AFRICOVER LAND COVER CLASSIFICATION AND MAPPING PROJECT

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Keywords: Remote sensing, G.I.S., Natural resources mapping, Africa

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Summary

Current land cover is essential information for a reliable environmental database. Land cover is the expression of human activities and as such changes with alteration in these. Hence, land cover is a geographical feature which may form a reference base for applications ranging from forest and rangeland monitoring, production of statistics, planning, investment, biodiversity, climate change, to desertification control. Despite the high demand for such types of information in most developing countries, the data is usually missing, outdated or not consistent.

The overall objective of the AFRICOVER-EA project is to improve the availability of reliable, timely and location-specific land cover information in twelve African countries

(Egypt, Sudan, Ethiopia, Djibouti, Eritrea, Somalia, Kenya, Uganda, Tanzania, Rwanda, Burundi and the Democratic Republic of Congo) covering an area of over 9.5 million km^2. Being the first operational module of the AFRICOVER program, the AFRICOVER-EA has developed the whole methodological approach for the so-called "MADE" Multipurpose AFRICOVER Data base for Environmental resources. This work resulted in spin-off developments of great importance:

- A complex interpretation chain tested and continuously refined during the whole project activity.
- A detailed set of cartographic standards to homogenise the interpretation process and to facilitate and enhance the utilisation of the database.
- The development (both theoretical and practical) of the "AFRICOVER Interpretation Tools": Land Cover Classification System (LCCS), AFRICOVER Interpretation and Mapping System (AIMS), Geographic Vector Interpretation System (GeoVIS)
- The development of the "AFRICOVER End User Tools": AFRICOVER Data-base Gateway (ADG), AFRICOVER Interactive Data-base for interpretation (AID).

Completion of the AFRICOVER-EA project is planned in December 2002; the inventory of the potential users of its products has been completed and a potential client network established. The AFRICOVER-EA project, when successfully completed, will thus contribute to a more effective and efficient management of renewable natural resources and environmental protection in East Africa.

1. Introduction

Current land cover is essential information for a reliable environmental database. Land cover is the expression of human activities and as such changes with alteration in these. Hence, land cover is a geographical feature which may form a reference base for applications ranging from forest and rangeland monitoring, production of statistics, planning, investment, biodiversity, climate change, to desertification control. Despite the high demand for such types of information in most developing countries, the data is usually missing, outdated or not consistent.

The AFRICOVER project was initiated by the Food and Agriculture Organisation of the United Nations (FAO) on the request of several African countries to provide accurate and reliable land cover information, based on a systematic and harmonised land cover classification system and on uniform cartographic and mapping specifications for the whole continent of Africa.

The main product consists of a detailed digital land cover and basic topographic layer (roads, rivers, toponymy, international and administrative boundaries) digital database. Map production methodologies and facilities, land cover classification and mapping methodologies, GIS, image analysis and cartographic equipment, and training of national staff are by-products of AFRICOVER mapping activities.

The AFRICOVER project implementation is based on a close co-operation with relevant African regional and national organisations. These have been involved in its preparatory activities, including the specification of land cover information requirements (land cover classes, classification accuracy and mapping scales), geodetic and cartographic specifications (geodetic reference data, cartographic projection and co-ordinate system) and specifications for field validation of preliminary interpretation results (field validation methodology, sampling design and frequency).

FAO has been increasingly involved in the assessment, mapping and monitoring of land cover and land use (LCLU) at global, regional and country levels. This reflects the need for reliable information on current LCLU and their changes. Such information is essential for sustainable management of agricultural land, forest and fresh water resources, as well as for environmental protection and rehabilitation. Yet, in most developing countries the LCLU information is collected by a number of organisations using different standards. Existing LCLU databases are usually outdated or not reliable.

The lack of reliable information on the current LCLU situation is slowing down the land use planning and implementation of effective measures for prevention of land degradation and deforestation, as well as mitigation of the effects of natural disasters, such as agricultural drought, floods, and forest and rangeland fires. Increasing population pressure, threatening the future food security prospects in developing countries, particularly in Africa, further aggravates the situation.

2. Project Design

The project design is modular, to allow its implementation either at the sub-regional or country levels. The original design was based on five sub-regional modules:

- East Africa – 12 countries, 9 582 907 km^2 (includes Democratic Republic of Congo);
- North Africa – 4 countries, 5 017 440 km^2 (excludes Egypt, which is part of module 1);
- Sahelian – 9 countries, 5 307 820 km^2 (includes Cape Verde);
- West and Central Africa – 15 countries, 5 066 955 km^2 (includes Sao Tome and Principe);
- Southern Africa – 13 countries, 5 350 747 km^2 (includes the Indian Ocean countries Madagascar, Mauritius, Comoros and Seychelles).

Only the East African module is being implemented at present. Although negotiations regarding the implementation of other sub-regional modules are ongoing, it soon became obvious that some prospective sponsors preferred a more flexible approach, allowing them to select a country or group of countries according to their priorities and available budget. At the same time considerable achievements were obtained by the first AFRICOVER operative module (the AFRICOVER-EA), both on the implementation/validation of a new land cover mapping methodological approach and on the setting up of common world wide cartographic standards. These will allow the implementation of the land cover mapping activities in different ways as a forecast at

the beginning of the program. The revised project design in fact can now accommodate its implementation at a country level (instead of sub-regional modules) as long as the AFRICOVER concept and technical specifications *ad hoc* produced are followed.

