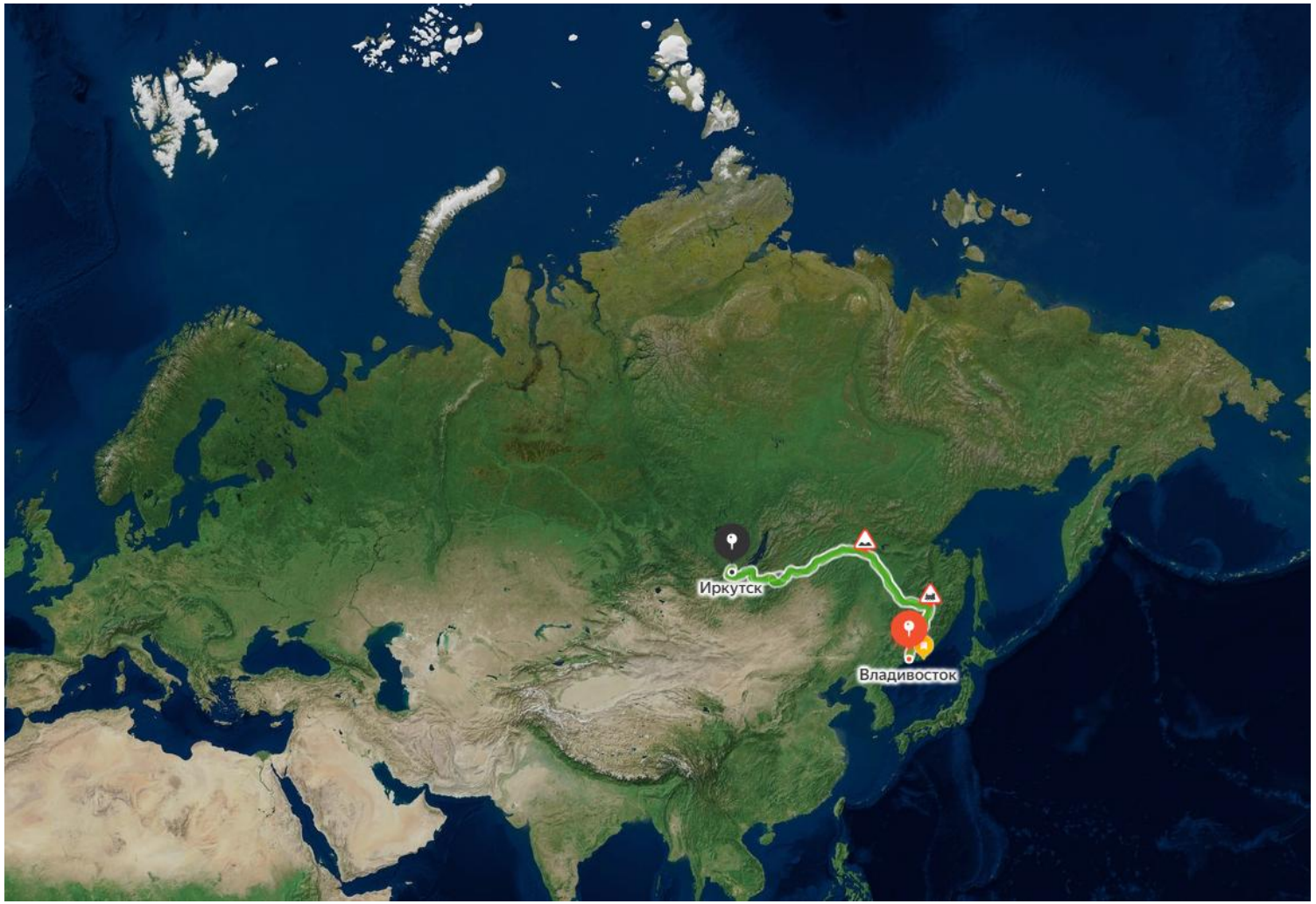
# *Mapping Plants of Asian Russia: Contribution from the Botanical Garden-Institute.* Vladivostok, Russia

Alla V. Verkhozina

Botanical Garden-Institute FEB RAS, Vladivostok, Russia

September 1, 2026, Harbin, China

# *Why mapping plants of Asian Russia is challenging*




*Area of Asian Russia = 13.1 m km²*

*8.8% of the world's total land area*

*77% of the area of Russia*

*25% of Russia's population lives on this territory*

# *Vascular flora of Asian Russia according to 2024 data*

Botanica Pacifica. A journal of plant science and conservation. 2024. 13(Special issue):3–310
DOI: 10.17581/bp.2024.13S01

## Checklist of vascular plants of Asian Russia

Victor V. Chepinoga[1,2*], Vyacheslav Yu. Barkalov[3], Alexandr L. Ebel[4,5], Mikhail S. Knyazev[6], Konstantin S. Baikov[5], Alexander A. Bobrov[7,8], Andrey V. Chkalov[9], Vladimir M. Doronkin[5], Petr G. Efimov[10], Nikolai V. Friesen[11], Dmitry A. German[12], Andrey A. Gontcharov[3], Alisa E. Grabovskaya-Borodina[10], Irina I. Gureyeva[4], Yury A. Ivanenko[13], Alexey A. Kechaykin[12], Alexandr A. Korobkov[10], Elena A. Korolyuk[5], Petr A. Kosachev[12,14,15], Andrey N. Kupriyanov[16], Alexandr N. Luferov[17], Denis G. Melnikov[10], Marina A. Mikhailova[10]†, Olga D. Nikiforova[5]†, Larisa V. Orlova[10], Svetlana V. Ovchinnikova[5], Ekaterina A. Pinzhenina[5], Tatjana A. Poliakova[18], Irina N. Shekhovstsova[5], Aleksey B. Shipunov[19]†, Aleksandr I. Shmakov[20], Sergey V. Smirnov[12], Natalia Tkach[21], Victoria I. Troshkina[5], Natalja N. Tupitsyna[22], Vladimir M. Vasjukov[23], Natalja V. Vlasova[5], Alla V. Verkhozina[24], Oleg A. Anenkhonov[25], Andrey N. Efremov[26], Valerii A. Glazunov[27], Maria G. Khoreva[28], Tatjana I. Kiseleva[5], Pavel V. Krestov[29], Maria V. Kryukova[30], Igor V. Kuzmin[31], Nikolai N. Lashchinskiy[5], Igor N. Pospelov[32], Elena B. Pospelova[33], Natalia V. Zolotareva[34] & Alexander N. Sennikov[35]

