



→ 6th ESA ADVANCED TRAINING COURSE ON LAND REMOTE SENSING

Land Remote Sensing in Romania

Alexandru BADEA

Romanian Space Agency / USAMV

14–18 September 2015 | University of Agronomic Science and Veterinary Medicine Bucharest | Bucharest, Romania

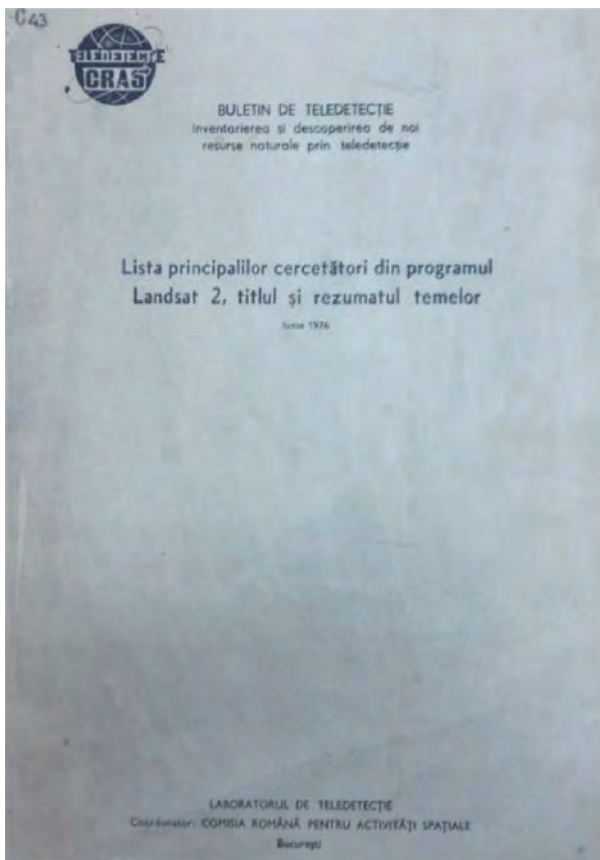
The Romanian activities in the field of remote sensing have a considerable tradition

Due to the fact that the problems of assessment of available natural resources, agriculture activities and, more later , environmental pollution were considered as priority for any administration, the possibility to use remote sensing was taken into account.

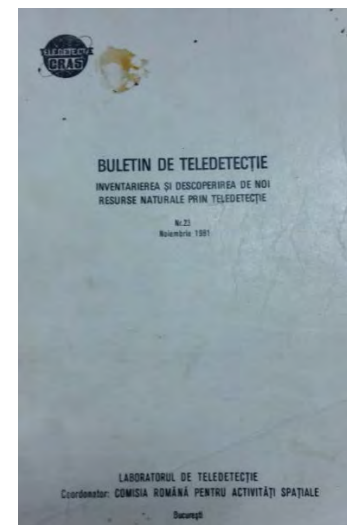
Romanian researchers, trained in USA after 1968, become promoters of this amazing technology in Romania. Their effort convinced the authorities to create the Romanian Commission for Space Activities (CRAS) under the coordination of the National Council for Science and Technology.



The creator of the Romanian school of Remote sensing was Nicolaie Opreescu, professor at the College of Civil Engineering of Bucharest.



Professor Opreescu organized the first Remote Sensing Laboratory in Romania at the beginning of Landsat era. Being selected as principal investigator by NASA, he coordinated important studies especially for wet ecosystems (Danube Delta) and costal areas (Black Sea).



27540-P028-P00-0200

TITLE: LIE OF EATS DATA FOR NATURAL RESOURCES INVESTIGATION IN THE DANUBE DELTA AND THE COASTAL SEDIMENTATIONS

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ABSTRACT: THE DANUBE DELTA AND THE COASTAL ZONE OF THE BLACK SEA REPRESENTS A REGION OF SPECIAL INTEREST FOR THE STUDY OF COMPLEX PROCESSES TAKING PLACE IN SUCH AREA. THE OBJECTIVES OF THIS PROJECT ARE: 1) EVALUATE THE POSSIBILITIES OF REMOTE SENSING IN DELTA AND COASTAL ZONES (ESTIMATION OF SPECIFICITY OF INDICATORS, CECIPERIAL DETERMINATIONS, DYNAMICS OF COASTAL SEDIMENTATIONS) AND 2) ELABORATE AN INVENTORY OF ECOLOGIC RESOURCES AND AN INTERDISCIPLINARY ANALYSIS FOR MULTIPLE RESOURCE DEVELOPMENT, LAND-USE PLANNING AND ZONING, AND IDENTIFYING SOURCES.		

The covers of reports of one study of Prof. Oprescu (1976)*

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E76-10259
CR-14663
SR N° 27940.01

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USE OF LANDSAT DATA FOR NATURAL RESOURCES
INVESTIGATION IN THE LOWER BASIN
OF DANUBE AND DANUBE DELTA

RECEIVED
NASA STI FACILITY
ACQ. DIV.
APR 07 1976

Nicolas OPRESCU

Laboratory for Remote Sensing
College for Civil Engineering
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TYPE I REPORT-Progress Report
for period May-December 1975

Report Date: December 1975

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SIS/902.6

Sponsoring Agency:
ROMANIAN COMMISSION FOR SPACE ACTIVITIES
NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY
Str. Roma 32, Sector 1, Bucharest, Romania

876-20605
Unclas
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CSCL 08H G3/43
May - Dec. 1975 (College for Civil
Engineering) 13 P HC \$3.50
(E76-10259) USE OF LANDSAT DATA FOR
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LOWER BASIN OF DANUBE AND DANUBE DELTA
Progress Report,
May - Dec. 1975 (College for Civil
Engineering) 13 P HC \$3.50

E77-10032
CR-149097
SR N° 27940.01

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Report Date: July 1976

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The Remote Sensing laboratory created by professor Oprea in the Danube Delta



Field test
(equivalent
of two ERTS
1 pixels)



Other teams initiating remote sensing activities for thematic applications

- **Institute of Geodesy , Photogrammetry, Cartography and Land Management -IGFCOT- (Mihai Albotă)**
- **Institute of Soil Sciences and Agro-Chemistry – (Ion Munteanu and Dumitru Teaci)**
- **National Institute of Meteorology – (Horia Grumăzescu)**
- **Geological Institute of Romania**
- **Military Surveying Service**
- **Forest Research and Management Institute**

