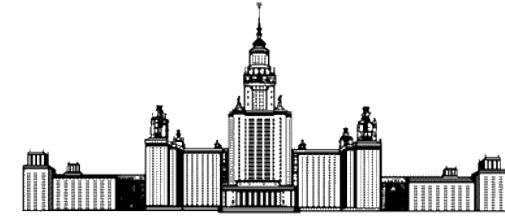




ДЕПОЗИТАРИЙ  
ЖИВЫХ СИСТЕМ  
«НОЕВ КОВЧЕГ»



# Moscow Digital Herbarium: A Global Approach Through The Regional Actions

Dr Sci Alexey P. Seregin

Lomonosov Moscow State University

# Moscow University Herbarium (MW)

- Founded ca. 1780
- The second largest herbarium in Russia
- Six staff members (science & technical)
- Part of the *National Depository Bank of Live Systems* initiative (launched by the Moscow University)
- No international loans due to custom regulations



# Specimen Total

- **1,047,009** specimens (as of Nov 2018) including:
  - 955,640 vascular plants
  - 81,369 bryophytes
  - ca. 10,000 lichens

Stats update is available once a year.



# Specimen Ranking



*Stipa* specimens from Eastern Europe

- 63<sup>rd</sup> in the world
- 24<sup>th</sup> among university herbaria
- 2<sup>nd</sup> in Russia (after Komarov Institute)

# Taxonomic Outline

- 37,857 species (excl. historic collections) including:
    - 35,634 vascular plants
    - 2,223 bryophytes

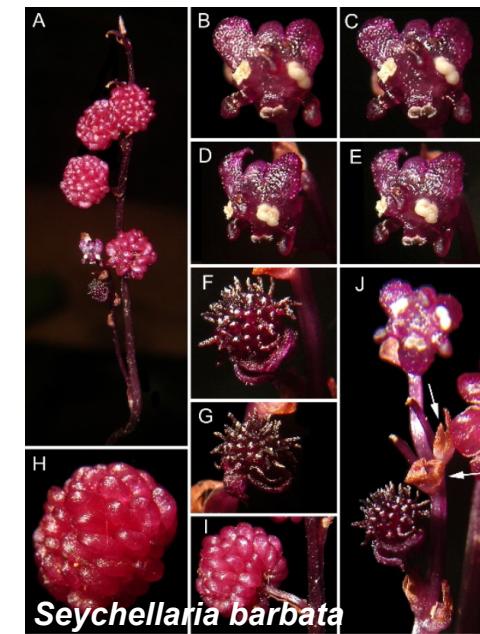
Types of ca. 3,000 taxa  
are curated separately  
(4,821 specimens).



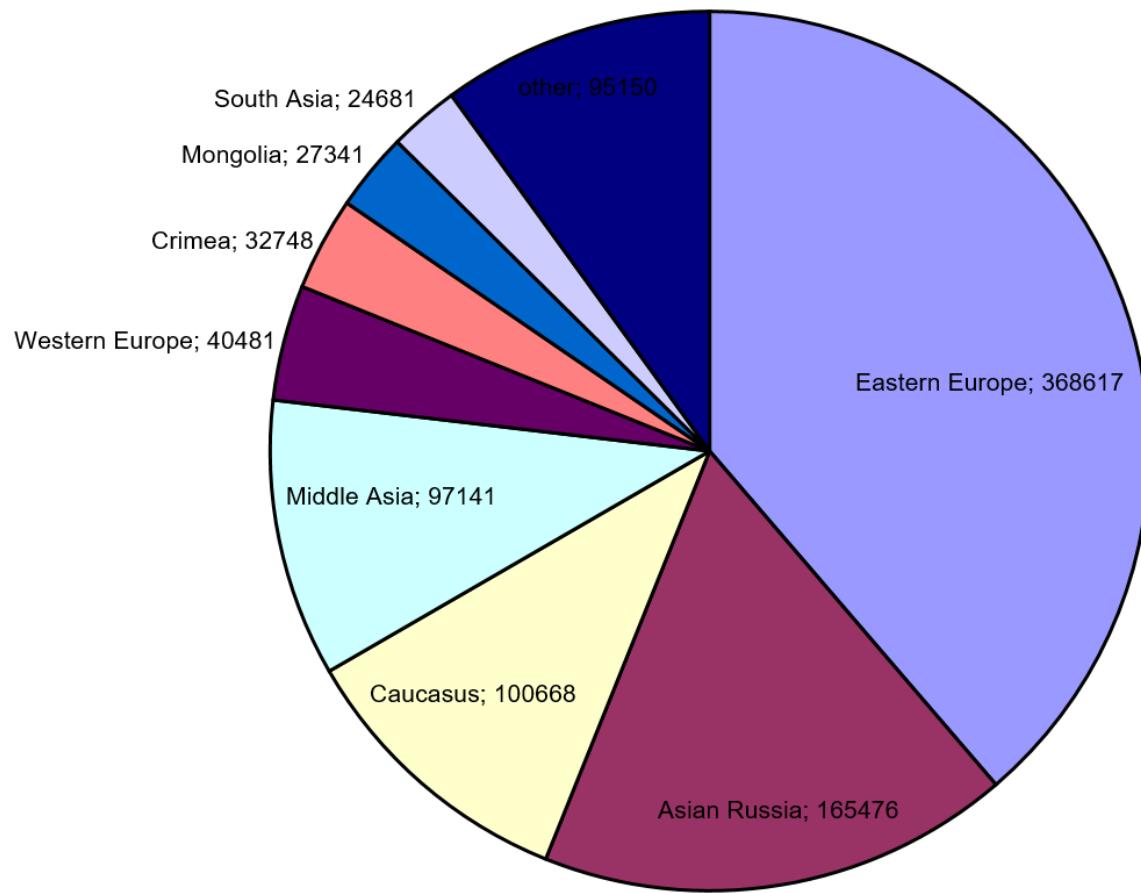
# Plant Taxonomy in the Moscow University

60 new species of vascular plants were described by the  
Moscow University staff members in 2012-2016:

- **Apiaceae**: 15 species (M. Pimenov, E. Kljuykov, D. Lyskov et al.)
- **Amaranthaceae s. l.**: 11 species (A. Sukhorukov)
- **Asparagaceae**: 10 species (N. Vislobokov et al.)
- **Amaryllidaceae s. l.**: 9 species (A. Seregin)
- **Apocynaceae**: 2 species (Y. Alexeev)
- **Cucurbitaceae**: 2 species (M. Nuraliev)
- **Polygonaceae**: 2 species (O. Yurtseva)
- **Thismiaceae**: 2 species (M. Nuraliev)
- **Molluginaceae**: 2 species (A. Sukhorukov)
- **Asteraceae, Centrolepidaceae,  
Lophiocarpaceae, Orchidaceae,  
Triuridaceae**: 1 species



# Geographical Scope: Vascular Plants



# Moscow University Project

- Moscow University have received budget for foundation of the ***National Depository Bank of Live Systems.***
- 4-year project (2015-2018).
- Five branches: 1) Plants; 2) Animals; 3) Fungi & Microbes; 4) Human Material; 5) Bioinformatics.
- Nine labs studying plants, including my lab (Moscow University Herbarium).

# Digitisation as a World Trend



Courtesy: Naturalis (L)

Leiden (Netherlands)



Courtesy: Paris Museum of Natural History (P)

Paris (France)



New York (USA)



# Equipment or Services?



or

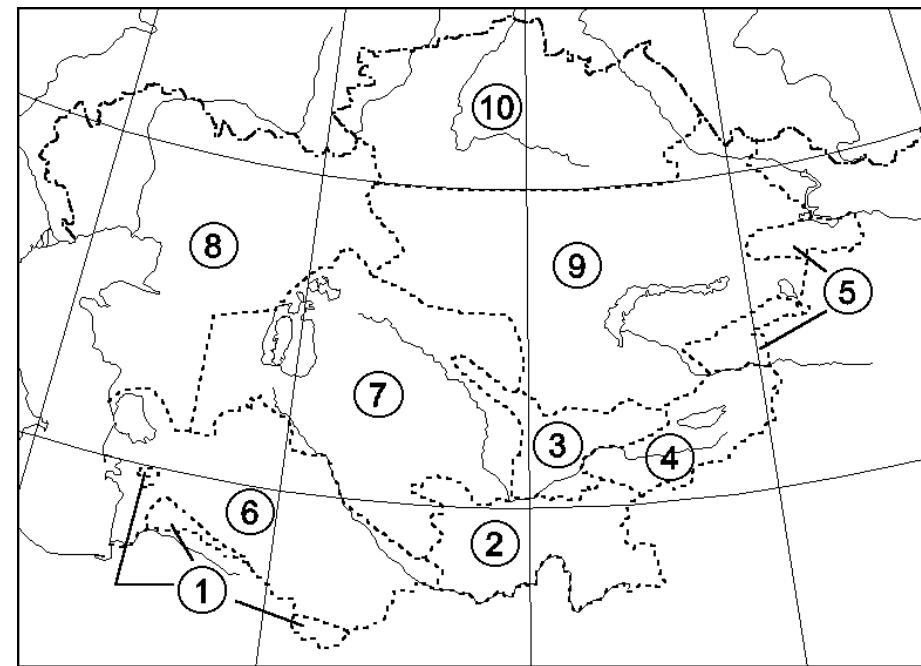
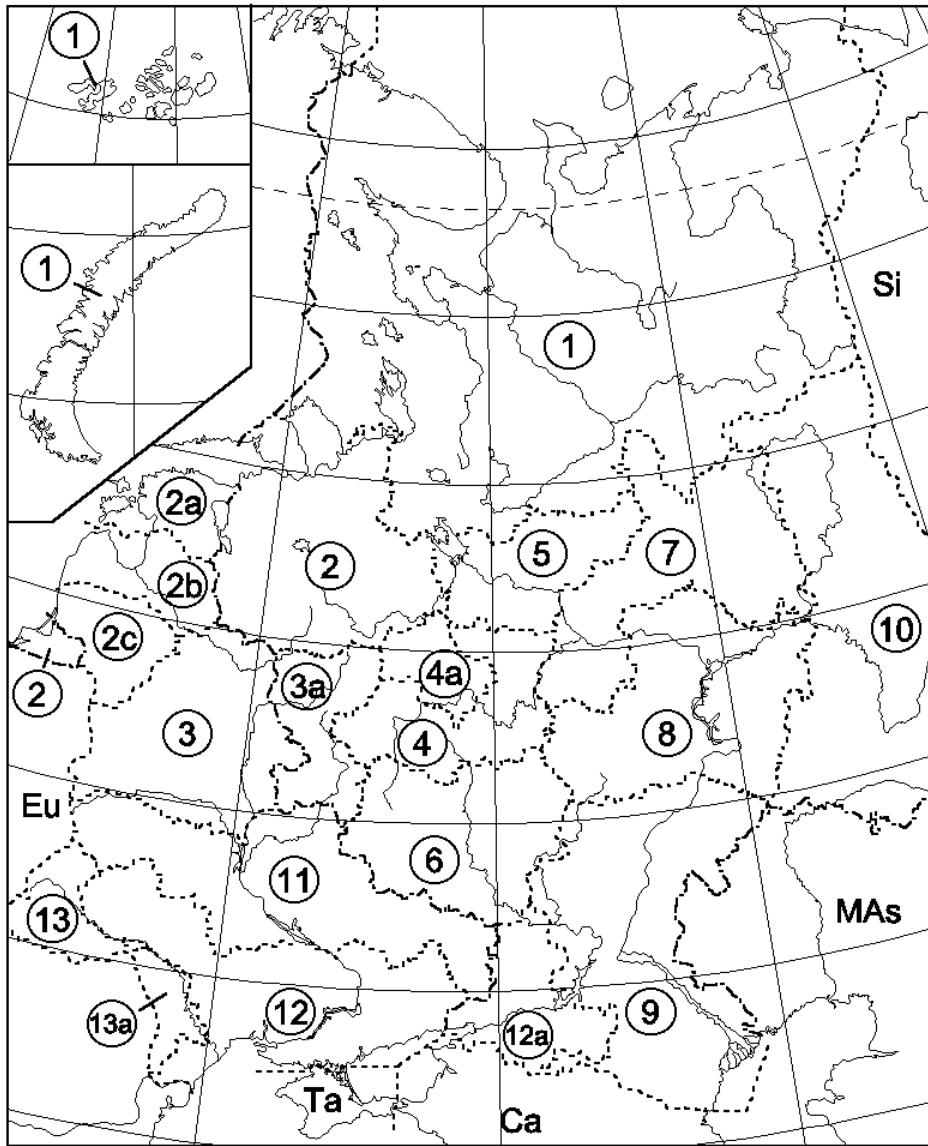


# Digitisation: Imaging as the First Step

- Only imaging at 300 dpi TIFF (JPG copy)
- Basic metadata from folders (ID, species name, area code)
- No label data
- Free full online access



# Area Codes from Folders



↑ Area codes of Middle Asia

← Area codes of Eastern Europe

# Metadata Production

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	
		Fam	Index	×	Genus	×	Species	Authors	ssp/va	Infraspecific epit	Synonym	Msp	M1	M2	M3	M4	M5	M6	M7	M8	I
26856	26903	238a	6351		Limonium		bicolor	(Bunge) Kuntze													
26857	26904	238a	6351		Limonium		bungei	(Claus) Gamajun.													
26858	26905	238a	6351		Limonium		californicum	(Boiss.) Heller													
26859	26906	238a	6351		Limonium		cancellatum	(Bernh. ex Bertol.) Kuntze													
26860	26907	238a	6351		Limonium		carnosum	(Boiss.) Kuntze													
26861	26908	238a	6351		Limonium		caspium	(Willd.) Gams													4 15
26862	26909	238a	6351		Limonium		chinensis	Girard.													
26863	26910	238a	6351		Limonium		chrysocomum	(Kar. et Kir.) Kuntze													
26864	26911	238a	6351		Limonium		congestum	(Lebed.) Kuntze													
26865	26912	238a	6351		Limonium		coralloides	(Tausch) Lincz.													
26866	26913	238a	6351		Limonium		cordatum	(L.) Mill.													
26867	26914	238a	6351		Limonium		cretaceum	Tscherkasova													3
26868	26915	238a	6351		Limonium		densiflorum	(Guss.) Kuntze													
26869	26916	238a	6351		Limonium		dichroanthum	(Rupr.) Ikonn.-Gal.											11 1	1	
26870	26917	238a	6351		Limonium		diffusum	(Pourr.) Kuntze													
26871	26918	238a	6351		Limonium		donetzicum	Klokov													
26872	26919	238a	6351		Limonium		echiooides	(L.) Mill.													
26873	26920	238a	6351		Limonium		echiooides	(L.) Mill.													
26874	26921	238a	6351		Limonium		erythrorhizum	Ikonn.-Gal. ex Lincz.													
26875	26922	238a	6351		Limonium		feralaceum	(L.) Kuntze													
26876	26923	238a	6351		Limonium		ferganense	Ikonn.-Gal.													3 4
26877	26924	238a	6351		Limonium		fischeri	(Trautv.) Lincz.													
26878	26925	238a	6351		Limonium		flexuosum	(L.) Kuntze													
26879	26926	238a	6351		Limonium		gmelinii	(Willd.) Kuntze													2 8 5 16
26880	26927	238a	6351		Limonium		grubowii	Lincz.													

