Article

Remote Sensing in Mongolia

Multidisciplinary Use of Satellite Data in Central Asia

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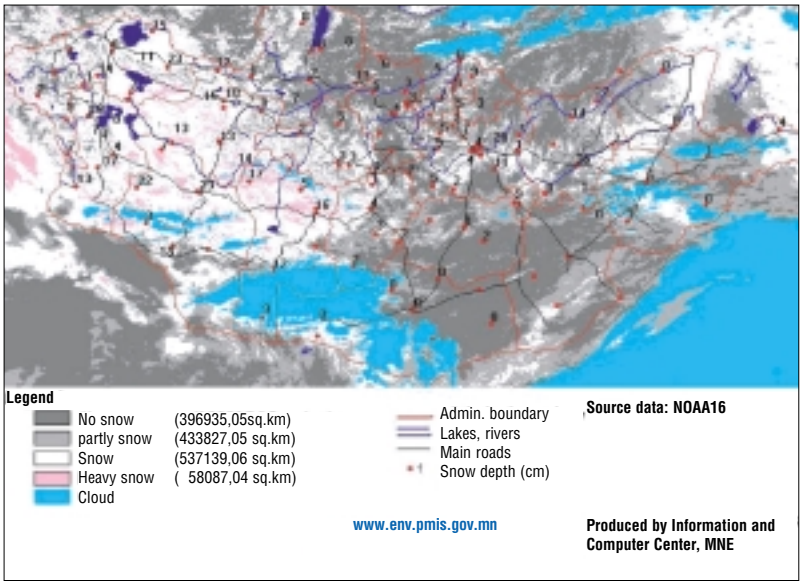
The Government of Mongolia attaches great importance to the development of remote sensing technologies and values their application for the economic development and environmental management of the country. The authors describe examples of various applications in a number of disciplines in Mongolia.



Snow map of Mongolia, 24th February 2002.

In Ulaanbaatar, the capital of Outer Mongolia, the first meteorological station was established in 1971. Initially, it received cloud data only and this was accordingly successfully used in the weather forecasting services. The data was collected by TV channel. Since 1987, Mongolia has been using an upgraded meteorological satellite station with data captured for meteorological and non-meteorological applications, including forest and steppe fires, land cover mapping and flood assessment. At the same time, this data has also become important for the estimation of weather conditions over the whole of Central Asia.

Concurrently, the Civil Aviation Meteorological Centre uses a satellite data receiving station to gather data from NOAA and weather satellites and processes it for the civil aviation services and short-term weather forecasting concerning Ulaanbaatar city.

Mongolian RS Organisations

There has been considerable expansion over the past decade in national organisations working in the field of remote sensing applications. Currently, the following national government institutions are actively using and developing remote sensing applications:

- The Ministry for Nature and Environment
- National Remote Sensing Centre
- The National Hydro-meteorological Agency and meteorological-related research institutes and centres
- The Ministry of Agriculture and Enterprises
- The Ministry of Infrastructure Development
- State Agencies for forest and water management
- State Agency of Geology and Mineral Resources
- Land Management Agency
- State administration of Geodesy and Cartography
- Institutes belonging to the Mongolian Academy of Sciences

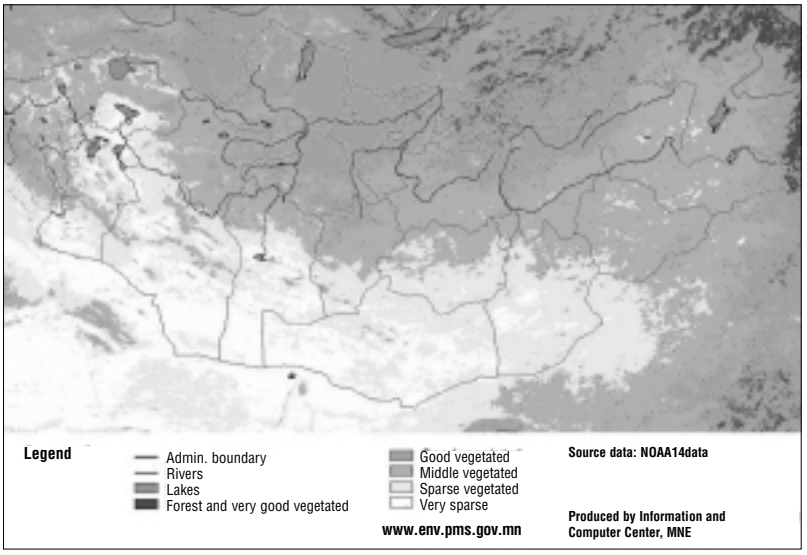
A number of private and non-government organisations are at the present time starting to use remote sensing data and ground positioning systems.

National Remote Sensing Centre

The National Remote Sensing Centre of Mongolia was established in 1987. The responsibilities of this centre include its functioning as an umbrella organisation for the co-ordination of all activities related to remote sensing in Mongolia. It is also aiming to develop local capabilities for efficient methods of investigating, classifying and monitoring the natural resources of the country using modern space sciences and remote sensing technologies.

