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Faculty of Land Reclamation and Environmetal Engineering
Address: 59 Marasti Blvd., District 1, Zip code 011464, Bucharest, Romania
Phone: + 40 784 276 174
E-mail: simpozionifimcad@gmail.com
Web: http://simpozionifimcad.usamv.ro

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University of Agronomic Sciences and Veterinary Medicine of Bucharest
Faculty of Land Reclamation and Environmental Engineering
Address: 59 Mărăşti, Bvd, District 1, Zip code 011464
E-mail: simpozionifimcad@gmail.com
Web: http://simpozionifimcad.usamv.ro
Phone: +40 784 276 174

TABLE OF CONTENTS

SECTION 01. ENVIRONMENTAL SCIENCE AND ENGINEERING

SECTION 02. SUSTAINABLE DEVELOPMENT OF RURAL AREA

SECTION 03. WATER RESOURCES MANAGEMENT

SECTION 04. CADASTRE

SECTION 01
ENVIRONMENTAL SCIENCE AND ENGINEERING

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GLOBAL WARMING - TRUE STORY OR URBAN LEGEND?

Anca BARCU

Scientific Coordinator: Assoc. Prof. PhD Alina ORTAN

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67, Email: anca.barcu@gmail.com

Corresponding author email: anca.barcu@gmail.com

Abstract

Global warming has been a controversial factor with polarizing supporters for many years. Initially, claims were made that global warming was a myth, given the relative short span of observed climate, but nowadays more and more scientists believe that global warming is a fact and this paper aims to prove that. From shrinking ice in Antarctica, acidification of oceans or CO_2 emissions effects to temperature graphs, there is ample evidence that there are snowballing effects that will impact Earth mid to long term. More than 97% of climate experts agree that anthropogenic actions are determining a steady increase in global temperatures, with compounding effects on the environment.

Key words: *global warming, climate, greenhouse gases, anthropogenic activity.*

INTRODUCTION

For many years, global warming has been a controversial subject in popular media, with even some political leaders coming out and stating that there is no evidence that global warming is caused by mankind (Trump, 2017). However, the majority of the scientific community agrees with the global warming theory. This article is going to present the major facts pertaining to global warming as being of anthropogenic cause. It will also address some common popular beliefs and provide counter arguments in this sense.

Regarding the temperature and ice melting

MATERIALS AND METHODS

Various scientific articles were used to present the main points of the global warming theory in order to counter some of the most popular misbeliefs (Anderson et al, 2016; Kusahara, 2015; Morice, 2012).

One of the popular beliefs about global warming is there is no global warming. "January 2008 capped a 12 month period of global temperature drops on all of the major well respected indicators. HadCRUT, RSS, UAH, and GISS global temperature sets all show sharp drops in the last year" (Watts, 2008).

A different author, Lindzen, states that climate has changed before and that this is no reason for concern. "Climate is always changing. We have had ice ages and warmer periods when alligators were found in Spitzbergen. Ice ages have occurred in a hundred thousand year cycle for the last 700 thousand years, and there have been previous periods that appear to have been warmer than the present despite CO_2 levels being lower than they are now. More recently, we have had the medieval warm period and the little ice age" (Lindzen, 2009).

Anderson mentions the work of Callendar on the topic of temperature increase that compared monthly average temperature records from the World Weather Records from 147 stations and calculated a global increase in land temperature of approximately 0.3oC between 1880 and 1935. He also approximated a 6% increase of atmospheric CO2 during the same period of time (Anderson, 2016).

These early calculations were the basis of future data analysis that concluded that the global temperature has increased during the period time when temperature was observed.

In an article published in Journal Of Geophysical Research, Morice et al. showed that state that “the trends in the northern and southern hemisphere for HadCRUT4 were 0.077/0.071°C per decade between 1979 and 2010” (Morice, 2012).

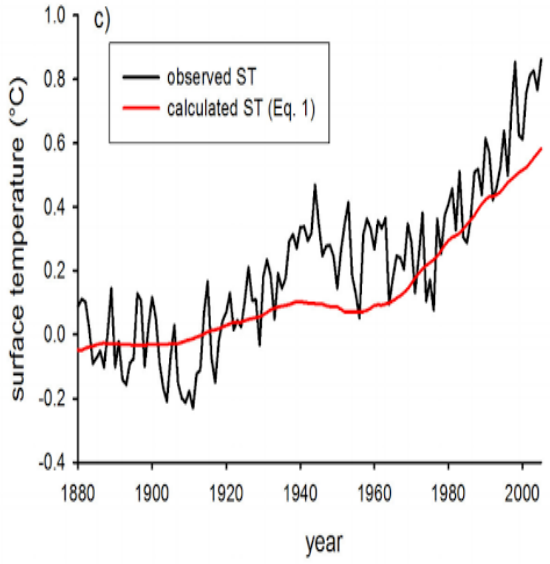

Figure 1. Temperature increase 1880-2000 (Anderson, 2016).

The amount of ice in Antarctica and thus the level of ice melting cause by increased average temperatures is another topic addressed in mainstream media: "ICE is expanding in much of Antarctica, contrary to the widespread public belief that global warming is melting the continental ice cap" (Roberts, 2009).
However Vaughan clearly shows a graphic image (Figure 2) of the evolution of Antarctic ice over a long period of time, thus proving that the levels of ice are actually shrinking. At the same time, Kusahara argues that the warming of the Southern Ocean compounded by an increase in greenhouse gas concentrations augment the basal melt of Antarctic ice shelves, resulting in the retreat of the grounding lines. If the entire ice on the planet, including Antarctic ice which holds a large portion of global water in solid form, were to melt, ocean levels would rise by more than 60 meters (Kusahara, 2015).

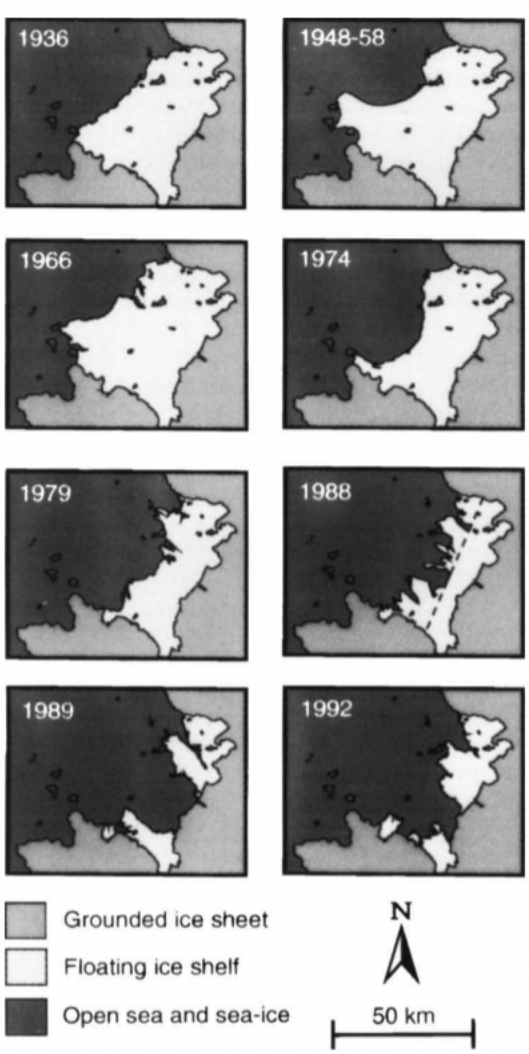

Figure 2. Cartoon of 50 years of retreat of Wordie Ice Shelf from 1936 to 1992 (Vaughan, 2009).

In terms of ocean acidification, the common belief is that the level of CO_2 emissions is insufficient to cause any harm. Christopher Monckton stated that: “Our harmless emissions of trifling quantities of carbon dioxide cannot possibly acidify the oceans. Paper after paper after learned paper in the peer-reviewed literature makes that quite plain. Idso cites some 150 scientific sources, nearly all of them providing hard evidence, by measurement and experiment, that there is no basis for imagining that we can acidify the oceans to any extent large enough to be measured even by the most sensitive instruments” (Monckton, 2009).
On a global level coral reefs are threatened by ocean acidification as a result of climate change and some of their effects include coral bleaching, increased marginal carbonate saturation and increases in coral diseases caused by temperature increase (Fiedler, 2014).

Around half of the amount of CO2 introduced into the atmosphere by human activities over the past two hundred years has been dissolved in oceans (Raven et al., 2005; LeQuéré et al., 2009). A large quantity of CO2 is present in surface waters, generating an overall decline in pH of *0.1 (Raven et al., 2005).
The steady increase in ocean water pH can be seen in Figure 3 (Feely, 2011).

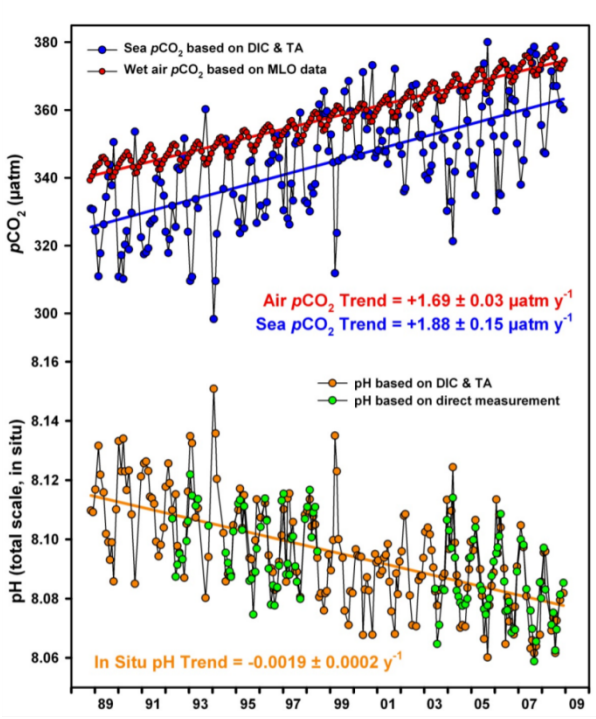

Figure 3. pH levels in Hawaii 1989-2009 (Feely, 2011).

The Petition Project states that over 31,000 scientists agree with the idea that "There is no convincing scientific evidence that human release of carbon dioxide will, in the foreseeable future, cause catastrophic heating of the Earth's atmosphere" (Petition Project, 2007).
On the other hand, Cook et al argue that the consensus that humans are causing recent global warming is shared by 90%–100% of publishing climate scientists according to six independent studies. An analysis of 11944 abstracts of research papers shows that 4014 took a position regarding the cause of recent global warming. A survey of the authors of some of the papers (2412) shows a 97% consensus (Cook et al, 2013).

CONCLUSIONS

Despite common belief, global warming is a reality and there is ample evidence supporting the effects of CO2 emissions on the environment. Its effects on marine and terrestrial wildlife have been documented and proven as being the result of anthropogenic activity by 97% of the scientific community.

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WATER HOLDING CAPACITY OF SOIL FROM MOLDAVIAN PRUT RIVER BANK - DETERMINATIONS IN LABORATORY CONDITIONS

Maxim COROCHII

Scientific Coordinators: Lect. PhD Adela HOBLE, Prof. PhD Eng. Marcel DIRJA

University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, 3-5 Calea Manastur St., 400372, Cluj-Napoca, Romania, Phone: +40-264-596.384, Fax: +40-264-593.792, Email: corochiimaxim@gmail.com

Corresponding author email: corochiimaxim@gmail.com

Abstract

The degradation phenomena of river bank after afforestation still persists. The tree stands were established in 1998, and 1999. The method used for river bank stability was to establish tree stands mixed with unplanted stripes. The aim of research is to determine the water holding capacity of soil, due to the related events regarding water in soil. The phenomena of water moving through hydrophilic porous materials are conditional for land properties. Due to the aspect of mixed afforestation method, it was observed a difference opposite with expectations: water hold capacity should be very good (higher than 50% of dry soil weight) in tree stands. The mean of water holding capacity, determined in laboratory conditions, for soil located at the edge of tree stand is 19.47% of dry soil weight, and for soil located in the unplanted stripe is 30.53% of dry soil weight.

Key words*: dry soil weight, edge effect, unplanted stripe, tree stand.*

INTRODUCTION

In spring of 1998, and 1999, it was proposed a stand establishment for Moldavian Prut river bank stability. The proposed solution was to establish unplanted stripes mixed with tree stands, and until 2003 they were also carried out various planting interventions.
In 2016, the studied area still shows river bank degradation phenomena. The hypothesis of the study is to determine if there is an edge effect regarding water holding capacity of the soil, which occurs at the boundary of the two habitats: unplanted stripes and tree stands.

The studies of water in respect of porous materials are important for understanding water as a factor which condition land properties (Chirita et al., 1967). Also, water in relation with soil represents a factor which determines soil erosion (Motoc, 1963; Dirja, 2000).
The water holding capacity is influenced by mechanic characteristics, structure and texture of soil (Budoi et al., 1965).
A method to prevent soil erosion and land degradation, with ecological benefits, is afforestation (Traci and Costin, 1966).

MATERIALS AND METHODS

Figure 1. Site location: Moldavian Prut River Bank
Latitude: 47º59ˈN; Longitude: 27º10ˈE

Figure 2. Soil profile - Moldavian Prut River Bank: soil profile at the edge of tree stand

Figure 3. Soil profile - Moldavian Prut River Bank: soil profile in unplanted stripes with 60% vegetation cover

Water holding capacity was determined in laboratory conditions. The soil samples were collected from two sites after a soil profile was opened for each site (Figure 2 and Figure 3).

Figure 4. Soil put for drying after field sampling

Soil samples were collected in October 2016. They were let dry at room temperature (Figure 4), and after one week they were put in drying stove for 8 hours, at a temperature of 105oC. The soil samples were grid into fine powder using a mortar and pestle. The powder was sieved to obtain fine powder with diameter lower than 0.25 mm.

It was weight 10 g of fine powder with diameter of minerals < 0.25 mm using a weighing balance with precision of e=0.1g/0.1ct and d=0.01g/0.1ct. The 10 g of fine powder were transferred in glasses with volume of 50 cm3.

The water was dropped on fine powder using a pipette with an accuracy of 0.1 ml.

The statistical analysis was conducted for the quantity of water used to saturate the samples.

The values were calculated using the formula after Brici and Lepsi method (presented in Luca et al., 2013):

$$WHC = \frac{C_n \cdot 100}{M} \cdot k$$

where:

WHC – water hold capacity [% of dry soil weight];

Cn – water quantity used to saturate the soil samples [ml];

M – soil weight [g];

k – 0.43, experimental coefficient.

Note: k – aftersoil factor, which includes particle size of the soils, organic matter content, soil structure and profile permeability).

RESULTS AND DISCUSSIONS

In Figure 4 is presented the variation of mean values determined for each site regarding water holding capacity.

The values determined in laboratory conditions were statistical analysed (Table 1).

Table 1 shows the values of F computed for each factor and for interaction between the two factors.

The location of soil sampling have F values higher than theoretical values for p=5% and p=1%.

Analysing the influence of site location (Table 2) was determined a difference of 11.05 % of dry soil weight between the mean values of water holding capacity.

At the edge of trees stand the mean value of water holding capacity was 19.47 % of dry soil weight and in the unplanted stripes was determined a value of 30.53 % of dry soil weight. The difference is statistically: distinct significant.

According with Obrejanu and Puiu (1972; p. 192), the water holding capacity at the edge of tree stand is unsatisfactory (lower than 25% of dry soil weight), but for unplanted stripe is satisfactory (between 20-30% of dry soil weight), and overall, this trend of satisfactory regarding water holding capacity is maintained (Figure 6).

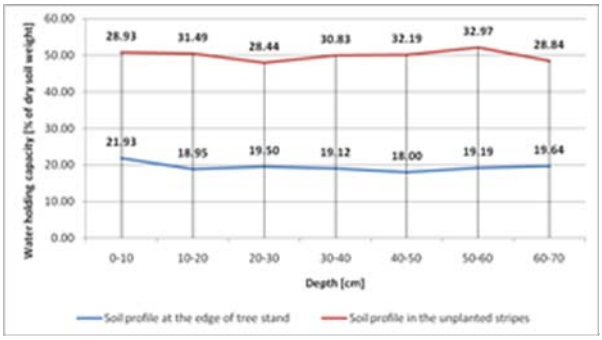

Figure 5. Variation of water holding capacity (% of dry soil weight) for soil profile opened at the edge of tree stand (blue line) and in unplanted stripes (red line)

Table 1.The analysis of variance for bifactorial observations with vegetation cover location and soil sampling depth

Source of variance	SS	df	MS	F	p
Factor A - location	1282.518	1	1282.518	716.615	>18.51 ; 98.58
Factor B - depth	18.271	6	3.045	0.312	<2.51; 3.67
Interaction AxB	66.280	6	11.046	1.131	<2.51; 3.67
Total	1619.985	41			

Note: SS – sum of squares; df – degrees of freedom; MS – mean of square; F – Test (statistics); p – significance for p – 5%; 1%.

Table 2. Statistical analysis of influence of soil sampling location

Variant	Water holding capacity [% of dry soil weight]	Differences [% of dry soil weight]	Significance
Edge of trees stand	19.47	-	-
Unplanted stripe	30.53	11.05	**
		$p_{5\%}$	1.78
		$p_{1\%}$	4.10
		$p_{0.1\%}$	13.05

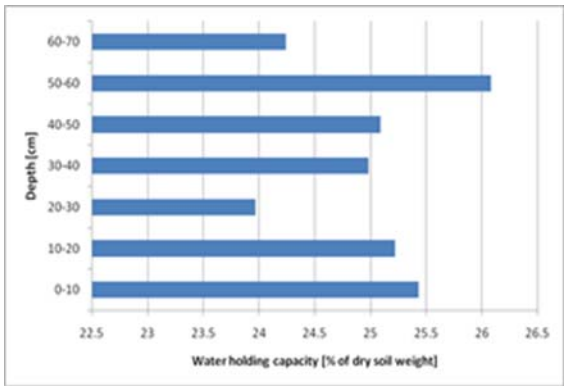

Figure 6. The water holding capacity ranging on soil profile depth

CONCLUSIONS

The analysis of variance shows that the location of soil sampling influences water holding capacity of soils.

The depth of profile layers does not influence the water holding capacity.

The differences computed for the same depth (0-10 cm) are statistical significant. Water holding capacity in unplanted stripe is higher with 7% of dry soil weight.

The differences computed for the following depths: 10-20 cm, 30-40 cm, 40-50 cm, and 50-60 cm are very statistical significant, ranging from 11.71% of dry soil weight to 14.19% of dry soil weight.

The differences computed for 20-30 cm, and 60-70 cm are statistical distinct significant.

The soil profile at the edge of tree stand is deeper than the soil profile of unplanted stripe with 30 cm. The determinations water holding capacity at the 70-100 cm depth (tree stand) showed a very high variability, ranging from 18.49 to 46.30 % of dry soil weight (within replications).

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PREPARATION OF ADHESIVES FROM THE EXPANDABLE POLYSTYRENE WASTE

Andreea - Simona CURIAC, Andrei PETRE, Andreia-Gabriela STOICA
Stefan-Adrian SANDU

Scientific Coordinators: Lect. PhD Eng. Mirela Alina SANDU, Prof. PhD Eng. Ana VIRSTA

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67

Corresponding author email: stoica.andreia96@gmail.com

Abstract

In daily life, expanded polystyrene foams (EPS) are widely used as packaging material, construction material, and in household appliances as well as many others. On the other hand, waste EPS has caused lots of environmental pollutions because it cannot be decomposed by the natural processes.With law 211/2011, to add in 2016 romanian entrepreneurs in construction sector had to find a friendly solution with the environment for recycling EPS. This article aims to present one of these Styrofoam organically recycling and also to prepare and use in the laboratory an adhesive from expandable polystyrene waste.

Key words*: adhesive, environment, expanded polystyrene*

INTRODUCTION

Polystyrene is extracted from oil. Thousands of small units of styrene, called monomers, link together to form large molecules of polystyrene by a process called polymerization (Figure 1) (http://www.jmt.in/what-is-expandable-polystyrene-eps.html).

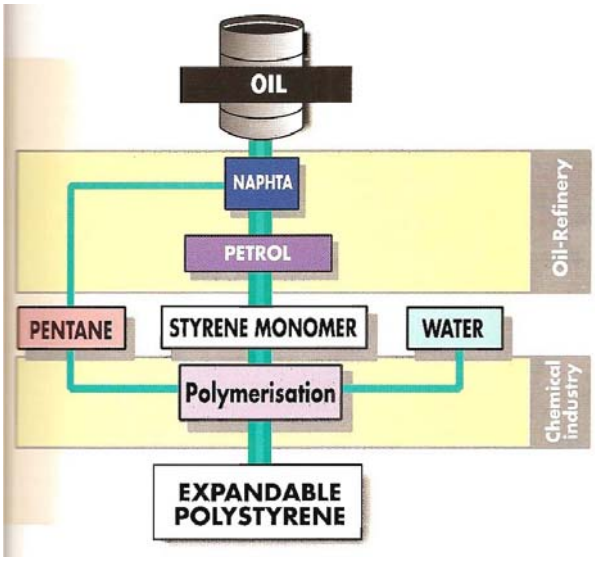

Figure 1.The polymerisation of EPS (http://www.jmt.in/what-is-expandable-polystyrene-eps.html)

The expanded version of polystyrene is about forty times the volume of the original polystyrene granule (Maharana T., 2007).
Originally discovered by Eduard Simon in 1839 in Germany by accident, EPS foam is more than 95% air and only about 5% plastic.
EPS, or Expandable Polystyrene is among the biggest commodity polymers produced in the world. EPS is a solid foam with a unique combination of characteristics, like lightness, insulation properties, durability and an excellent processability. EPS is used in many applications like thermal insulation board in buildings, packaging, cushioning of valuable goods and food packaging (Figure 2) (http://www.plasticseurope.org/what-is-plastic/types-of-plastics-11148/expanded-polystyrene.aspx.).

Figure 2.The versatility of EPS

Expanded polystyrene (EPS) is an innovative building material that lends to the design and structural integrity of many building projects (Figure 3). Since the 1950s, EPS has been recognized as a mainstream insulation material.

Figure 3. EPS used in constructions

The municipality from Bucharest has rehabilitated thermally from 2009 to now, up to 2314 blocks and another 758 are in rehabilitation (Figure 4).
(http://www.hotnews.ro/stiri-administratie_locala-20650690-analiza-cate-blocuri-fost-reabilitate-termic-bucuresti-cati-bani-cheltuit-cat-sigure-sunt-cladirile-anvelopate-caz-incendiu.htm)

Figure 4. Building rehabilitated with EPS

The amount of expanded polystyrene used in thermal isolation, is large. The impact of these works on the environment is high (parks and gardens filled with polystyrene beads and large pieces of polystyrene) (Figure 5).
When discarded in nature, expanded polystyrene threatens birds and aquatic fauna, especially because it has a very low density, which makes it able to float or drift. Styrofoam fragments are lethal to fish and birds that come to consume. (http://www.sigurec.ro/ro/despre-sigurec/reciclez1/reciclarea-polistirenului.html)
Time decay is very high, about 900 years, making from polystyrene an important source of pollution.
It is resistant to photolysis, or the breaking down of materials by protons originating from a light source. This, combined with the fact that Styrofoam is lightweight and therefore floats, means that over time a great deal of polystyrene has accumulated along coasts and waterways around the world.
It is now considered the main component of marine debris.While it can be recycled; the recycling market is diminishing it. In many communities people are told that their recycling companies will not accept polystyrene products. Those that are recycled are remanufactured into things like cafeteria trays or packing filler.
(http://cleanbayarea.com/recycling-environment/how-styrofoam-is-bad-for-the-environment/)

Figure 5. Polystyrene scrap remaining after rehabilitation

LAW NO. 211/2011 on waste regime, updated in 2016 prohibits throwing Styrofoam in landfills.
With the introduction of this law, the large amounts of unused EPS led to a need for recycling even by those who use this material for thermal insulation in constructions.

MATERIALS AND METHODS

1. Advanced recycling of EPS

An example of 'give way' 'it is a construction company in Bucharest that found that expanded polystyrene recycling can even bring profit. They bought an EPS recycling system from a chinese specialized company dealing with the production of specialized equipment in recycling. Foreign company wants to buy material that results from recycling in order to reuse it, because in Romania there is interest in introducing it back into circulation. This recycling system is unique in Romania. The machine is equipped with a superior worm wheel motor that acts a role to break down large pieces of polystyrene granules mixture. Afterwards, the balls are heated to a temperature between 160-180^{o}C, melting away. During combustion, it releases smoke and gas that are not very toxic. If this temperature range is exceeded, they become black and therefore cannot be reused (Figure 6).

Figure 6. System of recycling EPS

Polystyrene waste requires cleaning in advance before placing them in the recycling machine. This is the main drawback.

2. Recycling EPS in laboratory

The preparation of expandable polystyrene adhesives from the waste was performed in the Environment Engineering Laboratory, from the Land Reclamation and Environment Engineering Faculty - U.A.S.V.M Bucharest.
For this experiment we needed 100 ml of acetone, about 150 g of expanded polystyrene, cylinder, glass container for mixing materials, spatula (Figure 7).
At the introduction of expanded polystyrene in acetone, it seemingly disappears, and the gas bubbles in the material, when they were released, create an effect of effervescence (Figure 8). A small volume of propanone can dissolve an impressive amount of polystyrene (Figure 9). This experiment takes only minutes and is easy to repeat.

Figure 7. The quantity of polystyrene for experiment

Figure 8. Polystyrene in propanone

Figure 9. Dissolved polystyrene

RESULTS AND DISCUSSIONS

1. Specialized recycling of EPS

With the specialized recycling system of EPS, result a model foam at the moment, which later becomes solid and brittle, with a density much higher than classic polystyrene (Figures 10, 11).

Figure 10. Foam of polystirene

Figure 11. Pile with foam of polystyrene

This foam is subjected to chemical processes and then transformed into picture frames, helmets for cyclists, hangers and more (Figure 12). Compared to traditional materials with wooden frame, it is advanced in the aesthetic strength, durability and corrosion. It has simple techniques impression pigeon. Moreover, the cost is less. Consequently, it becomes popular to many customers. Within only 3-4 years of rapid market dominated by traditional products of wood framing and became the new environmentally friendly material applied decoration, outdoor advertising and construction materials industry and planning.

Figure 12. Frame and helmets made of polystyrene foam

2. Laboratory experiment

As a result of the experiment, we obtained a gel which can be used as an adhesive. We tried – and managed to bond plastic and even ceramics (Figures 13 and 14).

a)

b)

Figure 13. a) Before bonding, b) After bonding

a)

b)

c)

Figure 14. a) Before bonding, b) After bonding

The remained gel in the experiment was placed in special forms from silicone, resulting small art objects that could easily be loved (Figures 15, 16 and 17).

Figure 15. Molding process

Figure 16. After removal of form

Figure 17. After removal of form

CONCLUSIONS

Expanded polystyrene can be harmful to the environment if is not properly exploited.
Once updating the Law 211/2011 entrepreneurs in construction will have to use an advanced system of recycling of EPS.Expanded Polystyrene is completely recyclable; it can betransform into new foam packaging or durable consumer goods like cameras, coat hangers, CD jewel cases and more.

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THE EVALUATION OF HEAVY METALS CONTENT IN FRUITS AND VEGETABLES USING THE ICP-MS METHOD – (INDUCTIVELY CUPLED PLASMA-MASS SPECTROMETRY)

Alin DANCA

Scientific Coordinator: Prof. PhD Eng. Carmen CÎMPEANU

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67

Corresponding author email: danca.alin@gmail.com

Abstract

The aim of this paper was to assess the heavy metals contents of carrots and apples provided from Romanian markets and supermarkets. Arsenic, cadmium, copper, lead and zinc were the heavy metals selected to be analyzed. The amount of heavy metals was determined by using the ICP-MS method (mass spectrometry with inductively coupled plasma. The data showed that metal concentrations are in accordance with concentrations required by low for fresh vegetables and fruits, with the exceptions of zinc content in apple samples.

***Key words**: heavy metals, fruits and vegetables, toxicity,ICP-MS*

INTRODUCTION

Fruits and vegetables are beneficial to our health because they are an important source of nutrients such as vitamins and minerals needed for a balanced life. Vegetable farming is the main source through which these edibles are obtained on an industrial scale, then they are distributed from various suppliers to markets and supermarkets.This is the principal method of how fruits and vegetables arrive on our table for consumption. Due to pollution or chemical fertilizer application, agricultural soils can be altered with heavy metals (Jigau, 1995). Heavy metals are metals and non-metals (chemical elements with electropositive character) that have higher atomic density than 5 g / cm3 and in certain concentrations can have toxic effects and can affect the environment including living organisms. Metals are chemical elements essential for the metabolic processes of living organism, with some exceptions, such as cadmium, lead and mercury, which have not physiological roles, metals are chemical elements essential for the metabolic processes of living organism (Cîmpeanu and Vîrsta, 2011). However, every metals become toxic for human health if metals concentration is exceeding the maximum admissible concentration (MAC) required by low. The metals toxicity occur in low concentrations, on the order of ppm (parts per million). In this context, the paper aims to determine the concentration of metals such as cadmium, lead, copper and zinc, and non-metals as arsenic in fresh vegetables and fruits (apple and carrot) purchased from Romanian markets and supermarkets.

MATERIALS AND METHODS

The samples preparing. The apple and carrot samples were collected from one market and two supermarkets. The samples washed and cleaned by impurities were chopped with ceramic knifes to avoid contamination with metallic materials. Three average samples of apple (and carrot, too) from collected places were prepared. From each average samples 0.5 grams weighed in a Teflon cylinder with an analytical balance were used to establish the amount of heavy metals. Heavy metals analysis. The lab process was conducted in the Research Center for the Study of Quality Food Products - HORTINVEST of University of Agronomical Sciences and Veterinary Medicine from Bucharest. The samples mineralization was obtain using a digester oven. The interaction of microwave radiation

with samples and reagents results in fast heating of reaction mixtures and their efficient decomposition. Advantages of this strategy over conventional procedures are: broad application, much shorter reaction time needed, direct heating of samples and reagents,reduced need for aggressive reagents, minimal contamination and lack of loss of volatile elements (Welna et al., 2011). The samples digestion was carried out at 200 ºC for 15 minutes using 8 ml HNO3 and 2 ml H2O2 as mineralization reagents, and followed by 15 minutes of cooling. The addition of hydrogen peroxide leads to reduction of gas development and allows a better digestion quality and in the same time a reduction of NOx formation (Ethos Up User Manual, 2015). After digestion, the samples were brought to a volume of 50 ml with ultrapure water, and subjected to the analysis.For the final analysis it was used ICP-MS equipment. Mass spectrometry is a technique for determining the mass of an atom or molecule by using the movement of ions in a magnetic or electric fields. Molecular ions and fragment ions are accelerated by the electric field and then separated by diverting a variable magnetic field depending on the mass and their charge and generates an ion current proportional with the abundances of relative ions (Tanaselia, 2013). Finally, the device quantifies the results in data processed by a software program.

RESULTS AND DISCUSSIONS

Cadmium concentration (parts per Billion) of samples is presented in Figure 1.
Usually, cadmium content in plants is between 0.1 and 0.8 ppm. Values greater than 1 ppm are considered toxic. Cadmium toxicity is manifested by lung disease, hypertension, hemorrhagic necrosis selective testicles, sterility, kidney damage and bone damage. The most dangerous form of exposure to cadmium are by air, (by inhaling fine dust and smoke) and by ingestion of cadmium compounds with high solubility.Cadmium can cause pneumonia, pulmonary edema and even death (Hayes, 2007).

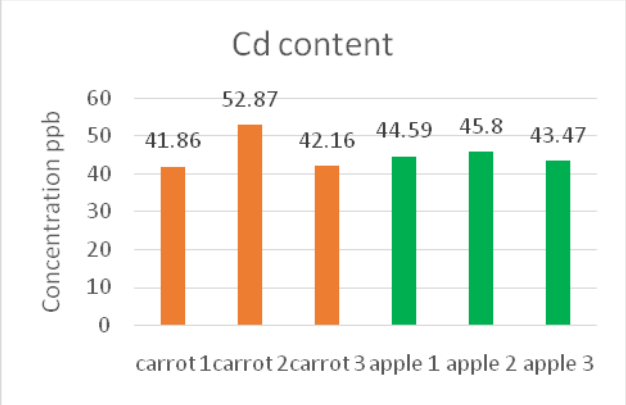

Figure 1. Cadmium content from samples

The absorption of lead in the human body is accomplished slow and it takes place mainly via the gastrointestinal way (and rarely the respiratory tract) in concentration of 5-15%. Chronic toxicity of lead is known from ancient times and is called lead poisoning. The disease is characterized by anemia, neurological disorders (ataxia, seizures, coma), kidney damage (nephropathy chronic Fanconi syndrome), and an increased lead content in blood (Cîmpeanu and Vîrsta, 2011). Lead concentrations in the samples are shown below in Figure 2.

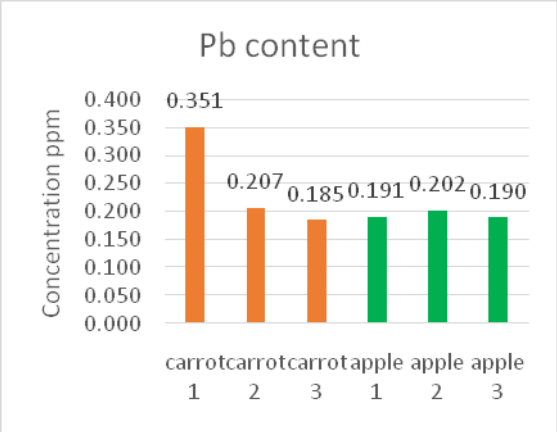

Figure 2. Led content from samples

The arsen has numerous health effects including skin problems, skin cancer, kidneys and lungs cancer, it can damage the blood vessels, but also can cause diabetes, high blood pressure and reproductive disorders.

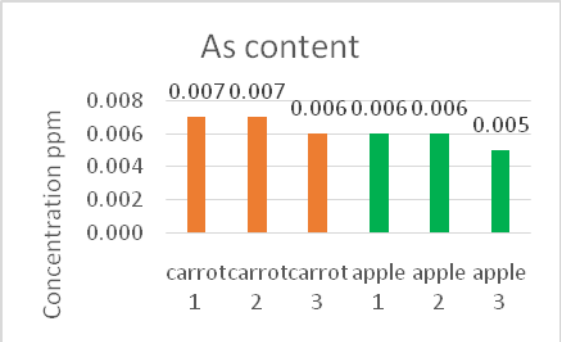

Figure 3. Arsen content from samples

The excess of copper causes the Wilson's disease, manifested by liver cirrhosis, degenerative changes of the lenticular region of the brain, kidney disorders and the occurrence of yellow and green rings in the outer part of the cornea (Underwood, 1977).

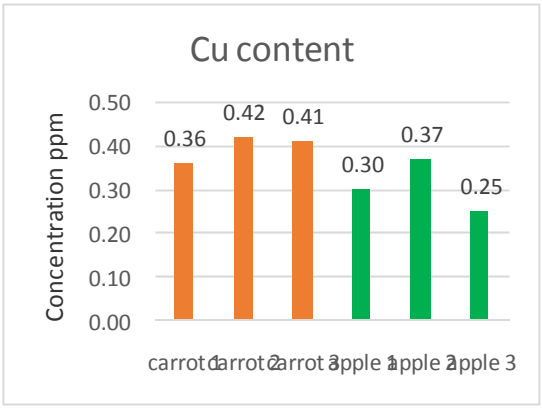

Figure 4. Copper content from samples

Zinc absorption is negatively influenced by: supplements containing iron, high doses of calcium, phytic acid (vegetables and cereals) and alcohol. The excess of zinc can occur both in acute form (fast - after high-dose) and chronic (in time - after multiple doses) .The acute form may occur even 30 minutes after the ingestion of massive doses, and it's manifested by nausea, vomiting, loss of appetite, abdominal cramps, diarrhea and headaches (Cîmpeanu and Vîrsta, 2011).

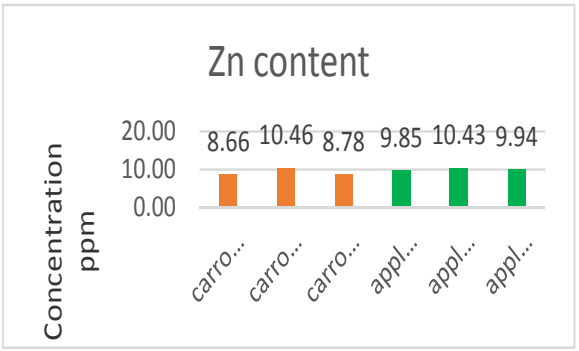

Figure 5. Zinc content from samples

CONCLUSIONS

The comparison between samples and maximum admissible concentrationaccording to the Order no. 975/1998 on the approval of sanitary food (expressed in mg / 1 kg of product) of permitted concentrationper day is shown below in Table 1.

Table 1. The maximum admissible concentation of heavy metals in fruits and vegetables according to Order no. 975/1998 compared with the analyzed samples.

	As	Cd	Pb	Zn	Cu
Vegetables	0,5	0,1	0,5	15	5,0
Fruits	0,5	0,05	0,5	5,0	5,0
Carrot 1	0,007	0,0418	0,351	8,66	0,36
Carrot 2	0,007	0,0528	0,207	10,46	0,42
Carrot 3	0,006	0,0421	0,185	8,87	0,41
Apple 1	0,006	0,0445	0,191	9,85	0,30
Apple 2	0,006	0,0458	0,202	10,43	0,37
Apple 3	0,005	0,0434	0,190	9,94	0,25

In generally, the carrot and apple samples provided from markets and supermarkets have proper contents of heavy metals that not exceed the maximum admissible concentration required by low. However, in apple samples were found Zn concentration values twice higher than maximum concentration allowed for fresh fruits. Also, the cadmium concentration in apple samples (0.044 ppm to 0.045 ppm) were very closely to MAC (0,05 ppm). If a person consumes daily a carrot and an apple (aprox.100 g each) this would lead to an accumulation in the human body of cca. 0,01 mg of Cd, 0.05 mg Pb and 0.1 mg Zn which is ten times under the safe daily dose of 0.1 mg Cd, 0.5 mg Pb, and 10 mg Zn, respectively (FAO/WHO, 2007).

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REMOVING HEAVY METALS FROM THE SOIL WITH PHYTOREMEDIATION

Halil Burak ERTÜRK, Nizamettin ÖZDOĞAN

Bülent Ecevit University, Department of Environmental Engineering, Farabi Campus, 67100, Zonguldak, Turkey, Phone: +90.372.291.19.34, Fax: +90.372.257.40.23

Corresponding author email: halilburak.ert@gmail.com

Abstract

In recent years, urbanization, industrialization, population, domestic and industrial productions are increasing. However, organic and inorganic wastes are released into the ecosystem. Mining, urban or industrial solid, gas and liquid waste, pesticide and artificial fertilizer use, paint industry and car exhaust gases cause excessive release of heavy metals in nature. Some activities of heavy metals accumulate in there sulting soil. This accumulation is not just about soil and ecosystem. At the same time affects the food chain also human and animal health. These polluted soils are the most difficult work in terms of environmental engineering. The high costs of clean-up activities of contaminated soil have limited the use of classical disposal technologies limited.

Environmental engineers have also developed phytoremediation and bioremediation techniques to remove these toxic elements. The phytoremediation technique is more preferrable in this field, because of its environmental friendly properties and cost.The ability of hyperacumulator plants to absorb large amounts of toxic elements in their bodies mad ethese plant spreferrable in clean up activities. One of the most important advantages of the phytoremedical technique is that it provides in-situtreatment and it requires very few extra efforts to remove the pollution. In addition, phytoremediation does not harm natural resources. However, the phytoremediation technique can only be use in shallow regions in water, soil and sediment. Another short coming of their technique is that plants can not show their efficacy in very short time in highly polluted areas. For this reason, the phytoremediation technique can only be used at low levels of contaminated sites. In this review, the effects of heavy metals in the soil, the applications of the phytoremediation technique to remove heavy metals from the soil and the prosandcons of these methods have been studied.

Key words: *heavy metals, soil, hyperacumulator, phytoremediation.*

INTRODUCTION

As a result of industrial activities, large amounts of organic and inorganic compounds permeate the environment every year. Soil pollution is a typical side effect of industrial activity (Sabateet al. 2004). Contaminants among organic anthropogenic compounds: Polycyclic aromatic hydrocarbons (PAH), chlorinated volatile organic compounds (VOC) and alkyl benzene (benzene, toluene, ethyl benzene and xylenes, BTEX) hydrocarbons, polychlorinated biphenyls (PCB) and trichlorethylene (TCE) are common pollutants in the soil (Reible and Demnerova, 2002). Besides, with the expansion of the petroleum industry and its market; Leakage from the tanks during filling, bursting oil spillage and the formation of waste petroleum products cause environmental pollution (Adeniyive Afolabi 2002). In recent years, the method of bioremediation in hazardous waste management has become very important. Some chemicals thought to be degradation resistant, including chlorinated species such as trichloroethane and some polychlorinated biphenyls (PCBs), were found to be biodegradable in laboratory conditions (Mohn 2004; Dindar, 2010).

Conventional engineering methods used in heavily contaminated areas are expensive (Salt et al. 1995). For this reason, instead of existing remediation techniques, the focus is on low cost and environmentally friendly phytoremediation techniques (Arshad et al. 2008). Plants that accumulate 50 to 500 times more metal in the organs of the earth than the concentration of metal in the ground are called as hyperaccumulators (Clemens 2006). Approximately 450 plant species have been identified as hyperaccumulators (Baker and Brooks 1989). However, the phytoremediation potential slow growth rate of many hyperacumer plants is limited by a low biomass

and a tight 2 relationship, usually with a specific habitat (Chaney et al. 2005). There is a need to develop genetically modified plant species that have the desired properties to come from above these limitations. For this reason, the physiological and molecular regulation of the mechanism of heavy metal accumulation in hypercapacitor plants needs to be well understood (Terzi, 2014).

MATERIALS AND METHODS

This work has benefited from many local and foreign sources. As a result of these evaluated resources, a literature study on the phytoremediation was made. While researching the articles, Google Scholar (https://scholar.google.com) and Prof. Dr. Özer Çınar's book "Çevre Kirliliğive Kontrolü", Bulent Ecevit University Environmental Engineering Soil Pollution and Hazardous Waste Management lesson notes were used in this study.

SOIL POLLUTION

Soil pollution is the physical and chemical degradation of soil by solid, liquid and radioactive waste and pollutants. Important factors in the pollution of the earth; Wastes from settlements, industrial waste, exhaust gases, pesticides and chemical fertilizers.
Uncontrolled storage areas of domestic solid waste cause to soil pollution. Exhaust gases, ozone, carbon monoxide, sulfur, sulphur dioxide, cadmium etc. carry wih winds long distance transportation and pollute soil and waters with rains. It is the result of unconscious and excessive use of agricultural products and fertilizers, increasing the toxic substances to the soil and polluting the natural environment.

SOURCES OF HEAVY METALS IN THE ENVIRONMENT

Heavy metals enter the environment from natural and anthropogenic sources. The most significant natural sources are weathering of minerals, erosion and volcanic activity while anthropogenic sources include mining, smelting, electroplating, use of pesticides and (phosphate) fertilizers as well as biosolids in agriculture, sludge dumping, industrial discharge, atmospheric deposition, etc. (Modaihsh et al., 2004; Chehregani and Malayeri,2007). In below gives anthropogenic sources of selected heavy metals in the environment (Table 1) (Ali, 2013).

Table 1. Gives anthropogenic sources of selected heavy metals in the environment.

Heavy metal	Sources	Reference
As	Pesticides and wood preservatives	Thangavel and Subbhuraam (2004)
Cd	Paints and pigments, plastic stabilizers, electroplating, incineration of cadmium-containing plastics, phosphate fertilizers	Salem et al. (2000); Pulford and Watson (2003)
Cr	Tanneries, steel industries, fly ash	Khan et al. (2007)
Cu	Pesticides, fertilizers	Khan et al. (2007)
Hg	Release from Au–Ag mining and coal combustion, medical waste	Memon et al. (2001), Wuana and Okieimen (2011), Rodrigues et al. (2012)
Ni	Industrial effluents, kitchen appliances, surgical instruments, steel alloys, automobile batteries	Tariq et al. (2006)

POLLUTANTS CAUSING SOIL POLLUTION

HEAVY METALS

The definition of heavy metals and the harm that chemical substances make to the ecological system have become generalized and have begun to take place in newspaper news that heavy metals frequently cause environmental problems. This common belief is that the accumulation of heavy metals relative to other metals in a living organism over a certain period of time leads to a gradual increase with the negative effect. In fact, the definition of heavy metals is used for metals with a physical

density greater than 5 g / cm^3. This group includes more than 60 metals including lead, cadmium, chromium, iron, cobalt, copper, nickel, mercury and zinc. These elements are usually present in the earth as a stabilizing compound in the form of carbonates, oxides, silicates and sulphides, or as imprisonment in silicates. Although the effects of the metals on the ecological system are tried to be defined by the action of the density values of the metals, in reality the density values of the metals are far from defining their biological effects. The most important industrial activities that cause heavy metals to be spread around are cement production, iron and steel industry, thermal power plants, glass production, waste and sludge incineration plants. Below is a list of metal species from the basic industries in general (Table 2). Heavy metals in the air eventually reach the land and animals and people through plants and food chains. They also breathe in case of aerosol by the animal and the people. Heavy metals are also active on animals and humans through the mixing of industrial wastewater into drinking water or by the pollinating of particles contaminated with heavy metals (Rether, 2007; Kahvecioğlu, 2003).

Table 2. List of metal species from the basic industries in general

INDUSTRY	Cd	Cr	Cu	Hg	Pb	Ni	Sn	Zn
Paper Industry	-	+	+	+	+	+	-	-
Petrochemistry	+	+	-	+	+	-	+	+
Chlorine Alkali Industry	+	+	-	+	+	-	+	+
Fertilizer Industry	+	+	+	+	+	+	-	+
Iron and Steel Industry	+	+	+	+	+	+	+	+
Thermic Industry	+	+	+	+	+	+	+	+

Heavy metals may be harmful to soil as well as substances that must be found for plant growth that must be found in terms of soil. In this respect, it is materialized as follows:

- Essential elements for plant growth (Fe, Cu, Zn, Mn, Mo)
- promotive for plant growth (V, Co, Ni)
- Direct toxic effects of plant (As, Pb, Cd, Cr, Hg)

Sources that cause heavy metals to be seen are pollution caused by irregular throwing of solid wastes from mineral processes, volatile wastes from thermal power plants and factory floors, wastewater muds from fueled vehicles, tire wastes, pesticides, commercial fertilizers and industrial products.

Impact of heavy metals on agricultural health and environmental health, the plants growing here and the heavy metals found in it can enter the human and animal and cause permanent damage.

PETROLEUM HYDROCARBONS

Petroleum products are raw materials for the production of many basic materials as fuel for energy, and they have a great impact on environmental pollution because they are produced at high speed and scattered around. It is important that petroleum hydrocarbons pollute the soil and water ecosystem during transport and purification of crude oil products such as gasoline, diesel oil, kerosene, asphalt and other pollutants.

Petroleum products contain complex toxic compounds such as polycyclic aromatic hydrocarbons (PAH), BTEX compounds, benzene and its derivatives, cycloalkane chains and if it spread, it leads to the degradation of the soil resource in such a way that it can not serve the agricultural, industrial or reusable purposes and the loss of its physical-chemical-biological qualities (Şen, 2010).

DIOXINS

Dioxins are colorless, odorless, water-insoluble, non-commercially produced plastic products containing C, H, O and Cl and are side product that are unfavorably showed up during combustion. Dioxins are a common name given to a large group of substances (dioxins and furans) whose properties and toxicity are related to each other. There are 75 different dioxins and 135 different furans in the nature and 209 different PCB types, of which 29 are

the most toxic compounds. Dioxins and furans are not commercially produced compounds and have no known uses. They are often exposed as undesirable byproducts in the production of chemical products (Güneş 2007). Dioxin and furan sources are as follows (Bawden 2004);

- Waste incineration
- Ferrous and non-ferrous metal production
- Electricity generation and heating
- Production of mineral (lime, cement, ceramic, glass and asphalt mixture) production
- Motor vehicles
- Uncontrolled combustion processes
- Production of chemicals and consumer foods (paper, textile, leather)
- Regular storage and accumulation (sludge treatment, composting, waste oil accumulation)
- Cigarette smoke
- Natural events such as forest fires, volcanic eruptions
- Animal feed

The toxicity of dioxins on the environment and human health Dioxins and similar compounds that are released to the soil due to various reasons remain in the soil for a very long time and do not interfere with groundwater because they are not soluble in water. The half life of dioxin in the soil is 25-100 years. Sediments under the lakes, rivers and oceans are another storage area for dioxin. Dioxins from rain, erosion and industrial aqueous systems constitute 1% of total dioxin contamination, which is extremely important for human health, because dioxin can accumulate in the food chain in the water and reach human beings and animals. They can also stay in the water for a long time because they do not evaporate easily and do not degradation (Hismioğullarıvd. 2012; Şen, 2010).

This expression we use as "Green improvement" in Turkish is the technology to improve the environment on the basis of plants. With this technology, organic and inorganic materials can be removed from the area where they are polluted by plants. The characteristics of plants used in these studies are that they can grow well in polluted areas without being harmed by existing pollutants.

The most important negative aspect of this technology is; it is not possible to display short-lived activities of plants in very dirty areas. For this reason it is only used at low levels of contaminated areas. The effectiveness of the system is limited by root depths and climatic conditions. The use of non-natural plants for this purpose can affect biological diversity negatively. Phytoremediation is the organic and inorganic pollutants of plants from the soil or water environment

- Immobilization in the root zone,
- Storage in the root and the upper organs of the plant,
- By transporting through the roots to the upper organs of the plant and metabolizing or evaporating in the body and leaves,
- Is a natural technology that cleans the soil (Vanlı, 2015).

TYPES OF PHYTOREMEDIATION

The types of phytoremediation are classified as follows (Table 3) (Aybar, 2015).

Table 3. Types of phytoremediation

Methods used in metal pollutants	**Methods used in organic pollutants**
1.1. Phytoextraction	**1.2.** Phytodegradation
1.3. Rhizofiltration	**1.4.** Rhizodegradation
Phytostabilization	**1.5.** Phytovolatilization

PHYTOEXTRACTION

Phytoextraction is a method of picking up inorganic pollutants especially by plant roots and collecting some of them by moving them to the stem and leaf. These plants can adsorb 100 times more pollution than others. Then the collected plants can be used again as a fertilizer and the heavy metals in it can be recovered.

This method, called phytomining, which can lead to the extraction of uneconomic mineral ores. In this way, elements such as Ag and Ni are being recovered in the USA. This technology is mainly applied to contaminated soil from heavy metals (EPA, 2000).This method is shown below (Figure 1).

Phytoextension is used only in areas where metal pollution is low or moderate. Because

very polluted areas are not suitable for growing plants. In this technology, natural hyperacuma plant plants are used. Plant residues harvested as a result of phytoextraction method;

- dried,
- burned to ash,
- being restricted by its decomposition for composting,
- can be isolated by recycling into a biological metal (bio-metal ore) (Memon and al., 2000).

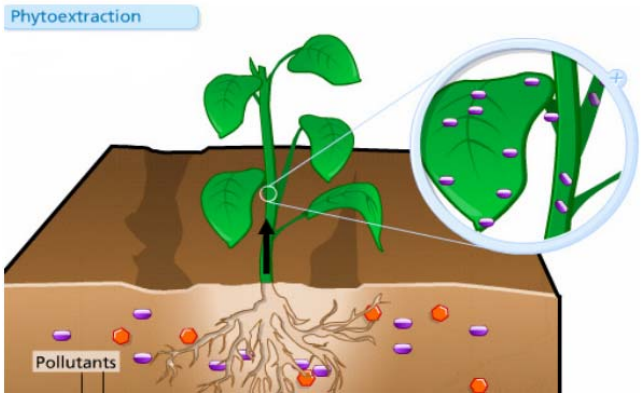

Figure 1. Phytoextraction

RHIZOFILTRATION

In the rhizofiltration method, a well-developed root system, which acts as a filter in the plants to be used, is needed compared to other methods. This method is used for the treatment of water contaminated with heavy metals rather than soil. The preferred hyperaccumulator plants for the rhizofiltration method are provided with adaptation of the pollutant in a different environment before being directly planted in the area. It is preferred that the roots of the plants are kept in clean water instead of soil until they develop at the desired level. These advanced root system plants are then transferred to a contaminated water source for adaptation purposes. Finally, after completing the adaptation problem of the plants, a rizofiltration method is applied to the contaminated area.The roots become saturated, the harvesting process is started and the destruction is carried out safely (EPA 1995; Aybar, 2015).

PHYTOSTABILIZATION

Phytostabilization is generally used to prevent the ingress of pollutants into groundwater and to prevent direct contact with the ground to prevent erosion in areas where erosion has occurred. In this technique, plant roots physically and chemically immobilize pollutants. The phytostabilization technique uses plants that are tolerant to high amounts of metals, sorption, precipitation, complexation of metals, or soil-immobilized plants by reduction of metal valences (Kocaer and Başkaya, 2003; Bert et al., 2005).

While some of the materials used in this technique are not suitable for every plant and every pollutant, some of them may cause metals to be taken, while others may cause more metal to be consumed. Root fixation is a method with the advantage of being applied in situ in soil, sediment and slurry. Planting makes the ecosystem enriched and prevents erosion and sediment movement (Anonymous, 1995). However, the pollutants are still in the environment and the risk continues (Yurdakul, 2015).

PHYTOVOLATILIZATION

In this method, heavy metals adsorbed by plants are transformed into less toxic volatile forms and given atmospheres by transpiration. Metals such as As, Hg and Se can be seen in the natural gas form. This method is shown below (Figure 2). It has been reported that some plants, such as naturally occurring or genetically modified Brassica Juncea and Arabidopsis Thaliana, adsorb heavy metals and convert them into gas form to give atmospheres (Ghosh and Singh, 2005). In addition, tree species such as Populus and Salix are frequently used in this technique due to their effective phytoremediation properties (Pulfordand Watson, 2003). It has been shown that Arabidopsis Thaliana and Brassica Juncea, which grew in the medium containing celentium, could produce volatile Se in the form of dimethylselenide and dimethyldiselenide.Nicotianatabacum and Arabidopsis thaliana plants containing the mercury reductase gene which transforms the ionic form of the helix (Hg^{+2}) into a less toxic form (Hg^{0}) have been genetically modified.

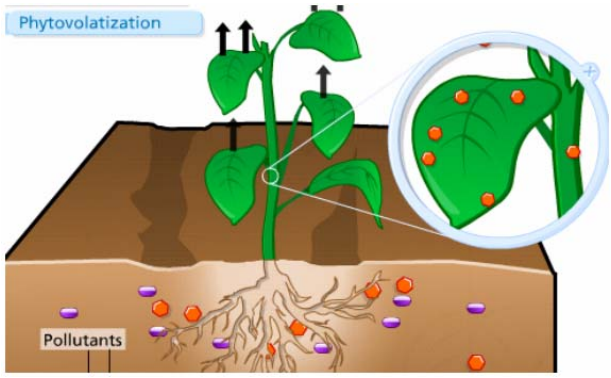

Figure 2. Phytovolatilization

PHYTODEGRADATION

Phytodegradation is the adsorption of pollutants in plant tissues. Contaminants that can be removed by the method of phytodegradation; Chlorinated compounds, pesticides, military chemicals and phenols. As an example of the removal of organic compounds, a myquatic plant Myriophyllumaquaticum (parrot feather) plant is used for the degradation of TNT. This method is shown below (Figure 3).

Using this method, many different pollutants such as solvents in groundwaters, petroleum and aromatic compounds in the soil and volatile compounds in the air can be treated (Newman and Reynolds 2004). However, plant enzymes, ammunition waste, as well as other harmful substances, such as organic herbicides, are used for the treatment of this harmful substance (Mirsal 2004; Kalkan, 2011).

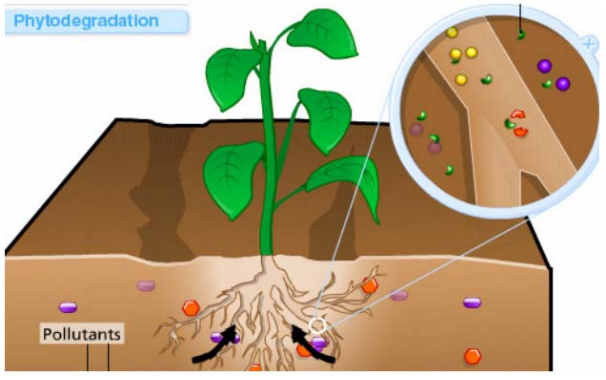

Figure 3. Phytodegradation

RHIZODEGRADATION

The working mechanism of this method is to work with soil microorganisms of plants to neutralize organic pollutants. The microorganisms that produce the nutrients needed to meet the energy needs of organisms bring about a change in the chemical structures of the pollution materials with the help of the root system. This association keeps microorganisms at an optimal level in order to sustain their vital activities and ensures a continuous breakdown of toxic pollutants.In this way, organic pollutants such as microorganisms, fuels and solvents found in the soil degrade and accumulate in their own bodies.

Among the plants used for rhizodegradation, red mulberry (Morusrubra L.), mint (Menthaspicata), alfalfa (Medicago sativa) and watercane (Typhalatifolia) plants can be counted (EPA, 2000; Vanlı, 2015). Schematic representation of the types of phytoremediation (Table 4).

AREAS OF USE OF PHYTOREMEDIATION

The currently widely used phytoremediation studies are being tested in different countries for heavy metal and organic pollutants and successful results are obtained. The following table shows the environments in which pollutants are used and the plant species used for different countries according to their application classes (Türkoğlu, 2006).

Also the types of phytoremediation are shown on a tree as follows (Figure 4).

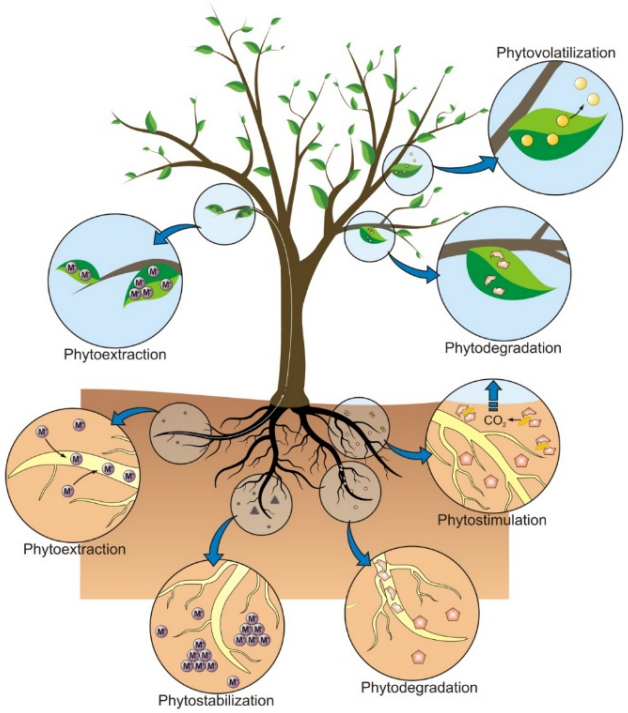

Figure 4. Types of phytoremediation

Table 4. Areas of application of the phytoremediation techniques in different polluting environments

MECHANISM	PLATFORM	OBJECTIVE	POLLUTANTS	PLANTS
Phytoextraction	soil, sediment,mud	Pollutant removal	Metals, Metalloids and Radionucleids	India mustard, Alyssum, moon flower, Hybrid poplars
Rhizofiltration	Surface and underground water	Pollutant removal	Metals, Radionucleids	Moon flower, India Mustard, water hyacinth
Phytostabilization	soil, sediment,mud	Pollutantdeactivation	As, Cd, Cr, Cu, Hs, Pb, Zn	India mustard,Hybrid poplars,Lawns
Rhizodegradation	Soil and ground water	Pollutant disperse	Organic compounds	Red mulberry, grass
1.6. Phytodegradation	Soil, sediment and mud, ground water, surface water	Pollutant disperse	Organic compounds,Chlorinate solvents,Herbicides, Phenols	Algae, Hybrid poplars,Black willow
1.7. Phytovolatilization	Soil, sediment and mud, ground water	Pollutant evaporation	Chlorinate solvents, inorganic ompounds(Se, Hg, As)	Poplars, clover, Indian mustard

HEAVY METAL REMOVAL WITH PHYTOREMEDIATION

Contaminants with potential to remove from the soil by hyperaccumulator plants; metals (Ag, Cd, Co, Cr, Cu, Hg, Mn, Mo, Ni, Pb, Zn), metalloids (As, Se), radionuclides (90Sr, 137Cs, 239Pu, 238U, 234U), and other organic compounds (TPH, PAHs, Pesticides, PCBs).However, in order for a plant to be able to remove a pollutant from the soil, ecological conditions must first be met. The most important of these is pH.Plants with high heavy metal capacity are usually local.ButTaraxacumOfficilane (dandelion) plant has a large area (Vanlı, 2015).

PLANT-METAL UPTAKE

Plants extract and accumulate metals from soil solution. Before the metal can move from the soil solution into the plant, it must pass the surface of the root. This can either be a passive process, with metal ions moving through the porous cell wall of the root cells, or an activeprocess by which metal ions move symplastically through the cells of the root.

This latter process requires that the metal ions traverse the plasmalemma, a selectively permeable barrier that surrounds cells (Pilon-Smits, 2005). Special plant membrane proteins recognize the chemical structure of essential metals; these proteins bind the metals and are then ready for uptake and transport. Numerous protein transporters exist in plants. For example, the model plant thale cress (A. thaliana) contains 150 different cation transporters (Axelsen and Palmgren, 2001) and even more than one transporter for some metals (Hawkesford, 2003). Some of the essential, nonessential and toxic metals, however, are analogous in chemical structure so that these proteins regard them as the same. For example arsenate is taken up by P transporters(Abedin et al. 2002) studied the uptake kinetics of as species, arsenite and arsenate, in rice plants and found that arsenate uptake was strongly suppressed in the presence of arsenite. (Clarkson and Luttge, 1989) reported that Cu and Zn, Ni and Cd compete for the same membrane carriers. For root to shoot transport these elements are transported via the vascular system to the above-soil biomassshoots. The shoots are harvested, incinerated to reduce volume, disposed of as hazardous waste, or precious metals can be recycled (phytomining). Different chelators may be involved in the translocation of metal cations through the xylem, such as organic acid chelators. Since the metal is complexed within a chelate it can be translocated upwards in the xylem without being adsorbed by the high cation exchange capacity of the xylem (Von Wiren et al., 1999)

ADVANTAGES AND DISADVANTAGES OF PHYTOREMEDIATION

The advantages and disadvantages of the phytoremedia are described below (Table 5) (Ghosh, 2005).

Table 5. Advantages and disadvantages of the phytoremedia

No	Advantages	Disadvantages / Limitations
1	Amendable to a variety of organic and inorganic compounds	Restricted to sites with shallow contamination within rooting zone of remediative plants.
2	In Situ / Ex Situ Application possible with effluent/soil substrate respectively.	May take up to several years to remediate a contaminated site.
3	In Situ applications decrease the amount of soil disturbance compared to conventional methods.	Restricted to sites with low contaminant concentrations.
4	Reduces the amount of waste to be landfilled (up to 95%), can be further utilized as bio-ore of heavy metals.	Harvested plant biomass from phytoextraction may be classified as a hazardous waste hence disposal should be proper.
5	In Situ applications decrease spread of contaminant via air and water.	Climatic conditions are a limiting factor
6	Does not require expensive equipment or highly specialized personnel.	Introduction of nonnative species may affect biodiversity
7	In large scale applications the potential energy stored can be utilized to generate thermal energy.	Consumption/utilization of contaminated plant biomass is a cause of concern.

CONCLUSIONS

The technologies used to control heavy metals, which constitute a serious danger to soil pollution, are not preferred because of the high cost of the treatment, the longer duration of the treatment and the problems of destroying contaminant residues accumulating at the end of the treatment. Therefore, the green improvement (phytoremediation) using plants makes it possible to obtain more favorable economic and ecological results. Thus becoming a more widely preferred method.

The many different methods that are preferred within the scope of phytoremediation and the availability of alternative plant species to be used increase the use of phytoremediation technology. However, methods of removing polluted plants that occur as a result of phytoremediation should be evaluate well.In addition, the plants in the environment form a vegetative cover and prevent pollutants from being transported from one place to another, especially by water and wind erosion. As a result of this study the importance of the removal of heavy metals by phytoremediation and applicabilities shown.

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EXPERIMENTAL RESEARCHES REGARDING THE DETERMINATION OF THE PHYSICO-CHEMICAL CHARACTERISTICS OF SOIL

Lazar FLAMIND[1], Maria-Olivia MOLDOVAN[2]

Scientific Coordinator: Prof. PhD Eng. Valer MICLE[1]

[1]Technical University of Cluj-Napoca, 103-105 Muncii Avenue, 400641, Cluj-Napoca, Romania, Phone: +4 0264 401 200, 401248, Phone/fax +4 0264 592 055, Email: Lazar.Flamind@imadd.utcluj.ro
[2]University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, 3-5 Calea Manastur St., 400372, Cluj-Napoca, Romania, Phone: +40-264-596.384, Fax: +40-264-593.792, Email: maria-olivia.moldovan@usamvcluj.ro

Corresponding author email: Lazar.Flamind@imadd.utcluj.ro

Abstract

The study's purpose is to determine the physico-chemical characteristics of soil (granulometry, organic substance, pH, humidity), the samples being gathered from three different areas regarding the internal zoning, but similar regarding the altitude, the aspect, the slope and the type of vegetation. The sample A1 from the strictly protected zone, the resort Corongis, is the control sample.
The granulometric analysis has been realized by using the Kacinski method. The soil's humidity (W) has been determined by drying in a stove at 105˚ C, the pH has been determined by using the Glass electrode method and the organic substance has been determined by using the Calcination method.

Key words: *soil, granulometry, pH, organic substance, humidity, analysis.*

INTRODUCTION

The geographical location of the Rodnei Mountains National Park overlaps with the geographical and morphological contact area of Rodnei's Mountains, representing an integral part of the Oriental Carpathians from the Northern Range. It spreads on a surface of 47.177 ha, the altitude being between 587 and 2303 m. This altitudinal range entails the existence of various conditions and landforms.
From a pedological point of view, the pedogenetic processes were conducted in the massif under the influence of bioclimatic factors specific to the different layers of vegetation but also under the direct influence of the lithologic substrate. The brown luvic soils are frequent in the hilly and sub mountain levels from the western and south-western branch of the massif, the automorphic soils from the mountain stage are brown acid and black acid. In the sub-alpine floor there are organic lithosoils, underdeveloped, which are evolving on crystalline rocks, usually boulders and consolidated gravels. They have a clayey texture, with a strongly acid reaction and a high percentage of organic matter. Under the upper limit of the sub-alpine floor and in the alpine lower floor, on the lands covered by shorter scrubs and primary pastures we find peaty soils, evolved on the excessively humid lands around the springs and sub-alpine brooks.
The internal zoning of the park is made depending on the importance, necessity and the protection of the species living in the park but also considering the sustainable development of the area, resulting the following zones presented in Figure 1:

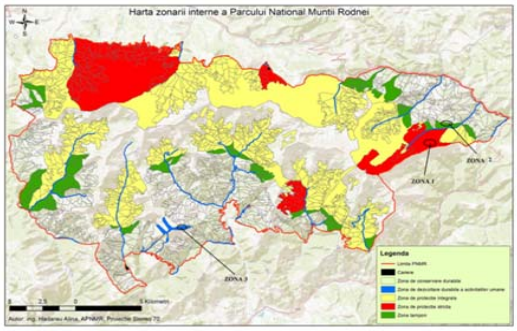

Figure 1. The map of the zoning of the Rodnei Mountains National Park and the soil sampling point locations (source: management plan 2017 Rodnei Mountains National Park)

In Table 1 there are presented the surfaces of each zone.

Table 1. The internal zoning of the Rodnei Mountains National Park (source: management plan 2017 Rodnei Mountains National Park)

Zone	*Surface (ha)*
The strictly protected zone (Scientific reservation)	5 104
Fully protected zones	19 967,7
The first row of whole limitrophe parcels of the zones strictly or fully protected	2 524,92
The buffer zone (sustained conservation) excepting the first row of parcels	19 384,44
The buffer zone (sustained conservation)	21 909,36
Zone of sustained development	195,94
Total area	**47 177**

MATERIALS AND METHODS

Considering the forest harvesting in the research area, the same type of soil (rendzina) has been studied in the following experimental versions (Figure 1):
1. Soil from the strictly protected zone Corongis (zone 1)
2. Soil from the buffer zone (zone 2)
3. Soil from the sustained conservation area (zone 3).
The geographic coordinates of the studied areas from which the samples were swabbed are presented in Table 2.

Table 2. The geographic coordinates of the areas from where the samples were swabbed

Zone	*Lat*	*Long*
Zone 1	47°31'49.51"N	24°58'11.73"E
Zone 2	47°32'54.09"N	24°58'57.28"E
Zone 3	47°26'58.51"N	24°49'1.28"E

We have chosen these three areas, from different locations within the park according to the internal zoning in agreement with Chapter 9 al 14 from the Regulations of Organization and Operation of the Rodnei Mountains National Park, Reservation of Biosphere, Nature Site 2000 (ROSCI0125 and ROSCPA0085).
The deduction of soil samples for physico-chemical and biological analysis has been made from the three zones previously mentioned in agreement with the methodological rules set in STAS 7184/1-84 "Soils. The deduction of the samples for pedological and agrochemical studies" and have been operated in agreement with the SR ISO 10281-6:1997 and SR ISO 11464:1998 standards called "The quality of soil.
According to the 184/1997 Order the number of the swabbing areas will be established depending on the surface of the study area. In advance, the swabbing areas are marked on the situation plan of the area, the vegetation has to be completely removed, and a probe or a spade will be used.
Considering the total surface of RMNP, 47.177 ha, measurements have been made in the three zones and finally the deduction of the three composed samples has been decided from a surface of 6 ha, 2 ha from each zone of study. Each sample has been noted A1, A2, and A3 (Figure 2).

Figure 2. The soil samples from the Rodnei Mountains National Park

In order to achieve the three composed samples, between 25-30 initial samples weighing 60-80 g have been deducted, in order for the composed sample to be as representative as possible.
The samples have been deducted with a probe-dill and a spade and then they have been introduced in air-tight bags and then homogenised.

The soil samples have been harvested from the depth of 10-25 cm by crossing the area in zig-zag. Every sample has been labelled, the place, date and depth from which the sample has been deducted being mentioned. The samples have been kept in the refrigerator, at the temperature of 4˚ C, until they have been operated.

RESULTS AND DISCUSSIONS

The analysis of physico-chemical properties of the soil from the sampling points

The analysis of the physico-chemical properties of the soil has been realised through field and laboratory methods, able to encompass and convey as accurately as possible the characteristics of the studied soil, these characteristics being represented by: the granulometrically fractions, the textural class, organic carbon, pH, conductivity, humidity and organic substances.

The analysis of the physico-chemical properties of the deducted soil have been realised by the National Institute of Research - Development for Pedology, Agrochemistry and Environmental Protection - ICPA Bucharest and The Environmental Protection Agency Cluj.

Table 3. Analytical results (ICPA)

	Granulometric fractions (mm) (% of soil mineral part)										
	Coarse sand				Fine sand				Dust	Clay	
Code	2.0-0.2	2-1	1-0.5	0.5-0.2	0.2-0.02	0.2-0.1	0.1-0.05	0.05-0.02	0.02	0	0.01
A2	29.2	11.3	8.4	9.5	39.4	7.2	0.4	31.8	21.4	10.0	17.4
A1	41.5	18.3	9.6	13.6	38.6	8.2	0.8	29.6	12.7	7.2	13.2
A3	37.7	12.8	10.3	14.6	31.5	10.3	0.8	20.4	26.0	4.8	24.3

The granulometrical analysis has been made according to the Kacinski method, mentioning that the samples which had over 5% organic matters have been treated with perhydrol.

The separation of the granulometric fractions bigger than 0.2 mm has been made through sieving and of those under 0.2 mm through pipetting.

The group of textural classes, the textural class and the textural subclass of the soil samples have been established by using the triangular diagram of texture.

The soil's humidity (W) has been established by drying in a stove at 105˚C.

For establishing the pH (soil's reaction), the pH of the aqueous slurry has been measured (H_2O pH) established for a soil-water report of 1:2.5 potentiometer with a double electrode of calomel glass.

The organic substance has been established through the Calcination method, meaning the elimination of the organic substance from the sample through calcination as a result of the carbon's oxidation with atmospheric oxygen. The loss of weight through combustion is established through weighing.

Regarding the soil's conductivity, it is established by calculating the electrical conductivity value at the temperature of 25˚C with correction (k) for the cell's geometry, then the total amount of soluble mineral salts is calculated by multiplying the calculated value of electrical conductivity with a F factor (experimentally determined).

Physical Parameters

The total granulometrical fractions (in mm) of the samples from the 3 zones are: coarse sand (2.0-0.2 mm) 41.5% for the zone 1 (the strictly protected zone), 29.2% for zone 2 (the buffer zone) and 37.7% for the zone of sustained development (Figure 3).

The percentages of fine sand, in the three studied zones are: 38.6% (zone 1), 39.4% (zone 2) and 31.5% (zone 3) and those of the dust are 12.7% (zone 1), 21.4% (zone 2) and 26.0% (zone 3). As a result of the granulometrical analysis, the clay's percentages are of 7.2% in zone 1, 10% in zone 2 and 4.8% in zone 3.

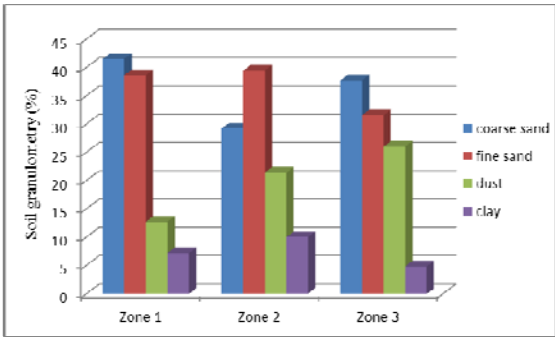

Figure 3. Granulometrical fractions (%) of the analysed soil

The content of the organic substance in the soil (Figure 4) is quite high in the strictly protected zone, 19.117%, in the buffer zone is 5.566% and in the zone of sustained development is 8.567%.

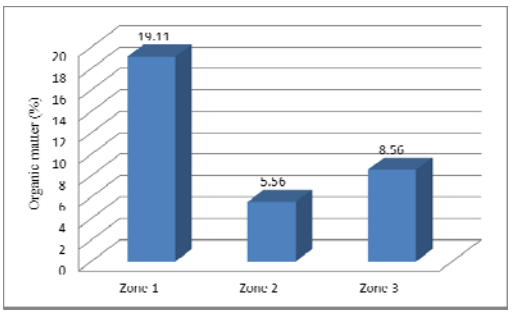

Figure 4. The organic matter content in the soil samples

The content of organic matter has been established through the Walkley-Black method, respectively wet oxidation. Generally, the low content of organic substance is due to the terrain's slope, to the usage type and to the vegetation (According to ICPA).

The chemical characterization of the studied soil

The distribution of vegetation in the Rodnei Mountains National Park plays an important role in the determination, acknowledgement and characterization of the soil in pedological studies.

The pH of the deducted and analysed samples shows the following values: 5.09 in zone 3, 7.53 in zone 2 and 7.59 in zone 1 (figure 5), which denotes a weak acid and neutral pH (weakly alkaline).

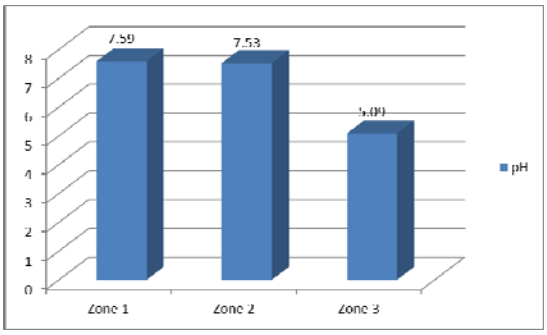

Figure 5. The pH values of the studied samples

The pH values have been established by calculating the percentage ratio between the content of exchangeable bases (SB, me/100g soil, determined through the Kappen method) and the total cationic exchange capacity. The soils having a pH reaction > 6.9 have been classified as saturated.

The soil's humidity is the amount of water that is physically connected to the soil at the moment when the samples are deducted. This water evaporates at 105˚C. The humidity of the soil is influenced by the climate, temperature, area's altitude, vegetation and the usage but also by the inclination and orientation of the field. Knowing the soil's humidity is important agrotechnically and ecologically speaking but also for choosing the required methods for the reconstruction of a degraded terrain, respectively the Rodnei Mountains National Park.

According to the studied area, the three zones show significant differences regarding the degree of water retention in the soil.

As follows: in zone 1, the strictly protected one, we have 43.69%, in the buffer zone 23.22%, where there is forest exploitation we have 16.82%.