Victor V. Chepinoga[1,2*]
e-mail: chepinoga@geobotanik.uni-hannover.de

Vyacheslav Yu. Barkalov[3]
e-mail: barkalov@biosoil.ru

Alexandr L. Ebel[4,5]
e-mail: alex-08@mail2000.ru

Mikhail S. Knyazev[6]
e-mail: knyasev_botgard@mail.ru

Konstantin S. Baikov[5]
e-mail: kbaikov2018@mail.ru

Alexander A. Bobrov[7,8]
e-mail: lsd@ibiw.yaroslavl.ru

Andrey V. Chkalov[9]
e-mail: biofor@yandex.ru

Vladimir M. Doronkin[5]
e-mail: norbo50@yandex.ru

Petr G. Efimov[10]
e-mail: efimov81@mail.ru

Nikolai V. Friesen[11]
e-mail: nfriesen@uni-osnabrueck.de

Dmitry A. German[12]
e-mail: oreoloma@rambler.ru

Andrey A. Gontcharov[3]
e-mail: gontcharov@biosoil.ru

Alisa E. Grabovskaya-Borodina[10]
e-mail: agrabovskaya@binran.ru

**ABSTRACT**

The first complete and updated checklist of vascular plants of Asian Russia is compiled. It is based on "Checklist of Flora of Asian Russia: Vascular Plants" (Baikov 2012) but incorporates numerous floristic, taxonomic and nomenclatural novelties. The territorial scope of the checklist is constituted by three federal districts of Russia (Ural, Siberian and Far Eastern). Sverdlovsk Oblast and Chelyabinsk Oblast are included in the checklist for the first time. Native, alien, naturalized, casual aliens and frequently cultivated (not found outside cultivation) taxa are included. The monotypic species concept is consistently followed. Species and nothospecies (interspecific hybrids) are distinguished; very closely related taxa are grouped into species aggregates. The generic concept of the Catalogue of Life (COL) is accepted to avoid conflicts between contrasting taxonomies. For accepted species, references are made to the corresponding taxonomy in Baikov (2012), COL and Plants of the World Online (POWO); in case of name changes, synonyms are provided. Further synonyms are added when deemed necessary to indicate taxonomic circumscriptions. Most important changes in nomenclature and taxonomy, recently described taxa and additions to the flora of Asian Russia are annotated. The occurrence and residence status (native, alien, cultivated) of species in 13 botanical provinces of Asian Russia are given. The vascular flora of Asian Russia includes 8251 species and 489 hybrids. Of these, 7340 species are native (+420 hybrids), 684 are alien (+46 hybrids) and 227 are cultivated (+23 hybrids). Altogether, 3683 species are assigned to one of 1156 species aggregates. Among native species, 1235 are endemic to Asian Russia; 252 species are included in the Red Data Book of the Russian Federation. The whole vascular flora of Asian Russia is classified into 165 families, 1199 genera and 9 nothogenera. According to our estimations, the floristic richness of Asian Russia comprises 73.3 % of the Russian flora.

**Keywords:** alien plants, botanical nomenclature, cultivated plants, flora, native plants, plant distributions, species list

Vascular flora of Asian Russia includes 8251 species and 489 hybrids.

The whole vascular flora of Asian Russia is classified into 165 families, 1199 genera and 9 nothogenera.

7340 species are native (+420 hybrids),

684 are alien (+46 hybrids)

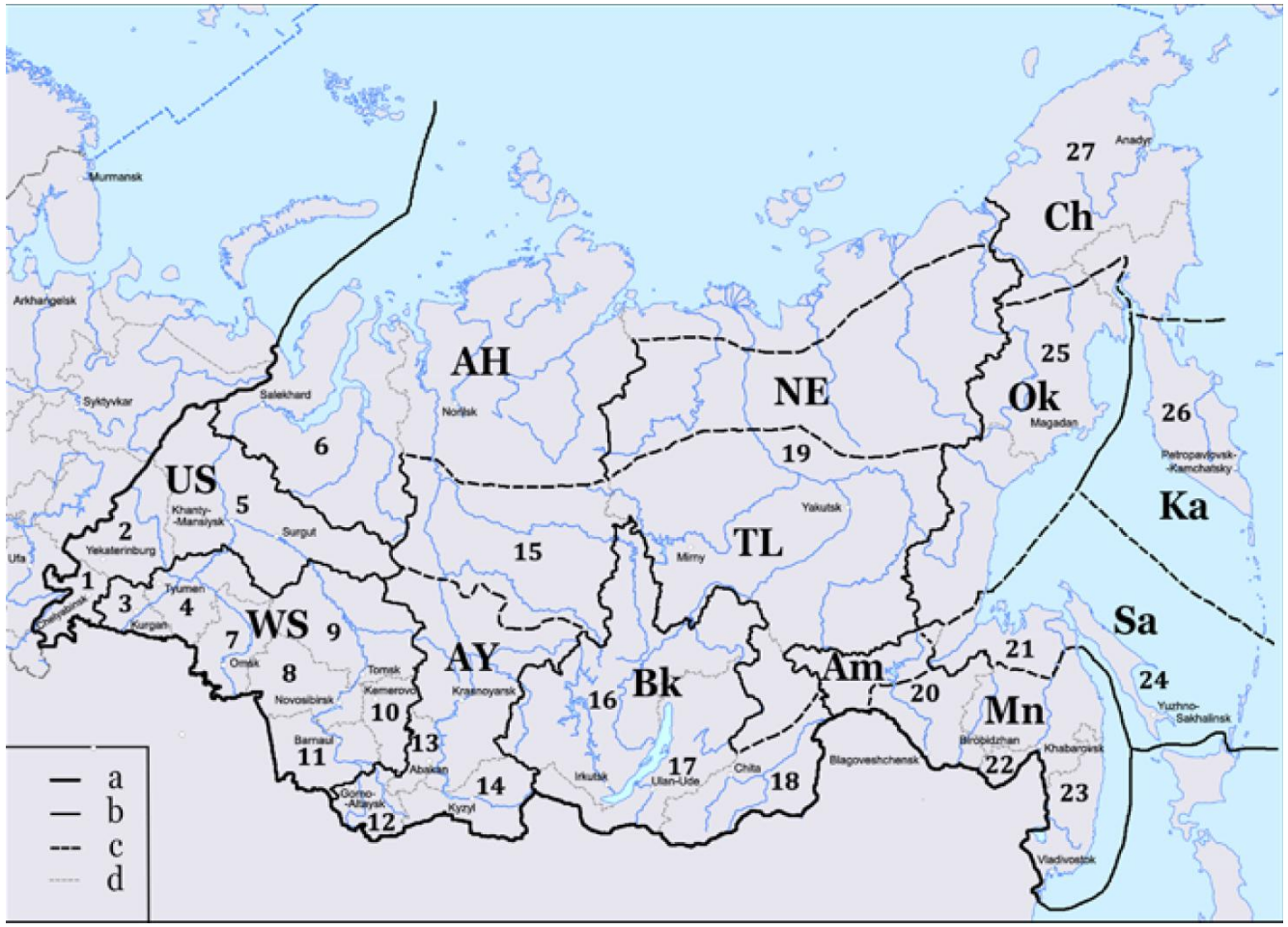
227 are cultivated (+23 hybrids).

1235 are endemic to Asian Russia;

252 species are included in the Red Data Book of the Russian Federation.

Floristic richness of Asian Russia comprises 73.3 % of the Russian flora.

# *Administrative and botanical regions ('provinces') of Asian Russia for the checklist: first stage*




**US** – Ural-West Siberian Boreal;
**AH** – Siberian Arctic-Hyparctic;
**WS** – West Siberian Hemiboreal;
**AY** – Altai-Yenisei Mountain-Hemiboreal;
**TL** – Tunguska-Lena Boreal;
**Bk** – Baikal Hemiboreal;
**NE** – Siberian North-Eastern Mountain-Hyparctic;
**Am** – Upper Amur Continental;
**Mn** – Manchurian Continental;
**Sa** – Sakhalin Oceanic;
**Ka** – Kamchatka Oceanic;
**Ok** – Okhotsk Mountain-Hyparctic;
**Ch** – Chukotka Arctic.

