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SPECIAL FEATURE

Circumpolar arctic vegetation

Editors:

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Based on contributions presented at the International Workshop on Classification of Arctic Vegetation, held at the Institute of Arctic and Alpine Research, University of Colorado, Boulder, CO, USA, 5-9 March 1992.

Contents

Circumpolar arctic vegetation: Introduction and perspectives

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Background

The circumpolar Arctic is a vast, remote area which experiences environmental change through both the indirect impacts of climate change and the more direct impacts of large-scale energy and industrial development and pollution. The vegetation of the Arctic is well-known only in a few relatively small regions near human settlements and areas of energy development; detailed studies of the composition and dynamics of plant communities are missing for many areas. Yet a synthesis is badly needed as we strive to understand the circumpolar Arctic as a single geo-ecosystem. To help meet this challenge, the High Latitude Ecosystems Directorate of the U.S. Man and the Biosphere Programme funded a workshop in March 1992 that brought together a large segment of the international vegetation research community dealing with the Arctic. The purpose of the workshop was to begin the task of completing a global synthesis of arctic vegetation. Ca. 30 lectures and posters were presented at the workshop. They treated general, phytogeographical aspects, local and regional vegetation-ecological descriptions, effects of human disturbance, challenges associated with mapping, geographic information systems, and remote sensing, and some ecophysiological aspects.

During 1992, manuscripts for a possible Special Feature in this journal were submitted. Due to communication problems, the reviewing and revision of many papers took a longer time than anticipated, but in the end we were able to include 13 papers. Together, they provide a broad overview of arctic vegetation, with a wide coverage of areas, from the Aleutian Islands over Alaska, Greenland, Svalbard, Kola, and Taymyr to Chukotka. Moreover, they make clear that vegetational variation can be convincingly linked to environmental variation. Finally, we learn how phytogeographical and local-ecological causes of floristic variation operate simultaneously in a complex way, which is unique and deviant from any other floristic kingdom in the world.

Special importance of arctic vegetation

Arctic ecosystems are of interest both for their inherent value as well as for their role in the global geosystem; ca. 15% of the world's carbon is estimated to be stored in boreal or arctic systems. General circulation models predict temperature increases in northern latitudes to be some of the most extreme (Mitchell et al. 1990). With low growing-season temperatures a change of only a few °C can lead to a several-fold increase in growing-degree days. Such changes may lead to (1) dramatic shifts in species distribution at many spatial scales, (2) movements of major boundaries, such as the treeline (Boreal-Low Arctic ecotone), and (3) local changes in snow cover and distribution along mesotopographic gradients, with important consequences to ecosystem function (M.D. Walker in press). Understanding and predicting how arctic ecosystems will respond to these impacts requires a global view of the region, but existing syntheses at that scale are very generalized (e.g. Aleksandrova 1980; Bliss & Matveyeva 1992). Global-scale research programs with foci or strong interests in the Arctic include the International Tundra Experiment, the U.S. Arctic System Science project, and the International Geosphere-Biosphere Program Global Change and Terrestrial Ecology core area. The success of these programs depend in part upon the existence of a common language for describing arctic ecosystems. Because the ecosystem must be characterized through the description of its plant communities, a multiple-scale, hierarchical system of classification is essential to all of these efforts (D.A. Walker & M.D. Walker 1991).

Arctic ecosystems largely belong to one biome, the tundra biome, with the polar desert biome represented beyond its northern boundary and with transitions towards boreal shrubland and forest at its southern boundary. Ca. 60% of the arctic vascular flora is in common throughout, increasing to as high as 90% in the northernmost regions. Other large biomes have substantial floristic differentiation among continents and are only similar at the physiognomically defined level of formation. At the same time, arctic vegetation has considerable ecological and phytogeographical variation. Several different terms and divisions are in use to describe this twofold variation. We refer first to the seminal paper by *Yurtsev* in this Feature. He recognizes three major climatically defined zones within the Arctic: (1) Hypoarctic, largely synonymous to Low Arctic as used by others; (2) Arctic, and (3) High Arctic, including what is often called Polar desert. *Yurtsev*'s contribution shows clearly how many local and regional endemics are available for the floristic characterization of plant communities. In combination with the climatic and edaphic variation, the phytogeographical variation leads to clear patterns of well-defined local plant communities with a relatively simple structure. Thus, arctic vegetation forms an ideal object of study from several viewpoints in vegetation ecology.

