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The Second International Arctic Vegetation Archive and Classification Workshop, Prague, Czech Republic, 30–31 March 2017

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Abstract. Here we present a brief overview of events and presentations at the International Arctic Vegetation Archive and Classification Workshop, held in Prague, the capital of the Czech Republic, on 30–31 March 2017. The purpose of the workshop was to collect and process data about the Arctic vegetation. The data supposed to be presented in a standard format for subsequent classification and analysis. Twenty-nine scientists from most of the Arctic states were among the participants of the workshop. They presented an overview of existing databases on vegetation, discussed the possibility of sharing and pooling of data as well as possible ways of classification for the pan-Arctic vegetation.

Keywords: *the Arctic, conference, classifications, databases, vegetation*

An objective assessment of the Arctic biodiversity and a significant increase in the effectiveness of its study require the creation and development of modern public information systems that manipulate biological data.

Despite the significant progress and achievements of information technologies in the science of vegetation, the proportion of geobotanical data bases for the Russian Arctic in the European and global resources is small as well as the number of published geobotanical descriptions. International cooperation and the creation of circumpolar databases and other information resources is of great importance for the study of the Arctic biome. It was proved at a seminar on the study and classification of the Arctic vegetation on 30–31 March, Prague. The seminar took place in the building of the Czech Academy of Sciences. Financial and organizational support was provided by the International Arctic Science Committee (IASC), the National Aeronautics and Space Administration (NASA), the international organization Conservation of Arctic Flora and Fauna (CAFF) and the University of Alaska in Fairbanks. The seminar was attended by 29 specialists from the Arctic states: Canada, Norway, Russia and the United States, as well as from Germany, the Netherlands, Switzerland, the Czech Republic and Slovakia. Despite the small number of participants, the presentations and discussions of the seminar can be regarded as a slice of modern science on the Arctic vegetation. The main objectives of the seminar — discussion on creating a database (DB), geobotanical descriptions in the Arctic, necessary for the subsequent classification of the Arctic vegetation, and harmonization of North American and European approaches to the creation of such databases and the classification of vegetation.

The history of these conferences began in 1992, in Boulder, Colorado, the USA. The town hosted the first workshop on classification of the Arctic vegetation. Russia was represented by B.A. Yurtsev, N.V. Matveeva, V.Y. Razzhivin, A.E. Katenin (BIN named after V. L. Komarov of the Russian Academy of Sciences) and N. E. Koroleva (PABSI KSC RAS). The 1990s were a time of "discovery" of the science of vegetation of the former USSR for the West. Russian botanists actively traveled abroad. The Arctic become an area of intense international cooperation. Expeditions with the participation of scientists from different countries worked in marine and terrestrial ecosystems of the Russian and American Arctic. An extremely important achievement of this international scientific collaboration is the Circumpolar Arctic Vegetation Map (CAVM) [1]. Marilyn Walker (Boulder, USA) spoke about the first international workshops on the classification of the Arctic vegetation, the impact of the articles by B. A. Urtsev on the scientific world and cooperation with Russian researchers during joint expeditions in the Arctic.

The organizer of the workshop Skip Walker (Fairbanks, USA) identified the main objectives: to get acquainted with European and Russian experience of creating databases of geobotanical descriptions and use them for the Arctic Vegetation Classification (AVC); to find out the current state of databases in each sector of the Arctic; to determine the possibility of integrating national databases in a unified all-Arctic database, which should be used for classifying vegetation and for the establishment of the Arctic prodromus of the known syntaxa. Also, S. Walker presented the database of Arctic Vegetation Archive (AVA-AK) for the American sector of the Arctic [2]. It includes more than 3000 descriptions of the 24 local bases of Alaska and Northern Canada. In addition, S. Walker analyzed the ratio of tundra habitats and known classes, orders and alliances of the Arctic Alaska.

Milan Chytrý (Brno, Czech Republic) told about the information system (IS) for storing and managing data on vegetation of Europe (European Vegetation Archive (EVA) URL: http://euroveg.org/eva-database) as the basis for the review of the European vegetation. The EVA has been collected since 2014 and now it includes more than 1.3 million geobotanical descriptions of about 70 national and local databases. Special attention was paid to the possible links between the EVA and the AVA databases, since the Arctic vegetation is still poorly represented in the basis of EVA, suggesting the need for cooperation between the two projects. Work on creating the EVA database of descriptions was closely associated with another European project — the creation and publication of a hierarchical classification of the European vegetation — EuroVegChecklist [3], which took 15 years of intensive work and cooperation of the most authoritative experts-geobotanists from 16 countries.

