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UKRAINIAN LAND AND RESOURCE MANAGEMENT  
CENTER (ULRMC)

A Not for Profit Center of Remote Sensing Excellence

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# **CONTENTS**

SUMMARY

TASK 1, IDENTIFY REQUIREMENTS

TASK 2, PROJECT PLANNING

TASK 3, INFRASTRUCTURE

TASK 4, OUTREACH OFFICE

TASK 5, ULRMC MANAGEMENT

TASK 6, INFORMATION (Data) ARCHIVE

TASK 7, DEMONSTRATION PROJECTS

DISCUSSION

## Summary

This is the 4th report to USAID under Grant 121-A-00-98-00615-00. This report and future reports will be organized by the Tasks as outlined within the Grant documentation, and will also include a forecast of activities planned to occur over the next 6 months. Any significant issues that have occurred during this period will be addressed in the "Discussion" section. Copies of this report will be provided to our new USAID Program Manager, Mr. Dan Thompson, in the Kyiv Mission as well as to the addressees listed in Attachment 1 of the Grant.

A number of major activities occurred during this reporting period, including the formal launch of ULRMC via press conference, participation in Earth Day and Peace Corps activities, rental of newly renovated space for the Outreach Office, and use of space for ULRMC's main offices, which meet western standards and are provided in-kind by the Government of Ukraine. In addition, the risk-assessment GIS of Zakarpattia was produced and made available on compact disk for the Ukrainian Government, after which flood modeling and run-off prediction began. Another GIS was created to support the decision-making process of the World Bank on Bio Reserves in Ukraine.

Over and above events that occurred during the reporting period, the annual nature of this report should be stressed, as major accomplishments during the first year of the program have occurred. The Ukrainian Land and Resource Management Center officially exists, and the legal basis for forming not-for-profit entities in Ukraine is now well understood. Geospatial products have been delivered in support of the flood events in Zakarpattia, and ERIM was instrumental in obtaining U.S. government support for addressing the snowmelt and water run-off problem in the oblast. Infrastructure has been rigorously defined and acquisition is ongoing. Additionally, ERIM has played a major role in supporting the USGS response to the snow melt issue. The ULRMC will host Dr. Ed Josberger, of the USGS, for the snow-melt workshop tentatively scheduled for the middle of June.

## Task 1 Identify Requirements

Requirements definition was an integral part of determining the types of demonstration projects that are to be completed. An emphasis is being given to address the needs and requirements of organizations that will have an ability to pay for services. Demonstrations of capabilities that are not commercially viable, but might be required by a governmental agency, require additional justification or potential third-party donors. As part of our agricultural monitoring demonstration project, a detailed data user requirements survey was completed. This included visits to USAID, the Ministry of Agriculture, and collective and private farms. Additionally, a rigorous requirements process was applied to the ULRMC GIS facility that will be installed at the Chokolovsky site. The breakout of the requirement definition for the GIS facility, as well as the hardware and software capability, are included in Attachment 1, "General Template for GIS Facility Plan."

## **Task 2 Project Planning**

Project planning continues. In the next quarter, training on business planning will be initiated and staffing plans will be finalized. Additionally, a long- to mid-term acquisition plan for additional receiving station sites is being contemplated. The ULRMC wants to be the most knowledgeable organization on land privatization. For this reason, last February ERIM arranged for Dr. Yartsev and Dr. Kolodyazhnyy to attend detailed briefings in Alaska on their leading-edge privatization process. The US Bureau of Land Management hosted them and presented a model for privatization that is applicable to Ukraine. We currently plan for a small delegation to return to Alaska in mid-July to finish the training and policy discussions that were begun in February.

To support ongoing project planning and coordination, ERIM designed a secure, interactive web site open to members of the project team. The design of the page reflects the design of our grant and is organized by Program Task. We have also developed a public web site for ULRMC, which can currently be accessed via ERIM's home page [www.erim.org](http://www.erim.org). We will transfer this ULRMC web site to a Ukrainian server as soon as the capability is in place at the Center for maintaining that site.