Table showing presence of 11 specimens of *Limonium dichroanthum* (Rupr.) Ikonn.-Gal. from M3 geographical area (Western Tian Shan).

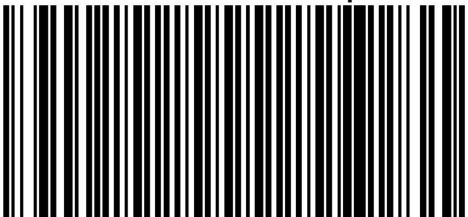
# Barcodes as an Accurate Counter

## Eastern European collections:

- 338,940 specimens before barcoding
- 352,720 specimens after barcoding
- 13,780 increase (+4.07%)



Herbarium Univ. Mosquensis



MW 0 000 001



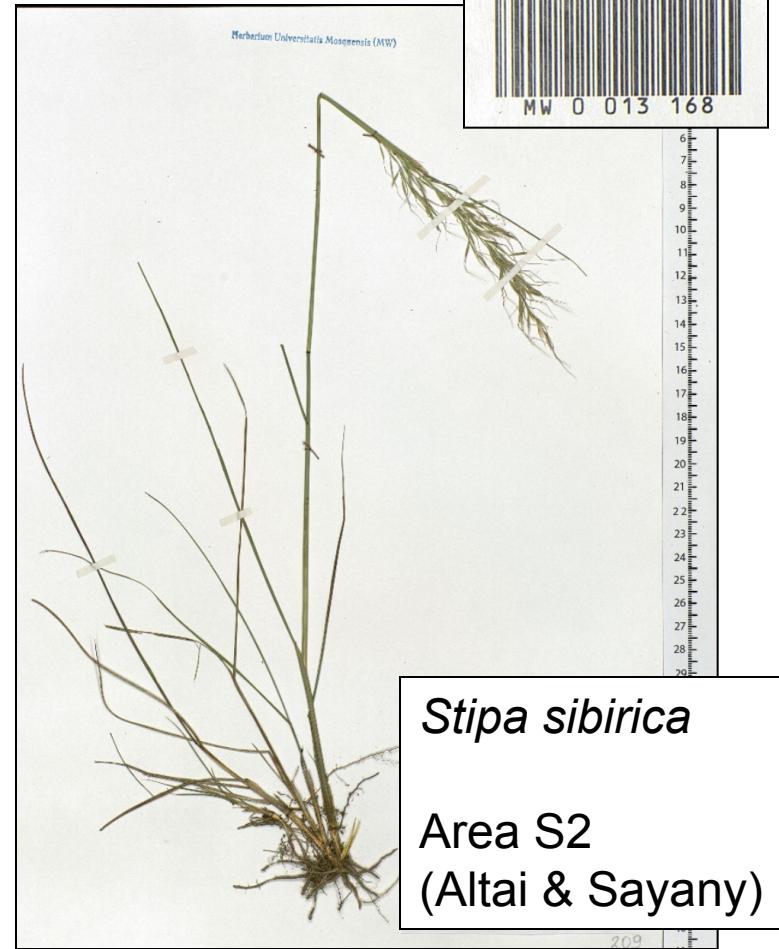
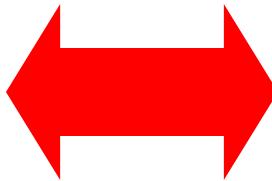
Herbarium

Universitatis

Mosquensis (MW)

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# Metadata Example



*Stipa sibirica*  
Area S2  
(Altai & Sayany)



# Digitisation: Quick Geotagging

- Country names were used as geotags
- 756K specimens were geotagged using existing country names from folders
- 200K specimens were geotagged manually in 2017-2019



# Collection Growth Due to Digitisation

- Mean annual increase in 2005-2016 was 15,100 specimens
- In 2016, we added 22,013 specimens (expeditions, old collections, gifts, exchange, etc.)



# Herbarium Specimen

A dry plant holds

- morphological
- anatomical
- genetic
- chemical

information.



A label holds

- geographical
- ecological
- historical
- material

information.

# Biodiversity Informatics



Marine Policy  
Volume 22, Issue 3, May 1998, Pages 269-280

Management of marine natural resources through by biodiversity informatics

Peter H Schalk<sup>1</sup>

Show more

[https://doi.org/10.1016/S0308-597X\(98\)00013-X](https://doi.org/10.1016/S0308-597X(98)00013-X)

Get rights and content

**Abstract**

Traditionally there has always been a barrier between scientists and policy makers. They live in different worlds so to speak. However, a close collaboration between the two will be needed if we want to tackle the problem of a responsible use of the Earth's natural resources. Also, a truly global collaboration will be needed and a polling of all information sources, including developed and developing countries. The ongoing large scale introduction of information technology in biodiversity studies will allow researchers to combine all kinds of different datasets and information systems. This will also create new tools allowing interpretation and extrapolation for various use, both for science and for policy-making. The Internet will provide the means to combine all knowledge into one electronic information facility that can be accessed by all parties involved. Electronic scientific information systems offer new avenues for

## Marine Policy (1998)

A discipline on the crossing of

- biology
- geography
- computer science

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

Science (2000)



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Гербарий имени Д.П. Сирецикова

# Online Access Started in 2017

- <http://plant.depo.msu.ru/> (public access)
- Russian and English versions
- 786K specimens at 300 dpi (JPG)
- Automatic linking of the collection names with *Catalogue of Life* taxonomy
- No label data at that moment
- No geographical coordinates

# <https://plant.depo.msu.ru/>



ДЕПОЗИТАРИЙ  
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Microorganisms and fungi

Plants

Animals

Human biodata

Bio. information

...

RU

EN



Login

[About](#) [Collections](#) [Contacts](#) [Links](#) [Infrastructure](#) [Cite As](#)

Database contains (herbarium specimens, DNA samples, pictures of living plants):

Specimens: [1011930](#) Images: [993586](#) Species: [37872](#) Georeferenced: [420749](#) Labels + OCR: [314257](#) + [628133](#)

Search

All fields



Suprageneric taxa



Genus / Species



[Advanced search](#)

[Label & OCR search](#)

[Taxonomic browser](#)

Collection

Acronym



Keyword

## National Depository Bank of Live Systems

### Moscow Digital Herbarium

The project of the Moscow State University "Noah's Ark" is dedicated to the creation of multi-functional network depository of biological material.

It is planned to work with all possible biomaterials from single biological molecules to separate living organisms.

The main purpose of depository bank creation is to preserve the biodiversity of our planet and create new ways of biomaterials usage.

### Distribution Atlas of the Russian Flora

Do you want to join the team of "Distribution Atlas of the Russian Flora"? Upload your photos of plants in wild with exact location on [iNaturalist](#), to contribute our new project "Флора России | Flora of Russia".

### Image of the day



### Species of the week



Home page



# Moscow Digital Herbarium Screenshots

The image displays three side-by-side screenshots of a web application for managing plant collections. The interface is in Russian and features a header with tabs for 'Файл', 'Правка', 'Вид', 'Журнал', 'Задачки', 'Инструменты', and 'Справка'. Each screenshot shows a different step in the process of adding or viewing a collection record for the species *Euphorbia semivillosa*.

- Screenshot 1:** Shows the initial collection entry page. It includes a large image of the plant, its scientific name (*Euphorbia semivillosa*), and a detailed form for entering metadata such as collection date (09.03.2017), location (Centralny district, East Europe), and author (Sergei A. П.).
- Screenshot 2:** Shows the 'Photo in nature' tab, displaying five photographs of the plant in its natural habitat.
- Screenshot 3:** Shows the final step of the workflow, where the collection is ready for publication. It includes a summary of the collection details and a button to 'Publish' the collection.

<https://plant.depo.msu.ru/open/>

The screenshot shows a web browser window with multiple tabs open. The active tab displays search results for the genus *Allium* on the Depository of Live Systems (Depo.msu.ru). The results are presented in a grid format, each row containing two or three items. Each item includes a thumbnail image of a herbarium specimen, a barcode number, the accepted name, the name as accepted in the collection, the accepted name, the geography, and the name in Latin. The interface includes a search bar at the top, a navigation menu, and a footer with various icons and links.

Файл Правка Вид Журнал Закладки Инструменты Справка

Depository of Live Systems | Depository: Search | Соединение... | capital letters in titles - Поиск | мгу новые виды растений -

https://plant.depo.msu.ru/publ/open/search?searchBy=any&queryString=Allium

80% | Поиск | Депозитарий живых систем | Division All divisions | Collections | RU | EN

All divisions / Collections / Search

Search: [genus species geography synonyms] |

Barcode MW0045398 Name accepted in collection *Allium splendens* Accepted name *Allium splendens* Willd. ex Schult. & Schult.f. Geography Сибирь, Altai & Sayany Mountains (Russia)

Barcode MW0045391 Name accepted in collection *Allium angulosum* Accepted name *Allium angulosum* L. Geography Сибирь, Altai & Sayany Mountains (Russia)

Barcode MW0045392 Name accepted in collection *Allium senescens* Accepted name *Allium senescens* L. Geography Сибирь, Russian Far East (Russia)

Barcode MW0045393 Name accepted in collection *Allium amphibolum* Accepted name *Allium amphibolum* Ledeb. Geography Сибирь, Altai & Sayany Mountains (Russia)

Barcode MW0045394 Name accepted in collection *Allium strictum* Accepted name *Allium strictum* Schrad. Geography Сибирь, Altai & Sayany Mountains (Russia)

Barcode MW0045395 Name accepted in collection *Allium tytthocephalum* Accepted name *Allium tytthocephalum* Schult. & Schult.f. Geography Сибирь, Altai & Sayany Mountains (Russia)

Barcode MW0045399 Name accepted in collection

Barcode MW0045396 Name accepted in collection

Barcode MW0045397 Name accepted in collection

Ожидание ответа от plant.depo.msu.ru...

9:02 | ENG | СМ | 0 1 2 3 4 5 6 7 8 9 10 | Гербарий имени Д.П. Сирецкого | Herbarium Universitatis Moscuensis (MW)

Alternative results page used for Google indexing

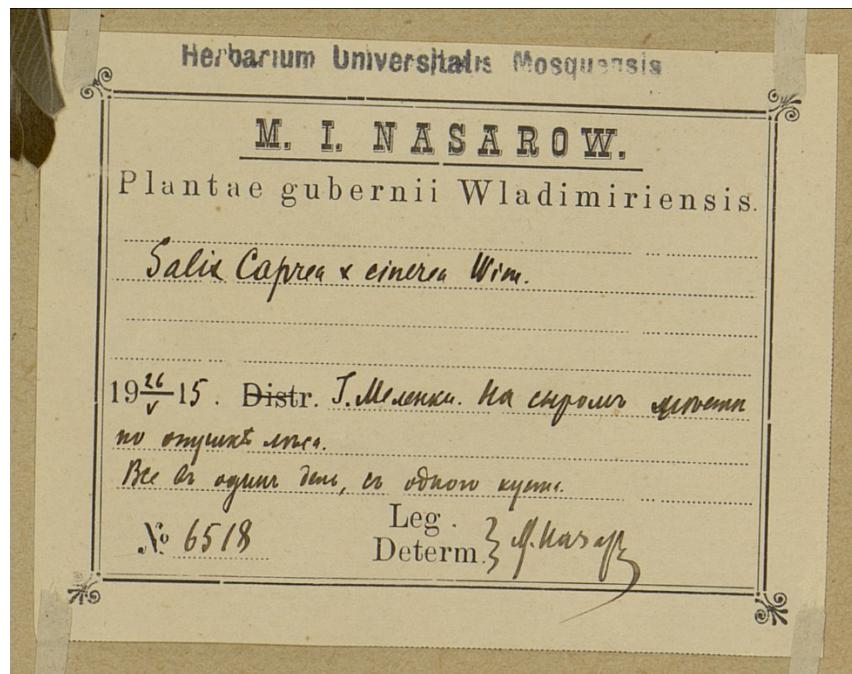
<https://plant.depo.msu.ru/open/>

The screenshot shows a web browser window with several tabs open. The main content is a herbarium specimen record for *Allium altaicum*. The specimen consists of two sets of dried plant parts: one set with long, narrow leaves and a small, dense flower cluster, and another set with shorter, broader leaves and a larger, more prominent flower cluster. A ruler scale is visible next to the specimen. To the right, detailed information is provided, including the barcode (MW0045374), name accepted in collection (*Allium altaicum*), accepted name (*Allium altaicum* Pall.), family (Amaryllidaceae), and geography (Siberia, Altai & Sayan Mountains (Russia)). A link to a full card is also present. The browser interface includes a search bar, navigation buttons, and a status bar at the bottom.

