Phytocoenologia Vol. 50 (2020), Issue 1, 79–92
Published online Januar 2020

Long Database Report

European Boreal Forest Vegetation Database

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Abstract

The European Boreal Forest Vegetation Database (EBFVD, GIVD ID: EU-00-027) is a repository for vegetation-plot data from the forests of the boreal and hemiboreal zones of Europe. In this report, we describe its structure, current content and future perspectives opened up by the database. In February 2019, the database contained 13 037 vegetation-plot records from Belarus, Estonia, Finland, Latvia, Norway, Russia and Sweden that are not yet stored in the databases of the European Vegetation Archive (EVA). Consequently, this database significantly improves the availability of forest plant community data from Northern Europe. The database is managed by the Vegetation Science Group, Department of Botany and Zoology, Masaryk University, Brno (Czech Republic), in the TURBOVEG 2 program. It is registered in the Global Index of Vegetation Plot Databases (GIVD) and included in EVA. The whole database, or a subset of it, can be requested via EVA, or directly from the database custodian.

Keywords: Boreal; Database; European Vegetation Archive (EVA); Forest vegetation; Hemiboreal; TURBOVEG; Vegetation plot.

Abbreviations: EBFVD: European Boreal Forest Vegetation Database; EVA = European Vegetation Archive; GIVD = Global Index of Vegetation-Plot Databases.

Submitted: 6 March 2019; first decision: 5 April 2019; accepted: 3 September 2019

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DOI: 10.1127/phyto/2019/0336

www.borntraeger-cramer.de
0340-269X/2020/0336 $ 6.30

GIVD Fact Sheet

GIVD Database ID: EU-00-027			**Last update:** 2019-02-26
European Boreal Forest Vegetation Database		**Web address:**	
Database manager(s): Anni Jašková (annipyy@mail.muni.cz)			
Owner: Anni Jašková, Tatyana Yu. Braslavskaya, Elena Tikhonova, Jaanus Paal, Solvita Rūsiņa, Māris Laiviņš, Ilya B. Kucherov, Nadezhda V. Genikova, Ilona Knollová, Tatiana V. Chernenkova, Elena Yu. Churakova, Martin Diekmann, Rune Halvorsen, Elena I. Kirichok, Vladimir N. Korotkov, Alexander M. Kryshen, Daria L. Lugovaya, Olga V. Morozova, Petr V. Potapov, Tatiana S. Prokazina, Fride H. Schei, Yury A. Semenishchenkov, Nikolai E. Shevchenko, Oksana V. Sidorova, Nikolai S. Smirnov, Olga V. Smirnova, Ruslan Tsvirko, Svetlana A. Turubanova & Milan Chytrý			
Scope: We collect vegetation-plot records of all types of forest communities occurring within the boreal and hemiboreal zones, including azonal forest communities, such as alder carrs, from the following countries and regions: Iceland, Scotland, Norway, Sweden, Finland, Estonia, Latvia, Lithuania, Belarus and between the 53rd and 69th parallel in European Russia.			
Availability: according to a specific agreement		**Online upload:** no	**Online search:** no
Database format(s): TURBOVEG		**Export format(s):** TURBOVEG	
Plot type(s): normal plots		**Plot-size range:** 1 to 2500	
Non-overlapping plots: 13037	**Estimate of existing plots:** 20000	**Completeness:** 65%	**Status:** ongoing capture
Total no. of plot observations: 13037	**Number of sources (biblioreferences, data collectors):** [NA]		**Valid taxa:** [NA]
Countries (%): BY: 3; EE: 12; FI: 3; LV: 32; NO: 1; RU: 44; SE: 3			
Formations: Forest: 100% = Terrestrial: 100%			
Guilds: [NA]			
Environmental data (%): altitude: 12%; slope aspect: 27%; slope inclination: 37%; surface cover other than plants (open soil, litter, bare rock etc.): 9%; other soil attributes: 10%; soil pH: 3%; soil depth: <1%; other attributes: stand age, fire and other disturbances, river, litter thickness...			
Performance measure(s): cover: 100%; number of individuals: 0%; measurements like diameter or height of trees: 13%; biomass: 0%			
Geographic localization: GPS coordinates (precision 25 m or less): 83%; point coordinates less precise than GPS, up to 1 km: 6%; small grid (not coarser than 10 km): 11%; political units or only on a coarser scale (above 10 km): 1%			
Sampling periods: before 1920: <1%; 1920-1929: 4%; 1930-1939: 2%; 1940-1949: <1%; 1950-1959: 3%; 1960-1969: 1%; 1970-1979: 4%; 1980-1989: 8%; 1990-1999: 15%; 2000-2009: 45%; 2010-2019: 17%; unknown: 1%			
Information as of 2019-02-26 further details and future updates available from http://www.givd.info/ID/EU-00-027			

Introduction

The boreal vegetation zone, including the hemiboreal subzone, situated between 53°N and 69°N in Europe, is the most extensive biome on this continent (Ahti et al. 1968). Boreal forests, which cover a major part of the zone, are primarily dominated by the coniferous trees *Picea abies* s. l. (incl. *P.* × *fennica* and *P. obovata*) and *Pinus sylvestris,* to which *Abies sibirica, Pinus sibirica* and *Larix sibirica* are added in north-eastern Europe. Additionally, mixed forests of broad-leaved trees (e.g. *Acer platanoides*, *Tilia cordata* and *Quercus robur*) and conifers occur on lime-rich soils and in topoclimatically favourable sites, increasing in abundance towards the south. Seral communities are often dominated by small-leaved deciduous trees, namely *Betula* spp. and *Populus tremula* (Kryshen et al. 2018, Smirnova et al. 2017). The vast extent of the biome requires international cooperation for its protection (Spribille & Chytrý 2002).

