (prokhozhyj) - ABCD and field work mainly in City of Moscow;
- D.R. Vladimirv (vladimirv) - ABCDEFG and field work mainly in Voronezh Oblast;
- A.A. Yakovlev (birdchuvahia) - CDEF and field work mainly in Chuvash Republic;
• D.A. Yumagulov (domir) - B and field work mainly in Bashkortostan;
• V.P. Zakharov (forestru) - CDF and field work mainly in Moscow Oblast;
• T.V. Zarubo (tatyanazarubo) - ABCG and field work mainly in Nizhny Novgorod Oblast;
• V.N. Zelenkova (sesquicentennial) - ABCDEFG and field work mainly in Belgorod Oblast;
• N.P. Zelenova (npz) - ABC and field work mainly in Kaliningrad Oblast;
• I.B. Zolotukhina (zibzap) - BC and field work mainly in Kursk Oblast;
• A.P. Zyrianov (alzov) - ABCDG and field work mainly in Novosibirsk Oblast.

A.P. Seregin compiled the dataset and edited it after the data audit. The earlier version of the manuscript was written by A.P. Seregin with great assistance from O.V. Biryukova (tables, layout), K.V. Dudova (references), Aleksandr L. Ebel (tables, references), A.N. Efremov (references), E.V. Garin (tables), E.S. Kashirina (graphs), A.A. Khapugin (text), O.E. Kosterin (text), S.V. Ponomarenko (text), G.M. Vinogradov (text, references) and V.N. Zelenkova (tables). All authors contributed to the discussion to a various extent. After numerous comments, suggestions and improvements, D.A. Bochkov finally edited the text.

Other active identifiers and observers who formally confirmed their participation in the project for this data paper are acknowledged here as contributors (in alphabetic order):

• T.I. Abazova (tannii66) - BCD and field work mainly in Sverdlovsk Oblast;
• A.Y. Afonin (disertinsky) - ABCD and field work mainly in Bryansk Oblast;
• V.I. Ainikeeva (valiaainikeeva) - FG and field work mainly in Voronezh Oblast;
• D.C. Albach, Germany (albach) - ABCD;
• S.A. Antipov (rucfavin) - CG and field work mainly in Vladimir Oblast;
• S.M. Appolonov (velibortravoved) - BCD and field work mainly in Chuvash Republic;
• S.K. Bakey, Belarus (leschij) - BC;
• S.V. Bevza (sergeybevza) - ABC and field work mainly in Kirov Oblast;
• E.I. Boginsky (evgenyboginsky) - BCDFG and field work mainly in Altai Krai;
• V.V. Bryukhov (woodmen19) - field work mainly in Kirov Oblast;
• V.V. Chepinoga (victorchepinoga) - ABCF and field work mainly in Irkutsk Oblast;
• S.A. Cherepushkin (s_chere) - BC and field work mainly in City of Moscow;
• V.A. Chistyakova (vera_chistyakova) - C and field work mainly in Kostroma Oblast;
• G. Dugied, France (mercantour) - ABCD;
• A.A. Efimova (anna_efimova) - C and field work mainly in Kostroma Oblast;
• D.G. Elin (deniselin) - D and field work mainly in Sverdlovsk Oblast;
• M. Esfahanian, United States (mali4622) - BCD;
• N.B. Fadeev (nicolayfadeev) - BC;
• E.S. Fedascheva (fedascheva) - G and field work mainly in Mordovia;
• P.J. Flood, Netherlands (padraicflood) - ABC;
• J.F. Gange, United States (arethusa) - ABC;
• N.A. Glushenkova (naturalist8307) - D and field work mainly in Chuvash Republic;
• O.Y. Goncharova (goncholgaj) - D and field work mainly in Kaluga Oblast;
• J.R. Grant, Switzerland (jasonrgrant) - ABCD;
• A.Y. Grigoryevskaya (a mentor of vladimirov) - field work mainly in Voronezh Oblast;
• J.M. Grindeland, Norway (jmgrinde) - BCD;
• E. Gruber, Austria (erwin_riteridophilos) - ABC;
• N.Y. Grudanov (nikolay_grudanov) - ABCD and field work mainly in Sverdlovsk Oblast;
• P. Hacker, Austria (pastabaum) - ABC;
• L. Hill, United Kingdom (laurence) - AB;
• C.A. Hoess, United States (choess) - BC;
• M.I. Ismaylov (maxim_ismaylov) - G and field work mainly in Leningrad Oblast;
• D.P. Ivanov (denis138) - ABC and field work mainly in Tatarstan;
• D.G. Ivanov (ivanovdg19) - DFG and field work mainly in Tver Oblast;
• L.V. Ivanova (millione) - field work mainly in Chuvash Republic;
• K.S. Ivlev (ikskyrskobol) - ABG and field work mainly in Kursk Oblast;
• V.A. Johansson, Sweden (veronika_johansson) - BD;
• T.V. Kalugina (tatyaya) - CDF and field work mainly in Kursk Oblast;
• S.A. Katana (svetlana_katana) - DG and field work mainly in Sverdlovsk Oblast;
• Y.V. Kazantseva (yulia_kazantseva) - ADG and field work mainly in Tula Oblast;
• J.J. Kinnunen, Finland (juhakinnunen) - ABC;
• T.D. Kolesnikova (tatyana_kolesnikova) - FG and field work mainly in Novosibirsk Oblast;
• S.Y. Korovacev (mrsalento) - G and field work mainly in Lipetsk Oblast;
• S.V. Krilov (sergeyus) - BC and field work mainly in Yaroslavl Oblast;
• P.V. Kudrin (pvk) - D and field work mainly in Kursk Oblast;
• M.A. Kushunina (naturalist7019) - BC and field work mainly in City of Moscow;
• R.A. Kutushev (radik_kutushev) - DF and field work mainly in Tatarstan;
• A.S. Kutuzova (nastay_kutuzova) - A and field work mainly in Tatarstan;
• A.F. Lakomov (alexanderlakomov) - C and field work mainly in Tula Oblast;
• A.A. Lapin (a-lapin) - D and field work mainly in City of Moscow;
• V. Lazzeri, Italy (blue_celery) - ABCD;
• P.J. Likhacheva (polinalikhacheva) - ACDF and field work mainly in Ryazan Oblast;
• N.S. Liksakova (nilks) - B and field work mainly in Orenburg Oblast;
• A.I. Lukinyh (ana_lu) - G and field work mainly in Krasnodar Krai;
• I.E. Lyaskovskaya (cambala) - G and field work mainly in Sevastopol;
• L.N. Magazova (maglove) - DG and field work mainly in Chelyabinsk Oblast;
• I.V. Matershev (merlu) - BFG and field work mainly in Moscow Oblast;
• J.A. Mattila, Finland (jaakkomattila) - ABC;
• A.E. Maximenko (rsn_max) - B and field work mainly in Lipetsk Oblast;
• S.M. Mechanda, Canada (subaya) - B;
• J.S. Medvedko (julia_medvedko) - DG and field work mainly in Bryansk Oblast;
• A.A. Merkulova (anastasiakemerkulova) - G and field work mainly in City of Moscow;
• M.S. Minullina (naturalist35399) - D and field work mainly in Sverdlovsk Oblast;
• A.S. Mostovaja (ankhen) - C and field work mainly in City of Moscow;
• T.S. Norton, United States (tsn) - ABC;
• T.G. Nurhajdarova (siburhan) - ADG and field work mainly in Novosibirsk Oblast;
• R.N. Nurkhanov, Kazakhstan (kastani) - ABC;
• M.A. Orlov (naturalist16000) - CDG and field work mainly in Crimea;
• N.N. Panasenko (panasenkonn) - ABCDEG and field work mainly in Bryansk Oblast;
• B.S. Parris, New Zealand (barbaraparris) - BC;
• E.W. Paterikina (naturalist29626paterikina) - DG and field work mainly in Voronezh Oblast;
• E.E. Perfilev (gyng) - CG and field work mainly in Kemerovo Oblast;
• J.A. Petrova (wrrite) - field work mainly in Irkutsk Oblast;
• D.A. Philippov (dmitriy_philippov) - BC and field work mainly in Vologda Oblast;
• W. Plieninger, Germany (enkidoo) - BC;
• A.V. Poluyanov (alex_pol_64) - CDG and field work mainly in Kursk Oblast;
• T.V. Popova (tatyana_popova) - D and field work mainly in Novosibirsk Oblast;
• Y.A. Postnikov (yu_postnikov) - ABC and field work mainly in Tver Oblast;
• H.E. Putschoegl, Austria (elenor) - BC;
• L.M. Rasran, Austria (lrasran) - ABCD;
• T.G. Repina (naturalist9429) - C and field work mainly in Primorsky Krai;
• O.V. Ryzhkov (rovzap) - BC and field work mainly in Kursk Oblast;
• I. Saltini, Italy (lvdt) - ABC;
• L.N. Saplitskaya (naturalist24318) - B;
• N. Sauberer, Austria (brothernorbert) - BC;
• I.A. Savinov (ivan_savinov) - BCDG and field work mainly in Tver Oblast;
• J.C. Sedbrook, United States (jcsedbrook) - C;
• K.V. Seliverstov (konstaintinseliverstov) - DG and field work mainly in Udmurt Republic;
• I.Y. Selyutina (inessa_naturalist) - BG and field work mainly in Novosibirsk Oblast;
• T.V. Shrayner (tatyana-omck) - field work mainly in Omsk Oblast;
• L.Y. Smirnova (lola73) - C and field work mainly in Altai Krai;
• N.V. Stepansova (nadia_stepantsova) - BC;
• A.L. Stukalova (naturalist26231) - ACDFG and field work mainly in Volgograd Oblast;
• M.V. Sudareva (marinavs) - BCDG and field work mainly in Novosibirsk Oblast;
• I.S. Sukhov (aquacielo) - ABCD and field work mainly in Novosibirsk Oblast;
• T. Sukhova (tatianasukhova) - BC;
• D.V. Sukhova (dariasukhova) - BC and field work mainly in Moscow Oblast;
• D.V. Tarasov (tarasov) - ABCDG and field work mainly in Irkutsk Oblast;
• I.N. Tislenko (tivanik) - BC and field work mainly in Saint Petersburg;
• T.Y. Tretyakova (tatiana_moscow) - BC and field work mainly in City of Moscow;
• M.E. Trubinova (mashat) - G and field work mainly in Perm Krai;
• J. Tuomola, Finland (juhatuomola) - BC;
• V.M. Vasjukov (vvasjukov) - B and field work mainly in Penza Oblast;
• A.V. Vedrova (annave) - C and field work mainly in Krasnoyarsk Krai;
• A.-M. Veith, Germany (annemirdl) - ABC;
• U.N. Vinokurov (urij777) - B and field work mainly in Bryansk Oblast;
• A.S. Vlasenko (andrewins) - CD and field work mainly in City of Moscow;
• V.S. Volkotrub (vvolkotrub) - ABCG and field work mainly in Primorsky Krai;
• E.A. Votinceva (elena-votinceva) - C and field work mainly in Kirov Oblast;
• R. Walkowiak, Poland (radekwalkowiak) - ABCD;
• J. Weiß, Germany (fahrenheit_66) - BC;
• B.L. Wilson, United States (sedgequeen) - BC;
• V.E. Yusupov (tomegatherion) - DEFG and field work mainly in Nizhny Novgorod Oblast;
• E.V. Zakharov (eugenezakharov) - field work mainly in Yaroslavl Oblast.