# Digitisation: Label Capturing as the Second Step

- 5,000 labels were databased by September 2017
- 796,508 partly captured labels by 3.09.2019 (collector & date)
- 314,257 fully captured labels by 3.09.2019
- Original label language (no translation)
- 50% of labels captured by the commercial partner

# Why We Really Need Label Capturing?



- M.I. NASAROW. Plantae gubernii Vladimiriensis.  
*Salix caprea × cinerea* Wim.  
Г. Меленки. На сыром месте по опушке леса.  
26.05.1915. Собр. М. Назаров, № 6518  
Все в один день, с одного куста.
- AUTOMATIC TRANSLATION: M.I. NASAROW. Plantae gubernii Vladimiriensis.  
*Salix caprea × cinerea* Wim. Melenki.  
In a damp place along the edge of the forest. 26.05.1915. Coll. M. Nazarov,  
No. 6518 All in one day, from one bush.

# Digitisation: Georeferencing as the Third Step

- 5,000 labels were georeferenced by September 2017
- 420,749 georeferences by 3.09.2019:
  - 216,952 precise manual georefs
  - 203,797 automatic georefs based on collector/date matches
- N, E coordinates (+ uncertainty)
- 100% of georefs made by the herbarium team

# Global Biodiversity Information Facility (GBIF)

Screenshot of the GBIF.org homepage:

The page features a large banner image of an Indian rhinoceros in water. Below the banner, key statistics are displayed:

- Occurrence records: 1 338 334 210
- Datasets: 46 162
- Publishing institutions: 1 450
- Peer-reviewed papers using data: 3 859

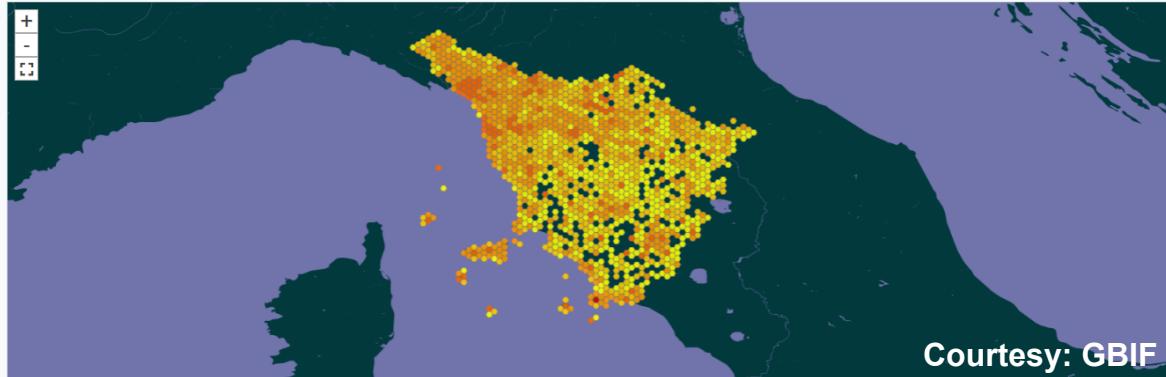
The main content area is organized into four columns of news cards:

Category	Image	Text
News		Five projects receive funding from 2019 Capacity Enhancement Support Programme 14 August 2019
Data use		GBIF-mediated occurrences of flying foxes predict Nipah virus transmission risk 22 August 2019
News		Belarus extends GBIF's European membership map eastward 16 July 2019
News		Programme seeks Biodiversity Open Data Ambassadors to expand best practices 10 July 2019
Data		New dataset: holdings of the National Herbarium of Poland
Taxonomy		<i>Calypotroete falkorae</i> sp. nov. Elongatulida from the Death Canyon, Eastern
Data use		Science Review 2019 Showcasing data on the latest research
Guidance		Establishing a national biodiversity information facility in Chile

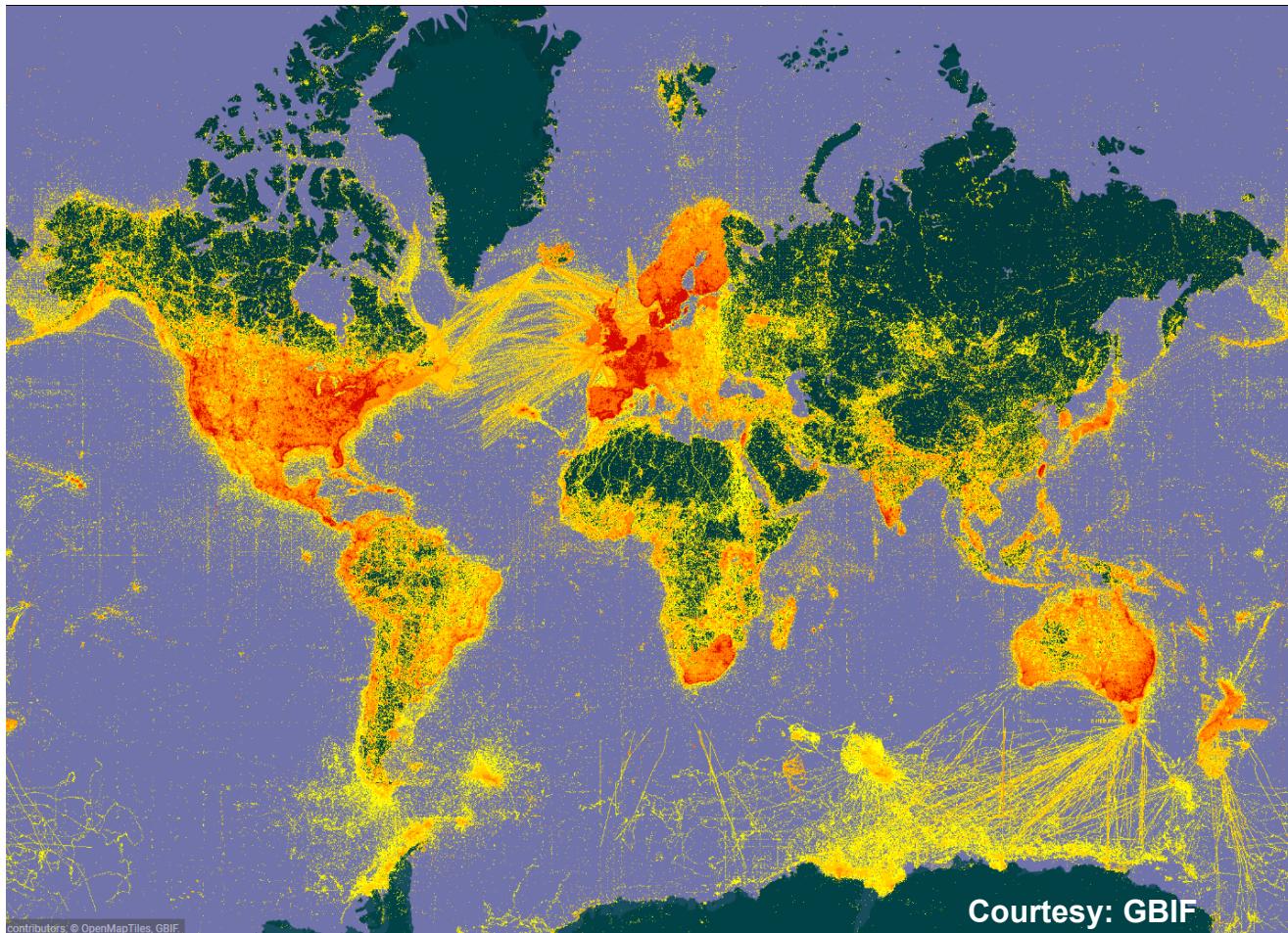
Courtesy: GBIF

# The Largest Italian Dataset in GBIF

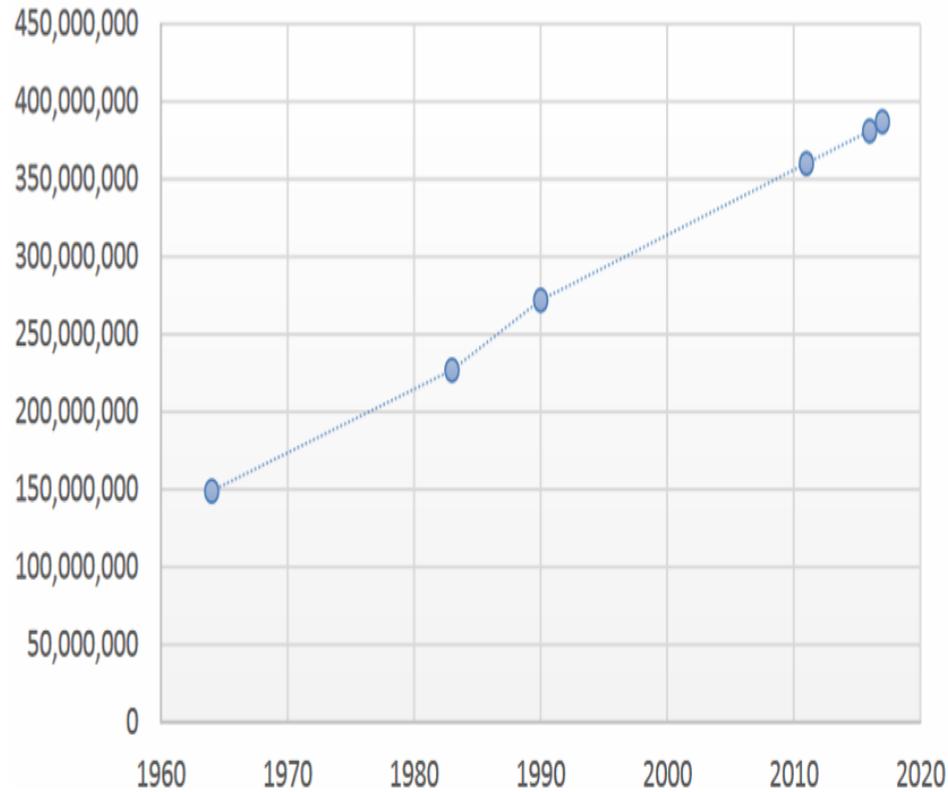
Get data Share Tools Inside GBIF OCCURRENCE DATASET | REGISTERED OCTOBER 11, 2017 Wikiplantbase #Toscana Published by Dipartimento di Biologia, Università di Pisa ☰ Lorenzo Peruzzi DATASET METRICS ACTIVITY DOWNLOAD 181,928 OCCURRENCES 36 CITATIONS The databases stores historical and current plant occurrence records relative to Tuscany administrative region of Italy (NUTS-2 code ITE1). Source of records may be bibliographical references, herbarium specimens, or human observations. The database is associated with the Wikiplantbase project, including sister databases for Sardinia, Liguria and Sicily Metadata last modified: August 28, 2019 Data last changed: June 28, 2019 Hosted by: Dipartimento di Biologia, Università di Pisa License: CC BY-NC 4.0 How to cite DOI 10.15468/kw8izq 181,928 Occurrences 99.9% With taxon match 100% With coordinates 98% With year 181,928 GEOFERENCED RECORDS Courtesy: GBIF



# Russia on GBIF Data Map



# World Herbaria Holdings



- 387 500 000 specimens are preserved in world herbaria (Thiers, 2019)
- 75 098 731 specimen records are indexed in GBIF, or **19,4%**
- 34 826 192 specimen records have coordinates in GBIF, or **9,0%**

# World Herbaria in GBIF: 75,098,731 Specimens

• The vascular plants collection (P) at the Herbarium of the Moscow University	5,426,095
• MEL AVH data	5,071,904
• Naturalis Biodiversity Center (NL) - Botany	4,824,298
• Tropicos Specimen Data	4,668,829
• The New York Botanical Garden Herbarium (NY)	3,266,213
• NMNH Extant Specimen Records	2,952,134
• Meise Botanic Garden Herbarium (BR)	1,424,986
• PRECIS	1,117,942
• Harvard University Herbaria: All Records	1,060,214
• Phanerogamic Botanical Collections (S)	1,018,284
• <b>Moscow University Herbarium (MW)</b>	<b>1,001,832</b>
• EURISCO, The European Genetic Resources Search Catalogue	956,422
• Royal Botanic Gardens, Kew - Herbarium Specimens	921,988
• Lund Botanical Museum (LD)	911,304
• Royal Botanic Garden Edinburgh Herbarium (E)	866,672

# Some Essential Additions

The screenshot shows the Specimen Search Portal interface. On the left, there's a search engine with fields for Latin name or English name, common name, family, collector, collect number, plant type, and status. Below these are filters for 'All' and 'Has Image' (with 'No Image' as an option). A green 'Start Query' button is at the bottom. To the right, a 'Specimen Query Results Statistics' section displays a bar chart titled 'Reserve Institutions'. The chart shows the count of specimens for various institutions, with 'Others' having the highest count (1742714). Other institutions listed include Herbarium, Nanjing University; Chinese Academy of Sciences, Institute of Chinese Medicine; Jiangxi Province, The Chinese Academy of Sciences; Wuhan Botanical Garden, Chinese Academy of Sciences; Institute of Applied Ecology, Chinese Academy of Sciences; Chengdu Institute of Biology, Chinese Academy of Sciences; Museum of Sichuan University Herbarium; Guangxi Institute of Botany; Northwest A&F University; South China Botanical Garden, Chinese Academy of Sciences; Kunming Institute of Botany, Chinese Academy of Sciences; and Institute of Botany, The Chinese Academy of Sciences.