One aspect which deserves further consideration, particularly regarding the future circumpolar phytosociological integration, is the position of mountain zones in or near the Arctic. As an example, Iceland is nowadays considered as not, or only partly Arctic (*Yurtsev* includes Iceland on his map as 'Oceanic treeless area'). However, according to the vegetation survey of Mt. Hekla (Bjarnason 1991) plant communities from 400 m a.s.l. and higher are ecologically arctic. An even more actual example is the Kola peninsula, which is excluded from the Hypoarctic on *Yurtsev*'s map, but a good deal of the communities described by *Koroleva* in this Feature, partly at 800 - 1000 m a.s.l., is ecologically highly arctic. Her paper, as well as that by *Talbot* & *Talbot*, points to another complication we should elaborate on: several coastal habitats in near-Arctic zones are edaphically and climatically more arctic than their zone indicates (Bliss 1993). On the other hand, the ecologically (low-) arctic southern part of Greenland (see *Daniëls*, this Feature) is not considered part of the Arctic floristic region (*Yurtsev*, this Feature).

Gradient structure and diversity of arctic environments

The contributions by *Koroleva*, *Razzhivin*, *Talbot* & *Talbot*, and particularly *Lloyd et al*., describe and reveal environmental gradients underlying the floristic variation that are not fundamentally different from those in temperate regions. Particularly *Matveyeva* makes clear that tundra vegetation has both high α and β diversities. In fact, the high biodiversity of arctic vegetation, challenging that of many other ecosystems, may be one of the outstanding results of this Feature.

One of the greatest challenges facing science today is to understand, document, and predict how biodiversity will be affected by the rapid and unprecedented changes currently taking place on the globe (Peters 1992; Chapin & Körner in press). Plant communities represent one of the major units of biodiversity beyond the species level (M.D. Walker in press). One of the more fascinating gradient types appearing in several of these contributions, e.g. *Elvebakk*, *Razzhivin*, *Walker et al*., is the gradient in depth and duration of the snow cover. In snowbed vegetation on basic to slightly acidic substrate there is clear similarity on the genus level with vegetation of temporarily inundated dune swales and valleys, as follows from a comparison with studies on coastal dunes in van der Maarel (1993a). An environmental similarity between the two situations is the prevention of budding (by snow and water respectively, for a longer or shorter period during the growing season), followed by a shorter or longer growing season under moist conditions.

Finally, the papers by *Lloyd et al*. and *Odasz* show how environmental gradients can be further understood by ecophysiological studies. Though not fitting the original theme of this Feature, they are presented here as models for causal-analytical approaches to arctic vegetation on the basis of sound field studies.

Floristic problems

A complete and accurate identification of plant species is necessary for a reliable phytosociological system. Floristic problems that are particularly significant in arctic phytosociology are the importance of cryptogams, uncertainty or disagreement about the status of lower-rank taxa, and vicariant species and species groups. Cryptogams play a decisive role in most arctic plant communities, yet these may be incompletely identified or even missing in many treatments. *Murray* comments on the uncertainty and difficulty regarding the taxonomic status of species and lower-rank taxa.

Phytosociologists have often used locally distinguished taxa for the distinction of vegetation units. Van der Maarel (1993b) mentions, as an example, several examples of coastal taxa once distinguished, but no longer recognized on Iceland (Bjarnason 1983): *Silene maritima* ssp. *islandica*, now *S. vulgaris* ssp. *maritima*, *Juncus balticus* ssp. *intermedius*, now *J. balticus*; *Festuca cryophylla*, now *F. rubra*.

