Electronic resources and patterns of the Russian flora

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Viktor Chepinoga (Novosibirsk & Irkutsk), Denis Sandanov (Ulan-Ude)

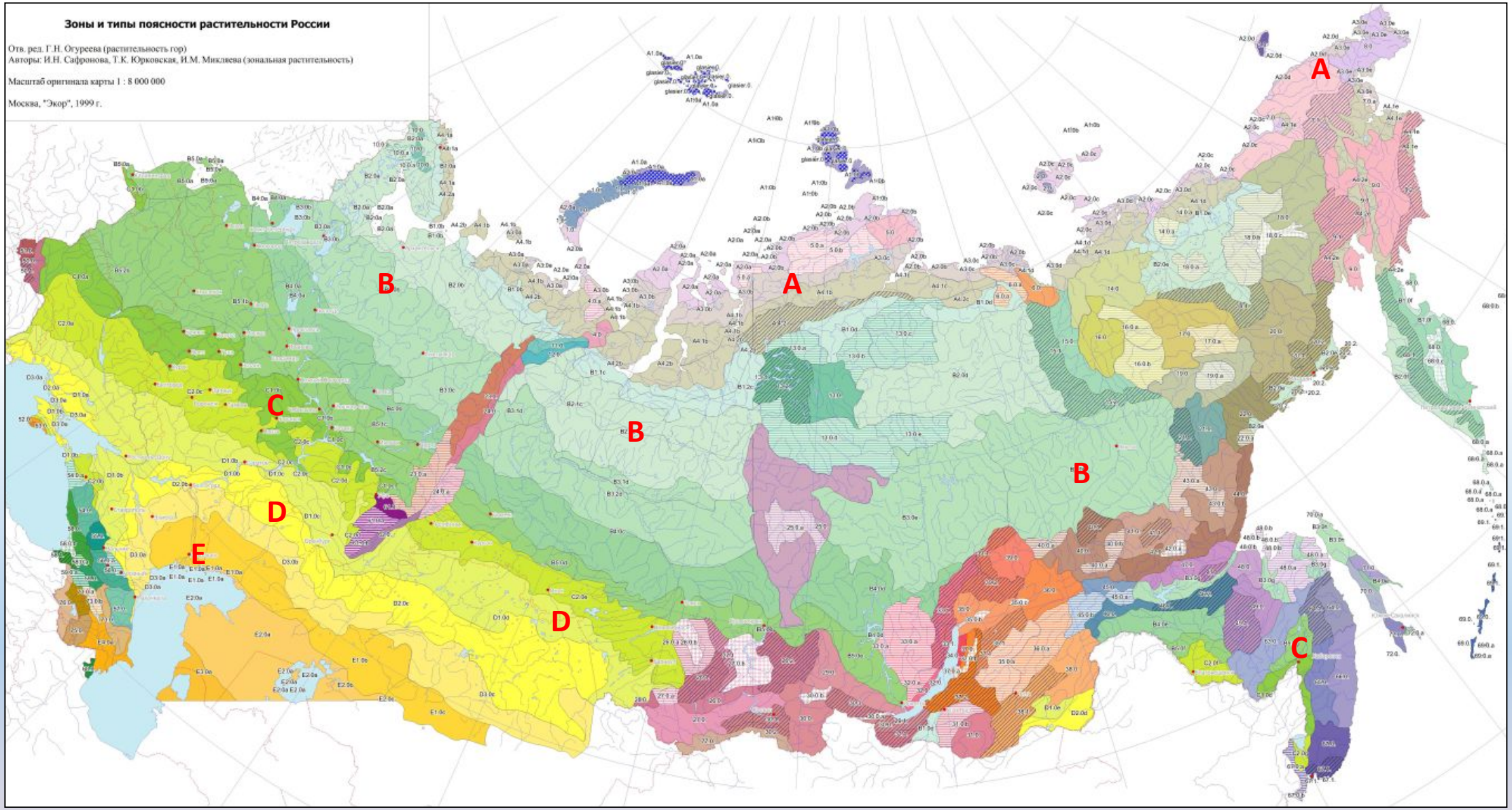
General Information about Russia

1. Geography
2. Biomes
3. Resources

Area 17,125,191 km² (1st), 23% in Europe and 76% in Asia

Population 146,748,590 people (9th)

Subdivisions 85 first-level administrative units



A – tundra
B – taiga
C – hardwoods
D – steppe
E – deserts

Main vegetation types of Russia (zonal biomes)

Source: Ogureeva et al. (1999)

Herbaria of the world: 396M specimens

Herbaria:

- World: 3,426
- Russia: 124

Specimens:

- World: 396,204,891
- Russia: 16,175,934

Source: Index Herbariorum (2021)
http://sweetgum.nybg.org/science/ih/

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

Top herbarium collections of Russia

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

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

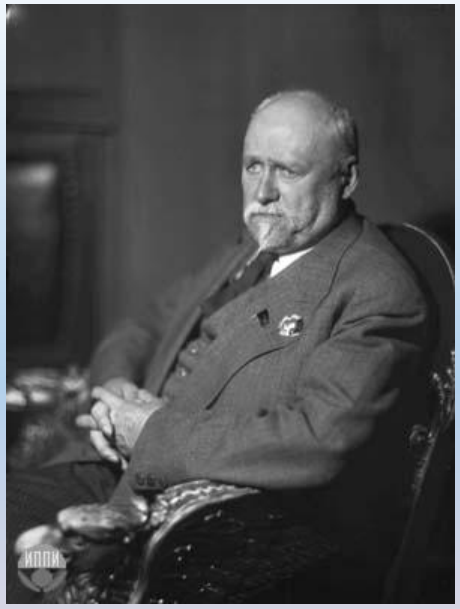
Standard Published Floras

1. Complete floras
2. Checklists by Czerepanov
3. Basic regional floras

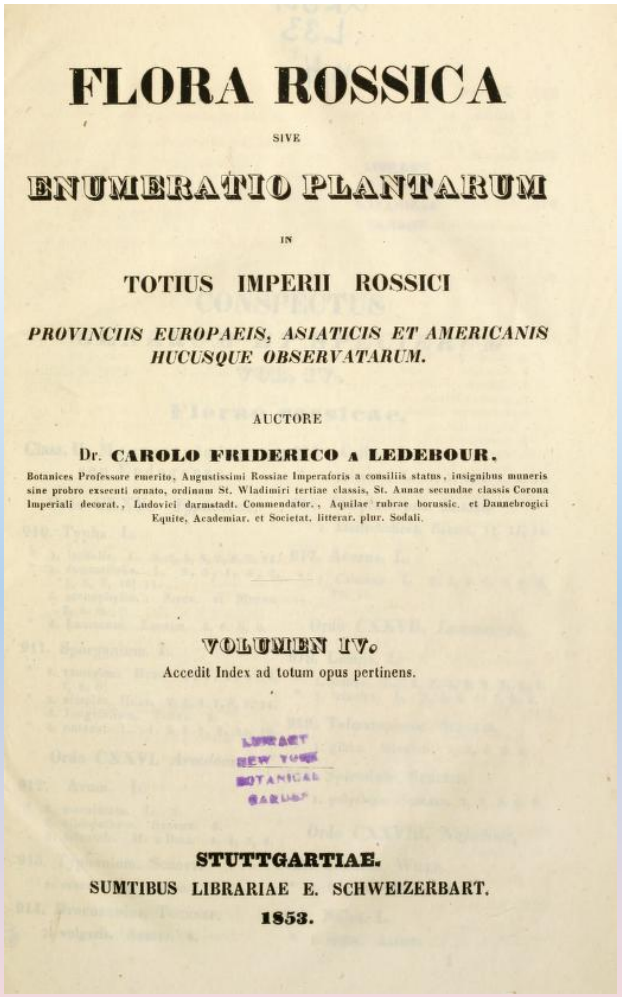
Two complete Russian floras in 200 years

“Flora Rossica” (1842–1853)
written by Ledebour

“Flora URSS” (1934–1964)
edited by Komarov



“Flora Rossica” (1842–1853) by Ledebour



FLORA ROSSICA

SIVE

ENUMERATIO PLANTARUM

IN

TOTIUS IMPERII ROSSICI

PROVINCIIS EUROPAEIS, ASIATICIS ET AMERICANIS HUCUSQUE OBSERVATARUM.

AUCTORE

Dr. **CAROLO FRIDERICO a LEDEBOUR.**

Botanices Professore emerito, Augustissimi Rossiae Imperatoris a consiliis status, insignibus muneris sine probro exsecuti ornato, ordinum St. Wladimiri tertiae classis, St. Annae secundae classis Corona Imperiali decorat., Ludovici darmstadt. Commendator., Aquilae rubrae borussic. et Dannebrogici Equite, Academiar. et Societat. litterar. plur. Sodali.

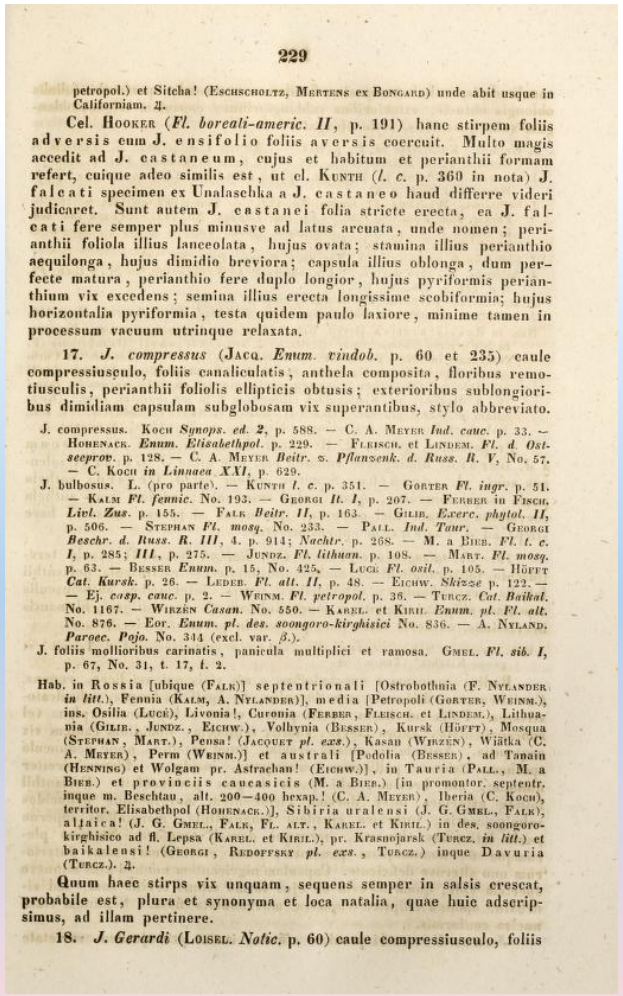
VOLUMEN IV.

Accedit Index ad totum opus pertinens.

STUTTGARTIAE.

SUMTIBUS LIBRARIAE E. SCHWEIZERBART.

1853.



229

petropol.) et Sitcha! (Eschscholtz, Mertens ex Bongard) unde abit usque in Californiam. ♃.

Cel. Hooker (*Fl. boreali-americ. II*, p. 191) hanc stirpem foliis adversis cum J. ensifolio foliis aversis coercuit. Multo magis accedit ad J. castaneum, cujus et habitum et perianthii formam refert, cuique adeo similis est, ut cl. Kunth (*l. c.* p. 360 in nota) J. falcati specimen ex Unalaschka a J. castaneo haud differre videri judicaret. Sunt autem J. castanei folia stricte erecta, ea J. falcati fere semper plus minusve ad latus arcuata, unde nomen; perianthii foliola illius lanceolata, hujus ovata; stamina illius perianthio aequilonga, hujus dimidio breviora; capsula illius oblonga, dum perfecte matura, perianthio fere duplo longior, hujus pyriformis perianthium vix excedens; semina illius erecta longissime scobiformia; hujus horizontalia pyriformia, testa quidem paulo laxiore, minime tamen in processum vacuum utrinque relaxata.

17. *J. compressus* (Jacq. *Enum. vindob.* p. 60 et 235) caule compressiusculo, foliis canaliculatis, anthela composita, floribus remotiusculis, perianthii foliolis ellipticis obtusis; exterioribus sublongioribus dimidiam capsulam subglobosam vix superantibus, stylo abbreviato.

J. compressus. Koch *Synops. ed. 2*, p. 588. — C. A. Meyer *Ind. cauc.* p. 33. — Hohenack. *Enum. Elisabethpol.* p. 229. — Fleisch. et Lindem. *Fl. d. Ostseeprov.* p. 128. — C. A. Meyer *Beitr. z. Pflanzenk. d. Russ. R. V*, No. 57. — C. Koch *in Linnaea XXI*, p. 629.

J. bulbosus. L. (pro parte). — Kunth *l. c.* p. 351. — Gorter *Fl. ingr.* p. 51. — Kalm *Fl. fennic.* No. 193. — Georgi *It. I*, p. 207. — Ferber in Fisch. *Livl. Zus.* p. 155. — Falk *Beitr. II*, p. 163. — Gilib. *Exerc. phytol. II*, p. 506. — Stephan *Fl. mosq.* No. 233. — Pall. *Ind. Taur.* — Georgi *Beschr. d. Russ. R. III*, 4. p. 914; *Nachtr.* p. 268. — M. a Bieb. *Fl. t. c. I*, p. 285; *III*, p. 275. — Jundz. *Fl. lithuan.* p. 108. — Mart. *Fl. mosq.* p. 63. — Besser *Enum.* p. 15, No. 425. — Luce *Fl. osil.* p. 105. — Höpft *Cat. Kursk.* p. 26. — Ledeb. *Fl. alt. II*, p. 48. — Eichw. *Skizze* p. 122. — — Ej. *casp. cauc.* p. 2. — Weinm. *Fl. petropol.* p. 36. — Turcz. *Cat. Baikal.* No. 1167. — Wirzén *Casan.* No. 550. — Karel. et Kiril. *Enum. pl. Fl. alt.* No. 876. — Eor. *Enum. pl. des. soongoro-kirghisici* No. 836. — A. Nyland. *Paroec. Pojo.* No. 344 (excl. var. *β.*).