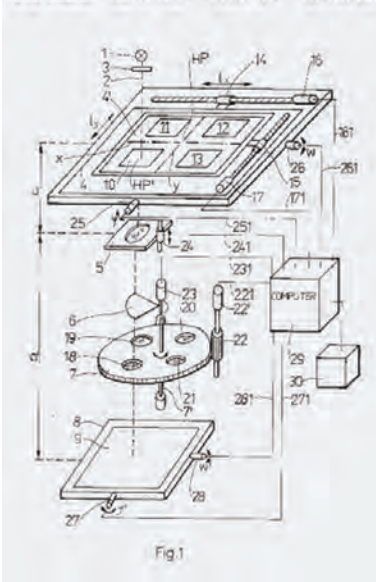
A second important step for the developpment of Land Remote Sensing in Romania was the constitution of two specialized laboratories (1985-1986)*

- **Institute of Studies and Design for Land Reclamations (ISPIF)**
- **Institute of Geology and Geophysics (IGG)**

*** Complete analogical and digital processing chains equipped the two laboratories**

Analogical equipment for RS studies - The MSP-4C multispectral projector

U.S. Patent Mar. 11, 1986 Sheet 1 of 2 4,575,232



Made by Carl Zeiss Jena (DDR) for the multispectral and/or multitemporal analysis of the images taken by MKF 4 or MKF 6 cameras installed on aircrafts and space platforms, the instrument consists of :

- four individual projectors each equipped with six color filters and one clear glass;
- electromechanical setting units for a correct registration of the images selected for generating color composites

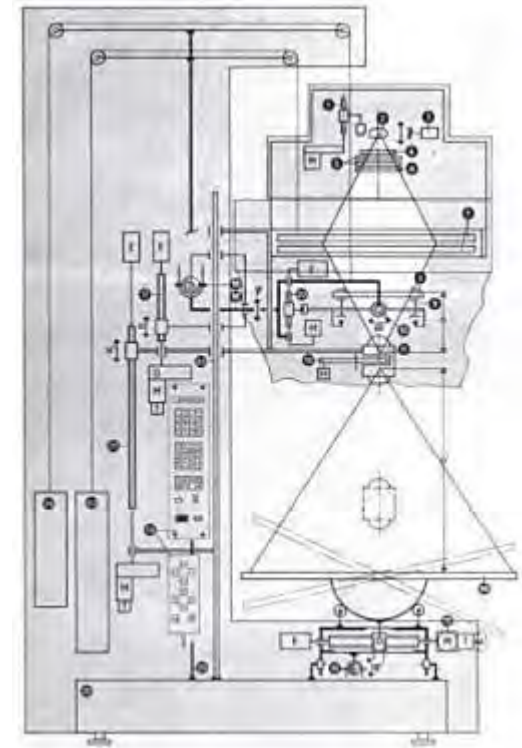
The MSP4 had four channels for producing a superimposed image for visual evaluation. It was possible to variate the spectral range and the density of each channel .



Analogical equipment for RS studies - The RECTIMAT-C precision rectifier



Made by Carl Zeiss Jena (DDR) for producing color composite images from multiband photographs with high resolution. The "Rectimat-C" rectifier was created for correcting space photos obtained by space platforms to a cartographic projection. The methods for calculating the errors caused by the curvature of the Earth surface and refraction of light beams in the atmosphere and a peculiar technology for composing multispectral color images was elaborated.



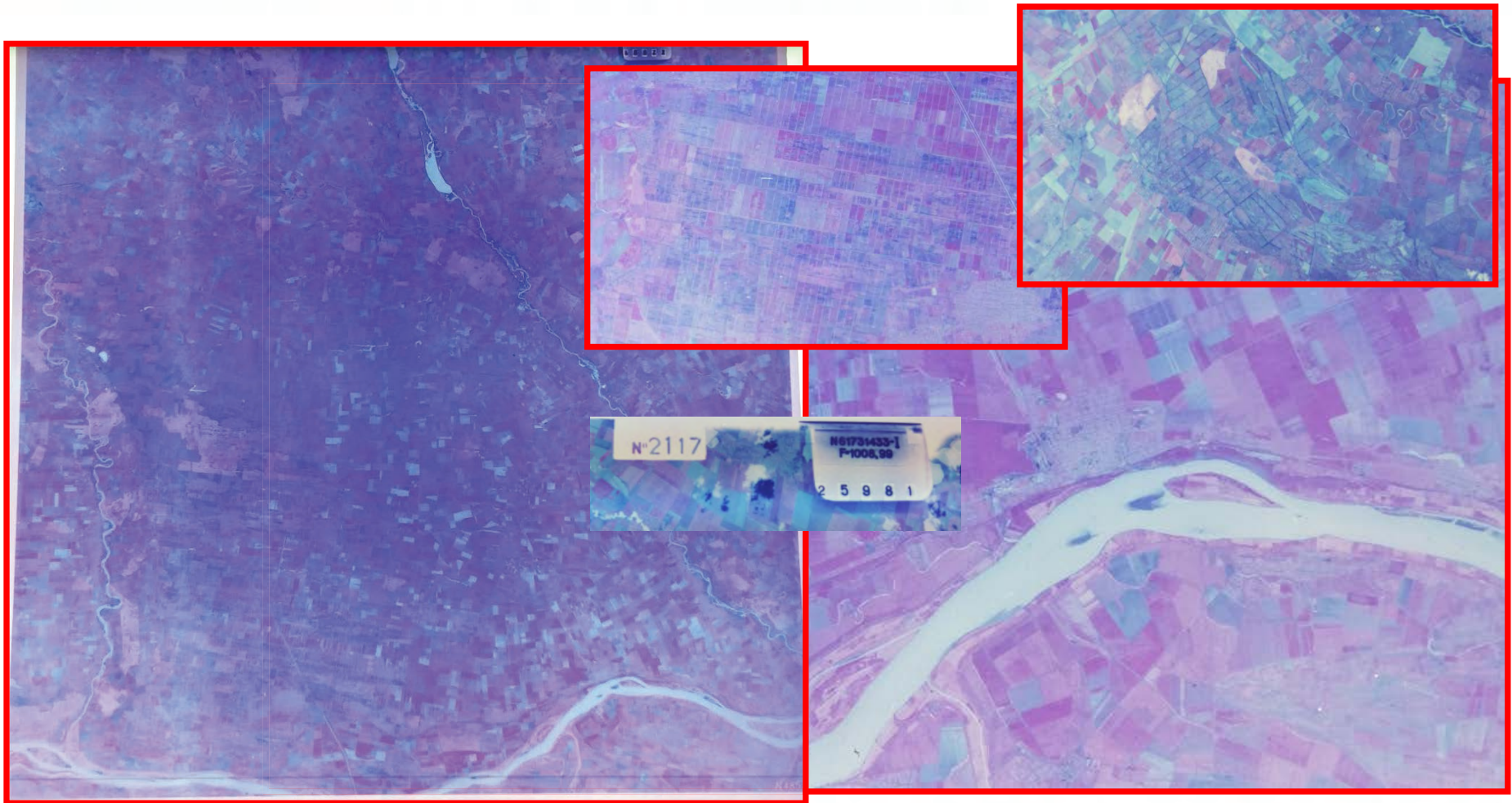
Characteristics of RESURS F satellite films

Table 9.6. Geometric characteristics of photo information (Resurs-F system).

