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

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(Moscow State University, Moscow, Russia)

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online meeting

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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

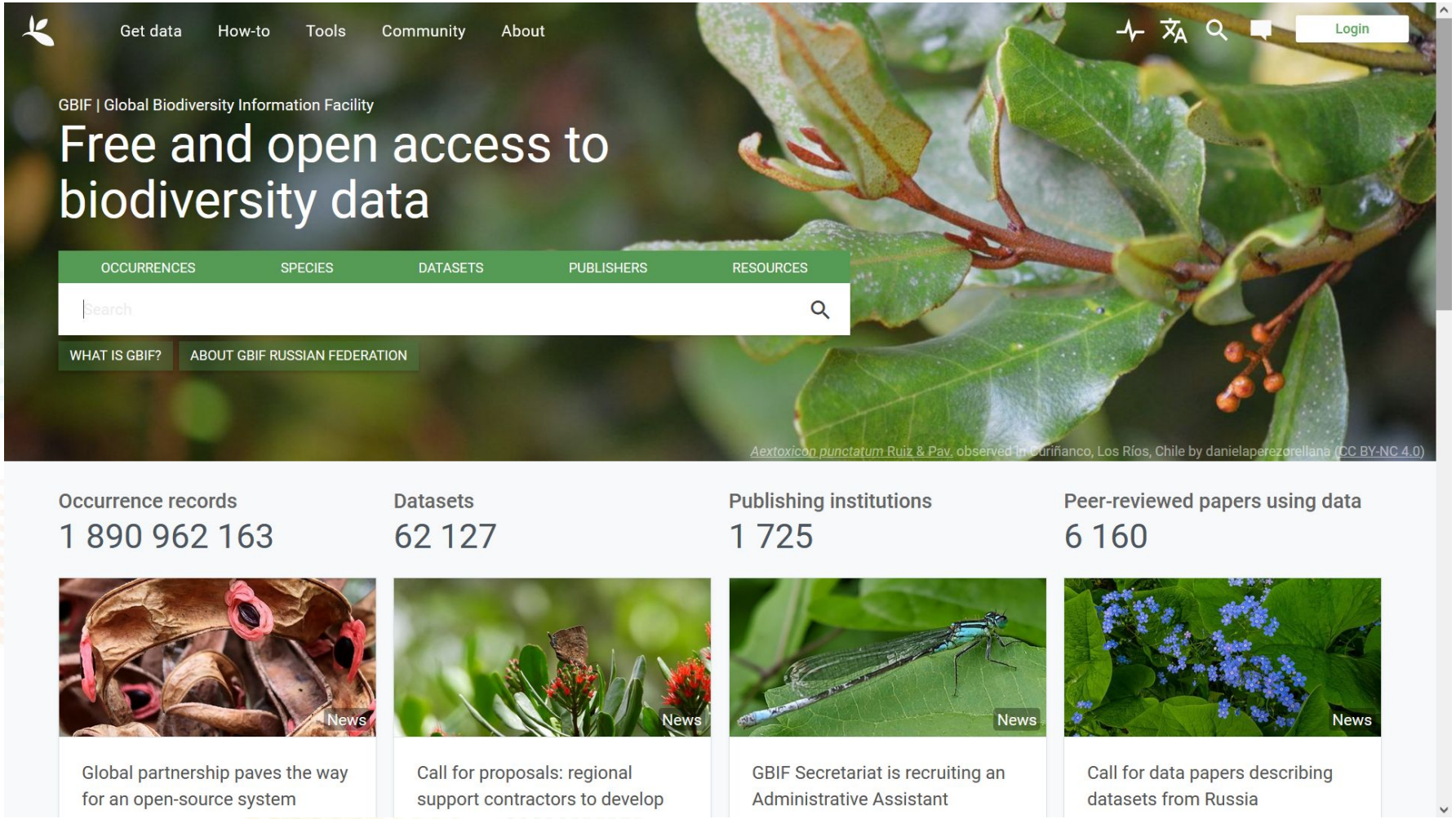
records. ERIN led the way by making the combined data available for Australia-wide Geographic Information System (GIS) analysis and modeling.

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
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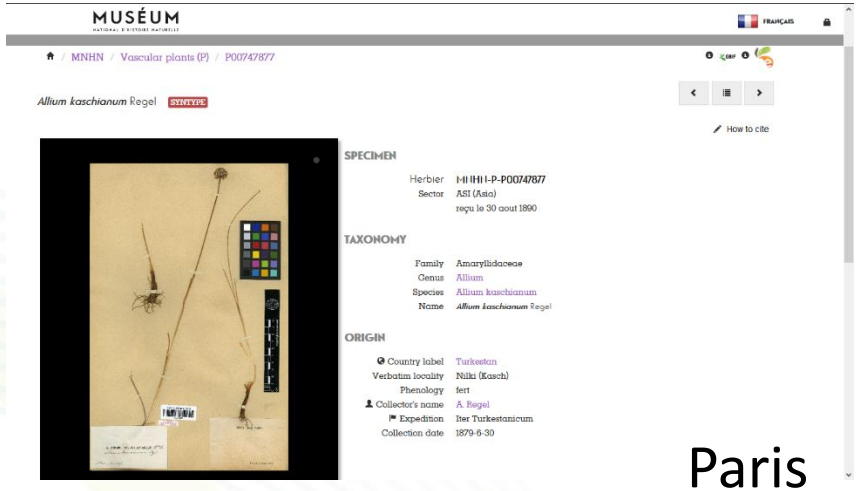
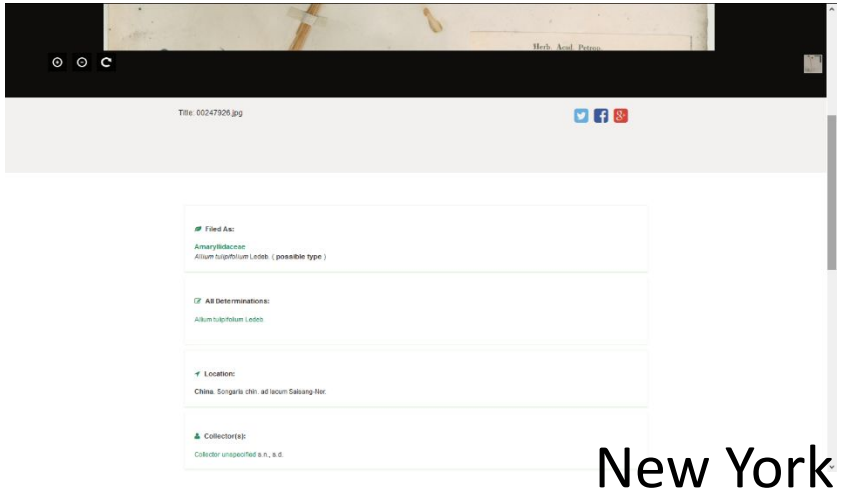
WHAT IS GBIF?
ABOUT GBIF RUSSIAN FEDERATION
Aextoxicon punctatum Ruiz & Pav. observed in Curiñanco, Los Ríos, Chile by danielaperezorellana (CC BY-NC 4.0)
Occurrence records
1 890 962 163
Datasets
62 127
Publishing institutions
1 725
Peer-reviewed papers using data
6 160
News
Global partnership paves the way for an open-source system
News
Call for proposals: regional support contractors to develop
News
GBIF Secretariat is recruiting an Administrative Assistant
News
Call for data papers describing datasets from Russia