J. foliis mollioribus carinatis, panicula multiplici et ramosa. Gmel. *Fl. sib. I*, p. 67, No. 31, t. 17, f. 2.

Hab. in Rossia [ubique (Falk)] septentrionali [Ostrobothnia (F. Nylander *in litt.*), Fennia (Kalm, A. Nylander)], media [Petropoli (Gorter, Weinm.), ins. Osilia (Luce), Livonia!, Curonia (Ferber, Fleisch. et Lindem.), Lithuania (Gilib., Jundz., Eichw.), Volhynia (Besser), Kursk (Höpft), Mosqua (Stephan, Mart.), Penza! (Jacquet *pl. exs.*), Kasan (Wirzén), Wiätka (C. A. Meyer), Perm (Weinm.)] et australi [Podolia (Besser), ad Tanain (Henning) et Wolgam pr. Astrachan! (Eichw.)], in Tauria (Pall., M. a Bieb.) et provinciis caucasicis (M. a Bieb.) [in promontor. septentr. inque m. Beschtau, alt. 200—400 hexap.! (C. A. Meyer), Iberia (C. Koch), territor. Elisabethpol (Hohenack.)], Sibiria uralensi (J. G. Gmel., Falk), altaica! (J. G. Gmel., Falk, Fl. alt., Karel. et Kiril.) in des. soongoro-kirghisico ad fl. Lepsa (Karel. et Kiril.), pr. Krasnojarsk (Turcz. *in litt.*) et baikalensi! (Georgi, Redoffsky *pl. exs.*, Turcz.) inque Davuria (Turcz.). ♃.

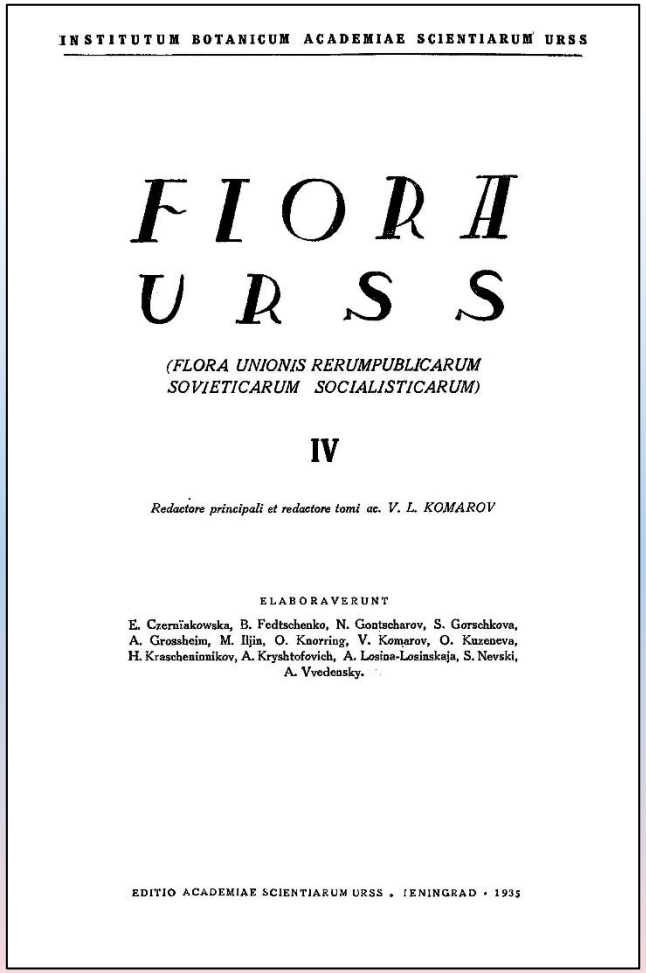
Quum haec stirps vix unquam, sequens semper in salsis crescat, probabile est, plura et synonyma et loca natalia, quae huic adscripsimus, ad illam pertinere.

18. *J. Gerardi* (Loisel. *Notic.* p. 60) caule compressiusculo, foliis

- 6,522 species
- 1,139 genera
- 146 families
- 4 volumes
- In Latin

Written by Carl Friedrich von Ledebour, a German botanists employed by Russia.

“Flora URSS” (1934–1964) by 92 authors



INSTITUTUM BOTANICUM ACADEMIAE SCIENTIARUM URSS

FLORA URSS

(FLORA UNIONIS RERUMPUBLICARUM SOVIETICARUM SOCIALISTICARUM)

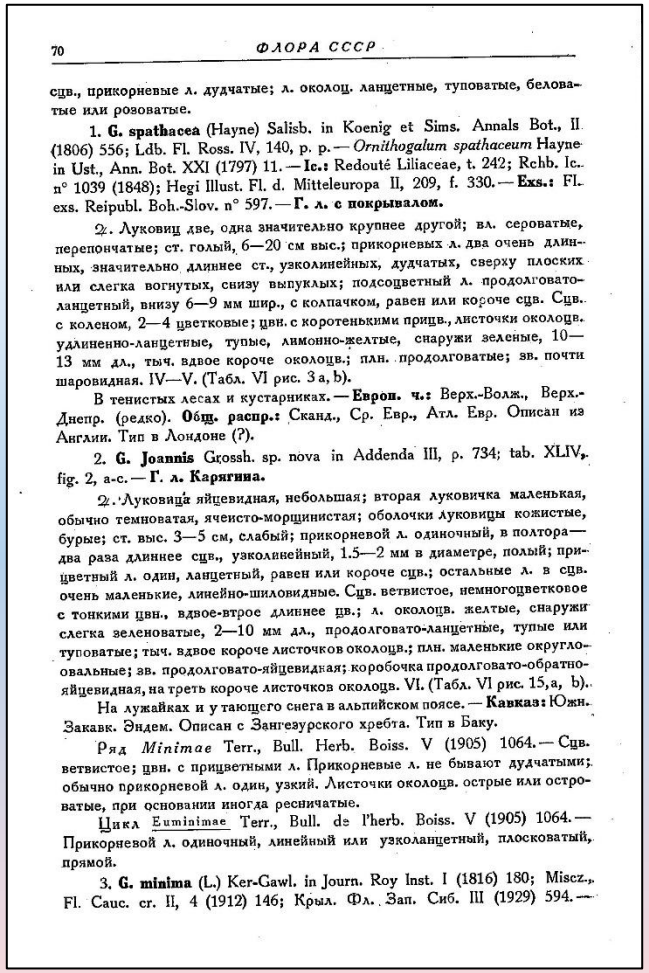
IV

Redactore principali et redactore tomi ac. V. L. KOMAROV

ELABORAVERUNT

E. Czernjakowska, B. Fedtschenko, N. Gontscharov, S. Gorschkova, A. Grossheim, M. Iljin, O. Knorring, V. Komarov, O. Kuzeneva, H. Krascheninnikov, A. Kryshtofovich, A. Losina-Losinskaja, S. Nevski, A. Vvedensky.

EDITIO ACADEMIAE SCIENTIARUM URSS . LENINGRAD . 1935



70 ФЛОРА СССР

цвв., прикорневые л. дудчатые; л. околоц. ланцетные, туповатые, беловатые или розоватые.

1. **G. spathacea** (Hayne) Salisb. in Koenig et Sims. Annals Bot., II (1806) 556; Ldb. Fl. Ross. IV, 140, p. p. — *Ornithogalum spathaceum* Hayne in Ust., Ann. Bot. XXI (1797) 11. — **Ic.:** Redouté Liliaceae, t. 242; Rchb. Ic. n° 1039 (1848); Hegi Illust. Fl. d. Mitteleuropa II, 209, f. 330. — **Exs.:** Fl. exs. Reipubl. Boh.-Slov. n° 597. — **Г. л. с покрывалом.**

2. Луковиц две, одна значительно крупнее другой; вл. сероватые, перепончатые; ст. голый, 6—20 см выс.; прикорневых л. два очень длинных, значительно длиннее ст., узколинейных, дудчатых, сверху плоских или слегка вогнутых, снизу выпуклых; подсоцветный л. продолговато-ланцетный, внизу 6—9 мм шир., с колпачком, равен или короче цв. Цвв. с коленом, 2—4 цветковые; цвн. с коротенькими прицв., листочки околоцв. удлиненно-ланцетные, тупые, лимонно-желтые, снаружи зеленые, 10—13 мм дл., тыч. вдвое короче околоцв.; плн. продолговатые; зв. почти шаровидная. IV—V. (Табл. VI рис. 3 a, b).

В тенистых лесах и кустарниках. — **Европ. ч.:** Верх.-Волж., Верх.-Днепр. (редко). **Общ. распр.:** Сканд., Ср. Евр., Атл. Евр. Описан из Англии. Тип в Лондоне (?).

2. **G. Joannis** Grossh. sp. nova in Addenda III, p. 734; tab. XLIV, fig. 2, a-c. — **Г. л. Карягина.**

2. Луковица яйцевидная, небольшая; вторая луковичка маленькая, обычно темноватая, ячеисто-морщинистая; оболочки луковицы кожистые, бурые; ст. выс. 3—5 см, слабый; прикорневой л. одиночный, в полтора—два раза длиннее цвв., узколинейный, 1.5—2 мм в диаметре, полый; прицветный л. один, ланцетный, равен или короче цвв.; остальные л. в цвв. очень маленькие, линейно-шиловидные. Цвв. ветвистое, немноголветковое с тонкими цвн., вдвое-втрое длиннее цв.; л. околоцв. желтые, снаружи слегка зеленоватые, 2—10 мм дл., продолговато-ланцетные, тупые или туповатые; тыч. вдвое короче листочков околоцв.; плн. маленькие округло-овальные; зв. продолговато-яйцевидная; коробочка продолговато-обратно-яйцевидная, на треть короче листочков околоцв. VI. (Табл. VI рис. 15, a, b).

На лужайках и у тающего снега в альпийском поясе. — **Кавказ:** Южн. Закавк. Эндем. Описан с Зангезурского хребта. Тип в Баку.

Ряд *Minimae* Terr., Bull. Herb. Boiss. V (1905) 1064. — Цвв. ветвистое; цвн. с прицветными л. Прикорневые л. не бывают дудчатыми; обычно прикорневой л. один, узкий. Листочки околоцв. острые или островатые, при основании иногда ресничатые.

Цикл Euminimae Terr., Bull. de l'herb. Boiss. V (1905) 1064. — Прикорневой л. одиночный, линейный или узколанцетный, плосковатый, прямой.

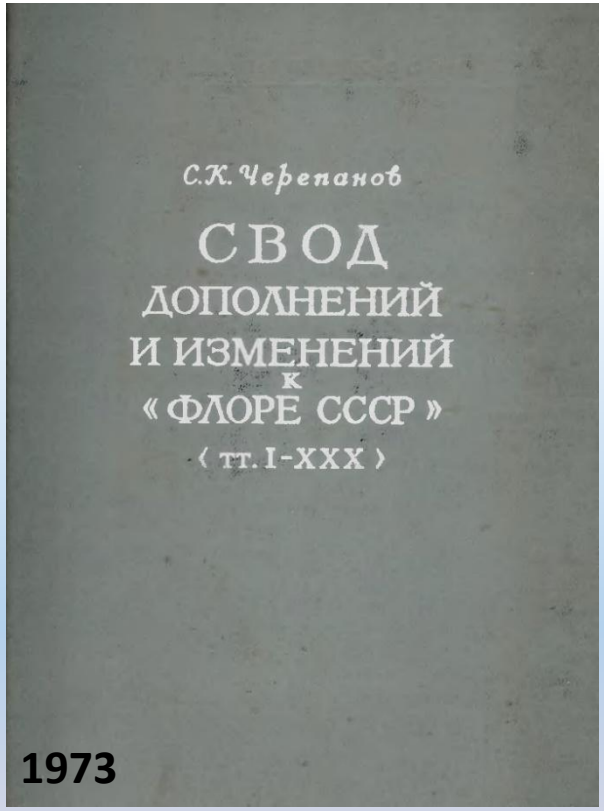
3. **G. minima** (L.) Ker-Gawl. in Journ. Roy Inst. I (1816) 180; Miscz., Fl. Cauc. cr. II, 4 (1912) 146; Крым. Фл., Зап. Сиб. III (1929) 594. —

- 17,520 species
- 1,676 genera
- 160 families
- 30 volumes
- In Russian

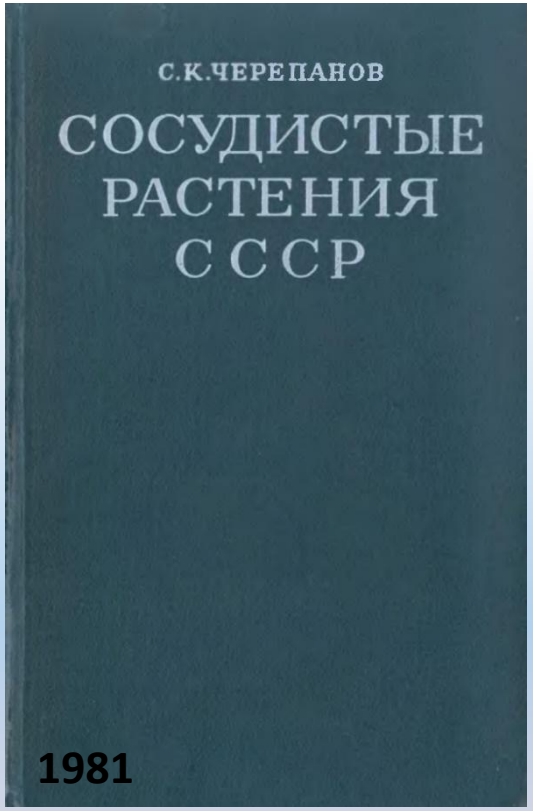
(translated into English)