There are vicariant taxa and species groups within the Arctic of uncertain status, and some of these play decisive roles in syntaxonomy. An example is the genus *Dryas*, which is of syntaxonomic and ecological importance because it predominates in many dry habitats throughout the circumpolar arctic and alpine regions. The genus has two vicariant arctic taxa, *D. integrifolia* and *D. octopetala*. The range of *D. integrifolia* extends from NE Greenland across North America to Asia, in the unglaciated Chukotka Peninsula region. The range of *D. octopetala* extends eastward from Greenland across N Europe and Asia, extending into North America only in Alaska. *D. octopetala* is divided into several subspecies, which some authors view as a complex of closely related species, and others as varieties only. *Matveyeva* describes upland communities on Taymyr dominated by *D. punctata*, which some taxonomists would recognize as *D. octopetala* ssp. *punctata*, and which others would recognize only as a morphological variety. Dierßen (1992) considered *Dryas* s.l. as faithful taxon of the order *Kobresio-Dryadetalia*, and then separated the order into two alliances according to the major species, with *D. octopetala* vegetation in the *Caricion nardinae* and *D. integrifolia* vegetation in the *Dryadion integrifoliae*. If *D. punctata* is recognized as a distinct species, then a third alliance might be described to include it. The situation is more complex in regions of overlap between *D. octopetala* and *D. integrifolia*, because there is hybridization; therefore it is not always clear with which species or subspecies one is working.

Another example stems from the work of Daniëls (1982, see also *Daniëls*, this Feature) who described associations based on *Vaccinium microphyllum*, now considered *V. uliginosum* ssp. *microphyllum* (e.g. the *Festuco-Salicetum microphyllae*), and on *Salix callicarpaea*, now *S. glauca* ssp. *callicarpaea* (e.g. *Phyllodoco-Salicetum glaucae*).

There is no correct answer as to whether splitting or lumping should prevail, as there is no absolute test for what defines and delineates a species. The application of molecular techniques in taxonomy may help clarify the picture in some areas, but the main point now is that a circumpolar synthesis and vision of the flora is necessary for a circumpolar synthesis of the vegetation.

Syntaxonomy

Despite the functional and floristic similarities within the circumpolar Arctic, synthesis has been hampered by differences in culture, language, and scientific heritage between ecologists working in the Arctic, even between people working in the same area, e.g. Greenland (*Daniëls*, this Feature). The phytosociological approach has a long history in the European Arctic and areas under European flags (see *Daniëls* and *Elvebakk* in this Feature), whereas North Americans have traditionally favored a gradient approach, using informal or individual classification systems, and the Russians have a rich tradition of their own - combining several approaches - which is little known abroad (Aleksandrova 1978). A major goal of the workshop was to cross language and scientific cultural barriers and to focus on finding a common ground. As an example of integration of approaches, elements of several North European approaches, with the sociation as an important classification unit (Malmer & Trass 1978), have been incorporated in the Braun-Blanquet approach (Westhoff & van der Maarel 1978) and units which were described as sociations may be redefined as associations under conditions summarized by Moravec (1993).

Arctic syntaxa are described for the first time or confirmed by new research in five contributions, those of *Koroleva, Matveyeva, Razzhivin, Walker et al.* and *Sumina*, whereas *Elvebakk* and *Daniëls* present general syntaxonomical surveys. In some cases new syntaxa are presented in a formal way; other syntaxa are described more provisionally. In this connection, we stress the importance of the inductive approach as characteristic of the Braun-Blanquet approach (with the contributions by *Matveyeva* and *Razzhivin* as examples). Plant communities are described locally as plant community types. After comparison with types in other areas they may be incorporated in the syntaxonomic system, as units of low rank, basically associations. Higher-level syntaxa should only be established after larger floristic regions have been included in our studies.