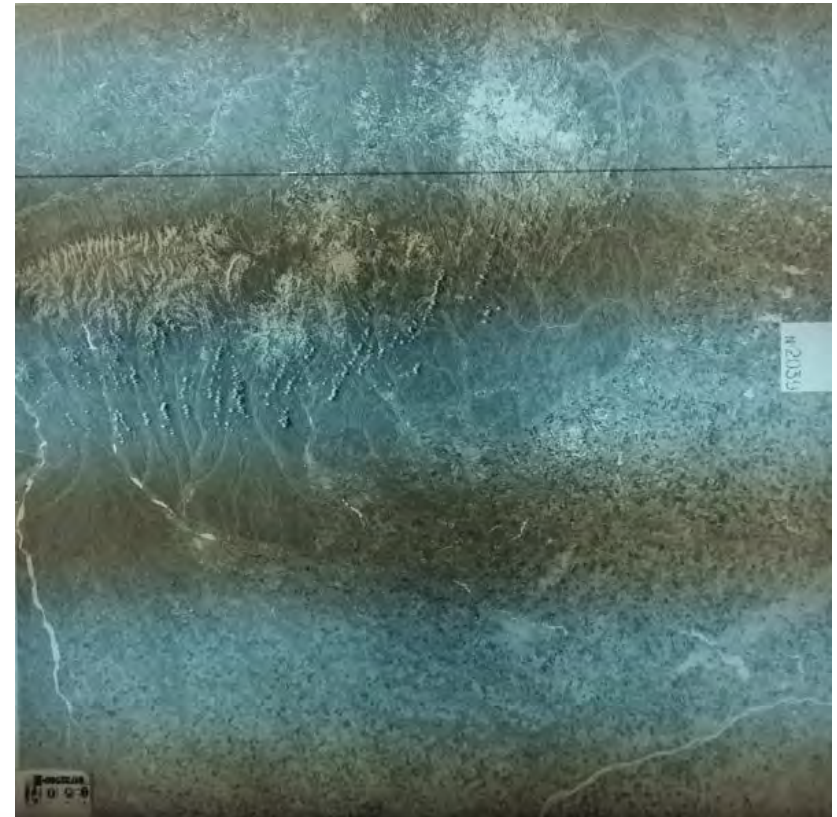
Characteristics	Photo cameras			
	KFA-200	KFA-100	MK-4	KFA-3000
Flight altitude (km)	275/235	275/235	240	275
Focal length (mm)	200	1,000	300	3,000
Picture format (cm)	30 × 30	18 × 18	30 × 30	—
Film length (m)	250	580	500	600
Swath width in flight altitude fractions	0.9	0.3 × 2/0.3 × 3	0.6	0.1 × 2
Spatial resolution (m) for survey in one spectral band	25–30/23–25	—/4–6	10–12/7–10	3
for spectrozonal survey	—	8–10/6–8	12–14/8–11	—

After Eugene A. Sharkov

Spectrozonal images for processing with RECTIMAT-C



Single band KFA 100 camera images



ROBOTRON digital equipment for image processing



The ROBOTRON console

Made by ROBOTRON (DDR) for the multispectral analysis of images (including Landsat CCT magnetic tapes), the system was able to read and display 256x256 pixels color composite images.

The processing chain was completed by a analog/digital converter FEAG 200 able to scan the films from MKF 4 and MKF 6 cameras.

NOTE : The Institute of Geology and Geophysics was the the owner of a MKF 4 aerial camera.

After 1990 started a new important period for the development of Land Remote Sensing in Romania

The setup of the Romanian Center for Remote Sensing Apply (CRUTA), based on the implementation of coherent projects in cooperation with the Joint Research Center of the European Union and CNES, generated a new concept regarding the remote sensing development. Operational applications become reality. The well known Romanian Crop Information System transferred the European knowhow for fully implementing the MARS (Monitoring Agriculture by Remote Sensing) methods.

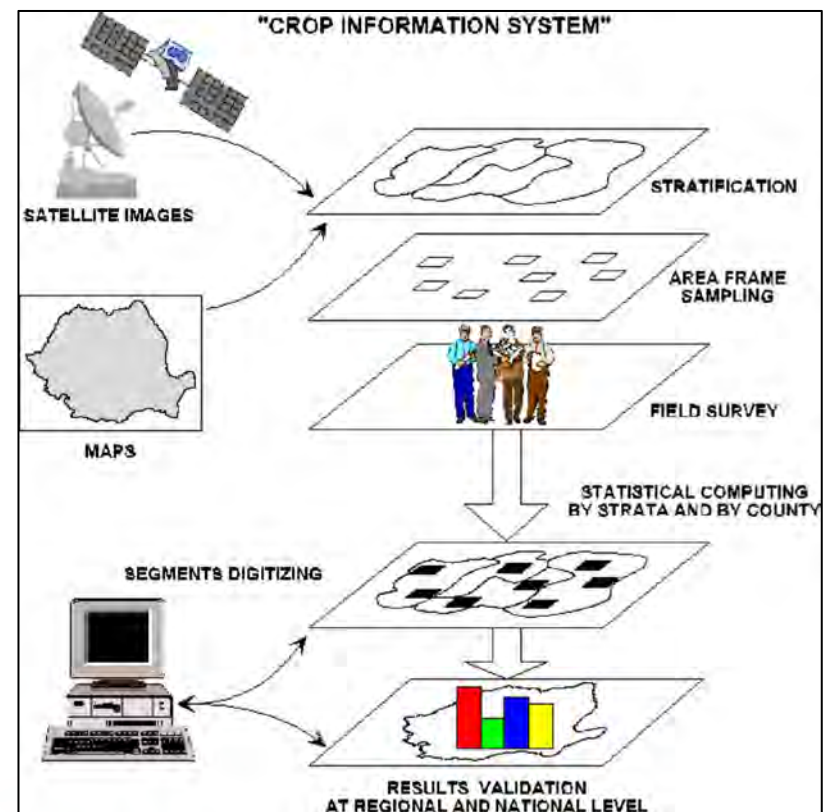
This project, started in 1992 with small pilot applications, was concluded in 1998 at country level.

