Received: 22 December 2022 | Revised: 15 March 2023 | Accepted: 1 June 2023

DOI: 10.1111/geb.13724

Global Ecology and Biogeography | A Journal of Macroecology | WILEY

DATA ARTICLE

Russian Arctic Vegetation Archive—A new database of plant community composition and environmental conditions

Vitalii Zemlianskii[1] | Ksenia Ermokhina[2] | Gabriela Schaepman-Strub[1] | Nadezhda Matveyeva[3] | Elena Troeva[4] | Igor Lavrinenko[3] | Mikhail Telyatnikov[5] | Igor Pospelov[6] | Natalia Koroleva[7] | Nadezhda Leonova[8] | Olga Khitun[9] | Donald Walker[10] | Amy Breen[10] | Nikita Kadetov[8] | Olga Lavrinenko[3] | Tatiana Ivleva[2] | Sergey Kholod[9] | Nataliia Petrzhik[2] | Yakov Gunin[11] | Maria Kurysheva[12] | Anna Lapina[3] | Denis Korolev[13] | Ekaterina Kudr[14] | Elena Plekhanova[1]

[1]Department of Evolutionary Biology and Environmental Studies, University of Zurich, Zurich, Switzerland

[2]V.N. Sukachev Laboratory of Biogeocenology, A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Science, Moscow, Russia

[3]Laboratory of Dynamics of the Arctic Vegetation Cover, Komarov Botanical Institute, Russian Academy of Science, Saint Petersburg, Russia

[4]Laboratory of Genesis and Ecology of Soil-Vegetation Cover, Institute for Biological Problems of Cryolithozone, Russian Academy of Science, Yakutsk, Russia

[5]Laboratory of Ecology and Geobotany, Central Siberian Botanical Garden, Siberia Branch of the Russian Academy of Science, Novosibirsk, Russia

[6]Laboratory of Biodiversity Conservation and Bioresources, A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Science, Moscow, Russia

[7]Polar-Alpine Botanical Garden, Department of Flora and Vegetation, Russian Academy of Science, Kirovsk, Russia

[8]Department of Biogeography, Lomonosov Moscow State University, Moscow, Russia

[9]Laboratory of Geography and Vegetation Mapping, Komarov Botanical Institute, Russian Academy of Science, Saint Petersburg, Russia

[10]Institute of Arctic Biology, Alaska Geobotany Center, University of Alaska Fairbanks, Fairbanks, Alaska, USA

[11]Laboratory of Mathematical Ecology, A.M. Obukhov Institute of Atmospheric Physics, Russian Academy of Sciences, Moscow, Russia

[12]Information Science and Computer Technology, HSE Tikhonov Moscow Institute of Electronics and Mathematics, HSE University, Moscow, Russia

[13]Department of Computer Engineering, HSE University, Moscow, Russia

[14]Department of Ecology and Plant Geography, Lomonosov Moscow State University, Moscow, Russia

Correspondence
Vitalii Zemlianskii, Department of Evolutionary Biology and Environmental Studies, University of Zurich, Zurich, Switzerland.
Email: vitalii.zemlianskii@ieu.uzh.ch

Funding information
Russian Foundation for Basic Research, Grant/Award Number: 18-04-01010; Russian Science Foundation, Grant/Award Number: 20-17-00160; Swiss Government Excellence Scholarship, Grant/Award Number: 2019.0075

Handling Editor: Brian J. Enquist

Abstract

Motivation: The goal of the Russian Arctic Vegetation Archive (AVA-RU) is to unite and harmonize data of plot-based plant species and their abundance, vegetation structure and environmental variables from the Russian Arctic. This database can be used to assess the status of the Russian Arctic vegetation and as a baseline to document biodiversity changes in the future. The archive can be used for scientific studies as well as to inform nature protection and restoration efforts.

Main types of variables contained: The archive contains 2873 open-access geobotanical plots. The data include the full species. Most plots include information on the horizontal (cover per species and morphological group) and vertical (average height

Ksenia Ermokhina and Gabriela Schaepman-Strub contributed equally to this study.

per morphological group) structure of vegetation, site and soil descriptions and data quality estimations. In addition to the open-access data, the AVA-RU website contains 1912 restricted-access plots.

Spatial location and grain: The plots of 1–100 m^2 size were sampled in Arctic Russia and Scandinavia. Plots in Russia covered areas from the West to the East, including the European Russian Arctic (Kola Peninsula, Nenets Autonomous district), Western Siberia (Northern Urals, Yamal, Taza and Gydan peninsulas), Central Siberia (Taymyr peninsula, Bolshevik island), Eastern Siberia (Indigirka basin) and the Far East (Wrangel island). About 72% of the samples are georeferenced.

Time period and grain: The data were collected once at each location between 1927 and 2022.

Major taxa and level of measurement: Plots include observations of >1770 vascular plant and cryptogam species and subspecies.

