JOURNAL OF YOUNG SCIENTIST

Land Reclamation, Earth Observation & Surveying,
Environmental Engineering

Volume VII

The XIV-th International Student Symposium „IF – IM – CAD"

Organized by:

University of Agronomic Sciences and Veterinary Medicine of Bucharest
Faculty of Reclamation and Environmental Engineering

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To be cited: Journal of Young Scientist, Vol. VII, 2019

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SECTION 01
ENVIRONMENTAL SCIENCE
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STUDY ON THE DEGREE OF POLLUTION IN THE CITY ALBA IULIA, ROMANIA

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Abstract

In recent years noise pollution has begun to make its presence felt more and more through intense road traffic and its effects, thus requiring a much higher dose of attention to this issue. This research work was carried out in order to bring to the forefront the harmful effects of the phonic pollution of the biotic and abiotic factors, the methods of improvement of the registered parameters and their evolution in the last years.

Keywords: noise, sound pollution, traffic.

INTRODUCTION

Noise is a group of sounds that have the effect of damaging both the psychological and biological stems of humans and other living organisms. In the beginning, sound pollution was considered a minor issue, not too important. This concept came into being following the publication of the Wilson Committee Report (1953), in which the first comprehensive review of the effects of noise was presented. With the passage of time, this subject became more and more publicized and more sensitive, Worrying values for wave and vibration recording.

So sound pollution has succeeded to rank among the main types of pollution classified according to the degree of harm.

The gravity of this problem was demonstrated by Kiernan (1997) who found that, although noise is relatively low, it affects human health, generating heart and insomnia, but also reduces the quality of optimal functioning of the auditory system, and all these in turn, lead to the generation of other health problems affecting organs of the human body over time.

In case of high levels of noise, there are more serious diseases of the human body which can lead to loss of hearing and diminish the capacity of the optimal functioning of the nervous system. The main factor in terms of noise pollution is road traffic. In the polls conducted by Pol. J. Environ (2004), which studied the effect of road traffic noise on the cardiac system, concluded that the results indicate a relationship between traffic noise exposure and the incidence of myocardial infarction among men aged 55-64 years. The study by Vinita Pathak (2007), which analyzed the problem of noise pollution in the city of Varanasi in India and its effects on the health of exposed people, showed that 65% of interviewed people were extremely disturbed by traffic noise, 51% reported they had headaches, 58% suffered from high blood pressure, 53% felt fatigued, 49% felt irritated, and 54% had dizziness.

Unfortunately, the noxious effect of road traffic noise is not only felt by man but by the whole ecosystem, whether biocenosis or abiotic factors, the effects are damaging to both categories. From buildings damaged by long exposure to noise pollution to birds and animals affected by noise often suffer from panic attacks, especially wild species, which, following our decisions, humans have invaded and destroyed the comfort of the natural environment life being exposed to pollution through a well-known action in our country, namely mass deforestation of the forests without considering the consequences of these decisions. In fact, according to the research,

one of the methods for reducing the effects of the noise pollution was removed. All these harmful effects from the road traffic effect affect the entire ecosystem for a long time, thus imposing the monitoring, research, discovery and application of the most efficient methods necessary to reduce these effects as much as possible. In the "Combating the noise pollution caused by the means of transport "have highlighted the following possible ways of reducing noise pollution in large cities and beyond: The machines or engines to be built is desirable to produce minimal noise. The blocks to be built must have an anti-static sound absorbing layer. Ideally, it would be the introduction of tree insulating curtains around industrial noise sources and around residential quarters. Until now, no sound quality standards have been established in Romania (Jadaneant and Mihon, 2010). This has been demonstrated in several research papers aimed at improving or reducing the noise pollution but unfortunately this topic still requires careful attention, so another solution for noise reduction intervenes in our help as a result of L. Dai's research that concluded: In order to reduce traffic noise, it is advisable to control the volume of traffic instead of its speed. (Dai L et al., 2015). In the "Novel solutions for quieter and greener cities" research, vegetal facades in the courtyard of the houses have been shown to significantly reduce the noise from all sources outside them, and the vegetation facades are also beneficial and for the noise that comes from inside the courtyard. The effect of the facades in the vegetation yard is higher at the highest frequencies and for the lower receptor with an average reduction of 4 dB (A) compared to the non-vegetal facades with very low absorption noise. In an elongated courtyard adjoining the street traffic, the longer side exposed to trafficking has shown that plant fa- cades only reduce the noise slightly, with no more than 0.5 dB. When a barrier is placed along, the edge of that roof closest to the yard reduces an average noise level of about 1 dB for a 0.6 m barrier. Placing low barriers along both sides of the central building reduces noise by an average of approximately 3 dB (A). For a narrow configuration with a street width of 10 m, the noise is reduced slightly more, still about 1 dB (A). Noteworthy is that low-height barriers without vegetation have an insignificant effect in terms of noise reduction being practically useless in order to reduce the degree of noise pollution.

The purpose of the paper is to investigate and determine the noise pollution degree of Alba Iulia but also to find the most efficient solutions to combat and reduce its noise pollution. The work also sought to compare the current noise level, with the one existing in 2012 (Popa et al., 2015), given the fact that in recent years the import of vehicles, especially second-hand, gradually increased with the elimination of the pollution tax.

MATERIALS AND METHODS

To determine the noise level, we chose five monitoring points in Alba Iulia, where I made noise determinations between 8-10 and 15-17, which are usually the busiest traffic hours.

Site 1, which is located in the Stadium area, at the intersection of Calea Motilor Street and Republicii Avenue. Site 2 is situated at Transilvania and Revolutiei 1918 Avenues intersection. Site 3 is located near Unirea shop, at Alexandru Ioan Cuza and Calea Motilor Streets intersection. Site 4 is located at the intersection of Incoronarii Avenue and Ferdinand I Avenue. Site 5 is located in Partos, Ferdinand I Avenue.

For the measurements it was used a portable acoustic analyzer 2250, manufactured by Brüel & Kjær is one of the best analyzers/ sound level meter/ portable vibration and noise meters. It is made for advanced applications of determination, analysis and recording of noise and vibration.

We determined the following parameters:

-LAFmax – the maximum 'A' frequency-weighted and 'F' time-weighted sound pressure level detected during a measurement-LAeq – the 'A' frequency-weighted equivalent continuous sound pressure level, that is, the average level representing the same energy as the measured fluctuating levels-LCpeak – the maximum 'C' frequency-weighted sound pressure level detected during a measurement.

In each of the six measurement points, measurements were performed in the same time spot. The sound meter installation was made respecting measurement conditions: the sound

meter was placed on a stand at a height of 1.2 m; the stand was placed at a distance of about 7 m from the road axis. Then it was measured the noise on the sound level meter for 15 minutes.

RESULTS AND DISCUSSIONS

The measurements were made in two hours of the day so that we can check the current parameters and compare the evolution of the noise pollution by comparing the parameters registered seven years ago at the same monitoring points of Alba Iulia. In the first part of the day the parameters were as follows: Center area -70.3 dB, Cetate area 62.5, Railway station -66.2, Partos-81.0 dB area, Stadion area -63.9 dB and in the second part of the day have registered: 63.7 dB-Cetate, 66.1 dB- Center, 80.4 dB -Gara, 78.1 dB- Partos and 65.3 dB - Stadium.In what follows they will be reported in the form tab values the sound parameters registered in the five monitoring points and maximum permissive limit. According to STAS 10009/2017, the level of continuous equivalent acoustic pressure weighted A - LAegT is: - for streets of technical category II, link: 70 dB, and the weighted sound pressure level infrequency A and weighted in time F exceeded10% of time T, L AF10T = 80 dB;- for the inhabited area, the permissive limit of noise at the property limit in the case of buildings with enclosed land (courtyard) with destination residential building with two or more levels is it; LAeqT = 65 dB (A);
for the inhabited area, the limit of the noise at the facade of the residential building that is the most exposed to the action of noise outside the building for any type of building residential or assimilated is; +LAeqT = 50 dB (A).

Table 1. Results obtained in the Cetate area, 12.03.2019

Measured parameters	Hour-09:32	Hour-16:36
LCpeak(dB)	100.3	100.9
LAFmax(dB)	86.1	85.2
LAFmin(dB)	46.5	58.2
LAeq(dB)	63.9	65.3
Permissible limit (dB)	70.0	70.0

At this point of measurement it can be appreciated from the table above that the values are below the legal limit and below the values recorded in 2012 by 4.9 dB (Popa et al., 2015).

Table 2. Results obtained in the Center area, 11.03.2019

Measured parameters	Hour-08:45	Hour-15:55
LCpeak (dB)	101.5	
LAFmax (dB)	74.9	88.2
LAFmin (dB)	53.5	58.5
LAeq (dB)	62.5	63,7
Permissible limit (dB)	70.0	70.0

As can be seen from the table above, the results obtained are below the limit, with a maximum value of 63.7 dB, which is by 4.44 dB less than the maximum value recorded at the same time interval in 2012 (Popa et al., 2015).

Table 3. Results obtained in the Stadion area,12.03.2019

Measured parameters	Hour -08:06	Hour -15:12
LCpeak (dB)	102.5	109.3
LAFmax (dB)	93.0	83.1
LAFmin (dB)	62.6	55.4
LAeq (dB)	70.3	66.1
Permissible limit (dB)	70.0	70.0

At this point of measurement it can be observed that the maximum admitted value is slightly exceeded in the morning and at the same time there is a slight increase of the noise level by 2 dB compared to 2012 (Popa et al., 2015).

Table 4. Results obtained in the Partos area, 12.03.2019

Measured parameters	Hour -08:00	Hour -15:00
LCpeak (dB)	114.1	114.7
LAFmax (dB)	106.3	100.8
LAFmin (dB)	57.4	58.8
LAeq (dB)	81.0	78.1
Permissible limit (dB)	70.0	70.0

As can be seen from the table above, the obtained results exceed the admissible limit, registering the maximum value of 81.0 dB, which is 4 dB higher than the value registered in 2012. Taking into account the provisions of SR 10009 of 2017 regarding the allowed limit in the zones residential measurement, at the measuring point, the maximum limit admitted to the 60 dB yard boundary limit and the permissible limit on the facade of residential buildings in the 50 dB area (Popa et al., 2015).

Table 5. Results obtained in the Train Station area, 12.03.2019

Measured parameters	Hour -08:42	Hour -15:32
LCpeak (dB)	99.1	138.3
LAFmax (dB)	81.4	111.8
LAFmin (dB)	53.7	52.0
LAeq (dB)	62.2	80.4
Permissible limit (dB)	70.0	70.0

According to the table above, the maximum registered parameters exceed the legal limit but also the values registered in 2012 by 11.8 Db (Popa, et al., 2015).

CONCLUSIONS

The study shows that over the past few years the noise pollution has increased by about 40% compared to the previous years.

In the city of Alba Iulia, in the follow-ups performed, the allowed parameters of the noise pollution were exceeded.

According to the above, the effects of noise pollution are very damaging to the entire ecosystem and its values are on the rise, therefore requires urgent application of reduction methods to avoid a global disaster in future years.

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OUR BIODIVERSITY, OUR FOOD, OUR HEALTH

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Abstract

Most human beings want to use medicinal plants to treat some diseases. This means that we want to return to nature to prevent some diseases and pains. Although diseases are currently being treated more often through medicines of synthetic origin, the use of some medications leads to certain damages to the body. Therefore, the importance of medicinal plants and their products is increasingly recognized and public confidence in their use is constantly strengthened. In my Case Study -,,The Benefits of Using the Medicinal Plants", I concluded that: it is important to protect some green areas (100% of people agreed with this); it is important to protect the plant species with a risk of extinction (86,3% of people agreed with this); we prefer herbal products (86,3% of people agreed with this); it is important that the medicines be prepared only from medicinal plants (76,5% of people agreed with this); it is important to focus only medicinal plants and their products (63,7% of people agreed with this).

Keywords: green areas, health, medicinal plants, treat, protect.

INTRODUCTION

This year's celebrations of the International Day for Biological Diversity, on 22 May 2019, focus on biodiversity as the foundation for our food and health and a key catalyst to transforming food systems and improving human health. The theme aims to leverage knowledge and spread awareness of the dependency of our food systems, nutrition, and health on biodiversity and healthy ecosystems. The theme also celebrates the diversity provided by our natural systems for human existence and well-being on Earth, while contributing to other Sustainable Development Goals, including climate change mitigation and adaptation, ecosystems restoration, cleaner water and zero hunger, among others.
In the last 100 years, more than 90 percent of crop varieties have disappeared from farmers' fields. Half of the breeds of many domestic animals have been lost, and all of the world's 17 main fishing grounds are now being fished at or above their sustainable limits. Locally-varied food production systems are under threat, including related indigenous, traditional and local knowledge. With this decline, agrobiodiversity is disappearing, and also

essential knowledge of traditional medicine and local foods. The loss of diverse diets is directly linked to diseases or health risk factors, such as diabetes, obesity and malnutrition, and has a direct impact on the availability of traditional medicines. Individuals can mobilize and catalyse action around their concerns on health, nutrition, and food systems, together with awareness raising on how to conserve and sustainably use biodiversity for our well-being. Plants play an important role by providing essential services in ecosystems. Without plants, humans and other living organisms cannot live in a way living should be. Herbals especially medicinal herbs have constantly acted as an overall indicator of ecosystem health. Medicinal plants have undoubtedly been considered by human beings since ancient times. It can be said that before the history and since the early humans recognized and exploited the plants around them for use as fuel, clothing, shelter and food, they became aware of their properties more or less. Medicinal plants have been transformed into one of the oldest sciences in countries such as China, Greece, Egypt and India. In ancient Persia, plants were commonly used as a drug and disinfectant and aromatic agent. In fact, the

use of medicinal plants for the treatment of diseases dates back to the history of human life, that is, since human beings have sought a tool in their environment to recover from a disease, the use of plants was their only choice of treatment.

The World Health Organization (WHO) defines traditional medicinal plants as natural plant materials which are used at least or in the absence industrial processing for the treatment of diseases at a local or regional scale. Traditional herbal medicine has been used in developing and developed countries for thousands of years because it is natural and causes comparatively fewer complications. According to the WHO, more than 80% of the world's population rely more often on traditional drugs, mainly plants, serving as the main source of health care (27). This figure includes not only a large population of China, India and all the developing countries of the world but also many advanced countries. Although diseases are currently being treated more often through medicines of synthetic origin and specifically developed in laboratories, and their definite effects in the treatment of diseases have contributed to the development of their use, the use of some medications leads to certain damages to the body. Therefore, the importance of medicinal plants and their products is increasingly recognized and the public confidence in their use is constantly strengthened. Phytotherapy is widely being used across the world on a constantly growing basis. Therefore, the global trend of synthetic compounds has turned to herbal drugs, which we can refer to it as a return to nature to prevent diseases and pains. Nature has been served as the source of medicinal herbs.

One of the challenges facing medicinal plants is the loss of medicinal plant species due to the non-principled use of these resources. According to the International Union for Conservation of Nature, there are between 50 000 and 80 000 flowering plant species that are used for pharmaceutical purposes around the world. Among these numbers, about 15 000 species are exposed to a risk of extinction due to high harvesting and destruction of habitats and 20% of their wildlife resources are decreasing due to growing human populations and excessive consumption of plants. Therefore, the environmental code of ethics that preserves biodiversity in the processes of exploiting natural resources to discover natural drugs should be considered. Good agricultural practice (GAP) for medicinal plants are planned to regulate production and ensure quality and facilitate the standardization of herbal drugs. GAP is an approach that uses high-quality, safe and non-contaminated (raw drugs) herbal medicines to help solve various problems. GAP includes comprehensive items such as environmental ecology, production locations, germplasm, cultivation, collection and quality aspects of pesticide detection, macroscopic or microscopic validation, chemical identification of active compounds, and checking of metal elements. Many countries seriously implement and promote the GAP. For example, in China, GAP has promoted the growth of conventional medicinal plants in areas where these plants are traditionally cultivated.

The demand for plant-derived products has increased across the world. In the Middle East, Latin America, Africa and Asia more than 85 percent of the populations predominantly rely on traditional medicine, especially on herbal medicines, for their health care needs. About 100 million people in the European Union and in some countries as high as 90% of the population, still use traditional, complementary or herbal medicines. The herbal medicine has an increasing big market. In 2012, the whole sales of Chinese herbal medicines reached more than US$83 billion which was 20% more than the market in 2011. It has been suggested that the whole market for all herbal supplements will reach more than US$115 billion by 2020, which in Asia-Pacific is the fastest and in Europe is the largest growing markets. These demands are predominantly driven by women subjects by growing emphasis on concerns on the adverse effects of synthetic drugs. Jamshidi-Kia F, Lorigooini Z, Amini-Khoei H. Medicinal plants: past history and future perspective. J Herbmed Pharmacol. 2018;7(1):1-7. doi: 10.15171/jhp.2018.01.

MATERIALS AND METHODS

DESCRIPTION OF THE APPARATUS USED AND THE DATA PROCESSING SOFTWARE

The creation of the form and the questionnaire with Google Drive

Step 1

We created a user account Google using the browser, I accessed Gmail, and then the "Create an account" to enter the information required for registration as a user of all Google services.

Step 2

I accessed Google Drive and then the window „New" that provides the sub-menus: 'File', 'upload a file", "upload a file", "Google", documents, spreadsheets, Google" „Google Presentations", "More". We have chosen window „More" which provides options: „Forms Google", "Drawings Google", "My Google Maps", "Google Sites" and "connect to multiple applications". We came to the window „Forms Google".
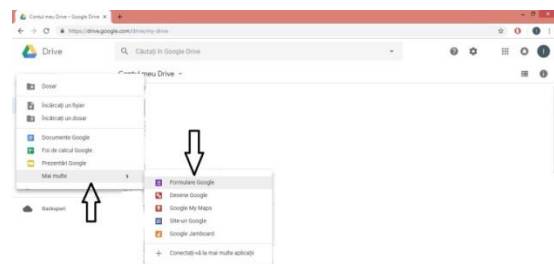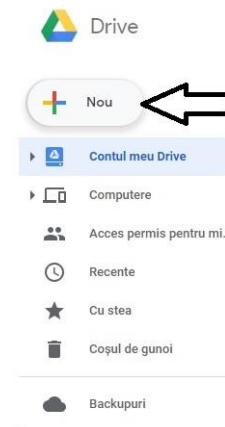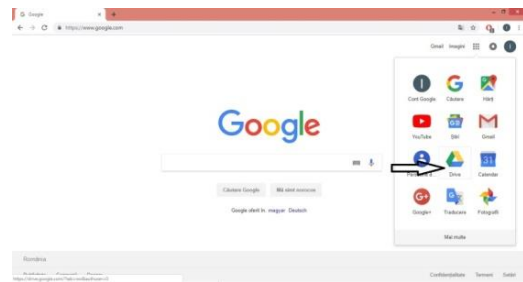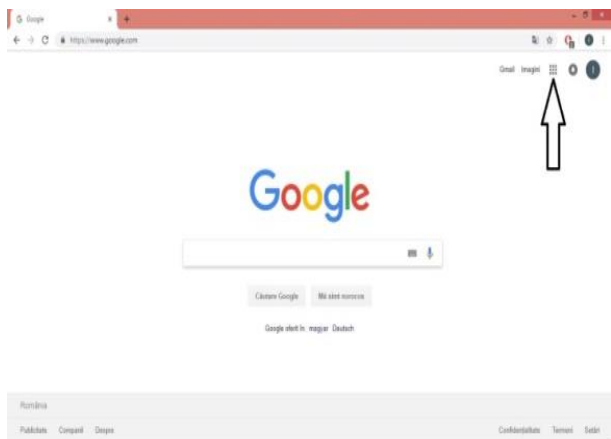
Step 3

We completed the title of the form, the description of the form and I made the first question with multiple versions of answer. To add another question i accessed the icon in the top right-hand side „Add a question".
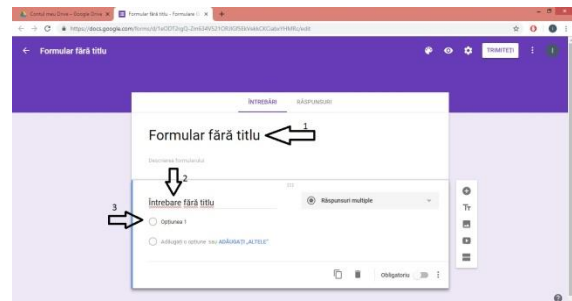
Step 4

After the completion of the questionnaire I viewed by clicking on the icon, View", which is located in the top right of the bar functions. By clicking on the icon "Send" from the

Toolbar functions, I sent a questionnaire via e-mail and by accessing the link.

Step 5

After completing the form, view the answers is done by clicking on the icon ,,Answers".
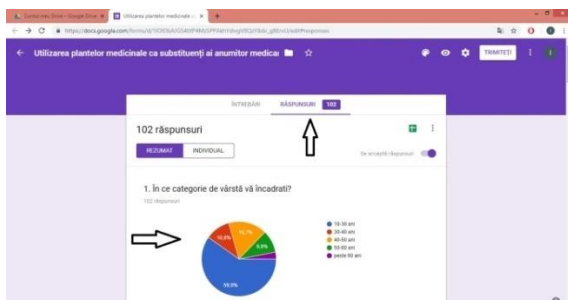
It was the last step completed for the observation of the results and their use for the case study.

The Case Study on the benefits of using medicinal plants

This case study will help us to see if people consider medicinal plants or products on the basis of medicinal plants more beneficial than conventional drugs we closely 102 answers to the questions addressed, they are:

1. În ce categorie de vârstă vă încadrati?
102 răspunsuri
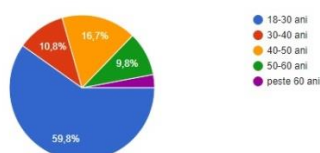
From the first question I found out that the 59.8% (61 people) of those who responded to the questionnaire were aged between 18 and 30 years, 16.7% (17 people) aged between 40-50 years, 10.8% (11 people) aged between 30 and 40 years, 9.8% (10 people) aged between 50-60years, and the remaining 2,9 % (3 people) aged over 60 years.

2. Este în regulă să protejăm anumite zone verzi?
102 răspunsuri
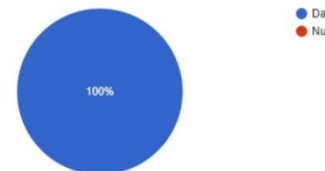
To this question 100% (102 people) have been agreed with the protection of the green areas.

3. Este important să protejăm speciile pe cale de disparitie a plantelor?
102 răspunsuri

99% (101 people) of platforms which have answered this question have considered that it is important to protect species in danger of extinction of plants, and the remaining 1% (1 person) considers that it is important to protect the plant species in danger of extinction.

4. Vi se par mai benefice medicamentele preparate din plante medicinale fată de medicamentele conventionale?
102 răspunsuri
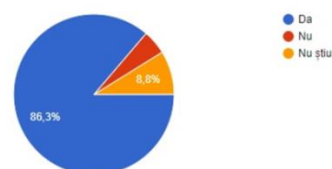
86.3% (88 people) of people who have answered consider herbal products seemed more beneficial. On the basis of medicinal plants, 8.8% (9 people) do not know exactly if they are definitely most beneficial, and 4.9% (5 people) consider conventional medicines most beneficial.

5. Ați utilizat produse din plante medicinale pentru o anumită afecțiune până acum?

102 răspunsuri

- Da
- Nu

96,1%
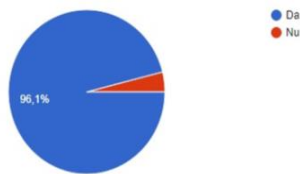
To this question 96.1% (98 people) used products from medicinal plants, and the rest of 4.9% (4 people) have not used products from medicinal plants.

6. Pentru ce afecțiuni ați folosit plante medicinale?

102 răspunsuri

- Migrene
- Insomnii
- Răceală
- Alergii
- Infectii
- Alte afecțiuni

8,8% 13,7% 53,9% 10,8% 8,8%
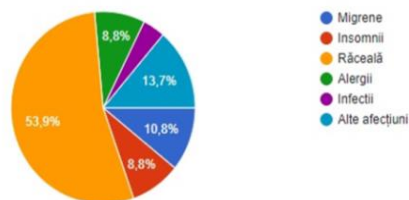
53.9%(55 people) of people who have answered have used medicinal plants for cold, 13.7% (14 people).They used for other diseases, 10.8% (11 people) used for headaches, 8.8% (9 people) used for allergies, 8.8% (9 people) used for insomnia, and 3.9%(4 people) used for some infection.

7. Considerați că este important ca medicamentele sa fie preparate doar din plante medicinale?

102 răspunsuri

- Da
- Nu

76,5% 23,5%
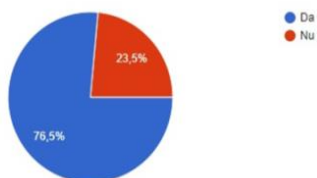
To this question 76.5% (78 people) consider that it is important that the medicines be prepared only from medicinal plants, and 23.5% (24 people) consider that it is not important that medicines be prepared from medicinal plants.

8. Ar trebui să se pună accentul mai mult pe plantele medicinale sau pe medicamentele conventionale?

102 răspunsuri

- Plante medicinale
- Medicamente conventionale
- Ambele

63,7% 34,3%
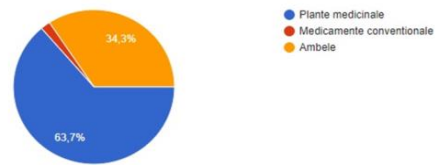
63.7% (65 people) of people who have answered the question consider that it is necessary to focus only on medicinal plants, 34.3% (35 people) consider that we should focus on medicinal plants and on conventional plants, and 2% (2 people) consider that the emphasis should be on conventional medicines.

9. De unde ați aflat de plantele medicinale si de beneficiile acestora?

102 răspunsuri

- TV
- Internet
- Radio
- De la cunoscuți

41,2% 32,4% 23,5%
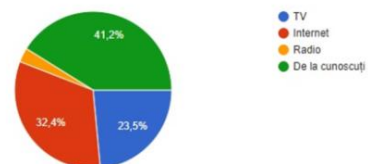
To this question 41.2% (42 people) who replied have found out about the medicinal plants from mates, 32.4% (33 people) have found out of these from the internet, 23.5% (24 people) have found out about the medicinal plants from TV, and 2.9% (3 people) have found out from the radio of medicinal plants.

10. Ați recomanda utilizarea plantelor medicinale cunoscuților?

102 răspunsuri

- Da
- Nu
- Nu sunt sigur/ă

92,2% 7,8%
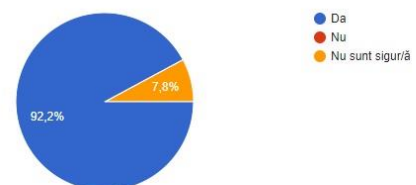
92.2% (94 people) of people would recommend products from medicinal plants, and 7.8% (8 people) would not recommend to friends.

CONCLUSIONS

Often medicinal plants are recommended as a substitute of conventional drugs, that they do not have adverse effects. Indeed these natural treatments are better tolerated by the organism from the medicines classics, but this does not mean that they have any adverse reactions.