## **Task 3 Infrastructure**

The infrastructure plan for ULRMC's technical capability has been approved, and it provides both significant capability as well as flexibility. Many of the required hardware items as well as software are available in Kyiv, which demonstrates the maturity of the remote sensing industry in Ukraine. Costing is based on a market survey of vendors both within Ukraine and the United States. To obtain the best possible price, hardware and software will be purchased through U.S. or Ukrainian not-for-profit entities.

## **Task 4 Outreach Office**

The Outreach Office will double in physical size to better accommodate visitors and facilitate training and community education. The executive office will remain but all operations will be moved to the ground floor. The new facility will contain a briefing and training room that will have Internet access as well as computer availability. A wall-mounted monitor will be available for the use of training videos and will accept both European and U.S. formats. Work stations for the Outreach staff will be located immediately to the rear of the training room.

Additionally, the Outreach Office participated in the Earth day activities that were organized by the Peace Corps. We provided declassified KH-4 imagery of Kyiv for the participants, and the importance of having the KH-4 available was briefed in-depth to the Peace Corps volunteer that coordinated the activities. ERIM also made a small community donation to the Peace Corps in Ukraine to support their Earth Day events. Additionally, the Outreach Office hosted a delegation from the White House Office of Science and Technology its visit to Kyiv in mid-April. Mr. Dan Apple arranged for the delegation to receive in-depth briefings on ULRMC formation, activities, and operations. Dr. Yartsev and Dr. Kolodyazhnyy also participated in these briefings.

## **Task 5 ULRMC Management**

After the legal formation of Ukrainian Land and Resource Management Center was completed on 14 January 1999, the ULRMC Board of Directors was formed. As stated in our Foundation Agreement, for the first two years the Board of Directors is composed of three Americans and two Ukrainians. The Board members are Dr. Craig Marks, Mr. Bob Henry, Mr. Al Fuerst, Dr. Konstantine Yartsev, and Dr. Oleksandr Kolodyazhnyi. The first meeting of the Board was a video teleconference between ULRMC's offices in Kyiv, Ukraine, and ERIM's offices in Ann Arbor, Michigan. During this meeting, officers were appointed and given tasks and reporting requirements.

The second Board of Directors meeting is scheduled for 21 May 1999 in Kyiv, and the important work on corporate governance will continue. For this meeting Dr. Craig Marks, ERIM President, and Mr. Bob Henry, ERIM Corporate Counsel, will visit Kyiv for the first time. Both will be in attendance at the Technical Review Board Meetings and the Board of Directors meeting. The Center budget has been prepared and negotiated with all components of the Center and will be approved by the Board of Directors on 21 May.

ULRMC held a press conference in Kyiv on 19 March to officially announce the opening of the Center and to educate the public about services we offer. We had a great response in local and international press, and several leads for business for ULRMC ensued. We are proud to report that commercial and nongovernmental organizations are interested in obtaining services from the Center.

To learn more about AID contractual requirements, Ms. Laura Cinat, CFO of ULRMC attended a workshop entitled "AID Rules and Regulations, OMB Circular and AID Update" in Washington on April 21-23. She will make plans for the transfer of this knowledge to ULRMC so that it will be equipped with all policies and procedures necessary to receive future government money.

## **Task 6 Information Archive**

The initial Landsat purchase of data for Ukraine has been processed and the scientific staff is awaiting the data delivery. Additionally, KH-4 scenes have been identified and also are being purchased. The Center is exploring the possibility of obtaining Russian KVR data as well as unique software required for this imagery. A decision will be reached on this issue no later than the end of June. Spot data that was acquired for the work in Zakarpatia is available in both Ann Arbor and Kyiv. SeaWiFS data will be archived at the Center once the receiving station is installed and certified. If approved by the technical review board a remote sensing data availability system similar to the USGS GLIS is proposed for Center operation. However, to be totally successful such a project would also have to be accompanied by declassification of current archival holdings.