Software format: CSV files (1 file with species list and abundance, 1 file with environmental variables and vegetation structure) are stored at the AVA-RU website (https://avarus.space/), and are continuously updated with new datasets. The open-access data are available on Dryad and all the datasets have a backup on the server of the University of Zurich. The data processing R script is available on Dryad.

KEYWORDS
Arctic, Arctic Vegetation Archive, biodiversity, Braun–Blanquet plots, tundra, vegetation classification

1 | INTRODUCTION

Climate warming, industrial activities and an increase in tourism are increasingly impacting the Arctic environment, its biodiversity and the livelihoods of indigenous people (Bartsch et al., 2021; Forbes et al., 2009; IPCC, 2019; Pearson et al., 2013). Protecting Arctic nature requires broad-scale monitoring activities, such as monitoring plant-community diversity and distributions, wildlife habitat and modelling changes in the structure and functioning of the Arctic ecosystems. This leads to the necessity of developing large data archives providing information on species and trait diversity for all Arctic regions. Existing projects include the European Vegetation Archive (Chytrý et al., 2015), the Alaskan Arctic Vegetation Archive (Walker et al., 2016) and the Tundra trait database (Bjorkman et al., 2018). However, especially for the Russian Arctic, the assessment and prediction of plant biodiversity and ecosystem functioning are hampered by a lack of standardized in situ data accessible to the research community (Walker et al., 2016). The development of the Russian part of the Arctic Vegetation Archive (AVA) can fill this gap and deliver full and open access to Russian Arctic vegetation data.

Despite well-established Soviet research (Sekretareva, 1999; Tikhomirov, 1956; Yurtsev, 1994) as well as significant Russian and international efforts conducted in the 1990–2010s (Koroleva & Kulyugina, 2015; Koroleva & Kopeina, 2018; Matveyeva, 1994, 2006; Matveyeva et al., 2013, 2017; Matveyeva & Lavrinenko, 2011, 2021, 2023; Pospelova & Pospelov, 2007, 2010; Rebristaya, 2013; Walker et al., 2018, 2019), the Russian Arctic remains the area most poorly covered by geobotanical research north of the Polar circle (Ermokhina, 2017, 2018). International access to datasets collected by Russian scientists is often hampered by political, bureaucratic and language barriers. Another important factor that hinders broader data access is the lack of data standardization. It is estimated that about 5000 relevés (phytosociological plots following the Braun–Blanquet method) are published (mainly in Russian), and many more are digitized, but not published, or still in field books (Ermokhina, 2017). Harmonization and integration of the data into internationally available archives would facilitate pan-arctic vegetation research impeded by existing data gaps.

Here, we present a newly assembled Russian Arctic Vegetation Archive (AVA-RU), which consists of 4785 Braun–Blanquet plots (Figure 1). The goal of AVA-RU is to unite and organize existing Russian Arctic geobotanical data into a single data repository according to international AVA protocols (Walker et al., 2013). The AVA-RU is part of the international Arctic Vegetation Archive project supported by the Conservation of Arctic Flora and Fauna (CAFF, 1997; https://www.caff.is/flora-cfg/ava) and the International Arctic Science Committee's Terrestrial Working Group (IASC TWG). The AVA-RU is the only resource containing historical Soviet geobotanical plots, as well as modern Russian and international data collected in Russia. The data were sampled at 40 major sites ranging from the Norwegian Svalbard archipelago and the Kola peninsula (Murmansk oblast') in the West to the