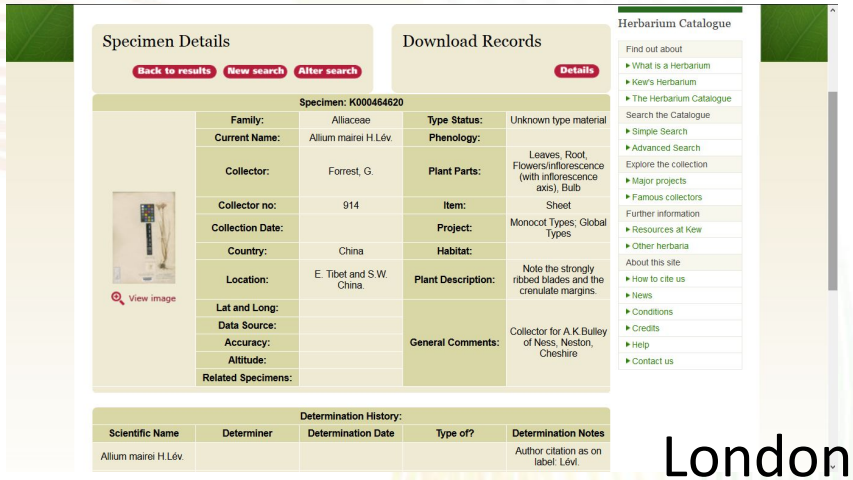
Diversity of original databases



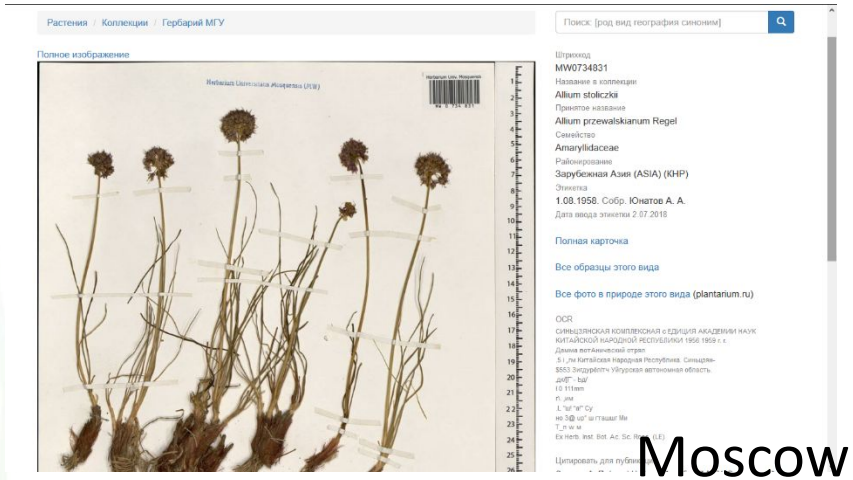
Paris



New York

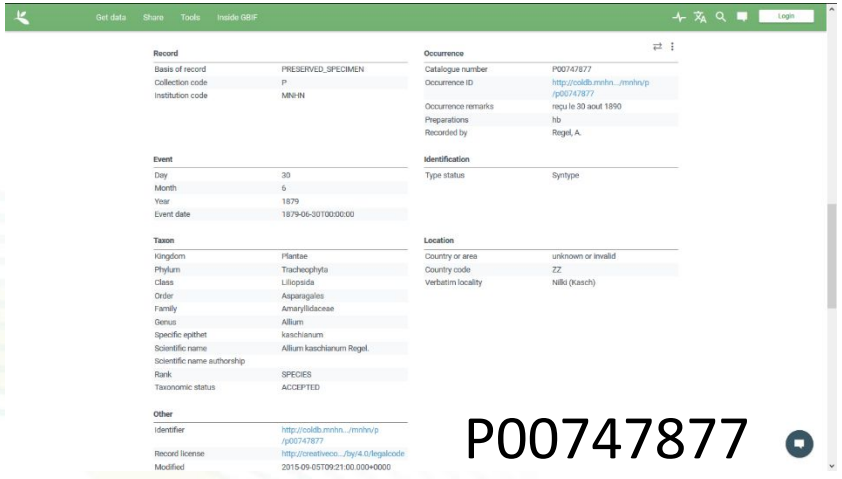


London



Moscow

Universality of GBIF standards



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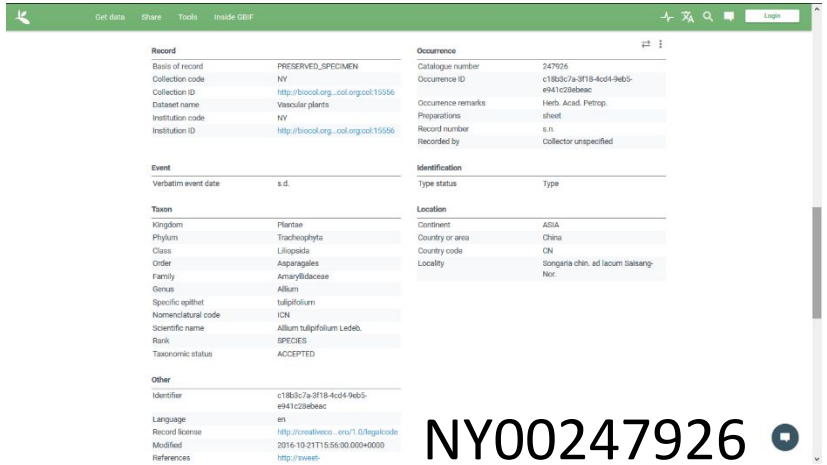

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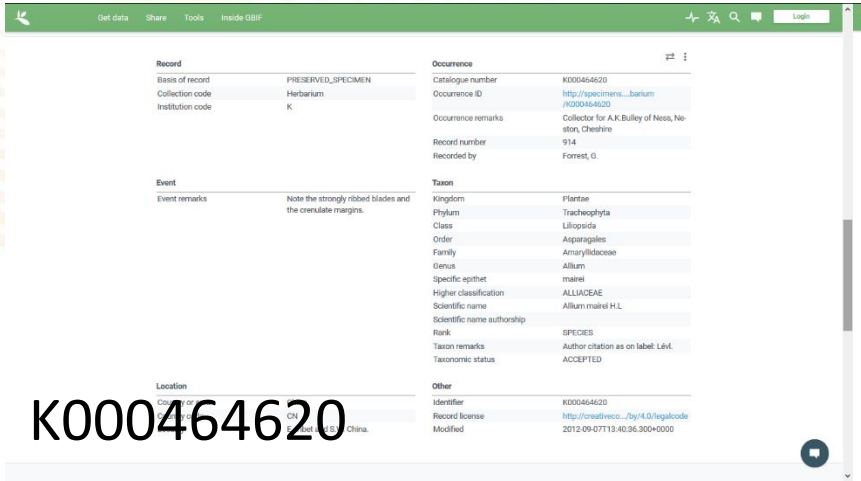

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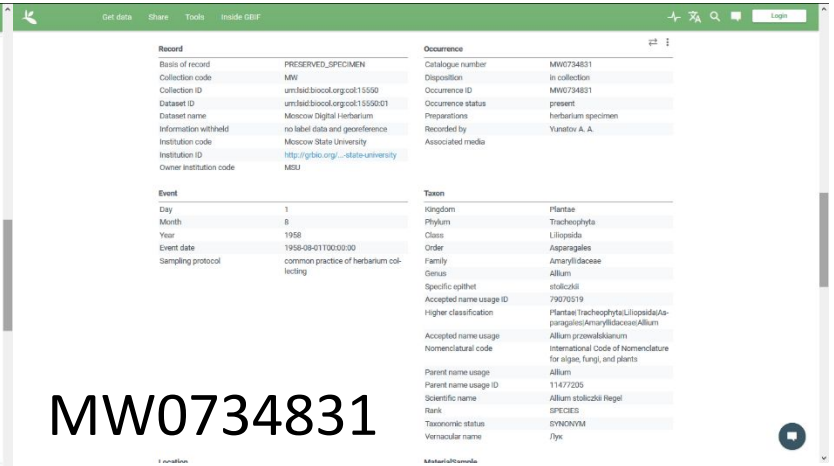
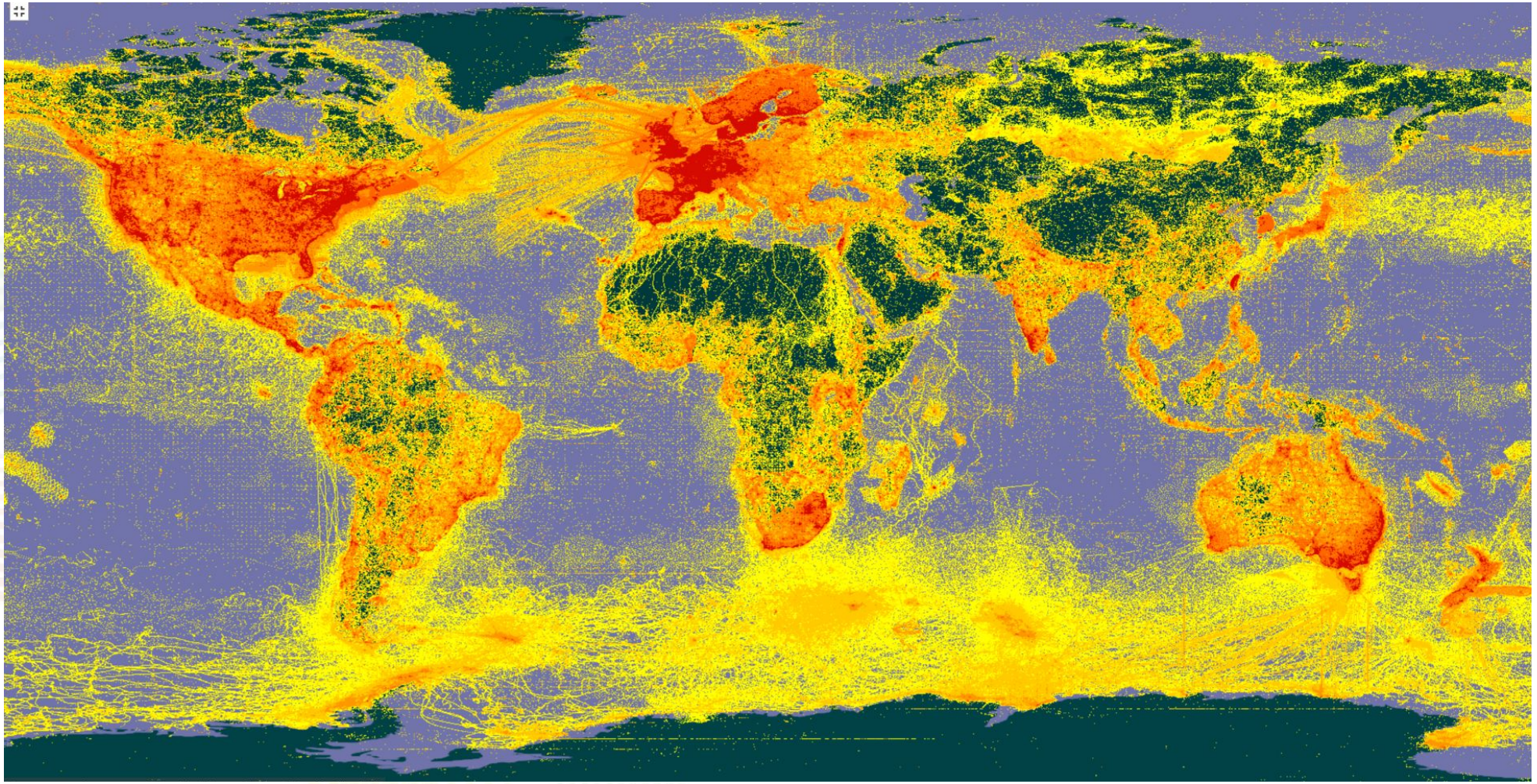