Arabic numbers denote administrative regions of Asian Russia in Table 2. a – borders of Asian Russia, b – boundaries between provinces that coincide with administrative boundaries, c – boundaries between provinces crossing the administrative regions, and d – boundaries between administrative regions

# *Checklist of the Flora of Asian Russia: Next Stage*

| No. | Administrative unit / center | Area, sq. km | Number of sp./subsp. | Floristic province (see Table 1) | Reference |
|---|---|---|---|---|---|
| **Western Siberia** | | | | | |
| 1. | **Chelyabinsk Oblast** / Chelyabinsk | 88 529 | 2130 | **US** | Kulikov 2010 |
| 2. | **Sverdlovsk Oblast** / Yekaterinburg | 194 307 | 1876 | **US** | Gorchakovsky 1994, Knyazev et al.* 2016, 2017, 2018, 2019a, 2019b, 2020, 2021, 2022 |
| 3. | **Kurgan Oblast** / Kurgan | 71 488 | 1183 | **WS** | Naumenko 2003*, 2008 |
| 4. | **Tyumen Oblast** / Tyumen | 160 122 | 1430 | **WS** | Glazunov et al. 2017 |
| 5. | **Khanty-Mansi** Autonomous Okrug – Yugra / Khanty-Mansiysk | 534 801 | ~1200 | **US** | Krasnoborov 2006 |
| 6. | **Yamal-Nenets** Autonomous Okrug / Salekhard | 769 250 | 1073 | **AH** | Rebristaya 2006, Knyazev & Morozova 2006, Pismarkina 2019* |
| 7. | **Omsk Oblast** / Omsk | 141 140 | 1284 | **WS** | Bekisheva 1999, A. Efremov* (pers. comm.) |
| 8. | **Novosibirsk Oblast** / Novosibirsk | 177 756 | 1379 | **WS** | Krasnoborov 2000, Kleshcheva 2011* |
| 9. | **Tomsk Oblast** / Tomsk | 314 391 | 1170 | **WS** | Revushkin 2014 |
| 10. | **Kemerovo Oblast** / Kemerovo | 95 725 | 1733 | **WS** | Krasnoborov 2001, Sheremetova 2016, 2023* |
| 11. | **Altai Krai** / Barnaul | 167 996 | 2264 | **WS** | Silantyeva 2013 |
| 12. | **Altai Republic** / Gorno-Altaysk | 92 903 | 2136 | **AY** | Krasnoborov & Artemov 2012 |
| **Middle Siberia** | | | | | |
| 13. | Republic of **Khakassia**/ Abakan | 61 659 | 1820 | **AY** | Ankipovich 1999, A. Ebel* (pers. comm.) |
| 14. | **Tyva** Republic/ Kyzyl | 168 604 | 2066 | **AY** | Shaulo 2007 |
| 15. | **Krasnoyarsk Krai** / Krasnoyarsk | 2 366 797 | >2064 | **AY, TL, AH** | Polozhiy 1984*, Andreyeva & Tupitsyna 2014 |
| **Eastern Siberia** | | | | | |
| 16. | **Irkutsk Oblast** / Irkutsk | 774 846 | 2295 | **Bk** | Malyshev 2008 |
| 17. | Republic of **Buryatia** / Ulan-Ude | 351 334 | 2161 | **Bk** | Anenkhonov 2001 |
| 18. | **Zabaykalsky Krai** / Chita | 431 892 | ~1847 | **Bk, TL** | Chepinoga 2014 |
| 19. | Sakha (**Yakutia**) Republic / Yakutsk | 3 083 523 | 2129 | **NE, TL, AH** | Cherosov 2012, Nikolin 2013, 2020* |
| **Russian Far East** | | | | | |
| 20. | **Amur Oblast** / Blagoveshchensk | 361 908 | 2024 | **Am, Mn, Sa** | Starchenko 2008 |
| 21. | **Khabarovsk Krai** / Khabarovsk | 787 633 | >2516 | **Ok, Sa, Mn** | Shlotgauer et al. 2001 |
| 22. | **Jewish** Autonomous **Oblast** / Birobidzhan | 36 271 | 1443 | **Mn** | Rubtsova 2002, 2017* |
| 23. | **Primorsky Krai** / Vladivostok | 164 673 | 2781 | **Mn** | Kozhevnikov & Kozhevnikova 2014, Kozhevnikov et al. 2019* |
| 24. | **Sakhalin Oblast** / Yuzhno-Sakhalinsk | 87 101 | >2000 | **Sa, Ka** | Barkalov & Taran 2004, Barkalov 2009, Eremin & Taran 2019* |
| 25. | **Magadan Oblast** / Magadan | 462 464 | 1457 | **Ok, Ch** | Berkutenko 2010 |
| 26 | **Kamchatka** Krai / Petropavlovsk-Kamchatsky | 464 275 | ~1300 | **Ka, Ch, Ok** | Yakubov & Chernyagina 2004, Chernyagina 2018* |
| 27. | **Chukotka** Autonomous Okrug / Anadyr | 721 481 | >1060 | **Ch** | Yurtzev et al. 2010 |

For example increase in the number of species compared to previous checklist

***Primorsky Krai***

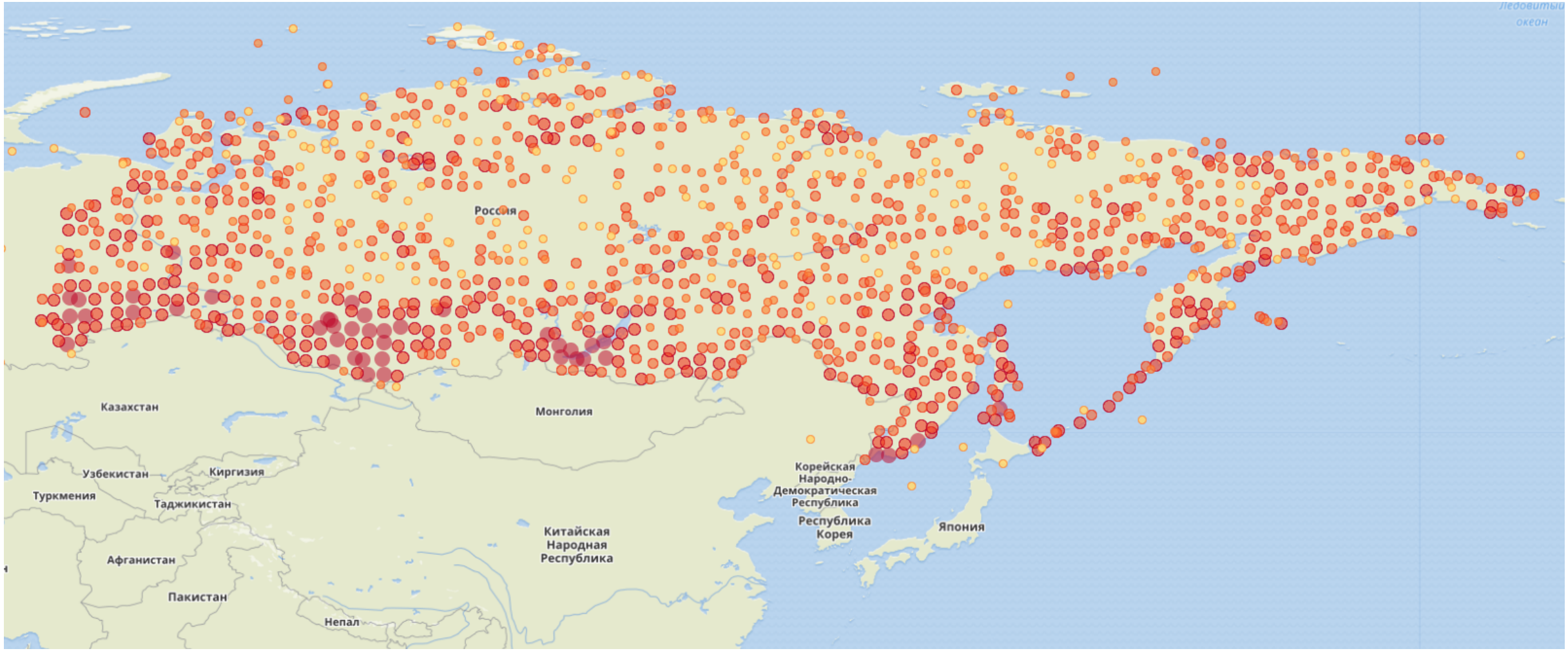
Flora "before" – 2781
Flora "after" – 2891