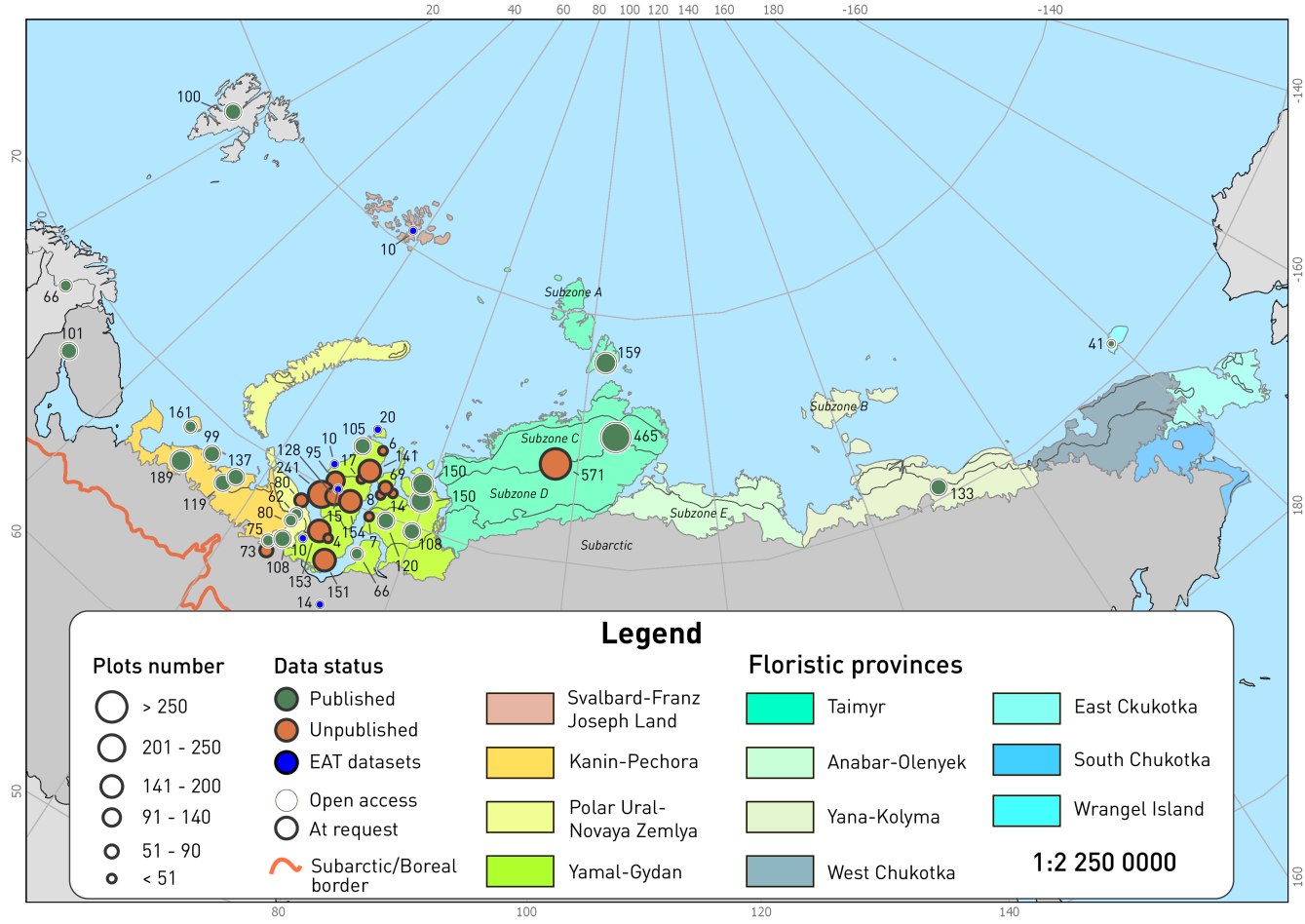

FIGURE 1 Overview of locations and number of geobotanical plots included in the Russian Arctic Vegetation Archive (Eurasian Arctic transect data included, status 3 March 2023).

Indigirka basin (Sakha Republic) in the East, covering all bioclimatic subzones from high polar deserts to forest-tundra and northern taiga (CAVM Team, 2003). Most plots (72%) are georeferenced and can be used for modelling applications. The time range of the data varies from the late 1920s (Kola peninsula historical data) to 2022 (Yamal peninsula).

The Arctic Vegetation Archive can be used to address a wide range of scientific and practical issues. We aim to promote the use of AVA-RU datasets for scientific research, biodiversity conservation and ecosystem restoration.

2 | DATA ACQUISITION AND HARMONIZATION

2.1 | Data acquisition and compilation

VA-RU data have been sampled following the Braun–Blanquet sampling method, which is the standard methodology for Russian Arctic vegetation records (Walker et al., 2017). The size and shape of relevés can vary from 1 to 100 m^2 depending on vegetation type and characteristics of the site. The species cover/abundance is indicated by the percentage of plot area or using a categorical scalar. Whenever possible, photos of the plots were taken (Figure 2).

A significant part of the Western Siberian dataset (1003 plots) was compiled by team members during the 2017 expedition to the Yamalo-Nenets Autonomous district (Sofronova et al., 2019; Telyatnikov et al., 2019a, 2019b; Telyatnikov, Khitun, Chernyadyeva, & Kuzmina, 2021; Telyatnikov, Khitun, Chernyadyeva, Kuzmina, & Ermokhina, 2021; Potemkin et al., 2021), while other datasets were independently contributed by researchers or based on previously published data (Dedov, 1940; Kholod, 2007; Koroleva & Kopeina, 2018, Koroleva et al., 2019; Lavrinenko et al., 2016; Lavrinenko & Lavrinenko, 2018a, 2018b; Matveyeva, 2006; Matveyeva & Lavrinenko, 2011; Pospelova & Pospelov, 2010; Telyatnikov et al., 2015, 2022; Walker et al., 2019).

