Arctic Vegetation Archive Workshop

14-16 April, 2013, Krakow, Poland

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Meeting agenda

13 April: Travel to Krakow

14 April: Joint CAFF FG / AVA meeting. The AVA concept, progress to date on the PanArctic Species List, CFG activities

Morning: Welcome, keynote addresses, goals for the workshop, species list issues

09:00: Welcome and introduction of participants: ***Skip Walker***
09:15: Welcome from CAFF: ***Kári Fennar Larusson***
09:20: Keynote Address: Some reflections on the realization of an international pan-Arctic vegetation classification**:** ***Fred Daniëls***
10:15 21 years to common ground: Protecting our shared biodiversity legacy: ***Marilyn Walker***
09:50: Overview and history of the AVA concept and goals for the workshop: ***Skip Walker***

10:30: Coffee break

11:00: Summary of CAFF FG meeting activities: ***Steffi Ickert-Bond***
11:15: PanArctic Species List (PASL v. 1.0) for the AVA: ***Martha Raynolds*** *et al. (presented either remotely or by Amy Breen)*
11:45: Discussion with CAFF FG specialists re: how to maintain the species lists and the PASL: (*Mora Aronsson, Rene Belland, Helga Bültmann, Lynn Gillespie, Steffi Ickert-Bond, Starri Heidmarsson, Henry Vare, Kristine Westergaard, others*)
12:15: Application of the Russian Arctic local floras database to the issues of biodiversity conservation: ***Olga Khitun,*** *T.M. Koroleva, S.V. Chinenko, V.V. Petrovsky and A.A. Zverev*

12:45: Lunch on your own at local restaurant

Afternoon: Potential applications of the AVA.

14:30: The AVA as a source for understanding spatial distribution of Arctic biodiversity: ***Loïc Pellisier & Laerke Stewart***
15:00: Towards assessing biodiversity feedbacks to climate in the Arctic - future application of the AVA: ***Gabriela Schaepman-Strub,*** *Maitane Iturrate, Reinhard Furrer*
15:30: Further discussion of applying the AVA to vegetation classification: ***Fred Daniëls***
16:00: Preliminary discussion of databases and maybe demos.

18:00: Dinner on own or with group in local pub or restaurant.

15 April: Status of circumpolar plot-based vegetation datasets

Morning: Summaries of vegetation data from the circumpolar countries

09:00: Arctic Alaska AVA prototype: ***Amy Breen****, Martha Raynolds, Stephan Hennekens, Skip Walker*

09:20: Vegetation data available for classification of Canadian Arctic sites: ***Esther Lévesque****, Noémie Boulanger-Lapointe and Greg Henry*

09:40: Greenland AVA prototype: *The status of Greenland vegetation data sets stored in Münster:* ***Helga Bültmann****, Fred Daniëls, Christian Bay*

10:00: The Scandinavian contribution to the AVA**:** ***Lennart Nilsen & Dietbert Thannheiser*** *(delivered by Fred Daniëls)*

10:30: Boreal Tundra Vegetation of the North Atlantic and North Pacific Regions: **Anna Maria Fosaa**, Fred J. A. Däniels, Starri Heiðmarsson, Ingibjörg S. Jónsdóttir & Stephen S. Talbot

11:00: Coffee Break

11:30: The Russian input to the Arctic Vegetation Archive: ***Matveyeva N. V.,*** *Cherosov M. M., Telyatnikov M.Yu (delivered by Elena Troeva)*

11:50: Plant communities of southern hypoarctic tundra of the Anabar River basin (North-West Yakutia): ***Michael Telyatnikov*** *, E.I. Troeva, M.M. Cherosov, S.A. Pristyazhnyuk, P.A. Gogoleva, and L.A. Pestryakova*

12:10: Maps and syntaxonomical data in the tundra zone of the Kola Peninsula: ***Natalia Koroleva*** *(delivered via*

12:30: Vegetation Basin Vasyaha - case study of community biodiversity in the European sector of the Russian Arctic: ***Ekatierina Kulyugina***

12:50: Spatial vegetation structure of southern tundra from three sectors of Siberian Arctic: ***Nikolay Lashchinskyi***

13:10: Yamal and Gydan datasets: ***Ksenia Ermokhina*** *(delivered by Skip Walker)*

13:30: Vegetation datasets for Chukotka: ***Volodya Razzhivin*** *(delivered by Skip Walker)*

13:50: Lunch

Afternoon: Database issues

15:00: Unifying and analyzing vegetation-plot databases in Europe: the European Vegetation Archive (EVA) and the ´Braun-Blanquet´ project: ***Borja Jiménez-Alfaro,*** *and EVA Team*

15:30: The Canadian vegetation database approach: ***Will Mackenzie***

16:00: VegBank: A Permanent, Open-Access Archive for Vegetation Plot Data: ***Michael Lee***

16:30: The Russian vegetation database approaches:
Presentation of the module “Graphs” for analyzing geobotanical data: ***Alexander Novakovskiy***

17:00: Demos of Turboveg, VegBank and other databases.

18:00: Dinner on own or with group in local pub or restaurant.

16 April: Next steps

Morning:

09:00: Ideas on funding possibilities

1. Canadian Arctic Research and the AVA: ***Greg Henry,*** *Donald McLennan, Esther Lévesque, Will MacKenzie*
2. How to use the initiatives of the Russian Government in the field of science for vegetation biodiversity study in the Russian Arctic (propositions of Russian partners): ***Cherosov M.M.****, Matveyeva N.V., Troeva E.I., Gogoleva P.A., Telyatnikov M.Yu, and Pestryakova L.A*
3. A proposal to recover and archive key Arctic Alaska vegetation map and plot data for the NASA Arctic-Boreal Vulnerability Experiment (ABoVE): ***Skip Walker***
4. **Scandinavian possibilities: *Anna Maria Fossa,*** *Lennart Nilsen, Ingibjörg Svala Jónsdóttir,*
5. **Thoughts from CAFF regarding the AVA in relationship to the future of Arctic biodiversity monitoring: *Kári Fennar Larusson,*** *Tom Barry, Mike Gill, et al.*

10:00: Discussion of organization: Nodes in each country to pull the database together.

11:00: Publications

1. Workshop proceedings volume: CAFF technical report
2. Journal publications?
   Announcements of AVA in European and North American publications (IAVS, ESA, others)
   Research publications: group of papers for *Phytocoenologia* or other vegetation science journal
3. Ideas for next meeting

12:00: Summary of action items, Last words, wrap-up and end of workshop.

Abstracts

Toward an Arctic Alaska Prototype for the AVA

Amy Breen, Martha Raynolds, Stephan Hennekens & D. A. (Skip) Walker

Here we present an Arctic Alaska prototype for the Arctic Vegetation Archive (AVA). A preliminary survey revealed over 3,000 relevés from the Brooks Range, Arctic Foothills, Coastal Plain and the Seward Peninsula regions in Arctic Alaska (Walker & Raynolds et al. 2011). These relevé data are scattered across many institutions in a variety of formats ranging from spreadsheets, to data reports and publications, to field notebooks. Relevés were collected along the primary arctic environmental gradients, including temperature, soil pH, soil texture, and soil moisture (Walker 2000). Data include complete species lists and cover estimates for vascular plants, mosses and lichens, and canopy structure, soils and environmental site information in plots with areas from 1-100 m^2.

The first step toward creating the prototype was to construct a species list for use in Turboveg. We have now completed this task and the beta version of the Panarctic Species List (PASL) is available for use and review (Raynolds et al. 2013, this workshop). The next step that is now underway is to import the most readily available vegetation data sets into Turboveg, paying particular attention to the environmental header data. The first data we imported into the prototype were pingo relevés from the Coastal Plain and Arctic Foothills (M.D. Walker 1990, 293 relevés). The other data sets in the prototype to date include relevés from Toolik Lake (Walker 1991, 81 relevés), Imnaviat Creek (Walker 1987, 84 relevés), and Happy Valley (Walker 1997, 56 relevés) in the Arctic Foothills. We are in the process of compiling a suggested list of required header data and pop-up menus that we will ask all contributors to include with their relevés submitted to AVA. This is a necessary and important task as it will assure the data included are of high quality and can eventually be included in a circumpolar classification of Arctic vegetation.

We will show the geographic distribution of relevés to be included in the Arctic Alaska prototype and an overview of the data sets imported thus far. We will also identify the next data sets we will import into the prototype grouped by priority. Finally, we will present our list of suggested required environmental header data for comment and discussion and present the lessons learned through construction of the Arctic Alaska prototype to aid others in their eventual regional prototype efforts.

