Newsletter

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The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 262786 EUFODOS

Message from the editor

By Stefanie Linser, Environment Agency Austria

This newsletter will show you the results of the economic parameter assessment in the boreal zone. One more newsletter is expected to be published by the end of 2013 describing the results for protective forests in the alpine zone.

In this issue

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Forest Stem Volume and Storm Mapping in Finland and Russia

By Heikki Astola and Magnus Simons, VTT Technical Research Centre of Finland, Paula Susila, Stora Enso

The VTT Technical Research Centre of Finland was developing EUFODOS Downstream Services for two test areas: one in South-Eastern Finland, the other one in Russia (Nizhniy-Novgorod). Another responsibility of VTT was to produce the economic service model for the Forest Downstream Services being produced in EUFODOS.

Downstream Services

The VTT Services included the production of Stem volume maps (1) for selected test case areas in Finland and in Russia. The stem volumes were produced as total stem volume, and as species-wise products (pine, spruce, broadleaved). During the project a new product called the Assessment of Storm Damage Economic Impact (2) was included into the VTT service portfolio.

The product development was conducted in close co-operation with the user organization Stora Enso which is an international forest company employing 28 000 people worldwide. It is a publicly traded company listed in Helsinki and Stockholm (http://www.storaenso.com/).

The most important user needs were:

- To improve forest variable estimate accuracy, especially for the higher stem volumes
- To improve the separation of conifers (pine and spruce) in mixed conifer forest
- To produce indication of map reliability
- To obtain accurate information of storm damages

From the system level point of view the need to develop the existing in-house software tools into operational level was considered as a major development driver. New tools to screen reference data outliers, to improve model consistency and to evaluate the product accuracy were implemented.

Stem Volume Maps by Species from Finland and Russia

Four separate demonstration maps were produced for the two test case areas using IRS-P6 Liss3, RapidEye data, simulated CORE Service data (Finland) and SPOT5 (Russia) data as the input EO data for the modelling. The reference data in the Finnish test site included 15 forest variables for 256 000 stands and stem volumes of pine, spruce, birch and aspen from 156 field plots from the Russian test site. Figure 1 shows an example of the produced maps.

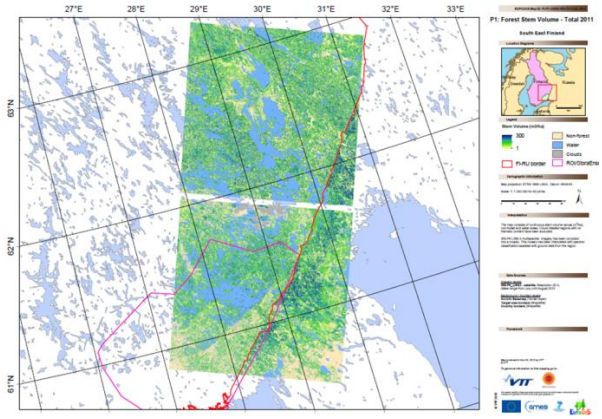

Figure 1: Total Stem Volume map for the Finnish test area.

The quality of the produced maps was evaluated using a test reference data set separated from the original reference data set. The relative RMS errors (RMS%) of total stem volume maps varied between 30% and 40%. The best performance (RMS% = 30%) was obtained using IRS-P6 Liss3 data together with screened reference data and using a new sub-clustering method developed during the project. The maps produced using the simulated CORE service data reached the accuracy RMS% = 34% if used as the only input for the map production.

The obtained coefficients of determination varied between 0.1 and 0.7 depending on the estimated variable and the used EO data. In general, the worst performance was reached for deciduous stem volume (R2 = 0.1 – 0.2) and the best for total stem volume (R2 = 0.6) as well as spruce volume (R2 = 0.7) and with RapidEye data.

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The developed new methods for reference data screening and model sub-clustering improved the dynamic range by 25-35%, without introducing bias or sacrificing the product accuracy.