2.2 | Data-processing algorithms and quality control procedures

We used the standard AVA protocol to enter geobotanical data (https://arcticatlas.geobotany.org/catalog/dataset/current-turbo

FIGURE 2 Russian AVA data collection process. (a) 2017–2018 field campaign camp (Yamal peninsula); (b) Pre-sampling photo documentation; (c) Photo of the plot (Baidara Bay); (d) Geobotanical plot sampling; (e) Plants height measurements; (f) Soil composition identification; (g) Plant biomass field sampling; (h) Plant biomass samples sorting. *Photos by Olga Kulikova, Anton Romanov, Yakov Gunin, Ivan Sergeev and Vitalii Zemlianskii (2017–2018).*

veg-data-dictionary-and-panarctic-species-list-pasl). To process the species data, the Turboveg data management system was used (Hennekens & Schaminée, 2001). Alternatively, some datasets were standardized using R software (R version 4.2.2) (R Core Team, 2022). In this case, we compared the species name provided by the author with the Pan-Arctic species list (Raynolds et al., 2013), which we used to maintain taxonomic consistency. We indicated species that were not found in PASL, as 'Unknown' in the column 'PASL taxon scientific name, but kept the original name in the column 'Dataset taxon'. The quality of vascular plant and cryptogam data were estimated by the AVA team. Six classes of data quality were used: 1. highest, 2. high, 3. high but incomplete, 4. moderate, 5. moderate and incomplete and 6. low.

2.3 | Data description

The AVA-RU contains 4785 geobotanical plots belonging to 40 datasets. All the datasets consist of at least two separate files: a species list and a habitat data list. The species list contains a full species list for each plot, and species abundance is given in classes or percentage. The habitat data list contains information about vertical (average layer height) and horizontal (layer cover) structure of vegetation, as well as a variety of information about habitat and environmental conditions. The full structure of the database is described in the AVA protocol (https://arcticatlas.geobotany.org/catalog/dataset/current-turboveg-data-dictionary-and-panarctic-species-list-pasl) and the most relevant parts are highlighted in Appendix Table 1. The majority of the plots (72%) have handheld GPS (WGS 84 datum) georeferencing.

Some datasets are also supplemented by Additional data files, which contain data not included in the international AVA protocol such as active layer thickness or plant biomass. These non-AVA format files can also include information about vegetation layer coverage (vascular plants, dwarf shrubs (without separation by erect and prostrate dwarf shrubs) or hemi-prostrate-dwarf shrub coverage, etc.).

2.4 | Future data contributions to AVA-RU

Data owners can contribute their data to the Archive by contacting our team through the AVA-RU website form (https://avarus.space/profile/about/). The submitted datasets will be accepted if they meet the following minimal criteria: (a) completeness of vascular plant list; (b) georeferencing (not mandatory for historical USSR data); (c) some habitat data. We encourage small datasets collected in the same region to be contributed as a single archive whenever possible. The AVA-RU team can support the authors by standardizing their data according to AVA-RU rules. For collective datasets, permission of all data owners is required. Datasets can be updated upon the author's request (update history is indicated in the dataset description).

3 | DATA ACCESS AND RIGHTS

AVA-RU data are maintained and updated on the project website, which is available in English and Russian (Ermokhina et al., 2022; http://avarus.space/). The website contains information about the project, team members and data use guidelines.

The AVA-RU data can be used for research, education or conservation and protection of nature. The publication should be cited as follows: Zemlianskii, V., Ermokhina, K., Schaepman-Strub, G., Matveyeva, N., Troeva, E., Lavrinenko, I., Telyatnikov, M., Pospelov, I., Koroleva, N., Leonova, N., Khitun, O., Walker D., Breen A., Kadetov, N. Lavrinenko, O., Ivleva T., Kholod, S., Petrzhik, N., Gunin, Y., Kurysheva, M., Lapina. A., Korolev, D., Kudr, E., & Plekhanova, E., (2023). Russian Arctic Vegetation Archive—A new database of plant community composition and environmental conditions. *Global Ecology and Biogeography*, (issue number and pages). We encourage AVA-RU data users to inform the AVA-RU team about their publications using the Archive data through a website form (http://avarus.space/profile/about/). The titles of the projects will be published on the AVA-RU website in the 'supported projects' section.

3.1 | Data regimes

Open access is the default regime for published datasets. Open-access data can be freely and directly downloaded from the AVA-RU website as Creative commons 4.0 (https://opendefinition.org/licenses/cc-by/), but citation of the data source is required (see above). A copy of the open-access part of AVA-RU data is stored regularly on the external data archive Dryad, using a versioning system. The status of the open-access data as of March 3rd, 2023 (AVA-RU-v.1.0), is accessible on Dryad (Zemlianskii et al., 2023; https://doi.org/10.5061/dryad.5tb2rbp8d). For open-access data, it is necessary to provide references both to the original publication and this AVA-RU data publication. We encourage reporting on any inaccuracies found in the AVA-RU datasets.

Contributors of unpublished datasets can opt for *restricted access*. The use of restricted access data requires permission from the data owner. The restricted access regime lasts for 5 years, after which the datasets are automatically transferred to open access. Applicants can contact data owner(s) through a website form on AVA-RU and ask for permission and conditions of use. The AVA-RU team checks the data request by the applicant(s) as quickly as possible, normally within 2 weeks, and contacts the data owners, requesting permission to use the dataset. In case of questions from the data owner, the AVA-RU team contacts the applicant(s) directly and requests additional information. Once permission is received from the owner, the team sends the dataset to the applicant. The data users should propose co-authorship to restricted-access data owners. Co-authors should be offered the possibility to contribute to the research and interpretation of the results.

