



可持续发展大数据国际论坛  
International Forum on Big Data for  
Sustainable Development Goals

# Towards the Atlas of the Russian Flora: e-data are changing our reality

Alexey P. Seregin, Dr. Sci.

(Moscow State University, Moscow, Russia)

# Special issue of «Science» (2000)



BIOINFORMATICS FOR BIODIVERSITY  
VIEWPOINT

## The Quiet Revolution: Biodiversity Informatics and the Internet

Frank A. Bisby

The massive development of biodiversity-related information systems on the Internet has created much that appears exciting but chaotic, a diversity to match biodiversity itself. This richness and the arrays of new sources are counterbalanced by the maddening difficulty in knowing what is where, or of comparing like with like. But quietly, behind the first waves of exuberance, biologists and computer scientists have started to pull together in a rising tide of coherence and organization. The fledgling field of biodiversity informatics looks set to deliver major advances that could turn the Internet into a giant global biodiversity information system.

There is a resonance between the needs of biodiversity science and the opportunities for globalization and interoperability provided by the Internet. One is that biodiversity workers are distributed all over the globe, literally dotted about in every country and on every island. A second arises from our interdependence. Global events and global syntheses in

records. ERIN led the way by making the combined data available for Australia-wide Geographic Information System (GIS) analysis and modeling.

A number of interoperative systems are approaching the tasks originally offered by ERIN for its centralized data, but with the powerful possibility of extending to data

Australia (7) and by the European Natural History Specimen Information Network (ENHSIN) team in Europe (8).

A second area for networking and interoperability is the taxonomic framework itself. Again, there are centralized models from the 1990s where organizations bring together taxonomic treatments from authors and institutions to provide a centrally collated system. It now seems agreed that these taxonomic frameworks should be constructed “taxon-by-taxon” as in Species 2000 (1), the Integrated Taxonomic Information System (ITIS) (9), and the UNESCO-IOC Register of Marine Organisms (URMO) (10), thus avoiding the “flora-by-flora” work of integrating systems in which the taxonomies overlap, a contrast illustrated in Fig. 1. Only the International

# GBIF today



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GBIF | Global Biodiversity Information Facility

## Free and open access to biodiversity data

OCCURRENCES SPECIES DATASETS PUBLISHERS RESOURCES

Search

WHAT IS GBIF? ABOUT GBIF RUSSIAN FEDERATION

Aextoxicum punctatum Ruiz & Pav. observed in Curiñanco, Los Ríos, Chile by danielaperezorellana (CC BY-NC 4.0)

Occurrence records **1 890 962 163**

Datasets **62 127**

Publishing institutions **1 725**

Peer-reviewed papers using data **6 160**

[Global partnership paves the way for an open-source system](#)

[Call for proposals: regional support contractors to develop](#)

[GBIF Secretariat is recruiting an Administrative Assistant](#)

[Call for data papers describing datasets from Russia](#)

# Diversity of original databases



MUSÉUM  
NATIONAL MUSEUM OF NATURAL HISTORY  
FRANÇAIS

Herbier MHNH-P-P00747877  
Sector ASI (Asia)  
reçu le 30 aout 1890

SPECIMEN

TAXONOMY

Family Amaryllidaceae  
Genus Allium  
Species Allium korchinum  
Name Allium kaschianum Regel

ORIGIN

Country label Turkestan  
Verbatim locality Niki (Koch)  
Phenology fert  
Collector's name A. Regel  
Expedition Iser Turkestanicum  
Collection date 1879-8-30

Title: 00247926.jpg

Filed As:  
Amaryllidaceae  
Allium tulipifolium Lebed. (possible type)

All Determinations:  
Allium tulipifolium Lebed.

Location:  
China. Szechuan Chin. ad lacum Sankang Nor.

Collector(s):  
Collector unapotted s.n., a.d.

Paris

New York

Specimen Details

Download Records

Specimen: K000464620

Family:	Alliaceae	Type Status:	Unknown type material
Current Name:	Allium mairei H. Lév.	Phenology:	
Collector:	Forest, G.	Plant Parts:	Leaves, Root, Flowers/infructescence (with inflorescence axis), Bulb
Collector no:	914	Item:	Sheet
Collection Date:		Project:	Monocot Types, Global Types
Country:	China	Habitat:	
Location:	E. Tibet and S.W. China	Plant Description:	Note the strongly ribbed blades and the crenulate margins.
Lat and Long:			
Data Source:		General Comments:	Collector for A.K. Bulley of Ness, Neston, Cheshire
Accuracy:			
Altitude:			
Related Specimens:			

Determination History:

Scientific Name	Determiner	Determination Date	Type of?	Determination Notes
Allium mairei H. Lév.				Author citation as on label: Lévi

London

Растения / Коллекции / Гербарий МГУ

Полное изображение

Название: Несколько экземпляров (P.R.)

Штамп №: MV0734931

Название в коллекции: Allium stoliczki

Принятое название: Allium przewalskianum Regel

Семейство: Amaryllidaceae

Распространение: Зарубежная Азия (ASIA) (KHP)

Локальность: 1.08.1958. Собр. Юнгов А. А.

Дата ввода экземпляра: 2.07.2016

Полная карточка

Все образцы этого вида

Все фото в природе этого вида (plantarium.ru)

ОСР: ОСНОВНАЯ СИСТЕМА КОМПЬЮТЕРНОЙ СДОХЦИИ АКАДЕМИИ НАУК КИТАЙСКОЙ НАРОДНОЙ РЕСПУБЛИКИ 1956-1959-г.г.

Даны пятьдесят страниц

5.1. Ли Капитолий Народной Республики. Синьцзян-Уйгурский Автономный район. Уезд Чугучак. долина реки Чугучак. 10.11.1958.

Л. Чж. Чж. Су

на 30° от горизонта

1.7. м

1.7. м

1.7. м

Цифровые данные для публикации

Moscow

# Universality of GBIF standards



**P00747877**

**NY00247926**

**K000464620**

**MW0734831**

The figure displays four screenshots of GBIF record pages, each showing a different specimen record with its unique identifier at the top center. The records are arranged in a 2x2 grid.

**P00747877 Record Details:**

- Occurrence:** Catalogue number P00747877, Occurrence ID <http://coldb.mnhn.fr/mnhn/p/p00747877>, Preparations hb, Recorded by Regel, A.
- Event:** Day 30, Month 6, Year 1879, Event date 1879-06-30T00:00:00.
- Taxon:** Kingdom Plantae, Phylum Tracheophyta, Class Liliopsida, Order Asparagales, Family Amaryllidaceae, Genus Allium, Specific epithet kochianum, Scientific name Allium kochianum Regel, Scientific name authorship Regel, Rank SPECIES, Taxonomic status ACCEPTED.
- Other:** Identifier <http://coldb.mnhn.fr/mnhn/p/p00747877>, Record license <http://creativecommons.org/licenses/by/4.0/legalcode>, Modified 2015-09-05T09:21:00.000+0000.

**NY00247926 Record Details:**

- Occurrence:** Catalogue number 247926, Occurrence ID <http://biocore.org.col.org/ci/1556>, Preparations sheet, Record number 813, Recorded by Collector unspecified.
- Event:** Verbatim event date s.d.
- Taxon:** Kingdom Plantae, Phylum Tracheophyta, Class Liliopsida, Order Asparagales, Family Amaryllidaceae, Genus Allium, Specific epithet tulipifolium, Nomenclatural code ICN, scientific name Allium tulipifolium Ledeb., Rank SPECIES, Taxonomic status ACCEPTED.
- Other:** Identifier <http://biocore.org.col.org/ci/1556>, Language en, Record license <http://creativecommons.org/licenses/by/4.0/legalcode>, Modified 2016-10-21T15:56:00.000+0000, References <http://sweet-e.org/eprint/10>.

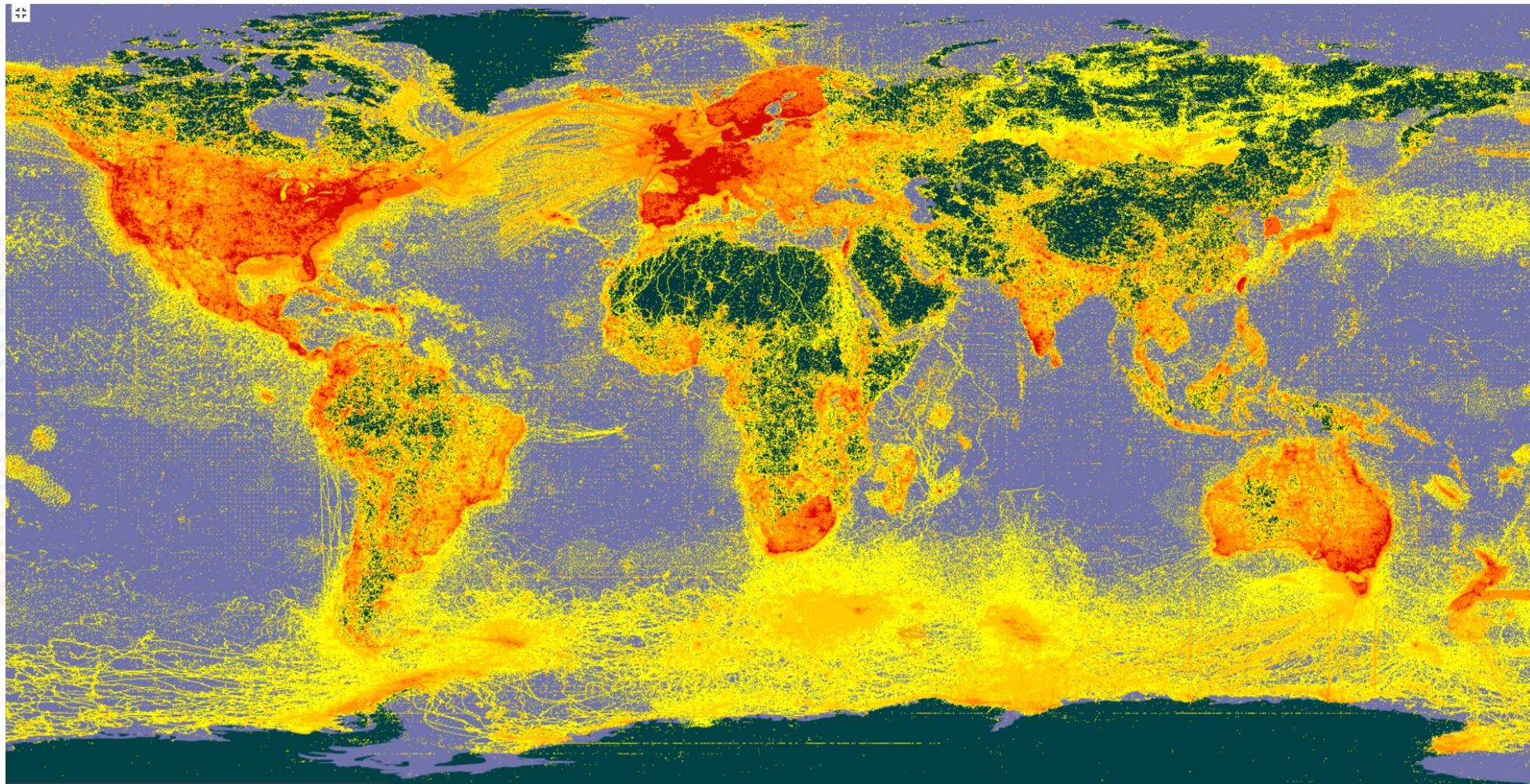
**K000464620 Record Details:**

- Occurrence:** Catalogue number K000464620, Occurrence ID <http://specimens.barium.ru/000464620>, Preparations Collector for A.K.Bulley of Ness, Neston, Cheshire, Record number 914, Recorded by Forrest, G.
- Event:** Event remarks Note the strongly ribbed blades and the crenulate margins.
- Taxon:** Kingdom Plantae, Phylum Tracheophyta, Class Liliopsida, Order Asparagales, Family Amaryllidaceae, Genus Allium, Specific epithet mairii, Higher classification ALLIACEAE, Scientific name Allium mairii H.L., Scientific name authorship H.L., Rank SPECIES, Taxon remarks Author citation as on label: Lev., Taxonomic status ACCEPTED.
- Other:** Identifier <http://specimens.barium.ru/000464620>, Record license <http://creativecommons.org/licenses/by/4.0/legalcode>, Modified 2012-09-07T13:40:36.300+0000.

**MW0734831 Record Details:**

- Occurrence:** Catalogue number MW0734831, Occurrence ID <http://biocore.org.col.org/ci/1556>, Preparations herbarium specimen, Recorded by Yusupov, A. A., Recorded by Associated media.
- Event:** Day 1, Month 8, Year 1958, Event date 1958-08-01T00:00:00, Sampling protocol common practice of herbarium collecting.
- Taxon:** Kingdom Plantae, Phylum Tracheophyta, Class Liliopsida, Order Asparagales, Family Amaryllidaceae, Genus Allium, Specific epithet stoliczki, Accepted name usage ID 700000000000000000, Higher classification Plantae-Tracheophyta-Liliopsida-Asparagales-Amaryllidaceae-Allium, Accepted name usage Allium przewalskianum, Nomenclatural code International Code of Nomenclature for algae, fungi, and plants, Parent name usage Allium, Parent name usage ID 11477205, Scientific name Allium stoliczki Regel, Rank SPECIES, Taxonomic status SYNONYM, Vernacular name Ryk.
- Other:** Identifier <http://biocore.org.col.org/ci/1556>, Record license <http://creativecommons.org/licenses/by/4.0/legalcode>, Modified 2016-10-21T15:56:00.000+0000.

# GBIF geodata



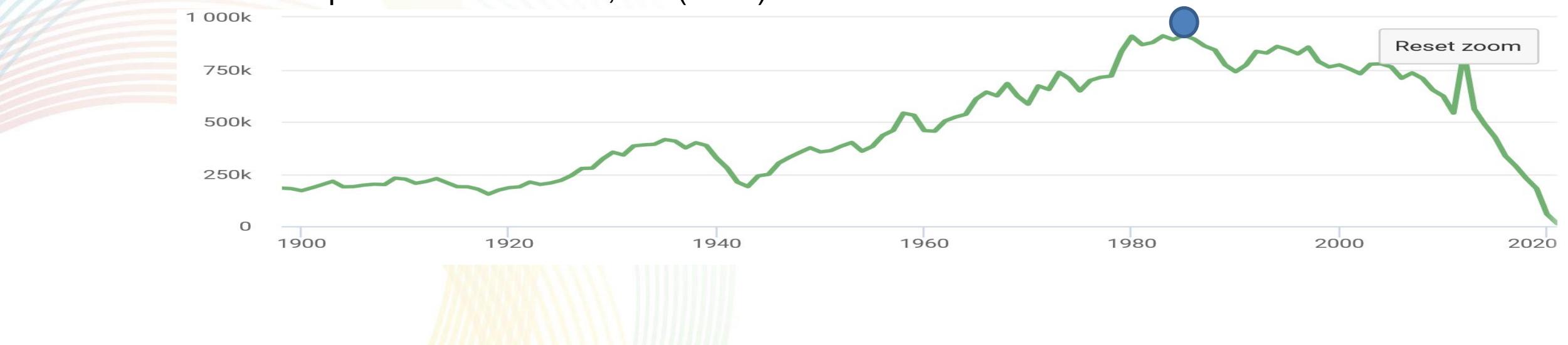
# GBIF data by years



All data: max. 188,197,913 (2020)



Herbarium specimens: max. 913,455 (1985)