When it was launched, the Crop Information System Project was considered as being a too ambitious operation given the economic state of Romania.

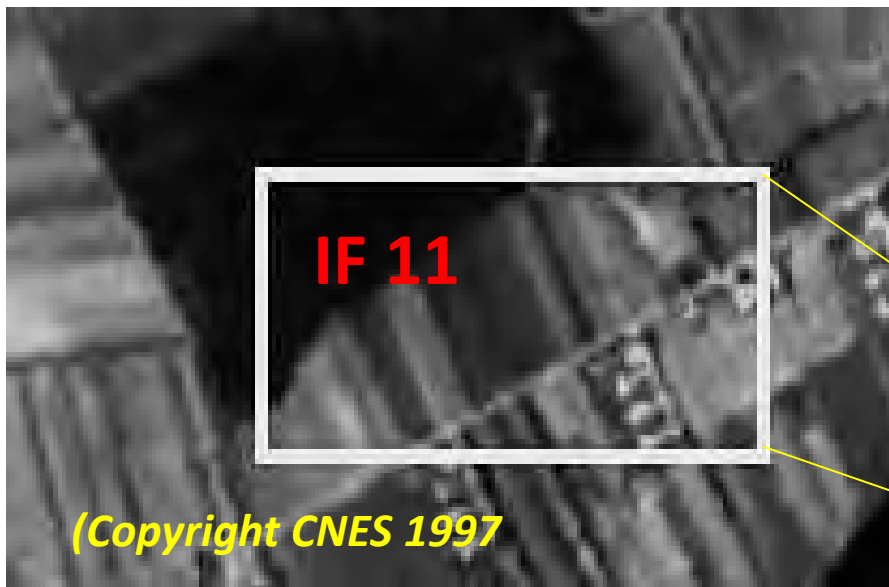
After 1990 started a new important period for the development of Land Remote Sensing in Romania

The “Crop Information System” project occurred together with the first structural modification of Romanian agriculture, generated by Land Law application. These modification leaded to:

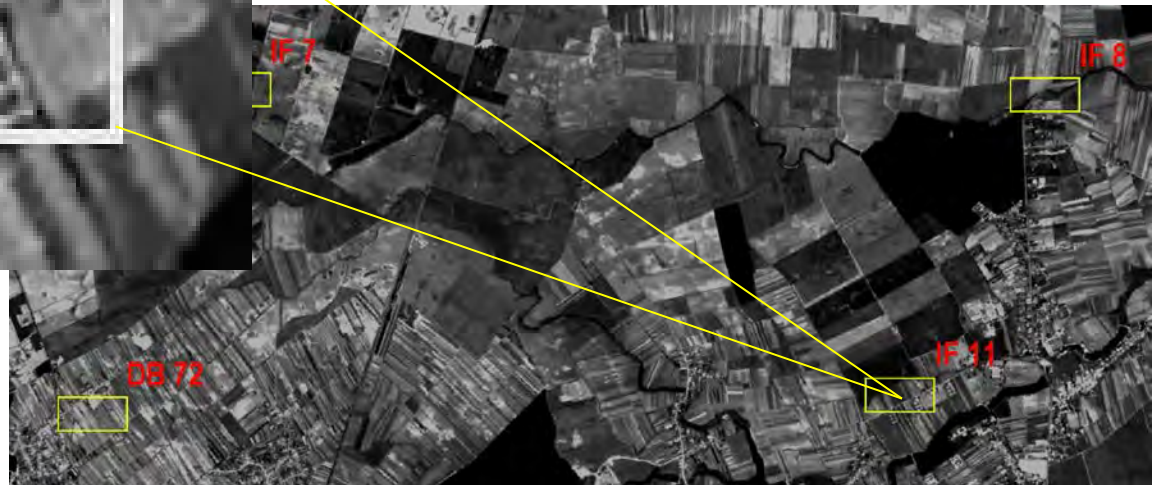
- an excessive fragmentation of parcels;
- an increased number of landowners (from about 3,000 to 4,000,000).



The use of printed images for collecting ground information



FIELD DOCUMENT (SPOT P IMAGE)



In parallel with the setup of CRUTA, under the co-ordination of the Ministry of Agriculture, at national level another more important initiative occurred : constitution of the Romanian Space Agency (ROSA)

After 1995 the RS activities developed for agriculture were considered as a key development target. As result, since 2001, the National Program for Research and Development includes as main topics agriculture and environmental space applications. A part of the experienced researchers working for CRUTA have been nominated for coordination of RS activities at ROSA.

Very important projects were developed by the common group of experts ROSA / CRUTA.

Romanian Space Agency

- **ROSA - National Space Agency established 1995**
- **Public organization in the system of the Ministry responsible for Research and Technology**
- **Representative and Coordinator of space activities in Romania**
- **Financing agency for research in Space, and Security Research**
- **Developer and integrator of its own RTD programmes by the ROSA Research Centre (RRC)**

Several R&D projects developed by ROSA and CRUTA (in partnership with JRC and FAO) foreshadowed compulsory components of the National Spatial Infrastructure :

- IACS/LPIS (2002-2007)**
- LCCS database (2003-present)**
- ROENV geoportal (2007-2009)**

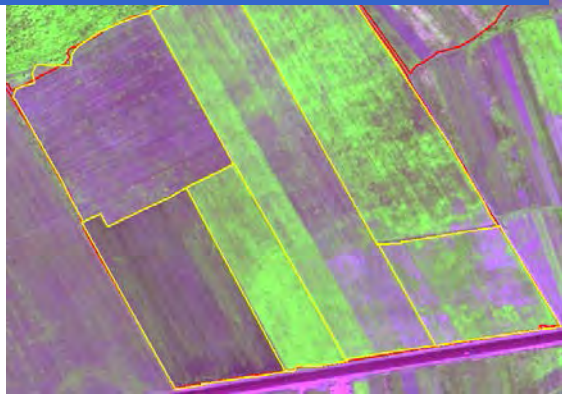
IACS/LPIS (2002-2007)

IACS-LPIS and CwRS (Integrated Administration and Control System - Land Parcel Identification System in Romania and Control with Remote Sensing) as next step of the MARS (Monitoring of Agriculture with Remote Sensing) implementation.

