

Earth's Pollution Monitoring. Legal and Technical Tools

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Abstract

The current paper presents the results of the personal scientific research regarding the Legal and Technical Support for monitoring the water Pollution on Earth. Among these results we mention:

- 1) The consequences of different rhythms for the environment's degradation.*
- 2) The rhythm of perfecting the control techniques for the climatic modifications which are due to the pollution.*

Also, within this paper, it is shown the finding of the common temporal route of the right of the environment and that of the right of the sustainable use of the water. Regarding the technical instruments used for monitoring the levels of the water pollution on Earth there are presented the structure, functions and technical instruments that are required to implement them. These technical tools are composed of wireless sensors networks (WSN). This equipment composed of wireless sensor systems that has the role of measuring the intensity and the pace of climate change is based on research recommendations proposed at the first inter governmental conferences on environment monitoring (Kenya, 1974).

Key words: *sustainable development, wireless sensor nets, monitoring, topological and architectural models, WSN*

"My name is Earth. I was born on April 22nd millions of years ago. I am very wealthy. I have everything. I could be immortal, but in the last years I have been pretty ill. The specialist gave me a bad prognosis for some of my reserves. That is why I must follow a special treatment of SD (Sustainable Development). This treatment has to be administered by Doctor MAN. Help Doctor MAN !"

(Excerpt from "Earth Manifesto", launched by the Asociation "Friends of the Environment")

Introduction

Basically, the environment is defined as being the nature that surrounds us and houses all beings and things. In more detail, the environment represents the sum of the physical, chemical,

meteorological and biological factors from a given location, with which an organism comes into contact. The unity between an organism and its environment is best and most clearly expressed in the historical interaction between living matter (organisms) and the primary inorganic nature (abiotic factors). The organisms belonging to a certain species assimilate throughout their existence certain external condition, that afterwards become life conditions for other species, either by becoming food source for them, either by altering the physical, chemical and biological composition of these species.

Using on a large scale science and technology for the purpose of industrial development, it has been ignored the necessity for maintaining a permanent balance between satisfying our own material needs, which are in a constant growth, and the protection of all the factors of the environment. The disruption of man, through his hasty interventions and not always very well thought through, of the natural balance is a feature of the second half of the 20th century, although isolated occurrences have been noticed long before.

The bibliographic research and the analysis of the climate changes have led us to a conclusion which we named the issue of rhythm difference, RD.

The environment's pace of change is much higher than the pace of creating and perfecting the means of control and prognosis for the evolution of the environment's degradation level. Consequence of RD: man can only notice the bad ecological effects, he cannot prevent them.

EXAMPLE: Deforestations of huge areas, it is an action of man whose negative effect was noticed only after the disaster of 1934 from south-west US, when, in a manner of minutes, there occurred a great wind erosion, the winds turning into dust approximately 300 million tons of fertile soil. Similar events occurred in Romania, such as the floods and land slides that couldn't be prevented.

Common in-Time Path of Environmental Law and Sustainable Use of Water Rights

Judicial tools of use and protection of the aquatic environment appeared and received a specific judicial status within the world wide process of instauration of the international environmental law.