Table 1 presents a synopsis of higher syntaxa as mentioned in the various contributions. This survey is a first start of an Arctic Vegetation Survey. Several syntaxa should be considered as provisional. Research in many more areas will reveal many other syntaxa, needed to describe the overall variation and the geographical distribution of all types. We caution against early formalization of types, because further research will almost certainly lead to changes in the syntaxonomy. As follows from the scheme, several higher units are used under different synonyms - or is there room for a division of higher units? As a synthesis develops, we stress the need for practicality and a focus on clarifying relationships. The example of *Dryas* described above may serve as a model for how to treat complex situations of closely related taxa, i.e. by lumping closely related species and species groups at the highest syntaxonomic levels and then splitting the units into finer groupings at lower hierarchical levels. These questions are obvious impulses for further research.

Classification and ordination

Most centers for vegetation research have access to standard programs for classification and ordination, and their use is steadily increasing. This can only be welcomed, although some recommendations seem appro-

Table 1. Survey of higher syntaxa of communities mentioned in any of the papers in this Special Feature. Provinces and phytogeographic zones (*Yurtsev*, this Feature) and areas included here: E = East Siberian; ET = Taimyr; EC = Chukotka; A = Alaska; G = Canada-Greenland; GG = South Greenland; W = European-West-Siberian; WS = Svalbard; WK = Kola; a = Arctic; h = Hypoarctic; ah = mainly Arctic; ha = mainly Hypoarctic; b = boreal. Order of syntaxa within each habitat type alphabetical.

Zone/region Habitat/Class/Order/Alliance	ET ah	EC ha	A ha	GG h	WS a	WK b
Rock vegetation						
Asplenietea trichomanis	.	.	.	x	.	.
Rhizocarpetea geographici	.	.	x	.	.	.
Polar desert and scree vegetation						
Thlaspietea rotundifolii[1]	.	x	.	x	x	.
Thlaspietalia rotundifolii	.	.	.	x	.	.
Caricion nardinae	.	.	.	.	x	.
Cerastio-Saxifragion cernuae	.	.	.	.	x	.
Luzulion arcuatae	.	.	.	.	x	.
Papaverion dahlianae	.	.	.	.	x	.
Poion glauco-malacanthae	.	x	.	.	.	.
Ranunculo-Oxyrion digynae	.	.	.	.	x	.
Saxifrago-Oxyrion digynae	.	.	.	x	.	.
Basic grass- and dwarf shrub heath vegetation						
Carici rupestris-Kobresietea bellardii[1]	x	x	x	x	.	x
Dryadetalia octopetalae	.	x	.	.	.	.
Dryado-Cassiopion tetragonae	.	x	.	.	.	.
Kobresio-Dryadetalia	.	.	.	x	.	x
Dryadion integrifoliae	.	.	.	x	.	.
Kobresio-Dryadion octopetalae	.	.	.	.	.	x
Acidic grass- and dwarf shrub heath vegetation						
Caricetea curvulae	.	.	.	x	.	.
Juncetalia trifidi	.	.	.	x	.	.
Carici-Juncion trifidi	.	.	.	x	.	.
Cladonio-Viscarion alpinae	.	.	.	x	.	.
Cetrario-Loiseleurietea	.	.	x	.	.	x
Cetrario-Loiseleurietalia	.	.	.	.	.	x
Loiseleurio-Vaccinietea	.	x	.	x	.	x
Rhododendro-Vaccinietalia	.	.	.	x	.	x
Loiseleurio-Diapension lapponicae	.	.	.	x	.	x
Phyllodoco-Vaccinion myrtilli	.	x	.	x	.	x
Snowbed vegetation						
Salicetea herbaceae[1]	x	x	x	x	.	x
Salicetalia herbaceae	.	.	.	x	.	.
Luzulion arcticae	.	.	.	x	.	.
Salicion herbaceae	.	.	.	x	.	x
Saxifrago-Ranunculion nivalis	.	x	.	x	.	.
Salicetalia polaris	.	x	.	.	x	.
Drepanoclado-Poion alpinae	.	.	.	.	x	.
Festuco-Salicion chamissonis	.	x	.	.	.	.
Bog vegetation						
Oxycocco-Sphagnetea	.	.	x	x	.	.
Sphagnetalia magellanici	.	.	.	x	.	.
Oxycocco-Empetrion hermaphroditi	.	.	.	x	.	.
Wetland, mire and fen vegetation						
Scheuchzerio-Caricetea[1]	x	.	x	x	x	.
Caricetalia davallianae[2]	x	.	.	x	.	.
Caricion atrofuscae-saxatilis	.	.	.	x	.	.
Caricion stantis[3]	x	.	.	.	.	.
Caricetalia nigrae	.	.	.	x	x	.
Ranunculo-Drepanocladion	.	.	.	.	x	.
Scheuchzerietalia palustris	.	.	.	x	.	.
Spring and spring brook vegetation						
Montio-Cardaminetea	.	.	.	x	.	.
Montio-Cardaminetalia	.	.	.	x	.	.
Montio-Epilobion hornemannii	.	.	.	x	.	.
Moist forb and scrub vegetation						
Mulgedio-Aconitetea[1,4]	.	x	x	x	.	x
Adenostyletalia alliariae	.	.	.	x	.	x
Adenostylion alliariae	.	.	.	.	.	x
Lactucion alpinae	.	.	.	x	.	.
Pyrolo-Salicion callicarpaeae	.	.	.	x	.	.
Amphibious and aquatic vegetation						
Littorelletea uniflorae	.	.	.	x	.	.
Potametea pectinati	.	.	x	x	.	.
Seashore vegetation						
Asteretea tripolii	.	.	.	x	.	.
Carici-Puccinellietalia	.	.	.	x	.	.
Caricion glareosae	.	.	.	x	.	.
Puccinellion phryganodis	.	.	.	x	.	.
Honckenyo-Elymetea arenariae	.	.	.	x	.	.
Honckenyo-Elymetalia arenariae	.	.	.	x	.	.
Honckenyo-Elymion arenariae	.	.	.	x	.	.

