Environmental Monitoring and Information Systems (EMIS)
Final Report to USAID
Overview of Themes and Project Activities

Theme 1 – Remote Sensing of Human Impacts
Theme 2 – Organizing Data and Regional GIS Data Access
Theme 3 – Networking Among Regional Data Users for Capacity Building
Theme 4 – Sustainable Tree Crop Management, Monitoring, and Certification
Theme 5 – Soil Carbon Sequestration

Prepared by Larry L. Tieszen
USGS – EROS Land Cover Applications and Global Change Branch
Background:

The USGS-EROS, responsible for management and distribution of Landsat and other imagery, strives for national and international leadership in the applications of remote sensing; the integration of ecosystem process modeling, ground data, and remotely sensed information; and capacity building in developing countries. We attempt to support USAID's sustainable development goals, its natural resources and environmental considerations, and the incorporation of results into planning, implementation, and monitoring. EROS works with support from EGAT, Africa Bureau, national missions, U.N. organizations, international cooperators, NGOs and national entities to improve the environmental monitoring and information systems in Africa.

EGAT/NRM intends to increase the flow and use of natural resource management and environmental information and strengthen the analytical capacity of selected partners to assess and advise on environmental trends and management of the environment. EROS supports capacity building and sustainable development in the areas of remote sensing and monitoring of land resources, standardization of geographic information system (GIS) data development and information delivery, networking and using data when establishing environmental policy and making decisions, sustainable tree crop management and monitoring and carbon sequestration within soils as well as aboveground biomass in sub-Saharan Africa.

This report identifies accomplishments for each theme and provides access to recent accomplishments, to products available on web sites, or to reprints of publications.

**Theme 1 - Remote Sensing of Human Impacts**

*Activity: Human Impacts on Land Performance in the Sahel*

Work under this theme identifies successes in natural resource management in West Africa’s drylands. Environmental improvements in the Sahel have resulted from farmer-led practices to increase vegetation cover and conserve soil and water resources. The activity combined time-series remotely-sensed data with field data to document land-cover changes from the 1960’s to the present supporting the Agency’s biodiversity interests. Activities include assessments of geo-referenced changes in plant biodiversity, proximity of native species to various resource management systems, and sustainability of the management systems. Soil carbon will be compared between “successful” management systems and nearby “control” systems in selected sites and with other themes (Theme 5). Outcomes include the following:

- Assessment of changes in land cover/land use,
- Assessment of changes in plant biodiversity over time and associated biodiversity threats,
- Assessment of carbon status and land productivity in study areas, and
- Completion of materials to effectively communicate findings to a broad audience, such as reports for national managers and policy makers in West African countries, posters with images, maps, and text in French and English, and presentations to key players at appropriate international meetings.
**Theme 2 – Organizing Data and Regional GIS Data Access**

Two activities are included in this theme.

*Activity#1: Threats Analysis Framework for Biodiversity Impacts*

This continuing activity supports the Global Integrated Trends Analysis Network (GITAN), a network, developed by the USGS and in support of GEOSS, of governments and non-governmental organizations that are compiling comprehensive and spatially referenced information on landscape change and biodiversity around the world. This activity will use remotely sensed information as well as data from field surveys for Senegal, a GITAN pilot-study country. It includes compiling the following core geographic datasets for Senegal: land cover and land cover trends, vegetation, and soils; providing these datasets via internet technologies to the public; establishing permanent monitoring sites in biologically diverse areas, and establishing buffer zones for assessing human and climate pressures. Outcomes of this activity include:

- Establishment of an integrated database of biodiversity information (including source data, imagery, derived classification, associated elevation data, and time series of coarse resolution imagery) for Senegal to be made available to the public via the internet through an Internet Map Server at USGS and the regional West African remote sensing center, AGRHYMET, located in Niamey, Niger;
- Improved capacity of organizations in Senegal, such as the Centre de Suivi Ecologique (CSE), to contribute to the nation’s biodiversity and climate change treaties; and
- Permanent geo-referenced plots with biodiversity information in selected sites to be studied by counterparts in Senegal.

*Activity#2: Remote Sensing for Sustainable Development in Africa*

This activity collaborates with regional centers in Africa to enhance their ability to use remote sensing applications for societal benefit. USGS, NASA, NOAA, FEWS-NET, and other relevant organizations assess the needs in Africa for building a “SERVIR-Africa.” SERVIR is a regional monitoring and visualization system for Meso-America, managed in Panama and initiated with USGS support for SDI and satellite imagery to monitor and forecast ecological changes, respond to disasters such as forest fires, tropical storms, floods, drought, and volcanic eruptions. The system has four distinct functions, serving as a portal for satellite and vector data, an online mapping tool, decision support for GEOSS (which addresses nine societal benefit areas: biodiversity, ecosystems, agriculture, water, disasters, health, energy, weather, and climate), and a three-dimensional visualization tool. This activity identifies current needs and capabilities of existing remote sensing centers in west, east, and southern Africa, evaluates an expansion of system functionality to Africa, and proposes a sustainable implementation plan.

