USE OF REMOTE SENSING IN MONITORING WATER QUALITY

UTILIZAREA TELEDETECȚIEI ÎN MONITORIZAREA CALITĂȚII APELOR

***SLAVE Camelia*[1]*, MAN C.M.*[1]*, ROTMAN A.L.*[1]*, DIMA C.I.*[1]**

e-mail: camelia_slave@yahoo.com

Abstract. *Environmental pollution has become one of the most debated issues of the contemporary and one first order for the company management. Man and environment are inseparable entities, human existence is dependent on the environment, and environmental factors (air, water, soil) may change as a result of their use by humans. Such pollution occurs, dimension of life, in the course of which some products resulting from physiological processes and human activity and animal residues are likely to interfere with the welfare of the nature and quantity. With the great scientific advances, the amount and nature has changed dramatically. In recent decades, the degradation of the environment from all over the planet has fared increasingly worrying amount of pollutants reaching in excess of imagination. Removing pollution is a problem that causes error correction To study the effects of water pollution on the river, we chose Arges River. The aim is to show the changes caused by pollution on water quality using remote sensing images.*

Key words*: basin, confluence, decay, wastes, pollution, environment*

Rezumat. *Deoarece în ultimele decenii, spațiul românesc s-a confruntat cu reale aspecte ce țin de poluarea mediului, acum este momentul aprecierii corecte, reale a situației pe care o regăsim atât în sfera calității aerului, a solului și bineînțeles a apei, astfel încât protecția mediului să fie o problemă de actualitate prin abordare şi prin înțelegerea tuturor fenomenelor naturale şi a celor influențate sau produse de om. Pentru studiul efectelor poluării asupra apelor unui râu, am ales râul Argeș. Scopul este de a arăta modificările produse de poluare asupra calității apelor cu ajutorul imaginilor de teledetecție. Pentru studiul efectelor poluării asupra apelor unui râu, am ales râul Argeș. Scopul este de a arăta modificările produse de poluare asupra calității apelor cu ajutorul imaginilor de teledetecție.*

Cuvinte cheie: *bazin hidrografic, confluență, degradare, deșeuri, poluare, mediu*

INTRODUCTION

Environmental pollution has become one of the most debated issues of the contemporary and a first order for the company management. The man and the environment are inseparable entities, human existence is dependent on the environment, and environmental factors (air, water, soil) can change as a result of their use by humans. Such pollution occurs, dimension of life, conduct which some products of physiological processes and human and

[1] University of Agronomical Sciences and Veterinary Medicine of Bucharest, Romania

animal activity are residues that may interfere with the welfare, depending on the nature and quantity.

Environment, the space in which we operate daily, the place where we want to develop and progress, or to relax, is the vast sphere that must defend the implementation of all levers and environmental policies and updating environmental legislation, both internal and international. Considering that the environment is "all elements of physical, chemical or biological, natural and artificial, which makes human life, animal or plant, or species" (Le Petit Larousse, 2003). or an essential factor for the continuity of the human race (Mancino et al., 2009), Michel Prieur shows that the environment is now a "**chameleon concept**" with specific meanings and dimensions.

Environmental Protection Law no. 137/1995 defines "environment" as "the set of conditions and natural elements of the Earth: air, water, soil and subsoil, the characteristics of the landscape, all layers of the atmosphere, all organic and inorganic materials, as well as living beings interacting natural systems, including the items listed above, including material and spiritual values, quality of life and the conditions that may affect human health and welfare.

In the same manner, the current Romanian legislation, pollution-from the Latin-polluoere-is defined as "the direct or indirect introduction, as a result of human activities, of substances, vibrations, heat and / or noise into the air, water or soil that can harm human health or the environment, which may damage property or cause damage or prevent the use of the environment for recreational or other legitimate purposes (Environmental Protection Law no. 137/1995 republished) pollutant being "any solid, liquid, gas, vapour or any kind of solid, liquid, gas or vapour matter or any kind of energy introduced in the environment which modify the balance of constituents.

MATERIAL AND METHOD

Characterisation of river basin Arges Arges basin has rich water resources sufficient to major users in the area, but unevenly distributed in time and space. The main sources of water in the basin of Arges surface waters represented by rivers, lakes and groundwater (groundwater and deep).