New species for the ***Primorsky Krai*** – 110
29 of them are cultivated

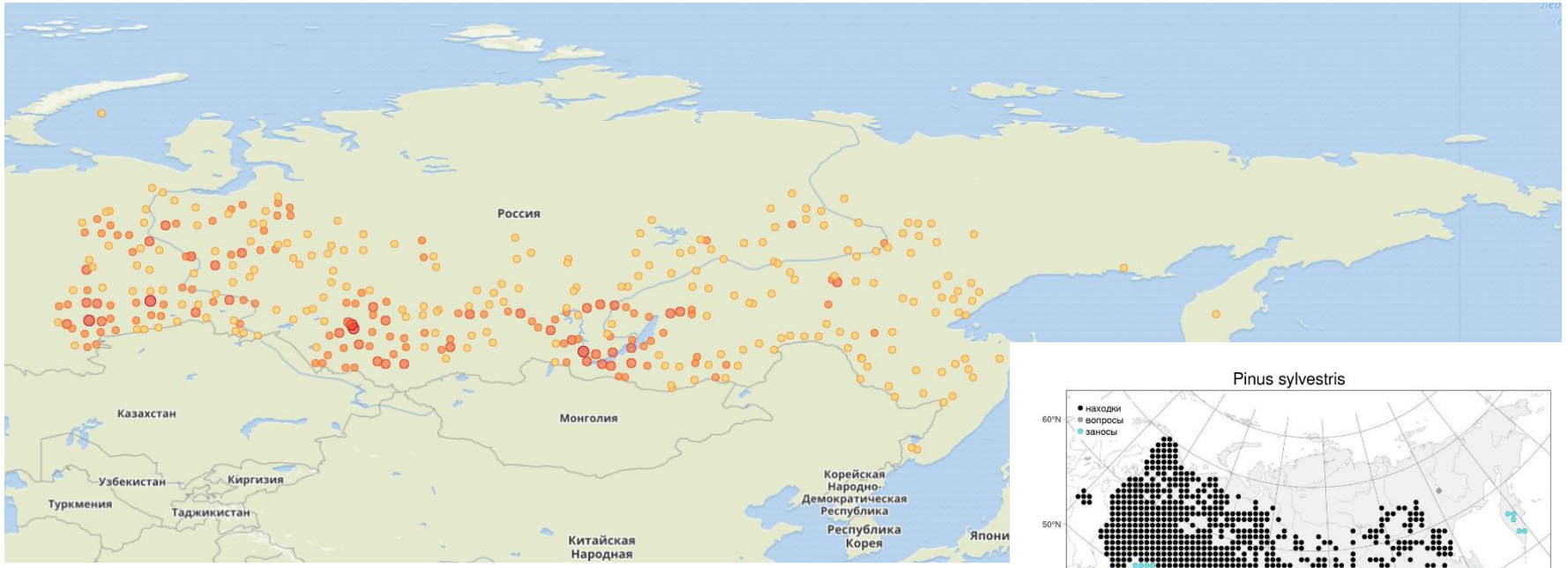
New species for the Flora of Asian Russia – 12

Need to publish:
– via iNaturalist – *22*
– from other sources – *7*

# Vascular plants in Asian Russia (GBIF)



# *Pinus sylvestris* L. in Asian Russia (GBIF)







# *Pinus in Asian Russia (GBIF)*

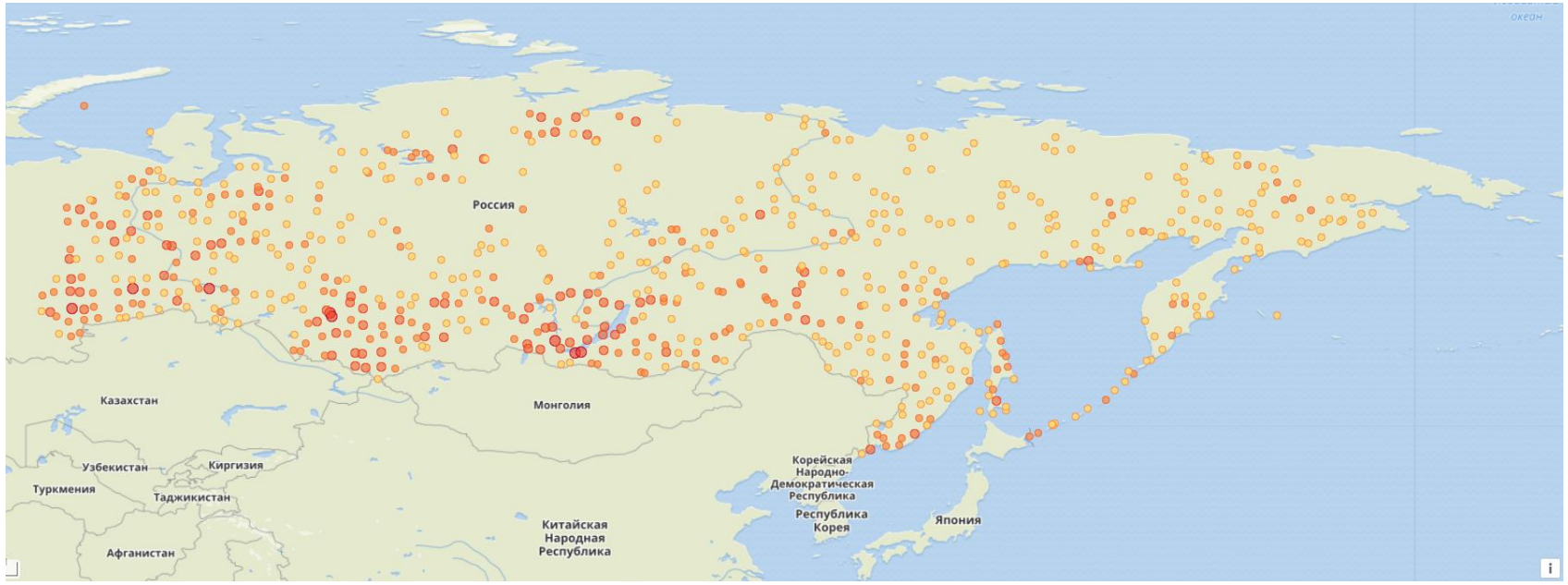
***Pinus densiflora*** Siebold & Zucc
***Pinus x funebris*** Kom.
***Pinus koraiensis*** Siebold & Zucc.
***Pinus parviflora*** Siebold & Zucc.
***Pinus pumila*** (Pall.) Regel
***Pinus sibirica*** Du Tour
***Pinus sylvestris*** L.