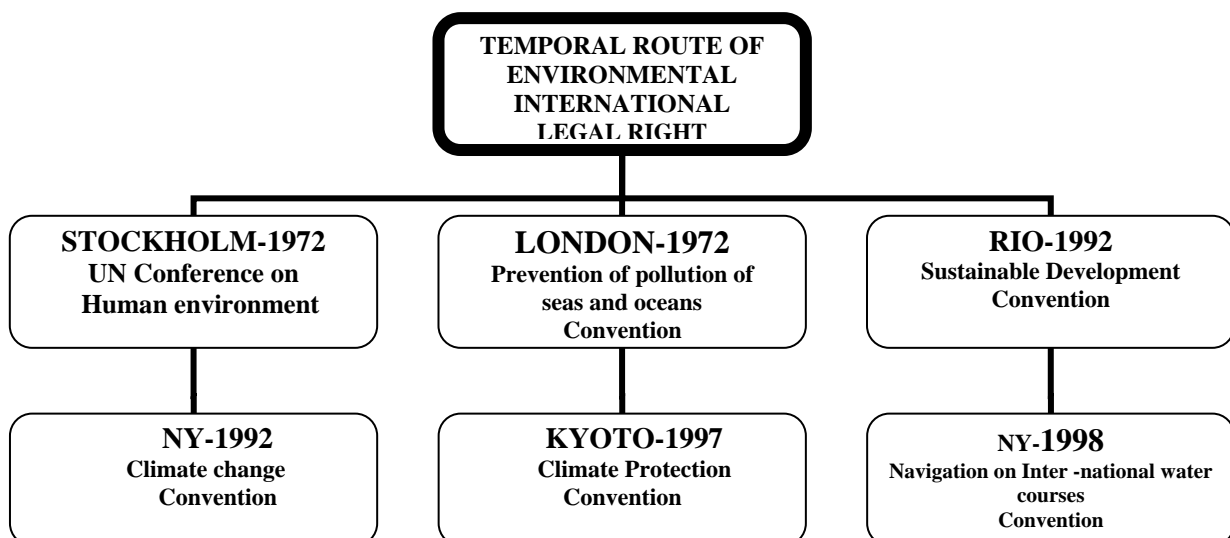


Fig. 1. Common in-time path of environmental law and sustainable use of water rights

The international law plays a significant role in the field of environmental protection, its contribution being very multiple and varied since it has at its basis certain principles, rules and international mechanisms, their ensemble constituting the international environmental law. It is important to mention that, regarding its contribution, the international environmental law has not been updated at all. The international environmental law started to be created within the first years of the 8th decade of the last century (Fig. 1). The conference for the human environment, the first consecrated international conference for the protection of the environment at a large scale, reconvened in June 1972 at Stockholm under auspice of the United Nations, constitutes an important stage within the perspective of its elaboration. As a consequence of this conference there have been countless initiatives at an international, regional or national level, and they were either about negotiating international conventions, legislative actions or either about operational activities or about establishing certain bodies and institutions with specific expertise in the field of the environment under aegis of U.N. The administration council of the United Nations Environment Program (UNEP) was established in accordance with the resolution 2.998 (XXVII) of the General Assembly of U.N. (of December 15th 1972, institutional and financial agreements for international cooperation in the field of the environment) and it is formed of 58 members elected by the General Assembly of the U.N. for a mandate of four years, taking into consideration the principle of equity of the regional representation. *Global Environmental Monitoring System (GEMS)* project was established upon a decision of the *Governing Council of UNEP (GC)* at its first session held at Geneva from June 1973 etc (Table 1). Romania was reelected for a mandate of four years, starting from January 1st 2010, as a member of the Administration Council (GC) of the United Nations Environment Protection Program (UNEP).

Table 1. Special judicial documents referring to the global monitoring of the environment generated by CG at its sessions held under the aegis of U.N.

<i>The first international conference dedicated to the protection of the environment, reconvened in June 1972 at Stockholm under the auspice of U.N.</i>	<i>Consecrated to the protection of the environment at a global scale where it is elaborated the UNEP and is established the Governing Council of UNEP(GC)</i>
<i>First session of Governing Council of UNEP held at Geneva from 12 to 22 June 1973.</i>	<i>The Global Environmental Monitoring System (GEMS) project was established upon a decision of the Governing Council of UNEP</i>
<i>Executive Director of GEMS convened an International Meeting on Monitoring held at Nairobi in February 1974 (UNEP/GC/24).</i>	<i>Outlined the objectives, principles, programs, goals and general guidelines of GEMS and listed the environmental variables that it recommended should be monitored as a matter of priority.</i>

The decision was made at the elections held, in November, at the General Assembly of U.N., from New York. "The presence of Romania for a new mandate within the Council of UNEP gives the authorities from Bucharest the opportunity to continue to actively implicate themselves, along with the other member states, in identifying solutions for the approach of a world wide major issue, about the climatic changes and about the protection of the environment" [1]. One of Romania's objectives, as well as of the entire European Union, is to sign a Global agreement about the climatic changes

Environmental Damage

The damage of the environment consists of the discordance between the conditions of the environment and the objective requirements (biological, psychological, economical, social, etc.)

of man. The environmental damage is not caused by the change of the environment as such, but by the appearance of certain imbalances within the relationships of man and nature. The environmental damage caused by man doesn't imply only the destruction of the ecological balance, but also the appearance of a reaction towards man from the modified environment: the new environmental conditions are less favorable for the life of man, for the development of his economical activities. A battle to the death is held every moment, in every corner of the planet. Such a battle is invisible, until there are registered major macroscopic effects such as:

- The extinction of certain species of plants or animals,
- The death of men suffering of asthma because of the pollution of the atmosphere,
- The impossibility of science to find a cure for diseases such as AIDS or cancer, when the fight becomes outright,
- In countries that are in constant development, pollution kills daily over 250000 people.