# GBIF data for Russia



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## Russian Federation

Names of countries and areas are based on the ISO 3166-1 standard

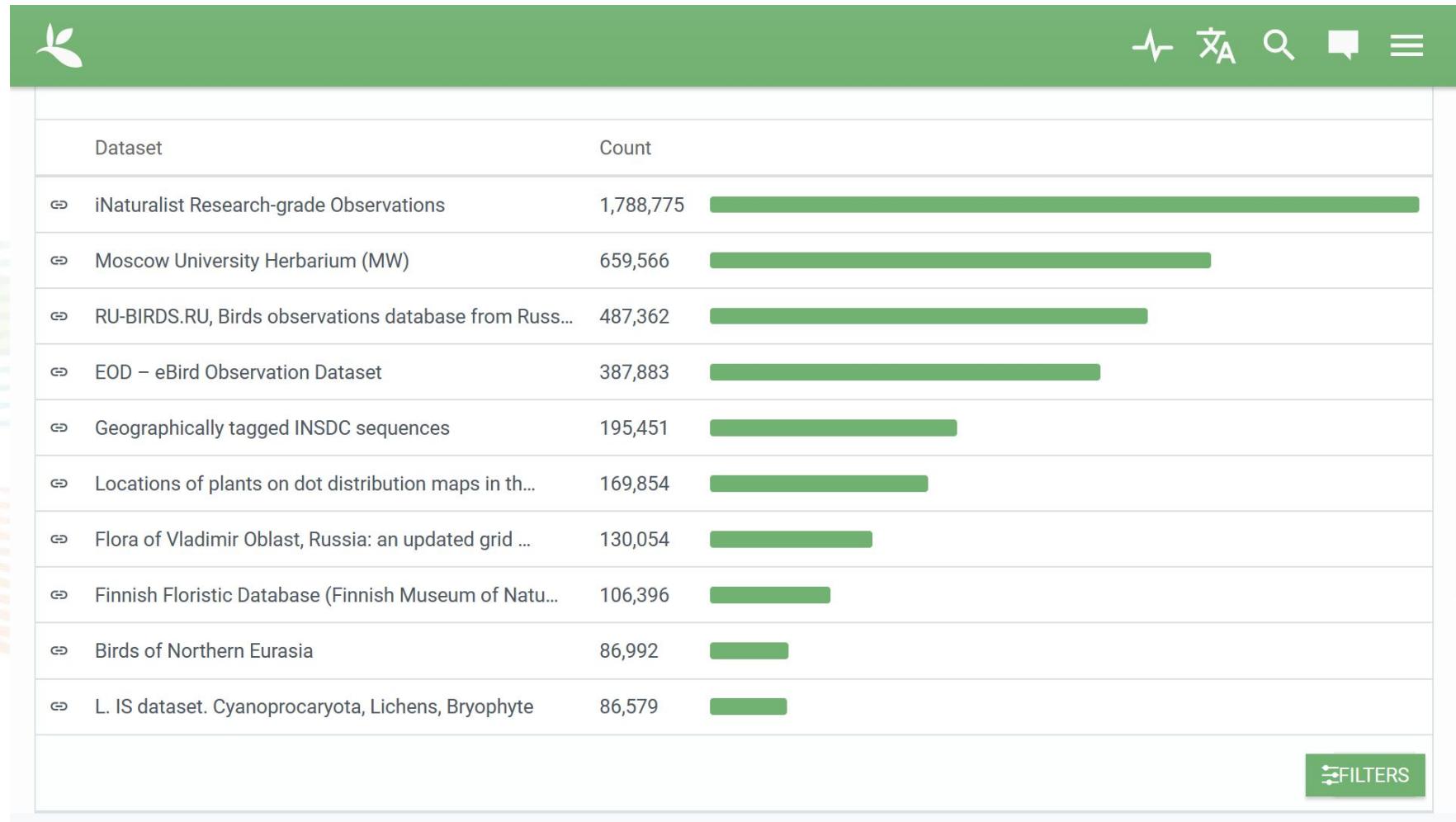
SUMMARY DATA ABOUT DATA PUBLISHING ALIEN SPECIES MORE... ACTIVITY REPORT

DATA ABOUT RUSSIAN FEDERATION

7,132,280	2,400	37	470
Occurrences	Datasets	Countries and areas contribute data	Publishers

A world map where the occurrences of data for Russia are represented by a dense cluster of colored dots. The dots are concentrated in two main regions: the European part of Russia and the Far East (Siberia and the Russian Far East). The colors of the dots range from yellow to red, indicating different levels or types of data density. A zoom control icon (+, -, x) is visible in the top-left corner of the map area.

# Top sources for Russia in GBIF



# GBIF data from Russian institutions



Get data How-to Tools Community About

Russian Federation

Names of countries and areas are based on the ISO 3166-1 standard

SUMMARY DATA ABOUT DATA PUBLISHING ALIEN SPECIES MORE... ACTIVITY REPORT

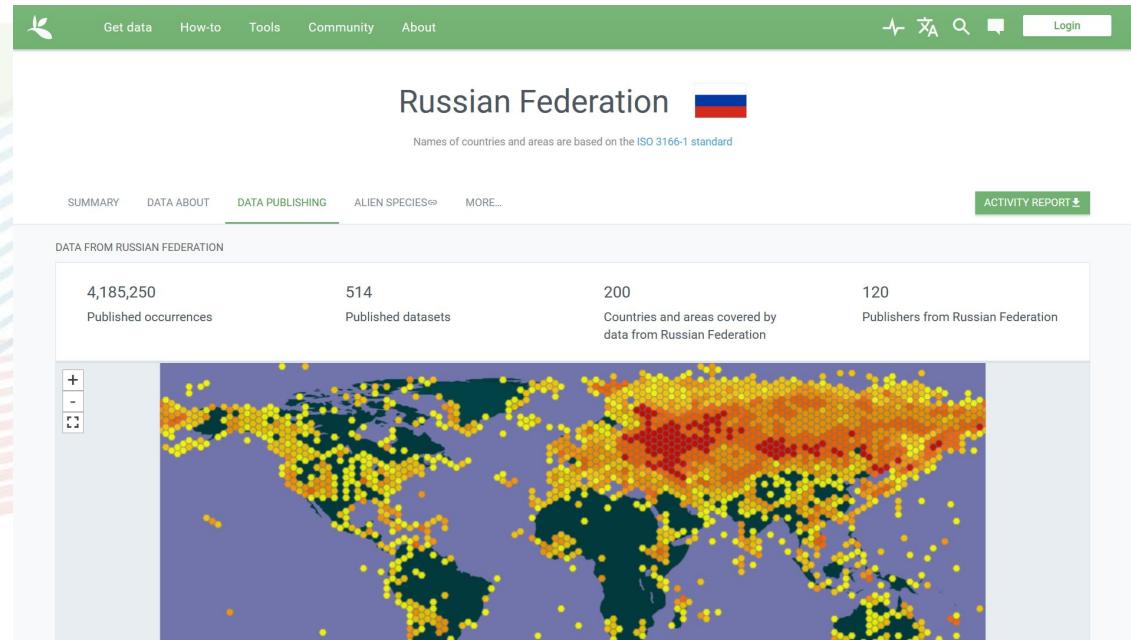
DATA FROM RUSSIAN FEDERATION

4,185,250 Published occurrences	514 Published datasets	200 Countries and areas covered by data from Russian Federation	120 Publishers from Russian Federation
------------------------------------	---------------------------	--	---