Written by Komarov Institute, RAS staff members under the leadership of V.L. Komarov (Leningrad, USSR)

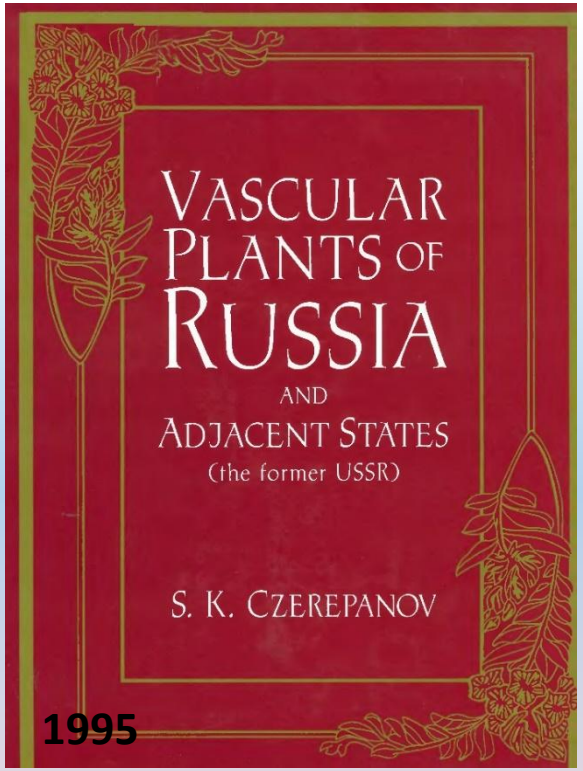
Checklists by Sergei Czerepanov

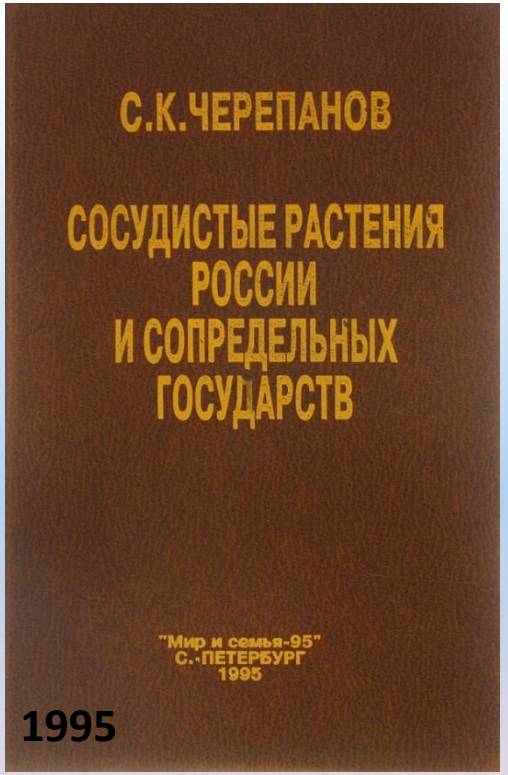


Additions to the “Flora URSS”:
4,745 species and subspecies added



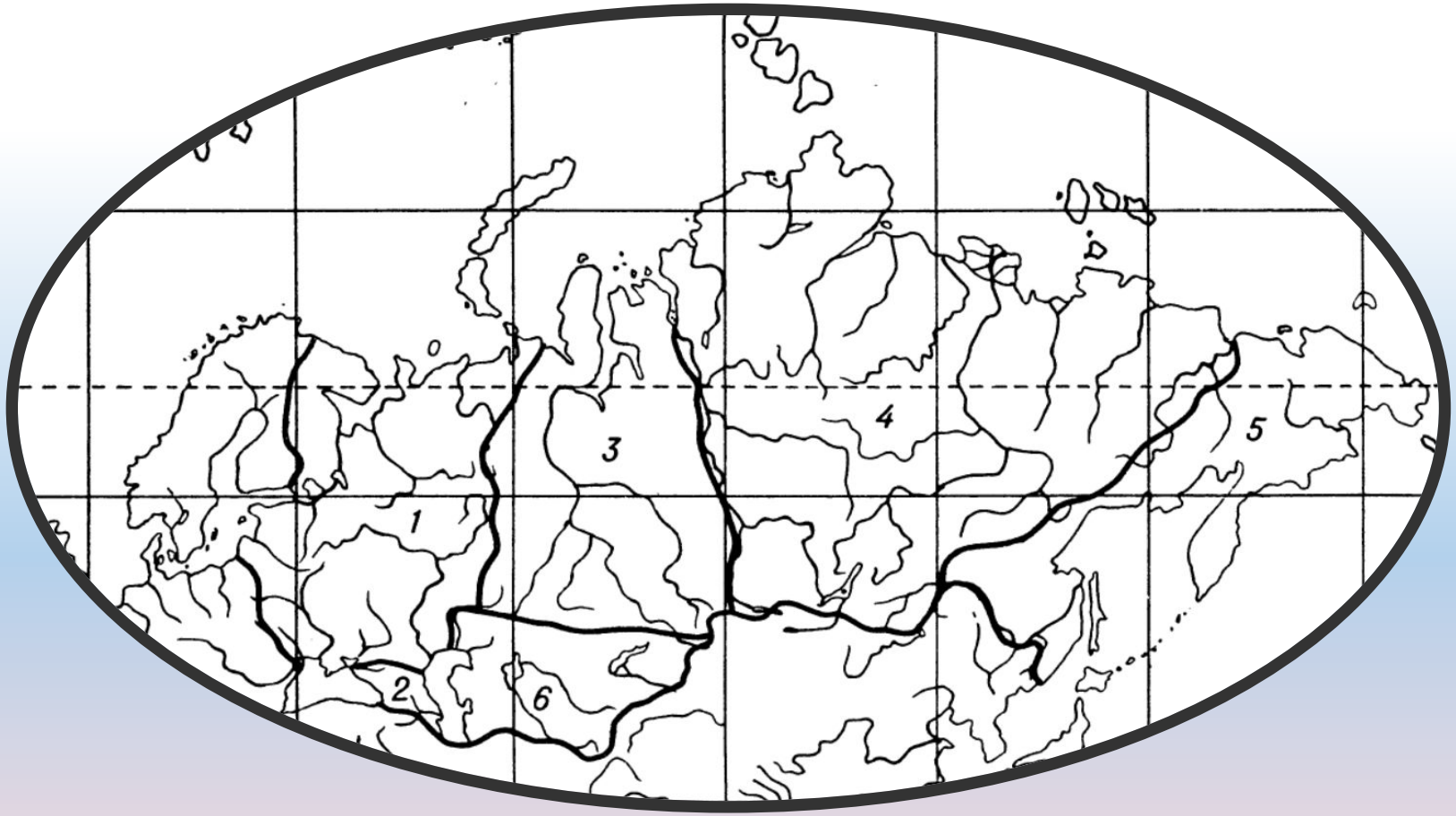
A checklist #1: **22,238 taxa**
21,463 species
330 subspecies
445 hybrids





A checklist #2: **23,397 taxa** (international and Russian editions)
21,770 species, 500 subspecies, 594 hybrids,
533 most widely cultivated species

Czerepanov (1995): a distribution map



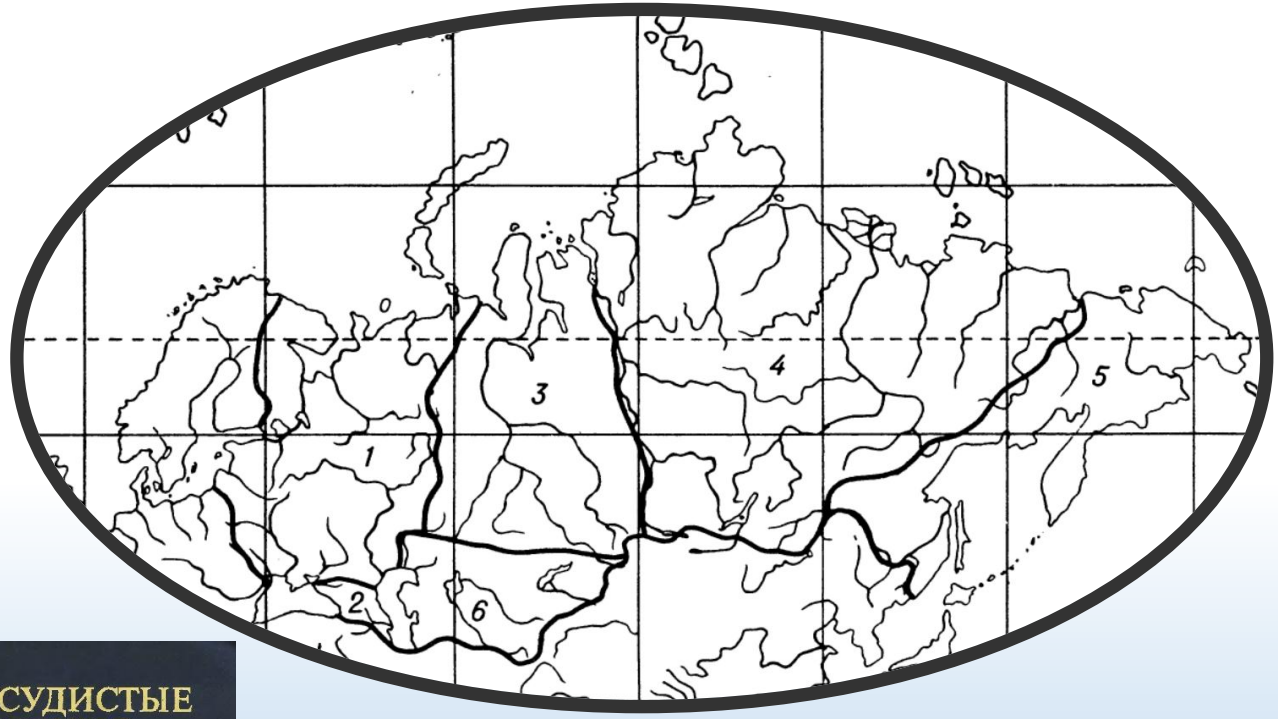
1. Eastern Europe
2. Caucasus
3. Western Siberia
4. Eastern Siberia
5. Far East
6. Middle Asia

3,4,5 – in Russia

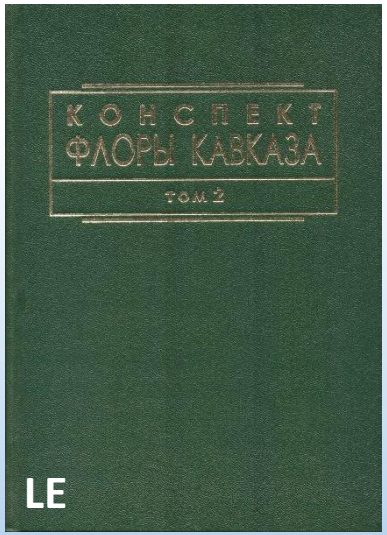
1,2 – partly in Russia

6 – outside Russia

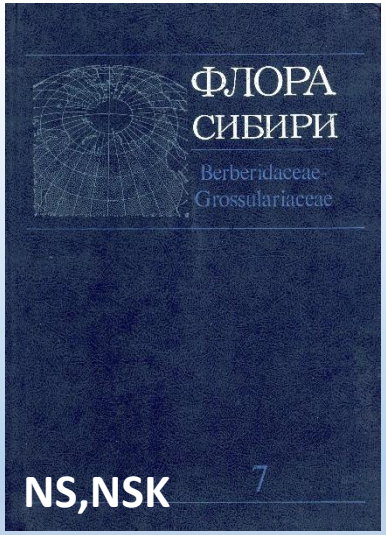
Five standard floras



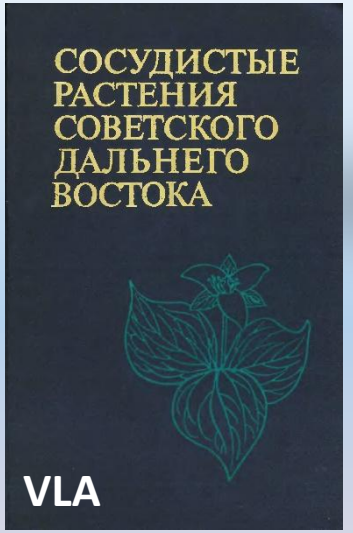
Area 1
1974-2004



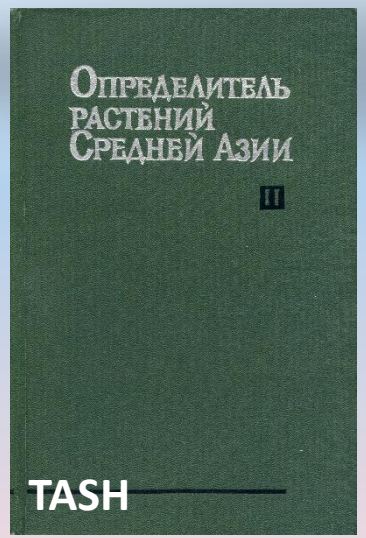
Area 2
2003-?



Areas 3,4
1988-2003



Area 5
1985-2006



Area 6
1968-1993

Санданов

No reliable data on the number of species in the flora of Russia

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On the Rostrum of the RAS Presidium | Published: February 2007

The Flora of Russia project (Russian federation)

R. V. Kamelin

Herald of the Russian Academy of Sciences **77**, 22–26(2007) | Cite this article

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RAS Corresponding Member R. V. Kamelin

Additional information

Original Russian Text © R.V. Kamelin, 2007, published in Vestnik Rossiiskoi Akademii Nauk, 2007, Vol. 77, No. 1, pp. 22–26.