In our days into the biosphere there are released a huge quantity of waste, some that are very hard biodegradable (detergents, pesticides, plastics, radioactive waste). For a long time it was thought that the biosphere has unlimited absorption and pollution neutralization abilities. When the quantity of pollutants exceeds the environments neutralization ability, the ecosystems go through a process of degradation, the changes varying from complete destruction to the development of certain lifeless ecosystems (for example – entire rivers or portions of rivers that are very polluted). That is why the issues of economic development and growth cannot be separated from the ecological issues. Economy and ecology are becoming more and more intertwined – locally, regionally, nationally and globally, into a network of cause and effect.

The relationship between development – environment is a relationship between present and future. Development seeks to satisfy the need of present generations, while, the environment's protection is an investment for future generations.

In the situation created on earth the main factor is time, because humanity has about 20-30 years left to stop at the edge of the fall towards which it is heading at a great speed [2]. In the age of automobiles, the exploitation of the means of production becomes a dominant feature. Industrial enterprises, tending to rid of the unrecoverable waste by throwing them into rivers, water basins, at the bottom of seas and oceans. It is well known that England, France and Belgium annually discharge into the waters of the Atlantic Ocean tens of tons of radioactive waste. In 1970, US discharged into the Atlantic Ocean 418 containers of toxic gas. If this gas would ever reach the surface, the consequences would be disastrous.

Throughout the world the ecological disasters have intensified. It is well known what were the consequences of the accident from the chemical plant of Bhopal, from India, that caused 10 thousand human victims. Another major catastrophe was the accident from the chemical plant of Basel, Switzerland. It led to a powerful contamination of the river Rhine. The water became inappropriate for use in vital purposes, many fish died and other creatures from the Rhine. The same situation was created at the accident from the mineral fertilizers plant of Stebnic, from the region of the river Nistru. As a result of this accident, within the river there were dumped approximately 5 million square meters of concentrate used waters.

The protection of the environment presumes the realization of the complex of social, economical, scientific, research and technical measures that guarantee the preservation of the natural environment useful for the vital action of the present and future generations. These measures may be applied globally, achieving vital interests of the entire population of earth but also locally, for the solving of ecological problems that have a regional character. At the same time it is becoming more and more difficult to divide the ecological issues into local and global because, in the contemporary world, everything is in a mutual connection.

Within the sphere of the new economical relationships, which stimulate the ecological purity of the agricultural and industrial production, an important role is given to the

implementation of the results of the scientific – technological progress in order to solve the issues of the protection of the environment. This refers mainly to perfecting the technological processes from their ecological purity and resource sustainability point of view, to the automation and optimization of the processes, to the application of waste-free technologies, to the use of water recirculation designs.

Life on planet earth appeared and evolved because of the presence of water, mainly, and life may become extinct along with the extinction freshwater (table 2).

Table 2. Earth's water dowry

<i>Ocean Water (salt water)</i>	App 97,5% of Earth's water dowry
<i>Continental water (freshwater)total</i>	2,5%
<i>Freshwater accesible to man on earth</i>	<1%

The currently escalating danger of the negative influence exerted by the intensification of the industrial and agricultural production over the human health and over the state of the biosphere overall imposes the requirement to develop a prevention system, a system of control and prognosis not only for the state of certain objects from the surrounding environment, but also for the state of the biosphere itself.

Computerization of the Environment Monitoring

Monitoring the advancements in water resources management is essential if the political commitment is to be sustained and put into practice. This need has been widely acknowledged in several occasions. In January 1992, the UN Dublin Conference on Water and the Environment established the main principles of modern water management which served as the basis of Chapter 18 of the United Nations Conference on Environment and Development (UNCED), Agenda 21 (Rio de Janeiro, June 1992). It includes the imperative necessity of reliable information for water resources planning and management. This issue has been reemphasized in a recent series of UN conferences, such as the World Summit on Sustainable Development (WSSD, Johannesburg, August-September 2002), the 12th and 13th Session of the Commission on Sustainable Development (CSD, New York, April 2004 and April 2005), as well as other recent international meetings. Moreover, the strategy paper of the European Union Water Initiative (EUWI), launched in 2002, calls for a monitoring and reporting mechanism for progress and quality control.

