

Special Mapping Applications in Africa

Land Cover and Sustainable Development

Remote Sensing of Human Impacts in Africa - This project builds upon work from previous years to identify changes in the performance and/or state of land resources using coarse resolution (8 km) NDVI, based on time-series imagery from 1982 to 1999. Focus is now being applied to developing monitoring tools to distinguish effects or trends related mainly to human impacts. In particular, several remote sensing tools are being tested, and this involves assessing the influence of weather anomalies and long-term climate change on the analysis. In 2001, the investigation is applying medium and high-resolution imagery to monitor and characterize the anomalies, both positive and negative. This includes use of 1 km AVHRR NDVI imagery, Landsat TM and MSS, aerial videography and/or photography, and historical Corona satellite photography. If feasible, the research team also will examine use of IKONOS satellite imagery at 1-m and 4-m resolution. The investigation is focusing mainly on the West Africa semi-arid region. Specific study areas within the greater region are also being identified based upon supporting evidence from the field regarding successful natural resource management initiatives, or conversely, areas of known degradation.

Sahel Land Use / Land Cover - EDC scientists are collaborating with West African scientists to carry out an effort to monitor long-term land use and land cover trends over the West African Sahel. They are using a wealth of new worldwide coverage offered by Landsat 7 and a remarkably complete satellite photo archive of West Africa from the Corona Program of the 1960's. The Sahelian states comprising the CILSS Region of West Africa form an immense geographic area, nearly the size of the USA. Proposals to inventory or map the land use and land cover of this large region have not become reality, in part owing to the high cost and technical challenges of undertaking such a major effort. Tracking temporal changes complicates the task because of the need to conduct surveys at multiple points in time over large areas. Rather than a wall-to-wall mapping approach that would involve major expenses in imagery, computing power, and a large human effort, we propose an approach based on an area frame sample stratified by agro-ecological regions (thus, a stratified random sampling= approach). This approach is building upon the experiences of quantifying LU/LC changes at a national scale in Senegal. In 2001, EDC scientists are working with their counterparts to produce an ecological regions stratification of the West Africa study area. They acquired recent Landsat ETM imagery of the entire area, and obtained partial coverage using historical Landsat TM and Corona imagery. Many hundreds of image data sets have been prepared for analysis of land use / land cover change, which will be the primary effort for 2002. The present monitoring program will help national and regional environmental planners understand the environmental changes of past 40 years, and better predict with an acceptable degree of certainty what awaits humanity in the coming decades.

Capacity for Aquatic Ecosystem Monitoring and Information Support in East African Nations (CAEMIS) - This project involves the development of a monitoring and information system for the Lake Victoria Basin of East Africa. Clean Lakes, Inc. is funded by USAID/Uganda and is responsible for the development of an operational water hyacinth control program. A major component of the overall strategy involves the use of various spaceborne and airborne sensors to acquire information at scales ranging from individual bays to the entire lake and to ensure that usable information is available throughout the year, irrespective of cloud conditions. Clean Lakes, Inc. established a partnership with the USGS/EROS Data Center to fulfill some of the region's monitoring and geospatial information requirements. The three main activities are to: (1) develop a Lake Victoria Monitoring Network (LVMN) to support the

monitoring and information needs of the water hyacinth management community and others through remote sensing and GIS, (2) in cooperation with LVMN and other East African institutions, process, provide, and integrate geographic data to support ecosystem level and other analyses of the Lake Victoria basin, and (3) develop and implement a Lake Victoria Basin Information System (LVIS) in order to facilitate the exchange of data and information on the Lake Victoria basin ecosystem. A pilot study has been conducted that demonstrates the detection of water hyacinth with Radarsat, a radar-based remote sensing system.

Regional Information Systems

EMIS Data Distribution – The USGS is contributing to the USAID sponsored Environmental Monitoring and Information System (EMIS) for Africa. One of the principle components emphasizes the standardization of digital geospatial data collection, mapping, and dissemination. EROS Data Center, in close collaboration with African partners, is promoting the implementation of geospatial data standards in Africa and developing country contexts. This activity also includes the identification of available data and the review of consistent and useful approaches to spatial data collection, description, access, and distribution, with special attention to appropriate scales, missing data sets or geographic areas, and interactive mapping capabilities. Additional data or map serving are meant to augment the already operational Africa Data Dissemination Server (ADDS) as a portal for Africa data.

Rift Valley Fever (Interplay of Climate, Landscape Ecology, and Epidemiology) - Using climatic landscape ecology and epidemiological data, a research team consisting of the Center for Disease Control (Atlanta), EDC, and Data Technologies will develop predictive models for outbreaks of Rift Valley Fever in Zimbabwe. The work will start in 2002, and aims to establish local prediction capabilities based on ecological, climate, and remote sensing variables.