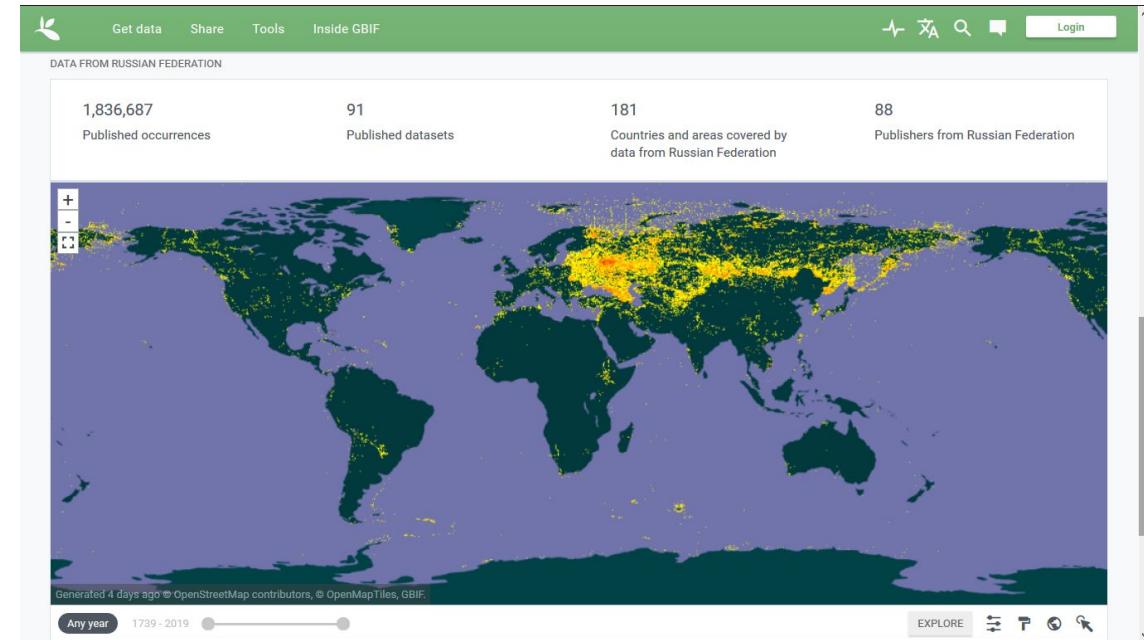
# GBIF data from Russia: 2021 vs. 2019



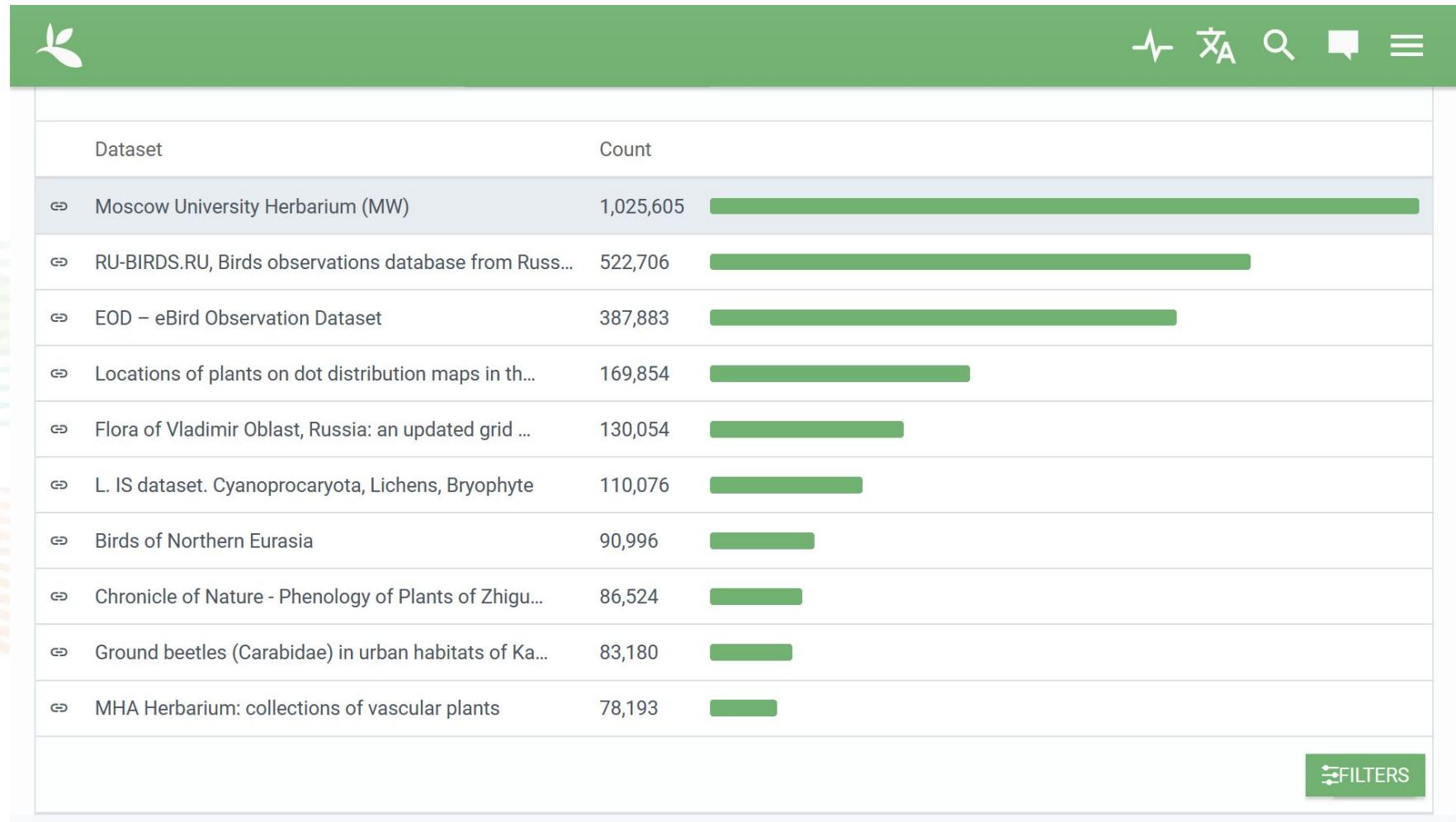
Sep 2021: 4.2M records



Aug 2019: 1.8M records



# Top sources from Russia in GBIF



# Top 20 countries by plant data in GBIF



## Ranks 1 to 10



## Ranks 11 to 20



# Source #1 for the Russian flora: 1.2M



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OCCURRENCE DATASET | REGISTERED FEBRUARY 9, 2012

## iNaturalist Research-grade Observations

Published by iNaturalist.org  
Ueda K

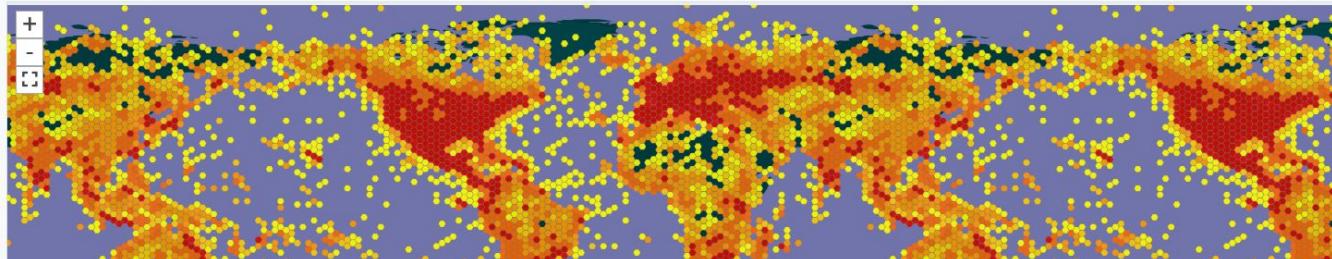
DATASET METRICS ACTIVITY DOWNLOAD HOME PAGE

32,825,022 OCCURRENCES 1,491 CITATIONS

Observations from iNaturalist.org, an online social network of people sharing biodiversity information to help each other learn about nature. iNaturalist is a joint initiative of the California Academy of Sciences and the National Geographic Society. Observations included in this archive met the following requirements: \* Published under one of the following licenses or waivers: 1) <http://creativecommons.org/publicdomain/zero/1.0/>, 2) <http://creativecommons.org/licenses/by/4.0/>, 3) <http://creativecommons.org/licenses/by-sa/4.0/>. [More](#)

32,825,022 Occurrences 99.9% With taxon match 99.7% With coordinates 99.9% With year

32,738,186 GEOFERENCED RECORDS

A map of Russia and surrounding regions, showing a dense distribution of georeferenced records. The points are color-coded by taxon match, with a high concentration of orange and red points across the country, indicating a high density of observed species.