References

• Abramov NV (1995) Конспект флоры Республики Марий Эл. [Check-list of the flora of the Republic of Mari El]. MarSU, Yoshkar-Ola, 192 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/abramov1995_konspekt_flory_marij_el.djvu [ISBN 5-230-13058-X]
• Anenkhonov OA (Ed.) (2001) Определитель растений Бурятии. [Keys to plants of Buryatia]. Respublikanskaya tipografiya, Ulan-Ude, 672 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/opred_rast_burjatii_2001.djvu
• Bakin OV, Rogova TV, Sitnikov AP (2000) Сосудистые растения Татарстана. [Vascular plants of Tatarstan]. Publishing house of Kazan University, Kazan, 496 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/sch-ru.htm
• Bakka SV, Kiseleva NY (2008) Особо охраняемые природные территории Нижегородской области: аннотированный перечень. [Specially protected natural areas of the Nizhny Novgorod Oblast: the annotated list]. Ministry of Environment and Natural Resources of Nizhny Novgorod Oblast, Nizhny Novgorod, 560 pp. [In Russian]. URL: http://oopt.info/data/files/publications/oopt_novgorod.pdf
• Baktasheva NM (2012) Конспект флоры Калмыкии. [Check-list of flora of Kalmykia]. Publishing House of Kalmyk University, Elista, 112 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/baktasheva2012_konspekt_flory_kalmykii.djvu
• Baranova OG, Puzyrev AN (2012) Конспект флоры Удмуртской Республики (сосудистые растения). [Check-list of the flora of the Udmurt Republic (vascular plants)]. Izhevsk Institute of Computer Science, Moscow; Izhevsk, 212 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/baranova2012_konsp_flory_udmurtskoj Resp.pdf [ISBN 978-5-4344-0091-6]
• Barthlott W, Hostert A, Kier G, Kueper W, Kreft H, Mutke J, Rafiqpoor MD, Sommer JH (2007) Geographic patterns of vascular plant diversity at continental to global scales. Erdkunde 61 (4): 305-315. https://doi.org/10.3112/erdkunde.2007.04.01
• Barve V, Brenskelle L, Li D, Stucky B, Barve N, Hantak M, McLean B, Paluh D, Oswald J, Belitz M, Folk R, Guralnick R (2020) Methods for broad-scale plant phenology assessments using citizen scientists’ photographs. Applications in Plant Sciences 8 (1): e11315. https://doi.org/10.1002/aps3.11315
• Bekisheva IV (1999) Флора Омской области: дис. канд. биол. наук. [Flora of Omsk Oblast: Cand. Biol. Sci. Diss.]. CBG SB RAS, Novosibirsk, 255 pp. [In Russian]. URL: https://www.dissercat.com/content/flora-omskoi-oblasti
• Berkutenko AN (Ed.) (2010) Флора и растительность Магаданской области (конспект сосудистых растений и очерк растительности). [Flora and vegetation of Magadan Oblast (checklist of vascular plants and an outline of vegetation)]. IBPN FEB RAS, Magadan, 364 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_i_rast_magad_obl.djvu [ISBN 978-5-94729-104-9]

• Bolshakov VN (Ed.) (2012) Красная книга Курганской области. [Red Data Book of Kurgan Oblast]. 2nd. Publishing House of Kurgan State Univ., Kurgan, 448 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/kr_kn_kurganskoj_obl_2012.pdf [ISBN 978-5-4217-0175-0]

• Borzée A, Baek HJ, Lee CH, Kim DY, Song J, Suh J, Jang Y, Min M (2019) Scientific publication of georeferenced molecular data as an adequate guide to delimit the range of Korean Hynobius salamanders through citizen science. Acta Herpetologica https://doi.org/10.13128/acta_herpetol-24102

