

Africover – Eastern Africa Module

Land cover mapping based on satellite remote sensing



LAND COVER MAPPING BASED ON SATELLITE REMOTE SENSING AFRICOVER

Background and rationale

The renewable natural resources of many African countries have come under severe strain over the past decades and most indicators point toward a continuation of this trend. Deforestation, desertification, soil erosion and salinisation, often triggered by excessive population pressure on fragile areas, affect both food security and economic development in many countries. Whilst a large amount of new remote sensing data for the assessment of natural resources is available, and technologies exist for its storage, analysis and integration, Africa shows a severe shortage of quantitative and qualitative information on vegetation cover and current land use at national and regional levels. Natural resources development and management require accurate methods to help in making sound decisions. Earth surface remote sensing including the mapping and analysis of the spatial distribution of land cover, offers considerable advantages over current alternatives. It provides a vehicle for rapid and up-to-date collection of detailed land use and resource data for a variety of planning purposes, which are so urgently needed in Africa. The importance of the availability of reliable land cover and land use information for sustainable management of the Earth's renewable natural resources was emphasized at the UN Conference on Environment and Development (UNCED), better

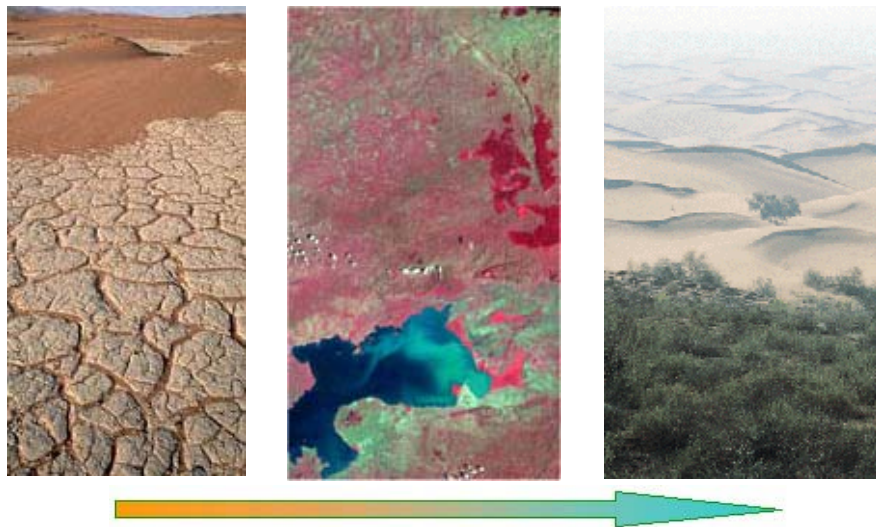


Figure: Use of remote sensing and GIS technology is useful to produce the information required for decision making and sustainable use of natural resources

known as the “Earth Summit”, which took place in Rio de Janeiro in 1992. Its action plan, the Agenda 21, has provided a rational basis for planning of sustainable development. The following two specific actions related to land cover assessment were listed among the UNCED priority requirements: bridging the data gap and improving the availability of information. The Earth Summit recommended the use of remote sensing and GIS technologies for coordinated, systematic and harmonized collection and assessment of data on land cover and environmental degradation.

The analysis of national needs proved that any information system on early warning, forests, rangelands, catchment basins, production of statistics, bio-diversity or climate change, has to be based upon a reliable and homogeneous baseline geographic information, showing both usual landmarks (infrastructures, settlement, landscape) and land cover, to be effectively useful.

This Italy-funded project was formulated to meet several African countries request for assistance in the set-up of reliable and geo-referenced data-bases on natural resources. It is part of FAO assistance to the Nile Basin countries, and a component of a larger multi-donor programme known under the title of "AFRICOVER", which will provide a homogeneous database for land cover mapping of whole Africa. The Project has been operational in the period 1995-2002 and was signed by ten countries: Burundi, Democratic Republic of Congo, Egypt, Eritrea, Kenya, Rwanda, Somalia, Sudan, Tanzania and Uganda.

AFRICOVER is complementary to another East-Africa international Italy-funded project, "Capacity Building for Nile Basin Water Resources Management", which gathers the nine Nile Riparian Countries for the common and sustainable management of the Nile basin.

Last, the Project will be one of the building blocks of a new partnership the Italian Cooperation is developing with multilateral agencies, among which FAO and UNEP, and bilateral cooperation agencies, among which USAID. In this new wide-ranging agreement, AFRICOVER will contribute its data-bases and its know-how developed so far to produce user friendly models for supporting decision makers in planning and management of sustainable development.

Goals, objectives and expected outputs

The development objective of the project is to strengthen the capabilities of East African and Riparian Nile countries for sustainable planning and management of natural resources, by producing reliable land cover maps and strengthening the national capacities in operational applications of remote sensing.