7,7M records (China)

At least 10M specimen records are not currently available in GBIF making the world's total ca. 85,000,000 databased specimens, or **22%**

The screenshot shows the Consortium of California Herbaria dataset page on GBIF.org. At the top, it says 'METADATA DATASET | REGISTERED JANUARY 10, 2014' and 'Consortium of California Herbaria'. Below that, it says 'Published by Consortium of California Herbaria' and lists contributors: Jason Alexander, Joyce Gross, Staci Markos, Nancy Morin, and Brent Mishler. It also notes that the dataset was deleted on May 16, 2019. The page includes tabs for 'DATASET', 'DOWNLOAD', and 'HOME PAGE'. There are 116 citations. The main content area describes the Consortium of California Herbaria, mentioning its founding in 2003 and its growth to 35 California herbaria. It also provides metadata last modified, data last changed, host information (Berkeley Natural History Museums), license (CC BY-NC 4.0), and citation details (How to cite: DOI 10.15468/15cqdk).

2,3M records (California)



# Records from Russia in GBIF: a Big Bang in November, 2017

PUBLISHING TRENDS

## Number of occurrence records

These charts illustrate the change in availability of the species occurrence records over time.

**Records by kingdom**

The number of available records categorized by kingdom. "Unknown" includes records with taxonomic information that cannot be linked to available taxonomic checklists.

**Records for Animalia**

The number of animal records categorized by the basis of record. "Unknown" includes records without defined basis of record or with an unrecognised value for basis of record.

**Courtesy: GBIF**

**Records for Plantae**

The number of plant records categorized by the basis of record. "Unknown" includes records without defined basis of record or with an unrecognised value for basis of record.

# MW Dataset in GBIF: 1,002,033 Records

Get data Share Tools Inside GBIF OCCURRENCE DATASET | REGISTERED NOVEMBER 2, 2017 Moscow University Herbarium (MW) Published by Lomonosov Moscow State University ☰ Alexey Seregin DATASET PROJECT METRICS ACTIVITY DOWNLOAD HOME PAGE 1,002,033 OCCURRENCES 72 CITATIONS

Moscow University Herbarium (MW) is the second largest herbarium in Russia after the Komarov Institute. It is almost completely imaged at 300 dpi and available at <https://plant.depo.msu.ru/>. The herbarium is focused on the flora of temperate Eurasia with an emphasis on the flora of Russia. As of 1 August 2018, physical collections of MW Herbarium include 1,030,669 specimens (incl. 4.8K type specimens) representing 37,200 species and subspecies of vascular plants and 2,223 species and subspecies ... [More](#)

Project ID: 14-50-00029  
Metadata last modified: August 20, 2019  
Data last changed: August 6, 2019  
Hosted by: Lomonosov Moscow State University  
License: CC BY 4.0  
[How to cite](#) [DOI](#) 10.15468/cpnhcc

1,002,033 Occurrences 99.9% With taxon match 41% With coordinates 79% With year

412,062 GEOFERENCED RECORDS

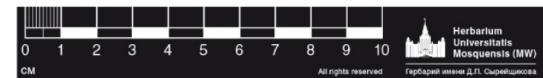
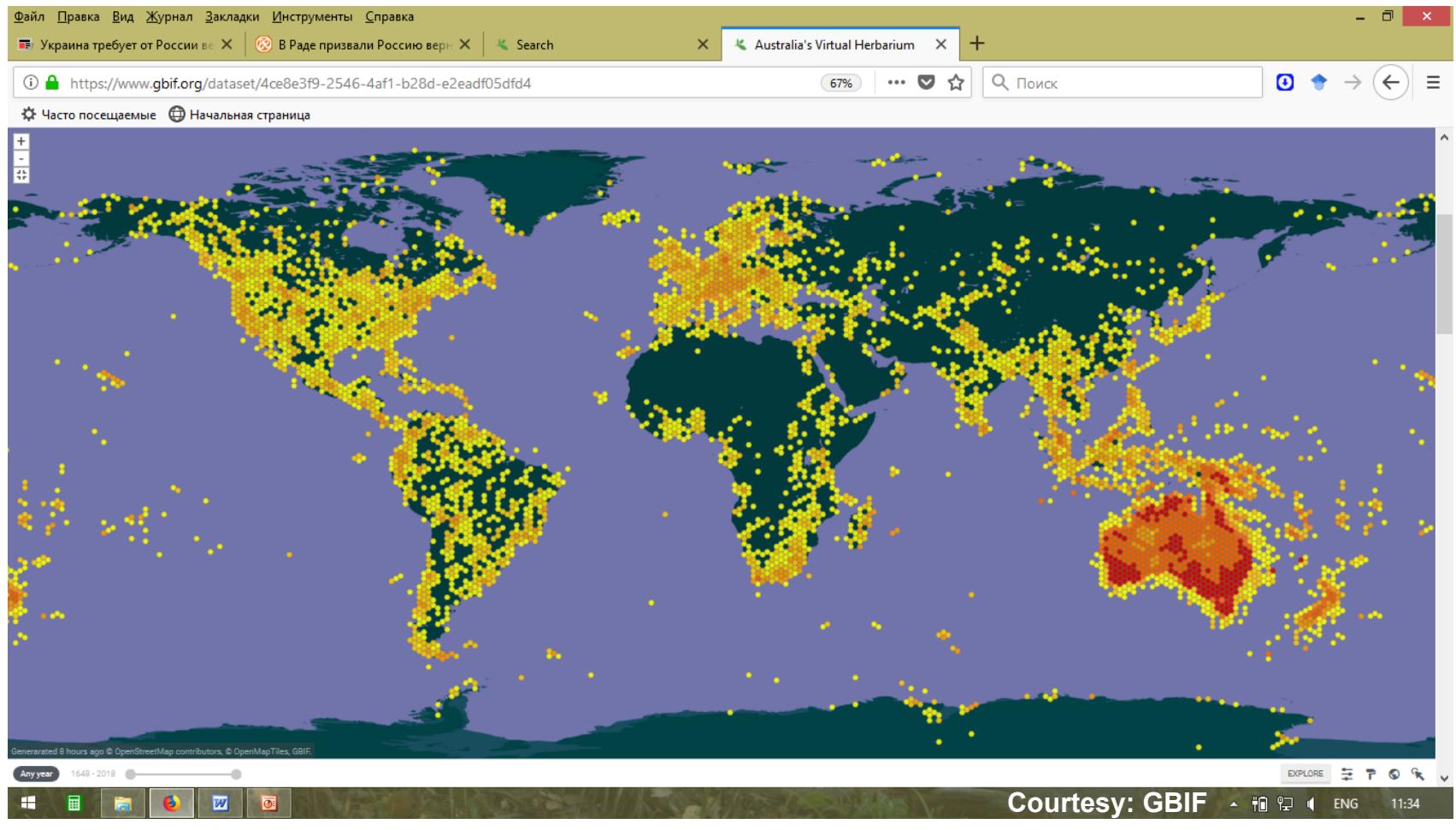
Courtesy: GBIF



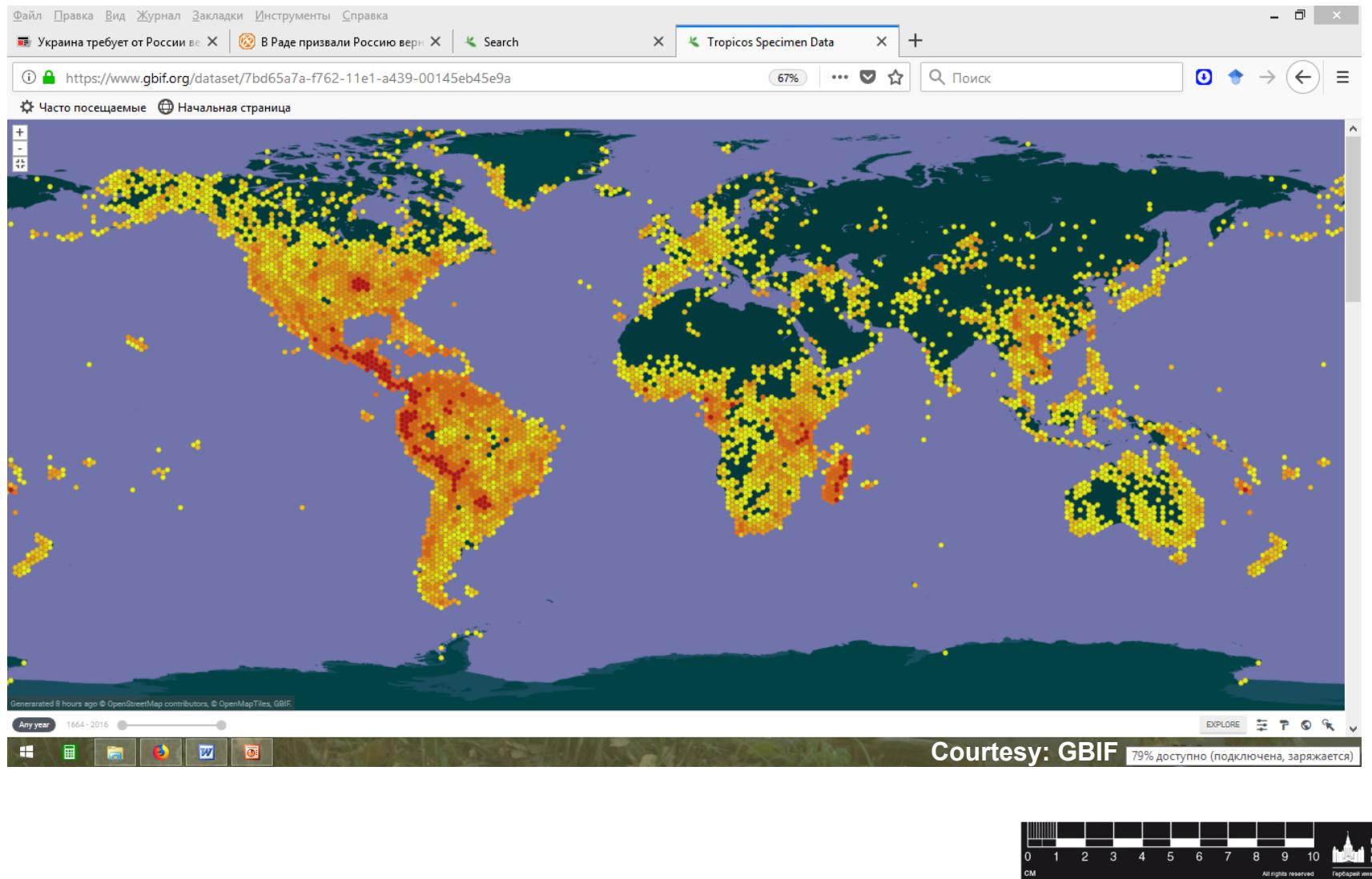
# World Herbaria in GBIF: 34,826,192 Georeferences

• MEL AVH data	4,667,925
• Tropicos Specimen Data	3,125,919
• Naturalis Biodiversity Center (NL) - Botany	1,488,255
• The New York Botanical Garden Herbarium (NY)	1,021,598
• PRECIS	903,698
• Lund Botanical Museum (LD)	871,034
• Vascular Plant Herbarium, Oslo (O)	584,762
• Field Museum of Natural History (Botany) Seed Pla...	554,080
• NMNH Extant Specimen Records	512,474
• BRI AVH data	500,208
• <b>Moscow University Herbarium (MW)</b>	<b>412,188</b>
• Finnish Floristic Database (Finnish Museum of Natu...	397,381
• Plantae of Costa Rica (INBio)	351,417
• Natural History Museum (London) Collection Specime...	332,557
• OEH Atlas of NSW Wildlife	328,787

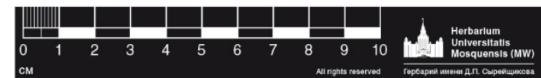
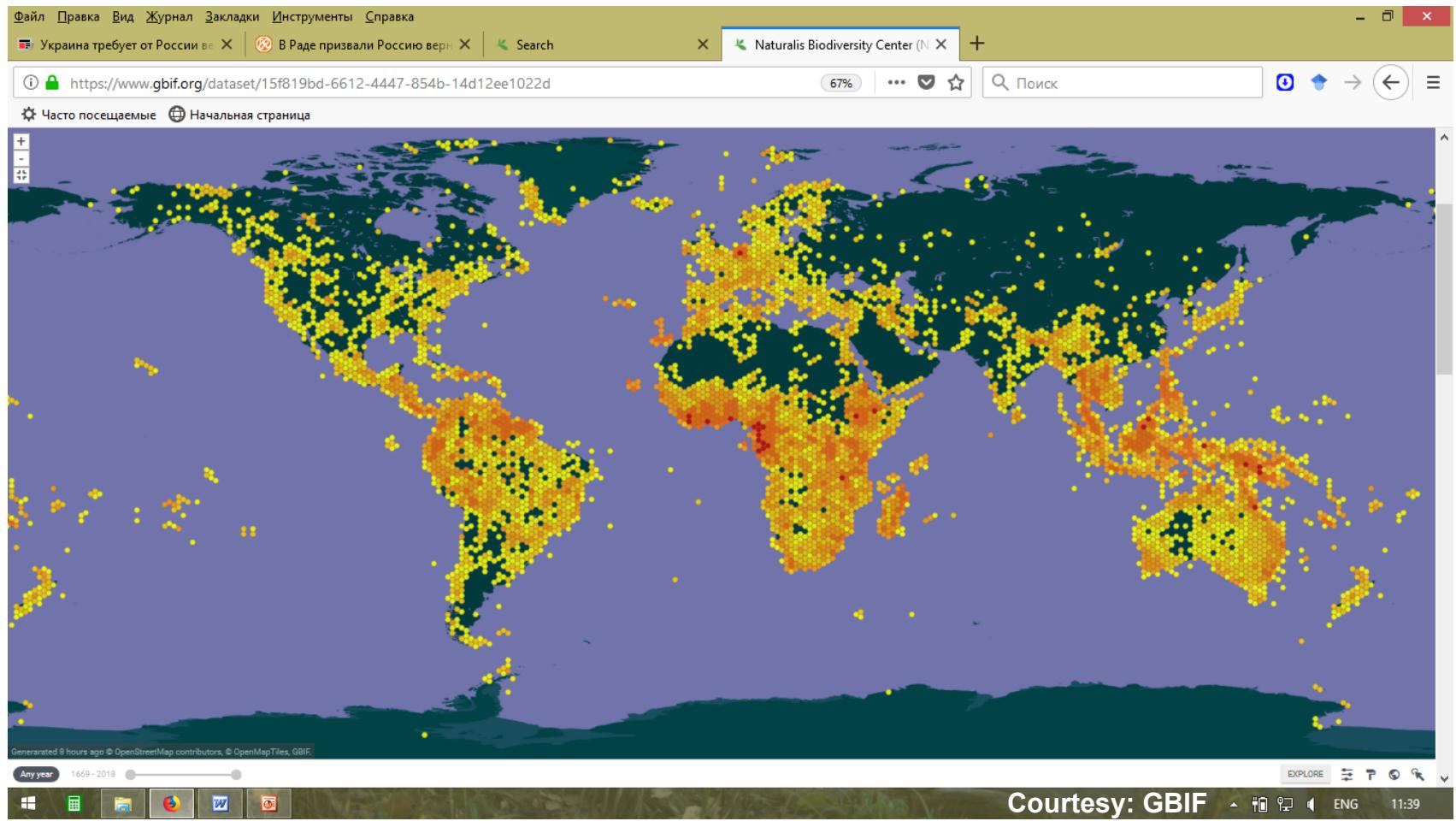
# 1. Australia's Virtual Herbarium