Progress on the Greenland Vegetation database prototype in Münster

Helga Bültmann & Fred Daniëls

The status of the Greenland vegetation datasets, which are stored in Münster is reviewed. In January 2013 in all 1399 original relevés from the Kangerlussuaq Area in W Greenland, 139 from other parts of W Greenland and 795 relevés published by Böcher were stored in Turboveg. Further 734 relevés from W and NW Greenland, 727 from E Greenland and 76 from N Greenland are digitized but not in Turboveg. Importing those files will be continued until the workshop in Krakow.

The relevés include header data, e.g. geographical data and soil analyses. The cryptogams were studied with scrutiny in most relevés.

Several hundred more relevés have been sampled in W and NW Greenland, but as the proper identification of cryptogams takes time their identification is not (yet) finished. By means of examples from datasets from the Kangerlussuaq Area and NW Greenland the data structure and quality is illustrated.

We aim to finish cryptogam identification this year and get the data into TV at least for those areas and vegetation types with the largest knowledge gaps in Greenland.

Some reflections on the realization of an international pan-Arctic vegetation classification

Fred Daniëls

A circumpolar uniform plot-based floristic classification system of Arctic plant community types does not exist so far. Such a system is needed and essential for other types of terrestrial biodiversity research, modeling and management of Arctic ecosystems (Walker & Raynolds 2011, Walker et al. 2013). The Braun-Blanquet approach seems the most appropriate method. It is used successfully all over the world. The vegetation is analyzed by means of representative sample plots. Plant community types are distinguished based on similarities of their floristic composition, including vascular plants, bryophytes and lichens. These are classified according to diagnostic species into associations, and these are hierarchically arranged into in alliances, orders and classes (syntaxa). All have their own unambiguous nomenclature; this provides a precise scientific language understood all over the Arctic. In addition these syntaxa provide ecological and phytogeographical information that contributes to a more detailed understanding of Arctic environments, biodiversity and ecology — past, present and future. It is indispensable for an appropriate human attitude to future changes in the Arctic territory. A preliminary circumpolar survey will be presented of the higher vegetation units described so far from Arctic areas according the Braun-Blanquet method. The survey follows the results from Arctic classification and mapping workshops in Boulder (1992) (Walker et al. 1994) and Tromsö (2004) (Daniëls et al. 2005) and includes a number of more recent important local contributions, including those published from Russia, Alaska, N. Canada, Greenland and Svalbard. It also shows knowledge gaps and problems (see also Walker & Raynolds 2011). The establishment of an AVA is necessary for a more efficient approach to reach a first circumpolar vegetation survey. Prerequisite is that there is a user-friendly powerful panarctic species list to be used in Arctic vegetation classification. The management of the database should be a responsibility of CAFF (other options are possible) and of a user-friendly species list maintained and kept up to date by an active small group of specialists in vascular plant taxonomy, bryology and lichenology.

Literature

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Yamal and Gydan vegetation datasets

Ksenia (Ksusha) Ermokhina

There is a number of available Yamal and Gydan vegetation databases owned by several RAS institutes. The most important of them are listed in the table 1. In the different parts of the Yamal peninsula also worked following botanists: S. Pristyazhnyuk (disturbed habitats; mainly lichens and vascular plants), M. Telyatnikov (mainly vascular plants), N. Andreyashkina (mainly vascular plants), M. Boch (wetlands; mainly vascular plants and bryophytes), S. Gribova (mainly vascular plants and bryophytes), L. Meltser (mainly vascular plants). All these datasets are of landscape levels and each of them is focused mainly on particular group of organisms (vascular plants, bryophytes or lichen). Datasets may also include information on different ecotope parameters, productivity of communities and etc. During the presentation main and some additional datasets will be described. The overview of the datasets will include such characteristics as: exact number of releves or key sites, completeness of species lists, additional environmental and community data, format of data, etc. Also the quality of stored information will be estimated to find possible use.

Table 1. Vegetation datasets of Yamal and Gydan peninsulas

Datasets holders	**Institutes**	**Groups**	**№ of key sites / releves**	**Area***
S. Ektova, L. Morozova	Institute of Plant and Animal Ecology UB RAS, Yekaterinburg	lichens, *vascular plants***	690	PU, SY, MY
K. Ermokhina	Earth Cryosphere Institute SB RAS, Moscow	vascular plants, bryophytes, lichens and environmental data	600 releves	PU, SY, MY, NY, G
D.A. Walker et al.	Institute of Arctic Biology, UAF, Alaska, USA	Vascular plants, bryophytes, lichens and environmental data	79 releves	Eurasia Arctic Transect: SY, MY, NY, FJL
S. Pristyazhnyuk, M. Telyatnikov	Central Siberian Botanical Garden SB RAS, Novosibirsk	vascular plants, bryophytes, lichens	212 releves	PU, MY

* PU – Polar Urals, SY – Sothern Yamal, MY – Middle Yamal, NY – Northen Yamal, G – Gadan, FJL – Franz Josef Land.
***not always and not full list*

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Boreal Tundra Vegetation of the North Atlantic and North Pacific Regions

Anna Maria Fosaa, Fred J. A. Däniels, Starri Heiðmarsson, Ingibjörg S. Jónsdóttir & Stephen S. Talbot

The maritime Atlantic area of the Faroe Islands, Iceland, southwestern Greenland and the ecologically homologous regions within the North Pacific area of southwestern Alaska are included within the Conservation of Arctic Flora and Fauna (CAFF) area. We present an overview of its vegetation focusing on treeless tundra, which is in a transition zone between the Arctic and the boreal zone. In the Atlantic area, oceanicity increases from the west to east with the Faroe Islands being most oceanic. Atlantic vegetation is characterized by dwarf shrub and moss heaths, grasslands, alpine tundra, and with the exception of the Faroe Islands, mountain birch woodlands. In the North Pacific area of North America, oceanicity increases from east to west. The vegetation of the southwestern Alaska mainland and Kodiak Island is dominated by crowberry heaths, alder thickets, bluejoint meadows, and alpine tundra, while the Aleutian Islands are dominated by crowberry heaths, forb meadows, and alpine tundra. The boreal tundra flora of southwestern Alaska is rich in amphi-Beringian species with similarities to the Russian Far East. We review and assess the quality of available relevé, or similar plot data, and its accompanying environmental data. We conclude with a strategy to include boreal tundra areas in the proposed Arctic Vegetation Archive (AVA).

Vegetation data from central Iceland

Starri Heiðmarsson

The central highlands in Iceland are mainly above 400 m a.s.l. The vegetation cover is sparse in large areas while other areas sustain different vegetation types. Vegetation mapping began in Iceland in 1955 and large part of the central highlands have been mapped and some areas even revised. More thorough study of the vegetation has been conducted from 1999 resulting in classification of different habitat types. The habitat types classification has included vegetation mapping, remote sensing and field studies where several parameters where studied including vegetation cover of all vascular plants in several plots on a 200 m transect. Overview of the available vegetation data from the central highlands of Iceland will be given in the talk.

Canadian Arctic Research and the AVA

Gregory H.R. Henry

Vegetation data have been collected throughout the Canadian Arctic for many decades as part of a wide variety of projects, including academic ecological research, National Park inventories and environmental assessments of industrial development. Classifications have been conducted at individual sites usually to produce vegetation maps. The Canadian IPY program funded a large project on Climate Change Impacts on Tundra Ecosystems (CiCAT), which supported vegetation classification and mapping in Arctic National Parks and the collection of archived vegetation data for the Canadian National Vegetation Classification (CNVC). The CNVC is based on standardized concepts and methods used in North America, and preliminary classifications of the Arctic data have been completed. The new Canadian High Arctic Research Station (CHARS) will have a mandate for environmental monitoring and will conduct and support research throughout the Canadian Arctic, as a hub in the network of Arctic research stations and sites. It is expected that the CNVC-Arctic will be supported as part of CHARS monitoring and research and the development of standardized vegetation classes for tundra systems will be one of the objectives. With the standardized classifications, individual researchers conducting vegetation descriptions will be able to contribute to the CNVC-Arctic data base, and can use the intention to contribute as an objective in proposals. The standardized classifications will be useful as baseline data for future changes, for scaling-up process studies (e.g. carbon fluxes), for analyses of wildlife habitats, and in environmental assessments. Hence, Canadian Arctic tundra vegetation data archiving and classification will be supported by research proposals from individual researchers and by agencies (e.g. CHARS, ArcticNet, NSERC, government departments) and institutions. At present, there is no single Canadian agency or institution that would sponsor Arctic vegetation classification research and development.