Medicinal plants are still a sort of drugs, even if they have a price less than the face of conventional medicines and natural, even if they are one hundred percent. Medicinal plants treating certain diseases under the following conditions: to be administered in suitable concentration and to be administered in a certain period of time. In the case in which are administered properly they may have adverse effects, as well as traditional medicines. The adverse effects are caused by incorrect tinctures preparation, management of plants in incorrect quantities, the change in frequency of administration compared to the one recommended.

In certain situations medicinal plants are even more efficient than conventional medicines. They act for a range wide enough for the affections. However, they may present a very high risk to cause allergies.

By the interpretation of the questionnaire we noticed that medicinal plants are used for various diseases and in particular for cold (53% of the total number of people who replied to the questionnaire medicinal plants used for cold, and the rest of the use of medicinal plants for diseases such as: headaches, allergies, insomnia, infection or other diseases).

A large part of the people who replied to the questionnaire (86.3%) prefer medicinal plants at the expense of conventional medicines.

A percentage of 63.7% of the total number of people who replied to the questionnaire considers that it should focus on medicinal plants, which are considered by the people who replied to the questions as more beneficial than conventional medicines.

The majority of people who replied to the questionnaire (59.8%) fall in a category of age between 18-30 years, and the lowest percentage, namely 2.9%, is a category of aged over 60 years.

All people who replied to the questionnaire consider that should protect green areas.

A big percentage of people (99%) considers that some plant species in danger of extinction would be protected.

96.1% of the whole number of people have used medicinal plants for various diseases.

It is considered that it is important that the medicines be prepared only from the medicinal plants (76.5%) and the rest of the 23.5% consider that it is not important.

Most people have heard of medicinal plants from known (41.2%), while a few people have heard of medicinal plants from the radio.

A percentage of 92.2% of people who replied to the questions would recommend friends medicinal plants, and the rest of them are not sure if would recommend medicinal plants.

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SLOPE STABILITY ANALYSIS USING GEO 5 SOFTWARE IN BREBU COUNTY CASE STUDY

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Abstract

The purpose of this paper is to analyze the stability of a slope that was subsequently affected by a landslide through several methods of analysis. The well known limit equilibrium methods are conventional ways for the assessment of stability for homogeneous and layered soils. A comparison between the percentages of utilization of these methods has been done according to the norms in force. The following methods had been used: Bishop Method, Fellenius Method and Janbu Method. Landslides are phenomena that occur regularly in our country. They can cause serious damage to the environment and can endanger human lives. This article will present a case from a rural area that has been affected by such a phenomenon and its harmful consequences.

Keywords: Bishop, Fellenius, Janbu, Landslides, Limit Equilibrium Method, Slope stability.

INTRODUCTION

The DC4B communal road was affected by a landslide that caused major traffic issues. This road passes through the village of Pietricioaia and belongs to the Brebu County. This county is located in the central eastern part of the country. This area is part of the Subcarpathian arc that consists of sedimentary formations of Cretaceous and Paleogenic age.

Figure 1. Map Location

From a morphological point of view, the area shows an uneven relief. The slopes are generally varied with an arched structural shape. These slopes consist of silty clay deposits and have the appearance of forested hills, with medium altitudes, their summits having a generally rounded shape on the anticline.

The hydrographic network on the territory of the Brebu commune belongs to the hydrographic system of Ialomita through its tributary river Prahova. Prahova River receives as main tributaries on the left side of the studied area, the Doftana River and the Teleajen River.

To collect the necessary data for the assessment of the slope, 2 drillings were made in the area. The purpose of the drills was to take the necessary samples to be later tested in the laboratory, to identify the terrain stratification, the groundwater level and a possible slip surface. Shear strength tests were carried out to evaluate the shear strength parameters: angle of friction and cohesion. The samples were also weighed to determine the bulk weight.

Figure 2. On site perspective after the landslide occurred

MATERIALS AND METHODS

The slope analysis was conducted using the "Slope Stability" software which is individual program that is part of the GEO 5 software suite. It uses various norms from different countries and continents and it also includes the Eurocode norms that are used throughout Europe. The program uses conventional ways of obtaining circular and polygonal slip surfaces (Gorog and Torok, 2007).

The Design Approach 1 and 3 were used to assess whether the slope was stable or not. The following information regarding the types of soils, their physical parameters and soil stratification can be found within the Geotechnical study.

Table 1. F1 drilling

Drilling	Location	Depth(m)	Description
F1	Placed on the roadway. The P1 sample was taken at a depth of 2m and at the depth of 5m the P2 sample was taken	0-0.10	Asphalt
		0.10-1.10	Gravel
		1.10-1.50	Filling out of boulders
		1.50-3.80	Brown clayey sand with light green interlaces and sandstone fragments
		3.80-8.50	Sandy siltwith sandstone fragments

Table 2. F2 drilling

Drilling	Location	Depth(m)	Description
F2	placed on the slipped ground surface at a distance of 15m from F1. The P1 sample was taken at a depth of 2m and at the 4m depth the P2 sample was taken	0-0.30	Vegetable soil
		0.30-3.50	Yellow brownishsilty sandwith green grey interlaces
		3.50-6	Grey clayey silt with sandstone fragments, with carbonized roots

Two layers were taken into account for analysis. Their geotechnical index parameters and an overview of the model can be seen below. A distributed load of 200 kPa was assigned on the road platform.

Table 3. Soil index parameters for the first layer

Brown clay sand with light green interlaces and sandstone fragments	
Unit Weight γ	17.49 kN/m^3
Angle of internal friction $\emptyset$	24.00 °
Cohesion of soil c	23.40 kPa

Table 4. Soil index parameters for the second layer

Grey clayey silt with sandstone fragments, with carbonized roots	
Unit Weight γ	18.88 kN/m^3
Angle of internal friction $\emptyset$	17.00 °
Cohesion of soil c	27.30 kPa
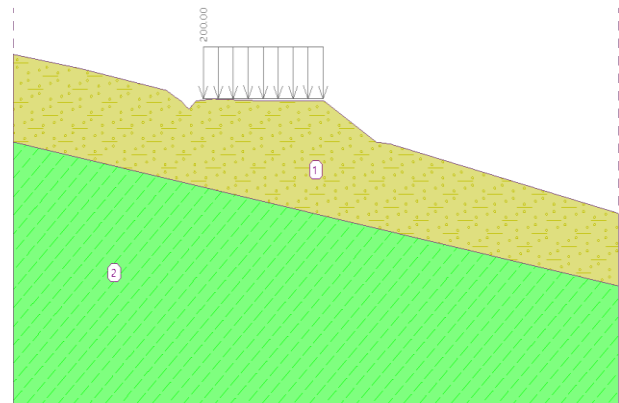
Figure 3. Overview of the model

Three methods were used to evaluate the slope's stability: Bishop, Fellenius and Janbu.

The characteristic values tabulated above will be affected by partial safety coefficients according to the norms in force for each calculation approach used (Eurocode 7). These coefficients are integrated into the software's database.

Design Approach 1 (DA1): according to EN 1997 - reduction of actions and soils parameters
C1: A1+M1+R1
C2: A2+M2+R2

Table 5. Partial safety factors for DA1

Design Approach 1			Combination 1			Combination 2		
			A1	M1	R1	A2	M2	R1
Permanent Actions	Unfavorable	γ_G	1.35			1		
	Favorable	$\gamma_{G.fav}$	1			1		
Variable Actions	Unfavorable	γ_Q	1.5			1.3		
	Favorable	$\gamma_{Q.fav}$	0			0		
Partial factor on internal friction		$\gamma_{\varphi'}$		1			1.25	
Partial factor on effective cohesion		$\gamma_{c'}$		1			1.25	
Partial factor on undrained shear strength		γ_{cu}		1			1.4	
Partial factor on unconfined strength		γ_{qu}		1			1.4	

Design Approach 3 (DA3) - according to EN 1997 - reduction of actions (GEO,STR) and soil parameters
A1/A2 + M2+R3

Table 6. Partial safety factors for DA3

Design Approach 3			A1	A2	M2	R3
Permanent Actions	Unfavorable	γ_G	1.35	1		
	Favorable	$\gamma_{G,fav}$	1	1		
Variable Actions	Unfavorable	γ_Q	1.5	1.3		
	Favorable	$\gamma_{Q.fav}$	0	0		
Partial factor on internal friction		$\gamma_{\varphi'}$			1.25	
Partial factor on effective cohesion		$\gamma_{c'}$			1.25	
Partial factor on undrained shear strength		γ_{cu}			1.4	
Partial factor on unconfined strength		γ_{qu}			1.4	

RESULTS AND DISCUSSIONS

Slope stability verification (Bishop) DA1
Combination 1

Utilization: 98.6   %
Slope stability ACCEPTABLE

Slope stability verification (Bishop) DA1
Combination 2

Utilization :   106.1   %
Slope stability NOT ACCEPTABLE
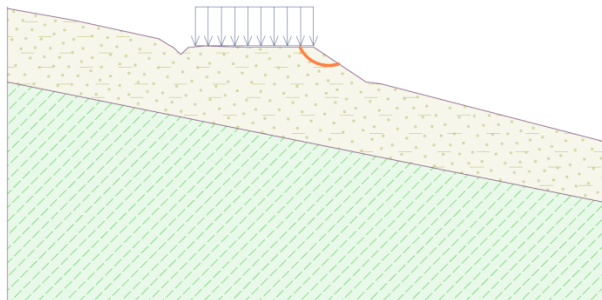
Figure 4. Slip surface Bishop DA1

Slope stability verification (Bishop) DA3

Utilization :   122.8   %
Slope stability NOT ACCEPTABLE
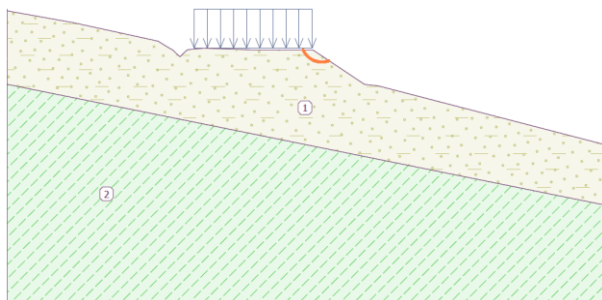
Figure 5. Slip surface Bishop DA3

Slope stability verification (Fellenius / Petterson) DA1
Combination 1

Utilization :   116.2   %
Slope stability NOT ACCEPTABLE

Slope stability verification (Fellenius / Petterson) DA1
Combination 2

Utilization :   122.6   %
Slope stability NOT ACCEPTABLE
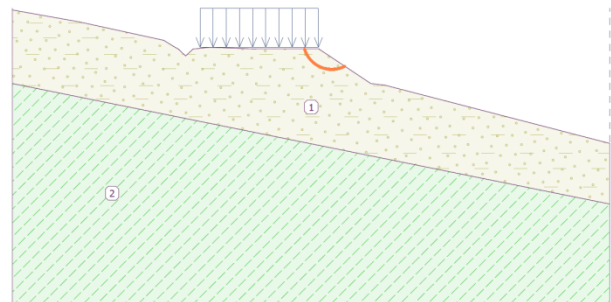
Figure 6. Slip surface Fellenius DA1

Slope stability verification (Fellenius / Petterson) DA3

Utilization :   145.4   %
Slope stability NOT ACCEPTABLE
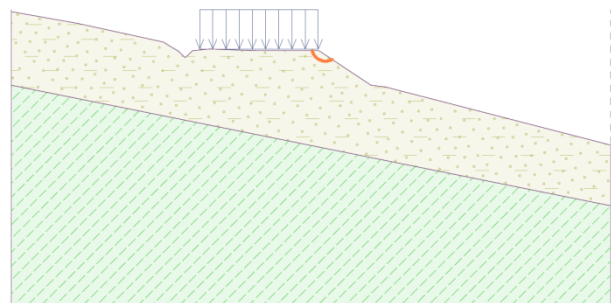
Figure 7. Slip surface Fellenius DA3

Slope stability verification (Janbu) DA1
Combination 1

Utilization: 99.0   %
Slope stability ACCEPTABLE

Slope stability verification (Janbu) DA1
Combination 2

Utilization :   106.8   %
Slope stability NOT ACCEPTABLE
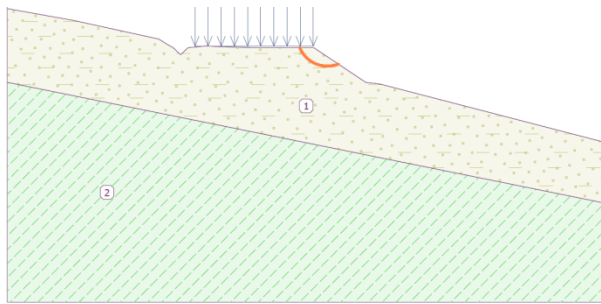
Figure 8. Slip surface Janbu DA1

Slope stability verification (Janbu) DA3

Utilization :   123.4 %
Slope stability NOT ACCEPTABLE
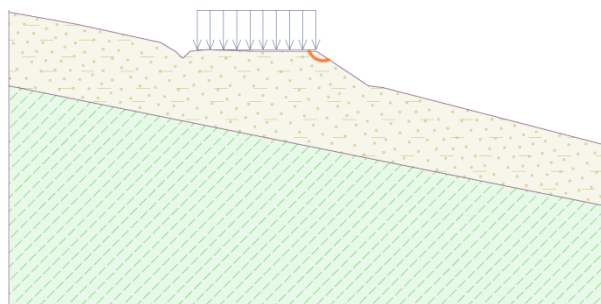
Figure 9. Slip surface Janbu DA3

It can be observed that for each of the methods applied, DA3 proved to be the most unfavorable approach. The Fellenius stability test recorded the highest percentage of utilization: 145.4%.

CONCLUSIONS

Following the evaluation of the results, it turned out that the slope was not subjected to a correct analysis in terms of stability. It is possible that at the time when the road was designed, the civil engineers did not take into account an adequate surcharge that would simulate the passing of vehicles on that road. There is also the possibility that at the time when the construction of the road began the slope stability was calculated according to the old norms, and probably following the old approaches it became apparent that the slope was stable. Landslides like these are dangerous because they can cause damage to the road structure and raise traffic and safety issues.

ACKNOWLEDGEMENTS

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TRASH OR TREASURE: AWARENESS OF THE POPULATION ON THE USE OF SEPARATE COLLECTION SYSTEMS AND RECYCLING OF WASTE

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Abstract

By studying the literature and the information available on various sites, we noticed that Sweden is the country with the most advanced and efficient waste collection and recycling system. Sweden is a top performer when it comes to sorting and recycling its waste and is in the rare situation of lacking garbage at its incineration centres, which produce enough electricity to supply 250,000 homes and heating for 950,000 homes. Swedish municipalities are individually investing in futuristic waste collection techniques, like automated vacuum systems in residential blocks, removing the need for collection transport, and underground container systems that free up road space and get rid of any smells. In the Romania, each local authority has its own system, making it difficult for residents to be confident about what they can recycle and where. We think we need more of a coherent national strategy in Romania to the collection of recyclable materials, rather than the current approach, whereby it is largely left to individual local authorities to determine their own collection policies.
Don't waste more time and money – let's get started! A holistic mindset is the key! Getting the whole system and industry involved creates the best conditions for the changes and actions needed to make waste management truly sustainable. It means getting the municipal sector (where the infrastructure is, or should to be) and the private sector (which sells the technology and services) to work together. Both inside municipalities and between municipalities!
Making this happen creates scope for long-term planning – and short-term action. For getting priorities right and starting at the right end of the chain. And for agreeing who should do what and why.
This paper aims to draw the attention of all people to the importance of separate collection of waste and reuse. For this purpose we created two questionnaires which we addressed to all categories of people in terms of age and social status. Surveys have accumulated a total of 154 and 117 responses, respectively.

Keywords: opinion poll, questionnaire, waste management.

INTRODUCTION`

Just over 40 years ago Sweden was one of the most oil-dependent countries in the world. Not surprisingly, the oil crises of the 1970s triggered calls for domestic energy alternatives that were economically sustainable. This led them to decide to collect and incinerate waste on a bigger scale than ever before. Political pressure for less waste to be sent to landfill forced them to take a long and hard look at their waste management system. And so the transition began. Working to national targets and a commitment to progress, they started searching for methods and solutions to minimize and recycle waste and to harness the resources in the waste left over. Gradually, they succeeded in introducing a resource-efficient waste management system that maximize benefits on all levels: environmental, economic and social.

Today they have one of the world's best waste management systems. A system that's constantly evolving and always focused on making the best use of resources. Less than 1% of household waste goes to landfill nowadays! In fact, the system is so effective that they have the capacity to help countries that don't yet share the opportunities they do. They can assist them by importing and handling their waste.

Their vision is to reduce waste volume even more. By 2030 they want Sweden to be the world leader in waste minimization and at using – through energy recovery and recycling

– the waste that is produced. By 2050 they expect their net greenhouse gas emissions to be zero.

In the last few decades they've acquired unique experience and know-how. Their technical solutions are world class along every step of the waste management chain. But their knowledge and technological innovation are not the most important things they've learnt about sustainable, resource-efficient waste management. The complexity lies not in technical solutions but in understanding the system and then figuring out how all parts of the system can work together.

Sweden is so good at recycling that, for several years, it has imported rubbish from other countries to keep its recycling plants going. Less than 1 per cent of Swedish household waste was sent to landfill last year or any year since 2011.

We can only dream of such an effective system in the Romania. Their system is so far ahead because of a culture of looking after the environment. Sweden was one of the first countries to implement a heavy tax on fossil fuels in 1991 and now sources almost half its electricity from renewables. "Swedish people are quite keen on being out in nature and they are aware of what we need do on nature and environmental issues. We worked on communications for a long time to make people aware not to throw things outdoors so that we can recycle and reuse," says Anna-Carin Gripwall, director of communications for Avfall Sverige, the Swedish Waste Management's recycling association.

Over time, Sweden has implemented a cohesive national recycling policy so that even though private companies undertake most of the business of importing and burning waste, the energy goes into a national heating network to heat homes through the freezing Swedish winter. "That's a key reason that we have this district network, so we can make use of the heating from the waste plants. In the southern part of Europe they don't make use of the heating from the waste, it just goes out the chimney. Here we use it as a substitute for fossil fuel," Ms Gripwell says. Ms Gripwall says the aim in Sweden is still to stop people sending waste to recycling in the first place. A national campaign called the "Miljönär-vänlig"

movement has for several years promoted the notion that there is much to be gained through repairing, sharing and reusing.

She describes Sweden's policy of importing waste to recycle from other countries as a temporary situation. "There's a ban on landfill in EU countries, so instead of paying the fine they send it to us as a service. They should and will build their own plants, to reduce their own waste, as we are working hard to do in Sweden," Ms Gripwall says. "Hopefully there will be less waste and the waste that has to go to incineration should be incinerated in each country. But to use recycling for heating you have to have district heating or cooling systems, so you have to build the infrastructure for that, and that takes time," she adds.

Romania is the country with the lowest recycling rate: only 5% of the waste is subject to recycling processes. The causes are multiple. Among these: poor waste management, low landfill taxes, and household waste payment system different from other EU countries, say market specialists. Municipal waste contains all types of waste and only in Bucharest are generated over 2,000 tons of mixed household waste per day. Of these, only 20% is waste that can be recycled.

In Romania, besides the lack of sorting waste, the collection fees for garbage are very low compared to those in the EU. A Romanian pays 18 euros per year for waste collection, while a Swedish pays six times more.

Compared with other European countries such as Sweden, the latter is the first to selective waste collection, recycling about 100% of household waste.

In Sweden, 50% of household waste is burned and used to produce energy at incineration plants.

Swedish households keep separate newspapers, plastic, metal, glass and electrical appliances, bulbs and batteries. They are collected by machines that sort them by color. Many municipalities also encourage consumers to separate food waste. And all of these are reused, recycled or composted.

The households in Târgovişte place their waste at the pre-selection centers located in the neighborhoods, markets, central areas. They are collected by road vehicles that transport them

to landfills where they are sorted for recycling in recycling centers.

Aninoasa garbage can't produce energy. This process recycles only 1% of the quantity of waste taken over.

Due to the lack of citizen education to sort and recycle household waste, there is this discrepancy between the quantities of recycled waste, between heavily developed countries such as Sweden and economically underdeveloped countries such as Romania.

The town of Târgovişte does not have an advanced technological system for collecting, sorting or recycling household waste from the population or other institutions.

In the town of Târgovişte is collected on average 1 kg of household waste per day, per person.

Aninoasa garbage collector collects 1% propylene recyclable waste. Most of these are PETs, collecting 100 tons/ month. They are transported to Green Tech Buzău for recycling.

Cardboard and paper collected, with a mass of 100 tons / month, are transported to Suceava for recycling.

The collected ferrous metals represent 20-30 tons per month and are recycled with the help of the Târgovişte Steelwork.

The collected glass has a mass of 3-4 tons / month and is transported to recycling centers in the country.

The green waste resulting from the greening of green areas in the city is 300 tons/ year. They are composted - they are chopped and stored in the form of prisms, and after 5-6 months they pass through a sorting machine and are sold.

Waste transport in Sweden is carried out with self-propelled trucks that consume biogas obtained from waste recycling, and in Târgovişte it is made with truckloads that use fossil fuel.

MATERIALS AND METHODS

Creating the form and questionnaire with Google Drive

Step 1

We have created a Google user account as a browser, we have accessed Gmail and then the "Create an account" window to enter the required information for registration asuser of all Google services.

Step 2

We went to Google Drive and then the New window that offers the submenus: "Folder","Upload a file", "Upload a folder", "Google Docs", "Google Sheets","Google Presentations", "More".

We chose the "More" window that offers the options: "Google Forms", "Drawings Google", "Google My Maps", "Google Sites", and "Sign in to multiple apps". We chose the "Google Forms" window.
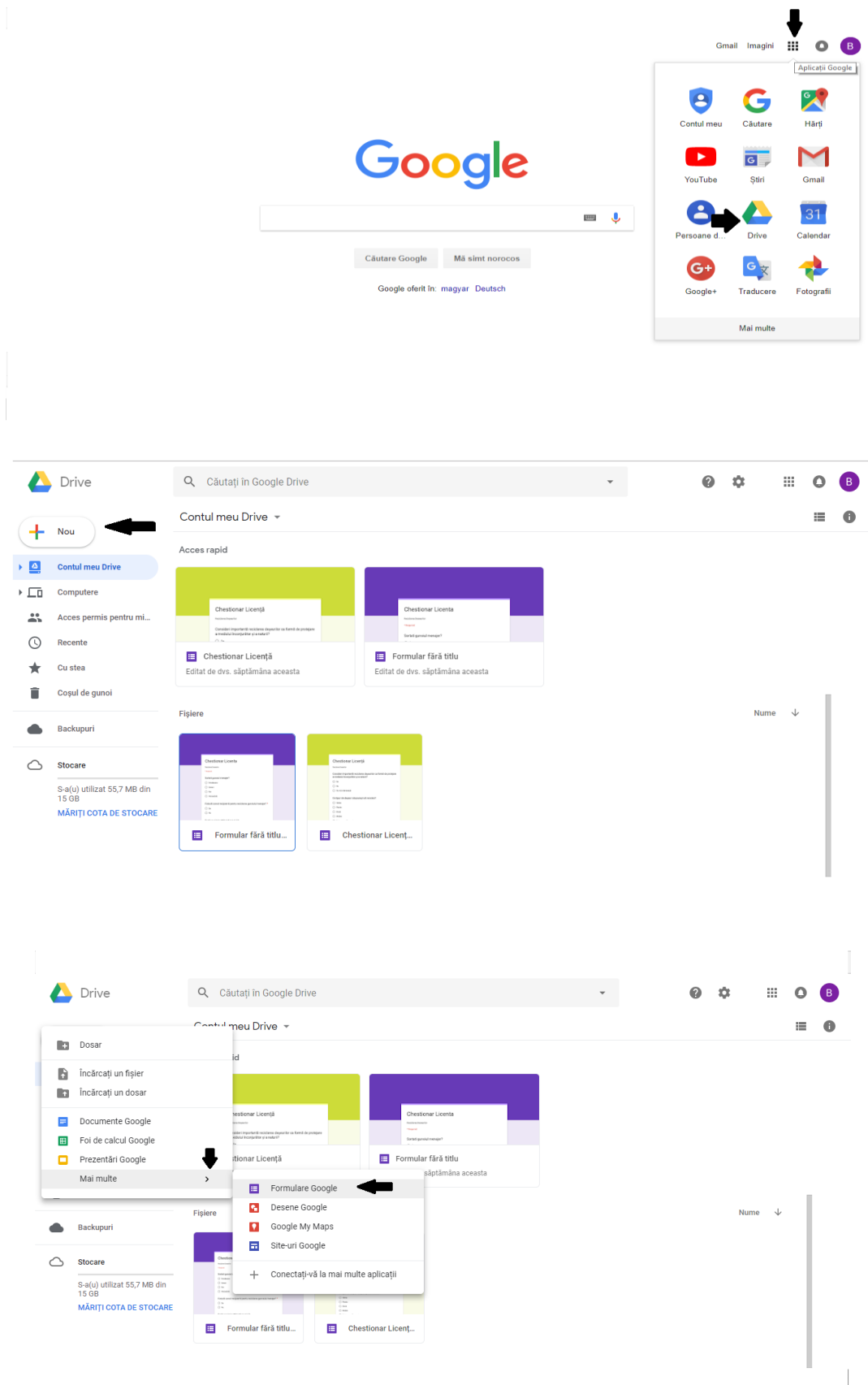
Step 3
We filled out the title of the form, the form description and we asked the first question with multiple response variants. To add another question, we went to the right icon "Add a question".