# «Flora of Russia» on iNaturalist



iNaturalist Исследуйте Сообщество ▾ Ещё ▾ Вход или Регистрация

New Flora of Russia • Новая флора России

1 326 382 НАБЛЮДЕНИЙ 7 498 ВИДОВ 5 700 ЭКСПЕРТОВ 15 431 НАБЛЮДАТЕЛЬ

**Подробно** Участники 231

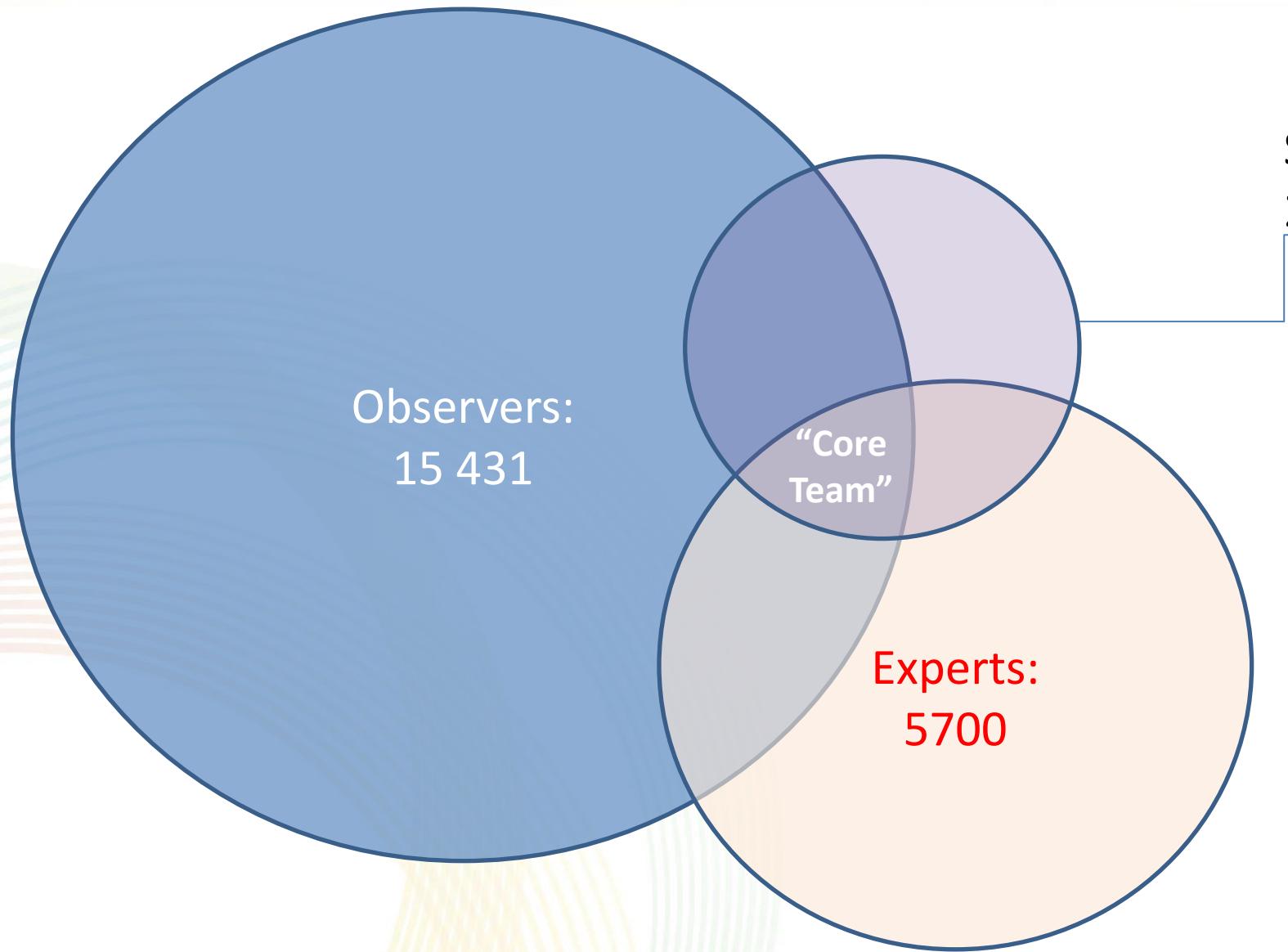
Проект "Флора России | Flora of Russia" достиг технологического потолка платформы iNaturalist: с середины марта 2021 г. главная страница портала перестала загружаться.

Подробнее > Журнал проекта

**Статистика**

10 Aug 2021

# Community of “Flora of Russia”



# Top observers on iNaturalist (Flora of Russia)



Alexey Seregin,  
Moscow State University



Nikolay Degtyarev,  
Central Chernozem Reserve



Nikolay Panasenko,  
Bryansk State University



Ekaterina Kashirina,  
Moscow State University



Sergey Appolonov,  
Independent Res., Shumerlya



Igor Pospelov,  
Severtsov Institute, RAS



Vladimir Teploukhov,  
Omsk Forest Department



Marina Gorbunova,  
Independent Res., Korolyov

# Top experts on iNaturalist (Flora of Russia)



Dmitry Bochkov,  
Moscow State University



Igor Kuzmin,  
Tyumen State University



Sergey Mayorov,  
Moscow State University



Julia Shner,  
Moscow State University



Alexey Seregin,  
Moscow State University



Alexander Khimin,  
Pavlovsk School #2



Natalya Gamova,  
Moscow State University

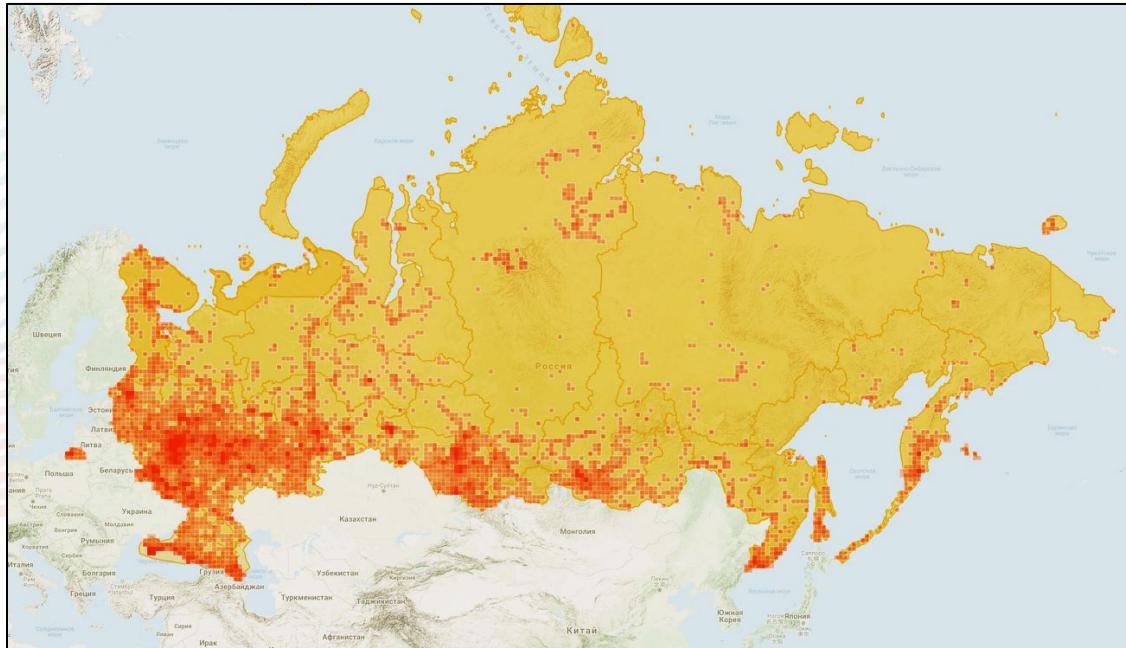


Sergey Lednev,  
Moscow State University

# Data density vs. Population density



**Data density on iNaturalist**



**Population density of Russia**



Sources:

<https://www.fresher.ru/2019/12/03/karty-plotnosti-naseleniya-rossii-i-evropy-ssha-i-avstralii/>

<https://www.inaturalist.org/projects/flora-of-russia/>

# Source #2 for the Russian flora: 0.6M



Get data How-to Tools Community About

OCCURRENCE DATASET | REGISTERED NOVEMBER 2, 2017

## Moscow University Herbarium (MW)

Published by Lomonosov Moscow State University  
Seregin A

DATASET PROJECT METRICS ACTIVITY DOWNLOAD HOME PAGE

1,025,605 OCCURRENCES 424 CITATIONS

Moscow University Herbarium (MW) is the second largest herbarium in Russia after the Komarov Institute. Being available at <https://plant.depo.msu.ru/>, it is almost completely imaged either at 300 dpi for regular collections or at 600 dpi for type specimens. The herbarium is focused on the flora of temperate Eurasia with an emphasis on the flora of Russia. As of 1 November 2018, physical collections of MW Herbarium include 1,044,571 specimens (incl. 4.8K type specimens) representing 37,200 species... [More](#)

Project ID: 14-50-00029, Russia2019\_14  
Publication date: September 1, 2021  
Metadata last modified: September 1, 2021  
Hosted by: Lomonosov Moscow State University  
License: CC BY 4.0  
[How to cite](#) DOI 10.15468/cphcc

1,025,605 Occurrences 99.9% With taxon match 58% With coordinates 87% With year

591,860 GEOFERENCED RECORDS

# Herbarium collections: top countries



1. USA	78,462,700
2. France	24,046,688
3. UK	23,655,232
4. Germany	22,120,100
5. People's Republic of China	20,375,136
<b>6. Russia</b>	<b>16,175,934</b>
7. Japan	12,860,724
8. Sweden	12,033,000
9. Switzerland	12,027,534
10. Italy	11,596,611



Source: Thiers (2021)