## **Task 7 Demonstration Projects**

The ULRMC technical and management staff has generated the proposal projects (see Attachment 2) Additionally, USAID has put forth topical areas that support their vision for ULRMC Examples of these are the two agricultural projects For each of the projects listed in the attachment, a description, author/organization, project justification, and potential sponsor or client is indicated A summary of each of the proposed projects is also found in the Attachment Detailed write-ups on all the projects are available and will be furnished in English or Ukrainian Language upon request

## **Discussion**

Major future areas of focus will be the timely completion of demonstration projects and the development of continued funding for the Center There are several potential programs that are under consideration by the World Bank, as well as follow on work for AID within the realm of agricultural monitoring A very real prospect is the interest of the Western NIS Enterprise fund in agricultural monitoring programs This may be an area where it would be appropriate to create a for-profit spin-off company as described in the Grant

Management is also aggressively looking into mechanisms to leverage work that was completed to create ULRMC as a not-for-profit institution in Ukraine This may be in the form of a follow on proposal that specifically addresses this issue There is already considerable interest in this topic, and the Center has been approached on how best to make this model available to other programs

The Center will continue to work to build consensus in the security, scientific, and political communities for both declassification and the modernization of Ukraine's security regulations This is a recurring theme in conversations that ULRMC staff have with members of the Ukrainian government

The Annual Report, "The State of Remote Sensing in Ukraine," is being prepared Some data remain to be analyzed and it is anticipated that this report will go to print on or about 30 May

## Attachment 1—General Template for GIS Facility Plan

### 1 0 Scope

This document outlines and describes the elements that would need to be addressed in detail to design and operate a GIS facility. The specifics of such a plan are closely related to the purpose of the facility and are not addressed here. Rather this document is intended to serve as the road map for developing an operational plan.

### 2 0 GIS Facility Plan Elements

The basic elements of a GIS Facility plan include an assessment of current capabilities and projected needs, design of a system/facility to fulfill unmet needs, development of a plan to implement the selected design, and development of a plan to operate and maintain the facility once developed. These steps are discussed below.

2 1 Baseline Assessment / Needs Assessment The first step in developing an operational design and implementation plan is to define the needs for a GIS within the organization. This task can start with a review of the organization's mission statement and an inventory of existing capabilities (Baseline Assessment) and then proceeds with a need assessment. A sample needs assessment is included as Attachment A.

### 2 2 GIS System Design

#### 2 2 1 Applications

– What applications need to be developed to provide the products and services identified during the needs assessment?

For each identified application, provide

- Objective/description
- Priority
- Functions
- Inputs/Outputs
- Estimated development cost

#### 2 2 2 Data

– What data are required to support the applications to be developed?

– How will they be conditioned, stored and maintained?

##### 2 2 2 1 Content

- Identify sources for required data
- Develop cost estimates to acquire, condition and maintain

##### 2 2 2 2 Database Structure

- Develop plan (or application or system) for cataloging and archiving data

- 2 2 3 Infrastructure
  - What are the functional requirements and specifications of the computation and communication (e g , network) technologies?
  - What are the physical environment requirements?
  - What are the estimated costs?
  - 2 2 3 1 Hardware
  - 2 2 3 2 Software
  - 2 2 3 3 Communications / Networking
  - 2 2 3 4 Physical Environment
    - 2 2 3 4 1 Floor space
    - 2 2 3 4 2 Electrical Power
    - 2 2 3 4 3 A/C, Fire suppression

### 2 3 Implementation

- How will the designed system be built? Are there alternative implementation methods?
- How long will it take to implement? What are major phases?
- What will it cost to build?
  - 2 3 1 Strategies
    - Explore and rank alternative implementation strategies (e g , outsource development vs build internally, pilot projects, parallel development paths, etc )
  - 2 3 2 Schedule
    - Develop timeline showing development phases, major milestones (and associated reviews)
  - 2 3 3 Budget
    - Develop detailed budget for purchasing, integrating and/or developing
      - 2 3 3 1 Hardware and software
      - 2 3 3 2 Data
      - 2 3 3 3 Applications
      - 2 3 3 4 Consulting

### 2 4 Operations

- How will the system be operated and maintained now that it has been built?
- What are the staffing requirements? What training will be required?
- What will the operational budget requirements be?
  - 2 4 1 Staffing
    - 2 4 1 1 Job Descriptions / Profiles
    - 2 4 1 2 Training requirements and plans
  - 2 4 2 Maintenance
    - 2 4 2 1 H/W, S/W
    - 2 4 2 2 Data
  - 2 4 3 Financial
    - 2 4 3 1 O&M costs
    - 2 4 3 2 Projected revenues

# Detailed GIS Needs Assessment

## Organization Information

### Mission

Summary of organizational purpose / mission statement

Why does this organization or agency exist?