MW0734831

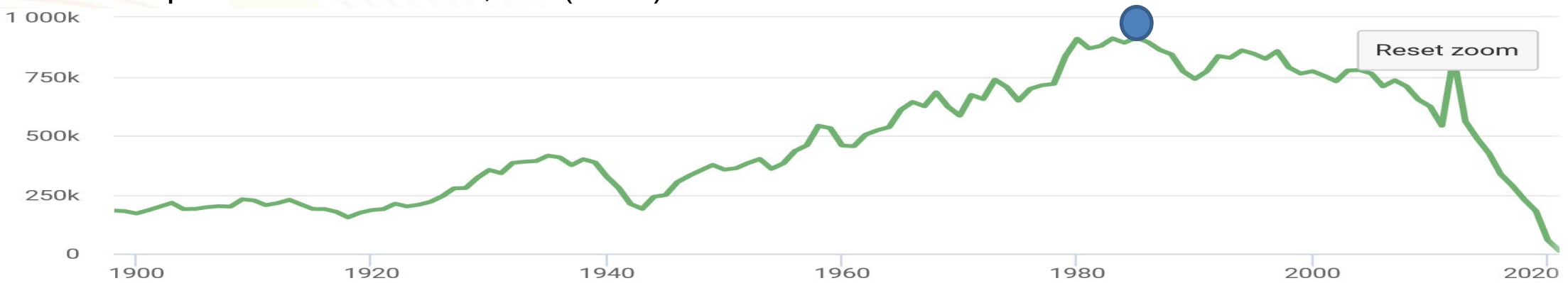
GBIF geodata



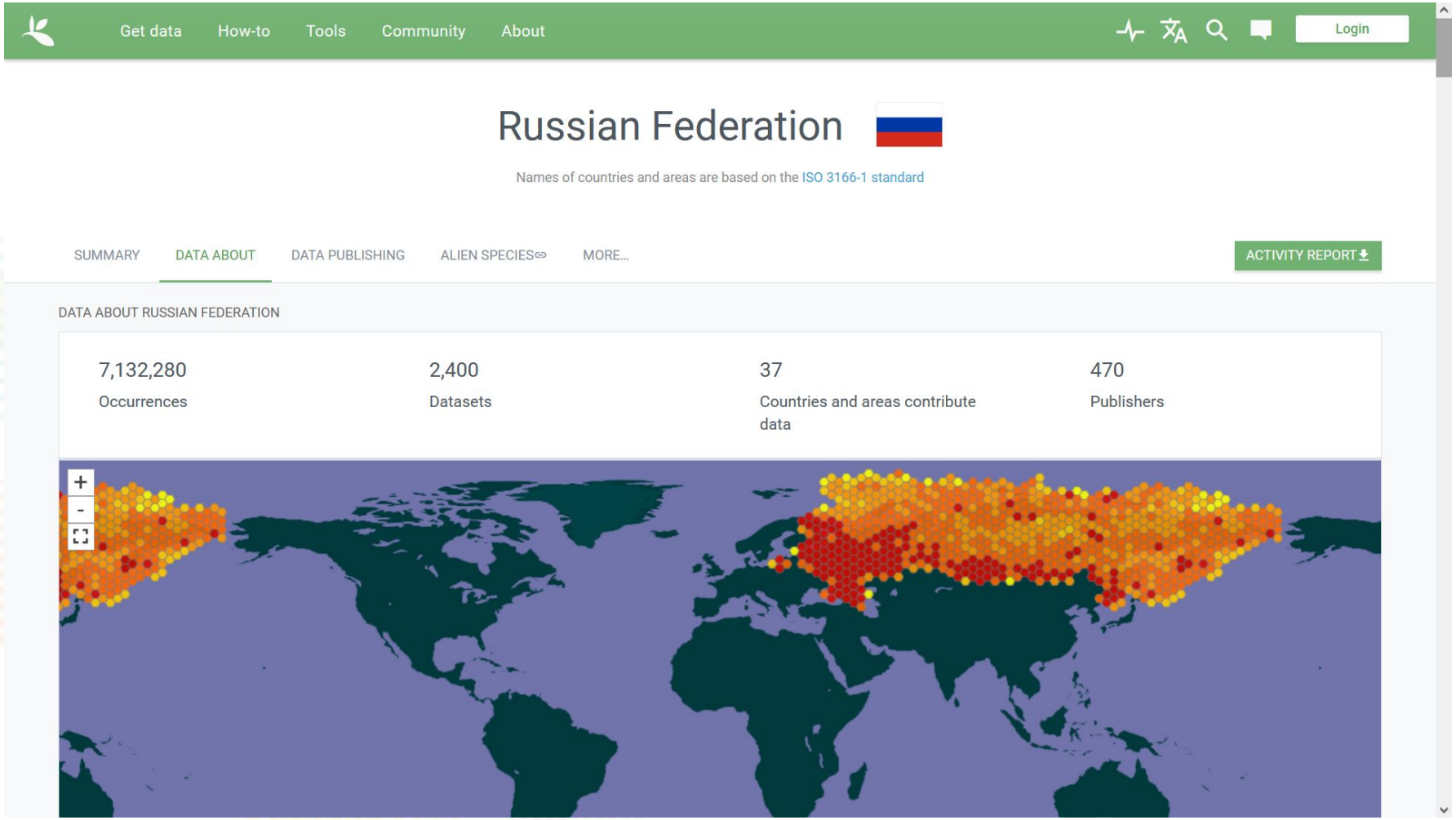
GBIF data by years

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

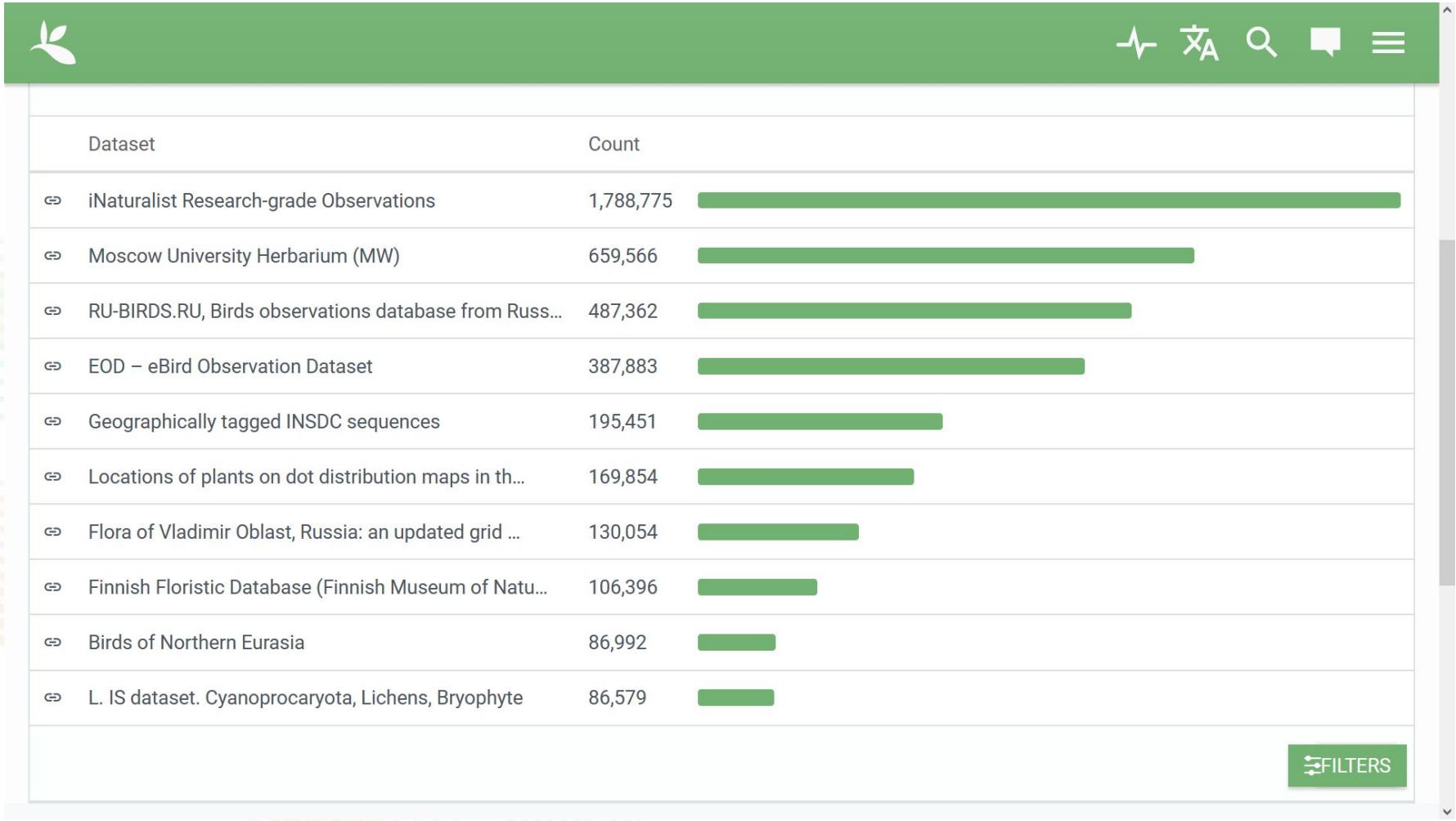
Herbarium specimens: max. 913,455 (1985)