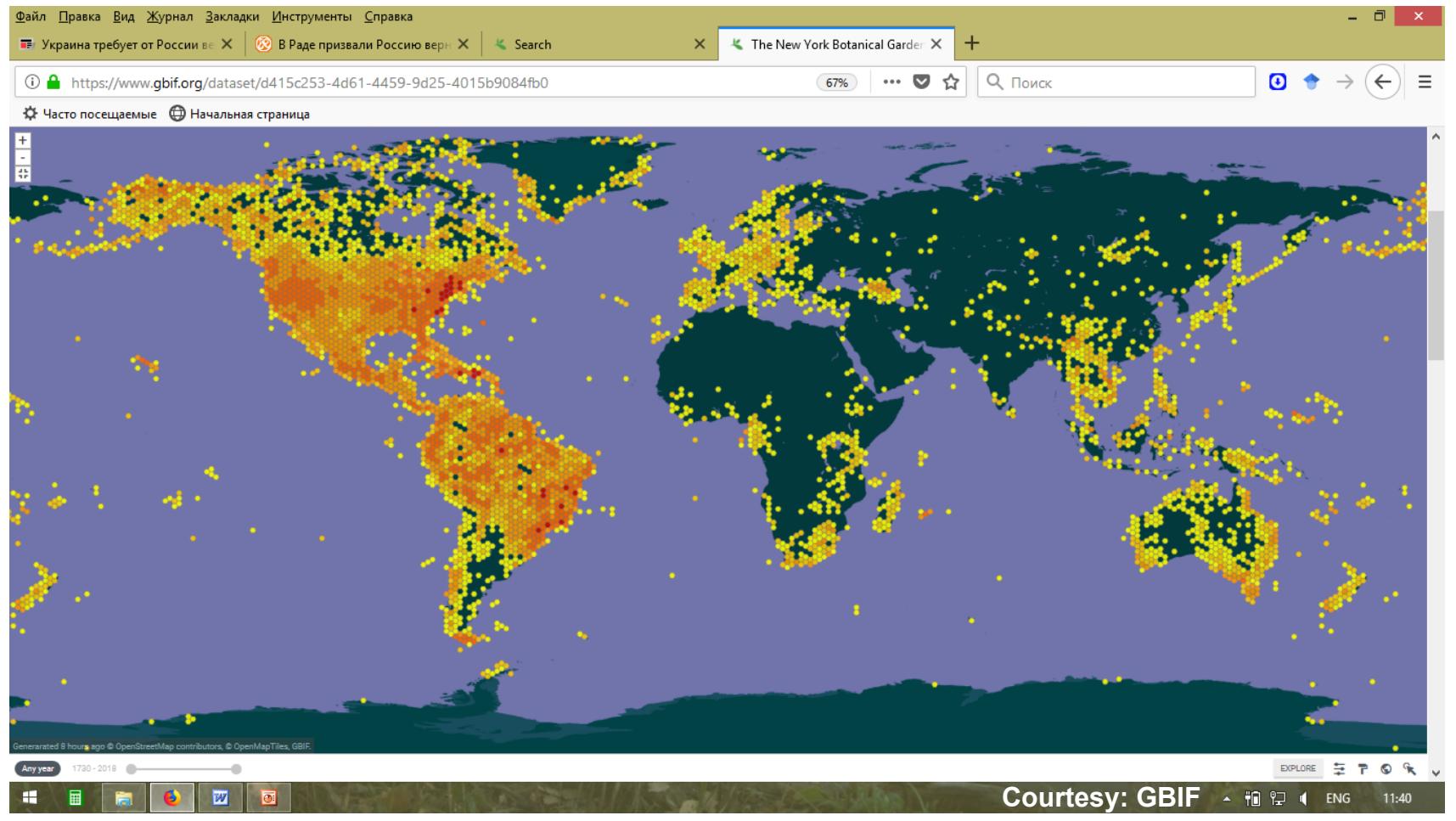
# 2. Tropicos Specimen Data



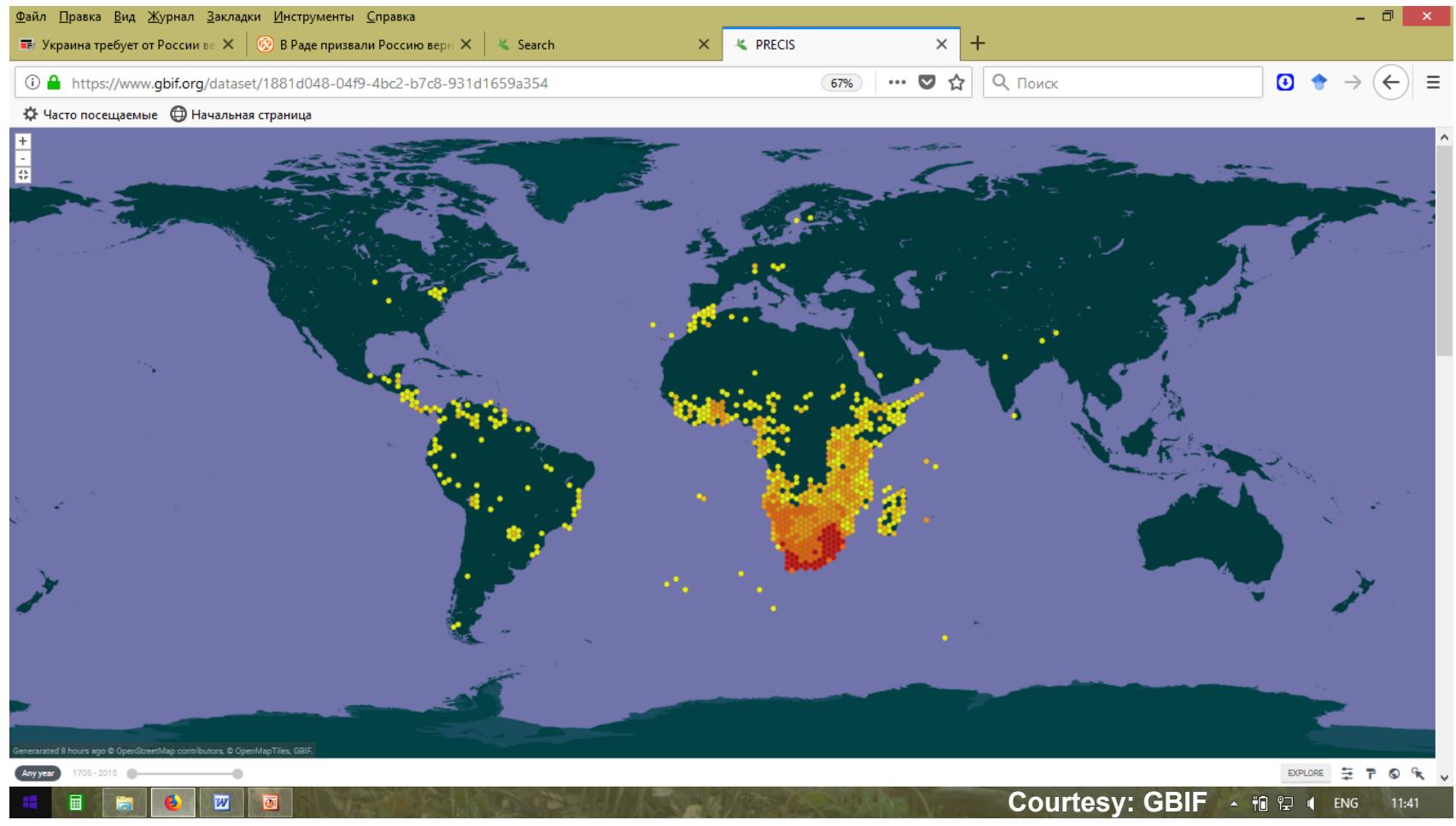
# 3. Naturalis Biodiversity Center (NL) - Botany



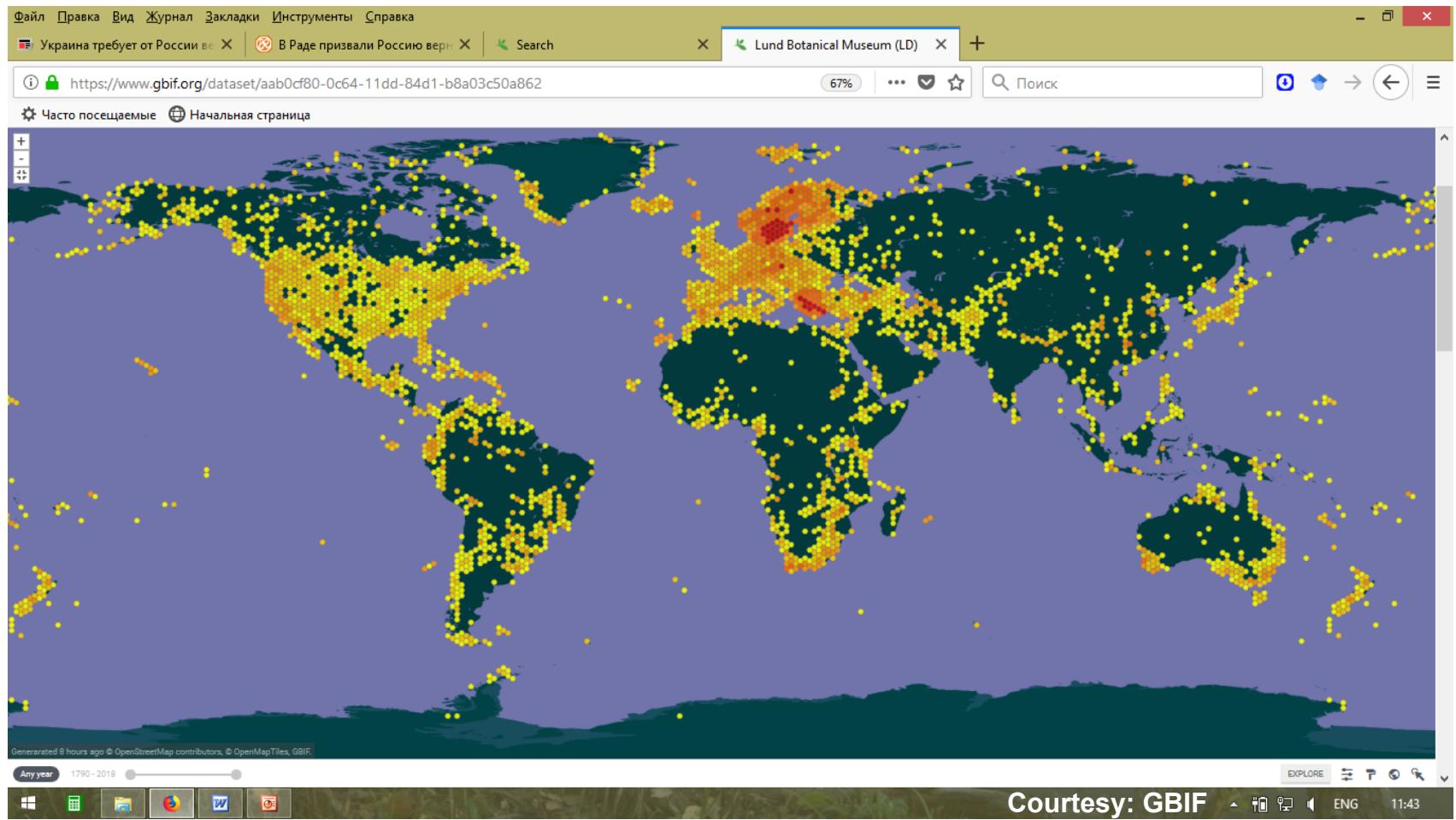
# 4. The New York Botanical Garden Herbarium (NY)



