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Carbon in the Former Soviet Union: The Current Balance

**Annual Report
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The Ecology and Atmospheric Chemistry Branch

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The purpose of the general program of which this work is a part is an appraisal based on satellite imagery of the standing stock of carbon in the forests of the Former Soviet Union. The purpose extends to measurements of changes in the standing stock and the development of the potential for monitoring those forests. Financial support includes this grant from NASA supplemented by grants from various other sources. We have also had support over recent years from the EROS Data Center of the USGS, NASA, and the US Forest Service.

The primary route to the overall objective was expected to be through the new Goward Global Vegetation Index (GVI) data set as the basis for a phenological map of the region of the former Soviet Union (see letter to D. Wickland, June 7, 1993). These data are being prepared by Dr. Goward and are expected to be available sometime in the future through the National Geophysical Data Center (NGDC) in Boulder although the date is still not known (David Hastings, NGDC, pers. comm. October 26, 1994). Meanwhile, our own collection of NOAA GVI data have been used to assemble a 10-year data set so that preliminary and proof of concept work can be completed quickly. In addition, we are preparing ancillary thematic data sets based on a combination of well-known digital global land use maps and selected digitized Russian or Soviet maps.

Full 15 km Resolution GVI Data Set

A 10-year GVI time series for the former Soviet Union has been assembled from our own archives and from those of others. Data from the NOAA First Generation Weekly Composite product have been re-mapped from a Polar Stereographic to a Platte Carree map projection. These data with data from the NOAA second generation weekly composite product, are being read into both IDRISI and ERDAS formats for subsequent processing. Three additional years of GVI data (1985, 1992, and 1993) are currently on order from NOAA.

Defining Characteristic Phenology Curves

A spatially reduced data set was created by linearly resampling the Platte Carree gridded NOAA data to a 1° x 1° raster grid. Seven years of weekly data for a region conforming to a mask of the former Soviet Union were used in a Quattro Pro spreadsheet with a geographically-based searching and plotting routine. The resulting program can plot and print phenology curves over time for any grid cell in the former Soviet Union. These curves were evaluated by comparison with the Kurnaev (1990) ecoregions map of the former Soviet Union. A thirty-year monthly average temperature and precipitation data (Leemans and Cramer) were added to the vegetation phenology plots to aid in their interpretation. Methodology similar to that to be used in the global 1 km land cover map being produced at EDC with IGBP guidance have been used in some portions of the analysis.

Ancillary Data Set Preparation

Ancillary thematic data sets are being assembled that will allow better identification of seasonality and recognition of regions of similar patterns of seasonality. A partial listing of these data sets includes: 1990 Russian Forest Map (1:2,500,000), the 1990 Vegetation Map of the USSR (1:4,000,000) now fully digitized, and other maps by Olson, Henderson-Sellers, Holdridge, Ryabchikov, and Matthews. Additional vector data used in the work will come from the Digital Chart of the World.

Digitization of the Geobotanical Map of the USSR (1:4,000,000) (Komorov Geobotanical Institute, Academy of Sciences, St. Petersburg, 1954) is almost complete for the region of Krasnoyarsk (map on loan from Dr. Vladislav Alexeyev, Sukachev Inst. of Forest Research, Russian Academy of Sciences, Krasnoyarsk, Russia).

Taiga Workshops

T. A. Stone attended, at the invitation of NASA, the Joint US/Russian TAIGA Workshop, sponsored by the International Forestry Institute of A. Isaeyev and NASA, in Moscow in November 1993 and the Joint US/Russian TAIGA Workshop, also sponsored by the International Forestry Institute and NASA MTPE, held in Washington, in April 1994. These workshops have been useful in expanding our contacts in Russia beyond Siberia and in defining possible future projects that may use the new NOAA AVHRR receiving station.

Other Russian Collaborations

We continue our collaboration with colleagues at the Sukachev Institute of Forest Research in Krasnoyarsk and have established further discussions with staff of the Institute of International Forestry and the Institute of Geography in Moscow. During January and February, 1994 we were pleased to have Dr. Vladislav Alexeyev as a collaborator in Woods Hole supported by a special grant to the Center. Dr. Alexeyev is head of the Dept. of Forest Ecology and is a leading expert on the forests of Russia and the former Soviet Union. This effort with Sukachev and with other Russian organizations will continue and, if it can be financed, expand. Boris Klimushin, also of Sukachev Institute and a visiting scholar here in 1993 for three months, is seeking a fellowship from UNESCO to allow his return here for three months in 1995. We expect to have additional scholars from Russia for extended periods with us over the next years.

