

CLIMATE CHANGE

DESERTIFICATION

Africover

**Eastern Africa Module
Land Cover Mapping
based on Satellite
Remote Sensing**



› CAPACITY BUILDING

› ENVIRONMENTAL
MONITORING

› NETWORKING

› TRANS-NATIONALITY



Ministero degli Affari Esteri

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 resources 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 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 the planning of sustainable development. The following two specific actions related to land cover assessment were listed among UNCED's priority outputs: bridging the data gap and improving the availability of information. The Earth Summit recommended the use of remote sensing and Geographic Information System (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, statistics production, biodiversity 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 databases 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 databases and its know-how developed so far to produce user-friendly models for supporting decision makers in the planning and management of sustainable development.

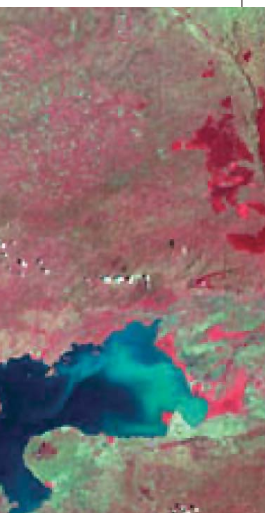
Goal, objectives and expected outputs

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 building the national capacities in operational applications of remote sensing.

Specific objectives are as follows.

- Produce a regional assessment of East Africa land cover as a basis for regional and national level planning, by 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.

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



The expected results are the following.

- ① National and regional multipurpose AFRICOVER Database for Environment (MADE) produced.
- ② A set of tools and methodologies for multipurpose land cover mapping developed.
- ③ 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.
- ④ National level institutions strengthened, including capacity building and stakeholders involvement through the planning and implementation of operational activities, mainly at the sub-national level.

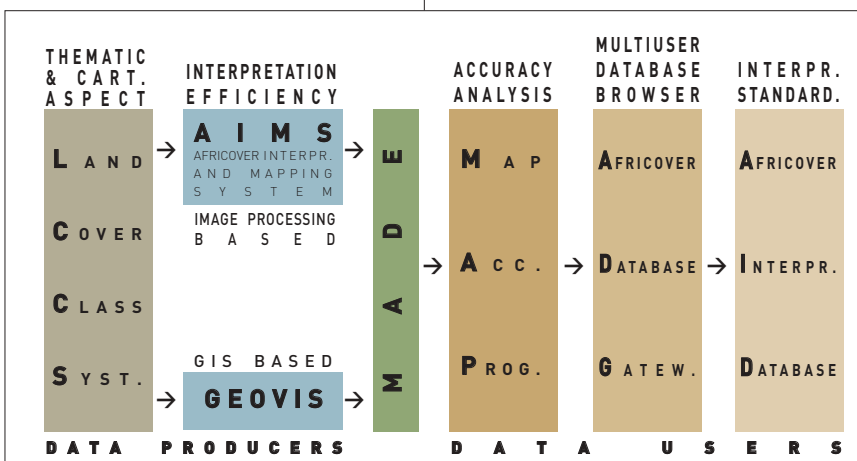
Implementation and results

The Project was declared operational in 1995. The first activities included the establishment and equipment of national working groups, composed of representatives of ministries and institutions concerned. During the first phase the Project reached an advanced state of implementation with the completion of several national MADEs. The second phase of the Project started in 2000 to complete the remaining MADEs and develop other methodological and normative components.

The achievements of the Project up to the year 2002 are summarised in the following table and are detailed below.