Unifying and analyzing vegetation-plot databases in Europe: the European Vegetation Archive (EVA) and the ´Braun-Blanquet´ project

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Vegetation-plot databases have enormous potential for biodiversity research and for developing systems of vegetation and/or habitat classification. In Europe there are about 2 million vegetation-plot records stored electronically. However, this information is mainly used on national or sub-national scales. It is an urgent task for vegetation scientists and biodiversity managers to develop international synergies addressing supra-national and continental scales. Here we present two projects that are being pursued by the IAVS Working Group European Vegetation Survey (EVS; www.euroveg.org). As a key infrastructure for unifying the vegetation-plot data, the European Vegetation Archive (EVA) has been launched, aiming at establishment of a centralized European vegetation database and stimulating international feedbacks between database managers and potential users. EVA is conceived as a dynamic system for sharing data among national databases while they would continue their normal, country-focused activities. The EVA consortium has developed Data Property and Governance Rules that guarantee the rights of the data contributors are respected.

Individual data contributors can decide on the mode of data availability from restricted to open access. At the moment the TURBOVEG version 3 program and the SynBioSys Europe information system are being developed as the management software for EVA. Parallel to the EVA development, the European Vegetation Survey is developing projects to benefit from this infrastructure but also to involve other collaborators beyond the EVA consortium. An example is the ´Braun-Blanquet Project´, the main aim of which is the compilation and analysis of floristic and geographical information related to European phytosociological alliances as defined in the new European syntaxonomical overview (EuroVegChecklist, Mucina et al. in preparation). This information will be summarized in the form of constancy-based synoptic tables for all alliances and related outputs. At the moment 22 extensive datasets from 18 European countries are involved in this project. The information collated by the ´Braun-Blanquet Project´ will be essential for offering a parameterized overview of European vegetation types for researchers and conservation managers. Parallel with these scientific projects, the European Vegetation Survey team is working with the European Environment Agency to supply real data and scientific background to the EUNIS habitat classification which is used as a crucial tool of nature conservation survey, planning and reporting in Europe. Both EVA and the ´Braun-Blanquet Project´ are open to new partners.

Application of the Russian Arctic local floras database concept to the issues of biodiversity conservation

Olga Khitun, T.M. Koroleva, S.V. Chinenko, V.V. Petrovsky, & A.A. Zverev

The concept and method of "concrete" floras (later called "local" floras) was introduced by A. Tolmatchev in the 1930s and is widely used by Russian botanists especially when studying extensive and hardly accessible northern territories. A local flora is a flora of a relatively small territory (100-300 km^2) studied by radial routes where all key habitats including rare habitats are visited repeatedly and species lists are compiled. The "Arctic Flora of the USSR" was written mainly on the basis of material obtained by studies of local floras. Ideally, both a local flora and vegetation plot data would be obtained within an area of intensive vegetation research. The two methods have different and wholly compatible objectives. A complete list of the species in a local area is most desirable for biodiversity comparisons with other areas, whereas more intensive plot surveys are required for vegetation classification and many types of ecological research. Researchers at the Far North Vegetation Laboratory at the Komarov Botanical Institute have used the concept of local floras for more than 50 years. Study of a large number of localities across the Russian Arctic revealed that their floras are characterized by certain species richness and geographical structure. For example, in bioclimatic subzone D, local floras in the central Yamal Peninsula have 130-160 species, in the Gydan Peninsula 150-170, in East European tundra 190-200, and in the Taymyr Peninsula 200-250. Knowledge of these patterns help researchers estimate how complete the flora of new locality may be. Some often-overlooked species can be specifically searched for and in many cases found. The species richness of a local flora depends on a characteristic set of habitats and historical factors. Study of local floras provides information about species populations; both frequency and abundance of each species is recorded. Our database is created in IBIS and now contains species lists and short characteristics of 250 local floras from Arctic and Subarctic Russia (totally about 2000 vascular plant species). Different tables (with both quantitative and qualitative values) can be constructed in IBIS and exported if necessary. We made sketch maps in CorelDraw showing studied localities and on them different floristic parameters can be drawn and their spatial changes can be followed. We are planning to transfer these data to GIS. We use the database for analysis of changes in geographic and taxonomic structure both across latitudinal and longitudinal gradients and for purpose of regionalization but it can have direct implementation for biodiversity conservation issues – indicating areas with any species of interest (rare, endemics, non-endemics), areas with increased species richness, etc.

The tundra zone of Kola Peninsula on the syntaxonomical 'conjunction' in the European Arctic

Natalia Koroleva

Syntaxonomical data take into account floristic and ecological properties of plant cover, and are suitable for representation of biogeographical patterns at local, regional and circumpolar scales. That provides proper background for assessment of plant cover biodiversity and selection of value and rare habitats and areas of special conservation interest. It's why the database on arctic vegetation has important issues into some European projects, i.e. Emerald Network and Pan-European Ecological Network.

Though there exists a gap instead of tundra vegetation on the Kola Peninsula in the Circumpolar Arctic Vegetation Map, 1:7 500 000 (2003), there yet is to 80 km wide sub-arctic (or southern) tundra zone. On the base of Braun-Blanquet classification of 390 releves of zonal tundra of Kola Peninsula there was discovered gradual transition in species composition and structure for some syntaxa from north-west to south-east, but other stay of the same composition from the Rybachij (Fisher) Peninsula to Bolshesemel'skaja and Malozemel'skja Tundra in Nenets District.

Tundra heathlands and barrens. There is gradient in tundra zone from north-west to south-east in All. Loiseleurio-Diapension (Br.-Bl. et al. 1939) Daniels 1982 on the level of subassociations (Koroleva, 2006, http://www.binran.ru/journals/vegros/contents/20069.htm), but associations of All. Phyllodoco-Vaccinion myrtilli Nordh. 1936 don't change their composition. Communities of All. Cassiopo–Salicion herbaceae Nordh.1936 are well-represented in western part of Kola Peninsula and get sparse eastwards. All. Caricion nardinae (Nordh. 1935) Dierssen 1992 is represented only in the north-western part of area, and includes rare in Murmansk Province habitat types (Koroleva, 2011, transactions.krc.karelia.ru/publ.php?plang=r&id=8523).

Coastal marshes and beaches. Communities of Honckenyo–Elymion arenariae (Fernandez-Galiano 1954) Tx. 1966 on sandy beaches and rocky terrains keep the same composition and structure along Sea shores of all European sub-Arctic and seems to be amphi-oceanic. All. Puccinellion phryganodis Hadač (1946) 1989 and Caricion glareosae Nordh. 1954 include European arctic and sub-arctic marshes; all of them represent value habitat types (Koroleva et al., 2011, http://kpabg.ru/veget/koroleva_fitoeuro.pdf).

Bogs and fens. Communities of pounikkos, flat and dome palsa of all. Oxycocco-Empetrion hermaphroditi (Nordh. 1936) R. Tx. 1937 are very similar through all European arctic and sub-arctic. Poor fens are supposed to be put into separate Alliance

Caricion rotundatae (Kalliola 1939) stat. nov. prop. (non Scheuchzerion palustris Nordh. 1937) (Koroleva, 2012, in print).

Grasslands and meadows. Tall-herb meadows show well-expressed species composition gradient eastwards, but their syntaxonomy is still under consideration.

Large-scale vegetation mapping in key areas of European Arctic based on syntaxonomical background, satellite images and topographical maps provides value data about relationship of vegetation with geographical environment, role and proportion of syntaxa and their complexes in plant cover of the territory, and value habitats and areas to be protected (Loshkareva, Koroleva, 2013, in print).

Vegetation of the Vasyaha River Basin – Case study of community biodiversity in the European sector of the Russian Arctic

Ekaterina Kulyugina

Investigated area belongs to the eastern part of the Bolshezemelskaya tundra and located near the town Mallaja Padeja. It became a model site for complex expedition work of the Institute of Biology of Komi Scientific Centre in the Yugorsky Peninsula. Field studies have been carried out in summer 2010. Diversity of plant communities, their composition, structure, and ecotopic preferences have been found. This area belongs to typical tundra.

Reveles (76) have been carried out in 25 m^2 sites. The data were classified using Brown-Blanque approach with the help of Excel, software «Graphs» and Landsat satellite images.