Step 4

After completing the questionnaire, we viewed it by visiting the "View" icon at the top right of the function bar. By tapping the "Send" icon on the function bar, we have submitted the questionnaire via E-mail and accessing the Link.
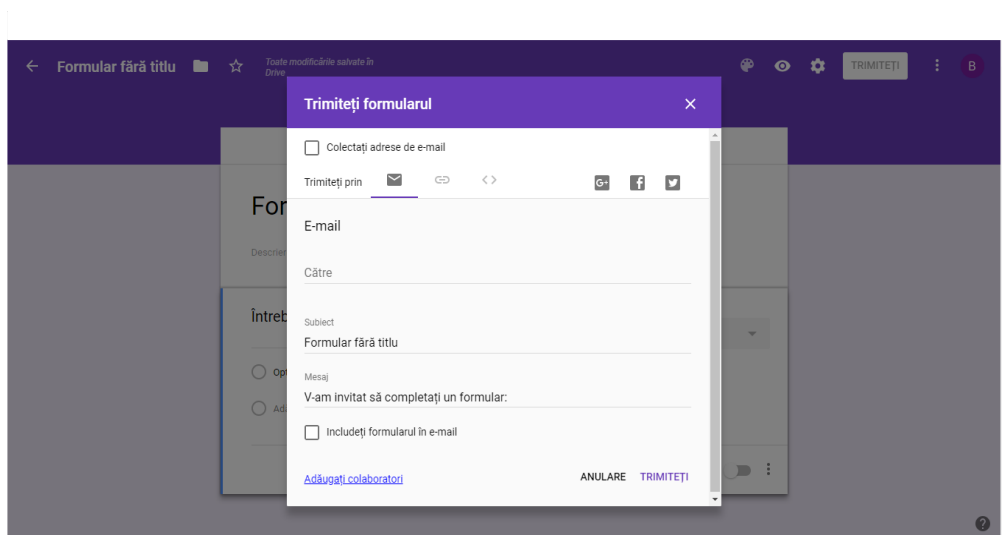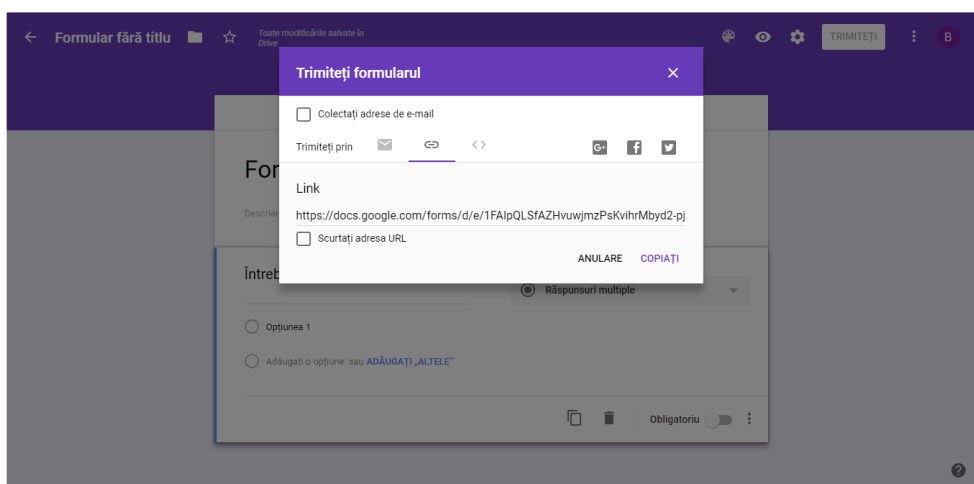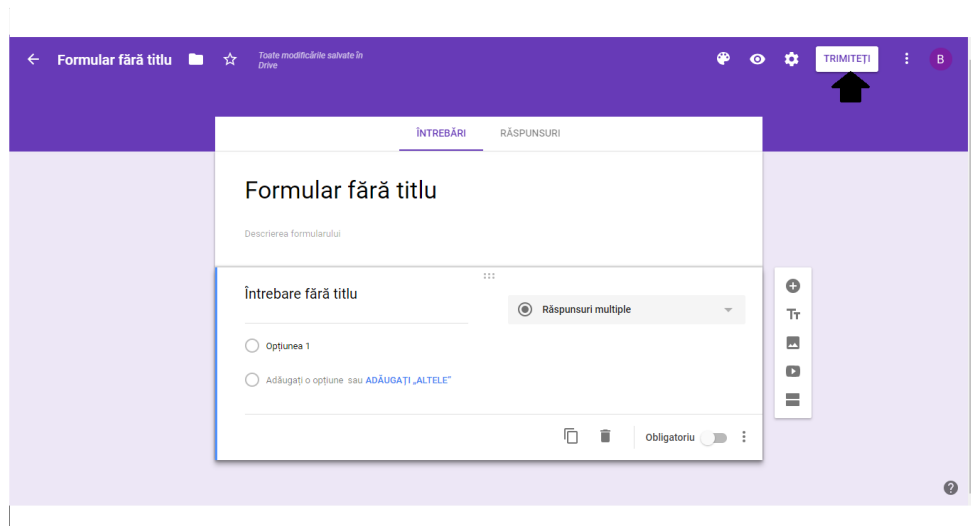
Step 5

After completing the form, viewing the answers is done by going to the "Answers" icon. This was the last step completed for observing the results and using them for the case study.
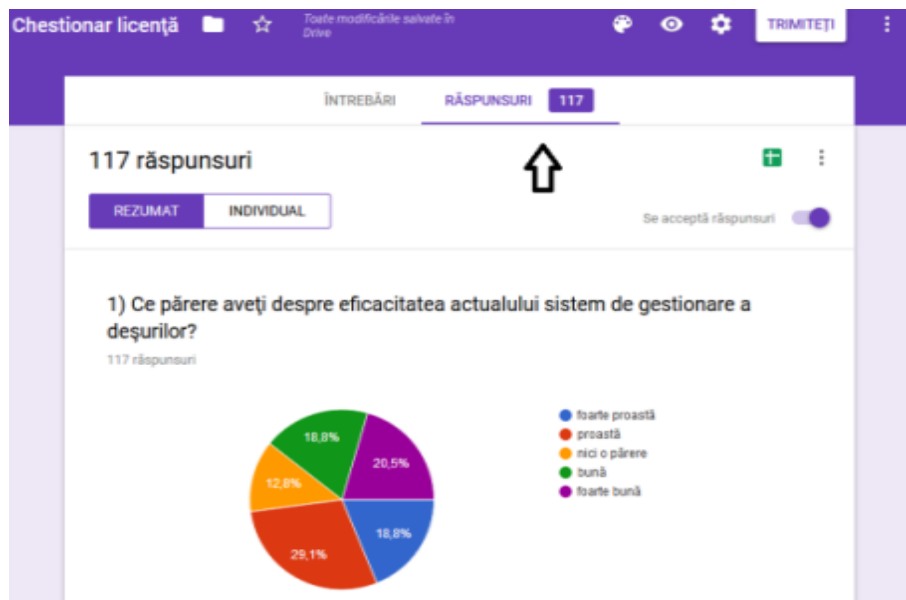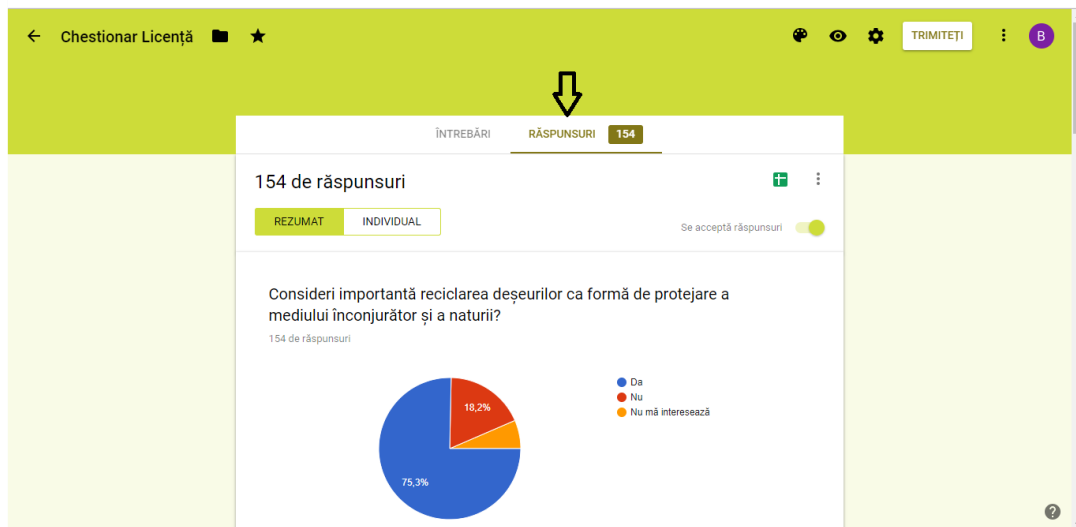
RESULTS AND DISCUSSIONS

In this first case study we will present a questionnaire addressed to all age and social categories. This study will show to what extent people are accustomed to recycling waste and what would motivate them to do it more often.

154 responses to the questionnaire were collected, these were:

The first question was to what extent waste recycling is considered to be important as a way of protecting the environment and nature.
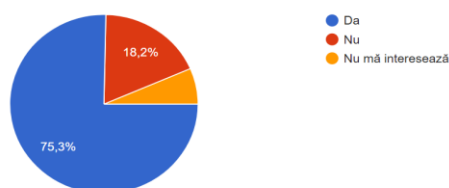
75.3% of responses considered waste recycling to be a form of environmental and nature protection.

18.2% of the responses considered it is not important to recycle waste as a way of protecting the environment and nature.

6.5% of respondents felt they were not interested in recycling waste.

The second question looked at the types of waste that people used to recycle and the answers were as follows:

Ce tipuri de deșeuri obișnuiești să reciclezi?

153 de răspunsuri

- Hârtie
- Plastic
- Sticlă
- Metale
- Echipament Electornic
- Nu reciclez nici un deșeu
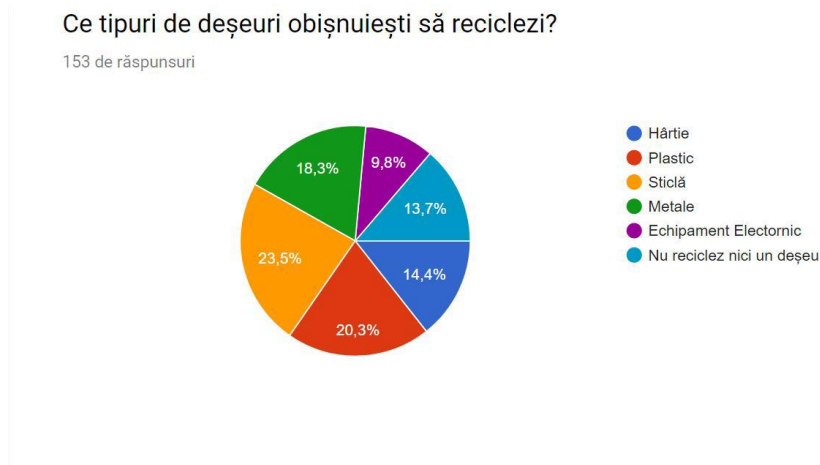
23.5% of respondents replied that they typically recycle the bottle.

20.3% of respondents said they used to recycle plastic.

18.3% of respondents said they used to recycle metals.

14.4% of respondents said they used to recycle paper.

13.7% of respondents said they did not get used to recycling waste.

9.8% of respondents said they used to recycle electronic equipment.

The third question asked the awareness of the consequences of uncoordinated behaviour towards waste recycling. The answers were the following:

Care considerați că este consecința cea mai gravă a unui comportament neorientat spre reciclarea deșeurilor ?

154 de răspunsuri

- Irosirea unor resurse naturale valoroase,materii prime care ar putea susține fabricarea altor obiecte
- Poluarea gravă a mediului datorită lipsei de biodegradabilitate
- Consecințe asupra sanatații,datorită emisiilor din momentul arderii acestor deșeuri
- Creșterea costurilor materiilor prime

43.5% of responses show that the most serious consequence of uncoordinated behaviour recycling of waste is the wasting of valuable natural resources, raw materials that would be able to support the manufacture of other objects.

29.2% of responses show that the most serious consequence of uncoordinated behaviour the recycling of waste is the serious environmental pollution due to the lack of biodegradability.

20.1% of responses show that the most serious consequence of uncoordinated behaviour waste recycling is health, due to emissions from burning of these wastes.

7.1% of responses show that the most serious consequence of uncoordinated behaviour the recycling of waste is the increase in the cost of raw materials.

The fourth question in the questionnaire concerned the knowledge of the waste collection containers of the city of residence.

The answers were the following:

Ce tipuri de containere de colectare a deșeurilor cunoașteți în orașul dumneavoastră?

151 de răspunsuri

- Coșuri de gunoi și tomberoane stradale
- Containere stradale pentru colectarea selectivă
- Containere inteligente care eliberează bonuri valorice
- Nu stiu
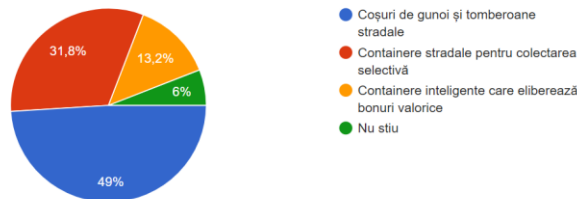
49% of responses show that subjects know the types of collection containers waste garbage bins and street litter.

31.8% of the responses show that subjects know the types of collection containers street container waste for selective collection.

13.2% of the responses show that subjects know the types of collection containers intelligent container waste releasing value vouchers

6% of responses show that subjects do not know types of collection containers waste.

The fifth question of the questionnaire refers to the main reasons for the questionnaire prevents the subjects from collecting the waste.

The answers were the following:

Care sunt motivele principale care v-ar împiedica sa colectați?

150 de răspunsuri

- Nu stiu unde găsesc containere de colectare
- Nu am in apropiere de mine asemenea containere
- Nu am timp să mă ocup de asta
- Sunt convins că deșeurile colectate de mine ajung tot la groapa de gunoi
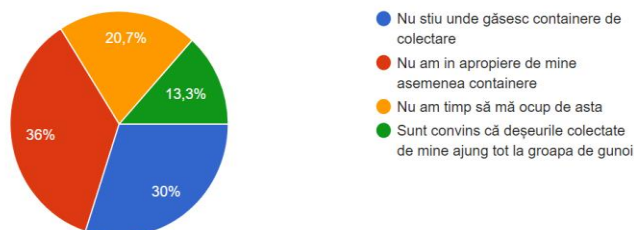
36% of the answers show that the subjects do not collect the waste because they are not in the vicinity housing their collection containers.

30% of responses show that subjects do not collect waste because they do not know where they are he could find collection containers.

20.7% of responses show that subjects do not collect waste because they do not have time enough to handle their collection.

13.3% of responses show that subjects do not collect waste because they are convinced that the waste they collect reaches the garbage dump.

The last question is whether the financial reward would help to collect more efficient waste.

The answers were the following:

Credeți că ar trebui să fiți recompensați financiar pentru colectarea deșeurilor?

154 de răspunsuri

- Da
- Nu
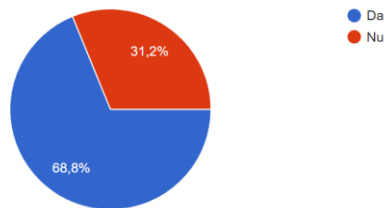
68.8% of responses showed that subjects considered they should be rewarded financially for waste collection.

31.2% of responses showed that subjects did not consider it necessary to be rewarded financially for waste collection.

In this second case study we will present a questionnaire addressed to all people.

This study will show to what extent they are accustomed to recycling and collecting household waste.

As a result of the inquiries we find that 117 responses were collected, these being the following:

The first question was to find people's opinion about the effectiveness of the current waste management system and the answers are as follows: 1) What do you think about the effectiveness of the current waste management system?

1) Ce părere aveți despre eficacitatea actualului sistem de gestionare a deșurilor?

117 răspunsuri

- foarte proastă
- proastă
- nici o părere
- bună
- foarte bună
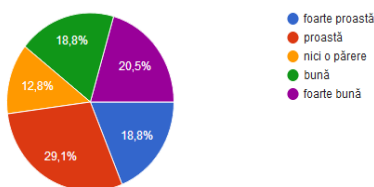
18.8% of responses considered the effectiveness of the very poor waste management system

29.1% of responses considered the effectiveness of the bad waste management system

12.8% of respondents had no opinion of how effective the waste management system.

18.8% of responses considered the effectiveness of the good waste management system.

And last but not least, 20.5% of responses considered the effectiveness of the management system to be very good.

The second question focused on the importance of selective collection and the answers were: 2) Do you think it is important to collect selectively?

2) Considerați că este important să colectăm selectiv?

117 răspunsuri

- da
- nu

nu
1 (0,9%)
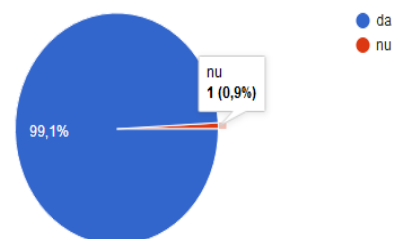
99.1% of responses believe it is important to collect selectively and only 0.9% of responses believe it is not important to collect selectively.

The third question was asked to find out if people are collecting selectively or not.

The answers were: 3) Do you collect selectively?

3) Dumneavoastră colectați selectiv?

117 răspunsuri

- da
- nu
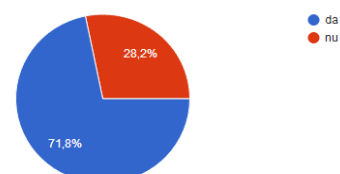
71.8% of responses responded that they collectively collected and 28.2% of responses said they did not collect selectively.

The fourth question was whether we need to protect the environment. 4) Do you think environmental protection is a necessity?

4) Credeţi că protejarea mediului este o necesitate?
117 răspunsuri

- da
- nu

100%
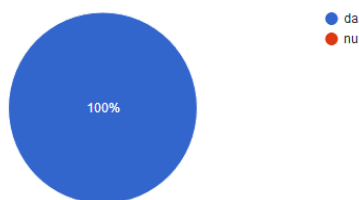
The answer was 100% that we need to protect the environment.

The fifth question is whether people are willing to recycle in order to prevent air, water and soil pollution. 5) To prevent air, water and soil pollution, are you willing to recycle?

5) Pentru a preveni poluarea aerului, apei si a solului ,sunteţi dispuşi să reciclaţi?
117 răspunsuri

- da
- nu

100%
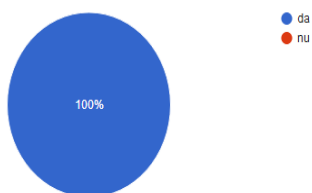
100% of the replies they thought would recycle to prevent pollution.

Question 6 is about reusing bottles and bottles from the supermarket to reduce costs. 6) Do you want to reuse bottles and jars purchased from the supermarket to reduce costs?

6) Doriţi să reutilizaţi sticlele şi borcanele achiziţionate de la supermarket pentru a micşora cheltuielile?
117 răspunsuri

- da
- nu
- nici o părere

nu
3 (2,6%)

89,7%
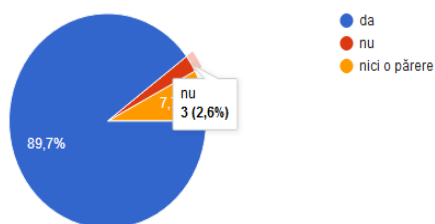
The answers are as follows: 89.7% of responses have agreed to reuse bottles and jars to reduce spending 2.6% of responses disagreed with the reuse of bottles and jars 7.7% of respondents had no opinion.

The seventh question is whether people agree with the "polluter pays" principle. 7) Do you agree with the polluter pays principle?

7) Sunteţi de acord cu principiul " poluatorul plăteşte " ?
117 răspunsuri

- da
- nu
- nici o părere

17,9%

80,3%
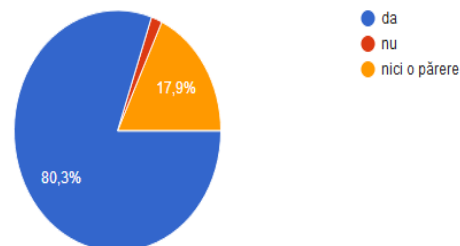
The answers are as follows:

80.3% of responses agreed to this principle

1.7% of respondents disagreed with this principle

17.9% of the answers had no opinion

Question eight focuses on how much people recycle. 8) How much do you recycle?

8) Cât de mult reciclaţi ?
111 răspunsuri

- 0-10%
- 10-30%
- 30-60%
- 60-100%
- 60-100

28,8%

27,9%

17,1%

24,3%
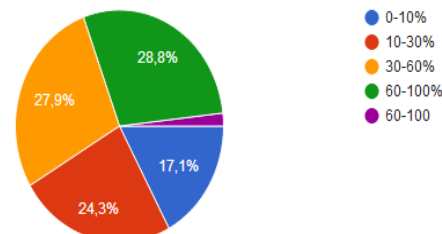
17.1% of responses responded that they recycle between 0-10%

24.3% of responses replied that it recycles between 10-30%

27.9% said they reclaim that they recycle between 30-60%

28.8% and 1.8% of responses said they recycle between 60-100%

The ninth question addresses the desire of people to recycle further if the sanitation would take selective waste. 9) If the sanitation would take selective waste, would you continue with recycling?

9) Dacă cei de la salubritate ar lua deșeurile selectiv, aţi continua cu reciclarea?

117 răspunsuri

- da
- nu

nu
2 (1,7%)

98,3%
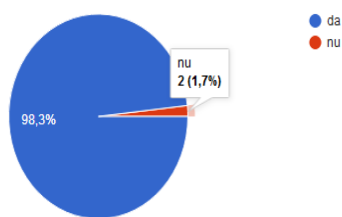
98.3% of responses agreed to continue recycling.

1.7% of responses did not agree to recycle.

And the last question, the tenth, is about waste reduction. 10) What do you think about reducing the amount of waste?

10) Ce părere aveţi despre a reduce cantitatea de deşeuri ?

117 răspunsuri

- foarte bună
- bună
- proastă
- nici o părere

nici o părere
8 (6,8%)

20,5%

71,8%
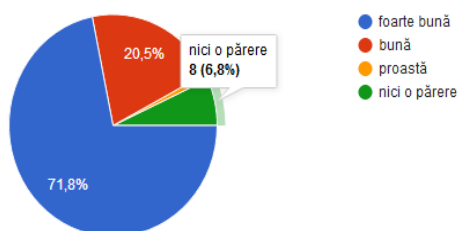
71.8% of responses had a very good opinion to reduce the amount of waste

20.5% of the responses had a good opinion to reduce the amount of waste

0.9% of responses had a bad opinion to reduce the amount of waste

6.8% of the answers had no opinion.

CONCLUSIONS

Following the questionnaire applied to 154 subjects of Romanian nationality, different age and social categories, the conclusions are as follows:

For the vast majority of subjects surveyed, ie 75.3%, it is important to recycle waste as a form of environmental and nature protection, and 24.7% of the subjects consider it not important to recycle waste as a form of environmental protection and nature or do not know.

The most important recycled materials as shown in the questionnaire are: glass (23.5%), plastic (20.3%), metals (18.3%), and the least recycled category: paper (14.4%) and electronic equipment (9.8%).

14.4% of the subjects said they did not get used to recycling waste.

Of the surveyed subjects, 43.5% consider that the most serious consequence of uncoordinated behavior towards waste recycling is the wasting of valuable natural resources, raw materials that could support the manufacture of other objects. This shows that they are aware of the risks of a behavior that neglects recycling of waste.

Of the surveyed subjects, 49.3% believe that the most serious consequence of uncoordinated behavior towards waste recycling is the serious pollution of the environment due to the lack of biodegradability. This shows that half of the subjects believe that the lack of waste recycling seriously pollutes the environment and has serious health consequences.

7.1% of the subjects consider that the most serious consequence of uncoordinated behavior towards waste recycling is the increase in raw material costs.

Half of the surveyed subjects (49%) know as garbage containers and garbage cans, so they do not use recyclable containers and do not have a waste recycling pipeline.

Approximately half of the subjects (45%) are aware of types of collection containers for selective or intelligent collection containers that release value vouchers, indicating that they are using selective waste collection containers or intelligent containers, so they have a recycling behavior waste.

6% of the subjects do not know types of waste collection containers and do not have a waste recycling pipeline.

One-third of the subjects (36%) do not collect the waste because they do not have containers to collect them.

30% of the subjects do not collect the waste because they do not know where to find collection containers.

20.7% of subjects do not collect waste because they do not have enough time to handle their collection.

13.3% of the subjects do not collect the waste because they are convinced that the waste they collect reaches the landfill.

In conclusion, most subjects believe they do not recycle waste as they do not have selective waste recycling containers in their homes.

Approximately 3/4 of the subjects (68.8%) consider that they should be rewarded for waste collection.

About one-quarter of the subjects (31.2%) do not consider it necessary to be financially rewarded for waste collection.

In conclusion, most of the subjects surveyed think they need to be rewarded financially for waste collection.

In my opinion, the Romanian state must intervene and achieve a better education of citizens regarding the selective collection of waste and the recycling of recyclable materials.

With the use of financial resources from European funding, modern waste collection and recycling systems can be built, as they already exist in other European countries such as Sweden that recycles 100% of waste.

Otherwise, if this is not the case, Romania risks drastic sanctions in accordance with the European rules in force and dispenses with a significant financial resource.

The conclusions for the second questionnaire are the following:

Pollution is a global problem, mainly caused by the large amount of waste generated.

It affects the environment and people's health. Many animal species die due to choking, especially because of plastics.

We can significantly reduce waste if we are really involved. We can help if we collect selectively and recycle as much as we can.

Thus, by making the second questionnaire, we hope to learned people about selective collection and recycling.

According to the questionnaire we have the following results:

1. How do you feel about the effectiveness of this waste management system?

To this question, 29.1% of respondents had a bad opinion and only 20.5% had a very good opinion, the highest percentage being negative.

2. Do you think it is important to collect selectively?

Most people find it important to collect 99.1% and only one person does not agree.

3. Are you collecting selectively?

This question is important to see the involvement of residents in protecting the environment by reducing pollution.

We have a 71.8% answer with affirmative answer, which is very good that more people are aware of the impact of waste on biodiversity and act. And 28.2% are those who do not collect selectively.

4. Do you think that protecting the environment is a necessity?

It is great that all who have completed the questionnaire believe we have to protect the environment, here we have a 100%.

5. To prevent air, water and soil pollution, are you willing to recycle?

As with the earlier question, we have a 100% percentage of people willing to recycle to prevent pollution, which is a very good thing.

6. Do you want to reuse bottles and jars purchased from the supermarket to reduce costs. In this question, the highest percentage of 89.7% responded affirmatively and only 2.6% responded negatively.

7. Do you agree with the "polluter pays" principle?

Here we have 80.3% to which most responded that I agree with this principle. The principle means that if a company or person causing environmental damage is responsible for it and must take the necessary repair or preventive measures and bear all the related costs.

And only 1.7% disagrees with this principle.

8. How much do you recycle?

For this question, responses with the highest percentage of 28.8% recycle between 60-100% and with 17.1% recycle between 0-100%.

9. If the sanitation would take selective waste, would you continue with recycling?

Here most people agree to recycle, which means 98.3% and 1.7% do not agree to recycle.

10. What do you think about reducing the amount of waste?

This is the last question in the questionnaire.

71.8% have a very good opinion to reduce the amount of waste, 20.5% have a good opinion and only 0.9% have a bad opinion. It is important to remember that many want to get involved in order to keep the environment clean and to be an example for all.

Most people want to selectively collect and recycle, contribute as much as they can to keep the environment clean, being beneficial to our health.

In conclusion, by engaging us in improving the environment, by collecting and recycling, we

become an example for the future generation, providing them with a clean and healthy environment.

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SOIL WATER MOBILITY: AN ALTERNATIVE LABORATORY METHOD FOR ITS DETERMINATION

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Abstract

A new laboratory method was proposed to establish an easily performed standard for the determination of mobile soil water close to real conditions during the infiltration and redistribution of water in a soil. It consisted of applying a water volume with a tracer ion on top of an undisturbed ring sample on a pressure plate under a known suction or pressure head. Afterwards, soil water mobility was determined by analyzing the tracer-ion concentration in the soil sample. Soil water mobility showed to be a function of the applied water volume. No relation between soil water mobility and applied pressure head could be established with data from the present experiment. A simple one- or two-parameter equation can be fitted to the experimental data to parameterize soil water mobility as a function of applied solute volumes. Sandy soils showed higher mobility than loamy soils at low values of applied solute volumes, and both sandy and loamy soils showed an almost complete mobility at high applied solute volumes.

Keywords: laboratory method, mobile-immobile water, pressure head, soil texture.

INTRODUCTION

Solute movement models are essential for estimating impacts of waste disposal, surface mining, and pesticide application and for predicting fertilizer efficiency and environmental impacts.

