United States
Environmental Protection
Agency

Office of Research
and Development
Washington, D.C. 20460

EPA/620/N-93/003
February 1994

EPA EMAP MONITOR

An Interagency Program to Monitor the Nation's Ecological Resources

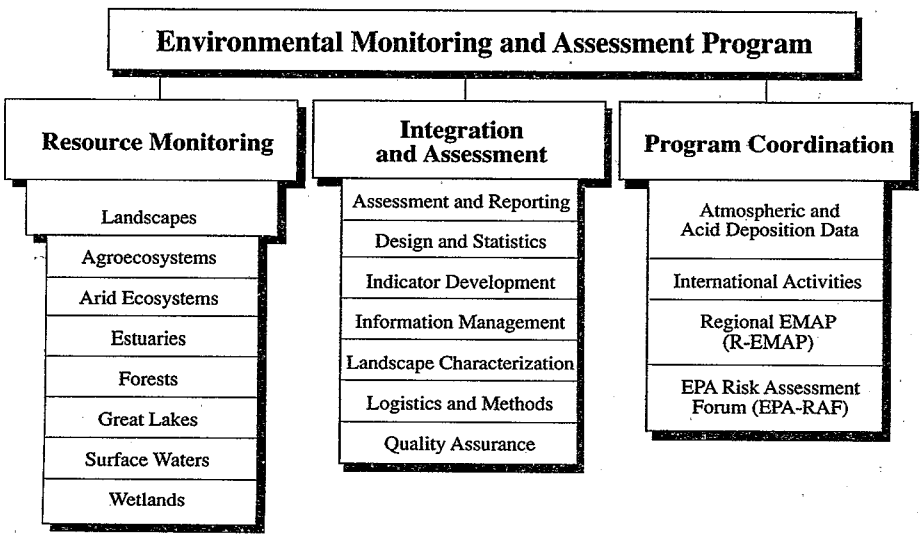
EMAP Overview

The Environmental Monitoring and Assessment Program (EMAP) is an innovative research, monitoring, and assessment effort designed to report on the condition of our Nation's ecosystems. EMAP objectives are (1) to estimate the current status of and trends and changes in selected indicators of the condition of the Nation's ecological resources on a regional basis with known confidence; (2) to estimate the geographic coverage and extent of the Nation's ecological resources with known confidence; (3) to seek associations between selected indicators of natural and anthropogenic stresses and indicators of the condition of ecological resources; and (4) to provide annual statistical summaries and periodic assessments of the Nation's ecological resources. EMAP-generated data and techniques ultimately will provide the Agency with tools for assessing and managing environmental risk.

The program is organized into functional groups that address the resource monitoring, integration and assessment, and coordination requirements of the program (see Figure 1). These groups are highly integrated and are designed to meet changing program needs. For example, through internal and external peer review, EMAP recognized that Landscape Characterization was filling a dual role—addressing both resource monitoring and integration and assessment activities. EMAP also determined that our Nation's landscapes, components of all ecosystems, merit closer evaluation at the resource level. As a result, in Fiscal Year 1993, EMAP divided its Landscape Characterization program into two separate but related components, EMAP-Landscape Characterization and EMAP-Landscapes. Activities of these two groups are highlighted on pages 4 and 5.

EMAP will continue to undergo critical evaluation; evolve in response to the peer-review process; capitalize on improved scientific understanding; incorporate advances in methods, data analysis, and reporting techniques; and retain continuity in the long-term data sets it develops.

Figure 1.



Inside Highlights

R-EMAP 2
Landscape Activities 4
GIS Jargon 5
EMAP Tools 6
Publication Highlights 7

including drainage ditches used for agricultural management. In addition, the study will develop indices of biotic integrity based on community assemblage data (e.g., population, distribution, and types of indicator organisms) that are appropriate for use as environmental indicators in this highly modified ecosystem.

Through the use of a probability-based sampling grid, field stations will be selected for collecting fish and invertebrates and performing physical habitat assessments. The study also will sample a network of stations to compare well-managed versus poorly managed agricultural areas. The data will be analyzed to evaluate the condition of the aquatic resources.

The project will complement Region IX's strategic plan through Fiscal Year 1996. The strategic plan identifies major resources subject to ecological risks and focuses on protecting aquatic ecosystems in agricultural areas. The results of the R-EMAP study will contribute to short-term policy decisions as well as to long-term monitoring and environmental protection strategies.