4 | APPLICATIONS AND PUBLISHED STUDIES

The AVA-RU data have already been used for a broad range of research including vegetation classification and mapping (Koroleva & Kulyugina, 2015; Lavrinenko & Lavrinenko, 2018a, 2018b; Lavrinenko, Matveyeva & Lavrinenko, 2016; Matveyeva, 2006; Telyatnikov, Khitun, Chernyadyeva, & Kuzmina, 2021; Telyatnikov, Khitun, Chernyadyeva, Kuzmina, & Ermokhina, 2021; Telyatnikov et al., 2022), species distribution modelling (Ermokhina et al., 2023) and species richness prediction (Zemlianskii et al., 2023). We also plan the import of the AVA-RU datasets into sPlot (s–Plot, 2023; https://www.idiv.de/en/splot.html). The publication of the datasets now allows further applications, which might include spatial modelling of vegetation height and plant biomass, and conservation studies.

ACKNOWLEDGEMENTS

This work is supported by a Swiss Government Excellence Scholarship (2019.0075), RFBR 18- 04-01010, RSF 20-17-00160 and the University Research Priority Program Global Change and Biodiversity (URPP GCB) of the University of Zurich. We would like to express our gratitude to all the members of the 2017–2018 expeditions, as well as the developers of the AVA-RU website and the lichenologists and bryologists who supported our work. We also thank Martha Raynolds and Ramona Heim for their comments that greatly improved the manuscript. We would also like to show our gratitude to Ivan Sergeev, Anton Romanov and Olga Kulikova for sharing their photos. Open access funding provided by Universitat Zurich.

CONFLICT OF INTEREST STATEMENT

None.

DATA AVAILABILITY STATEMENT

The AVA-RU data are stored on the Russian Arctic Vegetation Archive website (https://avarus.space/) as well as linked through the CAFF website (https://www.caff.is/flora-cfg/ava/links). The open-access data are available on the Dryad repository (Zemlianskii et al., 2023; https://doi.org/10.5061/dryad.5tb2rbp8d). The data processing R script is available on the Dryad repository (Zemlianskii & Plekhanova, 2023; https://doi.org/10.5061/dryad.prr4xgxr1).

ORCID

Vitalii Zemlianskii https://orcid.org/0000-0001-6597-2415

REFERENCES

Bartsch, A., Pointner, G., Nitze, I., Efimova, A., Jakober, D., Ley, S., Högström, E., Grosse, G., & Schweitzer, P. (2021). Expanding infrastructure and growing anthropogenic impacts along Arctic coasts. *Environmental Research Letters*, *16*(11), 115013. https://doi.org/10.1088/1748-9326/ac3176

Bjorkman, A. D., Myers-Smith, I. H., Elmendorf, S. C., Normand, S., Thomas, H. J., Alatalo, J. M., Alexander, H., Anadon-Rosell, A., Angers-Blondin, S., Bai, Y., & Baruah, G. (2018). Tundra trait team: A database of plant traits spanning the tundra biome. *Global Ecology and Biogeography*, *27*(12), 1402–1411. https://doi.org/10.1111/geb.12821

CAVM Team. (2003). Circumpolar Arctic vegetation map. Conservation of Arctic Flora and Fauna (CAFF) Map No 1 [Map].

Chytrý, M., Hennekens, S. M., Jiménez-Alfaro, B., Knollová, I., Dengler, J., Jansen, F., Landucci, F., Schaminée, J. H., Aćić, S., Agrillo, E., & Ambarlı, D. (2015). European vegetation archive (EVA): An integrated database of European vegetation plots. *Applied Vegetation Science*, *19*(1), 173–180. https://doi.org/10.1111/avsc.12191

Conservation of Arctic Flora and Fauna (CAFF). (1997). CPAN Progress Report 1997 (p. 39). https://www.caff.is/expert-groups-series/94-cpan-progress-report-1997

Dedov, A. A. (1940). *Rastitelnost Malozemelskoy i Timanskoy tundra [Vegetation of Malozemelskaya and Timanskaya Tundra]*. Severnaya Baza Akademii Nauk S.S.S.R.

Ermokhina, K. (2017). Russian arctic datasets of releves meeting requirements for classification of vegetation using Braun-Blanquet approach. Presented at Arctic Science Summit Week, Prague, CZ, 31 March-7 April. (Abstract P 142, p. 134) (Poster).

Ermokhina, K. (2018, October 9). *The next steps for bringing Russian Arctic vegetation datasets into the AVA*. Arctic Biodiversity Congress.

Ermokhina, K. A., Terskaia, A. I., Ivleva, T. Y., Dudov, S. V., Zemlianskii, V. A., Telyatnikov, M. Y., Khitun, O. V., Troeva, E. I., Koroleva, N. E., & Abdulmanova, S. Y. (2023). *The high–low Arctic boundary: How is it determined and where is it located?* Unpublished manuscript. A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences.