In order to extend predictions of hydraulic and preferential flow properties in modelling of solute transport processes, models usually distinguish a mobile and an immobile water fraction (Gaudet et al., 1977). Mobile is located inside the mobile pore domain (usually large and inter-aggregate pores) and immobile water is mostly located inside aggregates (small and intra-aggregate pores). Transfer by diffusion between mobile and immobile domains is proportional to the concentration difference between the mobile and immobile liquids.

A hydrological sulphur model (HYSUMO) was developed and simulates the S cycle in the soil. The soil water fractions, and plant uptake, including the mobile and immobile soil water fractions and the importance of this concept for S balance modelling have been discussed by Bloem et al., 2005 that showed the immobile soil water fraction affected leaching, nutrient availability, and groundwater pollution, storing a non-negligible part of nutrients and therefore contributing to plant nutrition.

Equipment, tracers, and the necessary equations support for deterministic or stochastic assessment of soil water mobility have been developed for both field and laboratory conditions (Clothier et al., 1992; Jaynes et al., 1995).

To improve and validate a model like HYSUMO it is necessary to develop a non-steady state method that allows the quantification of the mobile and immobile soil water fractions under non-equilibrium conditions. In this paper a laboratory method for this determination is described.

MATERIALS AND METHODS

Undisturbed soils samples (0.04m high; 0.056m diameter) were collected from four German soils, differing in texture, physical

properties and groundwater conditions, at a depth between 0.05 and 0.15m (Table 1).

Table1. Physical characteristics of the to soil and groundwater conditions of the investigated four soils

Soil	Bulk density	Clay	Silt	Sand	GW deep
	kg m^{-3}	----------------g kg^{-1}----------------			m
Loam 1	1492	260	470	270	2.3
Loam 2	1480	310	510	180	1.5
Sand 1	1426	100	80	820	5.5
Sand 2	1140	120	120	760	0.8

From each soil, 45 undisturbed samples were used to perform the hydraulic pulse experiment and 3 to determine soil water retention at selected pressure heads (-5, -10, -20, -40, -60, and -100 cm). One of the retention samples of the loam 1 soil showed very different results compared to the others samples and was thus not consideredin subsequent analyses. For hydraulic characterization, retention data were fitted to the van Genuchten (1980) equation:

$$\Theta = [1 + |\alpha h|^n]^{(1-n)/n} \qquad (1)$$

with:

$$\Theta = (\theta - \theta_r)/(\theta_s - \theta_r) \qquad (2)$$

where Θ is soil water fraction, θ, θ_s and θ_r are water content, saturated water content and residual water content (m m^{-3}), respectively, h is the pressure head (cm), α (cm^{-1}) and n are empirical parameters.

To allow calculating the soil water mobility, a non-reacting, non-absorbing and easy to detect ion was used as a tracer. Chloride was chosen in this study and to assure that soil samples were totally equilibrated to a known concentration (C_0) of the ion, initial tests were performed and showed that it took a considerable time for soil samples to equilibrate by diffusion. Therefore, samples were left in a chloride solution for 28 days and ceramic plates were equilibrated to the same concentration for 24 h. Samples were put on the suction plate to equilibrate hydraulically to a pressure head (h) equal to -5, -10, -20, -40 and -60 cm. Filter paper was put on top of the samples and different volumes of solution (0.5, 1.0 and 2.0 times of the mean sample pore volume) with a chloride concentration C_1 was applied on that. Sample and porous plate were then covered to minimize evaporation.

Twenty four hours after C_1 application samples were analysed. On third of the sample was used to determine the soil water content and the remaining part to measure the chloride concentration [Cl$^-$] in the soil solution. For this, the soil samples were shaken with 50 mL deionized water for 24 h. The suspension was then filtered through Schleicher & Schuell No 593 filter paper and analyzed with a Cl specific electrode (S7, Mettler Toledo), from which [Cl$^-$] in the soil solution (C_s, mol L^{-1}) could be recalculated.

Supposing chloride diffusion to be negligible, the values of C_0, C_1 and C_s allow to estimate the mobile and immobile soil water fraction relative to the soil water content (Θ_m and Θ_{im} respectively, in m^3 m^{-3}) (Clothier et al., 1995):

$$\Theta_m = (C_0 - C_s)/(C_0 - C_1) \qquad (3)$$

$$\Theta_{im} = (C_s - C_1)/(C_0 - C_1) \qquad (4)$$

Values for mobile and immobile water contents were thus obtained as a function of pressure head and applied pulse volume.

RESULTS AND DISCUSSIONS

The observed soil water retention curves are shown in Figure 1. The sand soils especially sand 1 showed a high porosity in the lower suction ranges. Sand 1 released more than half of its water at a pressure head around -50 cm.

The loamy soils showed little variation in water content up to -100 cm. Thus, higher water mobility as well as greater differences between the investigated pressure heads could be expected for the sandy soils.

Mathematical analysis of Eq. showed that a high value of α was associated to an inflection point (*i.e.*, a maximum porosity) at low values of h, corresponding to a high macroporosity. However, values of n close to 1 led to a low inclination at the inflection point, smoothing the porosity distribution and making its maximum less significant. This was the case for loam 2. In general, high values of α are expected to be associated to higher water mobility.

The experimentally determined mobile fractions are shown in Figure 2.
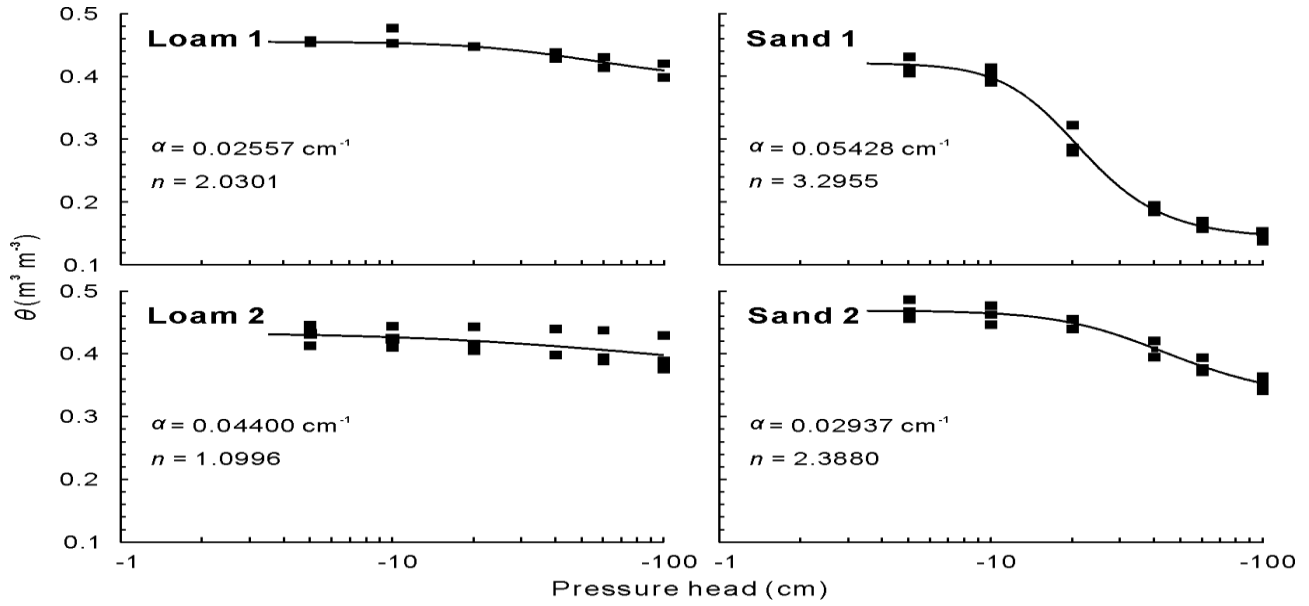
Figure 1. Water retention curves for the investigated loamy and sandy soils without (loam 1 and sand 1) and with (loam 2 and sand 2) groundwater influence
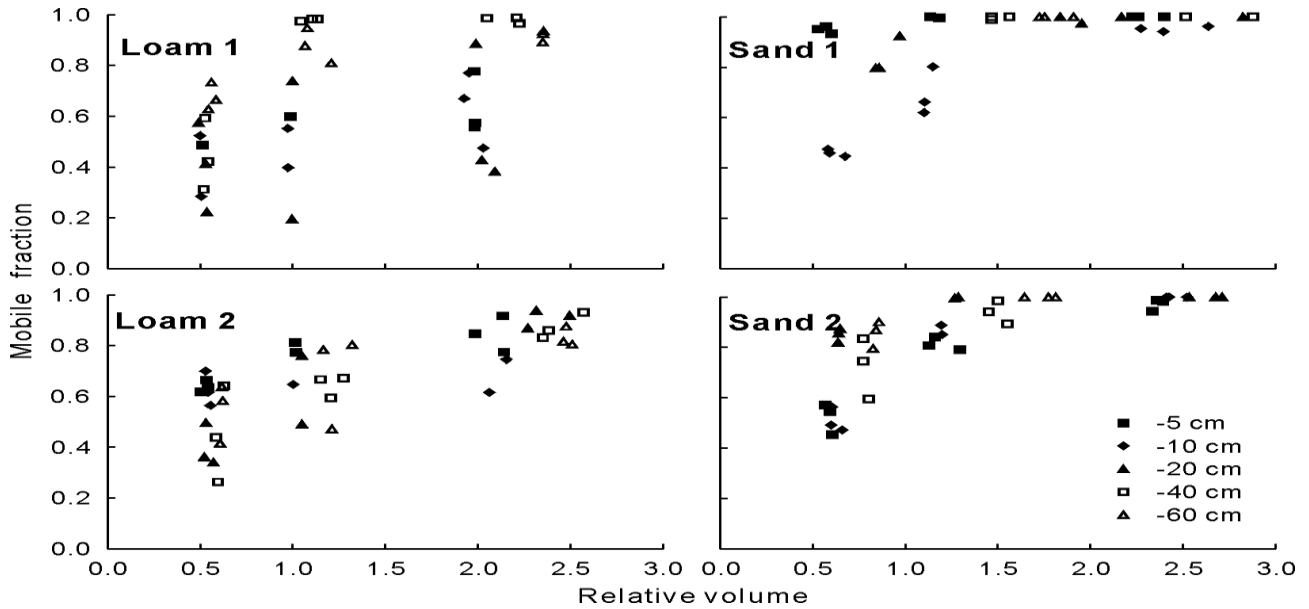
Figure 2. Calculated mobile water fraction relative to the soil water content in the investigated loamy and sandy soils without (loam 1 and sand 1) and with (loam 2 and sand 2) groundwater influence, as a function of the relative applied solution volumes determined at five different pressure head

While the applied volumes V a equalled 0.5, 1.0 and 2.0 times of the mean sample total pore volume, results were expressed as a relative applied volume v, defined in function of the applied volume and the sample water content at the respective pressure head:

$$v = V_a / V\theta_h \qquad (5)$$

where V is the total sample volume and θ_h is the water content at a respective pressure head. The retention data for the sandy soils showed a greater water content range on the studied pressure head intervals, corresponding to a higher dispersion of v values.

The two sandy soils, but especially sand 1, showed mobile water fractions close to 1 even for small relative volumes of applied water. A distinct tendency for different pressure heads were not observed from these data, indicating that almost all water fractions participated in movement within the studied pressure head range. This is in agreement with the general idea that water in sandy soils is retained in interconnected pores with large diameters. The

41

loamy soils showed higher immobile water contents. In the case of loam 1, there seemed to be a tendency of increasing Θ_m at higher pressure heads. Higher Θ_m in drier conditions is to be expected, as very large pores, responsible for almost all water transport and thus reducing Θ_m under wet conditions are not available for transport at higher pressure heads.

To quantify soil water mobility, a simple asymptotic equation is suggested to be fitted to data:

$$\Theta_m = v/ (\alpha + v) \tag{6}$$

where the dimensionless parameter *a* determines the shape of the curve. Low values of *a* indicate a steep curve, which reaches high values of Θ_m at low values of *v*. No significant differences in *a* values were found between different pressure heads, but regression to all data obtained for one soil led to significant differences between the sandy and loamy soils (Table 2). This suggested a significant correlation between α and n from Eq. and *a* from Eq. 6, however, present data were insufficient to confirm this hypothesis.

Table 2. Mean values and 95% intervals for parameter a (Eq. 6) for the different investigated loamy and sandy soils

Soil	Mean	95% minimum	95% maximum
Loam 1	0.5311	0.3665	0.6958
Loam 2	0.4947	0.4118	0.5776
Sand 1	0.1623	0.1010	0.2236
Sand 2	0.2286	0.1722	0.2851

Eq. 6 yields $\Theta_m = 0$ for $v = 0$ and tends to 1 for high values of *v*. Alternatively, a parameter might be added to Eq. 6 to account for the fact that, especially in soils with higher clay contents, a fraction of soil water might be immobile even at very high flow volumes. Thus:

$$\Theta_m = v\Theta^*_m/ (\alpha + v) \tag{7}$$

where Θ^*_m represents the high flow volume mobile fraction. Regressions to this equation with present experimental data resulted in values for Θ^*_m close to 1 for all soils, indicating that was (almost) no immobile water in these soils at very high flow conditions.

CONCLUSIONS

Soil water mobility was shown to be a function of applied water volume and could be parameterized by fitting a simple one- or two-parameter equation to experimental data. However, no relation between soil water mobility and pressure head could be established with data from the present experiment.

Sandy soils showed higher mobility than loamy soils at low values of applied solute volumes. As a consequence, under less intense leaching scenarios common to the studied region in Germany, nutrient retention in the immobile water fraction should be taken into consideration in these soils. The establishment of physical relations between soil water mobility and other soil hydraulic functions should be an object of further investigation, allowing the more routinely determined retention and conductivity properties to be translated in soil water mobility.

ACKNOWLEDGEMENTS

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GENERAL ASPECTS REGARDING NATURAL AND SYNTHETIC ADDITIVES IN FOOD

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Abstract

Since the dawn of man, our species searched for better ways to feed themselves, by developing more efficient methods of hunting, animal / vegetable domestication, food preservation by physical methods, and finally, by adding molecules to food in order to enhance flavours or to preserve it.
Today, more than 2500 additives are intentionally added to food in order to keep certain properties or to extend shelf life, while many others were banned throughout the years, some of them at a global level and others only in specific countries. In essence, food additives are substances added to food to preserve flavour or enhance its taste, appearance, or other qualities.
We distinguish two important categories of food additives: artificial and natural ones. No matter the origin is, they both present advantages or disadvantages. On the one hand, synthetic substances are, obviously, cheaper and easier to produce than the natural ones, but in the same time they can be the major cause of a variety of diseases. On the other hand, natural substances are an easier way to a healthier life, if they are used in the right doses. Also, we have to be aware that their price can be even twice higher compared to the artificial additives.
This paper attempts to highlight the benefits of natural additives, their synergy and potency as a great leap from synthetic additives that in most cases have a single effect on food.

Keywords: natural additives, synthetic additives, benefits.

INTRODUCTION

Since the dawn of man, our species searches for better ways to feed itself, by developing more efficient methods of hunting, animal/vegetable domestication, food preservation by physical methods, and finally, by adding molecules to food in order to enhance flavours or to preserve it.

Back in the 1800s, food additives were intentionally used for food adulteration. Years later, the availability of effective methods for food analysis, together with regulatory pressures, started to reduce the significance of this problem. In the middle of the 20th century, processed food became an important part of human nutrition, and legal chemical additives became increasingly prevalent in them.

Today, more than 2500 additives are intentionally added to food in order to keep certain properties or to extend shelf life, while many others were banned throughout the years, some of them at a global level and others only in specific countries (Ackroff, 2014; Ackroff, 2016).

As for their purpose, food additives are substances added to food to preserve flavour or enhance its taste, appearance, or other qualities. Some additives have been used for centuries; for example, preserving food by pickling (with vinegar), salting, as with bacon, preserving sweets or using sulphur dioxide as with wines. With the advent of processed foods in the second half of the twentieth century, many more additives have been introduced, of both natural and artificial origin. Food additives also include substances that may be introduced to food indirectly (called "indirect additives") in the manufacturing process, through packaging, or during storage or transport (Arias-Carrión, 2010).

METHODS AND MATERIALS

For preparing this review, the search for scientific paper was carried out considering the following key words: 'Natural Additives',

'Synthetic additives' or 'ADHD'(attention deficit hyperactivity disorder), on the database PubMed (US National Library of Medicine, National Institute of Health) and ScienceDirect (the leading platform of peer-reviewing literature).

After the examination of the found titles, there were selected only the titles of the articles that include information about food additives and human body's health. For an advanced selection, there were applied the following filters: publications after 2007, English and Romanian articles. The bibliography was studied with the intention of finding the most relevant articles for the aim of this review. The results of recent studies were considered before the older hypothesis and, after that, the information was systemized, so the present paper presents the main issues regarding the contemporary vision of nowadays, natural and artificial substances added on food.

EUROPEAN REGLEMENTATIONS

In the European Union, the use of additives is based on very strict requirements about their replacement and the need to use them. An additive, in order to be marketed and used, has to be on the Union list of allowed additives (community's legislation based on the so-called "positive lists"). Basically, if an additive is on such a list, it means that it has been undergoing evaluation, which concluded that at the intended dose of use it does not have problems which could affect consumers' health (risk assessment test). Also, a reasonable technological need for its use is prove, its use does not mislead the consumer (concerning the nature, freshness, quality or quantity of the used ingredients) and it complies with specific purity to requirements (so that the substance itself is safe and won't occur problems regarding the use of additives in foodstuffs because of contaminants such as heavy metals).

The whole process of evaluating and authorizing food additives requires human and material resources, the costs being particularly high in the case of new additives introduction, but the aim is ensuring the European consumer's food safety who is protected from any potential risks caused by food additives (Zugravu, 2008).

A substance can or cannot be an additive. It depends on the circumstances. For instance, in the purification of cooking salt, it is not permitted the usage of iodine or sodium iodate as food additives. Although, these substances are used at the iodination of salt, because it represents a healthy source for human body needs. In this situation, the sodium iodate is not considered an additive, but a source of minerals. Moreover, the sodium ascorbate and the calcium carbonate are two substances that can be used as additives, but also as sources of nutrients in food supplements or fortified foods.

It is not enough that an additive does not have negative effects over health. Its usage must be technologically motivated, otherwise it is not allowed to be used.

Another always important aspect is the labelling, because it is directly connected with the right informing of the consumer. The main concern when labelling is that the consumer needs to be aware of what he is buying (in terms of ingredients, properties and other characteristics of the food) costumer's health is protected and the product can be used without risks (whether we talk about allergens, persistence, storage conditions or usage information) (Zugravu, 2008).

CLASIFICATION

Within the EU, food additives are divided into 26 functional classes, depending on their function in food and registered with an 'E' number: sweeteners, colorants, 'preservatives' antioxidants, carriers, acids, acidity regulators, anticaking agents, antifoaming agents, bulking agents, emulsifiers, emulsifying salts, firming agents, flavour enhancers, foaming agents, gelling agents, glazing agents, humectants, modified starches, packaging gases, propellants, raising agents, sequestrants, stabilizers, thickeners, and flour treatment agents (Council Regulation 1333/2008) (Table1).

Table 1.The 'E' number of food additives

E number	substance
E100 – E199	Colorants
E200 – E299	Preservatives
E300 – E399	Antioxidants and acidity regulators
E400 – E499	Thickeners, stabilizers & emulsifiers
E500 – E599	pH regulators & anti-caking agents
E600 – E699	Flavour enhancers
E700 – E799	Antibiotics
E900 – E999	Miscellaneous (e.g. foaming agents, waxes)
E1000 – E1299	Various additives
E1400 – E1499	Modified starches
E1500 – E1525	Artificial flavors and solvents for flavorings

The American approach of food additives narrows down the number of classes and allows additives to be mentioned in 2 or more classes. According to the FDA (Food and Drugs Administration), there are more than 3000 food additives allowed in the United States, which are distributed into 6 groups: Preservatives, nutritional additives, colouring agents, flavouring agents, texturizing agents, and miscellaneous agents (Alonso, 2015)

The preservatives group is divided into 3 subgroups, although some additives may serve more than 1 function in foods: antimicrobials, antioxidants, and antibrowning agents. Within the flavouring agents group, there are 3 subgroups: the sweeteners, the natural or synthetic flavours, and the flavour enhancers. The texturizing agents comprise emulsifiers and stabilizers. Finally, the miscellaneous agents are composed of many classes: chelating agents, enzymes, antifoaming agents, surface finishing agents, catalysts, solvents, lubricants, and propellants (Branen and others 2001). Despite the various classes of additives and the different classifications used, they can be divided in 4 fundamental groups with regard to their origin and manufacture: natural additives (obtained directly from animals or plants); similar to natural additives (produced synthetically imitating natural ones); modified from natural (natural additives that are then modified chemically); and finally artificial additives (synthetic compounds).

ARTIFICIAL ADDITIVES

When it comes to artificial additives, it is easy to understand that there are lots of topics to be debated. As the name states, it is a substance invented by man to improve different characters in food. But what man did not expected was that his product would have secondary negative effects.

There are positive and negative sides on each topic, so even artificial substances have their qualities. Synthetic additives improved and developed the entire food world, giving it a new aspect and booming the standard level of people expectations (Ackroff, 2012; Akihisa, 2007).

As a general knowledge, the most 3 important man's needs are water, food and the need for reproduction, so each of them represent the key point for some of the greatest industries. Nowadays, we live in the speed, but also the obesity century, so the demand for food has grown surprisingly. The big companies tried to reproduce what nature gives us in small quantities, which involves lower costs for bigger amount of additives. The final result is the variety of food additives, the diversity of food assortments and the special aspects and tastes that make the human brain release the hormone of happiness, the well-known "dopamine".

On the other hand, it is obviously that any chemical substance added on food can cause a lot of health diseases such as obesity, neuronal diseases or ageing (Figure 1).
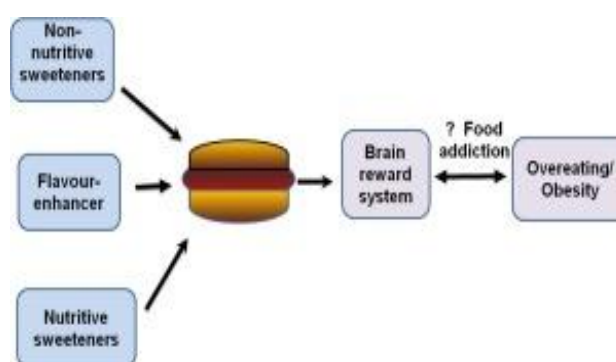
Figure 1. Dependence between additives and obesity

Studies have shown that certain foods or their additives appear to induce reinforcement behaviours that are similar to or possibly exceed those associated with drug addiction. Another topic that is debated today refers to the possibility of artificial food adds of causing attention deficit hyperactivity disorder (ADHD) on children. It is very important to know ADHD has increased in the last 20 years. The increase may be due to more accurate

diagnosing or it could be partially related to the preservatives and other food additives that children consume.

NATURAL ADDITIVES

On the other side of the topic there are natural additives. But what do we really know about them? Are natural additives shedding some light on the controversy of food additives or creating more entropy? For some decades now, natural food additives have been gaining more interest both from the public and food manufacturers. Generally, the middle-income consumer will choose food at a lower cost, but the high class of the society prefers choosing a food containing natural additives over synthetic ones (Ackroff, 2010; Ackroff, 2013).

In a time where the public is more aware and interested in what they eat, natural additives have been gaining interest both from the food industries and the consumers. Some studies show that consumers prefer food prepared with natural additives rather than chemical ones, due to health reasons. Although quite promising, natural additives still face some drawbacks and limitations as well as conflicting information (Avena, 2008).

For example, the additive called Annatto is yellowish orange and is obtained from the seeds of the tropical tree Bixaorellana. It has been reported as an occasional cause of urticaria and anaphylaxis. Saffron, from the flower of Crocus sativa, is another yellow food colouring that has been reported to cause anaphylaxis in patients. Both have also positive aspects making the food tasty and good looking in the same time.

Tartrazine-a synthetic azo dye- has been reported as a rare cause of urticaria and may increase bronchial reactivity in children with asthma. There is a general belief and some confusion about cross-reactivity between tartrazine and acetylsalicylic acid. Increased hyperreactivity to tartrazine in patients with asthma and who are aspirin sensitive was reported in a few studies but not by others. Tartrazine, a widespread food colorant has been linked to irritability, restlessness and sleep disturbance in children (Figure 2).
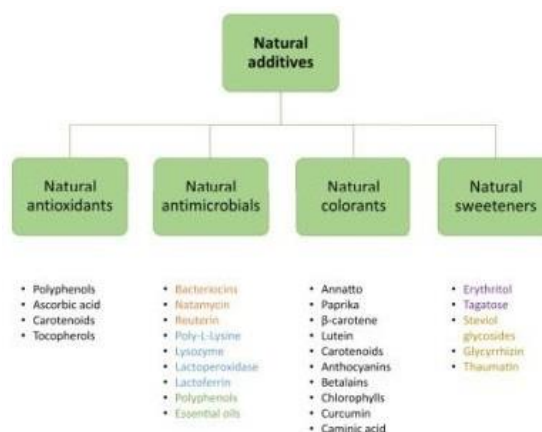
Figure 2. Natural Additives Classification

The benefits of natural additives are, anyway,almost endless, their synergy and potency is a great leap from synthetic additives that carry out, in most cases, only one effect over the food. While synthetic compounds have just a single aim, when it comes to the natural ones things look differently. Used properly, they can have good influence to people's health or provide severe diseases such as cancer, diabetes or depression. For instance, beta carotene is a red-orange pigment used as antioxidant, colorant, raw material for vitamin A and also may slow down cognitive decline (Anton, 2010; Apovian, 2014)

An aspect that can be expected is that not even nature is perfect. A major disadvantage of natural adds is the big amount of money needed to extract them and, in addition, their capacity to enhance flavours is not always uniform (Astbury, 2013; Astbury, 2014).

Moreover, in the latest decade, food industry developed a new exotic brunch, forgetting about the toxicity of some natural substances. Products compounded of marijuana and cannabis constitutes, today, the well-known "high cuisine". Brownies are among the most common food products infused with marijuana, however, almost any food product may be infused with marijuana. In addition to placing marijuana directly in food, marijuana-infused cooking oil can be used when frying or searing different products, and marijuana-infused butter can be spread directly on prepared food. Cannabis is another secret ingredient for fine tastes and it starts to be added in the most of luxury dishes. What people overlook is that these hallucinogen substances keep their

properties and may causes severe health problems (Alcaraz-Iborra, 2014).

CONCLUSIONS

To conclude, what we all can expect is the fact that any chemical substance added on food can cause a lot of health diseases such as obesity, neuronal illnesses or aging. Certain sources proved that some foods or their additives appear to induce reinforcement behaviours that are similar to drug addiction.

All in all, even though natural additives have their weaknesses, those are overlooked by the advantages of eating something natural over some synthetic products. Used properly, these additives can balance a right diet for a healthy body, because, all that truly should matter would be a healthy living and every person's aim should become 'Mens sana in corpora sano'.