• Bowser A, Hansen D, He Y, Boston C, Reid M, Gunnell L, Preece J (2013) Using gamification to inspire new citizen science volunteers. Proceedings of the First International Conference on Gameful Design, Research, and Applications - Gamification '13 18-25. https://doi.org/10.1145/2583008.2583011

• Brown B, Kusakabe E, Antonopoulos A, Siddoway S, Thompson L (2019) Winter bird-window collisions: mitigation success, risk factors, and implementation challenges. PeerJ 7 https://doi.org/10.7717/peerj.7620

• Budantsev AL, Yakovlev GP (Eds) (2006) Иллюстрированный определитель растений Ленинградской области. [Illustrated guide to plants of Leningrad Oblast]. KMK Scientific Press Ltd, Moscow, 799 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/illustr_opred_rast_leningr_obl_2006.djvu [ISBN 5-87317-260-9]

• Bulany YI (2010) Флора Саратовской области: автореф. дис. докт. биол. наук. [Flora of Saratov Oblast: Ext. Abstr. Doct. Biol. Sci. Diss.]. Moscow State University, Moscow, 57 pp. [In Russian]. [ISBN https://www.dissercat.com/content/flora-saratovskoi-oblasti].

• Bulokhov AD, Velichkin EM, Panasenko NN (2005) Flora of Bryansk Oblast: results and perspectives of the study. In: Sennikov AN, Geltman DV (Eds) Study of the flora of Eastern Europe: achievements and prospects. Proceedings of the International Conference St. Petersburg, May 23-28, 2005. Moscow; St. Petersburg, 15 pp. [In Russian]. [ISBN 5-87317-206-4].

• Chandler M, See L, Copas K, Bonde AZ, López BC, Danielsen F, Legind JK, Masinde S, Miller-Rushing A, Newman G, Rosemartin A, Turak E (2017) Contribution of citizen science towards international biodiversity monitoring. Biological Conservation 213: 280-294. https://doi.org/10.1016/j.biocon.2016.09.004

• Chepinoga VV, Stepanstova NV, Grebenyuk AV, Verkhozina AV, Vinkovskaya OP, Gnutikov AA, Dulepova NA, Enushchenko IV, Zarubin AM, Kazanovsky SG, Konovalov AS, Korobkov AA, Lufervo AN, Rosbakh SA (2008) Конспект флоры Иркутской области (сосудистые растения). [Check-list of the flora of Irkutsk Oblast (vascular plants)]. Publishing House of the Irkutsk State Univ., Irkutsk, 327 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/konspekt_flory_irkutsk_obl_2007.pdf [ISBN 978-5-9624-0311-3]

• Chernyagina OA (Ed.) (2018) Красная книга Камчатского края. [Red Data Book of the Kamchatka Territory]. 2. Kamchatkpress, Petropavlovsk-Kamchatsky, 388 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/krasnaja_kniga_kamchat_kr_2018_2.djvu [ISBN 978-5-9610-0294-2(T.2)]
• Ciceoi R, Badulescu LA, Gutue M, Mardare ES, Pomohaci CM (2017) Citizen-generated data on invasive alien species in Romania: trends and challenges. Acta Zoologica Bulgarica 9: 255-260.

• Cui Y, Song Y, Sun C, Howard A, Belongie S (2018) Large scale fine-grained categorization and domain-specific transfer learning. 2018 IEEE/CVF Conference on Computer Vision and Pattern Recognition https://doi.org/10.1109/cvpr.2018.00432

• Cui Y, Jia M, Lin T, Song Y, Belongie S (2019) Class-balanced loss based on effective number of samples. 2019 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) https://doi.org/10.1109/cvpr.2019.00949

• Dakieva MK (2003) Флора Республики Ингушетии и её анализ: дис. канд. биол. наук. [Flora of the Republic of Ingushetia and its analysis: Cand. Biol. Sci. Diss.]. Kabardino-Balkarian State University named after H.M. Berbekov, Nalchik, 368 pp. [In Russian]. URL: https://www.dissercat.com/content/flora-respubliki-ingushetii-i-ee-analiz

• Efimov PG (2020) Orchids of Russia: annotated checklist and geographic distribution. Nature Conservation Research 5 (Suppl. 1): 1-18. [In English]. https://doi.org/10.24189/ncr.2020.018

• Efimov PG, Legchenko MV (2020) Platanthera chorisiana Cham. (Orchidaceae), a possible new member of the flora of European Russia. Phytodiversity of Eastern Europe 14 (2): 116-124. [In Russian]. https://doi.org/10.24411/2072-8816-2020-10069

• Eremin VM (Ed.) (2005) Красная книга Сахалинской области: растения. [The Red Book of Sakhalin Oblast: Plants]. Sakhalin Book Publishing House, Yuzhno-Sakhalinsk, 348 pp. [In Russian]. URL: http://boomerangclub.ru/up/images/informaciya/priroda-sakhalina-i-kuril/multemediinie-diski/red%20book/pl/index2.htm [ISBN 5-88453-127-3]

• Fedyeva VV (Ed.) (2014) Красная книга Ростовской области. [Red Data Book of Rostov Oblast]. 2nd, 2. Ministry of Environmental of the Rostov Oblast, Rostov-on-Don, 344 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/kr_kn_rost_obl_rast_2014_2.pdf [ISBN 978-5-904079-93-2]

• Fourcade Y (2016) Comparing species distributions modelled from occurrence data and from expert-based range maps. Implication for predicting range shifts with climate change. Ecological Informatics 36: 8-14. https://doi.org/10.1016/j.ecoinf.2016.09.002

• Gafurova MM (2014) Сосудистые растения Чувашской Республики. [Vascular plants of the Chuvash Republic]. Saksonov S.V. (sci. ed.), 3. Kassandra, Togliatti, 333 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/gafurova2014_sosudist_rast_chuvashsk RESP.pdf [ISBN 978-5-91687-144-9]

• Gardiner L, Bachman S (2016) The role of citizen science in a global assessment of extinction risk in palms (Arecaceae). Botanical Journal of the Linnean Society 182 (2): 543-550. https://doi.org/10.1111/boj.12402

• Goldstein E, Mullins E, Moore L, Biel R, Brown J, Hacker S, Jay K, Mostow R, Ruggiero P, Zinnert J (2018) Literature-based latitudinal distribution and possible range shifts of two US east coast dune grass species (Uniola paniculata and Ammophila breviligulata). PeerJ 6 https://doi.org/10.7717/peerj.4932