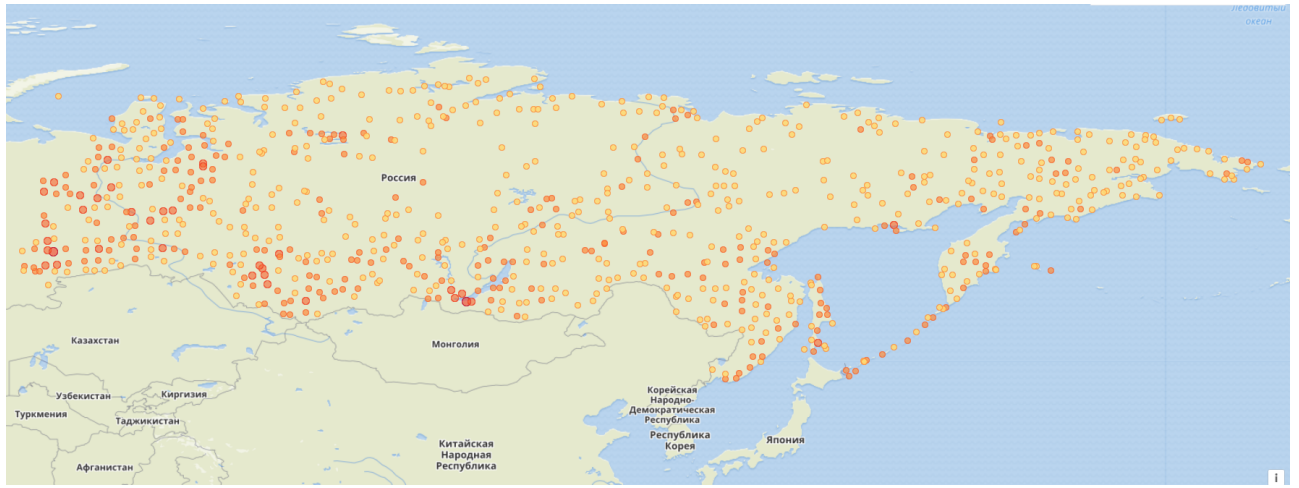
*Larix* L. (GBIF)




*Larix* L. + *Pinus* L. (GBIF)



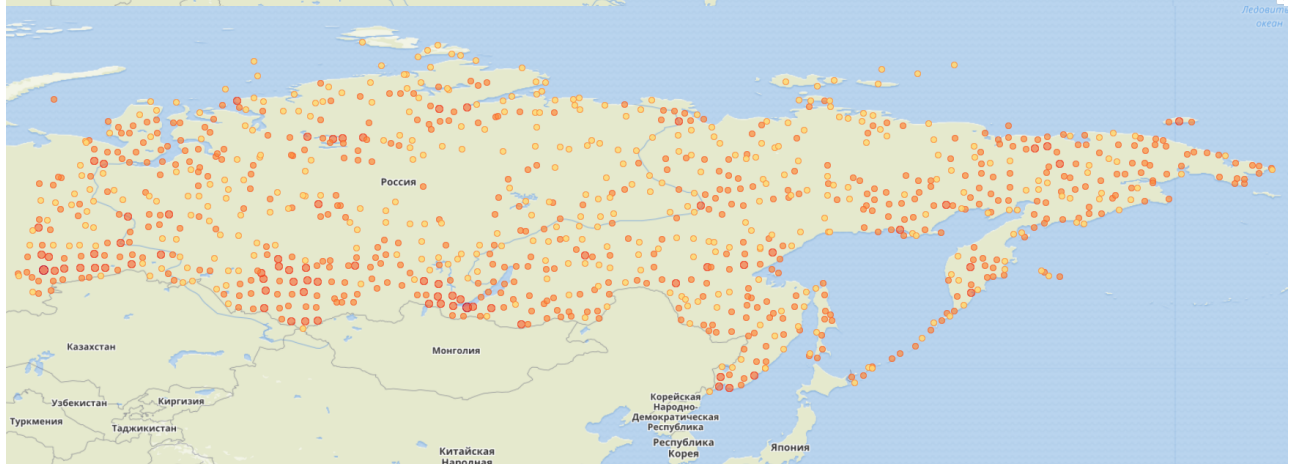
*Vaccinium* L.




*Carex* L.

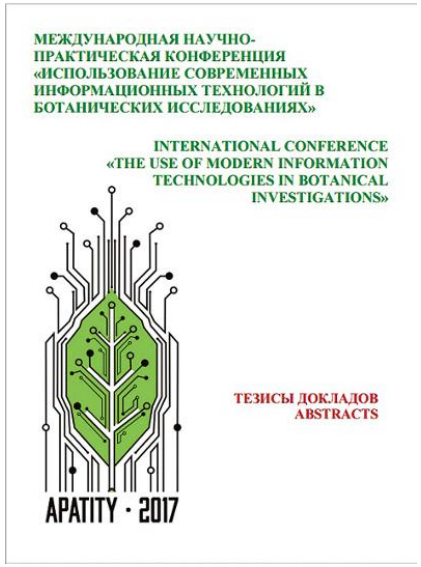



*Salix* L.



# 2017 г

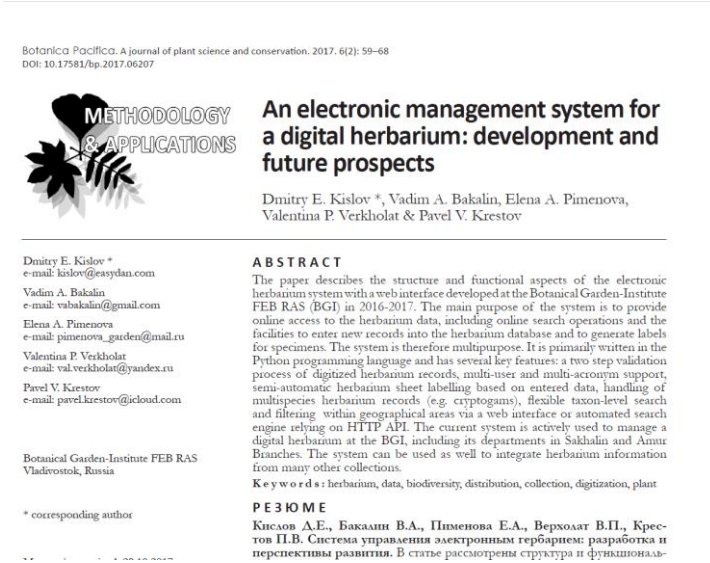
**Meeting «The use of modern information technologies in botanical investigations» (Apatity, Murmansk Province, March, 28–31, 2017)**




**Launch of the Moscow Digital Herbarium**

**The start of iNaturalist's rise in popularity in Russia**

**The Botanical Garden-Institute of the Far Eastern Branch of the Russian Academy of Sciences presented an electronic management system for the digital herbarium**


Botanica Pacifica. A journal of plant science and conservation. 2017. 6(2): 59–68
DOI: 10.17581/bp.2017.06207

METHODOLOGY & APPLICATIONS

An electronic management system for a digital herbarium: development and future prospects

Dmitry E. Kislov *, Vadim A. Bakalin, Elena A. Pimenova, Valentina P. Verkholat & Pavel V. Krestov

Dmitry E. Kislov *
e-mail: kislov@easydan.com

Vadim A. Bakalin
e-mail: vabakalin@gmail.com

Elena A. Pimenova
e-mail: pimenova_garden@mail.ru

Valentina P. Verkholat
e-mail: val.verkholat@yandex.ru

Pavel V. Krestov
e-mail: pavel.krestov@icloud.com

Botanical Garden-Institute FEB RAS
Vladivostok, Russia

* corresponding author

ABSTRACT

The paper describes the structure and functional aspects of the electronic herbarium system with a web interface developed at the Botanical Garden-Institute FEB RAS (BGI) in 2016-2017. The main purpose of the system is to provide online access to the herbarium data, including online search operations and the facilities to enter new records into the herbarium database and to generate labels for specimens. The system is therefore multipurpose. It is primarily written in the Python programming language and has several key features: a two step validation process of digitized herbarium records, multi-user and multi-acrounm support, semi-automatic herbarium sheet labelling based on entered data, handling of multispecies herbarium records (e.g. cryptogams), flexible taxon-level search and filtering within geographical areas via a web interface or automated search engine relying on HTTP API. The current system is actively used to manage a digital herbarium at the BGI, including its departments in Sakhalin and Amur Branches. The system can be used as well to integrate herbarium information from many other collections.