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ASSESSMENT OF ECONOMIC FLOOD DAMAGE: A CASE STUDY IN SWITZERLAND

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Abstract

Floods remain one of the major causes of natural disasters affecting society. The consequences of floods to man on a world wide scale have been well documented. Damage assessments of natural hazards supply crucial information to decision support and policy development in the fields of natural hazard management and adaptation planning to climate change. Thus, in this paper we want to bring to the forefront the modern monitoring tools, such as drones for image acquisition and data processing software to possible flood-affected areas, and an economic assessment of the losses due to them.

Keywords: economic evaluation, flood damage, Pix4D Software, UAV.

INTRODUCTION

Worldwide, there is a need to enhance our understanding of vulnerability and to develop methodologies and tools to assess vulnerability. One of the most important goals of assessing coastal flood vulnerability is to create a readily understandable link between the theoretical concepts of flood vulnerability and the day-to-day decision-making process and to encapsulate this link in an easily accessible tool.

Damage assessments of natural hazards supply crucial information to decision support and policy development in the fields of natural hazard management and adaptation planning to climate change. Specifically, the estimation of economic flood damage is gaining greater importance as flood risk management is becoming the dominant approach of flood control policies throughout Europe (Merz et al,. 2010).

This study deals with an assessment of flood vulnerability zones in the West part of Switzerland by using a hydrological technique based on some measurable physical characteristics of flooding and vulnerability factors. This area is predisposed to floods, due to leakage from the slopes in case of torrential rain or appearance of a break of the river La Glanefrom the vicinity of city La Pierraz and Romont. An image from that area can be observed in figure 1, when a main road between Vaulruz and Romont was closed because of flooding and several smaller residential roads were also impassable, on the 12 December 2017, according to National News, worldradio.ch.

Figure1. The main road between Vaulruz and Romont

MATERIALS AND METHODS

In order to acquire the images an eBee Classic drone was used (Figure 2) with a SenseFly S.O.D.A sensor. The SenseFly S.O.D.A. is the first camera to be built for professional drone photogrammetry work. It captures amazingly sharp aerial images, across a range of light

conditions, allowing you to produce detailed, orthophotomaps and ultra-accurate 3D digital surface models (Figure 3).

Figure 2. SenseFly eBee Classic

Figure 3. SenseFly S.O.D.A.
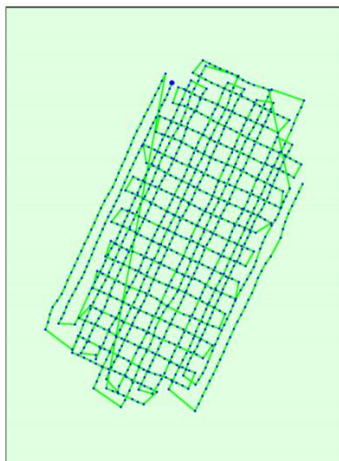
Figure 4. Top view of the initial image position.

The fly was made on the 20 November 2018. The surface targeted it was about1.335 km2 / 133.4981 ha. 1075 images were taken, the average Ground Sampling Distance (GSD) was 3.77 cm, and the time of the fly was 45 m and 21 s. So, according to the flight plan, the drone route it can be analyse in fig. 4. The green line follows the position of the images in time starting from the large blue dot.

The pre-flight plan it was made in Pix4Dcapture application, where it's set all the parameters of fly.

After taking all the pictures, the orthophotomap and the digital field model was drafted with the help of the software Pix4D in cloud. These images are available on the official site of SenseFly in educational purpose. When the orthophotomap is ready, we create 3D model, the elevation and the surfaces.

This software enables data processing online, precisely to be as user-friendly as possible due to the needs of the PC and a dedicated video card that is not so affordable. Pix4D is an image processing software from drones and UAVsand allows to plot orthophotomaps and digital terrain models in on-line cloud with Cloud and local processing. Pix4D offers a 15-day trial of the product after which it can be purchased as a subscription.

RESULTS AND DISCUSSIONS

In the next figure it can be seen the digital model of the field in 3D version and with the determination of the elevation. So, we can see a level difference of 269 m between higher point, which was positioned on the hill at 1123 m, and the lowest point of 854 m altitude. This lowest point was positioned at the level of house construction and this is the reason of the lightly flooded area. This level differences put in danger approximate 85 houses and historical buildings from Romont, Switzerland (Figure 5).

Figure 5. Digital Terrain Model (DTM)

According to plan 2D shown in figure 6, it can made determination of the real estate vulnerable to floods. With the orthophotomap and 3D model of fields it can be observed the houses, public buildings, historical monuments, roads, electricity network, agricultural areas which belong to the landscape. So, according determinations of altitude, it's confirmed that

this city is into a valley and it is vulnerable in case of torrential rain.
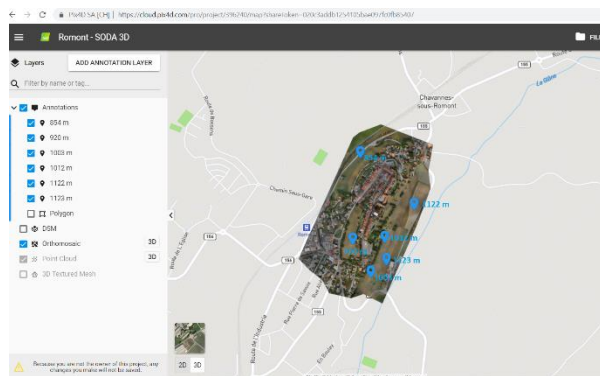
Figure 6. The determination of the quota and surfaces

In the next figure was determinate the limits of the flood areas. The vulnerability area has been divided in three zones with differential economic assessment: the first area of 17,3 ha includes agricultural lands, the second area of 15,33 ha includes historical monuments and public buildings like markets, church, hall and the last one includes houses (Figure 7).
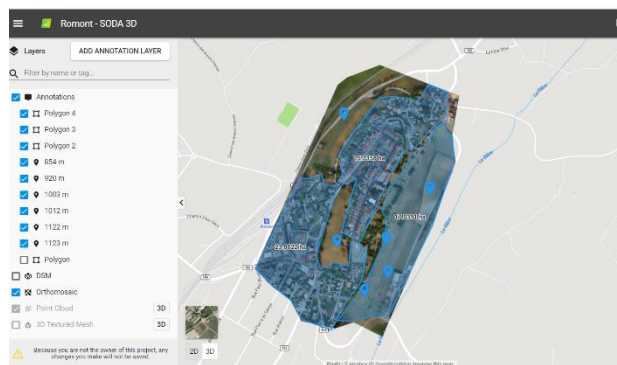
Figure 7. Evidence of the 3 vulnerable areas

Damage assessment and the cost of recovery from floods:
Area I – 17,03 ha: approx. 23.000 euro;
Area II – 15, 33 ha: approx. 120.000.000 euro;
Area III – 23,80 ha: approx. 740.000.000 euro.
The prices are approximative and are based on the work performed in the same situations in Europe. These approximations are made with the help of the contracts from the halls and the mass-media. These works include the drain excess of water, rehabilitation of roads, consolidation of buildings, house painting and other refurbishment works following the withdrawal of water.
UAVs are operationally more versatile and visible compared to land-based approaches or other aerial methods, such as manned aircraft and satellites. Conducting atmospheric measurements in remote locations is one situation where the use of small, lightweight UAVs is of particular benefit (Popescu et al., 2017). In fact, the reduced size, weight and power needs of these flying robots, along with the reduced cost of the platforms and instrumentation, make them highly suitable for these operations (Trif et al., 2018; Villa et al., 2016). So, with the help of them we realized the numeric model of the land and on this based we determinate: quota, surface and we delimited the vulnerable areas for floods, in a simplified way, precise and in a short time with the help of GIS instruments and functions of the program Pix4D.

CONCLUSIONS

The number of hydrological (flood, mass movement), meteorological (tropical storm, extratropical storm, convective storm, local storm), climatological (extreme temperature, drought, wildfire) and geophysical (earthquake, tsunami, volcanic activity) events continue to increase in the last decades at global level (Vîrsta et al., 2007).
The assessment of direct economic damages can be divided into three steps, each having potential for improvement. The classification of elements at risk is mostly based on economic sectors with different detail concerning subclasses within a certain sector. These classifications describe only a rather limited share of the variability that is observed in damage data. Moreover, they are not based on objective and/or statistical classification methods. Expert knowledge and conditions of the damage assessment currently determine the details of classification and the actual derivation of class boundaries. A future research direction is the development of classification schemes which are less subjective. Further, it should be investigated under which conditions classification schemes are advantageous which are more oriented towards damage mechanisms. An open question in the classification step is the use of sectoral versus object-specific approaches.
A single large industrial plant can incur direct damage that exceeds that of nearby dwellings

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and other commercial operations by orders of magnitude. Such large variability in industrial damages might suggest the use of synthetic damage functions, using questionnaires or expert opinions for the individual assessment of damage potentials at every industrial plant. However, this approach is not feasible for damage assessments in large areas. Besides, it has been shown that uncertainty in damage modelling decreases with increasing areas and numbers of affected objects, since outliers lose their importance (Merz. et al., 2004).

As a recommendation for the avoiding floods in cities can be cleaning, deepening, or making, where it's not, rainwater collection ditches; creating the basins for the flood water; maintenance of land improvement works; protection of shores and dams.

The Earth Observations data offers the capabilities to monitor the disasters at a large scale, being able to identify areas where the events are not in-situ observed or to monitor large vulnerable areas potentially affected by disasters (Stancalie et al., 2016).

It's recommends applying modern methods of image acquisition and processing the date where are used the drones and software for the determination of the digital land model. On that base we can make a lot of measurements and observations.

ACKNOWLEDGEMENTS

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USE OF IDEXX COLILERT AND ENTEROLERT AS A RAPID AND SIMPLE METHOD FORGROUGWATER QUALITY MONITORING MANAGEMENT

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Abstract

Groundwater quality monitoring management requires the implementation and/or expansion of routine groundwater quality monitoring programs in all villages in the counties of Romania. While the standardization of sample collection and laboratory testing protocols is essential, the ability to provide timely public notification is an equally important element. In preparation for the implementation of the groundwater quality monitoring management programe we investigated the use of IDEXX Colilert-18, IDEXX Enterolert E, Quanti-Tray/2000 (IDEXX) as a means to reduce the time necessary for public notification of freshwater quality while still providing accurate and consistent test results. The fact that IDEXX decreases the time from sample collection to public notification by over six hours coupled with its ease of use and consistent results make this method an attractive choice for the implementation of groundwater management programs.

Keywords: Escherichia coli, Enterococcus faecium, E. faecalis, ground water quality monitoring management.

INTRODUCTION

In the past, fecal coliform bacteria were recommended for monitoring the microbiological quality of freshwaters and groundwaters. Many states adopted this standard for the testing of both fresh and marine environments. More recent studies have indicated that E. coli and enterococci may be better indicators of fecal contamination than the fecal coliforms. The USEPA recommends E. coli (freshwater, groundwater) or enterococci (freshwater, groundwater or marine) as indicators of fecal contamination because high densities of these microorganisms are linked to an increase in gastrointestinal illness (Kinzelman et al., 2005).

Implementation of the groundwater quality monitoring programs in all villages in the counties of Romania requires authorities to develop monitoring and notification programs based on water quality criteria and standards for their groundwaters consistent with published criteria for pathogen indicators. Routine monitoring, employing appropriate indicator organisms, allows for successful protection of public health but the regulation of groundwaters can suffer several limitations including a turn around time in excess of 24 hours, unavailability of trained staff, lack of laboratory facilities and a potential increase in costs associated with implementation.

The membrane filtration technique for the recovery of E. coli from groundwater or surface water samples has disadvantages, including the necessity of a traditional laboratory staffed by personnel proficient in basic microbiological techniques and a turn-around time in excess of 24 hours (Kinzelman et al., 2005). Environmental modeling and other analytical methods that could significantly reduce the turn around time are currently under investigation (fiber optics, flow cytometry, real-time PCR) but are not yet available to testing laboratories and are very expensive. In this study we tried to investigate simple and more rapid methods for the detection of E. coli and fecal enterococci in groundwater as a means for more timely public notification regarding drinking water quality.

Previous studies have verified the use of IDEXX Colilert (18-hour & 24-hour) as an acceptable alternative to other test methods for

the recovery of E. coli from drinking water, source water, and wastewater. Few studies worldwide explored the use of IDEXX as an alternative to traditional membrane test methods for the recovery of microorganisms from bathing waters. Of those studies, the major focus has been on marine recreational waters rather than fresh (Kinzelman et al., 2005). By utilizing the 18-hour formulation of this test in drinking and ambient water quality method for the detection of E. coli and fecal enterococci we sought to protect the public by providing a consistent monitoring program while working within the resources (both monetary and technical personnel) of local authorities.

MATERIAL AND METHODS

Sample Collection

A total of seven water samples from six different counties Buzău, Călăraşi, Ilfov, Ialomiţa,Prahova, RâmnicuVâlcea and one from Bucharest were analyzed during the period four years for the presence of E. coli and fecal enterococci. Groundwater samples were collected from Gura Teghii - Buzău, Drajna – Călăraşi, Tamaşi – Ilfov, Ciochina – Ialomiţa, Adunaţi – Prahova, Bogdăneşti - Râmnicu Vâlcea,2 3 August district – Bucharest in sterile screw-top bottles. Samples wereobtained from wells of varying depths between 6 and 12 meters and taking a 500 ml sample of the water. Samples were transported in a cooler on ice packs to the Ecology and Microbiology laboratory from Faculty of Land Reclamation and Environmental Engineering, University of Agronomic Sciences and Veterinary Medicine of Bucharest. All samples were received at the laboratory and processed immediately. Split samples from each individual monitoring site were simultaneously tested, within one hour of arrival, using the IDEXX defined substrate methods.

IDEXX Colilert-18®

Colilert simultaneously detects total coliforms and E. coli in water. It is based on IDEXX's proprietary Defined Substrate Technology. When total coliforms metabolize Colilert's DST nutrient-indicator, ONPG, the sample turns yellow. When E. coli metabolize Colilert's DST nutrient-indicator, MUG, the sample also fluoresces. Colilert can simultaneously detect these bacteria at 1 cfu/100 mL within 24 hours even with as many as 2 million heterotrophic bacteria per 100 mL present.

The IDEXX most probable number (MPN) test was performed according to procedures recommended in the IDEXX package insert. The chemical reaction of this test is based on Defined Substrate Technology™ (DST). Chemical substrate containing 4-methyl-umbelliferyl β-D-glucuronide (MUG) was added to a 100-ml poured into a multi-well tray, and sealed Quality control was run daily to validate test performance and included both positive (E. coli ATCC 25922) and negative (Pseudomonas aeruginosa ATCC 27853) controls. E. coli possesses the enzyme β-glucuronidase, which metabolizes MUG, releasing the 4-methyl-umbelliferyl dye. This dye has the ability to fluoresce under long wave ultra-violet light (365 nm). After incubating for 18 hours at 35°C, the samples were examined for fluorescence. A MPN table provided with the kit converts the number of wells producing fluorescence to MPN/100 ml.

IDEXX Enterolert - E

Enterolert-E detects enterococci, such as E. faecium and E. faecalis, in groun water, fresh and marine water. It is based on IDEXX's proprietary Defined Substrate Technology (DST). When enterococci utilize their ß-glucosidase enzyme to metabolize Enterolert-E's nutrient-indicator, 4-methyl-umbelliferyl ß-D-glucoside, the sample fluoresces. Enterolert-E detects enterococci at 1cfu per 100 mL sample within 24 hours.

RESULTS AND DISCUSSIONS

Sampling of water were done in 500milliliter sterile screw-top bottles. Water samples were taken from six families in the counties Buzău, Călăraşi, Ilfov, Ialomiţa, Prahova, Râmnicu Vâlcea and one from a family in Bucharest. Samples were transported in a cooler on ice packs to the Ecology and Microbiology laboratory from Faculty of Land Reclamation and Environmental Engineering, University of Agronomic Sciences and Veterinary Medicine

of Bucharest. Split samples from each individual monitoring site were simultaneously tested, using laboratory WTW pH-meter, laboratory WTW turbidimeter and the IDEXX defined substrate methods. Table 1 presents logistics data related to the sampling water sample.

Table 1. Logistics data ground water sample

The place of sampling	Identity of the sample
Gura Teghii Village Gura Teghii Commune Buzău County	GTGTBZ
Drajna Village Dragalina Commune Călăraşi County	DDCL

Tamaşi Village Corbeanca County Ilfov County	TCIF
Orezu Village Ciochina Commune Ialomiţa County	OCIL
Adunaţi Village Adunaţi Commune Prahova County	AAPH
Bogdăneşti Village Bujoreni Commune Râmnicu Vâlcea County	BBRV
Bucharest	B

Organoleptic, physico-chemical indicators for ground water

Table 2 presents the organoleptic, physicochemical indicators of the water samples.

Table 2. Organoleptic, physico-chemical indicators of the ground water samples

(laboratory environmental conditions - T oC = 23 oC, humidity = 54%)

Indicator name	Test method	Maximum allowable values (see L 458/2002 republished in 2011)	Quantification limit	The determined values
Color	SR ISO 7887/2012	Acceptable to consumers and no abnormal change	-	White - yellowish
Smell	SR EN 1622/ 2007	Acceptable to consumers and no abnormal change	-	Acceptable to consumers and no abnormal change
Taste	SR EN 1622/ 2007	Acceptable to consumers and no abnormal change	-	Acceptable to consumers and no abnormal change
pH / Temperature	SR EN ISO 10523/ 2012	6,5 – 9,5 unit pH/°C	-	1.GTGTBZ sample – 7,912 unit pH/ 28 °C 2.DDCL sample - 7,923 unit pH/ 28°C 3.TCIF sample – 7,103 unit pH/ 28°C 4.OCIL sample – 8,124 unit pH/ 28°C 5.AAPH sample - 7,125 unit pH/ 28 °C 6.BBRV sample - 7,501 unit pH/ 28°C 7.B sample - 6,745 unit pH/ 28 °C

| Turbidity | SR EN ISO 7027/2001 | < 5 NTU | - | 1.GTGTBZ sample – 0,18 NTU
2.DDCL sample - 0,01 NTU
3.TCIF sample – 0,08 NTU
4.OCIL sample – 0,11 NTU
5.AAPH sample -0,01 NTU
6.BBRV sample - 0,04 NTU
7.B sample - 0,02 NTU |

The result obtained with the WTW turbidimeter for the fountain water sample, the recorded value being 0.01 NTU and 0,18 NTU, below the minimum admissible limit according to the standard of <5 NTU.

Table 3 presents the microbiological indicators of the water samples.

Table 3. Microbiological indicators of the groundwater samples

(laboratory environmental conditions - T oC = 23 oC, humidity = 54%)

Indicator name	Test method	Maximum allowable values	The determined values
Total coliform bacteria / 100 ml water sample	Colilert IDEXX	0 coliform bacteria/100 ml sample	1.GTGTBZ sample – 0 coliform bacteria/100 ml sample 2.DDCL sample – 0 coliform bacteria/100 ml sample 3.TCIF sample – 0 coliform bacteria/100 ml sample 4.OCIL sample – 0 coliform bacteria/100 ml sample 5.AAPH sample -0 coliform bacteria/100 ml sample 6.BBRV sample –0 coliform bacteria/100 ml sample 7.B sample - 0 coliform bacteria/100 ml sample
Escherichia coli/ 100 ml water sample	Colilert IDEXX	0 *Escherichia coli*/100 ml sample	1.GTGTBZ sample – 0 *Escherichia coli*/100 ml sample 2.DDCL sample - 0 *Escherichia coli*/100 ml sample 3.TCIF sample – 0 *Escherichia coli*/100 ml sample 4.OCIL sample – 0 *Escherichia coli*/100 ml sample 5.AAPH sample - 0

			Escherichia coli/100 ml sample 6.BBRV sample - 0 *Escherichia coli*/100 ml sample 7.B sample – 0 *Escherichia coli*/100 ml sample
Intestinal enterococci (faecal streptococci *Enterococcus faecalis, E. faecium*)	Enterolert IDEXX	0Intestinal enterococci (faecal streptococci *Enterococcus faecalis, E. faecium*) /100 ml sample	1.GTGTBZ sample – 0Intestinal enterococci (faecal streptococci *Enterococcus faecalis, E. faecium*) /100 ml sample 2.DDCL sample - 0Intestinal enterococci (faecal streptococci *Enterococcus faecalis, E. faecium*) /100 ml sample 3.TCIF sample – 0Intestinal enterococci (faecal streptococci*Enterococcus faecalis, E. faecium*) /100 ml sample 4.OCIL sample – 0Intestinal enterococci (faecal streptococci *Enterococcus faecalis, E. faecium*) /100 ml sample 5.AAPH sample -0Intestinal enterococci (faecal streptococci *Enterococcus faecalis, E. faecium*) /100 ml sample 6.BBRV sample - 0Intestinal enterococci (faecal streptococci *Enterococcus faecalis, E. faecium*) /100 ml sample 7.B sample - 0Intestinal enterococci (faecal streptococci *Enterococcus faecalis, E. faecium*) /100 ml sample
Escherichia coli/ 100 ml water sample	Enterolert IDEXX	0 *Escherichia coli*/100 ml sample	1.GTGTBZ sample – 0 *Escherichia coli* /100 ml sample 2.DDCL sample - 0 *Escherichia coli* /100 ml sample 3.TCIF sample – 0 *Escherichia coli* /100 ml sample 4.OCIL sample – 0

			Escherichia coli /100 ml sample
			5.AAPH sample -0 *Escherichia coli* /100 ml sample
			6.BBRV sample - 0 *Escherichia coli* /100 ml sample
			7.B sample – 0 0 *Escherichia coli* /100 ml sample

CONCLUSIONS

Sampling of water were done in 500 milliliter sterile screw-top bottles. Water samples were taken from six families in the counties Buzău, Călăraşi, Ilfov, Ialomiţa, Prahova, Râmnicu Vâlcea and one from a family in Bucharest. Samples were transported in a cooler on ice packs to the Ecology and Microbiology laboratory from Faculty of Land Reclamation and Environmental Engineering, University of Agronomic Sciences and Veterinary Medicine of Bucharest. Split samples from each individual monitoring site were simultaneously tested, using laboratory WTW pH-meter, laboratory WTW turbidimeter and the IDEXX defined substrate methods.

The physical parameters of the laboratory were: 23 degrees Celsius and 54% humidity. The determinations were made with the laboratory instruments WTW pH meter and WTW turbidimeter.

For microbiological analyzes IDEXX Colilert - 18® and IDEXX Enterolert were used. All the ground water samples incubated 18 hours at 35 degrees Celsius in the Memmert thermostat incubator and after these period results were interpreted.

Following the organoleptic, physicochemical and microbiological analyzes of samples, we identified the following: colour white - yellowish; odour: acceptable to consumers without any abnormal change; taste: acceptable to consumers without any abnormal change; pH range beteewn6.745 and 7.923 pH units / 28 oC; turbidity range between 0.01 NTU and 0.18 NTU; no total coliform bacteria were detected; no Escherichia coli were detected; no intestinal enterococci (fecal streptococci Enterococcus faecalis, E. faecium) were detected; Organoleptic, physicochemical and microbiological results have shown that fountain water falls within the normal limits for these parameters.

Advantages of the IDEXX 18-hour method include minimal labour costs and training, ease of use, ease of interpretation, and more rapid availability of results. IDEXX may be of interest to other communities who need to routinely monitor ground water resources.

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ANTIMICROBIAL RESISTANCE- RESISTING THE CURE

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Abstract

Living organisms are known for their ability to adapt to environmental changes, to evolve to overcome the challenges these new environments they encounter, and microbes are no different. They have an outstanding ability to adapt to differences in environments, to different antimicrobial substances which are synthesised in order to counter them, or to quickly multiply to overcome their inevitable fate if they chose to not adapt. And that is extermination. Another factor that plays nicely with them is the chaotic usage of antibiotics, which leads to these microbes' natural ability of developing an anti-antibiotic behaviour.

Keywords: DNA, drugs, salmonella, antibiotics, genes.

INTRODUCTION

The concept of antibiotics harbours a bigger range of substances which are synthesised either naturally, semi-synthetically or synthetical, and are used to a) inhibit bacterial growth (bacteriostatic) or b) annihilate/destroy them (bactericidal) (O'Neill, 2016; Pourmand et al., 2017; World, 2015). These are categorised by the way they go about dealing with the bacteria, either bacteriostatic or bactericidal, and by how little or how strong are the effects of said antibiotic, or even by how many different species of bacteria they can deal damage to. In addition, in agriculture, global-wide class antibiotics drugs have been used with no regard to: what kind of potential side-effects they have, or what risk managements steps have to be taken in the worst-case scenario. The antibiotics which are used in agriculture come from the following classes: tetracyclines, aminoglycosides, β-lactams, lincosamides, macrolides, pleuromutilins and sulphonamides (Klein et al., 2018; World, 2018; Dar et al., 2016; Manyi et al., 2018).

Of course, the antibiotic resistance pattern varies between regions and countries due to differences in how and what antibiotics are used, and also in what quantity. All activity with regard to antibiotic consumption is regulated by said country's antibiotic policies. In recent years, China has led both production and consumption of antibiotics for both human and animal use. Antibiotic crisis is generally caused by misuse of antibiotics which are ultimately released to the environment, in the presence of residues (parent antibiotic or the metabolites from said parent, livestock waste and animal derived products), livestock products, and finally because of the lack of effective supervision and control over the production, usage and disposal of antibiotics.

In a nutshell, antibiotic resistance is an "One Health subject", both in cause and solution, because it addresses the interactions between human, animals and the environment. In an attempt to control this whole ordeal, the WHO (World Health Organisation) instituted a GAP (Global Action Plan) which demands each and every country develop national plans to align themselves with the GAP, within their limits, especially the developing countries due to their lack of capacity and integration which affects their surveillance systems.

MATERIALS AND METHODS

A study in Nairobi, Kenya, sampled fresh chicken droppings from 150 chicken Households at random and tested them for: *Salmonella, Escherichia coli*, and antimicrobial

susceptibility tests were carried out in the scientific papers I have studied. This test illustrates the current situation in a developing country, in part because it is estimated that by 2050 that drug resistant infections are likely to be the cause of death of 10.000.000 people annually if the current trend of antimicrobial resistance persists. Global efforts have generally been slow and inadequate, while antibiotic consumption has been on the rise. A report of the WHO indicated that several bacteria, including *Escherichia coli and Salmonella*, have mutated and have high resistance to current antibiotics.

In developing countries, such as Kenya, poultry farming is a flowering livestock enterprise, with surveys revealing that Kenya has ~37.000.000 birds, with about 65% of Kenyan households keeping chicken, and out of all places, Nairobi has the biggest CPP (chicken per capita) in Kenya (Omiti and Okuthe, 2009). These chickens are drugged with antibiotics to prevent and treat diseases, while previous studies have shown that bacteria swabbed from chicken rectums has shown that antimicrobial resistance levels were high.

Back to the study in Kenya. There have been 6 steps to be addressed to complete the study:

1. Sampling. Between 2017.09 and 2017.12, 150 chicken households were randomly selected from slum settings of: Kawangware, Kiberia, Mukuru, Kariobangi, Dandora and Mathare in Nairobi. From each household, fresh chicken dropping samples were collected, based on previous studies, to ensure isolation of bacteria like *Salmonella* and *Escherichia coli*.
2. Isolation and identification. ~10g of each sample was enriched in selenite F broth and buffered peptone broth overnight. Then, selenite enriched samples were subcultured onto XLD (Xylose Lysine Deoxycholate) while buffered peptone enriched samples were inoculated onto EMB agar media (Eosin Methylene Blue agar) and then were incubated at 37°C for 24 h.