- An estimate by Kamelin (2007) is 12,500 species

- An estimate 10,197

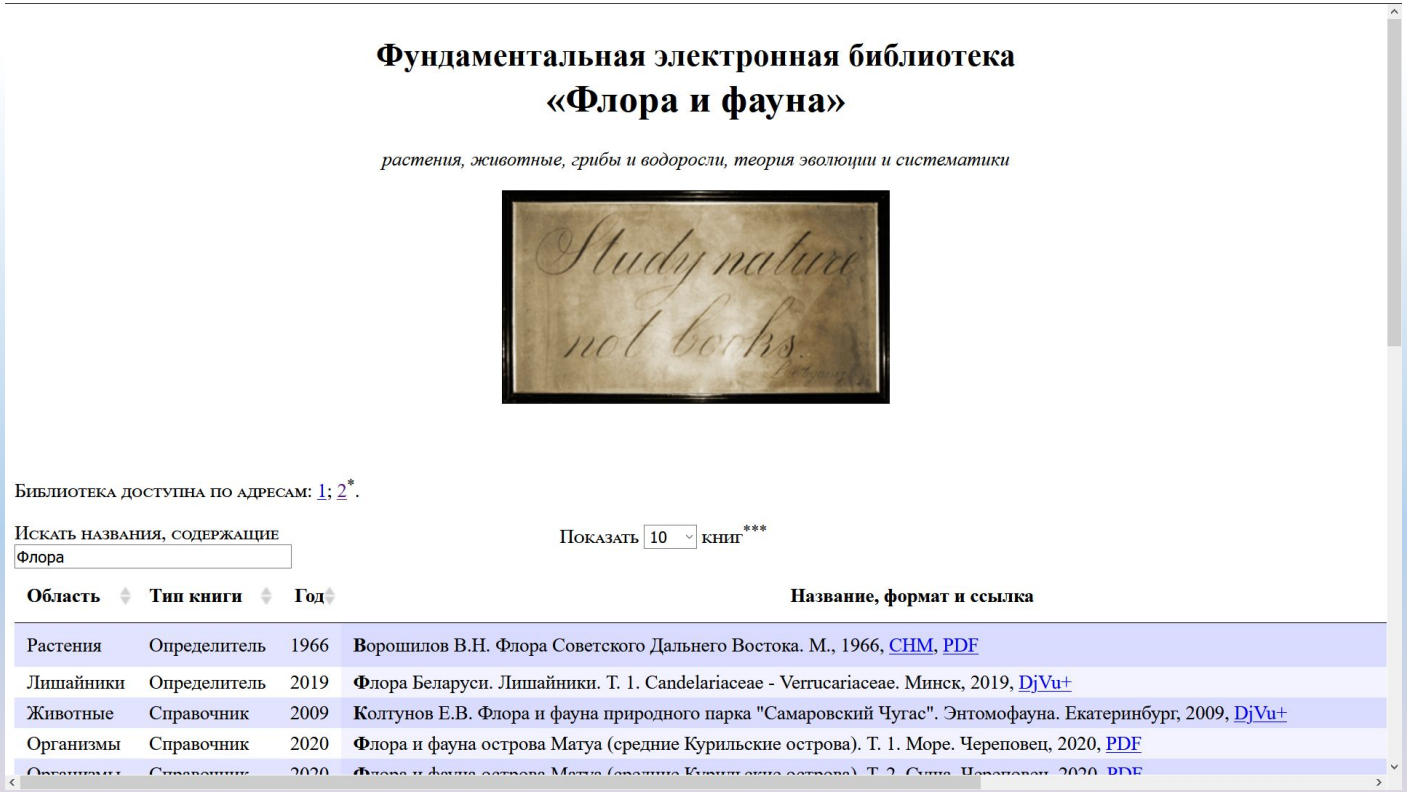
Source: Kamelin, R.V. The Flora of Russia project (Russian federation). *Her. Russ. Acad. Sci.* **77,** 22–26 (2007) https://doi.org/10.1134/S1019331607010042

Electronic resources

1. Digitized literature
2. Databased literature records
3. Digitized herbarium collections
4. Observations with photos

Biblioteka “Flora i Fauna”

- A library of the Russian-language scanned monographs and serials on biodiversity
- 14,321 volumes
- Initiated by Alexey Shipunov (currently in US)
- Available at http://herba.msu.ru/shipunov/school/sch-ru.htm
- Russian language only



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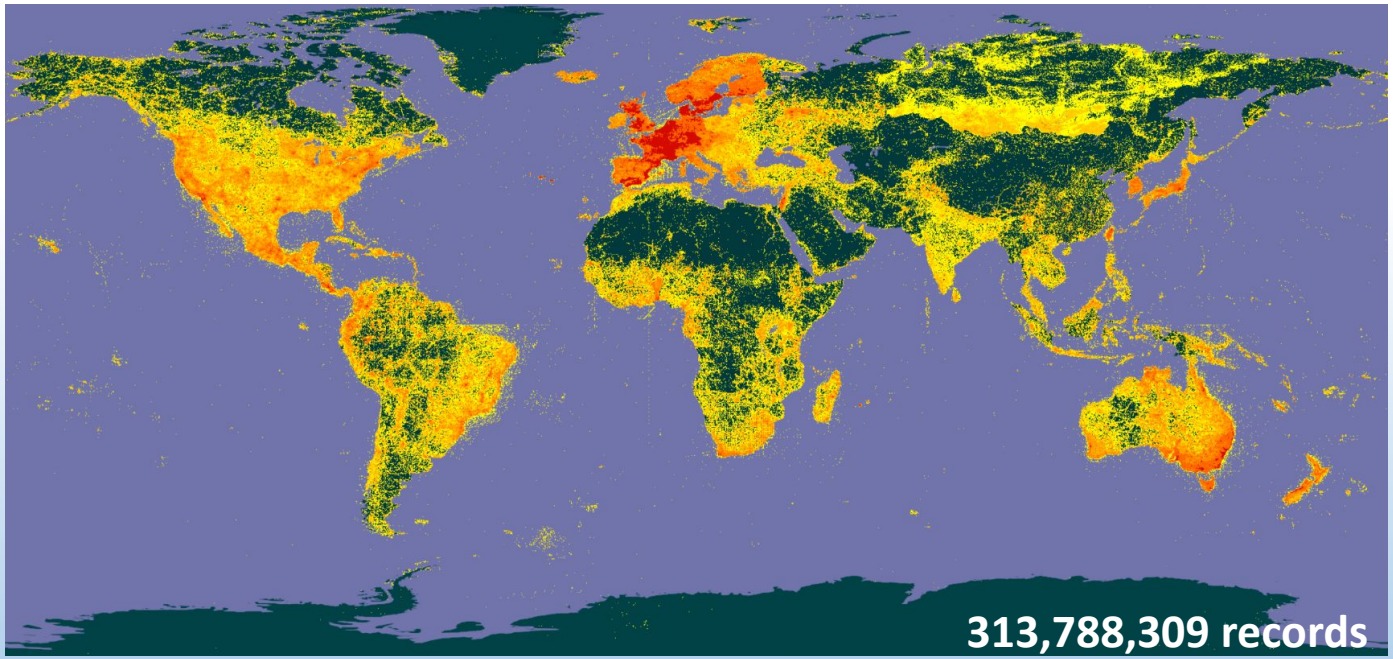
Область	Тип книги	Год	Название, формат и ссылка
Растения	Определитель	1966	Ворошилов В.Н. Флора Советского Дальнего Востока. М., 1966, CHM, PDF
Лишайники	Определитель	2019	Флора Беларуси. Лишайники. Т. 1. Candelariaceae - Verrucariaceae. Минск, 2019, DjVu+
Животные	Справочник	2009	Колтунов Е.В. Флора и фауна природного парка "Самаровский Чугас". Энтомофауна. Екатеринбург, 2009, DjVu+
Организмы	Справочник	2020	Флора и фауна острова Матуа (средние Курильские острова). Т. 1. Море. Череповец, 2020, PDF

Russia in GBIF: vascular plants

1. France 58,273,994
2. Germany 27,264,091
3. Netherlands 20,562,419
4. Australia 19,328,323
5. United Kingdom 18,616,825
6. Spain 17,600,567
7. United States of America 17,352,134
8. Sweden 16,266,611

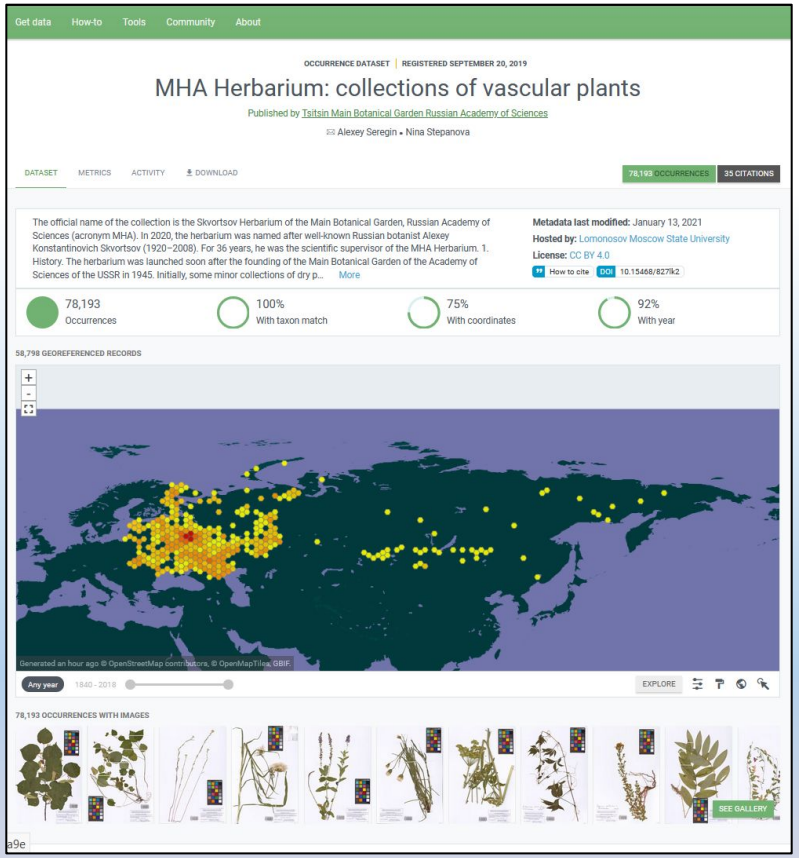
…

16. Russian Federation 2,852,102



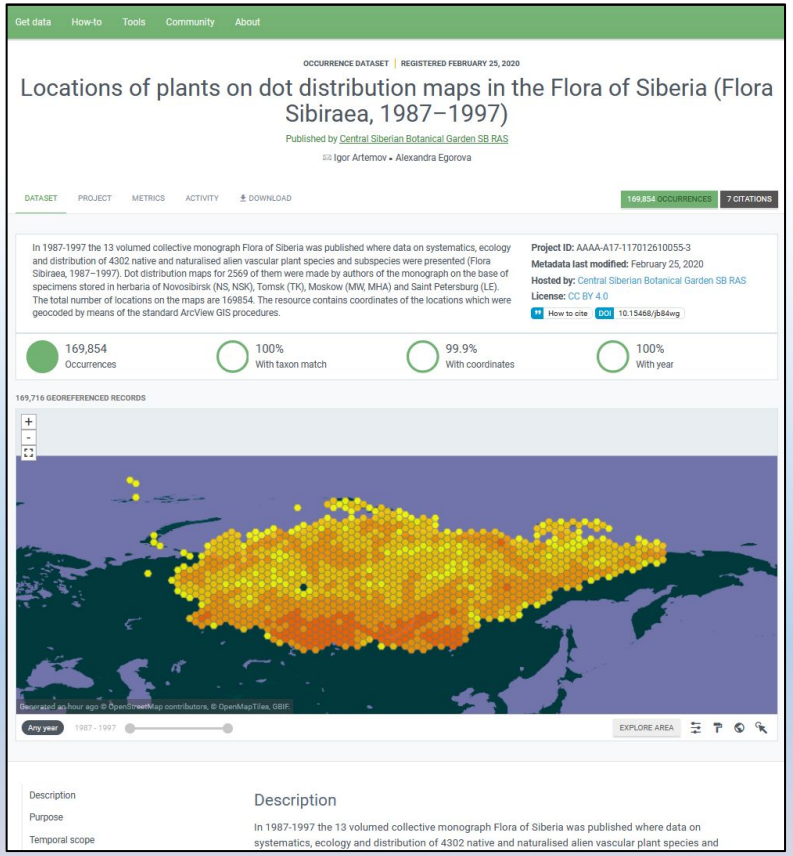
Source: GBIF (2021)
15 Jan 2021

Three main sources of e-occurrences in GBIF



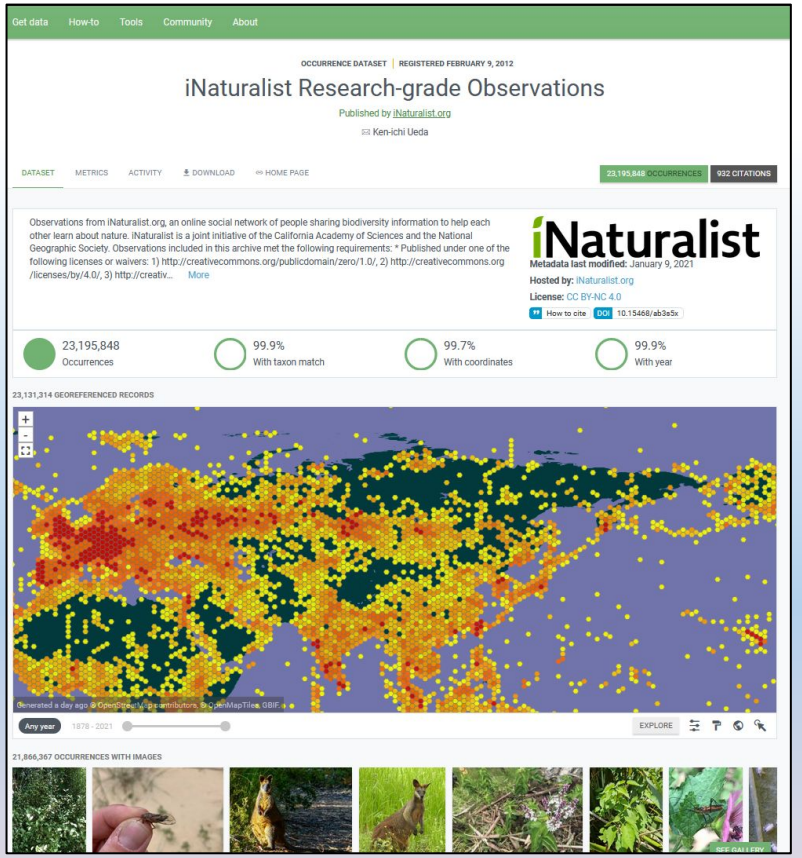
1. Digitized herbarium specimens

821,390 (29%)