In Romania, the laws of environmental protection establish a series of principles and strategic elements, for the purpose of ensuring a sustainable development, which are:

- a) The principle of caution when taking a decision; the principle of prevention, reduction and of integrated control of pollution through the use of the best available means for activities that may cause significant pollutions;
- b) The principle of preventing ecological risks and preventing the causing of damages;
- c) The principle of conserving the biodiversity and the ecosystems specific to the natural biogeographical environment;
- d) The principle “the polluter pays”;
- e) Removing with priority the polluters that are a grave threat for human life;
- f) ***Creating a national system for monitoring the environment;***
- g) A sustainable use of the natural resources;
- h) Maintenance, improvement of the quality of the environment and reconstruction of the damaged areas;

- i) Creating a framework of participation for non-governmental organizations and population at the development and application of the decisions;
- j) Developing an international collaboration in order to ensure the quality of the environment.

This computerized monitoring system, which was referred to at every global, state and U.N. organized conference tale, proposes to have as an objective the gathering of information regarding the environment's state and its levels of pollution in time and space according to a previously developed program..

The environment may be characterized through a complex of parameters, through a certain methodology of "remedial" and prognosis of the consequences of the "ecological affections". The prophylaxis of these "affections" requires a permanent diagnosis and adjustment of the state of the environment.

Computerized systems of monitoring and control, which are referred to in all these documents, have the following functions (Fig. 2):

- Surveillance;
- Evaluation of the real state;
- Prognosis for certain changes. Prognosis for certain climate and environment changes.
- Generate certain recommendations for the actions that have to be taken in order to counteract the environments degradation and to eliminate certain pressures over the environment.

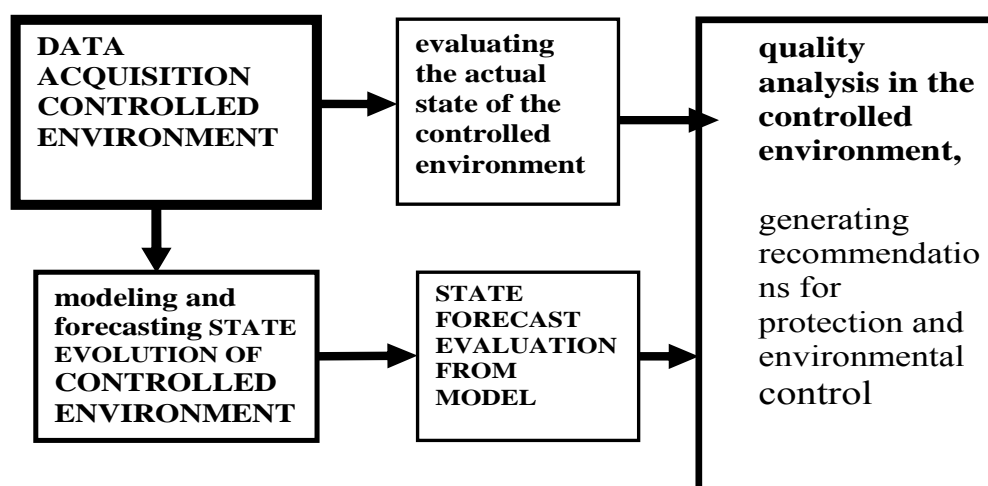


Fig. 2. System structure and functions for monitoring the aquatic environment

The stages of these evaluations regarding the real state and the forecast state of the environment under surveillance are [3]:

1. The selection of the indices and of the characteristics of the environment factors (water, air, soil);
2. A direct measurement of the chosen indices.

The development of a prognosis by the SIMCM presumes:

1. Knowing the laws about the changes in the pollution levels and in the state of the environment;
2. The availability of the use of certain mathematical models for environmental changes;
3. The possibility of numerical calculation and simulation of certain scenarios on climate changes etc.

In order to evaluate the environment's state and to make a prognosis about certain changes there have to be taken into consideration two aspects: the surveillance sub-systems from the abiotic sector of the biosphere (geo-physical monitoring) and from the biotic sector (bio – monitoring).