The investigated area is characterized by severe climatic conditions, large quantities of mires and hilly relief. All these factors determine specificity of vegetation cover. Lowland sedge-moss mires appear mainly in waterlogged spaces between the hills and on the banks of thermokarst lakes. *Carex stans* and *Warnstorfia exannulata, Calliergon cordifolium* dominate here. Coastal and aquatic communities of *Arctophila fulva* and *Carex aquatilis* occur at the edge of lakes, streams and rivers. Community of willows *Salix glauca, S. lanata, S. phylicipholia* occupy different landscape positions. Height of these communities and their closeness varies depending on landscape position: in lower parts of slopes they are maximal (1m), on the tops of hills and watersheds willows reaches 30 cm of height, forming open vegetation layer. In wet places under the canopy of willow sedges (*Carex stans, C. arctisibirica*) and mosses (*Hylocomium splendens, Sanionia uncinata*) dominate, in dry sites – grasses (*Equisetum arvense, Bistorta vivipara, Polemonium acutiflorum*). Grass-sedge-moss meadows appear on the watershed between willow communities and banks of lakes, streams and the Vasyaha river. Dominating species complex includes *Carex stans, Calamagrostis lapponica, Alopecurus pratensis, Polemonium acutiflorum*. Shrub-sedge-moss tundra is located on flat-topped hills. *Carex arctisibirica* dominates here. *Salix nummularia, Salix polaris, Salix reticulate* and *Dryas octopetala* are abundant. Moss layer is well developed and is dominated by *Hylocomium splendens, Aulacomnium turgidum, Tomenthypnum nitens*. Grass-shrub-moss-lichen tundra marks only the driest sites of the investigated area: high hills near the river and the ridge. Dominant species complex includes *Salix nummularia*, *Dryas octopetala, Vaccinium vitis-idaea, Racomitrium lanuginosum, Polytrichum hyperboreum, Cladonia arbuscula*, *Sphaerophorus globosus*, *Flavocetraria nivalis*, *Thamnolia vermicularis, Stereocaulon alpinum*. Generally, willows and sedge-moss-shrub tundra cover the largest areas of the investigated territory; sedge-moss mires also cover considerable areas. The other communities are fragmentary distributed.

Our investigations have been performed under the research program of UB RAS (12-P-4-1018) Project for Basic Research "Arctika" (12-4-7-006 – Arctika)

Spatial vegetation structure of southern tundra from three sectors of Siberian Arctic

Nikolay Lashchinskyi

In last three years spatial structure and syntaxonomical diversity of southern tundra vegetation was studied in three spots of Siberian Arctic: Low Kolima (East Siberia), Central Taymir (Central Siberia) and Low Taz (West Siberia). We combined remote sensing with traditional vegetation description on ground. In addition we looked at relief, soil formation and parent rock material. For the each spot diversity of plant communities was described according to their position in mesorelief. Floristic composition of higher vascular plants, abundance and distribution of certain species and communities were compared between sites. An importance of geological substrate, relief and geographical position were discussed as possible reason for the differences between sites.

VegBank: A permanent, open-access archive for vegetation plot data

Michael Lee

Rapid progress is being made in North American vegetation science through recent developments with the U.S. National Vegetation Classification (NVC). Central to these advances is sharing, archiving, and disseminating field plots, the fundamental data required for describing and understanding vegetation communities. VegBank accomplishes these objectives as the vegetation plot database of the Ecological Society of America's Panel on Vegetation Classification.

VegBank currently archives more than 70,000 plots from throughout North America, though there is no restriction on the geography of plots that can be submitted. The web-interface of VegBank allows public searches of the data, by geography, species, date, investigator, environment, and community. Plots of interest can be assembled into datasets, which can be further summarized and downloaded.

Data may be submitted to VegBank through a downloaded client tool, called VegBranch. Data mapping, reformatting, error-checking, and prompting for metadata and methods standardize and fully document the data.

Concept-based taxonomy connects a plant name to a taxonomic standard, which allows data from different regions and eras to be compared. Without this tactic, dynamic plant names makes comparison ambiguous or impossible. As many plots may contain rare or threatened species, VegBank uses reduced-precision geocoordinates as the public location for these plots to prevent harm to these plant populations.

As an open-source project, the VegBank software system may be shared or installed elsewhere. The open architecture and framework help ensure that the permanence of valuable data deposited in VegBank. The open acceptance of data allows ecologists to make their data accessible permanently without the costs of designing and maintaining their own internet interface. Well into the future, researchers may use these data points in very different ways and to answer very different questions than those in the original research.

Vegetation data available for classification of Canadian Arctic sites

Esther Levesque E., Noémie Boulanger-Lapointe, & Greg Henry

Arctic Canada covers more than 30 degrees in latitude and nearly 90 degrees in longitude ranging from treeline to polar deserts. If relatively few classical relevé datasets are available, a large number of studies sampled vascular plants with some degree of bryophyte and lichen information. Some dataset are associated with satellite image analyses whereas others are associated with project specific studies. We will present the spatial distribution of available datasets suitable for the Arctic Vegetation Archive. Similarities and differences in vegetation sampling approaches will be presented to aid in developing a suitable way to integrate various datasets. The Circumpolar Arctic Vegetation Map will be used to assess how well these datasets cover the diversity of vegetation types in Arctic Canada.

A data compilation of Canadian Arctic vegetation releve data and preliminary classification

William H. MacKenzie

The ecosystem plot database program, VPro, was created to manage plot data (currently 55,000 releves) and resulting hierarchical classifications for the Biogeoclimatic Ecosystem Classification system of British Columbia, Canada. VPro uses Microsoft ACCESS for all database functions and EXCEL for most reporting functions. This relational database stores ecosystem data in linked vegetation, site, and soils tables and relates to taxonomic and environment code libraries. Single level and hierarchical classification structures are also managed within this system and data summaries and exports can be made using any level of the classification. The program is designed to be relatively simple and flexible so that it can be understood by ecologists with limited understanding of databases

In 2006, Natural Resources Canada initiated a Canadian National Vegetation Classification (CNVC) program with the aim to harmonize provincial forest classifications and provide a national classification product. The Boreal forest was the first biome addressed as it spans almost all provinces. The CNVC adopted VPro as the tool to compile and harmonize all of the separate provincial plots data sets (and vegetation associations.

Funding acquired by the Yukon Territorial government through the International Polar Year (IPY) was used to compile existing plot data from the Canadian Arctic and Subarctic following similar protocols to the Boreal project. The initial arctic data compilation included approximately 9000 releves derived from historical and contemporary published and unpublished sources. Approximately 3000 of the releves were used to generate an association classification of for the Canadian Arctic broadly following Braun-Blanquet tabular methods.

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The Russian Input to the Arctic Vegetation Archive

N.V. Matveyeva, M.M. Cherosov, & M. Yu.Telyatnikov

The plant cover diversity of the Russian Arctic is great due to the huge area (about 27 000 000 km^2) and large variety of landscapes stretching between the Kola and Chukchi peninsulas. The widest part is situated in its longitudinal centre on Taymyr Peninsula where the complete range of latitudinal subzones from treeline to polar desert landscapes is represented. The study of plant cover started in the 1930s and intensified gradually reaching its peak in the 1970s and 1980s. There were initially very few phytocoenologists who sampled vegetation using a relevé approach and even less who published these with enough repetition. However, the famous tundra ecologists B. N. Gorodkov, A. A. Dedov and V. D. Aleksandrova were among those who did. The formal methods of the Braun-Blanquet approach were used by some Russian phytosociologists who worked in southerner biomes in the late 1970s, but only at the beginning of 1990s did the approach begin to be applied in the Russian Arctic. As a result, according to the preliminary Prodromus (Telyatnikov, unpubl.), about 80 associations have been recorded within the 35 alliances of 18 orders and 14 classes while about 40 new associations have not been placed into higher units.

There are about 15 researchers who have published their data according to the Codex of Phytosociological nomenclature (Weber et al. 2000), and that pool contains about 5 000 releveés. These are the best source that is ready for entry into the AVA. Most of these are stored in Excel tables by their owners in botanical institutions in six cities (Saint-Petersburg, Syktyvkar, Kirovsk, Novosibirsk, Yakutsk, Magadan). Some authors used the programs “Turboveg” by S. Hennekens and “IBIS” by A. Zverev, for treating and storing the data, and “Graph” by A. Novakovskyi, for preliminary sorting both species and releveés. Many more data are still in field notebooks and boxes with incompletely identified cryptogam specimens.