Ermokhina, K., Zemlianskii, V., Kurysheva, M., & Korolev, D. (2022). Russian Arctic Vegetation Archive website. https://avarus.space

Forbes, B. C., Stammler, F., Kumpula, T., Meschtyb, N., Pajunen, A., & Kaarlejärvi, E. (2009). High resilience in the Yamal-Nenets social–ecological system, west Siberian Arctic, Russia. *Proceedings of the National Academy of Sciences*, *106*(52), 22041–22048. https://doi.org/10.1073/pnas.0908286106

Hennekens, S. M., & Schaminée, J. H. J. (2001). TURBOVEG, a comprehensive data base management system for vegetation data. *Journal of Vegetation Science*, *12*, 589–591. https://doi.org/10.2307/3237010

IPCC. (2019). *Special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems: Summary for policymakers*. Intergovernmental Panel on Climate Change.

Kholod, S. S. (2007). Classification of Wrangel Island vegetation. *Vegetation of Russia*, *11*, 3–135.

Koroleva, N. E., & Kopeina, E. I. (2018). The floodplain meadows of class Molinio-Arrhenatheretea Tx. 1937 in the Varzuga River valley (Murmansk Region). *Rastitelnost Rossii*, *34*, 85–100. https://doi.org/10.31111/vegrus/2018.34.85

Koroleva, N. E., Kopeina, E. I., Novakovskiy, A. B., & Danilova, A. D. (2019). The syntaxonomy of the grasslands and meadows in mountain tundra of Murmansk Region. *Rastitelnost Rossii*, *37*, 79–105. https://doi.org/10.31111/vegrus/2016.28.55

Koroleva, N. E., & Kulyugina, E. E. (2015). K sintaksonomii driadovykh tundr evropeyskogo sektora rossiyskoy Subarktiki [To the syntaxonomy of Dryas tundra of European Russian Subarctic]. *Trudy Karelskogo Nauchnogo Tsentra Rossiyskoy Akademii Nauk*, *4*, 3–29. https://doi.org/10.17076/bg11

Lavrinenko, O. V., & Lavrinenko, I. A. (2018a). Classification of salt and brackish marshes vegetation of the Bolschezemel'skaya tundra (Barents Sea coastal). Phytodiversity of Eastern. *Europe*, *XII*(3), 82–143. https://doi.org/10.24411/2072-8816-2018-10028

Lavrinenko, O. V., & Lavrinenko, I. A. (2018b). Zonalnaya rastitelnost ravninnykh vostochnoyevropeyskikh tundr [Zonal vegetation of the plain East European tundras]. *Rastitelnost Rossii*, *32*, 35–108. https://doi.org/10.31111/vegrus/2018.32.35

Lavrinenko, O. V., Matveyeva, N. V., & Lavrinenko, I. A. (2016). Communities of the class Scheuchzerio–Caricetea nigrae (Nordh. 1936) Tx. 1937 in the east European tundras. *Rastitelnost Rossii*, *28*, 55–88. https://doi.org/10.31111/vegrus/2016.28

Matveyeva, N., Koroleva, N., Lavrinenko, O., Lavrinenko, I., Kulyugina, E., Ermokhina, K., & Razzhivin, V. (2017). *Overview progress on the AVA in Russia*. Arctic Science Summit Week.

Matveyeva, N. V. (1994). Floristic classification and ecology of tundra vegetation of the Taymyr Peninsula, northern Siberia. *Journal of Vegetation Science*, *5*(6), 813–828. https://doi.org/10.2307/3236196

Matveyeva, N. V. (2006). Rastitelnost yuzhnoy chasti ostrova Bolshevik (arkhipelag Severnaya Zemlya) [vegetation of southern part of Bolshevik Island (Severnaya Zemlya archipelago)]. *Rastitelnost Rossii*, *8*, 3–87. https://doi.org/10.31111/vegrus/2006.08.3

Matveyeva, N.V., Cherosov, M.M. & Telyatnikov, M.Yu. (2013). The Russian input to the Arctic vegetation archive and an example of the value of plot data for assessing climate change on the Taymyr Peninsula. 76–80.

Matveyeva, N. V., & Lavrinenko, O. V. (2011). Marsh vegetation in the north-east of Malozemelskaya tundra. *Rastitelnost Rossii*, *17–18*, 45–46. https://doi.org/10.31111/vegrus/2011.17-18.45

Matveyeva, N. V., & Lavrinenko, O. V. (2021). The checklist of the syntaxa within the Russian Arctic: Current state with vegetation classification. *Rastitelnost Rossii*, *42*, 3–41. https://doi.org/10.31111/vegrus/2021.42.3

Matveyeva, N. V., & Lavrinenko, O. V. (2023). Carici arctisibiricae–Hylocomietea alaskani–a new class of zonal tundra vegetation. *Botanica Pacifica*, *12*(1), 3–20. https://doi.org/10.17581/bp.2023.12106

Pearson, R. G., Phillips, S. J., Loranty, M. M., Beck, P. S. A., Damoulas, T., Knight, S. J., & Goetz, S. J. (2013). Shifts in Arctic vegetation and associated feedbacks under climate change. *Nature Climate Change*, *3*(7), 673–677.

