Information

TOWARD A NEW ARCTIC VEGETATION MAP: ST. PETERSBURG WORKSHOP

The Arctic is in many ways a single natural unit, with many common ecological and political interactions. A new map and series of derived products is needed for a wide variety of important circumpolar issues, including studies of arctic biota and biodiversity, arctic ecosystems and their interactions with the global climate system, land-use planning by circumpolar native peoples, planning for international protected areas, and education. A new circumpolar vegetation map would provide a common legend and language for the ecosystems of the arctic region. It would also be a key component of circumpolar geographic information system (GIS) databases. As a first step toward a new map, the Circumpolar Arctic Vegetation Mapping Workshop was held in St. Petersburg, Russia, 21–25 March 1994. The 51 participants reviewed the status of vegetation mapping in each of the circumpolar countries, formulated a strategy for making a vegetation map database, and developed a framework for the vegetation map legends.

The idea for a circumpolar arctic vegetation map grew from earlier International Workshop on Classification of Circumpolar Arctic Vegetation held in Boulder, Colorado, in March 1992, where the attendees recognized that our knowledge of arctic vegetation has increased markedly in recent years and that no single existing classification or map accurately portrays the synthesis of existing knowledge (Walker et al., 1994). Several coarse-scale (greater than 1:10,000,000) vegetation maps exist for the Arctic as part of global vegetation databases. The scales of these maps are, however, too coarse for regional modeling efforts. Similarly, many more detailed vegetation maps portray relatively small areas of the Arctic. The weaknesses of this collection of maps are that they entail many different scales and classification schemes, are derived using different mapping techniques, and are often constrained by political boundaries. For regional or global extrapolations, all the maps must be generalized to the lowest common denominator, so that the power and information contained in the original high-quality data sets are lost.

The participants at the St. Petersburg workshop agreed that a new map should be derived from an electronic map database that contains the latest state of knowledge and could be updated as new information comes available. Currently there is a need for two types of vegetation maps, one that displays the circumpolar distribution of biomass, and a second depicting regions with characteristic sets of vegetation types based on plant physiognomy and floristic composition. The first is important for numerous studies related to global carbon budgets and climate change and can be derived rather quickly using remote-sensing technology. The second requires the synthesis of vegetation information contained in existing maps.

The boundaries on existing coarse-scale maps of the Arctic are very general and of marginal use for global GIS databases. The new vegetation map will be tied to global satellite-derived spatial databases and digital terrain models. One of the products of the project will be a false-color mosaic of cloud-free composited false-color images from the Advanced Very High Resolution Radiometer (AVHRR) aboard the NOAA satellites (1.1-km pixel resolution). The image will be a polar projection of the terrain north of 50° latitude, and will be used as a base for the vegetation mapping. The first map products will utilize a Lambert azimuthal equal-area projection of the circumpolar region at a scale of 1:7,500,000. At this scale, the entire circumpolar Arctic north of treeline can be displayed on a single 100 × 100-cm map sheet. The projection is compatible with the US-Canada ecoregion mapping program and the circumpolar permafrost mapping projects.

A map of the normalized difference vegetation index (NDVI) will be prepared from the same data set as the base map for the vegetation-type map. The map will display the maximum NDVI value during the growing season for each pixel. The U.S. Geological Survey Earth Resources Observation System (EROS) Field Office in Anchorage, Alaska, will prepare both remote-sensing products as color hard-copy maps and in digital form on a CD-ROM.

To make the first synthesis map, regional experts will manually interpret regions with similar assemblages of vegetation classes. This will be done from combinations of aerial photographs and satellite images. Map-polygon boundaries will be interpreted from existing vegetation maps and guided by landscape units as they appear on false-color AVHRR images. Because this will be a synthesis, no field effort will be involved. Separate teams of scientists will work on vegetation maps for each of the circumpolar countries. Frequent communication between representatives from each country will be necessary to ensure uniformity of the maps. The separate maps will be assembled and recast into a single map with some simplification where necessary. Remote sensing and GIS technology now make map creation a dynamic process. The raw data can be continually updated and maps modified based on new information.

The legend will employ a combined floristic-physiognomic-ecological approach (Sochava, 1962) used extensively by the Komarov Botanical Institute. It will be a three-level hierarchic legend that will use a derivative of Yurtsev's (1994, in press) north-south floristic zones at the highest level of the hierarchy. The second level of the hierarchy will be derived from Yurtsev's (1994, in press) east-west floristic sectors. The lowest level of the mapping will be based on physiographic, geomorphic, and geologic boundaries that enclose areas with similar vegetation assemblages. The maps will also employ matrices of supplemental information that will characterize each map unit in terms of dominant phytosociological units, dominant and differential plant species, characteristic parent material, and geomorphic situation.

The participants agreed to collaborate on the following products:

1. A compendium of abstracts for the workshop in time for the Circumpolar Arctic Flora and Fauna meeting in Reykjavik, Iceland, September 1994. This is being published as an Open File Report by the U.S. Geological Survey and includes a review of the current status of arctic vegetation mapping in each of the circumpolar countries (Walker and Markon, in press).

2. A bibliography of arctic vegetation maps. This is being further pursued within the context of the Circumpolar Arctic Flora and Fauna (CAFF) project.

3. The first map products showing zonal divisions and sectors according to the scheme of Yurtsev (1994).

4. A map of the normalized difference vegetation index

(NDVI) integrated for an entire summer season for the Arctic region and displayed at 1:9,000,000.

5. A satellite-derived false color image of the circumpolar region in a snow-free state, which will be used as the base map for production of the vegetation map. The image will be produced at 1:7,500,000 scale using a Lambert equal area projection. Items 4 and 5 are being developed by the USGS/EROS Alaska Field Office. Both map products will be published in color and in digital form on CD-ROM.

The following are members of the Circumpolar Arctic Vegetation Mapping (CAVM) executive committee: Christian Bay, Denmark; Fred Daniëls, Germany; Eythor Einarsson, Iceland; Arve Elvebakk, Norway; Andrei Kapitsa, Russia; Sergei Kholod, Russia; David Murray, U.S.A.; Steve Talbot, U.S.A.; Skip Walker, U.S.A.; Boris Yurtsev, Russia; and Stephen Zoltai, Canada. The executive committee agreed to meet again at Arendal, Norway, in 1995 to present the progress on the legends. The workshop was funded by the U.S. Department of State through the National Fish and Wildlife Foundation as part of the Circumpolar Arctic Flora and Fauna (CAFF) project and the U.S. National Science Foundation as part of the Arctic System Science (ARCSS) program. For further information contact Skip Walker at the Institute of Arctic and Alpine Research, University of Colorado, Boulder, Colorado 80309-0450, U.S.A., phone 303-492-7303, email swalker@taimyr.colorado.edu.

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