• Gubareva IY, Dedkov VP, Napreenko MG, Petrova NG, Sokolov AA (1999) Конспект сосудистых растений Калининградской области: справочное пособие. [Check-list of vascular plants of Kaliningrad Oblast: a reference book]. Publishing House of Kaliningrad University, Kaliningrad, 107 pp. [In Russian]. URL: http://herba.msu.ru/
- Happel A (2019) A volunteer-populated online database provides evidence for a geographic pattern in symptoms of black spot infections. International Journal for Parasitology: Parasites and Wildlife 10: 156-163. https://doi.org/10.1016/j.ijppaw.2019.08.003
- Heberling JM, Isaac B (2018) iNaturalist as a tool to expand the research value of museum specimens. Applications in Plant Sciences 6 (11): e01193. https://doi.org/10.1002/aps3.1193
- Hiller T, Haelewaters D (2019) A case of silent invasion: Citizen science confirms the presence of Harmonia axyridis (Coleoptera, Coccinellidae) in Central America. PLOS One 14 (7). https://doi.org/10.10371/journal.pone.0220082
- Ivanov AL (2005) Конспект флоры Ставрополья. [Check-list of the flora of Stavropol Oblast]. Edition 3rd, rev. and add. Publishing House of SSU, Stavropol, 175 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/ivanov2005_konsp_flory_stavrop.pdf [ISBN 5-88648-276-8]
- Jacobs C, Zipf A (2017) Completeness of citizen science biodiversity data from a volunteered geographic information perspective. Geo-spatial Information Science 20 (1): 3-13. https://doi.org/10.1080/10095020.2017.1288424
- Kamelin RV (2007) The Flora of Russia project (Russian Federation). Herald of the Russian Academy of Sciences 77 (1): 22-26. https://doi.org/10.1134/S1019331607010042
- Kazakova MV, Shcherbakov AV (2017) Floristic study of municipal districts of Ryazan Oblast. Proceedings of the Ryazan branch of the Russian Botanical Society 4: 84-138. [In Russian].
- Kiseleva LL, Vyshegorodskikh NV, Fandeeva OI (2012) A variety of flora and fauna of meadow steppes of the Oryol Area. In: A.A. C (Ed.) Steppes of Northern Eurasia: The Materials of the VI Int. Symposium and VIII Int. School-Seminar ‘Geoenvironmental problems of the steppe regions. Steppes of Northern Eurasia, Orenburg. Gazprompechat, Orenburg, 383–386 pp. URL: http://www.spsl.nsc.ru/FullText/konfe/SolINE-2012.pdf [ISBN 978-5-94397-138-9].
- Klescheva EA (2011) Analysis of additions to the flora of the Novosibirsk Oblast. Plant Life of Asian Russia 2 (8): 71-76. [In Russian]. URL: http://www.izdatgeo.ru/pdf/rast/2011-2/71.pdf
- Knazyev MS, Tretyakova AS, Podgaevskaya EN, Zolotareva NV (2019) Checklist of the flora of the Sverdlovsk Region as a stage for preparing of the «Flora of Urals». In: Geltman DV, Efimov PG, Leostrin AV (Eds) Innovations and traditions in modern botany: Proceedings of the All-Russian Scientific Conference with Int. Part. St. Petersburgh, October 21-25, 2019. Komarov Botanical Institute of RAS, St. Petersburgh, 43 pp. [In Russian]. URL: https://www.binran.ru/files/publications/Proceedings/Proceedings_Komarov/Komarov_48_Proceedings.pdf [ISBN 978-5-9909439-5-7].
- Komzha AL (2000) Vascular Plants. In: Komzha AL, Popov KP (Eds) Natural resources of the Republic of North Ossetia-Alania. Proyekt-Press, Vladikavkaz, 109-187 pp. [In Russian]. [ISBN 5-88734-012-6].
- Konchehnaya GY, Suslova TA (Eds) (2004) Красная книга Вологодской области. [Red Data Book of Vologda Oblast]. 2. VSPU, Publishing House ‘Rus’, Vologda, 360 pp. [In Russian].
Конецнауя Г.Ю., Ефи́мов П.Г. (2018) Конспект флоры Псковской области: сосудистые растения. [Check-list of the flora of Pskov Oblast: vascular plants.]. KMK Scientific Press Ltd., Moscow, 472 pp. [In Russian]. URL: https://rffi.molnet.ru/rffi/ru/books/o_2079537 [ISBN 978-5-6040894-6-0]

Константинова Н.А., Койякин А.С., Макарова О.А., Бьянки В.В. (2014) Красная книга Мурманской области. [Red Data Book of Murmansk Oblast]. 2nd, rev. and add. Asia-print Publishing, Kemerovo, 584 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/krasn_kn_murm_obl_2014.pdf [ISBN 978-5-85905-446-6]

Козьменков А.Е., Козьменкова З.В. (2014) Таксономический состав и особенности природной флоры Приамурья. Komarovskie Readings 62: 7-62. [In Russian]. URL: https://www.biosoil.ru/Files/KR/62_7.pdf

Красноборов И.М. (ред.) (1988) Флора Сибири. 1 Lycopodiaceae – Hydrocharitaceae . Нauka, Сиб. branch, Novosibirsk, 200 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri1988_1.djvu [ISBN 5-02-028894-2]

Красноборов И.М., Малышев Л.И. (реды) (1988) Флора Сибири. 5 Salicaceae – Amaranthaceae. Нauka, Сиб. branch, Novosibirsk, 472 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri1992_5.djvu [ISBN 5-02-030077-2]

Красноборов И.М., Артемов И.А. (реды) (2012) Определитель растений Республики Алтай. [Keys to plants of the Altai Republic]. Publishing House of the SB RAS, Novosibirsk, 701 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/opred_rast RESP altaj_2012.pdf [ISBN 978-5-7692-1231-4]

Красноборов И.М. (ред.) (2006) Определитель растений Ханты-Мансийского автономного округа. [Key to plants of Khanty-Mansiysk Autonomous Okrug]. Basco, Novosibirsk; Yekaterinburg, 304 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/opredelitel_hanty_mans_okruga2006.djvu [ISBN 5-02-031181-2]

Кравченко А.В. (2007) Конспект флоры Карелии. [Check-list of the flora of Karelia]. KSC RAS, Petrozavodsk, 403 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/kravchenko2007_konspr_flory_karelii.pdf [ISBN 978-5-9274-0324-0]

Куликов П.В. (2005) Конспект флоры Челябинской области. [Check-list of the flora of Chelyabinsk Oblast]. Geotour, Yekaterinburg; Miass, 543 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/kulikov2005_konspr_fl_chel_obl.pdf [ISBN 5-7691-1162-5]

Кузмин И.В. (2018) To the flora of the Tyumen Oblast. In: Budantsev AL (Ed.) Botany in the modern world: Proceedings of the XIV Congress of the Russian Botanical Society and Conference, 1. Makhachkala, June 18-23, 2018. ALEF, Makhachkala, 147–149 pp. URL: https://www.binran.ru/files/publications/Proceedings/Proceedings_RBO/XIV_RBO_Proceedings_T1.pdf [ISBN 978-5-00128-021-7]

Кузнецова Л.В., Захарова В.И. (2012) Конспект флоры Якутии: сосудистые растения. [Check-list of the flora of Yakutia: vascular plants]. Нauka, Novosibirsk, 272 pp.
• Laktionov AP (2009) Флора Астраханской области. [Flora of the Astrakhan Oblast]. Astrakhan University Publishing House, Astrakhan, 296 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/laktionov2009_flora_astrachanskoj_oblasti.djvu [ISBN 978-5-9926-0338-2]

• Lapwong Y, Juthong W (2018) New records of Lepidodactylus lugubris (Duméril and Bibron, 1836) (Squamata, Gekkonidae) from Thailand and a brief revision of its clonal composition in southeast Asia. Current Herpetology 37 (2): 143-150. https://doi.org/10.5358/hsj.37.143

• Larson ER, Graham BM, Achury R, Coon JJ, Daniels MK, Gambrell DK,Jonasen KL, King GD, LaRacuente N, Perrin-Stowe TI, Reed EM, Rice CJ, Ruzi SA, Thairu MW, Wilson JC, Suarez AV (2020) Frome DNA to citizen science: emerging tools for the early detection of invasive species. Frontiers in Ecology and the Environment 18 (4): 194-202. https://doi.org/10.1002/fee.2162

• Leong M, Trautwein M (2019) A citizen science approach to evaluating US cities for biotic homogenization. PeerJ 7 https://doi.org/10.7717/peerj.6879