Pospelova, E. B., & Pospelov, I. N. (2007). *Vascular flora of Taimyr peninsula and neighboring territories: Part 1. The annotated list of flora and his common analysis*. KMK Scientific Press.

Pospelova, E. B., & Pospelov, I. N. (2010). Flora of the Taymyr peninsula. http://byrranga.ru/about.htm

Potemkin, A., Vilnet, A., Troeva, E., & Ermokhina, K. (2021). Gymnocolea borealis (Anastrophyllaceae, Marchantiophyta) in Asia and Russia: Morphology, ecology, distribution, and differentiation. *Novosti Sistematiki Nizshikh Rastenii*, *55*, 487–494. https://doi.org/10.31111/nsnr/2021.55.2.487

R Core Team. (2022). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.R-project.org/

Raynolds, M. K., Breen, A. L., Walker, D. A., Elven, R., Belland, R., Konstantinova, N., Kristinsson, H., & Hennekens, S. (2013). *The pan-Arctic species list (PASL)*. Workshop.

Rebristaya, O. V. (2013). *Flora poluostrova Yamal: Sovremennoye sostoyaniye i istoriya formirovaniya. [Flora of the Yamal peninsula: Modern state and history of the formation]*. Izd-vo SPbGETU «LETI».

Sekretareva, N. A. (1999). *The vascular plants of the Russian Arctic and adjacent territories*. Pensoft.

Sofronova, E. V., Bezgodov, A. G., Biryukov, R. Y., Boychuk, M. A., Braslavskaya, T. Y., Churakova, E. Y., Czernyadjeva, I. V., Doroshina, G. Y., Dyachenko, A. P., Ermokhina, K. A., Fedosov, V. E., Grishutkin, O. G., Ignatov, M. S., Ignatova, E. A., Kholod, S. S., Kolesnikova, M. A., Konstantinova, N. A., Kozhin, M. N., Kudr, E. V., … Zolotov, D. V. (2019). Novye brologicheskye nakhodki [New brological findings]. *Arctoa*, *28*, 116–142. https://doi.org/10.15298/arctoa.28.10

s-Plot—The Global Vegetation Database. (2023). https://www.idiv.de/en/splot.html

Telyatnikov, M. Y., Troeva, E. I., Ermokhina, K. A., & Pristyazhnyuk, A. (2019a). Vegetation of the two regions of the northern part of the Gydan peninsula (the subzone of typical tundras). *Turczaninowia*, *22*(4), 128–144. https://doi.org/10.14258/turczaninowia.22.4.14

Telyatnikov, M. Y., Troyeva, E. I., Ermokhina, K. A., & Pristyazhnyuk, S. A. (2019b). Rastitelnost srednego techeniya r. Yakhadyyakha (yuzhnaya chast arkticheskikh tundr p-va Yamal) [Vegetation of the middle reach of the Yakhadyyakha river (Southern part of the Yamal peninsula arctic tundra)]. *Turczaninowia*, *22*(2), 58–79. https://doi.org/10.14258/turczaninowia.22.2.3

Telyatnikov, M. Y., Troeva, E. I., Prystyazhnyuk, S. A., Gogoleva, P. A., Cherosov, M. M., & Pestryakova, L. A. (2015). Vegetation in the lower reaches of Indigirka river (zonal and mountain tundras). *Turczaninowia*, *18*(4), 128–168. https://doi.org/10.14258/turczaninowia.18.4.16

Telyatnikov, M. Y., Khitun, O. V., Chernyadyeva, I. V., Kuzmina, E. Y., & Ermokhina, K. A. (2021). Novyye dannyye o rastitelnosti dvukh rayonov yuzhnoy chasti podzony tipichnykh tundr Gydanskogo poluostrova [new vegetation data of two areas located in southern part of Gydan peninsula typical tundra]. *Turczaninowia*, *24*(3), 5–23. https://doi.org/10.14258/turczaninowia.24.3.1

Telyatnikov, M. Y., Khitun, O. V., Czernyadjeva, I. V., Kuzmina, E. Y., & Ermokhina, K. A. (2021). A contribution to the syntaxonomic diversity of the Tazovsky peninsula, Arctic Russia. *Botanica Pacifica. A Journal of Plant Science and Conservation*, *10*(1), 37–51. https://doi.org/10.17581/BP.2021.10106

Telyatnikov, M. Y., Khitun, O. V., Ermokhina, K. A., & Pristyazhnyuk, S. A. (2022). Vegetation of the ultramafic mountain massif Rai-Iz (upper reaches of the Enga-Yu River, the Polar Urals, Russia). *Botanica Pacifica: A Journal of Plant Science and Conservation.*, *11*(1), 37–50. https://doi.org/10.17581/bp.2022.11108

Tikhomirov, B. A. (Ed.). (1956-1966). *The vegetation of the Far North of USSR and its development. Botanical Institute named after V. L. Komarov, USSR Academy of Sciences*. USSR Academy of Sciences Publishing House.