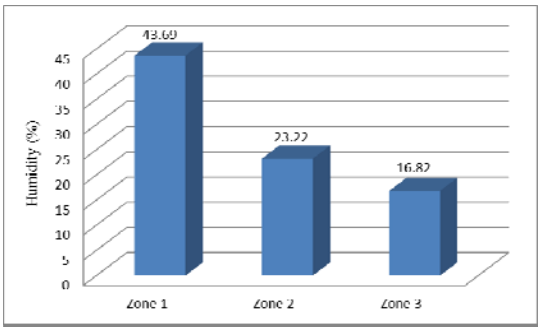

Figure 6. The humidity of the collected soil

Due to the higher humidity in the areas where there was forest exploitation or which are heavily wooded, we can say that the soil's texture is not fragile and does not cause the removal of the soil as dust under the wind's action, but it becomes more fragile, which causes the removal of the soils as dust in some periods where there is a higher wind activity.

CONCLUSIONS

The physical and chemical characterization of the collected soil highlights some major differences between the three studied zones.

During the study, the sample from the zone 1 (the resort Corongis) is the control sample.

This sample has been chosen because in the zone 1 there are no forest exploitation activities, the zone being still a virgin one.

The purpose of this study is to highlight the importance of a protected area of national interest, the manner of usage of the terrain,

respectively the practices of each specific area of the park, being also of importance.

By using the achieved data (pH, humidity, organic substance, granulometry) the soil's degree of susceptibility to erosion can by quantified.

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AN OVERVIEW OF THE LONG-TERM IMPACTS OF GLOBAL WARMING ON HUMANITY

Alexandra-Maria GEORGESCU, Andreea DESPA

Scientific Coordinator: Assoc. Prof. PhD Alina ORŢAN

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67

Corresponding author email: alexandra.georgescu.1997@gmail.com

Abstract

A novelty of our time is that humanity faces a global phenomenon whose consequences are still hard to assess by scientists, this phenomenon is global warming. Some people still doubt its existence however not only is it a real event but it is much more complex and urgent than it is considered to be. In the following reference we will evaluate if the phenomenon is favourable, dangerous or neutral for the global ecosystem. The idea of saving the planet may seem utopian, but it is necessary to think about the need to maintain a stable and beneficial climate in order to have an ideal habitat for human beings for as long as possible.
In this reference we also intend to describe the "fight" between those involved in climate campaigns versus climate skeptics / industrial groups. The ultimate goal would be to influence the audience and implicit, on climate policy making.

***Key words**: climate, deforestation, global warming, pesticides.*

INTRODUCTION

In the last twenty years, all the developed countries of the world have accepted the fact that they are facing numerous challenges of prime importance. More specifically, the rise of the energy consumption, which is a challenge of utmost importance, is believed to be a result of not only the increasing population but also of the extravagant needs that come along with it, reported to the current state of economic and social development, which is correlated with the increased resource exploitation and leads to global warming, a direct and often uncontrolled consequence(Vac, 2012). These challenges are closely interdependent and we have to deal with them accordingly.

MATERIALS AND METHODS

This work is a study of published literature data using search engines where we found that are so many factors that increase the global warming impacts on humanity and we discuss about this in the next section.

RESULTS AND DISCUSSIONS

Causes, Effects and Measures

Not only the necessity for economic growth in highly developed countries such as USA, Japan, Germany, France, but also in emerging countries such as India, China, Brazil, South Africa, Central and Eastern Europe, leads to massive deforestation. This actions result in the reduction of the forest vegetation on a certain surface, without being followed by its regeneration. It also leads to soil pollution with pesticides that causes increased toxicity among cereals, vegetables and fruits.
Considering these particularly important and alarming aspects, the word started looking for solutions and those identified so far are: recycling, energy and heat saving and thermal insulation of houses.

The effects of using fertilisers and pesticides

The use of chemicals for agriculture through fertilisers, herbicides, pesticides, plant hormones is closely related to both increased production and environmental issues. In order to increase the productivity of the soil people

used to practice an extensive agriculture, then they introduced irrigation (Mesopotamia, Egypt), later on they start to treat the soil with natural fertilisers, so that now to use chemical fertilisers based on nitrogen, phosphorus, potassium and anti pests. In the last half century, the use of fertilisers based on nitrogen has increased exponentially (Amza, 2011). The problem is that the oxides of nitrogen have the ability to retain up to 300 times more heat per unit volume than carbon dioxide. It has been found that the intensive use of fertilisers with nitrogen, phosphorus and potassium leads to increased soil content in some elements such as: Zn, Pb, Ni, Cr, elements that were previously found only in traces and in soluble forms.

The pollution of food with nitrate produces anaemia especially to children and young animals and also favoursthe synthesis of cancerous compounds which is a big disadvantage. This compounds are being found mainly in fruits and vegetables such as carrots, spinach or cauliflower, etc. When the oxidising processes are taking place, the reducing denitrification processes are being intensified which leads to soil erosion. Moreover occurs the soil structure damage and the gradual reduction of fertility by reducing the percentage of humus.

Agriculture is in a way an intervention against nature and when it is practiced unreasonably it leads to the decrease of fertility, the change of biocenosis and finally the change of the ecosystem.

On the one hand agriculture has a positive role as it purifies atmosphere. The green plants inhale CO_2 from the atmosphere and exhale O_2. On the other hand we are dealing with the industrial objectives which contaminates the atmosphere with SO2, Na, NO2, cement powders and affect agriculture.

Regarding the fact that a lot of pesticides cannot be biologically degraded we have some serious impacts on the human beings. Pesticides are being accumulated in the liver and in the adipose tissue and they can cause serious poisoning and massive weight loss, up to 20-30 Kg/3-4 months (Ciobotaru et al., 2011).

The effects of deforestation

Deforestation rate is high, especially in the tropics. There the poor quality of the soil has led to deforestation in order to make available new lands for agriculture. Irrational deforestation creates crucial imbalances in nature. Some of them are the change of precipitation regime (drought), the change of the movement of air currents, degradation and erosion of the soil, the appearance of floods, the loss of biodiversity due to the extinction of some species of plants and animals and the greenhouse effectwhich is determined by the increment of the amount of carbon dioxide in the atmosphere (Dumitru, 2005). Several countries have initiated afforestation or reforestation projects to combat the effects of deforestation and to increase the amount of wood available.

Every minute, 26 hectares of forest are being lost and if the process continues at the same pace, Terra will become a planet without forests (Paraschiv, 2016). This would be an ecological catastrophe because forests are the natural habitat of many species of plants, animals and birds. It is also the most effective natural organizer because it adjusts the water circuit in nature by decreasing the intensity of the evacuation of the water in soil. Moreover forests are important because they diminish the intensity of strong winds, they prevent the flow of water from peaks and they adjust the content of carbon dioxide and oxygen from the atmosphere. Last but not least, every single forest from our planet retains a huge amount of dust and atmospheric impurities (Roșulescu, 2016).

The effects of irrational waste management

The problem of the waste is a global problem, not only from the perspective of the impact towards the environment and the human population's health and also towards resource depletion. Waste management can contain hazardous substances with a highly environmental and human health risk but at the same time it is also possible to provide secondary resources, material resources and

energy resources which can be recycled (EEA, 2013).
On the European level it is required to have a standard adoption towards managing the impact on the environment and for the durable usage of the resources, the main methods are: the prevention and the minimization of the quantity of waste, recycling (material or energetic), the incineration (with energy recovery) and the depositing (in controlled deposits).
The integrated waste management approach involves the evaluation of the impact that the manufacture of products for consumption has on the environment (which is the growth due to the high population density, but also because of the comfort that today's society demands), until their disposal in the form of waste management („from cradle to grave").

CONCLUSIONS

The effects of global warming may be diminished by planting trees. Trees are providing a vast amount of O2, they also absorb CO2 which helps to achieve photosynthesis; furthermore it helps to keep the soil, in this case we prevent landslides. Tree roots filter the water from precipitation, by pouring it into the layers of muscle and dead leaves, providing purified water.

Along with deforestation, thrown pesticides in agriculture and avoiding the use of traditional crops for the healthy growth and also the pollution from waste we prevent the correct operation and the natural cycle of life, after that it will occur natural events that will destroy everything that was created/born until the present day=”Global Warming”.

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THE RIVER DEPOSITS TRANSPORTATION FROM THE HYDROGRAPHIC BASIN GURGHIU – PR. SIRODUL MIC

Iulia Diana GLIGA, Maxim COROCHII, Maria-Olivia MOLDOVAN

Scientific Coordinator: Prof. PhD Eng. Marcel DIRJA

University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, 3-5 Calea Mănăştur St., 400372, Cluj-Napoca, Romania, Phone: +40-264-596.384, Fax: +40-264-593.792, Email: iulia.gliga@usamvcluj.ro , maria-olivia.moldovan@usamvcluj.ro, corochiimaxim@gmail.com

Corresponding author email: iulia.gliga@usamvcluj.ro

Abstract

The river deposits transportation prognosis is required to draft the improvement planning of the torrential hydrographic basin, considering that the basin torrential potential shall be established based on this hydrological dimension, together with the retention capacity of the transversal hydro-technical works and with an estimation of the hydrological and anti-erosion efficiency of all the measures and works which are to be applied within the basin. The hydrographic network of the torrential basin Gurghiu is mostly dominated by the river deposits erosion and transportation. In order to calculate the annual average transportation the method advanced by R.Gaspar and by A. Apostol was used, a method which is conceived for the specificity of the torrential basins of our country. To draw a conclusion, based on the previously made calculations, the annual volume of the basin river deposits is of 130 m3/year. The bank deposits retention in the earthworks shall determine a stabilization of the river beds in the hydrographic works emplacement region, thus reducing its slope and depositing the alluvial deposits quantities.

Key words: *river deposits, transport, earthwork/alluvial deposits, torrential hydrographic basin.*

INTRODUCTION

The bank deposits transportation is represented by the transported material quantity/mass, depending on the water speed, on the slopes inclination, on the riverbed or on its debit. Water torrents transport, from basins, large quantities of alluvial deposits, branches or even entire trees. During transportation, a torrent diminishes, after 10 km, pieces of granite of 20 cm in diameter into small pebbles of 2-3 cm in diameter, whereas after other 10 km they turn into sand. (Kiss et al., 1981).

The alluvial deposits form where the land slope becomes smoother, by depositing the transported materials on the thalweg or into the dejection cone. In the case of torrential watercourses/floods, the sand and the gravel are deposited first, then the rocks and the large stones, because of the driving speed (Baloiu, 1965; Bădescu, 1972)

The river deposits transportation prognosis is required to decide the torrential hydrographic basin improvement solutions, as it is based on this hydrologic dimension that the torrential potential of the basin is evaluated, the retention capacity of the transversal hydrographic works is dimensioned, the hydrologic, anti-erosion efficiency of all the measures and the works which are to be applied within the surface of the basin being therefore estimated.

The design of the basin retention functional capacity is based on knowing the river deposits quantity which may be stored under the form of alluvial deposits. In this case, the present volume shall be generated by both the annual average alluvial deposits transportation, and also by the alluvial deposits transportation during storms or rains.

MATERIALS AND METHODS

The river/alluvial deposits transportation calculus was performed within the hydrographic basin Gurghiu, on the river Siriodul Mic.

Based on the measurements performed and based on direct observation, we shall retain that a significant quantity of river deposits is transported during the process of the torrential floods flow.

The torrential basin under research, measuring a surface of 44,347 ha, is classified within the small basins category, with $F \leq 100$ ha.

The basin hydrographic network is mainly subject to erosion and to the alluvial deposits transportation. The lands on the slopes are distributed on erosion degrees as follows:

Weak erosion E1 for unit 2 measuring a surface of 7,235ha, 16,3%,

Average erosion E2 for unit 1 measuring a surface of 15,881ha, 35,8%,

Powerful erosion E3 for unit 4 measuring a surface of 15,323 ha, 34,6%,

Extremely powerful erosion E4 for unit 3 measuring a surface of 5,908 ha 13,3%.

The calculation of the annual average river alluvial deposits transportation used the method advanced by R.Gaspar and A. Apostol, a method which is conceived for the specificity of the torrential basins of our country. To be able to calculate the transported alluvial deposits quantity, the following parameters of the hydrographic basin were determined: the basin surface, the basin average length, the average slope, the slopes average length.

The measurement of the slope of the alluvial deposits already formed or which is about to form used the hypsometer Silva ClinoMaster, the length consolidated by these alluvial deposits (Lat) being measured by the help of the 50 m ruler, whereas the surface consolidated by the alluvial deposits was calculated by multiplying the length of the alluvial deposit with its width in the area of the hydro technical work emplacement, at the level in which this was in that specific section.

RESULTS AND DISCUSSIONS

For the evaluation of the annual average volume of the river deposits resulted following the slopes erosion, Wav (m3/year), the following formula was used:

$$W_{av} = a \cdot b \cdot \sqrt{I_V} \cdot \sum F_i \cdot q_{1i} = 22 \text{ m}^3/\text{a}$$

Table 1. Elements used to calculate the river deposits volume transported on the slopes

U.S.H.	1	2	3	4	Total
F_I	15,881	7,235	5,908	15,323	44,347
Land categ.	11	10	6	2	
q_i (m^3/an · ha)	0,1	0,2	0,8	1,2	
z_i (mm)	17	15	8	4	
$F_I \cdot q_{Ii}$	1,588	1,447	4,726	18,388	
$Z_i \cdot F_I$	269,98	108,53	47,26	61,29	
a =1,4; b= 0,90; $\sqrt{I_V} = 0,677$; $\sum F_i \cdot q_{1i}$ =26,149; Results W_{av} = 1,4·0,9·0,677·26,149=22 m^3/year					
$Z = \frac{\sum Z_i \cdot F_i}{F} = \frac{487,06}{44,347} = 10,98$					

a – a-dimensional coefficient with values ranging between 0,7 and 2,2 based on the average length of the slopes. We shall consider/adopt a = 1.40

b- a-dimensional coefficient for the diminution of the volume of the river deposits rolled down from the slopes, whether they are formed of a succession of terraces or whether their lower part is a smooth slope, backgrounds in which the river deposits sedimentation and local consolidation becomes possible. In the case of this coefficient, values ranging between 0,5 and 1,0 shall be used. We shall use b = 0,9.

Iv – the average slope inclination

q1i – the erosion specific index in surface of a certain land category of the basin (m3/year·ha).

Fi – the surface in ha of that specific land category

Figure 1. Silt/river deposits and floats carried in the torrential valleys

The river deposits transportation from the river beds is generated by the riverbeds

erosion W_{aa} (m^3/year), the results being got by applying the relationship:

$$W_{aa} = b \cdot \sum (L_i \cdot q_{2i}) \cdot \sqrt{\frac{I_a}{i}},$$

L_i – length of the hydrographic network sectors, mainly developed within unconsolidated river deposits, which might be slightly eroded, expressed in km

q_{2i} – the specific depth erosion index alongside the length sector L_i, in m^3/year/km;

I_a – the average slope of the mail bedside alongside the length sector L_i;

i - the "standard" value of the slope of the bedsides of a certain width, taken into consideration while establishing the values of the index q_{2i} , i = 0,135.

As, in the given situation the hydrographic network could not be mapped directly in the field, we shall consider in a first stage that the hydrographic network shall provide river deposits from the entire river network. The result thus obtained (Waa100%) shall be further on corrected by a subunit coefficient of the river deposits influx (ca), a coefficient which approximates the participation degree of the basin network to the genesis of the annual average river deposits transportation. In the present situation we shall define the above-mentioned coefficient in correlation with the state of decay of the fields on the corresponding slopes. We shall therefore have:

$$\varphi al = \frac{F_{e3} + F_{e4}}{F} = \frac{15{,}323 + 5{,}908}{44{,}347} = 0{,}48$$

Considering the given specifications, the above relation can be further on applied under the form:

$$W_{aa} = \varphi al \cdot W_{aa}^{100\%} = \varphi al \cdot b \cdot \sum (L_i \cdot q_{2i}) \cdot \sqrt{\frac{I_a}{i}},$$

For the erosion index prognosis q_2 (m^3/year·km) one of the diagrams recommended by the authors shall be used, the following remarks being taken into consideration:

1. As, based on the previous calculations, the average retention at the level of the basin has the value Z=10,98 mm for the prognosis we shall use the diagram corresponding to the case 10 mm < z < 15 mm;
2. The average width of the basin riverbeds can be differentiated based on their hydrographic order and on their surface, in the following way:
   - order I l_I = 0,1 · F - 0,4= 0,1·44,347-0,4=4,03m ,
   - order II l_{II} = 0,1· F + 1,8 - I_{aver} = 0,1· 44,347+1,8-0,46 = 5,77 m,
3. From the point of view of the size composition the network deposits can be classified as follows:
   a. the first order/I riverbeds under the category of river deposits over 7 mm ;
   b. the second order riverbed/II under the category of river deposits between 1-7 mm .

Table 2. Elements for the calculation of the river deposits transported alongside the riverbeds

	I	II	Calculations
The riverbed length L_i(km)	0,752	0,478	φ_{al}=0,49;b= 0,9 $\Sigma L_i \cdot q_{2i}$ =142,507; I_a = 0,41 ; i = 0,132 ; $\sqrt{\frac{I_a}{i}}$ =1,76
The riverbed width l_i (m)	4,03	5,77	
The river deposits diameter	>7	1 - 7	
Erosion index q_{2i} (m^3/an ·ha)	90	160	
The standard slope	-	1,32	
$L_i \cdot q_{2i}$	67,707	74,800	
Results : W_{aa} = 108 m^3/year			

In conclusion, based on the above calculations, the annual volume of the basin river deposits can be: $W_a = W_{av} + W_{aa}$ = 22+108 =130 m^3/year.

Figure 2. River deposits transported along the river Siriodul Mic

By determining the river deposits volume of the alluvial, we shall be able to design the basin functional retention capacity, as it is based on information relative to the river deposits quantity which can be stored under the form of alluvial deposits. This volume shall be generated by both the annual average river deposits transportation, and also by the river deposits transportations during insurance rains. For an indicative estimation of the annual average volume of river deposits which might form alluvial deposits, R. Gaşpar and A. Apostol recommends, for riverbed slopes of at least 3% and heights of the dam elevation of up to 6 m, the application of the formula:

Waater $= A \cdot W_{av} + B \cdot W_{aa}$ =4,4 +64,8= 69 m3/an,

Wav –the annual average river deposits volume generated by the slopes erosion [m3/year]

Waa- the annual average river deposits volume generated by the river beds erosion [m^3/year]

A and B – table coefficients depending on the diameter of the river deposits generated by the slopes erosion and therefore by the erosion of the riverbeds.

As, in the present situation, the hydro technical works shall be emplaced on a 2nd degree riverbed, the correction coefficients shall have the values: A=0,2; B = 0,6

$W_a^{ater} = A \cdot W_{av} + B \cdot W_{aa} = 0{,}20 \cdot 34 + 0{,}60 \cdot 159 = 102{,}4$ m^3/an.

$K_a^{ater} = W_a^{ater}/W_a = 38/70 = 0{,}53$ (53%)

We shall note that only 53% of the initial river deposits quantity entrained within the basin space shall be stored in the alluvial deposit.

Figure 3. Alluvial deposit formed and volume of the captured river deposits

We shall note that, the bigger the volume of the river deposits directly caught by the transversal hydro technical works, the higher the volume of river deposits consolidated along the torrential valleys, a thing also contributed to by the number of hydro technical works executed on each single torrential valley.

CONCLUSIONS

By determining the river deposits volume of the torrential hydrographic basin we shall be able to identify solutions to improve the basin by a set of measures and biological works, biotechnical and hydro technical works the purpose of which is the diminution of the river deposits transportation.

The retention of the river deposits shall determine a consolidation of the banks of the riverbeds in the hydro technical works development region, a diminution of its slope and a river deposits quantities storing.

The estimation method of the river deposits volume reveals the approximate quantity of the river deposits which might have been transported alongside the torrential network, respectively the evolution in time of the event.

In order to reduce the river deposits transportation we shall have to intervene by works of afforesting the river deposits sources, if they are unstable or by using timber vegetation provided that this kind of vegetation is unlikely to be planted in a natural way.

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USING A METAL DETECTOR FOR LOCATING MASS GRAVES FROM WORLD WAR I AND WORLD WAR II

Beata KACZMAREK[1], Ewelina WERNER[2]

Scientific Coordinators: Prof. Janusz CZEBRESZUK[1], PhD Eng. Maria HELDAK[2]

[1]University of Adam Mickiewicz in Poznan, Wieniawskiego 1, 61-712, Poznan, Poland,
email: bk34033@st.amu.edu.pl
[2]Wrocław University of Environmental and Life Sciences, Wrocław, Poland, Norwida 25, 50-375
email: ewelina.werner@up.wroc.pl

Corresponding author email: bk34033@st.amu.edu.pl

Abstract

The aim of this article is to present possibility of use of a metal detector, homing objects by generating a magnetic field, to identify unknown mass graves from the time World War I and World War II.
Mass graves are usually located in difficult, usually wooded area. Therefore they are inaccessible to the majority of archaeological methods such as aerial photography. Detecting the mass graves using a detector in this case is the best solution, because inside the graves are often found metal knives, buttons from uniforms, badges, or other such items.
For the prospecting research will be helpful VLF model which after appropriate setting detects a specific kind of metal.

Key words*: metal detector, mass graves, metal artefacts, World War I, World War*

INTRODUCTION

Some part of the mass graves from period of World War I and World War II have been found and exhumed. Although a significant number of them are still non-localized. The corroded metal of knives, buttons, medals and such items reaches directly into the soil and groundwater. An elevated concentration of heavy metals is a serious threat to human health.
The article concentrated mainly on the unknown graves on the west part of Poland and dated on periods of two tragic stages in the history of Poland: 1914-1918, 1939-1945.
Currently the investigations which are aimed at finding graves are conducted by the Commission for the Prosecution of Crimes against the Polish Nation in Warsaw. Unfortunately many cases are rejected, because of insufficient evidence and no direct witnesses of the incident. An important and the most dubious evidence is the testimony of people which are often contradictory. Investigations there were not made immediately after the murders, and therefore the memory of the details of the day and the event is fuzzy or complemented by what witnesses they heard from others at a later time.
False memories relate also to the location of mass graves.
The another reason to not easy identify the mass graves from World War I and World War II is mostly wooded, hardly accessible area. This kind of environment has provided to criminals hidden and peaceful place, without inconvenient witnesses.

MATERIALS AND METHODS

The mass graves from World War I in Poland probably are located near to Łódź and Piotrków Trybunalski.

Figure 1. Metal detector, model VLF

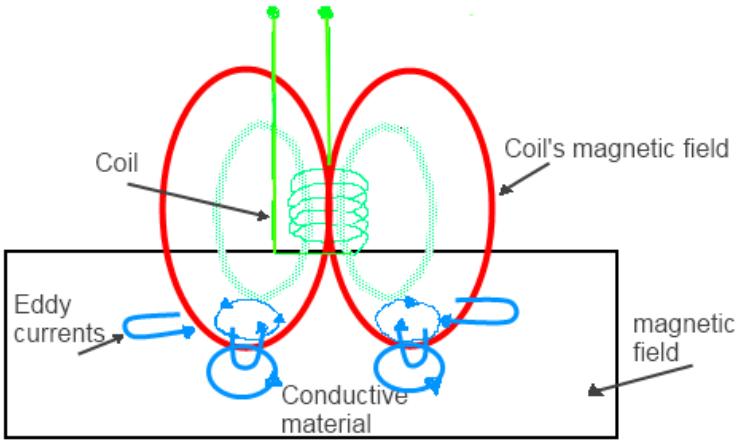

Figure 2. Discrimination level settings

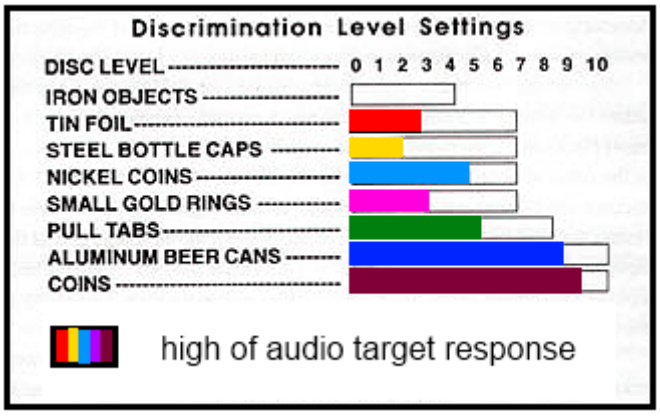

Figure 3. How metal detectors work

The location of unknown mass graves from World War II may be found on the whole territory of Poland, but mainly on the eastern part, on the borders of big cities or villages located near to them. Documents and witnesses indicate areas near to Lublin (Czechowski hills), Białystok, Przemyśl, villages near to Gniezno, probably also near to Poznań, Gdańsk and Wrocław (Szwagrzyk, 2013).
Proposed solution assumes use of the metal detector; model VLF for detecting a specific kind of metal (Figure 1, Figure 2, Figure 3).

RESULTS AND DISCUSSIONS

The information from different sources (documents and relations of people) is showing possible area of the hidden mass graves, but because witnesses have confused memories, these areas are too big to check it with traditional archaeological research method which is a trial trench. It is also difficult to use aerial photos, because studied fields in the main part are inside the forest or on the bushy hills.
The Commission leading contemporary investigations need to have clear directions about place of inhumation, in other way they will not go further in their research.
The proposed solution indicates use of metal detector to make easier finding the mass graves of World War I and World War II. With this way bigger area can be checked by a small group of people, walking alongside designated straight paths. Additionally, wooded territory is free of devices interfering with the work of detector, such as power lines.
The area of the potential research includes:
Lublin - Czechowski hills it is area of 150 ha with natural hills and gullies. The territory is considered as a natural complex. There might be place of the execution of prisoners from the Lublin Castle. It could happen on March, April, May and June 1940.
We could look here for 4 separate mass graves or one - big where new bodies were added. The collected material is not enough to open investigation, because doesn't indicate the exact place of the mass graves.
Białystok - Officers of the Office of Public Security in the years 1939-1946 killed embedded in Bialystok prisoners. Inhumation places are unknown to this day.
Forests near to Mielno - commune Mieleszyn. Indirect witnesses indicate wooded area between a few villages around Mielno city (Wierzyce, Września, Kiszkowo, Oborniki, Rogoźno) as a place of mass graves.
In 1942 year, 3100 patients of psychiatric hospital called "Dziekanka" in Gniezno were killed by the Nazis. Until now, were found only grave with 500 bodies (www.piastowskakorona.pl/news.php?readmore=127).
Lublin province - it is 25 155 km² big, mostly wooded lowland-hilly area.
A significant part of the non-localized mass graves from period of World War II is on the Lublin province.
Soviet prisoners of war and civilians were killed during the escape from the camps to locate partisan groups in 1939, 1941 and 1945 year. Small part of mass graves were found and exhumed in 1948-1954 and 1957-1958 year, on the base of field lists drawn up by the Ministry of Public Administration, and then called the Ministry of Public Utilities (http://www.archiwum.radaopwim.gov.pl/article_details/12/groby-zolnierzy-armii-radzieckiej-poleglych--w-polsce-w-ii-wojnie-swiatowej/).
Borders of the Przemyśl city - in September 1939 Wehrmacht troops for 3 days killed Jews living in Przemyśl.
Their number is estimated at about 20,000. First, they capture Jews and then they took them to places outside the city and nearby villages, where killed and buried bodies in mass graves. So far we found only one mass grave of 900 people (Böhler, 2011).
District sieradzki – villages: Maciejów, Szadek, Wólka Wojsławska, areas near to Łódź and Piotrków Trybunalski.
During World War I German soldiers were buried in this part of Poland. Known graves were exhumed and transferred to the cemeteries. Still we have a large number of unknown graves (Młyńska, 2015).

CONCLUSIONS

The use of metal detector, which discriminate different kinds of metal, would be easy and suitable in the case of mass graves from period of World War I and World War II on the difficult area.

Many times collaboration with other fields of science can help us to go beyond the frame and resolve the problem. In the case proposed in this article, physical methods could be useful in making planning of the surface research.

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NOISE POLLUTION AND HEALTH IMPACTS STAFF EDUCATIONAL INSTITUTIONS

Elena MARICA

Scientific Coordinator: Lect. PhD Mihai Teopent CORCHES

"1 Decembrie 1918" University of Alba Iulia
Bethlen G. street, 5 , Zip code 510 009, Alba Iulia Romania,

Corresponding author email: elenamarica93@yahoo.com

Abstract

Noise pollution is neglected in schools, although it can cause multiple effects on students and teachers. This article will be presented potential sources of noise that affect the smooth conduct of classes, methods of measuring noise pollution, methods of combating this type of pollution, then I will briefly effects that may occur on the health staff in institutions education.

***Key words**: health effects of noise, noise, noise sources, the noise in schools.*

INTRODUCTION

Noise pollution is caused by noise that can come from natural or anthropogenic sources.
Noise is defined as sound or combination of sounds discordant strong, unpleasant noise, noise, noise, thunder, etc. Noise is unwanted sound and unpleasant hearing. It is characterized by two of its important attributes: intensity, measured in decibels [dB], and frequency, measured in hertz [Hz]. Noise intensity is measured in dB and measuring scale is logarithmic. Normal conversation is about 65 dB, and the cry is around 80 dB. Although the difference between normal conversation and is only 15 dB cry, cry intensity is 30 times higher (Munteanu).
Noise pollution is a threat to quality of life. It is more severe and widespread than before and will continue to increase in intensity because of population growth, industrial development and road, air and rail, will become a major problem in all major cities in the world (Marica and Corcheș, 2017).
Noise pollution is also felt in educational institutions because their neighborhood was developed traffic, appeared at bus stops and public squares were developed. Most campuses are near busy roads so students are exposed to high noise levels for more than 8 hours per day, which causes many health problems and also suffers learn. Must process to pay particular attention to this problems and to find solutions to remedy this situation in which the majority of students in campuses.
I intend to determine the level of noise in the University where I study. Initially you identify the sources producing noise, then continue with measuring noise using a sound level meter, I will propose some solutions to reduce such pollution. Mention that such studies were carried out in a small number, so a to present some data from international studies that address the subject of noise in educational institutions.

MATERIALS AND METHODS

To monitor noise levels in schools we need a sound level meter. This measure of sound pressure level (sound pure and complex sounds, noises), is composed of a directional microphone or the environment, an amplifier, a voltmeter graduated in decibels and possibly a filter generally octave or third octave. More evolved versions contain adjustments for sensitivity, maximum and minimum levels, boost digital displays of sounds recorded on split second until the loudness average over more or less long.
The lever meter are commonly used in noise pollution studies to determine almost any type of noise, but especially for industrial,

environmental and airport noise (https://ro.wikipedia.org/wiki/Sonometru).
Noise pollution in schools can be countered by two methods: reducing noise propagation path and method reduce noise at source.
The first method involves implementing several measures such as:
a) the location of absorbing panels on the walls of classrooms, including the ceiling, where lighting systems allow this change. I mention that these boards do not affect the aesthetics classrooms.
b) The location of the educational institution to be surrounded by high concrete fences, which can absorb waves sound or driving them to other areas, thus protecting personal inside the institution noise from outside.
c) Planting of trees that can absorb the noise level to 6 dB depending on the characteristics of the trees planted, which may have an aesthetic role (Debnath D, 2012).
Method reduce noise at source admits the realization of several measures such as:
a) restricting car traffic near these institutions.
b) speed limit for vehicles that are forced to move in that area.
c) students and teachers can help reduce noise respecting rules on restricting the production of noise during breaks or during any school hours.

RESULTS AND DISCUSSIONS

There have been studies addressing noise in educational institutions worldwide. The results of studies according to answers given by students and teachers from questionnaires show that students and teachers are bothered by the noise of traffic. According to studies done in India sources of noise are the traffic rate of 46%, students 40%, of people moving around institutions 9% and the remaining 5% is accounted for by other sources (Debnath et al., 2012).
In Turkey following a study by Nermin Bulunuz, over 90% of students say they are bothered by noise pollution (Nermin, 2014).
According to a study conducted at the University of Sulaimani was found in the morning and at noon hours are noisy. In the chart below you can see how noise varies depending on the traffic. Morning is more intense because most students and teachers come Driving there from the same cause is pollution afternoon and greater (Rauf et al., 2015).

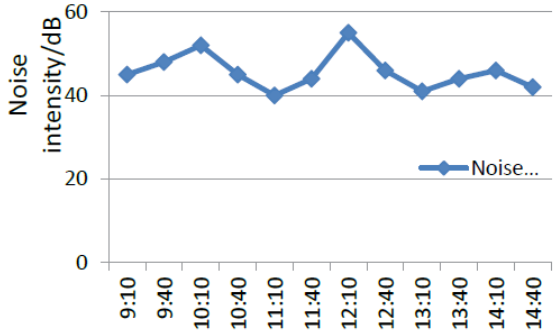

Figure. 1 Noise in school

According to the World Health Organization there are seven categories of adverse human health effects of noise pollution. According to the report, noise pollution may be responsible for: hearing loss, impaired the communicate, sleep disorders, heart disease, impaired psychic system, preventing obtain performance and negative social behavior.
Regarding the major cause hearing loss is exposure in the workplace, although other sources of noise, especially noise leisure, can produce significant deficits. Studies suggest that children seem to be more vulnerable than adults to noise. There is also a general agreement that the exposure time of more than 8 hours at sound levels greater than 85 dB is potentially dangerous.
Noise pollution interferes with the ability to understand normal speech and can lead to a number of shortcomings personal handicaps and behavioral changes. These include trouble concentrating, fatigue, uncertainty, lack of confidence, irritation, misunderstandings, decrease working capacity, disturbed interpersonal relationships, and stress responses
A growing number of evidence confirms that noise pollution has both temporary and permanent effects on humans, the endocrine system and the autonomic nervous. It has been assumed that the noise acts as a biological stress which causes the body to fightprepare (Goines and Hagler, 2007).

In schools and college campuses where the noise level exceeds 50 dB student performance and teacher greatly decreases.

CONCLUSIONS

From the above it can be concluded that there is noise pollution and educational institutions, which normally would be the perfect setting for learning-teaching. In general the main sources of noise which disturbs the smooth running of the courses coming from outside the building and inside sources are lower because their values are lower noise, also during the interval from occurring is less.

As regards the effects of noise we can say that levelhigh noise affects first attention, the degree of storing information, and while effects may occur such as: heart disease, chronic psychical, social behavior negativ, sleep disorders, hearing loss.

We can reduce noise by implementing methods to combat noise pollution presenting the corresponding chapter, even if we fail to stop this phenomenon, at least bring it to a level where the effects are not so pronounced and numerous.

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MONITORING OF BRIDGE OVER THE DANUBE-BLACK SEA CANAL AT AGIGEA

Andrei Iulian MIHALACHE, Iosua Andrei PANTEA, Catalina Georgiana LEAHU

**Scientific Coordinators: PhD Eng. Georgiana RUSU,
Asist. PhD Eng. Anca-Maria MOSCOVICI**

Politehnica University of Timisoara, Faculty of Civil Engineering, Department of Land Measurements and Cadastre, 2A- Traian Lalescu str., Timisoara, Romania email: andreimihalache01@gmail.com

Corresponding author email: andreimihalache01@gmail.com

Abstract

Topo-geodetic methods are in many cases the only one methods allowing the absolute determination of the size and direction of the movement of a building or area of land with constructions as well as the determination of the movements and deformation made by other methods.The monitoring of constructions on a timeline is a very complex process, which requires a rigorous planning. In order to be able to diagnose, it is necessary to analyze thoroughly the characteristics of the structure. The paper aimed to present this paper the process of monitoring Agigea is the first cable-stayed bridge made in Romania, and until 2002, span over waterway 162.5 meters was the highest road bridge span from country. Cable-stayed structure is 246.65 meters long.

Key words*: monitoring, bridge, displacements and deformations*

INTRODUCTION

Buildings and constructions are constantly changing by the influence of time, temperature and environment changes, there occur shifts and deformations. For bridge structures, these changes are most obvious and frequently monitored, as they may affect the functionality and safety of the structure (Palamariu, 2010).
A good logistics and deformation analysis of bridges can optimize the route and reduce the costs and time of transportation of exceptional transports.
The monitoring of constructions on a timeline is a very complex process, which requires a rigorous planning. In order to be able to diagnose, it is necessary to analyze thoroughly the characteristics of the structure, to be more specific, it is highly important to analyze the materials of which the building has been realized from, also all the environmental factors that interact with the building and the actual state of it (Figure 1), (Herban, 2006). The subject of building management implies compulsory periodic inspections and measurements in order to track how the building behaves when it is exposed to the elements and to prevent eventual failures.

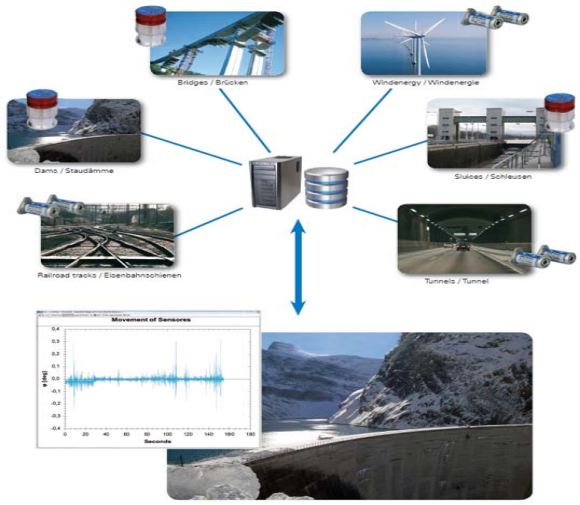

Figure 1. Monitoring of the structure

It is known that land surveying has a interdisciplinary character which gives us the much needed support from the general theories of construction in order to correctly study the behavior of the building or to do special research on it. When monitoring the behavior of a building it is required to have specialists from different fields of research in order to be provided with the most efficient and sustainable solutions. Furthermore it is a requirement for each expert to be in the know

of all the basics about the other experts' fields of study. Our society has to head in an upward direction in order to prevent problems with the help of the engineers who can provide new solutions.
In academic studies and engineering works, it is required to determine height differences between points or the height of points itself in those applications such as measurements of national or local networks, vertical applications of bridge, dam and infrastructures, maintenance and control measurements, determination of vertical crustal movements, motorway, railway, sewerage and pipe line measurements.

MATERIALS AND METHODS

Control measurements can be performed in a variety of ways depending on the structure. In practice, control measurements are performed with the help of geodetic measurements, the basic goal of which is to capture any geometric changes in the measured object. Displacements and deformations are determined. This means defining the position of changes and the object's shape with respect to the environment and time. The size of the vertical displacement can be predicted or interpolated in advance.
The case study for this paper is Bridge over the Danube - Black Sea channel at Agigea located on Route 39 at km 8 + 988, it is a cable-stayed bridge, asymmetrical, one pillar located on the left bank of the canal to Constanta (Figure 2)

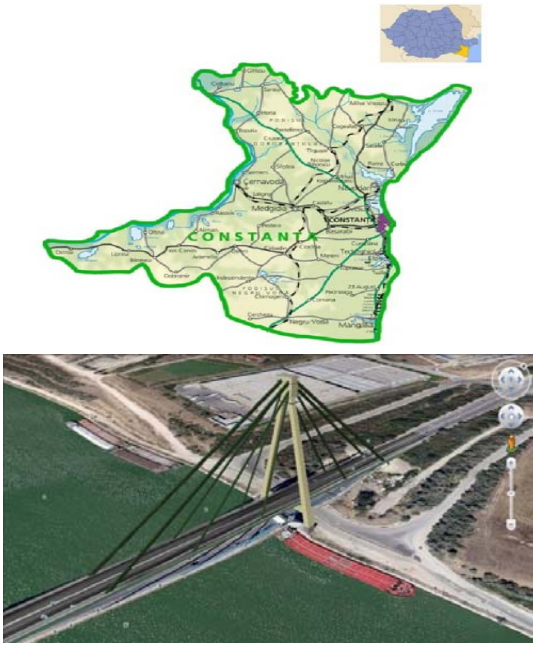

Figure 2. Location of the Bridge over the Danube

The superstructure of the bridge over the Danube - Black Sea channel at Agigea has a total length of 269,50m, composed of two distinct parts, separated by an expansion joint with the opening of 15cm specifically a cable-stayed structure, towards Constanta, covering three 44,00m openings, 162,00m 40,50m and an independent structure towards Mangalia, having a length of 23,00m, which ensures DN 39 crossing over the road on the right bank of the canal.
Establishing the compaction of the construction is generally made with the geometric precision levelling with mobile benchmarks embedded in the construction, moving in the same time with them, constrained by other fixed points outside the building that mak up the support network.

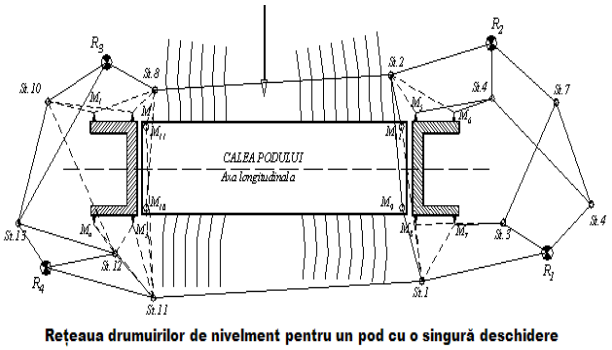

Figure 3 The Geometric precision levelling (Musat 2006)

Depending on the goal, the shape and size of the object examined, the geometric levelling network can be realized as closed polygons, or traverses approximately parallel to each other. In order to determine the values of deformations (subsidence) in the characteristic points of the bridge using this method there were performed geode
Special tracking of the behavior of a construction involves, besides identifying the technical condition of the building and its effect on the ability to exploit it, including identifying the causes of the changes that the building supports. In addition, it involves the ability to make the diagnosis and propose constructive solutions and appropriate measures to ensure its future through expert reports based on the findings of the technical condition of the building.
Analyzing the technical documentation which led to the implementation of the project Agigea, it was noted that two years after the commissioning of the bridge cable-stayed

respectively in May of 1985, was made an adjustment of the tensile stresses in the beams.

Figure 4. Construction of the bridge

From measurements made in February of 1992, there was an increase in the maximum deformation of the main opening by 12 mm from the reference measurement performed on 18 June 1983. This increase was driven by the measurements in different weather conditions. To be more specific, the measurements of 1983 were performed during the summer when the temperature was high, while the ones in 1992 were performed during the winter, which impacted the accuracy.

By using real-time deformation observations when performing measurements, designers or the construction team shall receive information on the deformations of the construction, data that can be immediately compared with those established in the project, enabling in this way the consideration also of other charging schemes, if the deformation limits given in the project are not respected.

Figure 5. Measurements realized in our time

Of particular importance in determining the actual value of travel on a building subjected to stress is how the points, both the reference and the control ones are materialize, preserved and how they make up the network of reference and observation network.

The surveyor should plan the creation of the monitoring network so as to ensure the framing area of interest and a uniform distribution of landmark control (Figure 7).

RESULTS AND DISCUSSIONS

Displacements and deformations of the bridge are the result of loads acting on it:

a) loads due to the influence of external disturbing factors, such as weather and / or tectonic (wind, temperature, precipitation, earthquakes);

Figure 6. Bridge colaps

b) load from weight of the structure (uneven subsidence of the bridge leading to the emergence of strains);

c) loads imposed by the functional destination of the building (traffic)

Causal elements, which could lead to weakening the resistance of the bridge over the Danube - Black Sea channel in Agigea, can be grouped as follows:

a) failure due to design (structure as a whole, including foundation or parts of the structure can not take actions in accordance with local design criteria);

b) failure due to exceeding load levels (local loading conditions exceed the anticipated loads);

c) failure due execution of construction (improper execution of the construction, poor quality of construction materials);

d) failure through damage (damage successive result of the construction, lack of maintenance program)

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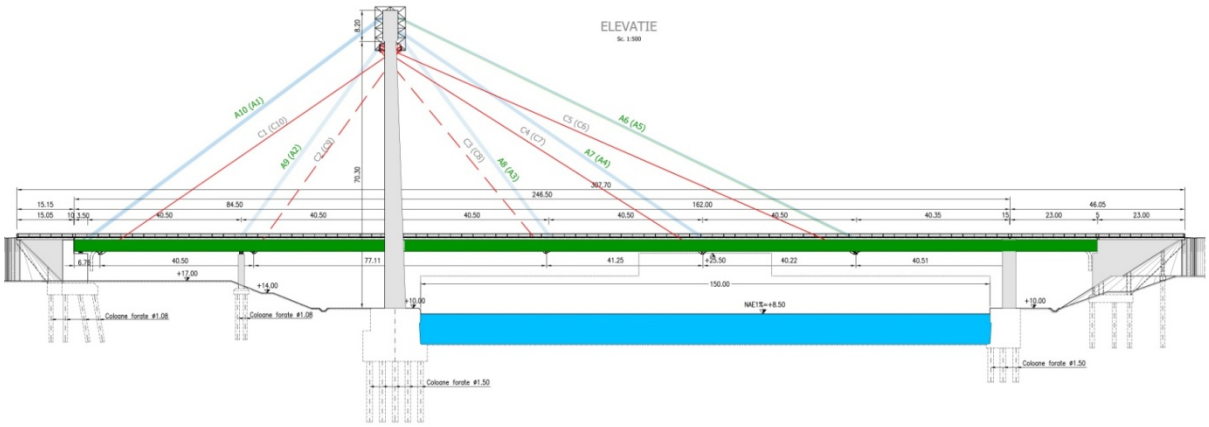

Figure 7. Structure of the bridge (Rusu 2016)

CONCLUSIONS

The purpose of monitoring the behavior of a building on a timeline is to obtain information to ensure suitability construction for normal operation and improvement of construction activity, assessing conditions to prevent incidents, accidents, failures and to adopt appropriate measures to mitigate damage, loss of human lives and environmental degradation risk (natural, social, cultural).

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THE INFLUENCE OF MUSIC ON SEED GERMINATION OF *BETA VULGARIS* L.VAR. *CICLA* L.

Ştefan PETRESCU, Roxana MUSTĂŢEA, Iosif NICORICI

Scientific Coordinator: Assoc. Prof. PhD Alina ORŢAN

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67

Corresponding author email: stef@spic.ro

Abstract

In horticulture, recent technological advances has inevitably led to studies and research conducted on plants interactions with the environment, and further to the development of new theories and assumptions regarding the plants ‚senses'. A large part of the experiments conducted worldwide represents those that aim to understand the effects of music on plant growth, in various stages of development.
In this context, the present paper aims to describe the influence of different types of music on the germination of Beta vulgaris L.var.*cicla* L. *seeds. The seeds were divided into three groups (five seeds in each group), one subject to the experimentation and two control groups. Two control groups were chosen in order to establish if any differences could be noticed according to their proximity to the music source. The observations were taken twice a day, for 28 days, the total period of the experiment. Notes, photos, measurements for a better and fair description of the experiment have been taken. The results where rather unpredictable, proving the effect of music on plants in an unexpected way.*

Key words*: Beta vulgaris, music, stress, germination, growth.*

INTRODUCTION

In the vast domain of horticulture, technological development and the ease of global information exchange have contributed to a shift and development in man's idea of 'plant organism'.
It was discovered that plants can 'hear', 'see', 'move', facts considered quite surprising and often enough at the fringe of scientific acceptance. However, because of these abilities, plants started to be seen as complex beings, capable to feel, interact with one another and their environment.
Many experiments studied the connection between sounds and the development of plants. Jagadis Chandra Bose, indian physicist, biologist and botanist, dedicated his life to the study and research of plants' responses to environment stimuli.
Among others, he reached the conclusion that plants react to the attitude of those with whom they interact. It was also proven that plants are sensitive to external factors such as light, cold, movement, noise. J. C. Bose documents his research in books like *Response* in *the living and non-living (*Bose, 1902) published in 1902 and *The nervous mechanism of plants (*Bose, 1926), published in 1926.
In the same frame of mind, american botanist and horticulturist Luther Burbank studied the way in which plants react when thy are taken out of their natural habitat. He used to speak to his plants. Based on his experiments, he assigned approximately 20 sensory perceptions to plants (Burbank, 1939).
So, if plants are capable to respond to different stimuli, are capable to have sensory perceptions and interaction, how do they respond to sound waves and the vibrations created by music?
Various studies have tried to answer this question, focusing especially on music's influence on the growth of plants.
In 1962, dr. T. C. Singh, chief of the Botany Department of the Annamalai University in India, experimented with the effect of sounds on plant growth. He discovered on balsa plants, that the rhythm of growth accelerated with 20% for height and 72% for biomass, when exposed to music. Initially, he experimented with classical music. Later, he tried ragga, flute, violin, harmonica and reena, an indian

instrument. He discovered similar effects. Singh repeated the experiment on cereal crops, finding the crop to grow by 25-60% above the regional average.

As a result of many experiments, Singh concluded that the violin has the biggest impact on plant growth. He discovered that 'feeding' the seeds with music before and during germination, will result in bigger plants with more leaves.

Experimenting in the same time period as Singh, the canadian engineer Eugen Canby exposed wheat to J. S. Bach's violin sonata and observed a 66% growth in the rhythm of the plants' development (Robertson, 1998).

In 1973, Dorothy Rettalack developed an experiment within the Women's College in Denver, using three biotronic control rooms. She exposed three groups of plants to different types of music sounds. The first group had the musical note E played for 8 hours a day. The second group had the same note broadcast, but for a period of 3 hours a day, while the third group was left in silence.

The findings showed the first group to die within 2 weeks from the start of the experience and the second group of plants to be healthier than the control one.

Plants exposed to Hayden, Beethoven, Brahms and Schubert, grew towards and around the speakers. Those exposed to country music showed no reaction. Jazz seemed to have a beneficial effect, stimulating growth. A different group of plants grew away from the speakers which played rock music. The plants seemed to try and climb the glass walls, in an attempt to escape the noise.

Dorothy Retallack repeated the experiment with rock music on various species. She observed an abnormal vertical growth, smaller leaves ad lessions associated with excessive water absorption. No matter which direction they were turned to, the plants would grow away from the rock music.

These discoveries were documented in Dorothy Retallack's book ' The sound of music and plants' (1973), (Retallack, D.L., 1973).

In the well known TV-show 'Myth Busters' a similar experiment was developed which concluded that plants react positively on any type of music.

The famous book 'The secret life of plants' (1973) written by Peter Tompkins, Cristopher Bird, describes among others the sense of 'hearing' in plants. How do plants hear? The sound is transmitted as waves that move through a medium (the cytoplasm) and determine the movement of the particles found in this medium. When humans hear, sound waves create vibrations in the air making the eardrums vibrate. This pressure energy is transformed in electrical impulses translated by the brain.

In a similar way, the pressure in soundwaves creates vibrations picked up by plants. Plants do not hear music. They feel the vibrations of the sound wave. These, in turn, modify the protoplasm's movement inside the cell, modifying the sysnthesis of nutritious substances and therefore the development of the plant.(Tompkins and Bird, 1989)

Different sounds have different frequencies and different pressure degrees, so many ways in which they can influence the growth of plants. DeMorgenzon wine estate, in Stellenbosch, South Africa, uses baroque music since 2008 to enhance the grape's maturation process. Not only for the plants but also for the soil. The vibrations help with the production of useful bacteria and fungi in the soil, fact that encourages a strong root formation and as a result a healthy growth of the plants (DeMorgenzon Wine Estate, 2017).

Paradiso di Frassina in Toscana, Italy, also uses classical music in order to obtain a better production. They observed that plants mature faster when exposed to Mozart, Vivaldi, Hayden, Mahler. They broadcast music 24 hours each day, without negative effects (Al Paradiso di Frassina, 2017).

Starting from these premises, the present study represents a first experiment which is looking to investigate the influence of music on the germination of Beta vulgaris L. var. cicla L. seeds, in order to verify the theories proposed by all these researches throughout the years. The purpose is to accumulate more data and use the information gathered in the future planning of different plant crops.

MATERIALS AND METHOD

Because the experiment took place in December, a cold month with short days, Beta vulgaris L. var. cicla L. seeds were chosen, commonly known as 'chard'.
Part of the Chenopodiaceae family, this plant is closely related to spinach, known for its ability to germinate and start its vegetation cycle at relatively low temperatures (around 10ºC).
The following materials were used:

- 3 glass aquariums (A1, A2, A3) with the following dimensions: 30x10x25.5 cm(A2) and 33x12x26.5 cm (A1 and A3);
- egg cartons for soundproofing the aquariums;
- duct tape and thread;
- iPod and headphones to play music in one of the aquariums;
- camera and tripod;
- organic, pre-fertilized soil, with pH=6.6;
- distilled water for watering the plants and keeping the soil's pH constant;
- 3 thermometers for each aquarim;
- measuring jar for water;
- plotting paper;

The experiment too place in a west-oriented room, which allowed the plants to receive direct sunlight few hours in the afternoon.
It was decided that there will be 5 chard seeds in each of the three containers.
Aquariums were chosen, so that each growing medium could be somewhat isolated from the rest. The first aquarium (A1), designated the experiment group held the seeds that were going to germinate in the presence of music. A2 and A3 were set as control groups. Two were chosen because whenever the room was being set up, there were three empty aquariums available, and it was envisaged that differences between the two could be observed, depending on their proximity to the music source.
The three containers were placed on a table, facing the window, one next to the other, in the following order: A1, A2, A3. They were set up on egg cartons, useful to absorb the sound vibrations. Also, they were separated and covered with the same materials, to maintain a phonic medium specific to each aquarium: A1 with music, A2 and A3 without. In the first aquarium the headphones connected to the iPod, were attached to the cardboard ceiling, the music being broadcast from above the plants.
Plotting paper was stuck on the eastern (back) side of the aquariums, in order to measure the height of the plants emerging.
All 3 aquariums were treated identically. They had the same type of soil, they were watered constantly with the same amount of water, they were provided with the same quantity of heat and light, being set at equal distance from the heater and window.
Distilled water was chosen so that the soil's pH will be kept constant, considering that the soil was fertilized in advance. The seeds and young plants were watered according to their need, temperature, humidity inside the aquariums. They were watered in the morning, but not at equal intervals, considering that some days were warmer or colder, the water evaporated quicker or slower. Because the containers lacked a drainage system, it was taken care so that water doesn't accumulate in excess, so that the soil becomes soggy. With the graded jar the same amount of water was distributed to all three containers. During the experiment no fertilizers were used.
The temperature inside the aquariums was measured with a thermometer placed inside each of them, and it fluctuated between 15-20ºC at night and 16-24ºC during the day. In the first 8 nights the heater was turned to ensure the cold will not interfere with the germination. The temperature reached 20ºC.
The experimental variable – the music – was broadcast in A1 through a pair of headphones connected to an iPod.
Bach was chosen, due to previous experiments (see introduction) which confirmed the composer's beneficial effect on plants. The pieces of music were the same, repeating each day: Johann Sebastian Bach, Goldberg Variations; Brandenburg Concertos no. 1-6; Mass in B minor; Minuet and badinerie; Prelude in C; Toccata in D. In order to test the effect music has on the germination of chard seeds it was decided to keep the music on for a duration of approximately 10 hours each day. The iPod was turned on every morning around 7-7.30 and turned off in the evening around 17-18.00, for a total of 28 days.

All the aquariums were photographed on a regular basis, to observe the rate of germination and growth of the seedlings, at the same time constituting proofs for the evolution of the experiment.
The containers were set up and the music turned on for the first time on the 15th of November 2016. the experiment ended on te 13th of December 2016.

RESULTS AND DISCUSSIONS

During the fifth day, three emerging plants were observed in A1. They were grouped together, right under the headphones. At first sight it seemed quite strange because there were 5 seeds placed in each aquarium, with approximately 5 centimeters in between. So, the first seeds to germinate were the ones in the experimental aquarium.
The following day, in A1 another plant appeared and in A2 two solitary plants and a group of 4 plants. In A3 a group of three seedlings and a solitary one emerged. The days in which new plants were noticed to have emerged are organized in Table 1.1. After the 13th day the seeds stopped germinating and no other plants appeared.
At the beginning, the first five days from germination, all plants had the same development rate and the same vitality. In spite of this, during the 17th day (2.12.2016) a loss of vitality was observed for the six seedlings in A1. No signs of abnormalities were found inside the aquarium like yellow leaves, mold, parasites, neither were there any substances used, aside distilled water.
The condition worsened during the following days and only for these plants.
These looked like they couldn't sustain their own weight, they grew in height but couldn't stand straight, their stems looked somewhat wavy, while the plants in A2 and A3 had straight stems. Figure 1, figure 2 and figure 3 will show the state of the plants in all three aquariums in the 17th day.
During the following days the chard seedlings slowly lost their mechanical capacity to sustaintheir own weight and fell to the ground. Once more, this condition was only present in A1.

Table 1.1 The emergence of new plants in each aquarium. With 'g' were noted those plants which germinated in groups from the same compound seed. 'P' are those plants which germinated alone from one seed. 'Pl' are the plants in one group. As an example: on 20.12.2016 in A1 there were 3 plants germinating from the same compound seed forming 1 group.

Date		A1	A2	A3
20.11.16 (Day **5**)	g	1x3pl		
	p			
21.11.2016 (Day **6**)	g	1x3pl	2x4pl	1x3pl
	p	1	2	1
22.11.2016 (Day **7**)	g	2x3pl	1x3pl, 1x4pl, 1x2pl	1x3pl
	p			1
24.11.2016 (Day 9)	g	2x3pl	2x3pl, 1x4pl, 1x2pl	1x3pl, 1x2pl
	p			1
27.11.16 (Day 12)	g	2x3pl	1x3pl, 2x4pl, 1x2pl	1x3pl, 1x2pl
	p		1	1
28.11.2016 (Day 13)	g	2x3pl	1x3pl, 2x4pl, 1x2pl	1x3pl, 1x2pl
	p		1	2

To observe the plants' evolution in time, a comparison between figure 1, figure 2 and figure 3 (day 17) and figure 4, figure 5 and figure 6 (day 25) should be made. The difference between the plants in A1 and those in A2 and A3 can be clearly seen.
Considering the height of the plants and analyzing the photographs and data, at a first glance it may appear that the plants in A2 grew fastest, comparing them with the seedlings in A1 and A3. But this impression is insubstantial because in the second aquarium there simply are more plants.
As an example, during the 17th day the seedlings in A2 presented heights between 5 and 7 cm. A1 and A3 had five plants each, with heights between 4 and 7 cm, therefore the same length. Because of this, the height of the plants cannot be considered as a cause for the weakening of the plants' tissue.
Moreover, it is difficult to verify whether this variable was affected by the exposure to music.

As a result of germinating first, the plants in A1 were supposed to grow taller, but the collected data found this to be untrue.
During the 22 days of growth, the plants' development didn't pass the cotyledon stage. This fact can be attributed to the season in which the experiment took place, the natural light in this period not being sufficient for a heathy and normal growth cycle.
No artificial lighting sources were added due to a lack of funds.

CONCLUSIONS

The objective of the experiment was to follow the effect music has on plants, for possible future applications.
During the 28 days, the music's influence on the chard seedlings was clearly observed, an influence that could only be explained by the presence of music.
Firstly, it is important to note the fact that the seeds in the experimental aquarium were the first ones to germinate. It is true that the difference between A1 and the control groups was of only 1 day, but this fact cannot be seen as a coincidence.
The enviromental conditions were the same in all 3 growing mediums.
It is possible that the music stimulated in some way the plants' embryos, motivating them to germinate. Secondly, the unexpected turn things took in A1 after 7-8 days of growth, signals a negative influence of the sound waves over the seedlings.
One hypothesis is that the music source was too close to the plants, causing them some kind of phonic stress.
It is also possible that the number of hours the music was played for daily, to have interfered with the plant's normal life cycle. However, it is certain that the plants state was not normal, indicating a real problem inside the aquarium.


Figure 1. Plants in A1 in the 17th day


Figure 2. Plants in A2 in the 17th day


Figure 3. Plants in A3 in the 17th day


Figure 4. Plants in A1 in the 25th day


Figure 5. Plants in A2 in the 25th day


Figure 6. Plants in A3 in the 25th day

This problem existed only in A1, fact prooven by the photographs taken during the experiment. Interestingly enough, the studied bibliography did not indicate any negative effects in relation to the number of hours of

music exposure, nor did they mention any increases in sensitivity of the young plants to music.

On the contrary, the literature states the pozitive effect Bach's music has on the development of the plants.

As mentioned in Results and discussions, until the collection of new data, the hypothesis remains that the Beta vulgaris L. var. cicla L. seedlings lost their mechanical capacity to sustain their own weight due to the phonic stress they were exposed to. In order to establish whether the duration of the 'music hours' was the culprit, the experiment should be repeated by testing the length of music exposure on different groups of plants.

In conclusion, this experiment confirmed once more music's influence on plant development . It was observed how these organisms modify their life cycle as a response to external sound stimuli.

Even if the results are slightly surprising and different from those of previous researches, our team considers that studies on this domain are as diverse as plant species and music genres.

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STUDIES REGARDING THE INFLUENCE OF MUSIC ON THE WHEAT PLANTS GROWTH

Mihai Adrian RACHIERU, Irina IACOB, Maria CRISTEA

Scientific Coordinator: Assoc. Prof. PhD Alina ORTAN

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67

Corresponding authors email: iacobirina20@yahoo.com, cristea_maria21@yahoo.com

Abstract

The positive effect of music not only on humans, but also on animals and plants is well known for a long time, being used in music therapy. Studies have shown that a harmonious musical concert stimulates songbirds from forests. Moreover, monkeys, depending on the nature of music they listen to, could cheer or fall into melancholy. If music is a mean of relaxation or even healing for people, which is its effect on plants? The current paper aims at answering this question, by presenting the results of an experiment that studied the biological effects of different genres of music on the wheat plants growth. The Triticumaestivum seeds were placed into three pots and the humidity, temperature and damping program were kept constant. One of the pot was set as the control group, the other two being subjected to the following musical compositions: Havasi - Rise of the instruments and Led Zeppelin's tracks for 2 and a half hours a day. The experiment lasted 6 weeks, during which plants height was measured weekly and change in leaves color was visually estimated. The obtained results were in accordance with the literature data: both classical and rock music affect living biological systems, those exposed to classical music being higher and brighter than either the control group or those exposed to rock music.

Key words*: wheat, growth, classical music, rock music.*

INTRODUCTION

The positive effect of music not only on humans, but also on animals and plants is well known for a long time, being used in music therapy. Studies have shown that, being multicellular organisms (Benford, 2002; Dossey, 2001; Kristen, 1997), they react to sound vibrations even in the seed stage (Braam and Davis, 1990). In a study conducted on plants exposed to different styles on music, O'Donnell et all showed that plants growth was influenced in a negative way by the rock and acid rock music (O'Donnell et all, 2009). In their experiment, Popescu and Mocanu demonstrated that the treatment with folk music from pipe flute determined an increase in salad yield by 12.8 - 19.8% (Popescu and Mocanu, 2013).

Researchers from Canada and the former Soviet Union found that wheat will grow faster when exposed to special ultrasonic and musical sounds. They estimated the effects of music on plant growth using different genres including classical, rock, acid rock, and East Indian music. They found that the plants grew well for almost every type of music except rock and acid rock.

Another experiment was based on insect music and they demonstrated that after different acoustic frequency treatment, in besides soybean plant height,dry root weight of cabbage and greengrocerythere was significant difference of plant height,fresh weight and dry weight between the other vegetables and control groups.

The current paper aims at presenting the results of an experiment that studied the biological effects of different genres of music on the wheat plants growth.

MATERIALS AND METHODS

The Triticumaestivum seeds were placed into three pots. The pots were filled with peat without any kind of fertilizer (Figure 1).

One of the pots was set as the control group, the other two being subjected to music. After studying the literature data, the following musical compositions were chosen: Havasi -

Rise of the instruments and Led Zeppelin's tracks; the music was played for 2 and a half hours a day for the whole period of the experiment. The humidity, temperature and damping program were kept constant. Thus, water was used as a damping agent, and the watering program was as follows: 3 times a week in first two weeks, then 3 times a week for the next 2 weeks and once a week for the last 2 weeks. Humidity recorded and maintained constant throughout the experiment was 40%.The temperature for the three potswas kept constant as well, respectively 24 degrees Celsius, which is the optimal temperature for wheat growth. The plants have benefited from natural light.

Figure 1. *Triticumaestivum* seeds planted in peat

In order to recognize the pots, they we noted by letters: B was the control group, A was the pot with plants subjected to classical music and C was the pot with plants listening to rock music.
The experiment lasted 6 weeks, during which plants height was measured weekly and change in leaves color was visually estimated.

RESULTS AND DISCUSSIONS

As it was mentioned above, the height of the plants were measured and also the color was vissualy estimated. For comparison, figures 2, 3 and 4 show the differences in height registered for pot A during the experiment. The measurements made after the first week showed tha the growth was differentiated even from the beginning: 3 cm for the clasical music (pot A), 2 cm for the control group (pot B) and only 1 cm for the plants subjected to rock music (pot C).In terms of color, it could be observed even from this stage a differentiation: the color for plants in pot A was bright green, while the one for pot C was yellowish green.

Figure 2. Image with Triticum aestivum in pot A after first week

In second week we could notice more significant differences in plants' growth and colour.
After the third measurment we could find that plants' growth was much more aggressive, and this rate was held in the fourth week as well (for example, after third week plants subjected to clasical music had 14 cm in height, the control grup 10 cm, and the plants subjected to rock music only 6 cm in height).
According to fifth measurement it could be observed thatthe plants were changing their growth rate, some of them keeping the aggressively rythm, some of them decreasing it (plants in pot A and B decreased their growth rate, while plants in pot C maintained it constant). In turn, the color of plants began to differentiate more. From this point we could notice a difference in color also between the plants in the control group and the plants subjected to classical music.

The last measurement (sixth week) showed that the growth rate was constant dor all of the three groups.

Figure 3. Image with Triticum aestivum in pot A after third week

Figure 4. Image with Triticum aestivum in pot A after fifth week

The results obtained in this experiment are mostly in accordance with literature data: after 6 weeks, the plants subjected to clasical music had 20 cm in height, the control grup 14 cm, and the plants that listened to rock music had a height of only 10 cm. Figure 5 shows the different dimensions of the plants of all 3 pots during the experiment.

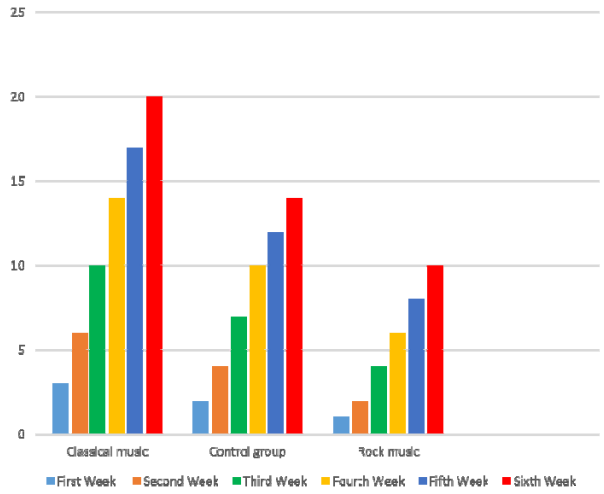

Figure 5. Evolution of Plantsgrowth during the 6 weeks of experiment

As it could be noticed from the figure, the plants subjected to classical music (pot A) had the most significant growth, while the one subjected to rock music had the lowest growth rate.

The experiment showed that the average growth for the plants subjected to classical music was 3.33 cm per week, 2.33 cm per week for plants from the control group and in the case of plants subjected to rock music the average growth rate was 1.33 cm per week.

Regarding the color, the plants' color at the end of this experiment presented also significant differences, from bright green at the plants exposed to classical music to yellowish green for plants subjected to rock music.

What was unexpected was the fact that wheat from pot C didn't present any injuries. According to specialty literature, the plants subjected to rock music often develop some lesions, which were not present in our experimental group. The only differences were in plants height and colour.

Recent studies based on physics and molecular biology research provide much more accurate information on the sensitivity of plants to music. According to Neacsu , the amino acids,

under the influence of sound waves, are organized into proteins through a suite of resonance phenomena; when plants listen to "favorite song," acoustic waves are transformed into electromagnetic waves, producing the protein of this song (Neacsu , 2010). Therefor, we can affirm that there is a link between protein and music, and music can ease the synthesis of proteins useful to the body.

CONCLUSIONS

Our study confirmed what was found in studied literature: plants are dainty and cannot agree with every type of music. They develop easier and grow faster only on slow rhythms, especially played by instruments made of natural elements like violin, piano, cello.

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THE CHANGE IN UNDERSTANDING CLIMATE CHANGE – A STUDY ON HOW AND WHY PUBLIC PERSPECTIVE OVER CLIMATE CHANGE IS SUBJECT OF A CONTINUOUS TRANSFORMATION

Luiza-Cecilia SPIRIDON, Denisa Elena-Maria POPOCEA, Mihaela-Andreea SOLOMON

Scientific Coordinator: Assoc. Prof. PhD Alina ORŢAN

University of Agronomic Sciences and Veterinary Medicine of Bucharest,59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67

Corresponding author email:luizaspiridon@yahoo.com

Abstract

This article aims to present the multiple perspectives that compete in defining public perception over global warming and the impact that several endogoenous and/or exogenous factors have on it. Due to the overwhelming amount of existing information, often conflicting and vague,we have confined ourselvesto try to identify common patterns - elements and differences in the discourse on global warming of different actors that have agreat impact on public opinion. We consulted materials provided by scientists, activists, politicians and public media and we have also aligned ourselves to previous research and studies on the controversy aroused by the subject of global warming in order to better graspthe complex relation between existing arguments and counterarguments and how theyaffect public opinion. In the conclusion section, we bring to attention some of the most relevant factors of confusion and misinterpretation that we have identified as leading to a continous dynamic of the public perception over global warming, thus contributing to a general state of confusion and insecurity.

Key words*: climate change, climate skeptics, climate variability, global warming, sustainabiliy.*

INTRODUCTION

When trying to get an accurate picture about what climate change really means, one can not help but notice that scholars nowadays have really different opinions on the topic and that despite the continuous feedbacks and arguments they have been giving each other by the time being, many aspects of the climate change debate remain still controversial, generating three main attitudes around the topic (Giddes, 2009). To start with, the climate change skeptics either claim that we are still at the stage of insufficient knowledge and because of this the global warming produced by human activity can not be demonstrated, or they accept that climate change is happening and that it is humanly induced, but argue that the threat it poses has been exaggerated. In either case, the skeptics find themselves at the opposite corner to the mainstream view of global warming due mainly to the negative action of the human factor and especially to the increase of GHG emissions, supported and promoted above all by the publications of the Intergovernmental Panel on Climate Change (IPCC, 2007).

In addition to these two sides, there is also a third party, represented by the radicals, who think climate change will bring even greater threats and sooner than is conventionally expected.

Taking into account the long exposure of the concept to the analitical tendencies of different parties, period in which all sciences, social sciences and humanities and political, economical and even religious behaviours kept changing and impacting public opinion in countless ways , climate change has ended up being percieved by some scholars as a "mutating idea" (Hulme, 2009). As climate change is being examined from different angles, such as those mentioned before, which apart from affecting general perception over climate change, have also been affected by the mere idea and concept of it,carrying quite different meanings for each of them.

Although conflicting conversations about climate change could be seen as a mark ofthe diversity of ourvalues, beliefs and expectations, this is only possible when we get really engaged with the subjectand when we have the necessary information to have an opinion that

really reflects our beliefs or our inner system of ethical, ideological and political values. However, this is rarely the case, mostly because of the intrinsic nature of the conflict and the way in which it is presented to the general public.

When examining whether readers'assessments of the certainty of scientific findings regarding climate change depend on how news are presented, research shows that adding controversy and/or context to a news story about global warming influenced readers' perceptions of its certainty. The context treatment produced the highest level of certainty about global warming, while controversy treatments resulted in the lowest levels of certainty (Corbett, 2016). Key findings from other studies on how science stories from radio, television and the press are percieved, including those on topics such as climate change,also suggest that there is a clear link between media coverage and the way people understand science, that the presence of more researchers in the media does not seem to build open comprehension of science issues and that a clear and consistent story behind an issue helps create public engagement (Hargreaves, 2008).

In this article we intend to emphasize, in the first part, the main differences of perspective between the different sides. These are mainly based on the uncertainties that still exist regarding the manifestation of the phenomenon. The second part will be dedicated tothe impact these differences have on public opinion and even on our daily lives.

MATERIALS AND METHODS

In order to achieve a better understanding of the yet unclarified controversy regarding climate changes and global warming, we first identified the most relevant official documents on global warming and the dynamics of its perception both inside and outside the European space. Subsequently, documentsin which counter-arguments about global warming are provided have been identified and ranked from the point of view of the sources' credibility. The contribution of the media was taken into account for both sides. As a last resort, studies previously carried out by specialists in various fields, which presented in parallel the pros and cons of the two sides, were analyzed. This research brought to a number of observations, which will be presented in detail in the next chapter.

RESULTS AND DISCUSSIONS

Skepticism on global warming: Although nowadays most climatologists claim that we are witnessing a global phenomenon of climate change accelerated by the multitude of human activities based on fossil fuel consumption (Raileanu, 2015), there are a considerable number of skeptics, the voices whose main points of view are based on uncertainties existing regarding how this phenomenon actually occurs. They claim to have various arguments for being skeptical, of which the most commonly used are the following:

- The weather forecast faces challenges even in the short term –the fact that the weather can not be predicted for sure for the coming weeks makes the forecasting capacity for longer periods of time (like centuries) even less reliable
- The atmosphere does not suffer abnormal temperature changes in relation to the geological time scale: there have been other global warming periods in the history of the planet, they are normal and are part of the cyclical climate change. In addition, measurements proving a warming of the atmosphere are recorded at the surface of the earth and are insufficient to establish a verdict, as similar rising of temperatures are not recorded in the upper atmosphere.
- Global warming and cooling processes are not due to human activities, but to natural causes,which could explain the rapidity of the global warming process over certain segments of time, such as the last half of the last century. The climate cycles are influenced by the solar activity, which happens independently of human activity. Moreover, even if at present humanity finds itself in a period of climate warming, some researchers claim that we should rather worry about the dropping temperatures that are about to come.
- The recorded climate changes will not cause any disasters, so we do not have to implement any type of measures, but on the

contrary, as the current climate trends show an increased potential for increasing the crop yield.

- The presence of carbon dioxide is not fully understood - at present, the percentage of carbon dioxide in the atmosphere is at the lowest level in the last 500 million years and the percentage in the atmosphere accounts for only 0.001% of the total quantity in the oceans, rocks, soil and different forms of life. In addition, Plimer states that human activity only contributes very little to the presence of the gas in the atmosphere (Plimer, 2009).

The oceans and earth hold about50 times more carbon dioxide than there are in the atmosphere, and the circulation between these carbon dioxide reservoirs is still poorly understood. Due to the carbon dioxide property of having a "greenhouse" effect, allowing more solar energy to enter the atmosphere than it leaves, the hypothesis of global warming has come to find its logical sense. However, the definition according to which climate change brings an extreme greenhouse heating of the atmosphere with catastrophic environmental consequenceshas ended up seen as exaggerated by many scientists (Robinson et al., 1997).

Arthur Robinson and Zachary Robinson are chemists at the Oregon Institute of Science and Medicine in the United States. They show that there is a relationship according to which the shorter the solar cycle, the more active it gets and the higher are the temperatures, which explains the heating and the high temperature fluctuations that took place starting with the Little Ice Age. According to the chart, the highest temperatures since then were recorded around 1940 when the temperatures began to drop. Most of the increase in carbon dioxide in the atmosphere has occurred over the last 50 years, and growth has continued over the last 20 years. However, there has been no significant increase in atmospheric temperature during these 50 years, and in the 20 years with the highest levels of carbon dioxide, temperatures have actually dropped, according to their interpretation.

In critical papers on the position of climate skeptics, these arguments are sometimes fought and then the arguments of these critics are once again tackled by skeptics in a chain that does not seem to seek to get to an end.

In his exhaustive work entitled Global Warming - Myth or Reality?: The Erring Ways of Climatology, Marcel Leroux goes through all these elements of interest to the skeptics that we mentioned above. He pursues the history of the global warming concept since his appearance and analyzes past climates and recent climate developments, sea and ocean levels, atmospheric behavior, and the events we are currently exposed to, the causes of climate change, greenhouse effect, and numerical patterns, concluding that we can not consider human behavior responsible in any way for climate change (Leroux, 2005).

Marcel Leroux is an empiric climatologist and emeritus professor of climatology at the Jean Moulin Lyon 3 University, director of the Institute for Climatology, Risk and Environment Research and Cavalier in the Ordre des Palmes Académiques. His work also criticized the tabloid climatology that dominates the attention of the media and of the governmental decision makers as well. Leroux was outraged by the amount of money invested by the U.S. into global warming research, a level of funding providing the climate modelers with generous research grants dependent upon producing dramatic statements and arguments exclusively in favor of global warming.

While the United Nation’s Intergovernmental Panel on Climate Change (IPCC) warns of a dangerous human effect on climate, the Nongovernmental International Panel for Climate Change concludes the human effect is likely to be small relative to natural variability. Also in contrast to the IPCC, NIPCC is sponsored by three non-profit organisations (Center for the Study of Carbon Dioxide & Global Change, The Science and Environmental Policy Project and The Heartland Institute).

Those who are sceptical about climate change see the IPCC as the enemy of free and proper scientific thinking (Giddes, 2009), being responsible for the politization of climatology.

