IES Prototype EnviroSecurity Assessments Project
Promoting Environmental Security and
Poverty Alleviation in Three Case Study Areas

Overview of International Mapping and Monitoring Initiatives

October 2005

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1. Introduction

While the current IES Prototype EnviroSecurity Assessments are limited to focusing on only three eco-regions[1] the approach taken by the Institute to eco-regional assessments, mapping and monitoring stands out by virtue of our use of the combination of satellite and aerial remote sensing involving the regular updating of land use/cover data, the most up-to-date socio-economic spatial data, information on applicable legal instruments and jurisdictional boundaries and 'ground truthing' by local organisations.

We also make the information (observations, analysis, forecasting of trends and recommendations) available in the form of case study background reports, legal analyses, eco-region atlases (maps) and an interactive GIS interface on the internet that does not require special GIS software or high speed internet connections allowing the user to view various combinations of data and indicators for different time periods.

By comparison, for example, the IMaps available on-line from the UNEP – World Conservation Monitoring Centre (WCMC) are designed to allow users to create customised maps for specific regions, incorporating information on environmental sensititives such as protected areas, breeding areas, species and background information but the WCMC does not fully integrate socio-economic and legal spatial data, does not regularly update the land use/cover data available from satellites and does not indicate the date of information shown or allow the user to select different time frames in order to discern trends.

Although there are many ad-hoc mapping (one time assessment) initiatives, initiatives that pursue systematic monitoring and regularly update their information are still very scarce. Very valuable mapping projects can take a long time to be implemented. They can provide an important picture of a certain area at a certain point in time but they cannot provide information on rapid and dramatic changes occurring over a large geographical area and impacting on an eco-region in unprecedented way. [2]

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[1] The IES Prototype EnviroSecurity Assessments issued in 2005 focus on Kalimantan in Indonesia, Virunga-Bwindi in the the Great Lakes region of Africa and the Matavén area in the Colombian Guiana Shield region.

[2] Another example of the limitations of otherwise excellent mapping (as opposed to monitoring) initiatives can be seen with regard to the EU Joint Research Centre's Global Vegetation Monitoring unit (a mapping initiative).
Similarly to the WCMC (World Conservation Monitoring Centre) their name suggests they systematically monitor on a regular basis. However, they have made an excellent _baseline assessment_: a global vegetation map for 2000 only using SPOT Vegetation data. In that project more than 30 research teams comprised of local experts have been involved, contributing to 19 regional area studies.
The resulting 'GLC2000 land cover map/database' has been chosen as a core dataset for the Millennium Ecosystems Assessment. This means in particular that the GLC2000 dataset is a main input dataset to define the boundaries between ecosystems such as forest, grassland, and cultivated systems.
SarVision uses exactly this satellite data and experience as a basis to (where possible) refine the classifications and, most importantly, update the information on a regular basis (every 3 monthly or yearly).

2. Definitions

Unfortunately, definitions of monitoring are not consistent, and this has often resulted in semantic confusion. First, a clear distinction must be made between (baseline) assessment and systematic monitoring.

The term "*monitor*" is defined as to watch or check. Although it is not an explicit part of the definition, the term monitoring suggests a series of observations over time. This repetition of measurements over time for the purpose of detecting change and trends distinguishes monitoring from assessment or inventory (Harper et al., 2005) [3]. Monitoring data are most accurate and useful when the same methods are used consistently to collect data over the same locations over a long time period. (Yarnell and Gayton, 2003) [4]

Assessment (or mapping in case of spatial information, such as here) is useful for gaining an overview of the situation at a specific, marked point in time, but is inherently static.
Within the context of the IES Horizon 21 programme the purpose of both mapping (baseline assessment) and monitoring is to provide accurate real-time support for early warning, awareness raising and informed decision making. Rapidly accessible, spatially explicit information should allow policy makers, managers, and civil society to evaluate, and assess in near real time, the condition and status of threats to the world's ecosystems.
Monitoring data on ecosystems and threats can be collected using two approaches that will often complement each other:
- ground measurements or observations
- remote earth observations (by satellite or aircraft providing an overview of large geographic areas)

So, whereas the GLC2000 is static (it is a snapshot, not updated), the IES and SarVision need - in collaboration with local partners - to regularly update this information in order to keep a finger on the pulse of the world's ecosystems.

In Indonesia, SarVision found that the GLC2000 map was already outdated when it was released in 2003 (it took 3 years to develop the map). Mapping is not monitoring - as unprecedented changes occur very rapidly and over large geographic areas.

[3] Harper, J., M. George, and K. Tate, 2005. Types of Monitoring. University of California Fact Sheet no. 15 URL: http://danr.ucop.edu/uccelr/h15.htm

[4] Yarnell, P., and D. V. Gayton, 2003. Community-based ecosystem monitoring in British Columbia: a survey and recommendations for extension. FORREX–Forest Research Extension Partnership Series 13. URL : www.forrex.org/publications/forrexseries/fs13.pdf

The initiatives listed in this paper by no means represent an exhaustive overview of initiatives,[5] but rather provide some useful or illustrative examples. Important aspects taken into consideration include:

- Is the initiative about mapping (one-time assessment) or systematic monitoring?
- Is the monitoring initiative (currently) capable of providing users timely spatial information on a regular basis?
- What attribute (environmental security issue) is mapped or monitored?
- Is earth observation employed or ground measurements and observations?
- What is the spatial extent of monitoring (for example Colombia, South America, Global)?
- How often is information updated?
- Is (spatial) information made available (through the Internet) to policy makers, managers, or civil society?

3. Selected Initiatives by Focus

3.1 Marine Environment

POSEIDON

There are many examples of scientific or governmental (research) institutions that monitor specific marine systems around the globe using ground (sea) measurements. One such example is the operational POSEIDON monitoring and forecasting system in the Aegean Sea by the National Centre for Marine Research, Athens, Greece. The POSEIDON system, based on a network of 11 oceanographic buoys and a system of atmospheric/oceanic models, provides real-time observations and forecasts of the marine environmental conditions in the Aegean Sea. The buoy network collects meteorological, sea state and upper-ocean physical and biochemical data.

3.2 Forest cover and change

Resource Extraction Monitoring (REM) – Central Africa
http://www.rem.org.uk/

Resource Extraction Monitoring is a UK-based organisation specialised in the independent observation of natural resources extraction and its control by government services, for instance in Cameroon, Republic of Congo and Democratic Republic of Congo. Founded in 2003 REM seeks to bridge the gaps between governments, environmental and human rights NGOs and local communities, donors and the private sector by providing objective and timely information on natural resource allocation and use. REM operates as an independent observer via in-country partnerships with the recipient government, an active and engaged range of donor organisations and the local population. It operates in the field to identify and investigate cases of illegal activity and follow their progress through administrative and judicial systems.

[5] These and additional mapping and monitoring organisations and activities will be included in the forthcoming **EnviroSecurity Action Guide**, an inter-relational searchable data base to be available on the IES website in late 2005 / early 2006.

This initiative is fully based on ground measurements, visiting forest areas using GPS and topographic maps. However: the organisation indicated the systematic satellite monitoring approach proposed by IES and partners (see below) could help them target their field trips better, and, to derive spatial information on (illegal) logging impact and forest condition in areas that are simply too dangerous to visit on the ground (such as the forests in the Republic of Congo where rebel forces are active and logging profits may likely be used to finance local conflicts).