Sustainable Tree Crops – Scientists are building capacity within small organizations of cocoa, coffee and cashew growers to collect data that will allow the development of Internet based information systems that will document parcel history, production certification, natural resources management practices, and efforts towards environmental protection.

Early Warning and Monitoring

Famine Early Warning Systems – The USAID Famine Early Warning System for Africa provides data, information, and analyses to decision makers so they can evaluate and anticipate the need for famine interventions. The FEWS Program has entered into its fourth phase, referred to as FEWS Net. One of the principle goals of FEWS Net is to provide timely access to satellite data/products in order to identify potential or actual problems related to drought and/or flood risk in Africa. The USGS/EROS Data Center has participated in the FEWS Program since its beginning in 1985. USGS supports USAID Washington, USAID Missions, and other collaborating early warning partners with improved access to relevant satellite data at key designated periods within the agricultural growing season. Specifically, these data are being provided to identify potential or actual problems related to crop growing conditions in the major agricultural producing areas in some 20 countries throughout sub-Saharan Africa. With unique government facilities and staff, USGS (1) provides access to relevant satellite data (AVHRR-derived NDVI, Meteosat-derived rainfall estimates (RFE), RFE-derived start-of-season and moisture index, etc.) in PC-format to FEWS/Washington office, field-based FEWS representatives and FEWS cooperators, (2) collects, archives, manages, and distributes other FEWS-related spatial and tabular data, (3) develops web-enabled versions of PC-based data management and analysis software to meet specific needs of FEWS (e.g., Spaceman, Priceman,

Rainman), (4) provides remote sensing and GIS services and analyses where EDC's expertise and unique computer resources are required, (5) develops and evaluates GIS-environment models for rainfall estimation, flood risk monitoring, and crop index and yield reduction assessment, (6) evaluates, recommends and develops new data sources and analysis techniques.

FEWS Flood Risk Monitoring – This activity was established in September 1998 to provide real-time flood risk information to food security analysts and organizations in the Greater Horn region of Africa. The work has continued to develop flood risk monitoring products and decision support tools for Mozambique. Operational flood risk monitoring model of all the basins that drain into Mozambique during the floods of 2000 and 2001 was implemented. A visual presentation of the data with color-coding that highlights areas that have higher stream flow than normally. The Mozambique Flood Risk Decision Support System provides flood risk predictions and potential impact assessments to assist decision-makers in targeting relief efforts for the region.

Mozambique Land Cover Change Monitoring - This USAID-funded project provides image interpretation supervision and land cover map analysis for determining land cover change resulting from improved road access in Mozambique from 1991 to the year 2000 or later. This includes the evaluation of historical maps (1991) and their comparison to newly created land cover maps derived from satellite data (1996). Maps of agriculture/forest/mineral concessions will be incorporated into the analysis if/when available. Results of the analysis will provide an assessment of the impact of road rehabilitation projects.

Madagascar Conservation - Madagascar Conservation project's goal is to support natural resource management, biodiversity conservation, and geospatial data dissemination via GIS and remote sensing technology. USGS/EDC provides support directly to USAID sponsored projects and institutions such as the National Office for the Environment (ONE) and the organization responsible for Madagascar's Protected Area network (ANGAP). The work involves providing GIS technology and training for the implementation of a geospatial data clearinghouse and in the development of metadata for geospatial datasets. Support also includes the provision of fire data for year 2001 for each night for which DMSP-OLS (Defense Meteorological Satellite Program-Optical Line Scanner) data are available during the period August through December in near real-time. A pilot intranet, including interactive presentation of mission projects and activities is also being developed.

Carbon Sequestration

Soil Carbon in Africa - This project extends work recently initiated to define the potential for carbon sequestration in soil organic matter in semi-arid and sub-humid Africa. The project is selecting appropriate large areas in each agroecological zone for detailed study. Carbon biogeochemical modeling and soil organic carbon analyses will document the soil carbon status, potential for sequestration, appropriate management, and economic costs and benefits. In association with the University of Arizona and a project funded by the European Union (EU), the project will identify the socioeconomic conditions and policy decisions that are necessary to enable the aggregation of small holders to sell carbon credits to buyers from Annex I countries. The project includes feasibility studies among small holders in Senegal, the integration of remote sensing and carbon flux measurements to estimate sequestration in agroforestry applications in Cameroon.

Data (connected to USGS)

<http://edcintl.cr.usgs.gov/adds/>

African Data Dissemination Server provides public access to satellite data, maps and other African data sets archived by the FEWS project.

Satellite/Image Data

Tabular Data (agricultural stats, precipitation, price)

Digital Map Data

Administrative Boundaries

Agro-Climatic Zones

Cropland Use Intensity

Digital Elevation Model

Hydrology

Railroads

Rain Stations

Roads

Vegetation

West African Spatial Analysis Project

<http://edcwww.cr.usgs.gov/webglis>

Global Land Information System (GLIS) contains references to regional, continental, and global land information including land use, land cover, and soils data; cultural and topographic data; and remotely sensed satellite and aircraft data.