Criticisms on the hypothesis of human impact on global warming: The hypothesis of climate warming due to anthropogenic factors is most frequently challenged by skeptics, who claim that the causes of this climate change are natural (solar activity variation or astronomical

causes). Regarding the global warming that occured since the end of the small glacial era, there are no uncertainties, but the fact that global temperatures have seen countless variations over time, even before the carbon dioxide levels in the atmosphere began to rise significantly (Easterbrook, 2001) has easily become a reason for controversy.

The new hypothesis according to which global warming has natural causes is supported by the Nongovernmental Panel on Climate Change (NIPCC) Report, published in 2008 and coordinated by Professor Fred Singer, with the collaboration of 24 scientists of the highest degree. This report insists on the fact that short-period climate changes have taken place well ahead the existence of people and polluting technologies. The report also makes a severe critique of the Intergovernmental Panel on Climate Change and their methods, which have led to the conclusion that Earth may warm up during this century by 2-6 ° C due to human activity (IPCC, 2007). In the United States, over 31,000 scientists, of whom about 9,000 doctors from various disciplines, signed a petition against the thesis that, due to greenhouse gas emissions, mankind has become exposed to catastrophic warming.

The main arguments put forward by those who contest the main contribution of the human factor to global warming are the following (Argelean et al., 2008):

- The numerical models used for prediction are considered less reliable instruments;
- Sea level rise is not clearly linked to increased emissions of greenhouse gases; melting ice may not be the result of global warming (but of the interference with warmer waters brought by currents from the Atlantic Ocean);
- The actual role of the greenhouse gas in the reported increase of ocean temperatures is unknown;
- Incomplete understanding of the balance of carbon dioxide in the atmosphere;
- Weather stations for the measurement of concentrations of pollutants in the troposphere are not placed uniformly (they are often placed in urban centers and not taking into account the urban heat islands effects);
- The phenomenon can be observed on other planets as well (e.g. on planet Mars, it takes place even four times faster than on Earth);
- There is a number of internal factors that affect climate and which have not been taken into account for the theoretical modeling;

The main natural factors currently known and influencing climate change are: insolation, Milanković parameters or Milanković cycles (terrestrial orbit eccentricity, terrestrial obliquityand terrestrial precession movement) and terrestrial albedo. For the skeptics, the most important causes of climate change remain the astronomical phenomena and the variation of solar activity.

Extending skepticism:Whereas in the early years of the movementagainst pollution the number of skeptics was rather small compared to the promoters, the numbers started to change with the loss of control over the quality of information which led to global warming being perceived as a hoax, a mean for mass manipulation and manipulation of data, one of the greatest scientific scandals of all time (Global warming-a manipulation, 2015). Consequently, supporters started changing sides chaotically.

This was made possible by a number of elements, but their impact was boosted with the contribution of the media. We present an extract from the activity of the publications that stand out for having a high-value impact factor:

- questioning the official temperature records and suggesting that there was a change in the official data, systematically "adjusted" to show that the Earth was warming up more than it really did –with respect to this matter, the daily newspaper The Telegraphis citingblogger Paul Homewood, who claimed that by checking the temperature charts recorded by weather stations in Paraguay or the Arctic region, from Canada to Siberia, they would have been modified so that the cooling trend would have been changed with a significant heating one.
- highlighting the fragmentary character of the phenomenon - in this regard, The Vancouver Sun quotes geologist and professor Ian Plimer, one of Australia's most famous academic voices, and one of the main critics of the theory that human society is causing global

warming and the idea that people could stop the rise in temperature by changing lifestyle (Global warming has become the new religion, 2009). In his book,*Heaven and Earth - Global Warming: The Missing Science*, Plimer draws attention to the fact that geologists use a much wider time frame, that reaches hundreds of millions of years, unlike ecologists, who justify their theories on climate change on data from a temporally reduced fragment (Plimer, 2009).

- claiming that in reality the climate behavior does not follow the initial forecasts of rising temperatures. Moreover, simultaneously the UK Met Office Meteorological Institute revised its 2012 forecast for the following decade: this initially predicted a succession of years with record-breaking temperatures, but after the revision it instead advocated a pause in the heating process at least until 2017 (Rose, D., 2013). This new developing context also affected the attitude of an increasing number of researchers.
- developing the hypothesis that information is deliberately exaggerated – there was a massive scandal generated around over 1000 electronic messages and 3000 documents stolen by a group of hackers from the computers of a UK research center and belonging to famous American and British climatologists (Documente secrete, n.d.). These mails supposed to contain discussions between the scientist over the past 10 years concerning how to tackle the arguments of the skeptics and possible ways of manipulating public opinion to be convinced that these climate changes are more serious than they really are (Incălzire globală o farsă, n.d.). In addition, according to these new discovered sources, soon supported by different scientist (Leroux, 2005; Idso et al., 2015) the Earth would actually face an opposite, global cooling phenomenon, with average temperatures not actually emerging since 1960 (Încălzirea gobală adevăr sau conspirație, 2016). According to The Washington Times, the main contributors to the altered presentation of this data would be the director of the Department of Climate Research at East Anglia University, and a scientist of climatic conditions from Pennsylvania State University,
- promoting the idea that only one party can be right and skeptics are discriminated against - The Weather Channel meteorologist and co-founder John Coleman claims that there is no consensus in science and, moreover, that ”Science does not mean voting. Science works with deeds. If you judge only on the facts, you find that there is no climate change". Furthermore, in October 2016, he wrote a letter to the Los Angeles University of California, claiming that the US government is biased about the financial support of scientists , his statement being made public later on the "Reliable Sources" program at CNN (Padure, R., 2014).
- the loss of credibility on research quality - climatologist Patrick Michaels, senior fellow in environmental studies and director at the Cato Institute in Washington D.C.and former president of the American Association of State Climatologistsasserts that only one-third of those who produce the IPCC reports are scientists, the rest being government bureaucrats (Giddens, 2009). Michaels was also a professor of environmental sciences at the University of Virginia and associated with other universities such as University of Wisconsin, and University of Chicago.

Creating myths: ”the myth” of global warmingis rooted in the observation that we are witnessing an increase in the amount of carbon dioxide in the atmosphere. Starting from this information, however, as a result of its assimilation by various economic and political actors and adding the way in which the media has alternatively positioned itself on one side or another of the conflict (Thirty Global Warming Myths, 2016), the public opinion has become affected by certain beliefswhich, in the absence of complete arguments, remain only myths.

Looking from a single perspective, and without engaging in a diligent research process, the public opinion remains to be anchored in personal preferences regarding the subject. A number of factors of influence, such as political ambitions or scientific interests make it even more difficult for the audience to position themselves in this conflict generated around global warming, as it is overly challenging to find out what is really real and what is supposition or misinterpretation.

In this context, climate change is not a technical issue anymore, but a challenge to

reinterpret relationships (Hulme, 2009). Maybe the only "consensus" that there is among climate scientist is that human activities can have a certain impact on local climate (Idso et al., 2015), however they do not agree whether it is likely or not to become a dangerous change outside the range of variability. This disagreement is due to various reasons that generate fundamental uncertainties among people at a global scale. These reasons could be classified as follows:

- Management errors: climate is an interdisciplinary subject which requires insights from many fields, however only few of the scholars have mastery of more of these disciplines, some practitioners lack even basic qualification; research funding by the state depends on the result of research, which makes both the state and the research less reliable
- Research errors:poor observational evidence and bad measurements, data misinterpretation and improper setting of the parameters of models might have led to an exageration of the role of CO_2 as a prime suspect in affecting world climate;
- Dissemination errors: The media alters the information and paints a picture of doom to attract attention; censorship of the opposition; environmental news is socially constructed and it reflects the multiple competing claims that need to be sorted out in the course of putting together a story (Hannigan, 2014).
- External factors: mass-media seeking for impact oversized the role of political and economic reasons, while social media as a dissemination channel is being linked to the poor quality of research, methods and methodology, scientists can be biased - careerism, grant-seeking, political views and confirmation bias (Idso et al., 2015)

We believe that this classification will be able to facilitate a better understanding of the factors that create confusion among people regarding scientific aspects. Also, this synthesis can be used for understanding the character of the information we have at the first hand, understanding the conflict scale in science, and building prerequisites for developing self-defense mechanisms and better accessibility to correct information.

CONCLUSIONS

Although at first impression it may seem that the subject of climate change has nothing left to offer from a scientifical point of view, the truth is that we are still far from fully understanding the phenomenon and the appropriate solutions to minimize its effects.

Climate change is such a complicated phenomenon that it still leaves space for interpretation and weak spots in argumentation both for promotors as well as for skeptics.

Both groups are mixed groups containing people active in climate research, others working in the field of atmospheric science, consultants, writers, or spokespersons of various institutions, which makes it more difficult to control the quality of the transmited information or the numerical representativeness of each side.

The conflict generated around the causes of global warming is continuously growing in proportions, since accepting or rejecting any of the existing hypotheses would lead to certain economic agents having to bear huge costs.

The role of this paper is to raise awareness over the existing scientific conflict, its scale and impact over everyday life. We think that this type of research should be continued in the fields of climatology as well as in other fields that concern public opinion, to better identify truth from delusion and to smoothen everyday conflicts that make us waste energy instead of finding real solutions for real problems. No matter which of the two scenarios is closer to the truth, at the end of the day, we should be able to find better ways of adapting ourselves to an ever changing world and keep seeking to achieve a sustainable lifestyle, based on care and wise administration of resources.

The paradox that we have to face in the end is that the most important thing in order to be able to adapt and take action against climate change is to prevent it from being transformed into a cliché before being fully understood, while in the same time understant and accept that at least at the time being, it can not be fully understood.

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CLIMATE CHANGE – IN THE AIR AS IT IS ON EARTH

Robert STAN, George TOMA, Cătălin RADU

Scientific Coordinator: Assoc. Prof. PhD Eng. Alina ORTAN

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67

Corresponding authors email: george.toma13@yahoo.com, rcatalin96@gmail.com

Abstract

This article is based on a scientific report made by the Intergovernmental Panel on Climate Change of the European Commission. The information in the report shows that global warming is still ongoing and its effects are becoming clearer from year to year. It is good to know these things, but it is important to understand the causes: people are the main cause of climate change; less ice means more heat and the growing level of carbon dioxide in atmosphere has bewildering effects on creatures of seas and oceans. We bring into question the opinion of some political figures who are or have been skeptical about the warnings of scientists. In conclusion, the present paper doesn't aim to form a general opinion, but rather to stimulate a debate.

Key words: *record heat, new epoch, albedo, acidification.*

INTRODUCTION

Global warming is a topical issue, even though the debate has begun long ago.The Kyoto Protocol is an international environmental agreement. 160 countries negotiated this in December 1997, but in the last seven years, the debates on this issue have intensified (Kyoto Protocol, 2014).

We hear or read more often news whose main topic is "global warming", "greenhouse effect", etc. Not only articles have been written on this topic, people have passed to action. For example, the documentary films "An Uncomfortable Truth", an Oscar-winning film in 2007 for the best documentary film. Another example of this is the latest documentary film about climate change, "Before the Flood", film directed by Fisher Stevens and produced by Leonardo DiCaprio, a well-known environmental activist. This documentary film had record views for such a genre.

While the authorities of some countries or cities have resorted to the banning of motor vehicles for a few days and have asked people to use bicycles, long-term measures have been taken in other countries.The Netherlands has developed a plan that includes the extension of river canals as a way to prevent floods.In Chicago, decorative trees have been replaced with species that are adapted to warmer climates. The United Kingdom has planned to lift the height of the flood control barrier that protects central London by 30.5 centimeters to prevent possible flooding caused by the future increase of the Tamisa flow (Vârlan, 2011).

ANALYSIS

Scientists afirm that we are entering a new geological age. This is due to dramatic changes - massive floods, more and more hurricanes, heat records, fires and droughts. Apparently we move from *Holocene* to *Anthropocene* and even if we like change, the latter is an age where people are the main drivers of change on the planet.

All of these climate trends that we do not like to hear have been predicted by scientists decades ago and have now become reality.

Although the Earth has been constantly heated for more than 100 years, with the increase of pollution by the CO2 that wrapped the planet with a gas curtain with a heat-catching effect, one aspect is not clarified yet: the second industrial revolution that took place at the end of the nineteenth century as a result of which industrial branches such as the electrotechnical, chemical and automotive industries have developed has not been after all such a

beneficial event? We believe that both the first industrial revolution, at the beginning of which James Watt invented the perfected steam engine, and the second revolution were favourable to evolution.

We do not like the fact that a small change in Earth's average temperature produces a dramatic climate change as we see the signs of warming everywhere, from temperature monitoring, satellite measurements to news stories about the melting of ice caps. For example, in the United States, new record temperatures are more frequent than regular and there was an unprecedented peak in hot nights during the heat waves (Cutting, 2016). Such information we can access on a daily basis makes us aware of the advanced stage of global warming.

Research has shown that the albedo of the Arctic region may be declining much faster than it was estimated just a few years ago. A paper published in the Proceedings of the National Academy of Sciences (Pistone, Eisenman, Ramanathan, 2014) argues that the percentage with which the Arctic region fell between 1979 and 2011 is 25%.

The effects of global warming are also visible in the aquatic environment. CO2 bubbles rise from volcanic venting on the seabed and dissolve to form carbonic acid. Interestingly, carbon dioxide is relatively weak, we humans always drink it in carbonated drinks. However, carbonic acid accumulated in a sufficient amount makes the seawater corrosive. Marine biologist at the University of Plymouth, Jason Hall-Spencer, says that when we enter the high CO2 area, nothing can bear it (Kolbert, 2011).

Hall-Spencer studied the sea around CastelloAragonese, assessing the properties of the water and monitoring the fish, corals and molluscs that live, and in some cases dissolving there. The barnacle piles formed a whitish strip at the base of the rocks hit by the waves. "The barnacles are very strong," says Hall-Spencer, but curiosity is that they were lacking where water was the most acidified.

However, in 2003, Vladimir Putin told to an international conference on climate that, for Russians, global warming would mean "less spending on fur clothes," while agricultural specialists said "our cereal production will grow, and we thank God for that". Putin believed at the time that there was no global warming, that this is a fraud to limit the industrial development of several countries, including Russia. He also said, "Climate is a complicated system and so far the evidence presented for the need to fight global warming has been rather unfounded". Although in 2003 the evidence presented for the need to fight global warming did not convince Vladimir Putin, in 2004 Russia ratified the Kyoto Protocol.

Al Gore, former US Vice President of the United States during Bill Clinton's presidency, presents in his book “An Uncomfortable Truth” (Gore, 2007) ten prejudices that circulate about global warming, including: it makes no sense to worry about CO2, because many things can affect the climate; Cities keep the heat, so the warnings of scientists have nothing to do with greenhouse gases; Global warming is a myth, because temperatures do not grow everywhere.

CONCLUSIONS

We are witnessing the climate change that is happening now.

The atmosphere tends to maintain the warming of the planet due to CO2 pollution. So the Earth will not stop heating until the pollution stops. We cannot reverse the heating, but we can stop it.

One of the measures that can be implemented to slow global warming is to reduce energy consumption. By reducing energy consumption, the load on thermal plants is decreasing. Another measure is alternative energy that aims to reduce CO2 emissions. Solar, wind and wind are recommended because they are not based on combustion technology, but they also have some drawbacks: the capture of solar energy is cumbersome, the currently exploitable hydraulic energy is limited, and wind power is only available in certain areas.

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ANALYSIS OF PHYSICAL FACTORS OF POLLUTION IN THE WEST JIU

Dorin TATARU, Andreea Cristina TATARU

Scientific Coordinator: Assoc. Prof. Phys. PhD Aurora STANCI

University of Petrosani, 20 Universitatii Street, 011464, Petrosani, Romania, Phone: +40721044767, Email: andreeastanci@yahoo.com

Corresponding author email: dorin.tataru@yahoo.com

Abstract

The water is an indispensable factor of life and also has an important role in ecological balance and its pollution is a serious problem with the current population. The water pollution is altering the physical, chemical and biological characteristics of their being produced directly or indirectly, natural or man-made, the polluted water is unfit for normal use. One of the most important properties of water, in addition to temperature, color and electrical conductivity, is turbidity. In this paper we present a method of determination of turbidity and electrical conductivity. The method is based on the measurement of luminous intensity weakening which passed through a liquid containing suspended solid particles are absorbed or released. Following these measurements can be verified and determination the degree of pollution and what are major pollution sources.

Key words*: pollutants, water*

INTRODUCTION

Water is an essential factor of life and also plays an important role in the ecological balance and its pollution is a current problem with serious consequences for the population.
Water pollution represents quality alteration of physical, chemical and biological characteristics, being produced directly or indirectly, natural or human, polluted water unfit for normal use.
Water pollution must be regarded not only as a potential human and biotic risk, but as disruption of aquatic ecological systems. For complex characterization of water is necessary to take into account many physical and chemical factors, among which are:
- temperature
- color and turbidity
- suspensions
- the content of dissolved substances
- the content of dissolved oxygen
- oxidized organic content
- chemical interactions of water

Industrial and agricultural pollution sources contribute to the pollution of water resources by discharging pollutants specific to the type of activity conducted. Thus, it can evacuate organic matter, nutrients (food, chemicals, fertilizers, pulp and paper, animal farms, etc.), heavy metals (mining and manufacturing, chemical industry, etc.) and hazardous organic micropollutants (organic chemical industry, oil industry, etc.) (Naşcu and Jäntschi, 2006).
In this paper we propose to determine the physical factors of pollution of the West Jiu.

OVERVIEW OF BASIN JIU

Jiu basin is located in the south - western Romania.
The contour of the basin is limited:
- To the north, the heights of the mountains Suriani, Parang, Retezat, Cerna, who split the basin tributaries Mures, SebesStreiului and CernaMures;
- To the west, the high peaks of the hills and platforms, near to the town of Sarbatoarea, and among towns Sarbatoarea - Segarcea - Macesu detaching it from the Cerna - Danube Bahnei, Topolnita, Blahnita and Desnatuiului;
- To the east limit of Jiu basin, follows a narrow ridge which separates at the Olt River, up near the Craiova. Jiu south enters the Romanian Plain and basin boundary follows a line that would unite the villages Leu - Ghizdavesti - Bechet;
- South boundary is formed by the river Danube. Within these limits, the Jiu river basin covers an area of 10,080 km2 and has a length

of about 260 km and an average width at the top of 60 km and about 20 km to the bottom (Figure 1).

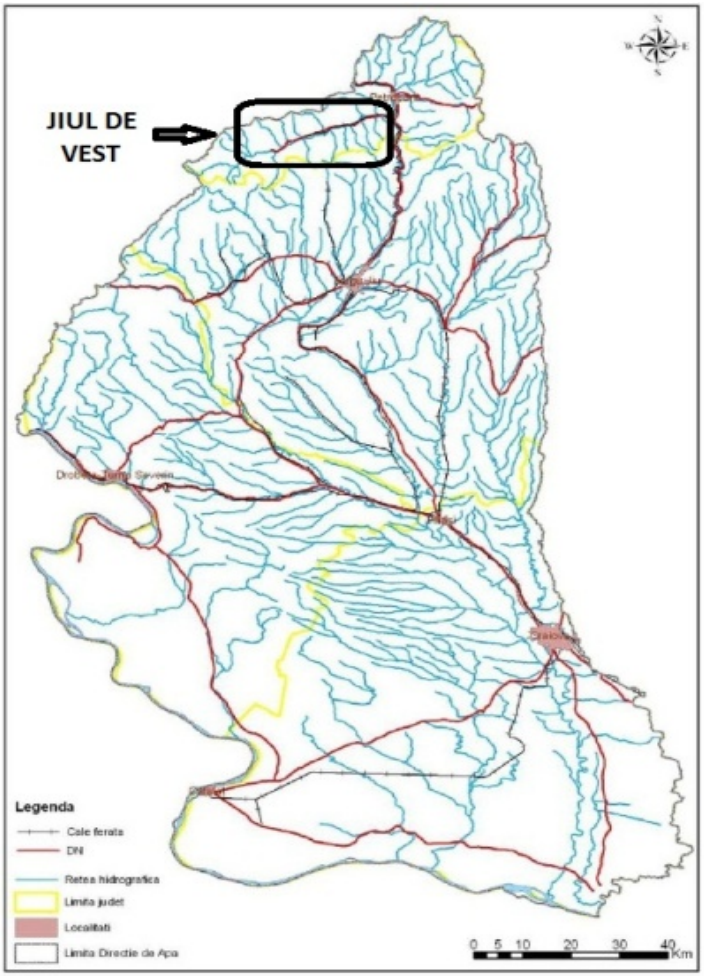

Figure 1. Basin of Jiu.

Hydrographic basin Jiu identifies 275 rivers with areas greater than 10 km2, 14 lakes and 12 lakes with an area exceeding 50 hectares.

Jiu is a 1st order tributary of the Danube and confluence at 692 km upstream of the mouth of the river into the Black Sea.

Jiu river has a length of 339 km, average slope 5 ‰, a convolution coefficient of 1.85 and a basin of 10,080 km^2. The hydrographic network totalling 3876 km. Flashy stream is 0,38km^2 being superior to the national average (0,33km^2) (Management Plan).

Formed by the union of two main tributaries: the West Jiu which comes from Retezatul Mic in step Cerna-Jiu, separating the basin Jiu River of Cerna, the upper reaches of the river is known as the River Cimpuselu and East Jiu what comes from the southern slopes of the mountains Surianu at altitudes around 1500 m. all this sector of West Jiu, Jiu East and their tributaries are having a mountain character with slopes between 30-18 ‰ and 120-25 ‰ Jiu for tributaries. This explains the general physiognomy of the valleys, characterized by narrow, deep V-shaped, lacking a major bed with large alluvial material (rocks, gravel, etc.) (Wikipedia).

RESULTS AND DISCUSSIONS

West Jiu river flows parallel to the ridge south of Retezat Mountain and north of the Mountain Vilcan and has a length of 51.4 km before of the confluence with the East Jiu.

To determine the degree of pollution of the West Jiu with suspended solids and for measuring the electrical conductivity of water, in order to verify that that the water samples were taken from the river of points: Campusel, Buta, Valea de Pesti, Mine Uricani, Tusu, Carolina, Rosia, Paroseni Thermal Power Plant, Danutoni and Coroesti (Figure. 2).

Figure 2. Location of sampling points

Using Pulfrich photometer (Figure 3) was analyzed the turbidity of samples, this method is based on measuring the luminous flux intensity weakening when passing through a liquid containing solid particles in suspension which is absorbed or released (Iuşan et al.,1981; Stanci, 1999).

Figure 3. Photometer Pulfrich

With the aid of the calibration graph of concentration versus absolute turbidity, we can determine the concentration of suspended solids in the samples, the results are shown in Table 1.

Water in nature contains, according to source various solutes. The conductivity in the case of aqueous solutions is influenced by the concentration of substances, which are used as the indicator of mineralization of water.

The conductivity is the property of the solutions to allow electric current to pass through them. The conductivity change when ions of different substances (salts, acids, bases) in contact with water. For rapid measurement of electrical conductivity we used conductivity meter GT12 (Figure 4) (Iuşan et al.,1981; Stanci, 1999).

Figure 4. Conductivity meter GT12

The working principle of this device is based on measuring the voltage across a pair of electrodes, well-defined geometrically, when introduced into the liquid under test. The results are shown in Table 1.

Table 1. The concentration of suspended solids and electrical conductivity of samples

Location of sampling points	Tr	T	Concentration (mg/l)	Conductivity (μS/cm)
Campusel	103,09	2,47	1,1	50
Buta	181,81	4,36	4,3	54
Baraj Valea de Pesti	188,68	4,54	4,5	68
Mina Uricani	526,32	12,63	19,0	72
Tusu	500,00	12,00	18,0	76
Carolina	666,67	16,00	25,1	85
Rosia	909,09	21,82	33,9	150
Baraj Paroseni	500,00	12,00	18,0	73
Uzina electrica Paroseni	625,00	15,00	23,4	90
Coroesti	666,67	16,00	25,1	97
Danutoni	714,28	17,14	27,3	98

CONCLUSIONS

Factors of pollution from the West Jiu river as it results from measurements are:
- Sewage of the cities located along the West Jiu (Uricani, Lupeni, Vulcan)
- Water discharged from Uricani Mine, Lupeni, Paroseni, Vulcan
- Paroseni Thermal Power Plant
- Preparation plant Coroesti
- Rosia river

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CONCEPT AND EXECUTION OF WATER SYSTEM IN ARBORETUM AREA

Vasile TIGANASU

Scientific Coordinators: Assoc. Prof. PhD Eng. Augustina TRONAC, Lect. PhD Eng. Tatiana OLINIC

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67, Email: vasile.tiganasu@gmail.com

Corresponding author email: vasile.tiganasu@gmail.com

Abstract

The water system from arboretum is part of a complex project of landscaping (improvement) into the University of Agronomical Sciences and Veterinary Medicine of Bucharest (UASVMB) campus area. The aim is to valorise the park by harmonizing the natural space with the anthropogenic one. The water system consists of two reservoirs at different levels. Those are connected by a channel with a trapezoidal section and a pipeline that transports the water from the downstream lake to the upstream lake using a pump for water recirculation*. The lack of natural water sources and the local soil high permeability imposed a waterproofing solution in order to reduce water loss. The channel path intersects an alley used by pedestrians and having auto traffic. For overpass it, there was built a bridge of reinforced concrete. The project in its entirety improves the landscape and social life of both students and employees of UASVMB and also of the people who visit the park for recreation.*

Key words: *imitate natural, hydraulic sizing, channel, sinuous and curved line, waterproofing*

INTRODUCTION

The water system in arboretum is part of a complex project of landscaping the UASVMB campus area whose basic idea is to value the garden by harmonizing the natural space with the anthropogenic one. It was thought to create a landscape setting that wants to imitate natural forms, the lines are sinuous and the chosen shape are irregular (Gedeus, 2016). Thus, it is found that the ensemble fits on the free technique of landscape composition.

Since the project is complex it was thought in stages, at the beginning the upstream lake already existed and it was functioning as a reservoir.

To build the water system it was necessary to design, construct, put into commission and monitoring in exploitation of the downstream lake and channel that mimics the natural course of a river, the connecting pipe and pump system, essential in obtaining a closed circuit.

MATERIALS AND METHODS

The work involves stages of design, construction and operation. The design required a hydraulic sizing of the channel and of the pipeline so that the circuit avoids to heighten the water level in the lake upstream in the case of a small water level in the channel, but also in the case of a excessive draining of the lake downstream, in the case of a massive pumping. Then the two routes of the constructions were established, the channel for aesthetic reasons and for the protection of vegetation, the pipeline trying to track the route with minimal length, but also preserving valuable elements of the arboretum. The hydraulic isolation solutions for the components are then defined as part of the final solution. The next phase is establishing the execution technology taking into account dimensions and the constructive solutions agreed upon, with supplementary constraints about the costs of execution or available materials.

It has been designed, staggered the proper execution by phases and time moments in correlation with resources and it is constantly

providing maintenance of water system components, depending of climate changes and operational conditions.

RESULTS AND DISCUSSIONS

The first stage of the work was to establish the channel route. The route was made based on topography and vegetation in the park in order to not change the existing landscape. Drawing the channel axis (riverbed line) was made in a sinuous and curved line so it would have a natural look; in the field that was made through pickets stuck in the ground. In every picket topographic measurements were made from the ground elevation for conducting longitudinal profile and establish the ground slope. Left and right of the channel axis, at distances of about 30 cm, were manually excavated two trenches with a depth of 10 cm, for delimitation of mechanized excavation area.

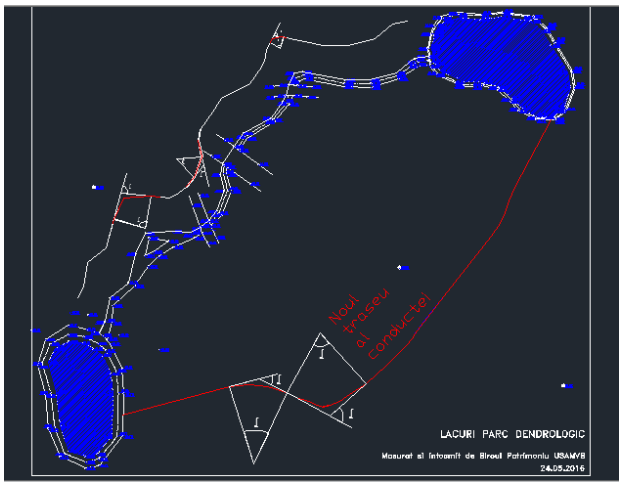

Figure 1. Water system plan view

For stage two, there were made calculations for the hydraulic sizing of the channel, of the pipe also and have determined the pumping plant characteristics.
The slope of the bottom channel is the ground slope.
It was imposed the channel bank to be covered in gravel and to have 1:2 slope for stability reasons relating to the ground put above the sealing layer.
The value of the upper limit of the speed of water flow in channels lined with gravel is 0.9 m/s.

Figure 2.Channel axis – execution stage

The channel section was chosen to be trapezoidal, with the bottom base of 50 cm, slope on the bank of ditch 1:2 and height of water column 10 cm in the channel, to which it is added a safety height of 15 cm.

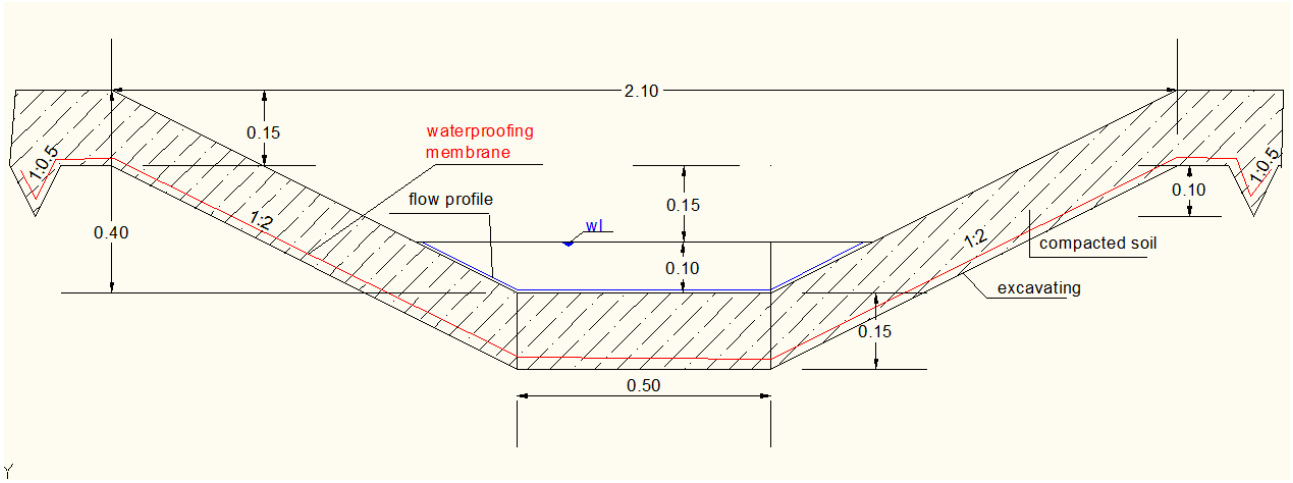

Figure 3.Typical main cross section of the channel

On the channel route, for avoiding a tree, there was designed a channel split in two branches, also with trapezoidal section, each with the bottom base of 25 cm and slope on the bank of ditch 1:1, so that the sum of that 2 sections area to be equal with the main section area.

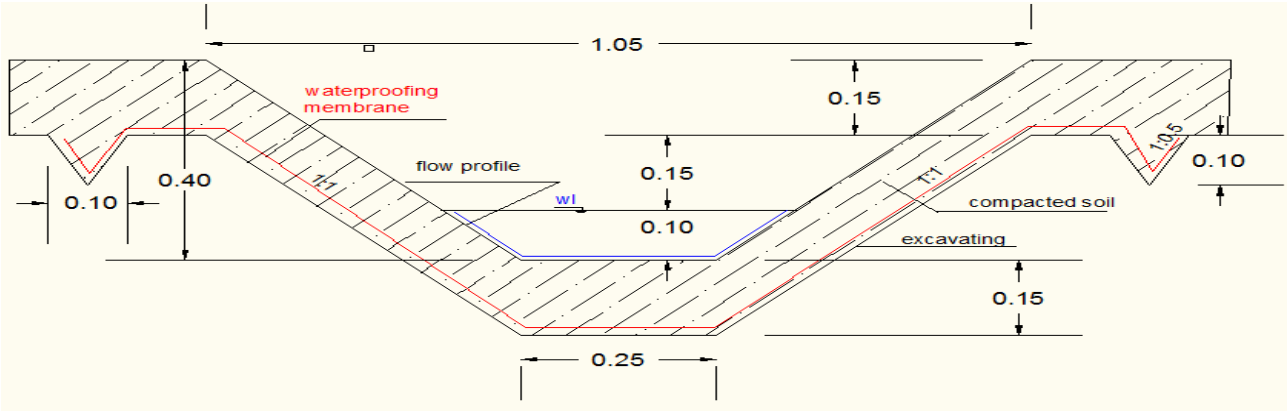

Figure 4.Typical cross section of the branch channel

The water speed was calculated using the Chezy formula that describes the flow movement in open channel:

$v=C\sqrt{R*i}$

where:

v- flow velocity

C- Chezy coefficient, C= (1/n)*R0.16

R- hydraulic radius

n- Manning's roughness coefficient

i- bottom slope

The water flow was calculated using the equation:

$Q = \dot{\omega} * v$

where:

$\dot{\omega}$= cross-sectional area of flow.

The calculations were conducted as in Table 1.

For the pipeline route it was chosen the minimum distance between the lakes, so they do not disturb protected areas of the park. Sizing calculations for the pumping system were made for 100 m of HDPE pipe length with diameter of 90 mm, buried at 1.5 m depth and accessories mounted on the network (bends, valve, connection elements). In calculation it is used Altchul formula for determination of the friction loss factor:

$\lambda=0.11*(De/D)^{0.25}]$

where:

λ- friction loss factor

De- relative roughness

D- pipe diameter

For friction losses it is used Darcy-Weissbach equation:

$h_d= \lambda*(L*v^2)/(D*2*g)$

where:

h_d- friction losses

L-pipe length.

v- velocity

g- acceleration of gravity

For local losses it is used the general formula:

hl = ζ*v2/(2*g), where

ζ- local loss coefficient

v- velocity at the section exit point

g- gravitational acceleration

It is used a pump of 25 m3/h and discharge head of 10 m water column, already existing. The calculations for friction loss and local losses were conducted as in Table 2 and Table.3.

The total head loss (discharge head) it is resulting as a sum of the friction losses, local losses and level difference between pump enter in point and exit pipe point (Mocanu, 2015):

Ht=hd+hl+hg

where:

Ht – pumping head

Hg - level difference

Level difference is about 1.50 m.

The second row concerns the actual situation, due to the fact that the pump equipment,

already existing, has the following characteristics: Hp = 10 m, Qp = 25 m3/h.

Table 1. Hydraulic sizing of channel cross section

	Water height h(m)	Water slope i	Cross section slope m	Channel base b(m)	Water area ώ(m2)	Water perimeter P(m)	Hydraulic radius R	Chezy coefficientC	Water velocity v(m/s)	Water flow Q	
										(m3/s)	(m3/h)
channel	0.1	0.0032	2	0.5	0.045	0.947	0.048	15.045	0.186	0.008	28.88
branches	0.1	0.0032	1	0.25	0.0225	0.533	0.042	14.753	0.171	0.004	13.89

Table 2.Calculations of friction loss

Qchannel=Qpipe		Flow velocity v(m/s)	Flow area ώ(m2)	Pipe diameter D(m)	Relative roughness De	Reynolds number Re	Friction loss factor λ	Pipe lenght l(m)	Friction losses hd(m)	Comment (Qpump = 25 m3/h)
(mc/s)	(m3/h)									
0.008	28.8	1.258158	0.006359	0.09	0.007	112113	0.0582	100	5.22	Qpipe>Qpump
0.0069	24.84	1.085162	0.006359	0.09	0.007	96698	0.0582	100	3.88	Qpipe≈Qpump

Table 3.Calculations of local loss

	α	R(m)	v(m/s)	l(m)	De	λ	ζ90	ζ	hl(m)
curve 1	45	10.12	0.15	7.9442	0.007	0.058	0.88	0.74454	0.00085
curve 2	70	11.87	0.15	14.495	0.007	0.058	1.02	0.79246	0.00091
hl(bend1)	90		0.15		0.007			0.15	0.00017
hl(bend2	90		0.15		0.007			0.15	0.00017
hl(valve)			0.15		0.007			1.7	0.002
hl(divider)			0.15		0.007			2	0.002
hl(exit)			0.15		0.007			1	0.001
								Σhl	0.047

The discharge head of the pump resulted Ht= 5.427 m.

The lack of silt from the two lakes and a regular maintenance allows operation system in optimal conditions.

Stage three consisted in excavation for the channel and trench for the water recycling pipe and was made mechanized and manually.

Channel excavation section is greater than the determination of the hydraulic section, as is required by the waterproofing solution. (Figures .3-4).

Mechanized excavation was done at the depth calculated in stage two, depth to which were added 15 cm, meaning layer of soil that coated the waterproofing membrane.

Manual excavation was carried out to achieve the required slope on the bank of ditch, having slope of 1:2, and for the execution of the trench in which was embedded the waterproofing membrane. The embedded trench had a triangular section with a depth of 15 cm and a slope of 2:1.

For an easier way to work on arranging the riverbed it is recommend using a trapezoidal frame with the desired dimensions to be made.

For the recycling pipe was excavated a trench with the width of 30 cm and depth of 1.5 m and a pit with a unit square section and width of 1.50 m, where was mounted an inspection chamber. The inspection chamber is from polyethylene with a circular section, radius of 1.00 m, and height of 1.20 m. Inside it was fitted a butterfly valve and a divider device.

Figure 5. View within the mechanised excavation stage

Figure 6. View within bank of ditch arrangement

For the bridge abutment there were dug manually two tranches of 1.00 m depth, 0.30 m width and 3.20 m length.

Figure 7. Bridge abutment tranche - view

There were used two types of materials: polyethylene film and bentonitic geocomposite. The polyethylene film was placed first and over it there was laid the bentonitic geocomposite.

The settlement of the waterproofing system in the trench channel was made by placing the pieces upstream over downstream ones on a length of 30 cm. The width of the two materials was cut so that it covers 90% of the embedment trench. At the exit point of upstream reservoir, the channel waterproofing membrane was placed 70 cm under the lake waterproofing; at the discharge point into the downstream reservoir the channel waterproofing membrane was placed 70 cm over the lake waterproofing.
For step Four, the waterproofing membrane was mounted and coated with a layer of soil.
After the membrane was placed there was put over a layer of soil, which has reached a thickness of 15-20 cm after compaction. It was used the soil obtained from channel excavation and a borrow pit. For compaction, after laboratory tests conducted before execution stage (Proctor test), it was determined that the soil needed to be moistened. Laboratory tests are intended to simulate the field process and to indicate the most appropriate compaction moisture for achieving the maximum dry density for soil (Ivasuc, 2012). The calculations were conducted and are present in Table 4.

Table 4.The optimum moisture content

Optimal water content	%	17
Maximum Dry density	g/cm^3	1.7

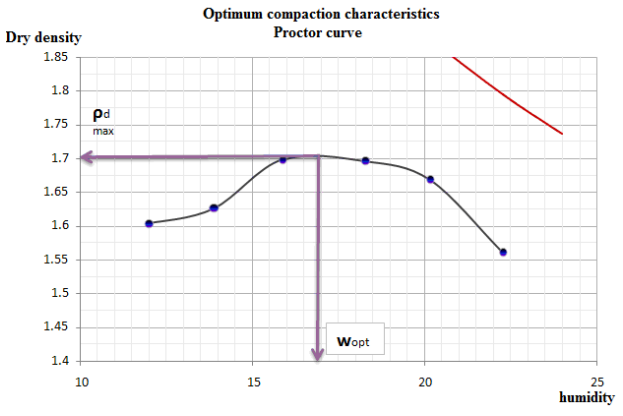

Figure 8.Proctor curve

Compaction was done with a compactor plate, first on the shoulders slope, to embed the hydro isolation, after that, the trench floor and finally it was compacted the slope soil. At the end, it was placed a layer of gravel with thickness of 4 -5 cm, sort 16/31.

Figure 9. View of soil ready for compaction

Figure 10. Channel sector finished - view

In step Five, since the water intersected the main alley of the park, alley used both by pedestrians and the machinery of the administration of the park, the project required the construction of a reinforced concrete bridge in length of 4.00 m.
The concrete use was Bc 30.
The concrete placement was performed continuously and thus obtaining a monolithic structure supported on two abutments with a small elevation.

Figure 11. Preparing for concrete placement - view

Figure 12. View of concrete placement

CONCLUSIONS

UASVMB campus would like to have the title of "greatest campus in Romania", so it benefits from a complex landscaping project.
Staging of the project has led to sequential water system works and adopting solutions used less.
It was conceived a river stream to humanize the surrounding place, leading to an idyllic area with a minimum financial effort and maximum aesthetic effect.
It was obtained a meandering stream with variable flow sections. The project did not disturb the existing vegetation in the park and creates the impression of naturalness.
The technical solution based on engineering dimensioning and appropriate technologies accompanied by the need to protect existing vegetation valuable, lead to a development scheme that improves the quality of life of students and employees of UASVMB and also generates a major recreational context which attracts visitors of all ages any time of day or of year.

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CHILLED BEAMS AS A SOLUTION TO ACHIVE INTERIOR MICROCLIMATE FOR AN OFFICE BUILDING

Ciprian VATASESCU

Scientific Coordinator: Assoc. Prof. PhD Eng. Augustina TRONAC

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67, Email: ciprianvatasescu@yahoo.com

Corresponding author email: ciprianvatasescu@yahoo.com

Abstract

Bucharest is Romania's capital,and in the north of this town from Romania it is a place located in Baneasa and on this surface it is intended to be built a construction having offices and administrative offices destination. Ensable wich make the object of study consists of two buildings and I decide that the cooling beams are a very good solution for air conditioning because they perform two functions : heating and cooling. These cooling beams are two types : active beam and passive beam.Both of them are very useful,but the difference between them is this one : For passive chilled beams, the heat transfer is done by radiation and convection, while in case of active chilled beams, heat transfer is enhanced because of recirculated air that is driven within the phenomenon of induction by introducing fresh air via a heat exchanger.

***Key words**: cooling beams,heat transfer ,radiation, convection ,recirculated air, heat exchanger, active beams, passive beams.*

INTRODUCTION

Bucharest is Romania's capital, a city with a population of 2,106,144 residents in 2016 according to the National Statistics Institute. (INS, 2016)
It is intended that on a surface located in Baneasa area to be built a construction having offices and administrative offices destination, and it heating-cooling system to be adopted in a version that fully use the existing potential in the site.
Starting from the geological and hydrogeological context of north Bucharest area, where lithology and aquifer layering are favourable, it was analyseda solution for using of geothermal well to support the needs of the heating-cooling system for office building to be designed, I proposed the constructive solution based on cooling beams.

MATERIALS AND METHODS

Ensemble which make the object of study consists of two buildings:first of them has a height B + GF + 6F + Ftehand it is a building with mixed functions (offices, halls for meetings, etc.), and the second building has regime of height GF + 4F and has the function of shopping complex at the ground floor and office space eventually used in operating leasing regime to a third party (BAU, 2014).
General heating-cooling system will consist of 78 geothermal wells, 98.25 m depth each, connected to a heat pump, ground has an output of 240 kW and will produce heat temperature to 450C for tour circuit (Tt) and for return circuit the temperature will be of 350C.
The heating source that will be designed, will consist of three wallboilers, one ground-water heating pump and a chiller that works only for water coolers.
Nominal thermal power of each boiler will be 150 kW and produces a heat value of 550C to 350C for tour circuit and return circuit. The boilers are equipped with modulating burners (burners where the flame is constantly changing his geometry, making it possible to maintain the temperature or pressure parameter with a certain precision, adjustable around a preset value).
For water-cooled air conditioning system it will be provided the following: an aggregate of air cooled condenser which produces chilled water

and a ground-water heatingpump (located in theadministrative space in the basement) equipped with vertical wells.
Ground-water heating pump is equipped with vertical geothermal wells and has a capacity of358 kW heating and cooling capacity is 418 kW. For the same purpose, it will be used a chiller equipped with a cooling water condenser. This chiller has a cooling capacity of 600 kW.
To obtain thermal comfort conditions, it was designed a heating system based on beam cooling; the facility is made up of four main pipes.
The operating principle of cooling beams is as follows (Figure 1):
1.Primary air (outdoor air dehumidificated) into supply air supply chamber
2.Primary air is supplied through small nozzles.
3.Primary induces room air supply air to be re-circulated through the heat exchanger of the chilled beam.
4.Re room-circulated air and the primary air is mixed prior to diffusion in the space
5.Cold water connection.
6.Warm water connection.

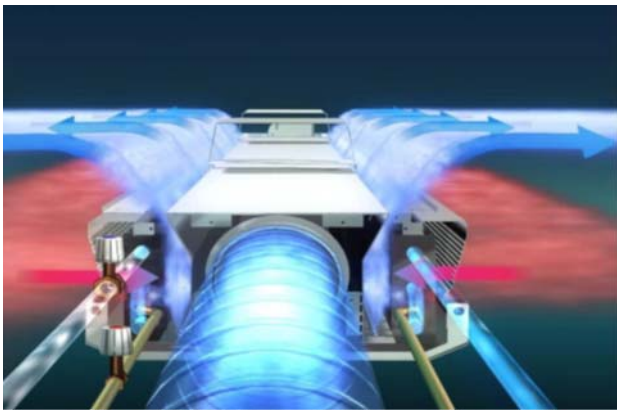

Figure. 1 Operation principle of cooling beams (Virta et al, 2006)

For passive chilled beams, the heat transfer is done by radiation and convection, while in case of active chilled beams; heat transfer is enhanced because of recirculated air that is driven within the phenomenon of induction by introducing fresh air via a heat exchanger. The difference between active and passive beams is evidenced in Figures 2 and 3.

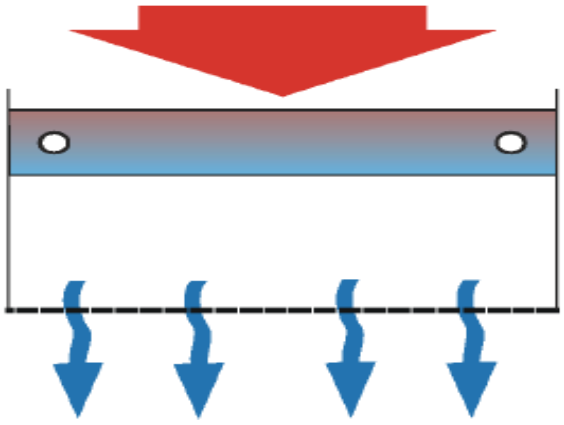

Figure 2. Passive beam (Virta et al., 2006)

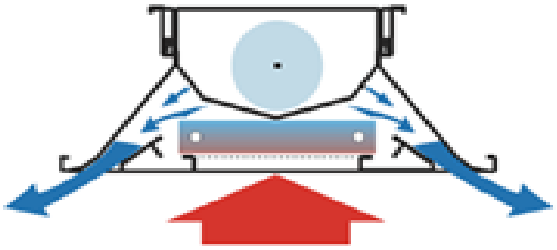

Figure 3. Active beam (Virta et al. 2006)

RESULTS AND DISCUSSIONS

For system sizing, it is required the calculation of heat loss calculation based on which it will be establishes the heating-cooling system configuration.
Heat loss calculation was done according to STAS 1907/1-2014 (ASRO, 2014), based on the following assumptions: the internal temperature for offices is of 150C, for meeting rooms, toilets are of 220C, for kitchen is of 180C, for technical areas is of 150C, and relative humidity is uncontrolled.
The relationship calculation is applied for each floor:

$Q=QT + 1(\frac{\sum A}{100} + Q) + Qi$, where:

QT– the low of heat lost through the construction elements
Qi– the flow of heat needed for heating the incoming cold air in the room
A – additions to heat loss through transmission.

QT = Qe+ Qp,where:

Qe– heat losst hrough building elements that separate two identical environments but with different thermal potential.
Qp– heat loss through building elements in direct contact with the ground.

Qi= max (Qinfiltration, Qventilation) + Qdoor ,where:

Qi – needed heat to heating coming cold air into the room
Qinfiltrations,ventilation– heat flow for heating cold air entered the room through infiltration / ventilation
Qdoor– the flow of heat to cold air warming entered the buildings through open doors.
For example, for the 1st floor of the building it results:

Table 1. Calculation of heatloss for determination of heatingneed for the 1 st floor

Name of room	Ti	QR	Qp
	[°C]	[W]	[W/mp]
E1.01- Hall	24	4.726	71
E1.02-Open space	24	12.013	60
E1.05-Server	20	1.636	334
E1.06- Kitchenette	24	3.503	141
E1.07-Open space	24	20.893	68
E1.19-Extention	24	12.013	60
E1.20- Kitchenette	24	2,762	173
E1.09- Hall	24	4.670	35
E1.12- Meetings room	24	2.082	74
E1.13-Oficiu	24	1.220	165
E1.14- Meetings room	24	3.468	136
E1.15- Meetings room	24	2.704	90
E1.16- Meetings room	24	3.264	104
E1.17- Meetings room	24	4.764	119
E1.18- Meetings room	24	3.783	126
E1.19- Meetings room	24	2.777	161
Σ S + P +6		57547	
Σ P+4		28.732	
ΣTOTAL		86.278	

Heat dissipation and contributions were calculated in accordance with STAS 6648/1 (ASRO 2014) based on the following assumptions: outside temperature of about 36^0C, inside temperature for offices and meeting rooms of about 24^0C, relative humidity is uncontrolled.
Heat dissipation and contributions were calculated in accordance with STAS 6648/1 (ASRO, 2014) and include: consideration of heat throught the window type inertial elements, input elements of heat through walls inertial type, terrace, input heat from neighboring rooms unconditioned, releases heat from electrical lamps and releases heat from occupants.
For example, for the 1st floor of the building it will result:

Table 2. Calculation of releases and incoming heat for determination of heating need for the 1st floor

Denumireincapere	Ti	QR	qR
	[°C]	[W]	[W/mp]
E1.01- Hall	24	4.726	71
E1.02-Open space	24	12.013	60
E1.05-Server	20	1.636	334
E1.06-Kitchenette	24	3.503	141
E1.07-Open space	24	20.893	68
E1.19-Extention	24	12.013	60
E1.20-Kitchenette	24	2,762	173
E1.09- Hall	24	4.670	35
E1.12- Meetings room	24	2.082	74
E1.13- Office	24	1.220	165
E1.14-Meetings room	24	3.468	136
E1.15-Meetings room	24	2.704	90
E1.16-Meetings room	24	3.264	104
E1.17-Meetings room	24	4.764	119
E1.18-Meetings room	24	3.783	126
E1.19-Meetings room	24	2.777	161
Σ S+P+6		57547	
Σ P+4		28.732	
ΣTOTAL		86.278	

Based on these analytical determinations for the 1st floor, which was taken as an example calculation, I chose to use six variants beams induction type DISA cooling, 4 pipes each, as follows:

Table 3. Summarizing table of heating-cooling beam bodies used

No	Cooling beam	No	Oi	OR
	[mm]	-	[W]	[W]
1	1800x300	6	1049	467
2	1800x600	14	1977	1018
3	2100x600	4	2440	1189
4	2400x600	3	3009	1407
5	3000x300	16	1270	527
6	3000x600	36	3139	1439
ΣTOTAL		79	186.083	86.287

Basically, choosing the total number of bodies and their power is imposed by the cooling function, the heating function becoming more oversized. But there is the possibility of using

graded to this option, in accordance with the comfort desired.
All these beams are equipped with condensation sensors and are ceiling mounted.

CONCLUSIONS

The buildings require an interior microclimate, according to the main destination. It includes heating, cooling interiors spaces for each season separately.
Solving solutions are multiple, the consumption varying accordingly.
One of the most modern solutions is the use of so-called cooling beams which have a double function (heating-cooling), which is accompanied by benefits related to:
-comfortable indoor climate conditions (desired air temperature, low room air velocity, low noise in operation)
-economical life cycle (competitive investment cost savings in running cost, limited maintenance requirement, easy to use with free / low energy systems)
-hygienic solution (dry coil operation, no drains or filters, openable construction for easy serviceability and cleaning).

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MONITORING OF HEAVY METAL FROM SOILS ON THE INDUSTRIAL PLATFORM FROM BUCHAREST, ROMANIA

Luciana-Marilena VRANCUTA[1], Gabriela VASILE[2]

Scientific Coordinator: Prof. PhD Eng. Sevastel MIRCEA[1]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67
[2]National Research and Development Institute for Industrial Ecology, 71-73 Drumul Podu Dambovitei Street, 060652, Bucharest, Romania, Phone: +4031.805.22.22; +4021.410.03.77/125

Corresponding author email: lucpoptrade@yahoo.com, anandagabi@yahoo.com

Abstract

The aim of this study was to determine the content of heavy metal from different profile of soil from the industrial platform situated in the southern part of Bucharest, in order to identify the risk of contamination with his chemical element in this area. Samples (0-0.05 and 0.20-0.025 m depth) were taken directly from four points situated in the proximity of some of the Bucharestrepresentative industrial centres with anonferrousactivity (manufacture of basic iron and steel and of ferrous-alloys; manufacture of basic precious and other non-ferrous metals), as required by law.All analyses were performed in the Pollution Control Department, Water, Soil, Wastes Pollution Control Laboratory from National Research and Development Institute for Industrial Ecology, Bucharest, Romania, in accreditation system according to (SR EN ISO 17025/2005) referential standard.
The results display that there is a constant risk of contamination with the following heavy metals: Nickel (all four locations) and Lead, Copper, Chromium (total) and Zinc (in at least three locations).

Key words: heavy metal, contamination, industrial platform, Bucharest.

INTRODUCTION

One of the chemical elements which represent a risk of soil contamination is those which make part from the group of heavy metals.
The term contamination is different from pollution and implies that the concentration of heavy metal is higher than would naturally occur, but does not necessarily mean that the chemical element is causing any harm. Polluted also refers to a situation in which the concentration of a heavy metal is higher than would naturally occur but also indicates that the substance is causing harm of some type. Therefore a soil could be contaminated but not polluted. The source of heavy metal comesfrom both the natural environment (there are occasionally sourceswho don´t cause pollution) and especially from anthropogenic activities (e.g. industrial field).
Intensive human activities have resulted in over-accumulation of heavy metals in soilscausing environmental pollution (Luo et al., 2009).
Over the last few decades, the anthropogenic inputs of several heavy metals into soils have exceeded the natural heavy metal components of the Earth´s crust (Facchinelli et. al., 2001). Facchinelli et al. (2001) analyzed the effects of anthropogenic and natural influences on the heavy metal concentrations of cultivated soils in the Piedmont (northwest Italy) using multivariate statistic and geostatistical approaches. They found that the Cr, Co and Ni concentrations were mainly controlled by the parent rocks, whereas Cu together with Zn and Pb alone were controlled by anthropogenic activities.
Other authors revealed that the As and Ni concentrations in the topsoil mainly originated from the soil parent materials and the Cd, Zn, Cu, Pb and Cr concentrations largely originated from anthropogenic sources (Hu and Cheng, 2013).Soil heavy metal concentrations are dynamic; they are in a state of change with a variety of natural and anthropogenic sources (or"input pathways"), as well as output pathways (Xia et.al., 2014).

Among the various anthropogenic sources we can include the following activities: current and/or historical industrialization, urbanism and intensive chemical use in agriculture.

In agricultural soils, the accumulation of heavy metals is a growing public concern because it threatens environmental health; elevated heavy metal uptake by crops may also affect food quality and security (Harmanescu et al., 2011; Wu et al., 2015).Heavy metals can be accumulated in agricultural soils from industrial emissions, disposal of high metal wastes and sewage sludge and agricultural sources, such as livestock manure, inorganic fertilizers, agrochemicals, pesticides (Hu and Cheng, 2013; Khan et al., 2008; Mohammed et al., 2011).

Considering that soil is animmense „crucible"/melting pot that brings together in timeubiquitous heavy metals, their accumulation in soils is now one of the issues that concern public opinion because it is the main cause of diseases. According to the Center for Disease Control (CDC) the USA incidence of autism spectrum disorders rose 2.2 timesin the year 2010 compared to 2000 (Wingate et.al., 2014).

In the UK a five-fold increase in autism in the 1990ˈs, reached a plateau in the 2000ˈs up to 2010 (Taylor et al., 2013). One of the important causes of this increase is environmental influence, including many candidates. Many chemical classes or specific chemicals related to autism have been reviewed by Rossignol or Sealey and C.J. Carter or R.A. Blizard (Rossignol et.al. 2014; Sealey et. al., 2016). The first two of them are pesticides and heavy metals (cadmium, lead, arsenic, manganese, or mercury). Soil heavy metal pollution has become an important environmental issue (Tchounwou et al., 2012). Therefore, an important prerequisite in the control and remediation of heavy metal contaminated soils is to determine the source of contamination (Lin et al., 2010; Zhang et al., 2009b).

In Romania, there are four important laws which define the legal frame regarding soil pollution (OM 756/1997, OM 184/1997, HG 1403/2007 and HG 1408/2007). Our country, as an EU Member State, has implemented national Pollutant Release and Transfer Register establishing the European Pollutant Release and Transfer Register (Regulation E-PRTR). This institutes a register of emissions and transfers of pollutants at Community level (hereinafter "the European PRTR/E-PRTR) as a publicly accessible electronic database in order to let them the opportunity to participate at the environmental decision making and help prevent and reduce environmental pollution.

E-PRTR covers 28 EU Member States, Iceland, Liechtenstein, Norway, Serbia and Switzerland; contains annual data reported by more than 30,000 industrial facilities and refers to 91 pollutants falling under seven groupswhich includes heavy metals.One type of data to be reported annually by each industrial facility for which the applicable thresholds are exceeded are the releases to air, water and land of any of the 91 E-PRTR pollutants.

The E-PRTR data for Bucharest-Ilfov and for industrial activity revealed that this area didn´t have soil pollution with heavy metal, in the period 2007-2014. On the other side, the E-PRTR provides data regarding the pollution with heavy metals in water and air (Table 1).

Table 1.E-PRTRdata regarding the pollution with heavy metals in water and air

Year	Sector of activity	Types of pollutions with heavy metal (Kg)	
		air	Water
2014	waste and waste water management	-	Cr (360), Cu (460), Ni (1270)
2013	production and processing of metals	-	Cr (128)
	waste and waste water management	-	Cr (269), Cu (209), Ni (1070)
2012	energy	Cd (11.4), Hg (12)	-
2011	energy	Cd (31.2), Hg (31.9)	-
2010	energy	Cd (46), Hg (48)	-
2009	energy	Cd (94.6), Hg (96.7)	-
2008	energy	Cd (31.3), Hg (32.3)	-
2007	energy	Cd (73), Hg (76)	-

In the period 2013-2014, the sources of pollution water with heavy metals were the sectors of waste and waste water management and the production and processing of metals.

The largest amount of heavy metal that polluted water was: Nickel (2340 Kg), Copper (669) and Chromium (629).

MATERIALS AND METHODS

This study was conducted in the industrial platform situated in the southern part of Bucharest, the capital of Romania (Figure 1). The main industries in the area include manufacture of basic iron and steel and of ferrous-alloys and manufacture of basic precious and other non-ferrous metals.
The industrial complex has developedits activity since 60´s.

Figure 1. The location of study area

The samples were taken in a plain area, from four locations where there are potential sources of heavy metal (Table 2).

Table 2. Details of sampling points

Locations	Point Number	Coordinates	The smell of the probe	Depth (m)	Presence/ absent of groundwater
1.	1-1	44.35°N 26.14°E	no smell	0-0,05	absent
	1-2		no smell	0,20-0,25	absent
2.	2´-1	44.35°N 26.15°E	no smell	0-0,05	absent
	2´-2		no smell	0,20-0,25	absent
3.	3´-1	44.36°N 26.14°E	No smell	0-0,05	absent
	3´-2		No smell	0,20-0,25	absent
4.	4´-1	44.36°N 26.14°E	No smell	0-0,05	absent
	4´-2		No smell	0,20-0,25	absent

We analysed an area of about 1000 square meters and in order to know the actual quality of soil we sampled eight soil profiles (0-0.05 and 0.20-0.25 m) - one soil sample was collected from each layer of the profile of soil (fig. 2).

Figure 2. Locations of samples in the industrial platform

The first two locations of the samples were collected directly from the industrial platform (fig 3) and another two samples from the proximity of the Nonferrous Centre (fig. 4).

Figure 3. Picture of the first two locations

Figure 4. Picture of the second two locations

Sample preparation

All eight soil samples were air-dried at room temperature (24 hours), crushed and retained

the particle dimensions less than 150 μm. Around two grams of sample were dissolved in aqua regia (a mixture of suprapure acids HCI 30% and HNO3 65% in the ratio 21 to 7 mL). The mixture was mineralized on sand bath until complete dissolution.
After cooling, the samples were filtered on paper filter (porosity less than 45 μm) in a 50 mL volumetric flask and filled with ultrapure water.
The heavy metal content in the samples was determined by inductively coupled plasma optical emission spectrometry.
A calibration curve in the range of 0.5-2.5 mg/L (Arsenic/As, Cadmium/Cd, Chromium/Cr, Copper/Cu, Manganese/Mn, Molybdenum/Mo, Nickel/Ni, Lead/Pb and Zinc/Zn) was performed using a Certified Reference Material solution (100 mg/L Multi Element Standard Solution, Certipur, Merck).
The quality control of the data was carried out according to Quality Control Standards 21A, 100mg/L, produced by PerkinElmer.
A reagent blank in order to estimate the metal contents from acids was prepared.
All analyses were performed in the Pollution Control Department, Water, Soil, Wastes Pollution Control Laboratory from National Research and Development Institute for Industrial Ecology, Bucharest, Romania, in accreditation system according to (SR EN ISO 17025/2005) referential standard.

Equipment

Analytical technique used for determination of Arsenic/As, Cadmium/Cd, Chromium/Cr, Copper/Cu, Manganese/Mn, Molybdenum/Mo, Nickel/Ni, Lead/Pb and Zinc/Zn from soil samples was inductively coupled plasma optical emission spectrometry performed using a Perkin Elmer Optima 5300 DV ICPEOS Spectrometer.
All the chemicals were of analytical reagent grade (Merck quality).

Figure 5. Picture of Perkin Elmer Optima 5300 DV ICPEOS Spectrometer

RESULTS AND DISCUSSIONS

For an actualand accurate review of the risk of contamination with heavy metalsfrom one of the industrial platform from Bucharest, we selected four points from this area.
Therefore we calculated the values of concentrations ofsome heavy metal from two profile of soil(0-0.05 and0.20-0.25 m) and compared it with references value,accordingtoRomanian law(Table 3).
Also, we analysed the variation of pH values sampled from those four locations and two profile of soil. We determined that pH are weakbasic, values are ranging between 7,3-7,7 (Table 3).
The Arsenic/As contentwas over the normal value from the samples soils where we had a pH at 7.3-7.4. We can appreciate that in theindustrial area (location one and two) we have a risk of soil contamination with Arsenic, especially in the soils profiles from the surface (0-0.05 m depth).
The Cadmium /Cd content exceeded normal value in soil samplesfrom location number three situated in the proximity of industrial platform. Therefore, we identified that there is a risk of soil contamination with Cadmium. Also, the content of Cd exceeded in samples belonging to first location (0.05 m depth).
The Cobalt/Co and Chromium (VI) contents from all soil samples were below normal values of heavy metal under the Romanian law.
The Chromium/Cr (Total) andCopper/Cu contents were over normal value in soil samples from the industrial platform (location 1, 2 and 3). Therefore, there is a risk of soil

contamination with Chromium (total) and Copper.
The manganese/Mn and Molybden/Mo contents were over normal value in soil sample where we had a pH at 7.3.In those two locations there is a risk of contamination with this heavy metals.
The Molybden/Mo content was at alert levels in the soils samples from the fourth location (0-0.05 m depth).
The Nickel/Ni content exceeded normal value in all soil samples from industrial platform and therefore, there is a risk of contamination with this heavy metal.
The Lead/Pb content was at alert levels in the soil sample from the first location (at 0-0.05 m depth). Also, it exceeded the normal values in soil from three locations fromindustrial platform and therefore represents a risk of contamination.
The Zinc/Zn content was over the normal value in the soil samples from three locations from industrial platform (at 0-0.05 m depth) where there is a risk of contamination with this heavy metal.

Table 3. The heavy metals content from soil samples and pH value

Soil Profile	The chemical element – Heavy metal											pH
	Arsenic (As)	Cadmium (Cd)	Cobalt (Co)	Chromium (Cr)		Copper (Cu)	Manganese (Mn)	Molybdenum (Mo)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	
				Total	Cr (VI)							
	Mg kg^{-1} dm (dry matter)											
Location 1.												
1-1	6.06	1.38	12.8	90.1	<0.5*	61.2	1019	13.9	70.0	449	345	7.3
1-2	5.91	0.30	11.7	41.6	<0.5	22.9	707	1.97	36.9	22.8	56.6	7.4
Location 2.												
2'-1	5.38	0.98	11.9	112	<0.5	50.8	1078	3.94	47.8	44.9	207	7.3
2'-2	3.54	0.45	11.9	245	<0.5	39.2	853	1.69	42.6	35.3	86.3	7.7
Location 3.												
3'-1	4.07	1.23	8.82	37.7	<0.5	54.1	649	<0.03	31.1	181	180	7.7
3'-2	4.26	1.07	7.71	49.9	<0.5	51.9	582	0.57	30.1	218	208	7.5
Location 4.												
4'-1	1.44	0.14	4.27	29.3	<0.5	12.6	207	15.0	83.6	13.8	45.8	7.7
4'-2	2.96	0.26	5.60	17.3	<0.5	27.1	309	0.20	21.4	20.7	78.6	7.5

*Quantification limit of the applied analytical method

Color legend for soils less sensible (industrial area) according to MO756/1997

Color / Heavy Metal	Arsenic (As)	Cadmium (Cd)	Cobalt (Co)	Chromium (Cr)		Copper (Cu)	Manganese (Mn)	Molybdenum (Mo)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)
				Total	Cr (VI)						
Normal values (Mg kg^{-1} dm (dry matter)	5	1	15	30	1	20	900	2	20	20	100
Over normal Values (Mg kg^{-1} dm (dry matter)	5<x<25	1<x<5	15<x<100	30<x<300	1<x<10	20<x<250	900<x<2000	2<x<15	20<x<200	20<x<250	100<x<700
Alert thresholds (Mg kg^{-1} dm (dry matter)	25	5	100	300	10	250	2000	15	200	250	700
Action levels (Mg kg^{-1} dm (dry matter)	50	10	250	600	20	500	4000	40	500	1000	1500

CONCLUSIONS

After the determination of the content of heavy metal in soils samples from an industrial area we highlight the following:

- in all four locations of the industrial platform there is a constant risk of contamination of the soil with Ni. This result confirms the E-PRTR data for Bucharest-Ilfov which revealed that, in 2013-2014, the largest amount of heavy metal that polluted water was Nickel (2340 Kg). The source of this pollution was the sector of waste and waste water management which represent one of the actual and important cause of contamination of soil;
- in addition, in three locations of the industrial platform there is another constant risk of contamination of the soil with Pb, Cu, Cr (total), and Zn. The risk of contamination with Cu and Cr confirm the E-PRTR data for Bucharest-Ilfov which revealed that, in 2013-2014, two of the heavy metals that polluted water were Copper (669 Kg) and Chromium (629Kg). Thesource of the pollution with Cr was the sector ofproduction and processing of metals which is on the industrial platform that we studied. In addition to E-PRTR data we discovered in soil two new heavy metal: (Pb and Zn).

It is possible that the content of Cr, Co and Ni were mainly controlled by the parent rocks, whereas Cu together with Zn and Pb alone were controlled by anthropogenic activities.

- the pH value (7.3) determined the contamination of soil from location 1 and 2 with As, Mn and Mo;
- the more contaminated soils with heavy metals, especially Pb were in the location 1 which is in the proximity of agricultural soil (e.g. greenhouse);
- a certain situation which occurred is a high degree contamination of soil possibly because there is a particular source of pollution with the Pb (locations 1) and Mo (location 4).

With this actual data about the content of Ni, Cr, Cu, Pb, Zn, As, Mn and Mo in soil from industrial platform from the southern part of Bucharest I hope to prevent the pollution of soil with heavy metals, accordingly to the EU principle"it is better to prevent than to mend after".

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COST OF RECYCLING IN ZONGULDAK CITY CENTRE

Özgür ZEYDAN, Furkan ÇELEBİ, Betül AYDIN

Bülent Ecevit University, Department of Environmental Engineering, Farabi Campus, 67100, Zonguldak, Turkey, Phone: +90.372.291.15.62, Fax: +90.372.257.40.23

Corresponding author email: ozgurzeydan@yahoo.com

Abstract

Solid Waste Management (SWM) has becoming a great problem for urban areas. Although directly transferring waste to landfill are is the cheapest solution, it is difficult to manage landfills due to some environmental problems. Therefore, reduction of solid wastes by means of recycling is needed. Benefits of recycling include recovery of valuable materials and volume reduction in landfill. Zonguldak Municipal and Medical Landfill Site have been operating since 2008. This facility also contains packaging wastes collection and separation plant. Nevertheless, recycling has not been started in Zonguldak city centre, except Bülent Ecevit University Farabi Campus.

In this study, we investigated the cost of waste recycling in Zonguldak city centre. Total recyclable waste amount is calculated as 16876 kg/day. We found that 247 containers are required to temporarily store recyclable waste. Total cost of waste containers is 176605 TL (46844.8 €). Yearly recyclable waste transportation cost is 273567.5 TL, which is equal to 72564.3 €. The costs of new recycling waste containers require new investment; however, transportation cost is not a new expense. We only separated the transportation cost of recycled material from transportation of total wastes.

Key words*: cost analysis, municipal solid wastes, recycling, Zonguldak*

INTRODUCTION

Increasing in population, quality of life and rapid urbanisation bring about sharply increase in solid waste generation (Guerrero et al., 2013). Solid Waste Management (SWM) has becoming a great challenge for cities in developing and underdeveloped countries. SWM includes the following steps: control of generation, collection, transportation, processing and ultimate disposal of solid wastes (Daskalopoulos et al., 1997; Armijo de Vega et al., 2008; Akinci et al., 2012; Yıldız-Geyhan et al., 2016).Improper waste collection, open dumping, uncontrolled burning or discharge into surface watercan be seen in underdeveloped countries (Berkun et al., 2005; Gamze Turan et al., 2009). Inconvenient methods of SWM result in public health issues, soil, groundwater, air pollutions, other aesthetic problemsand loss of valuable materials (Gamze Turan et al., 2009; Kanat, 2010; Erses Yay, 2015). Although directly transferring of municipal solid wastes to landfill area is the cheapest method, it will be costly in highly populated cities. Also, there exist some environmental problems arising from landfill sites like landfill gas and leachate. Therefore, volume reduction is needed and that can be achieved by means of waste recycling (Daskalopoulos et al., 1997). Separately collection of recyclable waste is another problem since it depends on several factors like social, economic, cultural and environmental (Yıldız-Geyhan et al., 2016). Troschinetz and Mihelcic (2009) mentioned that there exist 12 important issues in sustainable recycling of municipal solid waste. These are:

1. Government policy
2. Government finances
3. Waste characterisation
4. Waste collection and segregation
5. Household education
6. Household economics
7. SWM administration
8. SWM personnel education
9. SWM plan
10. Local recycled material market
11. Technological and human resources
12. Land availability

Disposal of solid waste is one of the biggest environmental problems in Turkey (Berkun et al., 2005; Tınmaz and Demir, 2006; Gamze Turan et al., 2009). According to the Waste Management Regulation (a replacement of old Solid Waste Control Regulation, 1991)

municipalities are responsible from collecting waste separately.

Moreover, construction and management of waste disposal facilities are again the responsibilities of municipalities (WMA, 2015).

A decade ago, there was not a landfill area in Zonguldak, Turkey. Municipal and medical wastes were dumping on the shoreline. In 2006, environmental impact assessment report of Zonguldak Municipal and Medical Landfill Site has been approved. Landfill has started serving in 5 November 2008. Packaging wastes collection and separation plant was constructed in March 2010. However, recyclable waste collection has not started yet in Zonguldak city centre. Only Bülent Ecevit University has been separating wastes since 2012. Placing recyclable waste containers in city centre has not been performed so far (MİMKO, 2006; ZONCEB, 2016).

In this study, we tried to find the cost of waste recycling in Zonguldak city centre.

Firstly, we investigated the composition of Zonguldak wastes via previously published literature. Next, we calculated the amount of recyclable wastes generated. After that, the required amount and costs of recycle waste containers have been found for each district of Zonguldak. Finally, recycled waste transportation costs have been calculated.

The rest of the paper is organised as follows: study area is defined in Materials and Methods part. Also, information about waste generation rates, recyclable fraction, selected waste containers and waste trucks have been given in this part.

Calculations of the required amount recyclable waste containers and the calculations of truck routes have been given in Results and Discussion section. Moreover in this part, cost calculations have been given too. Also, benefits of waste recycling in Zonguldak are discussed. In conclusion part, brief summary of this study exists.

MATERIALS AND METHODS

Study Area

Zonguldak is located in North-Eastern part of Turkey on the Black Sea shore. Zonguldak is the first city of Turkish republic and founded in 1924. City covers 3310 km^2 area. Economy mainly depends on bituminous coal mining, iron and steel production, forestry and energy sectors.

According to the results of Address Based Population Registration System, 597524 inhabitants live in the entire city. There are 108180 people in Zonguldak city centre (within the boundary of Zonguldak Municipality) in 2016. 19 districts exist in city centre (Figure 1). Names and populations of these districts are given in Table 1 (TSI, 2017).

Total area of 19 districts is 23.9 km^2.

The climate of the city is Black Sea climate, rainy and temperate in all seasons. According to the long years (1950 - 2015) meteorological records, average temperature is 13.7 °C in Zonguldak. 1216.8 mm yearly annual precipitation is recorded (TSMS, 2017).

Table 1. Populations of districts in Zonguldak city centre

District Name	2016 Population
Asma	2255
Bağlık	1282
Bahçelievler	16718
Baştarla	2133
Birlik	3899
Çaydamar	3910
Çınartepe	2768
Dilaver	1966
İnağzı	2744
İncivez	8158
Karaelmas	9102
Meşrutiyet	7784
Mithatpaşa	8360
On Temmuz	3971
Tepebaşı	13051
Terakki	11201
Yayla	1845
Yeni	3072
Yeşil	3961
Total Population	**108180**

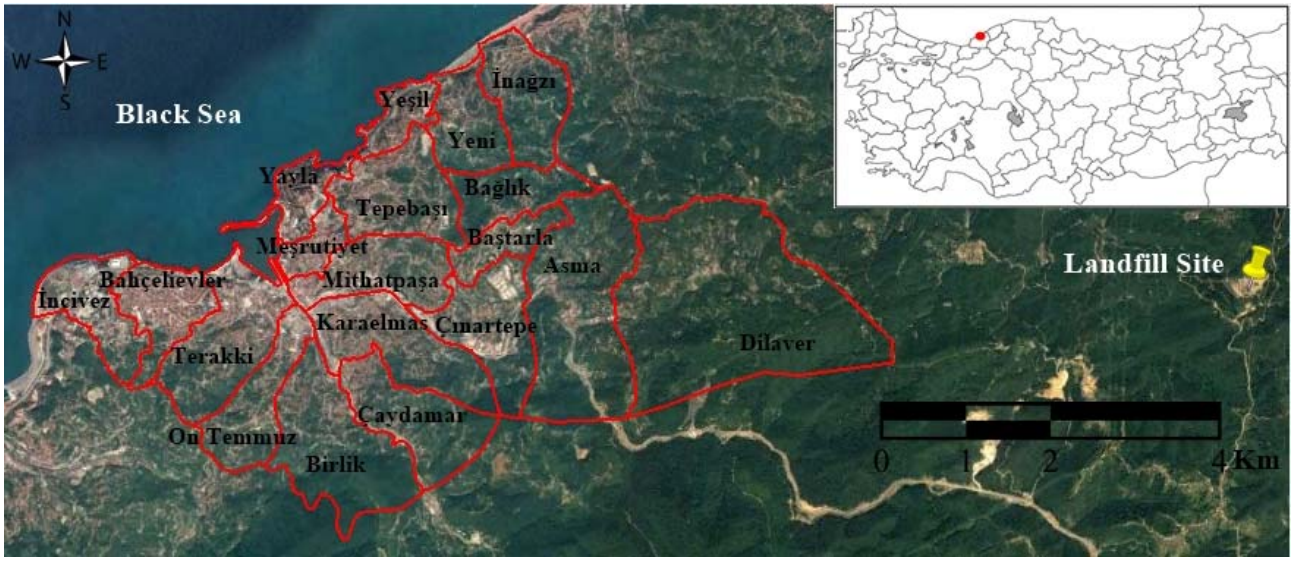

Figure 1. Zonguldak districts map and landfill site

Waste Generation and Recycling

Average municipal solid waste generation rate in Turkey is 1.15 kg/person-day according to the "Turkish Environment State Report - 2011" published by Ministry of Urbanization and Environment. Waste generation rate in the study area is 0.8 kg/person-day, which is less than country average. Waste composition is given in Table 2. Paper, plastic, glass and metal wastes can be recycled. According to the Table 2, total recyclable percentage of Zonguldak wastes are 19.5%. Metin et al., (2003) reported that nearly quarter of waste generated in Turkey is recyclable. Recyclable portion of wastes in Zonguldak is less than Turkey's average. There is no local study related with the density. Therefore, the value of recyclable wastes density is taken from another study. Lino et al., (2010) reported the density of recyclable wastes as 102.2 kg/m^3.

Table 2. Waste composition of Zonguldak

Waste composition	Percent (%)
Paper	5.0
Plastic	7.5
Glass	3.8
Metal	3.2
Textile	1.0
Organic wastes	47.0
Others	32.5

Zonguldak city centre does not have recyclable waste containers. Recyclable waste containers, shown in Figure 2, are selected to store glass, plastic, paper and metal separately at the same time. Unit price of container is 715 Turkish Liras (TL). The volume of each separate unit is 0.27 m^3 (120 × 30 × 75 cm).

Figure 2. Recyclable waste container

Zonguldak Municipal and Medical Landfill Site is located near Sofular Village, which is 18 km away from city centre (Figure 1). Landfill site covers 150000 m^2. Zonguldak Municipality has 13 waste trucks with volume of 15 m^3. If 19.5% of waste is recyclable, the same ratio of trucks is needed to transport recyclable waste. So, we decided that 3 of the trucks can be used to transfer recycled wastes with simple modifications. By this way, it is avoided to by new trucks. In order to calculate the fuel consumption cost of trucks several information are needed. "EMEP/EEA air pollutant emission

inventory guidebook 2016" states that typical fuel consumption of a heavy duty diesel vehicle is 0.24 kg/km (EEA, 2016). The density of diesel fuel is 0.87 kg/l. Finally, diesel fuel price in Zonguldak city centre is 4.66 TL/l (Opet, 2017) and 1 € is equal to 3.77 TL (24 February 2017).

RESULTS AND DISCUSSIONS

The total amount of municipal solid waste, recyclable waste amount and daily volume of recyclable waste generated in study area are calculated as follows:

Total waste amount = 108180 persons × 0.8 kg/person/day = 86544 kg/day

Recyclable waste amount = 86544 kg/day × 0.195 = 16876 kg/day

Daily volume of recyclable waste = 16876 kg/day / 102.2 kg/m^3 = 165.1 m^3/day

Daily volume of recyclable waste generated in study area is 165.1m^3/day. To determine that amount in each district, total volume is divided by districts' population and results are shown in Table 3. Among the 19 districts Bahçelievler, Tepebaşıand Terakki has highest daily recyclable waste volumes. Since recyclable waste volumes of these 3 districts are higher than the volume of a truck (15 m^3), 2 trips are required daily. The rest of the districts have less recyclable waste volumes. Therefore, recyclable wastes of two or more districts can be collectedin one trip. In previous section, it is mentioned that 3 trucks are enough for recyclable waste collection. Average distances of each district to landfill site have been roughly measured by using Google Maps. These values are represented in Table 3.
In order to calculate, the required number of containers volume of waste should be divided by container volume. However, at this point, it must be noted that recyclable waste generation amounts are different from waste to waste. Since plastic has the highest ratio in total recyclable waste (7.5/19.5 = 0.39) calculation should be done for this waste. The other waste container parts will not reach full capacity when plastic container is full. The calculation of number of container needed to hold daily recyclable waste for Asma district is shown below. Decimal result is rounded to the next integer. The rest is calculated and tabulated in Table 3 with the same manner.

Container number = 3.4m^3 × 0.39 / 0.27 m^3Container number = 4.98 → 5

According to Table 3, 247 containers are required to hold daily recyclable waste of Zonguldak city centre. The unit was 715 TL. So, the total capital cost of containers is:

Containers cost = 247 × 715 TL = 176605 TL
(Containers cost = 46844.8 €)

Table 3. Recyclable wastes

District Name	Recyclable waste volume (m^3/day)	Distance to landfill (km)	Number of containers needed
Asma	3.4	17.4	5
Bağlık	2.0	22.5	3
Bahçelievler	25.5	24.0	37
Baştarla	3.3	21.1	5
Birlik	6.0	26.1	9
Çaydamar	6.0	24.5	9
Çınartepe	4.2	19.8	7
Dilaver	3.0	18.2	5
İnağzı	4.2	26.2	7
İncivez	12.5	24.6	18
Karaelmas	13.9	22.1	21
Meşrutiyet	11.9	22.5	18
Mithatpaşa	12.8	21.2	19
On Temmuz	6.1	23.2	9
Tepebaşı	19.9	22.6	29
Terakki	17.1	23.9	25
Yayla	2.8	23.2	5
Yeni	4.7	23.6	7
Yeşil	6.0	24.8	9
Total	**165.1**		**247**

We divided study area into 3 zones for 3 trucks to minimize trip costs of trucks. First zone consists of İncivez, Bahçelievler, Terakki, On Temmuz and Birlik districts. Second zone covers Yayla, Meşrutiyet, Yeşil, Tepebaşı, Yeni, İnağzı, Bağlık and Baştarla districts. Finally, Mithatpaşa, Karaelmas, Çaydamar, Çınartepe, Asma and Dilaver fall into third zone. Total trips for each zone are shown in Table 4. Distances of each trip are again measured via Google Maps. Daily fuel consumptions of trucks are calculated

accordingly. Truck fuel cost of trip 1 in first zone is shown as an example. The rest is calculated and represented in Table 4 with the same manner.

Daily fuel consumption in Trip 1 of Zone 1:
49.2 km × 0.24 kg/km × 4.66 TL/l / 0.87 kg/l = 63.2 TL

Table 4. Trip costs

	Trips	Trip coverage	Total distance (km)	Daily fuel consumption (TL)
Zone 1	Trip 1	İncivez, Bahçelievler	49.2	63.2
	Trip 2	Bahçelievler	48.0	61.7
	Trip 3	Bahçelievler, Terakki	48.0	61.7
	Trip 4	Terakki, On Temmuz	47.8	61.4
	Trip 5	Birlik	52.2	67.1
Zone 2	Trip 1	Yayla, Meşrutiyet	46.4	59.6
	Trip 2	Yeşil, Tepebaşı	49.6	63.8
	Trip 3	Tepebaşı, Yeni	47.2	60.7
	Trip 4	İnağzi, Bağlık, Baştarla	52.4	67.4
Zone 3	Trip 1	Mithatpaşa, Karaelmas	44.2	56.8
	Trip 2	Karaelmas, Çaydamar	49.0	63.0
	Trip 3	Çaydamar, Çınartepe, Asma, Dilaver	49.0	63.0
Total trip length			**583.0**	**749.5**

Total fuel cost of all trucks is 749.5 TL/day (198.8 €/day). Yearly, 273567.5 TL will be spent on fuel consumption, which is equal to 72564.3 €. Actually, fuel cost of trucks is not a new expense. We only separated the cost of recyclable waste transport from total municipal waste transport expenditure. It is possible to reduce this expense, if recyclable waste could be sold.

CONCLUSIONS

In this study, we investigated the cost of municipal waste recycling in Zonguldak city centre.

Total recyclable waste amount is calculated as 16876 kg/day. We found that 247 containers are required to temporarily store recyclable waste. Total cost of waste containers is 176605 TL (46844.8 €). It is possible to reduce container costs by donation. For instance, Şişecam, one of the leading glass manufacturers in Turkey, has donated 12900 glass waste banks since 2011 (Şişecam Group, 2017).

Daily truck fuel cost is 749.5 TL/day (198.8 €/day) for transportation of recyclable wastes.

Recovery of valuable materials from municipal solid waste is the biggest gain of recycling. Arı and Yılmaz (2016) reported that the estimated value of recyclable items that go to waste is 1.5billion TL/year. Furthermore, recycled wastes will not consume any volume in landfill so that estimated use of landfill can be extended.

Waste recycling has not been started in Zonguldak city centre apart from Bülent Ecevit University Farabi Campus.

Recycling of municipal solid waste can be applied more easily in university campuses. Armijo de Vega et al., (2008) states that "universities have the moral and ethical obligation to act responsibly towards the environment". By performing recycling, reduction in financial costs and being an example to students can be achieved. Moreover, recyclable portion of the solid waste in university campuses is more thanthat of cities.

Armijo de Vega et al., (2008) mentioned that more than 65% of the wastes are recyclable in Campus Mexicali I of the Autonomous University of Baja California.

Developed countries give money back for return of package wastes and apply fines for throwing recyclable waste together with regular wastes. On the other hand, recycling is generally voluntary in developing countries. In order to be successful in waste recycling, public education plays an important role.

Arı and Yılmaz (2016) point out that majority of female adult population in Turkey is not working can be described as housewives, who works in home. Therefore, education of housewives on waste recycling is crucial.

There is also one final thing that should be mentioned here. Recycling alone is not the only way of sustainable SWM. Other waste management options must be considered together. For example, Erses Yay (2015) proposed an integrated system that consists of material recovery, composting, incineration and landfilling, as a sustainable way of SWM.

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ASSESSMENT OF PM_{10} LIMIT EXCEEDANCES IN TURKISH CITIES

Özgür ZEYDAN, Beste Nur KARAKAYA

Bülent Ecevit University, Department of Environmental Engineering, Farabi Campus, 67100, Zonguldak, Turkey, Phone: +90.372.291.15.62, Fax: +90.372.257.40.23

Corresponding author email: ozgurzeydan@yahoo.com

Abstract

Turkey, as a European Union (EU) candidate country, is harmonising the air quality limits to meet EU standards. For this reason, PM_{10} limit value is being reducing in yearly intervals till 2019 when daily PM_{10} limit value of 50 µg/m^3 will be met.On the other hand, as the limit value decreases, the air quality of Turkish cities are being considered as polluted.

The aim of this paper is to present the PM_{10} exceedance events in Turkey between 2014 and 2016. The daily measured PM_{10} concentrations were obtained from National Air Quality Monitoring Network of Turkey. We calculated the number of exceedance events. Then, we created thematic maps to evaluate the PM_{10} exceedances both spatial and temporal.

There is an increasing trend in total number of cities where the PM_{10} threshold is exceeded. Moreover, there exist a decreasing trend in the number of cities in which no PM_{10} exceedance events occurred.It would be difficult for Turkey to meet EU PM_{10} standards in 2019 unless certain precautions are applied. At the end of the paper, there are some suggestions to reduce PM_{10} emissions and to meet threshold value.

***Key words**: air quality standard, geographical information systems, limit exceedance, PM_{10}, Turkey*

INTRODUCTION

Particulate matter (PM) is the subset of atmospheric aerosols. Solid and liquid particles with aerodynamic diameter less than 10 µm are called PM_{10}, in other words inhalable coarse particulates.

Particulates with aerodynamic diameter less than 2.5 µm and 0.1µm are classified as fine and ultra-fine particulates respectively. PM may contain sulphates, nitrates, elemental and organic carbon, polycyclic aromatic hydrocarbons, metals, soil or dust depending on the origin.

The sources of PM can be either natural or anthropogenic. Volcanoes, fires, dust storms and sea salt are natural sources. Combustion of fossil fuels and industrial emissions are main sources of anthropogenic PM (Anderson et al., 2012; Fuzzi et al., 2015; Kim et al., 2015).

Studies related with particulate matter are in the focus of scientist due to the adverse effects of PM on climate, air quality, ecosystem, visibility and human health. PM is related with premature human mortality, cardiovascular diseases, lung cancer and other respiratory diseases (Polichetti et al., 2009; Fuzzi et al., 2015). In order to visualise the spatial distribution of air pollution, Geographical Information System (GIS) is used as a tool for pollution mapping.Geographic Information Systems is a computer-based tool that analyses, stores, manipulates and visualizes geographic information on a map (GISGeography, 2017). Markakis et al., (2010) used GIS to visualise the spatial distribution of anthropogenic emission inventory of PM_{10} in Greece. Elbir (2004) developed a GIS based decision support system to estimate, visualise and analyse the air pollution level in İzmir, Turkey. Behera et al., (2011) used a GIS based emission inventory for PM_{10} dispersion modelling in Kanpur city, India.

Turkey is a European Union (EU) candidate country. In order to meet environmental quality standards of EU, Turkey has started to adjust environmental legislations. Therefore, in terms of air quality, Turkey is in transition period and limit values are being reduced gradually.

Daily PM_{10} limit values in Turkey among the years are represented in Table 1. EU daily limit value of 50 µg/m^3 will be entered in force at the beginning of 2019. According to the EU legislation 35 days exceedance is allowed for daily PM_{10} concentrations.

Table 1. Daily PM_{10} Limit Values in Turkey

Years	2010	2011	2012	2013	2014
PM_{10} ($\mu g/m^3$)	**260**	**220**	**180**	**140**	**100**
Years	2015	2016	2017	2018	2019
PM_{10} ($\mu g/m^3$)	**90**	**80**	**70**	**60**	**50**

In this study, we investigated the daily exceedances of PM_{10} concentrations in Turkish cities for the years of 2014, 2015 and 2016.
The aim of this study is to decide whether the Turkish cities satisfy air quality standards in terms of PM_{10}or not. Materials and Methods section describe data acquisition, data flow and how thematic maps are created. PM_{10} exceedance thematic maps are represented and discussed in Results and Discussions part. Several suggestions have been made to reduce PM_{10} emissions in Conclusion section.

MATERIALS AND METHODS

There exist 195 stationary and 4 mobile stations in National Air Quality Monitoring Network of Turkey (Figure 1). Hourly and daily measurements of air pollutants are accessible via web site of this network (http://www.havaizleme.gov.tr/). Daily average values of PM_{10} measurements have been downloaded for the years 2014, 2015 and 2016 from that web page as Microsoft Excel files.

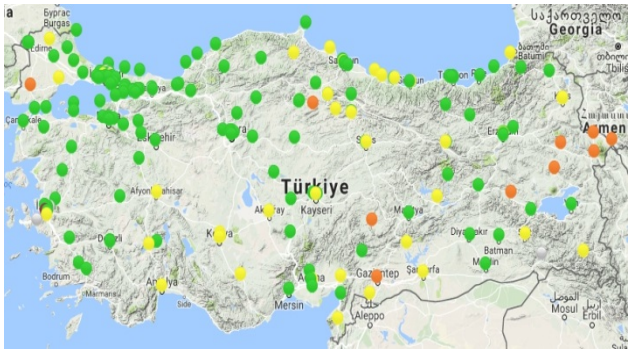

Figure 1.National Air Quality Monitoring Network of Turkey

As seen from Table 1, in Turkey, PM_{10} limits are 100, 90 and 80 $\mu g/m^3$ in 2014, 2015 and 2016 respectively. Both EU Legislation and Turkish Assessment and Management of Air Quality Regulation permit 35 days exceedance for daily PM_{10} limits. So as to calculate yearly exceedance number for cities following Excel formula in Equation 1 has been used.

=IF(COUNTIF(C2:C367;">80")-35>0; COUNTIF(C2:C367;">80")-35;0) (Eq.1)

Equation 1 assumes daily average PM_{10} measurements have been written on C2:C367 range. "80" is limit value for 2016 and "35" is allowable exceedance. This formula checks if there exist more exceedance than 35 days or not. If so, then formula calculates number of exceedance by subtracting allowable number otherwise it displays "0" which means upper limit is not exceeded.
Some cities have more than one air quality monitoring station. For these cities, average value of each station is calculated and single exceedance value is given.
After having calculating the data necessary to create thematic maps, MapInfo version 12 has been used as GIS software."Create Thematic Map" option is used from "Map" menu. We prepared 3 thematic maps for 2014, 2015 and 2016 that show number of exceedances in terms of PM_{10} pollutant.
To create thematic maps, we classified cities as severely polluted (red colour on map), highly polluted (orange), polluted (yellowish green), less polluted (light green) and no-exceedance (dark green).
In severely polluted cities, more than 100 daily exceedances occurred.

RESULTS AND DISCUSSIONS

The number of PM_{10} Exceedances in 2014, 2015 and 2016 in Turkey is shown in Table 2. Figure 2, 3 and 4 show PM_{10} limit exceedances for Turkish cities in 2014, 2015 and 2016 respectively. In 2014, there exist 5 cities that can be considered as severely and highly polluted in terms of PM_{10}.
Threshold value is exceeded 163 times in Siirt, 84 times in Muş, 82 times in Düzce and 70 times in Batman. There weren't any PM_{10} limit exceedance in 42 cities. Next year, the daily limit value of PM_{10} is reduced to 90 $\mu g/m^3$. There were 3 severely polluted cities. 199 times exceedance was occurred in Mus, followed by Siirt (126 times) and Batman (112 times) in 2015. 11 cities (Karaman, Manisa, Düzce, Muğla, Bursa, Hakkari, Kayseri, Iğdır, Afyonkarahisar, Kahramanmaraş and Bolu) were categorized as highly pollutedcities.

The number of cities with no-exceedance of PM_{10} limit was decreased to 26. In 2016, the daily limit value of PM_{10} is further reduced to 80 $\mu g/m^3$. 4 cities were fallen into severely polluted category.

These cities were Mus, Siirt, Kütahya and Manisa with 186, 157, 118 and 117 exceedance events respectively. The number of highly polluted cities (Düzce, Kayseri, Denizli, Karaman, Tekirdağ, Muğla, Gaziantep, Niğde, Erzincan, Afyonkarahisar, Batman, Bursa, Uşak, Iğdır, Ankara, Hakkari, Osmaniye and Kahramanmaraş) increased to 18.

In 2016, there were only 22 cities with no-exceedance events.

Table 2. Number of PM_{10} Exceedances in Turkey

	Number of Exceedances				Number of Exceedances				Number of Exceedances		
City	**2014**	**2015**	**2016**	**City**	**2014**	**2015**	**2016**	**City**	**2014**	**2015**	**2016**
Adana	1	12	3	Giresun	0	0	0	Samsun	3	13	21
Adıyaman	30	11	11	Gümüşhane	5	3	0	Siirt	163	126	157
Afyonkarahisar	39	65	72	Hakkâri	25	70	56	Sinop	0	16	44
Ağrı	0	15	26	Hatay	24	31	45	Sivas	0	9	35
Amasya	0	6	44	Isparta	36	20	20	Tekirdağ	9	36	86
Ankara	18	23	59	Mersin	0	23	8	Tokat	0	3	32
Antalya	6	0	4	İstanbul	6	13	8	Trabzon	0	6	11
Artvin	0	0	0	İzmir	2	2	3	Tunceli	0	0	0
Aydın	13	26	25	Kars	0	0	14	Şanlıurfa	0	0	0
Balıkesir	0	0	0	Kastamonu	0	0	12	Uşak	0	7	69
Bilecik	8	8	19	Kayseri	30	69	93	Van	0	0	0
Bingöl	0	0	0	Kırklareli	0	3	18	Yozgat	0	0	0
Bitlis	5	0	0	Kırşehir	0	0	0	Zonguldak	24	26	32
Bolu	47	50	0	Kocaeli	9	7	13	Aksaray	0	26	35
Burdur	0	13	25	Konya	5	7	15	Bayburt	0	0	0
Bursa	50	70	71	Kütahya	3	16	118	Karaman	45	94	92
Çanakkale	11	17	18	Malatya	0	0	0	Kırıkkale	0	0	0
Çankırı	0	0	1	Manisa	41	76	117	Batman	70	112	72
Çorum	0	2	49	Kahramanmaraş	21	52	51	Şırnak	0	0	0
Denizli	36	37	92	Mardin	0	39	40	Bartın	0	1	40
Diyarbakır	0	16	10	Muğla	44	71	85	Ardahan	0	0	0
Edirne	30	32	36	Muş	84	199	186	Iğdır	43	67	63
Elâzığ	0	0	0	Nevşehir	0	0	0	Yalova	0	0	18
Erzincan	0	27	74	Niğde	2	46	80	Karabük	36	28	18
Erzurum	0	0	31	Ordu	0	1	19	Kilis	0	0	0
Eskişehir	0	0	0	Rize	0	0	0	Osmaniye	28	34	55
Gaziantep	0	15	80	Sakarya	45	41	42	Düzce	82	72	94

As seen from Figures 2, 3 and 4, there is an increasing trend in total number of cities where the PM_{10} threshold is exceeded. Moreover, there exists a decreasing trend in the number of cities in which no PM_{10} exceedance events occurred.

In previous years, air quality was not considered as polluted due to the higher limits in Turkey.

However, after reduction in limit values, air quality is now being considered as polluted in most of the Turkish cities. It should be noted that daily PM_{10} limit is 70$\mu g/m^3$in 2017. There will be further reduction until 2019 when Turkey will meet EU limit value (50$\mu g/m^3$) for PM_{10}. Karaca (2012) used the PM_{10} data of year 2008 and geographical information system based interpolation technique to classify the air quality zones in Turkey.

4 hotspots were identified as a result of this study: the eastern part of the Black Sea region (Düzce, Zonguldak and neighbour cities), (ii) Kütahya, Afyon and Isparta area, (iii) Kahramanmaraş, Osmaniye and Hatay area, (vi) Easthern Anatolia (Muş, Bingöl, Erzurum, Iğdır).

Atmospheric PM_{10} levels of cities like Zonguldak, Kütahya and Kahramanmaraş were strongly influenced by coal based thermal power plant emissions.

In 2008, the natural gas usage as a fuel source for domestic heating was not available at Black

Sea region, Mediterranean Sea Region and Eastern Anatolia Region except few cities. At the beginning of 2017, there exist only 3 cities remaining (Artvin, Şırnak and Hakkari) which lack of natural gas distribution. However, the cities in Eastern Anatolia Region had natural gas quite recently. Shifting from coal to natural gas takes some time and that is why some cities have still high PM_{10} levels. On the other hand, Ministry of Energy and Natural Resources considers coal as a primary source for generating electricity.

Therefore, the number of coal based thermal power plants are increasing continuously in Turkey. Hence, PM_{10} levels are still high especially in cities with thermal power plants.

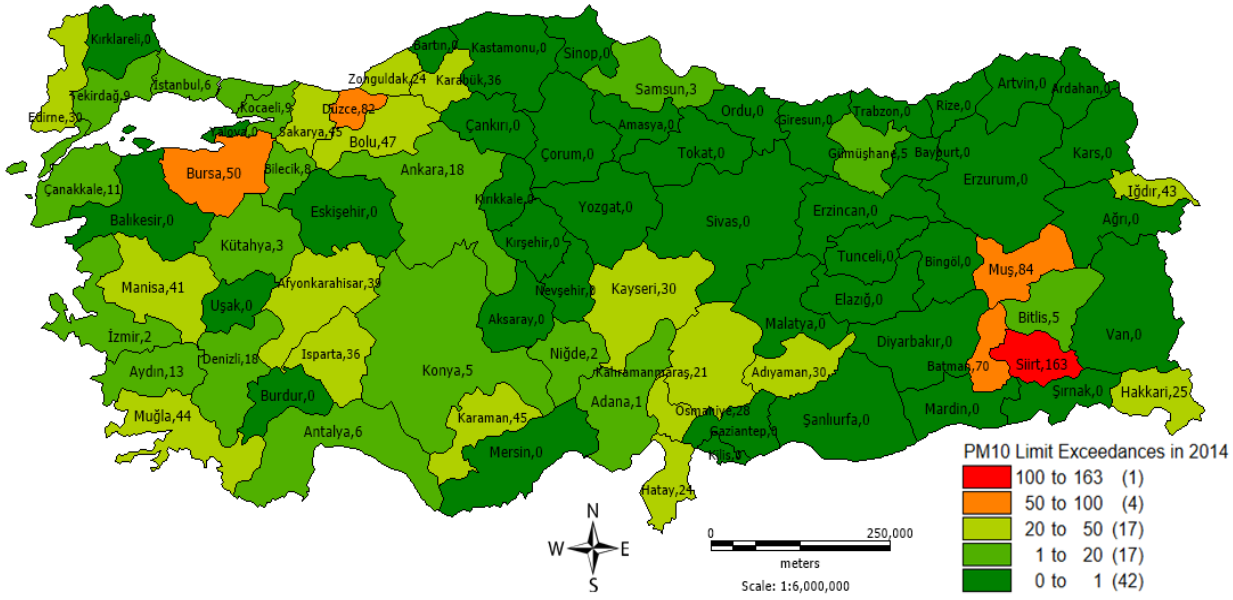

Figure 2. PM_{10} Limit Exceedances in 2014 (Limit: 100 µg/m^3)

Figure 3. PM_{10} Limit Exceedances in 2015 (Limit: 90µg/m^3)

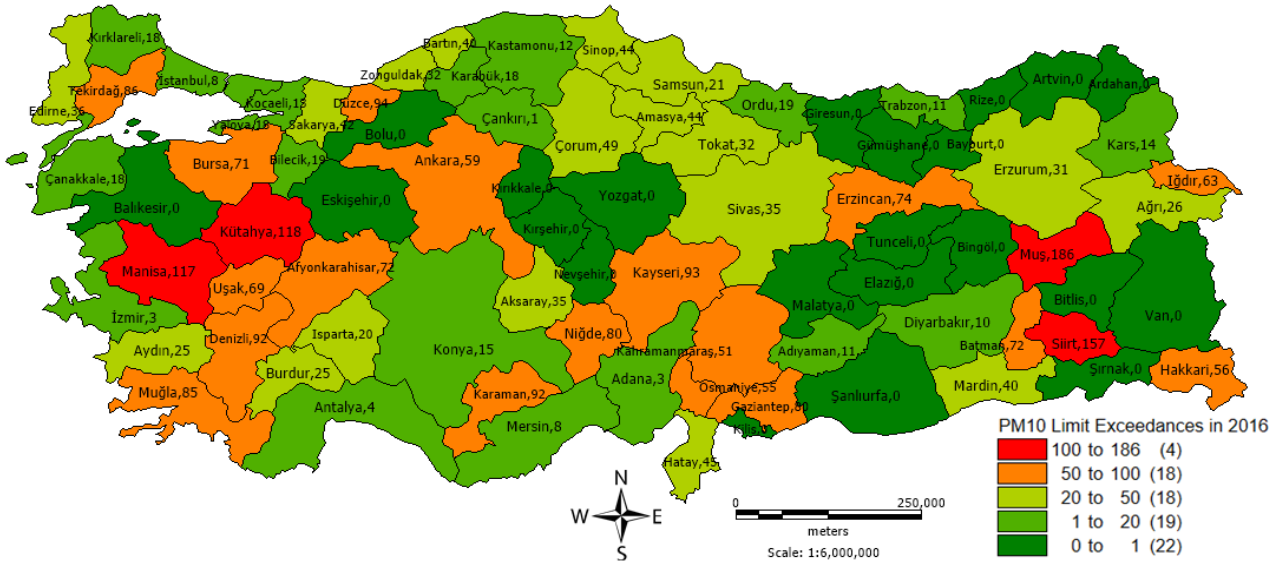

Figure 4. PM_{10} Limit Exceedances in 2016 (Limit: 80µg/m^3)

Exposure to PM_{10} concentrations in ambient atmosphere of Turkish cities causes health related issues. Tecer et al., (2008) investigated the relation between hospital admissions of children (younger than 15) for respiratory diseases and the levels of particulate pollution in Zonguldak, Turkey. The results of this study showed a significant relation between PM_{10} levels and hospital admissions due to asthma, allergic rhinitis, and upperand lower respiratory diseases.

In our study, we observed that Muş, Batman and Siirt can be considered as cities with poorest air quality which is similar to the study of Dolar and Saraç (2015). They examined the daily PM_{10}concentrations in 2014 in Southern Eastern and Eastern Anatolia Region.

They mentioned that highest PM_{10} concentrations were measured at Siirt, Iğdır, Muş, Batman, Hakkari, Adıyamanand Diyarbakır in 2014. They also stated that exceedance events were common both in summer and winter. The reason of high PM_{10} concentrations in summer days is dust transport from south. Saharan dust transport is one of the important sources of PM_{10} pollution in Turkey. Özdemir and Ertaş (2011) investigated two dust events during 2009 and 2010 period in Ankara, capitol city of Turkey. They stated that 566 µg/m^3 and 452 µg/m^3 PM_{10} concentrations were recorded at air quality monitoring stations in Ankara.

Özdemir and Ertaş (2011) also mentioned that air quality is heavily influenced by dust transport events, consequently health and economical hazards occurs.

Dust from Saharan Desert is not the only trans-boundary source of PM_{10} in Turkey. For example, Kindap et al., (2006) investigated the long range transport of PM_{10} to İstanbul, Turkey. They found that at certain times a quarter of PM_{10} concentration in İstanbul came from Eastern European countries. Therefore, in order to make an assessment about particulate matter levels of Turkish cities, long range transport from either Europa or Saharan Desert should be kept in mind. One of the limitations of this study is taking the average of exceedances if more than one station exists in a city. If there exist a station with high PM_{10} concentrations and the other stations have lower measurements, the air quality of that city may seem to be good. For example, Edirne Keşan has the poorest air quality. Özşahin et al., (2016) mentioned that poor quality of fuels and topographical structure of this site are the main reasons of this. However, air quality of central area of Edirne is much better than Edirne Keşan. Therefore, taking the averages of these two stations results less number of exceedances.

CONCLUSIONS

Turkey, as an EU candidate country, is trying to harmonise environmental regulations with EU. To meet the air quality standardspollutants levels have being reducing. In this study, the

daily exceedances of PM_{10} concentrations in Turkish cities for the years of 2014, 2015 and 2016 were evaluated. The numbers of exceedances were calculated using Microsoft Excel and data were transferred to GIS software MapInfo. Thematic maps crated to visualise the current levels of PM_{10} pollution. We found that, there is an increasing trend in the number of cities that exceed PM_{10} threshold levelover years. Turkey has been changing primary fuel from coal to natural gas for domestic heating.

Natural gas is much better fuel as compared to coal in terms of particulate matter emissions. On the other hand, Turkish Ministry of Energy and Natural Resources still considers coal as a primary source for generating electricity. Therefore, coal based thermal power plants continues to emit particulate matter to the atmosphere. Moreover, long range transport also affects air qualityin Turkey. As a result, it would be difficult for Turkey to meet EU PM_{10} standards in 2019 unless certain precautions are applied.

In order to meet EU air quality standards PM_{10} emissions must be reduced. Using coal for domestic heating is one of the main sources of PM_{10}. Shifting from coal to natural gas is an important solution and should be done quickly. Heat isolation of buildings keep temperature inside the building and less amount of fuel is required for domestic heating. Furthermore, renewable energy resources should be considered as an alternative for coal based thermal power plants. Diesel motor vehicles exhaust is another source of particulate matter. To reduce PM from vehicles, sustainable transport solutions should be developed.

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GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE VULNERABILITIES OF CERTAIN EUROPEAN COUNTRIES

Özgür ZEYDAN, Burçin SUNAR, Zümrüt DANIR

Bülent Ecevit University, Department of Environmental Engineering, Farabi Campus, 67100, Zonguldak, Turkey, Phone: +90.372.291.15.62, Fax: +90.372.257.40.23

Corresponding author email: ozgurzeydan@yahoo.com

Abstract

Climate Change is the most important and the most complex environmental problem. There are two ways to deal with climate change: mitigation of Greenhouse gases (GHG) emissions and adaptation to new climatic conditions. To achieve mitigation goals, accurate quantification of GHG is required. For this reason, GHG emission inventories are prepared. In order to calculate all GHG emissions in the same unit (carbon dioxide equal) Global Warming Potential (GWP) is used. Adapting to new climatic conditions is more difficult. It must be known that, which sectors will be affected from climate change. Vulnerabilities of sectors are important in climate change adaptation.
In this article, we firstly gave information about GWP. Then, GHG emission inventories of European Union member states and Turkey are represented and evaluated for the years 1990 and 2014. Finally, climate change vulnerabilities of certain European Union countries and Turkey are discussed. We mainly focused on the vulnerabilities of agriculture, forestry, water resources and human health sectors as a result of temperature and precipitation changes under the influence of man-made climate change.

***Key words**: climate change vulnerabilities, Europe, greenhouse gas emissions, national communication reports, Turkey*

INTRODUCTION

Two or three decades ago, air pollution was considered as a local environmental problem (Ramanatan and Feng, 2009). However, today we know that air pollutants are transported via long range transport and air pollution has no boundaries. It can create regional and global environmental problems.
Climate change, global scale air pollution, affects all of the Earth. Greenhouse gases (GHG) absorb and emit thermal infrared radiation and enhance the natural greenhouse effect. Therefore, these gases keep the temperature in the atmosphere and warm the planet (Shine and Forster, 1999; Ramanatan and Feng, 2009). Carbon dioxide (CO_2), methane (CH_4), dinitrogen monoxide or nitrous oxide (N_2O) and water vapour are natural greenhouse gases. Tropospheric ozone (O_3) and other synthetic gases like sulphur hexafluoride (SF_6), chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and perfluorocarbons (PFCs) are other greenhouse gases.
Stratospheric ozone and aerosols (except black carbon) have cooling effects on atmosphere (Shine and Forster, 1999). Increasing temperatures, changing precipitation patterns and extreme weather events alter the climate. Tol (2009) stated that climate change affects many aspects of the nature including agriculture, energy use and human health which in turn affects everything and everyone.
Fossil fuel use and destruction of forests (sinks of carbon dioxide) are the main causes of man-made climate change (Tunç et al., 2007). There are two ways to cope with climate change: reducing GHG emissions and adaptation to new climatic conditions. In order to reduce emissions, quantification of GHG is important. To do this, GHG emission inventories are prepared and some target values are set. After that, emission reduction is achieved by using cleaner fuels (shifting from fossil fuels to alternative energy resources), cleaner production, CO_2 capture and applying the principles of sustainable development. Adaptation to new climatic conditions is more difficult. To be adapted to new conditions, it must be known that how climate change affects our lives. Following sectors will be affected from climate change: coastal resources, agriculture, forestry, marine ecosystems, terrestrial ecosystems, water resources, human

health, tourism and energy (Hitz and Smith, 2004).

In the next sections in this paper, we focused on how to quantify GHG emissions in common unit and how GHG emissions inventories are prepared. Global Warming Potential term is discussed in Materials and Methods section. Also, the information is given how GHG emission inventories are prepared according to the Intergovernmental Panel on Climate Change (IPPC) methodology. Furthermore, the Vulnerability term is explained to understand the effects of climate change.

In Results and Discussion part, we represent the GHG emission inventory of European Union (EU) countries and Turkey. Then, we focused on the climate change vulnerabilities of some EU countries and Turkey. The sectors will be affected from climate change are discussed in detail. At the end of the paper, there exists a brief conclusion.

MATERIALS AND METHODS

Global Warming Potential (GWP)

In order to quantify the greenhouse gas emissions a common scale is needed. Generally CO_2 is taken as a reference gas. The amounts of other gases are converted into "CO_2-equivalent" by means of their Global Warming Potential (GWP) values.

IPCC defines GWP as "an index of the total energy added to the climate system by a component in question relative to that added by CO_2".

Global Warming Potentials of some greenhouse gases are represented in Table 1 (Myhre et al., 2013). According to the Table 1, GWP of CH_4 is 28, which means a single methane molecule is effective as 28 molecules of CO_2 in radiative forcing (the net change in energy balance between two reference years).

Table 1.Global warming potentials of some greenhouse gases (Myhre et al., 2013)

Gas	Lifetime (years)	GWP (100 years horizon)
CO_2	5 ~ 200	1
CH_4	12.4	28
HCF-134a	13.4	1300
CFC-11	45	4660
N_2O	121	265
CF_4	50000	6630

GHG Emission Inventories

Emission inventory is defined as systematic collection of all emissions from all sectors within a known boundary for a certain period of time (Elbir et al., 2000).The amount of emission is calculated by simply multiplying the activity with emission factor (Salt and Moran, 1997).

Intergovernmental Panel on Climate Change (IPPC) studies the effects of climate change. It is responsible for building worldwide GHG emission inventory.Each member state of United Nations has to use "Guidelines for National Greenhouse Gas Inventories" or "IPCC Guidelines" reference document to report GHG emissions. IPPC developed three approach named as Tier 1, Tier 2 and Tier 3. Tier 1 is basic approach and applied if data is insufficient (El-Fadel and Bou-Zeid, 1999). Tier 1 approach is generally for underdeveloped countries. When more data is available, Tier 2 or Tier 3 methodologies are used. Since nitrogen oxides (NOx), carbon monoxide (CO) and non-methane volatile organic compounds (NMVOC) are tropospheric ozone precursors; these gases are also included in inventory.

GHG emissions from following source categories are calculated in emission inventory:

- Public electricity and heat production;
- Residential fuels;
- Commercial/institutional fuels;
- Road transportation;
- Production of aluminum, cement, nitric acid, fluorochemicals, iron and steel, acidic acid;
- Coal mining and handling;
- Refrigeration and air conditioning;
- Fugitive emissions from natural gas;
- Enteric fermentation: dairy cattle;
- Agricultural activities;
- Waste disposal sites;
- Manufacturing industries (excluding iron and steel).

In order to evaluate GHG emissions of EU countries, emission inventory is directly taken from "Annual European Union greenhouse gas inventory 1990-2014 and inventory report 2016" (EEA, 2016).

GHG emissions of Turkey are added for comparison. Emissions of 1990 and 2014 are

compared. 1990 is the reference year according to the Kyoto Protocol and latest data is available for 2014. Population statistics are obtained from EuroStat for the year 2014 (EuroStat, 2017). Per capita GHG emissions are calculated by dividing emissions to population.

Climate Change Vulnerabilities

GHG emissions are needed be reduced to avoid the adverse effects of climate change (EEA, 2017a). However, if all CO_2 emissions are cut today, climate change will still take place due to the irreversible CO_2 concentration in atmosphere for 1000 years (Solomon et al., 2008). Therefore, we need to adapt to a new climatic conditions. In order to apply necessary precautions for climate change adaptation, climate change vulnerabilities of each sector must be estimated.European Environmental Agency defines "vulnerability" as "The degree to which a system is susceptible to and unable to cope with, injury, damage or harm" (EEA, 2017b). De Lange et al., (2010) defines vulnerability as a function of exposure, effect and recovery. Each member state of UN has to submit "National Communication Report on Climate Change" to UN. These reports are downloadable from UN web site (http://unfccc.int/national_reports/annex_i_natcom/submitted_natcom/items/7742.php). In 6th section of these reports,"effects, affectability and vulnerabilities"subjects are discussed. We have selected some of the EU-28 member states (Austria, Bulgaria, Finland, France, Germany, Italy, Lithuanian, Netherlands and Romania) and Turkey. We examined the latest reports of these ten countries and evaluated the climate change vulnerabilities of Europe and Turkey.

RESULTS AND DISCUSSION

GHG Emission Inventory

GHG emissions of EU member states (28 countries), Iceland and Turkey are shown in Table 2. 1990 is used as a base year. Unless otherwise stated, all emissions are in CO_2-equivalent. In 2014, the highest amount of GHG is emitted from Germany (900.2 million tonnes). United Kingdom (523.7 million tonnes), Turkey (467.6 million tonnes) France (458.9 million tonnes) and Italy (418.6 million tonnes) follow Germany. On the other hand, all of these countries except Turkey have reduced their GHG emissions according to 1990 level. GHG emissions of Turkey have been increased by 148% in this period. Turkey has still using coal as a primary fuel in both heating and electricity production. Apart from Turkey, only 6 countries (Spain, Portugal, Ireland, Cyprus, Malta and Iceland) have emitted more GHG as compared to the reference year's emissions. However, in 2014 total emissions of these 6 countries are nearly the same as the emissions of Turkey. Lithuania, Latvia and Romania have achieved more than 50% reduction in their GHG emissions in 2014 relative to 1990 emissions.In 2014, approximately 78% of GHG emissions of EU-28 plus Iceland come from energy sector (EEA, 2016). 67% of GHG emissions of Turkey emitted from energy sector in 2013 (6thN.C. Turkey, 2016).

The amount of total GHG emission is not the only criterion to compare the contribution of countries. If we look at per capita emissions Luxembourg (19.6 tonnes), Estonia (16 tonnes), Iceland (14.1 tonnes), Ireland (12.7 tonnes) and Czech Republic (12 tonnes) are top 5 countries. Per capita emissions of 15 EU member states and Turkey are below EU average (8.4 tonnes). GHG emission per person value is 6.1 tonnes for Turkey. Romania has lowest per capita emission, which is 5.5 tonnes.

Climate Change Vulnerabilities

The regions that are vulnerable to current or future climate change are called "hotspots". Hotspots indicate that variability in temperature and precipitation, climate related disasters (cyclones, droughts, floods, wildfires and landslides), agriculture and food security, water scarcity and migrations (de Sherbinin, 2014). Giorgi (2006) stated that the Mediterranean and North Eastern European regions are primary hotspots. Decrease in precipitation and increase in temperature in dry season will make Mediterranean most vulnerable to climate change. Increase in winter precipitation and increase in mean temperature will be observed in North Eastern Europe (Giorgi, 2006). Increases in temperatures, variability in

precipitation, reduced snow and ice cover will make mountainous and coastal areas of Europe more vulnerable.

Vulnerabilities of some European Union member states and Turkey are listed in Table 3 (6th N. C. of Austria, Bulgaria, Finland, France, Germany, Italy, Lithuania, Netherlands, Romania and Turkey). Because of the space constrains we tabulated only temperature and precipitation change and vulnerabilities of agriculture, forestry, water resources and human health. Other sectors are discussed briefly.

Table 2.GHG emissions in million tonnes CO_2-equivalent (EEA, 2016)

Member State	1990 (million tonnes)	2014 (million tonnes)	Change 1990-2014 (%)	Population (2014)	Emission per capita (tonnes)
Austria	78.8	76.3	-3.2	8506889	9.0
Belgium	146.0	113.9	-22.0	11180840	10.2
Bulgaria	104.0	57.2	-45.0	7245677	7.9
Croatia	34.8	24.5	-29.7	4246809	5.8
Cyprus	5.7	8.4	47.9	858000	9.8
Czech Republic	199.3	125.9	-36.8	10512419	12.0
Denmark	70.7	51.2	-27.6	5627235	9.1
Estonia	40.0	21.1	-47.3	1315819	16.0
Finland	71.3	59.1	-17.1	5451270	10.8
France	548.1	458.9	-16.3	65942093	7.0
Germany	1246.1	900.2	-27.8	80767463	11.1
Greece	104.8	101.4	-3.3	10926807	9.3
Hungary	94.1	57.2	-39.2	9877365	5.8
Ireland	56.2	58.3	3.7	4605501	12.7
Italy	521.9	418.6	-19.8	60782668	6.9
Latvia	26.2	11.3	-56.9	2001468	5.6
Lithuania	47.1	19	-59.6	2943472	6.5
Luxembourg	12.9	10.8	-16.3	549680	19.6
Malta	2.0	3	49.1	425384	7.1
Netherlands	222.2	187.1	-15.8	16829289	11.1
Poland	472.9	380.3	-19.6	38017856	10.0
Portugal	60.7	64.6	6.5	10427301	6.2
Romania	251.9	109.8	-56.4	19947311	5.5
Slovakia	74.7	40.6	-45.6	5415949	7.5
Slovenia	18.6	16.6	-10.9	2061085	8.1
Spain	285.9	328.9	15.0	46512199	7.1
Sweden	71.9	54.4	-24.4	9644864	5.6
United Kingdom	796.6	523.7	-34.3	64351155	8.1
EU-28 (Total)	**5665.5**	**4282.1**	**-24.4**	**506973868**	**8.4**
Iceland	3.6	4.6	26.5	325671	14.1
Turkey	188.43	467.6	148.2	76667864	6.1

All investigated countries reported increasing temperatures in the future except Italy. No information about temperature or precipitation is given in Italy's report (Table 3). Precipitation estimates are different among the continent. Some countries like Austria and Finland reported rising precipitations. Bulgaria, France, Germany and Lithuania estimated variable precipitation patterns from season to season. Decreasing in precipitation amount is expected in Romania, Netherlands and Turkey. Turkey reported significant reduction in precipitation (Table 3). Reduced precipitation will create further problems salinization of aquifers, costal subsidence, water pollution and increase in water demand in agriculture. Water scarcity may also cause water use conflicts, human health related issues and reduced crop yields (Francés et al., 2017).

Tol (2009) studied economic effects of climate change and mentioned that 1 or 2°C warming may have a positive effect on welfare. Further

increase in temperatures will resulted in economic losses. Faster growing plant due to more CO_2 in atmosphere, reduction in heating costs and cold related diseases are initial benefits of early stage climate change, however, Tol (2009) called this benefits as "sunk benefits". Bulgaria and Germany reported that there may be some benefit from climate change in their agriculture. Most countries reported that agriculture is vulnerable because of water shortages, droughts, desertification, invasive species, diseases and pests (Table 3). Bär et al., (2015) investigated the vulnerability of agricultural water resources due to climate change in Black Sea catchment. Climate change may positively or negatively affect agriculture. Increasing temperature reduces freezing risk and enhances plant growth. On the other hand, extreme weather events, water scarcity, pests and diseases cause poor harvests. According to the results of this study, some countries (Turkey, Ukraine, Romania, Moldova, Hungary and Bulgaria) will benefit from climate change whereas some (Montenegro, Austria and Bosnia-Herzegovina) will suffer from worse climatic conditions. Catchment will become more suitable for natural plant growth, but less precipitation will reduce irrigation potential and agriculture will be affected negatively.

Effects of climate change on forests are similar to that of agriculture. Climate change may increase tree productivity whereas extreme weather events, risk of forest fires, droughts, pests and insects have adverse effects (Lindner et al., 2014). Hanewinkel et al., (2012) developed a model based on interest rate and climate scenario. They mentioned that in 2100, between 14 and 50% (mean: 28%) of European forest lands (excluding Russia) will be lost and that will result in several hundred billion Euro economic losses. All of the countries investigated reported the risk of forest fires (Table 3).

Sea level rise creates some problems in coastal areas and salinization in groundwater. Sea level rise is an important problem in Netherlands, which is located below sea level. Lithuania reported the invasion of sea water masses in to the Curonian Lagoon. Other vulnerabilities on water resources include floods, increasing evaporation from water masses, decreasing flow regimes of rivers, reduced water quality (Table 3).

Another important impact of climate change is human health related issues. Heat waves and cold related deaths are the most important effects of climate change on human health. Also, vector-borne diseases and water-borne disease after floods or water pollution affects human health (Haines et al., 2006; Thornton et al., 2014). Most countries reported the risk of heat waves related risk especially for children and elderly people. Vulnerabilities of allergens, food or water borne diseases, vector borne diseases are also mentioned (Table 3).

Many other sectors that are not mentioned here in detail will be affected from climate change. For example, summer tourism is vulnerable in Mediterranean region of Europe and Turkey as a result of heat extremes. Ski tourism in mountainous areas of Europe and Turkey is again vulnerable due to diminishing snow cover (EEA, 2017a). Although, the demand of energy for heating will be decrease in Northern and Western part of the continent, the demand of energy for cooling will rise in Central, Eastern and Mediterranean regions of Europe (EEA, 2017a).

CONCLUSIONS

Climate change is the most important and the most complex environmental problem. In order to deal with it, both mitigation of GHG and adaptation to a new climatic conditions are equally important. Mitigation of greenhouse gas release to the atmosphere can be achieved by either fuel change or using alternative energy resources. This also results in reduction in air pollutant emissions as a co-benefit (Bollen and Brink, 2014). However, many of the countries are not ready for fighting climate change even in Europe. Reckien et al., (2014) performed an analysis of 200 cities of Europe among 11 countries and reported that only a quarter of cities have both adaptation and mitigation plans. 35% of cities have no mitigation plans and 72% of cities have no adaptation plans. According to the Reckien et al., (2014) these actions will be insufficient to meet the goal of avoiding global mean temperature rising 2°C above pre-industrial levels.

Table 3. Vulnerabilities of some European Union member states and Turkey

Country	Temperature	Precipitation	Agriculture	Forestry	Water resources	Human health
Austria	• 0.25°C increase per decade	• Increase in the western and south-eastern parts	• New invasive species and pathogens may affect crop production	• Forest fires risk	• In southern and eastern Austria, a decrease in groundwater recharge is likely	• Vulnerability to heat stress is high for children, elder people and people with heart diseases
Bulgaria	• Increase between 5° and 8°C over most of the countries in the Balkan Peninsula (HadCM3 model for 2080)	• Winter precipitation will increase • Summer rainfall is expected to decrease	• Variation of gross agricultural outputis positive (11 % and 23 % for the different climate scenarios)	• Most of the Bulgarian forests would be vulnerable to the drastic climate change	• Annual river runoff is likely to decrease	
Finland	• Increase 2.4°C by 2040 and 3.6°C by 2080 (RCP4.5 scenario) • Increase 2.9°C and 5.8°C (RCP8.5 scenario)	• Increases in wintertime	• Improve crop productivity • The risk of animal diseases may also increase • Diseases associated with the poor quality of water may become more common	• Increase significantly both the growth and production of Finnish forests • Risk of forest fires may also increase in southern Finland • Damage caused by numerous pest insects and pathogenic fungi will likely increase	• Floods caused by spring snowmelt will decrease • Autumn and winter floods caused by precipitation	• Increase heat-related mortality and morbidity in summer
France	• Rise of between +1.4°C and +3 °C by the end of the 21st century	• Difficult to highlight, vary fromterritory to territory	• Losses for the agricultural	• Increased productivity of plants • Forest fires	• Decline in water resources in zones already under pressure • 10 to 25% decrease in water recharging a sea-level rise end of the 21st century	• Heatwaves
Germany	• Increase at least 0.5 °C for 2021-2050 • Increase at least 1.5 °C and at most 3.5 °C in Northern Germany and 4 °C in Southern Germany for 2071-2100	• Decrease in the summer whereas increase in the winter • 15% decrease for 2021-2050 • Up to 25% decrease for 2071-2100	• Agricultural yields will be affected • Central German Uplands or Northern Germany could benefit from gradual warming and longer vegetation periods.	• Heat and drought stress in summer • Extreme weather events can cause early leaf drop and slow growth • Wild fire may also increase		• Morbidity and infectious diseases • New health risks (e.g. posed by the oak processionary moth)
Italy			• Water shortages may reduce the productivity of most crops	• Possible reduction of about 50% of the habitats at the national level	• Reduced water availability and quality • Summer droughts, Limited groundwater recharge	• Elderly people and children are vulnerable to impacts
Lithuania	• Increase depending on the scenario can be 4-8 °C	• Small increase of precipitation amount per year • Decrease in summer precipitation	• Current species are not adapted to climate change	• Plant productivity will increase • Risk of forest fires	• Heavy showers, sudden thaws and frosts, long-lasting droughts • Rising sea level • Invasions of sea water masses in to the Curonian Lagoon	• Natural aerial-allergens will increase • Heat waves may cause serious health problems
Netherlands	• 80% chance of the average winter temperature will rise by between 0.9 and 2.3°C in 2050	• Dry summers will occur more frequently	• The agricultural sector is particularly wary of increasing risks for diseases and pests	• There is an increased risk of natural fires in summer.	• Rising sea level and salt water penetrating further inland pressure the rivers and groundwater • Vulnerable to flooding	• Flooding • Allergies • Summer smog • Infectious diseases • Heat stress, Water- and foodborne diseases

Table 3. Vulnerabilities of some European Union member states and Turkey (continue)

Romania	• Up to 1.3 °C increase in Eastern and Southern regions	• 10% decrease in South Eastern and South Western regions (A1B scenario)	• Extended droughts will likely affect Romanian territory in the growing season, with significant impact on agriculture activities.	• In the south and southeast desertification process will lead to unfavourable conditions for forest vegetation development • Risk of forest fires	• Increase of the evapotranspiration in summer • 10-20% decrease in flowing conditions of the rivers • Increase stress on water as needs for irrigations in agriculture	• Heat waves effects are more severe in high populated urban areas, Young people and older one are most vulnerable
Turkey	• Rise by 2-3°C in average	• Precipitation will significantly reduce	• Food production will be affected due to factors like desertification, increase in fire risk, fast spread of pests	• Forest fires	• Coastal erosion, flood and inundation • Algal blooms will also deteriorate the ecological balance in the lakes	• Deaths and injuries related to extreme climate events • Diseases transmitted via water and food • Respiratory diseases • Allergic diseases • Diseases transmitted by vectors and rodents

In this study, we evaluated the GHG emissions of European Union member states and Turkey. In 2014, Germany, United Kingdom, Turkey, France and Italy have biggest contribution on GHG emissions. Turkey has the greatest increase in GHG emissions between 1990 and 2014 since Turkish energy sector still depends on coal.

Many sectors seem to be vulnerable to climate change. In this paper, we only focused on agriculture, forestry, water resources and human health as a consequence of temperature and precipitation changes. Vulnerabilities vary from region to region. Some countries reported some benefits in agriculture and forestry. The most of the countries reported forest fire risk. Water resources are under the pressure of decreasing precipitation and increasing evaporations. Flow regimes of rivers, groundwater and water resources in coastal regions will certainly be affected. Finally, countries reported that human health is vulnerable because of heat waves.

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SECTION 02
SUSTAINABLE DEVELOPMENT OF RURAL AREA

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SUSTAINABLE DEVELOPMENT OF A MULTISECULAR VILLAGE FROM A MURES MEADOW

Alexandru SÎNTU-LĂSAT, Vlad-Ștefan ALEXANDRU

Scientific Coordinators: Lect. PhD Eng. Adriana PIENARU, Assoc. Prof. PhD Eng. Doru MIHAI, Lect. PhD Eng.Patricia MOCANU

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67,
Email: alexandruvladstefan1@gmail.com

Corresponding author email: alexandruvladstefan1@gmail.com

Abstract:

From the studies and research carried out in this study, we present a model for a sustainable development of the Beldiu village, Teiuş city, Alba county. In the first part of the research, we present the development of the agriculture, respectively the pedological studies to date, the cultures and also the development of the irrigation system. In the second part of the research, we will present a model of strategy of the improvement of watercourse Mures. Through studies done in the area we want to attract investors for the development of small agricultural or non-agricultural businesses which will result in a certain economic development in the area. Through these methods we also want the agro-tourism development, such as the creation of places to relax, farm fishery, etc. The conclusion of these studies is to develop sustainable development projects for both communes and villages that are in the meadow, thus the development of Romania.

Key words: *business, agrotourism, meadow, development, production, sustainable*

INTRODUCTION

Located right in the heart ofMures, relatively isolated from the administrative center - the city Teiuş, Beldiu village is a picturesque place, special, fertile agricultural land and hardworking people, lately the area is strongly industrially reprezented.
Beldiu town is located in the center of Alba County, in a geographical area with a favorable climate at the foot of the hills bordering the Apuseni Mountains, in the rich and the fertile valley of Mures.
CLIMATE
Considering the existing climate data, we can say that the villageBeldiu fits in a boreal climate with wet winters and summers and mild calduroase.Temperature according to yearly averages is 9.4 ° C. Average annual rainfall is 577 mm.

Figure 1. Mures County

WATERS

From the point of view of hydrography, the territory belongs to the receiving basin of Mures witch traver

e the eastern part of the village. Phreatic waters are at different depths, depending on the geo-morphological form which there are: in the central meadow phreatic water occurs at depths of 2.5-3 m; then the central meadow appears slightly positive where the phreatic water is found at a depth of 1.5-2 m. In areas of negative ancient meadows, phreatic water in swampy areas surfaced and wetlands are found at a depth of 0, 5 to 0.8 m. On the terraces,phreatic water occurs at depths well in excess of 10 to 15 m, sometimes 20-30 m as evidenced by the appearance of springs on the terrace foreheads.
Mureşului meadow has an average width of 2.83-3 km and the depth of water during growth reaches 1.8-2.2 m. Mureşului feeding regime ispluvional. Because of the drainage slope,the river's meadows are powerful which also lead to flooding.

FLORA AND FAUNA

The relief, climate and soil conditions allowed the vegetation to grow with the altitude, starting with soft essences (willow, poplar, alder) accompanying Mures Valley and ending on terraces with grasses and bushes (hawthorn, brier, blackthorn, etc.). In this area, the main species found are hares, foxes, mices and hamsters. The birds are represented by the tits, shots, nightingales, crows, owls, ratter hawks, pigeons, starlings.

FLOOD DEFENSE WORKS

After floods in 1970, when Mures reached a historic high flow producing numerous damage (crops, livestock, housing, etc.), it was decided to build a dam longitudinal with a flood protection. Construction started in 1974, and is located on the right side of Mures and has the following features:
- height - 2.5-3.0 m;
- the width of the crest - 2.5 m;
- the width of the base - 4.0 m;
- equal slopes.

In 2013 the dam was securely placed, because there were some overheightening works and the river bed of Mures suffered some works of desilting and sanitation.

In 2014 were arranged tailboard at certain points in the dam to drain water from the polder, and during the floods it closes with valves that function as valves under pressure.

Figure 2. Beldiu Village

Figure 3.

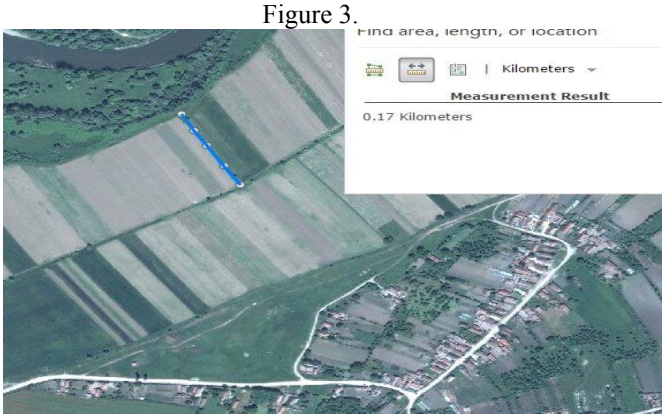

Figure 4.

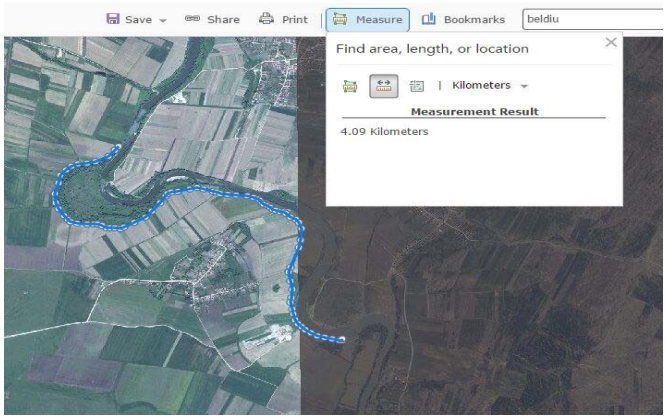

Figure 5.

The village had an irrigation system with a watering sprinkler specifically designed for vegetable growing, unfortunately the system was scrapped years ago. The system could be rehabilitated with minimal costs (cleaning channels and purchase of new pumps, pipes and sprinkler).

Since 2005 the villagers gave up growing vegetables because of low purchase price, as a result the cultivation of certain crops (wheat, canola, soy, corn, etc.). On this occasion we could redesign an irrigation system watering these crops for the benefit of a better production.

EXISTING LAND IMPROVEMENT WORKS

Profile number	Probe number	Depth (cm)	pH	Conductibili-ty (µS/cm)	Soluble salts (%)	Humus (%)	Clay (%)
P1	1-1	0-30	7,04	92,8	0,03	3,8	36
	1-2	30-60	7,06	149,3	0,05	2,6	48
P2	2-1	0-30	7,88	221,0	0,08	3,1	42
	2-2	30-60	8,17	192,0	0,06	2,4	34
P3	3-1	0-30	7,65	128,4	0,04	5,2	26
	3-2	30-60	8,00	123,3	0,04	4,3	30
P4	4-1	0-30	8,17	180,3	0,06	5,0	25
	4-2	30-60	8,30	184,4	0,06	4,1	22

Figure 6.

ASPECTS OF SOIL QUALITY

A pedological study was conducted, in which the team got soil samples from depths: 0-30cm and 30-60 cm. Geomorphological studied perimeters are uniform, which has enabled average samples.

Physical and chemical analyzes were performed in the Paedeological laboratory of the Faculty of Agriculture in Bucharest.

Profile number	Humidity (%)	CH	CO	CC	CUA
P1	29,34	7	13	23	10
	28,71	11	17	25	8
P2	27,55	10	15	23	8
	26,94	8	12	24	12
P3	24,92	6	9	22	13
	21,66	7	11	23	12
P4	27,31	6	9	22	13
	21,96	5	8	22	17

Figure 7.

Main soil types identified are:

P1 - preluvosoil (argillic brown Soil)
P2 - eutricambosoil (I-mesobasic brown Sol)
P3 - Faeoziom (Cernoziomoid)
P4 - Faeoziom (Cernoziomoid).

Soils contains no soluble salts studied and no risk of salinization.

Figure 8.

Figure 9.

Figure 10.

Figure 11.

Figure 12.

CONCLUSIONS

Natural environment, resources and risks

Strong points:

- Rich nature and varied cultural resources
- Abundant resources (water, soil, etc.)

Weaknesses:

- Soil and water
- Improper waste disposal
- Contradictions in the sustainable use of resources
- Risks in certain areas (floods, pollution, subsidence)

Opportunities:

- Development and enhancement of fish stock
- The practice of ecological agriculture
- Development of alternative energy forms
- Use of landscaping advantage
- The use of intact environment as unique element
- Use of the economic benefits of nature.

Methods of study:
- collection of data and relevant information on the Beldiu village;
- processing in ArcGIS Online;
- sampling and chemical analysis of soil samples, performed in the pedological laboratory of the Faculty of Agriculture pedological Bucharest;
- interpreting the results of measurements;
- analysis of sustainable development strategies developed for similar places.

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EVALUATION OF TECHNICAL DOCUMENTATION FOR MULTIFUNCTIONAL BUILDING IN BARAGANU VILAGE, BRAILA COUNTY

Daniel-Mihai TOMULESCU

Scientific Coordinator: Assoc. Prof. PhD Eng Augustina Sandina TRONAC

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +40726491384. Email: dm.tomulescu@yahoo.com

Corresponding author email: dm.tomulescu@yahoo.com

Abstract

The beneficiary of the investment has requested evaluation of technical and economic documentation for the multifunctional building construction in Baraganu village, Braila County, assessed in compliance with the technical requirements and standards in force. The construction is thus conceived as to cover minimum capacities and surfaces to create certain adaptable spaces for future intended use. The multifunctional building is constructed to be rented in order to re-establish services that are not provided or are insufficient, for the increase people's standard of living, the social and professional development of the commune, where preferably complementary activities should be conducted, but also the possibility of independent operation taking into consideration the organization criteria on the area of activity.

Key words*: multifunctional building, business premises rental, services, professional and social development*

INTRODUCTION

In terms of administrative matter, Baraganu village is the seat of Baraganu Commune. Baraganu Commune is seated in the South end of Braila County, in Calmatuiului Field, crossed by DN21 (National Road) (E584) which connects Braila to Slobozia.

The location proposed for the multifunctional building is located within the build-up area of the commune, nearby the kindergarten and the church, at the crossroads of Dudesti Street and Doicesti Street at no. 138A. It is a state-owned land with cadastre number 71247. The parcel where the building is to be located has a surface of 1138 m2 and it is classified under the category of use yards-buildings. At current date, there are no other buildings on the land.

Baraganu has a temperate continental climate with large seasonal variations and relatively low rainfall. The dominant winds blow moderate from Northeast. The average annual temperature is +10˚C and the amount of maximum rainfall is 400 mm/year.

Frost depth is 0.9 m (STAS 6054/1985).

In terms of geological matters, Baraganu features deposits belonging to the upper Holocene, made of loess deposits and sand dunes.

The seismic behaviour of the land is characterised by: the designing land acceleration ag=0.25g, corner period Tc=1.00s (P100-1,2013)

MATERIALS AND METHODS

The design of spaces in terms of technical and functional matters, according to the agreement with the beneficiary's point of view, took into account the fact that the Town Hall of Baraganu Commune will receive rental requests related to the building for setting a basic medical care group and therefore spaces appropriate for the public health services and spaces to accommodate medical staff were designed, divided on operational areas, namely (Anghel, 2013)

GROUND FLOOR:

Area 1 - front desk hall and waiting room for patients;

- 3 medical offices with surfaces that can be divided by slight items (plasterboard) thus separating the spaces for medical examinations from the treatment office;

- male/female rest rooms for medical staff, patients and disabled;
Area 2 – pharmacy and storehouses;
Annexes – technical spaces with thermal station;
- stairs leading upstairs

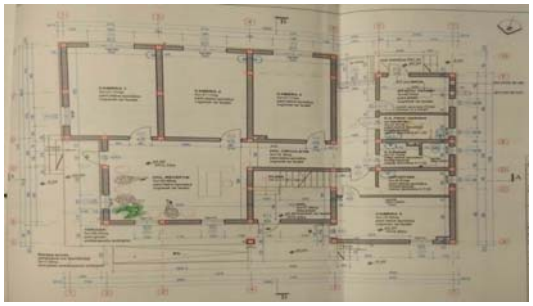

Figure.1. Groundfloor plan view

FIRST FLOOR:
Area 3 - 3 offices to accommodate the medical staff (office with rest rooms); In designing the system for the buildings within this project, we complied with the provisions related to the quality requirements (Law 10, 1995) that lay down the following basic applicable requirements during the whole period of constructions: mechanical resistance and stability; safety to the fire; hygiene, health and environment; safety and accessibility in operation; protection against noise; energy saving and thermal insulation; sustainable use of natural resources.

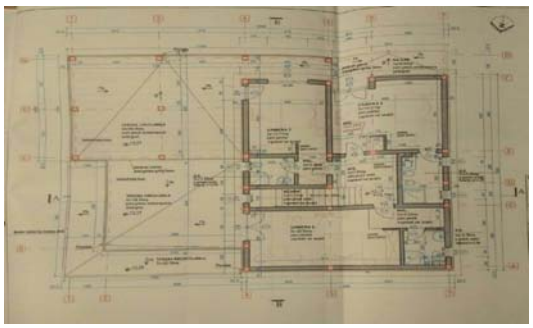

Figure.2 First floor plan view

The building is articulated in a square with maximum size 16.90 x 14.15 m, including the outer thermal insulation with thermal system, thickness 10 cm.
The building area at the level ±0.00 is Ac=204.65 m2 and gross building area Ad=322.60 m2; total useful area Au=273.27 m2, Hmax at the attic=6.50 m compared to the level ±0.00.

Figure. 3 General arrangement

The level ±0.00 compared to which the levels in the project were calculated is the level of the flooring in the ground floor of the building and it is located about 45 cm above the level of the outer land arranged (sidewalk).
A terrace located at the level –0.03 m provides independent accesses in the 3 functional areas. The access to the terrace is done by 2 packs of 3 stairs and a ramp for disabled people located on the Northern and Eastern construction sides.
The free height of the spaces in the ground floor is of 2.90 m, and in the upper floor, it is of 2.60 m.
The 3 accommodation units in the upper floor are each made up of: access hallway, the accommodation room in itself, toilet room, the possibility to use a terrace or a balcony.
The exterior walls, supporting walls, will be made of efficient brick masonry with 25 cm thick vertical holes, and the inner walls of masonry with 25 cm thick solid brick (the supporting ones). The light partition walls will be made of sandwich plasterboard, 10 cm thick, except for the partition wall separating the toilet in the upper floor from the floor hallway which shall be 20 cm thick to include the supporting structure of the ceramic sanitary ware.
The roof will be made as non-walk roof terrace with the following layers from bottom to the top: reinforced concrete slab 13 cm thick; self-levelling screed and shovel M100; PVC TEFOND membrane (diffusion layer and vapours barrier); polystyrene thermal insulation of 20 cm; supporting shovel of Thermo Concrete and backfall of min. 5 cm; cold bituminous primer with Hydrostop; hot working bituminous waterproofing

membrane – 3 layers; layer of white gravel, sort 15-25 mm, 10 cm thick.
Roof accessories will be provided with grey "Lindab" sheet metal gutters and water spouts.
The outer joinery will be made of PVC, walnut wood effect with double glazing.
The inner joinery in the ground floor will be of white PVC, and the upper floor of painted wood.
Finishing in the outer part are: plastering and facade painting, plywood face brick,
tiled outdoor flooring, slip and frost proofed on the terraces and steps.
Exterior finishes will be performed, for the exterior walls of mineral structured silicone plasters, white-limestone of at least 1.5 mm, the putty of at least 5 mm applied over the polystyrene panels, reinforced with fibreglass mesh
Some areas will be coated with face brick. At the base (45 cm height), we will use grey mosaic mineral plaster.
Indoor finishing:
GROUND FLOOR: ordinary plaster and painting with washable paints, epoxy floors and ceramic tiles, epoxy painting at a height of 1.5 m in medical offices and toilets.
UPPER FLOOR: ordinary plaster and painting with washable paints, parquet floors in rooms and ceramic tiles in hallways and bathrooms, earthenware tiles in bathrooms.
The stairs, ramp, parapets of the terraces will be equipped with stainless steel rails.
Insulation: thermal insulation will be provided for the outer walls, base and roof, interior and exterior waterproofing insulation.
The landscaping will include walkways for pedestrians, green spaces, protection sidewalks.
We have designed a vertical systematization with slopes outwards the construction allowing fast evacuation of rainwater.
The building will be equipped with interior and exterior plumbing, heating
and electrical connected installations, connected to the external networks installed in the area.
Water supply will be assured from existing common distribution pipe on Doicesti Street through its own branching made of a pipe and water tank with cold-watermeter.
Wastewater will be evacuated by means of gravitation through a connection to the drainable septic tank nearby, within the roadways.
The spaces will be heated by they own thermal plant solid fuel (wood) and heating devices using water as thermal agent. The thermal plan will be located in a specially arranged technical space with direct access from the outside and will have useful power P = 40 kW.
Gas will be discharged through flue – stainless steel flexible hose and a stainless-steel sheet flue insulated with mineral wool protected on the outside part with sheets of stainless steel.
The authorization of construction works (Law No. 50/1991) updated on October 5, 2012, the building falls into the next category and class of importance: category of importance C-normal (HGR 766, 1997); class of importance IV (P100, 2013); second degree fire resistance (P118, 1999).

RESULTS AND DISCUSSIONS

In designing the constructive system for multifunctional building there were respected the provisions of design regulations in force, regarding general concept of the resistance structure and constructive composition in detail. Necessary measures have been taken, by specific calculation, so loads likely to act on the building during construction and exploitation do not produce: partial or total collapse of the building; unacceptable deformations of structural elements; damage to other parts of building, plumbing, heating, electrical as a result of the large deformations of the load-bearing; damage to the building in relation to seismic risk.

CONCLUSIONS

Current statistics show that 9,632,500 inhabitants (44.80% of population) lives in rural areas (INS, 2007)
The basic staring point that prevention in the health sector is the cheapest and most effective method on population health maintaining. The main factor in disease prevention is health education and permanent supervision of people’s health. In order to do this, the family doctor must be perfectly integrated in its

professional environment and patients should have easy access to the physician.

By setting up healthcare groups in rural areas, it could be created all conditions required to implement national preventive healthcare programs quickly and accurately.

Clearly, the costs would be quickly recovered in savings resulted if the expenses are lowered in the medical system by improving population's health and reducing the number of illnesses. There are also results that cannot be quantified in terms of financial matters, but with major implications in increasing the quality of life, increasing life expectancy of the population, etc. The project can be doubled by a national housing project for general practitioners who intend to settle and conduct their activities in rural areas.

The importance of establishing a medical outpatient care facility in Baraganu Commune is imperative for all inhabitants, as in the nearby area there are no other medical facilities that can provide medical care.

ACKNOWLEDGEMENTS

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SECTION 03
WATER RESOURCES MANAGEMENT

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WASTEWATER TREATMENT PLANT AND QUALITY OF BIOLOGICAL TREATMENT PROCESS

Lucian HIRJOABA

Scientific Coordinators: Prof. PhD Carmen CIMPEANU
Lect. PhD Constanta MIHAI

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67, Email: lucian.nelutu@gmail.com

Corresponding author email: lucian.nelutu@gmail.com

Abstract

The aim of this paperwas to evaluate the quality of water povided from the municipal wastewater treatment plantof Tecuci town. In order to perform this objective, we collected the water semples and analysed them into the Faculty lab. We tested the physicaly and chemicaly characteristics of wastewater and compared theobtained values with the limits values for disposal of wastewater registeredin national Normative (NTPA 001).We found that water samples are in compliace with technical normative; the wastewater is properly treated and it can be discharged into the emissary.

Key words*: wastewater,enviroment, water analysis, secondary treatment*

INTRODUCTION

The objective of wastewater treatment plant is to produce a disposable effluent that will not harm the environment and thus, prevent pollution. The process consists of several steps, called preliminary, primary, secondary and tertiary treatment, see Figure 1.

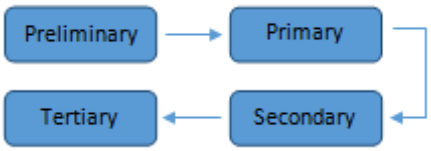

Figure 1. Conceptual scheme of the different steps in wastewater treatment plant

The principal objective of wastewater treatment is generally to allow human and all life form to live without danger to health or unacceptable damage to the natural environment. However some degree of treatment must normally be provided to municipal wastewater before it can discharge into natural receivers and be used.
The scope of this work was to evaluate the water quality before and after secondary and tertiary treatment process at wastewater treatment plant of Tecuci town, Galati county. The wastewater treatment plant was rehabilitated and extended, in september 2015 it was given in use so i decided to check the quality of water after the new treatment technology and process. Water samples were collected in sterile recipients before and after biological treatment step.
After analysis of water samples the physico-chemical indicator values were compared with technical standards for water quality provided in normative on the establishment of limits on charging industrial polluants and urban sewage discharge into natural receivers (NTPA 001).
In this work were checked the next parameters: pH, TSS, NH4, NH4-N, NO3, NO3-N, NT, PT, CODCr.

MATERIALS AND METHODS

Determination of pH
The pH defines alkaline or acid water as having values from 0 to 14. Values between 0-6 characterize an acid pH, the 7 designates a neutral pH and alkalinity is between 8-14. Determination of pH was performed using pH sensor (Figure 2). Before taking readings, sensor calibration was performed in solutions of known pH (4, 7, and 9).

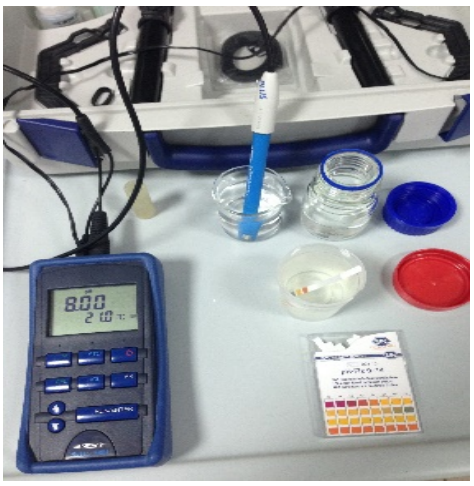

Figure 2. Determination of pH with pH sensor

Chemical oxygen demand (COD):
The organic matter, present in water sample is oxidized by potassium dichromate in the presence of sulphuric acid, silver sulfate and mercury sulfate to produce carbon dioxide (CO2) and water (H2O). The quantity of potassium dichromate used is calculated by the difference in volumes of ferrous ammonium sulfate consumed in blank and samle titrations. The quantity of potassium dichromate used in reactions is equivalent to the oxygen (O_2) used to exidize the organic matter of wastewater.

Test for Chemical Oxygen Demand:
1. Take 10 ml of sample into a round bottom reflex flask.
2. Add some glass beads to prevent the solution from bumping in flask while heating
3. Add 1 ml of Mercury sulfate (HgSO4) solution to the flask and mix by swirling the flask.
4. Add 5 ml of Potassium dichromate (K2Cr2O7) solution
5. Now add slowly and carefully 15 ml Silver sulfate – Sulfuric acid solution.
6. Connect the reflex condenser and digest the content using hot plate for 2 hours.
7. After digestion cool the flask and rinse the condenser with 25 ml of distilled water collecting in the same flask.
8. Add 2-4 drops of ferroin indicator to the flask and titrate with 0.025M ferrous ammonium sulfate solution to the end point.
9.Make the blank preparation in the same manner as sample using distilled water instead of the sample.
Calculate the chemical oxygen demand by follwing formula:

$$COD = \frac{8 \times 1000 \times DF \times M\ (Vb - Vs)}{\text{Volume of sample (in ml)}}$$

Where,
DF – Dilution Factor
M – Molarity of standardized Ferrous Ammonium Sulfate solution
Vb – volume consumed in titration with blank preparation
Vs – volume consumed in titration with sample preparation
Determination of Nitrogen/Nitrogen-N
Reagents
1. Solution of 50% NaOH.
a. dissolve 100 g of NaOH in water, dilute to 200 mL
2. Buffer solution:
a. to a 1000 mL flask add 600 mL of water,
b. add 14.2g of Na_2HPO_4 or 17.8g of $Na_2HPO_4.2H_2O$ or 35.8g of $Na_2HPO_4.12H2O$ and dissolve
c. add 50g of K Na tartrate($C_4H_4KNaO_6.4H_2O$)
d. add 108 g of 50% NaOH
3. Salicylate/nitroprusside solution
a. in a 1000mL flask dissolve 150 g of Na Salicylate ($C_7H_5NaO_3$) and 0.30g of sodium nitroprusside ($Na_2[Fe(CN)5NO].2H_2O$) and make up to 1L
b. store in dark in brown bottle
4. Hypochlorite solution
a. dilute 6 mL of 5.25% sodium hypochlorite to 100 mL
b. prepare daily as it isn't stable
5. A "Diluent" solution
a. This contains the metal catalyst, or digestion solution, or the extraction solution.

Standards:
2. 100 mg/L NH_4-N
a. Dilute 10 mL of the 1000 mg/L solution to 100 mL using "diluent"
1. Series of NH_4 standards
a. Dilute 0, 1, 2, 3, 4, 5, 6 of 100 mg/L to 100 mL with "diluent"
b. This series contains 0, 1, 2, 3, 4, 5, 6 mg/L of NH_4-N

Procedure
1. Turn on spectrophotometer and set `wavelength to 650 nm
2. Transfer 1mL of solution or standard to a test tube

3. Add 5.5 mL of buffer solution. Mix and agitate with vortex
4. add 4 mL of salicylate/nitroprusside solution and mix
5. add 2 mL of hypochlorite solution and mix
6. let rest for 45 min at 25C or 15 min at 37C
7. read absorbance at 650 nm within 2 hours.

Determination of total phosphotus
The phosphorus was determined by the method standardized by spectrometry.

RESULTS AND DISCUSSIONS

The seconday treatment (biological) is carried out using a sludge of active microorganism (bacteria, fungi, protozoa and algae) that transform different compounds found in wastewater. The process configuration for treating wastewater where microorganism are used for removal of polluants is called activted-sludge.
Most bacteria are heterotrophic, which means that they need an organic substance for the formation of cell tissue. They extract energy by an aerobic process where the organic matter is oxidized to carbon dioxide, water and oxygen is reduced. In the absence of oxygen there are autotrophic bacteria that can perform an anaerobic process where part of the organic matter is oxidized to carbon dioxide and water, while something other than oxygen, normally ammonia or sulphides, is reduce
At high pH values, over 8.0, nitrogen is mostly in the ammonia form (NH3) but when the wastewater is acidic or neutral (municipal wastewater is neutral), the majority of nitrogen is in the ammonium form (NH4+).

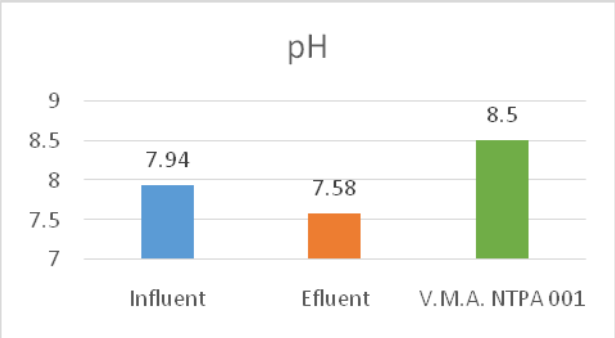

Figure 3. pH

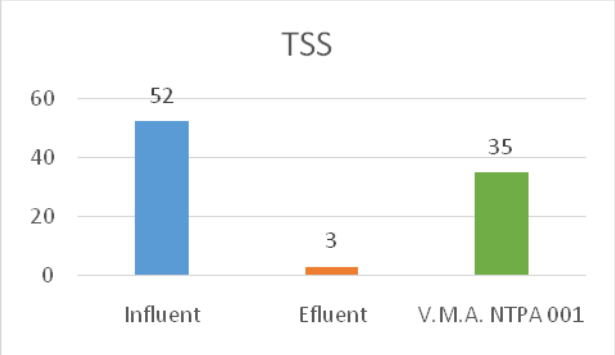

Figure 4. TSS

The removal of organic matter is important, because of the oxygen consuming reactions that pollute the recipient (Tchobangoglous and Burton, 1991). Removal of organic matter is the primary target for wastewater treatment. Equation (1) shows oxidation of organic matter and synthesis of cell tissue and equation (2) shows the endogenous respiration.

$$COHNS + O_2 + nutrients \xrightarrow{bacteria} CO_2 + NH_3 + C_5H_7NO_2 + other\ end\ products \quad (1)$$

$$C_5H_7NO_2 + 5O_2 \xrightarrow{bacteria} 5CO_2 + 2H_2O + NH_3 + energy \quad (2)$$

where,
COHNS = organic matter in wastewater (carbon, oxygen, hydrogen, nitrogen and sulphur)
$C_5H_7NO_2$ = cell tissue

The removal of organic matter is usually measured as BOD (Biological Oxygen Demand), TOC (Total Organic Carbon) or COD (Chemical Oxygen Demand).
COD test includes using a strong chemical oxidizing agent in an acidic medium and measuring the oxygen equivalent of the organic matter that can be oxidized. The COD can be determined in just two hours (Tchobangoglous and Burton, 1991). An advantage is that the test can be used to measure the organic matter in both industrial and municipal wastes that contain compounds that are toxic to biological life. In general, the COD test is higher than the BOD because more compounds can be oxidised chemically than biologically. Thus, the ratio between COD/BOD indicates the degree of biodegradability of wastewater. Matter that biodegrades relatively easily has low values, i.e. COD/BOD < 2 (Gillberg, et al., 2003) and a high value indicates that the organic matter will biodegrade slowly.

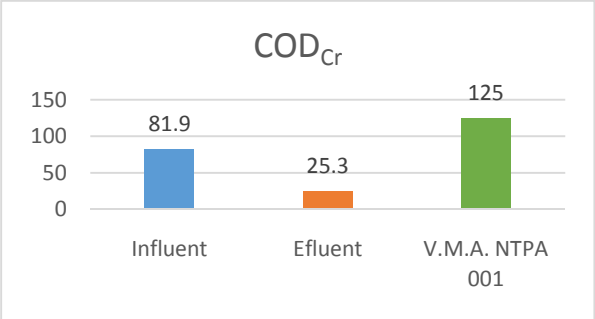

Figure 5. COD Cr

Treatment of nitrogen
Nitrogen is undesirable in wastewater effluent because of the environmental hazards. Free ammonia is toxic to fish and other aquatic organisms. It is also oxygen-consuming and depletes the dissolved oxygen in the receiving water. Nitrogen in all forms is a nutrient and therefore contributes to eutrophication.
The biological removal of nitrogen is a three-step process (US. EPA, 2008). First, organic carbon is converted to ammonium through hydrolysis and microbial activities according to equation (4), which is called ammonification. Then ammonia converts to nitrate, equation (5) and (6), under aerobic conditions with oxygen, the process is called nitrification. In equation (7) the nitrate then reacts with organic carbon to form nitrogen gas. This process is called denitrification and occurs under anoxic conditions, which means that there is no soluble oxygen present.
When wastewater enters the wastewater treatment plant, about 60 percent of the nitrogen is in organic form and 40 percent is in the ammonium form (Sedlak, 1991), i.e. equation (4) has already occurred. A build-up of nitrite is seldom seen, thus it is the ammonia to nitrate conversion rate that controls the rate of the overall reaction (Sedlak, 1991). The carbonic acid derived from equation (5) lowers pH and if pH goes below 7 (municipal wastewater often have a pH value of 7) the activity of nitrifying bacteria decrease butthe presence of denitrification, see equation (7), counteracts this reduction of pH. Optimal nitrification rates occur at pH values between 7.5 and 8.0 (Tchobanoglous et al., 2003). The effect on pH depends on the alkalinity of the wastewater. There is equilibrium, see equation (9), between the species of ammonia depending on pH value in the water. At pH below 9, a larger percentage is in $NH4^+$ form.

$$Organic\ nitrogen \xrightarrow{hydrolysis,bacteria} NH_4^+ \quad (4)$$

$$NH_4^+ + \frac{3}{2}O_2 + 2HCO_3^- \xrightarrow{bacteria} NO_2^- + 2H_2CO_3 + H_2O \quad (5)$$

$$NO_2^- + \frac{1}{2}O_2 \xrightarrow{bacteria} NO_3^- \quad (6)$$

$$NO_3^- + organic\ carbon \xrightarrow{bacteria} N_2(g) + CO_2(g) + H_2O + OH^- \quad (7)$$

where,

NH_4^+	= ammonium
HCO_3^-	= bicarbonate
H_2CO_3	= carbonic acid
NO_2^-	= nitrite
NO_3^-	= nitrate

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$$NH_4^+ \leftrightarrow NH_3 + H^+ \quad (9)$$

Total nitrogen (TN) is the sum of organic nitrogen, ammonia (NH4+/NH3) nitrogen, nitrite and nitrate. Another parameter is total nitrogen (TN), which is the total of organic nitrogen and ammonia nitrogen. Nitrifying bacteria fixate carbon dioxide which is highly energy demanding, this means they grow slowly. The generation time of nitrifying bacteria varies from eight hours to several days, this limits the process and requires quite long solids retention time (SRT) to maintain nitrification. About 10 – percent of influent nitrogen accumulates in sludge due the formation of cell tissue but the largest fraction will leave the system as harmless nitrogen gas (N_2).

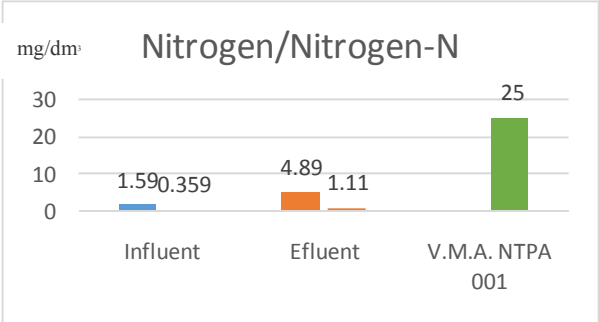

Figure 6. Nitrogen / Nitrogen-N

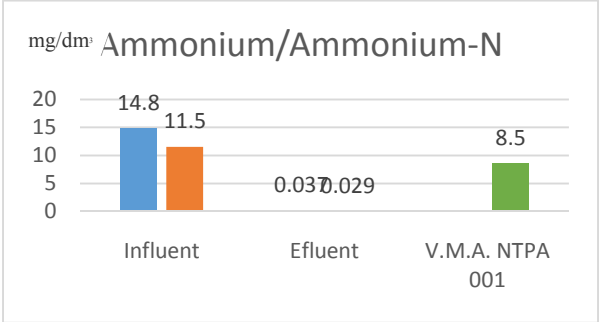

Figure 7. Ammonium / Ammonium-N

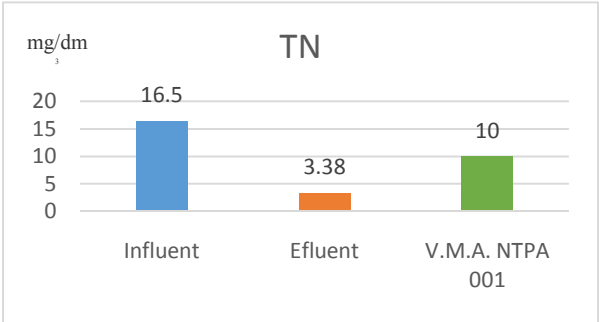

Figure 8. TN

Treatment of phosphorus

Phosphorus is normally removed through precipitation but in order to reduce the use of chemicals, which is costly, and reduce sludge production, biological removal in the secondary treatment is an alternative. Special bacteria, called phosphate-accumulating organisms (PAO) (US. EPA, 2008), assimilates short volatile fatty acids (VFA) and stores them in the cell. To release energy needed for the uptake, orthophosphate (OPO4) is cleaved, thus increasing the phosphorus concentration in the water. This occurs in an anaerobic environment. When the organisms reach an aerobic or anoxic environment, metabolism i.e. oxidation of organic matter releases energy and enables binding of phosphate to the bacteria cells. Due to disposal of stored phosphorus with the waste sludge the net effect will be a reduction of dissolved phosphorus in the water.

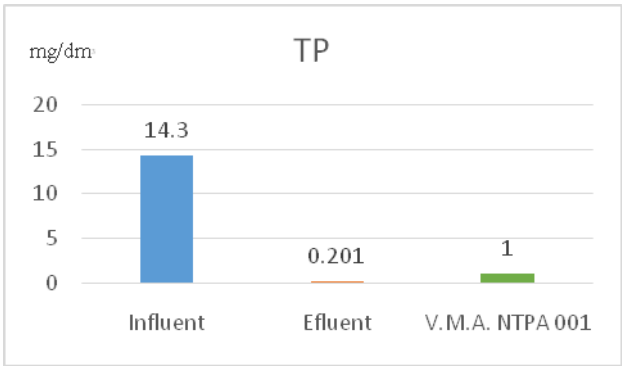

Figure 9. TP

CONCLUSIONS

Physico chemical analysis reflects the quality of treatment process in biological step. Concentrations of pollutants in water decresed, make it fits in the maximum value admitted in NTPA 001 which proves that water cand be deversed in natural receptors. Nitrification and denitrification process it is adapted according to quality of wastewater, concentration values may decrease or increase, the process being controlled by a quality monitoring system, automatic system – SCADA, or can be controlled manually.

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SECTION 04
CADASTRE

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METHOD OF TRACKING DEFORMATIONS FOR HYDROTECHNIC DAMS STRUCTURES

Daniel AVRAM, Carmen PREOŢESCU, Gigel CALDAREA, Iulian BRATOSIN, Raluca KIVU

Scientific Coordinators: Lect. PhD Eng. Daniela IORDAN, Assist. PhD Eng. Vlad PĂUNESCU

University of Agronomic Science and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: +4021.318.25.67

Corresponding author email: preotescu_carmen@yahoo.com

Abstract

This study was conducted in order to assess the usefulness and accuracy of dams deformations. Comparisons of observed movements during consecutive years show the stability of the dams. The observations are done trough levelling, a procedure that delivers altimetry data. Levelling is conducted trough points, marks and brands, of known coordinates, both in altimetric and planimetric systems.. Measurements were conducted in two consecutive years. The results will be processed using Gauss Markov model. The data analysis will be done using statistical tests. The multitude of phenomena affecting dams lead to movements and deformations that must be under permanent monitoring. Land surveyors have the tools and knowledge for such performance monitoring.

***Key words**: deformations, dams, land measurements, levelling network.*

INTRODUCTION

Dams, dikes, embankments and other control structures for floods are subject to external loads causing the deformation and the permeability of the structure itself. Any clue of an abnormal behavior may endanger the safety of the structure. In order to facilitate the monitoring of such structures, they should always be equipped with the appropriate tools and/or points that can be traced in accordance with the type of structure, size and site conditions.

Monitoring trips/ deformation space - 3D: the problem of determining the position of points in a single system of reference for the three coordinates, was and is one of the main concerns of geodesy. Tridimensional geodesy eliminates this separation, keeping unity of the reference system to solve the problem of space positioning of geodetic points. The result of the processing consists in determinig the three dimensional spatial position of the geodesic network of points, in a unitary system.

Figure 1. Dam Gura Apelor

Gura Apelor Dam is an artificial dam built between 1975 and 1986 on the Râul Mare valley, about 40 km from Haţeg at the entrance of National Park Retezat from Retezat Mountains (Southern Carpathians, Romania) (http://www.hidroconstructia.com/rom/raul_mare_retezat.html).

Design features

Dam construction began in 1975. Its size are impressive: 168 m high, 225 million cubic meters of water in the reservoir, the dimensions of the entire dam outpace three times those of Keops (date Hidroconstrucția) pyramid.

Râul Mare Retezat hydropower has the role of producing both electricity, regulate stream flow and mitigate flood waves. (Figure1).

Displacement: Movement of a point placed on a construction subjected to strains.

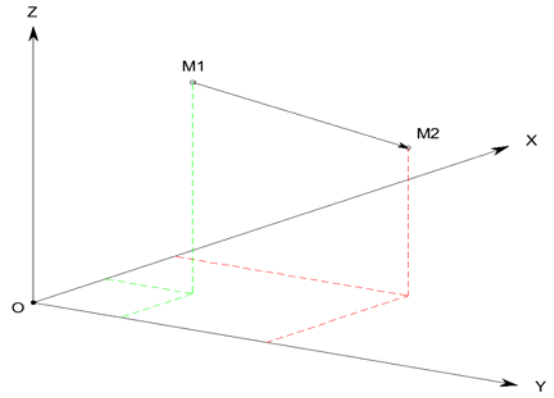


Figure 2. Displacement

Deformation: changing the relative distance between points located on a building subjected to strains .

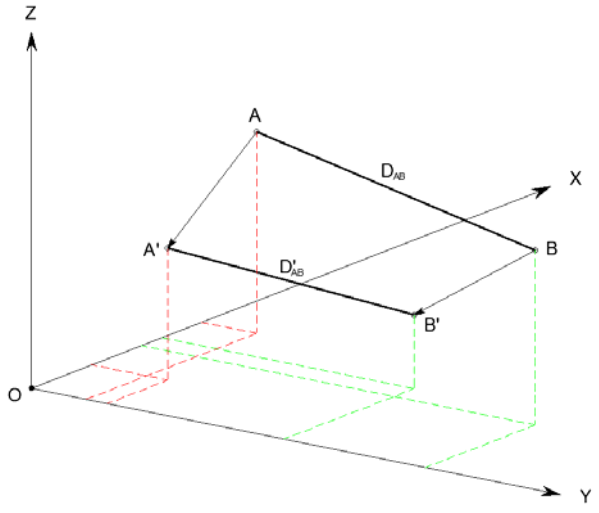


Figure 3. Deformation

MATERIALS AND METHODS

The multitude of phenomena that influence the appearance of construction displacements and deformations, as well as constructions response to the influence of these phenomena require the need for performance monitoring in time of the objective. Observations are done at different ages in time. Processing of these observations is hampered by practical difficulties the ages of measurement is subject to practical difficulties. Determinaiting building subsidence is usually done by precision geometric levelling of marks embedded in the building, that moves with it, to the fixed reference points outside the building and which make up the supporting network of points. (Figure 4) Depending on the type, shape and size of the examined object levelling network can take the form of closed polygons or traverses approximately parallel to each other. The levelling network of points is made up by marks placed on the observed object and by the control marks (placed outside the construction). Marks shape and material is chosen according to local conditions, the shape and material of the surveyed construction.

A network of geometric levelling consists of levelling landmarks. Between these land marks measurements are done to determine the differences in level and length of routes subjected to observations.

In such a network, to perform adjustment calculations one must know or determine:

-measure level differences (Δh_{ij}) by geometric levelling method;

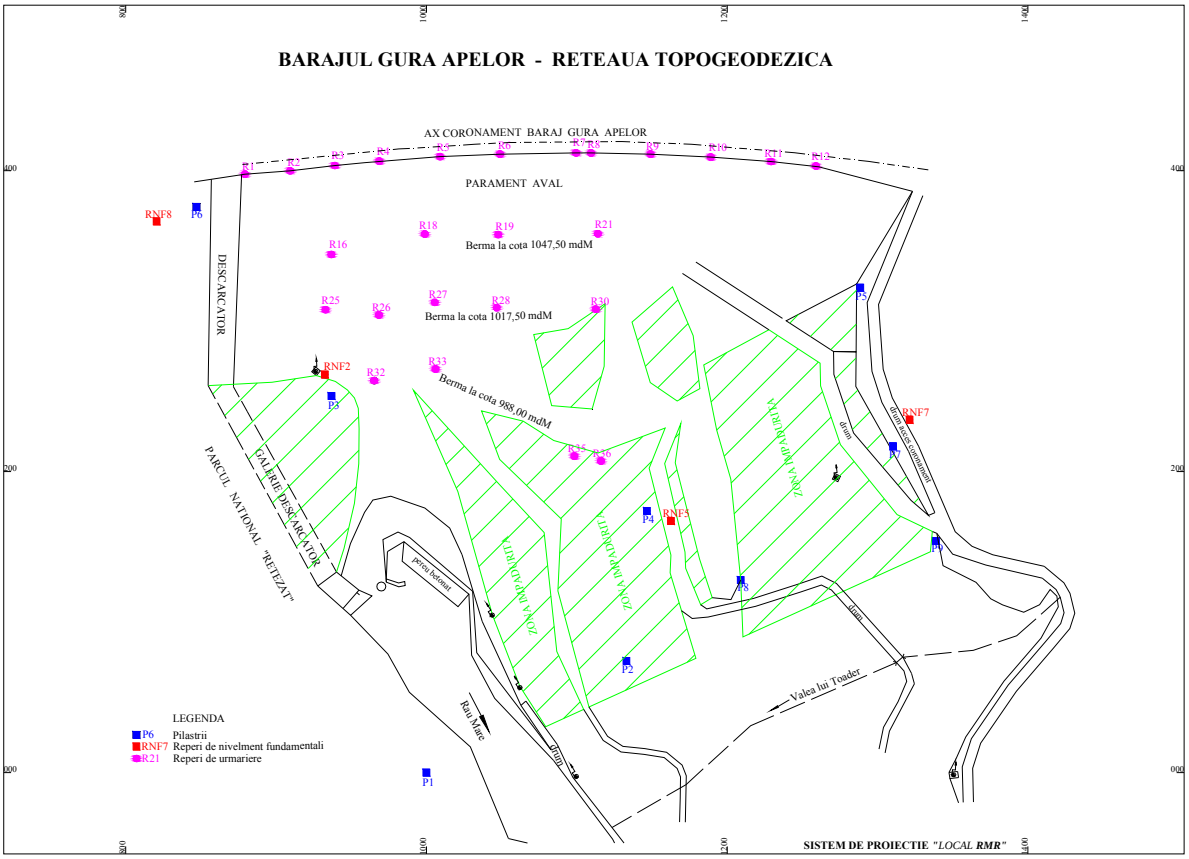


Figure 4. Dam Gura Apelor - Geodetic network

-the lengths of the paths followed to determine the level differences necessary for determining weights of the measurements, with the relationship:

$$P_{ij} = \frac{1}{L_{ij[km]}} \quad (1)$$

-the altitude (H_i) of one or more height marks of the levelling network of points considered;

With these elements, through a rigorous process, are to be determined:

a) absolute values (most likely) of altitudes of all the new network points, depending of the original known elements, in the adopted reference system;

b) the most likely values (compensated) of the level differences, on the routes on which they were measured;

c) The accuracy with which these values are determined by the processing method.

Depending on the nature of the variables involved in the model, this can be:

-functional model (Gauss-Markov) does not contains random elements and describes a pure relationship between sizes, defined by the formula:

$$v = Ax - l \quad (2)$$

-statistical mode (stochastic) that contains random variables that characterize the possibility of displacements and deformations, being expressed by the equation:

$$\Sigma_{ll} = \sigma_0^2 Q_{ll} \quad (3)$$

Based on these variables, complex relationships are established between random values, ie at a given value of the argument corresponds a set of possible values of the function.

Remarks:

v - the measurement corrections vector;

A - matrix coefficients;

x - parameter vector (unknowns vector);

l - vector of free terms;

C_m - variance covariance matrix of measurements;

σ_0^2 - factor variance share or unit variance;

$Q_{xx} = N^{-1}$ - this block is extracted from the general matrix of cofactors:

By processing these levelling observations geometric corrections are to be determined for

compensated values whose sizes are not yet known.

$$H_i = H_i^0 + x_i \quad , i = \mathbf{1}, \mathbf{2}, ..., n \text{ , (4)}$$

and for differences in level measured:

$$\Delta h_{ij} = H_{ij}^0 + v_{ij} \text{ (5)}$$

After writing the system of linear equations of corrections, the system is normalized and solving of the normal system of equations follows. A process which delivers corrections for new points altitudes and corrections for level differences.

$$N = A^T PA \text{ (6)}$$

$$x = -N^{-1} A^T Pl \text{ (7)}$$

Notations:

N - normal matrix system of equations;

A - matrix correction coefficients system of equations;

P - weights matrix

x - vector of the unknown elements

l - free terms matrix

These values added to the provisional elements will provide the most likely values (adjustments) for the two type of elements: relations (4) and (5).

Finally, the elements of accuracy should be computed.

The standard deviation of unit weight can be determined by the relation:

$$s_0 = \sqrt{\frac{[pvv]}{n-h}} \text{ (8)}$$

where n is the number of level differences measured in the network and h is the number of new points in the network (unknown).

The standard deviation of a single level difference is:

$$s_i = \frac{s_0}{\sqrt{P_i}}, \text{ i = 1,2,…,n (9)}$$

The standard deviation of the unknown quantities (quantities determined indirectly)

$$(s_x)_j = s_0 \cdot \sqrt{q_{jj}} \text{ ,j = 1,2,…,h (10)}$$

A global network standard deviation of the unknown quantities can be determined. This is an indication of the determination accuracy of the altitude of the network points:

$$s_t = \frac{1}{h} \sum_{j=1}^{h} (s_x)_j \text{ (11)}$$

At Gura Apelor Dam due to geological and structural conditions two field stages were conducted. (Figures 5- 8)

Figure 5. Stage –september 2015

Because we do not know and cannot always determine the limits of the territory affected by a construction (especially for large buildings), there is no guarantee that all reference bench marks of will be found out of the reach of deformations (Figure 6).

Figure 6. The area action deformations

In addition, the action of various factors such as geological, weather, etc. can lead to the disruption of stability of some of the control points. The remoteness of the control points of as opposed to the construction may not be specified with precision but must take into account the geological conditions in the area. So, for processing 8 bench marks were chosen. Geometric levelling measurements were made with the level Leica 250M and the altitude system used is the Black Sea 1975 (Figure 7).

Figure 7. Progress measurements - Leica Sprinter 250M

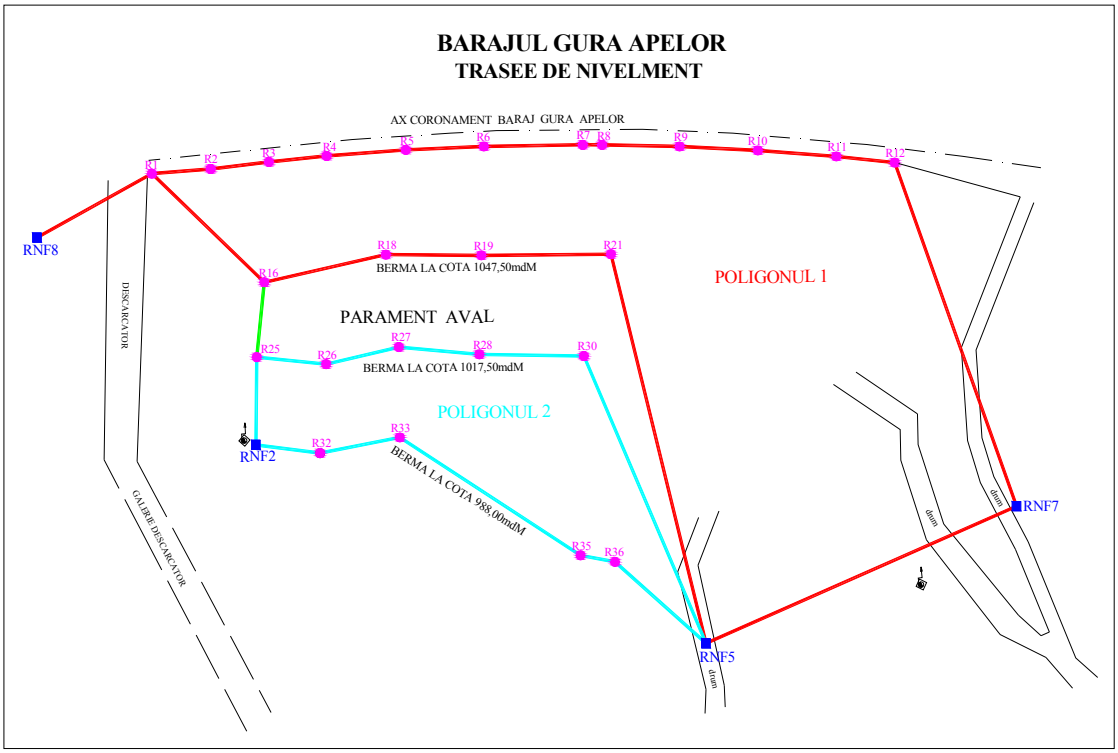


Figure 8. Geometry of the geodetic network with the same configuration at two different measurement periods

RESULTS AND DISCUSSIONS

By adding adjustments to the provisional values (Table 1) the most probable values of the parameters will be determined.

The normal system is compatible determined, so the values of the unknown elements can be uniquely determined. The results of the matrix calculus is presented below:

Compensation of the geometric levelling network through indirect measurement method was described in the processing algorithm. As a result of processing the corrections (vi) for measurements and (xj) parameters are determined.

$$x = \begin{pmatrix} -0.0004 \\ -0.0018 \\ -0.0026 \\ -0.0029 \\ -0.0036 \\ -0.0042 \\ -0.0044 \\ -0.0046 \end{pmatrix} \qquad v = \begin{pmatrix} -0.0004 \\ -0.0015 \\ -0.0007 \\ -0.0004 \\ -0.0007 \\ -0.0006 \\ -0.0002 \\ -0.0002 \\ -0.0022 \end{pmatrix}$$

Table 1. Selection field book

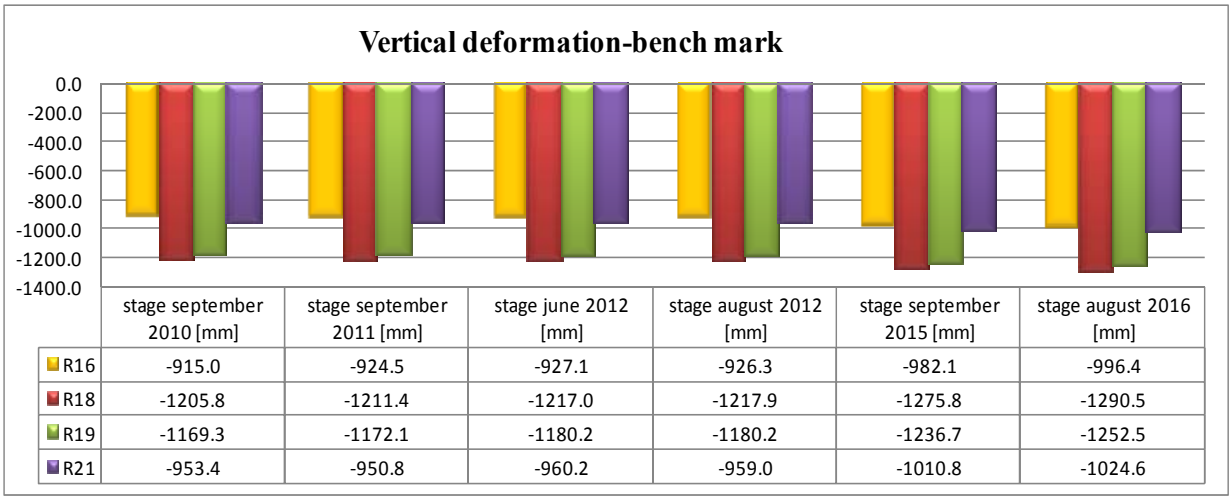
PtNo	Height [m]	Distance [m]	StaffType	Meas_Type	IsReferNo	Elevation [m]	D.Elv [m]	Cut [m]	Delta-Height-dH [m]	Denumire reper in teren
GA1	1.305313	10.541687	Upright	B	1	1000	1078.4695	1078.4694		RNF8
GA2	1.223997	10.88689	Upright	F	1	0				
GA2	1.223953	10.887767	Upright	F	1	0				
GA1	1.305303	10.541407	Upright	B	1	0				
GA2			Upright	BFFB-mean	1	1000.0813	1078.5508	1078.5506	0.081333	
.....										
GA19			Upright	BFFB-mean	1	973.55319	1052.0227	1052.0208	-1.28689	RND
GA19	0.30843	15.924212	Upright	B	1	973.55319				
GA20	2.651934	14.889211	Upright	F	1	0				
GA20	2.651931	14.890286	Upright	F	1	0				
GA19	0.308443	15.925622	Upright	B	1	0				
GA20			Upright	BFFB-mean	1	971.20969	1049.6792	1049.6772	-2.3435	
GA20	0.347603	9.756473	Upright	B	1	971.20969				
GA21	1.984819	9.900331	Upright	F	1	0				
GA21	1.984796	9.900642	Upright	F	1	0				
GA20	0.347602	9.757562	Upright	B	1	0				
GA21			Upright	BFFB-mean	1	969.57249	1048.042	1048.0399	-1.63721	
.....										
GA27			Upright	BFFB-mean	1	965.72147	1044.191	1044.1883	0.239767	R18
.....										
GA39			Upright	BFFB-mean	1	967.05407	1045.5236	1045.5197	-2.07299	R21

$$N=\begin{pmatrix} 18.7027 & -3.6797 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 \\ -3.6797 & 10.9340 & -7.2543 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 \\ 0.0000 & -7.2543 & 22.7454 & -15.4910 & 0.0000 & 0.0000 & 0.0000 & 0.0000 \\ 0.0000 & 0.0000 & -15.4910 & 23.4482 & -7.9572 & 0.0000 & 0.0000 & 0.0000 \\ 0.0000 & 0.0000 & 0.0000 & -7.9572 & 16.7533 & -8.7961 & 0.0000 & 0.0000 \\ 0.0000 & 0.0000 & 0.0000 & 0.0000 & -8.7961 & 38.5244 & -29.7283 & 0.0000 \\ 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & -29.7283 & 59.4383 & -29.7100 \\ 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & -29.7100 & 32.2267 \end{pmatrix}$$

Field measurements were carried out during the period September - November 2016, after which the data has been processed at the office. These were made in accordance with:

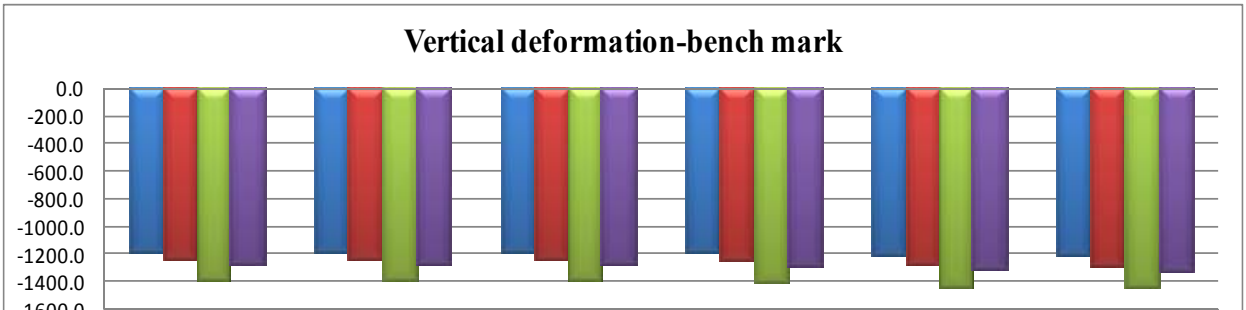
- STAS 10439/76-Marking and flagging points for construction supervision.
- STAS 2745/90- Surveying construction compression trough topographic methods.

The values obtained can be found as a comparative study towards 2010-2016 in stages (Figures 9 - 13). Altimetric tracking network consists of 4 fundamental height marks placed downstream of the dam: the RNF2-990.10mdM, RNF5-1021.12mdM, RNF7, and RNF8 located at the canopy level and 27 bench mark (Figure 4).



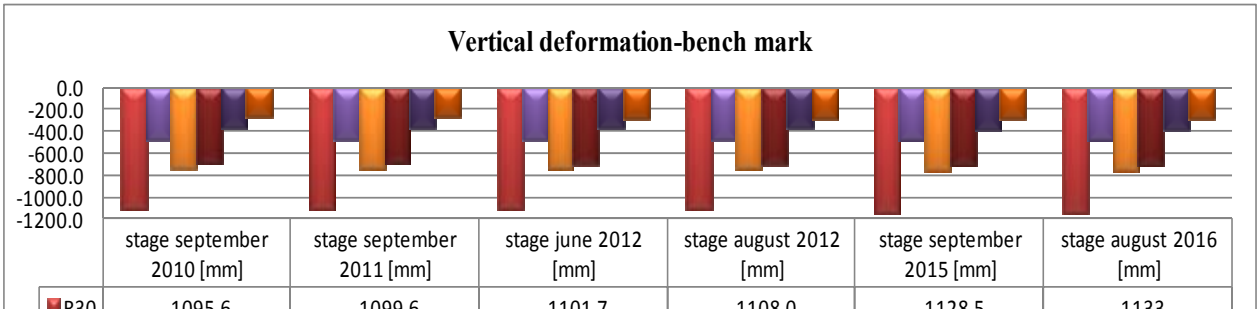
	stage september 2010 [mm]	stage september 2011 [mm]	stage june 2012 [mm]	stage august 2012 [mm]	stage september 2015 [mm]	stage august 2016 [mm]
R16	-915.0	-924.5	-927.1	-926.3	-982.1	-996.4
R18	-1205.8	-1211.4	-1217.0	-1217.9	-1275.8	-1290.5
R19	-1169.3	-1172.1	-1180.2	-1180.2	-1236.7	-1252.5
R21	-953.4	-950.8	-960.2	-959.0	-1010.8	-1024.6

Figure 9. -Vertical deformation-bench mark 1047.50m level bank



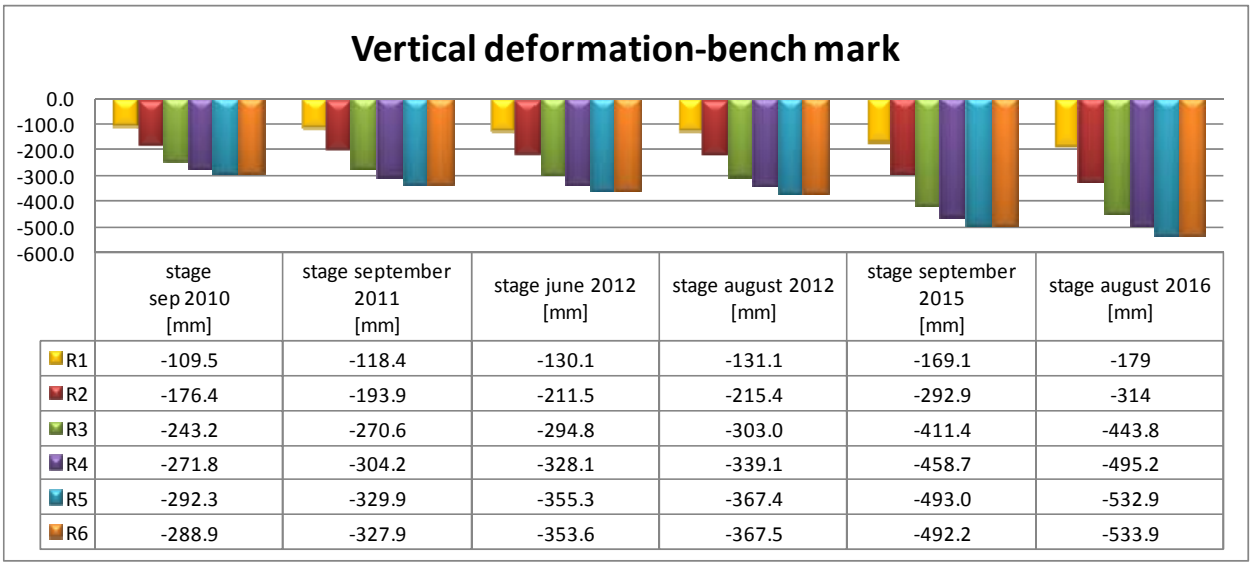
	stage september 2010 [mm]	stage september 2011 [mm]	stage june 2012 [mm]	stage august 2012 [mm]	stage september 2015 [mm]	stage august 2016 [mm]
R25	-1182.2	-1186.2	-1185.3	-1187.8	-1211.1	-1219.3
R26	-1237.0	-1244.4	-1243.6	-1248.0	-1281.4	-1292.4
R27	-1386.7	-1394.4	-1394.6	-1398.5	-1436.9	-1448.2
R28	-1271.9	-1276.9	-1280.8	-1285.1	-1321.0	-1331.2

Figure 10. -Vertical deformation-benchmark 1017.50m level bank



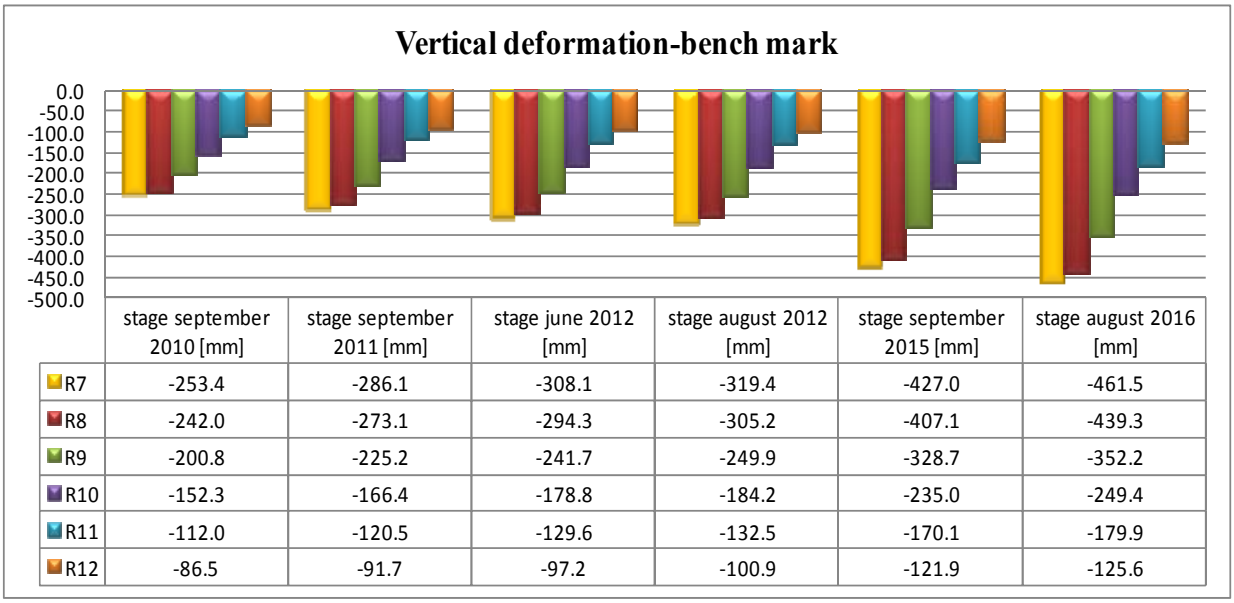
	stage september 2010 [mm]	stage september 2011 [mm]	stage june 2012 [mm]	stage august 2012 [mm]	stage september 2015 [mm]	stage august 2016 [mm]
R30	-1095.6	-1099.6	-1101.7	-1108.0	-1128.5	-1133
R32	-463.5	-466.8	-467.8	-467.4	-477.2	-479.7
R33	-736.5	-738.9	-742.6	-742.0	-755.0	-758.2
R34	-696.4	-699.0	-701.6	-703.7	-712.9	-715.6
R35	-371.7	-373.4	-374.8	-376.4	-385.8	-389.8
R36	-274.4	-274.0	-276.7	-278.6	-283.9	-286.3

Figure 11. -Vertical deformation-benchmark 988.0 m level bank



	stage sep 2010 [mm]	stage september 2011 [mm]	stage june 2012 [mm]	stage august 2012 [mm]	stage september 2015 [mm]	stage august 2016 [mm]
R1	-109.5	-118.4	-130.1	-131.1	-169.1	-179
R2	-176.4	-193.9	-211.5	-215.4	-292.9	-314
R3	-243.2	-270.6	-294.8	-303.0	-411.4	-443.8
R4	-271.8	-304.2	-328.1	-339.1	-458.7	-495.2
R5	-292.3	-329.9	-355.3	-367.4	-493.0	-532.9
R6	-288.9	-327.9	-353.6	-367.5	-492.2	-533.9

Figure 12. -Vertical deformation-bench mark crest



	stage september 2010 [mm]	stage september 2011 [mm]	stage june 2012 [mm]	stage august 2012 [mm]	stage september 2015 [mm]	stage august 2016 [mm]
R7	-253.4	-286.1	-308.1	-319.4	-427.0	-461.5
R8	-242.0	-273.1	-294.3	-305.2	-407.1	-439.3
R9	-200.8	-225.2	-241.7	-249.9	-328.7	-352.2
R10	-152.3	-166.4	-178.8	-184.2	-235.0	-249.4
R11	-112.0	-120.5	-129.6	-132.5	-170.1	-179.9
R12	-86.5	-91.7	-97.2	-100.9	-121.9	-125.6

Figure 13. -Vertical deformation-bench mark crest

CONCLUSIONS

Measurements at the Gura Apelor Dam are aimed at determining the vertical displacements of the dam through topo-geodetic measurements on the level point network. The values of displacements are obtained trough differences between heights determined in the current measurent age and heights determined in the initial age of measurements.

It can be seen from the comparative tables attached (Figures 9 - 13) that there are no significant displacements both in relation to the initial phase, as well as in relation to the previous ones. The level differences were corrected and accuracy values were determined. (Table 2)

Table 2. Values deviations

nr.crt.	stage 2016	s_0 [mm]
1	Crest	1.03
2	1047.50 level bank	1.92
3	1017.50 level bank	0.57
4	988.00 level bank	0.64

At the level of the canopy, the upstream and downstream movements-are between 0-15 mm, for downstream, and left bank-shore movements are between 0-29 mm, to the right, in comparison with the 2015 results. These

values fit into the rules P130/1999- Technical Instructions for the execution of surveying works, execution and operation of hydropower.
No displacements job is complete without an analysis of the data. The result of processing is interpreted trough statistical tests.

Normality tests

Test interpretation:
H0: the variable from which the sample was extracted follows a Normal distribution.
Ha: The variable from which the sample was extracted does not follow a Normal distribution.
As the computed p-value is greater than the significance level alpha=0.05, one cannot reject the null hypothesis H0.
The risk to reject the null hypothesis H0 while it is true is 61.54% (Figure 14).
Figures 15-17 show vertical movements of points placed on level banks.

Coronament-bench mark	
R1	-9.9
R2	-21.1
R3	-32.4
R4	-36.5
R5	-39.9
R6	-41.7
R7	-34.5
R8	-32.2
R9	-23.5
R10	-14.4
R11	-9.8
R12	-3.7

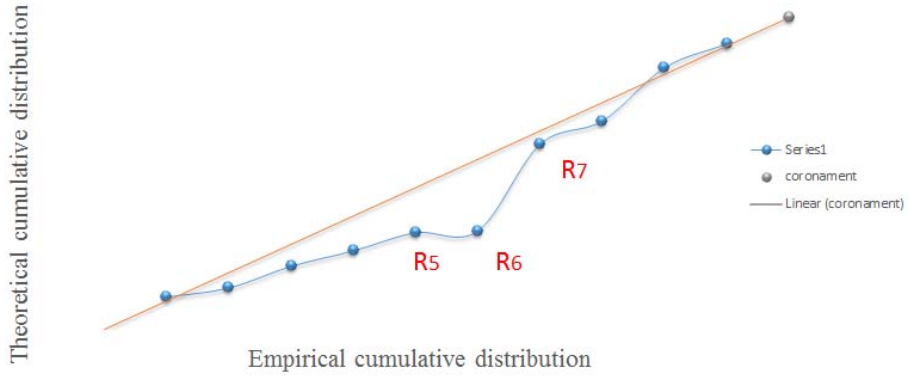


Figure 14. Deformation analysis stage (2015-2016)[mm]- Crest

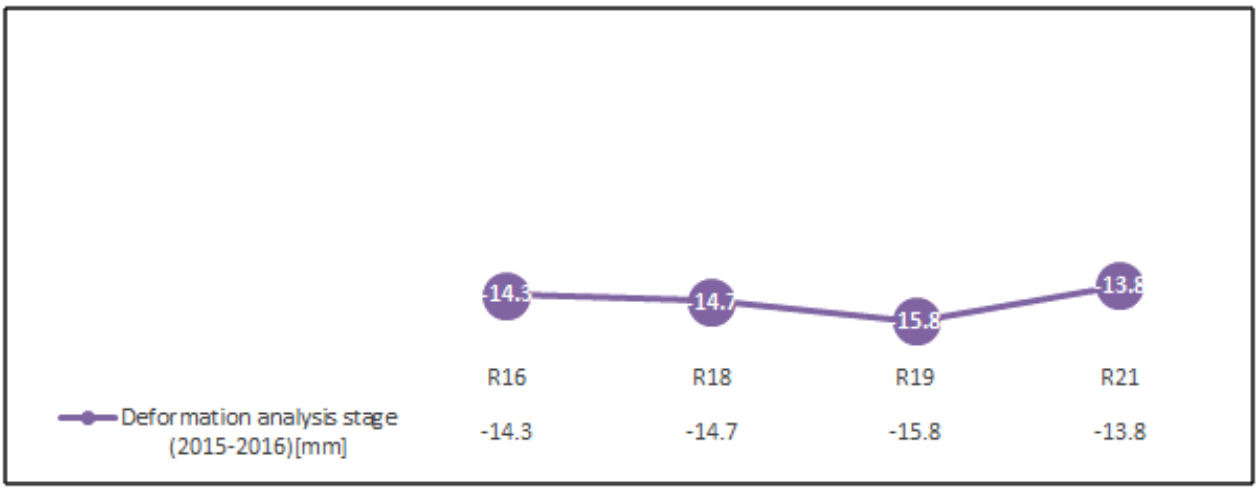


Figure 15. Bench mark 1047.50m level bank

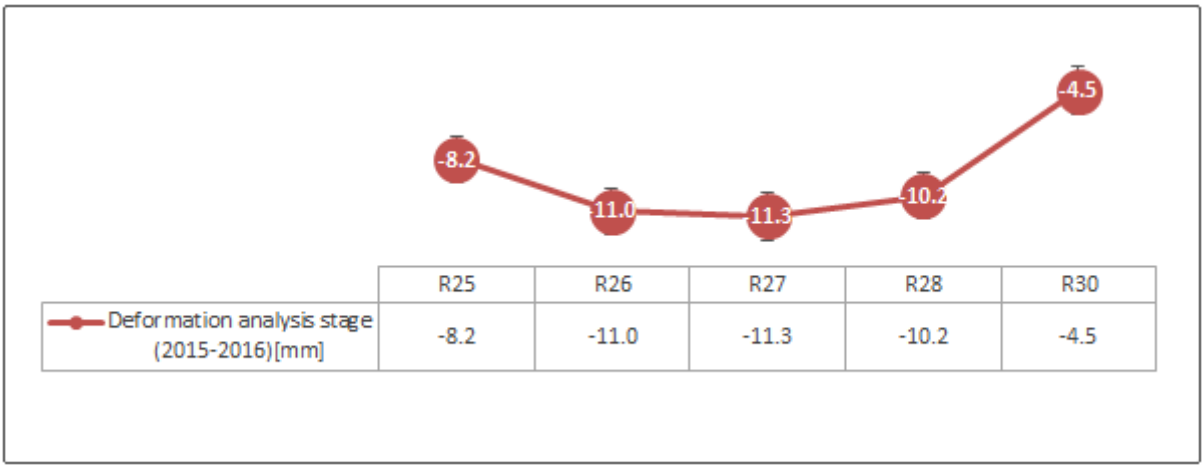


Figure 16. Bench mark 1017.50m level bank

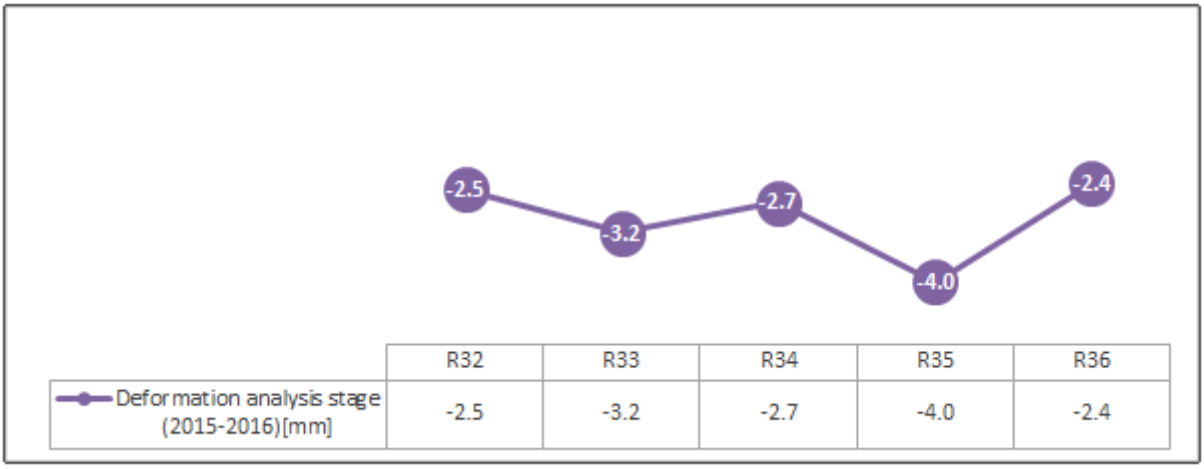


Figure 17. Bench mark 988.0m level bank

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THE DEVELOPEMENT OF PROJECTION SYSTEMS IN ROMANIA

Alexandru BĂLAN

Scientific Coordinator: Lecturer PhD Eng. Erghelegiu Bogdan

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67

Corresponding author email: alexandrucbalan@yahoo.com

Abstract:

This study puts forward two and a half centuries of development and changing projection systems used in Romania. It will be chronologically exposed a brief history of those, from Cassini's cylindrical projection (1873) to the system currently used (stereographic projection 1970). The purpose of this paper is to perform a comparative analysis to understand how they work, but also to see whether the current system used in the country is one ideal or can be improved. In this respect, there are considering factors such as the reference ellipsoid, axes, preservation / deflection of angles / distances or point of origin of the system.

Key words: *projection systems, comparative analysis, Romania.*

INTRODUCTION

People have always wanted to explore, to experience new territories, to let their life experience behind to their survivors so that they began to draw maps, at the beginning there had been maps of several cities, then of the countries, then of the continents and finally maps of the whole world. As time passes, maps have been improved and the people needed to enter the stairs, nomenclatures, projection systems, etc. In the last two decades, satellites have been sent into space, and now digital maps guide the everyday life of all mankind.

In Romania, the first cadastral surveys were performed in Transylvania, dating back to the nineteenth century under Emperor Franz Jozsef, based on Austro-Hungarian system of measurements. These measurements were using "Viennese fathom" as the unit of length (1 fathom Viennese = 1,896m).

Over time, several projection systems have been used in Romania. Of these, the most common are:

- Cassini cylindrical projection;
- Bonne equivalent conic projection;
- Azimuthal conformal stereographic perspective projection Targu Mures with tangent plane;
- Conic projection Lambert-Cholesky;
- Azimuthal projection stereographic perspective Brasov with Secant plan;
- Transverse cylindrical projection Gauss-Kruger;
- Stereographic azimuthal projection perspective 1970 with Secant plan.

MATERIALS AND METHODS

I. Cassini equidistant cylindrical projection:

In 1872, the measurements of Romanian territory had begun and the terrain map had been drawn up to 1: 20,000 in the Cassini-Soldner projection (Cassini-Soldner projection is Cassini ellipsoidal projection version). This is the first Romanian map which was used metric system for. Cassini equidistant cylindrical projection had been provided a basis for achieving the maps at scale 1: 50,000, 1: 100,000 and 1: 200,000 by the Romanian Military Topographic Service between 1873 and 1900. The cylindrical projections are obtained by projecting the reference ellipsoid on the lateral surface of a cylinder that then is cut after one of its generators and proceeds along the plan.

Technical Features:

- Type of projection: cylinder equidistant;
- Reference ellipsoid: Krasovski;

- Keep undistorted lengths;
- Distorts angles.

Cassini cylindrical projection has an important contribution to Romanian topography being the basis of the first map of Romania in metric system. While retaining lengths undistorted, it has some drawbacks that make the system imprecise as large deformation of angles and surfaces.

II. Bonne equivalent pseudoconic projection:
Cassini projection for the territory in the western of Zimnicea meridian was no longer used (Paris 23 ° E, 25 ° 20'14.025 "E Greenwich) since 1895 until 1917, but Bonne equivalent pseudoconic projection. For this area, starting from the map at 1: 20,000, it will be produced maps at 1: 100,000 in this new projection (first Romanian maps which method was used for to contour), maps at 1: 50,000 and 1: 200000. It was the first projection in Romania which was used for drawing maps for cadastral purposes and was set for maintaining accurate projection surfaces in the plane (Fodorean, 2007).

Tehnical features:
- type of projection: equivalent pseudoconical;
- reference ellipsoid: Clarke;
- parallels are presented as concentric circles with a common center located on the central meridian which is a straight line (to which other meridians are shown as symmetrical curves);
- Projecting is made onto the side surface of a cone;
- Keep undistorted areas;
- Distorts angles.

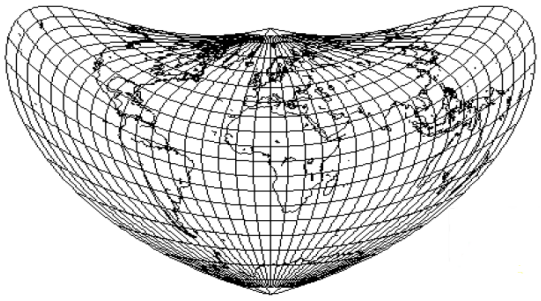

Figure 1.Carthographic network in Bonne pseudoconical projection

Bonne pseudoconical projection (Figure 1) has a special place in the history of the topography since it was the first projection which was used for cadastral purpose (not just for cartographic purposes as its predecessor's). While retaining undistorted surfaces and angles are deformed less than in Cassini projection, this one has been used regionally (Oltenia and Muntenia) because deformations for other regions of the country would have been very high.

III. Azimuthal conformal stereographic perspective projection Targu Mures with tangent plane:
It has been used between 1890 – 1916 in Transilvania.

Tehnical features:
- Type of projection: conformal perspective azimuthal line;
- Reference ellipsoid: Bassel 1841;
- The vantage point is on the sphere in the farthest position from the plane of projection;
- Projecting is made onto a plane;
- the point of origin has as geographical coordinates: φ = 46 ° 33` 8,85`` λ = 24 ° 23` 34,935``
- azimuths are kept undistorted, projection being done per the laws of linear perspective;
- it is a projection line, but the lengths greatly distort the network edge;

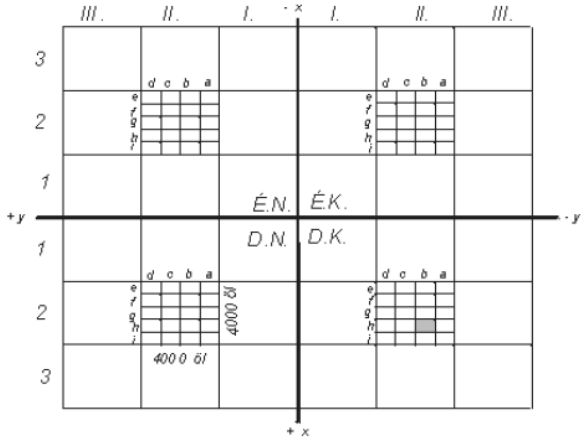

Figure 2. A map sheet in Targu Mures stereographic system (in Viennese fathoms)

As previously shown systems, **Targu Mures azimuthal projection** (Figure 2) was used regionally in Transylvania. Compared with projection systems mentioned above, it can be said that the Targu Mures azimuthal system is the most accurate, being a projection line, the azimuths are undistorted and the projection is

being made in the plan (per the laws of linear perspective).

IV. Lambert-Cholesky conic projection:

During the First World War, the maps of Moldova, Dobrogea and eastern Wallachia were made in Cassini projection, the maps of West Muntenia and Oltenia were in Bonne projection, the maps of Basarabia were in Muffling polyhedral projection and the maps of Banat, Transylvania and Bukovina were in stereographic projections (Budapest or Targu Mures). The situation being very unpleasant for the Romanian army, it was necessary to adopt a uniform projection for all Romanian territories. It has been introduced a new base area, a new projection system and a new nomenclature using the Lambert projection system modified by the surveyer, mathematician and French officer Andre Louis Cholesky between 1916-1917.

The maps in Lambert-Cholesky projection (especially those made in the first period) were not the result of new measurements, but came from previous sources (Romanian, Austrian, Russian), which were transposed graphically. This system was maintained in Romania until 1930, when it had been adopted Brasov stereographic projection.

The central point of projection is located on the Olt Valley, close to the village Stolniceni belonging to Valcea county. Cartesian coordinates of the central point of projection are x = 500000m and y = 504599, 11m (Rădulescu, 2006).

Tehnical features:

-type of projection: conformal conical;

-reference ellipsoid: Clarke;

- the projection is made on the side surface of a cone;

- normal projection (pole axis is the same with the axis of the cone);

- conformal projection;

- distorts lengths and surfaces;

Lambert-Cholesky projection was the first unitary projection, which was adopted in all regions of Romania, the triggering factor of this measure being the outbreak of the First World War. Having the central point in Valcea County, this projection was used less for creating maps resulting from new measurements but was used mainly to create maps with measurements from previous sources that have been translated about graphics, being of real help for the Romanian army recently entered the war.

V. Azimuthal projection stereographic line perspective Brasov (1933) with secant plane:

Stereographic azimuthal projection was introduced in Romania in the third decade of the twentieth century and was used for drawing maps and topographical plans, drawn at different scales, until 1951. Initially, it was adopted in variant with tangent plane (1930), later passing to the version with unique secant plan (1933).

It had as a fictitious central point (not embodied in the field), located at approximately 30 km north-west of Brasov.

Indication " Brasov single secant plan" is necessary because, as mentioned above, prior to the introduction of the projections in some areas of the country (especially Transylvania) it had been working on the Budapest tangent plan or in Targu Mures stereographic projection.

This stereographic projection relied on a network of new triangulation, which is why we used reference elements of Hayford ellipsoid (a = 6378388 m, b = 6356912 m; α = 1: 297) oriented on Military Astronomical Observatory from Bucharest (Rad, 2007). It had been chosen the stereographic system of plane axes so that its origin to represent the plane image of pole Q0 (λ0, φ0), so Ox-axis was on the east-west direction with positive direction towards east and the Oy-axis was on the north -sud, in a positive direction to the north.

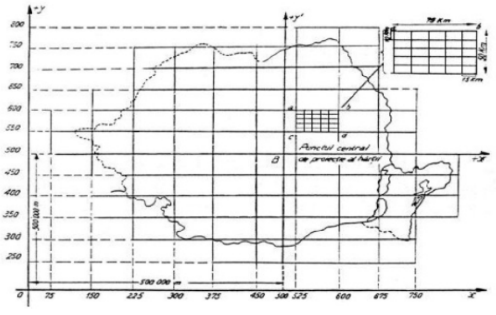

Figure 3. The system of axes in Brasov stereographic projection and the splitting system per sheets

Tehnical features:

- type of projection: stereographic oblique;
- Reference ellipsoid: Hayford;
- Conformal Projection;

- Measurements made can be processed directly in the projection plan after corrections are applied to reduce the plan;
- distorts lengths and areas;
- the point of origin has as geographical coordinates: φ = 51G 00c 00cc, 000 (45054'00 ', 0000) λ = 28G 21c 00cc, 510 (25023'32', 8722);

Stereographic projection Braşov, (Figure 3) like its predecessor, was a unitary projection, which preserves angles, but distorts lengths and areas. The advantage to system Lambert-Cholesky projection is that Brasov projection is a stereographic projection that preserves untainted the shapes angles on the field and distorts the lengths on the tangent plane, thus satisfying most representations to plan for scales smaller than 1: 2000.

VI. Transversal cylindrical projection Gauss-Kruger line:

This projection system was designed between 1825-1830 by the famous German mathematician Karl Gauss (which probably started from the conic projection Lambert, shown above, by changing the reference ellipsoid), and later, in 1912, Johannes Kruger has developed formulas required for transferring the coordinates of the rotating ellipsoid points on the projection plan.

Gauss projection was introduced in Romania in 1951, being used until 1973 for drawing the basic topographical plan of a scale of 1: 10,000, for basic topographic maps at a scale of 1: 25,000 and for unitary maps at various scales.

The introduction of this new projection system was a political decision, because the systems used in Romania (Lambert-Cholesky and Braşov) were not compatible with Gauss-Kruger projection used in the USSR, so Romania was forced to introduce a new projection system that was agreed by Russia. This projection has as a general principle the fact that a terrestrial surface is represented on the surface of a tangent cylinder and transverse to the reference spherical surface. The axis is inverted, so the Ox axis is considered parallel to the projection of the axial meridian and Oy-axis is considered the equator projection.

For unitary representation of the terrestrial ellipsoid, the Earth's surface is divided into 60 spherical cones of 6 ° longitude (starting from the Greenwich origin meridian) not to exceed the limit of length deformations (1/2500). For projection of the 60-resulted cones, the ellipsoid is considered wrapped in 60 successive cylinders (horizontally), where each cylinder is tangential to the axial meridian corresponding to each cone (Popescu, 2006).

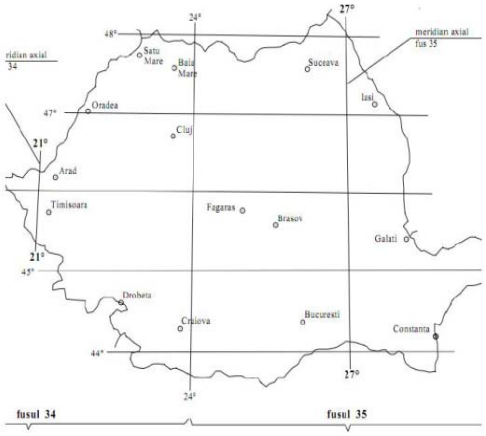

Figure 4. Romanian territory covered by 34 and 35 cone.

Tehnical features:
- Type of projection: cylindrical transversal;
- Reference ellipsoid: Krasovski 1940
- The surface projection of ground ellipsoid directly on the plan, without intermediary switching on sphere;
- Conformal Projection;
- distorts surfaces and lengths (to a small extent)

Gauss Kruger projection (Figure 4) is a universal projection, which allows any surface of any size to be represented, at any scale, providing an international feature. The main advantage of this projection is that the ellipsoid surface projection is done directly on a plan, which facilitates the work of cartographers as the intermediary transition is no longer made on sphere. It is also a conformal projection, and relative linear deformations are positive and directly proportional to the distance to the axial meridian. In Romania, the maximum deformations are along the meridian 24 ° (in Danube Delta), and these having variations from 7,1cm / km (φ = 44 °) to 6,15cm / km (φ = 48 °) (Rus and Buz, 2003).

VII. Stereographic azimuthal projection line perspective 1970 with secant plan:

To better respond to practical requirements in Romania, in 1973, it was adopted the stereographic system 1970 on unique secant plan, which followed a series of principles that satisfy accuracy terms and some specific aspects of the Romanian territory, of which reads:
- The country has an almost round shape, which can be placed in a circle with a radius of about 300 km;
- Land area is projected by the laws of linear perspective;
- Romania's territory can be represented on a single projection plan, thereby achieving a unique rectangular plan coordinates with origin in the midpoint of the projection;
The projection was used and is still used for drawing of basic topographic plans at 1: 2000; 1: 5000 and 1: 10000, as well as of cadastral maps at 1: 50000, being an alternative to Gauss-Kruger projection to remove the inconvenience created by that. The central point of the projection is a fictional, not embodied in the field, which is located approximately at the geometric center of the country, at northern side of the city of Făgăraș (25 ° east longitude, 46 ° north latitude).
The axis is inverted, so the Ox axis lies along the north-south and the axis Oy is considered on the east-west direction.

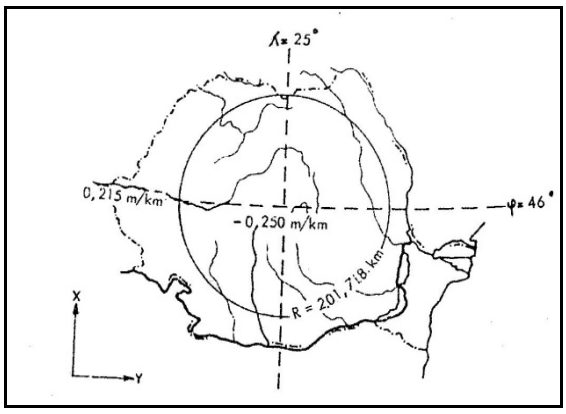

Figure 5. Stereographic projection 1970

Tehnical features:
- Type of projection: stereographic azimuthal;
- Reference ellipsoid: Krasovski 1940 oriented at Pulkov;
- Conformal Projection;
- Keeps undistorted angles and due to the use of secant plan the lengths deformations are more reduced to other projection systems;
- The reference plan for elevations is the Black Sea;
- The coordinates of the central point are φ = 25 ° and φ = 46 °

Stereographic projection 1970 (Figure 5) is a projection line, it keeps undistorted angles and due to the use of the secant plan, the lengths deformations are more reduced to other projection systems. Deformations are negative inside the circle, reaching on the center of projection - 25 cm / km and positive outside the circle, reaching on the periphery + 65 cm / km (counties Constanta, Timis). While giving a wide range of benefits, the system stereographic 70 is far to be called an ideal system because it is a local system (used only in Romania) and deformations (greater than deformations of the Gauss-Kruger system) are both positive and negative, which makes more difficult their compensation (Rădulescu, 2012).

RESULTS AND DISCUTIONS

Because of the above, it can be said that the projection system used today in Romania is not ideal because the Krasovski 42 geodetic datum has the following drawbacks:
- it is a local datum because of its position and different orientation of the reference ellipsoid in relation to geoid;
- Specific position of the ellipsoid in relation to geoid reduces angles and distances to ellipsoid, which is dependent on this position;
- Calculating the point's coordinates that refer to geodetic datum will have differences from those performed by another geodetic datum;
- Distance and azimuth between two different reference systems and coordinates can not be calculated precisely, regardless of the accuracy of individual datums.
Considering all the issues that our country has, an ideal system should have the following features:
- Romania can be represented on a single projection plan, thereby achieving a unique rectangular coordinates plan with origin on the midpoint of the projection;
- distortions should be minimal;
- to be appropriately to positioning needs from the European area;

- to ensure compatibility and interoperability of national spatial data with European and international standards;
- to ensure achievement of pan-European cartographic products in reference systems and European coordinates;
- to provide high accuracy of points coordinate, determined on GNSS technologies and thus improve the quality of national geodetic network.

Such a system, which meets all these conditions is ETRS89, it was developed in the 80's as a system applicable in all European countries. For applications at the continental level, EUREF defined ETRS89 system (European Terrestrial Reference System 1989), which is realized through a set of reference points with knowing and accepted coordinates at the time. It also had been introduced the hypothesis that all points placed on Eurasian tectonic plate do not admit relative speeds (move jointly with this tectonics plate). ETRS89 (Table 1) was put into practice after 1990, through campaigns of measurements and determining the coordinates of the points materialized in the land from each country of the European Union (Dragomir et al., 2010).

Currently, in Romania, it is used stereographic 70 system, which is based on the ellipsoid Krasovski 1940 and stereographic projection plan 1970. This reference system can be considered as one local as it is not completely geocentric, ellipsoidal elevations being known to have a poor accuracy (because it was not determined a precise geoid model) and the plane coordinates are determined in a specific projection plan (for Romania) - stereographic plan 1970.

Table 1. ETRS89`s datum

Entity	Value
Country	Romania (RO)
Reference System Identifier	ETRS89-GRS80
Alternative name of SR	European Terrestrial Reference System ETRS89
Valid area of SR	Romania
The purpose of SR	Geodesy, Cartography, GIS
Datum Identifier	ETRS89
Alternative name of datum	European Terrestrial Reference System 1989
Type of datum	Geodetic
Achievement year of datum	1989
Valid area of datum	Europa/EUREF
The datum purpose	European datum is identical to ITRS and is attached to the stable continental plate of the Eurasian.
First meridian identifier	Greenwich
Longitude of the first Greenwich meridian	0°
Ellipsoid Identifier	GRS80
Small semi-axis of the ellipsoid	6 356 752 m
large semi-axis of the ellipsoid	6 378 137 m
The reverse of flattened ellipsoid	298.257222101
Coordinate System	Ellipsoidal coordinate system
Type of the coordinate system	Geodetic
The size of the coordinate system	3
Geodetic latitude	The angle formed by the normal with the ellipsoid in a point with the equatorial plane of the reference ellipsoid
Measurement direction	To north
Unit of measurement	sexagesimal degrees
Geodetic longitude	The dihedral angle formed between the geodetic Greenwich meridian and the geodetic meridian of the considered point
Measurement direction	To east
Ellipsoid altitude	Normal segment between the position of a point on the physical surface of the Earth and its projection on the reference ellipsoid
Measurement direction	From ellipsoid to point
Unit of measurement	Meter

CONCLUSIONS

This study presents the evolution of projection systems used over time in Romania. Thus, Romanian projection systems were introduced in the country by the Austro-Hungarian Empire (XIX century), then it started to be introduced systems that advantage a specific region

(Cassini, Bonne, Targu Mures) and then, because of the outbreak of WWI it was introduced the first unified system from Romania, Lambert-Cholesky, with the successor systems Brasov, Gausss- Kruger and most recently, the stereographic system 70. Among the arguments, it can be said that none of the systems mentioned above do not constitute an ideal projection system, but one that fits best both the characteristics of Romania and those of Europe is ETR89 system.

Proposal for adopting the system ETRS89 in Romania was analyzed and discussed in the working meetings and conferences at ANCPI and national level (2005, 2006, 2007), all specialists in the field ruling favorable to implement a modern system based on global positioning systems using satellites.

In future, the need for cooperation at European and global level in the field of geodesy and cartography, the current disadvantages of the stereographic 70 system and perspectives opened by position determinations using artificial satellites, will lead to the adoption by European countries (including Romania) of the Reference and Coordinates System (SRC) ETRS89 for a wide range of works from different fields.

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PARTICULARITIES OF EXPROPRIATION WORKS IN ROMANIA

Ionela-Claudia BIRLEA, Catalina-Georgiana LEAHU, Loredana MARCU, Odet OLTEAN

Scientific Coordinators: Assist. PhD Eng. Anca-Maria MOSCOVICI, Assoc. Prof. PhD Eng. Cosmin MUSAT

Politehnica University of Timisoara, Faculty of Civil Engineering, Department of Land Measurements and Cadastre, 2A- Traian Lalescu str., Timişoara, Romania

Corresponding author email: marcu.loredana95@yahoo.com

Abstract

In this paper we wish to address the particularities of expropriation for highways that provide the legal basis by which an estate passes from private property to state ownership in the public interest needs, none the less compensation being paid.. The legal basis was Law no. 255/2010, the Director General Order nr.700 / 2014. To achieve highways will perform a high volume of work by meeting various individual cases to be approved under the law.

***Key words**: expropriation, highways*

INTRODUCTION

In the actual context of modernization and development of the road and railway infrastructure of Romania, we have to make some expropriation works. These works can assure the legal basis on which a said patch will be transferred from a private owner to the ownership of the Romanian state in order to be used for public interest, while the original owner would receive compensation for the patch of land (Musat 2016).

Through this paper we would like to address the particularities of expropriation so the land can be used to build a motorway, which has to follow the following steps:

a) Approval of the technical-economic work of national, county or local level;

b) calculate the amount corresponding individual payment representing compensation for properties that are part of the expropriation corridor and display a list containing the owners of the lands affected by the expropriation;

c) Ownership transfer;

d) Completion of formalities relating to expropriation procedure.

In 2006-2007 began the first works of expropriation of land, on the Arad-Timisoara motorway section, under Government Decision no. 1546/2006.

These decisions by the government were not sufficient for the preparation of works of this scale, so that was issued after discussions Law 255/2010.

Next we describe the construction objective on motorway SEBES TURDA A.T.D. Galda de Jos, County:ALBA (Figure 1 and Figure 2).

Figure 1.View form geoportal

This project's goal is to ensure a safe and quick connection between the North and the South parts of Romania, to be more specific, between Nadlac – Bucharest – Constanta and Bors-Bucharest. Furthermore this motorway would be a quick link between the two biggest urban

centers of central Transylvania: Cluj-Napoca and Sibiu.

Figure 2. Highways in geoportal ANCPI

MATERIALS AND METHODS

The motorway section we will bring up for discussion is situated in the administrative-territorial division Galda de Jos, Alba Iulia County.

Law No. 255/2010 on expropriation for public utility is necessary to achieve the objectives of interest on a national, county and local level.

The expropriation corridor is the area of land, with or without other property, to be affected by the works stipulated in Law no. 255/2010, on the basis of the final version of the feasibility studies or planning documents, as appropriate, approved in accordance with legal provisions and defined based on a topographical plan in the national projection made in STEREOGRAPHIC 1970 (Law 255).

The topographical plans mentioned above will be annexed to the coordinate database of the surfaces of land that need to be expropriated in order for the works to proceed.

The documentation concerning the expropriation corridor will be attached a list of owners and other rights holders identified on the records of the National Agency of Cadastre and Land and-administrative units. The parts of the expropriation corridor will be established under the law, in the feasibility study and / or town planning documentation, and planning.

Work location is established based on the final version of the feasibility study, or planning documents, as appropriate, approved in accordance with the legal provisions. It will be defined based on topographic plans made in the national stereographic projection 1970 respectively based on a topographical plan made in the national stereographic projection 1970 and materialized by marking all coordinate points that define it.

To finalize the expropriation of patches according to Law no. 255/2010, the person authorized at the request of an expropriator, prepares the cadastral documentation, according to Order nr.700, with subsequent amendments and of this Protocol.

In order to clarify the legal status of the areas affected by expropriation, the expropriator will prepare individual cadastral documentation observing the provisions of Ord. 700 approving the Methodological Norms for the application of Law no. 255/2010, as further amended and supplemented.

Documentation is prepared based on the limit of the expropriation corridor which was registered in the Land Registry within 10 days of its submission by the territorial office.