GBIF data for Russia

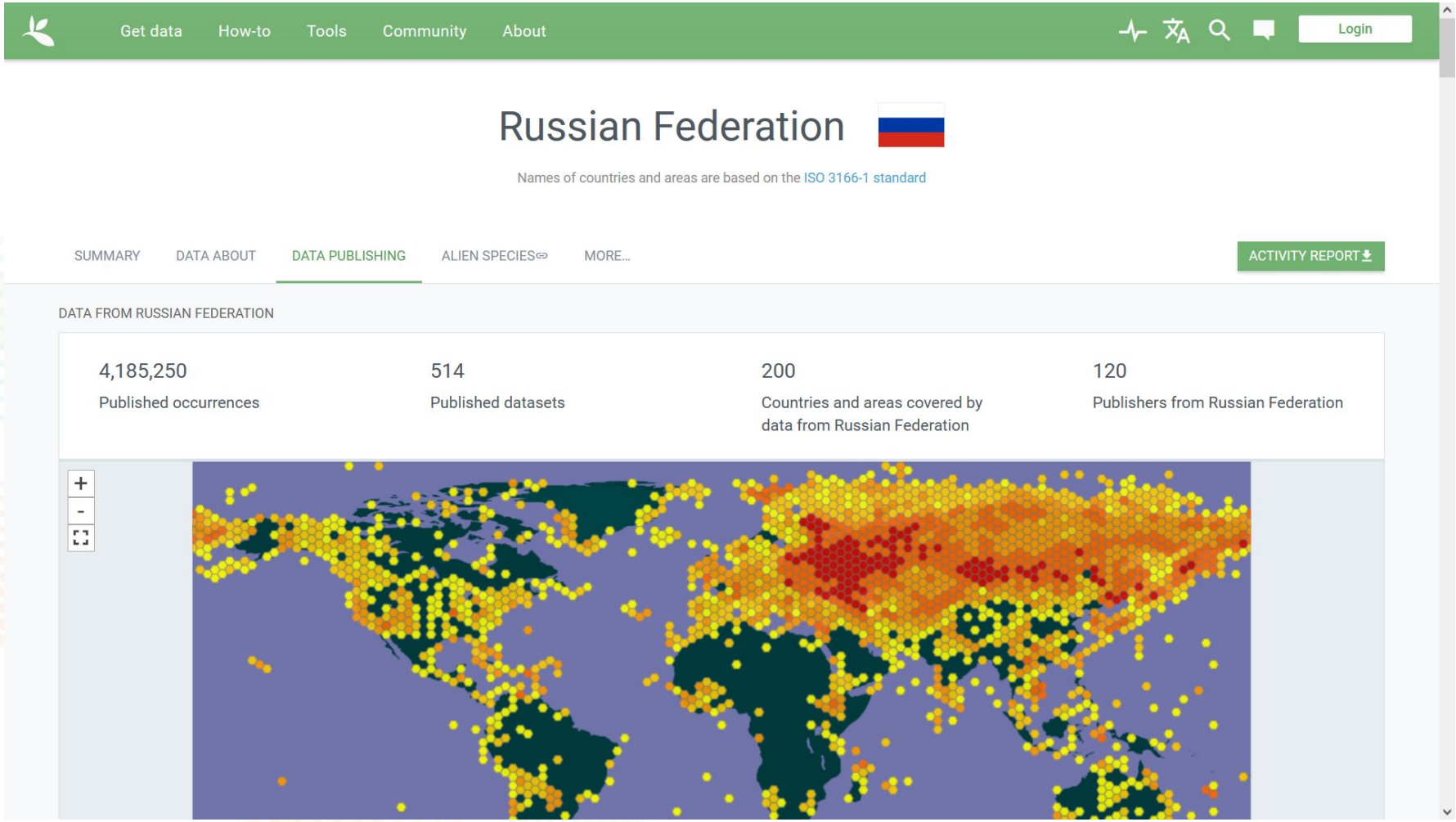


Top sources for Russia in GBIF



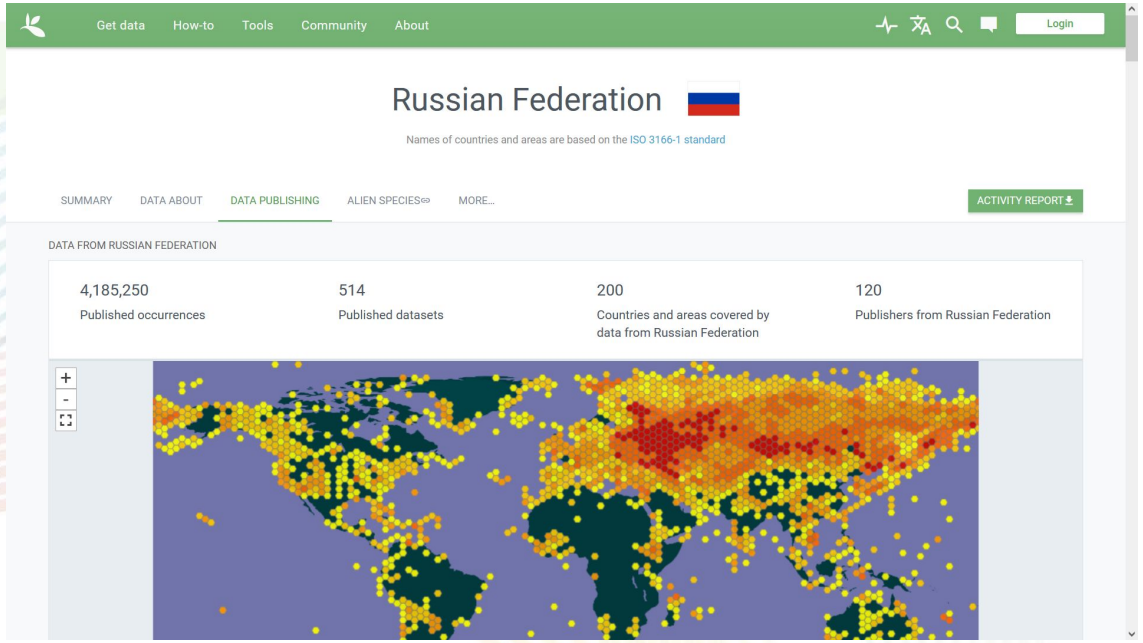
Dataset	Count
iNaturalist Research-grade Observations	1,788,775
Moscow University Herbarium (MW)	659,566
RU-BIRDS.RU, Birds observations database from Russ...	487,362
EOD – eBird Observation Dataset	387,883
Geographically tagged INSDC sequences	195,451
Locations of plants on dot distribution maps in th...	169,854
Flora of Vladimir Oblast, Russia: an updated grid ...	130,054
Finnish Floristic Database (Finnish Museum of Natu...	106,396
Birds of Northern Eurasia	86,992
L. IS dataset. Cyanoprocaryota, Lichens, Bryophyte	86,579

GBIF data from Russian institutions

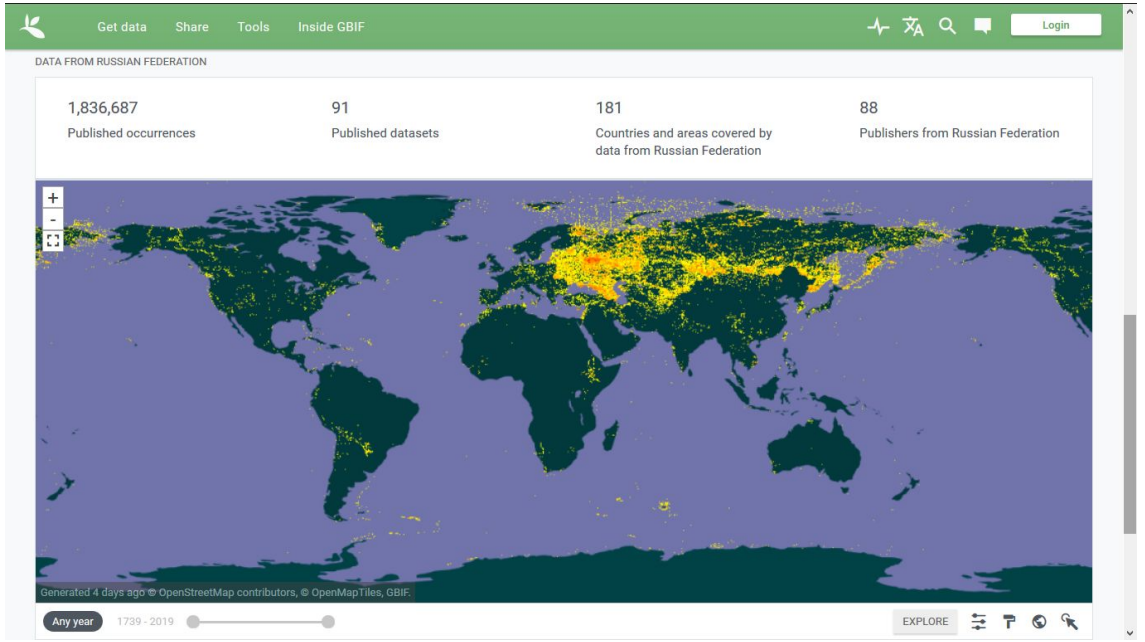


GBIF data from Russia: 2021 vs. 2019

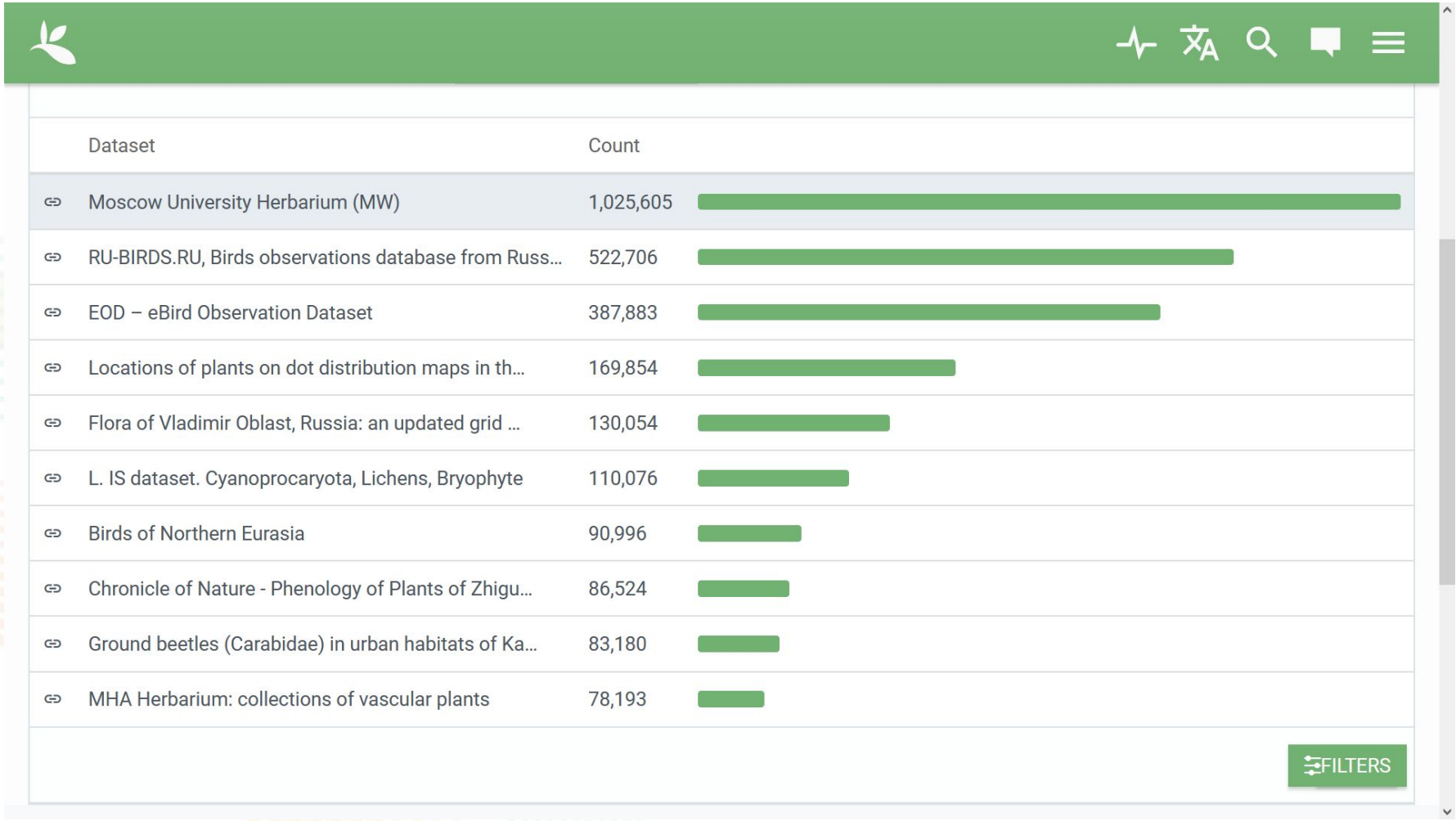
Sep 2021: 4.2M records



Aug 2019: 1.8M records



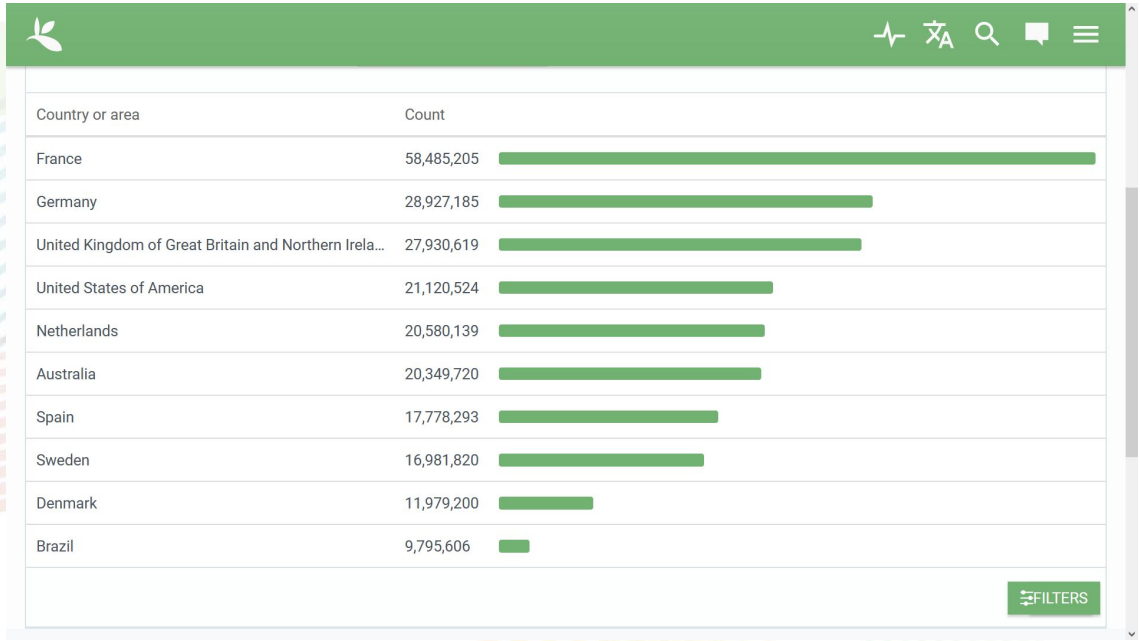
Top sources from Russia in GBIF



Dataset	Count
Moscow University Herbarium (MW)	1,025,605
RU-BIRDS.RU, Birds observations database from Russ...	522,706
EOD – eBird Observation Dataset	387,883
Locations of plants on dot distribution maps in th...	169,854
Flora of Vladimir Oblast, Russia: an updated grid ...	130,054
L. IS dataset. Cyanoprocaryota, Lichens, Bryophyte	110,076
Birds of Northern Eurasia	90,996
Chronicle of Nature - Phenology of Plants of Zhigu...	86,524
Ground beetles (Carabidae) in urban habitats of Ka...	83,180
MHA Herbarium: collections of vascular plants	78,193