[1]These are classes with a presumed circumpolar distribution; [2]Under the synonym *Tofieldietalia*; [3]The position of this alliance is uncertain; we would assign it to the *Caricetalia nigrae*; [4]Under the synonym *Betulo-Adenostyletea.*

priate. The program TWINSPAN, still popular as a tool in vegetation survey and classification, may be inappropriate due to its reliance on the Correspondence Analysis model (e.g. van Groenewoud 1992). If there is only one principal gradient in the data, or if any secondary gradients are nearly orthogonal to the first, then ordination-based clustering methods may give reasonably results (e.g. *Forbes,* this Feature). However, larger-scale surveys of arctic vegetation will often have at least three principal gradients: moisture, snow cover, and soil pH. Ordination techniques assume that gradients can be ordered, but secondary gradients may be different in different portions of the primary gradient; for example, along a landscape-scale moisture gradient, snow may be most important as a secondary gradient in drier habitats, whereas in wet areas changes in nutrient status may prevail. Generally, table sorting methods based on agglomerative clustering, for instance that used by *Talbot* & *Talbot* (this Feature), are more appropriate for phytosociological work. An interesting approach is the combination of the table sorting technique TABORD with Canonical Correspondence Analysis, taking into account as many relevant environmental factors as possible. It helps delineate community types and interpret them ecologically (Bjarnason 1991).