Detailed knowledge of habitats and their species composition is a prerequisite for systematic mapping and efficient application of nature conservation measures. A recent trend in vegetation science is the creation of large vegetation-plot databases which facilitate and promote data sharing (Chytrý et al. 2016, Bruelheide et al. 2019). This trend has been strengthened by the rapid increase in the processing capacity of vegetation data management software (e.g. TURBOVEG; Hennekens & Schaminée 2001). These advances open up numerous new opportunities, including broad-scale vegetation classification and species or community distribution modelling (Dengler et al. 2011). The establishment of the European Vegetation Archive (EVA, Chytrý et al. 2016; http://euroveg.org/eva-database) has substantially facilitated the sharing of European vegetation-plot data and enabled a joint analysis of several independent databases.

Several thematic vegetation-plot databases, covering selected vegetation types across their European range, have recently been established, e.g., for Mediterranean pine forests (Bonari et al. 2019, GIVD ID: EU-00-026). There is, however, a general tendency for Northern Europe to be sparsely represented in such databases, regardless of the habitat type (Chytrý et al. 2016). Two exceptions to the general pattern are The Nordic Vegetation Database (GIVD ID: EU-00-018), which improved the data coverage in the Nordic countries, and the European Mire Vegetation Database (Peterka et al. 2015, GIVD ID: EU-00-022), which, in turn, improved the data coverage for mires in the boreal zone, but yet there exists no international vegetation-plot database for boreal forests.

The boreal forests of Northern Europe have been studied by a multitude of approaches, using different sampling methods (Pätsch et al. 2019). This represents a challenge for the data compilation, and for conducting high-resolution European-scale vegetation studies. National Forest Inventories (NFI) have a long tradition in the Northern European countries, but their sampling designs primarily served forestry purposes. The applicability of NFI data for plant community studies, e.g., for analyses of species-richness patterns, varies between countries (Vidal et al. 2016), and so do the data-sharing policies. Relatively large datasets have been collected, e.g., in Belarus (Tsvirko 2017), Estonia (Paal et al. 2007), Latvia (Laiviņš et al. 2008), European Russia (Morozova et al. 2017, Smirnova et al. 2017, Zaugolnova & Morozova 2006-2012), southern Norway (Økland & Eilersten 1993) and southern Sweden (Diekmann 1994). Other focal vegetation studies in Northern Europe are reviewed by Spribille & Chytrý (2002). So far, the data on which these studies are based have not been brought together in a common database.

We established the EBFVD aiming to cover the forests within those countries of the boreal zone of Europe (including the hemiboreal subzone; Ahti et al. 1968) that were not yet adequately covered with forest vegetation-plot data by other databases registered in EVA, i.e.: Iceland, Norway, Sweden, Estonia, Latvia, Finland, Belarus, and north of 53°N in European Russia, including the Ural Mountains. This definition of the boreal zone closely corresponds to the terrestrial ecoregions of Scandinavian and Russian taiga and Sarmatic mixed forests (Olson et al. 2001). We compiled vegetation-plot records representing all forest communities within these zones, including azonal forest communities such as mire forests, alder carrs, and coastal birch forests. The EBFVD has a different scope than the previously registered GIVD-databases. For the first time, this database enables detailed European-scale investigation of vegetation patterns of the boreal and hemiboreal forests. In this report, we introduce the EBFVD and describe its structure, current content, intended applications and future perspectives.

Data compilation

In the initial phase of database establishment, we reviewed existing data and identified gaps. First, we requested boreal forest data from EVA. Thereafter, we searched the GIVD-registered databases not included in EVA to check whether all the boreal forest vegetation plots in all the GIVD-registered databases were included in EVA. On the European scale, boreal forests were poorly represented in EVA; only Lithuania and Scotland were adequately covered by data from the Lithuanian Vegetation Database (GIVD-ID: EU-LT-001) and the UK National Vegetation Classification Database (GIVD-ID: EU-GB-001), respectively. To fill in the gaps, we initiated cooperation within an international team of vegetation scientists and complemented the data by digitizing published vegetation-plot records from literature (Appendix 1).

The incongruent vegetation sampling methods were handled by using several data transformations. For instance, species abundances recorded on different cover scales were transformed into a percentage scale. Especially in datasets from Estonia, Finland and Norway, the herb layer was often recorded in several subplots but not in the whole plot. In such cases, species lists of subplots within the same plot were merged and cover values were averaged across the subplots. Missing coordinates were georeferenced based on locality descriptions or adjacency to geo-referenced plots, and the uncertainty of localisation was estimated. All the epiphytic lichens and bryophytes were excluded from the records. The applied transformations are described in Appendix 2.

Structure and content of the database

In February 2019, the EBFVD contained a total of 13037 vegetation-plot records from Belarus, Estonia, Finland, Latvia, Norway, Russia, and Sweden. The majority of the plots were sampled in Russia. The new database significantly improves the data availability of forest communities in Northern Europe compared with the data so far available in other EVA databases (Figs 1 and 2). However, large areas within the boreal zone still remain without data, including Iceland. Most of the original plot records have not been previously published in scientific literature, although they have been used in various published analyses. References for published datasets are listed in Appendix 1.