For expropriation, on these two cases, are regulated by Order 700, we will perform the first entry in the code documentation 2.1.1. respectively update the code documentation 2.6.2 and 2.5.4, which represents surface modification (Order 700).

For patches affected by the highway corridor, if it is to expropriate part of the patch, the cadastral documentation has to be established individually for each resulting lot, respectively for the lot/lots that remain in the ownership of the original owner, but also for the expropriated lot.

The cadastral documentation has to contain the following:

a) docket stating the contents of documentation;
b) reception and registration application, signed by the owner or the person authorized in the mandate given by expropriation;
c) request of information and response from O.C.P.I.;
d) solemn declaration on the alienation and identification of the patch of land;
e) technical report in analog format;

f) location and boundary plan for the entire building, which will represent all groups resulted, lot / lots remaining in the property of the expropriated and that expropriated lot in analog format;
g) location and boundary plan of the resulting lot scale 1:2.000-1.500 in analog format;
h) property deed in original or certified copy;
i) I.D. In original or copy;
j) expropriation decision or copy, in accordance with the original.

RESULTS AND DISCUSSIONS

The Following the preparation of the expropriation, there were discovered particular situations, which we detail below:

Case I:

According to the boundaries received from the O.C.P.I. Alba Iulia, it was found that some patches are found both in town as well as out of town.
While preparing the location and boundary plan for the patch, we considered the limit to be the lower boundary of the A.T.D. Galda de Jos, each resulting lot was to be divides into sub-patches which can be found both in town and out of town.
Following the approval of the documentation, there resulted a patch with the same electronic identifier, specifying the in town and out of town surface in the land registry.

Case II:

The numbering of lots shall be made in Arabic numerals, starting with number 1 in the north-west of the estate and increased conveniently. The ending sub-lot is usually numbered in the south-east of the patch.
Yet another particularity of the reception of works from O.C.P.I. Alba Iulia, is that we do not take in account the cadastral numbering. Lot no.1 is always the patch with the largest surface, excluding the expropriated lot, which will be numbered as no.2.

Case III:

In some situations, the expropriated lot can affect the already existing buildings, in such cases if is necessary to obtain a tear down authorization and suitable compensation. Such a case we've encountered while working on this A.D.T.
Normally, any construction delisting is done after a tear down process. In this case, the building has to be torn down completely, and the compensation will be fulfilled based on the refusal note where the surface of the building and of the lot should be stated by C.N.A.I.R.

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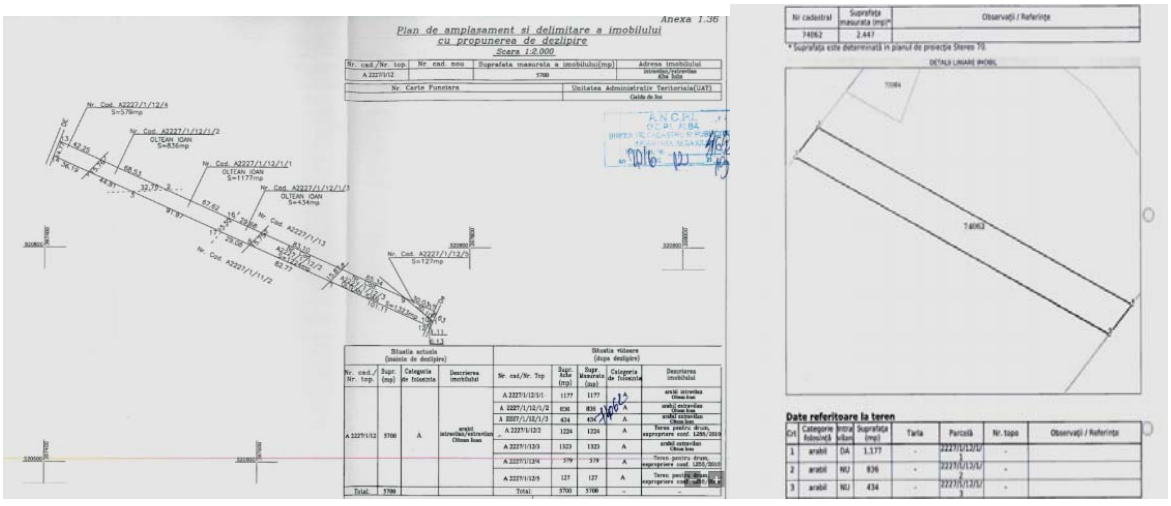

Figure 3. Examples for case I

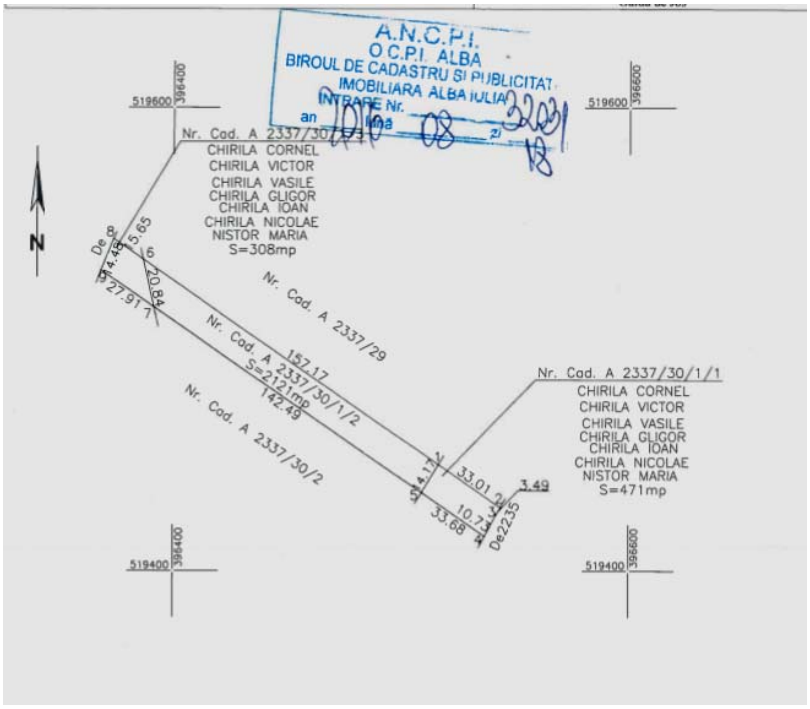

Figure 4. Examples for case II

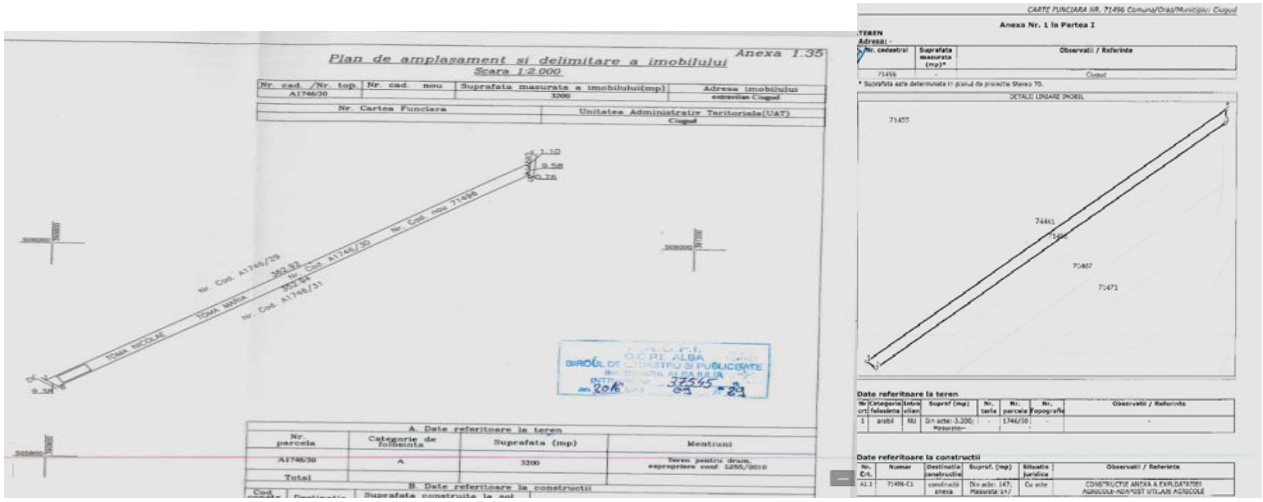

Figure 5. Examples for case III

CONCLUSIONS

In this paper, we wanted to highlight the particular cases that we encountered while performing these expropriation works. Furthermore, we also wanted to bring to light the importance of the cadastral works in order to rightfully compensate the affected owners.
In order to build the motorways we will perform a high volume of work by meeting various individual cases to be approved under the law.

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LIDAR FOR GROUND SURFACE MAPPING IN FOREST ENVIRONMENTS

Mihnea CĂŢEANU

Scientific Coordinators: Prof. PhD Eng. Arcadie CIUBOTARU
Assoc. Prof. PhD Eng. Cornel-Cristian TEREŞNEU

"Transilvania" University of Braşov, Faculty of Silviculture and Forest Engineering, 1 Şirul Beethoven Street, 500123, Braşov, Romania, Phone: +4026.841.86.00, Fax: + 4026.847.57.05

Corresponding author email: cateanu.mihnea@gmail.com

Abstract

Remote sensing enables the recording of accurate geomorphological data with the capability to efficiently cover large areas. However, the presence of vegetation makes the use of remote methods for terrain mapping difficult. LiDAR can be a solution for forestry projects, as the laser pulses can cross the entire forest canopy and reach the soil underneath. LiDAR data is stored as 3D point clouds containing the pulse returns from the ground or various objects above it (such as power lines, buildings or vegetation). In order to interpolate an accurate Digital Terrain Model (DTM), the points coresponding to the ground returns have to be extracted from the initial point cloud. This process is called ground-filtering or simply filtering.
This paper aims to provide a performance analysis of multiple algorithms for LiDAR data classification. Algorithm performance is reviewed for the case of mountainous terrain, characterised by moderate and steep slopes and forest vegetation of a generally high consistency. Our findings suggest that the Lasground-new algorithm implemented in the Lastools software package provides the most accurate results, with a Root Mean Square Error of elevation values for the study site of 0.34 metres (with over 80 percent of the area having an elevation error of less than 0.20 metres) and an average RMSE for the field plots of 0.66 metres. Free algorithms such as Maximum Local Slope or gLidar provide relatively similar results in terms of RMSE.
Taking into account the difficult test conditions (topographically complex surface with dense canopy cover) we consider LiDAR data to be a possible solution for collecting geomorphological data for forestry applications, as long as a sampling of elevation at finer scales is not required.

Key words*:ground filtering, forest cover, Airborne Laser Scanning, DTM.*

INTRODUCTION

Ground surface mapping has been an active field of research in remote sensing for the past decades. Major technological improvements have made digital surface representations a common data source for modelling physical processes, in practice or research. Within a GIS context, elevation data is usually stored as a *Digital Elevation Model* (DEM). This model is defined as a regular two dimensional array of sampled heights that describe a surface (Wood, 1996). When the model is a representation of the ground surface, it is referred to as a *Digital Terrain Model* (DTM).
DTM usage is widespread in many fields of research or practice, such as ecological and environmental studies, urban planning, soil science, forestry, watershed management or landscape design (Brovelli et. al, 2004).

A modern development in the field of remote sensing is an optical technology called *Light Detection and Ranging* (LiDAR). LiDAR uses active sensors that illuminate the surface of interest by emiting laser pulses at a very high repetition rate. A receiver measures the intensity of the reflected energy and records the time delay between the transmitted and backscattered pulses (Liang et. al, 2012).
Since laser pulses travel at a known speed (the speed of light), the distance between the sensor platform and the illuminated surface is determined. The platform is equipped with a GNSS positioning system so each pulse reflection (generally referred to as a *return*) is stored as a *x,y,z*data point.Most common LiDAR system are discrete return sensors. These have the capability of receiving multiple signal returns for each transmitted pulse (Hengl and Reuter, 2008). The first return could be at the top of forest canopy, for example. If the

canopy is sparse enough, part of the emitted energy can further travel, until it intersects another object (such as a leaf or tree trunk). Insome cases, a sufficient amount of energy reaches the ground surface so that a ground return is also obtained. This makes the technology particularly suitable in forestry, as ground surface mapping is possible even in conditions of dense vegetation cover. In addition, sampling density ensures that high resolution (sub-meter) terrain models can be obtained (Tarolli, 2014). For these reasons, LiDAR data collection from airborne platforms (*Airborne Laser Scanning* – or ALS) is being used on an increasing basis in forestry applications (Sithole and Vosselman, 2005).

Data recorded with a discrete return LiDAR system is stored in the form of point clouds. Besides position, additional attributes are stored for each point, such as the pulse number, number of returns per given pulse, intensity, GNSS timestamp or scan angle (the angle of the emitted pulse measured from nadir). Since only part of the recorded points are returns from the ground surface, these so-called ground points must be separated from object (non-ground) points before a correct DTM can be modelled from the LiDAR data. This process is the most time-consuming step in LiDAR data processing (Sithole and Vosselman, 2004) and is called*filtering* or *ground filtering*.

This study aims to exemplify the workflow involved in the processing of ALS data collected for a forested area, in order to obtain an accurate ground surface model. The issue of laser pulse ground penetration in dense canopy conditions is considered, along with its impact on the representation of small-scale landforms.

MATERIALS AND METHODS

The study site covers an area of 4.80 km^2 and is located in the Vâlcea county of Romania, in the region of the Lotru River Valley. The area is mountainous, characterised by steep slopes and a highly variable topography. Most of the area is covered by beech and spruce forest stands (Figure 1). For comparison purposes, part of the study area is open terrain (meadows, riparian areas) or built-up areas. LiDAR data was collected for the study area from an airborne platform in 2008, using a *RieglLMS-Q560*LiDAR system. The survey was carried out in summer, during full-leaf phenophase. The number of recorded points is aprox. 24 million, with an average density of 5.16 points/m^2.

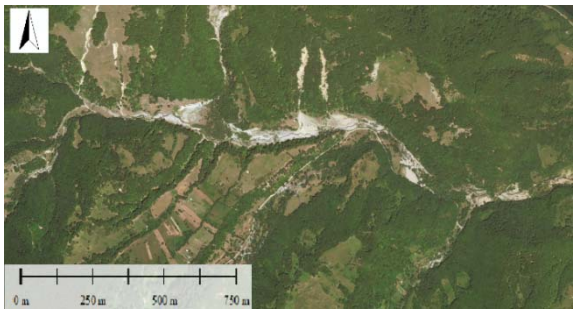

Figure 1. Extent of study area

LiDAR filtering was carried out by the company responsible for data collection, using the commercial filtering algorithm in *Terrascan* (Terrasolid). This filter is similar to the TIN (*Triangular Irregular Network*) densification algorithm developed by Axelsson (2000). A grid with a cell-size defined by the user is overlaid on the LiDAR point cloud.

Afterwards, for each cell, the point with the lowest elevation is added to a set of *seed* points. These points serve as the basis for generating a TIN, which represents a rough estimate of the ground surface. In an iterative process, this TIN is then densified by adding additional points to it. Whether a point is added to the TIN or not depends on its distance to the nearest TIN facet and angles to its nodes (Figure 2). The final TIN should resemble the bare-earth surface and all of its nodes are considered to be ground points. The rest of the points are considered to be above-ground.returns and are discarded from the point cloud.

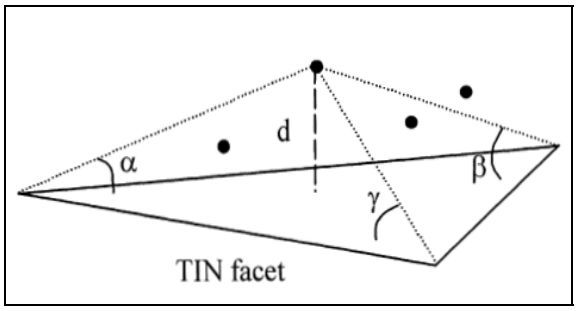

Figure 2.Elements considered when determining if a point is added to the TIN: distance to TIN facet (d) and angles to TIN nodes (α, β, γ). Illustration from Axelsson (2000).

The filtering result was improved by manual corrections. Extensive visual analysis did not highlight any significant filtering errors. Theeffect that filtering has on the generated surface model is presented in Figures 3-4.
The number of points classified as *ground* is aprox. 3.4 million, with an average density of 0.69 points/m^2.

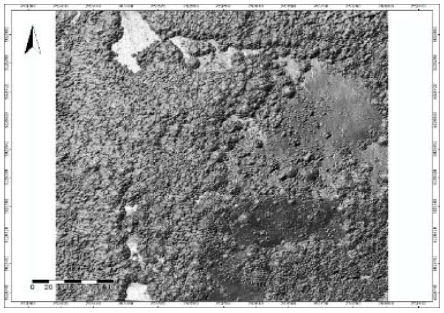

Figure 3. Surface model of forested area interpolated from all LiDAR returns

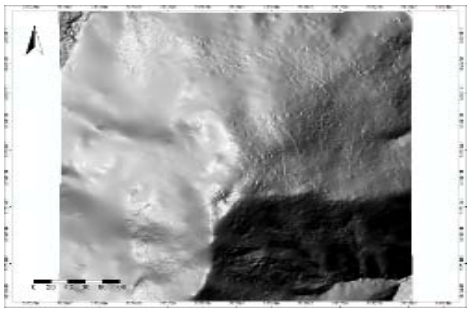

Figure 4. Surface model of forested area interpolated from LiDAR returns classified as *ground* (bottom)

A Digital Terrain Model of the study area was generated at a 0.5 meter resolution, using the *Thin Plate Spline* (TPS) algorithm (Briggs, 1974). Previous research suggests that TPS can generate smoother, oscillation-free surface models from LiDAR data when compared to other interpolators (Evans and Hudak, 2007;Mongus and Žalik, 2012) . Specifically, a variant of TPS implemented in SAGA GIS was used (Donato and Belongie, 2003), which involves the creation of a TIN from the scattered data points. Afterwards, a spline function is fitted to each TIN facet. This method ensures that the resulting DTM has no gaps, even in areas were point density is significantly reduced. The amount of interpolation artifacts in areas of low point density is also reduced.
For comparison purposes the *ASTER* (*Advanced Spaceborne Thermal Emissions and Reflection Radiometer*) Global DEM (ASTER, 2009) was used. Since the 30-arc seconds resolution of the dataset corresponds to a pixel size of 30x21 metres at the latitude of the test area, the raster data was resampled at a 21x21 metres resolution to generate square pixels.Landform feature classification maps were generated using the method proposed by (Wood,1996) and implemented in the Lanserf software (Wood, 2009). The kernel size for feature extraction is 5x5 cells for the ASTER GDEM dataset and 210x210 cells for the 0.5 metres resolution DTM interpolated from the ALS data. This leads to both feature extractions having the same scale of analysis (105x105 metres).

RESULTS AND DISCUSSIONS

The DEM of the study area is presented in figure 5. It can be seen that the ground surface model is relatively smooth, even though some areas are characterised by a rough surface representation. This could be caused by the presence of shrubs or other low-lying vegetation. LiDAR returns from this vegetation might not have been completely filtered out, due to their low height above ground.
An important aspect to consider regarding the use of LiDAR to map forested areas is the effect of dense canopy cover on the laser pulse penetration. There is a clear difference of ground point density between forested and non-forested areas (Figure 6). Even though theoretically the laser pulses can cross the entire forest canopy, and some of them clearly do, the data shows that in dense canopy conditions the ground point density is significantly reduced (Figure 7). Ground point density for maximum canopy density is 0.10 point/m^2, a decrease of 86 percent from the average point density of 0.69 points/m^2 of the study area. Note that these values are based on what are *classified* as ground points, not on what are certainly ground points. However, the effect of incorrectly classified points on the average values presented is likely insignificant.
This sparse distribution of ground points in forest environments makes the choice of interpolator very important. For this study, the TPS (TIN) algorithm in SAGA GIS was chosen because it leads to less pronounced artifacts in the DTM raster structure in areas where points

are scarce, as opposed to other common interpolators (Figures 8-11).

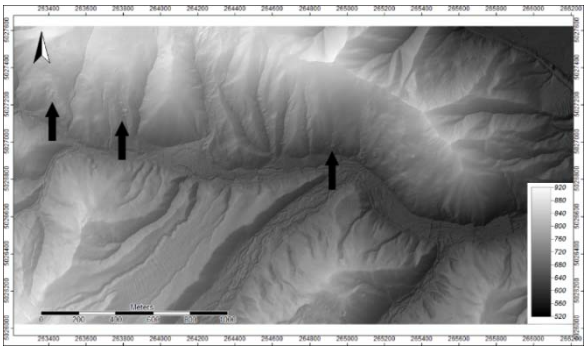

Figure 5.DTM of study area. Arrows indicate rough surfaces, most likely the effect of non-ground LiDAR returns not filtered out.

The feature classification maps generated from the ALS DTM and ASTER GDEM, respectively, are presented in figures12-13. Visual analysis indicates that, as expected, ALS data, with its sampling of elevation at a much higher resolution, leads to a more detailed representation of terrain features (even though the scale of analysis for both datasets is the same)

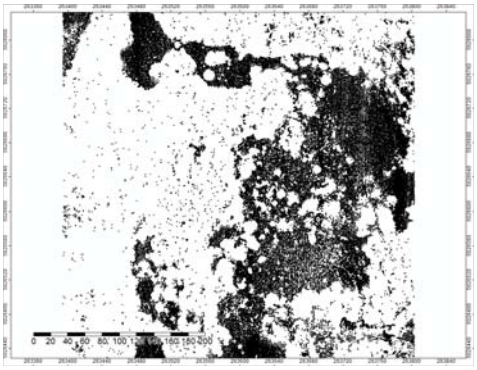

Figure 6. Ground point density in forested (left) areas vs. open terrain (right).

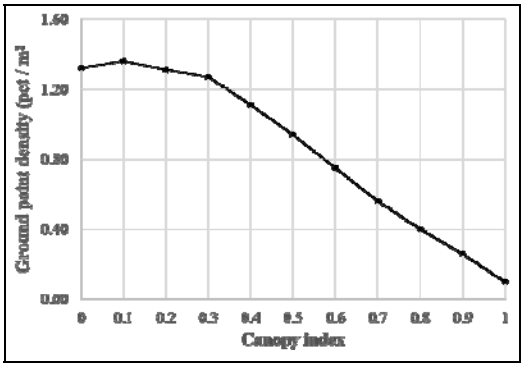

Figure 7.LiDAR ground point density in relation to canopy density index.

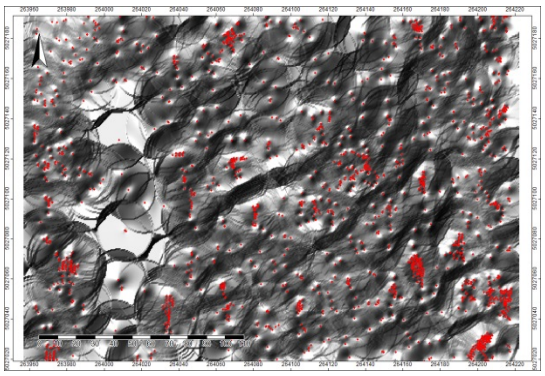

Figure 8. DTM for subset of study area, interpolated with IDW (*Inverse Distance Weighted)*

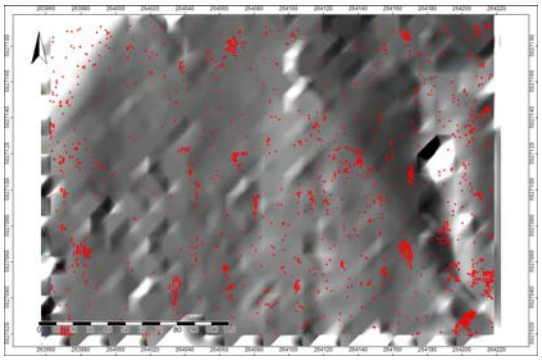

Figure 9. DTM for subset of study area, interpolated *Cubic Spline*

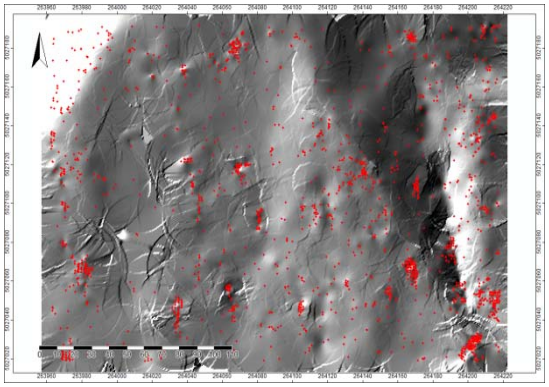

Figure 10. DTM for subset of study area, interpolated with TPS (*Thin-Plate Spline*)

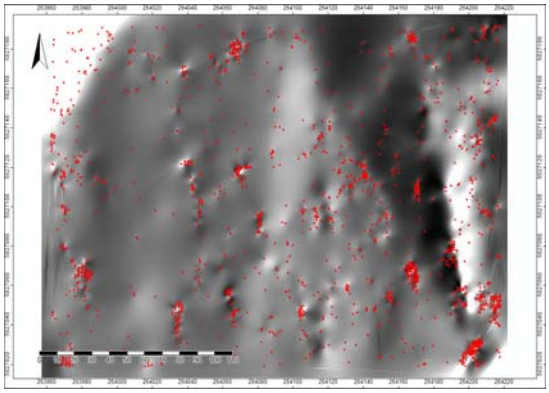

Figure 11. DTM for subset of study area, interpolated with TPS-by-TIN (*Thin Plate-Spline by Triangular Irregular Network*)

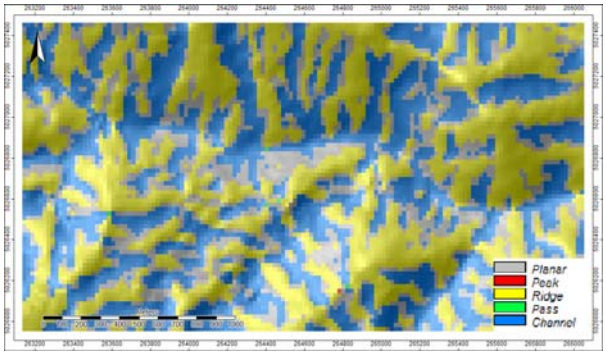

Figure 12. Feature classification map generated from ASTER GDEM

CONCLUSIONS

LiDAR is a recent development in the field of remote sensing that is of interest to many fields of research, including forestry. Laser pulses have the capability to cross through the forest canopy, therefore mapping the vertical structure of the forest and the ground surface underneath it. However, it has been shown that the ground penetration rate is significantly decreased in high consistency forest stands, at least when data is collected during full-leaf phenophase. The penetration rate is expected to increase for mapping campaigns carried out in leaf-off conditions. Nevertheless, even at lower ground point densities, the interpolated DTMprovides a detailed representation of micro-topography.

Since only a small percentage of the point cloud generated by ALS data collection represent ground returns, data processing involves filtering the dataset. As incorrect filtering is one of the main sources of elevation error (Hodgson and Bresnahan, 2004) in a DTM generated from LiDAR data, the choice of filtering algorithm is very important. Furthermore, areas with a complex topography and dense forest cover are among the most challenging conditions for any filtering algorithm (Guan et. al, 2014; Montealegreet al, 2015). In these conditions, manual corrections of filtering results are most likely necessary.

The uneven distribution of ground points (very dense in open terrain, sparser in forested areas) makes choosing an interpolator for DTM generation a non-trivial task. Spline interpolators, while more computing-intensive than linear ones (such as IDW), like the *TPS with TIN* algorithm used for this study, lead to a smoother surface, with less artifacts.

As long as these considerations are taken into account, LiDAR technology can provide a solution for mapping forest environments, providing accurate DTMs at a high-resolution (sub 1-meter) that capture small-scale features of the land surface.

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DIRECT GEOREFERENCING USING UNMANNED AERIAL VEHICLES (UAVs)

Constantin Răzvan CREŢESCU

Scientific Coordinator: Assoc. Prof. PhD Eng. Gabriel POPESCU

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67

Corresponding author email: c.razvan1995@gmail.com

Abstract

Unmanned Aerial Vehicles (UAVs) have become an attractive data acquisition platform in photogrammetric applications. As we know, the fundamental photogrammetric and remote sensing problem is the determination with high accuracy of the attitude, the position and the intrinsic geometric characteristics of the sensor. At the beginning, the aerial photogrammetric systems had a fairly low accuracy position, but today's, the new aerial photogrammetric systems allow the real-time determination of all parameters of exterior orientation with a good enough accuracy. Because of this, the advantage is that we can achieve direct georeferencing without needing to determine the coordinates of ground's control points, before or after the photogrammetric flight. In this paper I present some practical results of so called direct georeferencing of digital images, using of direct measurements of the image's exterior orientation parameters by a GNSS/IMU system. This application is achieved by the aid of the collinearity concept, and just for a good accuracy estimation of the method, I have used few ground control points.

***Key words**: Direct georeferencing, GNSS, IMU, Photogrammetry, UAV.*

INTRODUCTION

As the term implies, Direct Georeferencing is the direct measurement of exterior orientation parameters such as position (X; Y; Z coordinates) and attitude (roll; pitch; heading) in the real time when an aerial photograph is taken. That method can be used as an alternative or complement to Aerial Triangulation (AT). The parameters are obtained exactly at the time of photogrammetric flight, using data collected from Global Navigation Satellite Systems (GNSS) integrated with measurements from inertial sensors concerning Inertial Navigation System (INS) or Inertial Measurement Unit (IMU) that is directly attached to the mapping sensor, so that each pixel or range can be georeferenced to the Earth without the need for ground information collected on the field. Because of that, direct georeferencing method is essential for rapid mapping since it doesn't require the ground control points (GCP) which may require manual intervention.

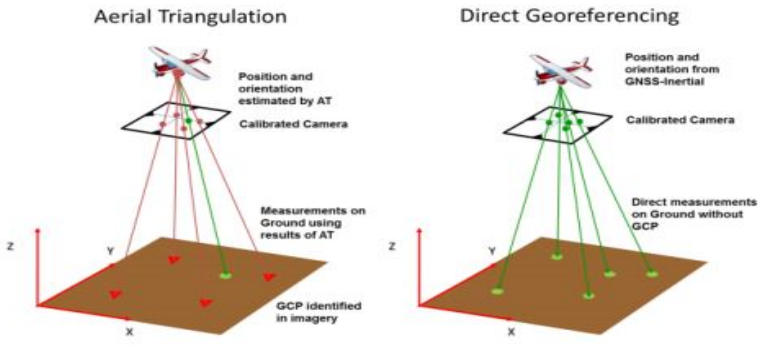
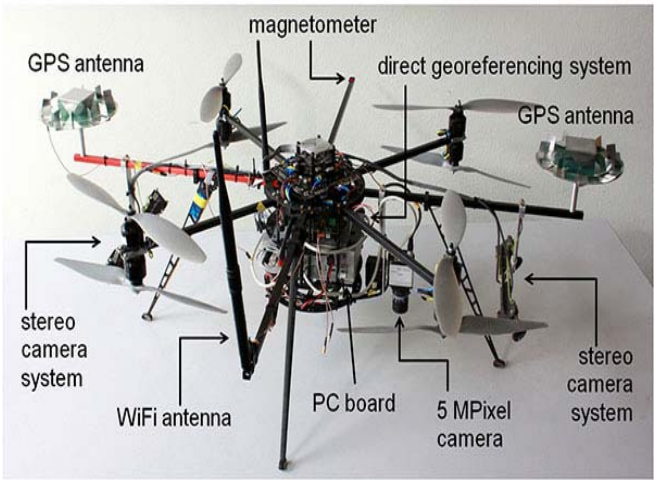


Figure 1: Direct Georeferencing Concept versus Aerial Triangulation

In this paper we present an application of direct georeferencing based on a system consisting of a GNSS, a IMU and a digital camera which allow us to know the exterior orientation parameters for aerial images. The method of direct geo-referencing allows us to transfer sensor or object data immediately into a local or global coordinate system (WGS'84) and makes their further processing possible.
It is very important to note that even if all these parameters are measured directly in real time, must be respected the fundamental photogrammetric conditions: collinearity, coplanarity and coangularity. (Popescu, 2016).

MATERIALS AND METHODS

The present paper uses the theoretical and practical experience of the authors in geomatics domain and it is practical applied using three aerial images and photogrammetric measurements, with a software program especially written for direct georeferencing based on a system consisting of a GNSS, a IMU and a digital camera which allow us to know the exterior orientation parameters for aerial images.



Unmanned Aerial Vehicle equipped for direct georeferencing

For our application of direct georeferencing we have used three digital images shown below in Figure 2.


Figure 2 . Digital images used for direct georeferencing

The mathematical model, which uses the collinearity equations, is a direct linear relationship between stereo-comparator coordinates and object coordinates (Abdel Aziz and Karara, 1971). This model is based on the two following collinearity equations (1):

$$\begin{cases} x_c = -f \dfrac{r_{11}(X-X_0)+r_{21}(Y-Y_0)+r_{31}(Z-Z_0)}{r_{13}(X-X_0)+r_{23}(Y-Y_0)+r_{33}(Z-Z_0)} \\ y_c = -f \dfrac{r_{12}(X-X_0)+r_{22}(Y-Y_0)+r_{32}(Z-Z_0)}{r_{13}(X-X_0)+r_{23}(Y-Y_0)+r_{33}(Z-Z_0)} \end{cases} \quad (1)$$

The relationship between the camera position (x_c,z_c) and the object (X,Y,Z) is determined by the seven parameters of the three-dimensional space, namely: the scale, three translation parameters and three rotation parameters. These relationships are expressed by collinearity equations (1) which express the basic condition in which an object point and its image lie on a straight line passing through the perspective centre.
Theoretically, a straight line has six degrees of freedom in the 3D Euclidean space: the coordinates of an arbitrary point lying on this line and the components of its orientation vector and in our application we have known all six parameters given by GNSS+IMU system (Popescu et al., 2015).

In our application, collinearity equations above use rotation matrix "R", whose elements r_{ij} ($_{i=1\ldots3,\ j=1\ldots3}$) are given by (2):

$$\begin{cases} r_{11} = \cos(\Phi)\cos(\mathrm{K}) \\ r_{12} = -\cos(\Phi)\sin(\mathrm{K}) \\ r_{13} = \sin(\Phi) \\ r_{21} = \cos(\Omega)\sin(\mathrm{K}) + \sin(\Omega)\sin(\Phi)\cos(\mathrm{K}) \\ r_{22} = \cos(\Omega)\cos(\mathrm{K}) - \sin(\Omega)\sin(\Phi)\cos(\mathrm{K}) \\ r_{23} = -\sin(\Omega)\cos(\Phi) \\ r_{31} = \sin(\Omega)\sin(\mathrm{K}) - \cos(\Omega)\sin(\Phi)\sin(\mathrm{K}) \\ r_{32} = \sin(\Omega)\cos(\mathrm{K}) + \cos(\Omega)\sin(\Phi)\sin(\mathrm{K}) \\ r_{33} = \cos(\Omega)\cos(\Phi) \end{cases} \quad (2)$$

So, we shall have a different rotation matrix "R", calculated with relations (2) for every image, like in aplication below.

RESULTS AND DISCUSSIONS

Knowing the following initial data, measured for three photograms from a band (for example: 1235, 1236, 1237) as follows:

a) Exterior orientation parameters of the camera for the three photograms in band 12 (1235, 1236, 1237) obtained using GNSS and INS / IMU are shown in Table 1, with the remark that the rotation angles are measured by IMU / INS in sexagesimal degrees.

Table 1. Exterior orientation parameters of the camera for the three photograms 1235, 1236, 1237 in UTM coordinates and sexagesimal degrees

photogr.	Xo (m)	Yo (m)	Zo (m)	Ω (°)	Φ (°)	K (°)
1235	432588,642	4921230,837	1550,103	-0,041011144	-0,038839342	-1,59315834
1236	433038,785	4921222,373	1550,445	-0,061545766	-0,052895769	-0,77850741
1237	433502,122	4921218,087	1549,643	-0,027192757	-0,016737128	-0,469175836

Before direct georeferencing processing we converted the rotation angles from sexagesimal :

Table 2. Exterior orientation parameters of the camera for the three photograms 1235, 1236, 1237 with rotation angles expressed in radians

photograms	Ω (rad)	Φ (rad)	K (rad)
1235	-0,000715779	-0,000677874	-0,027805859
1236	-0,001074176	-0,000923205	-0,013587518
1237	-0,000474603	-0,000292118	-0,008188663

b) Image-coordinates of 12 points of space-image on photos 1235, 1236, 1237, obtained with an accuracy of ± 2 μm (Table 3). :

Table 3. Image-coordinates of points

Nr.Point	Image - Coordinates					
	x (μm)	y (μm)	x (μm)	y (μm)	x (μm)	y (μm)
	1235		1236		1237	
11235	4018,444	76714,556	-31650	76907,02		
11236	38459,984	81184,516	3126	80891,405	-33900	80872,983
11237			40204,5	80669,587	2970	80459,285
21235	804,745	-498,625	-35916	-276,666		
21236	39083,272	2429,228	2418	2111,635	-35244	2069,329
21237			38959,5	4043,924	1344	3809,619
31235						
31236	43669,591	-72924,091	5976	-73295,995	-32046	-73446,304
31237			37275	-74279,736	-708	-74604,043
8833	30606,224	24756,586	-5755,583	24556,447	-43321,536	24570,721
8834			27805,5	29804,717	-9674,662	29646,372
8878			16570,5	-82352,868	-21462,932	-82576,736

c) Ground coordinates (in UTM map projection system and the reference altimetric plane *0 Black Sea 1975*) for three checkpoints in space-object, obtained with the help of ROMPOS RTK GPS with an accuracy of ± 1 cm (Table 4).

Table 4. Ground control points measured in the field and used for accuracy estimation of the method

Nr.Point	Ground Control Points		
	X (m)	Y (m)	Z (m)
8833	432973,714	4921522,930	77,027
8834	433386,403	4921582,038	76,102
8878	433229,952	4920204,247	74,495

For processing of the three images through direct georeferencing method, first of all we calculated the three rotation matrices with relations (2) for every image:

- The rotation matrix for the perspective centre 1235 is:

$$\begin{pmatrix} 0{,}999613212 & 0{,}027802269 & -0{,}000677874 \\ -0{,}027801783 & 0{,}999612701 & 0{,}000715779 \\ 1{,}05385E\text{-}06 & -0{,}000696656 & 0{,}999999514 \end{pmatrix}$$

- The rotation matrix for the perspective centre 1236 is:

$$\begin{pmatrix} 0{,}999907265 & 0{,}013587094 & -0{,}000923205 \\ -0{,}0135861 & 0{,}999906123 & 0{,}001074176 \\ 2{,}05126E\text{-}06 & -0{,}001061533 & 0{,}999998997 \end{pmatrix}$$

- The rotation matrix for the perspective centre 1237 is:

$$\begin{pmatrix} 0{,}99996643 & 0{,}008188571 & -0{,}000292118 \\ -0{,}008188432 & 0{,}999966222 & 0{,}000474603 \\ 1{,}49429E\text{-}06 & -0{,}000472195 & 0{,}999999845 \end{pmatrix}$$

Then we use the collinearity equations condition (3) and use several notations (4) for their ease calculation, which can be done in Microsoft Excel:

$$X = (Z - Z_0)\frac{r_{11}(x_c - x_0) + r_{12}(y_c - y_0) + r_{13}(-f)}{r_{31}(x_c - x_0) + r_{32}(y_c - y_0) + r_{33}(-f)} + X_0$$
$$Y = (Z - Z_0)\frac{r_{21}(x_c - x_0) + r_{22}(y_c - y_0) + r_{23}(-f)}{r_{31}(x_c - x_0) + r_{32}(y_c - y_0) + r_{33}(-f)} + Y_0 \qquad (3)$$

$$A1 = \frac{r11(Xc\text{-}Xo1)+r12(Yc\text{-}Yo1)+r13(\text{-}f)}{r31(Xc\text{-}Xo1)+r32(Yc\text{-}Yo1)+r33(\text{-}f)} \quad \begin{cases} Xp = (Zp - Zo1) * A1 + Xo1 \\ Yp = (Zp - Zo1) * B1 + Yo1 \end{cases}$$
$$A2 = \frac{r11(Xc\text{-}Xo2)+r12(Yc\text{-}Yo2)+r13(\text{-}f)}{r31(Xc\text{-}Xo2)+r32(Yc\text{-}Yo2)+r33(\text{-}f)} \quad \begin{cases} Xp = (Zp - Zo2) * A2 + Xo2 \\ Yp = (Zp - Zo2) * B2 + Yo2 \end{cases} \qquad (4)$$
$$A3 = \frac{r11(Xc\text{-}Xo3)+r12(Yc\text{-}Yo3)+r13(\text{-}f)}{r31(Xc\text{-}Xo3)+r32(Yc\text{-}Yo3)+r33(\text{-}f)} \quad \begin{cases} Xp = (Zp - Zo3) * A3 + Xo3 \\ Yp = (Zp - Zo3) * B3 + Yo3 \end{cases}$$

Where rij (i=1…3, j=1…3) are cosines directories of every photogram and (Xc,Yc) are the image-

coordinates of the point "p" on every photogram.
So, if we consider, for example, every stereo-couple 1235/1236, 1236/1237, 1235/1237, then ground-coordinate Z_p of the point "p" can be calculated and checked with relationships (5), as follows:

$$Xp = (Z_p - Z_{o1}) * A_1 + X_{o1} = (Z_p - Z_{o2}) * A_2 + X_{o2}$$

$$Z_p(A_1 - A_2) = Z_{o1}A_1 - Z_{o2}A_2 + X_{o2} - X_{o1} \Longrightarrow Z_p = \frac{Z_{o1}A_1 - Z_{o2}A_2 + X_{o2} - X_{o1}}{A_1 - A_2} \quad (5)$$

$$Z_p(A_2 - A_3) = Z_{o2}A_2 - Z_{o3}A_3 + X_{o3} - X_{o2} \Longrightarrow Z_p = \frac{Z_{o2}A_2 - Z_{o3}A_3 + X_{o3} - X_{o2}}{A_2 - A_3}$$

In a similar way shall be determined values for notations B1, B2 and B3, and then is calculated the value of ground coordinate."Yp" for points which appear on the three photograms, according to the relations (6):

For the photogram 1235: $Yp = (Z_p - Z_{o1}) * B_1 + Y_{o1}$
For the photogram 1236: $Yp = (Z_p - Z_{o2}) * B_2 + Y_{o2}$ (6)
For the photogram 1237: $Yp = (Z_p - Z_{o3}) * B_3 + Y_{o3}$

The notations A1, B1, A2, B2, A3, B3, mentioned in relationships above, are calculated in Table 5.

Table 5. The notations A1, A2, A3, B1, B2, B3 (the position vectors) for 12 points of space-image on photograms 1235, 1236, 1237

the position's vertors						
Nr.Point	A1	A2	A3	B1	B2	B3
	1235	1236	1237	1235	1236	1237
11235	-0,051902523	0,253921846		-0,637110179	-0,642903738	
11236	-0,33970323	-0,036103985	0,276591686	-0,666335859	-0,672123422	-0,67554223
11237		-0,344818029	-0,030522018		-0,666083222	-0,669582263
21235	-0,007265989	0,298381211		0,00505584	-0,000686813	
21236	-0,326804312	-0,021310052	0,293254345	-0,010464936	-0,016247084	-0,019174004
21237		-0,326002356	-0,011751529		-0,028210168	-0,031178977
31235						
31236	-0,347702421	-0,04244716	0,271839251	0,618561024	0,612891448	0,610496031
31237		-0,303308816	0,010701665		0,624645519	0,622288422
8833	-0,261329472	0,044245544	0,358997056	-0,198389942	-0,204151142	-0,207210504
8834		-0,235927025	0,078295216		-0,244063092	-0,247201492
8878		-0,129768135	0,184254374		0,689663029	0,687349529

In Table 6 are presented the calculated values of ground coordinates of object-points.

Table 6.

Nr.Point	Ground Coordinates								
	Xp	Yp	Zp	Xp	Yp	Zp	Xp	Yp	Zp
	1235			1236			1237		
11235	432665,023	4922168,418	78,488	432665,023	4922168,699	78,488			
11236	433092,330	4922218,831	67,376	433092,330	4922219,178	67,376	433092,225	4922219,213	67,685
11237				433547,091	4922204,266	76,316	433547,091	4922204,601	76,316
21235	432599,341	4921223,393	77,685	432599,341	4921223,384	77,685			
21236	433070,193	4921246,257	76,591	433070,193	4921246,319	76,591	433070,167	4921246,330	76,671
21237				433519,439	4921263,966	76,056	433519,439	4921264,032	76,056
31235									
31236	433101,396	4920318,651	75,413	433101,396	4920318,338	75,413	433101,381	4920318,102	75,457
31237				433486,340	4920300,662	74,870	433486,340	4920300,353	74,870
8833	432973,594	4921523,075	77,053	432973,594	4921523,168	77,053	432973,540	4921523,181	77,258
8834				433386,719	4921582,306	75,692	433386,719	4921582,450	75,692
8878				433230,318	4920204,457	74,484	433230,318	4920204,137	74,484

For the accuracy estimation, it's recommended to do an average between the ground coordinates of photograms which was determined.

Nr.Point	Final Ground Coordinates		
	Xp (m)	Yp (m)	Zp (m)
11235	432665,023	4922168,559	78,488
11236	433092,295	4922219,074	67,479
11237	433547,091	4922204,434	76,316
21235	432599,341	4921223,389	77,685
21236	433070,184	4921246,302	76,617
21237	433519,439	4921263,999	76,056
31235			
31236	433101,391	4920318,364	75,428
31237	433486,340	4920300,507	74,870
8833	432973,576	4921523,141	77,122
8834	433386,719	4921582,378	75,692
8878	433230,318	4920204,297	74,484

Accuracy estimation		
Δ X (m)	Δ Y (m)	Δ Z (m)
0,138	-0,211	-0,095
-0,316	-0,340	0,410
-0,366	-0,050	0,011

CONCLUSIONS

Direct georeferencing using UAVs has a lot of benefits compared to traditional aerial triangulation. This solution that has become a standard in wide area photogrammetric mapping is a GNSS-aided INS comprising an inertial measurement unit (IMU), a GNSS receiver, and a processing engine that implements a GNSS-aided INS solution both in real time and after mission via post-processing software with optimal smoothing running on a PC. So it makes possible getting a real-time aerial data acquisition system which is developed for the purpose of providing rapid and accurate geo-spatial information in the emergency situation such as disasters or accidents.

It also reduces the processing time required to create map products compared to traditional aerial triangulation techniques thereby increasing productivity.

A direct georeferencing method is also desired in order to reduce or eliminate field control expenses, such as making ground control points on a hard accessible area.

In conclusion, the emerging technology that appears to meet the challenging and sometimes conflicting requirements of direct georeferencing accuracy, size, weight, power consumption and cost is a new generation of GNSS-aided INS products using micro-electro-mechanical system accelerometers and gyros.

It is important to know that UAV photogrammetry is emerging as an alternative method of acquiring photogrammetry data to

the traditional systems using full-size manned aircraft.

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THE EFFECTS OF ELECTROMAGNETIC WAVES ON LIVING ORGANISMS

Raluca-Gabriela KIVU

Scientific Coordinator: Lect. PhD Eng. Bogdan ERGHELEGIU

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67

Corresponding author email: kivu.raluca@yahoo.com

Abstract

This paper shows the effects of electromagnetic waves on humans and other living organisms, waves that are being transmitted by instruments or machines which give off electromagnetic radiations during function, especially GSM relays. It contains general information about areas that are strongly radiated like the ones that are near GSM relays, more accurately, information about the Odobesti relay; it also presents summaries and conclusions as a result of passing along surveys in the nearby area of this relay, but also in areas in which it does not exist such a relay, and also interviews with beekeepers.
The purpose of this paper is to highlight the daily impact that electromagnetic waves has on humans and other living organisms, in order to determine the disadvantages of placing these relays in populated areas..

Key words*: relay, bees, electromagnetic waves*

INTRODUCTION

Explosive growth of electricity users and applications in transmission of electromagnetic media information specific to modern civilization has led to numerous problems related to the exposure biology, the field of environmental influence. The use of the radio frequency electromagnetic radiation is becoming more common. Satellite broadcasting, cellular telephone systems use thermal oven is expanding more and more.
The frequency range of technical applications has extended continuously, from frequencies of order Hz to order GHz, matching wavelengths from 1000 km to 0.1 m. The technical frequency range overlaps the natural spectrum of frequencies more and more every day. We have to retain the fact that any machine, equipment or electrical / electronic system can be at the same time the transmitter or receiver for electromagnetic radiation. This paper's purpose is to show what the consequences are in case a GSM relay is posted at a maximum distance of 300- 500 meters from people's houses and also, the effect of radiations on bee colonies in the area. I have chosen the orange relay from Odobesti, Dambovita County which is set on a Orange pylon of 50 meters high; this pylon transmitted electromagnetic waves on a distance of 4-5 km. The radiation has, in essence, the same frequency as microwaves of a microwave oven.

MATERIALS AND METHODS

Figure 1. GSM relay Odobesti

Figure 2. GSM relay Odobesti

I took as example the Orange relay Odobeşti, located at φ = 44.6055, 25.5583 = λ, H 145, is located on a mast ORG, P50_s structure, equipped with Shelter, with a height of 50 meters.

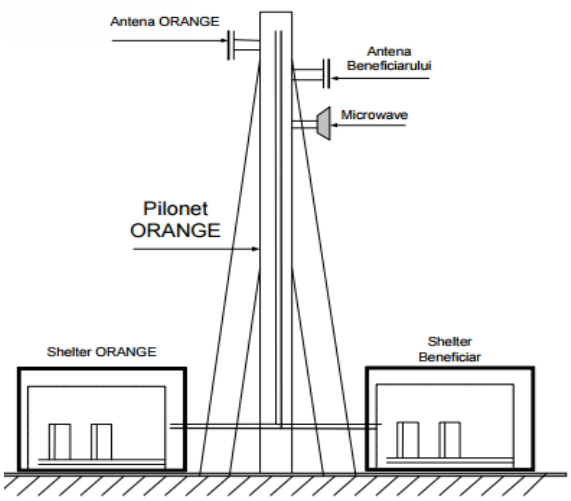

Figure 3. Sketch GSM relay

The Orange relay is situated near a school, a church, vulcanization, a barber shop, 3 stores, the city hall, a pharmacy, a medical centre and people's houses. By distributing surveys, both in an area with no relay and in the nearby of the Orange relay, I have made polls to differentiate the two cases. I interviewed two beekeepers from nearby the Odobesti relay who have been engaging them activity long before the placing of the relay in the area.

RESULTS AND DISCUSSIONS

I have distributed the form in the two areas, with a relay and without a relay. The form includes questions like:
„Name", „Age", „Do you live in the nearby area of a GSM relay? (300-500m)", „How many hours a day do you watch T.V.?", „Do you use a microwave oven?", „Are you tired or stressed all the time?", „Do you suffer from cardiac diseases?", „Do you suffer from neurological diseases?", „Do you have cancer?", „Do you think that placing a GSM relay in your area had negative effects on you or it affected you in any way?", „Observations (Diseases presented)".
I have chosen an equal number of people (64 people) with the age between 18 and 84, the average age in the both cases being 48-49. (Figure 4)

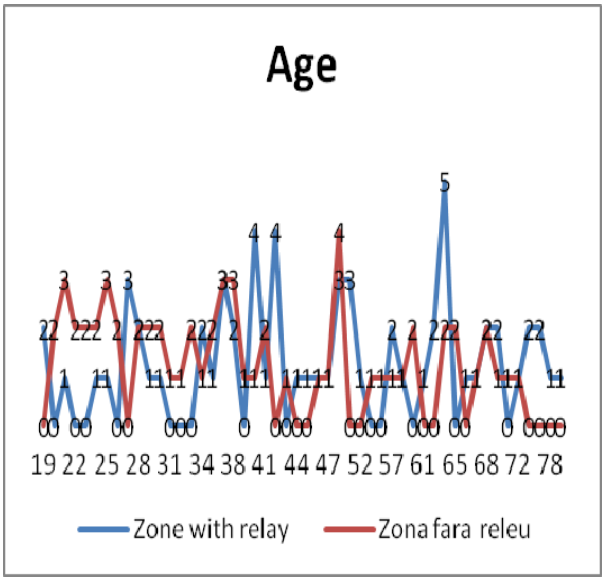

Figure 4.

By asking the question „Do you live in the nearby area of a GSM relay? (300-500m)", I wanted to know exactly the effects the nearby relay has on the population, therefore the distance I have chosen (300-500 m), but also to differentiate the two areas.
I asked the question „How many hours a day do you watch T.V.?", and in the two areas the percentage was different.

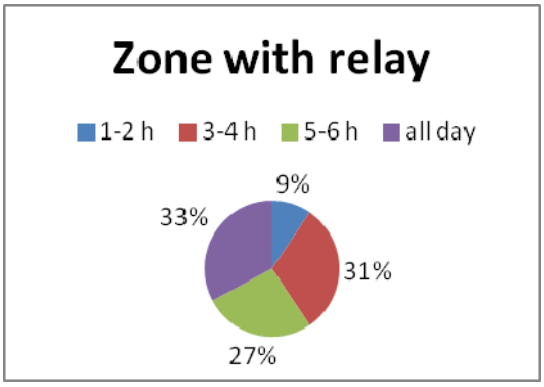

Figure 5

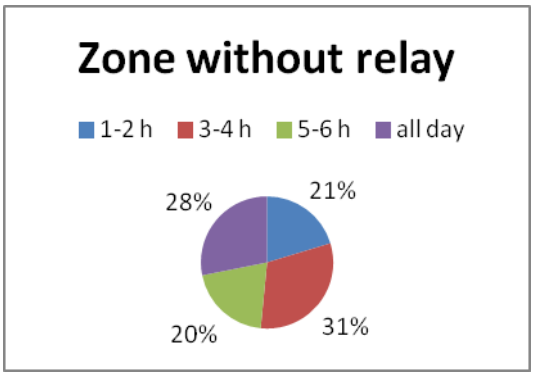

Figure 6

The older T.V.s, the box type, has cathodes tube which transmitters a higher level of radiation.

If you still own this type of TV, the experts recommend being at a distance of at least 2 meters from it, to limit exposure.

At lower levels of this type of radiation there is proof of cellular tissue deterioration and of the DNA, also there radiation have been connected to brain tumours, cancer, lower immunity functions, depression, miscarriage, Alzheimer's disease and numerous other affections. Children are being exposed to a bigger risk due to their thinner skull and the rapid growth rate. Also, at a bigger risk are exposed the older population, those who have a more fragile constitution, and pregnant women. Children under the age of 16 are advised not to use cell phones, to minimize their exposure to radiation.

Mobile telephony pylons represent a risk for health, there are numerous cases of epidemiology and medical that confirm the fact that exposure to radiation of the RF domain and microwaves transmitted by the mobile telephony pylons, even at low levels, can have huge adverse effects on biological systems. It can be related to: brain cancer, memory loss, DNA chain damage and neurological problems due to exposure to levels lower than the limit of the official safety standard. Some adverse effects of radiation can be seen almost immediately, but others are shown after many years of exposure – for example 3-10 years in case of cancer.

Interview with Mr. Nicu Pintea

Mister Pintea Nicu (50 years old) has been a beekeeper for 28 years; he started this with two hives which he multiplied very fast, he says. Within a 10 year period he made it to 120 hives.

In the present, mister Pintea has 258 hives, which he moves periodically in special places near the forest, sun flower fields etc.

He confessed that since the GSM relay appeared near his house it has affected considerably the honey production, and as for the population of bees, in the year 2000 he had 150 hives and lost 75 of them in only one year since the relay was placed. Mister Pintea was forced to move his hives in a further location; therefore he got to move his home in a neighbouring village.

Interview with Mr. Neacsu Mihail

Mister Neacsu Mihail (50 years old) has been a beekeeper from the age of 25, as he inherited from his father 80 hives.

„Before the revolution, my father worked very hard that me and my family to live a good life; I remember that he could keep about 10% of what bees produced. Seeing him all my childhood how hard he worked for these hives I couldn't give them up when he couldn't take care of them anymore.

I have learned pretty fast how to multiply bees and I got to make a good profit over them. In the year 2001 I had about 200 hives, but once the Orange Relay was placed my profit started dropping remarkably, so that in 2002 I was left with 120 hives, the production going from bad to worse and bees started dying more and more. So I started to sell the hives along with the bees. In the present I am no longer a beekeeper, but I can say that I regret very much the fact that I couldn't take my father's work further."

Bees are sensitive to magnetic fields, for they have in their bodies particles that are called magnetite, and radiation from GSM antennas contribute to the dramatic decrease of the bees population.

Animals, including insects, use for navigation a pigment called cryptogram. Bees use it to feel the direction of the magnetic field of Earth, but they are blocked by the radiation that comes from the terrestrial bases of mobile telephony operators. This is why bees get confused and they don't find their way to the hive.
To fully understand this subject, I can say that regularly, a loss of 10% per season of the bee colonies was considered normal. In cases of an epidemic or pests invasion, it wound get to a 30% loss. In case of this syndrome the losses get to about 70% - 80%. At this pace, bees are heading to extinction. The magnetic sense of bees allows them to navigate over the magnetic fields of Earth, ability which needed millions of years to develop and adapt, that is why it is affected by the smallest change in the electromagnetic environment.
The disappearance of all bees on the planet would be a disaster. It could mean the end of mankind. They are responsible for natural polarization which sustains the perpetuation on trees and plants. It has been estimated that for three quarters of plants, that provides man with cereal, vegetables, fruits, seeds, nuts, polarization is vital. The signal from cell phones disorients bees, making them fly chaotically before they die. Experts in beekeeping have put a cell phone under a bee hive, and then they closely monitories their reaction.
The result was that they have shown capable to figure out if the phone calls or receives calls, by answering through a signal which is usually used for gathering the swarm. After the end of each call, at approximately two minutes, the insects have calmed down. This shows clearly that the presence of cell phones disrupters bees, having a dramatic effect over them; cell phones signals are responsible for the graduate disappearance of bees.

CONCLUSIONS

By distributing the surveys I have created this poll:
States of fatigue or stress

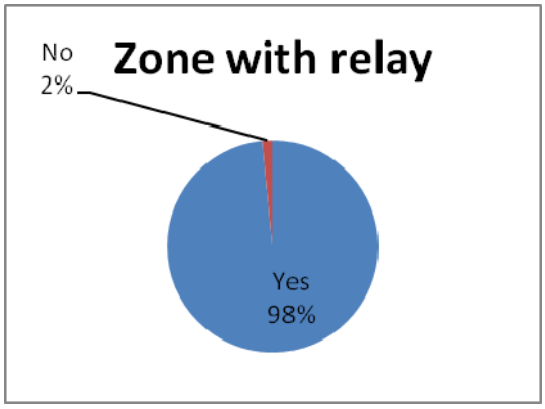

Figure 7

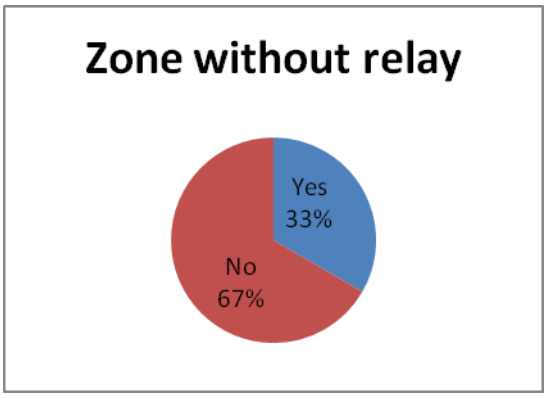

Figure 8

We can observe that in the nearby area of the relay, people are much more tired or stressed, and in the area which is not near a relay only a third of the people suffer from fatigue or stress. In the first case, about 98% are tired all the time or stressed (Figure 7), meanwhile in the second case there are 33% (Figure 8), so we can see a rather big difference.

Cardiac diseases

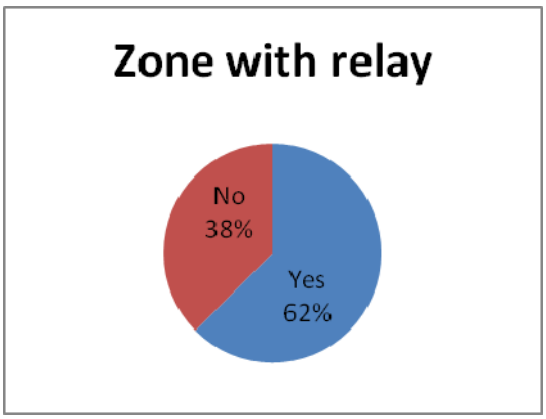

Figure 9

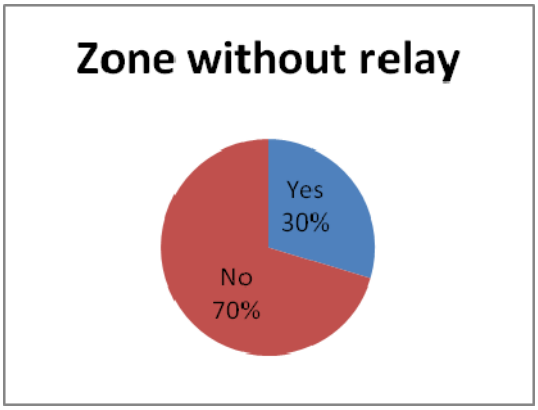

Figure 10

We can observe that the percentage of people that suffer of cardiac diseases in the area with a relay (Figure 9) is about 2 times bigger than the one in the area without a relay (Figure 10). There are people around the age of 19-30 that suffer from blood pressure disorder or strokes, and people over the age of 30 that have suffered from strokes, mild heart attacks, and heart attack.

Neurological diseases

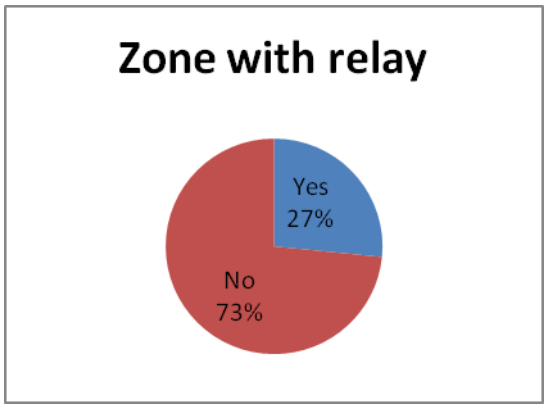

Figure 11

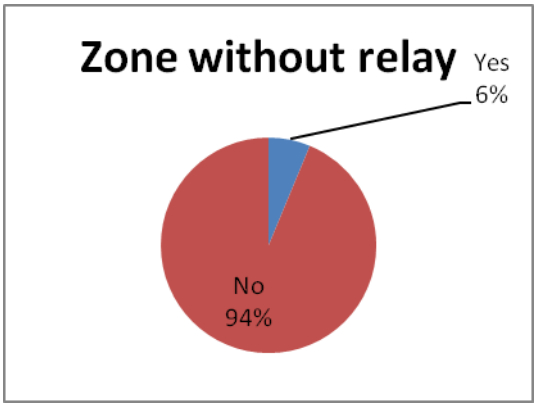

Figure 12

From the surveys answered in the area without a relay (Figure 12), has resulted that 6% of the people in that area have neurological diseases, as they have suffered from strokes; in the other case (Figure 11) the percentage is 4 times bigger, as people have suffered from Alzheimer's disease, Parkinson's and strokes.

Cancer

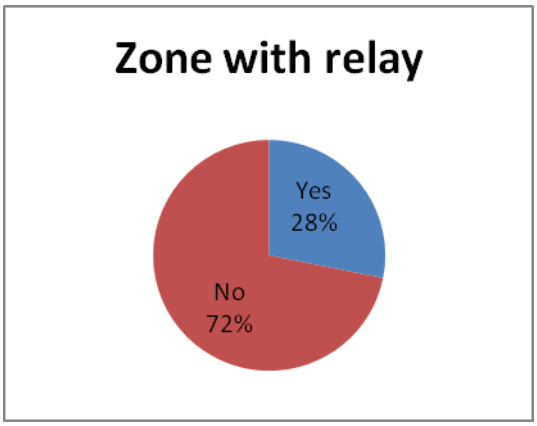

Figure 13

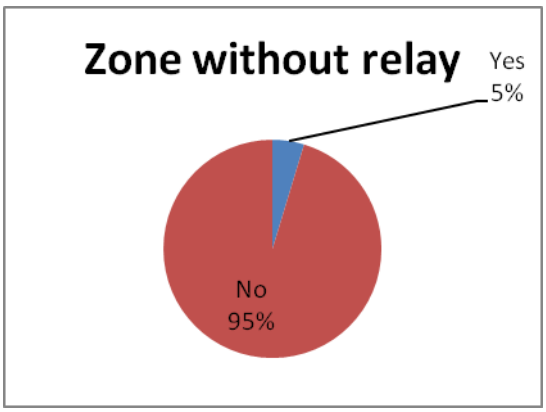

Figure 14

It seems cancer has affected 28% of the people in the area with a relay (Figure 13), these suffering from leukaemia, skin cancer, breast cancer, thyroid cancer or bone cancer. On the other hand, in the area without a relay (Figure 14) there are three persons who suffer from breast cancer or ovarian cancer.

From the surveys above we can see the remarkable differences between the two areas. In the area with a relay, 83% of people that have done the survey are sick, meanwhile in the second case, the area without a relay, only 18% has one of the three types of diseases.

We can observe differences between the diseases also. People either got sick because of the relay either were sick or their disease got started getting worse once the relay was placed.
In the area have been registered seven cases of suicide after the first 5 years since it was placed.
Bees have also been affected, in some cases the initial population has been halved in just a year, people being forced to quit or to move the hives far away from the relay.
We can observe that in both cases the bee colonies have had to suffer, so we conclude that bees are affected by the radiation transmitted by the GSM relay placed in the area, for their natural habitat is being disrupted, as they are used to follow the Earth's frequency (7.83 Hz).

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THE IMPORTANCE OF A CONCRETE DAM MONITORING

Raluca Gabriela KIVU, Carmen Mihaela PREOTESCU, Bogdan GHERED

Scientific Coordinator: Lect. PhD Eng. Catalina Mariana CALIN

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67

Corresponding author email: kivu.raluca@yahoo.com

Abstract

Hydro tehnical structures are part of the strategic structures of great importance in terms of environmental protection, due both to their environmental impact and potential environmental hazards. The reason for their importance policy is twofold: on the one hand, water resources controlled by these structures are of vital importance for sustainable regional development (water supply for the population, agriculture, power generation, etc.), and on the other hand hydro tehnical structures presents one of the greatest dangers given the energy potential of their destruction (dams, dikes) or potential hazards (ponds, wastewater). The paper shows the importance of monitoring the behaviour of hydro tehnical structures and to establish the vertical displacements towards the base and previous slice of instalment. As a case study we chose the concrete dam from Herculane.

Key words*: monitoring, concrete dam, vertical displacements*

INTRODUCTION

Monitoring and predicting the behaviour of hydraulic structures and adjacent areas represents a public priority. Ensuring the functioning of the projected parameters and corrective action most appropriate to preserve the functionality of these buildings is essential to: accident prevention and serious environmental and social consequences caused by natural disasters and technological accidents related to such construction; keeping appropriate environmental conditions of the surrounding areas of these buildings with an important role in regional sustainable development through sound management of natural resources (water, vegetation, crops, habitat).

Considering this fact, dam stability is monitored through topographic measurements regarding their vertical and horizontal movements (Manea, 2013; Onose et al., 2014). In the case of concrete arch dams, horizontal displacements predominates, and in the case of rockfill dams, vertical displacement predominates (Ortelecan et al., 2014; Sails et al., 2014)

These requirements can be met by monitoring and overall supervision of hydro-technical facilities. Every significant hydro-technical construction should have its own surveillance program. The surveillance program should be appropriate to building size, risk level to which the public is exposed and other consequences of construction failure level. One of the most important parts of the surveillance program is to monitor geotechnical instrumentation fitted in construction, to ensure the integrity of hydro technical structures (earth dams and rockfill dams, concrete dams, tunnels). (Manea, 2013; Onose et al., 2014).

Dams are constructions with a long-life term, besides the fact that making them requires important investments. Supervising their behaviour during construction, from the first load and throughout exploitation is the guarantee of their safety and prevents accidents that may become catastrophes. Collected data from surveying dams allows making decisions about routine maintenance works at the best moments. They also allow knowing the eventual onset phase phenomena atypical behaviour and take action accordingly before such phenomena to be dangerous for the safety of the construction. Supervising dam behaviour is achieved through visual inspections carried out by qualified personnel and interpretation of data obtained from monitoring the behaviour of

relevant parameters with measurement instruments. At the current stage there is a general opinion that a monitoring system as complete and sophisticated as it is cannot replace direct visual inspection. Some of the most dangerous events such as local deformation, cracks, seepage concentrated wet spots cannot be detected by instrumentation. But once an abnormality has been detected by visual inspections through the monitoring system, its progress can be tracked and interpreted based on the data provided by the monitoring system.

To determine the vertical displacements on the weir crest and downstream face, tracking landmarks are placed to observe vertical displacements. Considering the small values of displacements, to record these displacements is used high precision geometric levelling and the measurement processing is performed by rigorous methods using functional models from conditioned measurements and from indirect measu rements (Dima, 2005; Onose et al., 2009).

MATERIALS AND METHODS

The purpose for following the review period of the behaviour of construction is to obtain information to ensure suitability construction for normal operation, evaluating the conditions in order to prevent incidents, accidents and damage or diminish damage, loss of life and damage to the environment (natural, social and cultural) and also obtaining information necessary for improvement in construction activities. Performing tracking actions for the review period of behaviour in time of constructions are made in order to meet the resistance requirements stipulated, stability and durability of construction and of other essential requirements.

Engineering companies and contractors are facing challenges never experienced before. They are being charged with and being held liable for the health of the structures they create and maintain. To surmount these challenges, need to be able to measure structural movements to millimetre level accuracy. Accurate and timely information on the status of a structure is highly valuable to engineers. It enables them to compare the real-world and real time behaviour of a structure against the design and theoretical models. When empowered by such data, engineers can effectively and cost efficiently measure and maintain the health of vital infrastructure. The ability to detect and react to potential problems before they develop helps in the reduction of insurance costs and the prevention of catastrophic failures that may results in injury, death or significant financial loss.

Topo-geodetic measurements made in order to follow the review period of the behaviour of constructions in time represents the only external check that may reveal that vertical displacements of the entire structure or construction with the foundation ground. In this case there must be reported certain points that are fixed to the building (survey marks) at a series of fixed points (fundamental benchmarks) located outside the area of influence of factors acting on the building and the land on which they are located (Table 1).

Table 1 - Measured points set on the Herculane dam

OBJECTIVE	OBJECT	LEVELLING	Micro- triangulation
HERCULANE DAM	PLANT	4 SURVEY MARKS	43 SURVEY MARKS
	CROWN	15 SURVEY MARKS	
	ACCES ROAD TO CROWN	4 SURVEY MARKS	
	DRILLING DISPLACEMENT	6 SURVEY MARKS	
		4 FUNDAMENTAL BENCHMARKS	6 PILASTERS

Topo-geodetic measurements which were made to determine vertical displacements were conducted during September-November 2016, after which the data was processed at the office with a specifically software developed for this purpose. During performing the surveys, the ambient temperature was about 20 ° C to 4 ° C for levelling and micro triangulation measurements. Weather conditions were good, being able to perform measurements in optimal working conditions.

Micro triangulation network pillars are painted properly to be spotted easily. Also tracking marks from the access console are highlighted with paint and properly numbered (Figure 1).

Figure 1. Survey mark and pilaster

Pilasters considered fixed in this tranche of measurements were P7 and P4. Vegetation was cleared pillars both among and between them and the dam, but there were areas where, due to increased vegetation on the steep, rocky slopes, could not penetrate. These problems adversely affect the accuracy of determining the horizontal displacement of the parts of the dam, both the faulty-of-sight and the refractive error lateral occurs when the distance from the axis of sight to objects or building is less than 0.5 m.

Compared to the previous tranche there were no pillars or levelling marks destroyed.

Installing the instrument on pilasters was made by mechanical (forced) centring. On the other pillars of the network was installed circular total reflection prism, having zero or constant targets of sight.

The method of angles measuring for planimetric network of the dam was series method (sets of directions trough Schreiber method), performed four series for the pilasters, and three series for survey marks.

Altimetry measurements made at Herculane dam aimed to determining vertical displacements of the dam by topo-geodetic measurements made on benchmarks tracking. Movements are obtained by the difference between the rates determined in the current tranche of measurements and the one from the initial tranche. The altimetry network consists of four fundamental benchmarks RF1, RF2, RF3, located at the ends of the crown and RNFC, located near the plant, and 29 survey marks placed along the crown, on the crown access road, 4 embedded in the plant and wells that make up the network of tracking sliding the left side (Figure 2).

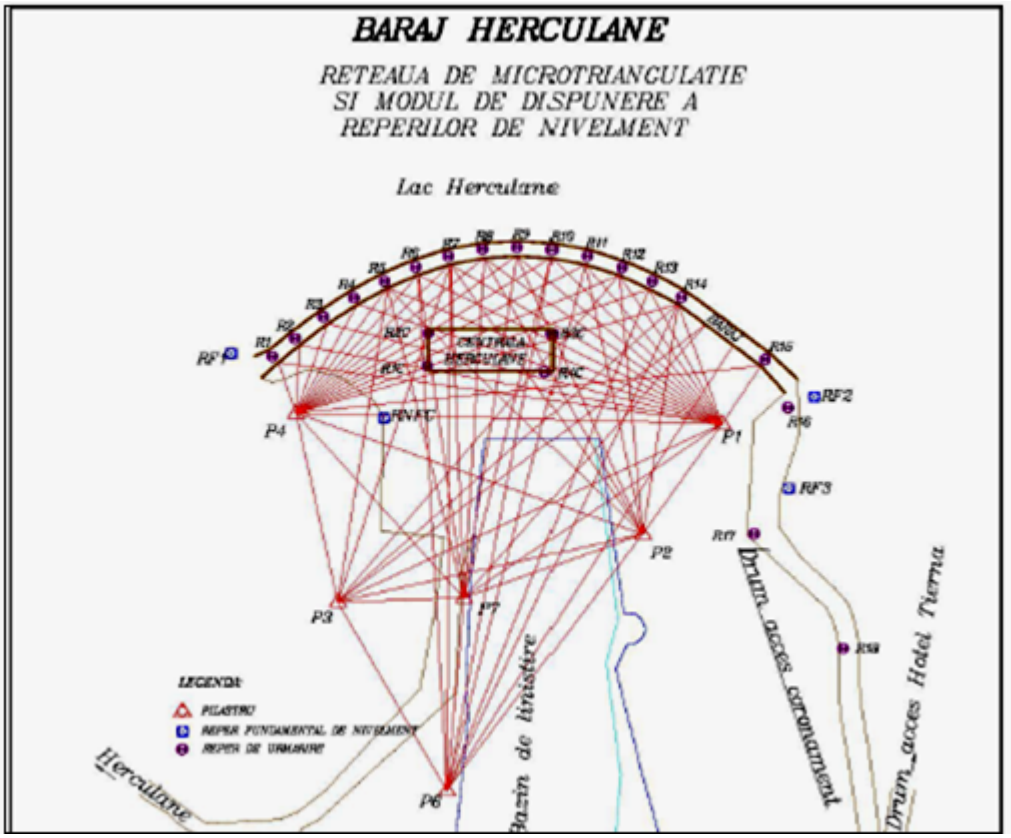


Figure 2. Micro triangulation network and the arrangement of the levelling marks

To determine the height of the marks embedded in the plant was made a closed traverse levelling on starting point, considering fixed the fundamental benchmark RNFC and for determining the height of the marks placed on the crown was made a traverse supported at the both ends on fundamental marks RF1 and RF3.
The works were performed with high precision equipment, both for surveying networks, and for microtriangulation. For microtriangulation stage respectively measuring directions and distances were used Leica total stations type TS 06. For levelling stage were used Leica Sprinter 250M digital levels, 3m barcode staff and levelling frogs 5 kg each (Figure 3).

Figure 3. Leica Sprinter 250M and barcode staff

The device used is the Leica Sprinter 250 M - is an electronic level automatically meant the measurements accurate and more precise, no skipping: USB interface, friendly menu, automatic calculation of height and elevation difference, applications for surveying, internal memory (250M) for measurements of height with a standard deviation of 1.0 / 0.7 mm * per km double levelling.

Test method for detecting vertical movements was middle geometric levelling method. Traverses high precision geometric levelling was carried out on the basis of the technical requirements of the 1 order of geometric levelling.

RESULTS AND DISCUSSIONS

Figure 4. Herculane dam

Accumulation Herculane, Cerna river located about 7 km upstream from Baile Herculane has 235 mdM NNR quota share which is 75.2 ha area. Multiannual average flow of the river Cerna, section barring order difference Cerna basin downstream from the dam is 5.1 m / s. Accumulation volume is 15.8 million cubic meters, of which 13.1 million cubic meters of useful energy and feeds on the distinction basin flow Cerna and the accumulation derived from Cornereva (Vele et al.2014, http://www.hidroconstructia.com).