An old but never satisfactorily solved problem in syntaxonomy is the following. Several authors in this Feature disagree as to the appropriate position of some of their lower syntaxonomical units in units of higher rank, particularly order and class. As follows from the vivid

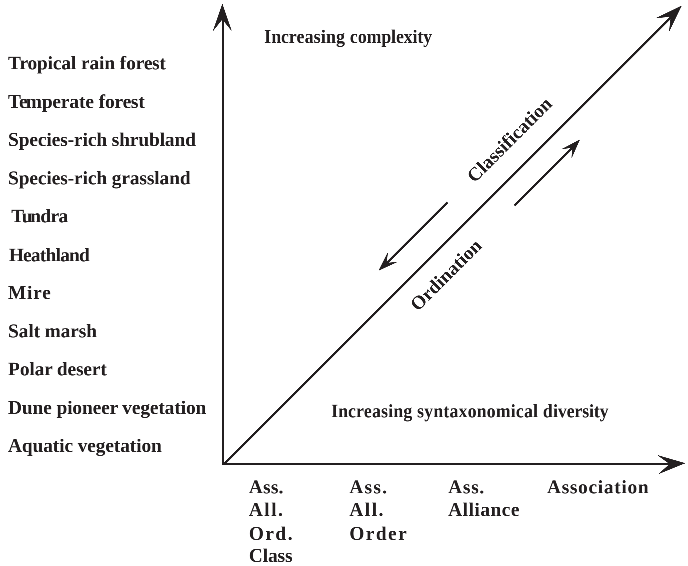

Fig. 1. Relation between the floristic-structural complexity of vegetation and the relative perspectives of classification and ordination as methods of summarization. From less diverse to more diverse situations the establishment of a full syn–taxonomical hierarchy becomes more difficult. In vegetation of medium complexity, including tundra, an optimum balance between the two approaches may be expected, including a successful syntaxonomy at the alliance/order level.

discussions amongst the syntaxonomists concerned, this disagreement is found particularly in species-rich community types as in the European classes *Molinio-Arrhenatheretea* and *Querco-Fagetea*. This problem was recognized long ago and related to the floristic complexity and environmental gradient structure of the communities under study (van der Maarel 1966), but it has not received much attention. Community types with many species and many transitions to other types along environmental (and geographical) gradients (ecoclines), though they can be recognized as (sub-) associations, are difficult to place in a syntaxonomic hierarchy; at the same time, ordination usually reveals the major floristic gradients covered by the data set under study and allows an ecological interpretation of the vegetation types distinguished. On the other hand, plant communities of relatively homogeneous environments with few species and clearcut (ecotone) boundaries towards neighbouring communities are not only easy to typify as (sub-) associations, but also less difficult to place in a syntaxonomic hierarchy; at the same time ordination does not contribute much to the ecological interpretation of the types distinguished. For communities of an intermediate complexity and diversity, both hierarchical classification and ordination, though not optimal in their own right, will give good results when applied together. For such intermediate communities, the resulting classification structure may have the following characteristics: (1) it can be expressed very well on the alliance and order level; (2) many associations and subassociations will emerge with increasing sampling density, which are connected to each other by gradual transitions; and (3) there will be several possible options for the assignment of alliances to orders and of orders to classes. In other words, the use of a hierarchic classification system becomes less feasible with increasing complexity, whereas in homogeneous environments with clearcut boundaries between types, plant communities can be distinguished with ease and also more easily fit in a hierarchical system. This idea can be put in the form of a diagram (Fig. 1).

Future cooperation

The final days of the workshop were devoted to the definition of specific goals for the future, and culminated in the signing of the following resolution:

Whereas, the distribution, characteristics, and history of arctic flora and vegetation are of essential importance with regard to (1) knowledge of how circumpolar terrestrial ecosystems interact with climate and contribute to the changing earth system, (2) conservation of the biodiversity of these regions; and (3) increasing exploration and development in the circumpolar nations; and Whereas, our knowledge of arctic regions and the environmental constraints on arctic vegetation has increased; and

Whereas, no single existing classification or map accurately portrays the synthesis of existing knowledge of the vegetation of the circumpolar Arctic; Be it resolved that the international community of arctic vegetation scientists undertakes the joint tasks of: (1) Creating a database of type relevé data, using the Panarctic Flora database as a common taxonomical base; (2) Developing a comprehensive synthesis of phytosociological information through the publication of a Prodromus of arctic vegetation syntaxa, publication of a bibliography of arctic vegetation studies, and development of a revised syntaxonomical classification for the circumpolar region; (3) Compiling, editing, and publishing an arctic circumpolar vegetation map depicting the distribution and boundaries of arctic vegetation north of the arctic tree line at a scale of approximately 1:7 500 000 and a legend that is acceptable and understood by the international community of plant scientists.