What basic mission do they perform?

Customers / users

Who uses the data or services that this org / agency provides?

Who funds this org / agency?

Currently, what does this organization produce/offer/have?

Products

Services

Data/information needs

Computing infrastructure

What near-term future does this organization expect to product/offer/have?

Are there unmet customer needs?

Are there newly mandated requirements being placed on this organization?

Products

Services

Data/Information needs

Computing infrastructure

## User Information

System Users - Data analysts / technicians who process data to prepare data products for internal or external customers

Educational background

Training issues

Current training

Restrictions/impacts of Proposed System training

Similarity with existing systems

- How important is it that the Proposed System "look & feel" like existing systems?

Compatibility with existing data

Product Users - Data analysts / domain experts who use final data products or services

Applications

- Describe general applications for spatial data

Projects

- Describe typical project(s) Customers, deliverables, etc

Training

Compatibility with existing data

New Users

- Would you expect the Proposed System data products to broaden your market/audience of users? If so, describe how? Who?

## Products (Standard data products delivered to internal & external users)

### Existing

- Baseline existing standard products, if any, description to include

### Product type

Digital vs hardcopy

Map vs image vs "report"

Formats

Raster vs vector

Digital interchange/storage formats (e.g., ARC/INFO, ERDAS, TIF, VPF, etc.)

Interchange/Storage media

Tape

CD

Diskette

Scale(s)

Accuracy(s)

Interface/compatibility with other digital data

Source(s)

Quantities

Formats

Planned

- as above

With Proposed System / Facility

- as above

## Services (Non-standard products / Application Studies)

- Review recent projects, including

Application

Data types

Formats, etc

Analysis Techniques

H/W - S/W

Deliverables

## Work Flow

- Baseline current operations, including

Hardware

CPUs

Peripherals

I/O

Storage

Hardcopy generation

Software

Image processing

GIS

Other (Visualization, models, etc.)

Staff

# Concurrent system users

Breakdown of operators vs analysts

Process/methods

Production rates

Backlogs

Data volumes

On-line

Near-line

Off-line

Distribution mechanisms

## Attachment 2—Demonstration Projects

The purpose of the demonstration projects is fourfold

- To demonstrate technical expertise at the Center in order to secure outside funding,
- To generate a GIS base layer(s) that can be used to sell a product or service, and
- To create a marketable capability (product or service)
- To train Center Personnel

Each project will include the potential client, whether that is government, commercial or an international foundation (i.e. World Bank). For example, in the Black Sea study, the project should not only address the remote sensing of oil spills, but should also address the infrastructure changes required to fine the violators as well as perform remediation.

A two-stage approach for project implementation is recommended. Certain projects such as the Flood Assessment, Ukraine National GIS, and agricultural project are already under way or completed. Others like the Black Sea Bio Reserves, Chernobyl GIS, Water Resource and Remote Sensing Data Availability satisfy a Congressional mandate, USAID deliverable, or support a potential source of follow on funding. It is recommended to formally begin the following five projects immediately.

- Western Ukraine Flood Assessment GIS (completed)
- Remote Sensing Data Availability System,
- Ukraine National GIS
- Chernobyl GIS DEM
- Agriculture Monitoring and Assessment

For each of these projects, as well as the others (Phase II) listed on Table 1, the objective, the approach, the anticipated results, the specific potential customers to market results, the schedule, and the resources required are well understood.

The other five projects listed on Table 1 (Black Sea Oil Spills, Agricultural Privatization Assistance, LANDSAT Base Map, and Water Resource Study) would be further refined, and a target date for either go ahead, or the development of additional funding be established by the Technical Review Board.

In summary, a two-stage approach makes sense. Projects that have been mandated and/or have immediate impact on the Center are under way. Demonstration project that will require additional resources or that do not have immediate public impact in Ukraine should be studied further to determine when they can be phased into the program.