For more information, contact Gary Wolinsky at (415) 744-2015.

Region X: Sampling Selected Wadable Streams

Working with the Oregon Department of Environmental Quality and the Washington Department of Ecology, Region X plans to perform a biological assessment of wadable streams in the Coast Range Ecoregion and the Yakima River Basin. These areas were assigned priority status because few data of this type have been collected and land disturbance is widespread in the region. In addition, the Coast Range Ecoregion crosses State boundaries, fostering inter-State cooperation for the project.

The State agencies will collect samples of fish and invertebrate communities at 80 randomly selected sites. Additional data on water chemistry and physical habitat also will be compiled. These data will be used to

- Determine the status of wadable streams within the Coast Range Ecoregion and Yakima Basin
- Compare the status of randomly selected streams with minimally affected reference streams
- Relate stream status and surrounding land uses, such as forestry, grazing, and agriculture.

The project will help establish biological criteria for surface water quality and set priorities for controlling nonpoint sources of water pollution.

For more information, contact Gretchen Hayslip at (206) 553-1685.

Landscape Activities

Landscape Characterization

EMAP-Landscape Characterization focuses on (1) developing a comprehensive landscape classification approach for EMAP, (2) assisting resource groups in developing sampling frames, (3) developing a national geographic reference database, and (4) acquiring and classifying multiscale remotely sensed data [i.e., Thematic Mapper (TM) and Satellite Pour L'Observation de la Terre (SPOT) imagery —for an explanation of remote sensing, see the information box on page 6]. As demonstrated by the following examples, data acquisition is being facilitated by interagency cooperation and data sharing:

- EMAP, through the EPA, and other Federal programs (see adjacent information box) agreed to purchase TM satellite scenes for the conterminous United States. EMAP-Landscape Characterization will coordinate identification of priority interest areas for these data within EMAP.
- EMAP-Landscape Characterization and the Illinois Natural History Survey are generating a land cover map of Illinois. Illinois has acquired TM data of the State and is asking EMAP for assistance. Illinois has a considerable geographic database and is interested in serving as a pilot study locale. EMAP will be

Federal Programs Cooperating to Acquire TM Satellite Images:

U.S. EPA, EMAP

U.S. Geological Survey, National Water Quality Assessment (NAWQA) Program and EROS Data Center

U.S. Fish and Wildlife Service (U.S. FWS), Gap Analysis Program (GAP)

U.S. EPA North American Landscape Characterization Program (NALC)

National Oceanic and Atmospheric Administration, Coastal Change Analysis Program (C-CAP)

working closely on this with U.S. FWS, GAP.

- EMAP also participated with other Federal agencies in purchasing 500 SPOT satellite scenes. As with the TM data, EMAP-Landscape Characterization will coordinate identification of priority scenes within EMAP.

For more information, contact Denice Shaw at (919) 541-2698.

Landscapes

EMAP-Landscapes focuses on developing and implementing a landscape monitoring component within EMAP to address landscape values such as biodiversity, landscape resiliency, and landscape aesthetics. In developing such a program, EMAP-Landscapes will follow protocols being used by other EMAP Resource Groups.

Major ongoing EMAP-Landscapes activities include

- Preparing and conducting peer review of a research plan for developing and implementing a national landscape monitoring program within EMAP
- Identifying landscape values or parameters that will form the basis for landscape monitoring within EMAP
- Developing conceptual models on the structure, composition, and function of landscapes as they relate to landscape values
- Initiating research on landscape scales, sampling units, overall sampling design, and landscape indicators.

Longer term goals of this resource group are to compare past and present remote sensing data to determine changes that occur at the landscape level. Land cover will be classified by type of landscape, type of change (e.g., forest to agriculture), and general properties of landscape pattern (e.g., degree of forest fragmentation). Landscapes that have undergone significant change or appear to have significantly compromised landscape value will be assessed in detail to determine potential consequences to wildlife habitat, water quality, socioeconomic value, and landscape stability.

For more information, contact Bruce Jones at (702) 798-2671.

EMAP-Landscapes Cooperators:

U.S. FWS, GAP

U.S. EPA, NALC

U.S. Department of Energy, Oak Ridge National Laboratory and Tennessee Valley Authority

GIS Jargon

The term "GIS" is often heard when people are discussing environmental planning or monitoring. Frequently one will hear "a GIS could handle that data" or "that is a good application for a GIS."

