Monitoring system for natural forest dynamic in the fragments of virgin forest of Carpathian region

Iván Barton¹, Géza Király²

University of West Hungary, Faculty of Forestry Inst. of Geomatics, Forest Opening-up and Water Management Dept. of Surveying and Remote Sensing

Some fragments of virgin forests still could be found in the Carpathian region. These are temperate zone forests with the native species. The artificial disturbances avoided these relative small separated areas. But the natural disturbances are driving the evolution of these forests. They have inhomogeneous structure due to the active self-regulating forest dynamic. They provide better habitats for species with the benefit of higher biodiversity (Fahrig, 2002). The research of virgin forests in Europe started in the 19th century. The old foresters at that time realized the importance of the remaining virgin forests and conserved them for the future. Most of them are under strict protection today (Bartha et al., 2010). But in the mid 20th century due to the economic change the forest management got further from the natural processes in this region. Fortunately in the last decades foresters are reinvented the close-to-nature forest management in form of continuous forest cover. Using the sub processes of the virgin forest dynamic the close-to-nature forest management could be done. Observing the interactions between individual trees, the dynamic of natural regeneration and the habitat requirements of species are helping to do better ecological management of forests (Brang, 2005). From the early 19th century until the 20th century there were a strong land cover and land use changes in the Carpathian region guided by the big socio-economic changes (Munteanu et al., 2015). The introduction of mechanized transport of timber caused irresponsible management of forest resources. Only those virgin forests remained after which was not accessible by these transportation methods. Today the illegal logging is threatening the existence of them in some regions. Numerous scientific works were published in the field of forestry and ecology from these fragments of virgin forests. Even there is an inventory which is claiming that there were more than 78 700 ha of this kind of forests (Bartha et al., 2010). But this study was based on archive maps and descriptions which could be out of date. The ecological studies are mainly based on in-situ observations. Comparing to other research methods remote sensing is the most efficient tool for monitoring large areas (Woodcock et al., 2001). There are some open imagery database which could be used for scientific purposes like Landsat and SPOT and they are providing thousands of satellite images (Townshend et al., 2012). Also Sentinel 2-A satellite will provide images in every 10 days in the near future. For the purpose of monitoring natural forest dynamic in Hungary a forest reserve network was established in the 1990's (Horváth et al., 2001). But these forests have not reached that stage of development to say they have virgin forest like structure. To gather experiences we have to look at the Carpathian virgin forests. There are more than 30 years of imagery could be reached and they are providing good spectral information from the past. This 30 year is enough to observe slow forest dynamics and to isolate different sub parts of forests (Kenderes et al., 2008). With long time data series analyze of satellite imagery we could see the changes and the trends of changes from moderate resolution images (Kennedy et al. 2012)(Cohen. et al., 2010). The data continuity has some gaps so multi sensor approaches could give us a result with good temporal resolution. This solution requires indexes for the forests which are depending less on the sensor type. During the time series analyze we collect huge amount of data. We process all the available images from the selected regions to gather as many information as possible. To manage these big data sets a new application need to be developed which can store the history of each pixel surface reflectance. Analyzing this GIS based solution we could extract in formations about the virgin forest dynamics. This would result a system which provides updated and open data for virgin forest fragments of the Carpathian region with spectral history. The system could detect the gap dynamic on the dataset and monitoring the regrowing forest parts. The outputs are thematic layers of the regeneration. This system makes easier to review our remaining fragments of temperate zone virgin forests. It would also support other researches on forest dynamic, too. Understanding the behavior of forests is important for a better and more nature friendly forest management.
References:


