Introduction to the Workshop Proceedings CD

The content of this CD is the final output of the Expert Workshop on "*Potentialities and Limitations in the Use of Remote Sensing for Detecting and Monitoring Environmental Change in the Horn of Africa* " organized by FAO SWALIM, and held on 12th and 13th June 2007 in Nairobi, Kenya. It contains, in an easy to access format, all the material collected from the experts before, during and after the workshop.

This CD acts as the proceedings of the workshop and includes all the presentations shown during the workshop plus other information.

The workshop saw the participation of more than 60 people during the two days, excluding SWALIM staff and presenters. It highlighted the existence of a very high level of expertise in the Horn of Africa. The high quality of professionalism was demonstrated not only by the presentations but also by challenging questions posed by the audience. Many institutions were represented, including International Agencies, Governmental Bodies, NGO's, Universities and the Private Sector.

The CD content has been subdivided into five main sections and Annexes, as indicated in the menu on the left.

The five main sections are:

1. **Workshop Summary:** the main outcome of the final Session 4 – Discussion & Conclusions.
2. **Final programme**
3. **Book of Abstracts**: short summaries of the 28 presentations submitted to the workshop.
4. **Keynote Speeches:** access to documents and presentations of the keynote speeches by Prof. Petri Pellikka (University of Helsinki) and Mr. John Latham (FAO-GLCN).
5. **Presentations**: the list of the speakers, subdivided according to the three sessions of the workshop, with links to each Powerpoint presentation.

The five Annexes are as below.

Annex 1 - Workshop circular: 1st and 2nd circular disseminated before the workshop

Annex 2 - RS resources: a list of web links to major associations, institutions and universities, representing the main sources of information for the application of Remote Sensing and data dissemination. Some links to Open Source software are also included in this annex.

Annex 3 - Additional material: a collection of freely available resources on the internet (pdf documents) about the main characteristics of existing and planned satellite or airborne sensors, and some of their possible applications.

Annex 4 - List of participants and contacts: complete list of participants, including their email addresses and web pages, if available.

Annex 5 - Group photo: photo of the participants of the workshop.

We greatly hope that the active participation in this SWALIM Workshop on Remote Sensing will be kept alive by the involvement of all the attendees in further activities. For this reason we invite all of you to maintain the contacts and networks that were established on this occasion.

The workshop could not have been realized without the contribution of all of the speakers, the support of many who expressed their interest in participating but could not be present, the financial contribution of FAO SWALIM in conjunction with the organizational efforts of JRC, and, last but not least, the hard work of the SWALIM team that offered their expertise well beyond the usual working hours! We acknowledge the contributions of all of you and express our sincere thanks.

We hope to see you soon at similar events. You can visit the SWALIM offices at Kalson Towers (3rd floor), Parklands, Nairobi, or the SWALIM website at www.faoswalim.org

Summary

The workshop on the Potentialities and Limitations in the Use of Remote Sensing for Detecting and Monitoring Environmental Change gathered together a large number of remote sensing specialists from Kenya and other countries, working in environmental remote sensing in the Horn of Africa. Altogether there were 28 presentations in the programme of which 20 were from organizations based in Kenya, one in Ethiopia, two in Laos, one in Holland, four in Italy and one in Finland. The participating organisations were governmental, international NGOs, national NGOs, companies, and universities, as well as EC and UN-based organisations, such as FAO and JRC. Despite the concentration of presentations from Kenyan based institutions, the papers reflected research carried out in a regional setting with examples from Uganda, Somalia and Ethiopia. In addition, some of the presentations dealt with aquatic environments of the Indian Ocean and with soils and land cover in the general African context. The presentations can be considered representative of state of the art in remote sensing for monitoring environmental change in East Africa.

The presentations were divided into three sessions: resource base inventory, assessing environmental change and process modelling, which described the broad scale applications of remote sensing.

In the resource base inventory the scope of the presentations was mapping agricultural resources (Zorogastua *et al*. 2007*), forest and tree cover (Gichecha *et al*. 2007, Khamala 2007), soils (Jones *et al*. 2007, Vargas & Omuto 2007), landforms (Paron & Vargas 2007), and wild animals (Watson *et al*. 2007).