BOS-MAWAS / SarVision – Central Kalimantan
http://www.sarvision.nl/main.php?sn=projects/proj_nav.php?id=13&ct=projects/mawas/mawas_monitoring.php

IES partner SarVision and the Indonesian conservation organisation, BOS Foundation, have developed a systematic high resolution (details 20 m) radar satellite monitoring approach. Changes (illegal logging, fires) detected every 35 days by radar satellites of the European Space Agency (that can see through clouds and smoke) are inspected by local law enforcement teams using cheap ultra-light aircraft over-flight in close collaboration with local police. Within the first few days of testing the system, input to enforcement teams resulted in catching logging teams that operated illegally inside the Mawas reserve, home to one of the last viable populations of the endangered orangutan. As a consequence the vulnerable peat swamp forest area is now practically free of illegal logging activities, with the main criminals having been arrested and prosecuted. Monitoring results are published on the Internet every month since 2003.

INPE - Brazilian Amazon
http://www.obt.inpe.br/deter/

Brazil's INPE has developed a near or almost real time monitoring application for deforestation detection known as the Real Time Deforestation Monitoring System (DETER) system. Satellite images allow scientists and policy makers to more quickly and accurately assess deforestation in the Amazon. Based on medium resolution MODIS and CBERS satellite data (250-500 m detail) forest changes and trends can be assessed every two weeks.

UNODC - Colombia, Peru, Myanmar, etc.
http://www.unodc.org/colombia/es/simci_project.html

The objectives of UNODC's Illicit Crop Monitoring Programme (ICMP) are to establish methodologies for data collection and analysis, to increase governments' capacity to monitor illicit crops and to assist the international community in monitoring the extent and evolution of illicit crops in the context of the elimination strategy adopted by the Member States at the General Assembly Special Session on Drugs in June 1998. The information provided by yearly monitoring efforts helps guide policy interventions and constitutes an invaluable tool for planning activities to tackle the illicit crops (Colombia, Peru, Bolivia, Afghanistan, Myanmar, Laos and Morocco).

Country-wide annual monitoring of the spatial distribution of coca plantations, fumigation areas and trends in changes is carried out using remote sensing technology ensuring a high level of reliability and transparency. Detailed high quality maps are published in documented reports yearly.

These last three initiatives are the only examples known to the authors of currently operational systematic monitoring initiatives providing continuous, timely, accurate spatial information on tropical forest status or threats (illegal logging, illicit crop plantation development) that is updated on a regular basis (every few days to yearly), so that it is possible to examine trends.

3.3 Arctic ecosystem and threats

Arctic- AMAP
http://www.amap.no/

A programme group of the Arctic Council, AMAP's current objective is "providing reliable and sufficient information on the status of, and threats to, the Arctic environment, and providing scientific advice on actions to be taken in order to support Arctic governments in their efforts to take remedial and preventive actions relating to contaminants".

This initiative develops comprehensive baseline assessments. Spatial information seems mainly derived from ground measurements and data collection. No up to date, systematic monitoring information is (yet) being made available on a regular basis.

3.4 Glaciers

OMEGA

Glacier monitoring is becoming increasingly important due to global climate change and its effects on glaciers. The mission of the (experimental) OMEGA project is to develop an operational monitoring system for glaciers using all the potential earth observation data of the past, present and future. Digital elevation models will be generated, glacier changes will be studied and visualised, and the results will be implemented as glacier databases and an operational monitoring system.

It remains unclear whether the (governmental) user organisations listed will adopt the system and ensure continued operation on a day to day basis.

3.5 Fire

Global: Web Fire Mapper NASA and University of Maryland
http://maps.geog.umd.edu/default.asp

Web Fire Mapper displays active fires detected by the MODIS Rapid Response System, a collaboration between the NASA Goddard Space Flight Centre and the University of Maryland in the USA. Fire information on any area on the globe is

processed and the end products (fire locations) are published on the internet on a daily basis. For selected regions and countries one can view an interactive map showing active fires for a specified time period, combined with a choice of GIS layers and satellite imagery. Users can also download all the data to do further analyses. The full database including all fire hotspots detected since 2001 is available.
Conservation International and the University of Maryland have set up an early warning email system to notify partners when there is a fire in or near a specified protected area.

This initiative is an excellent example of a systematic monitoring initiative providing continuous, timely, accurate spatial information that is updated on a regular basis (daily!).

Australia: Sentinel Fire Mapping
http://www.sentinel.csiro.au/index.html

An example from Australia, Sentinel Fire Mapping is an online mapping tool designed to provide timely (daily) fire location data to emergency service managers across Australia. The mapping system allows users to identify fire locations that pose a potential risk to communities and property. The information can be accessed on the Sentinel Fire Mapping website, an internet-based mapping tool that can be accessed using a standard web browser.

The initiative was started at the suggestion of the Australian Defence Force after disastrous fires in 2001. It is the result of collaboration between the Defence Imagery and Geospatial Organisation (DIGO), CSIRO Land and Water and Australian Geosciences to design and build a system that will help protect Australians during bushfires.

Sentinel Fire currently obtains data from the NASA Earth Observation Satellite Terra. Plans are well advanced to include data from other satellites in the near future.

This initiative is another excellent example of a truly systematic monitoring initiative providing continuous, timely, accurate spatial information that is updated on a regular basis (daily).

3.6 Biodiversity

Global: World Conservation Monitoring Centre (WCMC)
http://www.unep-wcmc.org/

The UNEP World Conservation Monitoring Centre provides information for policy and action to conserve the living world. Programmes concentrate on species, forests, protected areas, marine, mountains and freshwaters; plus habitats affected by climate change such as polar regions. WCMC also address the relationship between trade and the environment and the wider aspects of biodiversity assessment.

UNEP-WCMC, in partnership with the public and private sector, has commenced work on Project Proteus to develop a knowledge management system that will enable

easy access to wide-ranging information and analytical services about the environment and the living world.
The centre's Interactive Map Service (IMapS) has been designed to allow users to create interactive conservation maps online to meet their individual information requirements. IMapS can be created for specific regions, incorporating information on environmental sensitivites such as protected areas, breeding areas, species and background information. IMapS can be created for specific regions, incorporating information on environmental sensitivites such as protected areas, breeding areas, species and background information.

Examples of currently online IMapS applications include:

Marine
Black Sea - http://ipieca.unep-wcmc.org/imaps/ipieca/blacksea/
Caribbean - http://ipieca.unep-wcmc.org/imaps/ipieca/caribbean/
Caspian Sea - http://ipieca.unep-wcmc.org/imaps/ipieca/caspian/
Mediterranean - http://ipieca.unep-wcmc.org/imaps/ipieca/mediterranean/
Earthdive - http://www.earthdive.com/front_end/home/default.asp

Socio-economic
Donor information sharing - http://nene.unep-wcmc.org/imaps/DFIDProjects
Tsunami - http://tsunami.unep-wcmc.org/imaps/tsunami

Biodiversity
World Atlas of Biodiversity - http://stort.unep-wcmc.org/imaps/gb2002/book/
World Atlas of Seagrasses - http://stort.unep-wcmc.org/imaps/marine/seagrass
Great Apes - http://stort.unep-wcmc.org/imaps/grasp/
Marine turtles - http://stort.unep-wcmc.org/imaps/indturtles/
Migration routes and breeding areas - http://stort.unep-wcmc.org/imaps/AEWA/
Mangroves review - http://stort.unep-wcmc.org/imaps/marine/mangroves

The initiative provides an enormous wealth of spatial data and excellent (baseline) assessment material. It remains unclear however whether this information will be updated regularly to reflect the current condition of biodiversity. Despite what its name suggests the WCMC is not a systematic monitoring initiative according to the definitions stated in the introduction to this annex.

Africa/Global: BCTF IMAP
http://www.bushmeat.org/IMAP/welcome.htm

The Bushmeat Information Management and Analysis Project (Bushmeat IMAP) is an initiative developed by the Bushmeat Crisis Task Force (BCTF) comprised of several environmental NGOs to create a central repository of information on the causes and solutions of bushmeat hunting and trade in Africa and around the world, with a particular focus on Central Africa. BCTF and the Global Forest Watch (GFW) program of World Resources Institute (WRI) have a formal partnership to develop this project.