The National Remote Sensing Centre is also active in the monitoring of environmental and natural disasters such as cyclones, droughts, forest fires, hurricanes, severe snow cover and air pollution over the territory of Mongolia.

Mongolia also uses non-meteorological applications of NOAA satellite data for land-cover mapping, pasture vegetation, fodder resource mapping, snow cover, desertification, forest and steppe fires, drought, land and water sur-



Vegetation index map of Mongolia, 3rd decade of August 2001.

face temperature, soil moisture and evaporation/transpiration estimations.

Drought Assessment

Remote sensing data is used successfully for the Drought Assessment and Monitoring System. This aims to use both satellite and ground data covering the whole country, on a weekly basis, throughout the spring and summer when droughts tend to occur in Mongolia. For this study, NOAA AVHRR data was chosen in place of Landsat MSS data, because NOAA satellites cover the same area every six hours. This is very advantageous for monitoring changes in drought and helps in providing enough multi-temporal images within a short period of time.

At present, one fully-fledged National Remote Sensing Centre and several remote sensing sub-centres are active in Mongolia. The National Remote Sensing Centre has a scientific agreement with NASA regarding the archiving of 1km AVHRR data for the region. On top of this, the National Remote Sensing Centre has a bilateral co-operation agreement with the Centre for Environmental Remote Sensing at Chiba University in Japan.

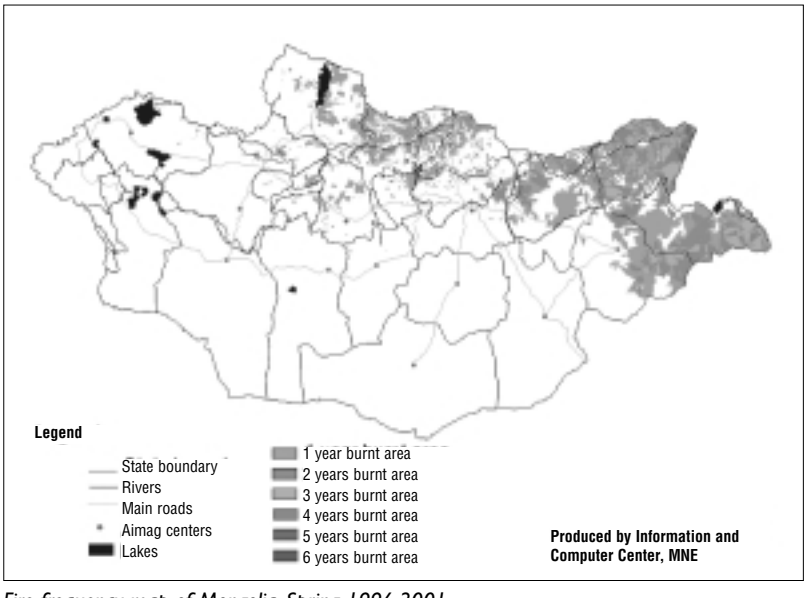
Other Facilities

According to an agreement between the governments of Mongolia and the former Soviet Union, a Meteorological Rocket Sounding Station was established in the south eastern part of Mongolia in 1984. The resulting information and rocket data was successfully used for studies of middle atmosphere processes, including the state of ozone layers over Mongolia.

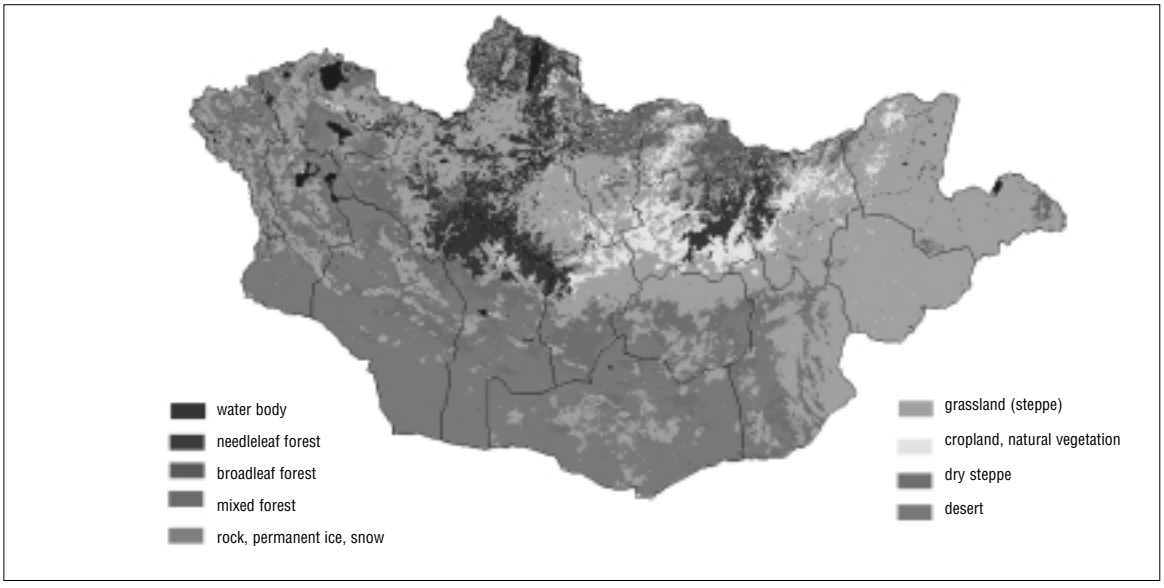
The Remote Sensing Laboratory of the Academy of Sciences works in close co-operation with the German Space Agency (DLR Germany) and in 1998 a mobile receiving station was established for collection of ERS data.