The environmental change studies mostly concentrated on land cover dynamics (Brink *et al*. 2007, Oduori *et al*. 2007, Pellikka 2007, Waruingi 2007, Watson *et el*. 2007), rehabilitation (Cherogony & Isse 2007), early warning systems (Galu & Aw-Dahir 2007), weather (Gilbert 2007), marine ecosystems (Hoepffner *et al*. 2007), and drought (Oroda *et al*. 2007). The presentation from Nyabenge (2007) discussed key challenges in change analysis in general.

The process modelling session consisted of advanced papers, in which key parameters were derived from remote sensing analysis and from geospatial datasets for soil erosion risk assessment (Arabu 2007), estimation of evapotranspiration (Farah & Ottichilo 2007), hydrology (Mutie *et al*. 2007, Korme *et al*. 2007), assessment of biophysical parameters (Gideyelew 2007, Odhiambo *et al*. 2007, Capecchi & Di Gregorio 2007), crop monitoring (Leo 2007), and coral reef bleaching (Maina 2007). In addition some presentations embedded in the

three sessions dealt with spatial data infrastructures (Wilson 2007), web ontology (Mayaka 2007) and data acquisition and distribution (Mwangudza *et al*. 2007).

Based on the presentations it can be seen that the range of applications in the Horn of Africa is wide. However most studies concentrated on vegetation cover studies, while fewer studies dealt with urban, soil, landform and hydrological monitoring and modelling. Most of the remote sensing studies were carried out with optical satellite remote sensing data and only a few incorporated aerial photographs. There has not been much use of radar or LIDAR remote sensing data. Methods ranged from visual analysis of satellite imagery to digital classifications and NPP modelling. Some papers included sophisticated field measurements (e.g. Zorogastua *et al*. 2007), some successfully combined other geospatial data (e.g. Paron & Vargas), while others took livelihoods into account (Galu 2007) or applied participatory GIS methods (Waruingi 2007).

Other geospatial data, e.g. digital elevation models, rainfall data and outgoing long radiation data (Ouma, 2007) were used as ancillary datasets. The most typical methods for derivation of land cover or change seem to be classification or calculation of the normalized difference vegetation index (NDVI). Classification schemes are generated according to producer or user needs, but in some studies also the land cover classification system (LCCS) developed by FAO and UNEP was applied (Omouri *et al*. 2007, Pellikka 2007).

Although very good resource base monitoring, change analysis and process modelling are carried out, the whole potentiality of the human resources, data resources and technical and scientific resources are not yet fully used. However, the current use of state of the art remote sensing in the Horn of Africa is promising. From a scientific point of view, the professional opinions of the experts on the various methodologies, approaches and the acceptance and use of various techniques differed significantly. Based on the outcome of the workshop, it is not possible to reach definite conclusions about the scientific value of the various approaches and to compare them; they need further research. It is also not possible to prepare practical guidelines for the application of remote sensing techniques in monitoring environmental change. Many impressive presentations gave good overview on general progress; however it would be too early to draw more definite conclusions on the subject.

Since the full potential of remote sensing has not yet been exploited, there remains a lot of potential in remote sensing applications. The full range of data types from hyperspectral remote sensing data to microwave and LIDAR data could be applied to more advanced remote sensing exercises. More practical ways could be found to refine methodologies in the application of optical satellite and airborne remote sensing data. The inclusion of atmospheric corrections, multitemporal relative spectral calibrations, topographic corrections and orthorectifications would increase the quality and accuracy of the products. Results should be validated by ground truthing, and proper statistical analysis should be used before drawing conclusions on environmental change. In addition to corrections and pre-processing, there is a need for standardization of classifications and a need to use standard schemes also for change detection and field work methods. Remote sensing products created by NASA, EC and UN organisations could be exploited more efficiently.

The workshop participants emphasised the need for closer co-operation between organisations and institutions active in applying remote sensing techniques in the Horn of Africa. SWALIM volunteered to promote steps in this direction. Everybody agreed that the workshop was a very useful first step and it should be followed by further events in the near future.

Congratulations and thanks to all who contributed presentations and to the success of the workshop; it was an important step towards developing methodologies to be used more commonly in the future.