The IMAP is a multi-year initiative developed in response to an expressed need for a *geographic* view of the bushmeat crisis. The project makes existing BCTF databases available online and geo-referenced by country or coordinate, assembles bushmeat-relevant datasets from around the world, and gathers recent data on wildlife and human impacts in the Congo Basin, where the opportunity to change the course of the crisis is greatest.

This initiative provides an interesting source of spatial (baseline) assessment information. However, Unfortunately, not all information is up to date (e.g. vegetation and forest concession areas), whereas information is not updated routinely.

3.7 Food Security

USAID-USGS FEWS Net
http://www.fews.net/

From the Famine Early Warning Systems Network some of the monitoring data (vegetation greenness, rainfall) are available for download at the Africa Data Dissemination Service website:
http://igskmncnwb015.cr.usgs.gov/adds/datatheme.php

FAO GIEWS
http://www.fao.org/giews/english/index.htm
This is the Global Information and Early Warning System on Food and Agriculture (GIEWS).

FAO – ARTEMIS and AGROMET Data and Information
http://metart.fao.org/default.htm

Low resolution satellite imagery, meteorological data and derived products and information used for environmental monitoring, crop forecasting, early warning, desert locust control and others are made available from the ARTEMIS and Agrometeorology Groups, FAO Environment and Natural Resources Service (SDRN). Up to date climatic data are online from a large number of field stations throughout the world. The FAO ARTEMIS system has a direct reception capability for digital transmissions from the METEOSAT weather satellite which allows ARTEMIS to receive images directly from this satellite.

Apart from those developed for fire monitoring, the bulk of systematic monitoring initiatives operational today appears to be related to the issue of agriculture and food security. All initiatives listed above provide a good example of systematic monitoring providing continuous, timely, accurate spatial information that is updated on a regular basis (monthly) and made available to users through the internet. These monitoring systems have specifically been designed for early warning and are fully operational. Besides, many statistical and other reports are published regularly on the respective websites.

3.8 Agriculture

Global: USDA FAS Crop Explorer
USDA's graphic display of agro-meteorological indicators
http://www.pecad.fas.usda.gov/cropexplorer/

NASA and the USDA Foreign Agricultural Service (FAS) jointly funded a new program to assimilate NASA's MODIS satellite data and products into an existing decision support system operated by the Production Estimates and Crop Assessment Division (PECAD) of FAS.

FAS promotes the security and stability of U.S. food supply, improves foreign market access for U.S. agricultural products, reports on world food security, and advises the U.S. government on international food aid requirements. FAS bears the primary responsibility for USDA's overseas activities: market development, international trade agreements and negotiations, and the collection and analysis of statistics and market information. It also administers USDA's export credit guarantee and food aid programs, and helps increase income and food availability in developing nations by mobilizing expertise for agriculturally led economic growth. The FAS, through PECAD, provides agricultural information for global food security. It produces objective, timely and regular assessments of global agricultural production outlook and the conditions affecting food security. PECAD is responsible for global crop condition assessments and estimates of production and yield of grains, oilseeds, and cotton. PECAD assessments are an integral component of the monthly crop assessments issued by USDA's World Agricultural Outlook Board - a primary source for agricultural information worldwide.

To meet its objectives, FAS/PECAD uses satellite data and data products to monitor agriculture worldwide and to locate and keep track of natural disasters such as short and long term droughts, floods and persistent snow cover which impair agricultural productivity. FAS is the largest user of satellite imagery in the non-military sector of the U.S. government and is upgrading and enhancing the satellite component of its PECAD decision support system through an information delivery system for MODIS satellite data and derived products. Integration of MODIS data and derived products into the PECAD FAS DSS provides FAS with better characterization of land surface conditions at the regional scale and enables monitoring of changes in the key agricultural areas of FAS focus regions in a more timely fashion and at a higher resolution than previously possible.

The time-series data results are accessible through a powerful web interface and analysis tool.

This initiative provides another good example of systematic monitoring providing continuous, timely, accurate spatial information that is updated on a regular basis (monthly) and made available to users through the internet. This monitoring system has specifically been designed for early warning and is fully operational. Besides, many statistical and other reports are published regularly on the PECAD websites.

3.9 Drought

Drought is strongly related to and to some extent already integrated in the systematic agriculture and food security monitoring initiatives listed in the above.

USA: US National Drought Mitigation Center
http://www.drought.unl.edu/dm/monitor.html

The National Drought Mitigation Center of the University of Nebraska-Lincoln helps people and institutions develop and implement measures to reduce societal vulnerability to drought. Drought Monitor is a synthesis of multiple indices, outlooks and news accounts, that represent a consensus of federal and academic scientists. New monitoring results in the form of maps are published on a weekly basis through the Internet.

3.10 Desease

Africa: ESA Epidemio Project
http://www.epidemio.info/index.php?section=projectdescription&kat=objectives

Improved up-to date spatial information of the environment in which infectious diseases occur will help epidemiologists to study, understand and predict threats to human health.

Within the scope of the Project "Epidemio", satellites will join this field as data source of epidemics. Satellites open up new opportunities to predict and help combat epidemic outbreaks, as well as joining the hunt for the origin of pathogens. The scope of this experimental project is to test and demonstrate the potential of Earth Observation for a new service which supplies new and improved types of information.

A group of dedicated users (epidemiologists) has provided the information requirements for their work to be supplied by the project. These include: urban maps, digital elevation maps, maps of water bodies, vegetation maps, land cover maps, historical maps, land surface temperature maps and a service for monitoring wind-blown Sahelian dust.

This initiative is currently mainly a research project, but all spatial data is available for download and excellent for (baseline) assessment. This is not a systematic monitoring initiative however.

Global: WHO Epidemic and Pandemic Alert and Response Unit
http://www.who.int/csr/en/

WHO EPR is working towards global health security in today's world. The WHO EPR believes that every country should be able to detect, verify rapidly and respond appropriately to epidemic-prone and emerging disease threats when they arise to minimize their impact on the health and economy of the world's population.

The Global Atlas of Infectious Diseases (http://www.who.int/globalatlas/) presents ready-made and interactive maps for different diseases at global, country, district and even community level.

Over the next year, the system aims to provide a single point of access to data, reports and documents on the major diseases of poverty including malaria, HIV/AIDS, tuberculosis, the diseases on their way towards eradication and elimination (such as guinea worm, leprosy, lymphatic filariasis) and epidemic prone and emerging infections for example meningitis, cholera, yellow fever and anti-infective drug resistance.

The database will be updated on an ongoing basis and in addition to epidemiological information, the system aims to provide information on essential support services such as the network of communicable diseases collaborating centres, the activities of the Global Outbreak Alert and Response Network among others.

Although some of the information is not up to date (e.g. until 2001), this initiative presents an interesting source of spatial (baseline) assessment information. There are prospects for systematic monitoring (likely using ground based methods for information retrieval on local statistics documents).

3.11 Natural Disaster – Earthquakes, Tsunamis, Flooding, etc.

Global: UNEP DEWA
http://www.grid.unep.ch/activities/earlywarning/preview/

"Most of the world has undergone fundamental demographic and environmental change that is projected to intensify in the twenty-first century. As the natural limits of the planet's life support systems are reached, human society will become increasingly vulnerable to environmental changes. It is therefore imperative that recent technological advances and tools be harnessed in reducing societal vulnerability. Improvement must, in part, come from constant and timely delivery of targeted early warning information obtained through scientifically credible vulnerability assessments and other monitoring methods within the framework of the broader environmental observation and assessment process."