Furthermore, we request the endorsement of the Man and the Biosphere Northern Sciences Network (MAB/NSN) for this project and ask their assistance in announcing that the cooperation, interest, and scientific expertise of the international community is welcome in the development of these products. Finally, be it resolved that the undersigned scientists begin the task of developing the organizational mechanism to accomplish these tasks and a schedule that will produce draft products by the Arctic Workshop in 1995, when we will again convene as a group.

[Signed by 44 attendees on 9 March 1992].

Work on the three stated goals has begun. In March 1994 a mapping workshop was held in St. Petersburg, Russia where substantial progress was made toward a circumpolar vegetation map (see the Report by D.A. Walker to be published in *JVS*). The development of a database for relevés and environmental data is both necessary and challenging, and we would like to conclude this introduction with some comments and recommendations regarding the database. There are models of such collaborative efforts in the fields of phytosociology as well as in floristics. For example, the Panarctic Flora database represents a formal international collaboration between D.F. Murray, B.A. Yurtsev and their many colleagues, who are working together toward a common computer database of arctic species. Such a tool will be essential for the proper working of a relevé database. The project European Vegetation Survey (Mucina et al. 1993), which is organized as a Working Group within the International Association for Vegetation Science, has similar goals to the arctic survey. This Working Group has elaborated national data bases which are available in several countries, and is about to start a general European data base. The Ecological Society of America has just recently established a committee charged with the development of a unified classification of North American vegetation; that group will undoubtedly encounter many of the same challenges as the others. Also, it will be necessary to fit any scheme developed for the circumpolar Arctic into these other surveys where geographic boundaries overlap.

With so many groups working toward unified classifications, and with relevé data bases being an obvious important aspect of any such work, we would like to end with some recommendations regarding the development and use of these data bases. One issue that arose during the development of this Special Feature was the expense and space necessary to publish relevé tables. Although the Code of Phytosociological Nomenclature (Barkman et al. 1986) requires only the publication of the single nomenclatural type relevé for the valid publication of new associations, without more complete data showing the variation within the association and the relationships with other groups, the publication is of very little value, particularly for poorly known regions, and other authors cannot easily access it for comparison. Even if the complete data are published, anyone who wishes to use it for quantitative comparative analyses must completely re-enter the data and carefully work out taxonomic problems and differences. We suggest that IAVS consider taking the lead in the development of a new model for phytosociology, where formal publication of new syntaxa in print may include only type relevés, but where the complete relevé data are formally placed into one or more electronic data bases, given an accession number which is published with the original publication, and that these data bases will be easily accessible via Internet utilities such as Gopher, Mosaic, and FTP - and, of course also in the form of printed copies. Many relevé data are already being treated in this manner, for example, the data of *Walker et al.* are available on compact disk through the National Snow and Ice Data Center. The European Vegetation Survey has started preparations for a huge Phytosociological Data Base. Although individuals may have access to such services, without a formal process for processing and storing the data, electronic sources may be even more difficult to use than printed sources. The opportunity to set this up correctly is now, when the data bases are still in the early stages.

Conclusion

The Boulder workshop was the first truly international meeting focused on arctic vegetation, and all geographical areas of the Arctic were covered to some degree. The region holds great potential for a phytosociological and ecological synthesis, but suffers from a lack of data in many areas and from a lack of history of collaboration. This Special Feature represents a first attempt to bring about such a synthesis, but clearly much hard work and cooperation will be necessary to gain a true circumpolar understanding of this important region. The Arctic Survey would profit from a strong and effective organization, both for the scientific organization and for fund raising. It would be ideal if this organization could work under the auspices of the IAVS, perhaps as a Working Group, which could also take care of the organization of regular scientific meetings.

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