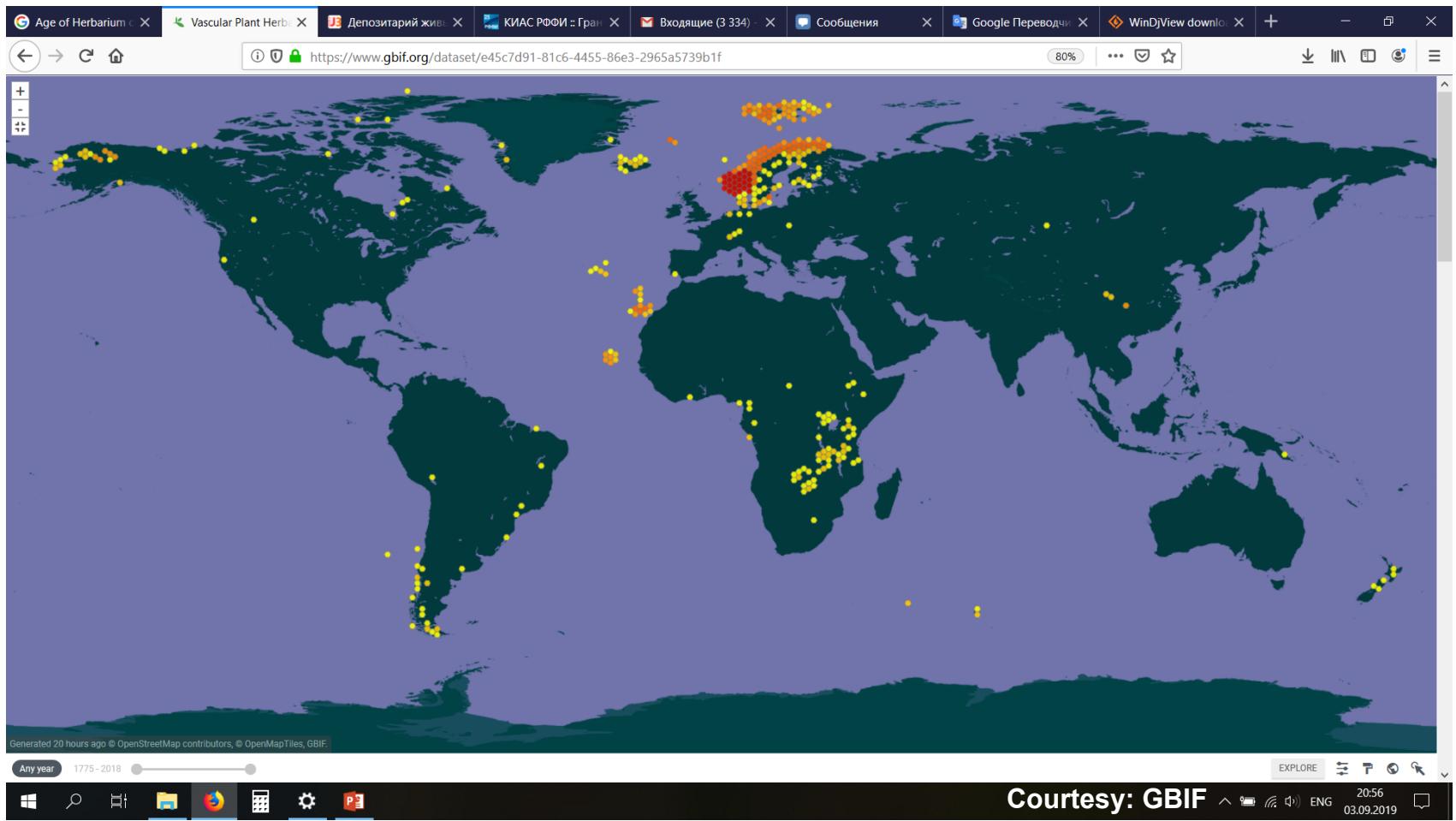
# 5. PRECIS



# 6. Lund Botanical Museum (LD)



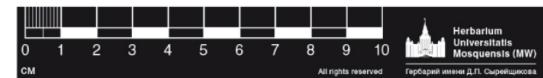
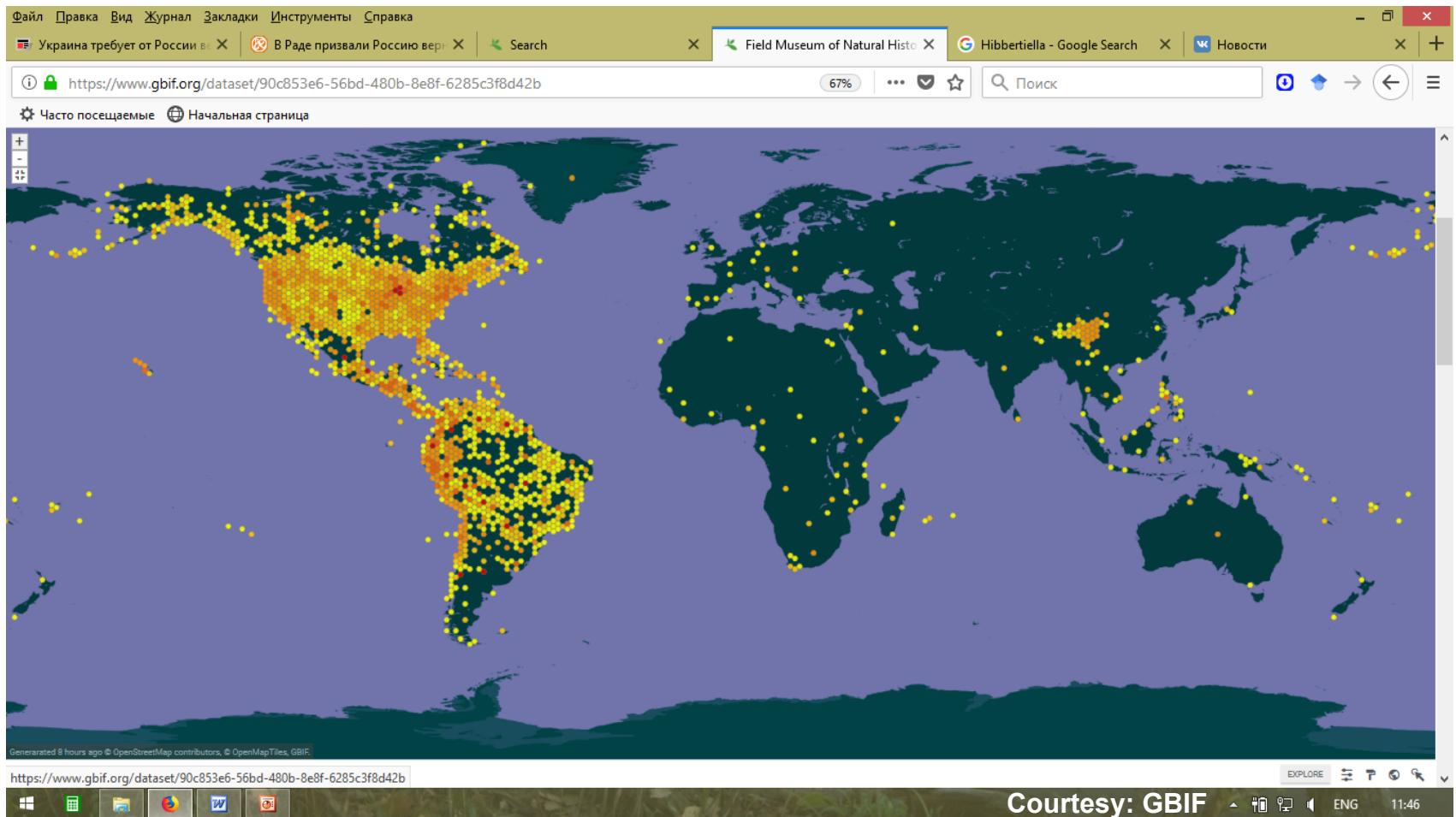
# 7. Vascular Plant Herbarium, Oslo (O)



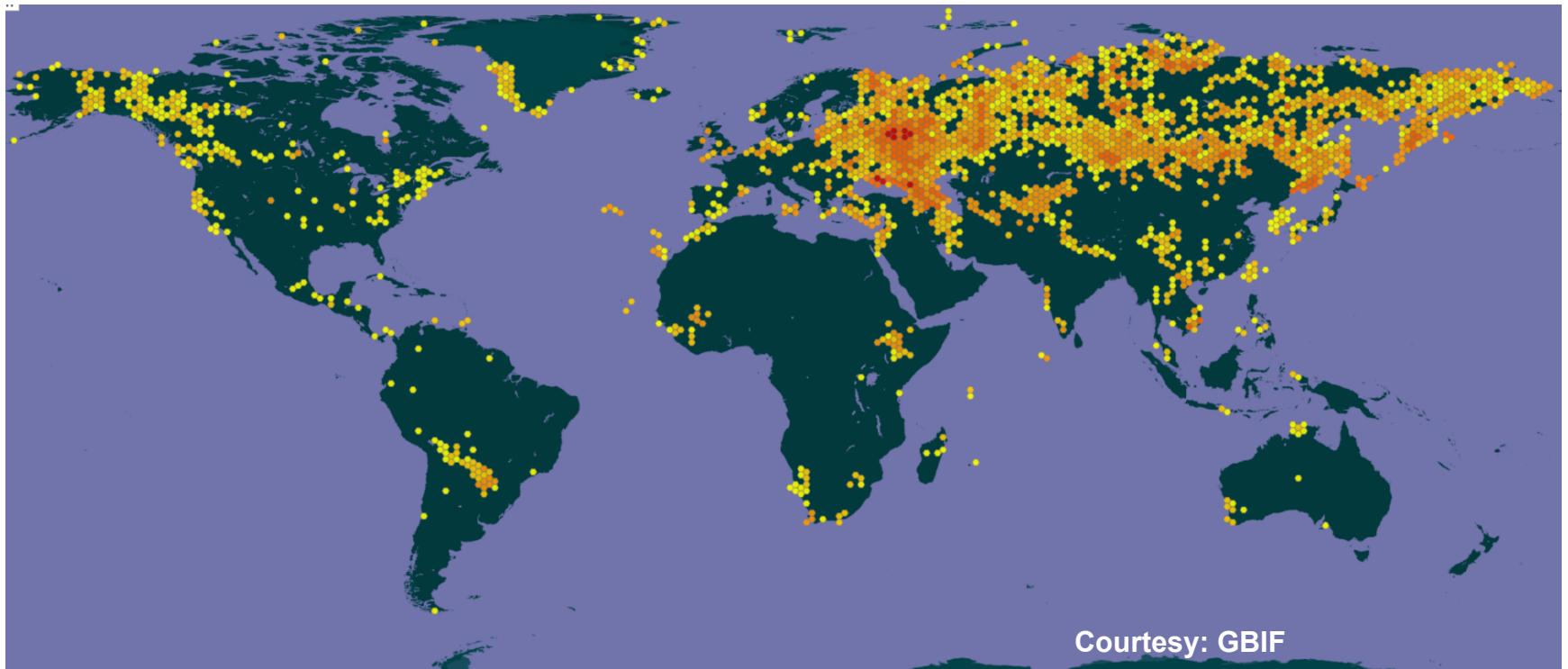
Courtesy: GBIF



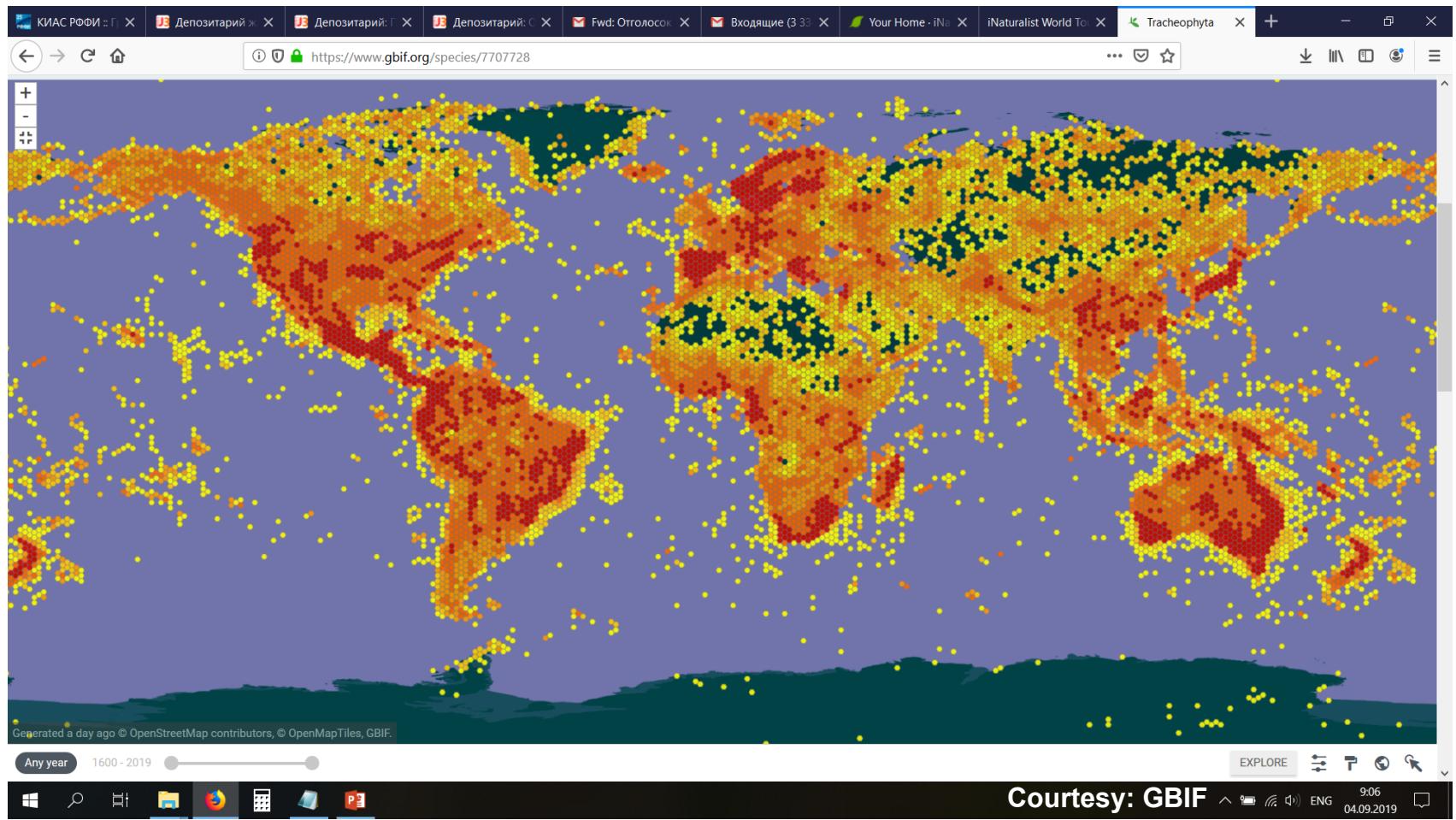
# 8. Field Museum of Natural History (Botany)