As called for in the UN Task Force on Environment and Human Settlements Report to the Secretary General (June 1998) early warning addresses the need to "monitor and assess existing and emerging environmental problems, alert policy makers and the world public to them (and) coordinate measures and action to tackle these problems and their causes, thereby reducing future risks." Within this context, UNEP/DEWA has based its early warning activities on the "guiding principles" that these be scientifically credible; policy relevant; and done through strategic alliances and international cooperation. Early warning of environmental threats is perceived from three different temporal and "thematic" perspectives:

- Near-term perspectives: Operational warnings normally associated with disasters such as floods, wild fires, volcanic eruptions, earthquakes, conflict, etc.

- Longer-term perspectives: Raising awareness about emerging environmental issues such as impact of climate change, endocrine disruptors (that is, acknowledging that unexpected new issues are inherently unpredictable).
- New ways of looking at contemporary environmental issues: Viewing environmental issues in a more holistic and integrated manner by establishing the connections (land-air-water-biodiversity) that amplify environmental problems.

UNEP Web interface for spatial data
http://www.grid.unep.ch/activities/earlywarning/preview/

The PreView - IMS project aims to identify risk and human vulnerability to natural hazards in relation with socio-economic and physical factors.

This tool allows the visualisation of data on natural disasters. Users may perform zooms, pan to a particular area, add different layers of general data including cities, national parks, etc... Different backgrounds can be chosen to highlight different components reflecting vulnerability, such as population density, Human Development Index (HDI) or the Gross Domestic Product (GDP). Layers of natural disasters can be added including droughts, earthquakes, fires, floods, cyclones and tsunamis.

This initiative provides highly useful baseline assessment information, but appears static. No truly systematic monitoring program seems to be set up to keep track of ongoing developments and update the system on a regular basis. The system is not (yet) proactive; disasters are mapped after they have occurred and then added to the database, which is updated slowly (no results for 2005 available yet).

Global: Reliefweb
http://www.reliefweb.int/rw/dbc.nsf/doc100?OpenForm

ReliefWeb is the global hub for time-critical humanitarian information on Complex Emergencies and Natural Disasters.

It publishes damage and situation assessment maps after disasters have taken place, many based on satellite mapping (not monitoring).
An illustrative example of proactive monitoring for early warning to natural disasters is provided below:

Pacific - Tsunami Warning System (TWS) in the Pacific
http://www.geophys.washington.edu/tsunami/general/warning/warning.html

As part of an international cooperative effort to save lives and protect property, the Tsunami Warning System (TWS) in the Pacific has been set up in 1965. It is comprised of 26 participating international Member States, has the functions of monitoring seismological and tidal stations throughout the Pacific Basin to evaluate potentially tsunamigenic earthquakes and disseminating tsunami warning information. The Pacific Tsunami Warning Center (PTWC) is the operational center of the Pacific

TWS. Located near Honolulu, Hawaii, PTWC provides tsunami warning information to national authorities in the Pacific Basin.

Earthquake information is provided by seismic ground stations, while tsunami significance is detected by sea-level monitoring instrumentation. Sea-level (or tidal) information is provided by NOAA's National Ocean Service, and university monitoring networks.

This operational initiative is based on ground (sea) measurements (earth observation data for early warning is probably not useful within this context). (Spatial) information on this issue after disasters have occurred is probably more relevant to IES.

3.12 Atmosphere

Global: NASA
http://toms.gsfc.nasa.gov/aerosols/aerosols_v8.html

Real-time information on current cloud cover and aerosol conditions (air pollution from dust/smoke, ash and haze resulting from forest fires for instance) can be accessed on a daily basis at the website of NASA's TOMS group. The aerosol conditions are measured by satellite using NASA's Earth Probe TOMS instrument, processed and published on the internet.

The British Atmospheric Data Centre (BADC; http://tornado.badc.rl.ac.uk/data/) also has daily TOMS data available for downloading. This site mirrors some of the content of the TOMS websites and may be a better choice for European users.

This initiative provides continuous, timely spatial information that is updated on a regular basis (daily to monthly).

Global: DLR World Data Centres

The German space agency (DLR) has established a cluster of 'World Data Centres' for Earth System Research, actively pursuing a strategy, using information technology, to make data related to Earth Systems available to as wide and as interdisciplinary audience as possible.

The first group (WDC-RSAT) does focus on providing sensor data and analysis products of the atmosphere (atmospheric trace gases, clouds, and the earth´s surface) which are primarily gathered from satellite based sensors. In support of its data provision activities WDC-RSAT utilizes decentralized on-line robot-driven technology with a storage capacity of more than 300 Tbytes, as well as electronic interfaces (EOWeb, interoperable catalogues, interactive post-processing and satellite data processing on demand).

WDC-RSAT grew out of the Atmos Users Center (AUC) of the German Remote Sensing Data Center which was established to provide the European atmospheric

satellite data user community with direct and easy access to measurements and derived data products from a wide range of sensors.

A second group (WDC-Climate (WDCC)) is maintained by the Model and Data (M&D) group hosted at the Max-Planck-Institute for Meteorology and is realized in cooperation with the German Climate Computing Center (DKRZ). WDCC aims at collecting, scrutinizing, and disseminating data related to climate change on all time scales. Emphasis is on data products from climate modeling and related observational data.

The third group is WDC for Marine Environmental Sciences (WDC-MARE) maintained by the Center for Marine Environmental Sciences (MARUM) at Bremen University and Institute for Polar and Marine Research of the Foundation Alfred Wegener (AWI). It is aimed at collecting, scrutinizing, and disseminating data related to global change in the fields of environmental oceanography, marine geology, paleoceanography, and marine biology.

Data at the WDC/RSAT are available to scientists of all countries. Data which is not available via direct download will be provided for a charge covering the cost of reproduction and distribution.

4. Selected Initiatives by Organisation

Food and Agriculture Organization of the UN (FAO)
Helping to build a world without hunger
http://www.fao.org/sd/eidirect/EIre0005.htm

Aim and Objectives

Structure: FAO/Sustainable Development Department/Resarch and Technology Division/ Environment and Natural Resources Services

The overall mission of the Environment and Natural Resources Service of FAO, comprising Remote Sensing, Agro meteorology, GIS, Energy and the follow-up to UNCED, is to contribute to and promote environmental and natural resources management and conservation in the context of sustainable agriculture, including forestry and fisheries, rural development and food security.

The Service provides technical support, including advisory services, formulation, backstopping and evaluation, to field projects and Headquarters programmes, including some 5O countries in Africa, Asia and Latin America and the Caribbean and Central and Eastern Europe. In addition, FAO provides support to the International Fund for Agricultural Development (IFAD) and the World Food Programme (WFP) for their field project activities as well as to the World Bank concerning guidelines on harmonization and standardization.

Special emphasis is on services to developing countries, with activities in capacity building and decision-makers awareness. Current activities are, broadly, the following:

- to assess Member Nations' needs in the field of information on natural resources, agriculture, forestry and fisheries for sustainable development and the protection of the environment, following up on the recommendations of UNCED;
- to keep abreast of the state-of-the-art and all developments and applications of space technologies, computer systems and databases, GIS software, crop forecasting methodologies and modeling activities;
- to develop methods and standards for testing in pilot projects;
- to provide guidelines in training and advice for the use of these tools and to prepare technical specifications for projects, in close cooperation with other FAO technical divisions and member nations' institutions;
- to maintain central facilities and databases and to produce for FAO Headquarters Services and member nations, global information on environmental conditions and crop conditions;
- to formulate and implement large regional projects and provide technical backstopping;
- to act, on behalf of ICSU, UNESCO, UNEP and WMO, as the Secretariat for the establishment of the Global Terrestrial Observing System (GTOS), in close coordination and cooperation with GCOS and GOOS;
- to liaise with other UN agencies and relevant national and international bodies (CEOS, ESA, NASA, a.o).