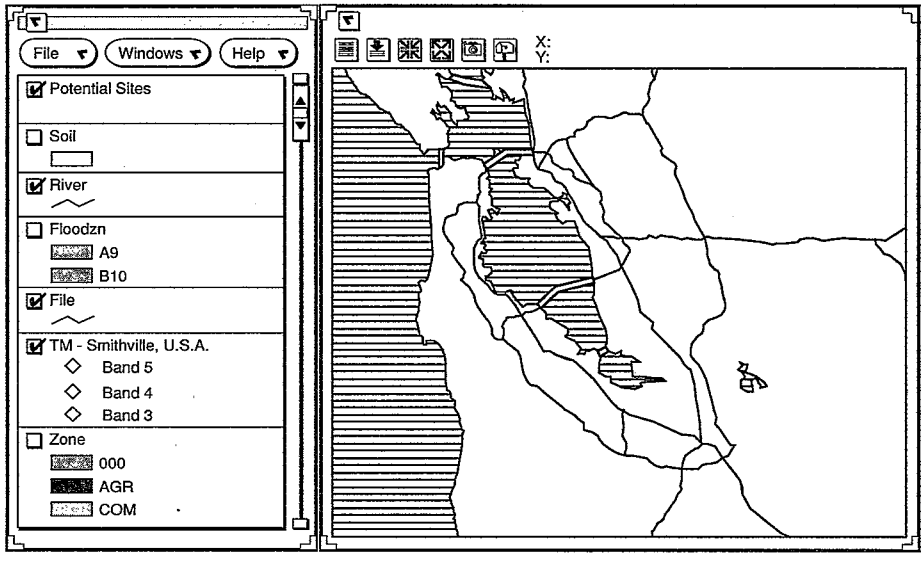
What is a GIS? GIS stands for geographic information system. It is a computer system designed to store, use, and display data in the context of their location on the earth's surface. GIS also describes the software that manipulates spatial data.

EMAP uses a GIS, which operates under a software package called ARC/INFO, to store and integrate the monitoring and spatial data that are collected throughout the program. EMAP's GIS component can help EMAP identify the following:

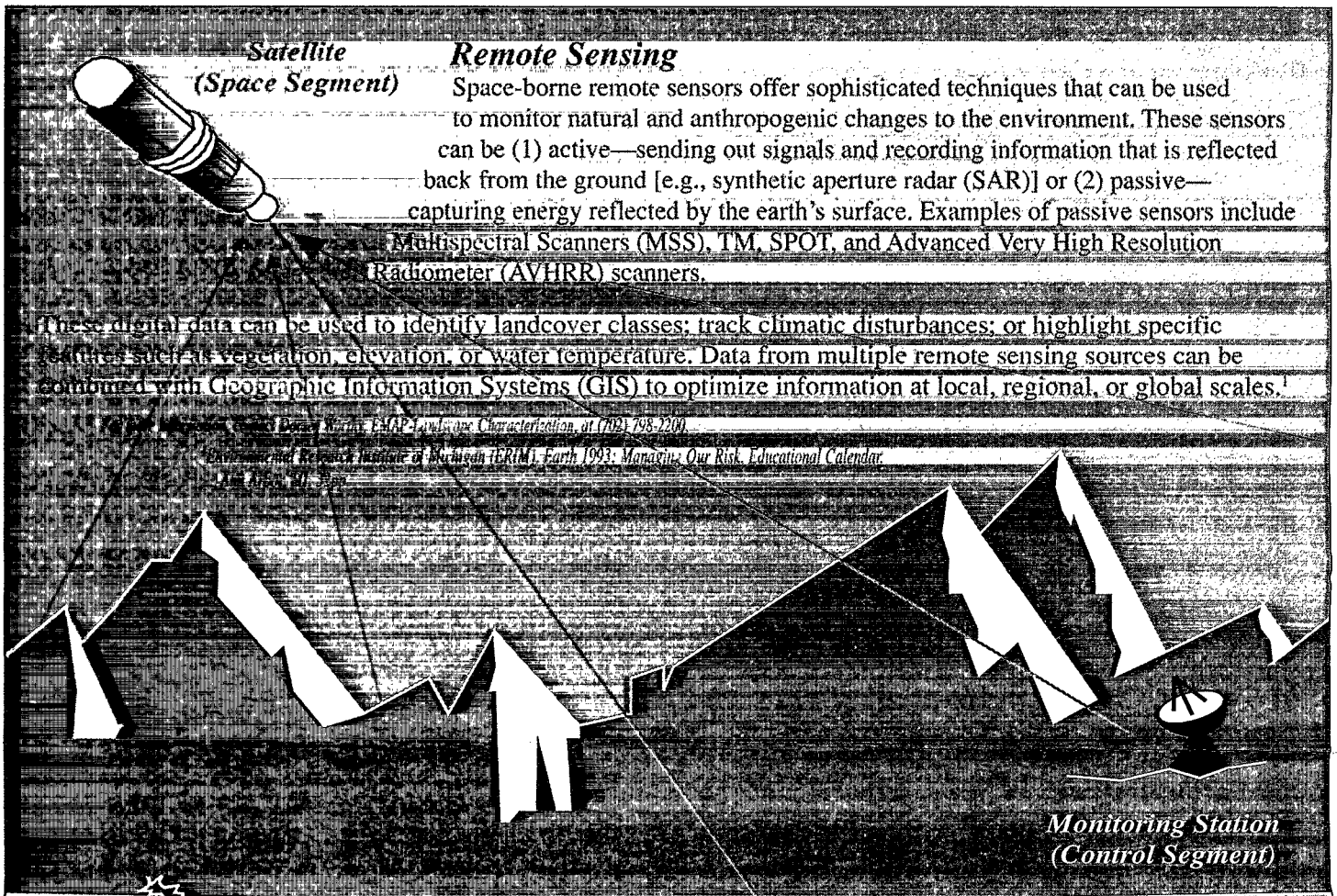
- Annual precipitation and average temperature at a given location
- Location of large estuaries that have fish with gross pathologies
- Percent change and the locational number of arid ecosystems experiencing desertification
- Land-use patterns within 50 miles of the Great Lakes
- Changes to agroecosystems that would likely occur over time if agricultural lands were converted to non-use status
- Options that must be addressed to assess environmental condition and manage environmental risk.

For more information, contact Mark Olsen at (702) 798-3155.

Sample GIS Information Screen



EMAP Tools



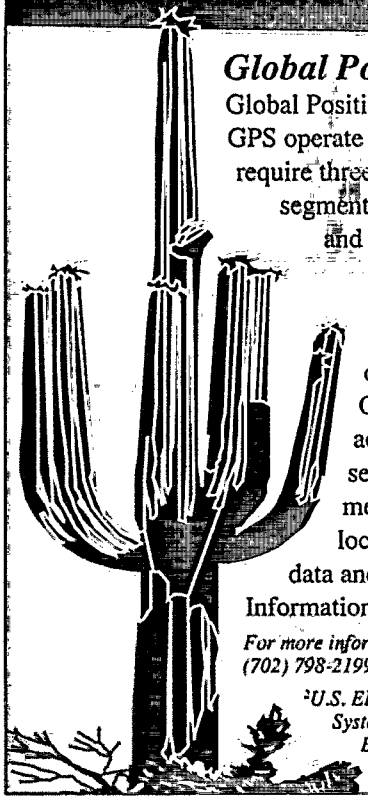
Remote Sensing

Space-borne remote sensors offer sophisticated techniques that can be used to monitor natural and anthropogenic changes to the environment. These sensors can be (1) active—sending out signals and recording information that is reflected back from the ground [e.g., synthetic aperture radar (SAR)] or (2) passive—capturing energy reflected by the earth's surface. Examples of passive sensors include Multispectral Scanners (MSS), TM, SPOT, and Advanced Very High Resolution Radiometer (AVHRR) scanners.

These digital data can be used to identify landcover classes; track climatic disturbances; or highlight specific features such as vegetation, elevation, or water temperature. Data from multiple remote sensing sources can be combined with Geographic Information Systems (GIS) to optimize information at local, regional, or global scales.[1]

For more information, contact Barry Wurtz, EMAP-Landscape Characterization, at (702) 798-2200.