The header data of the database follow the recommendations of EVA, including the following fields: author and contributor name, source (biblioreference, table number, plot number in the table, or if unpublished, original plot ID and source file name), topography (altitude, aspect, slope), vegetation structure (cover of the tree, shrub, herb and cryptogam layers, average height of trees, location (locality name, latitude and longitude in WGS84 coordinates with location uncertainty), date of survey and cover-abundance scale used. Many plots contain various types of additional information, e.g., about sampling method, data transformation, vegetation type, land-use information, average stand age, tree diameter at breast height or soil properties (e.g., soil type, litter thickness, bedrock type). The database covers sampling years from 1911 (Regel 1928) to 2018. The distribution of plots across sampling decades is shown in Fig. 3. The most intensive sampling decade was the 2000s. Plot sizes range from 1 to 2500 m^2, and both the median and mode plot size is 400 m^2. The distribution of plot sizes is shown in

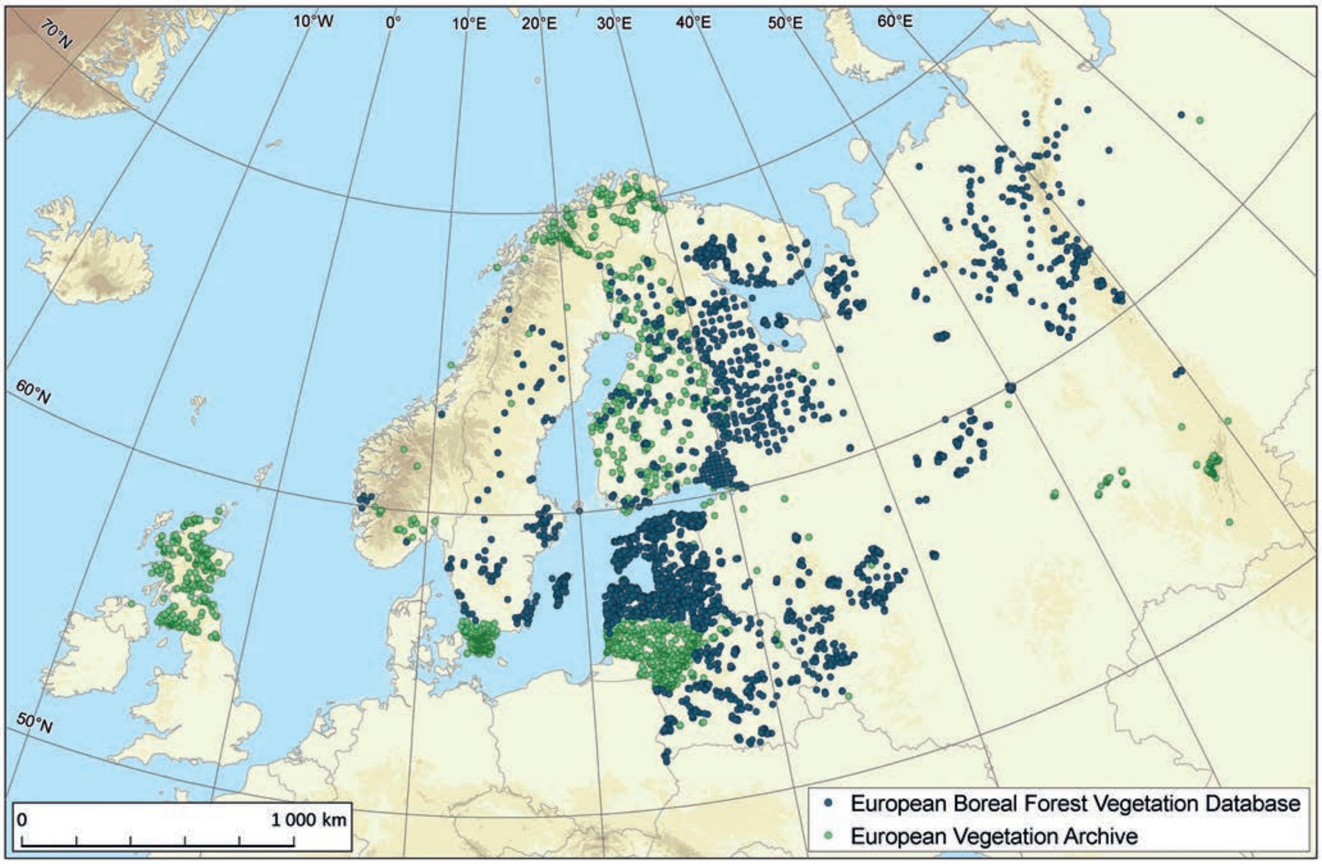

Fig. 1. Distribution map of forest vegetation plots in the study area of the European Boreal Forest Vegetation Database (n = 13037) and in the other databases in the European Vegetation Archive (n = 10015).