State Agency of Geology

The State Agency of Geology harbours a Remote Sensing and Geo-information Centre, established in 1980 on a commercial basis to meet the growing needs of geology. The main goals of this Remote Sensing and Geo-information Centre are to develop reliable and cost-effective remote sensing techniques for the compilation of topographic and thematic maps obtained by field surveying and to establish an integrated GIS for geology, especially for mineral, oil and gas assessment. This Centre has also implemented a joint Mongolian Advanced Geological Information Centre (MAGIC) project with the French SPOT-IMAGE company. Within this framework it established a modern geographic information and remote sensing centre in 1999 using SPOT data for geological applications. Satellite data is also being used for a variety of geological applications such as baseline geological evolution, regional geological mapping



Fire frequency map of Mongolia, Spring 1996-2001.



Land cover map of Mongolia, 1997.

and structural and tectonic studies, especially with reference to their potential in oil exploration.

Forestry and Environmental Management

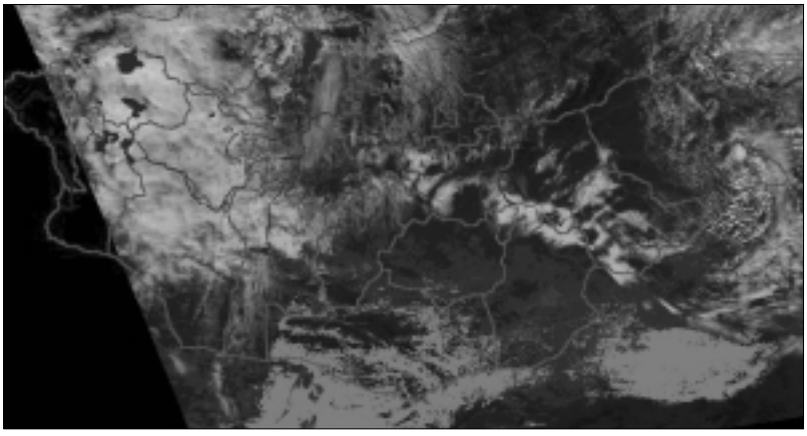
The Water and Forest Authority processes applied satellite data for the study of water and forest resources. Satellite data is also being applied for flood mapping, planning of flood control measures and routine river surveying and mapping.

The National Forestation and Land Inventory Programme successfully uses remote sensing technology for forest condition mapping of Mongolia. It has prepared a set of information at 1:200,000 scale identifying the different kinds of forest in the country, its location and areas covered. About 8.6 per cent of the territory of Mongolia is covered by national parks and protected areas. Remote Sensing and GIS data help to determine these areas for national parks and reservation territory, usually in virgin forest and undisturbed natural areas.

Freshwater Ecosystems

Monitoring by remote sensing will establish areas for activities incongruent with national park objectives, such as illegal logging, slash-and-burn activities and dynamite fishing (coral destruction). Although this technology will not be capable of monitoring endangered endemic species in themselves, it can determine whether habitats are threatened with destruction using spectral, spatial and temporal analysis of remotely sensed data.

Remote sensing data is important for the preparation and implementation of the Freshwater Ecosystems Programme because it makes possible monitoring of the rivers revival programme. This determines water quality changes as a consequence of increases in wastewater treatment by polluting industries and a decrease in pollution loads.



Dust storm image, 18th March 2002. NOAA16. MNRSC.

International Co-operation

Mongolia is currently trying to make the transition from centrally planned economy to a market-oriented one, thereby stimulating many private companies to use remote sensing and GIS technologies in business activities such as environmental impact assessment and mapping of natural resources. The Mongolian Government is also placing importance on the promotion of international co-operation in the field of space applications.

There are a number of programmes jointly executed with international organisations. Some of these are the World Wildlife Fund (WWF), The Netherland's Wildhorse Reintroduction Programme, Germany's Technical Co-operation Programme Eastern Steppe Biodiversity Project funded by UNDP (United Nations Development Programme), the German Foreign Co-operation Agency (GTZ) and the Danish International Co-operation Agency (DANIDA).
As part of regional remote sensing co-operation, Mongolia organised the 13th Asian conference on remote sensing (1992) and a 5th Meeting of the Asia/Pacific Regional Space Agencies Forum (1998) in Ulaanbaatar. Mongolia is widely involved in the Regional Remote Sensing programme for the Asia Pacific region, itself focusing on the implementation of pilot projects and training sessions organised in different countries of the Region.

Biography of the Authors

S. Khudulmur is Director of the Information and Computer Centre, National Remote Sensing Centre, Mongolia and M. Erdenetuya is Remote Sensing Specialist at the same Centre.

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