• Leostrin AV, Efimova AA (2018) Additions to "Flora ..." by P.F. Maevsky (2014) for the Kostroma Oblast. Transactions of the Karelian Research Centre of the Russian Academy of Sciences Biogeography 1: 89-96. [In Russian]. https://doi.org/10.17076/bg577

• Leostrin AV, Efimova AA (2020) Contribution to the vascular flora of Kostroma Region (European Russia). Turczaninowia 23 (2): 99-107. [In Russian]. https://doi.org/10.14258/turczaninowia.23.2.14

• Li E, Parker SS, Pauly GB, Randall JM, Brown BV, Cohen BS (2019) An urban biodiversity assessment framework that combines an urban habitat classification scheme and citizen science data. Frontiers in Ecology and Evolution 7: 277. https://doi.org/10.3389/fevo.2019.00277

• Liebgold E (2019) The spread of the parthenogenetic mourning gecko, Lepidodactylus lugubris (Duméril and Bibron, 1836) to Paradise Island, The Bahamas, with comments on citizen science observations of non-native herpetofauna. BiolInvasions Records 8 (1): 45-49. https://doi.org/10.3391/bir.2019.8.1.05

• Longbottom J, Shearer FM, Devine M, Alcoba G, Chappuis F, Weiss DJ, Ray SE, Ray N, Warrell DA, Ruiz de Castañeda R, Williams DJ, Hay SI, Pigott DM (2018) Vulnerability to snakebite envenoming: a global mapping of hotspots. The Lancet 392 (10148): 673-684. https://doi.org/10.1016/s0140-6736(18)31224-8

• Lori AB, Derek A, Nancy S, John P, Judy B, Jeanne P (2018) Using phenological monitoring in situ and historical records to determine environmental triggers for emergence and anthesis in the rare orchid Platanthera praeclara Sheviak & Bowles. Global Ecology and Conservation 16 https://doi.org/10.1016/j.gecco.2018.e00461

• Malyshev LI (1975) Quantitative annalysis of flora: spatial diversity, species richness, and representativeness of study sites. Botanicheskii Zhurnal 60 (11): 1537-1550. [In Russian].

• Malyshev LI, Peshkova GA (Eds) (1987) Флора Сибири. [Flora of Siberia]. 4 Araceae – Orchidaceae . Nauka, Sib. branch, Novosibirsk, 248 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri1987_4.djvu
• Malyshev LI, Peshkova GA (Eds) (1990) Flora of Siberia. [Flora of Siberia]. 2 Poaceae (Gramineae). Nauka, Sib. branch, Novosibirsk, 361 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri1990_2.djvu [ISBN 5-02-028948-5]

• Malyshev LI (1992) Biological diversity in spatial perspective. In: Yurtsev BA (Ed.) Biological diversity: approaches and prospects. Proc. Conf. BIN RAS and ZIN RAS, Leningrad, February 14-15, May 14-15, 1990. Nauka, St. Petersburg, 41-52 pp. [In Russian].

• Malyshev LI, Peshkova GA (Eds) (1993a) Flora of Siberia. [Flora of Siberia]. 6 Portulacaceae – Ranunculaceae . Nauka, Sib. published firm of RAS, Novosibirsk, 310 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri1993_6.djvu [ISBN 5-02-030132-9]

• Malyshev LI, Peshkova GA (Eds) (1993b) Flora of Siberia. [Flora of Siberia]. 7 Berberidaceae – Grossulariaceae . Nauka, Sib. published firm of RAS, Novosibirsk, 312 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri1994_7.djvu [ISBN 5-02-030578-2]

• Malyshev LI (Ed.) (1997) Flora of Siberia. [Flora of Siberia]. 11 Pyrolaceae – Lamiaceae (Labiatae). Nauka, Sib. published firm of RAS, Novosibirsk, 296 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri1997_11.djvu [ISBN 5-02-031176-6]

• Malyshev LI, Peshkova GA, Baikova KS (Eds) (2003) Flora of Siberia. [Flora of Siberia]. 14 Additions and corrections. Alphabetical indexes. Nauka, Novosibirsk, 188 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri2003_14.djvu [ISBN 5-02-032040-4]

• Maritz R, Maritz B (2020) Sharing for science: high-resolution trophic interactions revealed rapidly by social media. PeerJ 8 https://doi.org/10.7717/peerj.9485

• Matveeva NV (Ed.) (2006) Красная книга Ненецкого автономного округа. [Red Data Book of the Nenets Autonomous Okrug]. Nenets Information and Analytical Center, Naryan-Mar, 435 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/kr_kn_nenetskogo_ao_2006.djvu [ISBN 5-885952-018-2]

• Mayorov SR, Ivanov DG, Sukhova DV, Sukhov SV, Tikhonova EV (2020) Rubus hirtus in Moscow – a case of long distance dispersal or anthropogenic alien plant? Phytodiversity of Eastern Europe 14 (2): 158-165. [In Russian]. https://doi.org/10.24411/2072-8816-2020-10074

• Mueller M, Drake D, Allen M (2019) Using citizen science to inform urban canid management. Landscape and Urban Planning 189: 362-371. https://doi.org/10.1016/j.landurbplan.2019.04.023

• Murtazaliev RA (2016) Analysis of species distribution in the Dagestan flora. Botanicheskii Zhurnal 101 (9): 1056-1074. [In Russian]. URL: https://elibrary.ru/item.asp?id=28369660

• Myers N, Mittemeier R, Mittemeier C, da Fonseca GB, Kent J (2000) Biodiversity hotspots for conservation priorities. Nature 403 (6772): 853-858. https://doi.org/10.1038/35002501

• Naumova LG, Mirkin BM, Muldashev AA, Martynenko VB, Yamalov SM (2011) Флора и растительность Башкортостана: учебное пособие. [Flora and vegetation of Bashkortostan: study guide]. Publishing House of BSPU, Ufa, 174 pp. [In Russian].
• Nazarenko NN, Pasechnyuk EY (2019) Classification of ecological-coenotic groups. Different procedural approaches (the case of Khanty-Mansi Autonomous Area–Yugra vascular plant flora). Acta Biologica Sibirica 5 (2): 119-133. [In Russian]. https://doi.org/10.14258/abs.v5.i2.6194

• Notov AA, Zueva LV, Notov VA (2014) Флора и география Тверской области: учебное пособие. [Flora and geography of Tver Oblast: study guide]. Publishing House of Tver State University, Tver, 228 pp. [In Russian].