# 11. MW Dataset in GBIF: 412,062 georeferences

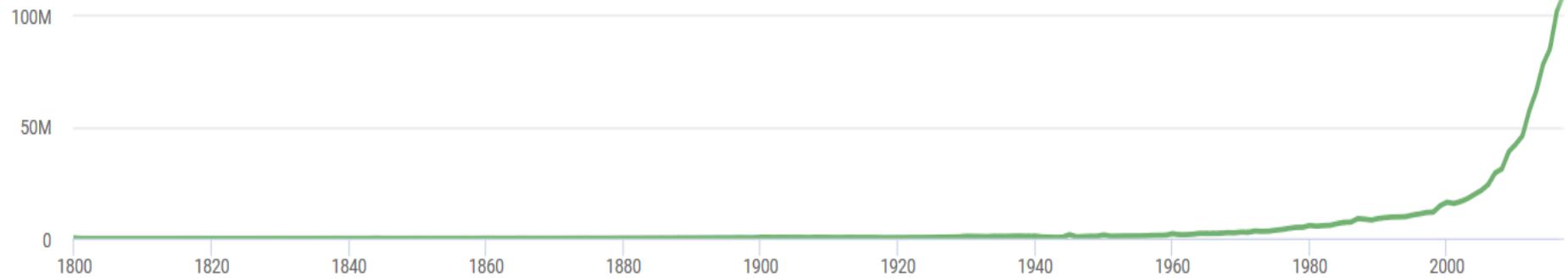


# GBIF Map for Vascular Plant Specimens

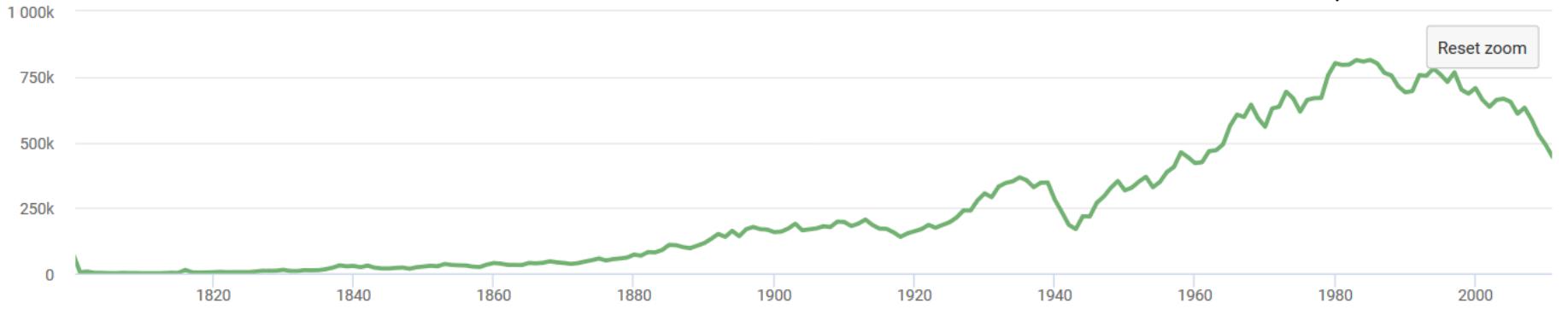


# The Age of e-Records in GBIF

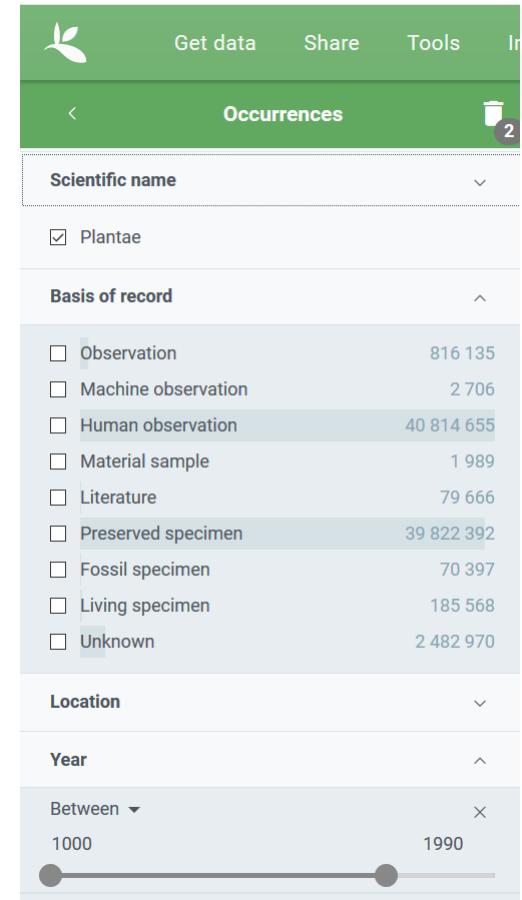
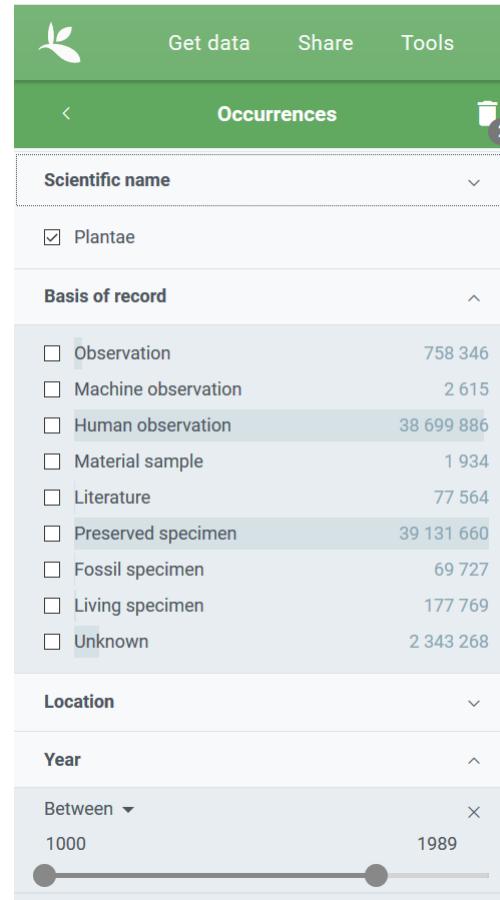
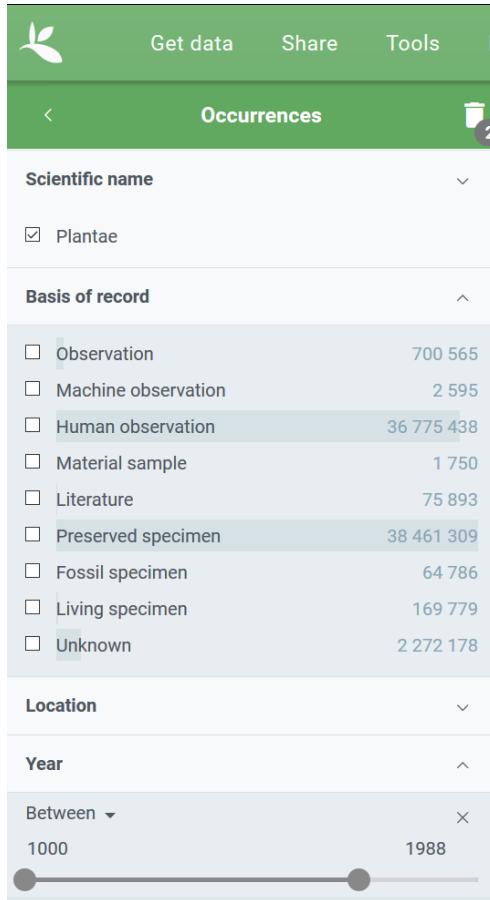
All records: max. 125,640,610 in 2018



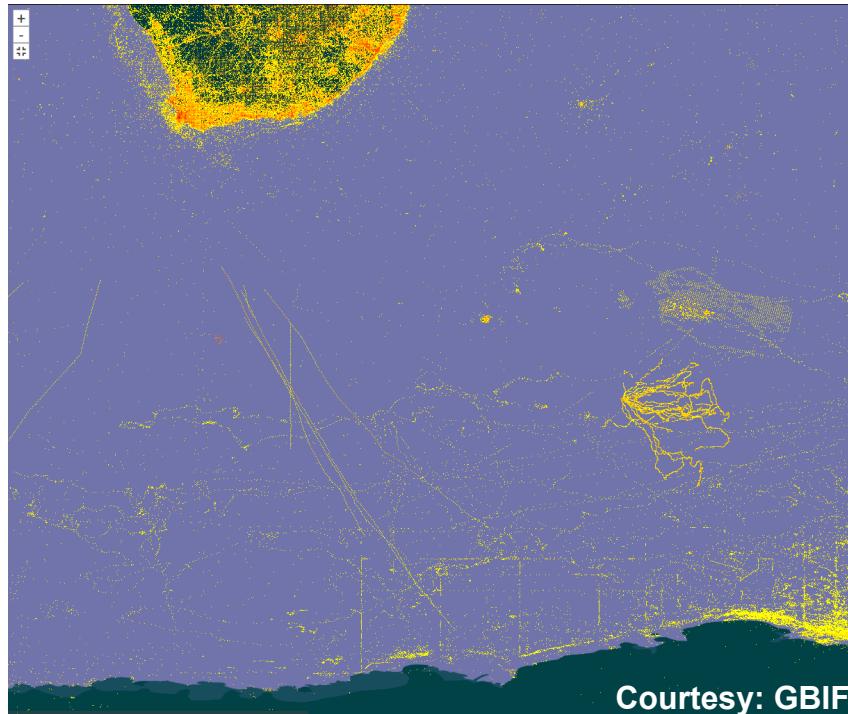
Herbarium records: max. 814,272 in 1985



# Plant e-Records in GBIF: 1988, 1989 & 1990

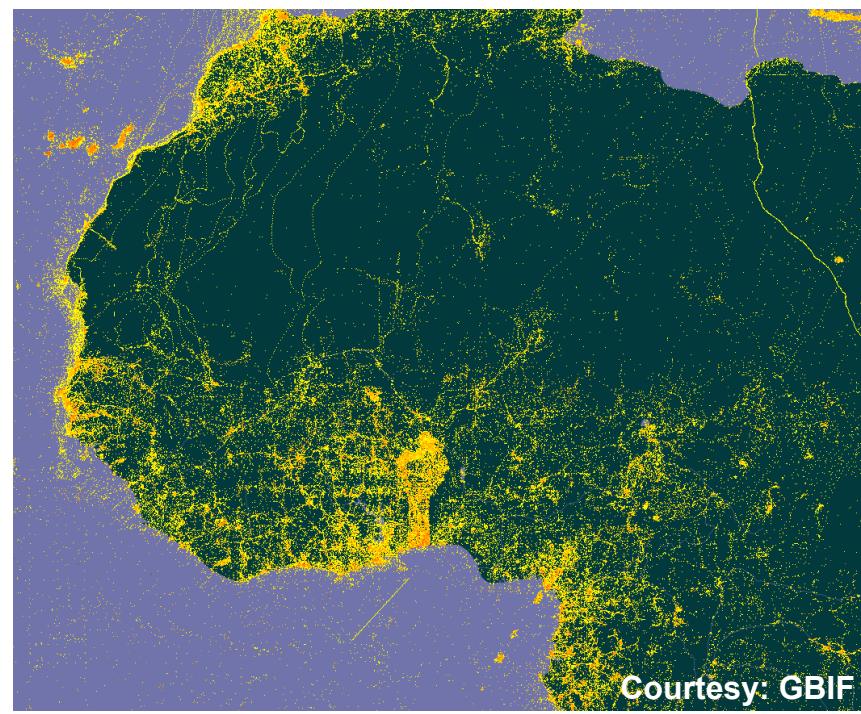


# Why There Are So Many New Records? New technologies!



Courtesy: GBIF

GPS trackers on king penguins and sea lions



Courtesy: GBIF

GPS trackers on migrating birds

# Why There Are So Many New Records? Citizen science!

iNaturalist Explore Your Observations Community More 25 0

## Observations

The World 26,036,655 OBSERVATIONS 233,071 SPECIES 95,754 IDENTIFIERS 723,479 OBSERVERS

Vespa crabro Oost-Vlaanderen, V... • Sep 3, 2019 2m  
Family Laxanidae Rosemead • Sep 3, 2019 2m  
Trifolium repens Emily Lake • Aug 22, 2019 2m  
Sphaerophoria scripta 379 01 Klec, Česko • Aug 31, 2019 2m  
Unknown

Map Legend ▾ Картографические данные © 2019 Условия использования

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Courtesy: iNaturalist



# iNaturalist Is Popular Both in Russia and Italy!



Courtesy: GitHub

# iNaturalist Country Rankings for Plants

## All records (including unidentified and unlicensed)

- United States of America 6,293,954
- Canada 716,059
- Mexico 486,909
- South Africa 341,706
- New Zealand 274,899
- United Kingdom 206,630
- **Russian Federation** **195,882**
- **Italy** **130,438**
- Taiwan 113,452
- Australia 104,031

## Records in GBIF (identified, verified and freely licensed)

- United States of America 2,262,798
- Canada 293,885
- New Zealand 184,462
- Mexico 148,207
- South Africa 138,320
- **Russian Federation** **126,136**
- United Kingdom 67,320
- Germany 47,009
- Taiwan 46,896
- **Italy** **45,732**

# “Flora of Russia” on iNaturalist: 160,596 Records Added in 2019

The screenshot shows the iNaturalist project page for "Флора России | Flora of Russia". The top navigation bar includes links for Explore, Your Observations, Community, Identify, and More. The main header features a map of Russia with numerous yellow dots representing observations. Below the map, the project name is displayed with the Russian flag icon. Key statistics are shown: 172,674 Observations, 5,207 Species, 1,670 Identifiers, and 3,345 Observers. A red sidebar on the right contains an "About" section with text about the project's purpose and its connection to the "Atlas of Flora of Russia", along with a "Read More" link, a "Members" count of 396, and buttons for "Edit Project" and "NEWS". The "Overview" tab is selected. A "Leaderboard" section displays a horizontal bar chart ranking various regional floras by observation count. The top entries are: Флора Москвы | Flora of Moscow (16,891), Флора Приморского края | Primorsky Krai Flora (14,417), Флора Подмосковья | Moscow Oblast Flora (11,981), Флора Алтайского края | Altai Krai Flora (11,207), Флора Нижегородской области | Nizhny Novgorod Oblast Flora (9,400), Флора Чувашин | Chuvash Republic Flora (8,913), Флора Брянской области | Bryansk Oblast Flora (8,808), and Флора Ярославской области | Yaroslavl Oblast Flora (7,393). The bottom right corner of the page features the text "Courtesy: iNaturalist".