**Table 1 Candidate Demonstration Projects for the Ukraine**

<b>Title</b>	<b>Description</b>	<b>Author/Organization</b>	<b>Project Justification</b>	<b>Potential Sponsor/Client</b>
Western Ukraine Flood Assessment	Spot/Landsat data analysis of November floods with GIS overlay	Fuerst/ERIM NFP Sadowski/EI Kolodyazhnyi/ULRMC	-Current issue -Center will get favorable press	Ukraine government Relief organizations
Environmental Monitoring and Management of Water Resources	Environmental management of water resources	Kolodyazhnyi/ULRMC	-Good technical capability -Continuation of REMIS -Utilize Center expertise -Resource management	Ukraine government Commercial (Environmental Impact Analysis)
Remote Sensing Data Availability System	Internet based data availability system	Kolodyazhnyi/ULRMC	-Service available for fee -Means to deliver data to customers -Good role for Center -Training in Western approach	Ukraine government Commercial
Ukraine National GIS	Country-wide GIS including physical and social data	Hearn/USGS with Center assistance	-Baseline data -Commercial sales of CD -Credibility for center	Ukraine government Commercial Academic organizations International organizations
Chernobyl GIS Data Layers	3m littoral time images 3m DEM	Shuchman/ EI Fuerst/ERIM NFP	-High resolution data -Unique contribution -Satisfies congressional language -Increases Center stature	Ukraine government International organizations
Black Sea Oil Spills and Bilge Dumping Monitoring	Detection of bilge dumping and oil spills in Black Sea	Fuerst/ERIM NFP Tsymbal /ULRMC	-Utilizes Ukraine RS capability -Ties into government infrastructure -Funding sources	Ukraine government Oil companies International foundations

System			-Important environment issue	
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Agricultural Privatization Assistance	Create GIS-based system including prediction and economics for management of farms	Fuerst /ERIM NFP Sadowski/EI Center personnel Wigton/AIIC	-US AID endorsed -Optimize profit of private farms -System can be sold to all 10,000 farms -Training	Commercial World Bank International foundations
Agriculture Monitoring and Production Estimation	Country wide remote sensing based agricultural status and distribution	Fuerst/ERIM NFP Sadowski/EI Wigton/AIIC	-USAID endorsed -Defined role for Center training -Good base line training -Potential for outside funding	Ukraine government World Bank International foundations
LANDSAT Base Map	Geo-coded with DEM Landsat imagery of entire country	Sadowski/EI and Center processing personnel	-Baseline data -Sellable -Used to train ULRMC staff	Ukraine government Commercial
Black Sea Bio Reserves	GIS Based Analysis of Habitat, Species Requirements, Corridors, Land use and Land change	Center White Sadowski	-Baseline Data -Environment Issue -Long Term Project -Applicable throughout region	World Bank Ducks Unlimited Ukraine Government
Real-Time NOAA/SeaWiFS Satellite Data Reception and Processing	Real-time reception and distribution of SeaWiFS and NOAA data	Shuchman/EI Center personnel	-Immediate revenue source from Orbital Science training in suitable operations -Internet distribution -Increase Center stature	Ukraine government Commercial International foundations <b>Designated as Infrastructure</b>

## **Western Ukraine Flood Assessment**

The flooding that occurred in the Zakarpatskaya Region in November has provided an opportunity for the Center to respond with maps and GIS analysis to assist in assessment and mitigation of future events such as this. A GIS has been developed for a portion of the flood region to demonstrate integrated spatial mapping and analysis of land cover, elevation, hydrology, populated areas, and human infrastructure. Satellite image data from SPOT has been used to provide an image base map immediately following the flood. Landsat TM has been used to derive land cover information. Maps (provided by USGS) of the region were used to capture human infrastructure (roads, populated places, etc.) and river structures (dams, bridges). Locations of known events affecting populated areas, infrastructure, and river structures were entered into the database. Elevation data was incorporated to evaluate landform and slopes contributing to mudslides. The GIS will be used by the Ukrainian Government Ministries and the local government to develop information products that can assist mapping areas susceptible to flooding, mapping potential slide areas, and predicting areas most susceptible to loss of property and lives.