3. Antimicrobial susceptibility tests. Disc diffusion methods were used to determine the antimicrobial susceptibility of isolated samples to antibiotics. Some antimicrobial agents were used, including gentamicin (10 µg) and ciprofloxacin (30 µg), and *Escherichia coli* ATCC 25922 was used as control, with results interpreted in accordance with CLSI (Clinical and Laboratory Standards Institute) guidelines.
4. Bacterial DNA extraction. For the organisms confirmed resistant to amoxicillin, samples were further subjected to molecular characterisation for the identification of resistance genes which are associated to amoxicillin resistance. The bacterial DNA was extracted with the use of boiling-centrifugal processes, with a slight change. A loop of overnight culture was suspended in 1000 µl of sterile distilled water, boiled for 15' at 95°C in a heating block, then the resulting suspension centrifuged for 5' at 14.000 RPM. The supernatant was used as a DNA template.
5. Characterisation of resistance genes. Resistance genes that encode resistance to: beta-lactams, TEM (temoneira), SHV (sulfhydryl variable enzyme), oxacillin and CTX-M (cefotaximiase-Munich) were screened, and polymerase chain reaction amplification was confirmed by visualisation with ethidium bromide staining of the gel.
6. Genotyping of sample carriers of TEM genes. Samples carrying TEM were analysed with (GTG) 5 genotyping methods, amplicons electrophoresed and fingerprint banding patterns recorded and analysed with GelCompar II software with UPFG arithmetic mean and dice correlation.

A few examples of aminoglycoside resistance genes discovered as of 2011, related to *Escherichia coli* and *Salmonella* are present in Table 1.

Table 1 Examples of genes which determine resistance to different bacteria

Gene name	Mechanism	Length (nt)	Accession number	Coding region	Genera
aac(3)-Ia	ACT	534	X15852	1250..1783	*Acinetobacter, Escherichia, Klebsiella, Salmonella, etc.*
aac(3)-Id	ACT	477	AB114632	104..580	*Proteus, Pseudomonas, Salmonella*
ant(2'')-Ia	NUT	543	X04555	1296.1829	*Acinetobacter, Enterobacter, Escherichia, Salmonella, etc.*

The most important bacteria which have mutated and developed resistance to antibiotics are:

-*Staphylococcus aureus*, which is methicillin resistant (MRSA);

-*Enterococcus*, which is resistant to vancomycin (VRE);

-*Mycobacterium tuberculosis*, which is multi drug resistant (MDR-TB);

-*Enterobacteriaceae gut bacteria*, which is carbapenem resistant (CRE).

RESULTS AND DISCUSSIONS

Of the 150 different dropping samples, over 57% of the samples were found to contain *Escherichia coli*, but just 12% were positive for *Salmonella*.

Escherichia coli isolates exhibited resistance to all but gentamicin and ciprofloxacin-based antibiotics. Out of 85 *Escherichia coli* samples, the highest resistance was observed to amoxicillin (54%) and the least resistance for nalidixic acid (2%) and for chloramphenicol (2%). Intermediate results were common in all antibiotics tested with a range of 1 through 24%.

Salmonella isolates differed in percentage of resistance, ½ of them being resistant to amoxicillin. Co-trimoxazole, tetracycline and streptomycin were 28%, 11% and 6% respectively, while absolutely no sample was resistant to gentamicin, nalidixic acid, ciprofloxacin and chloramphenicol.

Susceptibility profiles for both bacteria are presented in Tables 2 and 3.

Table 2. Antimicrobial susceptibility of *Escherichia coli*

Antibiotics	Susceptible No. (%)	Intermediate No. (%)	Resistant No. (%)
Streptomycin	64 (75)	13 (15)	8 (9)
Gentamicin	83 (98)	2 (2)	0 (0)
Chloramphenicol	69 (81)	14 (17)	2 (2)
Nalidixic acid	71 (84)	12 (14)	2 (2)
Ciprofloxacin	84 (99)	1 (1)	0 (0)
Tetracycline	55 (65)	20 (24)	10 (12)
Amoxicillin	23 (27)	16 (19)	46 (54)
Co-trimoxazole	52 (61)	11 (13)	22 (26)

Table 3. Antimicrobial susceptibility of Salmonella

Antibiotics	Susceptible No. (%)	Intermediate No. (%)	Resistant No. (%)
Streptomycin	12 (67)	5 (28)	1 (6)
Gentamicin	18 (100)	0 (0)	0 (0)
Chloramphenicol	18 (100)	0 (0)	0 (0)
Nalidixic acid	17 (94)	1 (6)	0 (0)
Ciprofloxacin	18 (100)	0 (0)	0 (0)
Tetracycline	11 (61)	5 (28)	2 (11)
Amoxicillin	2 (11)	7 (39)	9 (50)
Co-trimoxazole	8 (44)	5 (28)	5 (28)

The results illustrated a 57% prevalence of *E. coli* in chicken droppings from broilers and layers, which is different from other studies. In Kenya whole, a prevalence of 67 to 100% was reported in rectal swabs of indigenous and faecal samples of chicken (Wesonga et al., 2010; Adelaide et al., 2008). In Grenada, a prevalence of 99% was reported (Amadi et al., 2015). As far as *Salmonella* goes, the 12% the study revealed in Nairobi is higher than studies from the entirety of Kenya, where there is a prevalence of 3,6% from chicken rectal swabs. The difference can be attributed to many factors, including differences in hygiene practices between chicken farmers. In addition, direct transmission from humans and differences in contamination levels of different poultry feeds can be used to justify. In neighbouring Uganda, a prevalence of 21% was observed (Odoch et al., 2017).

Figure 1. Antibiotic resistance tests; the bacteria in the culture on the left is sensitive to the antibiotics contained in the white paper discs. The bacteria on the right are resistant to most of the antibiotics.

How Antibiotic Resistance Happens

1. Lots of germs. A few are drug resistant.

2. Antibiotics kill bacteria causing the illness, as well as good bacteria protecting the body from infection.

3. The drug-resistant bacteria are now allowed to grow and take over.

4. Some bacteria give their drug-resistance to other bacteria, causing more problems.

Examples of How Antibiotic Resistance Spreads

Animals get antibiotics and develop resistant bacteria in their guts.

George gets antibiotics and develops resistant bacteria in his gut.

Drug-resistant bacteria can remain on meat from animals. When not handled or cooked properly, the bacteria can spread to humans.

George stays at home and in the general community. Spreads resistant bacteria.

George gets care at a hospital, nursing home or other inpatient care facility.

Fertilizer or water containing animal feces and drug-resistant bacteria is used on food crops.

Resistant germs spread directly to other patients or indirectly on unclean hands of healthcare providers.

Healthcare Facility

Drug-resistant bacteria in the animal feces can remain on crops and be eaten. These bacteria can remain in the human gut.

Patients go home.

Resistant bacteria spread to other patients from surfaces within the healthcare facility.

Vegetable Farm

Simply using antibiotics creates resistance. These drugs should only be used to treat infections.

CS239559

Figure 2. How antibiotic resistance evolves and spreads.

CONCLUSION

Antibiotics: naturally, semi-synthetically or synthetically produced substances, are vital in the agricultural, veterinary, and clinical environments. These substances are endowed with bacteriostatic (inhibitory) or bactericidal activities necessary for prophylactic and therapeutic purposes in the lives of humans and animals. All for one purpose: to prevent and

treat diseases. Regardless of these beneficial roles, associated with antibiotics use are also side-effects; in addition to their implementation at a sub-therapeutic level as growth promoters in feed and water consumed by livestock over an extended period. These may lead to antibiotic pollution, resulting in antibiotic residues in animal-derived products, including meat, milk, eggs, and edible tissues, and when consumed by humans, can cause direct toxicity, the development and emergence of antibiotic-resistant strains of bacteria, as well as therapeutic failure in clinical cases (Vishnuraj et al., 2016).

Of great concern are the food/waterborne pathogens responsible for life-threatening and difficult-to-treat gastro-intestinal infections in humans thus, of great concern to public healthcare systems worldwide. Nevertheless, following the chronicles of multidrug resistance of these pathogens in the developing countries, the conclusion is that continuous surveillance of the antibiotic resistance profiles of bacterial pathogens (obtained from humans, animals, food, and other environmental sites) of public and environmental significance must be implemented because of the high burden of infectious diseases plaguing or soon-to-be-plaguing humans, their habitat, and ultimately altering their day to day life.

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PHENOMENA OF INSTABILITY DUE TO THIXOTOPY PHENOMENON

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Abstract

On the territory of Romania, we find a multitude of soils that have a special character from the point of view of physical and-mechanical behaviors, which can raise real problems without a thorough experience and a particular engineering approach. In Romania there are many regions in which there are found soils of low consistency, more specifically soft clays. The behavior of these clays, under the influence of mechanical stresses, has very distinct characteristics, namely: thixotropy and consolidation. Knowing the physical, chemical and mechanical properties of these soils is very useful in establishing engineering measures that will lead to a source of risk as small as possible. In Romania, during the construction of highways, there have been major phenomena of instability and bearing capacity failure of the foundation ground made of soft clays under the loads induced by the embankments of the infrastructure. The Sebeş - Turda highway, in the sector between km 63 + 700 - km 64 + 000, crosses the Stejeriş Lake through an approximately 500 m long viaduct.Alternatively, to this solution, the builder initiated the construction of a fill in the lake as a platform for the highway sector. The filling was constructed of sand and gravel aggregates, all embedded in a soft clay matrix with insufficient characteristics to bind the blocks together and form a whole. Thus, there have been mudslides and landslides in the lake and in the remaining filling there have been identified active landslides towards the lake.

Keywords: geoelectric measurements, instability phenomenon, low consistency clays, mineralogical composition, thixotropy.

INTRODUCTION

Given that the construction of highways in Romania is a sensitive matter, because both designers and contractors are confronted with a wide range of geotechnical problems, the subject of this paper is the presentation of an instability phenomenon that has the thixotopic behaviour as the triggering factor.The instability phenomenon triggered in this area led to the degradation of the embankment designed to overpass the area of the Stejeris Lake (Figure 1).

Figure 1 shows a comparison between the situation in 2013 and 2016. Here, we can see the shape of the lake before the construction of the highway section and after the filling, so by overlapping the two areas it can be concluded that approximately 40% of the lake surface was covered with rockfill.
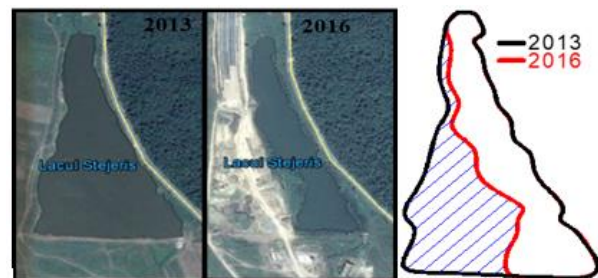

Figure 1. Filling in Lake Stejeris (Google Earth)

For the construction of the embankment cohesive, non-cohesive and even rockfill were used. The implemented technologies induced vibrations both for the embankment and for the foundation ground that later led to the thixotropy phenomenon.

The first to prove the thixotropic and sensitive clay behavior in relation with the engineering works was Karl Terzaghi (1925). A major role in this field was the optical microscopy (Chirică, 1991) and later the electronic one.In order to be able to characterize the phenomenon of geotechnical instability and to

take measures to reduce the geotechnical risk generated by the reduction of the cohesion due to the thixotropy phenomenon, the proposed approach is the following: knowing the geomorphological conditions of soft clay deposits, identification of special methods concerning geophysical and geotechnical investigation on site and in the laboratory (eg special sampling techniquesfor low consistency soils), development of physico - chemical methods and computations for the study of thixotropy, special in situ and laboratory tests specific to these soft clays to determine behavioral parameters under mechanical stresses and static and dynamic conditions.

The geotechnical works employed revealed that under the layer of soil fill, on a thickness of about 4.00 - 6.00 m the soil consists of muds, followed by cohesive or poorly cohesive soils (clays, silty clays, sandy clays), found in variable consistency states. The proper foundation soil was identified at a depth of 13.00 - 15.00 m from the base of the fill and is represented by clays and silty clays, plastically stiff to firm.

MATERIALS AND METHODS

For the geotechnical investigation, the following were carried out: 5 geotechnical drills with a depth from 19.00 m to 25.00 m (from the boreholes, undistributed samples were taken in Shelby tubes from which mechanical parameters were obtained), inclinometric measurements indicating the possible depths of the sliding surface, geoelectric measurements and, last but not least, diffractometry analysis to determine the mineralogical nature of the analyzed soils.

A SISGEO digital inclinometer was used to monitor land movements (Figure 2).

Figure 2. SISGEO inclinometer

Inclinometer is a tool for measuring angles (inclination) in relation to the vertical (gravitational direction), so itis used to monitor lateral movements of the soill mass in areas with landslides, overflows, deep excavation walls, etc.

Geophysical investigations were conducted through geoelectric surveys. These include all methods of the earth's crust investigation based on the study of the dependence between electromagnetic phenomena and physico-geometric parameters (depth, resistivity, thickness, porosity, etc.) of the component rocks. In this project, one of the best-knownmethods - Electrical Resistivity Tomography (ERT), was used. The ERT method consists in determining the resistivity along the observation profile with a succession of measuring devices, at which the equidistance between the electrodes increases successively, depending on the depth of investigation that is intended to be reached.

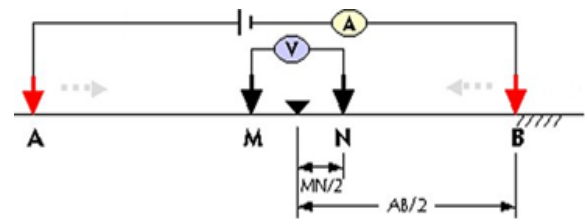The measuring device used in the measurements is Wenner + Schlumberger (Figure 3).

Figure 3. The Schlumberger device

This multi-electrode cable with active sockets consisting of 64 electrodes equidistant from 2.00 to 3.30 m is mainly used for prospecting horizontally layered terrains. The equipment is characterized by the fact that the distance between the MN electrodes is much lower than that between the AB electrodes (MN <AB / 5).

It is imperative to know the mineralogical nature of the clays because it depends on thixotropy. It is known that among the clay minerals, montmorillonite exhibits the highest thixotropy, thus explaining the strong tixotropic properties of bentonite. For the optical analysis of these minerals it is extremely important to refer to the treatment of the mineralogical composition, so that depending on the role played by each of the main constituents in the textural structure we can have an overview of the definition of the physico-mechanical properties.To determine the mineralogical

composition, a XRD diffractometer (Figure 4) was used in which the radiation source and the detector were located on the circumference of a circle (goniometer) to control the incidence angles, the sample to be analyzed occupying the center of the circle (Bragg-Brentano geometry). Peak positions occur if the X-ray beam has been constructively diffracted by the crystalline network. The unique set of interplanar d spacings can be used to identify the mineral.
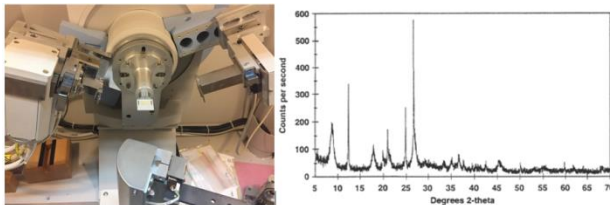

Figure 4. XRD diffractometer and diffractogram

RESULTS AND DISCUSSIONS

As a result of the laboratory tests, the land intercepted in geotechnical drilling granulometry falls within the field of clays, fatty clays (Figure 5), these being in a state of "plastically soft" and "plastically consistent", $0.25 \leq Ic < 0.75$, with very high plasticity $Ip > 35\%$.
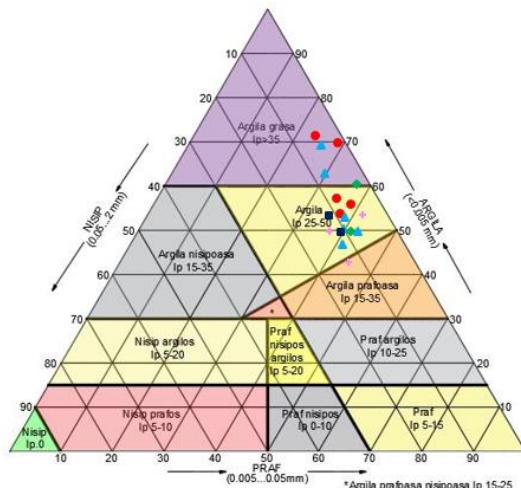

Figure 5. Granulometric distribution

Porosity, noted by n [%], for analyzed samples falls within a large range of values n = (40 ÷ 65)%, these values being specific to unconsolidated deposits. From the point of view of the compressibility parameters, the $M_{200-300}$, the values obtained from the laboratory tests, classifies the lands in the very

high compressibility range ($M200-300 < 5000$ kPa).

X-ray diffractometry can be applied on monocrystalline or in powder. For the study of clay minerals, due to the standard treatments applied to fraction separation <2μ, dry suspensions were analyzed on the glass blade according to Figure 6.
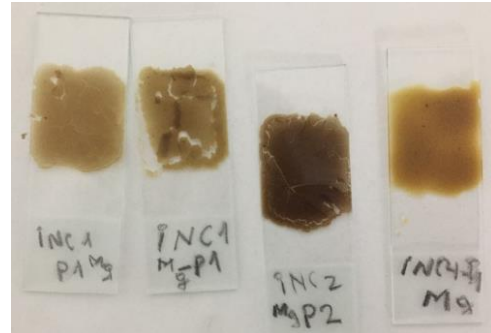
Figure 6. Placing the analyzed samples on the blade

For the analyzed samples, the mineral phases identified in the fraction <2μ are the following montmorillonite, illit, chlorite, kaolinite and iillite / smectite interlayers (Figure 7).

Figure 7. Diffractogram of analyzed samples

Figure 8 shows the semi-quantitative results for each analyzed sample, and we can see how the samples INC1_P1, INC1_P2 and INC4_P1 have a very high content of montmorillonite, which shows us that the soil can be considered thixotropic.

Figure 8. Semi-quantitative results
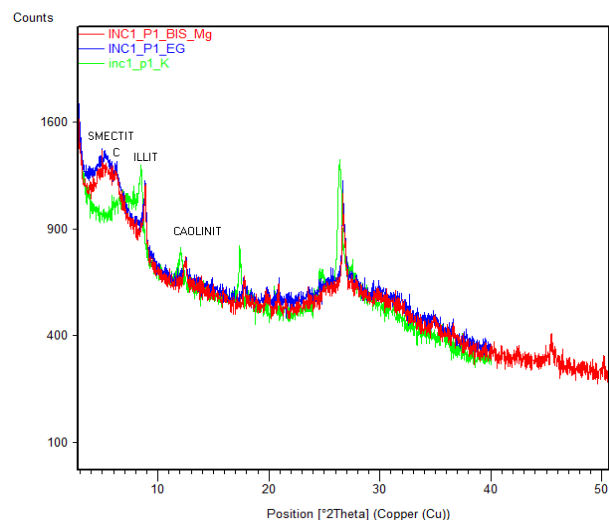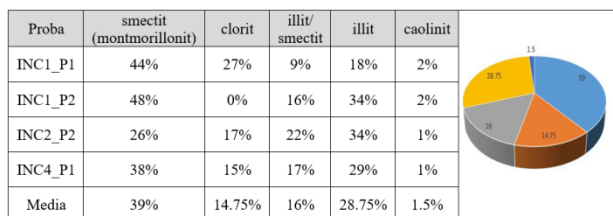
Proba	smectit (montmorillonit)	clorit	illit/ smectit	illit	caolinit
INC1_P1	44%	27%	9%	18%	2%
INC1_P2	48%	0%	16%	34%	2%
INC2_P2	26%	17%	22%	34%	1%
INC4_P1	38%	15%	17%	29%	1%
Media	39%	14.75%	16%	28.75%	1.5%

Montmorillonite (Figure 9) is characterized by a TOT philosophical structure (structural unit consisting of an octahedral layer between two tetrahedral layers) (Zamfirescu et al., 1985). etrahedron positions can be occupied by Si^{4+}in substitution with Al^{3+}in variable proportions, which determines octahedral linkage substitutions (Mg^{2+}ion and Fe^{2+}substituted by Al^{3+}). These substitutions lead to the emergence of negative residual charge on the pack, which are usually neutralized by the adsorption of polar water molecules.
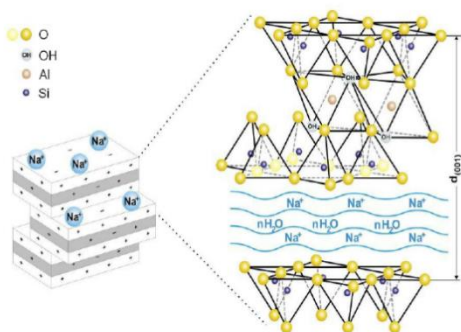

Figure 9. The montmorillonit structure

The electrometric analysis was carried out by means of 4 longitudinal geoelectric profiles and 32 transversal geoelectric profiles located according to Figure 10. Here it should be specified that for the cross-sectional profiles measurements were necessary also on the Stejeris Lake, which represented a national premiere.
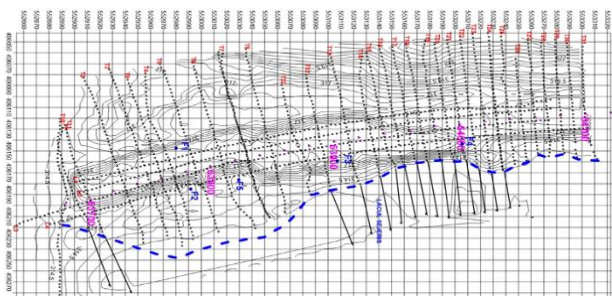

Figure 10. Location of electrometric profiles

From the analysis of the longitudinal geoelectric section (Figure 11), the following conclusions can be drawn regarding the filling and lithology of the foundation ground:
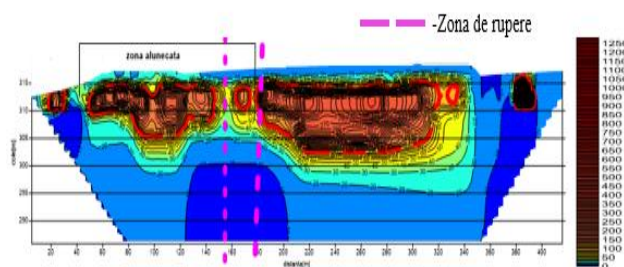

Figure 11. Longitudinal geoelectric section

Under the filler there is a thin layer of 0.50 - 1.00 m with resistances ranging from R = 40 - 60 Ωm indicating a mixture of soil in the ground and less coarse material in the filler. Consequently, we can say that the natural ground (bottom of the lake) can be found from the depth of 6.00 - 8.00 m.

Also, analyzing the thickness of the fillings at different distance intervals (10.00 m and 20.00 m), as shown by the transverse longitudinal sections, the filling did not settle evenly on the bottom of the lake and practically differed from 10.00 m to 10.00 m respectively the foundation conditions will be different.

Analyzing the values of the resistivities measured in the natural depth of the foundation (h = 8.00 - 35.00 m), we can see that they have small values ranging from R = 5-30 Ωm, characteristic of the saturated (flooded) cohesive lands, delimiting the following intervals resistivity, R = 5 - 10 Ωm; R = 10 - 20 Ωm; R = 20 - 30 Ωm.

From the analysis of the longitudinal geoelectric sections, we find that there is a sliding of the filling, a break.

Analyzing the transverse geoelectric sections, we can analyze at sections T5 (Figure 12) and T12 (Figure 13) that they show a pronounced inclination of the filling to the lake with an angle β = 16° - 32°indicating a possible sliding plane. The sliding plan is also confirmed by the existence of small islands formed from the material that has slipped from the filling off the lake.
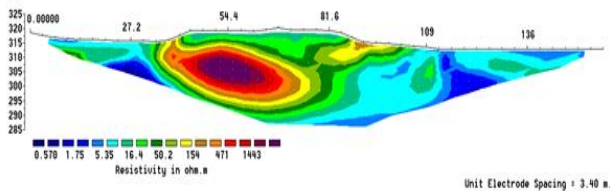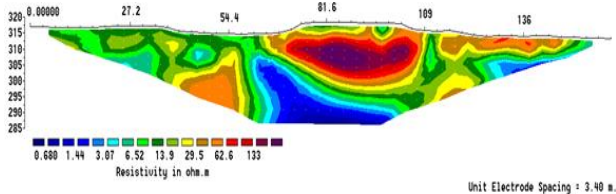
Figure 12. T5 transverse geoelectric section

Figure 13. T12 geoelectric cross section

From the analysis of the values of the inclinometric readings, we find the following: the horizontal displacements in each drilling with the direction towards the lake, the largest displacement (+ 8mm) is recorded in the drilling 1 at the depth of 5.00 m respectively in the filling. Also, from the analysis of the data presented in Figure 14, we find the existence of several sliding plans - one in the filling at 5.00 - 6.00 m depth, at the contact between the filling layer and the plastically soft clay layer in the foundation ground. Another plan at 8.00 - 9.00 m depth in the foundation ground at the contact between the plastically soft clay layer and the plastically consistent clay layer. Consequently, it can be concluded that the process of reinforcing the continuous filling and extrusion of the filling is also accelerated by the deposits behind the filling.
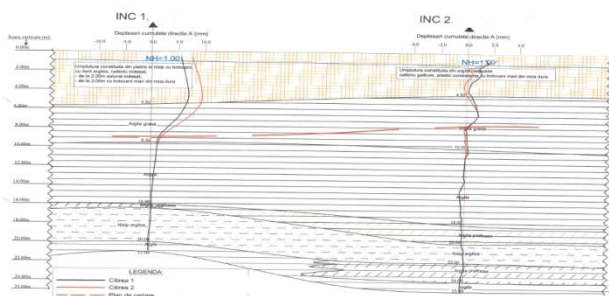

Figure 14. Position of the plan of sliding

In order to highlight this thixotropic behavior (Bancila et al., 1979), we have performed direct UU shear tests immersed on undisturbed samples as well as vibration samples. Before making the shear specimens, I have vibrated the material with a vibrating mass, so I tried to play back the situation on the ground. The

shear results lead us to a reduction in cohesion, the ratio of which is 2.26 (Figure 15), which is why this clay is a medium-sensitive soil.
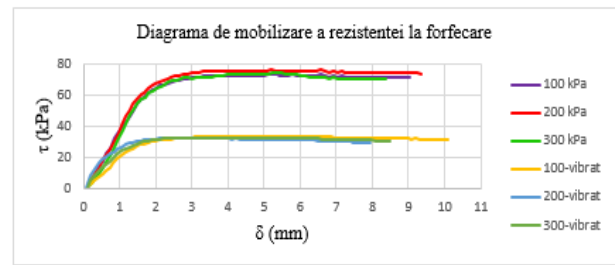

Figure 15. Stress-deformation curves for a clay

The modeling of the instability phenomenon has been accomplished with the help of specialized calculation programs based on both the limit equipments and the finite element method (FEM), programs that solve general stability problems in two-dimensional conditions adapted to allow for stability analyzes for sliding and non-circular surfaces.