# Digitization of herbaria in Russia



Russia:

- 16,176,000 physical specimens
- 1,309,000 imaged
- **7,8% imaged**



World:

- 396,205,000 physical specimens
- ca. 62,000,000 imaged
- **15,6% imaged**



Sources: Thiers (2021), Index Herbariorum, other sources  
Original counts and estimates

# Top herbarium collections of Russia



	Institution	Code	Collections
1	Komarov Botanical Institute, RAS (St Petersburg)	LE	6,000,000
2	Moscow State University	MW	1,044,751
3	Central Siberian Botanical Garden, SB RAS (Novosibirsk)	NS + NSK	800,000
4	Saint Petersburg University	LECB	800,000
5	Main Botanical Garden, RAS (Moscow)	MHA	610,000
6	Institute of Biology and Soil Science, FEB RAS (Vladivostok)	VLA	500,000
7	Tomsk State University	TK	500,000
8	Komi Scientific Centre, RAS (Syktyvkar)	SYKO	407,000
9	Vavilov Institute of Plant Genetic Resources (St Petersburg)	WIR	376,825
10	Southern Federal University (Rostov-on-Don)	RV	350,000

Source: Thiers (2021)

# Top digital herbaria of Russia



	Institution	Code	Images	Proportion of imaged specimens	Web-portal
1	Lomonosov Moscow State University (Moscow)	MW	1,029K	94%	<a href="https://plant.depo.msu.ru/">https://plant.depo.msu.ru/</a> <a href="https://www.gbif.org/">https://www.gbif.org/</a>
2	Main Botanical Garden, RAS (Moscow)	MHA	78K	13%	<a href="https://plant.depo.msu.ru/">https://plant.depo.msu.ru/</a> <a href="https://www.gbif.org/">https://www.gbif.org/</a>
3	Central Siberian Botanical Garden, RAS (Novosibirsk)	NS+ NSK	52K	7%	<a href="http://84.237.85.99:8081/">http://84.237.85.99:8081/</a> <a href="https://www.gbif.org/">https://www.gbif.org/</a>
4	Komarov Botanical Institute, RAS (Saint Petersburg)	LE	44K	<1%	<a href="http://herbariumle.ru/">http://herbariumle.ru/</a>
5	Botanical Garden-Institute, RAS (Vladivostok)	VBGI	42K	53%	<a href="http://botsad.ru/herbarium/">http://botsad.ru/herbarium/</a>
6	Institute of Plant and Animal Ecology, RAS (Yekaterinburg)	SVER	18K	14%	<a href="https://herbarium.ipae.uran.ru/">https://herbarium.ipae.uran.ru/</a>
7	Altai State University (Barnaul)	ALTB	17K	6%	<a href="http://old.ssbg.asu.ru/">http://old.ssbg.asu.ru/</a>
8	Tula State Pedagogical University (Tula)	TUL	9K	86%	<a href="https://plant.depo.msu.ru/">https://plant.depo.msu.ru/</a> <a href="https://www.gbif.org/">https://www.gbif.org/</a>

# Source #3 for the Russian flora: 0.3M



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OCCURRENCE DATASET | REGISTERED FEBRUARY 25, 2020

## Locations of plants on dot distribution maps in the Flora of Siberia (Flora Sibiraea, 1987–1997)

Published by Central Siberian Botanical Garden SB RAS

Artemov I • Egorova A

DATASET PROJECT METRICS ACTIVITY DOWNLOAD

169,854 OCCURRENCES 32 CITATIONS

In 1987-1997 the 13 volumed collective monograph Flora of Siberia was published where data on systematics, ecology and distribution of 4302 native and naturalised alien vascular plant species and subspecies were presented (Flora Sibiraea, 1987–1997). Dot distribution maps for 2569 of them were made by authors of the monograph on the base of specimens stored in herbaria of Novosibirsk (NS, NSK), Tomsk (TK), Moskow (MW, MHA) and Saint Petersburg (LE). The total number of locations on the maps are 169854. The resource contains coordinates of the locations which were geocoded by means of the standard ArcView GIS procedures.

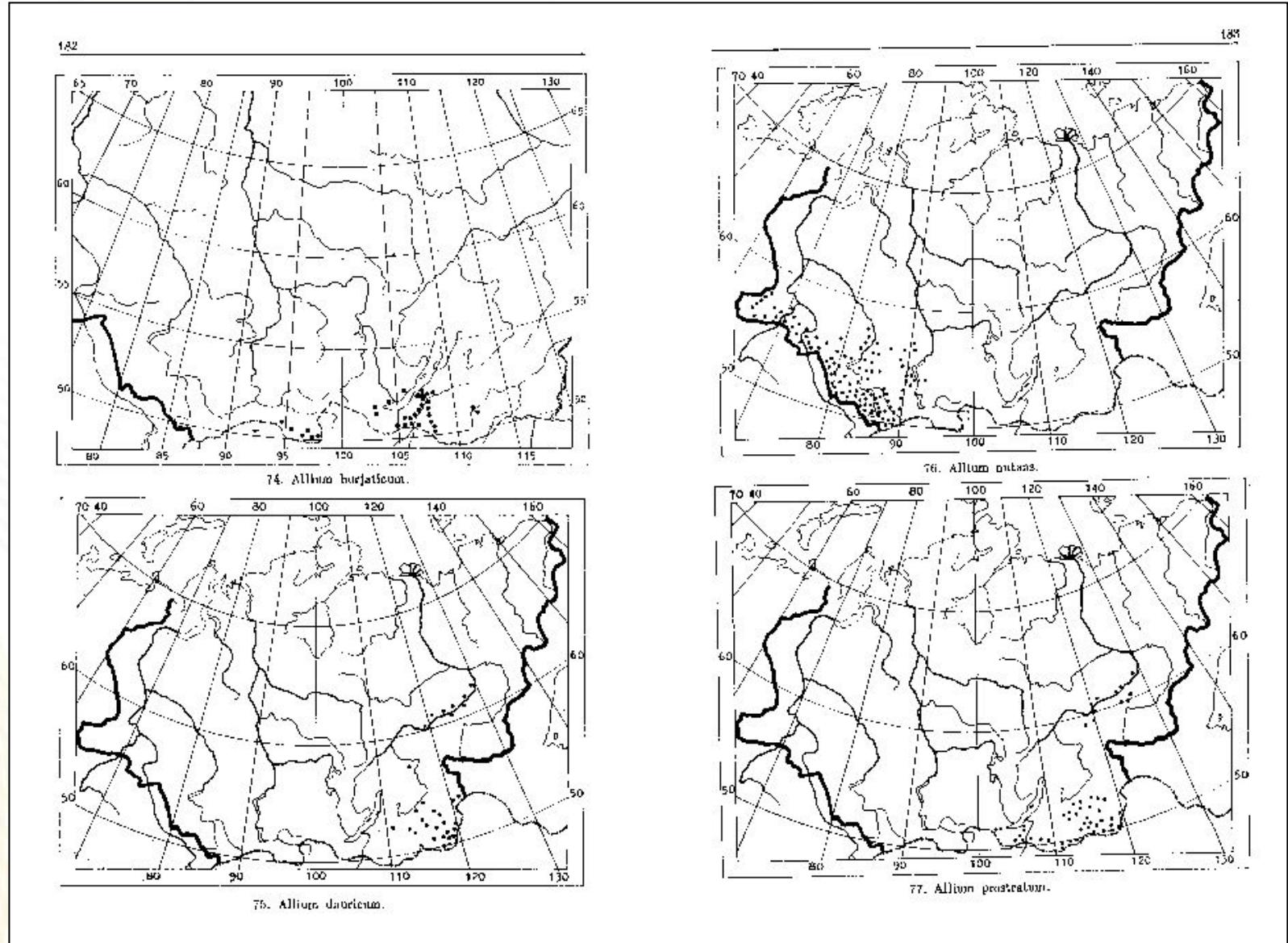
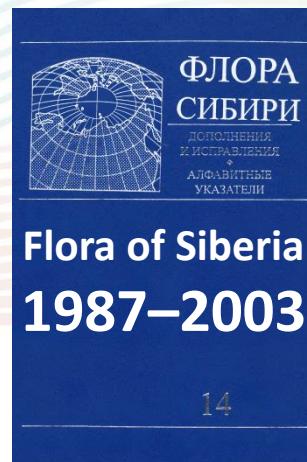
Project ID: AAAA-A17-117012610055-3  
Publication date: April 13, 2021  
Metadata last modified: April 13, 2021  
Hosted by: Central Siberian Botanical Garden SB RAS  
License: CC BY 4.0  
How to cite DOI 10.15468/jb84wg