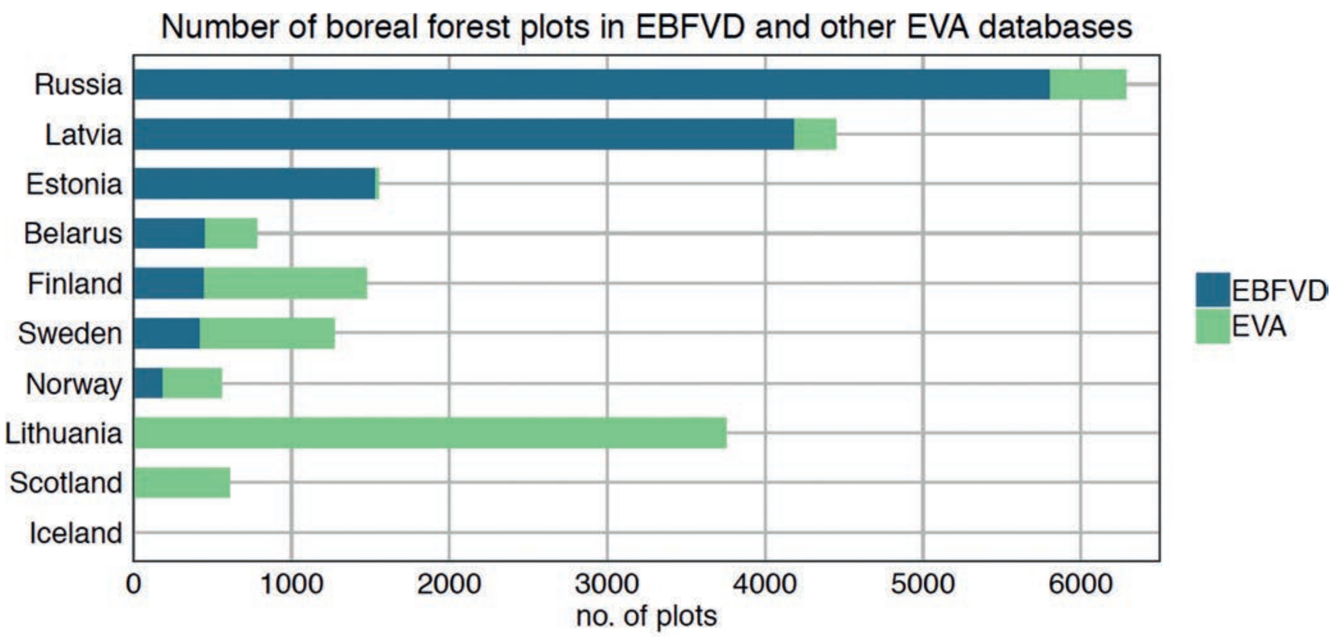

Fig. 2. A country-based comparison of the numbers of forest vegetation plots in the study area between the European Boreal Forest Vegetation Database (EBFVD) and the other databases in the European Vegetation Archive (EVA).

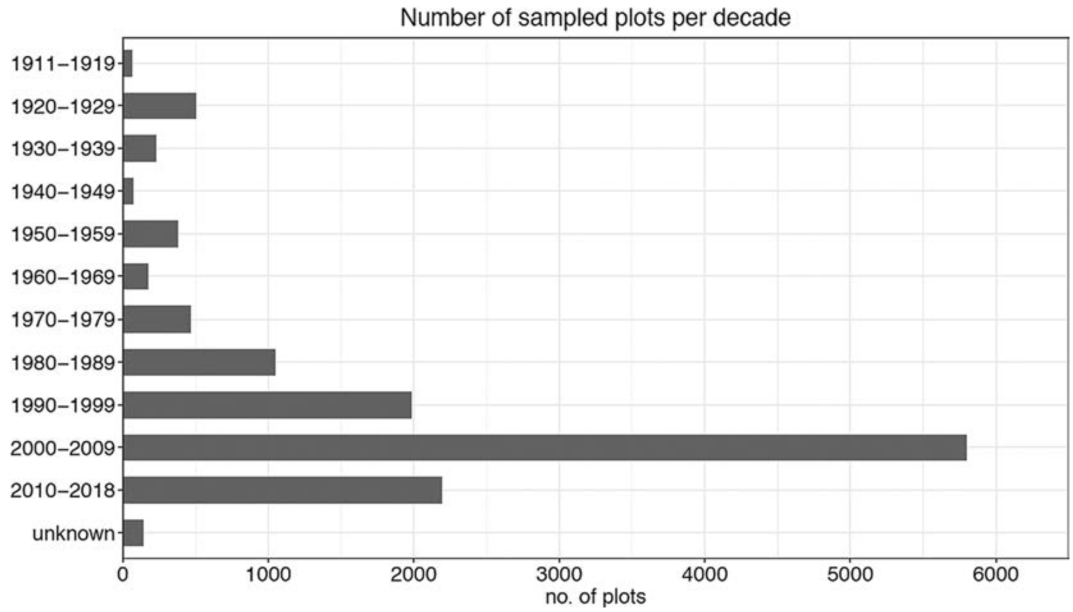

Fig. 3. Temporal distribution of sampled plots in the European Boreal Forest Vegetation Database. The sampling year ranges from 1911 to 2018.

