

ScanEx R&D Center introduces new technologies of space imagery for Russian forestry

In late 2004, the mass media announced for the first time that a satellite-based monitoring system of illegal logging was being created in Russia. In February 2005, Natural Resources Minister Yuri Trutnev submitted the new monitoring system project to President Vladimir Putin and starting summer 2005 the unprecedented in size and scope space monitoring project has already been launched. Around 44 million hectares of forests in six Russian regions were covered with images of high spatial resolution within the first year of 2005. In 2007, all the Russian regions with ongoing industrial logging – about 112 million ha – are to be covered with remote sensing data from space. It took only two years to establish the first Russian large-scale space monitoring system for the benefit of state forestry, using the technique of complete coverage of Russian forests with high-resolution panchromatic (6–10 m) and middle-resolution multispectral images (20–30 m).

Over the years of the “forest project” implementation ScanEx company in collaboration with the partners have resolved the following technical and managerial tasks:

- 1) The geographic footprint for middle and high resolution data of the Russian forests has been finally created (Fig.1). Three additional UniScan ground receiving stations were installed in Magadan, Moscow Region and Irkutsk capable of receiving the data from all the operating and perspective satellites. The Magadan ground station has finally revealed all the “blind spots” in the Far East, including Kamchatka and Sakhalin.



Fig. 1. Footprint of three ground stations, receiving SPOT-2 and SPOT-4 satellite images

- 2) A range of space crafts providing for the Russian forests imagery with high and middle resolution has extended, enabling to increase the total volume of received data. Starting in 2005, IRS-1C and IRS-1D satellites with the spatial resolution of 6 m (in panchromatic mode) and 23 m (in multispectral one) have joined the constellation. From spring 2006, they were replenished with SPOT-2 and SPOT-4 satellites with the scanner resolutions of 10 m (panchromatic) and 20 m (multispectral). Starting in

summer 2006, ScanEx Center initiated the multispectral LANDSAT-5 30 m resolution data reception.

- 3) The efficiency of the satellites fleet, involved per the forest monitoring program, has been considerably improved not only due to the introduction of new sensors, but due to the changes in the imagery program as well. According to the contract, signed with the French SPOT Image company, SPOT-2 and SPOT-4 satellites have been delivering images of the Russian forests on each pass and regardless of weather conditions – i.e. almost **continuously**.
- 4) Methods of preliminary processing, classification, selection and transfer of large data volumes to the forest monitoring centers have been worked out and tuned up. In particular, the size of the quick looks for preliminary scene selection placed on the web-catalog <http://catalog.scanex.ru> has been increased. The “cloudiness” image selection criterion was introduced for the SPOT data. Georeference files were added to quick looks to load them into GIS (including forest – TopoL, LesGIS) and to track down the monitoring process of large territories in dialog mode.



Fig. 2. Coverage of the Russian territory with SPOT-2/4 scenes (clear-day and low clouds), acquired in 2006

cloud images (Fig. 2).

The scope of space data reception and processing activities in 2006 can be demonstrated on the example of the SPOT satellites. Over one year 216 000 panchromatic and multispectral SPOT-2/4 scenes were acquired under the contract with SPOT Image, with 35 000 clear-day or low cloud scenes received. Basically, during one growing season around 80% of the Russian territory was covered with clear-day and low

ScanEx's participation in the forest monitoring project does not boil down to the space data acquisition and delivery. A multi-purpose ScanEx Image Processor 2.0 software package (a Russian analog of Erdas Imagine) is widely used for images preliminary processing and interpretation at the forest monitoring centers. In 2005–2006, 14 workstations for ScanEx Image Processor software were supplied to the regional monitoring centers, including two network versions; forest inventory enterprises employees have been properly trained. The most popular functions of the software package are: import/export and visualization of raster data, RS data geometric correction, ortho-rectification and automatic co-registration, spatial

resolution enhancement (Image Fusion), creation of mosaics and other operations with rasters (such as Change Detection).

In 2007, ScanEx NeRIS thematic interpretation software packages were presented to the monitoring centers.

Summing up the remote monitoring of Russian forests results at the RF government session on May 24, 2007 Yu. Trutnev, Minister of Russian Natural Resources, has highlighted that the amount of the recovered claims for forest damage in 2006 only has increased by 20% reaching the total of 336 mln rubles. Results of Russian forests monitoring from space were voiced up by the Rosleskhoz leader V. Roschupkin at the March 2007 18th Session of the UN's FAO Committee on Forestry in Rome. Based on successful application of space monitoring in forest sector, the Russian delegation advanced the initiative on the creation of an International Scientific and Educational Production Center on Forest Monitoring and Assessment under the auspices of UN's FAO (www.mnr.gov.ru).

Deployment of the forest space monitoring system has both economic and technological importance for Russia forestry, as it requires overall introduction of forestry GIS and GPS, electronic flow of documents and introduction of computer image interpretation techniques. Basically, the remote sensing monitoring program is part of the technological breakthrough in Russian forestry and forest service. Monitoring of illegal logging program became the **first functioning** governmental high-resolution remote sensing monitoring program in the country, in this respect putting the importance of this project far beyond the frames of the forest sector proper.

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