Three Projects of FAO Environment and Natural Resources Service
Subject area: Geoinformation, monitoring and assessment
http://www.fao.org/sd/en3_en.htm

AFRICOVER
http://www.fao.org/sd/eidirect/eire0053.htm (Updated June 1998)

The FAO objective is to assist the preparation (technical, institutional and financial arrangement) and the technical monitoring of AFRICOVER. Beyond this technical assistance function, FAO offers to act as a normalisation and labeling agency for AFRICOVER: this role will consist in defining in detail, in the framework of international working groups, the standards to be applied in all African countries in terms of information, tools, analysis methods and procedures. This standardisation will greatly integrate the national and sub-regional specificities: it is absolutely necessary, from a technical point of view, to allow a homogenisation and a better distribution of final products (databases, maps), as well as important scale savings for production, update and use of georeferenced data on resources. FAO will guarantee that these standards are respected and will deliver an AFRICOVER label. FAO in some cases (as in the Eastern Africa module) is involved as execution (or co-execution) agency for the project, on request of countries and sub-regions. The timing is estimated between 0.5 and 2 years depending on the country.

AFRICOVER's objective: For several years, FAO has been involved in the organisation of a project called AFRICOVER, whose goal is to establish, by and for the whole of Africa, a digital geo-referenced database on land cover and a geographic referential (geodesy, toponymy, roads, hydrography) at a 1:250,000/1:200,000 scale (1:100,000 for small countries and specific areas).

A further objective of AFRICOVER is to reinforce and to build up the national and sub-regional capacities for the establishment, update and operational use of the geographic referential and land cover maps and geodatabases.

This project has been prepared in response to a number of national requests for assistance to the implementation of reliable and geo-referenced information on natural resources (e.g. early warning, forest and rangeland monitoring, planning, catchment management, production of statistics, biodiversity or climate change) at sub-national, national and regional levels.

Hence, the purpose of AFRICOVER is to prepare the basic geographic information common to the information components of actual and future programmes on natural resources in African countries.

From a technical point of view, the preparation of AFRICOVER products relies essentially on remote sensing data and Geographic Information Systems (GIS). The land cover will be mainly derived from visual interpretation of recent high resolution satellite images digitally enhanced. It will be done according to a homogenised and hierarchical classification system (FAO Land Cover Classification System) which conception was done by an international working group and which was finalized in a joint effort between several FAO services (SDRN/AGLS). The Eastern -African sub-region has just started the execution of the project , due to a financing of 5.4M$ US provided by the Italian government.

Regional Environmental Information Management Project for Central Africa (REIMP)
http://www.fao.org/sd/eidirect/EIre0005.htm (Updated November 1997)

Objectives
In close cooperation with the World Bank and GEF, another regional AFRICOVER project for Central Africa is in preparation. A joint project formulation mission has been undertaken in Yaoundé, Cameroon in February 1996: Regional Environment Information Management Project (REIMP). The main goal of this project is to improve and strengthen planning and management of natural resources in the Congo basin by providing the various stakeholders with appropriate environmental information. The four specific objectives of the project are:

- ensuring information circulation and adding value to existing initiatives; - fostering involvement of decision-makers in environmental information use and facilitating sound land use planning in the Congo basin;
- providing users with environmental information meeting their demand; - strengthening relevant national capacities.

AFRICOVER should contribute to this project by providing the first information layer, i.e. land cover, of such a regional information system.

Africa Real Time Environmental Monitoring Information System
http://www.fao.org/sd/eidirect/EIre0005.htm Updated November 1997

Since 1988, the Service has been operating the Africa Real Time Environmental Monitoring Information System (ARTEMIS). The system acquires and processes routinely in realtime hourly estimates of rainfall and in near-realtime vegetation index

(NDVI) images, using Meteosat and NOAA data. The system covers the whole of Africa and the products are produced on a ten-day and monthly basis for use in the field of "early warning for food security" and "desert locust control".

Related technology transfer is being implemented through regional remote sensing projects in the SADC and IGAD regions with financial assistance from the Governments of The Netherlands and France and in West Africa through the FAO Regional Office for Africa in Accra, Ghana. The ARTEMIS related Regional Remote Sensing Project of FAO, which assists SADC in establishing a remote sensing and GIS capacity for its regional food security early warning system, has made significant progress in developing suitable information products, which are now available to various types of users in a timely fashion, using data transmissions through e-mail.

The ARTEMIS databases, which have recently been expanded with a rainfall assessment capability for Asia, using GMS data, constitute a significant source of information for a wide variety of programmes in the field of food security, insect pest control and animal health as well as the basic data for a variety of research programmes.

What has been achieved to present

AFRICOVER: Until June 1998, the Eastern African sub-region (12 countries: Burundi, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan, Tanzania, Uganda) has already started the implementation of the project, due to a financing of 5.4M$ US provided by the Italian government.
For the other sub-regions and countries, negotiations are very advanced between the different African partners and many sponsors or collaboration agencies including French Cooperation, European Union, GTZ, CIDA, World Bank. Already the REIMP World bank EU project for Central Africa adopted the Africover specifications and several EU regional programmes are considering to apply the Africover standards on more than 20 countries. In addition, a number of African countries (Ivory Coast, Equatorial Guinea, Guinea, Mali, Mauritania, Mozambique, Namibia, Nigeria, Senegal, Togo, Zimbabwe) have already sent official requests; a number of requests are under way within the different ministries of other countries. Several countries such as Senegal and Tunisia have built up national AFRICOVER Working Groups which started with the formulation of project documents according to the national approach.
At the website of METART, http://metart.fao.org, near real-time data from the ARTEMIS system can be visualized and analyzed. Specific data sets, such as global climatic maps and other agro meteorological and GIS databases, are also made available at that site.

Do they monitor?

AFRICOVER: will be used by other organizations to monitor but itself is an information system.
REIMP: like AFRICOVER, an information system
ARTEMIS: Monitoring products produced every 10 days and monthly "early warning for food security" and "desert locust control.

Terrestrial Ecosystem Monitoring Sites
http://www.fao.org/gtos/tems (Last updated May 4, 2004)

TEMS, Terrestrial Ecosystem Monitoring Sites, is an international directory of (plots) sites (named T.Sites) and networks that carry out long-term terrestrial monitoring and research activities. The database provides information on the "who, what and where" that can be useful to both the scientific community and policy-makers.

Found 43 networks and 152 T.sites. Topics ranging from carbon dioxide flux measurements to ecological monitoring, world glacier monitoring, land cover, and forest resources monitoring.

The FAO Forest Resources Assessment data for 1980, 1990 and 2000 are now available at the pan-tropical, regional, sub-regional and sampling unit level. Matrices, graphs, raster maps and a forest cover change variable sheet are also provided.

Global Observing Systems Information Center (GOSIC)
Facilitating Access to Global Observing Systems Data & Information

The Global Observing Systems Information Center (GOSIC) is established at the College of Marine Studies of the University of Delaware, USA, **to provide information and facilitates access to data and information** produced by the global observing systems:

Global Climate Observing System (GCOS)
Global Ocean Observing System (GOOS)
Global Terrestrial Observing System (GTOS)
and their partner programmes.

Time of Existence
Established in 1997, the first 3 year phase ended at the end of 2000 and was funded by NASA and NOAA. The second 3 year phase has been negotiated as of June 2001 and is funded by NOAA.

Objectives

- Provides information and access to data produced by G3OS for climate, oceans, and terrestrial observing systems (GCOS, GOOS, GTOS) and their partner programmes.
- Stores only metadata and links to data centres to obtain the actual data.
- Long term: to transfer the activity to a permanent operational centre.