Keywords: herbarium, data, biodiversity, distribution, collection, digitization, plant

РЕЗЮМЕ

**Кислов Д.Е., Бакалин В.А., Пименова Е.А., Верхолат В.П., Крестов П.В. Система управления электронным гербарием: разработка и перспективы развития.** В статье рассмотрены структура и функциональ-

# *Pinus + Larix*

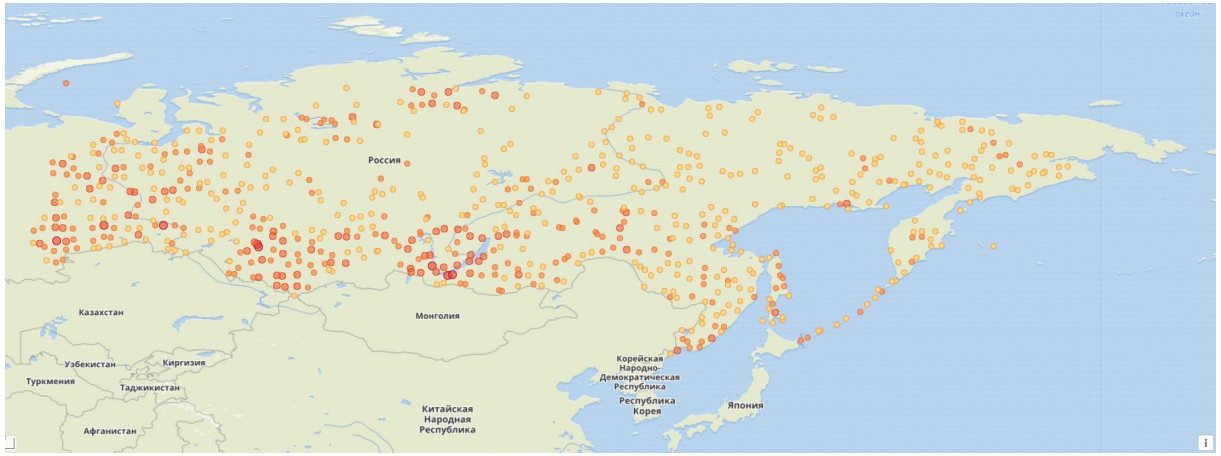
before 2017







# 2026




2026



# *Pinus* L.

excl. Inaturalist observstion




incl. Inaturalist observstion




# *Hordeum jubatum* L.

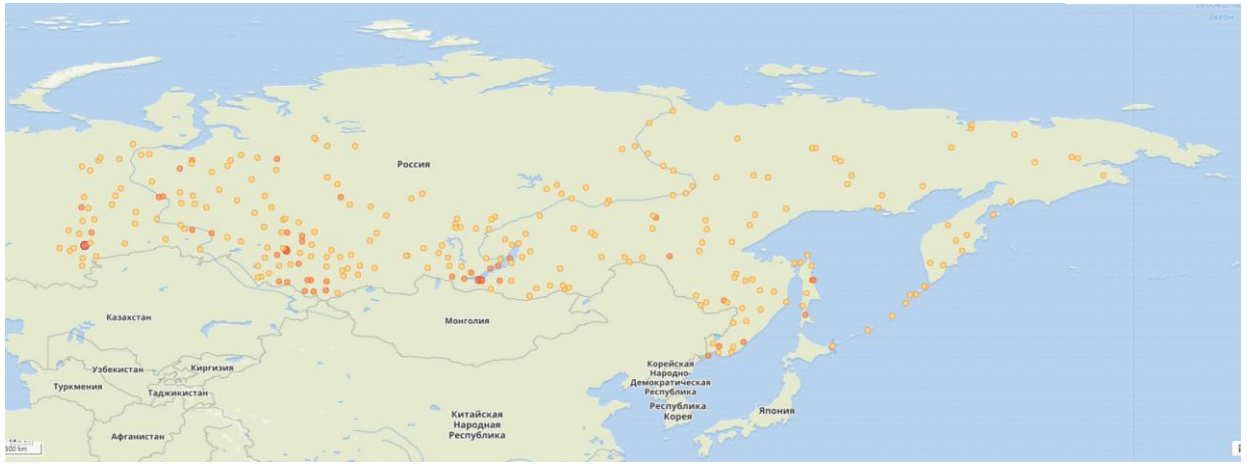
excl. Inaturalist observstion



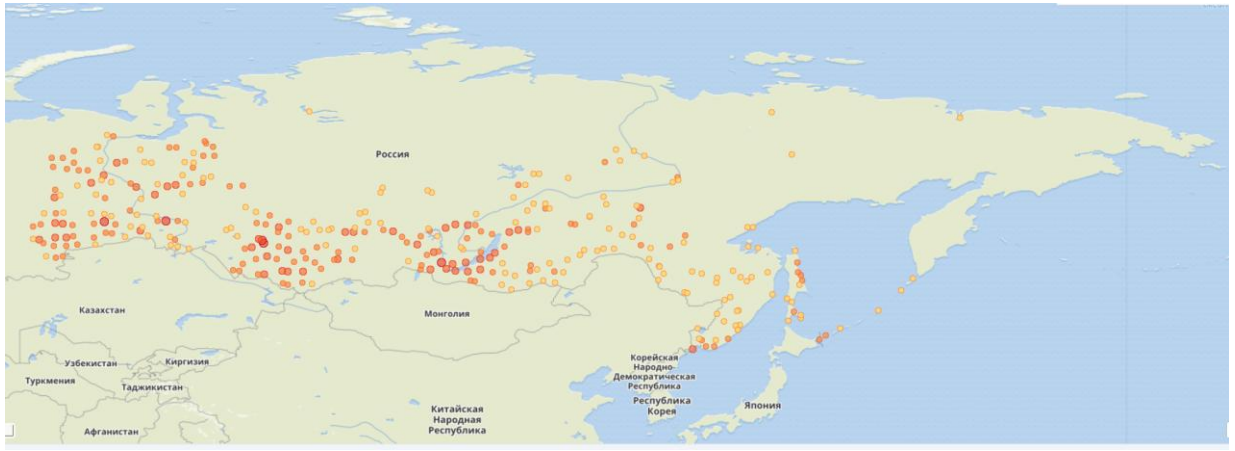

incl. Inaturalist observstion



# *Pinus* L.

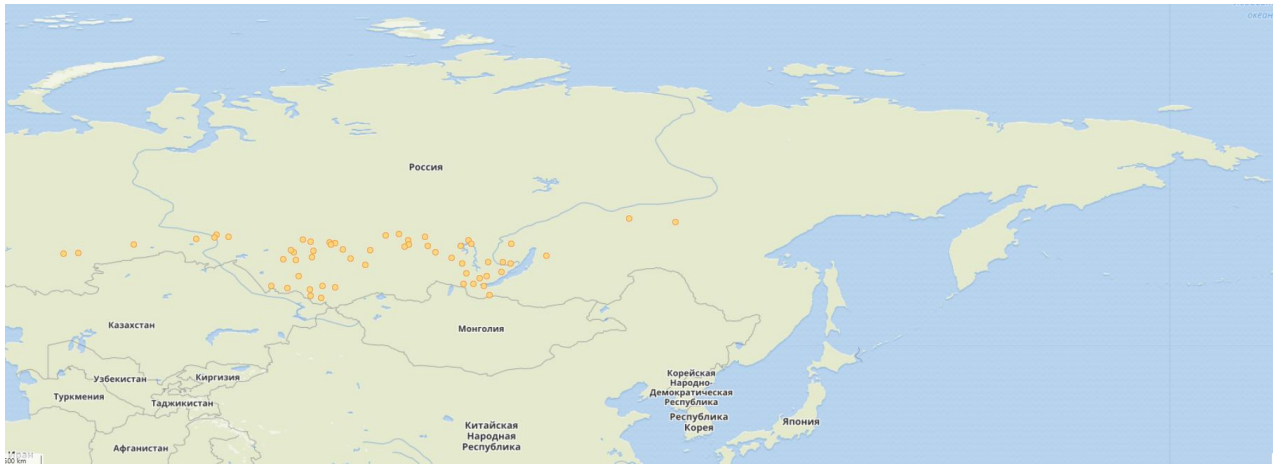



Before 2017
Total occurrences 4340
Inaturalist observationa 1130 (26%)