Immediate objectives were:

- Produce a regional assessment of East Africa land cover as a basis for regional and national level planning, preparing satellite interpreted land cover maps of the whole of East Africa
- Develop a network of local personnel trained in the utilisation of remote sensing and GIS technologies for land cover inventory and monitoring
- Develop a policy and mechanisms for data dissemination in joint cooperation with the national focal points established through the project support

The expected results are the following:

- National and regional multipurpose AFRICOVER Database for Environment (MADE) produced
- A set of tools and methodologies for multipurpose land cover mapping developed
- National and regional management and planning improved, including socio-economic and environmental analysis in support of sustainable development and environmental monitoring related to international conventions and initiatives
- National level institutions strengthened, including capacity building and stakeholders involvement through the planning and implementation of operational activities, mainly at the sub-national level

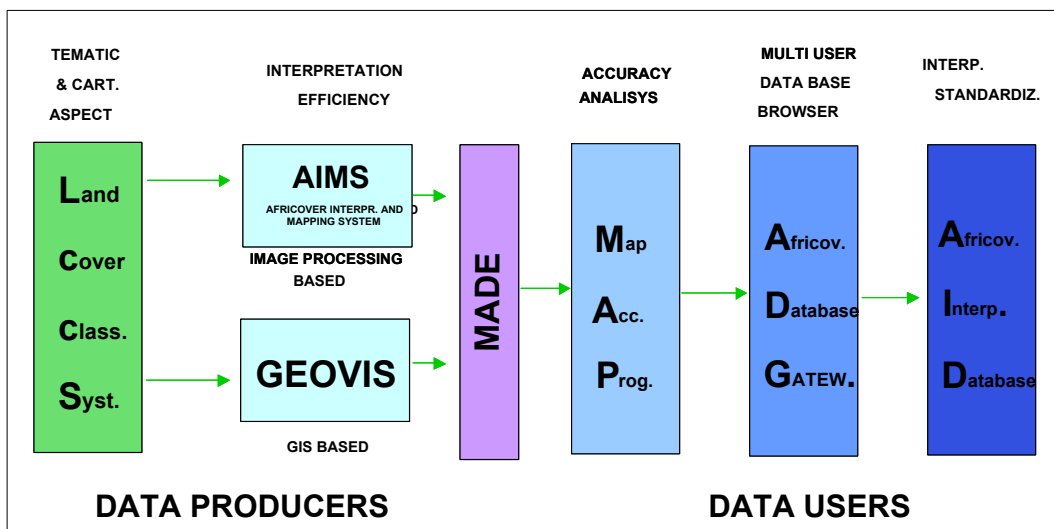


Figure: AFRICOVER system for data production, management and utilization: the new concept of multi user oriented natural resources data base

Implementation and results

The project was declared operational in 1995. Among first activities, the national working groups were established, composed by representatives of concerned ministries and institutions, and equipped. During the first phase the project reached an advanced state of implementation with the completion of several national Multipurpose AFRICOVER Database on Environmental Resources (MADE); a second phase of the Project has been started in 2000 to complete the remaining MADEs and develop other methodological and normative components.

Countries covered	10
Total surface mapped (Km ²)	8.5 millions
Average mapping scale	1:200.000
Cost per square Kilometre	1.13 €
National personnel trained	56
Years of implementation	7
Total cost	9,588,249 €

Table: AFRICOVER Project facts

The achievements of the project up to the year 2002 can be summarized according to the following areas of results:

(I) Data production

- National MADEs (that includes detailed land cover interpretation, roads, rivers, International and national boundaries) have been completed for the following countries: Somalia, Kenya, Tanzania, Egypt, Burundi, Rwanda, Eritrea
- National MADEs (that includes detailed land cover interpretation, roads, rivers, International and national boundaries) for Democratic Republic of Congo, Sudan and Uganda is under development and will be completed by the end of the project
- Regional standard MADE, built through the integration of national made, under development

(II) Capacity building and sustainable production and use of data

- Provision of equipment to National Focal Point Institutions (NFPs)
- Set up of communication and networking mechanisms (forums, workshops, web site – www.africover.org -, e-mailing system)
- Interpretation of satellite images for the national land cover map executed by national photo-interpreters
- Training of 40 national photo-interpreters on the AFRICOVER methodology
- Training of 16 national officers in updating, managing and distributing MADE
- Development of a complete set of integrated software that constitutes a cost effective reliable solution to produce, update and interact with land cover information:
 - GeoVIS, vector based topological gis system for visual image interpretation
 - AIMS, image processing suite
 - LCCS, legend development tool
 - AID, support to interpretation process through data integration (under development)
 - ADG, data gateway to extract user customized land cover information to answer specific needs (under development)

Most of these applications are available as freeware.

- Provision to the counties of the complete software toolbox for land cover data production, management and distribution
- Distribution of completed MADEs to the countries
- Development of an agreement on data custodianship, management and update of national MADEs to promote and facilitate use and maintenance of data at national level

(III) Normative and methodological development

- Development of Land Cover Classification System (LCCS) used to produce the MADEs and adopted by FAO and UNEP as the international standard for land cover classification
- Development of a cost effective methodology for the production of land cover databases assuring high quality standards

- Drafting of conceptual basis for the identification of a normative standard to assure consistency, compatibility and harmonisation of land cover data sets produced in different regions of the world
- Set up of a web site on land cover mapping focussed on the LCCS software (www.lccs-info.org)
- Organisation of conferences and workshops on land cover mapping standards and methodologies

(IV) Data distribution and dissemination

- Development of agreements on public distribution of re-aggregated MADE to allow the international and scientific community to access and use the data
- Set up of web based facilities to download the data
- Creation of partnerships with the most important bodies active in the environmental and development sector

An increasing number of initiatives are benefiting directly from the outputs of the project, that succeeded to fill an important data gap. Among the different initiatives there are: development of early warning facilities in Somalia, improved understanding of the hydrological regimes of the Nile, study of the migratory paths of large mammals to conserve local habitat in Tanzania, mapping of vulnerable coastal habitats in Tanzania and Kenya.

The overall results achieved by the project showed the feasibility of the production of accurate standardized land cover information for large areas of the world. The experience and technology developed with the AFRICOVER project, particularly in the development of normative standards and methodologies, are at the base of an initiative for global land cover mapping jointly launched by FAO and UNEP (Global Land Cover Network) to answer the need for user customized standard land cover information at global level.