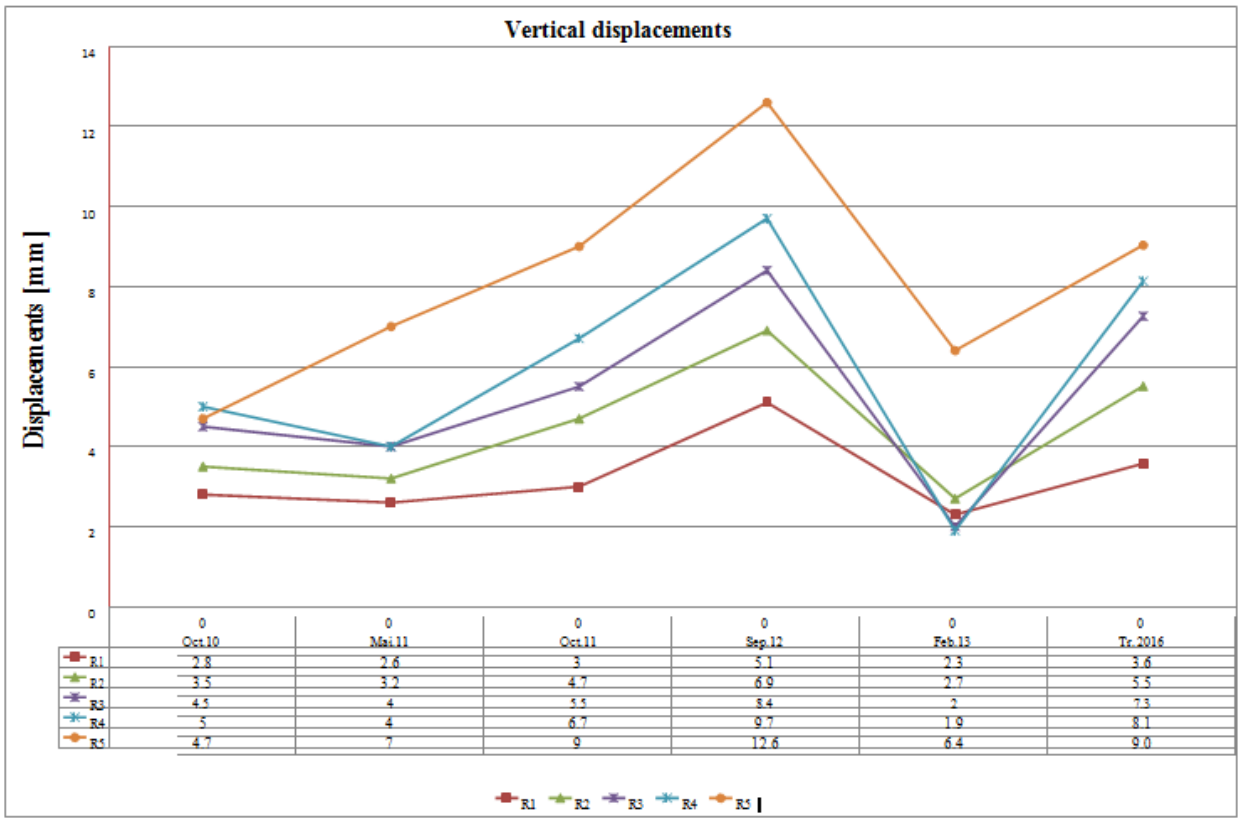
Dam, concrete arch, is founded on a massive granitic time Cerna of about 600 m length was sinking slowly upstream and downstream under sedimentary deposits. In the left side, about 250 m from shoulder dam, granite is limited by rock formations weak intensely altered and consists of shale clay marl, marl, limestone and sandstone marl, the area is a weak point, with permeability high of front retention.

In this situation sealing dam was made with a veil sealing 540 m long and 27-50 m depth, the entire front of retention consisting of dam slopes, on two floors of galleries to share bed and canopy (8500 ml). Injections were associated with a network of drainage wells 25 - 45 m total length of 5800 m.

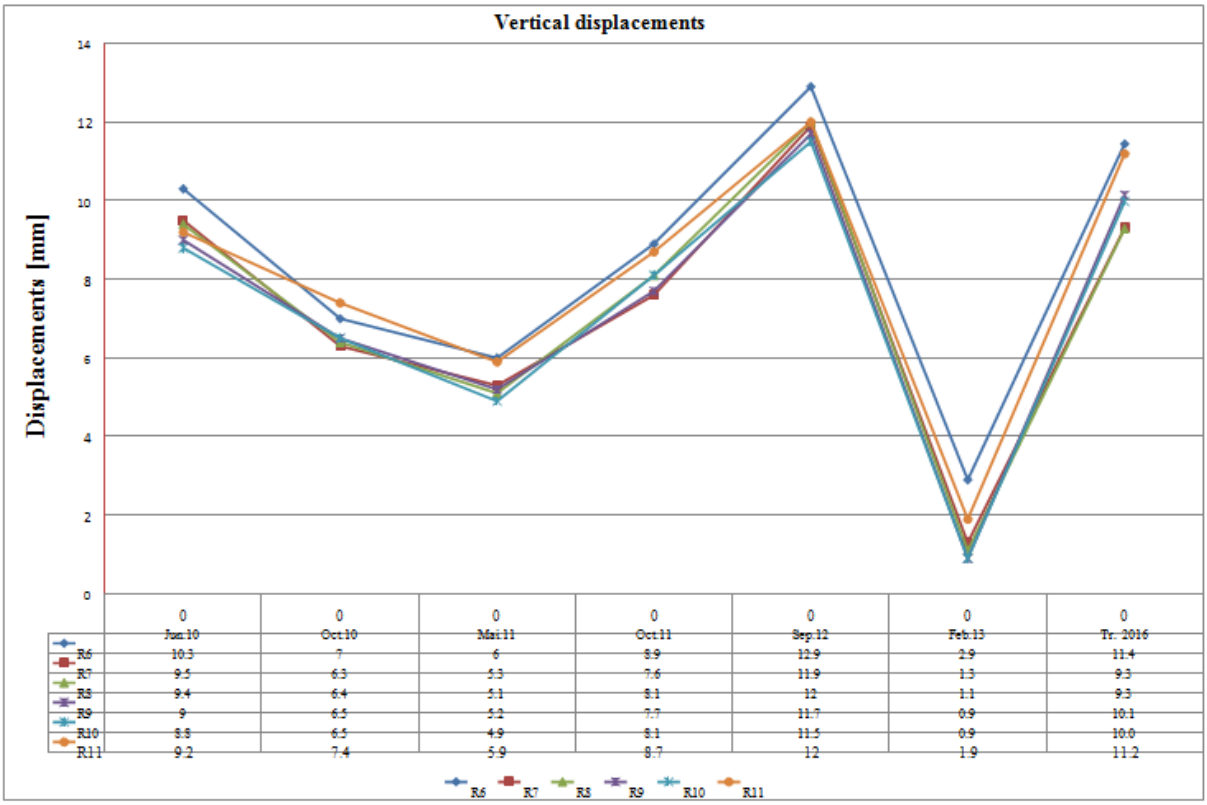
The dam is equipped with a perimeter gallery for injections, drainage and AMC, 2 galleries with 3 floors and access walkways to the downstream.

The dam is provided in plots 3 and 4 with two openings spillway without gates (length front spillway, 16 m), with channels exhaust 50m. Sleeps calculation is 530 m / s (of which 320 by trucks) and verification of 930 m / s. Bottom purges in number two plots located in the 8th and 9th, ensure discharge of 210 m³ / s at NNR. They are made of metal pipe d = 1200 mm total length of 65 m of which 10.70 m under pressure, equipped with crosspieces revision and valve segment and the downloading manoeuvre under power.

With measurements performed their interpretation was made comparing with those previously made. Graphic representations of survey marks differences in the crown vertically acquired from the monitoring process can be seen in the charts below.



	0 Oct.10	0 Mai.11	0 Oct.11	0 Sep.12	0 Feb.13	0 Tr. 2016
R1	2.8	2.6	3	5.1	2.3	3.6
R2	3.5	3.2	4.7	6.9	2.7	5.5
R3	4.5	4	5.5	8.4	2	7.3
R4	5	4	6.7	9.7	1.9	8.1
R5	4.7	7	9	12.6	6.4	9.0



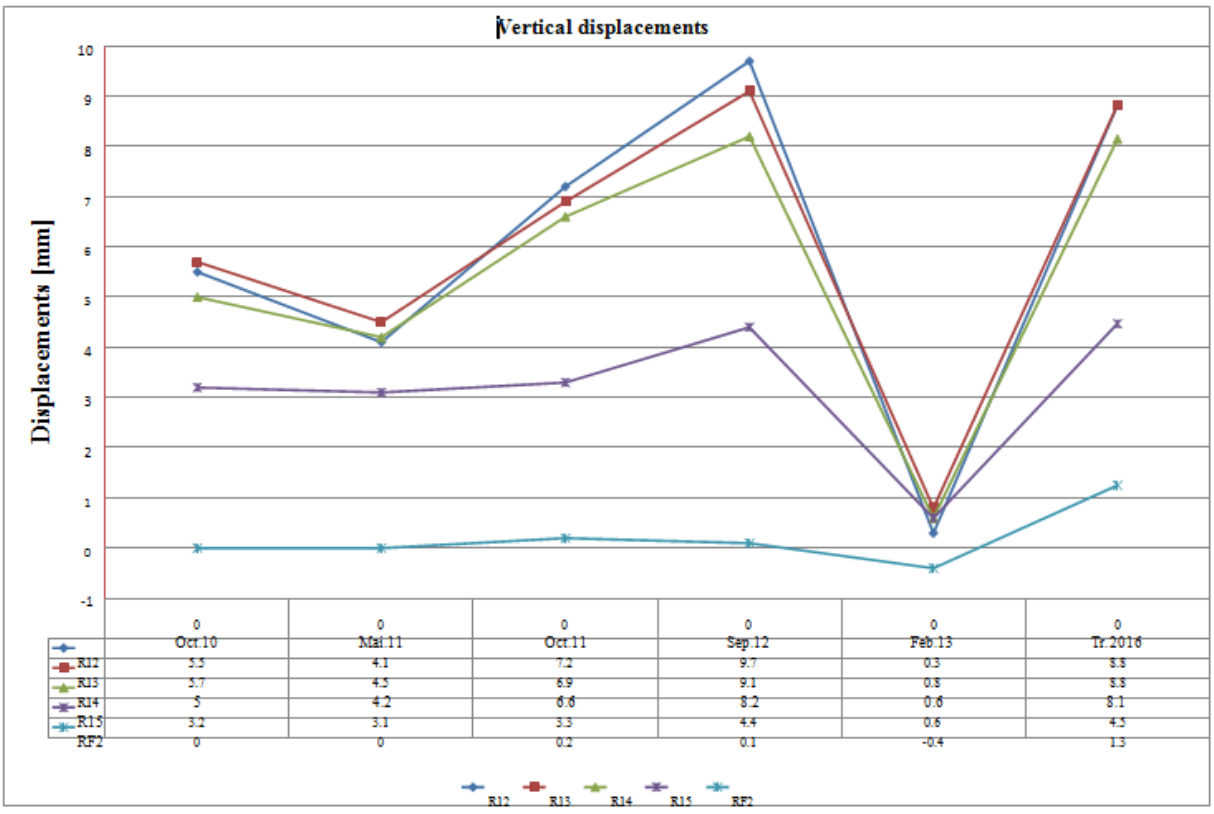


Figure 5. Vertical displacements obtained on the crown marks

CONCLUSIONS

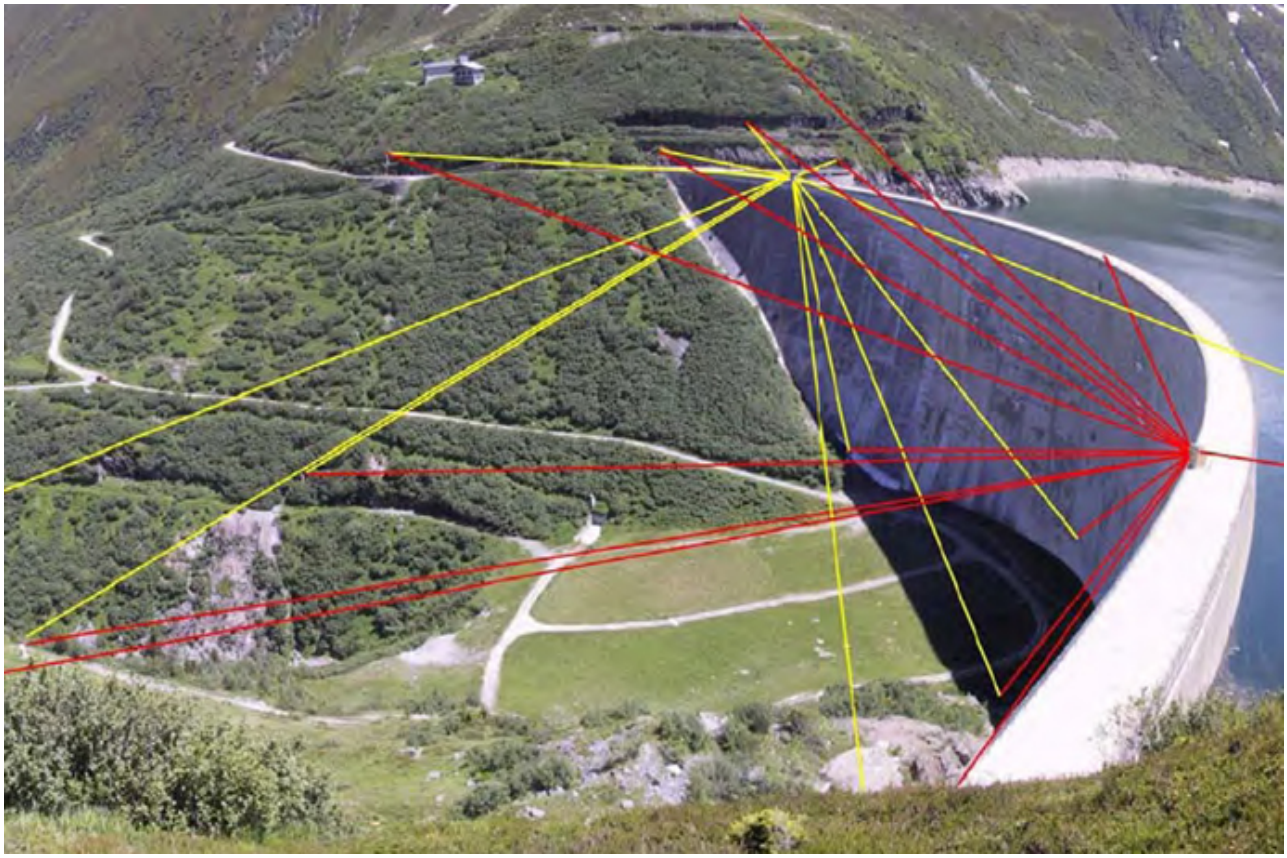


Figure 6. Dam Monitoring

It can be seen from comparative graphs that there isn't significant displacements of both the initial tranche, and to the previous tranche for the remaining marks that make up the network of tracking altimetry.

Hydro technical structures behaviour monitoring (Figure 6) by geodetic methods is an important component to ensure safe operation of the hydro, thermal and nuclear - electric objectives. When networks tracking optimally compliant and stable the instrumentation can provide the precision required if measurements are good and the mathematical model used for the processing of land is suitable, then it can highlight the changes over time in terms of geometry tracking network.

Monitoring systems are an essential part of risk management. By providing the early detection of instability they have prevented slope failures from causing injury, death and financial loss.

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ASPECTS REGARDING THE CADASTRAL WORKS IN ITALY

Michele LA RUNA

**Scientific Coordinators: Lecturer PhD Eng. Tudor SĂLĂGEAN,
Prof. PhD Eng. Mircea ORTELECAN**

University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, Calea Mănăştur 3-5, 400372, Cluj-Napoca, Romania | Tel: +40-264-596.384 | Fax: +40-264-593.792 Email: salagean_tudor@hotmail.com

Corresponding author email: michele_laruna@yahoo.ro

Abstract

This paper aims to present some aspects regarding the cadastral work in Italy. Cassini-Soldner is a afilactic projection, from the deformation point of view, that is arbitrary, usually from arbitrary was passed to equidistant (preserves the distances on a direction). The Soldner method was designed in 1809 in Germany. It uses as orientation ellipsoid the Bessel ellipsoid (1841). In terms of surface projection is a transverse cylindrical, the cylinder's axis is perpendicular to the pole's axis and the cylinder's tangent is at the origin meridian. The origin of the system is on the equator, the X axis is oriented on the north and the Y axis is oriented on the east. Unlike Cassini-Soldner projection, the Gauss-Kruger projection is a conform projection from the point of view of deformations (preserves the angles).

***Key words**: cadastral works, Cassini-Soldner, Italy, projection.*

INTRODUCTION

The Territorial Agency replaced the Planning Department regarding the central office, the land registry offices and the provincial and compartmental departments. The headquarters of the Territorial Agency is in Rome. The agency primary functions regard the land registry, geo-topo-cartographic services and the conservation of land registry.
Besides its headquarters in Rome, Territorial Agency has localized structures at regional and provincial levels.
Regional offices are located in regional capitals and have function of coordination and liaison between headquarters and local offices (Figure 1).

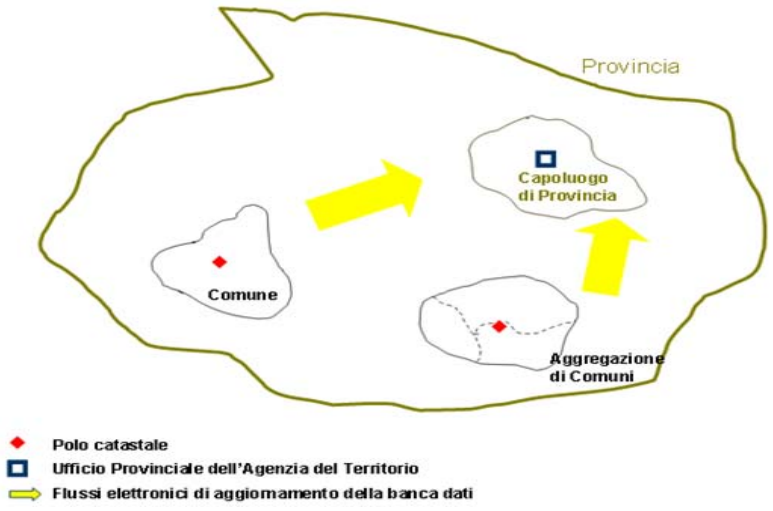


Figure 1. The organisation of cadastral offices

Provincial offices are located in all provincial capitals in regions with more than two provinces. In regions with two provinces the provincial offices are present only in the provincial capital, which is also the regional capital.

With the decentralization of municipalities and the subsequent establishment of cadastral offices, which are responsible for some of the operating functions of the cadastre, the Territorial Agency has expanded its operation also at the municipal level (Figure 2).

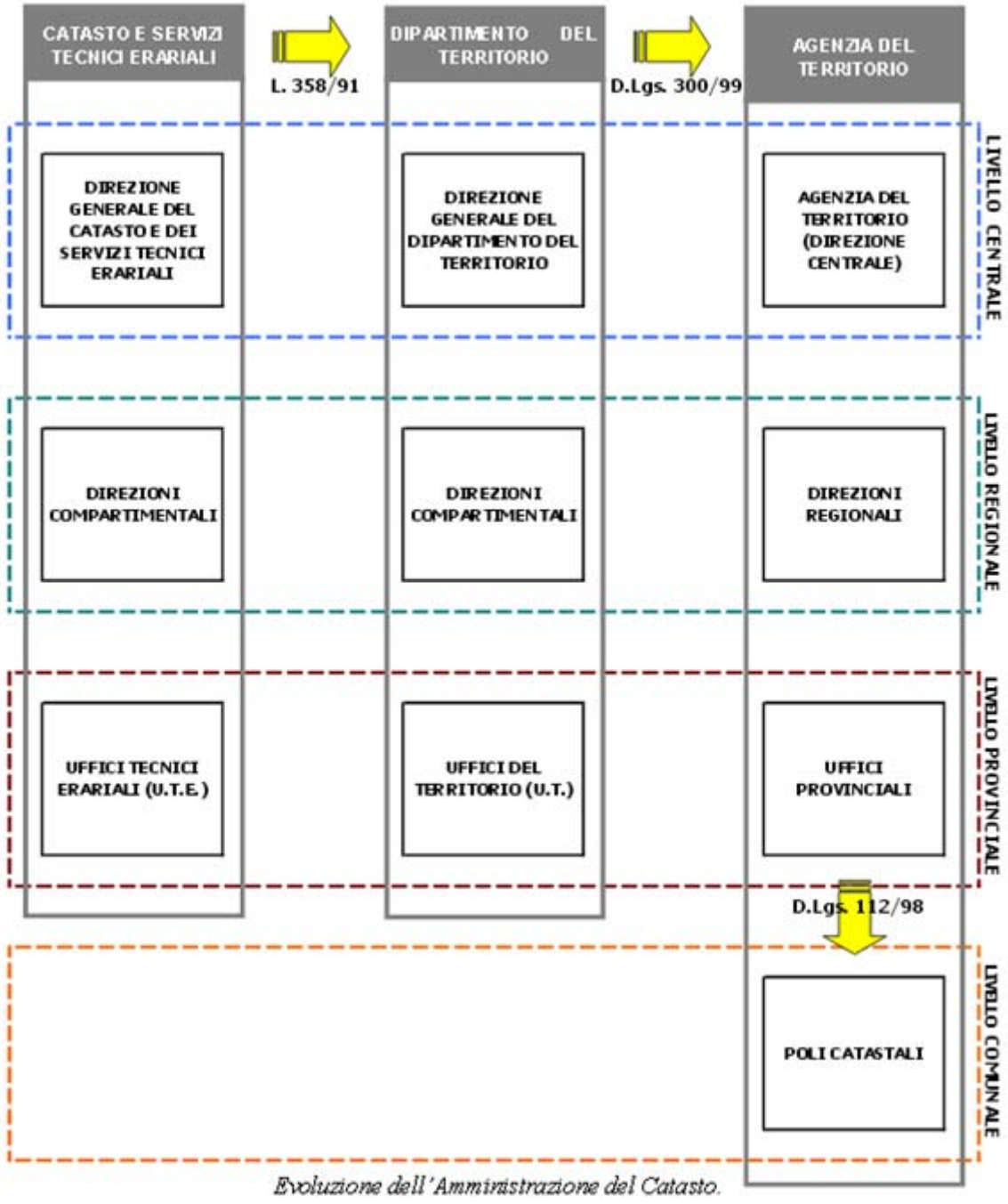


Figure 2. Evolution of the Cadastral Administration

MATERIALS AND METHODS

The Italian cadastral system in its current form comes from Law 3682/1886 as amended and supplemented (Messedaglia Law) regarding the land equalization. This required the establishment of a land tax calculation purposes by adopting the cartographic representation system Cassini-Soldner. The cadastral maps are usually drawn to a scale of 1: 2000 and offer a flat representation of the territory which is objects of interest with a standardized schematic representation.

Italian mapping is achieved by using Hayford ellipsoid, except the cadastre system which

uses pre-war system based on Bessel ellipsoid (1841).
The Italian cadastral system has three main origins namely in Genoa (Italy centre-north) in Castanea delle Furie (for southern Italy) and Rome Mario M. (part of central Italy).

The mapping system is based on a reference network (Figure 3) and consists of the points corresponding to the area identified for which the coordinates are known (Table 1).

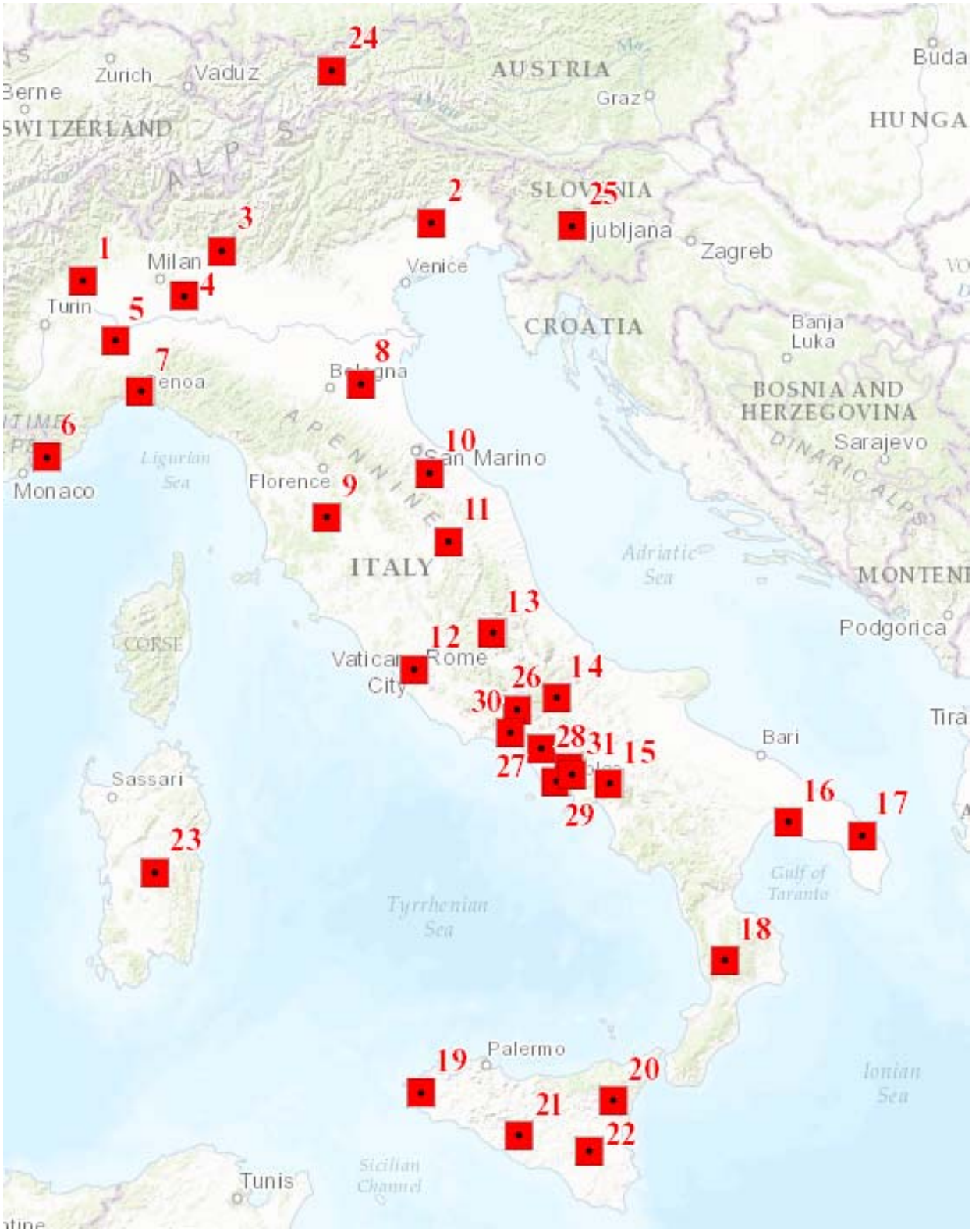


Figure 3. The refference points in Italy

Table 1. Coordinates of the refference points

N.	Centro di sviluppo	Foglio 1:100000	Latitudine	Longitudine	Centro di emanazione
1	P.I. (Vercelli)	-	-	-	-
2	Pordenone	39	45°57'15.104"	3°44'21.453"	GE
3	Monte Bronzone	34	45°42'31.080"	1°04'09.404"	GE
4	Lodi	60	45°18'49.219"	0°34'53.166"	GE
5	Alessandria	70	44°54'51.212"	-0°18'37.157"	GE
6	Monte Bignone	102	43°52'22.465"	-1°11'17.116"	GE
7	Forte Diamante	83	44°27'38.020"	0°01'04.180"	GE
8	Portonovo	88	44°41'55.045"	2°49'55.338"	GE
9	Siena (Torre del Mangia)	120	43°19'03.126"	2°24'39.027"	GE
10	Urbino	109	43°43'27.930"	3°42'54.290"	GE
11	Monte Pennino	123	43°06'02.076"	3°58'03.310"	GE
12A	Roma M.te Mario (Genova)	149	41°55'24.399"	3°31'51.131"	GE
12B	Roma M.te Mario (Castanea)	150	41°55'24.428"	-3°04'06.155"	Castanea
13	Monte Ocre	145	42°15'20.090"	0°59'28.010"	Roma M.M.
14	Monte Palombo	152	41°50'34.650"	-1°42'34.580"	Castanea
15	Monte Terminio	185	40°50'25.860"	-0°34'59.190"	Castanea
16	Taranto	202	40°28'30.105"	1°42'30.469"	Castanea
17	Lecce	204	40°21'02.850"	2°38'57.488"	Castanea
18	Monte Brutto	236	39°08'22.455"	0°54'06.199"	Castanea
19	Monte Titone	257	37°50'47.830"	0°05'14.870"	Roma M.M.
20	Monte Etna (P.Lucia)	262	37°45'47.600"	-0°32'05.810"	Castanea
21	Monte Castelluccio	267	37°24'52.480"	-1°44'28.140"	Castanea
22	Mineo	273	37°15'55.873"	-0°49'40.426"	Castanea
23	P.I. (Sardegna)	-	-	-	-
24	Nuovo Catasto (Innsbruck)	-	-	-	-
25	Nuovo Catasto (Krimberg)	-	-	-	-
26	Monte Cairo	160	41°32'26.080"	-1°45'36.050"	Castanea
27	Francolise	172	41°10'53.600"	-1°27'23.910"	Castanea
28	Cancello	172	41°04'21.230"	-1°29'39.740"	Castanea
29	Miradois (Napoli)	-	-	-	-
30	Monte Petrella	171	41°19'16.112"	4°44'40.000"	GE
31	Marigliano	184	40°55'26.880"	-1°03'51.620"	Castanea

RESULTS AND DISCUSSIONS

Cassini-Soldner is an afilactic projection, from the deformation point of view, that is arbitrary, usually from arbitrary was passed to equidistant (preserves the distances on a direction). (Figure 4 and 5)

The Soldner method was designed in 1809 in Germany. It uses as orientation ellipsoid the Bessel ellipsoid (1841).

In terms of surface projection is a transverse cylindrical, the cylinder's axis is perpendicular to the pole's axis and the cylinder's tangent is at the origin meridian. The origin of the system is on the equator, the X axis is oriented on the north and the Y axis is oriented on the east.

Unlike Cassini-Soldner projection, the Gauss-Kruger projection is a conform projection from the point of view of deformations (preserves the angles).

The afilactic representation is obtained which gives a deformation acceptable for X <Y, and 50 km <70 km for example, in an area of approximately 140 x 100 km origin O is an arbitrary point chosen (usually a network node).

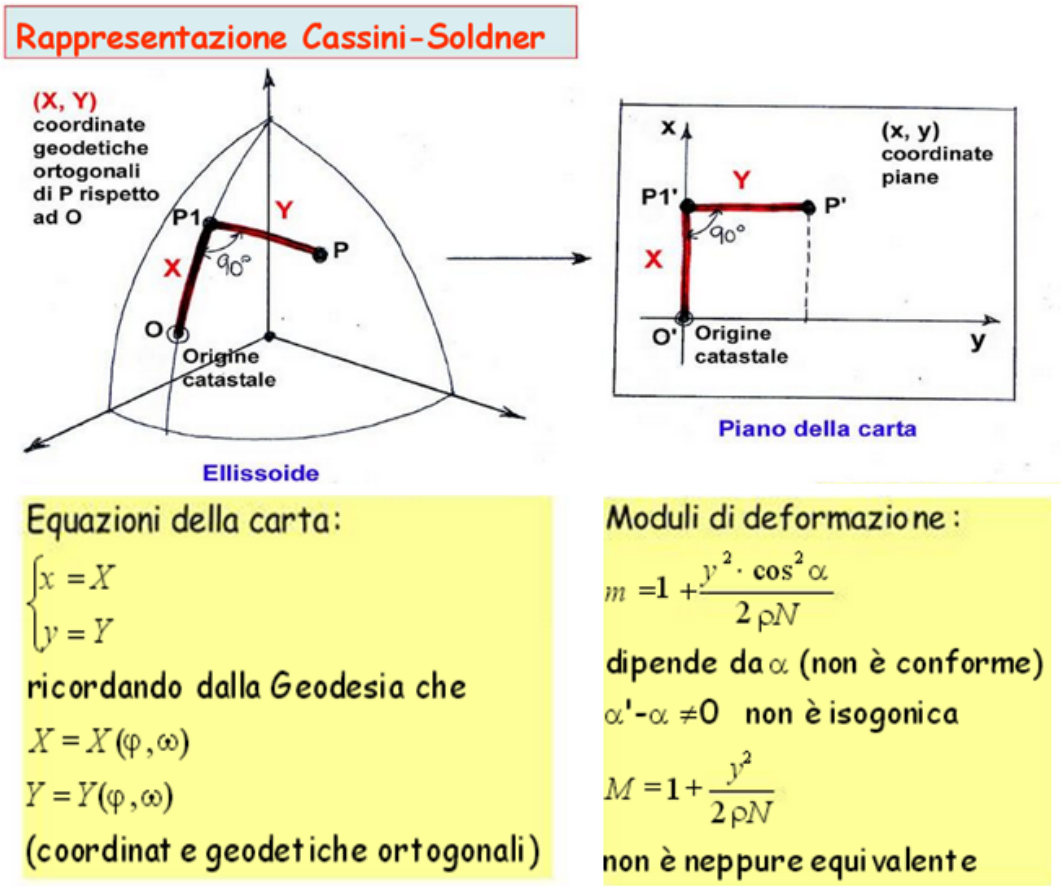


Figure 4. Cassini-Soldner representation

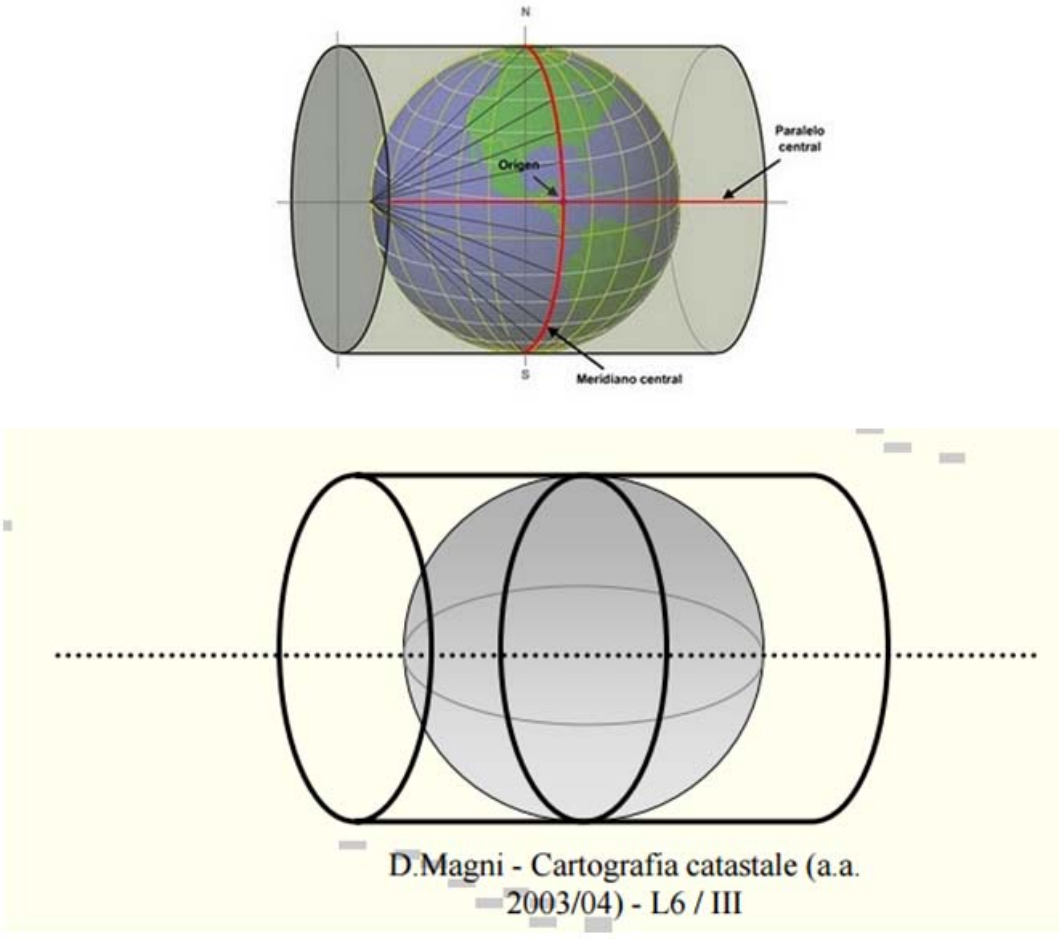


Figure 5. Cassini-Soldner projection

As an example, will be presented a part of the cadastral documentation for joining a proprety from Solarino village, Siracusa provence, Sicily region (Figures 6, 7 and 8).

Punto Fiduciale 01/014A/I785

agenzia del Territorio

Ufficio Provinciale di SIRACUSA

Sportello di SIRACUSA
Comune di SOLARINO

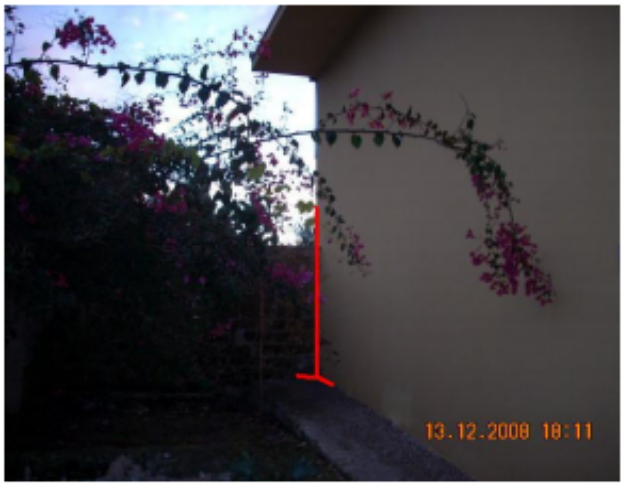
Comune: I785
Sezione:
Foglio: 014
Particella/e: 402
Allegato: A

Coordinate e quote

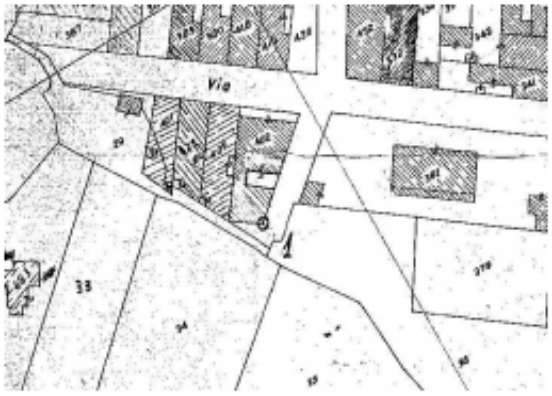
Cassini-Soldner	Gauss-Boaga	Quota s.l.m	UTM-WGS84
X: -18553.500	Nord:	206.000	Nord:
Y: 37374.500	Est:		Est:
Origine:	Fuso:		Fuso:
Attendibilità: 12		Attendibilità: 04	Q. elliss.:

Riferimenti
Planimetrico: SPIG.S.E.FABBR.
Altimetrico: BASE STRADA

Fotografia o schizzo prospettico



Estratto di mappa



Particolari

Note

Istituito:
Verificato:
Annullato:

Figure 6. Cadastral documentation

Agenzia del Territorio

TIPO MAPPALE
Atto di Aggiornamento
Informazioni geometriche

Ufficio provinciale di: SIRACUSA
Protocollo n:
Data :
Codice file PREGEO: 2.905.422

Dati generali del tipo

Comune:	SOLARINO	Sez. Censuaria:	
Foglio:	014A	Particelle:	434,435
Tecnico:	PACI DARIO	Qualifica:	INGEGNERE
Provincia:	SIRACUSA	N. iscrizione:	956

Proposta di aggiornamento cartografico: Rappresentazione grafica

I punti di appoggio e le nuove linee da introdurre in mappa sono descritte nel LIBRETTO DELLE MISURE

Scala 1 : 500

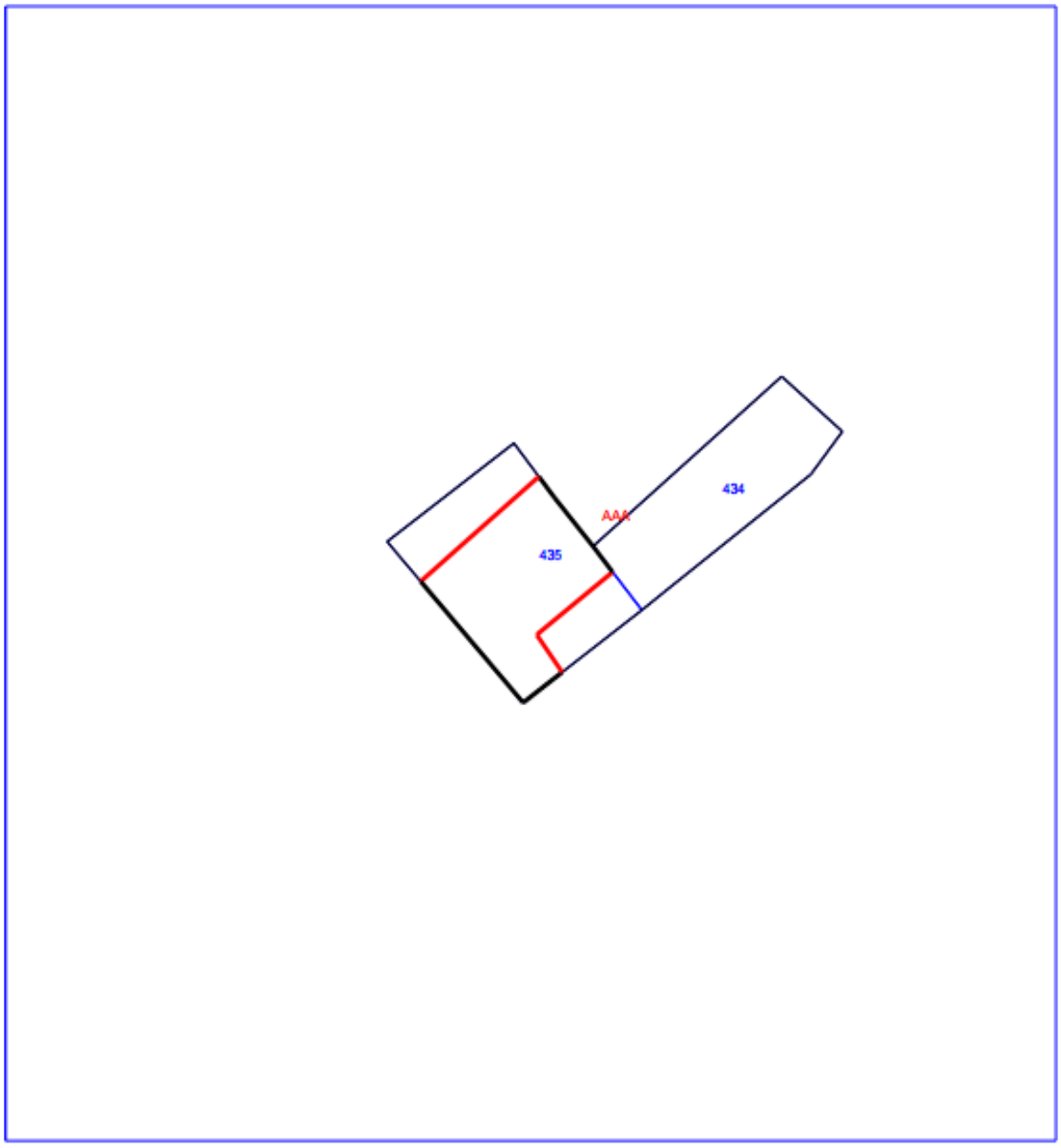


Figure 7. Cadastral documentation – graphic representation

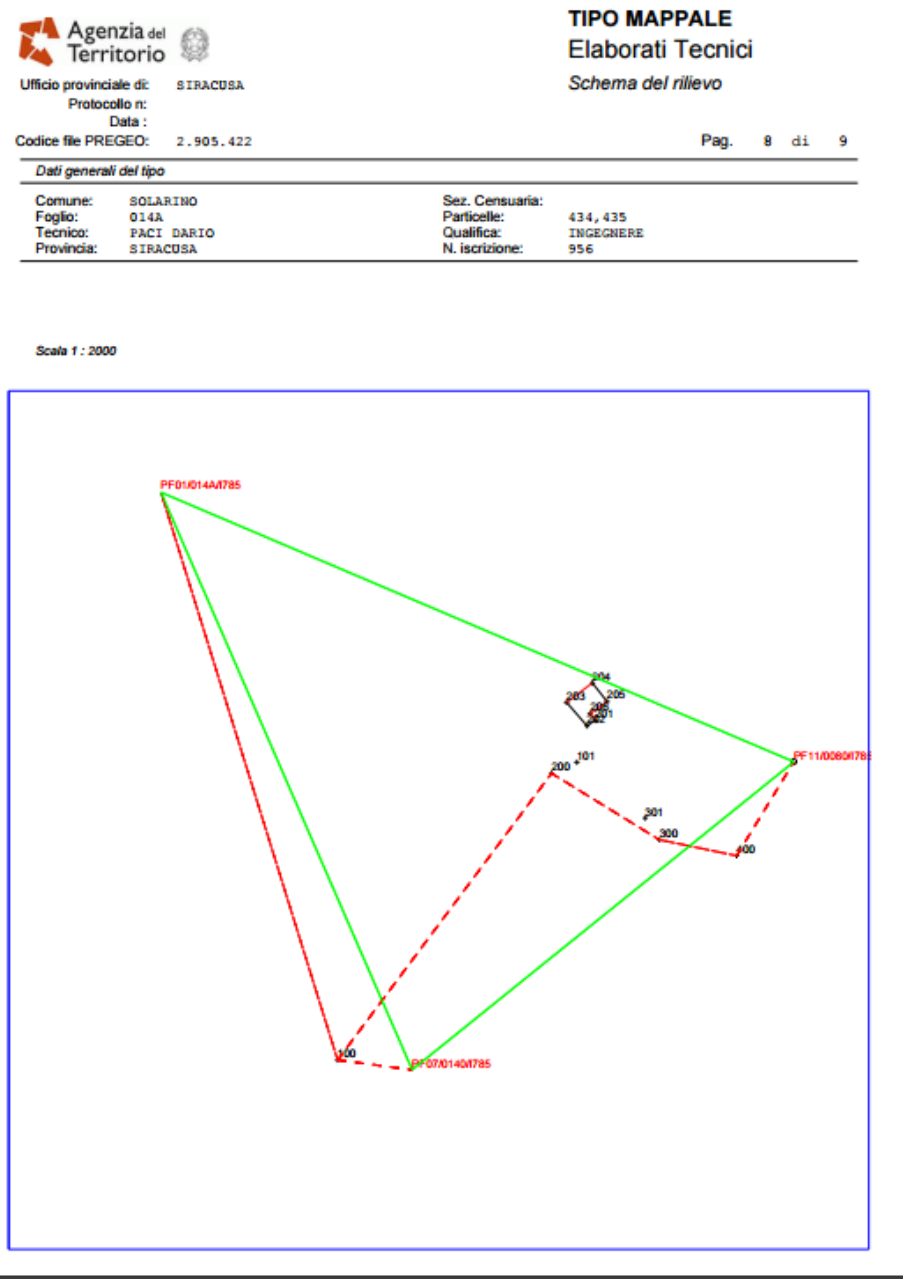


Figure 8. Cadastral documentation – refference points

CONCLUSIONS

Although, for making the cadastral works in Italy, it is used a different projection system and different coordinates system, the topographic measurements are the same.
Unlike Cassini-Soldner projection, the Gauss-Kruger projection is a conform projection from the point of view of deformations (preserves the angles).
In Italy, unlike Romania, it is not so great emphasis on precision of determination, such as cadastre made in Romania, because in Romania if you have some differences of surface etc. the project could be rejected at the cadastral offices.

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MODELLING AVERAGE ANNUAL TEMPERATURE THROUGH G.I.S. TEHNIQUES

Maria-Olivia MOLDOVAN, Maxim COROCHII, Iulia-Diana GLIGA

Scientific Coordinator: Prof. PhD Eng. Marcel DÎRJA

University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, 3-5 Calea Mănăștur St., 400372, Cluj-Napoca, Romania, Phone: +40-264-596.384, Fax: +40-264-593.792, Email: maria-olivia.moldovan@usamvcluj.ro,corochiimaxim@gmail.com, iulia.gliga@usamvcluj.ro

Corresponding author email: maria-olivia.moldovan@usamvcluj.ro

Abstract

The temperature is one of the most important climatic factors when it comes to land reclamation. The aim of this paper is modelling the average annual temperature for the year 2015 in Romania, in order to have information regarding the recorded values within the perimeter of the Horticultural Research Station, Cluj-Napoca. For the study area, a complex database will be created using spatial analysis specific factors. Spatial distribution of air temperatures is influenced by altitude, respectively there is a dependency between these two factors: air temperature decreases as the altitude increases. Thus, utilizing the data from the meteorological stations, the analysis aims to realize with the help of G.I.S. (Geographic Information Systems) techniques a map containing the average annual temperature for the year 2015 within the study area. The results obtained by this study indicate a temperature between 9.9 and 10.7°C.

Key words: *G.I.S., Horticultural Research Station from Cluj-Napoca, modelling, temperature.*

INTRODUCTION

The temperature is one of the most important climatic factors when it comes to land reclamation (irrigation, drainage, soil erosion and landslides).

The factor with the highest share in the formation of excess moisture is the climate through its main elements, precipitation, temperature and evapotranspiration. According to Pleşa et al. (1980), Romania was divided, depending on these factors into three climatic zones: the wet zone(annual temperature between 4-9° C), sub-humid zone (8-11°C) and dry zone (values between 10-11.5° C).

From the factors which influence the size of the irrigation regime elements, the temperature is also included (Mureșan et al., 1992). The temperature can play a decisive role in triggering and the evolution of landslides, high temperature values generating soil water evaporation, which leads clay lands to crack. Temperature influences the erosion process in two ways: physically (by producing frost and thaw, the soil structure being affected) and chemical (rocks are favoured for decomposition). Thus, the temperature by sudden changes favour the phenomenon of disintegration, which prepares the material to be dislodged and to be transported by leakageand also helps to trigger the process of erosion by the sudden melting of the snow (Dîrja, 2000).

Also, the temperature is a determining factor in terms of the potential suitability of territory to different types of farming.

Modelling the temperature targeted a large surface (Romania) afterwards to determine the average annual temperature to a small surface (Horticultural Research Station Cluj-Napoca) (Figure 1).

Figure 1. Horticultural Research Station Cluj-Napoca (Source: Google Earth)

MATERIALS AND METHODS

In order to obtain a characterization of the targeted area in terms of climate (temperature), were used the values recorded in the 23 essential meteorological stations of Romania, stations that measure in addition to air temperature, the atmospheric pressure, relative air humidity, rainfall, wind direction and speed, snow depth or duration of sunshine.

The 8395 records, provided by the National Meteorological Administration were processed, ultimately resulting the average annual temperature values (2015) related to each station. Regarding the modelling, the regression equation was identified by using the Microsoft Excel utility, describing with a high accuracy the relation between the temperature and the altitude. It was then integrated into the GIS environment using the Spatial Analyst toolbox of the specialized software ArcGIS 10.1. The used database within this study is presented in the following table:

Table 1. Database

Graphical
Digital Elevation Model Resolution: 25 m
Study area, National and county borders, Territorial Administrative Units
Meteorological station locations, County capitals
Numerical
The values of average annual temperature for each station (°C)
Station altitude (m)

RESULTS AND DISCUSSIONS

The data provided by the National Meteorological Administration contain records regarding the minimum temperature, maximum temperature and average temperature for each day. For each meteorological station the first values which were determined were the average monthly temperature values. The Cluj-Napoca station data are presented in Table 2.

Table 2. Average monthly and annual temperatures, Cluj-Napoca Station

Cluj-Napoca Station							
Month			*Average Monthly Temperature(^{0}C)*				
January	**-0.6**	April	**9.1**	July	**21.5**	October	**9.2**
February	**0.1**	May	**15.0**	August	**21.5**	November	**5.9**
March	**5.2**	June	**18.7**	September	**16.9**	December	**1.2**
Average Annual Temperature(AAL) (^{0}C)	**10.3**						

After processing the temperature values recorded in each of the 23 stations the average annual temperature was calculated (Table 3).

Table 3. Meteorological Stations

CODST	*Name*	*County*	*ALT (m)*	*LAT*	*LONG*	*AAL2015 (° C)*
15335	Tulcea	TL	4.36	45.1906	28.8242	12.6
15360	Sulina	TL	12.69	45.1622	29.7269	12.6
15480	Constanța	CT	12.8	44.2139	28.6456	13.3
15460	Călărași	CL	18.72	44.2058	27.3383	12.9
15310	Galati	GL	69	45.4731	28.0322	12.5
15090	Iasi	IS	74.29	47.1633	27.6272	11.6
15410	Drobeta Tr.Severin	MH	77	44.6264	22.6261	13.5
15420	Buc-Băneasa	B	90	44.5106	26.0781	11.9
15350	Buzău	BZ	97	45.1328	26.8517	12.6
15470	Roșiorii de Vede	TR	102.15	44.1072	24.9786	12.4
15200	Arad	AR	116.59	46.1336	21.3536	12.3
15020	Botoșani	BT	161	47.7356	26.6456	11.5
15150	Bacau	BC	174	46.5578	26.8967	11.0
15450	Craiova	DJ	192	44.3103	23.8669	12.4
15346	Rm. Vîlcea	VL	237	45.0889	24.3628	12.4
15230	Deva	HD	240	45.865	22.8989	11.4
15292	Caransebeș	CS	241	45.4167	22.2292	12.0
15120	Cluj-Napoca	CJ	410	46.7778	23.5714	10.3
15260	Sibiu	SB	443	45.7894	24.0914	10.4
15015	Oc.Șugatag	MM	503	47.7769	23.9406	9.7
15170	Miercurea Ciuc	HR	661	46.3714	25.7725	7.1
15108	Ceahlău Toaca	NT	1897	46.9775	25.9500	2.2
15280	Vf. Omu	PH	2504	45.4458	25.4567	-1.0

The meteorological stations are evenly distributed all over Romanian territory (Figure 2).

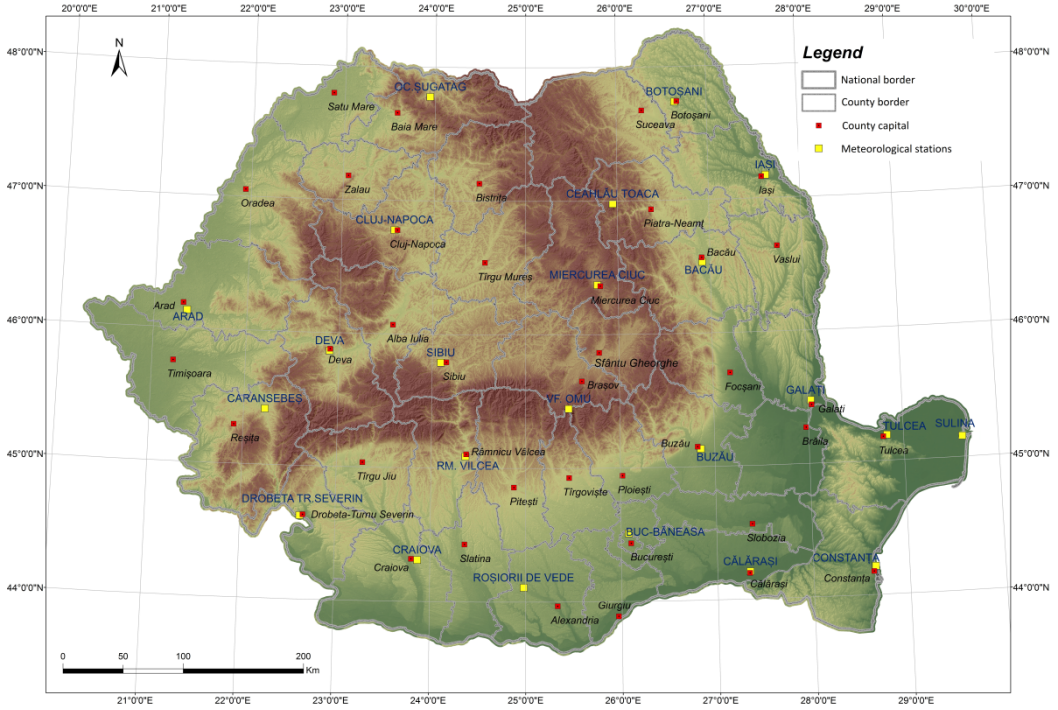

Figure 2. The location of the meteorological stations

The strength of the relationship between the altitude (x) and temperature (y) variables is expressed by the coefficient of determination, r2.

It is the proportion of the variation in the y variable that is explained by the variation in the x variable. r2 can vary from 0 to 1. Values near 0 meanthere is very little relationship between x and y, while values near 1 mean the y values fall almost right on the regression line (www.biostathandbook.com).

Regarding the temperature-altitude relation, several regression functions were applied by ensuring that the value of the coefficient of determination r2 is closer to 1.

Thus the following regression types were analysed:

- Linear regression (r^2= 0.9656)
- Polynomial, order 2 (r^2 = 0.9703)
- Polynomial, order 3 (r^2= 0.9704)
- Logarithmic (r^2= 0.5494).

By analysing the values ofr2, an order 3 polynomial function was chosen.

The dependency between the average annual air temperature and the altitude can be observed in Figure 3, where it can be noticed that the altitude explains 97.04% of the spatial variability of the temperature.

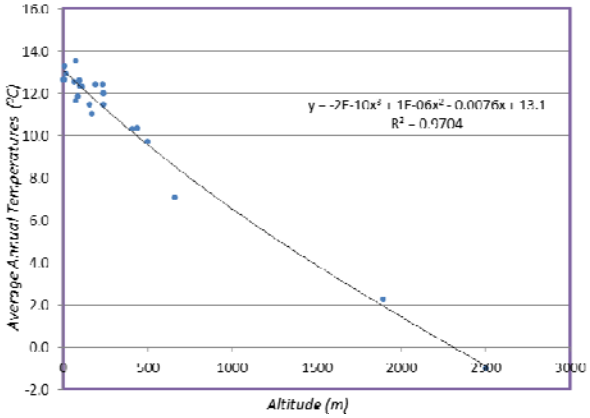

Figure 3. Graph (temperature-altitude)

The chosen equation has been implemented in G.I.S.environment using the Raster Calculator function (Figure 4).

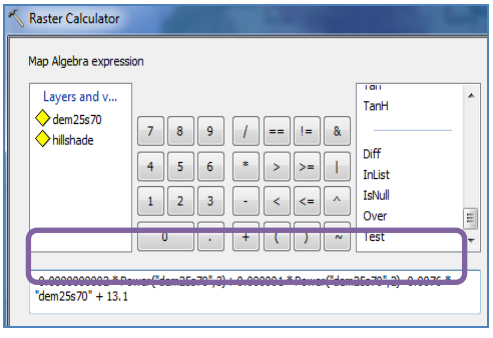

Figure 4. Implementing the equation in G.I.S.

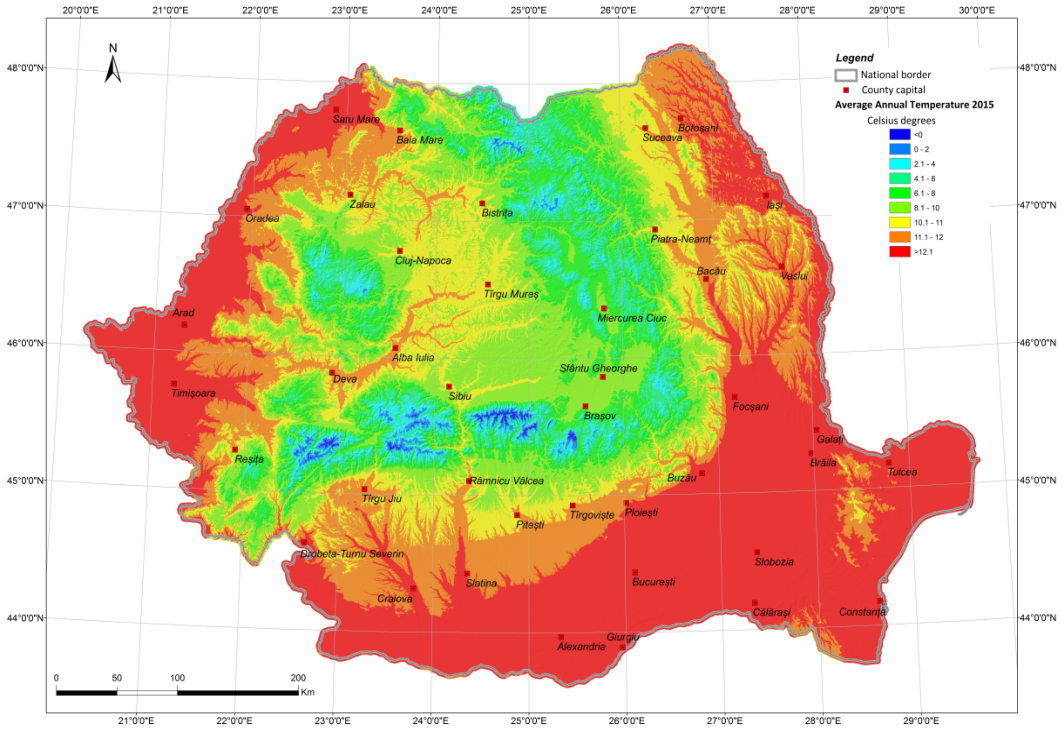

Figure 5. Average annual temperature map (2015)

The result takes the form of a map which presents the average annual temperature (Figure 5).

The resulting raster image from the analysis was cut after the limit of the study (Figure 6) so the temperature range corresponding to that area can be analysed. Thus, within the area of the municipality of Cluj-Napoca were obtained values between 7.39 and 10.87° C and in the perimeter in which the spatial analysis is performed, the average annual temperature for the year 2015 is between 9.9 and 10.7° C.

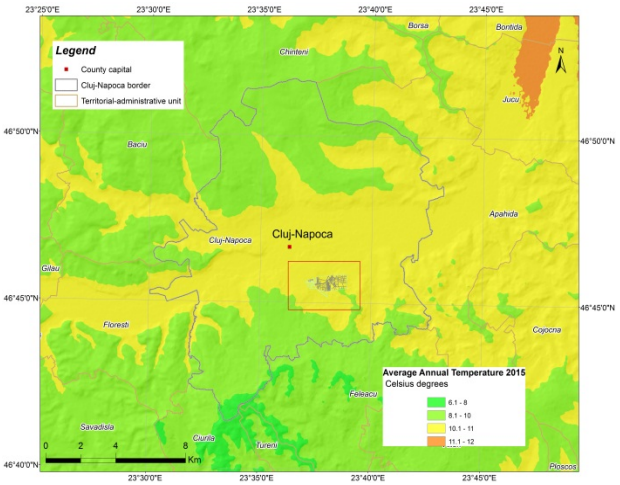

Figure 6. Average annual temperature map Cluj-Napoca, Red border – Study area (Horticultural Research Station Cluj-Napoca)

CONCLUSIONS

Temperature is one of the climatic factors influencing soil erosion, landslides or excess moisture formation. It plays a decisive role in land reclamation works, but also in determining the suitability of land for certain species.

Since study performed at the Horticultural Research Station is a complex one it was deemed necessary to model the temperature.

The average annual temperature was modelled from point values from the meteorological stations using the following equation:

$y = -0.0000000002x^3 + 0.000001x^2 - 0.0076x + 13.1$ yielding values between 9.9 and 10.7°C.

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MONITORING OF THE FREEZING DANUBE DELTA BASED ON SENTINEL-1/2 IMAGERY

Giulia-Laura PANTEA, Anca-Simona LACUSTEANU

Scientific Coordinator: Lect. PhD Iulia DANA NEGULA

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67, Email:giulia.pantea123@gmail.com; ancaanka27@yahoo.com; iulia.dana@fifim.ro

Corresponding author email: giulia.pantea123@gmail.com

Abstract

In January 2017, extremely low temperatures caused the freezing of the Danube Delta, leading to the complete isolation of some villages for a couple of weeks. The area was monitored from space, based on images acquired by Sentinel-1 and Sentinel-2, two satellite missions launched in the frame of the European Programme Copernicus. Sentinel-1 is equipped with a C-band synthetic aperture radar, while Sentinel-2 has a multi-spectral optical sensor acquiring data in 13 spectral bands. The spatial resolution of the GRD (Ground Range Detected) Sentinel-1 products used in this study is 10 meters, while the spatial resolution of the MSI (Multi-Spectral Instrument) Sentinel-2 products is 10 m, 20 m and 60 m, depending on the spectral band (B2, B3, B4, B8 – highest resolution, B5, B6, B7, B8a, B11, B12 – medium resolution and B1, B9, B10 – lowest resolution). The Sentinel-1/2 satellites collect complementary information that can be used for the frequent monitoring of vast areas, given the fact that each mission is composed of a pair of satellites (Sentinel-1A/B and Sentinel-2A/B). Sentinel-2B was launched on the 7th of March 2017 and it is currently in the commissioning phase. The present study aims at promoting the usefulness and adequacy of satellite data for monitoring the situation on the ground, especially when the area is not accessible by other means.

Key words:*Danube Delta, freezing temperatures,satellite imagery, Sentinel-1/2.*

INTRODUCTION

The Danube River (Figure 1) is considered the most international river on the planet due to the fact that its course runs across or forms a part of the borders of several countries: Germany, Austria, Slovakia, Hungary, Croatia, Serbia, Romania, Bulgaria, Ukraine, and four capitals: Vienna, Bratislava, Budapest and Belgrade (http://romaniatourism.com/danube-delta.html).

Figure 1. Danube River Basin (© WWF 2017)

The Danube Delta (Figure 2) entered the UNESCO World Heritage List in 1991, being classified as a biosphere reserve and as a national park in Romania. The Delta is formed around the three main channels of the Danube, named after their respective ports: Chilia - in the north, Sulina - in the middle, and Sfantu Gheorghe - in the south (http://romaniatourism.com/danube-delta.html).

Figure 2. Danube Delta (UNESCO © Marciela)

According to the UNESCO official description of the Natural Heritage Site, "the waters of the Danube, which flow into the Black Sea, form

the largest and best preserved of Europe's deltas. The Danube delta hosts over 300 species of birds as well as 45 freshwater fish species in its numerous lakes and marshes" (http://whc.unesco.org/en/list/588).

This year, the Danube Delta region experienced one of the harshest winters on record. Temperatures plummeted to -20°C, encasing landscapes in a thick coat of frozen water. Because of the low temperatures the area was completely isolated, and ships could not sail because floes were impenetrable, according to the local media (https://www.agerpres.ro and http://ziaruldetulcea.ro).

According to the historic records, the lowest value was recorded at Constanta in 1929 when the mercury thermometer dropped to -250C, but winters were heavy too in 1954, 1963, 1985 or 2000. In 1929, the Black Sea froze over five kilometres, causing a compact ice blanket. Due to those low temperatures the city of Constanta received the name "Little Siberia".

This year's low temperatures in Dobrogea made the Black Sea to freeze over a distance of 100 metres offshore. Beyond the major ice sheet on the sea, other large pieces of ice were observed. This freezing phenomena has proven that the Black Sea is one of the least salty sea in the world. In the case of the Black Sea, salinity values fall between 10-22‰ compared to 35‰ for the Mediterranean Sea.

The last time Black Sea was covered with a layer of ice was five years ago. According to the meteorologists, in the first decade of January 2017 (the time frame for the present study) the temperatures ranged from -160C to -220C. On the 1st of January, at 8:00 AM, the sea temperature was between -20C and +20C and the air temperature ranged from -140C to -160C, so that the surface layer of the sea water vaporized on the contact with the cold air, giving the impression that the sea "boils". This phenomenon of extreme frost rarely occurs only in areas where depths are relatively small along the coastline. On the other hand, the sudden temperature changes are due to global warming, which caused the reducing of the amount of ice in the Arctic. The blocks of ice appeared to have a considerable thickness for 25 days (http://earth-chronicles.com/anomalies /in-bulgaria-for-the-first-time-in-60-years-frozen-black-sea.html).In the case of the present study, satellite images acquired by Sentinel-1 and Sentinel-2 were selected, downloaded from the Copernicus Open Access HUB (https://scihub.copernicus.eu/) and processed using the open source software SNAP-Sentinel Application Platform.

Sentinel-1 is the first satellite launched in the frame of Copernicus - European Programme for Environmental and Security monitoring.

MATERIALS AND METHODS

Sea ice is a rapidly changing phenomenon. Timely measurements over large areas, at high spatial and temporal resolutions, are fundamental for its surveillance. Thus, the identification of risks and opportunities, such as the opening of shipping lanes, are possible thanks to satellite monitoring of sea ice (http://www.esa.int/Our_Activities/Observing_the_Earth/CryoSat/Sea_ice).

For example, since 2015, following the various MyOcean programmes that first started back in 2009, the Copernicus Marine Environment Monitoring Service (CMEMS) has been providing regular and systematic reference information on the physical state, variability and dynamics of the ocean and marine ecosystems, for the world's oceans and Europe's seas. The observations and forecasts produced by the CMEMS service support all marine applications. For instance, the provision of data on currents, winds and sea ice help to improve ship routing services, offshore operations and search and rescue operations, thus contributing to marine safety (http://marine.copernicus.eu/).

From the satellite images, analysts are able to extract how much ice there is over areas of interest and how thick it is, so that ice charts can be used to select the safest routes. Satellites provide the majority of information about the development of ice conditions in the Arctic. Sentinel-1(Figure 3) is equipped with a C-band synthetic aperture radar (SAR) that is capable of monitoring irrespective of cloud cover or light conditions, makes it possible to observe sea ice with higher reliability than optical methods and with better resolution than passive microwave ones. The spatial resolution of the GRD (Ground Range Detected) Sentinel-1 products used in this study is 10 meters. The

Sentinel-1 mission details are provided in Table 1 (https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/sentinel-1).

Figure 3. Sentinel-1 on orbit (© ESA 2017)

Table 1. Characteristics of the Sentinel-1 mission

Satellite	Launch date	Orbit type and altitude
Sentinel-1A	03 April 2014	Near-polar, sun-synchronous, 690 km, 98.18° inclination
Sentinel-1B	25 April 2016	

Sentinel-2 is a multispectral operational imaging mission within the Copernicus, former GMES (Global Monitoring for Environment and Security) Programme, jointly implemented by the EC (European Commission) and ESA for global land observation (data on vegetation, soil and water cover for land, inland waterways and coastal areas, and also provide atmospheric absorption and distortion data corrections) at high resolution with high revisit capability to provide enhanced continuity.

The satellite requires excellent pointing accuracy and stability and, therefore, high-end orbit and attitude control sensors and actuators. The multispectral imager is the most advanced of its kind, integrating two large visible near-infrared and shortwave infrared focal planes, each equipped with 12 detectors and integrating 450,000 pixels.

Pixels that may fail in the course of the mission can be replaced by redundant pixels. Two kinds of detectors integrate high-quality filters to isolate the spectral bands perfectly. The instrument's optomechanical stability must be extremely high, which has meant the use of silicon carbide ceramic for its three mirrors and focal plane, and for the telescope structure itself (https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/sentinel-2).

Sentinel-2 (Figure 4) has a multi-spectral optical sensor acquiring data in 13 spectral bands. The spatial resolution of the GRD (Ground Range Detected) Sentinel-1 products used in this study is 10 meters, while the spatial resolution of the MSI (Multi-Spectral Instrument) Sentinel-2 products is 10 m, 20 m and 60 m, depending on the spectral band (B2, B3, B4, B8 – highest resolution, B5, B6, B7, B8a, B11, B12 – medium resolution and B1, B9, B10 – lowest resolution). Sentinel-2 mission details are provided in Table 2.

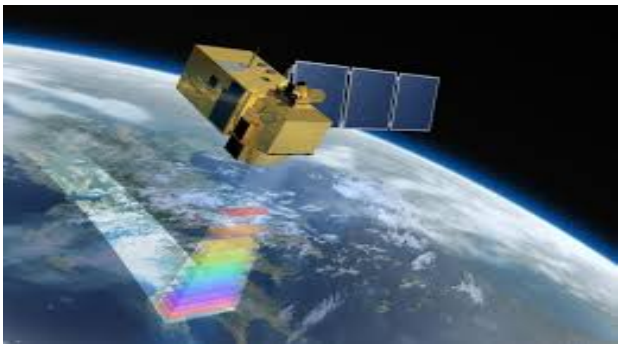

Figure 4. Sentinel-2 on orbit (© ESA 2017)

Table 2. Characteristics of the Sentinel-2 mission

Satellite	Launch date	Orbit type and altitude
Sentinel-2A	23 June 2015	Near-polar, sun-synchronous, 786 km, 98.50° inclination
Sentinel-2B	07 March 2017	

In the present study, two satellite images were downloaded from the Copernicus Open Access HUB. The Sentinel-1 image was acquired on the 9th of January, while the Sentinel-2 image was acquired on the 13th of January. The following processing steps were applied for the processing of the GRD Sentinel-1 image: orbit file application, calibration, speckle filtering and geocoding (based on a DEM). In case of the level-1C Sentinel-2 image, the data contain top-of-atmosphere reflectances in cartographic geometry.

RESULTS AND DISCUSSIONS

The following image windows illustrate some instances of the freezing Danube Delta, both in Sentinel-1 and Sentinel-2 imagery. Figures 5-8 are samples of Sentinel-1 data showing rivers parts unaffected by ice, while figures 9-15 illustrate ice floes, both on Sentinel-1 and 2.

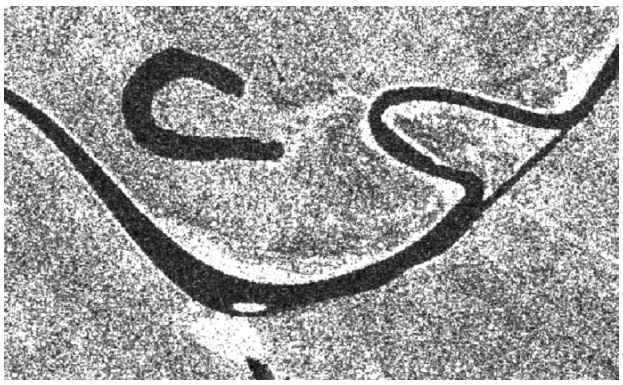

Figure 5. Processed Sentinel-1 image – river area without ice floes (example 1)

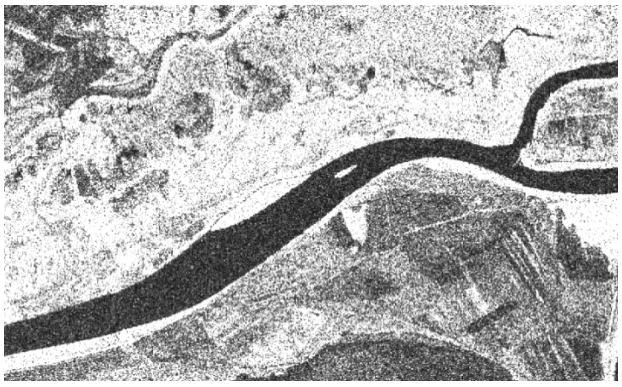

Figure 6. Processed Sentinel-1 image – river area without ice floes (example 2)

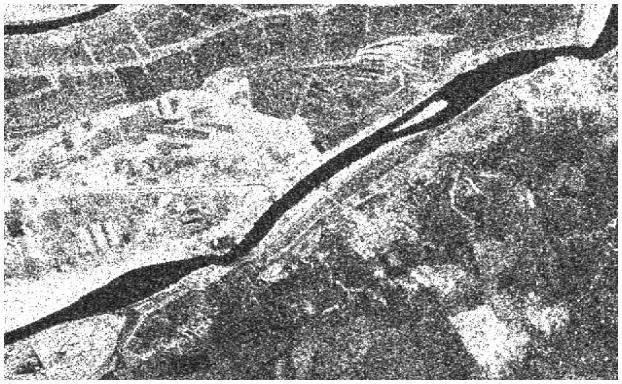

Figure 7. Processed Sentinel-1 image – river area without ice floes (example 3)

Figure 8. Processed Sentinel-1 image – river area without ice floes (example 4)

Figure 9. Processed Sentinel-1 image – river area with ice floes (example 1)

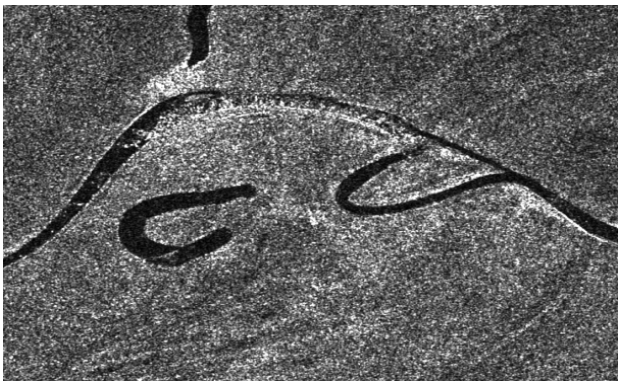

Figure 10. Processed Sentinel-1 image – river area with ice floes (example 2)

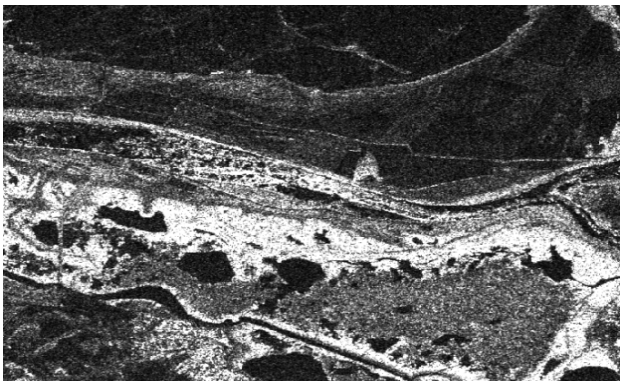

Figure 11. Processed Sentinel-1 image – river area with ice floes (example 3)

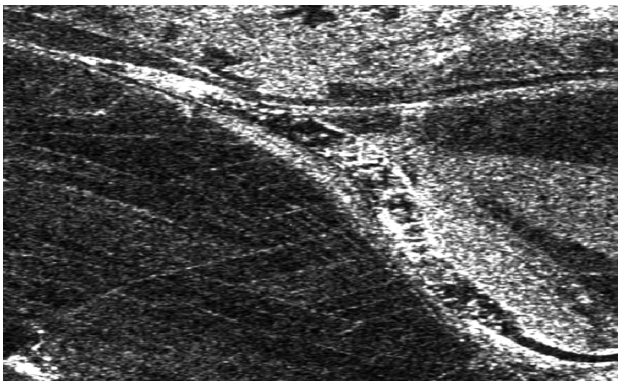

Figure 12. Processed Sentinel-1 image – river area with ice floes (example 4)

Figure 13. Sentinel-2 image (false colour infrared) – river areawith ice floes (example 1)

Figure 14. Sentinel-2 image (false colour infrared) – river area with ice floes (example 2)

Figure 15. Sentinel-2 image (natural colours) – river area with ice floes (example 3)

Figure 16. Sentinel-2 image (false colour infrared) – Razim Lake

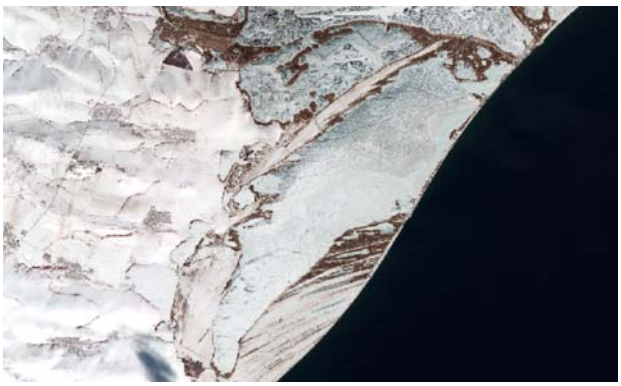

Figure 17. Sentinel-2 image (false colour infrared) – Sinoe Lake

CONCLUSIONS

Satellite data are the optimal solution for monitoring very large areas. The high spatial and spectral resolution of Sentinel enable the detailed monitoring of the different features on the ground, such as large blocks of ice on the navigable channels. With the great advantage of being free and immediately available for the users, Sentinel data can provide critical information for the responsible authorities, just by using visual interpretation without any advanced processing tools. Within the Copernicus Programme, ESA offers free and open access to Sentinel imagery and to data processing tools as well.