2017-2026
Total occurrences 29086
Inaturalist observationa 26453 (90%)

# *Orchis* Tourn. ex L.




Before 2017
Total occurrences 198
Inaturalist observationa 36 (18%)




2017-2026
Total occurrences 884
Inaturalist observationa 875 (98%)

# *Botanical Garden Institute FEB RAS (Vladivostok)*

- *169.5 hectares of total area*
- *155 hectares of undisturbed forests*
- *535 native plant species within the forest area*
- *5000+ species and varieties of plants in the collection*

- *two geographically remote branches: the Amur Branch located in Blagoveshchensk City and the Sakhalin Branch located in Yuzhno-Sakhalinsk City*

Vladivostok



Blagoveshchensk



Yuzhno-Sakhalinsk



# *Herbarium of the Botanical Garden Institute (VBGI)*

- The Herbarium at the BGI in Vladivostok (VBGI) was established in 1972.
- A few specimens stored in VBGI date from the 19th century, but by far the majority of existing records are from the 20th and 21st centuries.
- Since 2006, BGI incorporated two geographically remote branches: the Amur Branch located in Blagoveshchensk City and the Sakhalin Branch located in Yuzhno-Sakhalinsk City with their herbarium collections coded as ABGI and SAKH respectively. The herbarium of the AB BGI contains over 28000, and that of SB BGI more than 30000 specimens of higher vascular plants
- Today, this three herbaria houses about 170 000 specimens. Of these, 157 299 have been recorded in the database, all have coordinates.
- The data are being verified and are planned for publication in GBIF.






# *Herbarium of the Botanical Garden Institute (VBGI): collection of cryptogams*

- The BGI houses one of the largest collection of cryptogams in Russian and the largest collection of bryophytes in the Russian Far East
- The cryptogam collection in Vladivostok was established in 2000.
- Currently, the approximate number of lichen specimens in the VBGI is 15000, whereas the bryophytes collections exceed 35000 specimens, with over 25000 belonging to the liverworts.
- The cryptogam collection in AB BGI was established at the end of 1990s and consisted of mostly fungi (mainly hyphomycetes and basidial agaricoids), and, to a lesser extent bryophytes (mostly mosses).
- The cryptogam collection in the Sakhalin Branch of the BGI was established in 1991 and consisted of mostly lichens.

# *Electronic management system for the first digital herbarium in the Russian Far East (e-Herbarium)*

The main purpose of the system:

- to provide online access to the herbarium data
- to generate labels for specimens
- the facilities to enter new records into the herbarium database
- advanced online search operation

Key features:

- handling of multispecies herbarium records (e.g. cryptogams)
- flexible taxon-level search and filtering within geographical areas via a web interface or automated search engine relying on HTTP API.

# Digital Herbarium of the Botanical Garden-Institute (VBGI)

Botanical Garden-Institute FEB RAS

Rus • Eng
Main • Mail us

About us | What we do | Plant world | For visitors | For volunteers | Links




## Digital Herbarium of the Botanical Garden-Institute (VBGI)

Read the Documentation

Find | Clear

Amount | herbarium acronym | herbarium subdivision | Order by

Family:
Select Family

Genus:
Select Genus

Species epithet:

Search within synonyms
Search within additional species

Code:

Collector(s):
Text field

Identifier(s):
Text field

Country:
Select Country

Place of collection:
Place of collection

Collection start date:
Collection start date

Collection end date:
collection end date

Common info | Details | Map | Automatization tools

### Search results:

Page 1 of 7865 Next

Total: 157299

| Код образца | Species | Collection date | Collector(s) | Identifier(s) |
|---|---|---|---|---|
| VBGI181669 | Gnaphalium pilulare Wahlenb. | 2008-09-10 | Lapenko V.T. | Lapenko V.T. |
| VBGI181668 | Eleocharis yokoscensis (Franch. & Sav.) Tang & F.T.Wang | 2008-09-11 | Lapenko V.T. | Lapenko V.T. |
| VBGI181667 | Taraxacum stenolobum Stschegl. | 2008-07-07 | Lapenko V.T. | Barkalov V.Yu. |
| VBGI181666 | Amsinckia micrantha Suskd. | 2008-05-18 | Lapenko V.T. | Barkalov V.Yu. |
| VBGI181665 | Cardamine lyrata Bunge | 2008-06-02 | Lapenko V.T., Polit'ko V.F. | Barkalov V.Yu. |
| VBGI181664 | Aconogonon valerii (A. Skvorts.) Sojak | 2008-08-17 | Lapenko V.T. | Lapenko V.T. |
| VBGI181663 | Gnaphalium tranzschelii Kirp. | 2008-08-17 | Lapenko V.T. | Barkalov V.Yu. |
| VBGI181662 | Aster novi-belgii L. | 2008-08-17 | Lapenko V.T. | Barkalov V.Yu. |
| VBGI181661 | Fumaria officinalis L. | 2008-06-08 | Lapenko V.T. | Lapenko V.T. |
| VBGI181660 | Carex korshinskyi Kom. | 2008-06-08 | Lapenko V.T. | Barkalov V.Yu. |
| VBGI181659 | Plantago media L. | 2008-06-08 | Lapenko V.T. | Barkalov V.Yu. |
| VBGI181658 | Sisyrinchium montanum Greene | 2008-06-08 | Lapenko V.T. | Lapenko V.T. |
| VBGI181657 | Nonea rossica Steven | 2008-06-08 | Lapenko V.T. | Lapenko V.T. |
| VBGI181656 | Pimpinella saxifraga L. | 2008-06-28 | Lapenko V.T. | Barkalov V.Yu. |




Herbarium
of the Botanical Garden-Institute FEB RAS (VBGI)
690024, Russia, Vladivostok, Makovskogo, st. 142

ERICACEAE
*Pyrola incarnata* (DC.) Freyn

**Country:** Russia **Region:** Khabarovsky region
**Place:** Valley of the Yarap River, a poplar-spruce forest in the valley on the river's terrace
**Altitude, m. a.s.l.:** 550
**Coordinates:** LAT= 50.27826°N, LON=134.70892°E
**Date:** 31 Jul 2016
**Collector(s):** Krestov P.V.
**Identifier(s):** Krestov P.V.