Top 20 countries by plant data in GBIF

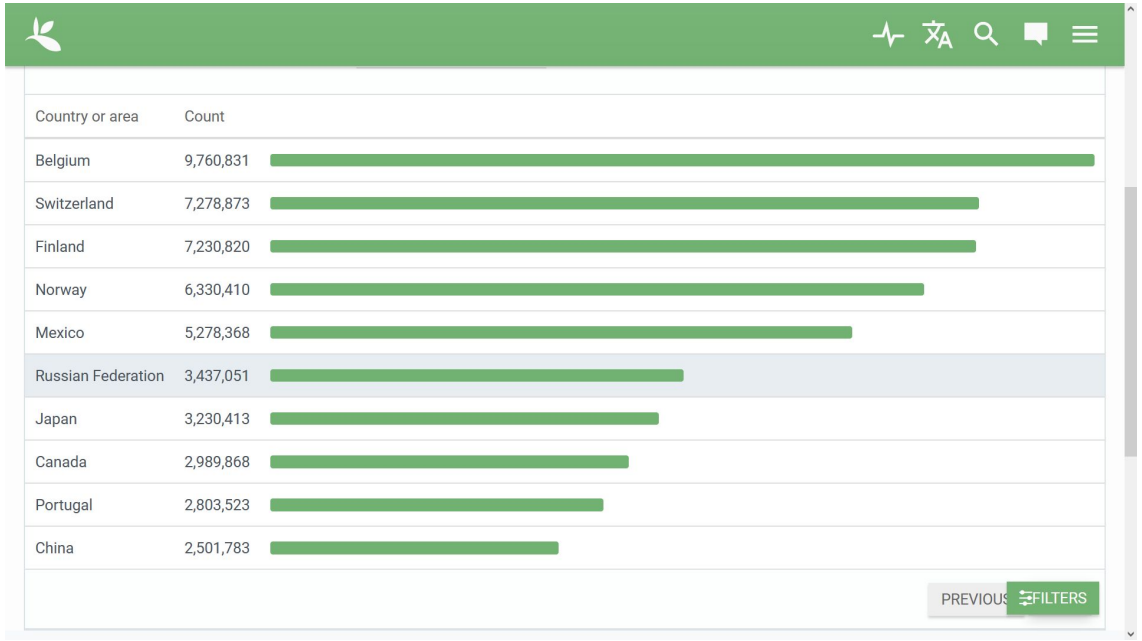
Ranks 1 to 10



Country or area	Count
France	58,485,205
Germany	28,927,185
United Kingdom of Great Britain and Northern Irela...	27,930,619
United States of America	21,120,524
Netherlands	20,580,139
Australia	20,349,720
Spain	17,778,293
Sweden	16,981,820
Denmark	11,979,200
Brazil	9,795,606

FILTERS

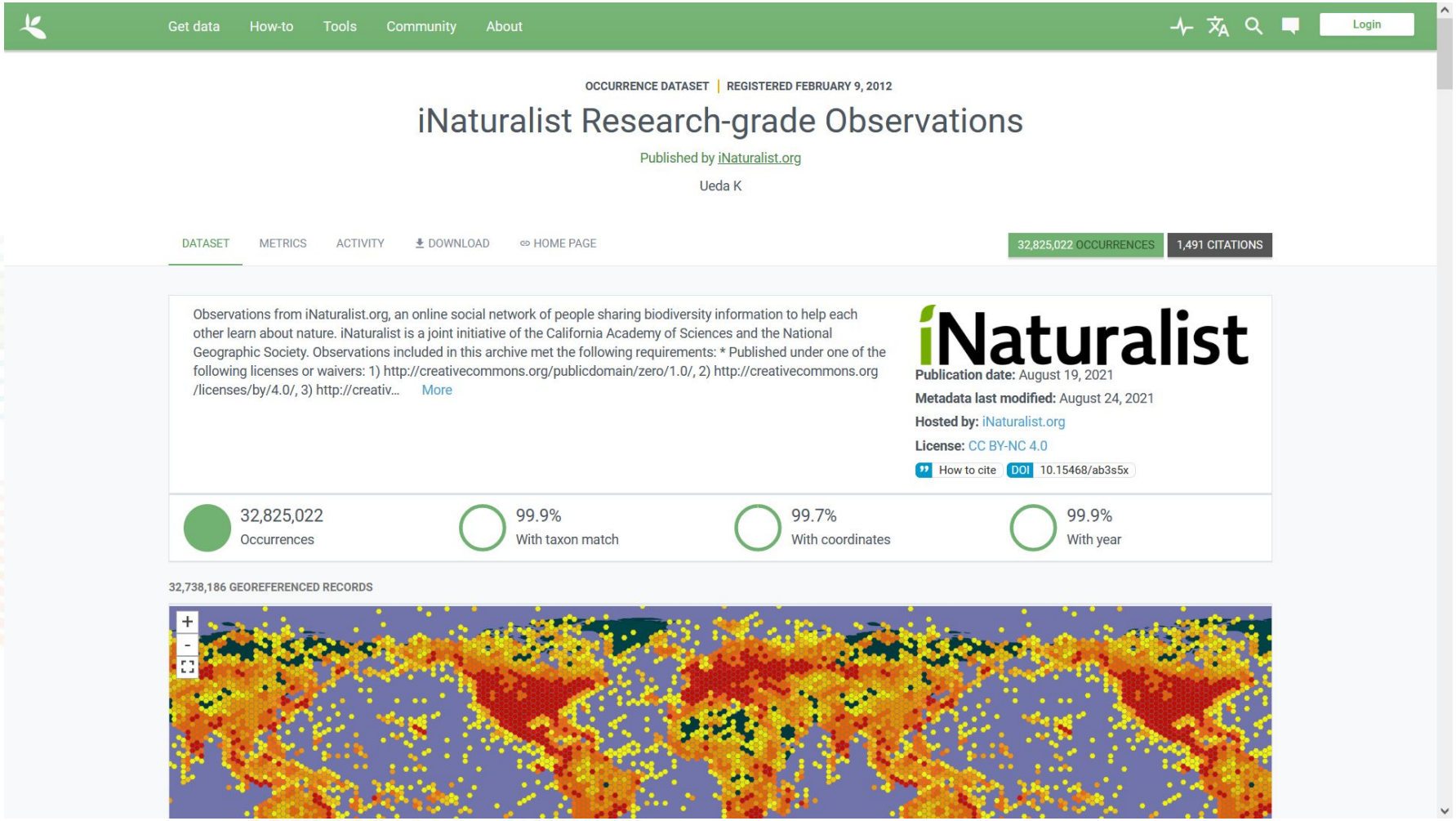
Ranks 11 to 20



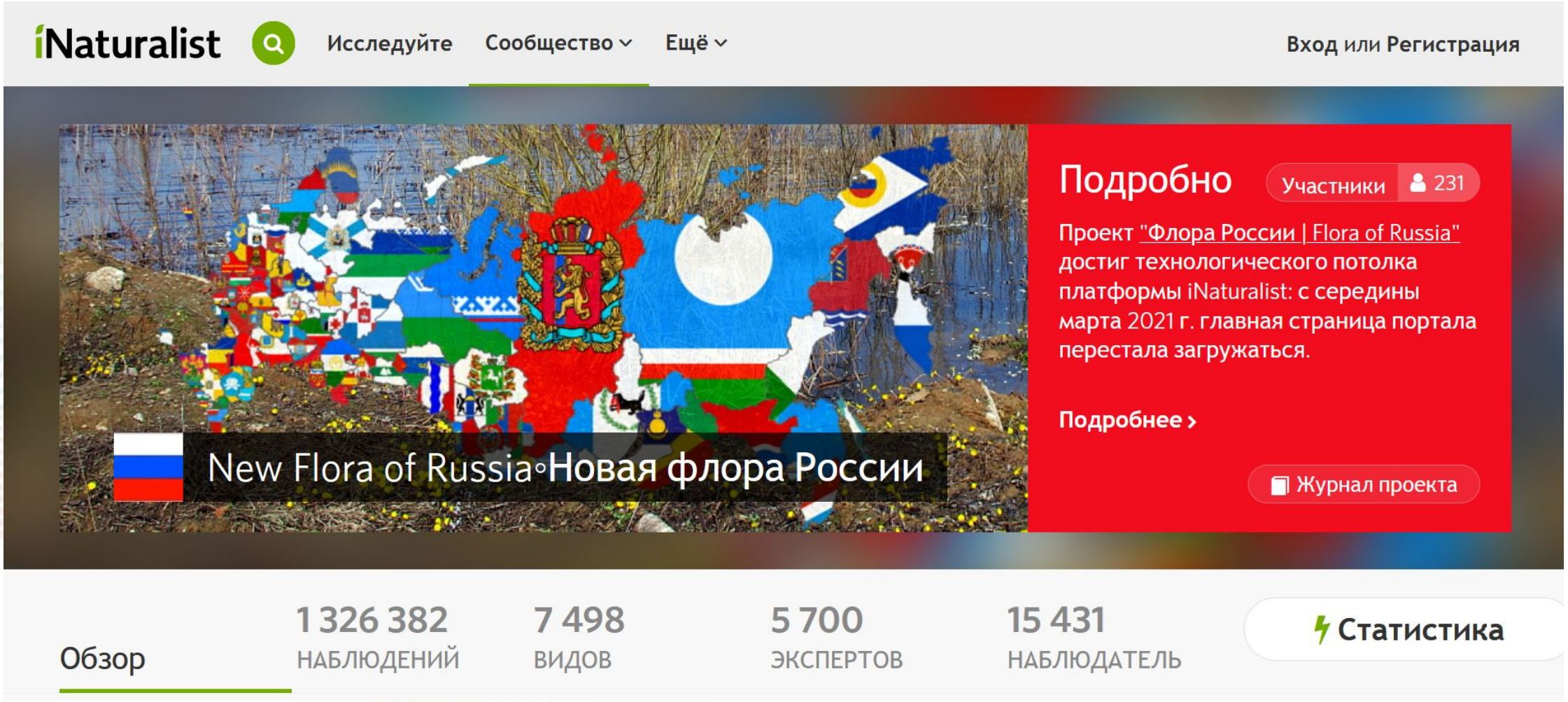
Country or area	Count
Belgium	9,760,831
Switzerland	7,278,873
Finland	7,230,820
Norway	6,330,410
Mexico	5,278,368
Russian Federation	3,437,051
Japan	3,230,413
Canada	2,989,868
Portugal	2,803,523
China	2,501,783