The creation of the National LPIS/IACS system started with pilot projects for evaluation of data sources for creating the geographical data base (aerial old photo vs. VHR satellite images)



THE FARMER IS ABLE TO LOCATE THE FIELD



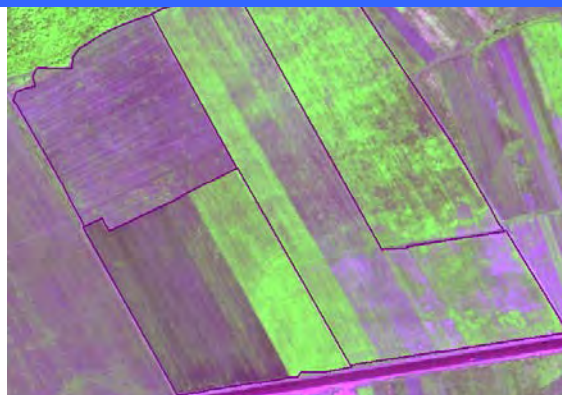
THE LAND REDISTRIBUTION MAP HASN'T A REAL INFORMATIVE VALUE



THE OWNERSHIP SITUATION IS VERY DYNAMIC ...



... AND THE WORK COULD BE REALISED BY AD-HOC AGREEMENTS



The value of Remote Sensing studies for agriculture depends of an objective understanding regarding the “de jure” and “the facto” situation of the land ownership as well as the local agricultural practices. The Romanian territory still depends of solving the problem of ownership.

LCCS database (2003-present)

The creation of the Land Cover Classification System LCCS, based on the FAO concept, offers the possibility to follow the dynamics of the landscape. Major rapid changes of the parcel structure generated errors in the elaboration of strategies for agricultural development. This objective method tested with good results as basis of analysis in different domains remains a priority for future developments.

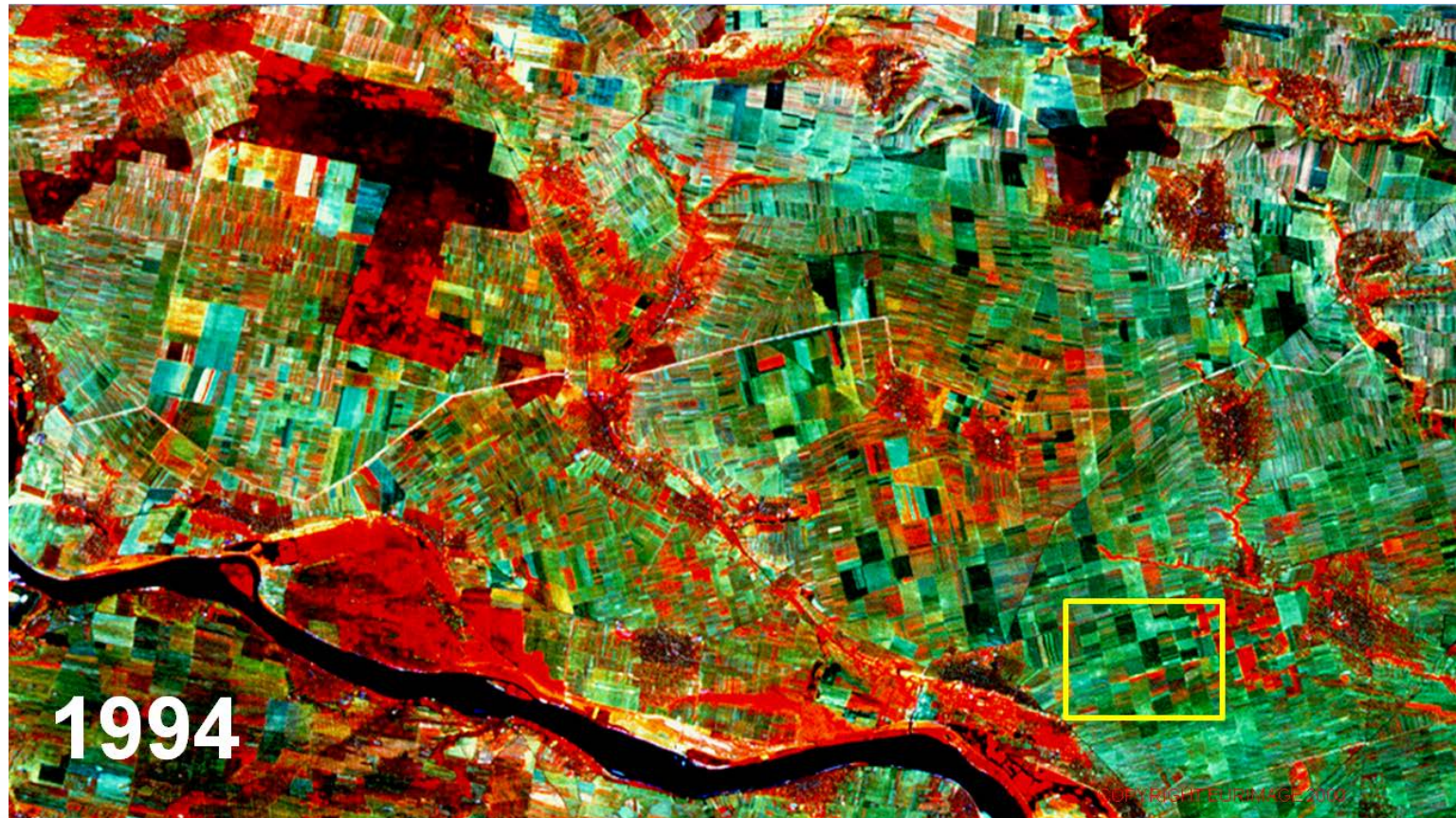
LCCS – Land Cover Classification System – in Romania