2. Dots from published floras

169,854 (6%)



3. Records with photographic evidences

1,718,185 (65%)

Source: GBIF (2021)
15 Jan 2021

How many specimens are imaged 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 digital herbaria of Russia

	Institution	Herbarium 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

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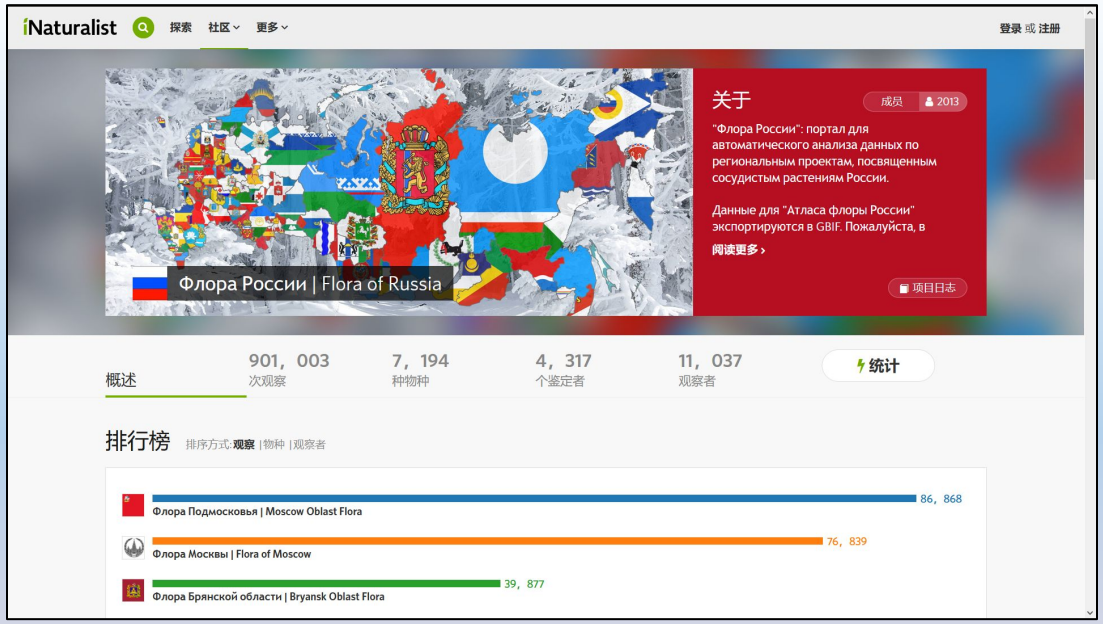
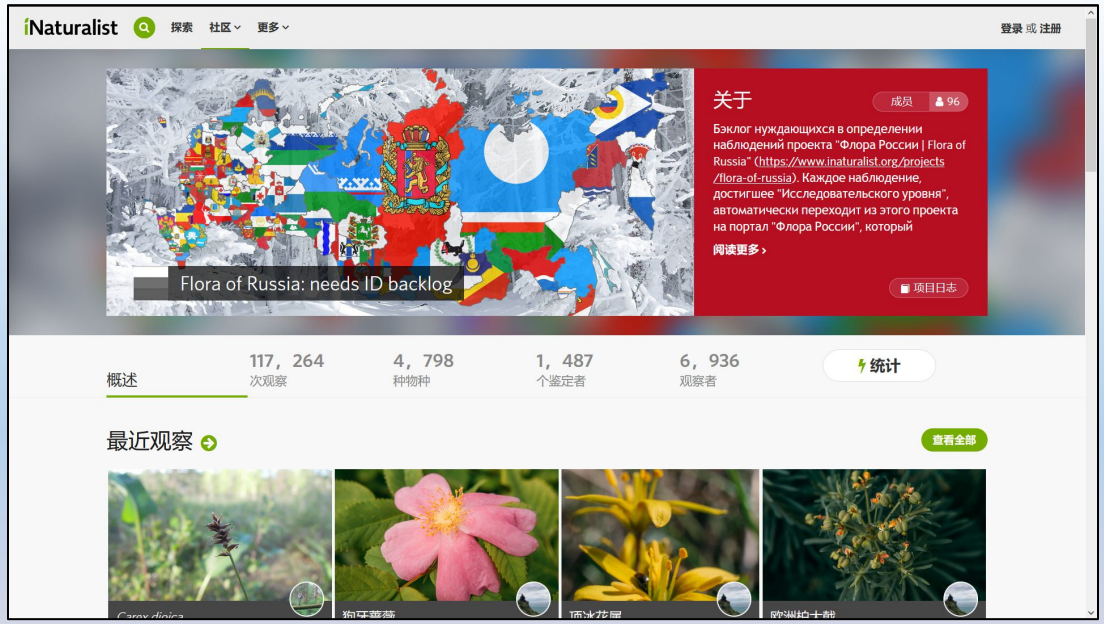
“Flora of Russia” on iNaturalist: photo observations from the community

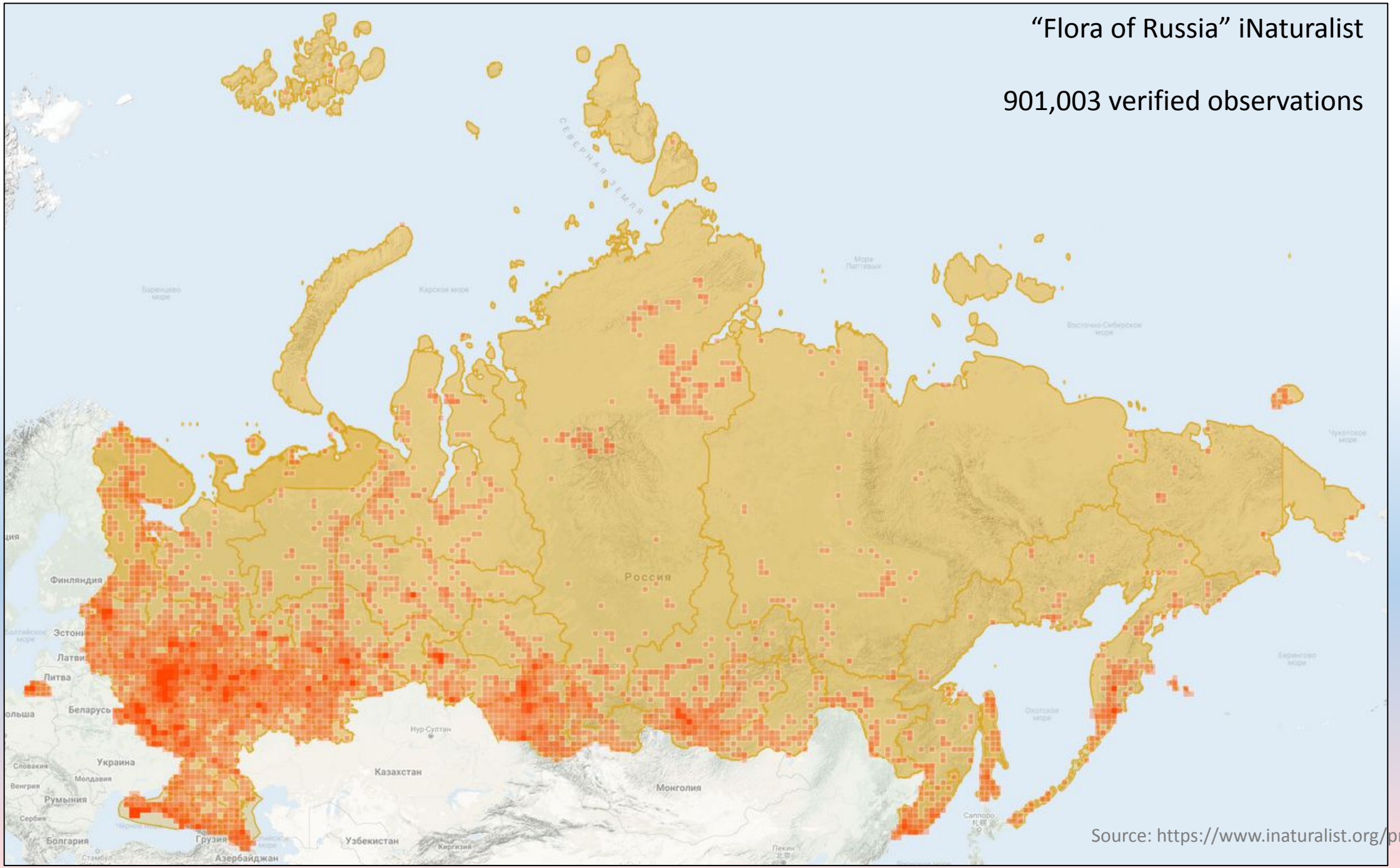




901,003 verified observations
7,194 species
11,037 observers
2,013 subscribers (members of the community)

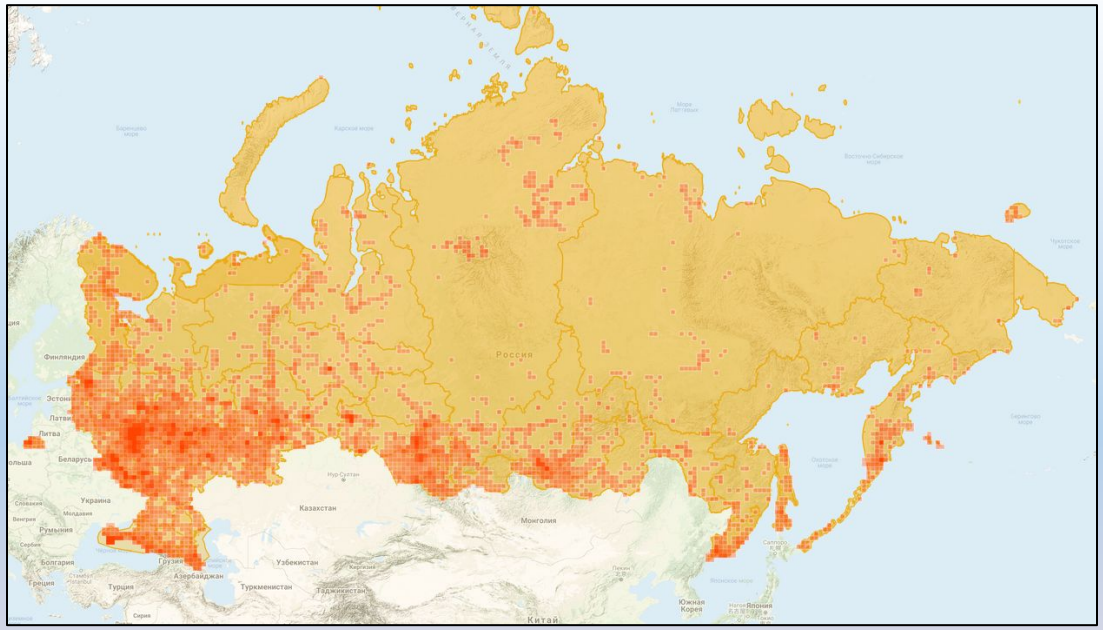
117,264 unverified observations

Source: https://www.inaturalist.org/projects/flora-of-russia
15 Jan 2021



Source: https://www.inaturalist.org/projects/flora-of-russia
15 Jan 2021

Density of citizen science data vs. population density



Sources: https://www.fresher.ru/2019/12/03/karty-plotnosti-naseleniya-rossii-evropy-ssha-i-avstralii/
https://www.inaturalist.org/projects/flora-of-russia/