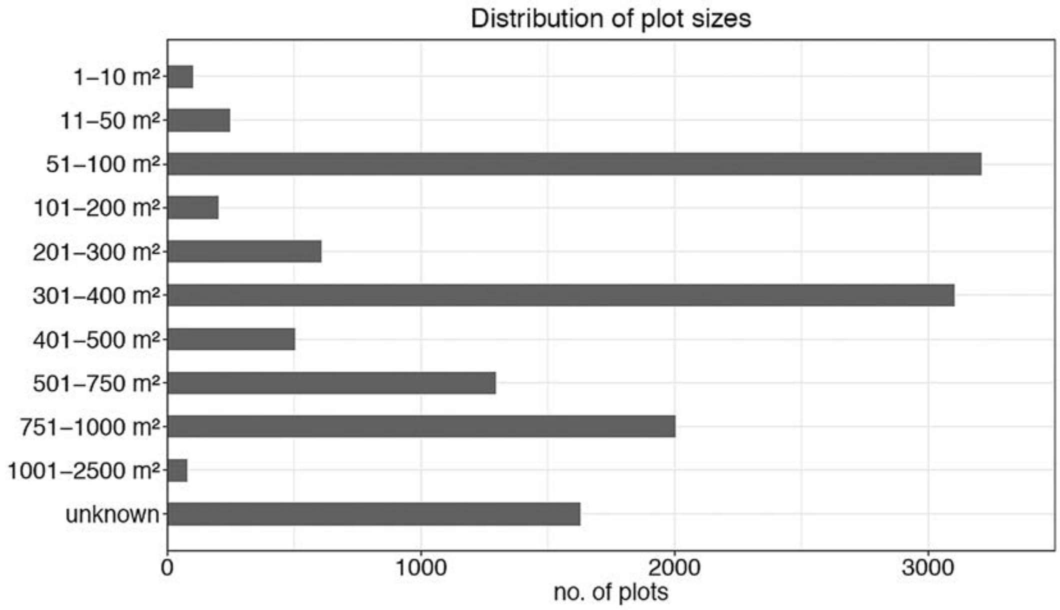

Fig. 4. Distribution of plot sizes in the European Boreal Forest Vegetation Database. The plot size ranges from 1 to 2500 m^2.

Fig. 4. Only 1.7% of the plots have been assigned to syntaxa according to the Braun-Blanquet school of phytosociology, either by their original authors or by the data contributors, whereas 22.6% of the plots have been assigned to other classification systems, e.g., the Russian eco-dynamic typology (Kryshen et al. 2018) or the Finnish forest site types (Hotanen et al. 2008), which are also applied in Estonia and Russian Karelia.

The species data consists of records of vascular plants, bryophytes and lichens. The exact number of plots where bryophytes and/or lichens were recorded is unknown, because the reason for their absence in the plot records was not documented. The cover-abundance of the majority of species was estimated in all of the plots (in some datasets, only the presence was recorded for lichens; see Appendix 2). Species were recorded separately for the following vegetation layers: tree (in some cases with two sub-layers), shrub, herb, and cryptogam layer. The database is divided into two parts that use different species lists. The nomenclature of the plots from Belarus and

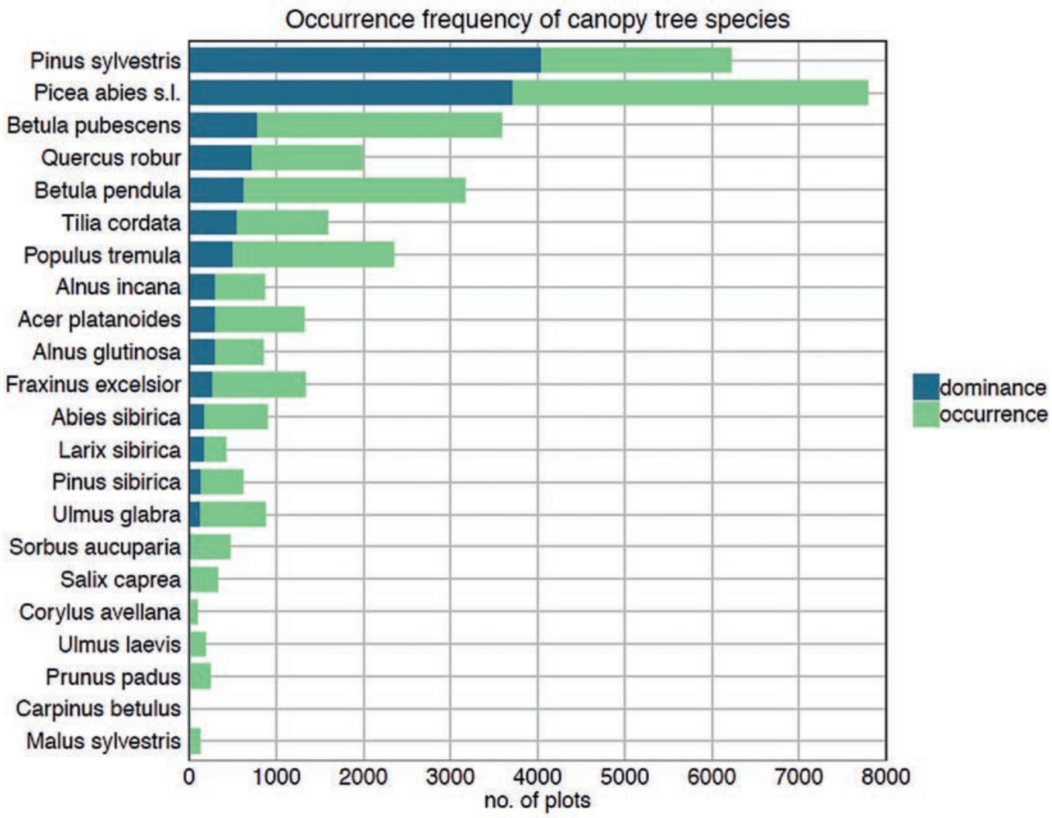

Fig. 5. The frequency of tree species occurring as canopy dominants (blue bars), and non-dominants (green bars) in the European Boreal Forest Vegetation Database. The species are ordered by the frequency of occurrence as dominants. Only species that occurred in more than 1% of all plots and were dominant in one or more plots are displayed.