• Ocampo-Peñauela N, Winton RS, Wu C, Zambello E, Wittig T, Cagle N (2016) Patterns of bird-window collisions inform mitigation on a university campus. PeerJ 4 https://doi.org/10.7717/peerj.1652

• Oficialdegui F, Sánchez M, Clavero M (2020) One century away from home: how the red swamp crayfish took over the world. Reviews in Fish Biology and Fisheries 30 (1): 121-135. https://doi.org/10.1007/s11160-020-09594-z

• Ovesnov SA (Ed.) (2007) Иллюстрированный определитель растений Пермского края. [Illustrated guide to plants of Perm Oblast]. Knizhnyy mir, Perm, 743 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/illjust_opredelitelj_permskogo_kraja_2007.djvu [ISBN 5-87317-260-9]

• Peshkova GA, Malyshew LI (Eds) (1990) Флора Сибири. 3 Cyperaceae. Novosibirsk: Nauka, Sib. branch, Novosibirsk, 280 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri1990_3.djvu [ISBN 5-02-028949-3]

• Peshkova GA (Ed.) (1996) Флора Сибири. 10. Geraniaceae – Cornaceae. Nauka, Sib. published firm of RAS, Novosibirsk, 254 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri1996_10.djvu [ISBN 5-02-031175-8]

• Pismarkina E (2019) Vascular plants of the Yamal-Nenets Autonomous Okrug. 2018-2019. Plantarium: open on-line atlas and key to plants and lichens of Russia and neighbouring countries. URL: https://www.plantarium.ru/page/flora/id/1085.html

• Polozhy AV, Malyshew LI (Eds) (1994a) Флора Сибири. 8 Rosaceae. Nauka Sib. branch, Novosibirsk, 200 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri1994_8.djvu [ISBN 5-02-028878-0]

• Polozhy AV, Malyshew LI (Eds) (1994b) Флора Сибири. 9 Fabaceae (Leguminosae). Nauka, Sib. published firm of RAS, Novosibirsk, 280 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri1994_9.djvu [ISBN 5-02-030500-8]

• Polozhy AV, Peshkova GA (1996) Флора Сибири. 12 Solanaceae – Lobeliaceae. Nauka, Sib. published firm of RAS, Novosibirsk, 208 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/flora_sibiri1996_12.djvu [ISBN 5-02-031177-4]

• Poluyanov AV (2005) Флора Курской области. [Flora of Kursk Oblast]. Kursk State University, Kursk, 264 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/poluyanov2005_flora_kurskoj_oblasti.djvu [ISBN 5-88313-479-3]

• Popova OA (Ed.) (2017) Красная книга Забайкальского края. Растения. [Red Data Book of the Zabaikalye Territory. Plants]. Dom mira, Novosibirsk, 384 pp. [In Russian].
• Popovich AV, Averianova EA, Shagarov LM (2020) Orchids of the Black Sea coast of Krasnodarsky Krai (Russia): current state, new records, conservation. Nature Conservation Research 5 (Suppl. 1): 46-68. [In English].
https://doi.org/10.24189/ncr.2020.047

• Prokopenko SV, Pospelova EV, Kudryavtseva EP (2019) Floristic records in Primorye territory. Komarovskie Readings 67: 209-231. [In Russian].
https://doi.org/10.25221/kl.67.5

• Prudic K, Oliver J, Brown B, Long E (2018) Comparisons of citizen science data-gathering approaches to evaluate urban butterfly diversity. Insects 9 (4).
https://doi.org/10.3390/insects9040186

• Rakov NS, Saxophon SV, Senate SA, Vasyukov VM (2014) Сосудистые растения Ульяновской области. [Vascular plants of the Ulyanovsk Oblast]. 2. Cassandra, Togliatti, 295 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/rakov2014_sosud_rast_uljanovsk_oblast.pdf [ISBN 978-5-91687-141-8]

• Reshetnikova NM (2004) Materials for the flora of the Smolensk province. Bulletin of the Main Botanical Garden 188: 70-102. [In Russian]. URL: http://www.gbsad.ru/science/doc/biuleten_gbs_2004_188.pdf

• Reshetnikova NM (2016) Динамика флоры средней полосы европейской части России за последние 100 лет на примере Калужской области: автореф. дис. докт. биол. наук. [The dynamics of the flora of the middle zone of the European part of Russia over the past 100 years (Kaluga Oblast case study): Ext. Abstr. Doct. Biol. Sci. Diss.]. Main Botanical Garden, RAS, Moscow, 47 pp. [In Russian].
URL: https://dlib.rsl.ru/viewer/01006653111

• Revushkin AS (Ed.) (2014) Определитель растений Томской области. [Keys to plants of the Tomsk Oblast]. Publishing House of Tomsk Univ., Tomsk, 464 pp. [In Russian].

• Robertson T, Belongie S, Adam H, Kaeser-Chen C, Zhang C, Chuan Tan K, Liu Y, Brulé D, Deltheil C, Loarie S, Van Horn G, Mac Aodha O, Beery S, Perona P, Copas K, Waller J (2019) Training machines to identify species using GBIF-mediated datasets. Biodiversity Information Science and Standards 3 https://doi.org/10.3897/biss.3.37230

• Rosenberg MS (2018) New record and range extension of the fiddler crab Uca princeps (Smith, 1870) (Brachyura, Ocypodidae) from California, USA. Journal of Crustacean Biology https://doi.org/10.1093/jcbiol/ruy071

• Rubtsova TA (2019) Ecological-cenotic analysis of aboriginal flora in Jewish Autonomous Region. Regional’nye problemy 22 (1): 5-11. [In Russian].
https://doi.org/10.31433/2618-9593-2019-22-1-5-11

• Ryabinina ZN, Knyazev MS (2009) Определитель сосудистых растений Оренбургской области. [Keys to vascular plants of Orenburg Oblast]. KMK Scientific Press Ltd, Moscow, 758 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/ryabinina2009_opred_sosud_rast_orenb_obl.pdf [ISBN 978-5-87317-572-7]

• Sagalaev VA (2008) General characteristics of the flora of Volgograd Oblast. In: Sagalaev VA (Ed.) Local history: biological and landscape diversity of the nature of Volgograd Oblast: guidance manual. Globus, Moscow, 272 pp. [In Russian]. [ISBN 978-5-9928-0010-4].

• Schmidt VM (2005) Флора Архангельской области. [Flora of Arkhangelsk Oblast]. Publishing house of St. Petersburg Univ., St Petersburgu, 346 pp. [In Russian].
• Schuette S, Folk R, Cantley J, Martine C (2018) The hidden Heuchera: How science
Twitter uncovered a globally imperiled species in Pennsylvania, USA. PhytoKeys 96:
87-97. https://doi.org/10.3897/phytokeys.96.23667

• Seltzer C (2019) Making biodiversity data social, shareable, and scalable: Reflections
on iNaturalist & citizen science. Biodiversity Information Science and Standards 3
https://doi.org/10.3897/biss.3.46670

• Senator SA, Saksonov SV (Eds) (2017) Красная книга Самарской области. [Red Data
Book of Samara Oblast]. 1. Publishing house of Samara State Regional Academy (by
Nayanova), Samara, 384 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/
books/kr_kn_samarskoj_oblasti_2017_1.pdf [ISBN 978-5-4436-0036-9.]

• Seregin AP (2011) The most common plant species in temperate Europe based on
frequency of occurrences in the national grid mapping projects. Feddes Repertorium
121: 194-208. https://doi.org/10.1002/fedr.201000013

• Seregin AP (2014) Флора Владимирской области: анализ данных сеточного
картирования. [Flora of Vladimir oblast, Russia: grid data analysis]. KMK Scientific
Press Ltd., Moscow, 441 pp. [In Russian]. URL: https://www.rfbr.ru/rffi/ru/books/o_
1924131 [ISBN 978-5-9905832-9-0]

• Seregin AP, Yeveseyenkov PE, Svirin SA, Fateryga AV (2015) Second contribution to the
vascular flora of the Sevastopol area (the Crimea). Wulfenia 22: 33-82.
URL: https://www.researchgate.net/publication/283503478_Second_contribution_to_the_vascular_flora_of_the_Sevastopol_area_the_Crimea

• Seregin AP (2018) The largest digital herbarium in Russia is now available online!
Taxon 67 (2): 465-467. https://doi.org/10.12705/672.34

• Seregin AP (2020a) Flora of the Troyeruchitsa State Reserve (Tver Oblast, Russia).
Phytodiversity of Eastern Europe 14 (1): 4-31. [In Russian].
https://doi.org/10.24411/2072-8816-2020-10061