169,854 Occurrences 100% With taxon match 99.9% With coordinates 100% With year

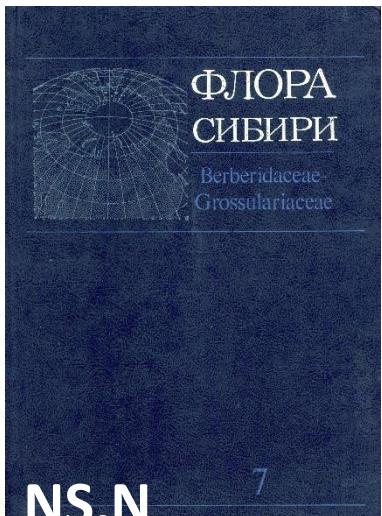
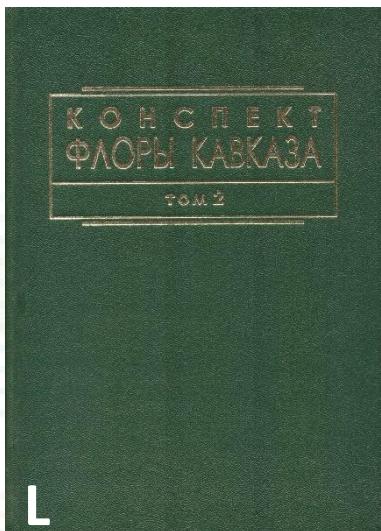
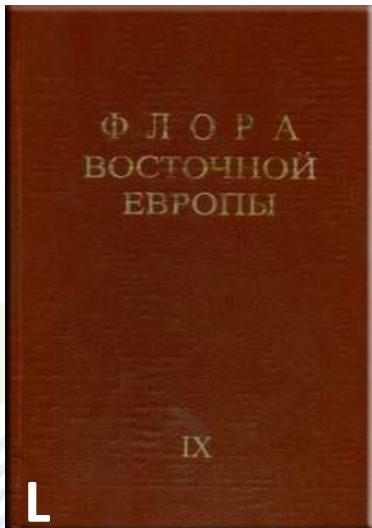
169,772 GEOREFERENCED RECORDS

A map of Eurasia showing the distribution of plant species. The map is color-coded by latitude, with darker blues representing higher latitudes. Overlaid on the map are numerous small dots of varying colors (yellow, orange, red) representing individual occurrences of plant species. A significant concentration of these dots is visible in the central and eastern parts of Siberia, particularly around the Ob River basin and the Yenisei River. There are also smaller clusters of dots in Europe, specifically in the British Isles, Central Europe, and Southern Russia. A legend in the bottom left corner indicates that there are 169,772 georeferenced records. On the far left edge of the map interface, there are zoom controls (+, -, x).