Russia follows the TURBOVEG species list Russia (with some modifications and additions, vascular plants adapted from Cherepanov 1995), and the nomenclature of the plots from Estonia, Finland, Latvia, Norway and Sweden follows the TURBOVEG species list Europe (with some modifications and additions, vascular plants adapted from Tutin et al. 1968–1993). The nomenclature of bryophytes and lichens in both species lists follows several different sources. The frequency of occurrence of tree species, as well as the frequency of their occurrence as canopy dominants, is shown in Fig. 5. *Pinus sylvestris* and *Picea abies* are the most frequently occurring dominant species within the EBFVD.

Data accessibility

The EBFVD is stored in EVA (http://euroveg.org/eva-database-participating-databases; Chytrý et al. 2016) and registered in the GIVD (http://www.givd.info/ID/EU-00-027). Data are made available in accordance with the Data Property and Governance Rules of EVA. The accessibility regime is currently set to restricted (see more in http://euroveg.org/download/eva-rules.pdf), due to an ongoing research project. Additionally, a subset of the database, 5 651 plots, is included in the sPlot (Bruelheide at al. 2019) database. The whole EBFVD, or a subset of it, can be requested by anyone via EVA or directly from the database custodian (first author). The EBFVD is an independent database and the data remains in the ownership of the data contributors. The decision on data sharing will be made individually for each data request.

Applications and future perspectives

The EBFVD can serve a wide range of scientific purposes. One of the intended aims is creating a unified classification of boreal forest types following the phytosociological approach, carefully tested against real data, and with formal definitions of syntaxa. The database has already been used for improving the EUNIS (European Nature Information System) habitat type system of the European Environment Agency (Schaminée et al. 2018). Moreover, the database can be used for gradient analyses of species-environment relationships, studies of species-richness patterns as well as for addressing biogeographical questions such as sharpening the definitions of the borders of the vegetation zones and subzones and exploring plant invasion patterns. Our ambition is that the new database will enhance the use of these data by a wide range of researchers. However, it must be noted that the large variation in sampling methods, particularly concerning the plot sizes, must be considered before further data analysis (Otýpková & Chytrý 2006), as well as the fact that the database does not contain time series.

The EBFVD still completely lacks data from Iceland and large parts of Norway, Sweden, Finland and European Russia. Moreover, not all the existing forest vegetation types are adequately represented in the database for all the countries of the boreal zone. For instance, in Belarus, only records of pine forests are currently available (Tsvirko 2017). The imbalance in plot numbers between countries can be explained by several reasons: firstly, the use of incompatible sampling methods, mainly in Fennoscandia, led to exclusion of some datasets. Secondly, digitization of vegetation-plot records from the literature has clearly been most active in Russia, Latvia and Lithuania. Most probably, sampling activity is also reflected in the plot numbers, but this is difficult to estimate. Finally, chance played its role too, via established contact networks directing the data inquiry, and via variable attitudes towards data sharing. We welcome potential collaborators from all the countries in the study area to contribute vegetation-plot data and act as local experts. To join the database, the potential contributors are encouraged to directly contact the database custodian (first author). The data do not necessarily need to be in TURBOVEG 2-format, and can be standardized by the database custodian. Our ambition is to continue digitizing the already published vegetation-plot records from literature, to include more existing local or regional datasets, and to conduct complementary field surveys to cover the most obvious gaps.

Author contributions

A.J. and M.C. developed the idea, A.J., T.Yu.B. and E.T. coordinated the data compilation, S.R., M.L. J.P. E.T., T.Yu.B. and I.B.K. contributed the largest datasets to the database, A.J., E.T., T.Yu.B., J.P., I.B.K. and N.G. digitized and/or transformed data particularly for the purposes of the database, I.K. was responsible for the database management, and A.J. wrote the paper. All the other co-authors collected vegetation-plot data and contributed to the preparation of the manuscript.

Acknowledgements

The compilation of this database would not be possible without the immense work of the countless field botanists across the boreal zone, including E.A. Aristarkhova, E.Yu. Bakun, B. Bambe, E. Basova, N.G. Belyaeva, A. Biryukova, A.D. Bulokhov, V.V. Buslakov, D.A. Bykov, P. Degtjarenko, T.D. Danilova, O.A. Dmitriyeva, O.S. Druzhinina, E.B. Filippova, E.P. Gnatyuk, O. Golubeva, A.V. Gornov, N. Ilyina, I.I. Istomina, I. Tsapova, N.V. Ivanova, N.G. Kadetov, L. Kantserova, E.V. Kocherina, A.V. Kolpakova, S.Yu. Koroleva, K.O. Korotkov, I.P. Kotlov, M.N. Kozhin, S.A. Kutenkov, A.K. Kvitkina, E.E. Leybonen, I.S. Makhova, V.N. Mamontov, V.P. Mironov, E.M. Murzina, V.Yu. Neshataev, E. Novinskaya, E. Ogiyevskaya, A.N. Ostanin, M.V. Ostrovskaya, O.A. Pesterova, K.B. Popova, Yu.V. Presnukhin, M.Yu. Puzachenko, A.O. Rozhin, M.V. Sementsova, E.S. Shaposhnikov, R.M. Shilikov, A.I. Shirokov, V.V. Shutov, I.A. Stepanov, P.V. Stepanov, A.V. Tanasevich, K.Yu. Teplov, N.I. Vasilenko, M.Yu. Vdovitchenko, I.S. Zadorina, N.V. Zakharova, A.D. Zhelezova, E. Zykina and passed T.P. Nekrasova, D.N. Saburov and L.B. Zaugolnova. Especially, we wish to thank Tomáš Peterka, Eva Šmerdová, Martin Jiroušek, and Anna Šímová who helped to collect field data, particularly for this project, Pavla Vlčková, Jarmo Laitinen and Oddvar Pedersen for their great help with data digitization, Teuvo Ahti for consultation and providing literature, Stephan Hennekens for database processing in TURBOVEG 3 and Ondřej Hájek for coordinate conversion and preparing the map. Finally, we wish to express our gratitude to EVA database custodians as well as all the associated data contributors for making their data available for this project.