• Seregin AP (2020b) Floristic records near Novosibirsk. Бюллетень Московского
общества испытателей природы. Отдел биологических 125 (4): 41-45. [In Russian].
URL: https://www.researchgate.net/publication/344310206_Floristic_records_near_Novosibirsk

• Seregin AP, Bochkov DA, Shner JV, Garin EV, Mayorov SR, Goliakov PV, Bolshakov
BV, Prokhorov VE, Mallaliev MM, Vinogradov GM, Ebel AL, Kashirina ES, Biryukova
OV, Kuryakova OP, Mirvoda SV, Khimin AN, Murtazaliev RA, Zelenkova VN, Dudov SV,
Gorbunova MS, Gerasimov SV, Ebel AL, Travkin VP, Chernyagina OA, Razina EA,
Zyryanov AP, Tretjakova DV, Lednev SA, Teploukhov VY, Kuzmenckin DV, Krivosheev
MM, Popov ES, Sultanov RR, Basov YM, Dudova KV, Tishin DV, Yakovlev AA,
Danilevsky YV, Pospelov IN, Kandaurova AN, Kutueva SB, Yamagulov DA, Samodurov
KV, Smirnova LY, Bury UV, Yusupov VE, Epikhin DV, Repina TG, Boginsky EI, Dubyin
AV, Korobkov AV, Nesterkova DV, Poluyanov AV, Danilin AV, Efremov AN, Pozhidaeva
LV, Verkhozina AV, Postnikov YA, Linnik EA, Kuzmukova IA, Prokopenko SV, Shumikhina
EA, Kushunina MA, Kuzmin IV, Rasran LM, Sukhovalova DV, Popov AV (2020) Flora of
Russia on iNaturalist: big data on biodiversity of a big country. Zhurnal Obshchey
Biologii 81 (3): 223-233. [In Russian]. https://doi.org/10.31857/S0044459620030070

• Shaulo DN (Ed.) (2007) Определитель растений Республики Тыва. [Keys to plants of
the Republic of Tyva]. Publishing House of the SB RAS, Novosibirsk, 706 pp. [In
• Shcherbakov AV, Lyubeznova NV (2018) Список сосудистых растений московской флоры. [Check-List of taxa vascular plants of Moscow flora]. Galleya-Print, Ltd, Moscow, 160 pp. [In Russian]. URL: https://msu-botany.ru/gallery/%D1%84%D0%BB%D0%BE%D1%80%D0%B0%20%D0%BC%D0%BE%D1%81%D0%BA%D0%BE%D0%B2%D1%81%D0%BA%D0%BE%D0%B3%D0%BE%20%D0%BC%D0%B0%20%D0%BA%D1%80%D0%BE%D1%80%D0%B5%D0%B3%D0%B8%D0%BE%D0%BD%D0%B0.pdf [ISBN 978-5-906936-36-3]

• Sheremetova SA, Ebel AL, Buko TE (2011) Supplement to the flora of Kemerovo Region since 2001 till 2010. Turczaninowia 14 (1): 65-74. [In Russian]. URL: http://old.ssbg.asu.ru/turcz/turcz_14_1_65-74.pdf

• Shkhagapsoev SK (2015) Растительный покров Кабардино-Балкарии. [Vegetation cover of Kabardino-Balkaria]. Tetraphraph, Nalchik, 350 pp. [In Russian]. [ISBN 5-7680-1723-2]

• Shlotgauer SD, Kryukova MV, Antonova LA (2001) Сосудистые растения Хабаровского края и их охрана. [Vascular plants of the Khabarovsk Territory and their protection]. FEB RAS, Vladivostok; Khabaros, 195 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/shlotgauer2001_sosud_rast_khab_kr.djvu [ISBN 5-7442-1279-5]

• Silaeva TB, Kiryukhin IV, Chugunov GG, Levin VK, Mayorov SR, Pismarkina EV, Ageeva AM, Vargot EV (2010) Сосудистые растения Республики Мордовия (конспект флоры). [Vascular plants of the Republic of Mordovia (flora check-list)]. Publishing House of Mordovian Univ., Saransk, 352 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/sosud_rast_mordovii2010.djvu [ISBN 978-5-7103-2167-6]

• Silantieva MM (2013) Контспект флоры Алтайского края. [Check-list of the flora of the Altai Territory]. Edition 2nd rev. and per. Publishing House of Altai Univ., Barnaul, 520 pp. [In Russian]. URL: http://elibrary.asu.ru/xmlui/handle/asu/101 [ISBN 978-5-7904-1451-0]

• Skejo J, Deranja M, Adžić K (2020) Pygmy Hunchback of New Caledonia: Notredamia dora gen. n. et sp. n. – A new cladonotin (Caelifera: Tetrigidae) genus and species from Oceania. Entomological News 129 (2): 170-185. https://doi.org/10.3157/021.129.0206

• Spear D, Pauly G, Kaiser K (2017) Citizen science as a tool for augmenting museum collection data from urban areas. Frontiers in Ecology and Evolution 5: 86. https://doi.org/10.3389/fevo.2017.00086

• Starchenko VM (2008) Флора Амурской области (состав, анализ, вопросы охраны): автореф. дис. докт. биол. наук. [Flora of Amur Oblast (composition, analysis, protection aspects): Ext. Abstr. Doct. Biol. Sci. Diss.]. Amur branch of the Botanical Garden-Institute of the Far Eastern Branch of RAS, Blagoveschenskens, 36 pp. [In Russian]. URL: https://www.dissercat.com/content/flora-amurskoi-oblasti