## **Environmental Monitoring and Management of Water Resources**

This project will demonstrate development of a GIS that includes remote sensing data resources, other spatial environmental data, and models to provide a Ukrainian Regional Environmental Management Information System (REMIS) for river watersheds. The system will be used to monitor river basins for events such as snowmelt and floods, assess the influence of point and distributed sources of pollution, and predict floods. Satellite image data will provide periodic snow cover and moisture content, land albedo, and vegetation presence and status. Other spatial environmental data will include infrastructure and *in situ* water quality monitoring data. Elevation data are a specific need for modeling land runoff.

## **Remote Sensing Data Availability System**

This project will develop an information system to enable search and access to remote sensing data resources in Ukraine as well as international data archive and distribution centers. An Internet accessible system will be developed to conduct searches in interactive mode. Access to the system will be provided at all Ukrainian government organizations requiring spatial data. This project will contribute to ULRMC program requirements for establishment of an information archive that identifies locations of data and develops metadata standards for use in Ukraine.

## **Ukraine National GIS**

This project will further develop a national-scale database of spatial environmental data developed by the U.S. Geological Survey. In its current state, the database includes coverages of several land parameters at 1:1M scale. These coverages include GTOPO30 global elevation data (DCW), Digital Chart of the World layers of hydrology, boundaries, populated places, and

human infrastructure, AVHRR land greenness, and several classifications of land cover. The USGS proposes to work closely with Center personnel to add additional information into the database to further enhance the information content of attributes associated with locations such as populated places. The additional information could include population size, per capita income, industries, landmarks, names of local government officials, etc., for demographic units ranging from oblasts to cities and towns. The effort will require Ukrainian support for provision of attribute information. The enhanced GIS will provide a country-wide view of Ukraine at relatively low data volume that, when put on CD-ROM with map viewing software, could be disseminated to governmental units, schools, and commercial groups such as travel agencies as evidence of the capabilities of the ULRMC.

### **Chernobyl GIS Data Layers**

The objective of this project is to produce fine resolution data layers for a GIS of the Chernobyl restricted zone to support modeling and remediation efforts, understanding of public health effects, studies of environmental impact and ecological succession, and land use planning. Specific emphasis will be placed on development of high resolution image maps and digital elevation data. Such data, integrated with other spatial environmental data acquired from maps and ground surveys, will dramatically improve capabilities for mapping land characteristics, monitoring change, and modeling surface processes. This project will support the efforts of the Canadian International Development Agency (CIDA) to develop a GIS for the Chernobyl restricted zone. The newly developed data products will be made available to other parties through the ULRMC.

### **Black Sea Oil Spills and Bilge Dumping Monitoring System**

The objective of this project is to provide Ukraine with a remote sensing and GIS based environmental monitoring system to detect, identify, and assist remediation of oil spills and bilge dumping in the Black Sea. A GIS of marine and coastal land environmental data will be configured to ingest daily SAR and optical satellite image data that have been acquired by Ukrainian reception stations and internet access. Image processing tools will be implemented within the GIS to geo-register the satellite images and exploit the data for evidence of surface slicks that may be indicative of oil spills or bilge dumping. Once detected, slick information will be compared to a database of historical accidents and other events affecting ocean surface characteristics to assist evaluation of the detected phenomenon. The system will generate map and information products showing location, size, and timing of the detected incident. Such products will be electronically disseminated to enforcement and remediation organizations for response. The results of this project will contribute to Ukraine efforts to reduce petrochemical pollution of the Black Sea. An important aspect of this project will be working Ukraine government officials to put in place an infrastructure to fine violations and remediate damage.

### **Agricultural Privatization Assistance**

The objective of this project is to implement GIS and remote sensing approaches for developing databases to assist local agricultural area assessments and farm management. Large-

scale image base maps will be integrated with spatial environmental information and ownership boundaries to demonstrate uses of information products by land-owners for economic planning of farm-level activities. The spatial context of infrastructure such as road networks will be added to demonstrate uses of information products for planning crop harvest activities and scheduling the transportation of farm products to commodity processing facilities and markets. Information products will be produced to demonstrate local government use for tax assessments relative to farm size, farmstead developments, and potential productivity. The project will support the privatization efforts of the Ukrainian government and USAID by demonstrating the use of land survey information for assisting local farm management and economic assessments.