For the stability calculation, a cross-sectional profile of the analyzed area was selected, on which geoelectric measurements were performed, in the neighbourhood of which the F1 and F2 drillings were made and these were monitored inclinometrically. In order to highlight the effect of the dynamic compaction of the filling on the soft clay layer, an overload of 200 KN/m3, corresponding to a compaction force of 2 kg/cm2, was applied to the embankment.

The analysis was performed in two hypotheses (variants) depending on the geometry of the filling. In variant 1 the filling layer considered is in the embankment and in the variant 2 the filling (the number 3) was made at an angle of 18° according to the geoelectric measurements. In Figure 16 is presented the calculation model (variant 1), in which it is considered that the layer numbered with 1 is the filler, 2 - embankment body, 3 - plastically stiff clay, 4 - plastically consistent clay, 5 - plastically soft clay, the aquifer level is at the natural ground.
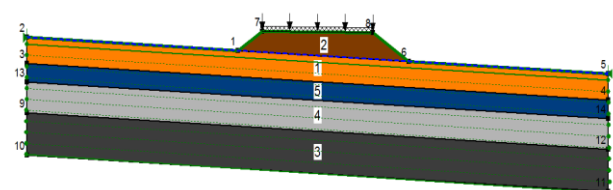

Figure 16. Calculation model-variant 1

Following the model analysis in variant 1 resulted a stability factor of 0.728 indicating the instability of the area at the contact between the plastically consistent clay layer with the plastically stiff clay layer.
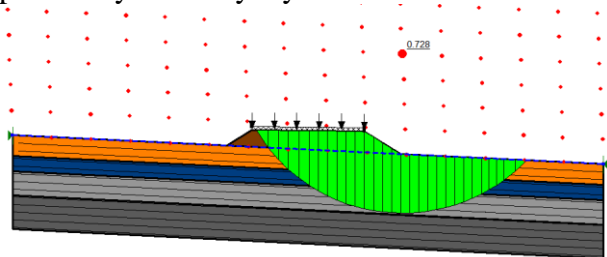

Figure 17. Factor de stabilitate varianta 1

In Figure 18 there is presented the calculation model (variant 2), in which it is considered that the layer numbered with 1 is the plastically stiff clay, 2- the embankment body, the 3-filler, 4-5- the plastically soft clay, 6-7 – plastically consistent clay, and the aquifer level is at the natural ground.
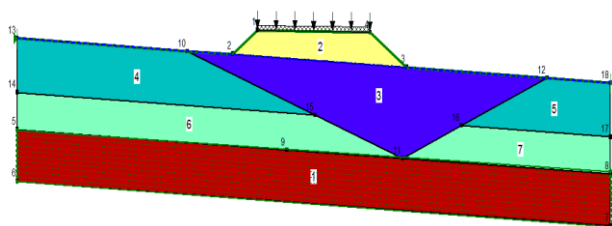

Figure 18. Calculation model-variant 2

Even if the calculation model in variant 2 was different from the variant 1 and in this case we obtained a value of the subunit stability factor, Fs = 0.869, the slip plane being intercepted also at the interface between those of the plastically consistent clay and of the plastically stiff clay.
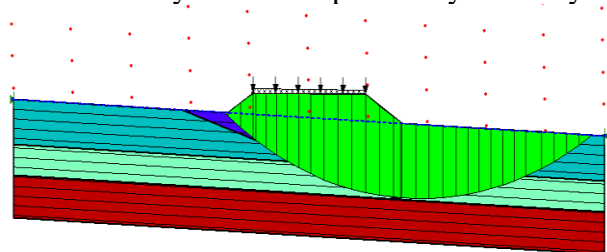
Figure 19. Stability factor variant 2

CONCLUSIONS

Saturated clay on the bottom of the Stejeris Lake has a mineralogical content rich in clay minerals, especially from the smectite group (montmorillonite), about 50%, so they have led to a phenomenon of instability that is hard to explain unless special attention is paid to mineralogical analysis

Due to its manifestation, thixotropy is an important cause of landslides because it can lead to a substantial reduction in shear resistance.

"In situ" monitoring of the instability phenomenon that affected the Sebes - Turda highway in the area of the Stejaris Lake through complex and conjugated methods (geotechnical investigations, geophysical investigations, inclinometric measurements, analyzes in mineralogy and earth mechanics laboratories, and mathematical modeling) allowed a correct understanding of the geotechnical risk induced by the relationship between the future geotechnical structure and the foundation ground.

Following the analysis of all the obtained documentation, design solutions have been adopted to ensure the strength and stability of the construction under normal operating conditions.

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THE EFFECTS OF BIODEGRADABLE PLASTICS

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Abstract

This review talks about the importance of biodegradable plastics that have a positive impact, for now positive, on the environment. Here you will find, the good parts of recycling, reusing, and how you can do better, step by step, doing small changes in your life.
Humans don't know exactly how to do good things for the planet, and so, here you will find information about bioplastic and biodegradable plastic that can be found around us and help us to improve our lives. It's not certain if bioplastic does too much good, or too much bad, but for now, the balance is on the good part. As long as we have microorganisms and we learn how to correctly recycle and appreciate what we have, we'll be fine.

Keywords: biobase, biodegradable, bioplastic, compost, environment, plastics ,recycle.

INTRODUCTION

The purpose of this review is to present the effects of Biodegradable Plastics and how they affect people and the environment. In fact Biodegradable Plastic is plastic that decomposes naturally in the environment. This decomposition is achieved when the microorganisms in the environment metabolize and break down the structure of biodegradable plastic. This means that this new type of plastic is less harmful to the environment than the traditional plastics.

Biodegradable plastic is composed of bio-plastics, which is made from renewable raw materials. These are two forms of biodegradable plastics: solid and injection moled.

Bioplastics are not made from one single material. They also comprise a whole family of materialsthat have different properties and applications.

The European Bioplasticssais that a plastic material is defined as a bioplastic only if it is either biodegradable, biobased, or features both properties.

Biodegradable is in fact biodegradation and it is a chemical processthat involves microorganism that are available in the environment converting materials into natural substances such as water, carbon dioxide, and compost (where artificial additives are not needed). The process is determined by environmental conditions, like temperature or location, that have an impact on the material and on the application.

The term "biobased" means that the material or the product is partly derived from biomass.

Biomass used for bioplactics stems from corn, cellulose, or sugarcane.

Figure 1.Represention of biobasedplastics
https://goo.gl/images/qsgEud

There is advantages and disadvantages of bioplastics. They are driving the evolution of plastics. In comparison to the conventional versions two major advantages are that on one hand they save fossil resources by using biomass witch regenerates annually andon the other hand they provide the unique potential of carbon neutrality.

Everything used in the production of biodegradable plastics is natural. Unlike traditional plastic, biodegradable plastic does not contain harmful chemicals and materials.

The disadvantages of this bioplastics are that they do not decompose unless they are disposed of properly, which means that if they are not treated like compost, they might not decompose. If they are simply tossed in a landfill with other trash, the plastic will not breakdown naturally. Even though they biodegrade in open environment, compostable plastics need to adhere to a set of requirements such as fragmentation, absence of ecotoxicity and threshold concentration of potential pollutants such as heavy metals.

I think that the biggest disadvantage when it comes to bioplastics is that consumers have a hard time telling the difference between biodegradable or compostable. Also it is difficult for them to distinguish which conventional plastics they're using are biodegradable, compostable, or otherwise recyclable. This explains why a big part of bioplastics don't get discarded correctly and because some municipalities don't even dispose sorting, composting, or recycling facilities. As a result everything that is not sorted, composted, or recycled ends up in a landfill. For example, you have a cup made from polylactic acid (PLA) looks and feels like recular plastic, so you could be tempted to throw it into the recyle bin, when in fact this cup could be composted. According to EarthIsland, here's what may happen: "At the recycling facility, a PLA cup can be mechanically separated from PET products using an infrared sensor. But recyclers don't usually take the trouble to do such sorting. It's an expensive process and no one is going to pay them enough for that PLA to justify the cost. Within the PET stream, PLA tends to muck things up. If enough PLA (or other non-PET material) ends up in a bale of PET, a plastics reclaimer is going to turn it away and the bale will likely end up in a landfill. So suddenly those earth-friendly packaging materials have cut short the possibility that the PET inside that bale will find another useful life before ending up in a landfill."
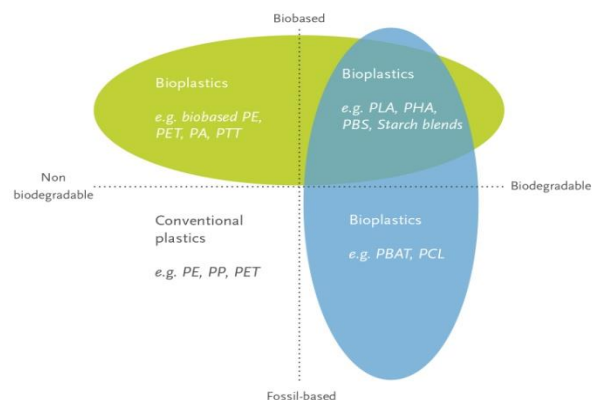
Figure 2.Bioplastics material coordinate system https://www.european-bioplastics.org/wp-content/uploads/2016/02/2.1_Material-Koordinatensystem_eng_2015_150109-1.jpg

In Figure 2 we have examples of the three main groups of a diverse family of materials with different properties that compose the bioplastics.

Biobased or partially biobased non-biodegradable plastics such as biobased PE, PP, or PET and biobased technical performance polymers such as PTT or TPC-ET;

Plastics that are both biobased and biodegradable, such as PLA and PHA or PBS;

Plastics that are based on fossil resources and are biodegradable, such as PBAT.

MATERIALS AND METHODS

My review is based on online articles and it presents the impact of biopastics on the environment and human life.

Using search engines I've found documents and data that sustain my subject and provide information about the environment, bioplastic and biodegradable plastic, that does not have neither a good or bad impact. The benefits would seem to outweight any potential drawbacks, but the question of rather or not the biodegradable plastics will someday replace traditional plastic is still a matter of debate.

RESULTS AND DISCUSSION

The following figures present the impact upon Production and Consumption over the years (or one year), Waste Management (the recycles and non recycled ones), Competitivness and innovation.

Production and consumption represent the initial steps in illustrating a circular economy. There are some economic sectors in EU that produce and consume materials.

Statistical indicators such as generation of different types of waste are used to better estimate the impact of production and consumption in the EU.
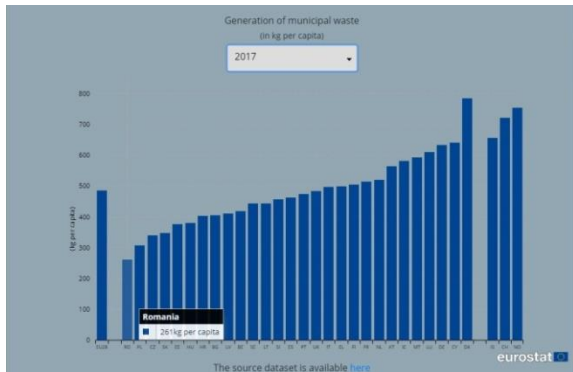

Figure 3. Production and consumption Romania's in 2017- https://ec.europa.eu/eurostat/web/products-eurostat-news

The statistics over the years show that in 2005 there was 383 kg per capital in Romania, in 2010 decreased to 313 kg per capital, in 2016 was recorded the smallest value 261 kg per capital, and in 2017 it increased to 272 capital.

Despite the fact that the numbers changed, Romania kept a position among the countries with low values.

Waste management is the next step towards a circular economy by recycling materials and products. The intention is to increase the share of waste which is recycled and returned into the economic circle. The following figure will illustrate the improved situation over the way waste is treated in the EU.
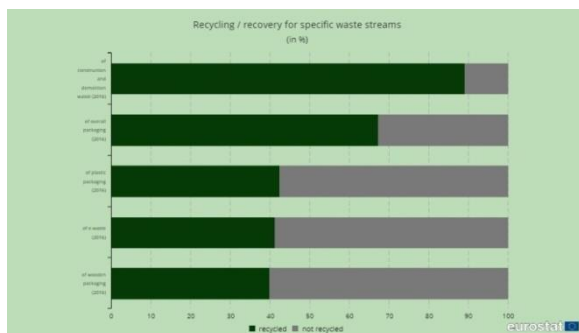
Figure 4. Waste management 2016
https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20180422-1?inheritRedirect=true

Table 1. Recycling / recovery for specific waste steam

Activity	Recycled(%)	Not recycled (%)
Construction and demolition	89	11
Overall packaging	67.2	32.8
Plastic packaging	42.2	57.6
e-waste	41.2	58.8
Wooden packaging	39.8	60.2

The table refers to the amount of waste that is more recycled than not, which is a good thing and means that we're going in the right direction.

The second row materials refer to materials and products that need to be re-introduced into the economy, to close the loop in circular economy. Also there are some advantages that are numerous: the size of the environmental footprint caused by production and consumption which is reduced, the future of supply of raw materials is secured.

Figure 5. Trade of selected waste 2017 (thousand tons) https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20180422-1?inheritRedirect=true

The previous figure represents the situation of waste during the period of 14 years (2004-2017) in exporting (blue) and importing (yellow) iron and steel; cooper, aluminium and nickel; precious metals (they do not exist in Romania); and paper and cardboard.

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Competitiveness and innovation talks about the circular economy and how it contributes to the creation of jobs and growth. When the innovative technologies improve, it also improves the product design to ease re-use and to promote innovative industrial proof.

Statistical indicators help us measure the competitiveness and innovation in the EU.

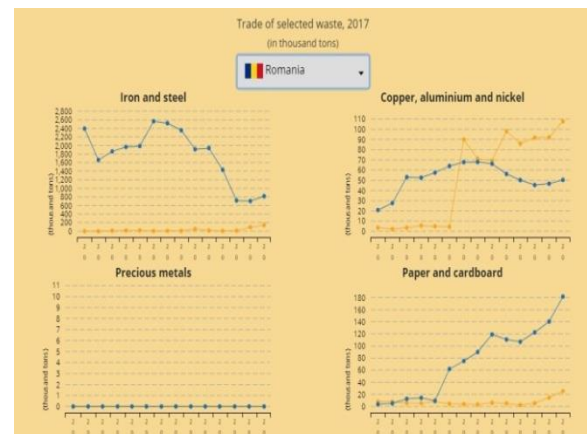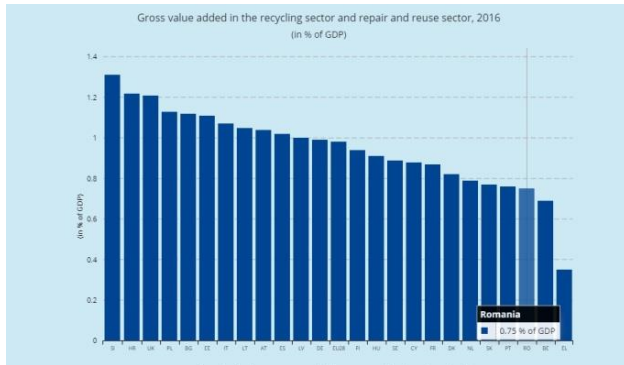Figure 6. Gross value added in the recycling sector and repair and reuse sector 2016 (in % of GDP) https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20180422-1?inheritRedirect=true

Romania is at the bottom of the list with a percent of 0.75 % of GDP.

Giving the fact that our planet is suffocating in plastics, there are some things you can do to help. Besides these biodegradable things, you can reuse.

Refuse to buy products with lots of packaging, don't buy things you don't really need, reduce the amount of unnecessary objects.

Learn to reuse the things you already have. Try to find then other purpose that is different from the initial use.

Compost, because 80 % of waste is organic, and they rarely end up decomposing in landfills.

Recycle, even though it takes a lot of energy and resources to do so, but it's better this way than sending stuff to the landfill, where they can affect more than you think, or let it become litter.

CONCLUSIONS

After the review we have concluded that the benefits outweigh the disadvantages, and they can be introduced in the composting process, on the special landfills where the waste can be directed easily. The only one affected, and the one that affects, is humanity, which does not care about what happens next.

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WHY ARE GMOs CONTROVERSIAL

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Abstract

Nowadays, there are many controversies around GMOs, mainly due to the lack of information, but also to the fact that the technology of obtaining the transgenic organisms is relatively new and therefore unknown by ordinary consumers. Many people believe that GMOs are harmful to human and animal health but also, for the environment. While some of these claims have been proven to be true, most of them are just speculations. Despite all the backlash, it has not been scientifically proved that GMO consumption is more dangerous than organic food. Regarding the environmental potential issues, in order not to bring ecological imbalances, the states that have embraced GMO breeding and cultivation have adopted very restrictive regulatory rules. This way, both ecosystems and food are secured. The present paper tries to detail, besides advantages and disadvantages, some myths and facts about GMOs.

Keywords: biotechnology, environment, food, GMO.

INTRODUCTION

Genetically modified organisms have been the subject of many controversies through the years due to a lot of misinformation spread to a wide audience and this is the reason why it peaked our interest. The world isn't black and white, there are some estimated dangers that come from GMOs production but they also have potential to solve some problems that we have been fighting for so long.

The term "Genetically modified organism" or GMO for short is pretty vague, but usually people refer to GMOs as organisms that, through genetic engineering (GE), receive genes extracted from the DNA of another plant, animal, insect, bacteria or virus. But GMOs can also be categorized as "Natural", which means that these are still GMOs but do not contain added flavours, colours or synthetic substances. Non-GMOs are a little tricky because these are not modified through GE but could have been modified through selective breeding over the centuries.

Selective breeding is a "traditional" agricultural method that farmers have been practicing since 10.000 years ago. People noticed that some plants or animals from a population are a little better than the rest, meaning that some plants are more resilient to heat than others or tastier and some animals are bigger than others, for example. So, farmers decided to breed the ones with the desired traits. One thing led to another and now the vegetables, fruits and animals that we know today look nothing like they used to. One popular example is the teosinte which is the ancestor of corn. Nowadays the corn, that we all know, is 1.000 times bigger than what it used to be and also sweeter.
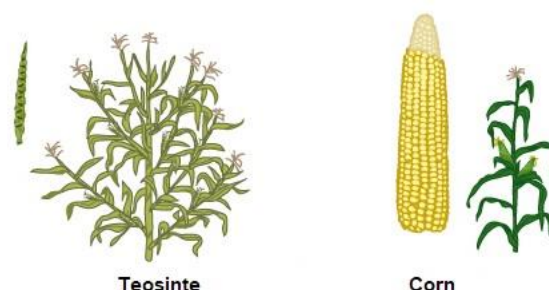

Figure 1. [1]

The difference between selective breeding and genetic engineering is that the latter is more precise. While through GE we can choose what trait we want, for selective breeding is more of a lucky strike to get what we want.

DEVELOPING A GMO SEED

We can divide the process of developing a GMO seed, in a few consecutive and easy

steps. This way it can be noticed the differences between a natural and an improved seed even better by analyzing the changes at a microscopic scale.

The first step requires choosing and finding the desired trait (like insect pest resistance or drought tolerance) in nature or in other related species, next, a copy of the gene for the trait is transferred into a plant that will be the GMO. This can be done with either a Gene Gun, that shoots DNA coated metal particles into the seed, or a plasmid inserted into the bacteria that will "infect" the cell. The final step is to place the seed into carefully controlled growth chambers that are monitored to ensure replication.
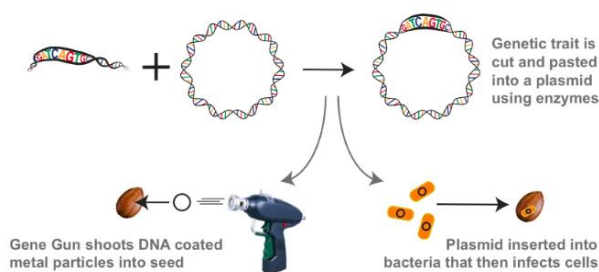

Figure 2. [2]

WHY DEVELOP A GMO SEED?

GMO's are using resources efficiently, because they are made this way. Some GMO corn crops for example, can protect harvests in water-limited conditions better than conventionally produced crops. They are also fighting pests and diseases, the scientists are developing crops that look and taste the same as their non-GMO counterparts, but are resistant to insects and plant-specific diseases that can impact a farmer's harvest. Some of the plants have traits that protect roots from insect damage, or other possible traits as specified during the first step of developing a GMO seed, by choosing a desired trait and gene from a related species. Another great reason to choose genetically modified seeds is for conserving natural habitats, these can help farmers around the world meet the increasing demand for food by making the most of their existing arable land, thus preserving nearby habitats.

ARE GMOS DANGEROUS?

There have been debates over debates regarding this subject: if GMOs can actually harm the environment, or if these are dangerous for us to consume?

The thing that "scares" farmers most is the gene flow.

Gene flow happens when the "organic" crops intermingle with GM crops and they acquire undesired traits. Another downside to this, is that GM crops may be harmful to the bee populations but that is still uncertain. Some people claim that GM crops are drenched in a type of insecticide called neonicotinoids or "neonics" for short, that is a danger to the honey bees' health, although this insecticide is also used for regular crops.

Another concern for the bees' health was the BT crops which are GM crops with a gene from the bacterium Bacillus Thuringiensis that allows the plants to produce a protein that destroys the digestive system of insects but this was debunked through several studies which concluded that the BT crops do not affect negatively the bees' health in any way.

BT crops have been controversial not only because they supposedly affect the bees but also humans. The problem was raised because these were engineered especially to be toxic to pests and people were concerned that it may also be dangerous for human consumption. The thing is that, even if these are poisonous to pests it doesn't necessarily mean that they are poisonous for humans. A good example is chocolate, while it is toxic for dogs, humans can consume it without any problem, in fact, it's quite delicious.

While we are on the topic of BT crops, it's worth mentioning that these help agriculture a lot, by reducing the use of multiple pesticides. A particular case was in Bangladesh, where farmers had to rely heavily on pesticides to defend the eggplant crops from pests. Pesticides are not only expensive but are also toxic to humans, workers occasionally getting sick from the long exposure to those. Another example of BT crops put to good use was in 1998 when the ring spot virus threatened 50% of the papaya population, which is Hawaii's second most important crop.

Now, going back to the main subject. We can't let GMOs contaminate other crops so what do we do?

A solution to this issue was the "terminator seeds" which are crop seeds that do no breed

any further. Although this sounds good, the downside and the reason this solution was dropped was because it was too costly for farmers to buy new seeds each year.

Another solution would be "buffer zones" which are empty spaces around the crops.

GM PIGS

Scientists from the University of Edinburgh announced that they had deleted the section of DNA that leaves pigs vulnerable to porcine reproductive and respiratory syndrome. However, genetically modified animals are banned from the EU food chain. Laboratory-based diagnostic tests have evolved significantly since initial discovery of the PRRS virus in the late 1980s. Initially viral culture was used to confirm PRRSV in serum or tissue samples [3].

GM MOSQUITOES

The British company Oxitec has created genetically modified male mosquitoes that carry a "self-limiting gene". When they are released into the wild and mate with females their offspring do not reach adulthood, so crucially do not contribute to the spread of the Zika virus. Other researchers are concerned about using genetic modification to curb the spread of malaria. Zika is spread mostly by the bite of an infected species. These mosquitoes bite both during day and night.

Zika can be passed from a pregnant woman to her fetus. Infection during pregnancy can cause certain birth defects.

There is no vaccine, nor medicine for Zika [4].

GM COWS

Scientists in both China and Argentina have developed genetically engineered cows to produce milk similar in composition to that made by humans. After modifying embryos, an Argentinian cow was born that expressed milk containing proteins present in human milk but lacking in cow milk. However, there are a number of scientific issues that we have to overcome before this replaces "mother's milk" for infants [5].

GM CHICKENS

The Roslin Institute is working on GM chickens that contain an extra gene that interrupts the transmission of avian flu. Unlike a vaccination, the modification still protects the bird if the virus mutates. However, some farmers argue it is better to enforce good farming practices than creating disease-free animals. Though the avian flu is adapted to birds, it can also stably adapt and sustain person to person transmission.

The type with the greatest risk is highly pathogenic avian influenza (HPAI). Bird flu is similar to swine flu, dog flu, horse flu and human flu, as an illness caused by strains of influenza viruses that have adapted to a specific host [6].

GM SALMON

The Canadian authorities allowed a GM salmon designed by the US company Aqua Bounty to be sold to consumers. It is engineered to reach market size in 18 months, half the time of its natural counterpart. However, the fish is not labelled GM in shops.

The bigger salmon is always going to be the GM specimen.

They both have the same age and are the same species, however, the difference is very clear between the two in size [7].

MONSANTO AND GMO

Having been voted "the evillest corporation" in the world by readers of the Natural New website in 2013, there's no denying Monsanto has had some reputation problems. In 1901 Monsanto company was founded and in 1920 it became the world's largest Aspirin manufacturer, and later in 1941, the globe's biggest manufacturer of "PCB". In 1960 Monsanto was one of the only producers of the biochemical weapon "Agent Orange". However, in 1970 the production and usage of PCB were banned due to birth defects and various disorders and in 1975, DDT (a chemical used in pesticides) was prohibited because it was somehow linked to cancer, Monsanto also being one of its manufacturers.

Perhaps because so many of the company's products have been banned, the executives at Monsanto decided by the 1980s that the group had to let go of both its chemical and plastic departments. Monsanto then headed in a new direction as it began buying up seed companies while also investing in biotech research. With approval from the US Department of Agriculture, in 1994 farmers began growing soybeans with Monsanto's GM seeds, making their crops immune to the most commonly used weed killer in the industry (Round-Up). However, backlash from anti-GM activists occurred all the same, with many accusing Monsanto of preventing farmers from using their best seeds; still the company's attitude at the time was "if they try to block it, we'll sue them". They even held a campaign called "Food biotechnology is a matter of opinions – Monsanto believes you should hear all of them".

And so, despite regulatory approval from the EU, consumers in the UK rebelled against Round-Up Ready seeds, they didn't want to have anything to do with Monsanto. In return, they dubbed the British as the "sad sacks of Europe". "The GMO opposition originally formed around two primary issues: the social and ethical aspects of designing life, and the potential impacts on seed diversity and control". Monsanto's biggest mistake has been its failure to understand the cultural significance of farming, or that many people feel strongly about the idea of 'parenting nature'. Nevertheless, this has been nothing but a war between letting Mother Nature follow her course and exploiting its potential for our increased benefits.

CONCLUSIONS

We believe that we should set out differences aside, pro-GMOs and anti-GMOs, be more open-minded and invest more in GMO research so we could know for sure if these are harmful or not, or if these can be actually helpful and in which way. GMOs use may not be able to solve all the problems that agriculture has, like the use of pesticides and fertilizers and deforestation, but at the very least it can lower the impact. Another problem is that the population of humans will keep growing, the arable land is lower every year and so we will need more and more food and other resources. From this point of view, rather than expanding the agriculture a solution would be to intensify it.

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SILENT DANGERS FROM UNDERGROUND - BUCHAREST SUBWAY AIR QUALITY

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Abstract

Every day, 600 000 people travel by subway. And every day, for a few dozen minutes, these passengers breathe the underground air. Many felt agglomeration, heat, dust. Few people wondered how harmful the particles invade their lungs. In this study we determined concentrations for the particulate matter (PM) and carbon dioxide, as well as the level of noise from the subway. The results are worrying and shows the differences between the maximum admitted and the actual levels that lead, in time, to the illness of the human body

Keywords: air pollution, health, subway.