# Published distribution maps



# Five standard floras



NS, N

Areas

3,4

1988-20

03

СОСУДИСТЫЕ  
РАСТЕНИЯ  
СОВЕТСКОГО  
ДАЛЬНЕГО  
ВОСТОКА

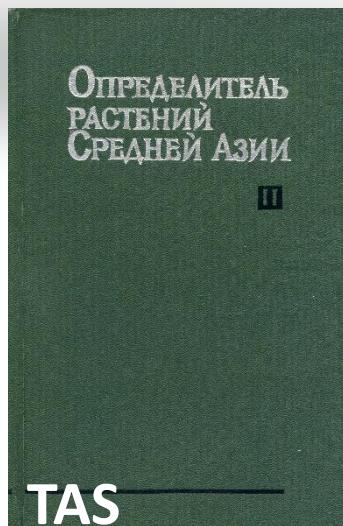


VL

Area 5

1985-20

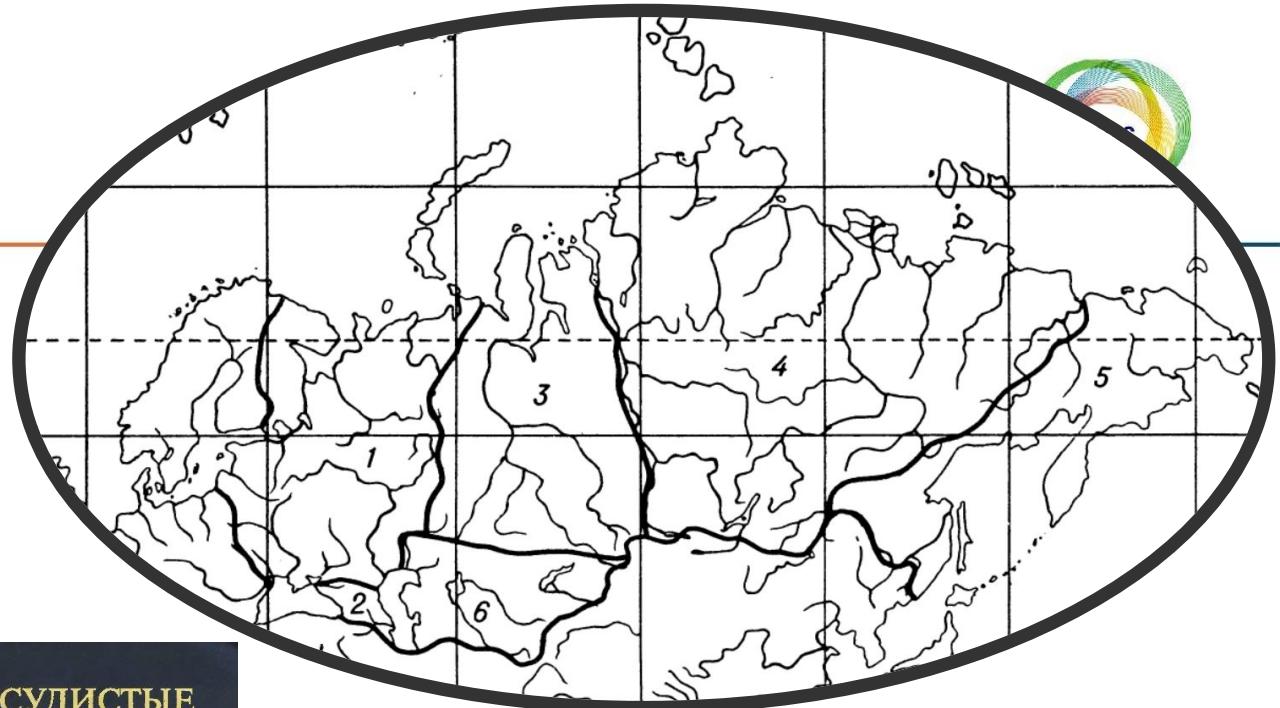
06



TAS

Area 6

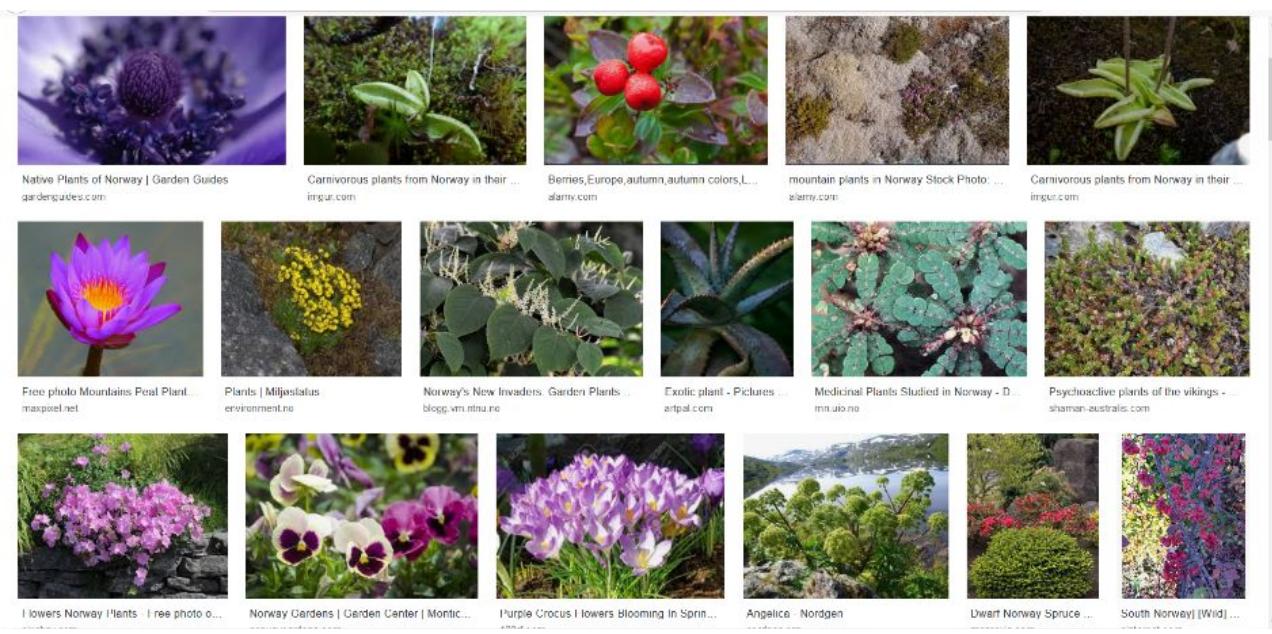
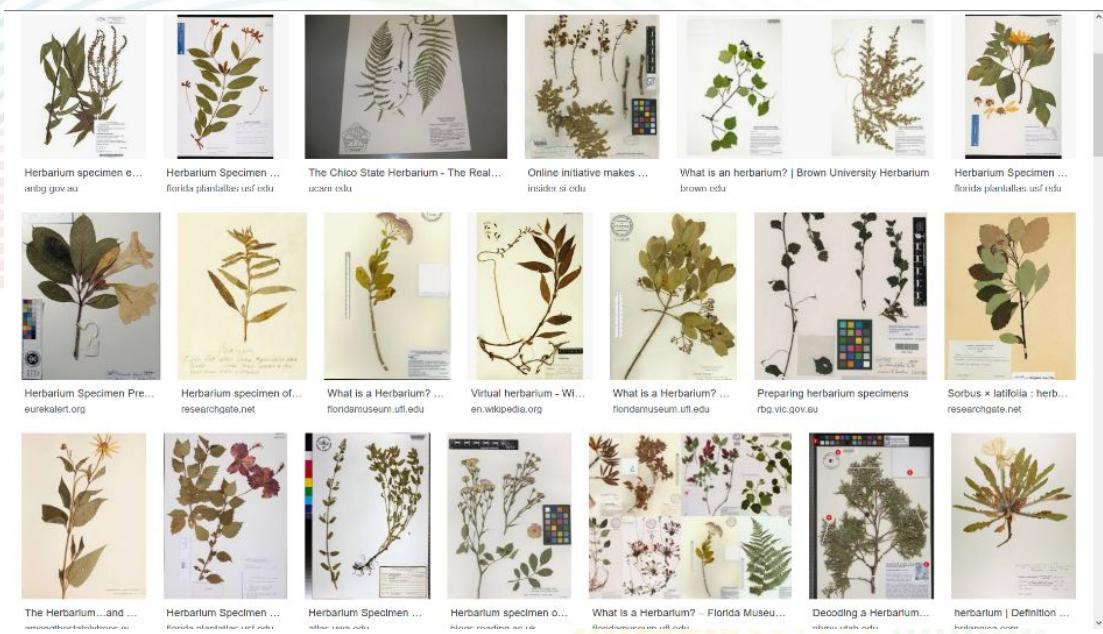
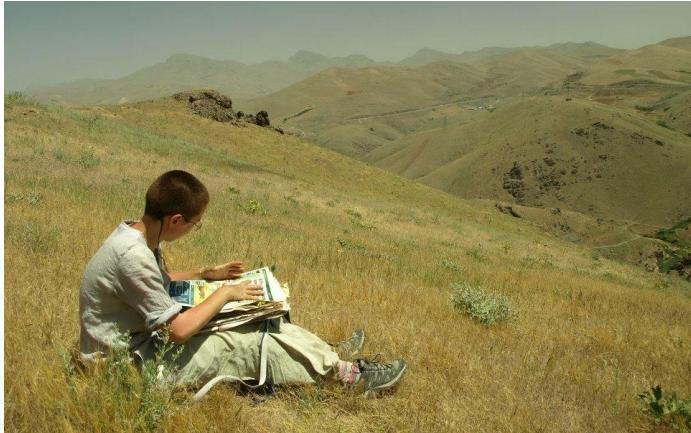
1968-19



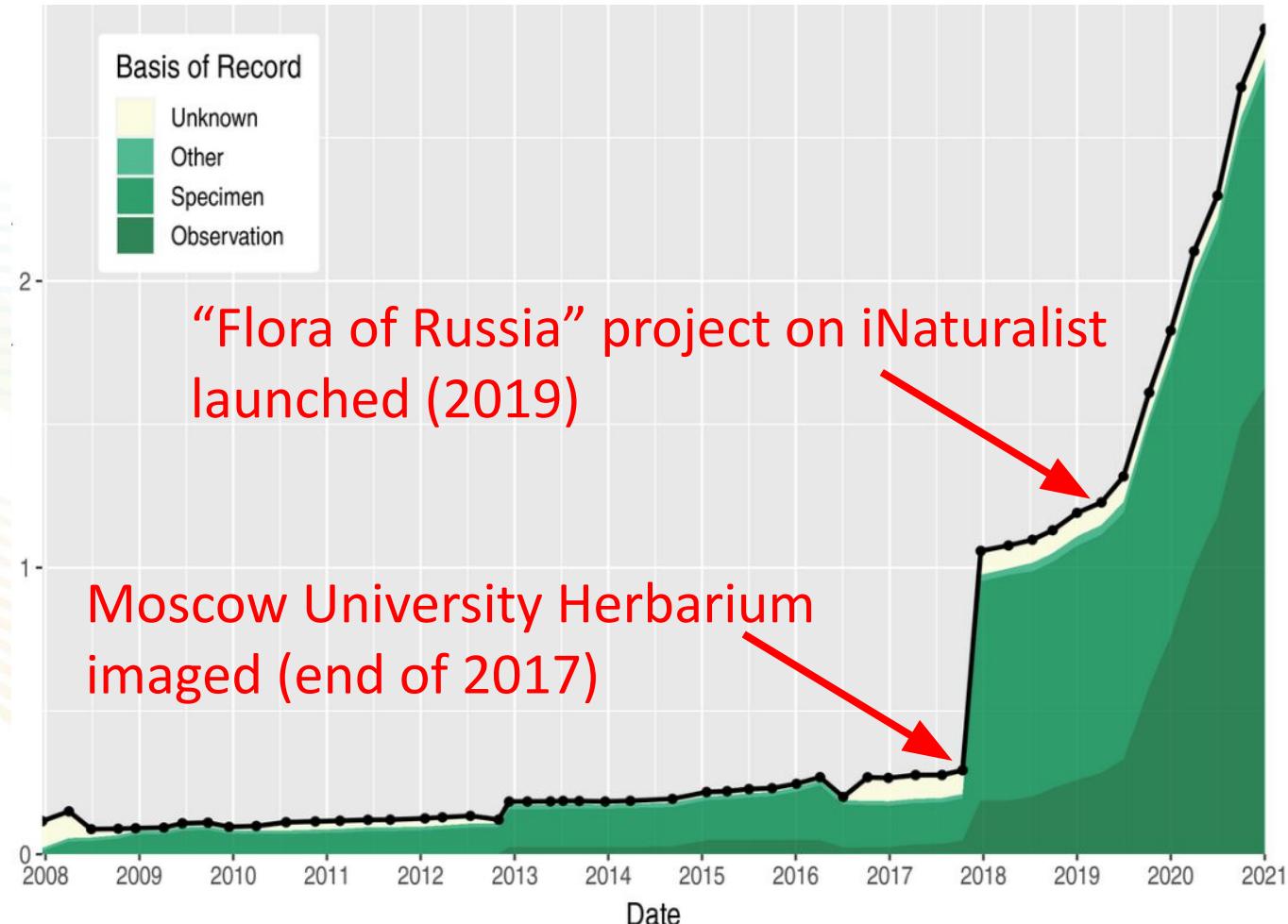
# Regional floras, guides, checklists



# Specimens vs. Citizen Science



# Data growth on Russian plants in GBIF





可持续发展大数据国际论坛  
International Forum on Big Data for  
Sustainable Development Goals

# Thanks

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