## **Agricultural Monitoring and Production Estimation**

This project will assist the development of GIS capabilities for integrating remote sensing data resources, other spatial environmental data, and ground collected data to enable the determination of agricultural status and distribution over extensive countrywide geographic regions. Procedures will be implemented for integrating satellite image data, land and climate parameters, and demographic data to stratify agricultural regions and measure cropland area. Methods will be demonstrated for integrating field measurements and farm survey data with satellite image data to estimate crop yield and agricultural production. To assist understanding the contributory role of satellite image derived information, initial efforts will review the current methods of agricultural production estimation for their adequacy and timeliness. The results of the project will contribute improved capabilities for monitoring agricultural regions and estimating production, thereby assisting the needs of agricultural reform in Ukraine. Issues relating to water resource requirements and harvest distribution will also potentially be addressed under this activity. This activity is currently on going. Interim products are expected to be available by the end of July. The area selected for this demonstration project is the Lviv Oblast, an area with other on going USAID programs.

## **Landsat Base Map**

The purpose of this project is to develop a national image base map for Ukraine. A total of 81 TM scenes will be required to achieve coverage of the country and include cross-border coverage of adjacent countries along the international boundary. The Landsat archive contains complete coverage for the summer season of the late 1980s, with almost all scenes (74 out of 81) occurring in the single year of 1988.

This project will orthorectify and mosaic Landsat TM scenes to create a seamless georeferenced digital image map of moderate resolution (30-m). The resultant digital map will provide a near-temporally consistent, multispectral image base of summer land cover conditions for the entire country. The image base will enable baseline documentation of the extent of active agriculture and forest cover, the conditions of coastlines, and other land cover conditions just prior to Ukraine independence. The image base will be useful as a source of information for land feature context when assessing national programs such as land privatization and agricultural reform, and when monitoring regional change associated with land development or disaster impacts. The digital map will be useful as an image base for cartographic maps ranging from

1 50,000 to 1 250,000 The digital map could be marketed as a product to be sold to commercial and educational interests requiring land cover information

### **Real-Time NOAA/SeaWiFS Satellite Data Reception and Processing**

This project will provide ULRMC with a High Resolution Picture Transmission (HRPT) station satellite receiving station capable of capturing data from the Sea Wide Field-of-view Sensor (Sea WiFS) and the NOAA Advanced Very High Resolution Radiometer (AVHRR) sensors as well as data from many other satellites ULRMC staff will receive training in all aspects of station operations, data processing, and applications SeaWiFS provides daily multi-spectral images optimized for the assessment of agricultural and forestry vegetation and production, oil spills, coastal water quality problems, and regional atmospheric pollution Several specific demonstrations will be developed with ULRMC staff The project will include all of the required hardware and software to collect, process, and analyze data from these satellites in support of ULRMC applications The hardware and software will also be capable of integrating and analyzing commercially available data from Landsat, SPOT, ESA, and other sources Orbital Sciences Corporation, which manages the SeaStar spacecraft, has a strong interest in supporting a ULRMC HRPT station for collecting and archiving the SeaWiFS data Such activities would provide a source of revenue for the ULRMC and the receiving station operations

### **Black Sea Bio Reserves (started)**

The World Bank Environmental Section is assisting Ukraine in the establishment of Bio Reserves along the Black Sea Coast This area is a major stop over point for many migratory Bird Species It is also home to many species listed in the Ukraine Red Book (Endangered) The project would establish a GIS as a management and monitoring tool for data collected in the field by Botanists, Biologists and Ecological Specialists The GIS would also assist in the management of these areas Adequate data currently exists over the area in question, SICH, ERS -1, LandSat, SeaWifs, AVHRR, Corona imagery is commercially available Data from the Russian imaging program is also available commercially Date ranges for imagery coverage range from the 1960s through current coverage Additional imagery from the mid 1940s may be available in the photo archives of the US This project is currently scheduled to be funded by the world bank A demonstration of Center capability could capture most of the funding for this project, for this reason an initial GIS was created to demonstrate capability Further work will populate the GIS with data as described above