Assessment of Storm Damage Economic Impact

The predicted stem volumes can be used to obtain the impact of e.g. a storm event on a forest in economic terms. The change (decrease) of forest stem volume in cubic meters/hectare can be estimated in damaged areas, which then can be combined with wood prices and other GIS data layers to obtain estimates of the financial figures involved.

Storm event in Finland at 30.7.2010

During ten days in July and August 2010, the thunderstorms named Asta, Veera, Lahja and Sylvi raged in southern and middle Finland. About 8.1 million cubic metres of forest was damaged and the storms caused severe damage to the country infrastructure (buildings, power lines, railroads etc.). The estimated financial losses of storm Asta alone were over 20 million euros.

The assessment of the Asta storm economic impact to forest was demonstrated by change detection analysis of two IRS-P6 Liss3 images acquired on 26.7.2010 and 14.8.2010. The change in species-wise stem volume per hectare was produced from two images and using GIS processing. The total loss in cubic metres caused by the storm was then computed for three hypothetical forest parcels in the damage area. By combining the market prices for log wood and pulp wood an estimate of the value of the damaged growing stock was produced. Using the age and stem diameter estimates from the pre-event map as category variables, the damages were also extracted for different age and diameter categories (see Figure 2.).

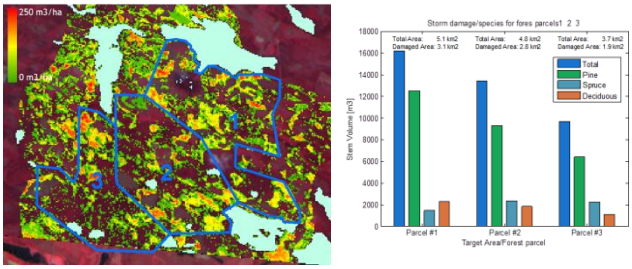

Figure 2. a) The damage area of storm Asta (30.7.2010), b) The damages for three hypothetical forest parcel in loss of total stem volume (per species) of growing stock

The range of the damage map was 0–250 m^3/ha, which corresponds to the stem volume ranges of pine forests in Finland, the maximum damage of 250 m^3/ha thus indicating total destruction.

Benefits of the developed products

The map for storm economic impacts facilitates targeted harvesting of the damaged forests and helps the customer to complete the customer relations. The obtained advances in the species-wise forest variable mapping give benefit for the forest company in planning and timing the wood procurement and harvesting. If the map accuracy is adequate, one of the two field visits that are presently needed for the procurement decision and pricing may be skipped. This brings immediate cost savings to the user. However, the utility of the developed products shall be further evaluated in practice and in the context of user organisation's applied practices and forthcoming standards for wood procurement. The developed software packages are being commercialized at VTT and are available for forestry actors worldwide.

Economic FDS Model

A central objective of the EUFODOS project was to ensure, that the tools and processing lines used and developed could be commercially exploited after the project. Two of the Service Providers involved in EUFODOS are commercially operating companies and three of the research organisations were already from the start of the project committed to develop commercially available Forest Downstream Services. A first step in planning for commercialisation was to understand factors affecting market size for the services. A central finding was that monitoring and analysis should cover not only damaged areas but all forest area. To support commercialisation of the developed services each Service Provider collected cost information during demonstration. This improved their understanding of the costs involved, but major challenges are large variations in EO data volumes, type and quality used in the analysis. This affects both data costs and the amount of work needed. Costs can be calculated fairly accurately once the data for the analysis is known. To increase the Service Providers understanding of the benefits the services provide to the Users, estimates of User Values were made to support discussion in the consortium. Some of the Service Providers also had direct discussions with their User on this topic. To enable the Users to achieve cost savings or other values, the Service Providers should build comprehensive service portfolios and reliable processes which Users can rely on regardless of conditions in the forest or otherwise. Finally, a road map was created to evaluate the effects of major trends in global environment, market and technology development on future development and actions by the Service providers.