PREVIOUS FILTERS

Source #1 for the Russian flora: 1.2M

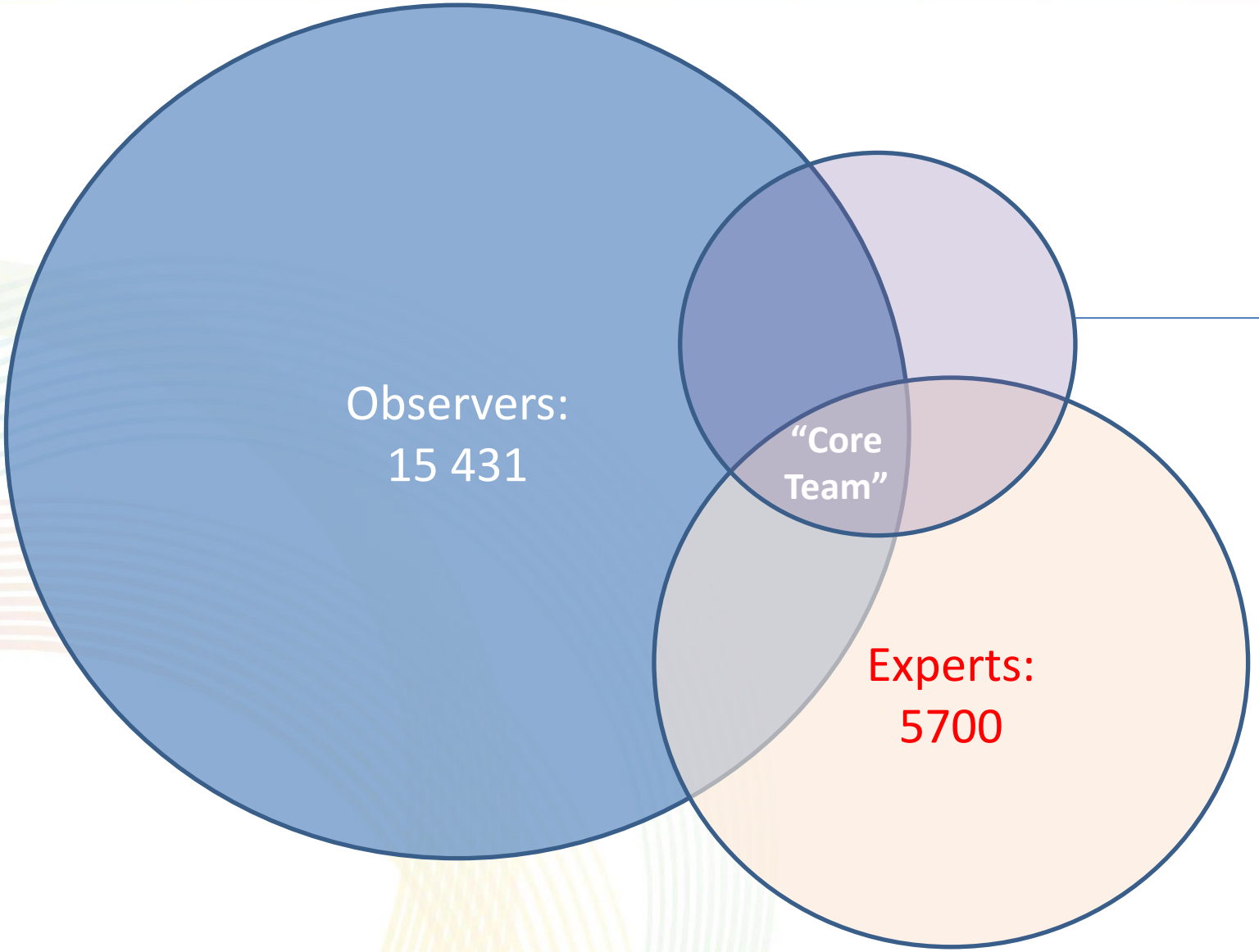


«Flora of Russia» on iNaturalist



10 Aug 2021

Community of “Flora of Russia”



Subscribers:
2208

10 Aug 2021

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

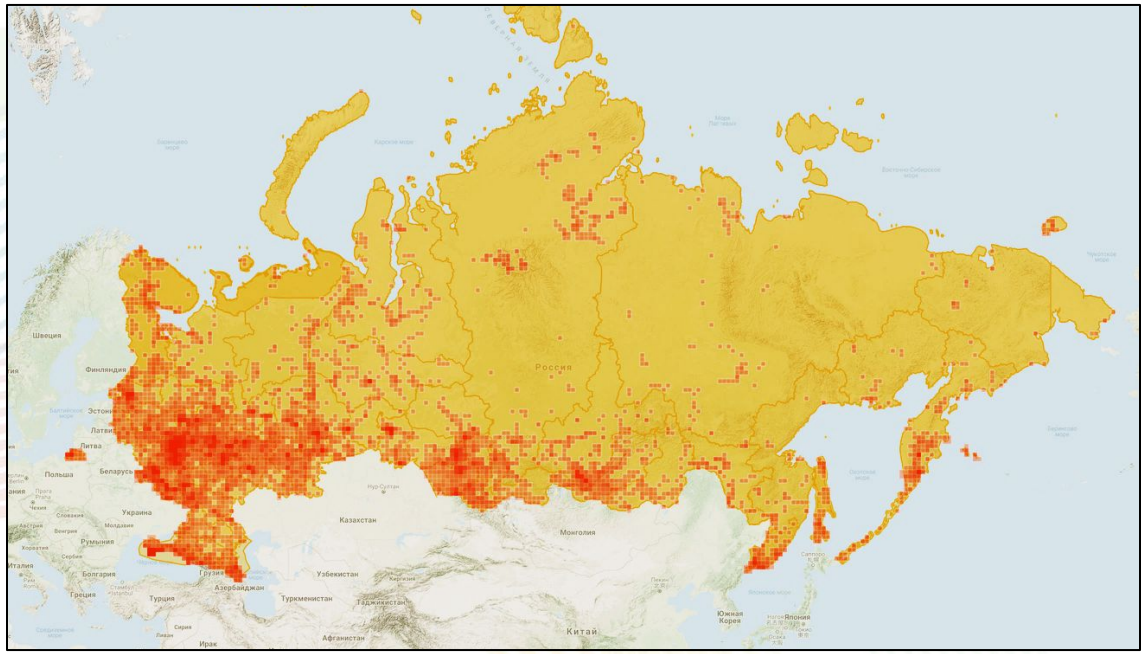
Alexander Khimin,
Pavlovsk School #2

Natalya Gamova,
Moscow State University

Sergey Lednev,
Moscow State University

Data density vs. Population density

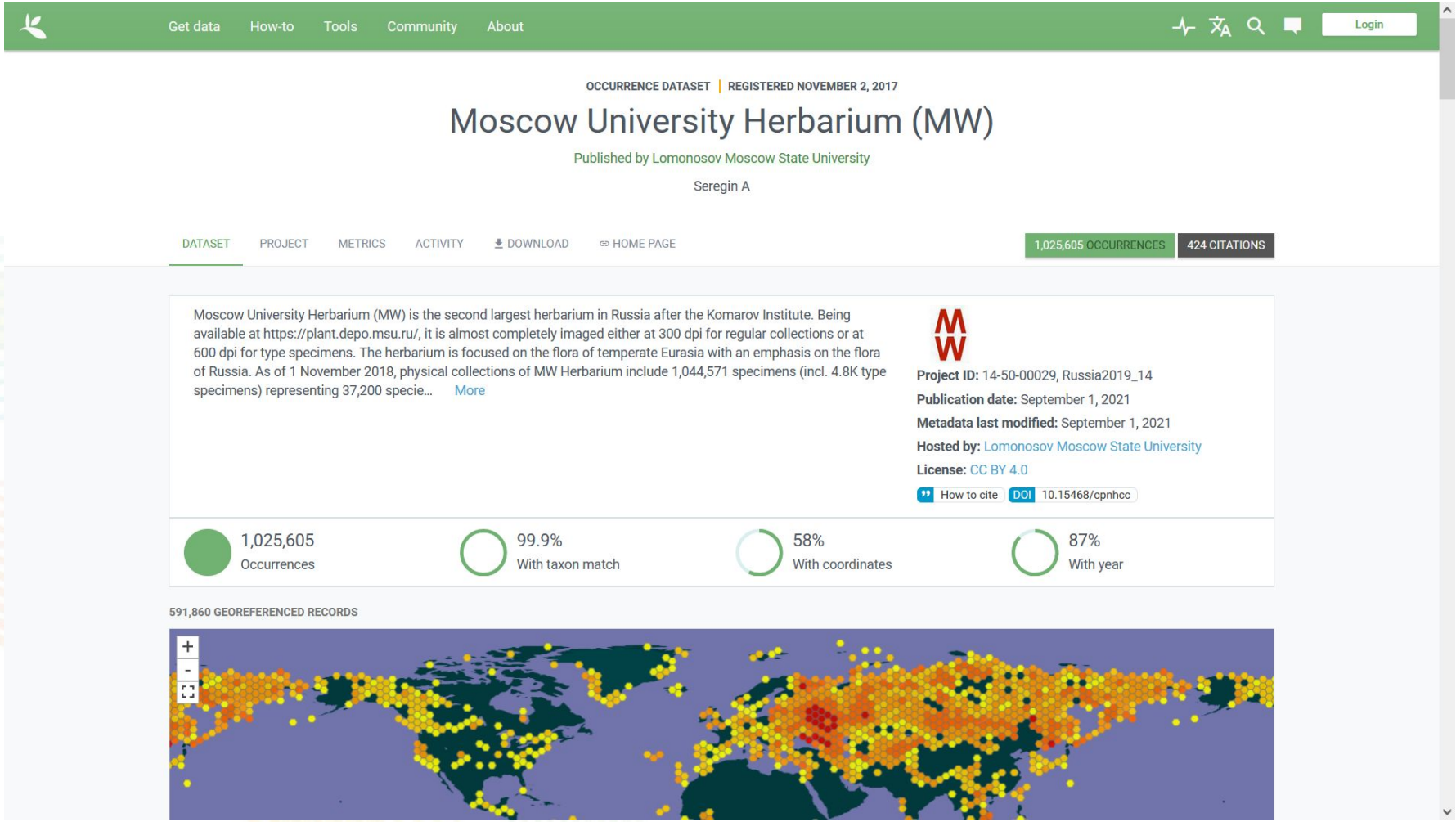
Data density on iNaturalist



Population density of Russia

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

Source #2 for the Russian flora: 0.6M



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
6. **Russia 16,175,934**
7. Japan 12,860,724
8. Sweden 12,033,000
9. Switzerland 12,027,534
10. Italy 11,596,611

Source: Thiers (2021)
http://sweetgum.nybg.org/science/wp-content/uploads/2021/01/The_Worlds_Herbaria_2020.pdf

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)
http://sweetgum.nybg.org/science/wp-content/uploads/2021/01/The_Worlds_Herbaria_2020.pdf