A.J., I.K. and M.C. were supported by the Czech Science Foundation (project 19-28491X, Centre for European Vegetation Syntheses). T.Yu.B., E.T. and O.V.S. were supported by Russian Foundation for Basic Research (projects 18-54-00029 – field work, 19-04-00-609 – manuscript preparation). T.Yu.B., E.T., N.G., E.Yu.C., A.K., I.B.K., T.S.P., N.E.S. and O.V.S. were supported by the Ministry of Science and Higher Education of Russian Federation (projects AAAA-A18-118052400130-7, AAAA-A17-117122990042-2, AAAA-A19-1190306900 58-2, AAAA-A17-117011210086-4). S.R. was supported by the University of Latvia grant (project AAp 2016/B041//Zd 2016/AZ03).

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Appendix

Appendix 1. List of biblioreferences of the digitized vegetation plots in the EBFVD.

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Appendix 2. Descriptions of the sampling methods and applied transformations for unifying the datasets in the European Boreal Forest Vegetation Database. When different combinations of methods were used in different datasets or individual plots, it is specified in the Remarks field of the database. For the full references of digitized data sources, see App. 1.

Plot ID (species list)	Country	Source	Description of sampling design & applied transformation
		Various datasets	Commonly applied transformations of cover-abundance scales into percentage class centres are indicated in the header data with a cover-scale code (or in the Remarks field when a combination of cover scales was used and the transformation was applied before the import). The Boreal Popup list in the TURBOVEG program contains all the cover-abundance scales used in the data-base, including the following scales used in the EBFVD: Braun-Blanquet scale, old (code 01): r = 1%, + = 2%, 1 = 3%, 2 = 13%, 3 = 38%, 4 = 63%, 5 = 88% Braun-Blanquet scale, new (code 02): r = 1%, + = 2%, 1 = 3%, 2m = 4%, 2a = 8%, 2b = 18%, 3 = 38%, 4 = 63%, 5 = 88% Domin scale (code 08) + = 1%, 1 = 2%, 2 = 3%, 3 = 4%, 4 = 13%, 5 = 23%, 6 = 29%, 7 = 42%, 8 = 63%, 9 = 88%, 10 = 99% Hult-Sernander scale (code 18): 1 (< 6.3) = 3.1%, 2 (6.3–12.5%) = 9.3%, 3 (12.5–25%) = 18.7%, 4 (25–50%) = 37.5%, 5 (50–100%) = 75%
965-2061 2394-3155 (Europe)	Estonia, Russia	Paal, J. (unpublished)	Several datasets by J. Paal contained records based on different combinations of sampling methods (specified in the Remarks field): circular plots of 1000 m^2, with a radius of 17.8 m (unless otherwise stated in the header data) were used to record the tree layer, while the shrub layer was recorded mostly with five 4 m^2 subplots. The herb and cryptogam layer were recorded in 5–15 1 m^2 subplots, then averaged. The presence of species occurring outside the subplots in the field and cryptogam layer within the 1000 m^2 circular plot was recorded. The following transformations were applied: the total canopy cover was corrected by multiplying by 0.9, to adjust the diffuse cover estimation into absolute, which is commonly used in the Braun-Blanquet school. (Diffuse cover estimation means that the total cover of the canopy is estimated including the gaps between the leaves within the canopy, while in absolute estimation, only the area covered by leaves against the sky is estimated.) When used, the following cover classes, with intermediate values, were transformed into percentage class centres as follows: + = 0.1%, 0.5 = 1%, 1 (1–3%) = 2%, 1.5 = 3%, 2 (3–10%) = 7%, 2.5 = 10%, 3 (10–25%) = 18%, 3.5 = 25%, 4 (25–50%) = 38%, 4.5 = 50% 5 (>50%) = 75% (after J. Paal). All percentage values <0.1% were replaced by 0.1%. In some datasets, only the presence was recorded for lichens, and in such cases, the presence was transformed into 1%. Two alternative methods were used to estimate the tree layer: (1) Average tree basal area, m^2/ha, measured with a relascope at a height of 1.3 m (3–5 measurements). The basal area values were transformed into percentage cover values as follows: basal area of a species/sum of all basal areas * total canopy closure. (2) Species abundance fraction (+, 1, 2...9, 10; where 1 = 10 %, and 10 = 100% of the total canopy cover): the abundance fraction values were transformed into percentage cover values: canopy closure * species abundance fraction. + was always replaced by 1%. Most commonly, the shrub layer was recorded with an average number of stems within 2-m radius subplots or 4 m^2 square plots (usually 5 subplots). The average stem number was transformed into percentage cover values as follows: stem count * 2. Sometimes it was recorded directly with percentage cover values or with the Braun-Blanquet cover-abundance scale. (The shrub layer comprised juveniles, shrubs and young trees (regrowth) <5 m. The field and cryptogam layers were recorded with the Braun-Blanquet cover-abundance scale or in percentage cover values.
2062-2161 (Europe)	Norway	Halvorsen, R. (unpublished)	Originally, the dataset consisted of vegetation plot transects with nested plots of 64, 16 and 1 m^2. The canopy tree species were recorded in sketch maps within 64 m^2 plots (in Økland & Eilertsen 1993, Appendix 3), and based on these sketch maps, the percentage cover values of each species were estimated post hoc by A. Jašková. The frequency of species in the shrub layer (height of 0.8–2 m) was recorded with two 1 m^2 subplots within the 16 m^2 subplot. These values were not transformed. The percentage cover of the species in the herb and cryptogam layer (including juvenile trees <0.8 cm) as well as environmental variables were also recorded within the two 1 m^2 subplots (or some of the variables within the 16 m^2 subplot).