<http://earthexplorer.usgs.gov> (replacing GLIS)

Satellite images, aerial photographs, and cartographic products through the U.S. Geological Survey.

<http://edcdaac.usgs.gov/1KM/comp10d.html>

FTP access to Global AVHRR 10-day composite data. The data set is composed of 5-channel, 10-bit, raw AVHRR data, at 1.1-km resolution (at nadir) for every daily afternoon pass over all land and coastal zones using data from NOAA's polar-orbiting TIROS.

<http://edcdaac.usgs.gov/gtopo30/gtopo30.html>

Global 30 Arc Second Elevation Data Set : A global digital elevation model (DEM) with a horizontal grid spacing of 30 arc seconds (approximately 1 kilometer).

<http://edcdaac.usgs.gov/main.html>

The EDC DAAC was established as part of NASA's Earth Observing System (EOS) Data and Information System (EOSDIS) initiative to process, archive, and distribute land-related data collected by EOS sensors, thereby promoting the inter-disciplinary study and understanding of the integrated Earth system. The EDC DAAC role subsequently was expanded to include processing and distribution responsibilities related to Landsat 7 data. We archive and distribute ASTER and MODIS data from Terra, the first EOS satellite, and will receive MODIS data from Aqua. We also produce ASTER higher-level products. The archives at EDC hold the world's largest collection of civilian remotely sensed data covering the Earth's land masses.

<http://edcwww.cr.usgs.gov/landdaac/glcc/glcc.html>

Global Land Cover Characterization: A recently completed data base of global land cover is now available on line

<http://edcwww.cr.usgs.gov/landdaac/gtopo30/hydro/index.html>

Hydro 1K Elevation Derivative Database : A geographic database aimed at providing comprehensive and consistent global coverage of topographically derived data sets, including streams, drainage basins and ancillary layers derived from digital elevation models.

<http://edcwww.cr.usgs.gov/earthshots/slow/tableofcontents>

Earthshots: Satellite Images of Environmental Change : Earthshots is a collection of Landsat images and text, designed to show environmental changes and to introduce remote sensing.

<http://grid2.cr.usgs.gov/datasets/datalist.php3>

UNEP/GRID : The United Nations Environment Programme/Global Resource Information Database (UNEP/GRID) WWW site provides access to UNEP, USGS and NASA data sets.

<http://edcwww.cr.usgs.gov/Webglis/glisbin/guide.pl/glis/hyper/guide/disp>

CORONA Satellite Photography

<http://edcsnw3.cr.usgs.gov/senegal/senegal.html>

<http://edcsnw3.cr.usgs.gov/senegal/maps.html>

Framework for Long-Term Monitoring of Natural Resources in Senegal
Centre de Suivi Ecologique (CSE)

Data (Other)

<http://164.214.2.63/geonames/GNS/>

US National Imagery and Mapping Agency

Geonames database/Gazetteer, geonames@nima.mil or rohrerf@nima.mil (Fred Rohrer)

Until recently coordinates were only for finding purposes and were rounded to the nearest minute. Since 1994 we have added seconds to coordinates of features that we add or modify.

<http://www.worldbank.org/lsms/index.htm>

Living Standards Measurement Study (LSMS) of the World Bank (household surveys)

<http://www.measuredhs.com/>

Demographic & Health Survey, MACRO International. Since 1984, the Demographic and Health Surveys Program has assisted institutions in collecting and analyzing data on population, health, and nutrition

<http://sedac.ciesin.org/plue/gpw/>

Gridded Population of the World (GPW) - Population Density, 1995

In this Gridded Population of the World (GPW) data set, the distribution of human population is converted from national or subnational units to a series of georeferenced quadrilateral grids.

<http://www.citypopulation.de/Africa.html>

Statistics and maps about the population of the major agglomerations of the world

<http://www.cred.be/emdat/intro.html>

EM-DAT: The OFDA/CRED International Disaster Database

<http://miombo.gecp.virginia.edu/cd/Miombocd/Docs/Database.html>

Miombo CD Database

<http://www.fstcu.org/data/default.htm>

SADC Forestry Databases

<http://spidr.ngdc.noaa.gov/>

SPIDR - Space Physics Interactive Data Resource

Nighttime Lights of the World: Interactive mapping of satellite images of nighttime lights, creating clear images of the urbanisation pattern and large industrial concentrations, fires etc. Based on the data from the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS). By the National Geophysical Data Center, USA

<http://carpe.umd.edu/products/index.asp>

CARPE Products: CARPE is a long-term initiative by USAID to address the issues of deforestation and biodiversity loss in the Congo Basin forest zone, in the middle of the African continent.