The Forest Watch Service: Automated Forestry Geoinformation Products from Remote Sensing Imagery

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One of the largest hurdles encountered by the remote sensing community is the inability to derive thematic information at the required speed, consistency, quality and cost, demanded by the geoinformation market, from available imagery.

Private industry, national government departments and the international community rely on such geoinformation, to optimise operations, enforce legislation and access global markets concerned with the use of natural resources. The international space community has organised itself within the Committee for Earth Observation Systems (CEOS) which South Africa currently chairs, to combine information systems providing a global information service under the Global Earth Observation System of Systems (GEOSS). The European Union has initiated a programme called Kopernikus, formally known as Global Monitoring for Environment and Security (GMES) which aims at providing these information services as contribution to GEOSS. Kopernikus / GMES provides three core services consisting of land, marine, emergency response, and two pilot services covering the atmosphere and security aspects. Each core service consists of service elements of which the Forest Monitoring Programme is part of the Land Core Service. (GMES Forest Service 2009)

The Department of Water Affairs and Forestry (DWAF) as well as the local forestry industry have approached the CSIR/ Satellite Applications Centre (SAC) to provide them with forest services. DWAF requires this information to enforce legislation regulating "Stream Flow Reduction Activities", as well as updating the "National Forest Inventory". The commercial companies on the other hand need to know the age, genus and timber volume distribution of plantations in Southern Africa as well as early growth stress indications attributed to a range of factors from nutrient deficiencies, pathogen and insect infestation. Furthermore they need to control the extent of timber harvesting and rapidly access fire damage.

SAC has a huge archive of satellite imagery for Southern Africa dating back to the 1970's and has access to aerial photography dating back to the late 1920's. In addition, SAC has purchased processing systems to automate the geo- and radio-metric correction of remote sensing imagery. An Object Oriented Image Analysis software package called Definiens Enterprise was installed on a powerful PC cluster. With these resources available, the author working at SAC is implementing a processing chain to automate the generation of Forest Service products which fulfil the requirements of National Government and the forestry

industry. These services will then be offered as African contribution to Kopernikus / GMES and GEOSS.

In this paper methodologies applied for the implementation of the forest service processing chain are explained and its performance evaluated. Products are updated annually and consist of a forest plantation mask, genus classification, volume estimates, burn scar mapping and growth vigour assessment. Historic data is provided back to 1989 with a classification up to genus level, whereas the full range of products can be provided dating back to 2006 relying on Spot 5 HRV, Landsat ETM+ / TM and MODIS data. The information products are suitable for analysis at 1: 50 000 mapping scale. Processing chains are developed and tested on the quarter degree map sheet 2930A, north of Pietermaritzburg, south of Greytown in the province of KwaZulu Natal, South Africa.

All satellite imagery used for this service is radiometrically normalised to at least at satellite reflectance using fully automated techniques. Forest masks are generated with modified techniques as used by Manninen (1999) & Pax-Lenny et al (2001), whereas timber volumes where estimated with an adapted technique as demonstrated by Mäkelä & Pekkarinen (2001).

With the Landsat sensors no longer being fully operational services are to use imagery from the Indian IRS Resourcesat (P6) satellite in future. The usefulness of this data has been proven by Falkenström & Ekstrand (2002).

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