There are various degrees of knowledge regarding syntaxa diversity both in different geographic regions and within the higher syntaxa. There are only four sites where the whole range of plant communities within a landscape has been characterized. These include three large islands in the Arctic Ocean - Alexandra Land (Franz Josef Land), Bolshevik Island (Severnaya Zemlya) and Wrangel Island. However the Arctic vegetation data are formally published using the Braun-Blanquet approach in only two of these (Matveyeva, 2006; Kholod, 2007). The vegetation of Alexandra Land (Aleksandrova, 1983) and Sivaya Maska (European North) (Katenin, 1972) is characterized by using other classification approaches. The data of various community types (e.g., salty marshes, sparse vegetation on sands, and *Dryas* fell-fields) in the northern Kola Peninsula and in the Bolshesemelskaya Tundra were published recently (Kuljuguna, 2008; Koroleva, 2011; Koroleva et al., 2011; Matveyeva, Lavrinenko, 2011), while a lot of information on sedge mires and lichen peat mounds (palsa) is forthcoming. There is still very little information on the vegetation of Yamal Peninsula with few syntaxa described according to Braun-Blanquet approach (Telyatnikov, 2012 a, b). The study of zonation on Taymyr Peninsula provides data for vegetation of different classes and allows us to trace the changes in association composition along the latitudinal gradient and distinguish subzonal vicariants within the main associations (Matveyeva, 1994, 1998). Similar study for colorful grass-herb meadows on relatively dry south facing slopes and for zoogenic grass stands was made within the tundra zone on Taymyr and in polar deserts on Bolshevik Island by L. Zanokha (2009). The willow shrub stands were classified along the large longitudinal gradient from the Polar Urals to Chukotka with many units within the association and few new alliances (Sekretareva, 1994, 2003, and others). Ten associations of the snow-bed vegetation of the far northeastern Asia were described by V. Razzhivin (1994). The diversity of restored vegetation on industrials careers from Vorkuta and Norilsk up to Wrangel Island was in focus of the long-term investigation by O. Sumina (1994, and others). Various sequences of anthropogenically disturbed tundra in northern Yakutia were described and classified by M. Cherosov and co-authors (2005).

About half of associations are known for classes ***Loiseleurio-Vaccinietea*** Eggler 1952 em. Schubert 1960, ***Carici rupestris–Kobresietea*** Ohba 1974 and ***Salicetea herbaceae*** Br.-Bl. 1948 that undoubtedly does not reflect the whole diversity of these types of vegetation on the vast territoty of the Russian Arctic. Even less information for classes ***Scheuchzerio-Caricetea nigrae*** (Nordh. 1936) Tx. 1937 and ***Oxycocco-Sphagnetea*** Br.-Bl. et R. Tx. 1943 that cover plenty of room in wet depressions on the large plains in particular in Yakutia. The vegetation of salt marshes within class ***Juncetea maritimi*** Br.-Bl. 1931 is described relatively full but only in few regions. All other classes are represented in available releveés even worse. In addition, syntaxa of at least six classes known for Spitsbergen and Greenland are still not described in Eurasian part of the Arctic. The necessity of describing new higher units including even classes is strongly felt by all participants taking part in the elaboration of Arctic syntaxonomy. In particular this is urgent for the polar desert region where the very specific vegetation is referred to the class ***Thlaspietea rotundifolii*** Br.-Bl. 1948 only because of it the very sparse cover. Also even formally the zonal vegetation of the northernmost regions of the tundra zone are still placed into ***Loiseleurio-Vaccinietea.***
Looking at the polar regions from space using satellite images one can realize how huge is the territory where no one phytosociologist has gone before. The AVA initiations might be a strong impetus for intensifying syntaxonomical researches.

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Phytosociological studies from arctic Norway

Lennart Nilsen & Dietbert Thannheiser

The presentation includes a short introduction to geography, landscape and environment of the north-eastern part of the Norwegian mainland (Finnmark county), the Svalbard archipelago with Bjørnøya, and Jan Mayen. Phytosociological literature pertaining to these areas includes c. 50 references at this moment, many of them with syntaxonomical classification schemes. A survey of higher syntaxa will be presented. The estimated number of published and unpublished relevés for these areas is ca. 4400 and ca. 700, respectively. Quality of plot-based vegetation analyses will be briefly discussed.

Presentation of the module "GRAPHS" for analyzing geobotanical data

Alexander Novakovskiy

Almost all the scientific research has three steps. First – to define the main purpose of the investigation and the way to reach it, second – to collect and store so much data as possible. The last step is to analyze the data using different approaches and to make the conclusions.

We concentrated on the third step in this work. Namely, we develop a special program module "GRAPHS" which can be used for the statistical analysis and visualization of the results.

Today, there are many computer programs available, which provide statistical analysis and data visualization, ranging from large, complicated and expensive ones, such as “STATISTICA” and “SPSS”, to relatively small and cheep ones, such as PC-ORD and CANOCO.

The main difficulties in using this kind of software by researchers are connected to learning (many windows and functions, unusual interface), preparing data for analysis (programs often use special data formats not well compatible between each other) and interpretation of the results.

The module “GRAPHS” have a simple interface and integrated into the Microsoft Excel. Therefore, researchers can use all the Excel abilities to prepare data for the analysis. Moreover, the Excel format is, in fact, the most widely used format for storing ecological data (especially in Russia). Another advantage is that most of the special programs can convert their own datasets into the Excel format (including TURBOVEG). Further, Excel has a flexible program language, VBA, which allows using external functional abilities, such as ActiveX controls and COM objects.

By now, the following data mining algorithms have been implemented in the "GRAPHS" module:
Calculation of the most common similarity indexes (e.g., Jaccard, Sorensen), correlations and rank correlations (Pearson, Kendell).
Calculation of biodiversity indexes (e.g., Shannon, Simpson, Berger-Parker.).
Ordination of data (CCA, DCA, NMS).
Cluster analysis (k-means, UPGMA, Ward clustering).
Using the graph theory and any of its algorithms (e.g., decomposition into connected components, tree construction).

The AVA as a source for understanding spatial distribution of Arctic biodiversity

Loïc Pellissier & Laerke Stewart

Observed as well as predicted trends indicate that warming is most pronounced and rapid in the Arctic. Indeed, the rate of warming in the Arctic in the past 150 years has already exceeded that experienced at the Pleistocene-Holocene transition, which resulted in widespread vegetation shifts and faunal extinctions. However, we are far from understanding the processes shaping this ecosystem. The arctic tundra is vast and even though some research stations have monitored changes for several decades, there has been limited spatial coverage of data collection throughout the circumpolar region, seriously limiting the degree to which the current state of biodiversity can be understood and the effects of climate change predicted for the entire Arctic. Species Distribution Models (SDMs) are empirical models relating field observations to environmental predictor variables. Combined with the AVA (=AVA) that systematizes existing information about distributions of arctic plant communities, SDMs may allow filling the gaps in our knowledge of arctic biodiversity and assess how species, as well as assemblages may be affected by climate change.

The Pan-Arctic Species List (PASL)

Martha K. Raynolds, Amy L. Breen, Donald A. Walker, Reidar Elven, David F. Murray, René Belland, Nadezda Konstantinova, Hörður Kristinsson & Stephan Hennekens

Introduction

The Conservation of Flora and Fauna (CAFF) Flora Working Group members have been compiling lists of accepted taxa for different groups in the Arctic: vascular plants, mosses, liverworts, lichens and lichenicolous fungi. These lists were combined into the first, beta-version of the PanArctic Species List (PASL). The goal is to have the PASL serve as the definitive source for arctic taxonomist and global species databases, to be used as the basis for the rare species Red Lists, and for harmonizing arctic vegetation plot data into an international arctic vegetation database, the Arctic Vegetation Archive (AVA) (Walker and Raynolds 2011). The vision is to have the PASL curated and updated on a regular basis by members of the CAFF Flora Working Group, and this information made available through the internet on the CAFF Data Portal.

The species lists for vascular plants, mosses, liverworts and lichens, as available in 2012, were converted by Martha Raynolds and Amy Breen at the University of Alaska Fairbanks to a common spreadsheet format, and combined into a TurboVeg species list by Stephan Hennekens. Specific details of the sources and dates of the lists are discussed below for each group. The numbers of taxa and synonyms included in the PASL for each group are listed in Table 1. The species lists were checked with other international vegetation databases using the Taxonomic Resolution Service (http://tnrs.iplantcollaborative.org). The search compared each taxon with lists from the Missouri Botanical Garden's Tropicos database, The National Center for Biotechnology Information's Taxonomy ITIS database, the US Department of Agriculture's PLANTS database, and the Global Compositae Checklist. Most of the PASL taxa were found in either the Tropicos or PLANTS databases. The results of the taxonomic resolution search are shown in Table 2.

In order to produce a more definitive PanArctic Species List, it will be critical to identify the people who will take responsibility for maintaining and curating the species list for vascular plants, mosses, liverworts and lichens and the combined PASL. It will also be important to make the PASL available to researchers and the public through the internet. The CAFF Flora Working Group with the support of the CAFF Secretariat could fill this important role.