Dynamics of the landscape



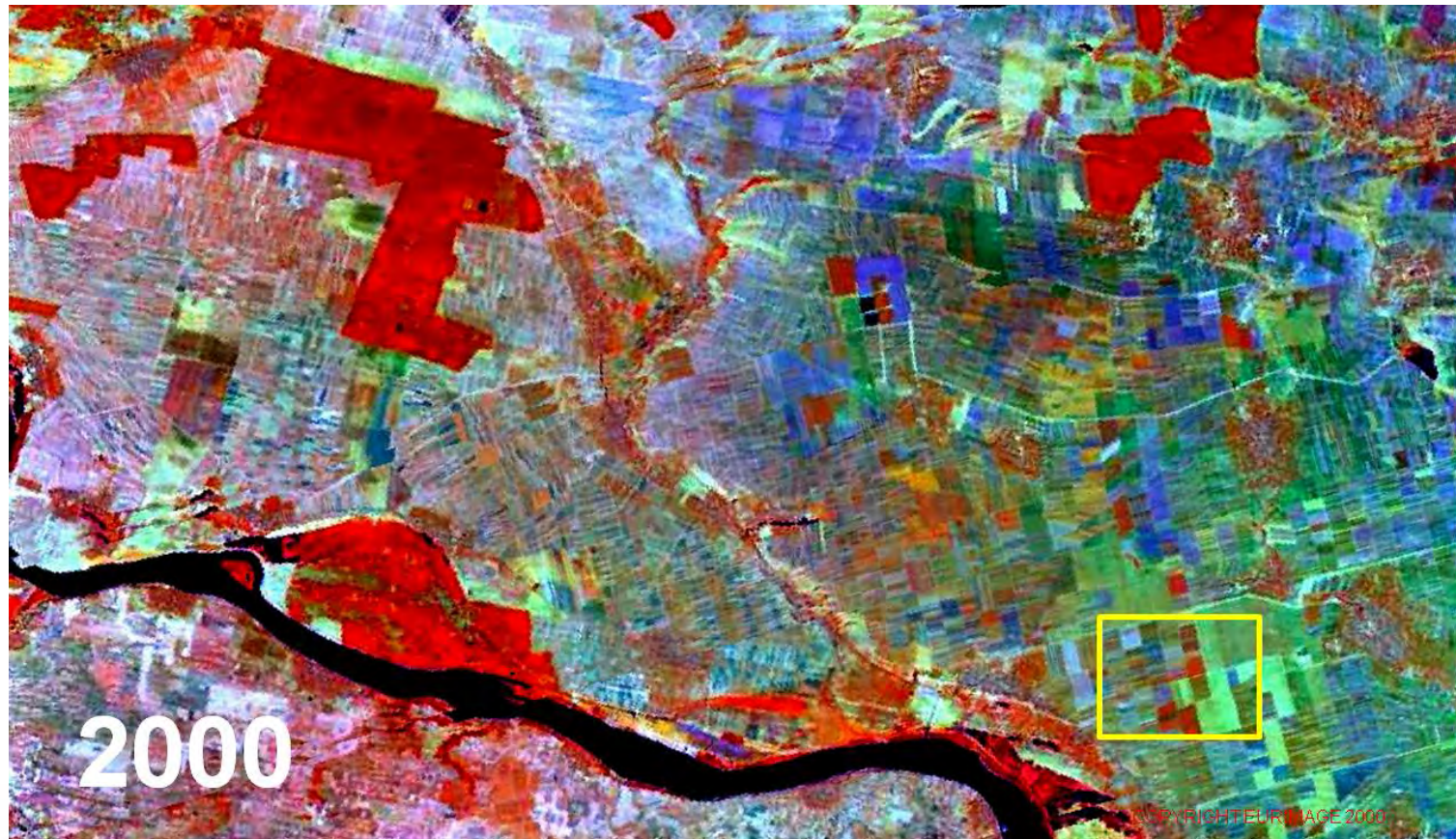
LCCS – Land Cover Classification System – in Romania