Top observers of “Flora of Russia” on iNaturalist

Alexey Seregin,
Moscow State University

Nikolay Degtyarev,
Central Chernozem Reserve

Nikolay Panasenko,
Bryansk State University

Sergey Appolonov,
Independent Res., Shumerlya

Ekaterina Kashirina,
Moscow State University

Marina Gorbunova,
Independent Res., Korolyov

Vladimir Teploukhov,
Omsk Forest Department

Igor Pospelov,
Severtsov Institute, RAS

Top experts of “Flora of Russia” on iNaturalist

Dmitry Bochkov,
Moscow State University

Sergey Mayorov,
Moscow State University

Julia Shner,
Moscow State University

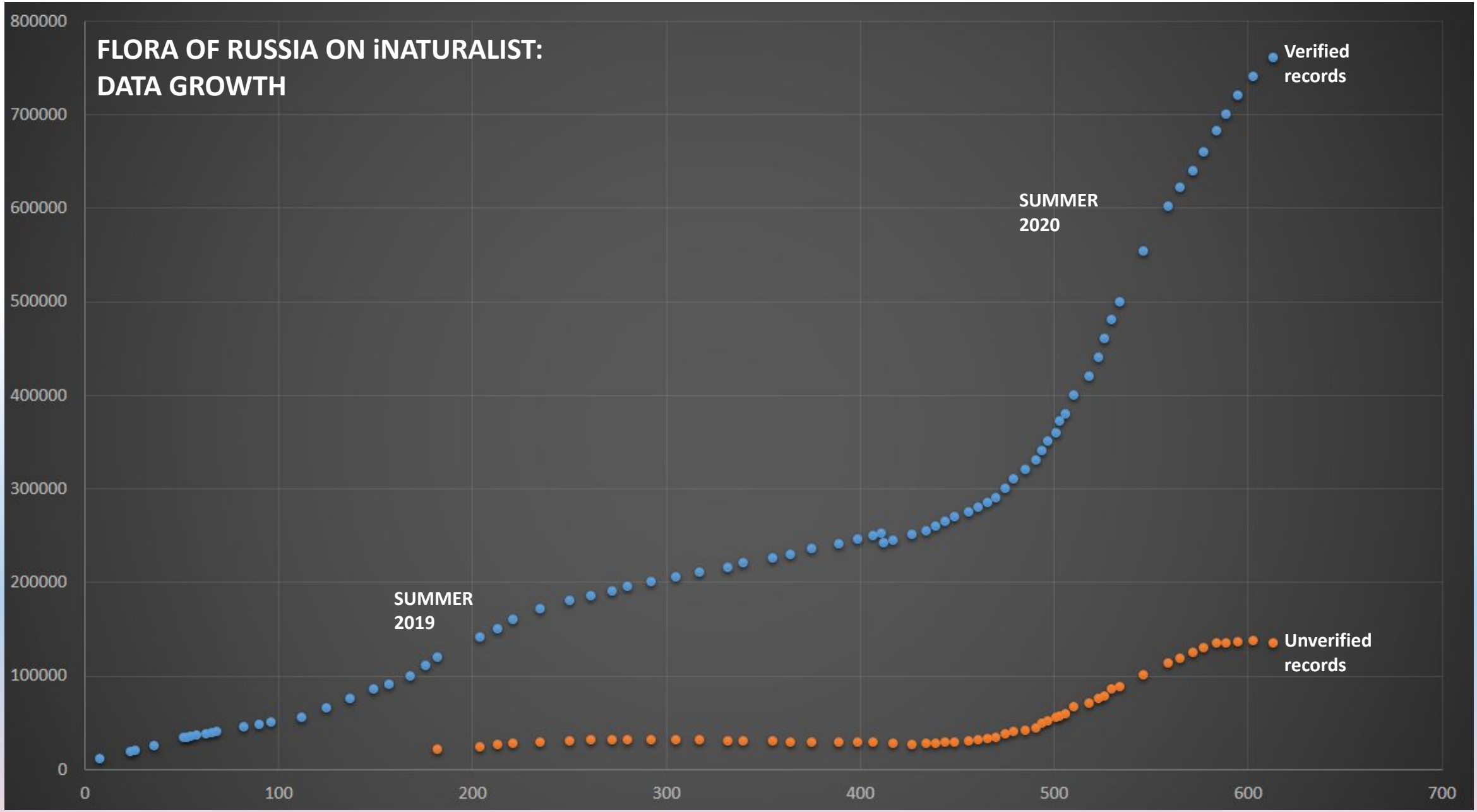
Alexey Seregin,
Moscow State University

Igor Kuzmin,
Tyumen State University

Alexander Khimin,
Pavlovsk School #2

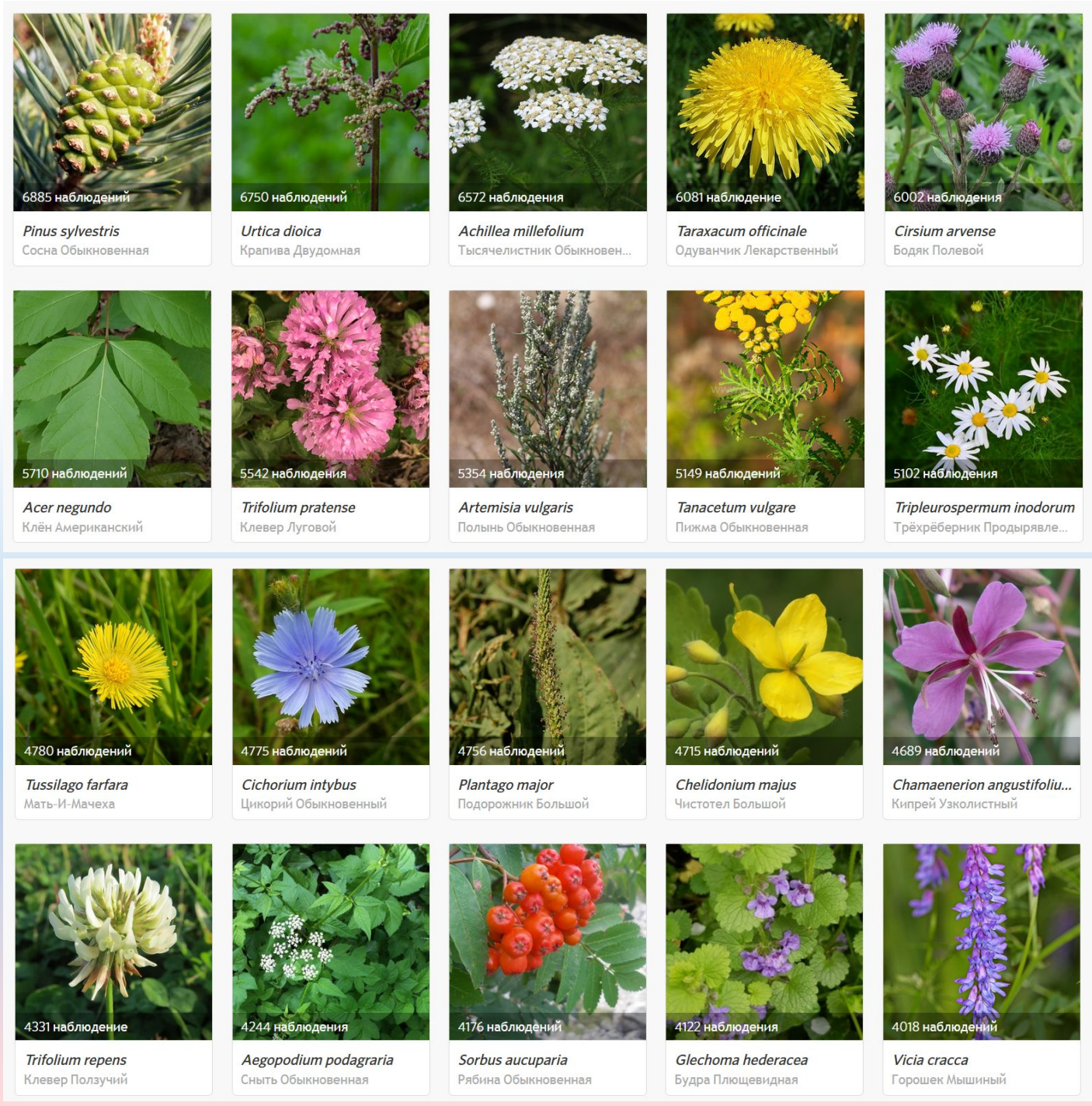
Ruslan Nurkhanov,
Almaty, Kazakhstan

Sergey Lednev,
Moscow State University



Source: Seregin et al. (2020)
09 Sep 2020

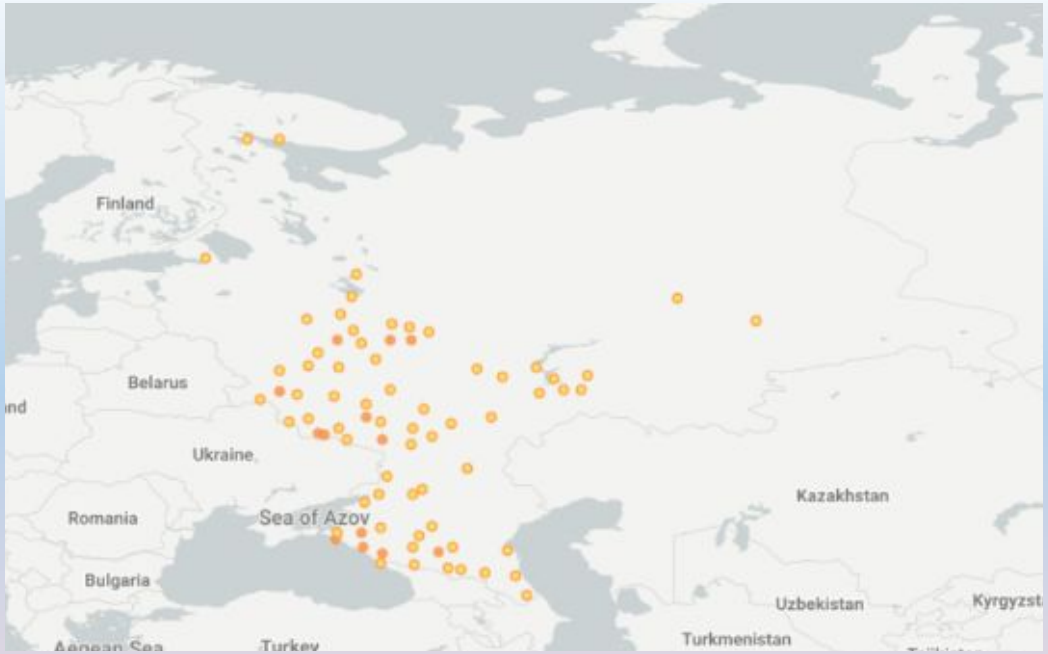
Top 20 most recorded species of the Russian flora on iNaturalist



Ambrosia artemisiifolia L. in Russia

All GBIF data: **653 records, incl.** **351 records (54%) from iNaturalist**

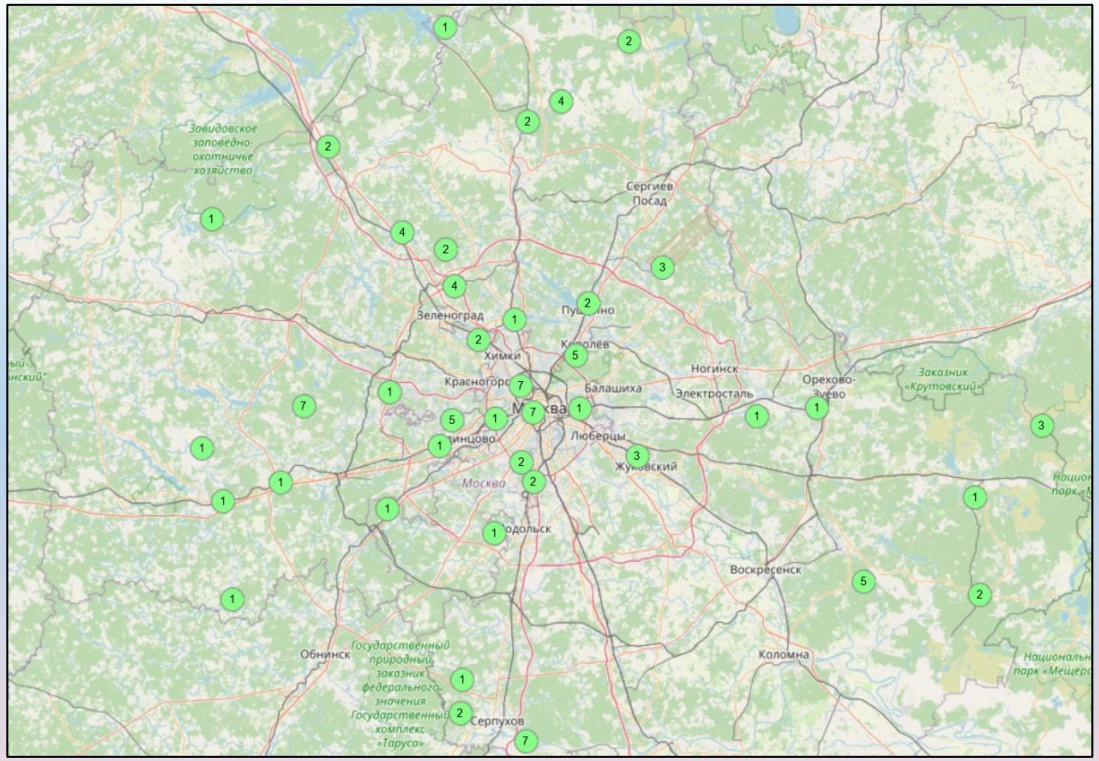
2019–2020: **376 records, incl.** **324 records (86%) from iNaturalist**