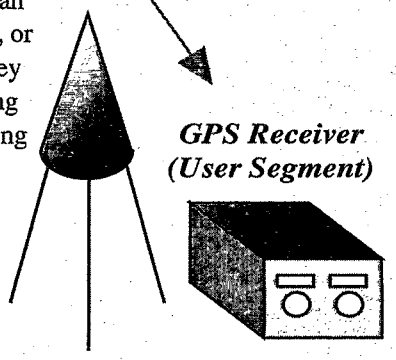
[1] *Environmental Research Institute of Michigan (ERIM). Earth 1993: Managing Our Risk. Educational Calendar.*



Global Positioning Systems

Global Positioning Systems (GPS) are satellite surveying receivers capable of highly accurate positioning. GPS operate by measuring the time delay of transmitted radio signals from satellites of known position and require three components: a control segment, a space segment, and a user segment. The U.S. control segment consists of five monitoring stations that track positions, predict orbits, ensure proper operations, and correct clocks for each satellite. The U.S. space segment consists of a group of NAVSTAR (Navigation Time and Ranging) earth orbiting satellites that transmit radio signals at regular intervals. Both the control and space segments are operated by the Department of Defense. The user segment consists of earth-based GPS receivers that decode signals from the satellites to determine latitude, longitude, elevation, and time of signal receipt for the unknown position.

GPS facilitate EMAP (1) field sampling by providing an accurate means to navigate to any position on land, air, or sea in a much shorter time span than conventional survey methods; and (2) landscape characterization by providing locational data at the ground level to verify remote sensing data and provide added dimensions to Geographic Information Systems.[2]



For more information, contact Rick Weber, EMAP-Landscape Characterization, at (702) 798-2199.

[2] *U.S. EPA. 1992. GIS Technical Memorandum 3: Global Positioning Systems Technology and its Application in Environmental Programs. EPA/600/R-92/036. Environmental Monitoring Systems Laboratory, Las Vegas, NV.*

Publication Highlights

Franson, S.E., Ed. 1993. *Arid Colorado Plateau Pilot Study - 1992*. EPA/620/R-93/001. U.S. EPA, Office of Research and Development. Washington, DC.

Larsen, D.P. and S.J. Christie, Eds. 1993. *Surface Waters 1991 Pilot Report*. EPA/620/R-93/003. U.S. EPA, Office of Research and Development. Washington, DC.

Summers, J.K., et al. 1993. *Statistical Summary, EMAP-Estuaries Louisianian Province - 1991*. EPA/620/R-93/007. U.S. EPA, Office of Research and Development. Washington, DC.

Weisberg, S.B., et al. 1993. *Virginian Province Demonstration Report, EMAP-Estuaries - 1990*. EPA/620/R-93/006. U.S. EPA, Office of Research and Development. Washington, DC.

Please address any comments, suggestions, or questions regarding the EMAP *Monitor* to

Thomas L. Baugh
U.S. EPA
8205
401 M Street, SW
Washington, DC 20460

The EMAP *Monitor* is prepared by the EPA Office of Research and Development. The EMAP *Monitor* is intended to inform interested agencies and individuals of current activities and findings from the Environmental Monitoring and Assessment Program.

If you currently do not receive the *Monitor* and would like to be added to the distribution list (or know of others who might be interested), please complete the form below. Please also use the form to inform us of any change of address. Return to Dorothy Williams, EMAP *Monitor*, U.S. Environmental Protection Agency (G-75), 26 West Martin Luther King Drive, Cincinnati, OH 45268.

Name: _____

Affiliation: _____

Address: _____

_____

_____

Please check appropriate box:

- ❑ **I am interested in receiving the EMAP *Monitor*. Please add my name to the distribution list.**
- ❑ **I am no longer interested in receiving the EMAP *Monitor*. Please remove my name from the distribution list.**
- ❑ **Please note my change of address.**

Name: _____

Affiliation: _____

Address: _____

_____

_____

Please check appropriate box:

- ❑ **I am interested in receiving the EMAP *Monitor*. Please add my name to the distribution list.**
- ❑ **I am no longer interested in receiving the EMAP *Monitor*. Please remove my name from the distribution list.**
- ❑ **Please note my change of address.**

EPA
United States
Environmental Protection Agency
Office of Research and Development
(8205)
Washington, DC 20460

Official Business
Penalty for Private Use
$300

EPA/620/N-93/003