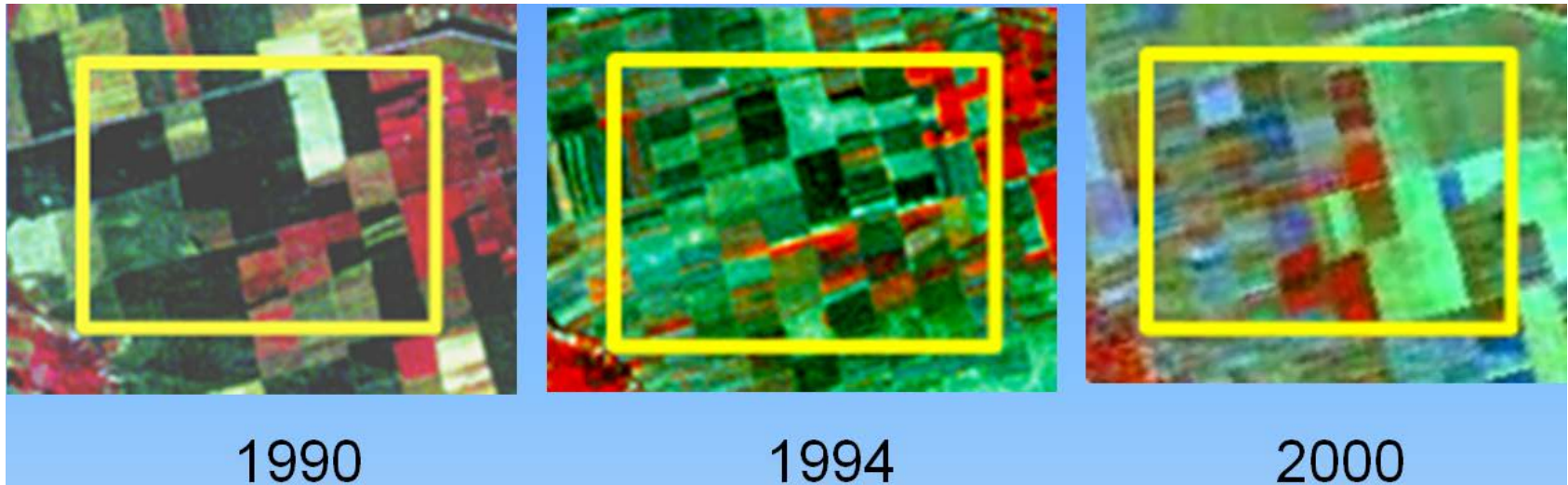
Dynamics of the landscape



LCCS – Land Cover Classification System – in Romania

Dynamics of the landscape

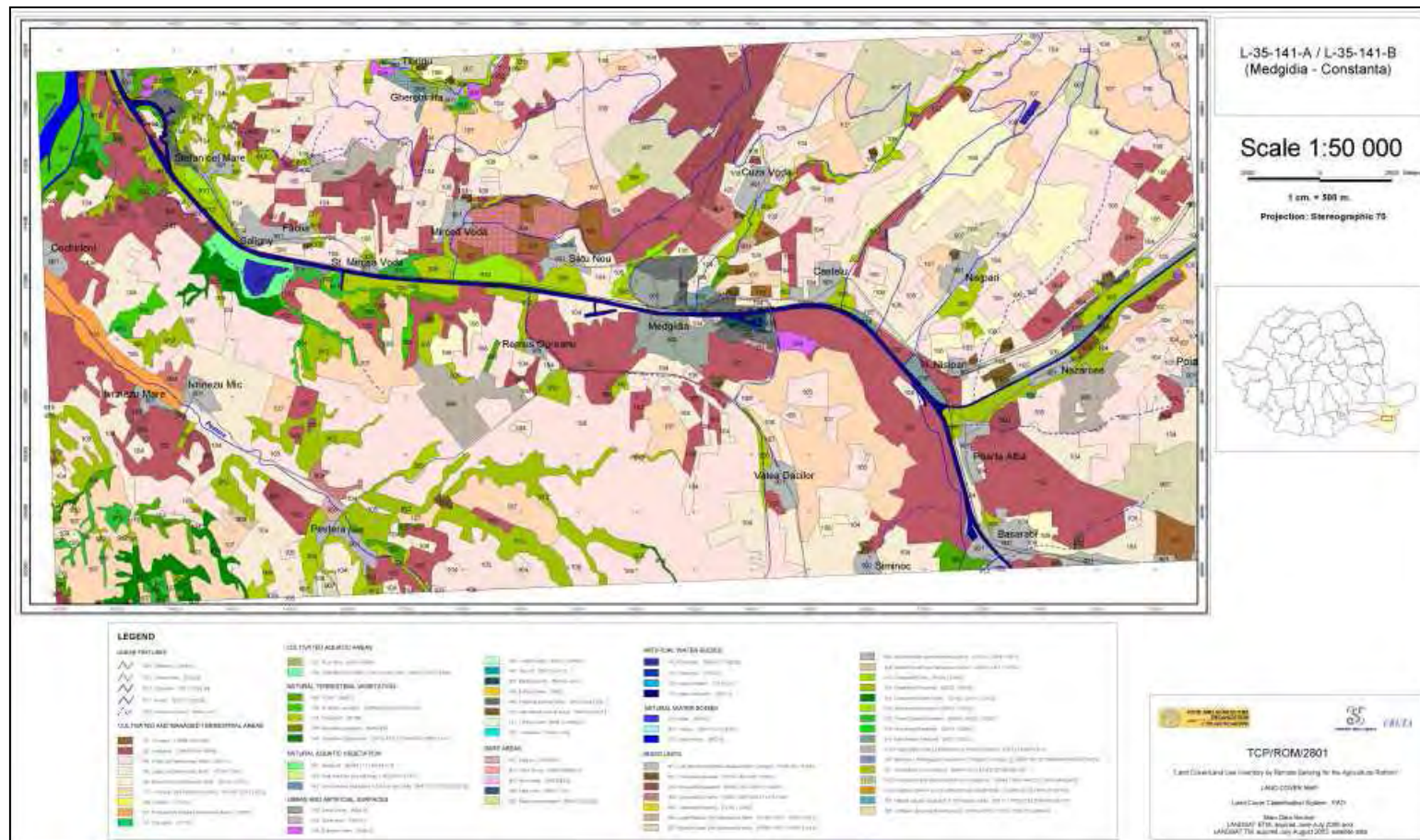




Land cover is (according to FAO):

- one of the most important elements for description and study of the environment
- the easiest detectable indicator of human interventions on the land
- a critical parameter for environmental databases
- changing quickly over time
- the basic geographic feature that environmental applications can use as reference

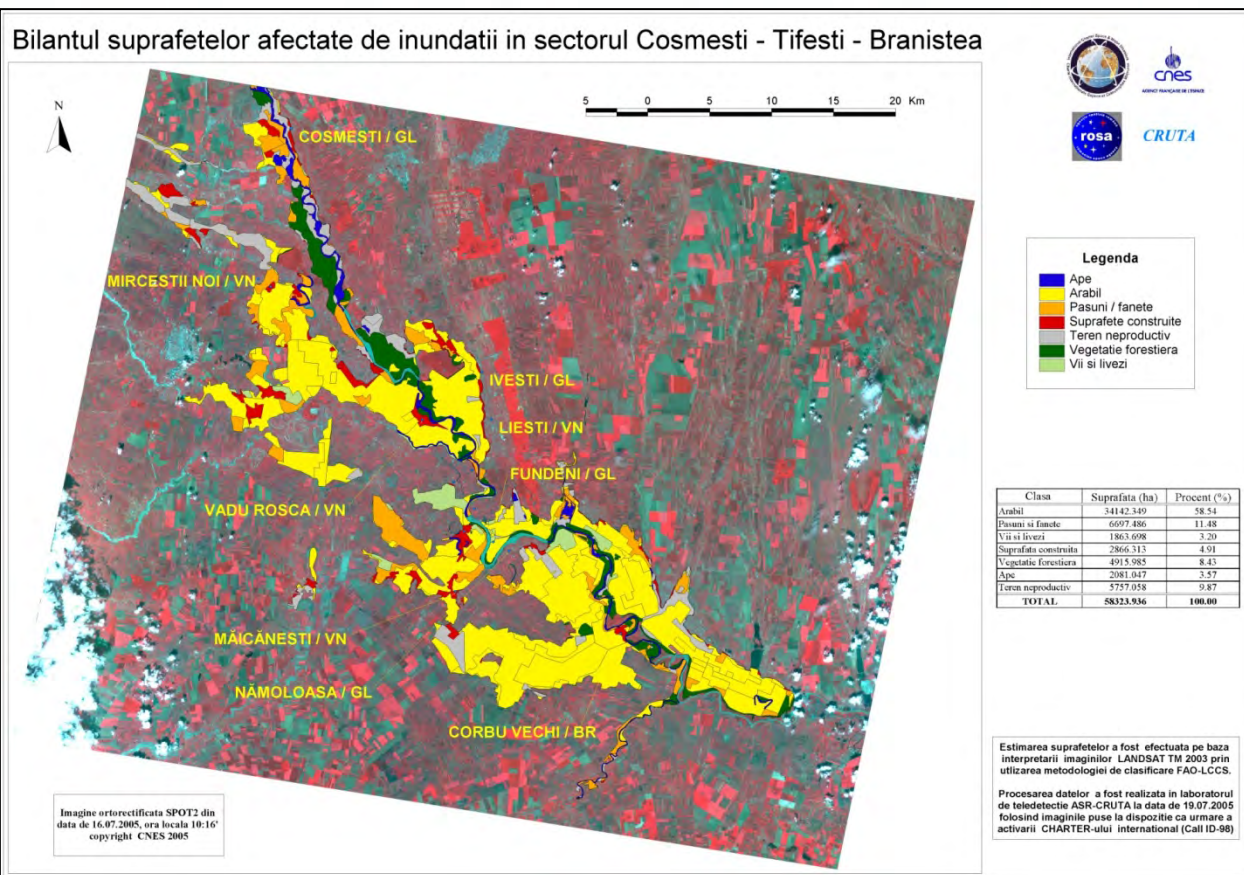
Examples of LCCS maps







The use of LCCS data base for evaluation of damages during the floods occurred in 2005



The experience acquired in the implementation of CIS, LCCS and LPIS/IACS projects offered the possibility to establish new certitudes.