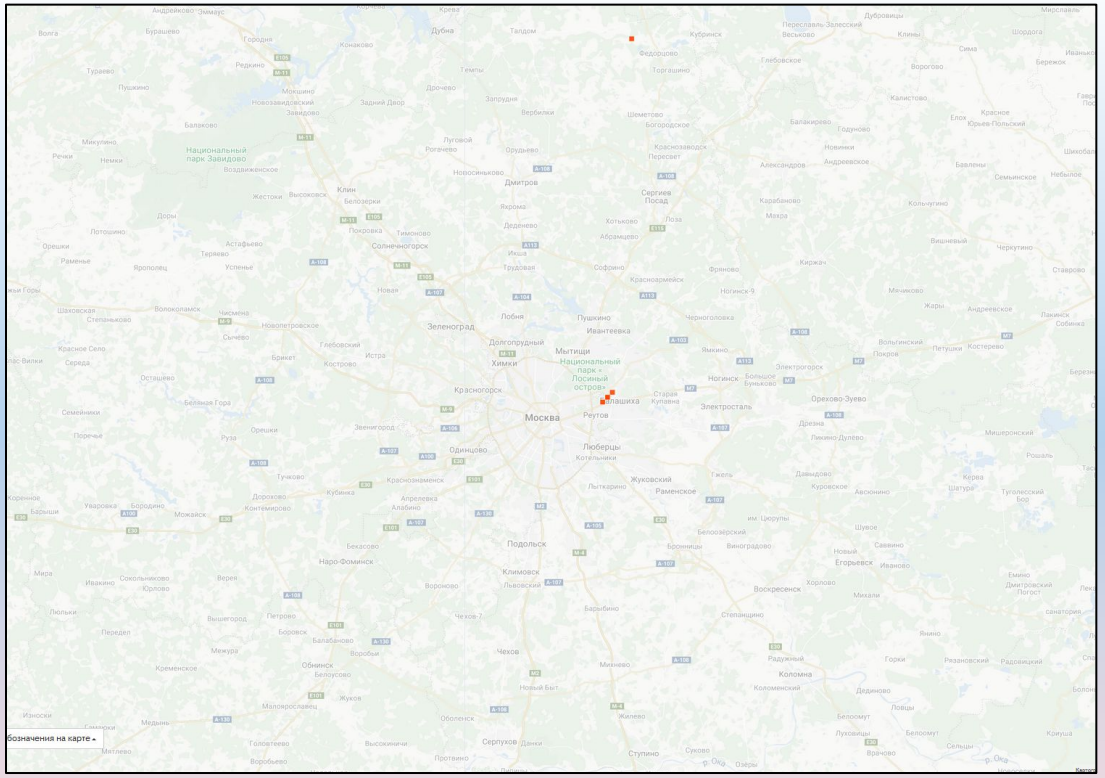
Source: GBIF (2021)
18 Jan 2021

Pedicularis palustris L. in Moscow Region

Herbarium data: 122 records



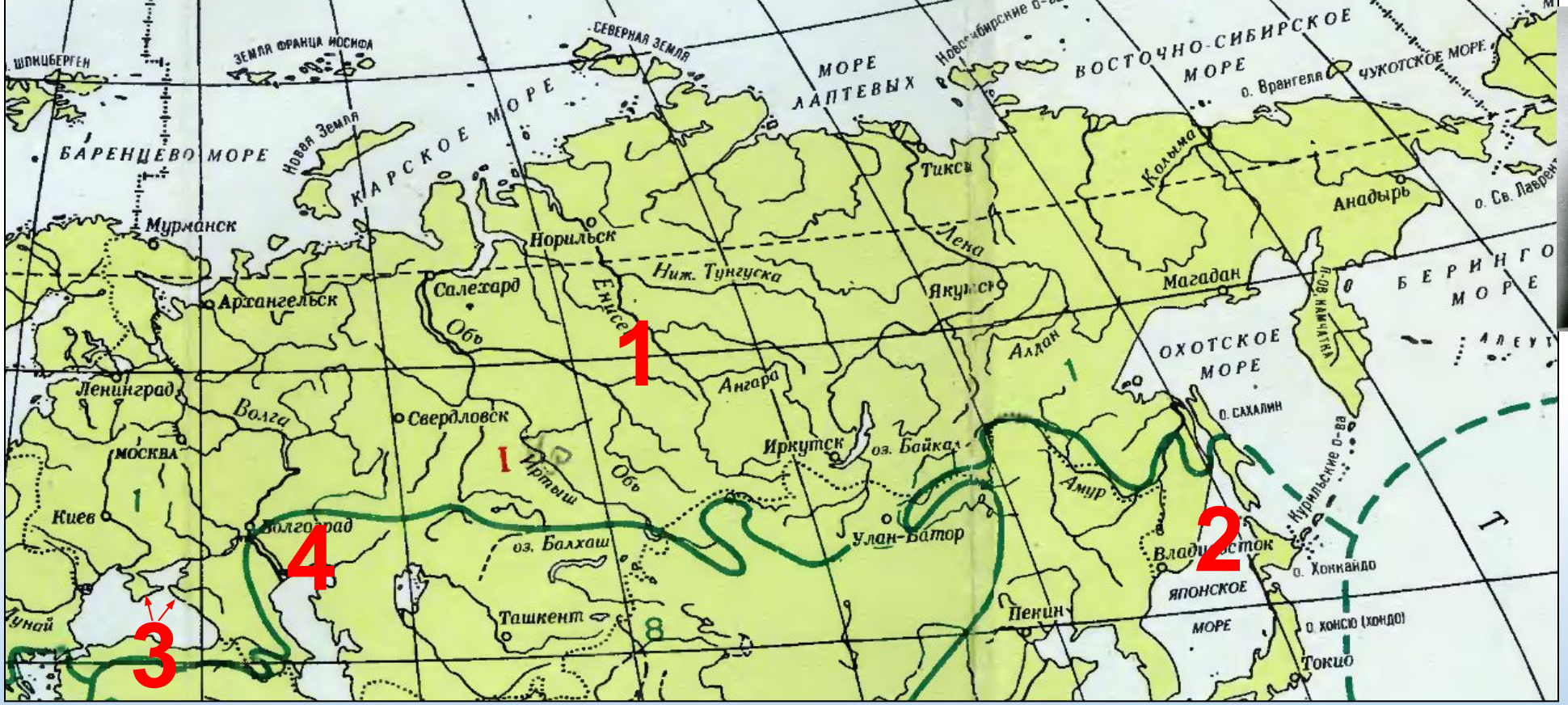
iNaturalist data: 7 records (4 localities)

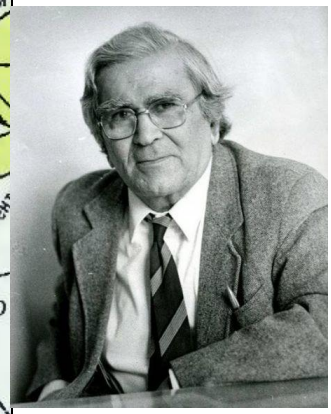


Sources: https://www.inaturalist.org/; https://plant.depo.msu.ru/
18 Jan 2021

Basic patterns of the Russian flora

1. Floristic divisions
2. Species diversity: standard areas
3. Species diversity: administrative units

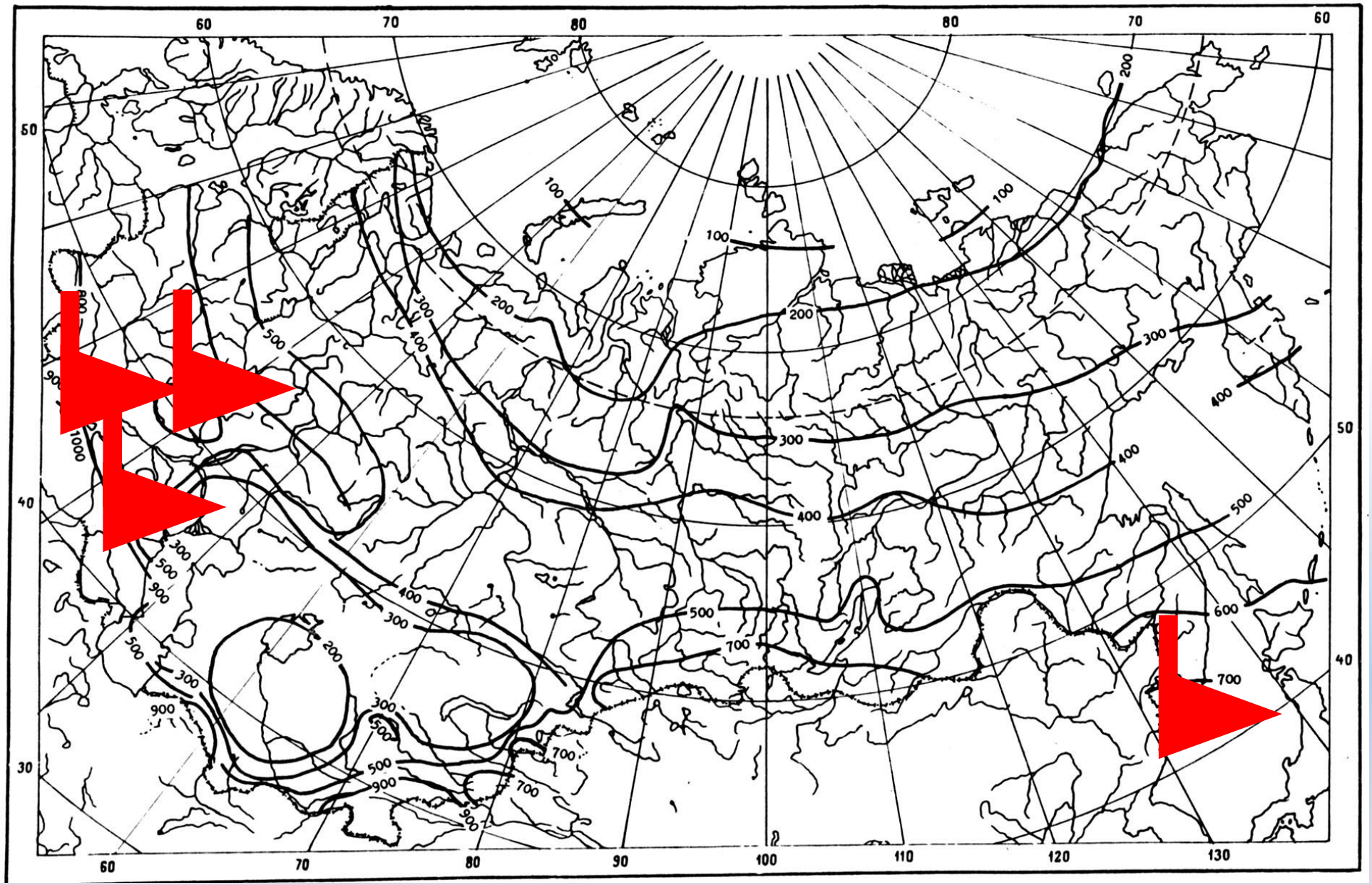




Four major floristic regions of Russia (Takhtajan, 1978)

	Area	Species diversity
Boreal subkingdom		
1. Circumboreal Region (12 provinces)	98%	?
2. Eastern Asian Region (2 provinces)	1,5%	24%
Ancient Mediterranean subkingdom		
3. Mediterranean Region (1 province)	0,01%	16%
4. Irano-Turanian Region (1 province)	0,5%	10%

Sources: Takhtajan (1978), Seregin et al. (2020), Original counts and estimates



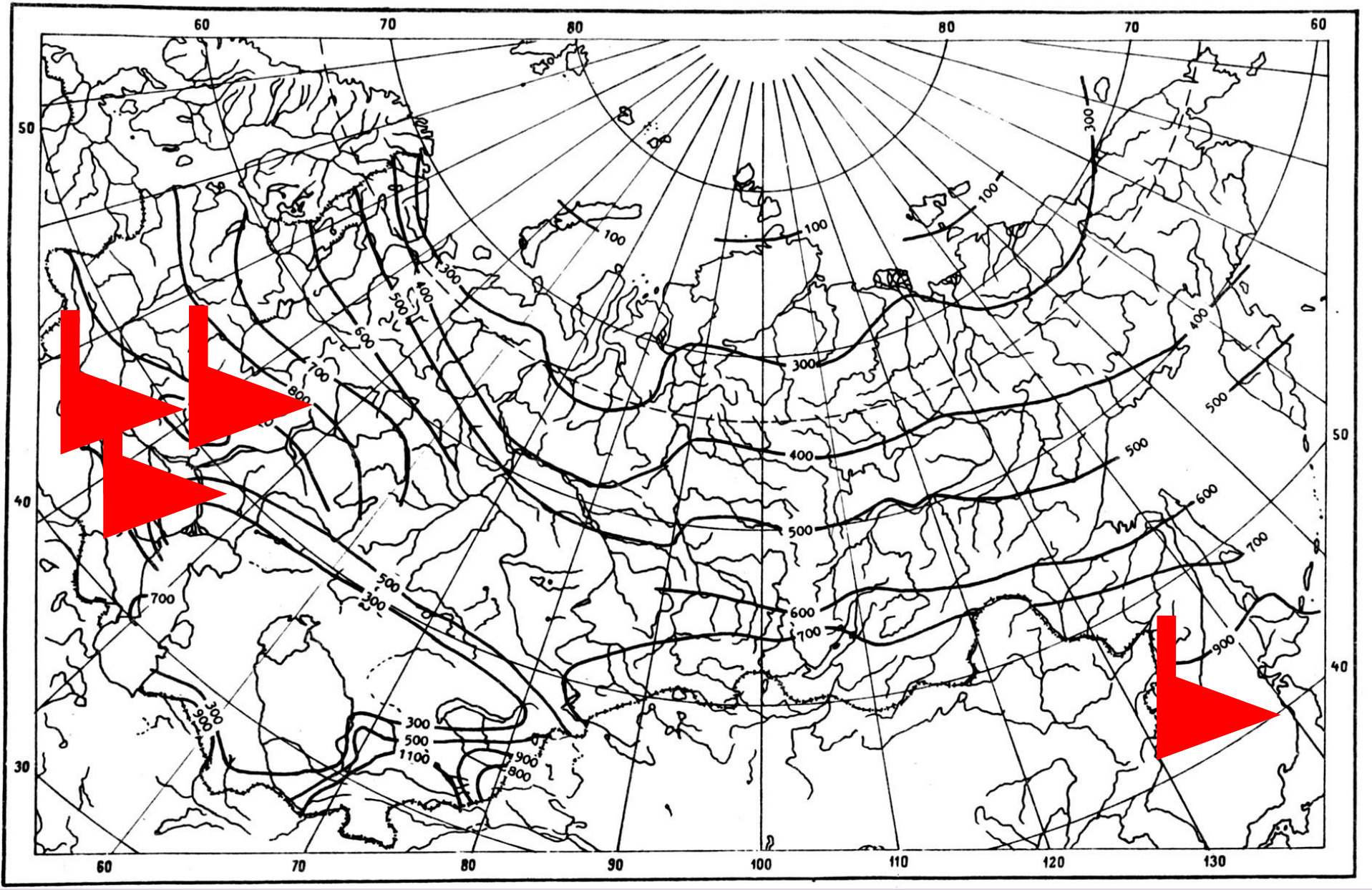
Number of vascular plant species per 100 km^2 (Malyshev 1992)