Stephan Hennekens (Wageningen University, the Netherlands) talked about the third version of the Turboveg v3 (URL: http://euroveg.org/download/eva-rules.pdf). This program is the basis for the IS of the EVA and is used by many Russian geobotanists for storage and processing of geobotanical data. An updated third version of the program will allow to choose data for processing in other programs and formats such as JUICE, GIS and Excel, and edit it, e.g., using the Google Maps.

Software issue were continued by the report of Lubomir Tichý (Brno, Czech Republic) and co-authors on the functions of formal classifications in the JUICE (http://www.sci.muni.cz/ botany/juice/), which can be useful in the classification of vegetation at any level of the hierarchy. It is based on automation of selection and definition of plant communities [4].

The report of the manager of the vegetation database project AVA-AK Amy Breen (Fairbanks, USA) and her co-authors contain a detailed description of the database, which was created in response to the requirement of time regarding the needs of inventory of the vegetation and environment in the industrial development of the American sector of the Arctic and global climate change [5]. Another important reason was the need of digitization and preservation of existing data on vegetation, which might otherwise be lost. The basis for the AVA-AK is a joint pan-Arctic database of vascular plants, mosses, liverworts and lichen, the software Turboveg and the necessary mapping information. In addition to data on vegetation, each geobotanical descriptions has information on the location, a detailed description of the conditions and anthropogenic impact. The AVA-AK is partly incorporated into the national US database of geobotanical data VegBank (URL: http://vegbank.org/vegbank/index.jsp).

The report of William MacKenzie (Smithers, Canada) was the Geobioclimate Ecosystem Classification (BEC). This approach to the classification of vegetation was developed by prominent Canadian geobotanist, an immigrant from Czechoslovakia, Vladimir Krajina for the forests of British Columbia. Essentially, it includes ecological and floristic classification of plant communities, classification of habitat types and identification of the zonal situation, based on the composition and structure of vegetation. All three methodologies are integrated into a single system that is currently used in forestry in two Canadian states, and was tested for classification of tundra vegetation of the Yukon [5].

The report of this author and the group of authors considered the possible contribution of Canada to AVA, which, made up almost 7.4 thous published and unpublished descriptions from the Canadian Arctic Vegetation Archive (CAVA), made with varying degrees of accuracy and completeness for the tundra areas of Canada.

Fred Daniëls and Helga Bültmann (Münster, Germany) spoke about the process of inclusion of geobotanical descriptions of Greenland into AVA (over 4,000 descriptions). They noted that the main issue is the compatibility of data on the habitat from different territories of the Arctic and the necessity of digitizing the descriptions from unpublished sources (master and PhD thesis) and the literature. The authors emphasize that the nomenclature of syntaxa types should be in the database.

Two reports were made in the format of a syntaxonomic overview of the position single territories of the Arctic: Dietbert Thannheiser (Hamburg, Germany) presented prodromus of the Arctic tundra — the Islands of the Canadian Arctic, analyzed changes in the composition and condition of the communities for two decades (1986 and 2014). D. Thannheiser and Lennart Nilsen (Tromsø, Norway) spoke about the syntaxonomy Arctic tundra of the Svalbard archipelago, including the Bear island and Jan Mayen.

Robert Peet (Chapel Hill, USA) presented his report via Skype. He spoke about the US database of plant communities' descriptions — VegBank (URL: http://vegbank.org/vegbank/index.jsp) and the US National classification of the vegetation, which includes 8 levels of hierarchy. As a criterion for selection they use species composition, structure, and appearance (physiognomy) of the community. All the details are set out in the national standard classification of vegetation (URL: http://usnvc.org/data-standard/).

The analysis of the current level of geobotanical exploration in the Russian Arctic and potential contribution of Russia in AVA was made by N.V. Matveeva (St. Petersburg, Russia) and 11 co-authors. It showed that the amount of data collected and processed in accordance with the Braun-Blanquet methodology possible to be included in the Arctic database. It is estimated at approximately 5,000 published geobotanical descriptions. N.V. Matveeva presented the history of the geobotanical research in the Russian Arctic (studies made by V.N. Andreeva, V.D. Alexandrova, A.A., Dedov, B.N. Gorodkov and others) also needed to be included in the circumpolar database. Also, she presented the preliminary prodromus of the Arctic vegetation, which includes 130 associations in 35 units, 21 orders and 19 classes. The speaker lamented the fact that a significant part of valuable information about the Arctic vegetation had not been published, was hidden in the field diaries, and the bigger part of the field herbarium of bryophytes and lichens needed descriptions and definitions. All this greatly complicated the inclusion of available information on vegetation in the Russian Arctic in the local, national and circumpolar databases.

Jozef Šibík (Bratislava, Slovakia) reported on the results of the classification of Alaska vegetation, based on descriptions from the AVA-AK, which were processed using the Detrended Correspondence Analysis (DCA), JUICE and PC-Ord for the interpretation of the syntaxa hierarchy.