Walker, D. A., Alsos, I. G., Bay, C., Boulanger-Lapointe, N., Breen, A. L., Bültmann, H., Christensen, T., Damgaard, C., Daniëls, F. J. A., Hennekens, S., Raynolds, M. K., Le Roux, P. C., Luoto, M., Pellissier, L., Peet, R. K., Schmidt, N. M., Stewart, L., Virtanen, R., Yoccoz, N. G., & Wisz, M. S. (2013). Rescuing valuable Arctic vegetation data for biodiversity models, ecosystem models and a panarctic vegetation classification. *Arctic*, *66*(1), 133–137.

Walker, D. A., Breen, A. L., Druckenmiller, L. A., Sibik, J., Hennekens, S., Daniels, F. J. A., Matveyeva, N. V., MacKenzie, W. H., Walker, M. D. & Wirth, L. M. (2017). An Arctic Vegetation Archive for circumpolar arctic vegetation classification. Presented at Arctic Science Summit Week, Prague, CZ, 31 March–7 April.

Walker, D., Breen, A., Druckenmiller, L., Wirth, L. W., Fisher, W., Raynolds, M. K., Sibik, J., Walker, M. D., Hennekens, S., Boggs, K., & Boucher, T. (2016). The Alaska Arctic vegetation archive (AVA-AK). *Phytocoenologia*, *46*, 221–229. https://doi.org/10.1127/phyto/2016/0128

Walker, D. A., Daniëls, F. J., Matveyeva, N. V., Šibík, J., Walker, M. D., Breen, A. L., Druckenmiller, L. A., Raynolds, M. K., Bültmann, H., Hennekens, S., Buchhorn, M., Epstein, H. E., Ermokhina, K., Fosaa, A. M., Heiðmarsson, S., Heim, B., Jónsdóttir, I. S., Koroleva, N., Lévesque, E., … Wirth, L. M. (2018). Circumpolar arctic vegetation classification. *Phytocoenologia*, *48*(2), 181–201. https://doi.org/10.1127/phyto/2017/0192

Walker, D. A., Epstein, H. E., Šibík, J., Bhatt, U., Romanovsky, V. E., Breen, A. L., Chasníková, S., Daanen, R., Druckenmiller, L. A., Ermokhina, K., & Forbes, B. C. (2019). Vegetation on mesic loamy and sandy soils along a 1700-km maritime Eurasia Arctic Transect. *Applied Vegetation Science*, *22*(1), 150–167. https://doi.org/10.1111/avsc.12401

Yurtsev, B. A. (1994). Floristic division of the Arctic. *Journal of Vegetation Science*, *5*(6), 765–776. https://doi.org/10.2307/3236191

Zemlianskii, V., Ermokhina, K., Schaepman-Strub, G., Matveyeva, N., Troeva, E., Lavrinenko, I., Telyatnikov, M., Pospelov, I., Koroleva, N., Leonova, N., Khitun, O., Walker, D., Breen, A., Kadetov, N., Lavrinenko, O., Ivleva, T., Kholod, S., Petrzhik, N., Gunin, Y., … Plekhanova, E. (2023). Russian Arctic vegetation archive—A new database of plant community composition and environmental conditions. Dryad, Dataset. https://doi.org/10.5061/dryad.5tb2rbp8d

Zemlianskii, V., & Plekhanova, E. (2023). PASL matching script. Dryad, Dataset. https://doi.org/10.5061/dryad.prr4xgxr1

Zemlianskii V. A., Brun P., Zimmermann, N., Ermokhina, K., Khitun, O., Koroleva, N., & Schaepman-Strub, G. (2023, May 16). Environmental and anthropogenic factors co-shape community-level plant species richness across the Western Siberian Arctic. *Authorea*. https://doi.org/10.22541/au.168421377.75493691/v1

BIOSKETCH

The Russian Arctic Vegetation Archive team is a network of Russian geobotanists. The goal of the team is to bring together geobotanical data and make it openly accessible through the Russian Arctic Vegetation Archive for the international research community. The team is part of the International Arctic Vegetation Archive group including scientists from the United States, Europe and Canada (https://www.caff.is/flora-cfg/ava).

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Zemlianskii, V., Ermokhina, K., Schaepman-Strub, G., Matveyeva, N., Troeva, E., Lavrinenko, I., Telyatnikov, M., Pospelov, I., Koroleva, N., Leonova, N., Khitun, O., Walker, D., Breen, A., Kadetov, N., Lavrinenko, O., Ivleva, T., Kholod, S., Petrzhik, N., Gunin, Y. … Plekhanova, E. (2023). Russian Arctic Vegetation Archive—A new database of plant community composition and environmental conditions. *Global Ecology and Biogeography*, *32*, 1699–1706. https://doi.org/10.1111/geb.13724