Vascular Plants List

The Annotated PanArctic Flora (PAF) Checklist is a compilation of accepted names and synonyms, and an evaluation of all vascular plant taxa at ranks of family, genus, species, subspecies, varieties, and hybrids (but only those with an independent existence), occurring regularly within the Arctic as circumscribed for the Checklist. The sources include published floras and checklists for different regions. The PAF Editorial Board consisted of Reidar Elven, David Murray and Boris A. Yurtsev until his death in 2010 when he was replaced by Vladimir Yu. Razzhivin. The Board was responsible for final decisions as to which taxa to include, their taxonomic ranks, and names. Each taxon has notes regarding taxonomic and nomenclatural problems, arguments for the choices made, prospects of future work, and also cases where the Editorial Board did not reach agreement on treatments and why. The PAF checklist was made available on the web in 2011 (Elven 2011). Detailed information about the methods is included in the introduction on the website (http://nhm2.uio.no/paf/introduction).

Reidar Elven e-mailed the complete list of the taxa in the PanArctic Flora (PAF) in a text document to Amy Breen in June 2012. The text included the PAF numbers and hierarchy, including family, genus, accepted taxa (including species, subspecies and varieties), authorities for accepted taxa, and synonyms and their authorities. Martha Raynolds converted this text file into a spreadsheet file in August 2012 by importing it into Microsoft Excel and parsing each line into columns. The final file is composed of three worksheets, one for families and synonyms, one for genera and synonyms and their authorities, and a third for species, subspecies and varieties that includes synonyms and authorities. It contains 2789 accepted taxa and 4118 synonyms (Table 1).

A comparison of the parsed vascular species list with the Taxonomic Resolution Service on October 2012 for the 6907 taxa (accepted and synonyms) found 6121 (89%) exact matches (Table 2). The remaining 786 taxa were checked with a fuzzy match. 204 had a fuzzy match score of 0.99, indicating a minor spelling discrepancy. An additional 174 had fuzzy match scores > 0.9, mostly issues as to whether a subspecies designation is necessary. Reidar Elven went through the list of taxa that had no exact matches and identified 74 taxa with spelling errors in the initial PAF list, which were then corrected by Martha Raynolds for the PASL. Most of the remaining 712 discrepancies were correct in the initial PAF list in Reidar Elven's opinion, though several needed further research to identify the correct name. He recognized 55 taxa with spelling errors in the Tropicos list, and 360 taxa missing from the Tropicos list.

The next step for this portion of the PASL will be to address the Taxonomic Resolution Service discrepancies.

Moss List

The moss species list for North America was compiled by René Belland of University of Alberta, Edmonton, Canada. René Belland sent Excel spreadsheets to Amy Breen in February and August 2012. These included a list of accepted taxa with authorities, region and country, and a list of synonyms. Amy Breen formatted these into the PASL format with three worksheets, one with families, one with genera and authorities, and a third with the accepted species (with authorities) and synonyms (no authorities). It contains 735 accepted taxa and 3934 synonyms (Table 1).

A comparison of the moss species list with the Taxonomic Resolution Service in October 2012 for the 4668 taxa (accepted and synonyms) found 4556 (98%) exact matches (Table 2). The remaining 112 taxa were checked with a fuzzy match. 30 had a fuzzy match score of 0.99, indicating a minor spelling discrepancy. An additional 64 had fuzzy match scores > 0.9, mostly issues as to whether a subspecies designation is necessary.

The next step for this list will be to add any additional arctic species listed in the "Check-list of mosses of East Europe and North Asia" (Ignatov et al. 2006). This will require converting the article to text in a spreadsheet, parsing the lines, extracting the arctic species, and comparing these with the existing PASL moss list.

Liverworts List

The liverwort taxa were extracted from "Checklist of liverworts (Marchantiophyta) of Russia" (Konstaninova et al. 2009). Michael Lee with the U.S. VegBank did the initial conversion from pdf to spreadsheet and parsing into columns in May 2012. He e-mailed the resulting spreadsheet to Amy Breen. Martha Raynolds extracted the species that occurred in the Arctic, and put the spreadsheet into PASL format with three worksheets, one with families and authorities, one with genera with authorities and synonyms, and a third with the accepted species and synonyms with authorities for both. It contains 222 accepted taxa and 393 synonyms (Table 1).

A comparison of the liverwort species list with the Taxonomic Resolution Service in October 2012 for the 615 taxa (accepted and synonyms) found 485 (79 %) exact matches (Table 2). The remaining 130 taxa were checked with a fuzzy match. 21 had a fuzzy match score of 0.99, indicating a minor spelling discrepancy. An additional 3 had fuzzy match scores > 0.9. Nadezda Konstantinova looked at these and found 2 spelling errors in the PASL (which were corrected) and 4 in the Tropicos list.

The next step for this data set is to add species from other parts of the Arctic, particularly information on liverworts of Alaska (Worley 1970), data from the Canadian Arctic (Hong and Vitt 1977, Damsholt 2007), Svalbard (Konstaninova and Savchenko 2012), work by Kristian Hassel in eastern Greenland, and others. Species as well as intraspecies taxa (subspecies, varieties, forma, etc.) should be extracted. Taxonomic discrepancies should be compared with global databases.

The next step for this data set is to add species from other parts of the Arctic, particularly information on liverworts of Alaska (Worley 1970, Steere and Inoue 1978, Potemkin 1995), data from the Canadian Arctic (Hong and Vitt 1977, Damsholt 2007, etc.), Svalbard (Frisvoll and Elvebakk 1996, Konstaninova and Savchenko 2012, etc.), and Greenland (Schuster and Damsholt 1974, Schuster 1988, Kristian Hassel, and others). Species as well as intraspecies taxa (subspecies, varieties, forma, etc.) should be extracted. Taxonomic discrepancies should be compared with global databases.

Lichen and Lichenicolous Fungi List

The list of arctic lichens was compiled by Hörður Kristinsson, Mikhail Zhurbenko and Eric Steen Hansen, and was published as a CAFF Technical Report (Kristinsson et al. 2010). The list was compiled from publications from North America, Greenland, Iceland, Svalbard, Norway and Russia, as well as unpublished data from the Russian Arctic and Greenland. The report is available electronically on the CAFF Arctic Data Portal, and data in spreadsheet format can also be downloaded (http://www.abds.is/publications/view_category/75-lichens-data).

The list in the PASL is from an Excel spreadsheet file sent by Hörður Kristinsson in April 2012. Martha Raynolds formatted the data to match the PASL, with one worksheet for accepted genera and synonyms with authorities for both, and one worksheet for accepted species with authorities and synonyms (no authorities). It contains 1699 accepted lichen and lichenicolous fungi taxa, and 240 synonyms (Table 1).

A comparison of the lichen species list with the Taxonomic Resolution Service in October 2012 for the 1939 taxa (accepted and synonyms) found 1276 (66 %) exact matches (Table 2). The remaining 663 taxa were checked with a fuzzy match. 65 had a fuzzy match score of 0.99, indicating a minor spelling discrepancy. An additional 69 had fuzzy match scores > 0.9.

The next step for this data set is to include more recent, common synonyms. Amy Breen is working on this. The list also needs to incorporate recent work by Helga Bueltmann on the lichens of Greenland. The discrepancies with nomenclature from global databases need to be further resolved.

Combining the lifeform lists into one PanArctic Species List (PASL)

Martha Raynolds e-mailed the spreadsheets with the lifeform lists to Stephan Hennekens in October 2012. Stephan Hennekens combined the lists and formatted them into a TurboVeg species list. Amy Breen has been testing this “beta version” of the PASL, using it to import relevé data from Northern Alaska into TurboVeg.

The next steps for the PanArctic Species list are to

1. Publish the PASL Version 1 as a CAFF technical report and post it on the CAFF Data Portal
2. Use the updates of the lifeform lists to create Version 2 of the PASL
3. Map synonymy to European sources (European Vegetation Database) and US sources (USDA PLANTS Database and VegBank).

Table 1. Number of taxa of each group in the PanArctic Species List (PASL).

Group	Number of accepted families	Number of family synonyms	Number of accepted genera	Number of genus synonyms	Number of accepted species, subspecies and varieties	Number of species, subspecies and variety synonyms
Vascular	91	30	426	194	2789	4118
Mosses	57	0	192	0	735	3934
Liverworts	34	0	72	8	222	393
Lichens	-	-	266	19	1699	240

Table 2. Results of Taxonomic Resolution Service (TRS) search (http://tnrs.iplantcollaborative.org).