We look forward to the completion of the new NASA-financed NOAA AVHRR satellite receiving stations in Krasnoyarsk and Kharbarovsk that will acquire, for the first time, daily low resolution imagery of all central and eastern Siberia. We are currently discussing with D. Cahoon of NASA Langley and B. Stocks of Forestry Canada possible collaboration on the use of that data for determination not only of forest fire location and extent but also of the type of vegetation affected.

Dr. Vladimir Sedykh, of the Novosibirsk Forest Department, Russian Academy of Sciences, will be visiting the WHRC this winter. He has invited our collaboration in studying the forests of Western Siberia and during his visit we will explore these possibilities more fully. Dr. Sedykh is one of the foremost users of remote sensing data of forests in Russia.

Related Activities of the WHRC

Progress toward a Satellite-Based Map of Russian Forests

The first product from our collaboration with Russian colleagues is a 1 km resolution digital map of Krasnoyarsk Kray (territory) similar to that produced for South America (Stone et al., 1994). This map has been independently financed and a preliminary version of this map was presented at an international boreal forest symposium in September 1994. The research has benefited from the input of Russian foresters at the symposium. The next step for this product is validation of the map. Such maps are the first step in determining rates of change and are very useful in the evaluation of the phenology based map to be produced for this grant as the two maps (1 km resolution for Krasnoyarsk and 15 km resolution for the Former Soviet Union) are based on independent sources.

A longer term objective is the establishment in Russia of several well equipped GIS/RS laboratories like the one we have helped to develop in Krasnoyarsk that will join us in the monitoring program. This topic will also be explored with Dr. Sedykh during his upcoming visit.

NASA, Mission to Planet Earth, Data Grant

Numerous Landsat Thematic Mapper data sets have been provided to the WHRC at low or no cost from the Landsat Pathfinder program. These data sets cover areas of forest loss due to pollution, radiation damage, and logging and also include areas of new forestry concessions. The availability of such data sets to the WHRC is a significant economy that is much appreciated. The data sets provided will be used in the validation effort described above.

Krasnoyarsk Satellite Receiving Station

We are also participating with the NASA effort to improve satellite coverage of the forests of Russia by assisting in establishing a GIS capable of using data from the new receiving station in Krasnoyarsk. The station will use the software acquired for Sukachev by the WHRC supplemented by ARC-INFO software donated to Sukachev this spring also through our efforts.

Related References

Stone, T.A., and P. Schlesinger. (in press) 1994. Building a Spatially Referenced Database of Landcover for the Region of the Former Soviet Union. Pecora 12 Symposium Proceedings, Sioux Falls, August 1993.

Stone, T., P. Schlesinger, G. Woodwell, V. Cherkasin, B. Klimushin, A. Latynsev and V. Alexeyev, in prep. Using Russian Forestry Management Maps with LANDSAT MSS data to Evaluate the Forest and Landcover of Krasnoyarsk Kray, Russia.

Stone, T. A. and P. Schlesinger [abs.], 1994. A Comparison of Satellite-Based and Russian Map-Based Estimates of the Forest Cover of Krasnoyarsk Territory, Siberia. International Boreal Forest Research Association, Boreal Forests and Global Change, Saskatoon, Sept. 1994. p. 83.

Recent Acquisitions of Soviet & Russian Map Data

1:2,500,000 Scale Soviet Forest Cover Map (1990). The map legend has been translated from Russian to English and all Krasnoyarsk Kray has been digitized.

1:16,000,000 Scale Forest Subdivisions of the USSR Map (1990). The map legend has been translated from Russian to English. We have digitized the map and it is now in our GIS.

1:4,000,000 Vegetation Map of the Soviet Union (1990). This map has been digitized with support from the USFS. The legend has been translated.

1:16,000,000 Map of the Forest, Woodworking and Pulp and Paper Industry Resource regions from Blackman and Wagner (1990) assumed to be originally from Lesnaya Entsiklopedia.

1:4,000,000 Scale map of Nature and Biosphere Reserves of the Soviet Union (1989). We have digitized all the polygons related to the reserves and they are now in our GIS. In addition, we have translated descriptions of the reserves. We have an informal collaboration with the Man and the Biosphere Program who have supplied us with the Map and the Reserves descriptions.

The 1973 Soviet Forest Atlas.