COUNTRIES COVERED	10
TOTAL SURFACE MAPPED	8.5 million sq km
AVERAGE MAPPING SCALE	1:200.000
COST PER SQUARE KILOMETRE	1.13 euros
NATIONAL PERSONNEL TRAINED	56
YEARS OF IMPLEMENTATION	7
TOTAL COST	9,588,249 euros

AFRICOVER system for data production and management: the new concept of multi-user oriented natural resources database



i. Data production

- ① National MADEs, that include detailed land cover interpretation, roads, rivers, international and national boundaries, have been completed for Burundi, Egypt, Kenya, Rwanda, Somalia, Tanzania.
- ② National MADEs for Democratic Republic of Congo, Sudan and Uganda are under development and will be completed by the end of the Project.
- ③ Regional standard MADEs, built through the integration of national MADEs, are under development.

ii. Capacity building and sustainable production and use of data

- ① Provision of equipment to National Focal Point Institutions (NFPs).
- ② Set up of communication and networking mechanisms: forums, workshops, Web-site and e-mailing system.
- ③ Interpretation of satellite images for the national land cover map executed by national photo-interpreters.
- ④ Training of 40 national photo-interpreters on the AFRICOVER methodology.
- ⑤ Training of 16 national officers in updating, managing and distributing MADEs.
- ⑥ Development of a complete set of integrated software, most of which is available as freeware, and which is a cost-effective and reliable solution to produce, update and interact with land cover information:
 - GeoVIS, vector based topological GIS 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.

- ❶ Provision to member countries of the complete software toolbox for land cover data production, management and distribution.
- ❷ Distribution of completed MADEs to member countries.
- ❸ 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

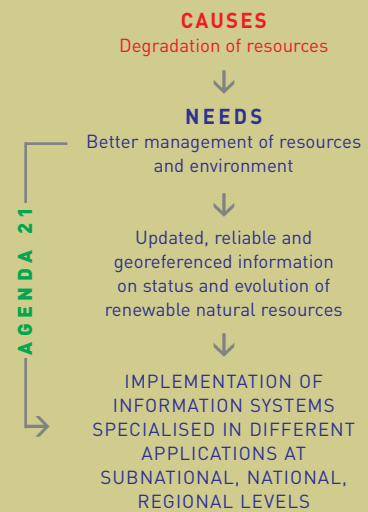
- ❶ Development of a Land Cover Classification System (LCCS) used to produce the MADEs and adopted by FAO and UNEP as the international standard for land cover classification.
- ❷ Development of a cost effective methodology for the production of land cover databases assuring high quality standards.
- ❸ 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.
- ❹ Set up of a Web-site on land cover mapping focused on the LCCS software.
- ❺ Organisation of conferences and workshops on land cover mapping standards and methodologies.

iv. Data distribution and dissemination

- ❶ Development of agreements on public distribution of re-aggregated MADEs to allow the international and scientific community to access and use the data.
- ❷ Set up of Web-based facilities to download the data.
- ❸ Creation of partnerships with the most relevant institutions.

An increasing number of initiatives are benefiting directly from the outputs of the Project, which succeeded in filling an important data gap. The different initiatives include the following: 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 have shown that the production of accurate standardized land cover information for large areas of the world is feasible. The experience and technology developed with the AFRICOVER Project, particularly in the development of normative standards and methodologies, serve as the foundation upon which to base an initiative for global land cover mapping jointly launched by FAO and UNEP (Global Land Cover Network) to answer the need for user-customised standard land cover information at global level.

THE PROBLEM ON THE DEVELOPMENT POINT OF VIEW



LAND-COVER CHANGE

Alters

- ❶ surface characteristics (roughness, albedo)
- ❷ material and heat fluxes
 - biogeochemical cycling (C, N, CH₄, etc.)

Affects

- ❶ evapotranspiration
- ❷ run-off and sedimentation rates
 - hydrological cycles

Impacts on

- ❶ soil quality (moisture, fertility, etc.)
- ❷ land degradation
 - net primary productivity
 - ecological complexity
- ❸ range of potential land uses

LAND-USE CHANGE

Alters

- ❶ land cover
 - conversion
 - modification (extensification or intensification)

Affects

- ❶ degree of human intervention
- ❷ economic return from land
- ❸ environmental impacts

Impacts on

- ❶ supported population density
- ❷ social processes
- ❸ supply of food, fiber and timber
- ❹ rural-urban relationships
- ❺ quality of environment

STATUS OF MAPPING (UN STATISTICS 1998)