Species	Exact matches in TRS (%)	Discrepancies found by TRS	Fuzzy matches > 0.9 in TRS*	Discrepancies resolved (%)
Vascular	6121 (89%)	786	204	74 (9%)
Mosses	4556 (98%)	112	30	0
Liverworts	485 (79%)	130	21	2 (2%)
Lichens	1276 (66%)	662	65	16 (2%)

*Likely simple spelling errors in either PASL or match database

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Vegetation datasets for Chukotka (Russia)

Volodya Razzhivin

Extensive field studies of vegetation in Chukotka started in 1930th both in the northernmost Wrangel Island by B. Gorodkov (1958) and in the southernmost tundra-forest ecotone by L. Tyulina (1936) and V. Vasiljev (1936, 1956). B. Gorodkov characterized the most extreme northeastern part of the Vrangel Island. L. Tyulina and V. Vasiljev described vegetation of the Anadyr River basin including larch forests, stlanik (*Pinus pumila*) shrubs and tundra vegetation. These three monographs include also tables of relevés.

Regular field study of flora and vegetation in Chukotka has been started in the late 1960th. The major case studies of vegetation in Chukotka were as follows (see the map):

1. large-scale mapping of the model territories in Chukotka Peninsula (Katenin, 1974, 1981, 1984,1988, Katenin, Rezvanova 2000), Wrangel Island (Kholod 1989, 1994, etc.), and in continental Chukotka (Kholod 1984, 1991) which are based on a fairly large sets of unpublished relevés (hundreds) per study site;
2. composition, structure, environments, vegetation classification and mapping of landscapes of the relict cryo-xeric (tundra-steppe) vegetation (Yurtsev 1974, 1978, 1981, 1986, Kozitskaya & Razzhivin 1985, Slinchenkova 1984, etc.)which were focused on cryo-xeric plant communities but also many relevés represent surrounding vegetation and transitional ecotones;
3. composition, structure and syntaxonomy of the willow and alder shrub vegetation by N. Sekretareva in the eastern part of Chukotka peninsula (1982, 1989, 1990, 1991, 1992, 1999), in Wrangel Island (1994, 1995), in southern and central Chukotka (2001,2003), upper Anadyr River, in Elgygytgyn Lake area and in middle Amguema River (Sinelnikova 2001);
4. composition, structure and syntaxonomy of the halophytic vegetation (Sergienko 2008);
5. syntaxonomy of the tundra vegetation in surrounds of Elgygytgyn Lake and in mid Amguema River (Sinelnikova 1992, 1993);
6. various case studies of vegetation accompanied with the mostly unpublished relevé datasets.

The most complete syntaxonomical treatment has been published by S. Kholod (2007) on the vegetation of Wrangel Island, which includes 29 associations (25 of them are new), 1community type, 18 subassociations, 8 variants and 5 facies. Several treatments were published about ecological units like ridge vegetation (Balandin 1978), snowbed vegetation (Razzhivin 1994) and vegetation of anthropogenically disturbed sites (Sumina 1991, 1994).

In terms of databasing of Chukotkan relevés the following difficulties should be taken into account:

- it is a special task to estimate the number of unpublished relevés in the above mentioned case studies and during floristic studies using “local flora” approach which were usually accompanied by some basic description of a local vegetation;
- a lot of relevés have incomplete list of cryptogams and can be used for e. g. estimate of distributional range of syntaxa;
- almost all relevé datasets have no co-ordinates and can be georeferenced with low accuracy.

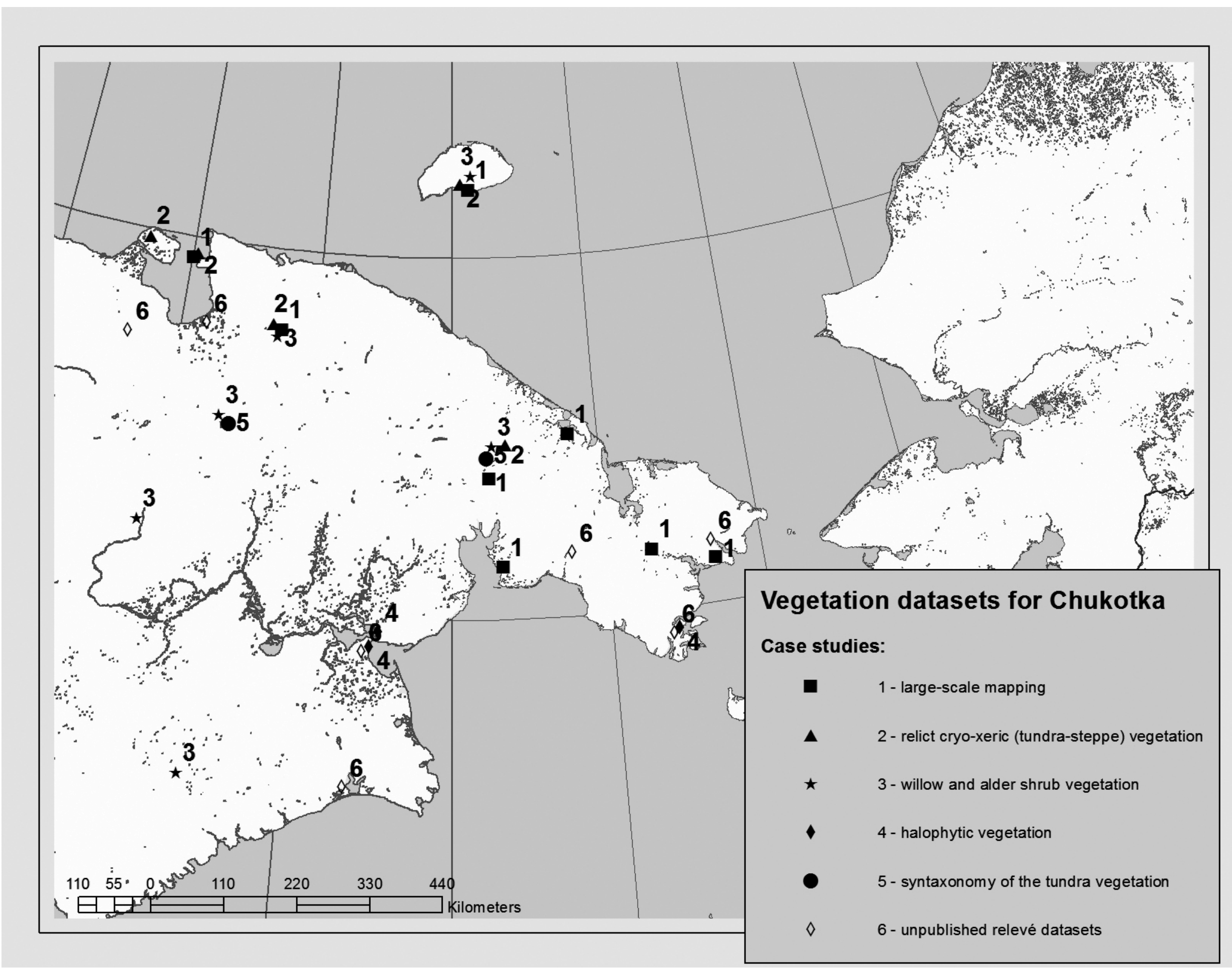

Figure 1. Location of Chukotka vegetation datasets.

Towards assessing biodiversity feedbacks to climate in the Arctic - future application of the AVA

Gabriela Schaepman-Strub, Maitane Iturrate & Reinhard Furrer

Terrestrial ecosystems interact with climate at the local, regional and global scale (e.g., Nobre et al., 1991; Oechel et al., 1993). While climate affects terrestrial ecosystems composition and function, vegetation exerts significant feedback on atmospheric processes by altering the land-atmosphere exchange of energy and matter (e.g. Feddema et al., 2005; Konings et al., 2011). Land surface schemes of climate models embody these interactions by implementing processes such as the absorption of photosynthetically active radiation, and latent and sensible heat fluxes. In the framework of a new research priority programme on global change and biodiversity at the University of Zurich, we will investigate the feedback of biodiversity at local to pan-arctic scale using physically based radiation modeling and statistical approaches. We will give a short overview on the research site in Kytalyk (71N, 147E) in the NE Russian Arctic. We will discuss how AVA can make an important contribution to analyze the feedback of biodiversity on essential climate variables at the pan-arctic scale. We will further address (meta-) data requirements of the AVA to be applicable to the planned analysis.