The report of Olga Khitun (St. Petersburg, Russia) and co-authors included the compilation and analysis of extensive data on local floras in the Russian Arctic and their relations with AVA database. The lists of local floras may not be included in the database of geobotanical descriptions. However, account for all the species composition in the study of local floras and a well-developed methodological analytical apparatus makes the data extremely valuable for study of the zonal structure and biodiversity in the Arctic, monitoring rare species and biologically valuable habitat types.

In addition, the seminar presented poster presentations I. Lavrinenko, “Large-scale geobotanical mapping of the East European tundra”, and O. Lavrinenko et al. “Vegetation of the East European tundra: Classification and Database”.

Figure 1. The organizers of the workshop Skip Walker (Fairbanks, USA) and William MacKenzie (Smithers, Canada) discuss the content of the Arctic vegetation description database.

Perhaps, most of the time of the seminar was taken by the discussions about databases and classification of the Arctic vegetation during the round tables and panel discussions. Because of that, the participants of the seminar made the following decisions:

1) Promote the updating, and maintenance of the Panarctic Flora (PAF) and the Arctic lichen, moss, and hepatic checklists as a panarctic standard for plant nomenclature.

2) Develop a checklist of existing described Arctic vegetation habitat and vegetation types according the European Vegetation Classification approach (an Arctic prodromus).

3) Secure funds for completing the AVA and AVC.

4) Develop and use standardized plot-data collection and archiving methods modeled after the European Vegetation Archive and the Alaska Arctic Vegetation Archive.

5) Modify the existing vector-based Circumpolar Arctic Vegetation Map to a raster-based format with 12.5-km resolution, and incorporate modifications based on new knowledge.

6) Develop a funding strategy to complete the Circumboreal Vegetation Map (CBVM) and link it to the Circumpolar Arctic Vegetation Map (CAVM) with a revised treeline, and a raster format.

7) Work with the Arctic Data Center (ADC) to develop data-sharing methods and rules for Arctic vegetation data.

8) Facilitate and promote the application of AVA, AVC, CAVM, and CBVM to the Arctic research community, land managers, and policy makers.

9) Contribute to training a new generation of young professional Arctic botanists and vegetation scientists through international field courses at the University of the Arctic and the Association of Polar Early Career Scientists (APECS).

10) Meet again at Arctic Science Summit Week 2019 in Arkhangelsk, Russia.

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Figure 2. The participants of the Second Arctic Vegetation Archive and Classification Workshop 2017:

1 — Inger Greve Alsos (Museum, University of Tromsø, Norway); 2 — Amy Breen (University of Alaska, Fairbanks, USA); 3 — Helga Bültmann (University of Münster, Germany); 4 — Milan Chytrý (Masaryk University, Brno, Czech Republic); 5 — Fred Daniëls (University of Münster, Germany); 6 — Ksenia Ermokhina (Institute of Earth Cryosphere, Moscow); 7 — Shawnee Gowan (University of Alaska, Fairbanks, USA); 8 — Stephan Hennekens (University of Wageningen, the Netherlands); 9 — Maitane Iturrate (University of Zurich, Switzerland); 10 — Olga Khitun (Botanic Institute named after V. L. Komarov, St. Petersburg); 11 — Ilona Knolova (Masaryk University, Brno, Czech Republic); 12 — Natalia Kotoleva (Polar-Alpine Botanical garden-Institute, Kirovsk); 13 — Flavia Landucci (Masaryk University, Brno, Czech Republic); 14 — Olga Lavrinenko and 15 — Igor Lavrinenko (Botanic Institute named after V. L. Komarov, St. Petersburg, Russia); 16 — William MacKenzie (Ministry of forests, lands and natural resources, Smithers. Canada), 17 — Nadezhda Matveeva (Botanic Institute named after V. L. Komarov, St. Petersburg, Russia); 18 — Lennart Nielsen (University of Tromsø, Norway); 19 — Robert Peet (University of North Carolina, Chapel Hill, USA); 20 — Jana Peirce (University of Alaska, Fairbanks, USA); 21 — Tomáš Peterka (Masaryk University, Brno, Czech Republic); 22 — Gabriela Chapman-Strub (University of Zurich, Switzerland); 23 — Joop Schaminée (University of Wageningen, the Netherlands); 24 — Jozef Šibík (Slovak Academy of Sciences, Slovakia); 25 — Dietbert Tannhauser (University of Hamburg, Germany); 26 — Lubomir Tichý (Masaryk University, Brno, Czech Republic); 27 — Marilyn Walker (HOMER Energy, boulder, USA); 28 — Skip Walker (University of Alaska, Fairbanks, USA); 29 — Starri Heiðmarsson (Icelandic Institute of natural history, Akureyri, Iceland).