Terms of Reference for GOSIC

- Focus on information systems;
- Provide access to a distributed directory of climate data and information, including links to the datasets;
- Point to other centres and information systems of the major climate, ocean, and terrestrial research and operational observing programmes;
- Provide information on GCOS, GOOS and GTOS programmes and plans including an inventory of data centres, sources, and experts;

- Prepare documentation on GCOS, GOOS and GTOS component programmes and systems;
- Disseminate information about standards and procedures;
- Provide access, without holding datasets;
- Present information as held in the centres, without either creating or modifying the presentation.

Specifically GOSIC provides:
Links to GCOS, GOOS, GTOS, Information and Science centres
Access to historical data sets
Dataflow diagrams and maps of GCOS
Planning and design documents

Main Activity of the G3OS is to provide datasets and analyses for:

- Research into global change
- Operational oceanographic and meteorological services
- Monitoring, change detection, prediction of future conditions

Added Value
GOSIC provides one central point for the three data centres, GCOS, GOOS, GTOS.

Phases
The first 3- year phase has evolved a variety of approaches, unique strategies, and examples for single-point access to a highly distributed operational data and information system. These approaches and strategies have been implemented in the on-line system and can be accessed at www.gos.udel.edu.

The first priority of the second 3-year phase of GOSIC is to address the recommendations of the GOSIC review conducted in April 2001. In addition, the goals are as follows.

- Achieve full implementation of the Data Set Registry for data identified as relevant to the Global Observing Systems.
- Complete development of the operational data flow diagrams for the Integrated Observing Systems.
- Develop, in cooperation with interested Global Observing Systems Data Coordinators, some functioning examples of effective automated data flow monitoring methods.
- Complete and maintain on-line access to the observing system documentation.
- Address the problems and implement examples for incorporating satellite and model data into the components of GOSIC.
- Begin organizing the transfer of the site to an operational agency.

Room for cooperation with others
GOSIC will work with existing national and international organisations who deal with global data collection analyses and exchange. Organisations are for example, WMO, IOC, FAO, NASA's Global Change Master Directory, ICSU and others.

GOSIC encourages participation of other sites in supporting the G3OS data and information systems and encourages standardization of presentations and methodologies between these sites and the GOSIC site.

Some needs of GCOS, GOOS, and GTOS are provided by partner observing programmes such as the Global Atmosphere Watch (GAW), the World Weather Watch (WWW), and the Joint Commission on Oceanography and Marine Meteorology (JCOMM).

Region of Focus
GOSIC: Global
The G3OS: global and regional datasets and analyses

What has been achieved to present?
In the first 3 year phase they have created a website with links to all the useful and relevant sites they have compiled.

They are fulfilling their objectives by allowing access to Data and Information (maps, data, information on national commitments, and data services), Dataset Registries (GOSIC's or NASA's GCMD - FGDC clearinghouse of NASA), and Programme information (national and international standards, meeting calendars, scientific and technical basis of its components e.g. G3OS and itself.)

Both 3 year phases are developmental. After which GOSIC will be expected to become an operational agency.

GOSIC supports sustainable development not only and not specifically environmental security, is to a large extent about remote sensing and supports monitoring but the focus is broader than environmental security. In fact, they are there to provide data and services to other organisations.

Global Monitoring for Environment and Security (GMES)

The Global Monitoring for Environment and Security (GMES) was launched in May 1998 and adopted in June and November 2001 by ESA and the EU Councils, respectively. It is an initiative to promote sustainable development and global governance through the supporting of environmental and security policies (by timely provision of data, info and knowledge).

Objective
Global Monitoring for Environment and Security (GMES) is a joint endeavour by ESA and the European Commission to establish an independent capability for global monitoring, in support of European environment and security goals.
The goal is to have a European Capacity for Global Monitoring of Environment and (civil) Security in place by 2008.

Main Activities
To produce and provide data and services
To ensure long term, continuous monitoring

To provide a frame to better integrate existing activities, projects, organisations etc. in Europe
To fill (knowledge, technology, etc.) gaps where possible
To ensure the sustainability and evolution of the GMES

The added value of the GMES is to develop a shared information system for Europe that allows for coherency, efficiency, and sustainability.

The expected benefit is to provide better information for users (policy and decision makers) and a more active economy in Europe's information production related sectors.

Region of Focus
Their "Global Dimension" entails monitoring of EU territories and contributing to the monitoring of non-EU territories which are outlined in a number of EU policies.

Phases
(Phase 1) Initial Period (2002-2003) Objectives
To deliver a set of pilot information and products for the priority themes, based on existing European capabilities, and allowing the assessment of current technical, organisational and institutional capabilities to meet users' needs; and, to prepare a report proposing how to progress through to the next GMES period, 2004 – 2008.

The priority themes are according to the 6th EU Environment Action Plan:

- (Initial period, Strand 1, EC Thematic projects included the areas)
    1. Nature Protection
    2. Soil degradation
    3. Marine Resources
    4. Air pollution
- Initial period, Strand 1, ESA Earthwatch **G**MES **S**ervices **E**lement (GSE)

(In November 2001 the ESA Ministerial Council approved a new 5-year ESA programme dedicated to GMES, called the Earthwatch GMES Services Element (GSE for short). This is the very first programme dedicated to GMES.
GSE will deliver policy-relevant services to end-users, primarily (but not exclusively) from Earth Observation sources. GSE is a key element of GMES, because it will enable end-users to become key players in the move from present generation Earth Observation satellites to future European systems that will deliver vital information on global environment and security. Source: http://earth.esa.int/gmes/index.html)
Complementary projects included the following subject areas:

1. Land Use/Land Cover change
2. Risk management
3. Agriculture- crop monitoring
4. Marine- ice monitoring, coastal zone
5. Urban- subsidence
6. Forest
7. Water pollution

(These services are being consolidated. Source: http://earth.esa.int/gmes/index.html)

(Phase 2) Implementation Period 2004 – 2008
Recommendations from the initial period will be evaluated and used as input to the improvement of existing systems and the establishment of the European technical information Capacity.

For a list of other related projects refer to the "Overview of Global Activities of Relevance to GMES".

GMES certainly has environmental security/sustainable development, remote sensing and monitoring as components of their activities.

NOAA

NOAA is dedicated to enhancing economic security and national safety through the prediction and research of weather and climate-related events and providing environmental stewardship of the nation's coastal and marine resources.
NOAA is part of the U.S. Department of Commerce.

International Agreement on Earth Environmental Observing System

Further to International Agreement on Earth Environmental Observing System at the second Earth Observation Summit on 25 April in Tokyo, representatives from 47 countries approved the framework document for implementing the observation plan, including the measures and goals for an observation network to be set up in ten years from 2005. The system is to be called the Global Earth Observation System of Systems(GEOSS).

US delegation: US EPA Administrator, President's Science advisor, and NOAA Administrator

ESA and the European Union's Global Monitoring for Environment and Security (GMES) joint initiative serves as Europe's contribution to the worldwide GEOSS effort. http://www.esa.int/export/esaSA/SEMTR077ESD_earth_0.html

There are four Co-chairs: Conrad C. Lautenbacher, NOAA Administrator; Achilleas Mitsos, director general for research, European Commission; Akio Yuki, deputy minister of education, culture, sports, science and technology, Japan; and Rob Adam, director-general of the department of science and technology, South Africa.

Right now many thousands of separate technological assets are demonstrating their value around the globe, in estimating crop yields, monitoring water and air quality, improving airline safety, and forecasting life-threatening natural hazards. However, these assets are not set up to talk to each other. Once linked as a system of systems, the societal and economic benefits will be enormous. By launching the development of a 10-year implementation plan at the summit, the ministers committed to make people and economies throughout the world healthier, safer and significantly better prepared to manage the basic needs of daily life.