ID: 139904/230

http://botsad.ru/hitem/230

02:16 ◂ Камера LTE

**Botanical Garden-Institute FEB RAS**

**Уникальный код образца:** 230 Сообщить об ошибке

**Инвентарный номер:** 139904

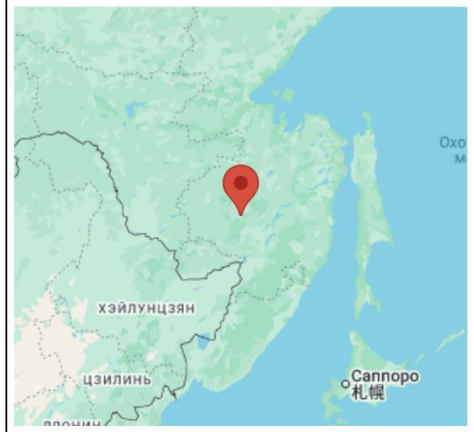
**Семейство:** Ericaceae

**Род:** *Pyrola*

**Вид:** *Pyrola incarnata* (DC.) Freyn

**Координаты сбора:**

**Широта:** 50.27826°, **Долгота:** 134.70892°




**Страна:** Россия

**Регион:** Хабаровский край

**Район:** Хабаровский район

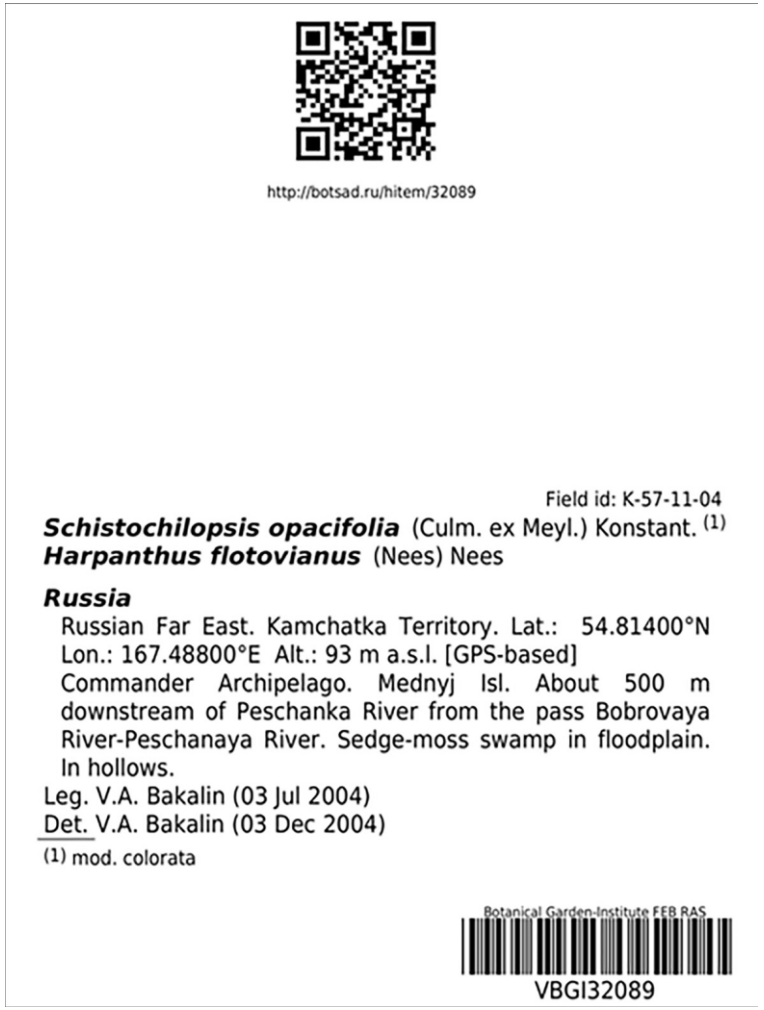
**Дополнительно:** Долина реки Ярап, долинный

**Высота:** 550

cy.vbgi142.beget.tech

# *Different sampling protocols: single- and multispecies*

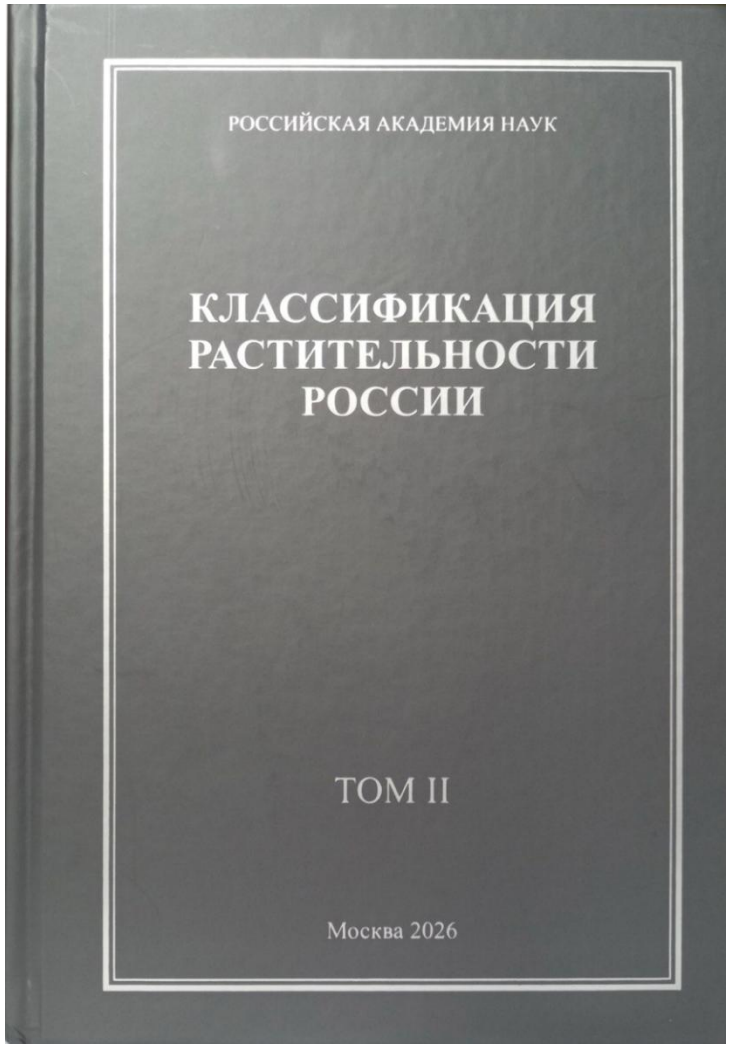
- Each label is supplied with a QR-code that encodes permanent URL of the current herbarium sheet.
- Working with the herbarium sheet one can decode the qr-link via a mobile device and obtain the full available information regarding the collection.
- For multispecies herbarium collections, the system can generate labels of another type – an envelope label. Such types of labels are designed to be printed on the paper of A4 format presuming that the latter will be folded into an envelope containing the specimens.
- When a user is marked as an “editor of multispecies collections“, then that user has an additional panel at the bottom of the edit web-page of the herbarium record. This panel allows the entry of information about additional species that belong to the collection.



# *Herbaria that make use of the e-Herbarium system*

- Botanical Garden-Institute FEB RAS (VBGI) (Vladivostok)
- Amurskii Branch of the BGI (ABGI) (Blagoveshchensk)
- Sakhalin Branch of the BGI (SAKH) (Yuzhno-Sakhalinsk)
- Kamchatcka Branch of the Pacific Geographical Institute FEB RAS (KAM) (Petropavlovsk-Kamchatsky)
- Sikhote-Alin Biosphere Nature Reserve (SABZ) (Terney settlement)
- Institute of Marine Geology and Geophysics FEB RAS (SAK) (Yuzhno-Sakhalinsk)

# *Additional biodiversity data sources from the Botanical Garden Institute (VBGI)*




*Classification of Vegetation of Russia. Vol. II was published this year*

- 6000 Relevés from the Russian Far East

- approach for tree species recognition from ultra-high-resolution UAV imagery, based on convolutional neural network (CNN) algorithms, has been developed using the example of mixed coniferous–broadleaved forests with *Pinus koraiensis* and *Abies holophylla*. *The algorithm can be applied to species mapping* (Korznikov et al., 2023).

# *What could help, in my opinion, to speed up data gathering in Asian Russia*

New ways to speed up data gathering in the field:

- Algorithms for the selection of areas for field researches that exclude subjectivity, road effects and gravitational pull of hotspots.
- Wider using of devices that can automatically or semi-automatically take geotagged photos, like action cameras and drones. And AI tools to process such kind of  raw data.
- App that tells when the area has a critical shortage of data.


*Thank you for your attention*