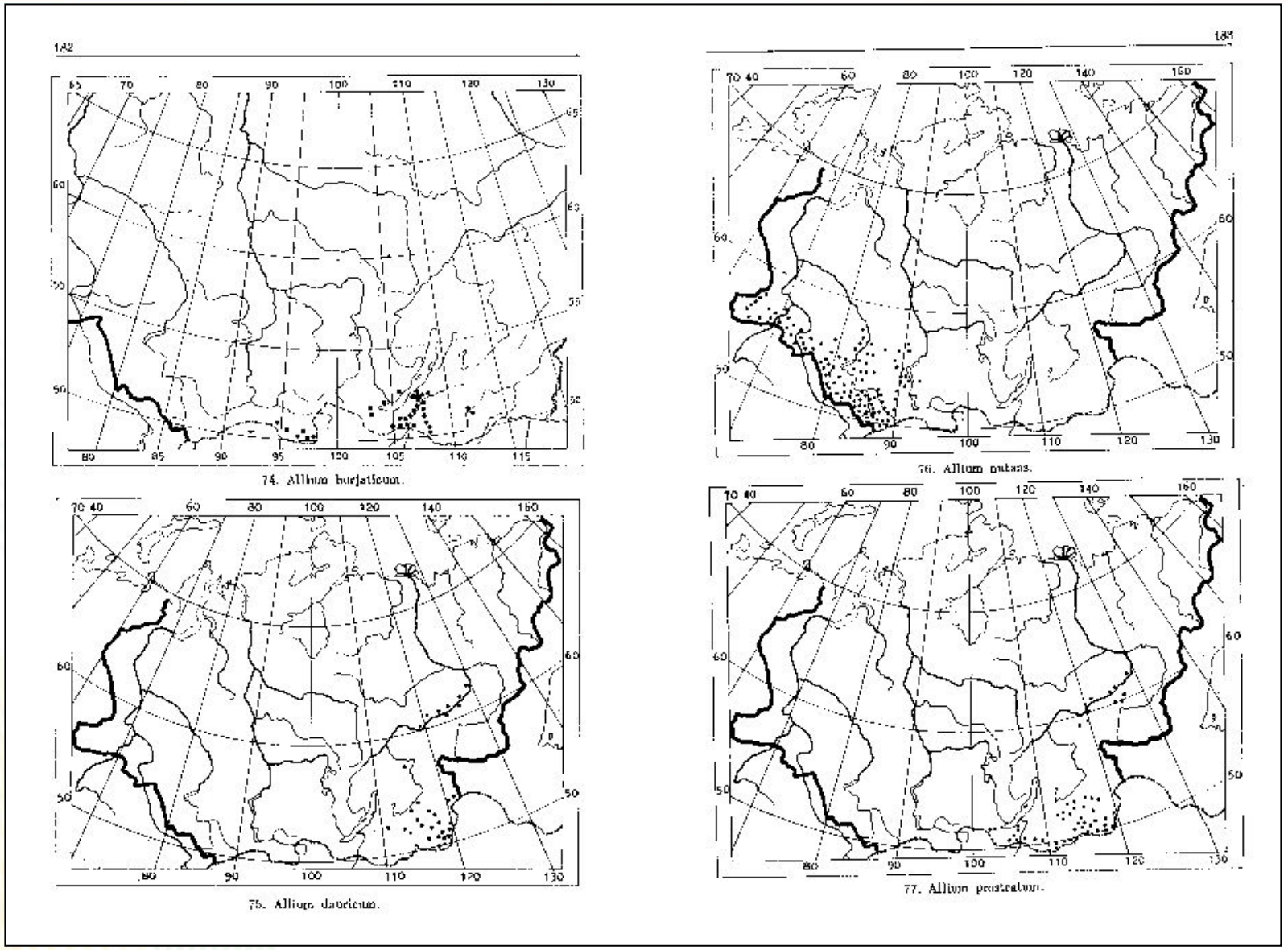
Top digital herbaria of Russia

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

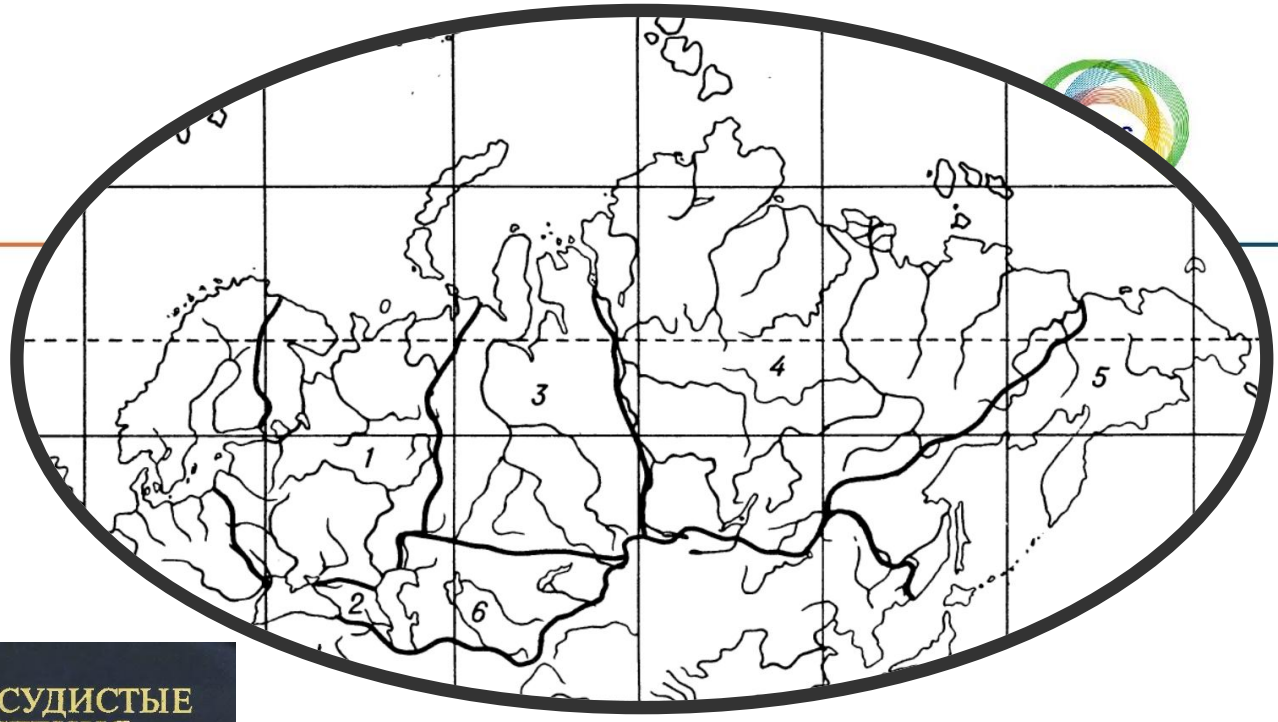
Source: Seregin (2020)
Modified 18 Jan 2021

Source #3 for the Russian flora: 0.3M

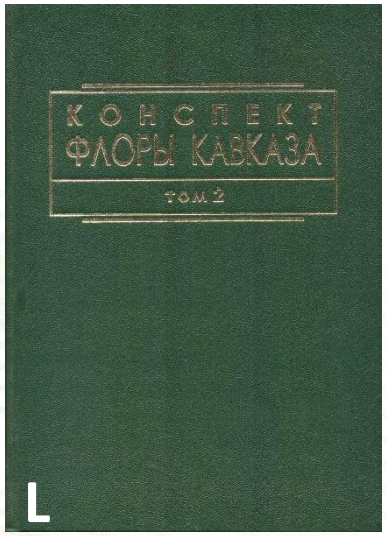
Published distribution maps



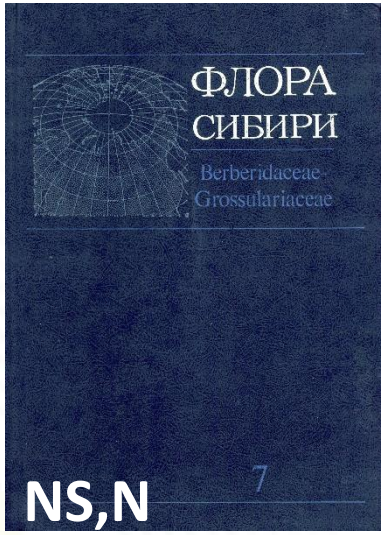
Five standard floras



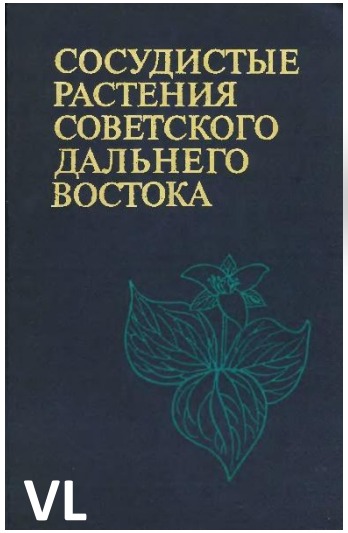
Area 1
1974-20
04



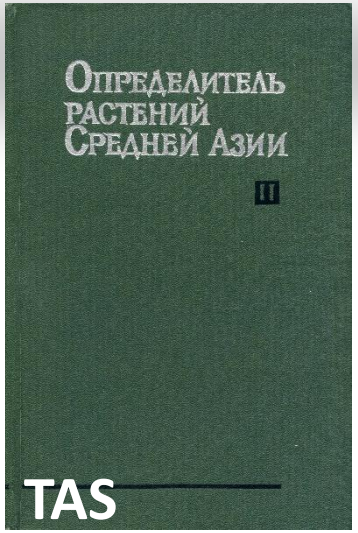
Area 2
2003-[20
21]