Plant communities of southern hypoarctic tundra of the Anabar River basin (North-West Yakutia)

Elena I. Troeva, M. Yu. Telyatnikov, M.M. Cherosov, S.A. Pristyazhnyuk, P.A. Gogoleva & L.A. Pestryakova

In summer 2011, a complex study of southern hypoarctic tundra ecosystems have been conducted at the monitoring site "Yurung-Khaya" (7.5 km south of Yurung-Khaya settlement, Anabar Region). We conducted the research work on syntaxonomy and mapping vegetation.

The previous generation of investigators has revealed general patterns of vegetation cover in Yakutian part of the Arctic using the ecological-phytocoenotic method of vegetation classification (Perfilyeva et al., 1991). Nowadays, the participants of NEFU grant program on the Arctic complex investigation (including study and mapping of vegetation cover) conduct the work on classification based on the floristic-sociological method. Vegetation diversity of the Anabar tundra is represented by 8 associations and 2 subassociations belonging to 3 classes of ecological-floristic classification (*LOISELEURIO-VACCINIETEA* Eggler ex Schubert 1960, *SALICETEA HERBACEAE* Br.-Bl. 1948, *CARICI RUPESTRIS-KOBRESIETEA BELLARDII* Ohba 1974). Position of new association ***Triseto sibirici-Astragaletum umbellati*** Telyatnikov, Lashchinskiy, Troeva ass. nova hoc loco is still under undetermined. All associations and subassociations were distinguished for the first time ever. A new alliance ***Carici concoloris-Aulacomnion turgidi*** was also distinguished belonging to order ***Rhododendro-Vaccinietalia*** of class *LOISELEURIO-VACCINIETEA*.

There are also data on azonal vegetation type (*VACCINIO-PICEETEA* Br.-Bl. in Br.-Bl. et al. 1939; *ASPLENIETEA TRICHOMANIS* (Br.-Bl. in Meier et Br.-Bl. 1934) Oberd. 1977; *THLASPIETEA ROTUNDIFOLII* Br.-Bl. 1948; *SCHEUCHZERIO-CARICETEA FUSCAE* Tx. 1937; *OXYCOCCO-SPHAGNETEA* Br.-Bl. et Tx. ex Westhoff et al. 1946; *PHRAGMITI-MAGNOCARICETEA* Klika in Klika et Novák 1941; *MATRICARIO-POETEA ARCTICAE* Ishbirdin 2002; *PUCCINELLIO-HORDEETEA JUBATI* Mirkin in Gogoleva et al. 1987) which are still under discussion.

In 2012 the authors supplemented their work with new field data on vegetation of the Kolyma River basin and the Lena River Delta (sample analysis stage).

The authors base their work upon the results of previous studies of tundra vegetation in Taimyr conducted by Dr. N.V. Matveyeva (Komarov Botanical Institute, saint-Petersburg), as well as on up-to-date conspectus of vegetation of Russia (Ermakov 2012).

Plant species determination (higher vascular plants, mosses, lichens), required for vegetation classification issues, is made by the specialists of Komarov Botanical Institute, RAS (Saint-Petersburg), Central Siberian Botanical Garden, SB RAS (Novosibirsk), Institute for Biological Problems of Cryolithozone, SB RAS (Yakustk). Thus, the specialists in flora and vegetation effectively collaborate in the project.

The study was conducted with support of Arrangement 2.17 “Biomonitoring of tundra ecosystems of North-East Russia under conditions of global climate change and intensification of anthropogenic progress” of the developmental program of North-East federal University.

Overview and history of the Arctic Vegetation Archive initiative and goals for the workshop

D.A. (Skip) Walker

The goal of the Arctic Vegetation Archive (AVA) is to unite and harmonize the vegetation data from the Arctic tundra biome into an archive for use in a panarctic vegetation classification and as a resource for climate-change and biodiversity research. This Krakow workshop brings together vegetation scientists from the circumpolar Arctic countries to begin building the database.

Arctic vegetation data are especially valuable because of the large time, cost, and risk associated with collecting vegetation data in remote areas of the Arctic. The data were collected over a long period of time and are scattered across many institutions in a variety of formats. Some of the data are maintained in electronic databases managed by various research groups and agencies working in the Arctic, while other data are in danger of becoming lost because they were never electronically catalogued, so there is an urgent need to archive these data in a consistent format before they are lost. The AVA is a coordinated effort to accelerate the preservation of these data and harmonize them for use in comparative studies.

Several milestones led to this meeting:

1992 The first International Arctic Vegetation Classification Workshop in Boulder, Colorado, resolved to develop a database of arctic relevés and a prodromus of vegetation types for the Arctic. Several papers presented at the workshop reviewed the status of phytosociological research in the Arctic and were published in the *Journal of Vegetation Science* (Walker et al. 1994).

2003 The Circumpolar Arctic Vegetation Map (CAVM Team 2003, Walker et al. 2005b) was published and helped to redefine the need for a vegetation classification for the Arctic. The attendees at the concluding workshop in Tromsø, June 2004 recommitted themselves to making the necessary database. Several contributions to the Tromsø workshop were published in *Phytocoenologia* (Daniels et al. 2005).

2011 The Conservation of Arctic Flora and Fauna (CAFF) and the International Arctic Science Committee endorsed the International Arctic Vegetation Database concept (later changed to the Arctic Vegetation Archive). CAFF recognizes the project as an important part of its Arctic biodiveristy efforts and published the IAVD Concept Paper (Walker and Raynolds 2011).

2012 Two workshops sponsored by the Nordic Network on climate and Biodiversity (CBIO-NET) in Roskilde, Denmark, helped to lay the foundation for the Krakow workshop and highlighted the application of the IAVD for modeling and predicting biodiversity trends based on patterns of plant distribution data that could be derived from an Arctic vegetation archive (Walker et al. 2013).

2013 Support from the International Arctic Science Committee, CAFF, and the U.S. National Aeronautics and Space Administration's Land-Cover and Land-Use Change program made this workshop possible.

Some elements of the AVA were resolved at the Roskilde workshops:
1. The basic types and format of the data will be compatible with the European Vegetation Archive (Chytrý et al. 2012))
2. Turboveg will be used for initial data entry (Turboveg, (Hennekens and Schaminee 2001)).
3. Metadata for all datasets will be archived with the Global Inventory of Vegetation Data (Dengler et al. 2011)
4. The AVA will be compatible to the greatest extent possible with other vegetation database approaches used in North America (VegBank in the U.S. (Peet et al. 2012) and VPro in Canada (MacKenzie and Klassen 2004)) and IBIS used in Russia.
5. The Panarctic Flora checklist (PAF, (Elven et al. 2012)), the CAFF species lists for the mosses and lichens (Kristinsson et al. 2010, Belland 2012), and the Russian liverwort list (Konstantinova and Bakalin 2009) will be used as initial checklist of accepted species names for the project and these will be harmonized with the names used by the Global Biodiversity Information Facility (Chavan 2012).

The name change from the International Arctic Vegetation Database (IAVD) to Arctic Vegetation Archive (AVA) was recently made to shorten the name, to eliminate the redundancy in the name (i.e., the Arctic is International by definition!) and to show conceptual and methodological connection with the European Vegetation Archive.

The major goals of the meeting are to review the status of relevé data in each of the circumpolar countries, unify the Arctic vegetation community behind an approach that will be acceptable to all involved and to begin recruiting the people and resources necessary to complete the work.

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Abstract of talk presented at the Arctic Vegetation Archive (a.k.a. International Arctic Vegetation Database) Workshop, Krakow, Poland, 14-16 April 2013.

21 years to common ground: Protecting our shared biodiversity legacy

Marilyn D. Walker

In Spring 1992, I convened the first Circumpolar Arctic Vegetation Workshop in Boulder, Colorado, bringing together a small group of dedicated vegetation specialists from the US, Canada, Germany, the Soviet Union, Norway, and Finland. The world was going through major political and technological change. Glasnost opened up the Soviet Union and made real collaboration with our colleagues possible for the first time. The National Science Foundation had recently launched NSFNET, a backbone of connectivity that would soon connect with other networks, forming the "network of networks" we now know as the World Wide Web. My own trip to the Taimyr Peninsula, in the summer of 1991, opened my eyes to the critical importance of sharing data on vegetation and species distribution. A growing legacy of data was scattered on bits of paper, in file drawers and notebooks, and increasingly on "floppy disks". As I edited and created the workshop volume, I grew to appreciate the potential of databases to create a common language and method for properly describing and understanding arctic vegetation. In 2013, I return to bring my knowledge of how databases and the Internet can help pull together the labors of love that have grown the vegetation legacy into a serious research and conservation tool.

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