Remote Sensing has moved beyond its traditional role of mapping natural resources, environment, infrastructure and risk mitigation, to making geo-spatial data infrastructure and services one important pillar supporting the information society. The main development directions are oriented towards :

- Implementation of dedicated applications to answer problematic concerning traceability and make better agronomy on all crops (fruits and vegetables, wine growing...)
- Production of land cartography, creation of geographic information systems on agri-environmental issues at local and national scales, for public and private institutional clients.



Technical Assistance to Develop Romanian Environmental related GIS maps / PHARE project RO 2005/017-553.03.03.04.01 -

The project realized in the framework of EU Phare program had as main goal the production of thematic harmonized data for the Romanian Ministry of Environment and Sustainable Development (MESD) keeping in mind the EU regulations for ensuring the interoperability between the interior (local, regional, national) and EU level.

Elaboration of GIS Maps and Datasets



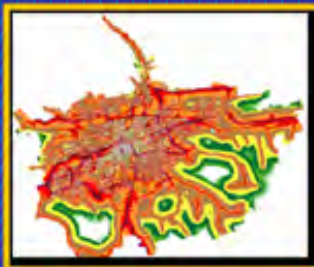
1. Topographic map



2. SCI Natura 2000 map



3. Mapping of an industrial waste landfill



4. Noise map



5. Map of lake water quality monitoring station/facilities



6. Mapping of a municipal waste landfill

1. With general content (to ensure the coherent topographic support)
2. For the nature conservation
3. For the representation of industrial pollution
4. For air quality and noise
5. For water quality
6. For waste management

- **More than 50 datasets are available for the use of the Ministry of Environment.**
- **Considering the implementation of the INSPIRE directive, the ROEnvGeoPortal offers wider access to geographic data and services, serving as a catalyst for advancing Spatial Data Infrastructure (SDI) activities in Romania.**
- **The implementation provides users with a set of tools to easily discover, query, and access information on geospatial data holdings and services, including the ability to interactively display and query the data and services.**
- **The deployment of the operational ROEnv GeoPortal allows easy discovery, query and use of geospatial data, Web services, and organizations from existing national, county, and local geographic information system assets.**

Final considerations-

The implementation of the projects was possible grace of a very confident partnership with experts working for important national and international organizations. It was possible to adapt the local experience taking into account the opinion of external advisors and to understand that Land Remote Sensing is a work for multi-thematic teams.

But that is not enough

We have to accept a modern **management approach** in the context **of a critical spatial thinking**.

A new management approach :

As technology becomes easier and mass use, what does everyone need to know?

(David Maguire, Bucharest, April 2009)

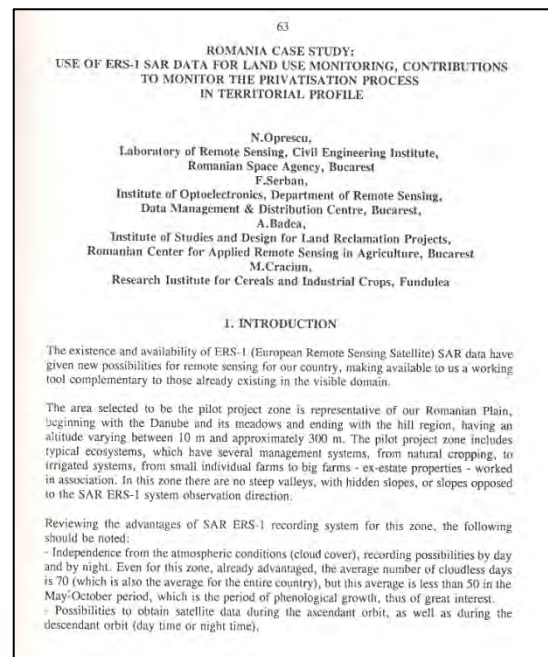
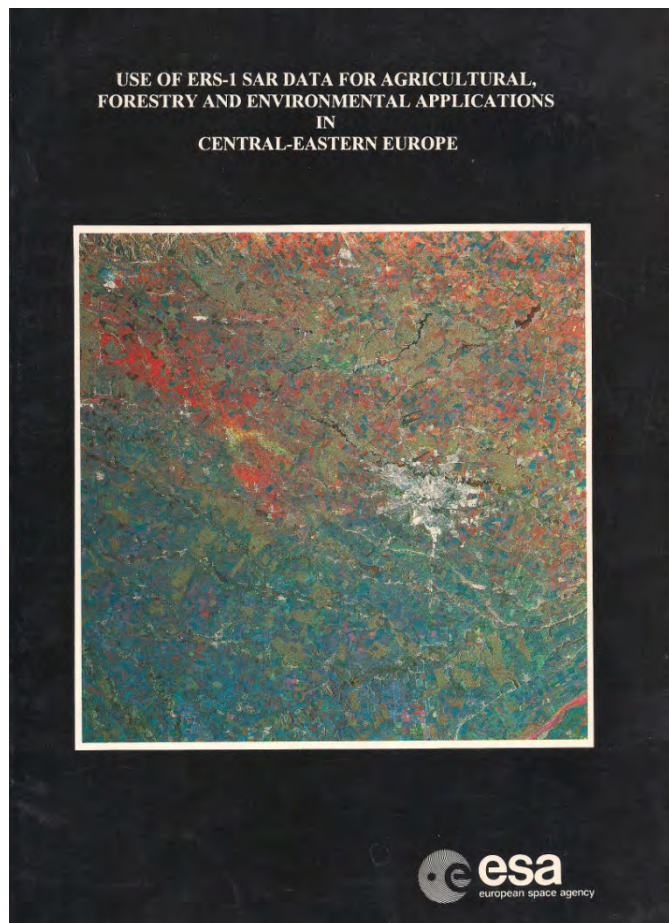
Critical spatial thinking:

Understanding the fundamental concepts behind the technology

(David Maguire, Bucharest, April 2009)

Cooperation with ESA

The first pilot project realized in 1992 concluded by the study : “Use of ERS-1 SAR data for land use monitoring, contribution to monitor the privatization process in territorial profile”





Thank you for your attention !