Areas
3,4
1988-20
03

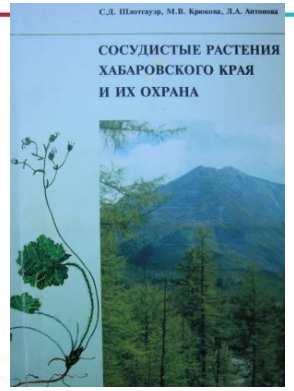


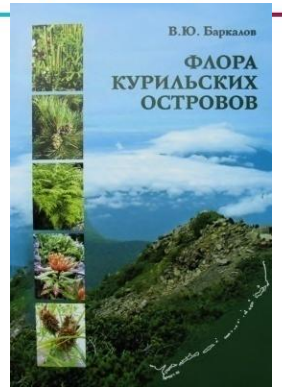
Area 5
1985-20
06

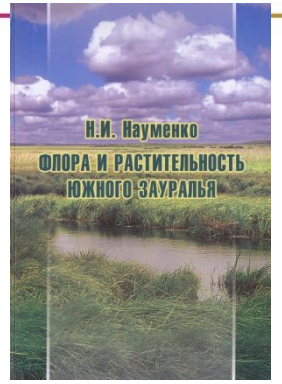


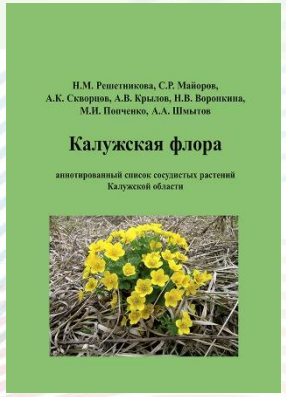
Area 6
1968-19

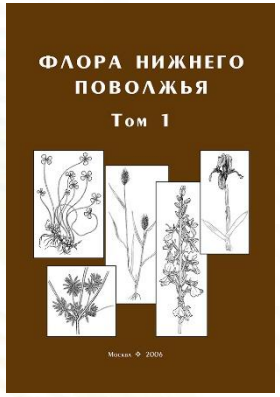
Regional floras, guides, checklists

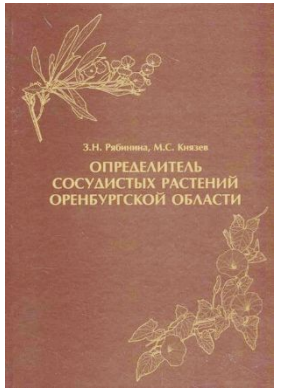


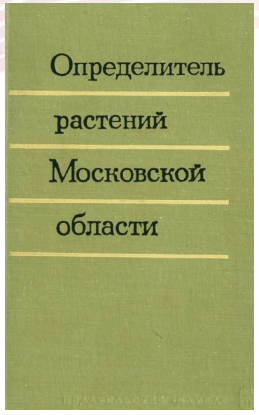


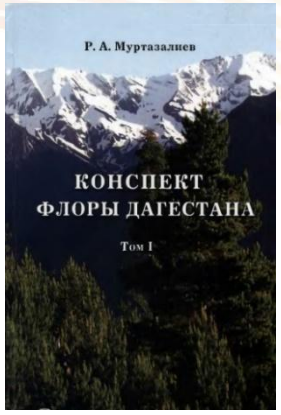


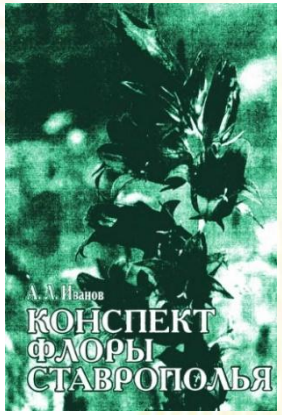


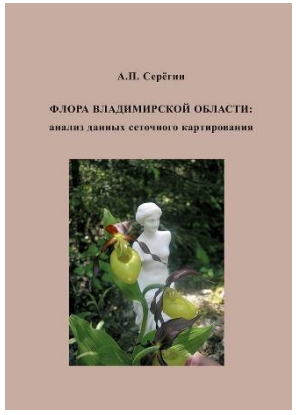


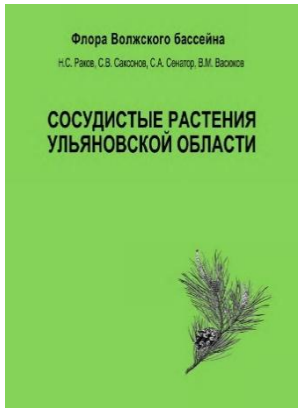




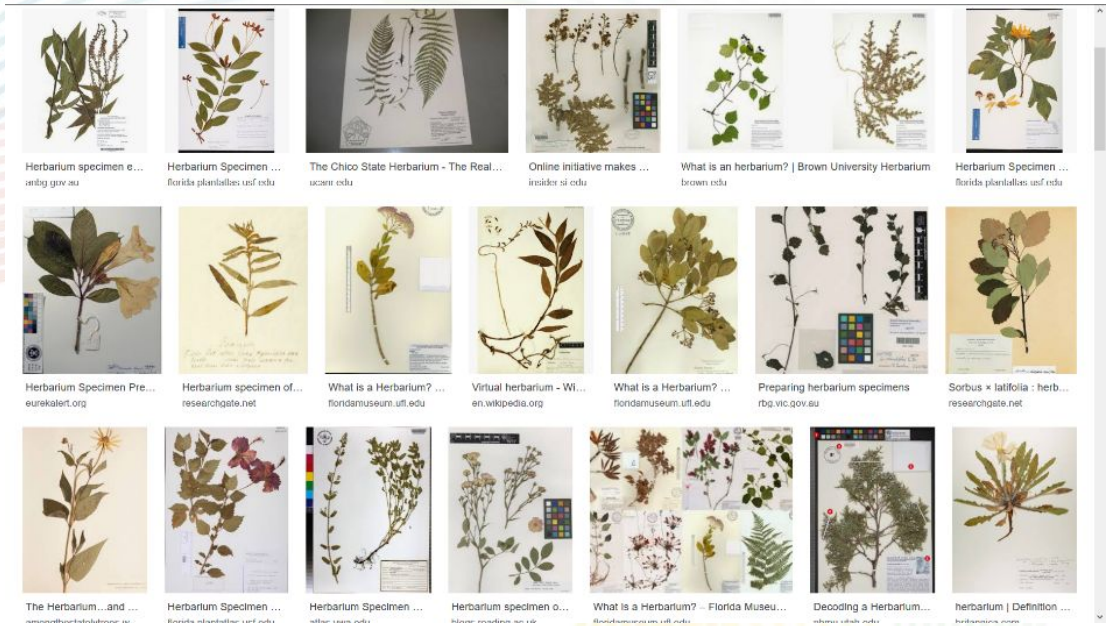


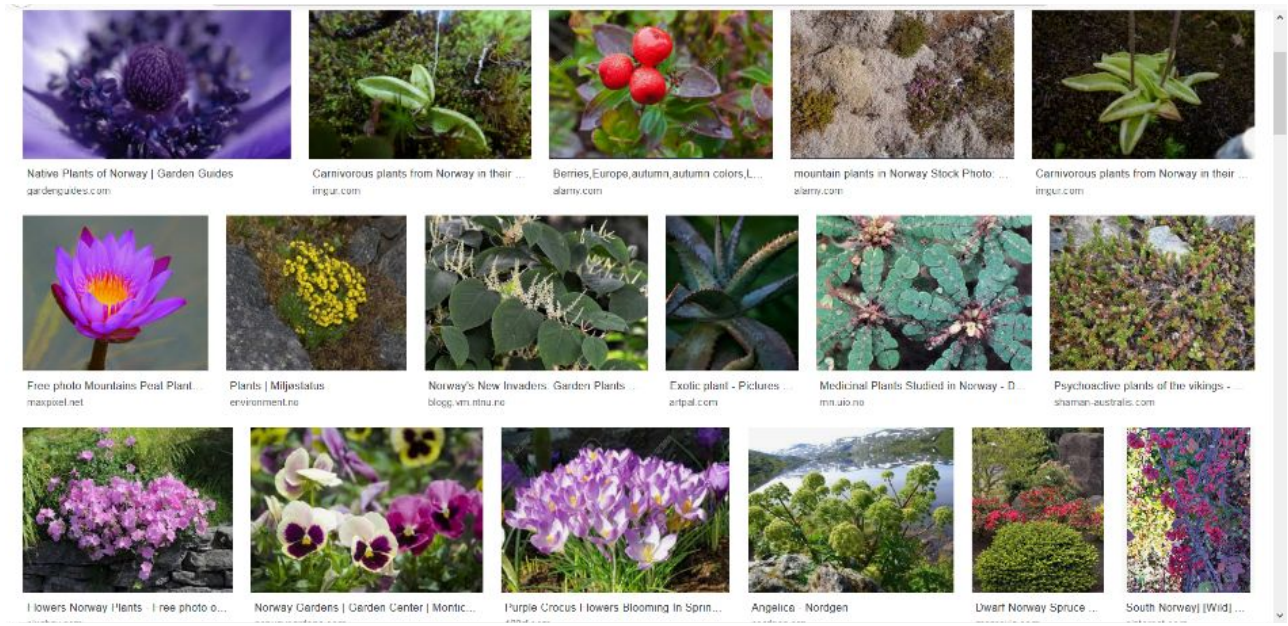




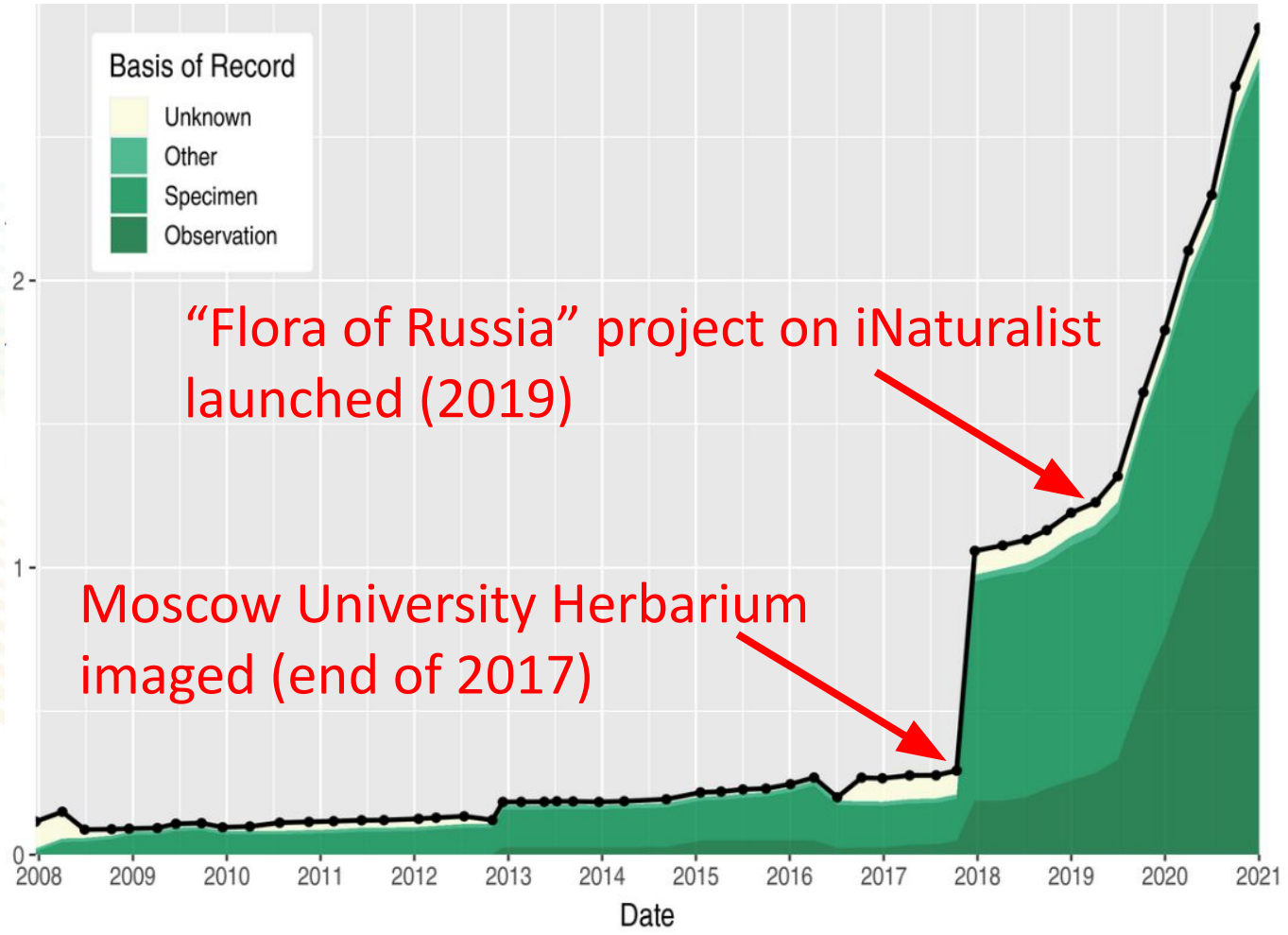


Specimens vs. Citizen Science





Data growth on Russian plants in GBIF



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Thanks

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