According to a news agency report, "The document adopted nine goals for observation, including minimizing damage from natural disasters and human-induced hazards, recognizing environment-related factors affecting human health and welfare, improving management of energy and water resources, and others. The document also emphasized the importance of building up an international observation network to share information gained through satellites, observatories and ships, and to cover spots left unobserved under the current observation network."

The benefits of a connected system are:

- Forecasting more accurate severe winter weather;
- Pinpointing where the next outbreak of SARS or West Nile virus, or malaria is likely to hit;
- Improving air quality monitoring to provide real-time information and accurate forecasts;
- Enhancing ocean instrumentation that, combined with improved satellite Earth observing coverage, will provide revolutionary decadal worldwide and regional climate forecasts; and
- Providing real-time monitoring and forecasting of the water quality in every watershed and accompanying coastal areas.

The summit in Tokyo fulfils a commitment made last year by the G-8. It builds on the first Earth Observation Summit hosted by the United States last July and directly feeds into the G-8 meeting in June in Georgia.
Sources:
Earth Observation Summit endorses action plan Vietnam News Agency, 04/26/2004
http://www.vnagency.com.vn/NewsA.asp?LANGUAGE_ID=2&CATEGORY_ID=34&NEWS_ID=96606
47 Countries, European Commission Agree To Take "Pulse Of The Planet"
Milestone Summit Launches Plan to Revolutionize Understanding of How Earth Works
NOAA release: http://www.noaanews.noaa.gov/stories2004/s2214.htm
Plan for global Earth monitoring agreed at Tokyo summit
ESA News http://www.esa.int/esaSA/SEMTR077ESD_earth_0.html

NOAA COMPUTER SYSTEM IS "FIRST STEP" TOWARD EASIER ACCESS TO ENVIRONMENTAL DATA
Source: http://www.publicaffairs.noaa.gov/releases2004 Contact: John Leslie
4/13/04

The Commerce Department's National Oceanic and Atmospheric Administration (NOAA) is using a new computer system that is a critical "first step" in giving users faster, easier access to America's environmental data. Last month, two NOAA sites began using the system, called the Comprehensive Large Array-data Stewardship System (CLASS), which provides researchers and policy-makers access to NOAA environmental data and products, obtained either from spacecraft or ground-based observations.
Officials pointed to the benefits of a two-site configuration:

- The sites are active continuously and share the processing load.
- The sites can search the same data catalog, since they are both synchronized.

- If there is a system failure, either site is able to run 100 percent of the processing load.

As NOAA advances the CLASS system, it will provide greater access to much of its environmental data, which is essential to minimizing environmental risk and maximizing environmental opportunities through effective planning and operations.
The NOAA Satellites and Information Service is the nation's primary source of space-based meteorological and climate data. It operates America's environmental satellites, which are used for weather and ocean observation, forecasting and climate monitoring.

GeoSpatial Data and Climate Services
http://www.eis.noaa.gov/ (Last updated Feb, 2001)

The primary mission of the GeoSpatial Data and Climate Services (GDCS) group, previously known as NOAA's Environmental Information Services (EIS) group, is to provide a cross-cutting service to all of NOAA regarding data, information, and other services needed to support data management activities within NESDIS, across all NOAA Line Offices, with other federal agencies, as well as with international organizations on matters of data and information management. Data management deals with acquiring, quality controlling, preserving, storing, and providing user access to data holdings. GDCS planning and liaison functions stress cooperative efforts across NOAA and among agencies and international partners for facilitating environmental information exchange and user access.

Specific programs administered by GDCS include the Environmental Services Data and Information Management (ESDIM) program, the NOAA central repository of over 14,000 metadata descriptions maintained on the NOAA Server, the main focus of Federal Geographic Data Committee activities across NOAA, the help desk function for the NOAA home page, as well as providing the national focus for the U.S. contribution to the international Global Climate Observing System (GCOS) program effort.

The International Coral Reef Initiative
http://www.nmfs.noaa.gov/pr/PR/fpweb/icri/text/453.htm
Research and Monitoring

The purpose of research and monitoring is to assess and provide regular updates on the condition of coral reefs and related ecosystems, understand problems and processes, to evaluate the success of management and conservation actions and to make the predictions essential for wise management decisions. Both research and monitoring require the collection of data using tools from the natural and social sciences and must be carried out as an integral part of management. It is only through this that management decisions can be made based on the best available information.

The Millennium Project
Strategic Global Intelligence for Today and Tomorrow
http://www.acunu.org/index.html

Time of existence
It was initiated by the The Futures Group International, and the United Nations University (UNU) with a 3 year feasibility study 1992 - 1995. Since 1996 it operates under the auspices of the American Council for the United Nations University (AC/UNU) with funding from UNU and others.

(The AC/UNU is a U.S. NGO that provides a point of contact between Americans and the primary research organ of the UN - the United Nations University (UNU)- which focuses intellectual resources from all nations on world problems.)

Aim and Objectives
The Millennium Project provides an international capacity for early warning and analysis of global long-range issues, opportunities, and strategies.

The Project assists in organizing futures research, up-date and improve global thinking about the future, and make that thinking available through a variety of media for consideration in public policy making, advanced training, public education, and back again as input through the Project's survey to create cumulative wisdom about potential futures.

Today, the Project accomplishes these ends by connecting individuals and institutions around the world, via an 18 node network, to collaborate on research and to address important global challenges.

The project *is not* a one-time study of the future, but provides an on-going *capacity* as a geographically and institutionally dispersed **think tank**.

Main Activities
The Millennium Project manages a coherent and cumulative process that collects (by means of questionnaires, interviews, meetings and online discussions) and assesses judgments from its several hundred participants.

Phases
Phase 1 of the feasibility study began in 1992 with funding from US EPA to identify and link futurists and scholars around the world to create the initial design of the Project and conduct a first test on population and environmental issues.

In 1993/94 during Phase II, a series of reports were created on futures research methodology and long-range issues important to Africa, funded by UNDP.

Phase III, conducted in 1994/95 under the auspices of the UNU/WIDER and funded by UNESCO through the AC/UNU, concluded with the final feasibility study report.

Region of focus
Global

What has been achieved to present

The Millennium Project's primary products include:

- On-going assessment of what are the most significant long-range issues and opportunities, as well as focused analysis of policies and agencies to address them. The questionnaire, Global Challenges Round 2 responses are due May 26 2004.
- Communication network of futurists and scholars with an international information system of futures research that is accessible by the public;
- The annual *State of the Future* report (based on an integration of others' forecasts and the Project's own work, and built on the foundation of the previous year's report);
- Special studies such as Future Issues of Science and Technology, Futures Research Methodology, Environmental Security, Lessons and Questions from History, and Future of Africa (a six part series *Africa in 2025*);
- Emerging Environmental Security Issues- Monthly Reports: The purpose of this study is to assess worldwide environmental-related issues in order to identify and analyze events that might trigger future international environmental treaties, conventions, or protocols and/or modifications to the existing ones.
- Advanced training in the methodology and analysis of critical issues, opportunities, and challenges of the future.

Do they monitor?

Solely, via questionnaires and surveys to correspondents all over the world, to compile and update lists of global issues etc.

Remote Sensing

Don't seem to have any remote sensing component

World Meteorological Organization

The World Meteorological Organization is an intergovernmental organisation with a membership of 187 Member States and Territories. It originated from the International Meteorological Organization (IMO), which was founded in 1873.

Established in 1950, WMO became the specialized agency of the United Nations for meteorology (weather and climate), operational hydrology and related geophysical sciences.

It has a unique role within the UN system it facilitates the free and unrestricted exchange of data and information, products and services in real- or near-real time on matters relating to safety and security of society, economic well being and the environment.