• Sukhorukov AP (Ed.) (2010) Определитель сосудистых растений Тамбовской области. [Keys to vascular plants of the Tambov Oblast]. Grif i Co, Tula. [In Russian]. URL: https://www.researchgate.net/publication/255700218_The_identification_manual_of_vascular_plants_of_the_Tambov_Region [ISBN 978-5-8125-1568-3]
• Svoboda H, Harris A (2018) Contributions toward understanding the biodiversity of Passiflorain North America: Updates and a new combination from the Baja California Peninsula, Mexico and vicinity. Journal of Systematics and Evolution 56 (5): 550-561. https://doi.org/10.1111/jse.12434
• Tarasova EM (2007) Флора Вятского края. [Flora of Vyatka Territory]. 1. Kirov Regional Printing House., Kirov., 440 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/tarasova2007_flora_vjatskogo_kraja.djvu [ISBN 978-88186-7638-8]
• Taskaev AI (Ed.) (2009) Красная книга Республики Коми. [Red Data Book of the Komi Republic]. Institute of Biology, Komi Science Center of Ural Branch RAS, Syktyvkar, 791 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/kr_kn_respub_komi_2009.pdf [ISBN 978-5-934-0811-0-1]
• Taysumov MA, Omarkhadzhieva FS (2012) Анализ флоры Чеченской Республики. [Analysis of the flora of Chechen Republic]. Academy of Sciences of the Chechen Republic, Grozny, 320 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/taysumov2012_analiz_flory_tchetchensk_respub.djvu [ISBN 978-5-91857-023-4]
• Tikhomirov VN (Ed.) (1986) Определитель высших растений Ярославской области. [Key to higher plants of Yaroslavl Oblast]. Upper Volga Book Publishing House, Yaroslavl, 182 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/opred_vyssh_rast_yarosl_obl_1986.djvu
• Tzvelev NN (Ed.) (2000) Красная книга природы Ленинградской области. [Red Data Book ofNature of the Leningrad Oblast]. 2. Mir i sem'ya, St Petersburg, 672 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/krasn_kn_prir_leningr_obl_2000_2.djvu [ISBN 5-94365-001-6]
• Ueda K (2020) iNaturalist Research-grade observations. Occurrence dataset. iNaturalist.org. Release date: 2020-9-13. URL: https://doi.org/10.15468/ab335x
• Unger S, Rollins M, Tietz A, Dumais H (2020) iNaturalist as an engaging tool for identifying organisms in outdoor activities. Journal of Biological Education 1-11. https://doi.org/10.1080/00219266.2020.1739114
• Vahidi H, Klinkenberg B, Yan W (2017) Trust as a proxy indicator for intrinsic quality of Volunteered Geographic Information in biodiversity monitoring programs. GIScience & Remote Sensing 55 (4): 502-538. https://doi.org/10.1080/15481603.2017.1413794
• Van Horn G, Mac Aodha O, Song Y, Cui Y, Sun C, Shepard A, Adam H, Perona P, Belongie S (2018) The iNaturalist Species Classification and Detection Dataset. 2018 IEEE/CVF Conference on Computer Vision and Pattern Recognition https://doi.org/10.1109/cvpr.2018.00914
• Varlygina TI, Zubakin VA, Sobolev NA (Eds) (2008) Красная книга Московской области. [Red Data Book of Moscow Oblast]. 2nd, add. and rev. KMK Scientific Press Ltd., Moscow, 828 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/kr_kn_mosk obl_2008.pdf. [ISBN 978-5-87317-500-0]
• Vasyukov VM, Saksonov SV (2020) Check-list of the flora of Penza Oblast. [Конспект флоры Пензенской области]. Anna, Togliatti, 211 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/vasyukov2020_konsp_fl_penz obl.pdf [ISBN 978-5-6044520-0-4]
• Vendetti J, Burnett E, Carlton L, Curran A, Lee C, Matsumoto R, Mc Donnell R, Reich I, Willadsen O (2018) The introduced terrestrial slugs Ambigolimax nyctelius (Bourguignat, 1861) and Ambigolimax valentianus (Férrussac, 1821) (Gastropoda: Limacidae) in California, with a discussion of taxonomy, systematics, and discovery by
citizen science. Journal of Natural History 53: 1607-1632. 
https://doi.org/10.1080/00222933.2018.1536230
• Verkhozina AV, Belous VN, Chernysheva OA, Ebel AL, Erst AS, Friesen NV, Iuzhakova MA, Kuznetsov AA, Luferov AN, MurashkoVV, Murzatalieva RA, Ovchinnikova SV, Wang W, Zavgorodnyaya OY, Korolyuk AY, Senator SA, Zibzeev EG, Vasukov VM, Krivenko DA (2019) Findings to the flora of Russia and adjacent countries: New national and regional vascular plant records, 1. Botanica Pacifica 9 (1): 143-154. https://doi.org/10.17581/bp.2019.08114
• Verkhozina AV, Chernysheva OA, Erst AS, Dorofeev NV, Dorofeyev VI, Grebenjuk AV, Grigorjevskaia AY, Guseinova ZA, Ivanova AV, Khapugin AA, Korolyuk AY, Korznikov KA, Kuzmin IV, Mallaliev MM, MurashkoVV, Murzatalieva RA, Popova KB, Safronova IN, Saksonov MM, Sarajeva LI, Senator SA, Troshkina VI, Vasukov VM, Wang W, Xiangv K, Zibzeev EG, Zolotov DV, Zykova EY, Krivenko DA (2020) Findings to the flora of Russia and adjacent countries: New national and regional vascular plant records, 2. Botanica Pacifica 9 (1): 139-154. [In English]. https://doi.org/10.17581/bp.2020.09115
• Vinogradov GM (2020) January flowers. Chemistry and Life - XXI century 2: 42-43. [In Russian]. URL: https://hij.ru/read/26980/
• White R, Sutton A, Salguero-Gómez R, Bray T, Campbell H, Cieraad E, Geekiyanage N, Gherardi L, Hughes A, Jørgensen PS, Poisot T, DeSoto L, Zimmerman N (2015) The next generation ofefaction ecology: novel approaches towards global ecological research. Ecosphere 6 (8): 1-6. https://doi.org/10.1890/es14-00485.1
• Winton RS, Ocampo-Peñuela N, Cagle N (2018) Geo-referencing bird-window collisions for targeted mitigation. PeerJ 6 https://doi.org/10.7717/peerj.4215
• Yena AV (2018) Flora of Crimea 9.2. In: Budantsev AL (Ed.) Botany in the modern world: Proceedings of the XIV Congress of the Russian Botanical Society and Conf, 1. Makhachkala, June 18-23, 2018. ALEF, Makhachkala, 125-127 pp. [In Russian]. URL: https://www.binran.ru/files/publications/Proceedings/Proceedings_RBO/XIV_RBO_Proceedings_T1.pdf [ISBN 978-5-00128-021-7].
• Young B, Dodge N, Hunt P, Ormes M, Schlesinger M, Shaw H (2019) Using citizen science data to support conservation in environmental regulatory contexts. Biological Conservation 237: 57-62. https://doi.org/10.1016/j.biocon.2019.06.016
• Yurova EA, Krupkina LI, Konchnaya GY (Eds) (2009) Кадастр флоры Новгородской области. [Flora cadastre of the Novgorod Oblast]. 2nd, rev. and add. Lema, Veliky Novgorod, 276 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/andreeva2009_kadastr_flory_novgor_obl.djvu [ISBN 978-5-98709-112-8]
• Yurtsev BA, Koroleva TM, Petrovskye VV, Polozoa TG, Zhukova PG, Katenin EA (2010) Конспект флоры Чукотской тундры. [Check-list of the flora of the Chukotka tundra]. VVM, St Petersburg, 628 pp. [In Russian].
• Zamotailov AS (Ed.) (2012) Красная книга Республики Адыгея: редкие и находящиеся под угрозой исчезновения объекты животного и растительного мира. [Red Data Book of the Republic of Adygea: rare and threatened representatives of the regional fauna and flora]. Edition 2nd, Volume 1. Kachestvo, Maykop, 340 pp. [In Russian]. URL: http://herba.msu.ru/shipunov/school/books/kr_kn_resr_adygeja_2012_1.pdf [ISBN 978-5-9703-0346-7]
• Zarubo TV, Mayorov SR (2020) Hydrocleys nymphoides (Humb. et Bonpl. ex Willd.) Buchenau (Alismataceae), a new alien species for the flora of Russia. Phytodiversity of
Eastern Europe 14 (1): 62-65. [In Russian].
https://doi.org/10.24411/2072-8816-2020-10065

• Zernov AS (2006) Флора Северо-Западного Кавказа. [Flora of the North-West Caucasus]. KMK Scientific Press Ltd, Moscow, 664 pp. [In Russian].
URL: http://herba.msu.ru/shipunov/school/books/zernov2006_fl_s-z_kavkaza.djvu
[ISBN 5-87317-338-9]

• Zernov AS, Alekseev YE, Onipchenko VG (2015) Определитель сосудистых растений Карачаево-Черкесской Республики. [Keys to vascular plants of the Karachay-Cherkess Republic]. KMK Scientific Press Ltd, Moscow, 459 pp. [In Russian].
URL: http://herba.msu.ru/shipunov/school/books/zernov2015_opred_rast_karach_cherkes.djvu [ISBN 978-5-9906895-2-7]

• Zheng H, Fu J, Zha Z, Luo J (2019) Looking for the devil in the details: Learning trilinear attention sampling network for fine-grained image recognition. 2019 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
https://doi.org/10.1109/cvpr.2019.00515