1. Crimean Mts.
>1,000

2. Caucasus
>900

3. Forest/steppe ecotone
(Voronezh area)
>800

4. Vladivostok area
>800



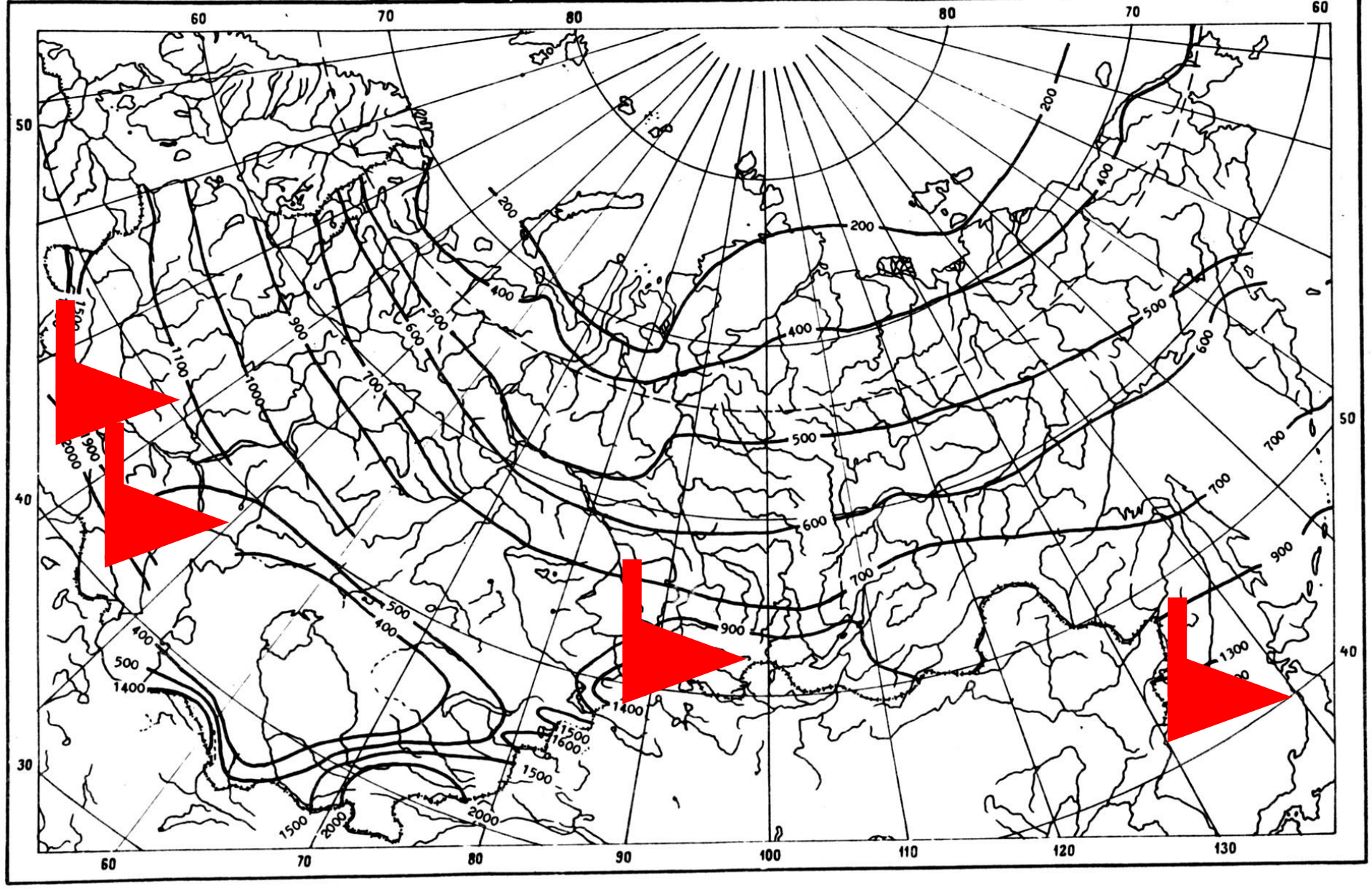
Number of vascular plant species per 1,000 km^2 (Malyshev 1992)

1. Crimean Mts.
>1,500 (!)

2. Caucasus
>1,300

3. Forest/steppe ecotone (Voronezh area)
>1,100

4. Vladivostok area
>1,100



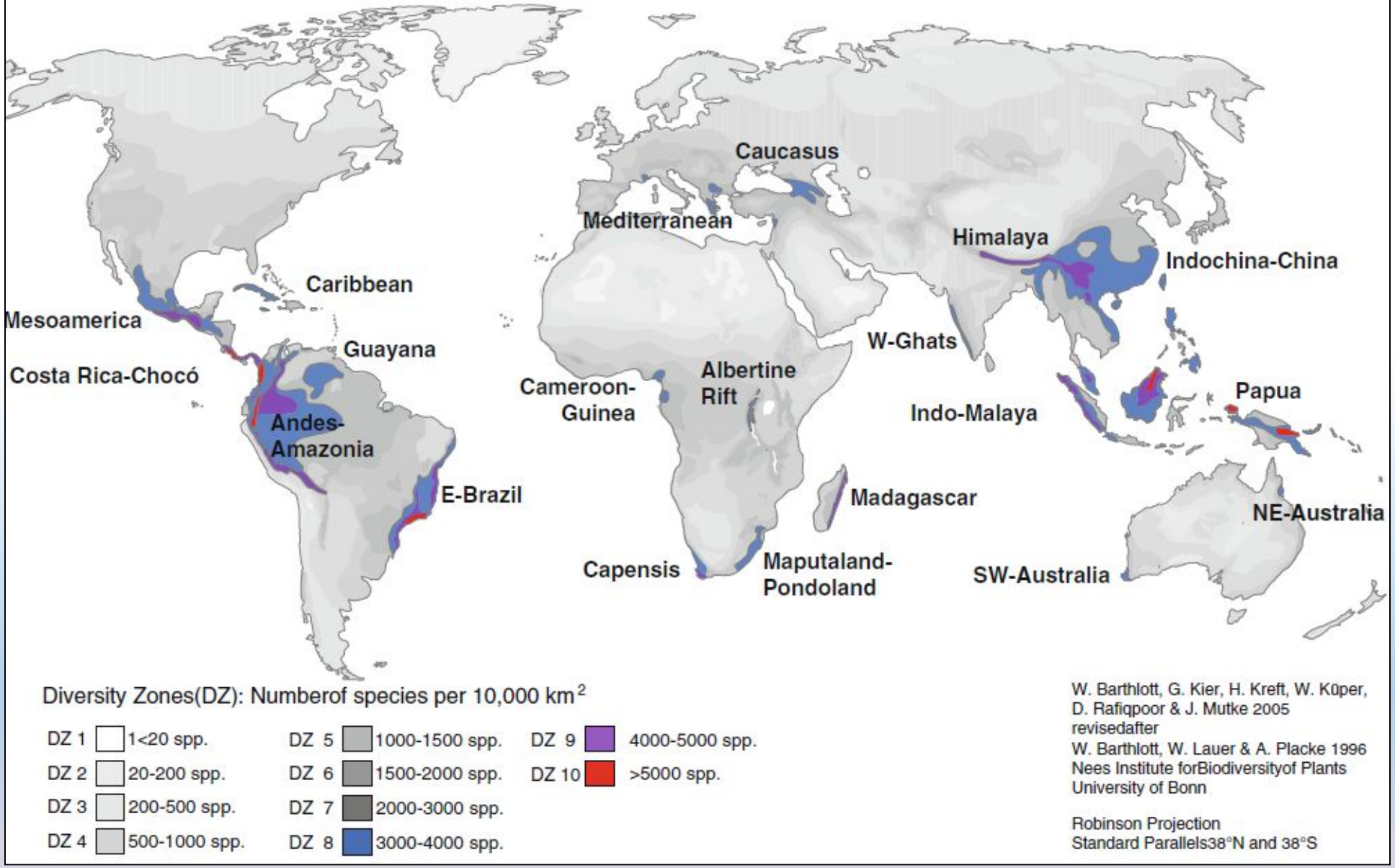
Number of vascular plant species per 10,000 km^2 (Malyshev 1992)

1. Crimean Mts.
>2,000

2. Caucasus
>2,000

3. Altai Mts.
>1,400

4. Vladivostok area
>1,400



20 центров максимального разнообразия сосудистых растений
(Barthlott et al. 2005, 2011)

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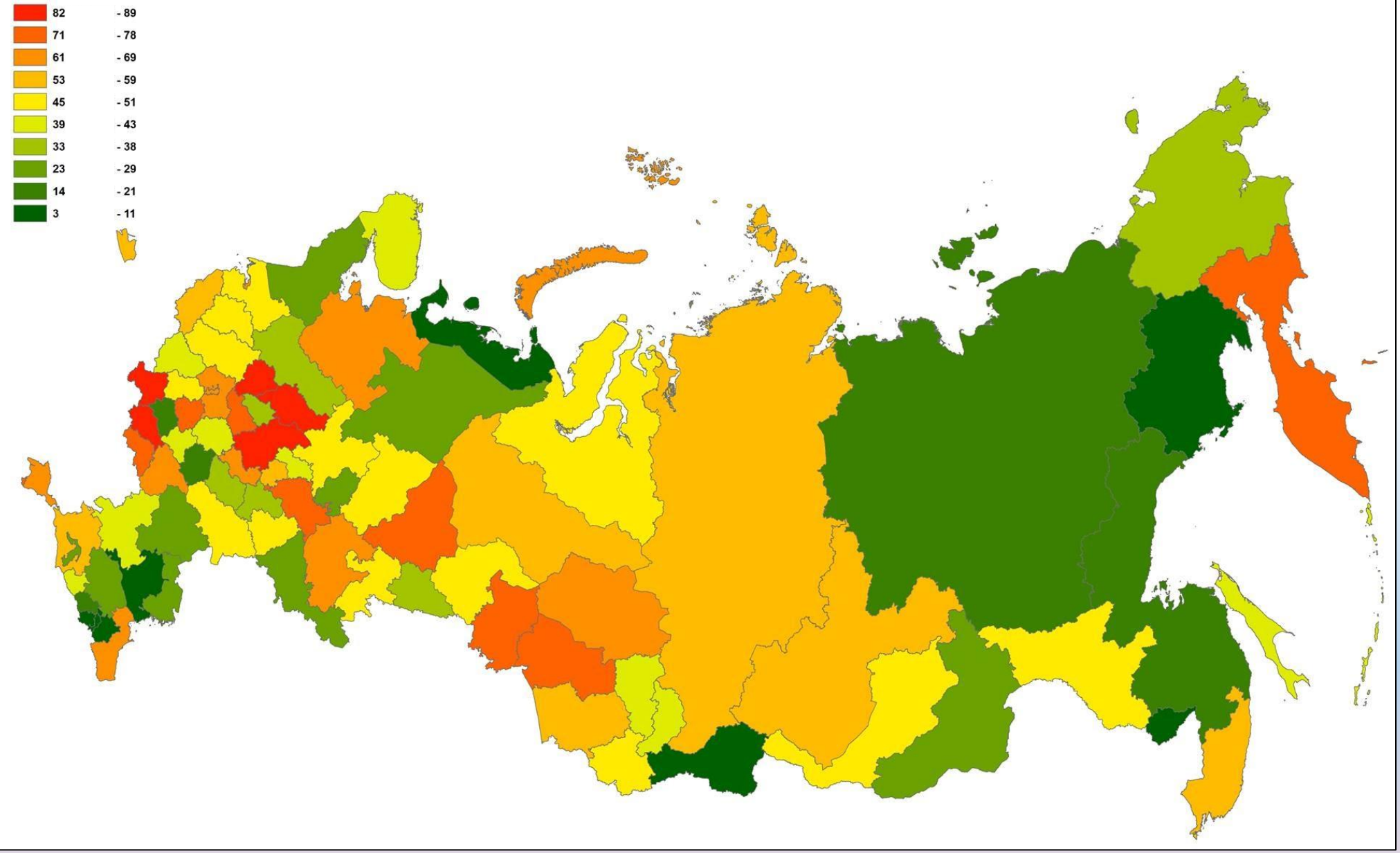
Number of vascular plant species per administrative units (by Igor Pospelov based upon Seregin et al. (2020))



Efforts of *iNaturalist* community in documenting of species diversity (by Igor Pospelov based upon Seregin et al. (2020))

Source: https://www.inaturalist.org/projects/flora-of-russia
11 Jan 2021

Citizen science data (left) vs. specimen data (right) for the Russian flora: top recorded species

7 740	Achillea millefolium L.
6 577	Urtica dioica L.
6 252	Acer negundo L.
6 076	Pinus sylvestris L.
5 774	Tanacetum vulgare L.
5 607	Cirsium arvense (L.) Scop.
5 423	Chelidonium majus L.
5 404	Cichorium intybus L.
5 190	Trifolium pratense L.
5 099	Taraxacum officinale F.H.Wigg.

2 187	Festuca rubra L.
2 024	Carex nigra Reich.
1 931	Deschampsia cespitosa (L.) P.Beauv.
1 861	Poa pratensis L.
1 842	Equisetum arvense L.
1 485	Cystopteris fragilis (L.) Bernh.
1 485	Festuca ovina L.
1 456	Elymus repens (L.) Gould
1 420	Carex acuta L.
1 392	Calamagrostis purpurea Trin.

Source: GBIF (2021)
18 Jan 2021

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Thanks for being with me today!

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