WMO is playing a leading role in international efforts to monitor and protect the environment through its Programmes, such as the:

- World Weather Watch Programme,
- World Climate Programme,
- Atmospheric Research and Environment Programme,
- Hydrology and Water Resources Programme.

For instance, in collaboration with the UN agencies and the National Meteorological and Hydrological Service(s) (NMHSs) of Members, WMO continues to support the implementation of relevant conventions such as the UN Framework Convention on Climate Change, the International Convention to Combat Desertification, and the Vienna Convention on the Protection of Ozone Layer and its Protocols and Amendments. WMO is instrumental in providing advice and assessments to governments on matters relating to the above Conventions. These activities contribute towards ensuring the sustainable development and well-being of nations.

Under the World Climate Programme falls the World Climate Data and Monitoring Programme.

The main objectives of the World Climate Data and Monitoring Programme are:

- To provide regular assessments and authoritative statements on the interpretation and applicability of instrumental and proxy data for the study of climate variability, the detection of climate change, and the validation of climate models and forecasts;
- To develop awareness of the interannual variability of the global climate system and to facilitate the generation, interpretation and dissemination of this information in global and regional scale climate fluctuations;
- To support the Global Climate Observing System (GCOS) in the maintenance and integrated development of existing observation systems, including traditional in situ surface and upper-air observations, satellite systems and new observing technologies;
- To facilitate the development and implementation of methods to enable the rescue, preservation and management of climate data by WMO Members, especially developing countries, and to promote the international exchange of climate data and related products; and
- To coordinate the preparation and distribution of global and regional data sets, including metadata, as required for both research and the development of Climate Information and Prediction Services (CLIPS).

Some of WMO's Global Priorities according to the "Fifth WMO Long-Term plan 2000-2009." WMO-No. 908, Geneva Switzerland 2000:

(a) Development of the Global Observing System (GOS) as a composite system, particularly for upper-air observing based on an optimal mix of observing components,
including ground-based remote sensing, AMDAR, satellites and Global Position System-Meteorology (GPSMET). GOS support to meeting GCOS requirements for climate monitoring and prediction will also be a priority goal.

(d) Development of global, regional and national meteorological capabilities to provide public weather services and related information to Members and international organisations in carrying out humanitarian relief operations.

(j) Full implementation of the initial operational system of GCOS, particularly with in situ measurements in the oceans, atmosphere and on the land surface, and make fully

operational a data and information management system which serves the G3OS (i.e.,GCOS; GOOS and GTOS).

(k) Development of realistic climate models for quantitatively more accurate predictions of the magnitude of climate change (including not only the physical climate system, but also chemical and biospheric processes). Particular attention will be devoted to cloud/radiation interactions, effects of aerosols and the global hydrological cycle.

(q) Development of applications of hydrology for the sustainable development and protection of areas under stress, such as areas with major changes in water quality; the critical situation in many coastal areas; small islands; and arid and semi-arid regions.

WMO and programmes support different aspects of Environmental Security, certainly uses remote sensing and carries out monitoring but the subject area is mainly meteorology (weather and climate), operational hydrology and related geophysical sciences.

According to the Sixth WMO Long-term Plan (2004–2011), the WMO measures the well-being of nations in terms not only of food security and safeguards against emergencies but also of scope to develop over time in ways that counter poverty and are environmentally sustainable. The Plan states that "For over 50 years, WMO has been working with and through its Members and their National Meteorological and Hydrological Services to apply the sciences of meteorology and hydrology to practical problem-solving for sustainable development and all that it implies, especially in terms of **poverty alleviation and environmental security**.

5. Links Indicator and Monitoring Sites

The following additional links are taken from the website of Geoindicators (GEOIN) Tools for Accessing Rapid Geological Changes: http://www.lgt.lt/geoin/

Arctic Monitoring and Assessment Program AMAP.
http://www.amap.no

British Columbia's site for Environmental Trends reporting.
http://www.gov.bc.ca/bvprd/bc/home.do

Canada's national Environmental Indicator publication series.
http://www.ec.gc.ca/soer-ree/English/Indicator_series

Drylandscope is a new US-based organization which aims to remedy problems associated with land degradation through a practical, ecologically based strategy. It provides a useful platform for open information access and dialogue on all subjects related to dryland management.
http://www.drylandscope.org

The Global Coral Reef Monitoring Network.
http://www.coral.aoml.noaa.gov/gcrmn

ICSU Dark Nature
http://www.brunel.ac.uk/depts/ges/ICSU-DN/ICSU-DN.html

The IGBP project on Past Global Changes.
http://www.pages.unibe.ch

INQUA - International Union for Quaternary Research
http://www.inqua.tcd.ie/

Indicators of Sustainable Development: The home page of the indicators work of the United Nations Division for Sustainable Development.
http://www.un.org/esa/sustdev/isd

The Intergovernmental Panel on Climate Change is the most authoritative source for climate change information.
http://www.ipcc.ch

International Association for Environmental Hydrology
http://www.hydroweb.com

International Geographical Union
Among its Commissions are the Commission on Coastal Systems (http://igu-ccs.ucc.ie)and the Commission on Hazards and Risks - (http://slide.giub.uni-bonn.de/igu-c12).
http://www.igu-net.org/

The International Geosphere-Biosphere Programme.
http://www.igbp.kva.se

International Permafrost Association: An international scientific organization with many links to frozen ground research.
http://www.geodata.soton.ac.uk/ipa/

The International Volcanic Health Hazard Network (IVHHN)
http://www.ivhhn.org

International groundwater resources assessment centre
http://www.igrac.nl

The Millennium Ecosystem Assessment (MA) is an international process designed to meet the needs of decision makers and the public for scientific information concerning the consequences of ecosystem change for human well-being and options for responding to those changes.
http://www.millenniumassessment.org

Mitigation of Climate Induced Natural Hazards.
http://www.mitch-ec.net

Natural Hazards Research Center, Macquarie University, Australia.
http://www.es.mq.edu.au/NHRC

Resource site for everything to do with Landscape
http://landscape.researcheasy.com

State of Environment of Lithuania, 2001
http://www.am.lt/EN/VI/files/0.919984001036055560.pdf

State of the Environment Australia
http://www.deh.gov.au/soe/

TEMS (Terrestrial Ecosystem Monitoring Sites) is an international directory of long-term terrestrial monitoring and research activities. It provides much useful information on the "who, what and where" and contains a convenient definition and description of many landscape parameters, including some relating to rapid geological change.
http://www.fao.org/gtos/tems/

The Global Observing Systems Information Center. GOSIC provides access to data and information, and overviews of the structure and programs for the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS), and the Global Terrestrial Observing System (GTOS)
http://gosic.org/

The World Glacier Monitoring Service, co-sponsored by WMO.
http://www.geo.unizh.ch/wgms

UK Climate Change Indicators: The home page for climate change indicators in the UK.
http://www.nbu.ac.uk/iccuk/

UN Environment Programme's Global Environment Outlook database.
http://geodata.grid.unep.ch/

The US Geological Survey Volcanic Hazards Program.
http://volcanoes.usgs.gov

US National Environmental Monitoring initiatives.
http://www.epa.gov/cludygxb

US National Park Service. The Geologic Division is currently developing a systematic plan for applying geoindicators in US Nationl Parks and Monuments.
http://www2.nature.nps.gov/grd/geology/monitoring/ib4/index.htm

World Data Centre.
http://www.ngdc.noaa.gov/wdc/

World Resources Institute, - annual State of the World reports.
http://earthtrends.wri.org/

WorldWatch produces regular global state-of-the-environment reports.
http://www.worldwatch.org

Institute for Environmental Security
www.envirosecurity.org