The primary outcome from this activity is a needs assessment that outlines the steps for implementation of a SERVIR-Africa, building upon the existing capacity of remote sensing centers in Africa. A completed, detailed plan was presented to USAID by March 15, 2007, and includes the following:

- Priority needs for remote sensing applications integrated into SERVIR-Africa;
- Agreed upon roles & responsibilities for each cooperating/contributing organization;
- Coordination plan with FEWS-NET;
- Options for receipt and delivery of remotely sensed data, processing it into useable products, and dissemination to constituents;
- Infrastructure requirements;
- Implementation plan, including timeline and cost estimates;
Theme 3 - Networking Among Regional Data Users for Capacity Building

Activity: MyCOE Biodiversity Project: Geographic Learning for Sustainable Development
This activity contributes to three important regional initiatives:
1) SERVIR, the Meso-American Monitoring and Visualization System;
2) MACGA, the Meso-American & Caribbean Geospatial Alliance; and
3) GCR-Gulf States Initiative, a public/private partnership working in the disaster-prone US Gulf of Mexico States and Greater Caribbean Region (GCR), supported by USDA, USGS, USAID, universities, the Association of American Geographers (AAG), and ESRI (GIS company).

The Greater Caribbean Region is rich in biodiversity and natural resources, but many biologically diverse areas are under threat. To improve management of natural resources and biodiversity, for both environmental and economic reasons, decision-makers need better information. Geospatial information technologies such as remote sensing, GIS, and GPS can help managers of these areas make better informed decisions. However, policy makers and their institutions often lack expertise in and access to geospatial data analysis. This activity will build long-term local capacity to use geospatial technologies for monitoring and managing biodiversity in the GCR. MyCOE (My Community, Our Earth) will form a biodiversity program to link university students with in-country organizations that need geospatial data. Students will be competitively selected, will use geospatial applications to address biodiversity issues, and will learn to use the SERVIR system at the training facility based in Panama. Candidate projects will be selected from ten target GCR countries: Colombia, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, and Panama.

All selected projects will address local areas with biological significance, respond to threats to local biodiversity, use geospatial technologies, include a committed local POC to participate in capacity building activities, and obtain USAID input and approval to ensure alignment with USAID-supported biodiversity conservation activities in the region.

Phase I: Recruitment  
Phase II: Capacity Building  
Phase III: Biodiversity Project Work  
All Phases: Community of Practice Networking and Dissemination

Expected outcomes include:
• Building long-term capacity in the GCR countries to use geospatial technologies for biodiversity goals,
• A community of practice with future leaders in biodiversity issues and practitioners that use GIS,
• Communication between students in different countries around geographic learning for sustainable development,
• Incorporation of local biodiversity data into broader regional efforts, and contributions to USAID biodiversity programs in the region, and
• Tangible deliverables include capacity building materials, a training workshop, a set of student projects, a functioning e-community, and dissemination materials.

Theme 4 – Sustainable Tree Crop Management, Monitoring, and Certification
Activities under this theme were completed in earlier implementations of EMIS and are not repeated in this summary.

**Theme 5 - Soil Carbon Sequestration**

*Activity: Trends in Land Cover, Carbon, and Biodiversity*
This continuing activity from the original PAPA and in the four West African countries of Senegal, Mauritania, Gambia, and Guinea Bissau complements and validates land cover change analyses, supported by USAID/WA, that quantify above-ground biomass through remote sensing techniques. This activity includes on-the-ground evaluation of study sites for species composition, geo-referencing the study sites, and reconciliation of the ground data to remotely-sensed land classifications. This activity also quantifies carbon stocks in the vegetation and soils of select countries, showing how these stocks have changed over time from land conversion, climate, and human pressure. Through biogeochemical modeling and spatial analysis, it determines the potential for sequestering carbon in the landscape from improved soil and water management practices. Analyses of “hot spot” areas will be compared to generalized national trends in carbon stock changes.

Outcomes from this activity include:
- Analyses of land cover change, evaluations of biodiversity and protected areas, and historical trends in carbon stocks;
- Briefing materials that explain impacts of land management practices and climate change on carbon and agricultural sustainability, for each country;
- Distribution of 30m SRTM derived products to each country, to support wall-to-wall land cover mapping by FAO’s Global Land Cover Network (GLCN), in Senegal and Ghana;
- SEMSOC (Spatially Explicit Modeling of Soil Organic Carbon) as a development of SOCSOM and SOCSAB, and
- Completion of publications on Carbon Sequestration in Ghana.