Appendix 2. cont.

Plot ID (species list)	Country	Source	Description of sampling design & applied transformation
34-111 883-927 2247-2367 (Europe)	Finland	Ruuhijärvi, R. (1960) Koponen, T. (1967) Eurola, S. (1962)	The plot sizes used in these three studies were 75 m^2 in Ruuhijärvi (1960), 1, 4, 5, 10 or 100 m^2 in Koponen (1967) and 100 m^2 in Eurola (1962). Hult-Sernander scale was used to estimate the tree and shrub layer cover, while the field and cryptogam layer covers were estimated with percentage cover values with the following class centres: 0.1, 0.5, 1, 2, 3, 4, 5, 10, 15...90, 95, 99%. Hult-Sernander scale class centres were transformed into percentage cover scale, and the class centres were further rounded to correspond with the percentage cover values as follows: 1 (< 6.3) = 3%, 2 (6.3–12.5%) = 10%, 3 (12.5–25) = 20%, 4 (25–50%) = 40%, 5 (50–100%) = 75% (code 15 in the Boreal popup list).
112-214 (Europe)	Finland	Linkola, K. (1929)	Species in all the vegetation layers were recorded within 100, 150 or 200 m^2 plots. A combination of two scales was used: Hult-Sernander scale for recording species in the tree layer and Norrlin abundance-density scale for the shrub, field and cryptogam layer (code 26 in Boreal popup list). Norrlin scale was transformed into percentage class centres as follows: 1 = 0.5%, 2 = 2.5 %, 3 = 4%, 5 = 15%, 6 = 25%, 7 = 40%, 8 = 60%, 9 = 80%, 10 = 95%. (Note that Norrlin scale is based on the density of individuals, therefore the conversion into percentage-cover values is rather arbitrary, and differing conversions have been used for the Norrlin scale.)
2212-2246 (Europe)	Norway	Klokk, T. (1982)	Mostly five (sometimes three or six) subplots of 4 m^2 were used to record all vegetation layers within a stand. Adjusted Hult-Sernander scale with six classes (instead of the commonly used five) was used for recording the cover of all species. The scale was transformed into percentage-cover values with the following class centres: 1 = 3%, 2 = 9%, 3 = 19%, 4 = 38%, 5 = 70%, 6 = 88%. The values were then averaged across five subplots. Also, slope and aspect values were averaged across five subplots. Canopy tree species covers were adjusted by A. Jašková based on the association descriptions by T. Klokk and personal field experience because too small subplots for evaluating canopy cover seemed to yield biased values.
9330-9519 9789-13037 (Russia)	Russia	Genikova, N.V. & Kryshen, A.M. (unpublished)	The most frequently used plot sizes were either 400 or 600 m^2. Species in the tree layer were recorded with species abundance fraction (1, 2...9, 10; 1 = 10% and 10 = 100%) of the total canopy cover. The total canopy percentage-cover values were estimated post hoc by A. Kryshen and N. Genikova. Abundance fraction values were then transformed into percentage-values as follows: species abundance fraction * canopy closure. The lower tree layer (2) and the shrub layer were recorded with stem density/ha, which was also transformed post hoc by A. Kryshen and N. Genikova into the Braun-Blanquet scale, and further into percentage cover values as follows: + (<1%) = 0.5%, 1 (1–5%) = 3%, 2 (5–15%) = 10%, 3 (15–25%) = 20%, 4 (25–50%) = 40%. The field and cryptogam layers were recorded with percentage cover values.
11041-12004 (Russia)	Russia	Several authors, Specified in the Biblioref field in the header data.	The following transformations were used with all the records digitized by I.B. Kucherov (see Zverev 2007, Kucherov 2018): Braun-Blanquet scale: r = 0.1%, + = 1%, 1 = 5%, 2a = 12.5%, 2b = 25%, 3 = 50%, 4 = 75%, 5 = 100% Drude scale for the tree and shrub layers: un = 0.5%, rr = 1%, sol = 5%, sp = 15%, cop^1 = 25%, cop^2 = 50%, cop^3 = 75%, soc = 95% Drude scale for the herb and cryptogam layers: rr = 0.1%, sol-rr = 1%, sol = 3%, sol-sp = 5%, sp = 10%, sp-cop^1 = 15%, cop^1 = 20%, cop^1-cop^2 = 30%, cop^2 = 40%, cop^2-cop^3 = 60%, cop^3 = 80%, soc = 95% References: Zverev A.A. 2007. Information technologies in plant cover studies. Tomsk Univ. Publ. Tomsk: 304 p. (In Russ.) Kucherov I.B. 2018. Phytocoenotical and ecological diversity of light-coniferous forests in the middle- and northern-boreal subzones of European Russia: Doct. Biol. Sci. Thesis. St. Petersburg: Komarov Bot. Inst. 959 p. (In Russ., available at https://www.binran.ru/files/phd/Kucherov_Thesis.pdf)