Earth Observation data offer necessary information for emergency and disaster management. Satellite remote sensing data and its derived products are essential components in the management of emergency situations. The integration of ancillary data improves the quality and content of the disaster crisis maps offering the guarantee of the in situ collected basic information. The knowledge of the studied area, from the geographical point of view, is vital.

A monitoring service for the Danube River and the Danube Delta can be successfully developed based on Sentinel data, considering the large number of interested parties, i.e. private and public port and marina operators, security, law enforcement and defence agencies, border control, commercial and leisure mariners, harbour responsible authorities, marine insurers, national naval authorities, fishermen organisations and last but not least, scientists from oceanography, riverine and marine environment and ecology.

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TRADITIONAL AND DIGITAL PHOTOGRAMMETRIC SYSTEMS

Carmen-Mihaela PREOŢESCU, Adrian-Mihai NEDEA

Scientific Coordinator: Assoc. Prof. PhD Eng. Gabriel POPESCU

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67,

Corresponding author email: preotescu_carmen@yahoo.com

Abstract

This appropriation is intended for the students of knowledge photogrammetric-related basic analog and digital: focal length,the inner and outer orientation ofphotogram, coordinate systems used in photogrammetry, useofspecializedprograms for processing.They are used in particular specialty programs, like VeCad, AgiSoft,PhotoScan and Pix4D, to bring out the advantages of using photogrammetric techniques "low-cost" digital as innovative practices in the process of education,with special effects in the fields of architectural and historical heritage. Digital stereoscopic measuring systems follow analytical stereoplotters well known as the more expensive systems. Many plottings are still done on analytical stereoplotters for metric documentation but as the performance and handle of digital systems increase and allow mass restitution. As textures are more and more required for 3D models, digital photographs and systems are getting more and more importance.

Key words*:photogrammetry, technology.*

INTRODUCTION

Photogrammetry- science and technology of obtaining reliable information, on objects from space, on the space around, trough registration processes, measuring, processing measurements made and interpreting photographic images and the results obtained, from a distance, without physical contact with the object, using this information as a support of the full spectrum of electromagnetic radiation and other forms of energy.

Digital photogrammetry is the science of using computers to obtain dimensions of objects photographed.Usually it involves analysis of one or more pictures / frames or existing video with specialized programs for photogrammetry to determine the spatial relationships. Digital photogrammetry from short range finds application in many areas such as medicine, archeology and conservation of historical and cultural heritage because of it’s advantages: measurement method is no direct contact with the object studied, the results are accurate and reliable.

Advantages and disadvantages of choosing photogrammetry as a research method are:

Advantages:Accuracy in showing leveling elements;If we need a voluminous amount of data, photogrammetry is by far the fastestsolution, enabling large areas of research and / or difficult to access;Costs per unit area are small;Satisfy all requests of precision;Terrestrial photogrammetry methods and those of the stereophotogrammetryhave the advantage that secures a fairly good accuracy the deformations constant and temporary;

Disadvantages: Working can be influenced by weather conditions and seasons; It is not appropriate shooting in summer, when vegetation is rich;

The hardware and the software required to work has very high price; Generally terrestrial geodetic measurements are needed to complement deficiencies.

MATERIALS AND METHODS

The principle of calibration is to achieve a set of 9 photos around the "chessboard", 4 pictures holding the camera right, other 4 with camera rotated 90 degrees and a photo above calibration sheet for the calculation of the parameters of indoor orientation. The case

described is the optimum and minimum number of photos for proper calibration is 6.

Figure 1.To the left „chessboard" used for calibration and to the right in the program interface CALIB

CALIB is a program that is used for calibrating digital cameras (Figure1).

VeCAD is a data processing 2D vector that can be used for practical applications such as CAD / GIS.VeCAD allows import / export file type DXF, HPGL, CNC and supports direct insertion Bitmap.Program options include good tools snap, control over the created layers, line types, colors, thicknesses, view-ports and types of text.

The camera is an optical device which can be obtained using real images of objects and was used in traditional photogrammetry. Appliances classic, setting the images was done on plates or films coated with photographic emulsion.

Parrot AR.Drone is a remote controlled flying quadcopter helicopter built by the French company Parrot. The drone is designed to be controlled by mobile or tablet operating systems such as the supported iOS or Androidwithin their respective apps or the unofficial software available for Windows Phone, Samsung BADA and Symbian devices (Figure2).

In digital photogrammetry, most of the measurements can be done automatically by correlation. The task is then to find the position of a geometric figure (called reference matrix) in a digital image. If the approximate position of the measured point is known in the image, then we can define a so-called search matrix. Correlation computations are used to determine the required position in the digital image. By correlation in the subpixel range the accuracy of positioning is roughly one order of magnitude better than the pixel size. Usually, the correlation process is very efficient on architectural objects, due to textured objects.

Correlation functions can be implemented in the different steps of the orientation : fiducial marks or reseau crosses can be measured automatically in the inner orientation; measurement of homologous points can be automated by the use of the correlation process both in the exterior orientation, and in the digital surface model and stereoplotting modules.

The correlation function is a real progress compared to manual measurements applied in analytical photogrammetry. The quality of the measurement is usually given by a correlation factor.

Figure 2. Unmanned aerial vehicle Parrot AR

RESULTS AND DISCUSSIONS

For realization the orthophotomosaic,shooting the front of the building, only 2 or 3 images will be needed in final, depending on the camera used so pictures to have a satisfactory longitudinal coverage and checkpoints to be visible in all photos (Figure 3).

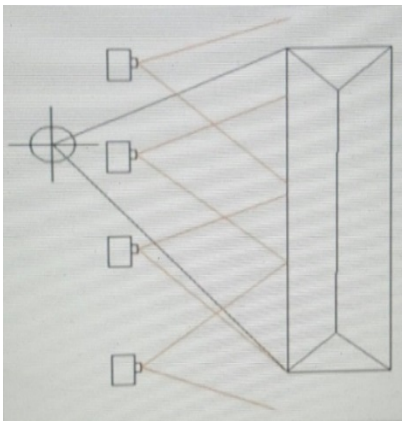

Figure 3. Operator position for shooting

These photographs shall be adjusted using the program CALIB, respecting the processdescribed and import VeCAD (Figures 4 and 5).

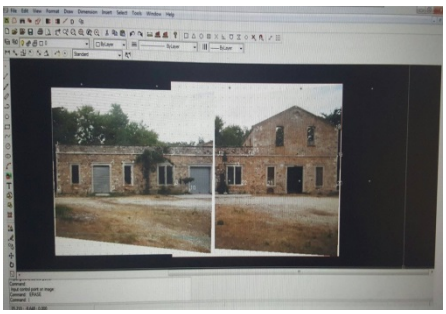

Figure 4. Creating theorthophotomosaic using 2 photos

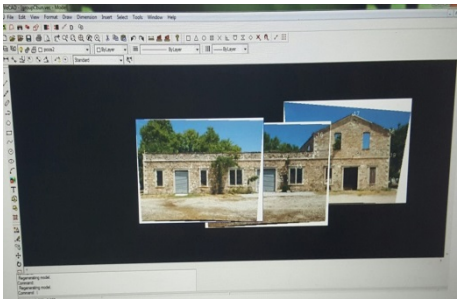

Figure 5.Creating the orthophotomosaic using 3 photos

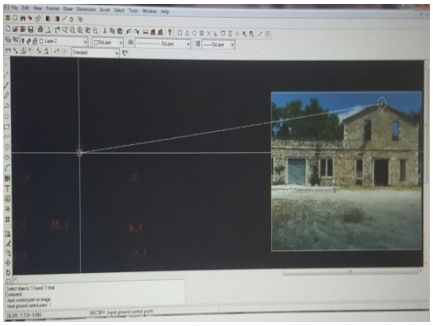

Figure 6. Linking checkpoints

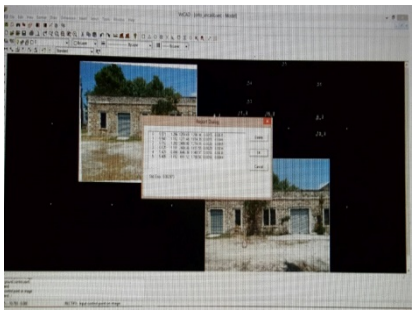

Figure 7. Dialog box with standard deviation error

The first step consists in making topographic measurements with the total station to determine the coordinates X, Y, Z control points.These checkpoints can be chosen from the material elements existing on the building area.Coordinates measured, after being discharged from the total station will be saved in a text file form X Y Z ID is then inserted in the program VeCAD.

The next step is inserting at a time, imaging to VeCAD. After finishing the marking checkpoints, they must be linked with those entered previously known coordinates to achieve georeferencing photos (Figure 5).

Finally, after selecting all control points press the right mouse button and a dialog box appears containing the error standard deviation calculated georeferencing program (Figure 6).

From the dialog box you can delete one or more points not corresponding to the desired accuracy. In the last two columns of errors georeferencing box displaying the planimetric coordinates (X, Y) Control Point. Corrected image processing can be done in AutoCad to highlights of important details such as doors, windows, bricks, building form.

Commercial CAD/CAM/CAE software packages often include image handling tools and allow also simple image transformation and rectification. But they seldom consider camera distortions, as opposed to photogrammetric software (Grussenmeyer et al., 2002).

In the case of a perspective rectification, radial image displacements in the computed image will occur for points outside the reference. The rectification obviously fails if the object isn't somewhat plane.

Some packages include functions for the photogrammetric determination of planes according to the multi-image process from two or three photographs that capture an object range from different viewpoints. Digital image maps can be produced by assuming the object surface and photo rectification. In the resulting orthophoto, the object model is represented by a digital terrain model. Image data of different planes can be combined into digital 3D-computer models for visualisation and animation with the help of photo editing or CAD software. ELSP from PMS (http://www.pms.co.at) and Photoplan (http://www.photoplan.net) are other examples of commercial systems particularly dedicated to rectification (Waldhaeusl et al., 1999).

CONCLUSIONS

Photogrammetry has been applied in numerous industrial fields and the potentially for further expansion and growth is seemingly limitless. Industrial photogrammetry has been described

as application of photogrammetry in building construction, civil engineering, mining, vehicle and machine construction, metallurgy, ship building and traffic, with their fundamentals and border subjects, including the phases of research, planning, production engineering, manufacture testing, monitoring, repair and reconstruction. Objects measured by photogrammetric techniques may be solid, liquid or gaseous bodies or physical phenomena, whether stationary or moving, that allow of being photographed (Popescu, 2016).
The main difference between a traditional photographic camera (Figure 8) and a digital camera (Figure 9) is in the different way of registering an image.

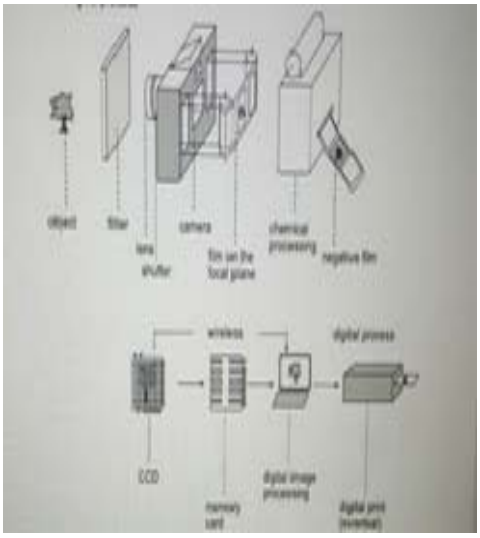

Figure 8. Traditional photographic camera

Photographic acquisition in the traditional process consists of: film, in analogical cameras; choice of photographic equipment: camera, lenses, film sensitivity; by means of the dispositive Charge-Coupled Device (CCD), conceptually like the sensors used for satellite acquisitions and in digital cameras; photochemical development and possible print; film scanning if the analogical acquisition is to be turned into digital; image digital processing.


Figure 9. Digital camera

The photographic process develops in subsequent operative and process steps,while with digital acquisition image availability and monitoring possibility are realtime with immediate feedback on the acquisition's quality. Except for the shot, or acquisition, processing and print operations take a longtime, are expensive and complex. Whereas, in the case of digital images, the operatorhas total and immediate control of the operative phases.

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GIS FOR THE EUROPEAN CAPITAL OF CULTURE 2021

Delia TOMESC, Cristina GANEA

Scientific Coordinators: Assist. PhD Eng. Anca-Maria MOSCOVICI, Prof. PhD Carmen GRECEA

Politehnica University of Timisoara, Department of Overland Communication Ways, Foundations and Cadastral Survey,Traian Lalescu no.2, Timisoara, Romania

Corresponding author email: delia_tomesc@yahoo.com

Abstract

The present paper brings forward proposals and trends in implementation of a dedicated geoportal for the management of heritage objects to complete the existing urban GIS primarily aiming to contribute to fostering the urban planning and the sustainability of the "European capital of culture" project. The need of this geoportal arises from the fact that Timişoara has the widest architectural heritage area in the country, of important value to both Romania and Europe. The preservation of this cultural heritage is a duty for the authorities and also for the owners.

Key words*: cultural heritage, historical sites, WebGIS, Timişoara, cultural centre*

INTRODUCTION

The Timiş County has a total area of 8,687km2 and is situated in the western part of Romania, on the border of three countries: Romania, Hungary and Serbia. The capital city of Timiş county has a population over 300,000 inhabitants and besides being the most representative university centre of the area, Timisoara stands for the most important economic and cultural centre. Along the capital city-Bucharest, Cluj-Napoca and Iași,Timișoara is one of the biggest cities of Romania.

Located in the western plains, throughout history the city was the capital of Banat, a region populated mostly by Romanians, who cohabited in harmony with other ethnic groups such as Germans, Hungarians, Serbs, Hebrews, Turks etc. On the other hand, its location in the Banat plain, has as disadvantage, the fact that natural resources are poor, so the richness of the region consists in the arhitectural and touristic potential.

As a national strategy, a key component in the policies of growth poles is promoting urban development, through the development of sustainable transport. According to national legislation, urban mobility plan represents a complementary documentation to urban/Metropolitan territorial development strategy and to the general urban plan, but also the territorial strategic planning tool by which spatial development of localities is related to the mobility and transportation needs of persons and goods.

The actuality of the paper is given by the fact that preserving cultural heritage and historical sites represents an important issue that must be taken into account when urban planning projects are required for developing the model of urban growth.

Figure 1. Romania, Timisoara

MATERIALS AND METHODS

The first record of the city of Timisoara, built on the site of an ancient Roman fortress called Castrum Regium Themes, dates back to 1212.
The charm of this city, settled on the northern bank of the Bega River, lies in its distinct.architectural character and vibrant cultural life. Frequently referred to as "Little Vienna," Timisoara is home to year-round musical and theatrical performances, art galleries, museums and a buzzing nightlife. A progressive, cosmopolitan place, Timisoara was the first city in Europe and second in the world after New York, to use electricity to illuminate its public streets.
Timisoara abounds with churches of several denominations, a Jewish quarter, an elegant baroque square and a pedestrian-only downtown area. Some of the monuments in the heart of the city afford panoramic views, while the many parks in this "city of flowers" provide an idyllic spot to take a break from sightseeing.
All these historical sites should be promoted at a high level, especially because the city has won the title of European Capital of Culture 2021.An effective way of promotion would be to create a Geoportal that would allow us to view all the historical sites of the city on an interactive map, as is the one in the following figure.


Figure 2. Timisoara, centre map with historical sites

The implementation of the GIS started in 1996 and covered a total area of 129.2 km^2; 34 Cadastral Sectors; 900 blocks and 27000 property sheets. Main objects defined in this Urban Information System of Timișoara are illustrated in Figure 3:

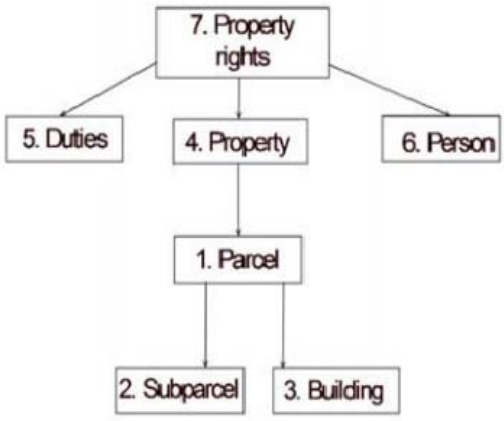
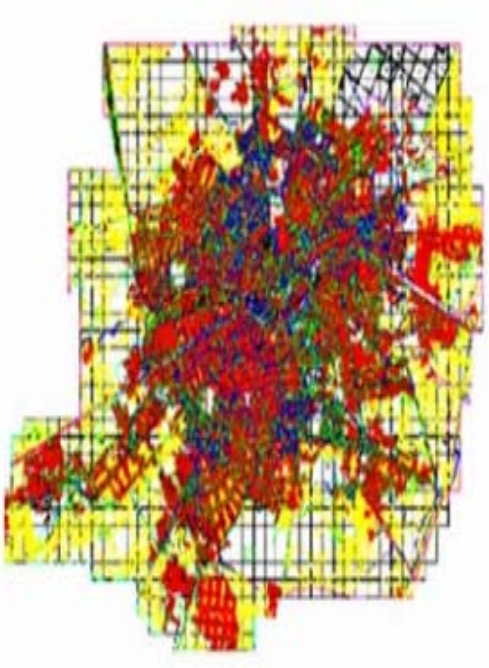


Figure 3.Object definition

Positioning of each entity is made on the reference given by the cadastral digital plan, 1:500. Updating this plan is based on a photogrammetric plan by using existing records, parcelling projects, urbanism certificates, documentations from achives, documents on land retrocession, and modifications the street scanning as a consequence of systematization etc. aiming to extend this system throughout the metropolitan area. An eloquent example of updating of the database for the Urban GIS (Figure 4) implied the acquisition of all information regarding the cemeteries, a project carried out between 2007 and 2009.


Figure 4. (a) Map of cadastral sectors;



(b) Overview of Urban GIS

RESULTS AND DISCUSSIONS

A Geographical Information Systemuses geographically referenced data as a well as non-spatial data and includes operations that support spatial analysis. The common purpose in GIS is decision making for managing use of land, resources, transportation, retailing or any spatially distributed entities. The connection between the elements of this system is geography (location, proximity and spatial distribution).

In this context, many definitions have been given to GIS, but all of them converge in that GIS is a system of hardware, software and procedures designed to support the capture, management, manipulation, analysis, modeling and display of spatially-referenced data for solving complex planning and management problems.

Although many other computer programs can use spatial data (e.g. AutoCAD and statistics packages). GIS include the additional ability to perform spatial operations.

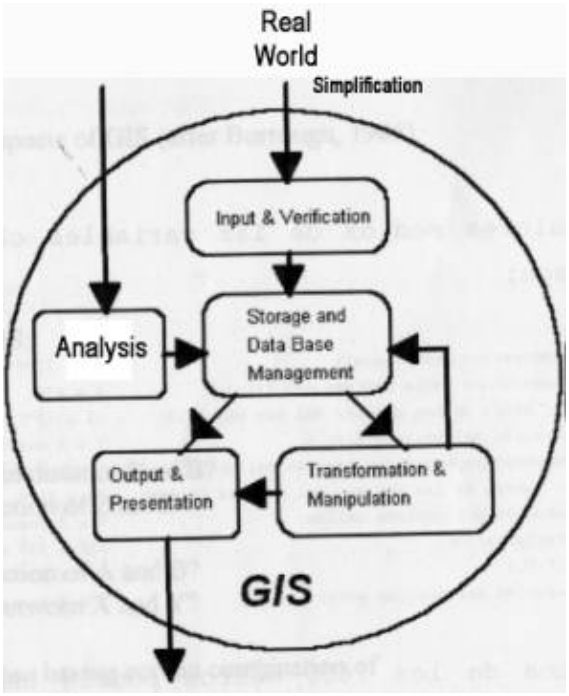


Figure 5. Information Flow in GIS

A GIS allows you to visualize your data as a map.

Figure 6. Maps + Data = GIS

The necessity of introducing a city database, concerning the historical sites:

- large amount of data
- quick access to information
- effective management
- frequent change of data
- avoid data loss

A clear example of interactive map was the one successfully implemented in 2008 in Liverpool. It was created a map that contained different colors for each type of tourist locations. Any person could have access to those data, being more maps. For example, on a map could very well see areas for young people in another one cultural areas and finally a map of the city combine the two areas.

Such a map it might accomplish in the case of Timisoara, which can be structured into three categories. One of these categories may be intended the entertainment, where it can see the parks, such as the Botanic Park, Roses

Park, Children's Park, the promenade places, for example Piata Victoriei, Piata Unirii, Piata

Libertatii. Another important category is represented by university area of Timisoara, where there are four public universities representing the academic center for the eastern part of Romania. One last category and perhaps the most important is the cultural area, which includes Palace of Culture, Theater and Opera, Palace of Culture, Theater and Opera, The Romano - Catholic Dome, Baroque Palace etc.

Figure 7. Timişoara, PiaţaVictoriei

Figure 8. Timişoara, Theater and Opera, Palace of Culture

Currently, in Romania there is a national project that provides implementing a geographical information system (GIS) for the protection of national cultural heritage. This program is called eGISpat and through it information about archeology and historical monuments are recorded.

The program allows editing and updating geo-spatial database in real time, historical monuments are treated as space objects. The recorded data processing program will outline strategies for conservation and integration of cultural heritage in contemporary society.

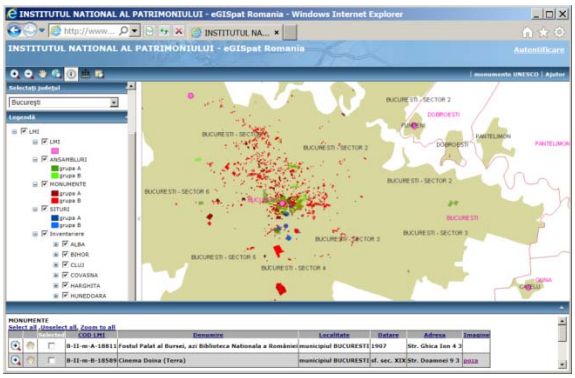


Figure 9. eGISpat program interface

CONCLUSIONS

An efficient urban planning strategy implies creating WebGIS for cultural heritage as the next natural step forward for both conservation and preservation of these objects, and also for understanding and promoting them. Also, together with the unlimited possibilities offered by the World Wide Web, creating physical virtual replicas of Cultural Heritage objects has become more and more attracting and interesting.

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RESEARCH INTO OPTIMIZING THE PROCESS OF ASSESING THE DEGREE OF DESTRUCTION OF RAPESEED CULTURES AFTER WINTER USING IMAGE PROCESSING

Alexandra TRIF[1], Alexandru BOAŞCĂ[2]

Scientific Coordinator: Lect. PhD Eng. Mihai GÎDEA[1]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, Bucharest, Romania, Email: trif_alexandra@yahoo.com
[2]Politehnica University of Bucharest, 313 Splaiul Independentei, District 6, Bucharest, Romania

Corresponding author email: trif_alexandra@yahoo.com

Abstract

Increasingly often we hear the terms "precision agriculture" and "modern monitoring tools". Thus, we wish to bring to the fore the drone, as an agricultural tool which can be used to take pictures of crops and to help determine the degree of destruction of rapeseed cultures during the end of winter and in the beginning of spring. To achieve this, we want to determine what is the optimal flight altitude of a drone for taking pictures of the ground and of the rapeseed cultures. The pictures from the drone are processed with modern methods of pixel classification, in order to obtain the most accurate percentage of vegetation. We will use GIS instruments, GPS measuring tools, custom Python scripts for pixel classification and the LeoWorks software.

Key words*: affected area, drone, GIS instruments, GPS measuring, pixel classification.*

INTRODUCTION

Over the years, Romania faced some harsh winters, with blizzards and cold temperatures. Following the winter of 2015, the research area of "Moara Domnească" had an affected area of 4300m^2 of the rapeseed cultures that were planted at different epochs. Thus, we want to determine the degree of destruction caused by external meteorological factors during the winter. We will identify the patches without rapeseed and they will be expressed as a percentage: the surface with vegetation out of the total analyzed surface. (Sandino et al, 2016)
We will use drones to capture images at different altitudes to determine the optimal altitude that will produce the best image. (Fu et al., 2012)
This method will be compared against the classic method that involves digitizing the field with the help of GIS instruments.

MATERIALS AND METHODS

First, we used the classic method of determination of affected areas in percentages, with the help of a 50x50 cm wooden frame. Then, we used the Phantom 3 Professional Drone to capture images of the culture at different altitudes: 50m, 150m, 250m and 500m. (Figure 1).The sensor on the camera is a 1/2.3"CMOS, with 20mm lens and f/2.8 focus. The ISO range is 100-1600.

Figure 1. Drone Phantom 3 Professional

The images were taken after fixing the milestones to serve as landmarks, which are used to determine the coordinates in the Stereo 1970 system. (Karl et al., 2014). (Figure 2)

Figure 2. Control Points + GPS Trimble

The results can be observed in the following figures. The first picture, taken at an altitude of 50m, captures an area of 4500m^2. The second picture, taken at 150m, captures an area of 13,500m$^{2.}$ The third picture, taken at 250m, captures an area of 22,500m^2. And lastly, the last picture, taken at 500m, captures an area of 45,500m^2.(Figures 3, 4, 5, 6)

Figure 3. Drone image taken at 50m

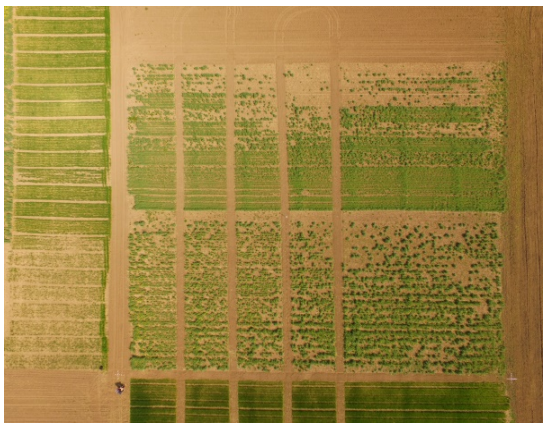

Figure 4. Drone image taken at 150m

Figure 5. Drone image taken at 250m

Figure 6. Drone image taken at 500m

RESULTS AND DISCUSSIONS

We started the analysis by determining the NDVI index with the help of the LeoWorks software and calculated it for all 4 images.
The NVDI index is used to aid the photo-interpreter in the visual analysis and the process of determining the percent of healthy vegetation. The NDVI index is usually defined by the following formula:

$$\mathrm{NDVI} = \frac{(\mathrm{NIR} - \mathrm{VIS})}{(\mathrm{NIR} + \mathrm{VIS})}$$

where VIS and NIR stand for the spectral reflectance measurements acquired in the visible (red) and near-infrared regions. (Karthika et al, 2014). In this case, we used the following adapted formula:
NVDI = (G-B)/(G+B), where G is the green band of the images and represents to the spectral reflectance measurements in the near-infrared regions (NIR), and B is the blue band in the images and represents the spectral reflectance measurements in the visible regions (VIS).

In the following figures you can observe the results and see that the images captured at 50m and 150m are optimal for photo-interpretation (Figures 7, 8, 9, 10)

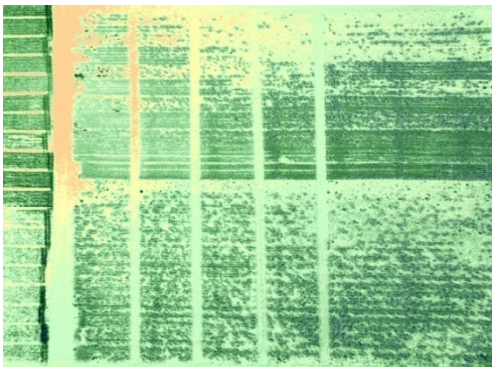

Figure 7. NVDI index at 50m

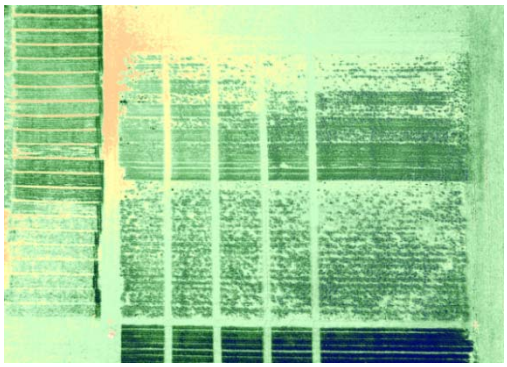

Figure 8. NVDI index 150m

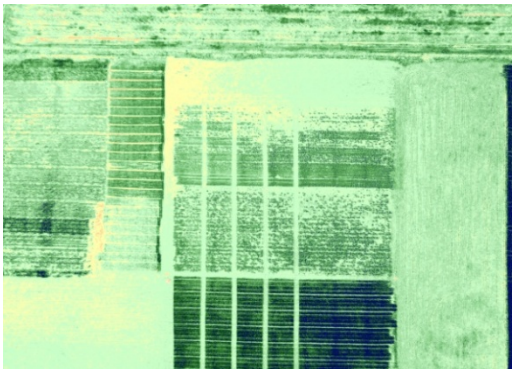

Figure 9. NVDI index 250m

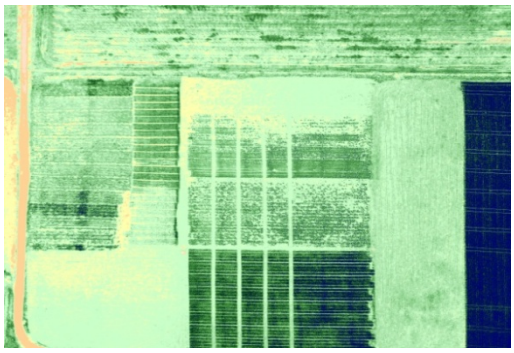

Figure 10. Indice NVDI 500m

Next, we performed an unsupervised classification with 2 classes and 12 iterations for each photograph. All green hues were included in a single color class, which will result in the most exact calculation. To do this we used a custom Python script. The results presented in the following figures are processed in the professional LeoWorks 4.0 software.

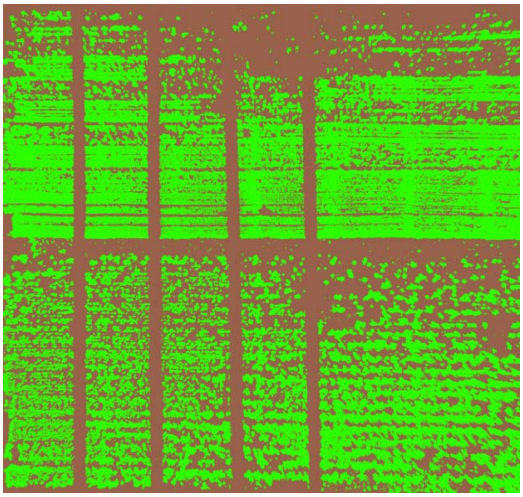

Figure 11. Image after classification, 50m

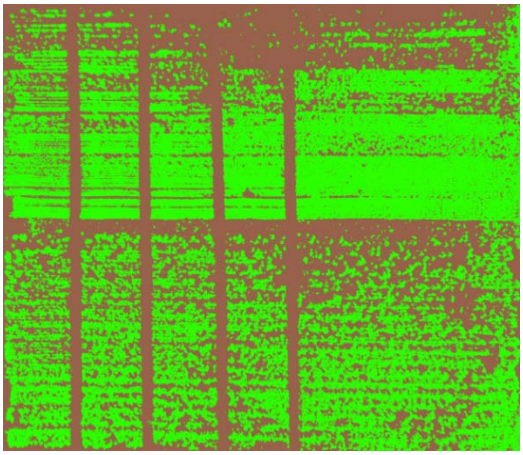

Figure 12. Image after classification, 150m

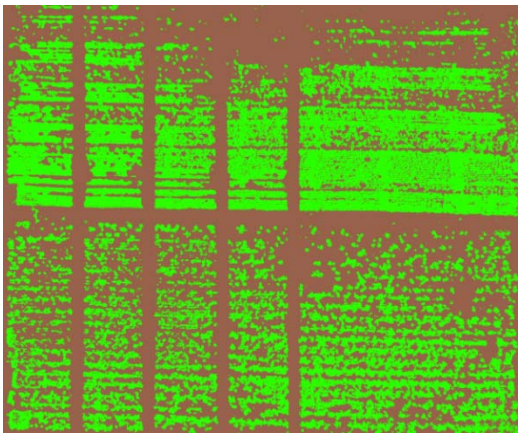

Figure 13. Image after classification, 250m

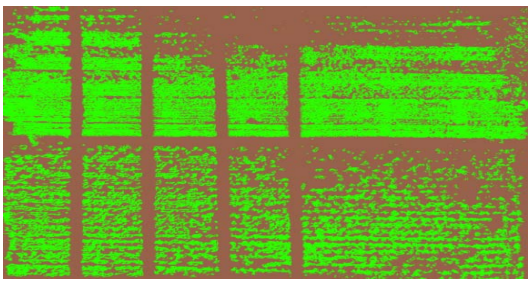

Figure 14. Image after classification, 500m

The graph below compares the percentages of affected area for each image taken at different altitudes, with the result obtained by using the classic method. We can see that the best results were given by the images taken at 50m and 150m, which have the smallest difference between their results and the 49,9% that was obtained using the classic method (Figure 15).

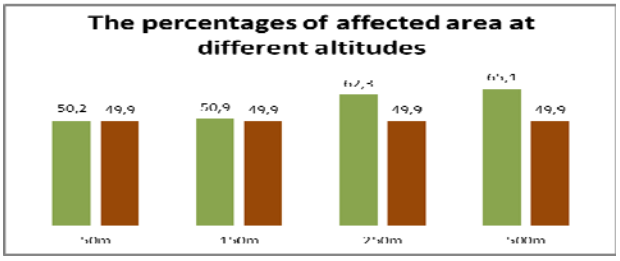

Figure 15. The percentages of affected area at different altitudes, compared to the percentage obtained by using the classic method

In the following figure it can be seen that 50m is the altitude that provides the most exact measurement, following the outline of the plants the best and excluding shadows. However, the picture taken at 50m provides a very good result, the difference being only 0.3%. Depending of the desired accuracy, the best altitudes are 50m, 100, and 150m. We can state for certain that as the altitude at which the pictures are taken increases, the accuracy of the measurements decrease (Figure 16).

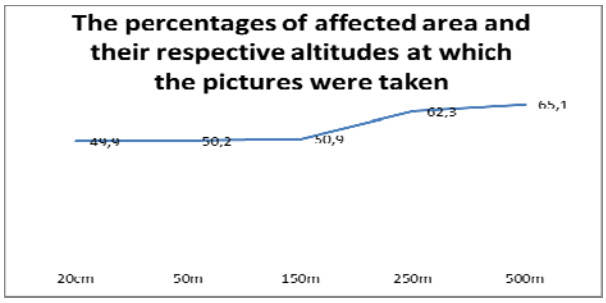

Figure 16. The percentages of affected area and their respective altitudes at which the pictures were taken.

CONCLUSIONS

We recommend taking your images as close to the ground as possible for the best accuracy, and if the land area is over 4500m2 we recommend taking multiple images and moving the center of projection.
The classic method requires a lot of time in the field, but the method which involves taking and processing images with a drone has a lowest time investment compared with all the available existing methods.
In conclusion, modern processing instruments are recommended for this kind of studies, as well as advanced drones that take pictures at high resolutions.

ACKNOWLEDGEMENTS

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TOPOGRAPHYCAL METHODS IN CIVIL ENGINEERING

Nicolae-Marius VASILESCU, Alexandru-Nicolae LUPU

Scientific Coordinator: Assoc. Prof. PhD Eng. Gabriel POPESCU

University of Agronomic Sciences and Veterinary Medicine of Bucharest,
Faculty of Land Reclamation and Environmental Engineering, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67, E-mail: vasilescuvnm@gmail.com

Corresponding author email: vasilescuvnm@gmail.com

Abstract

The methods, the techniques and the advanced instruments used in engineering field and the land surveying made possible the applicability in many engineering fields. It provides the ability to save time and resources while due to the precision offered by the instruments and the working methods can achieve sustainability studies, extent and hostile land for construction industry; the size of the construction components, precision topographic works to designing and building the edifice, the nature and volume of oscillation of level earth, the nature of the materials used, methods of execution deadlines for putting into use, etc. Application of topography can not be a passively act, but an active one, both in design and the execution of engineering objectives.

Key words: *effectiveness, methods, precision, topography.*

INTRODUCTION

In Civil Engineering works, topography, precedes and accompanies any study, phase and finishes the construction process. Benefits of topography applicability in construction works lead to a better development of the construction by shortening the term of design and building works, but also to a better organization of the workplace.

The domain of topographical engineering has had a remarkable development in terms of technical sciences in the last decades. Thus allowed to expand the area of application of topographical engineering in other activity fields than to draw up plans and maps necessary for the design of construction works.

The participation of the topographical engineering in design and management has increased significantly since the current stage of the industrialization of the construction process of surveying engineering works, tend to integrate in the construction and assembly work on construction sites.

As the mechanization of construction and use techniques with modern technologies has increased, topography plays a significant role in the design and execution of construction, since the methods and the topographical tools make available plans and topographic profiles updated on large scales without which the design, implementation and execution of the construction field can not be achieved. Furthermore, in the process of construction exploitation, starting with the reception of the project and finishing with the last observations and building inspection to ensure compliance with building regulations, requires geodetic surveying.

Land surveying engineeringis a branch of geodesy studying and solves a number of problems related to studies of engineering, design, construction and operation of buildings of any kind, including investments in transport, agriculture and machinery industry as well as land planning on towns and villages.

Engineering uses topography measuring instruments and methods of surveying and geodetic calculation used in the development of the state geodetic and cartographic data.

For solving construction-assembly verification on higher buildings of special shapes, comments on the strains and movement building, get in to use instruments with high accuracy.

MATERIALS AND METHODS

The network of the building is presented as a network of squares or rectangles compact the sides 100, 200 or 400 m, having the coordinates calculated in a particular system of axes parallel to the axes of the drawn construction (Figure. 1). Squares and rectangles network peaks are marked by concrete terminals, while being leveling and landmarks.

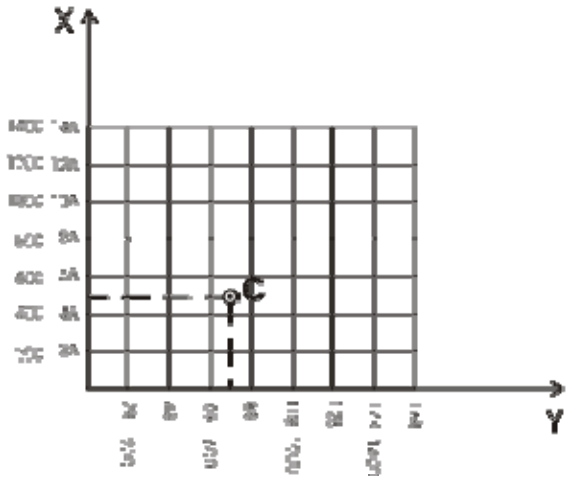

Figure 1. Coordinates Network construction.

Building network design is usually carried out on the overall design of the projection lens and consists of the locations network and finding the coordinates peaks network (coordinated design), compensation network and network final drawing.

The network design of the construction it must take consider the following criteria:

- network sides are parallel to the axis buildings so that the buildings to get fit into the rectangles or squares;
- building network points must be out of the excavation area, and the contour lines as close to the traced object;
- building network points enable linear and angular measurements;
- the network must have mostly an economical shape, which reduce or increase the density of points depending on tracing requirements;

Squares or rectangles grid coordinates are calculated from the general system of coordinates with translation. Basically calculate the coordinates of at least three points located in each alignment. After checking the points colinearity we calculate the coordinates of points, knowing the distance between points located on the same segment.

Given that all construction details are given by their axes, the construction slope will consist of:

- drawing axes to trace network points;
- drawing in detail about the axes materialized on the ground.

For the design and execution it will take in consider major axes, basic axes and intermediate axes.

The main axes are constituted by two perpendicular straight lines I-I and II-II arranged symmetrically in relation with the construction (Figure 2). The intersection point between two axes induce the coordinates in the given system. As a rule, the axles are applicable to the field for constructions that have a large area and a complex configuration (Mihail, 1966).

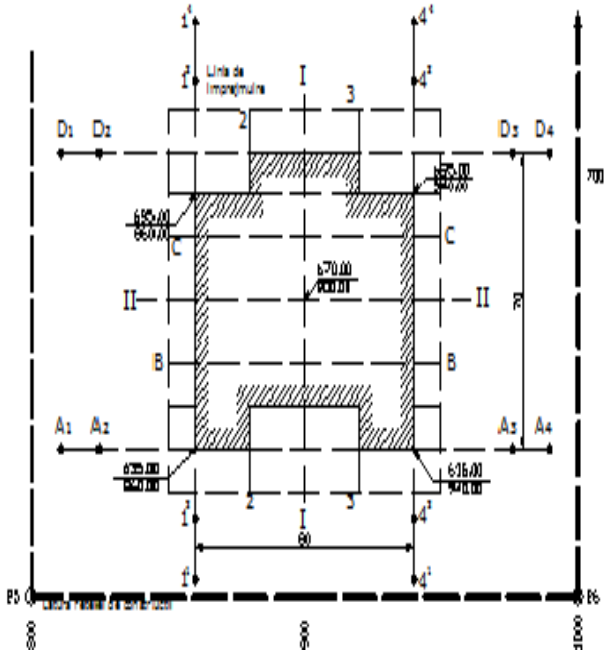

Figure 2. The tracing plan axes.

The basic axes are axes that forms the outline of the building. In practice, plotting construction apply on land just these axes passing through the main minutiae by Cartesian coordinates of the network construction. The other axis is called intermediate axes (secondary).
Materialization of the axes, is evidenced by at least twomaterialized landmarkson both sides of the building.
Axes basic plot points they are laying out on the ground points to the network construction by the rectangular coordinates method.
Checking the laying out construction points it's made by way of:

- laying-out these points by another method;
- lay-out the points on the other side of the network construction, using the same method;
- by comparing the measured distance between marked points, with the one given by the project;

Currently, when most businesses and surveying companies have total stations such as: Leica, Trimble, Topcon, etc, project implementation on the ground is made with high accuracy and at an optimal time (Figure 3).
Because Leica brand is placed on top three brands in the world, I will present the workstation program.
Setting out-calculate the necessary elements plotting of manually entering coordinates or angles, horizontal distanc and height of level, differences between the stationary point sought and can be displayed continuously.
Setting out coordinates from the following stages:

- Select the point:
- [DIST]: starts measuring and calculates the elements outlined.
- [REC]: saves readings.
- [Dir&Dis]:introduce trace elements.
- [MANUAL]: working towards introducing simplified point for ID and without storing it.

Orthogonal Setout:
You can enter differences coordinated out point to be mapped to the reference line. The program calculates the difference between the calculated and measured point. The program displays the orthogonal (ΔLine, ΔOffset, ▲) and polar (ΔHz, ▲, ▲).
Stages of work:
1.We introduce orthogonal stake out elements or searching point in the internal memory.
2. [SET] confirm the calculation and data entry.

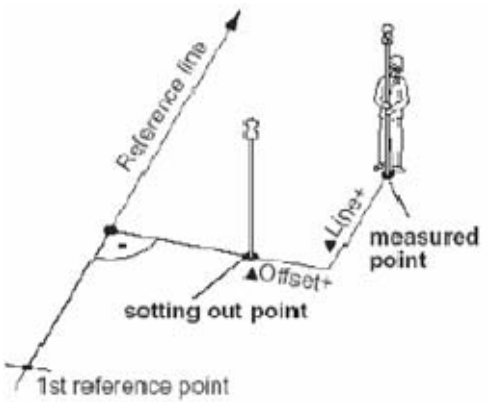

Figure 3. Laying-out orthogonal points.

1. setting out point (Figure 4).
2. measured point (Figure 5).

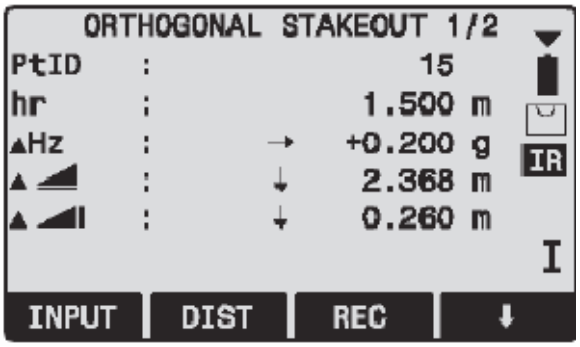

Figure 4. Settings screen for points orthogonal to the reference line.

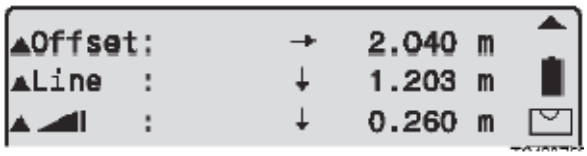

Figure 5. Lay-out corrections for a point to another field point by the measured position.

The sign for the angle and distance differences is exactly like the one on app "Setout"
Corrections values are presented as:

- +▲Hz : Turn the telescope clockwise to the stake point.

- : Out point is farther away than the measured point.
- : Out point is above the measuring point.

For designing and drawing bridges and viaducts we need primarily concerned basin lock plan, which can be obtained by copying from existing maps at scales of 1: 100,000, 1: 50,000,such as its size do not exceed 40x20cm time scale and which is the necessary basis for drawing up the situation plan and the necessary plan of the bridge on large-scale design in detail.

The situation plan: is drown on scale of 1:5000 for small rivers and on 1:10000 for those with a large width, usually using aerophotogrammetrical method, tachimetrical method for the zones with small stretching or fototheodolite for tough zones.

The large scale plan: laying out on a scale of 1:1000 with the equidistance of

level curves E=0,5 m for a crossing lenght <300 m and fot the scale 1:2000 with E=1m for longer lengths are used for drawing in detail of the bridge and for the detail studies of the access roads.

Network support for designing bridges and plotting their heads is achieved by the planimetric traversing and elevation on both sides (Figure. 6), related to the geodetic network.

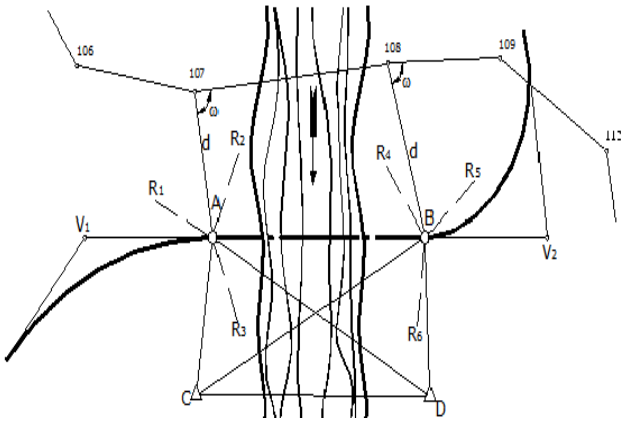

Figure 6. Reconstitution of a bridge axis.

The ends of the bridge by data points M and N are placed each on one shore areas from flooding (Figure. 7).

When is not known the position of the two points in the land, previously designed the plan situation, will be performed either by locating their plotting against surrounding objects existing in land and on the situation plan either by drawing angular peaks (V1.2; V1,3) axes access roads to the bridge.

The length of the bridge can be determined by the following methods: a tachometric, geometric, by direct measurement by measuring parallactic, trigonometric.

Tachometric method - consists of measuring the length of the axis of the bridge after previously were determined tachometric divisions bribery and constants.

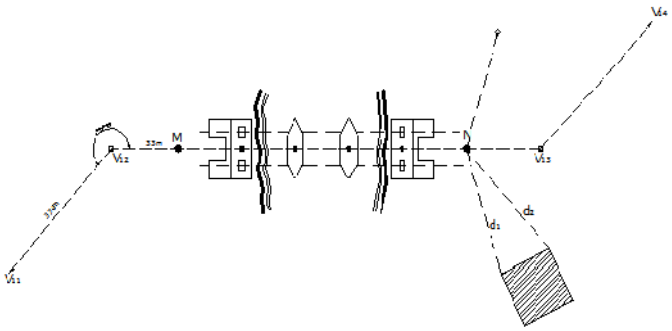

Figure 7. Drawing bridge access roads to the area.

Geometric Method, is used when we have materialized on the ground the ends of the bridge, without them being related to geodetic coordinate system (Figure 8).

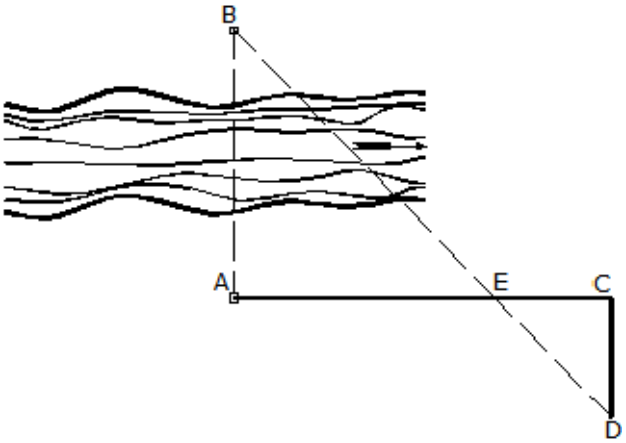

Figure 8. Determining the length of the bridge with the geometrical method.

It will be build on one of two sides at right angles at points A and C with a topographical square.

Likeness of right triangles that form we can write:

$$AB = CD\,\frac{AE}{EC}$$

All the elements will be measured in the horizontal values using the roulette.

Direct measurement method:

It can be applied in the following three assumptions:

a) When passing the bridge over the valley it is dry;

b) The floor built on rivers with water depth <3m;

c) In winter season when ice is formed.

When measuring over the dry valley or in winter season, (a and c) will be used invar wires or ribbons with millimeter divisions beeing necessary:

- to cleanse the land bridge axis direction, to enable direct measurement instrument settlement;
- to apply corrections to reduce the horizon, to align more closely the ribbon alignment and use dynamometer;

For the measurement of the distance across rivers with water depth up to 3 m,it can be build a scaffold of pilots beaten at intervals of 3 ... 4 m which are secured by cabinet on top.(Figure 9).Pilots will be mounted on a horizontal floor at the top and another at the bottom that moves the operator.

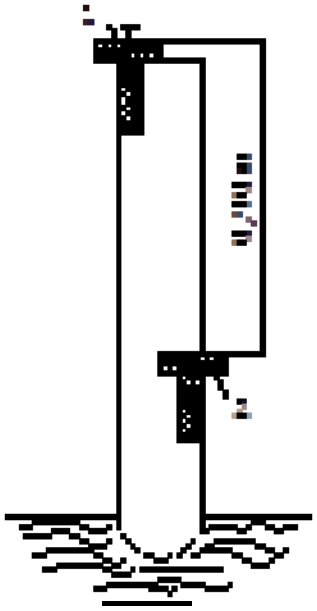

Figure 9. Scaffolding for the measurement of length.

Trigonometric method of determining the length of crossing obstacles, It is based on the determination of horizontal base on both sides of the river or only a part of it and precisely determining all the angles that are formed between the axis of the bridge.

Schemes for the bridge length about trigonometric calculation are:

a) Determining the CD length of the bridge from two bases, situated on a river side, accurately measuring all the angles that are formed by applying sine theorem (Figure 10).

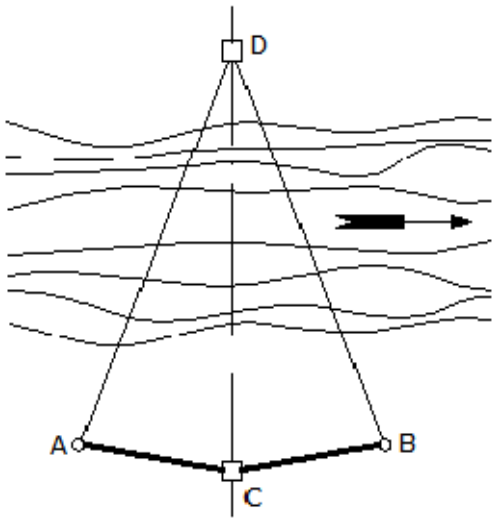

Figure 10. Trigonometric determination of the length of the bridge by using the adjacent triangles.

If the deviation between the two values obtained for length CD are insignificant then we will use their arithmetic mean.

b) Determining the CD length of the bridge from two bases on either side of the bridge. Depending on the obstacles on the ground, for placement on the basis of the same side of the bridge axis (Figure. 11) or opposite to the two ends (Figure 12) with lengths of 0.7 to 1 from C-D length .

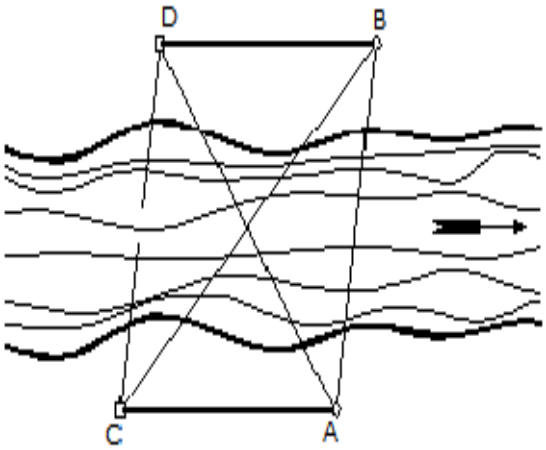

Figure 11. For placement on the basis of the same side of the bridge axis.

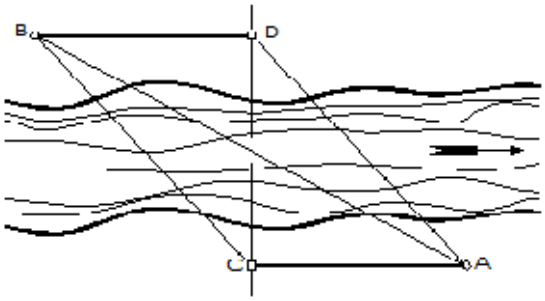

Figure 12. For placement opposite to the two ends.

It will measure and compensate all angles in a triangle, then we calculate applying the sine condition for more independent values of each triangle.

c) Determination of the length axis of the bridge (CD) with two equal and non-perpendicular and symmetrical to the axis CD of the bridge.

Applying this method will increase the accuracy of determining axis, because we have a double number of standing tops, compared to the previous method (Figure 13), and accuracy of calculation will be about 1 : 5000.

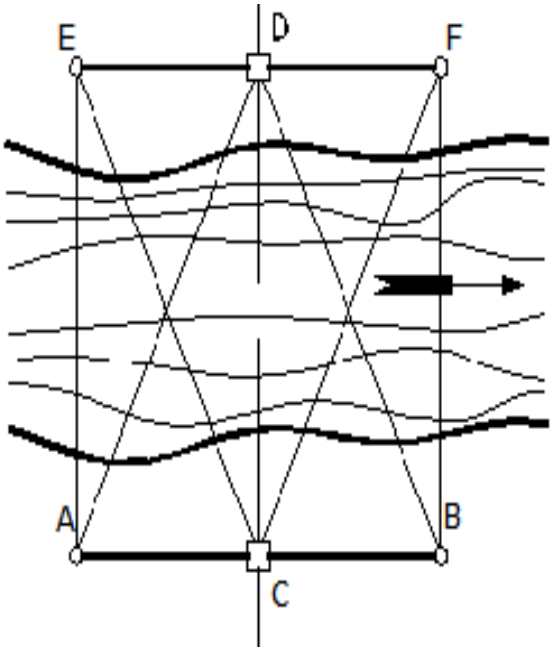

Figure 13. Determining the length of the bridge, using the adjoining quadrangles.

As a general rule all three schemes, it should be noted that the points C and D representing the ends of the bridge must be well marked planimetric related and altimetry network support of the site (Coșarcă, 2003; Onose 2004).

RESULTS AND DISCUSSIONS

As a result, following the measurements on the ground and the data obtained, the construction plan is drawn up, both in 2D and 3D. This helps to track construction,calculation of required material and checks in a relatively short and to the point.

Data processing softwer use various sites, being purchased from the manufacturer of the instrument used (ex. Leica Geo Office, TopoSys, etc.) or beeing the most common softwer office computing package, Microsoft Excel (Figures 14 and 15).

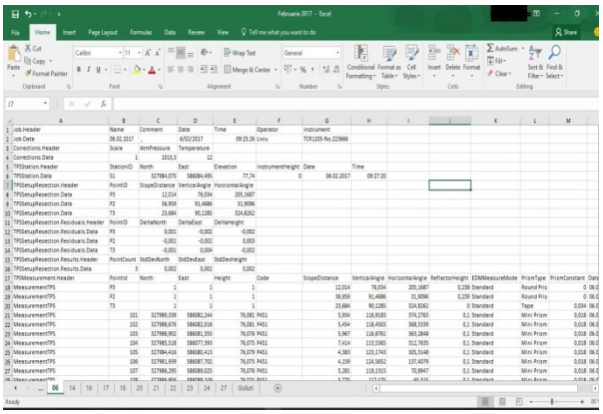

Figure 14. Data Station

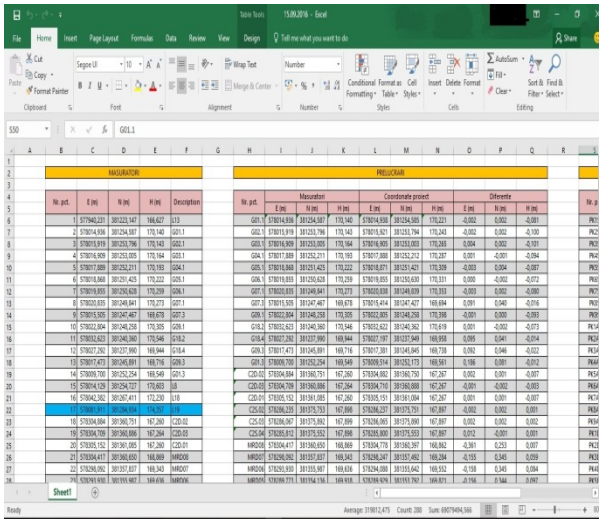

Figure 15. Data Results

Geodetic support network design is a complex operation, the project must anticipate and properly coordinate with other stages of realization of support networks:

- materialization networks, execution and processing of observations.

Drafting the construction of a geodetic network is dependent on the nature, purpose and characteristics considered significant structural geodetic network. In our country, state geodetic networks (respectively triangulation and leveling) are made in a in a suitable density for the majority of the work topographic - photogrammetry, cartography and cadastral.

Establishment of the draft triangulation is to establish a map at a certain scale, the position of geodetic points so that geometrical formats satisfies the conditions of that triangulation order.

Points position will be chosen to occupy a dominant positions in field,to ensure visibility between them by means of the lowest possible construction and to achieve a conformation as rigorously geometric figures.

For the design of any network triangulation, It takes place at the beginning a documentation which is used to gather information, data and materials design such as:

- preparing the draft is necessary to perform a preliminary reconnaissance of the area in order to gat;
- maps edited at any scale;
- (triangulation, poligonometrie, leveling bases and astronomical determinations), reports on these works, scheme, catalogs coordinate existing brands and descriptions of landmarks leveling, sketches, data and information on existing points, books comments;
- informative data on physicogeographic region working as: relief, river, woods, weather data, (wettest months, the average amount of water per m2, annual state and intensity of the winds, fog, temperatures are recorded during the year);
- economic data: settlements, employment opportunities labor and means of transport, network communication means, network communication ways;
- opportunities to supply food, construction materials, accommodation;
- before further information and confirmation of existing ones (Ursea, 1974).

The design is realized in the triangulation order, starting with the first order and with special care as the lower order to achieve strong links to higher order.I and II orders are projected on maps at 1:200,000, and orders III and IV on maps at 1:100,000.

After designing triangulation network, an analysis is made to show :

- maximum and minimum length of the sides, in order triangulation;
- minimum angles of figures formed on orders the weight value;

Compensate the geodetic networks using the method of indirect observations, known as compensation of the group of points, because it was very much used to hire a number of new points into an older network of a certain order.The documentation will be using both maps and plans, and recentphotogrammetric materials relating to the area. Also are needed data on the geodetic networks previously performed in the region, information on relief, climate, hydrology, ground stability and the existence of coordinated older catalogs: X, Y, H (Cristescu, 1978).

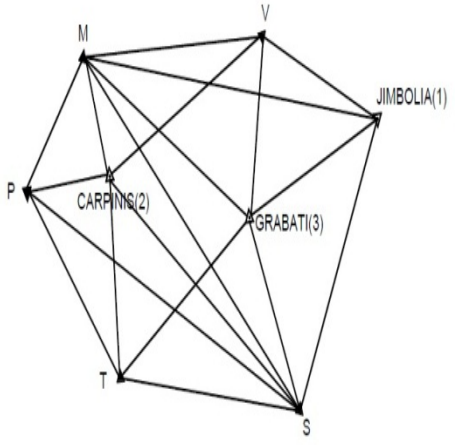

Figure 16. Sketch triangulation network

Calculating distances between old points.

$$tg\theta = \frac{\Delta X}{\Delta Y}$$

$$D^2 = \Delta X^2 + \Delta Y^2$$

Calculating the provisional coordinates for the new set points.

It makes through the intersection before, considering two combinations for each new point. We consider the average values thereof.

$$X = \frac{Y_1 - Y_2 + X_2 tg\theta_2 - X_1 tg\theta_1}{tg\theta_2 - tg\theta_1}$$

$$Y = Y_1 + tg\theta_1 (X - X_1)$$
$$Y = Y_2 + tg\theta_2 (X - X_2)$$

Or,

$$Y = \frac{X_1 - X_2 + Y_2 ctg\theta_2 - Y_1 ctg\theta_1}{ctg\theta_2 - cyg\theta_1}$$

$$X = X_1 + ctg\theta_1 (Y - Y_1)$$
$$X = X_2 + ctg\theta_2 (Y - Y_2)$$

(Trigonometric functions will choose that which is smaller in absolute value).
Calculating the provisional coordinates and the directions coefficients.

$$a_{ij} = -\rho^{cc} \frac{\Delta y_{ij}^0}{(D_{ij}^0)^2} = -\rho^{cc} \frac{sin\vartheta_{ij}^0}{D_{ij}^0}$$

$$b_{ij} = \rho^{cc} \frac{\Delta x_{ij}^0}{(D_{ij}^0)^2} = \rho^{cc} \frac{cos\vartheta_{ij}^0}{D_{ij}^0}$$

Note: For practical reasons, the state triangulation usually consider variation on decimeter and D, Δ_X and Δ_Y they are expressed in kilometers.
Consumables are formulas (for centesimal graduation):

$$a_{ij} = -\rho^{cc} \frac{(Dy_{ij}^0)_{km}}{(D_{km}^0)^2}$$

$$b_{ij} = \rho^{cc} \frac{(Dx_{ij}^0)_{km}}{(D_{km}^0)^2}$$

In this situation, dx and dy corrections resulting from the clearing will be also expressed in dm (Onose, 2004).
After obtaining the necessary data, they are imported into CAD softwares sites (ex. Autodesk, ArcGIS, etc.). Following import point cloud in the programs mentioned above, joins each point with the index thus forming the construction plan (Figure 17).

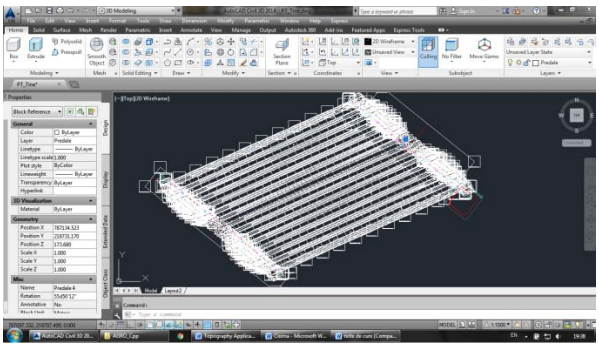

Figure 17. 2D Bridge construction plan.

Achieving 3D plan quickly calculate the volume of each piece of material of construction, concrete volume, the volume of reinforced concrete, shuttering boards and more (Figure 18-28).

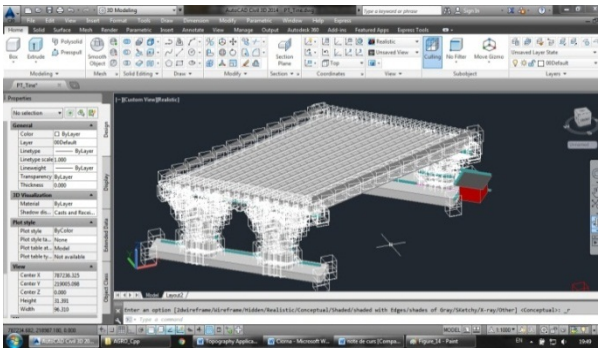

Figure 18. 3D Bridge construction plan.

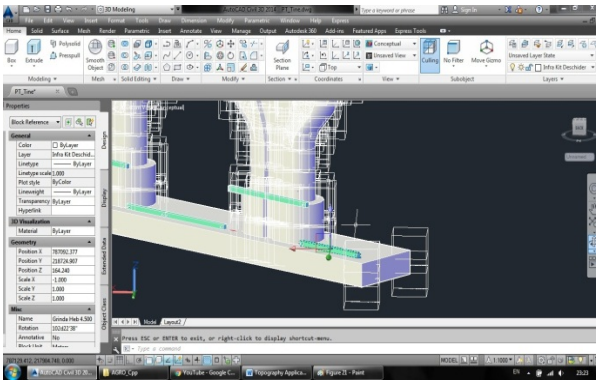

Figure 19. Infrakit Bridge Construction.

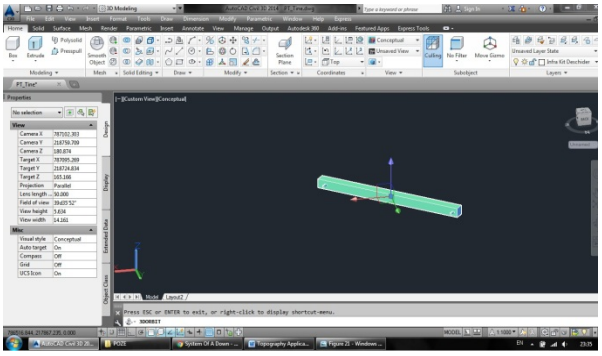

Figure 20. Infrakit Coordinates.

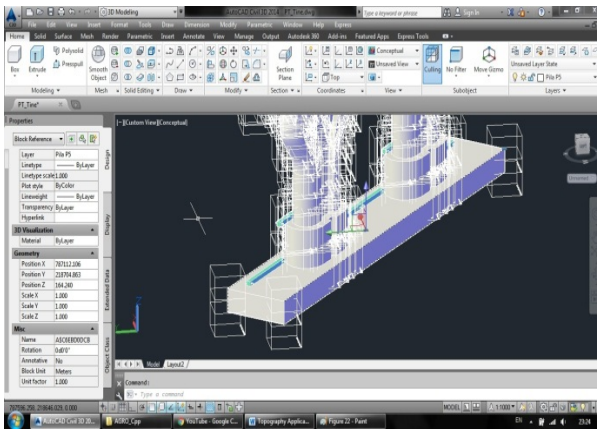

Figure 21. Bridge Foundation.

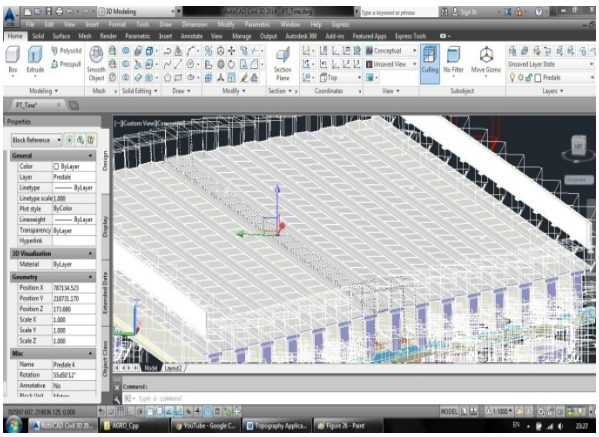

Figure 25. Floor plates.

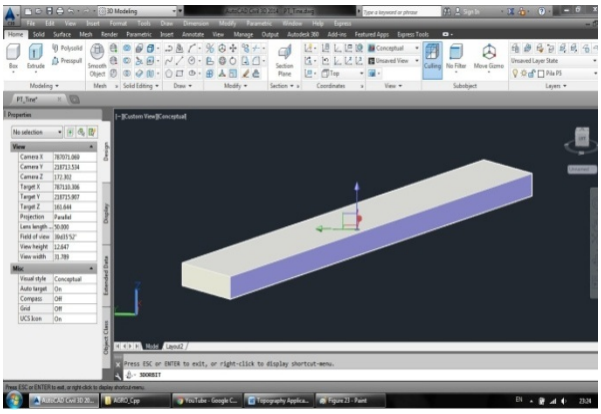

Figure 22. Bridge Foudation Coordinates.

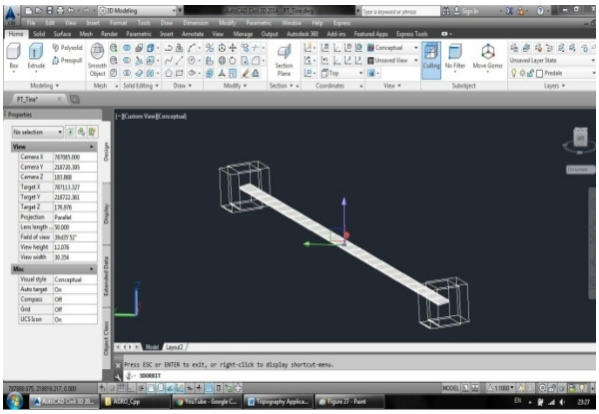

Figure 26. Floor plates coordinates.

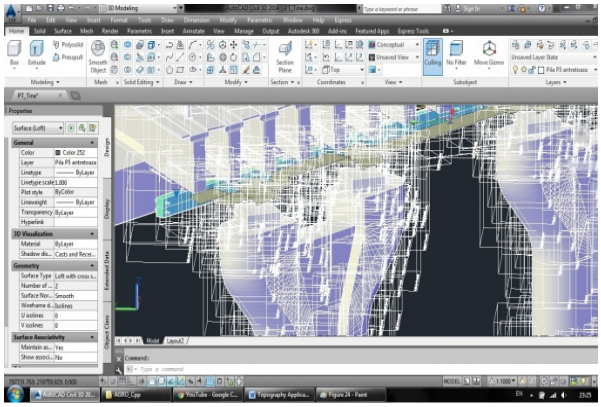

Figure 23. Threaded pin.

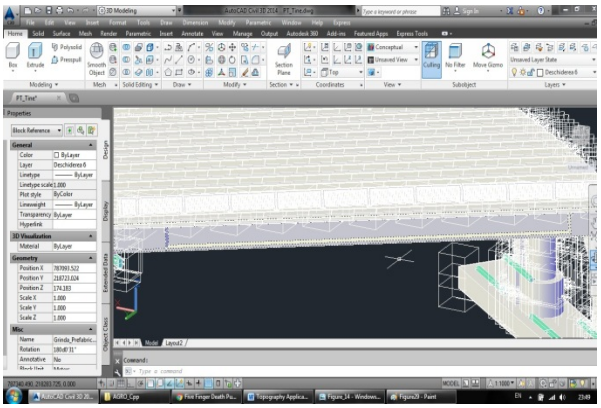

Figure 27. Support beam.

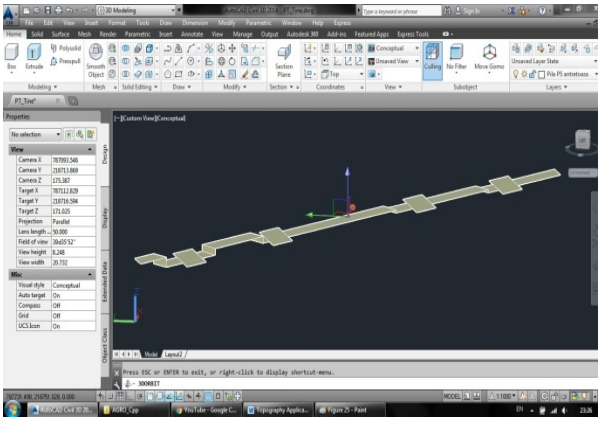

Figure 24.Threaded pin coordinates.

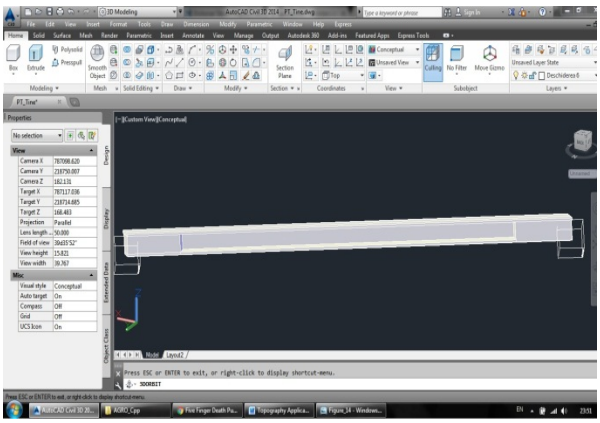

Figure 28. Support beam coordinates.

CONCLUSIONS

The topography has greatly advanced as one of the essential elements of any construction related activities. With the latest technology and methods of calculation, topography engineering reached to be irreplaceable on any type of construction sites. From determining and mapping foundations to completion of construction, topography is not missing from any phase of construction.

By making 2D and 3D digital models of the construction of accurate cartographic terms, they eliminated a lot of fundamental problems winning time on the works. It is important to have a software that will help you to reprocess all the data gathered from the field. Also you have to be very organized regarding data collected from all sources because the software will work with that data and if something is wrong there everything will be wrong when you start reprocess them. Anyway, the softwares are also developed to warn you if something is wrong so you don't go further with wrong data and this saves a lot of time. Working with softwares is more efficient, more precisely and helps you from wasting time.

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