Five AFRICOVER scenarios were developed for project implementation at a country level. They differ according to the level of country involvement:

- Project inputs are limited to training on AFRICOVER specifications. The LCCS (Land Cover Classification System and the two software dedicated to the photo-interpretation itself AIMS (AFRICOVER Interpretation and Mapping System) and GeoVIS (Geographic Vector Interpretation System). Implementation of all project activities is done by the country;
- AFRICOVER staff selects the satellite imagery, supervises its geometric rectification and enhancement and provides training as in (a). Remaining project activities are implemented by the country;
- AFRICOVER international consultant provides training and supervises the implementation of all project activities in the country;
- As above with the exception of digitising the delineated land cover classes and development of GIS database. Those two tasks are contracted to an international company;
- International company implements the project according to AFRICOVER specifications.

It is expected that the majority of countries will adopt the scenarios (c) or (d), when the international consultant supervises at different levels the project implementation.

Projects implemented at a country level, regardless under which scenario, will obtain the AFRICOVER certification only after it is asserted that they comply with the AFRICOVER specifications. This policy will assure the homogeneity of the AFRICOVER database for the whole continent of Africa and uniformity of its land cover mapping products in terms of their thematic content and accuracy.

3. AFRICOVER-EA Project Objectives

3.1. Overall Objective

The overall objective of the AFRICOVER-EA project is to improve the availability of reliable, timely and location-specific land cover information in twelve East African countries (Egypt, Sudan, Ethiopia, Djibouti, Eritrea, Somalia, Kenya, Uganda, Tanzania, Rwanda, Burundi and the Democratic Republic of Congo) covering an area of over 9.5 million km^2.

Being the first operational module of the AFRICOVER program, the AFRICOVER-EA project has been a vanguard in the application of advanced geo-information technologies for thematic mapping. New land cover interpretation methodologies as well as world wide common cartographic standards and specific software tools were implemented, developed and tested under the project activity. They are now an

inheritance of the whole AFRICOVER program and potentially for similar programs in other region of the world.

3.2. Specific Objectives of the AFRICOVER-EA project

- Development of technical specifications and methodology for land cover mapping of Africa at the basic scale 1:200000 and 1:100000. Derived scale is 1:1 million. This stage included important spin-off developments:
    - Concept and cartographic standards for (MADE);
    - Development of the AFRICOVER Land Cover Classification System (LCCS);
    - Development of Interpretation and Mapping Systems (AIMS and GEOVIS);
    - Development of a data base management tool (ADG);
    - Development of an interactive photo-interpretation guide (AID);
    - Concept development of statistical interactive software to determine the mapping accuracy (MAP).
- Development of land cover and basic topographic layers (rivers, roads, toponymy, administrative and international boundaries) digital database, referenced to uniform cartographic projection and co-ordinate system, for East Africa.
- Strengthening the land cover mapping and monitoring capacity, based on remote sensing, GIS and GPS geo-information technologies, of participating African regional and national organisations.

The project is hosted by the Regional Centre for Services in Surveying, Mapping and Remote Sensing (RCSSMRS) in Nairobi, Kenya in order to assure a close link with relevant national organisations.

In this context, the AFRICOVER-EA project has been long overdue. While the provision of reliable land cover information in standardised digital and paper map formats is the main project objective, an equally important objective is strengthening the technical capacity of the participating regional and national organisations. This will enhance the effective use of project products at country level and will facilitate follow-on activities, including the maintenance of a land cover database produced by the project. The project is fulfilling this latter objective through the organisation of training courses for technical officers and appraisal workshops for decision-makers. Furthermore, it provides on-the-job training to national staff assigned to the project.

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Biographical Sketches

Antonio Di Gregorio is a Vegetation Ecologist and Remote Sensing – GIS Specialist. He is actually the Remote Sensing/GIS Mapping Expert of the UN FAO AFRICOVER Project. His professional activity is mainly focused on the combined use of remote sensing and GIS techniques for the assessment, mapping and monitoring of natural resources and green biomass estimation for grazing capacity and ecological monitoring. For more than 20 years, he has been involved in the implementation and execution of UN Projects all over the world. He is the main author of the Land Cover Classification System (LCCS) that has become the FAO/UNEP official Land Cover Classification, and has also become a worldwide standard.

John Latham: During the past 20 years John Latham has been involved in the research, development, application, technology transfer and capacity building programs on the use of geographical information system and remotely sensed data from earth observation satellites in developing and developed countries. He has also worked on the design and development of agricultural crop area estimation procedures, crop growth modeling, natural resource assessment, coastal zone monitoring and management, land cover mapping, land cover classification systems, cadastral survey, the development of land information management systems, environmental information management systems and narcotic crop monitoring. This experience has been gained within the context of both private sector organization and for the last 14 years as part of the UN system with FAO. He continues to work closely with implementing agencies such as UNDP, UNEP, World Bank and many others. During his career he has lived and worked on projects in more than 40 countries in Africa, The Middle East, Nile River Basin Countries, India, China, and the Lake Victoria and Mediterranean Action Plans.