Total water resources in the basin are evaluated theoretically 2.656 billion m^3 (of which 1.96 billion m^3 from surface water and 696 million m^3 of groundwater). Approximately 85.5% of the theoretical resources can be used in technically (2.271 billion m3, of which 1.671 billion m^3 from rivers, lakes and reservoirs and 600 million m^3 of groundwater

Arges River is a major river that flows inside the Fagaras Mountains and flows into the Danube near Oltenița, through the mouth (Figure 1 and 2).

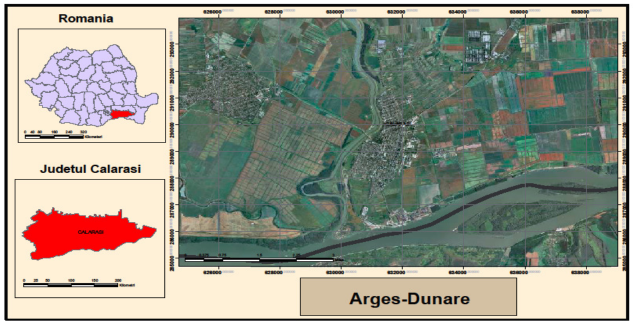

Fig.1 - Arges River confluence with the Danube

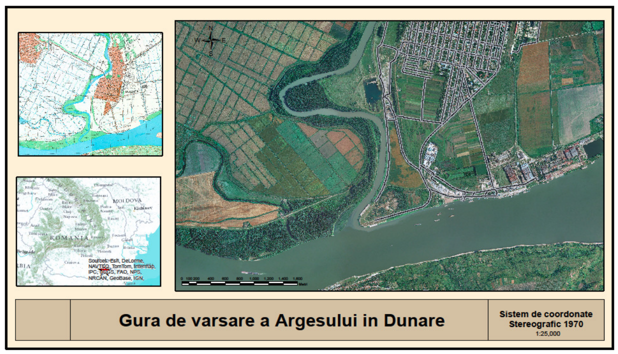

Fig 2. - Picture of the mouth

Analysis of Arges River polluation situation where this river flows into Danube River was done by using remote sensing images. We used Landsat TM/ ETM +. satellite images.

Using remote sensing images to monitor water quality Water quality is an important indicator in the treatment for human consumption. Analysis of water samples is made by analysing various physic-chemical parameters by which we can determine the degree of pollution. Collecting water samples can provide synchronous data for large areas. For a spatial and temporal approach from a distance without contact with that surface, remote sensing can be used.

Remote sensing can be defined as the science and art of obtaining information about the analysis of data acquired without coming into contact with the object, area or phenomenon under study.

The first studies that have used remote sensing to monitor water quality began in the 70s (Ritchie 1974).

Ritchie proposed an empirical equation by using the approximation that can be made on the amount of sludge in suspension:

$$Y = A + BX$$

or $Y = AB^X$

where:

Y - measured wavelength (radiation, reflection, energy)

X - water quality, represented by a parameter (suspended sediment, turbidity)

A, B- empirically determined parameters, obtained using statistical relationships between the spectral reflectance and in situ determination of a water quality parameter

In recent years, this equation was developed to estimate each parameter water quality.

RESULTS AND DISCUSSION

Eutrophication can be defined as the concentration of the chlorophyll contained in the plankton algal cells; chlorophyll is one of the colouring agents in water. In remote sensing mapping chlorophyll is used as a parameter for assessing water quality. To determine the amount of chlorophyll with remote sensing techniques we use the ratio of different spectral bands:

The ratio of green (0.50 to 0.60 μm) and red (0.60 to 0.70 μm) or inverse relationship between red and green. One can use the ratio of blue (from 0.40 to 0.50 μm) and red and vice versa (Mancino, 2009).

Vegetation is green because it absorbs red and blue, reflecting the green. Chlorophyll absorbs radiation with wavelengths between 0.45 to 0.67 mm. If, for various reasons, the vegetation does not produce enough chlorophyll unable absorb the red and blue give a reflection having a wavelength between them yellow.