Region	Observations
Флора Москвы   Flora of Moscow	16,891
Флора Приморского края   Primorsky Krai Flora	14,417
Флора Подмосковья   Moscow Oblast Flora	11,981
Флора Алтайского края   Altai Krai Flora	11,207
Флора Нижегородской области   Nizhny Novgorod Oblast Flora	9,400
Флора Чувашин   Chuvash Republic Flora	8,913
Флора Брянской области   Bryansk Oblast Flora	8,808
Флора Ярославской области   Yaroslavl Oblast Flora	7,393

# 85 Regional Projects

**iNaturalist** Explore Your Observations Community Identify More  25 0 

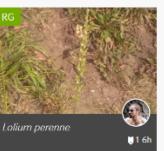
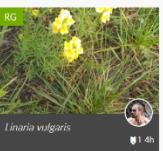
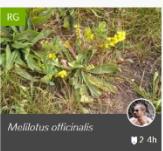


**About** Members 55  
"Флора Москвы": проект для автоматического сбора данных по сосудистым растениям города Москвы.  
Проект создан по гранту "Информационная система "Флора Москва" на платформе Цифрового гербария МГУ" (совместный Read More >)

 NEWS

Overview 16,891 OBSERVATIONS 912 SPECIES 514 IDENTIFIERS 625 OBSERVERS 

Recent Observations +



Mellilotus officinalis 2 hr Linaria vulgaris 1 hr Lolium perenne 1 hr Medicago lupulina 2 hr



**About** Members 10  
"Флора Приморского края": проект для автоматического сбора данных по сосудистым растениям Приморского края.  
Этот проект вдохновлен страницей "Флора Москвы | Flora of Moscow" на платформе iNaturalist, созданной по гранту Read More >

 NEWS

Overview 14,417 OBSERVATIONS 1,338 SPECIES 218 IDENTIFIERS 50 OBSERVERS 

Recent Observations +



Chelidonium majus ssp. majus 1 hr Sanguisorba officinalis 2 hr Silene fulgens 2 hr Androsace filiformis 2 hr

**iNaturalist** Explore Your Observations Community Identify More  25 0 

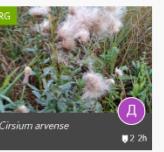


**About** Members 27  
"Флора Подмосковья": проект для автоматического сбора данных по сосудистым растениям Московской области.  
Этот проект вдохновлен страницей "Флора Москвы | Flora of Moscow" на платформе iNaturalist, созданной по гранту Read More >

 NEWS

Overview 11,981 OBSERVATIONS 913 SPECIES 485 IDENTIFIERS 619 OBSERVERS 

Recent Observations +



Cirsium arvense 2 hr Chamaenerion angustifolium 2 hr Cirsium arvense 2 hr Paris quadrifolia 2 hr

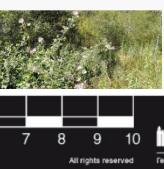
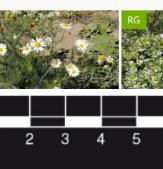


**About** Members 33  
"Флора Алтайского края": проект для автоматического сбора данных по сосудистым растениям Алтайского края.  
Этот проект вдохновлен страницей "Флора Москвы | Flora of Moscow" на платформе iNaturalist, созданной по гранту Read More >

 NEWS

Overview 11,207 OBSERVATIONS 963 SPECIES 296 IDENTIFIERS 101 OBSERVERS 

Recent Observations +



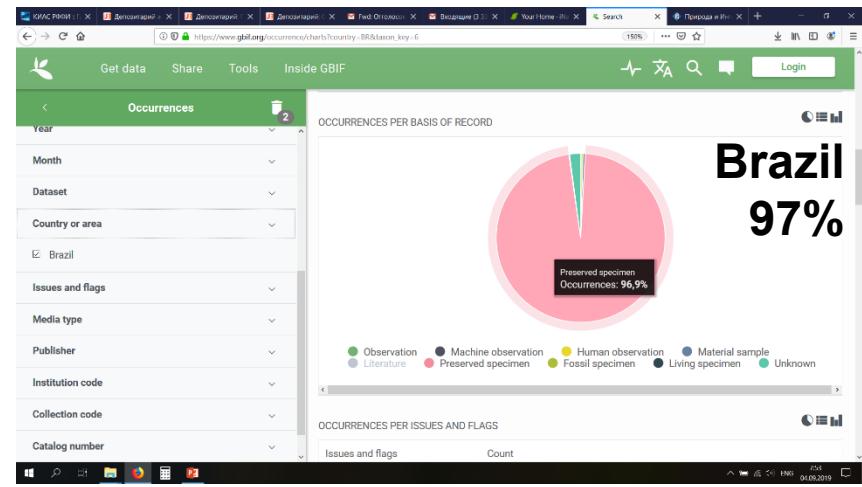
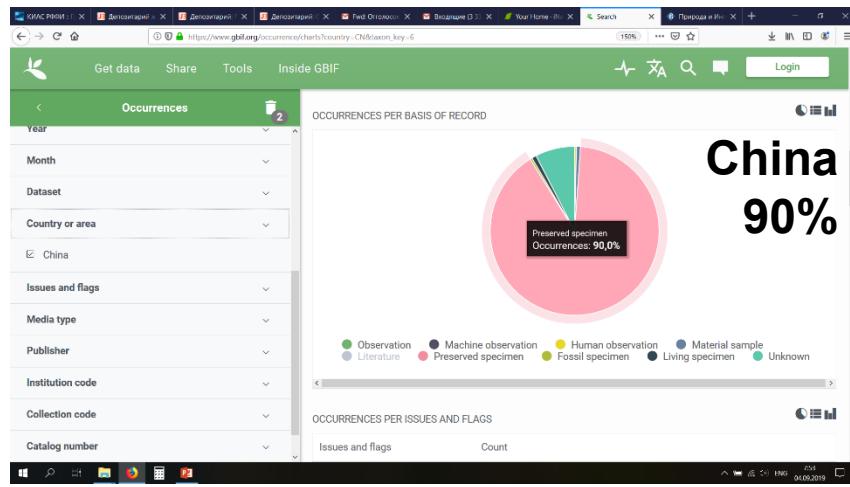
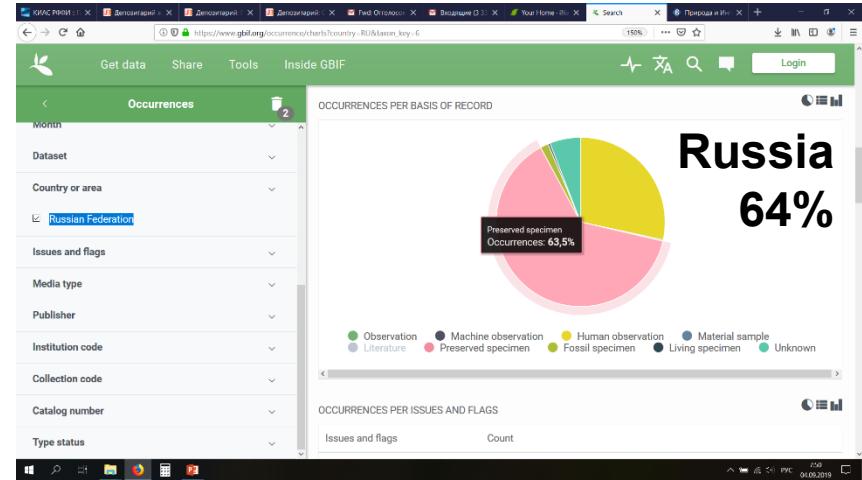
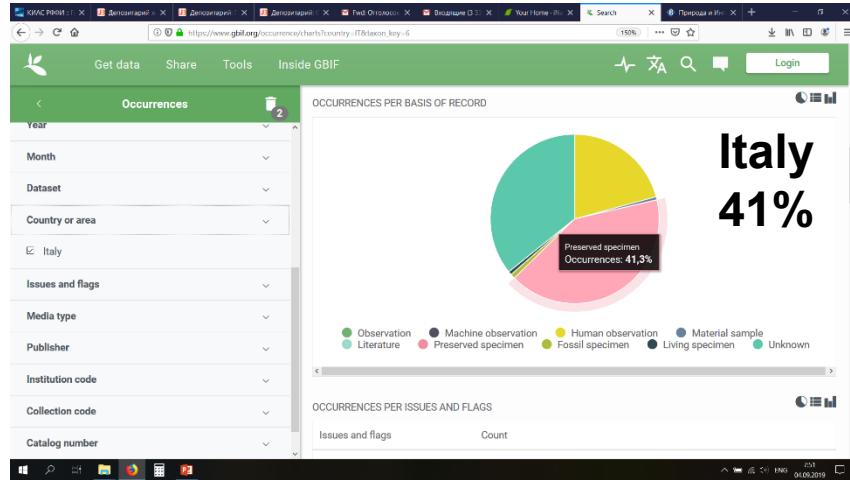
Plantago major 10 hr Matricaria discoidea 10 hr Dandelion 10 hr Dandelion 10 hr

0 1 2 3 4 5 6 7 8 9 10 CM

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**Courtesy: iNaturalist**

# Herbarium Collections Are Still Vital



Courtesy: GBIF

# Key Conclusion Notes

- World herbaria are growing constantly. Still!
- World herbaria are being rapidly digitized with current rate of digitization exceeding 22%.
- Herbaria are the major data source for plant e-records until 1989 in temperate zone and still in tropics.
- Herbarium collections are the only fully verifiable and universal source of plant records.
- Citizen science gives us tons of new data and we should start working with them.
- New recording techniques are complementing herbarium specimens, but not replacing them.

# Main Collaborators

## Moscow Digital Herbarium team

### Авторы системы

- А.В. Перехватов – руководитель группы
- О.Н. Плакто – архитектор системы, разработчик системы
- К.В. Скулачев – разработчик системы
- А.Б. Клюквин – разработчик системы
- А.Е. Соловченко – генеральный заказчик системы
- А.П. Серегин – автор технического задания системы

### Авторы ГИС-модуля

- Т.Е. Самсонов – руководитель группы, разработчик системы
- В.Н. Семин – разработчик системы
- А.Р. Апрудинов – разработчик системы

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- Н.С. Гамова – автор словаря русских названий, автор ключевых метаданных
- К.В. Дудова – автор ключевых метаданных
- А.Д. Шклярук – автор ключевых метаданных
- А.С. Бордова – автор ключевых метаданных
- А.В. Леонова – автор ключевых метаданных

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(в порядке убывания числа введенных этикеток, не менее 500 штук)

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- А.П. Серегин
- И.Н. Послепов
- П.Г. Ефимов
- В.Э. Федосов
- Д.В. Бородина
- А.А. Лапин
- В.В. Бурый
- Н.С. Гамова
- С.В. Дудов
- К.В. Дудова
- Т.М. Гаврилова
- М.А. Маташева
- М.С. Нуруалиев
- М.О. Иванова
- А.Н. Демидова
- В.И. Трошкина

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(в порядке убывания числа введенных ручных геопривязок, не менее 200 штук)

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- Н.В. Иванова
- А.С. Салмин
- А.П. Серегин
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- А.Г. Кузьмин
- И.В. Мельник
- Т.М. Гаврилова
- Е.В. Селезнёва
- С.В. Дудов
- К.В. Дудова

## "Flora of Russia" on iNaturalist team

Rank	User	Observations	Species
1	apseregin	11,568	1,339
2	snv2	9,772	752
3	welbiltbravoved	8,419	656
4	panasenkonn	5,464	866
5	eduard_garin	4,069	721
6	convallaria128	4,042	1,240
7	dryomys	3,336	650
8	pavel_golyakov	2,957	716
9	vekototrub	2,760	1,245
10	phlomis_2019	2,738	1,044
11	svetlanakutieva	2,436	434
12	melodi_96	2,297	697
13	julia_shner	2,289	481
14	max_carabus	2,230	400
15	npr	2,197	391
16	vadim_prokhorov	1,972	760
17	katerina_kashirina	1,839	616
18	ramazan_murtazaliev	1,775	1,164
19	borisbolshakov	1,741	473
20	alzov	1,697	499
21	evgenybobinsky	1,634	326
22	sokolkov2002	1,569	508
23	aleksandreb6	1,535	591
24	beerolla	1,499	456
25	alexeiebel	1,438	487
26	vladimir_teplouhov	1,398	376
27	maltailey	1,330	682
28	olga2019kuryakova	1,204	421
29	tomegatherion	1,171	466
30	denis_tishin	1,095	359



Thank you for being  
with me today!

Dr Sci Alexey P. Seregin  
[botanik.seregin@gmail.com](mailto:botanik.seregin@gmail.com)