The necessity to acquire at the same time data of different natures from a geographical area is becoming more and more acute. For a forecast with a high level of precision of the natural phenomena and/or artificial ones, there have to be taken into consideration the inter conditionings between them. Even if we are talking about an artificial phenomenon, the environment in which it occurs may influence its performances, depending on how the process may have an effect on its environment. A mobile unit for data acquisition may offer a prime diagnosis of the signal generating source, following that, if it is necessary, the data may be transferred into a laboratory for further studies, with a high level of precision.

In the present paper there are shown some of the results obtained in the field of In the present paper there are shown some of the results obtained in the field of wireless sensors networks based on the new product of scientific research from “Polytechnic” University of Bucharest (PUB): mobile unit for signals acquisition, processing, identification and diagnosis (MUSAPID) [4]. The system is to be organized within a three level hierarchy structure. The *upper level* is formed from the central unit for processing, identification and signal diagnosis, made up of a portable computer (laptop) and afferent software. The *median level* represents the nucleus of the entire system and it is formed from a *versatile interface for signal acquisition* (VISA) [5] and transmission. Finally, the third level includes (and may be improved with) sensors grouped into kits specialized on the different types of signals. The mobile unit (called MAPIDSU) is mainly designed for field monitoring of certain parameters with a geographical distribution and has a specific of ecological control of the environment and of the level of pollution of earth's water. The concept of monitoring does not refer only to the acquiring and display of the variation of data taken from different eco-climatic parameters, but also to the identification of the phenomena that influence these variations through certain numerical models. The identification models are used afterwards in the forecast of the evolution of the monitored parameters. The mobile system is open, from two points of view.

Mainly, as it is shown in the image, because it allows for the monitoring of a wide geographical area, without the use of cables for data transmission. *The system is also versatile in the sense that, because of its interface, it allows for a communication between any portable computer with approximately any sensor kit.* Finally the system is friendly with the environment and user-friendly. Its power consumption is mainly ensured by a greed power source: solar power. Also, the user may easily control the configuration parameters for the sensor network and for the data acquisition, through a natural graphic and accessible interface. The used technology is comparable at a competitive level with the European or American ones. The sensors of the MUSAPID sensors are grouped into specialized packages called kits. These kits are determined by the fields in which the acquired signals are situated.

The eco-meteorological kit – the one that is embedded within the product – is designed to measure specific values, such as: soil and air temperature and humidity, the level of dew, concentration of emissions or of special substances, the soil's erosion, wind speed, solar radiation intensity, precipitations flow, etc.

Concluding Remarks

This article addressed the problem of water pollution monitoring, in order to avoid disasters caused by leaking. There are presented some results of the analysis environment situation:

- 1) Different rates consequence of environmental degradation and improvement techniques to control the pace of climate change due to pollution;

- 2) Route finding is highlighted common temporal environmental law and sustainable use of water rights;
- 3) Technical instruments of water monitoring implementation. is the *wireless sensors networks* (WSN) technology based . To implement this system a *mobile unit for signals acquisition, processing, identification and diagnosis* (MUSAPID) was employed. Further developments include more sophisticated monitoring algorithms to be implemented and tested.

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Monitorizarea poluării Pământului. Instrumente juridice și tehnice

Rezumat

Lucrarea actuală prezintă rezultatele cercetării științifice în ceea ce privește asistența tehnică și juridică pentru monitorizarea poluării apei. Printre aceste rezultate amintim:

- 1) Consecințele asupra degradării mediului ambiant.
- 2) Ritmul de perfecționare a tehnicilor de control pentru modificările climatice, care urmează poluării.

De asemenea, în cadrul acestei lucrări, este prezentată o soluție juridică, care abordează integrat, atât legislația mediului cât și o legislația privind dezvoltarea durabilă în domeniul resurselor de apă. În ceea ce privește instrumentele tehnice utilizate pentru monitorizarea nivelului de poluare a apei sunt prezentate structura, funcțiile și instrumente tehnice care sunt necesare pentru a le pune în aplicare. Aceste instrumente tehnice sunt compuse din rețele fără fir (WSN senzori). Echipamentul propus este compus din sisteme de senzori wireless, care au rolul de a măsura intensitatea și ritmul schimbărilor climatice, și respectă recomandările de cercetare propuse în cadrul conferințelor inter guvernamentale privind normele de monitorizare a mediului (Kenya, 1974).