Turbidity is a measure of the clarity of water due to the amount of particulate matter (soil, sediment or plankton). Turbidity can be defined as an expression of the optical properties of water. Water causes more light to be reflected and absorbed rather than being transmitted in straight lines. Turbidity can be calculated using the suspended sediment concentration. The best results of correlation between turbidity and reflectance, which is consistent with reality, are obtained in the red spectral band.

Turbidity can be determined using the following spectral bands:

- Green band and red band
- Green Tape
- Blue and red tape strip

In figure 3, the reflectance curves are presented for three types of elements: vegetation (health), soil (dry) and water (clean). The lines represent the average reflectivity. In general, the curve shape is an indicator of the type of item and its physical properties. With regard to the ground, the reflection is influenced by the following factors: moisture, texture (the proportion of sand and clay), surface roughness, the presence of iron oxide, the content of organic matter. These factors are complex, varied and interrelated. Clean water reflects the blue – green radiation and other radiation are mostly absorbed them reflected. The presence of turbidity in water due to organic matter or suspended organic matter will produce another reflection curve.

Each spectral band is used for a precise application type. UV band is mainly used in mineral exploration and detection of oil; IR band in the 0.7 to 1.5 mm is used for the detection of polluted vegetation, pests, etc., IR in the 1,5 to 3 mm is a mixture of reflected solar energy and the energy emitted by Earth and it is used in the atmosphere to detect snow reside the clouds.

The data used are provided by the satellite Landsat TM / ETM + and are acquired in different spectral bands: blue 0.40 to 0.50 µm, 0.50 -0 green, 60 µm, red 0.60 to 0.70 µm, infrared 0 , 60 to 0.70 µm, the thermal infrared from 0.70 to 0.90 µm. Images are pre-processed in terms of atmosphere and atmospheric corrections.

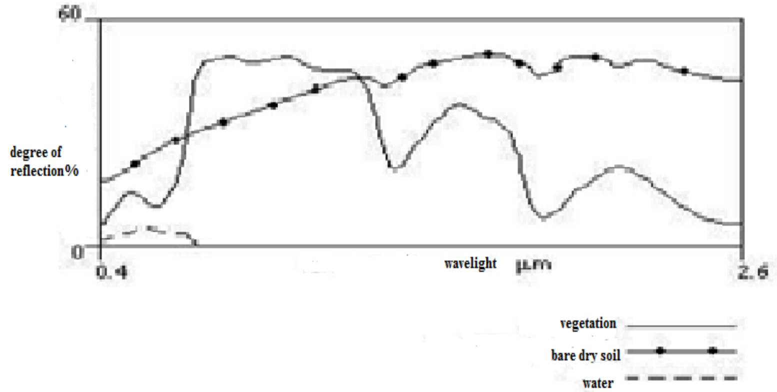

Fig. 3 - The curves of reflectance

A degradation of river banks was found because there had not been executed embankment works and bank protection in the area. In the area Oltenita city there is no water treatment plant. Sluice image no. 4 is heavily degraded and interior waters are eutrophicated.

Fig.4 -Sluice

CONCLUSIONS

Measures to improve water quality and pollution control:

1. Short term: - greening the area - recover useful materials from wastewater, thus having the advantage of ensuring a true source of raw materials by recycling plastic waste.

2. Medium term: - informing citizens of the area and find those who throw garbage, expanding collection procedures and evacuation of dry wastes, especially from animal farms.

3. Long term: - tangible results: scientific articles, leaflets, manual "best practice" recommendations to attract people's attention on protecting the environment;

- anthropogenic activities have decreased water quality and remote sensing techniques can provide information about the degree of pollution;
- monitoring by remote sensing can provide information on water quality parameters while monitoring large areas in situ is limited to the sampling points;
- using satellite imagery provided by Landsat, SPOT, IKONOS, depending on the resolution, you can create thematic maps;
- each water quality parameter (particulate matter, turbidity, amount of organic matter) has its own reflection in the range of 400-800 µm;
- water quality issues can be quickly resolved by using the tools offered by remote sensing for sustainable management of water resources.

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