INTRODUCTION

Subway systems offer the city a lifeline that allows the efficient transport of people without adding to road congestion and traffic emissions. The numbers are impressive, with over 600 000 people travelling every day in Bucharest.

One environmental disadvantage of any underground transport system is that it operates in a confined space that may permit dust accumulation. Furthermore, much of the inhalable particulate matter PM in subway platform air is actually produced underground and so is different from that breathed outdoors (Martins et al., 2015).

The sourced of PM in the subway is generated by friction between moving train parts such as wheels and brake pads, giving the particles a peculiarly metalliferous character, with iron being the classic "subway metal" and accompanied by a distinctive cocktail of trace elements (Martins et al., 2015). Ferruginous particles released from wheels for example contain trace amounts of chromium, nickel and cobalt (Adams et al., 2001), levels of which on platforms may rise to 30, 40 times higher than outdoors (Moreno et al., 2017).

In appropriate design and use of ventilation can result in substantial deterioration of subway air quality (Moreno et al., 2018).

Particulate matter are deposited in the lower air layers and manifest a stress over human body, which consist in inflamation of the bronchial tree. These powders have, over time, cumulative, and a carcinogenic effect. In the case of those with respiratory problems, the effects occur in a few minutes, but in healthy people, the first symptoms may occur in a few years or decades of exposure. Low but disturbing loudness that penetrates the man's home from the outside or adjoining rooms due to their permanent action, day and night, is a chronic irritant of the human body.

Noise exposure is a function of 2 main factors: (1) the frequency-weighted exposure level, measured in A-weighted decibels (dB), and (2) the exposure duration. The causal association between chronic exposure to excessive and permanent noise irreversible, noise-induced hearing loss (NIHL) is well known, as are the adverse social, psychological, and occupational effects associated with the condition.

In this study, we noted levels that potentially exceeded the community exposure limits initially recommended by the US Environmental Protection Agency (EPA) in 1974 and confirmed by the World Health Organization (WHO) in 1998. WHO and EPA recommended daily allowable exposure times are 24 hours at 70 dB, 8 hours at 75 dB, 2.7 hours at 80 dB, 0.9 hours at 85 dB, and 0.3

hours at 90 dB. Chronic exposures that exceed these allowable combinations of duration and noise level are expected to produce NIHL in some members of the exposed population (Berglund et al., 1999; EPA, 1974).
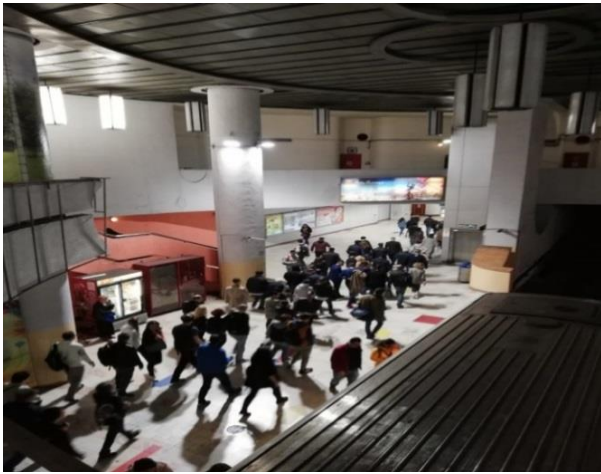

Figure 1. Piata Victoriei subwaystation

High concentration of carbon dioxide at subway cabin is one of the serious environmental concerns because carbon dioxide causes drowsiness, headache, and nerve lessness of passengers.

MATERIALS AND METHODS

The levels of $PM_{2.5}$, PM_{10}, CO_2 and noise were measured during the rush and non-rush hours at the subway in Bucharest. The equipment's were placed on the middle of cabin. The measurement campaign was conducted for a week in March 25 to 31, 2019.
The tools used are broadly presented:
Asound level meter was used for acoustic (sound that travels through air) measurements. It is commonly a hand-held instrument with amicrophone.
The model used to measure sound waves is the CEM DT-85A (Figure 2). The diaphragm of the microphone responds to changes in air pressure caused by sound waves. That is why the instrument is sometimes referred to as a Sound Pressure Level (SPL) Meter. This movement of the diaphragm, i.e. the sound pressure deviation (pascal Pa), is converted into an electrical signal (volts V).
A microphone is distinguishable by the voltage value produced when a known, constant sound pressure is applied. This is known as the microphone sensitivity. The instrument needs to know the sensitivity of the particular microphone being used.
Using this information, the instrument is able to accurately convert the electrical signal back to a sound pressure, and display the resulting sound pressure level (decibels dB). Sound level meters are commonly used innoise pollution studies for the quantification of different kinds of noise, especially for industrial, environmental, mining and aircraft noise.
The current international standard that specifies sound level meter functionality and performances is theIEC61672-1:2013. However, the reading from a sound level meter does not correlate well to human-perceived loudness, which is better measured by a loudness meter. Specific loudness is a compressive nonlinearity that depends on level and also frequency, which can be calculated in a number of different ways.

Figure 2. Sonometer DT 85A

For particulate matter PM concentration, we used the DT-96 particle counter (Figure 3).
The DT-96 particle counter ensures fast and accurate air quality testing by counting the number of suspended particles in the air and by determining the ambient temperature and humidity.
Airborne particles are the most dangerous category of pollutants, as they penetrate directly into the lungs and into the blood stream and cannot be filtered by the human body. The

particles include oxides of various metals, nitrates, sulphates, dusts, salts, etc., some of which are acidic (toxic, carcinogenic, sulfur dioxide, etc.).

It measures separately the number of fine particles with a diameter between 0 and 2.5 μm/microns and the number of particles with a diameter between 2.5 and 10 μm/microns in the air.

To have a comparison term, a human hair has about 100 μm/microns in diameter. It is a measuring instrument used for all maintenance and control of ventilation and air conditioning systems to determine the efficiency of filtration systems and to periodically check particulate concentrations in the air, both in door and production units, as well as outdoors

Figure 3. Particles counter

The model used to measure carbon dioxide in the air is EX CO-200 (Figure 4). This device monitors air quality in schools, office buildings, factories, hotels, hospitals, greenhouses etc.

Figure 4. CO2 measurement device

The obtained results was processed, tabulated and thus represented by graphs that mark the differences between the values.

The stations which were monitored are presented in Table 1.

In the table we used different colors depending on the crowd in the stations, namely:

- red for overcrowded subway stations,
- orange for crowded subway stations,
- green for less crowded stations.

Table 1. The subway station monitored

Subway stations	Hours	Degree of agglomeration
1 Mai Station	08:25	less crowded
1 Mai - Basarab	08:36	crowded
Basarab Station	08:43	crowded
Basarab - P-ta Victoriei	08:47	overcrowded
P-ta Victoriei Station	08:51	overcrowded
P-ta Victoriei Station	09:35	less crowded
P-taVictoriei - P-ta Romana	09:00	crowded
P-ta Romana Station	09:05	less crowded
Eroilor Station	09:56	less crowded
Eroilor Station	09:58	overcrowded
Eroilor - Crangasi	10:14	crowded

Crangasi Station	10:23	less crowded
Eoilor - P-ta Unirii	11:16	overcrowded
P-ta Unirii 1 Station	11:32	overcrowded
P-ta Unirii 2 Station	11:38	less crowded

Figure 5. Piata Victoriei - overcrowded subway stations

During that period of time, we moved to the subway stations in Bucharest and perfomed the measurements for $PM_{2.5}$, PM_{10}, CO_2 and noise levels (Figure 6).

Figure 6. Students performing the measurements

RESULTS AND DISCUTIONS

Concentration of CO_2

The amount of CO_2 in the subway air is growing worrisome at peak times, especially in the passages connecting the subway stations and the wagons (Table 2).

An increased concentration of CO_2 causes, to the exposed people decreased concentration and drowsiness. If the carbon dioxide concentration reaches a value comparable to the concentration of air (about 20%), it may even present a lifetime risk. Between 350 and 450 ppm is the normal level of CO_2 in the atmosphere. In enclosed spaces, the limit of CO_2 concentration for the body to feel no oxygen is 800 - 1000 ppm. In one of the metro wagons at the Piata Victoriei station around 10 o'clock, the device used to analyze the CO_2 concentration showed a huge value of 1571 ppm. At the Eroilor station the value of CO_2 was 1049 ppm.

The specialists recommend that in door the CO_2 concentration to not exceed 1000 ppm.

Particulate matter

LAW no. 104 of 15 June 2011 on ambient air quality sets limits for particulate matter (PM_{10} and $PM_{2.5}$). The monitoring of $PM_{2.5}$ and PM_{10} powder concentrations is required to comply with the requirements of the Directive 2008/50/EC on air quality and clean air for Europe.

The daily limit value or PM_{10}according to the Law 104/2011 is $50\mu g/m^3$and for $PM_{2.5}$is maximum 25. In almost all subway stations, where we analyzed the air quality, these values are far exceeded (Table 3). In one station, Eroilor - Crangasi, the values are below the limit imposed by law, $35\mu g/m^3$ for PM_{10} and $21\mu g/m^3$ for $PM_{2.5}$.

Noise level

The noise level is also very high (Table 4). In all areas the recorded noise exceeds 50 decibels. By comparison, at a rock concert, the noise level is, in general, about 110 decibels,

and a supersonic plane reaches 130 decibels at takeoff.

The maximum permissible noise limits differ according to the functional utility of the affected environment:

- according to WHO 536 the external noise level is measured at 3 m from the outside wall of your home and must be less than or equal to 50 dB (noise curve 45).
- in the house, the day, the maximum limit is 35 dB (noise curve 30);

At night, the maximum allowable noise level is reduced by 10 dB. Allowed:

max 40 dB out;

max 25 dB in house;

- according to STAS 10009/88, the functional areas have maximum admissible limits of different noise and at their intersection the minimum level is applied. Examples of functional areas and maximum permissible sound level:
- 2 m outside the house - max 50 dB;
- parks, gardens (rest and recreation) - max 45 dB. STAS 10009 also adds that for noise from other sources such as outdoor cinemas, playgrounds, car parks, etc., it is permissible to exceed the value of 50 dB and the noise curve of Cz 45 to 2 m on the facade of a dwelling.

Table 2. CO_2 values in the subway station

Subway stations	Hours	Degree of agglomeration	CO_2 min. values	CO_2 max values
			ppm	
Crangasi Station	10:23	less crowded	680	883
P-ta Romana Station	09:05	less crowded	861	883
P-ta Victoriei Station	09:35	less crowded	1571	678
Eroilor Station	09:58	overcrowded	1042	1049

Table 3. PM 2.5 and PM10 concentrations in the subway station

Subway stations	Hours	Degree of agglomeration	PM 2.5	PM10
			$\mu g/m^3$	
1 Mai Station	08:25	less crowded	54	92
1 Mai - Basarab	08:36	crowded	48	71
Basarab Station	08:43	crowded	62	107
Basarab - P-ta Victoriei	08:47	overcrowded	49	90
P-ta Victoriei Station	08:51	overcrowded	82	153
P-taVictoriei - P-ta Romana	09:00	crowded	102	231
P-ta Romana Station	09:05	less crowded	133	300
Eroilor Station	09:56	less crowded	32	58
Eroilor - Crangasi	10:14	crowded	21	36
Crangasi Station	10:23	less crowded	64	112
Eoilor - P-ta Unirii	11:16	overcrowded	59	100
P-ta Unirii 1 Station	11:32	overcrowded	36	59
P-ta Unirii 2 Station	11:38	less crowded	31	52

Table 4. Noise level in the subway station

Subway stations	Hours	Degree of agglomeration	Noise level dB	
			Max. values	Min. values
1 Mai Station	08:25	less crowded	85.1	68.2
1 Mai - Basarab	08:36	crowded	88.4	68.2
Basarab Station	08:43	crowded	72.4	66.6
Basarab - P-ta Victoriei	08:47	overcrowded	64.5	61
P-ta Victoriei Station	08:51	overcrowded	75.8	63.8
P-taVictoriei - P-ta Romana	09:00	crowded	74.4	72.8
P-ta Romana Station	09:05	less crowded	77.5	74.6
Eroilor Station	09:56	less crowded	76.2	59.3
Eroilor - Crangasi	10:14	crowded	70.3	62.9
Crangasi Station	10:23	less crowded	74.3	67.4
Eoilor - P-ta Unirii	11:16	overcrowded	73.8	62
P-ta Unirii 1 Station	11:32	overcrowded	71	65.7
P-ta Unirii 2 Station	11:38	less crowded	80.7	61.7

CONCLUSIONS AND RECOMMENDATIONS

The clues resulting from the measurements made, the centralization of the data and the comparison with the maximum admissible values are that the values obtained in the metro stations exceed the maximum values in a fairly high percentage.

There are a number of practical steps that can be taken to improve subway air quality, the first being to create an informed awareness of the problem. An initial air quality audit will assess the current situation on station platforms and inside trains. Everyday city noises are impossible to avoid but there are a few things people can do to help off hearing damage. It can be a good idea to use foam earplugs if you are stuck waiting for the express train.

Other useful solutions could be:
- automatic air dehumidifier for trains (so as not to stagnate there to increase humidity until it becomes suffocating); accidentally this is the effect of any A/C.
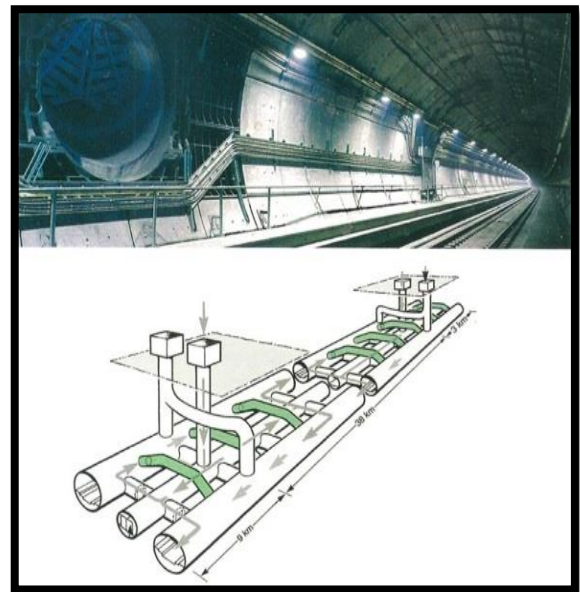

Figure 7. Ventilation system
https://www.systemair.com/no/Norge/Produktkatalog/Solutions/Tunnel-and-Metro/Metro-and-Rail/

- better ventilation of the stations to avoid significant temperature differences between the subway and the surface. It is solved by ventilation, in particular.
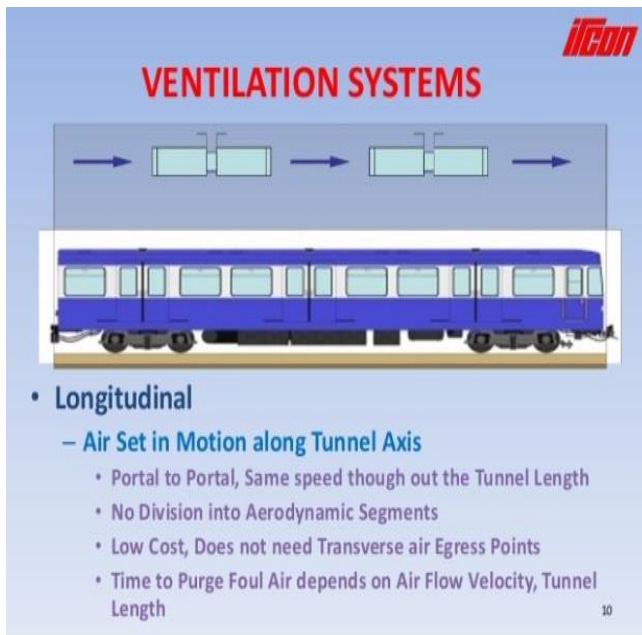
Figure 8. Longitudinal system ventilation
https://www.systemair.com/no/Norge/Produktkatalog/So
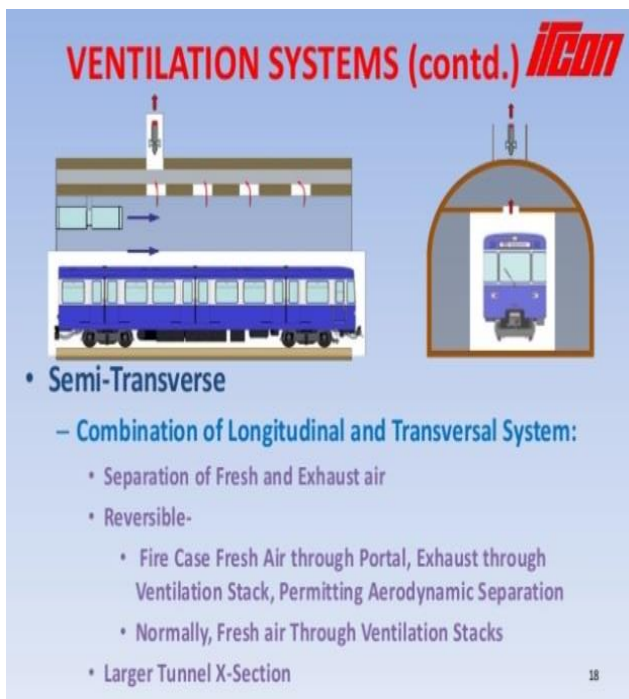lutions/Tunnel-and-Metro/Metro-and-Rail/

Figure 9. Semi-traverse ventilation system
https://www.systemair.com/no/Norge/Produktkatalog/So
lutions/Tunnel-and-Metro/Metro-and-Rail/

- evacuating the air from waiting area and introducing fresh air from the tunnel while driving, thus creating a system that allows it to circulate.
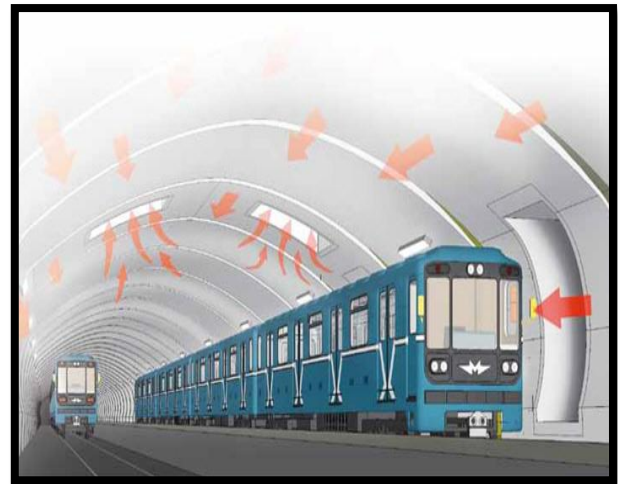

Figure 10. Ventilation of the station
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COMPARATIVE STUDY ON THE GROWTH AND DEVELOPMENT OF LETTUCE (*LACTUCA SATIVA LOLLOBIONDA*) IN AQUAPONIC SYSTEM AND HYDROPONIC SYSTEM

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Abstract

The study was designed to investigate the effect of the two systems (aquaponic and hydroponic) on lettuce yield and quality. The experiment was conducted within the laboratory C01 Environmental Sciences, FIFIM. The two systems were monitored weekly through the following parameters: pH, CE, NH4, NO2, NO3, KH, PO4 using colorimetric kits named, JBL test. Regarding the growth and development of the lettuce, the length of the lettuce was measured every three days. In addition to measuring the growth of the leaves, the lettuce was also analyzed in the form of dry substance. As a result, it was proved that at pH values were generally between 6.5-8.4 pH and CE between 1.37-1.43 dS / m-1. For the aquaponic tank, the concentration of nitrates decreased from 240mg / l to 60mg / l and phosphates at 3.6 - 2.0 mg / l. This results in a good absorption of the roots of the lettuce plant. In comparison to the hydroponic system, where the concentration of nitrates and phosphates was higher. in the hydroponic system, the lettuce had an average growth of two cm every three days, and in the aquaponic system it had an average growth of three cm every three days.

Keywords: aquaponic, comparison, hydroponic, lettuce.

INTRODUCTION

Plant cultivation integrated with fish farming in a water recirculation system, is an aquaponic production system. It is a technique successfully used in many countries, including the United States, Australia, and also in European countries. In Romania, there are no reports on commercial production in the aquaponic system, but there are three existing functioning systems in Focsani, Snagov and Timisoara. However, due to system characteristics such as low water consumption, reduction of environmental impact, production of two sources of income in a single system, it becomes necessary to carry out studies that provide information to enable implementation of the of this system.

Aquaponics is the combined fish and plant culture in recirculation systems (combines hydroponics with aquaculture), that is, it involves a method of plant growth in a soil-free system, but instead of element-added water, it uses natural nutrients from fish. In the aquaponics system, the characteristics of materials used as a substrate directly affect plant growth, because in addition to acting as a support base it must present a surface to fix microorganisms responsible for the conversion of nutrients into forms more easily accessible to plants. The aquaponic system is a way of cultivating vegetables in a non-nutritional bio-nutrient system in which plants take their nutrients from fish.

Aquaponics consists of a set of agricultural technologies that sustainably integrate intensive fish farming into a water recirculation system with hydroponics (Roosta and Afsharipoor, 2012). Such integration enables the conditioning of water for fish farming through the cultivation of plants and, at the same time, with water recirculation, the use of residues generated in fish farming and plant cultivation (Ihejirika et al., 2012; Geisenhoff et al. , 2016). This system behaves as a symbiotic relationship, in which fish provide the nutrients for plant cultivation (Martins et al., 2010; Roosta and Afsharipoor, 2012) and plants remove the metabolites present in the water, which are harmful to the fish, allowing their development (Hundley et al., 2013). Water recirculation between fish farming and plant

cultivation provides conditions for optimization of both activities, so that, during recirculation, the characteristics of water and fish farming are monitored and conditioned (Dalsgaard et al., 2013). As a result, fish farming and plant cultivation occur under adequate conditions resulting in a product with a high standard of commercial quality (Dediu et al., 2012; Geisenhoff et al., 2016).

Hydroponics is a way to grow plants without using soil. In a hydroponic system rooting elements such as clay, vermicelli, perlite and gravel are used, because not all plants have the ability to grow in water due to the lack of oxygen in the roots. Also, there are other important parameters for plant development, such as light, CO2 levels, etc. The hydroponic system is a way of cultivating plants in a pool of water, in which the plants grow in a controlled environment. The difference being that in this system we need to add micro and macro elements to feed nutrient plants.

In the aquaponic system, the role of the substrate has a higher importance compared to the hydroponic system, because in contrast to the latter, in which the soluble nutrients added to the water are adequate for use by plants (Pôrto et al., 2012), in aquaponics , the nutrients need to be converted into easily available forms, such as organic nitrogen, which through the action of microorganisms is converted into ammonia, which is later transformed into nitrate through the action of nitrifying bacteria (Tokuyama et. al., 2006). Thus, the substrate for aquaponics has an additional function acting as an adequate base for the fixation of microorganisms (Hoque et al., 2012). Considering the importance of the use of an appropriate substrate in aquaponic plant cultivation, this study aims to assess the effect of four growing substrates on the yield of lettuce cultivated in aquaponic systems.

MATERIALS AND METHOD

Our aquaponicsystems consists of (Figure 1):
- rearing tank for raising and feeding the fishes (47x30x42cm, V=62cm^3)
- biofilter, a place where the nitrification bacteria can grow and convert ammonia into nitrates; biofiltration material with a

high specific surface(600 m^2/m^3), is represented by expanded clay aggregates
- a pump that flow back the water to the rearing tanks (model EHEIM compact 300, with following characteristics: capacity 150-300 l/h, total head- 0.5, power- 5W)

Figure 1. Aquaponic and hidroponic system

Our hydroponic systems consists of (Figure 1)
- tank of nutritional elements (59x30x20cm, V=35cm^3)
- biofiltermaterial with a high specific surface(600 m^2/m^3), is represented by expanded clay aggregates
- a pumpthat flow back the water to the rearing tanks (model EHEIM compact 300, with following caracterics: capacity 150-300 l/h, total head- 0.5, power- 5W)

Live components:
- *Animals* – freshwater fish – *Carassiusauratus* (5 pieces) and *Hypostomusplecostomus* (2 pieces);
- *Plants* – our hydroponic and aquaponic system will include lettuce (Figure 2).

Figure 2. Lactuca sativalollobionda

For the hydroponic system, a standard nutritional solution of micro and macro-elements was used with the following composition:

Macroelements:
- Calcium nitrate ($CaNO_3$) 2700g;
- Iron (Fe) 60g;
- Ammonium nitrate (NH_3NO_3) 75g;
- Potassium Nitrate (KNO_3) 1650g;
- Potassium Sulphate (KSO_4) 225g;
- Nitrogen, Phosphorus, Potassium (NPK) 240g;
- Magnesium Sulphate ($MgSO_4$) 930g

Microelements:
- Magnesium (Mg) 0.60g;
- Bor (B) 0.90g;
- Zinc (Zn) 0.30g;
- Copper (Cu) 0.45;
- Molybdenum (Mo) 0.30g

For both systems, the following parameters were determined and monitored weekly: pH and CE (potentiometric method with multiparameter kit WTW), $NH_4 +$, NO_2-, NO_3-, KH, PO_4 using the JBL colorimetric test kits. Regarding the growth and development of the lettuce, the length and length of the salad were determined. leaf, as well as dry substance.

The analysis of water in both systems was obtained with the help of a lab kit, "JBL Combisettest" (Figure 3), in which it was determined the following parameters: pH, NH_4, NO_2, NO_3, KH, PO_4.

Figure 3. Determination with JBL Combiset test

RESULTS AND DISCUSSIONS

In the time frame of five weeks, the following results were obtained:

Table 1. Results obtained in the aquaponic system (B1)

B1	pH	C.E. dS/m	NH_4 mg/l	NO_2 mg/l	NO_3 mg/l	KH mg/l	PO_4 mg/l
Day 1	8.2	1.3	0.05	0.01	240	87.2	3.6
Day 6	8	1.4	0.05	0.01	80	109	3.4
Day 12	7.53	1.4	0.05	0.01	60	174.4	3.2
Day 18	6.8	1.4	0.05	0.07	100	109	2
Day 21	6.8	1.4	0.05	0.01	60	109	2.2

Ammonia and nitrites are toxic compounds for fish and require complete monitoring. However, nitrates are relatively harmless to them as well as the nitrogen form required for plant growth. They are easily absorbed.

Table 2. Results obtained in the hydroponic system (B2)

B2	pH	C.E. dS/m	NH_4 mg/l	NO_2 mg/l	NO_3 mg/l	KH mg/l	PO_4 mg/l
Day 1	7.2	2.2	5	0.6	240	152.6	7.2
Day 6	7.2	2.3	0.05	0.6	120	65.4	3
Day 12	7.5	2.7	0.05	0.05	120	87.2	2.4
Day 18	6.8	1.5	4	1	120	109	2.2
Day 21	7.2	1.6	0.05	0.03	40	65.4	2

The pH value determines the availability of nutrients for plants. As a result, the aquaponics system balances the pH for plants, fish and nitrifying bacteria. Nitrification prevents accumulation of ammonia (toxic to fish) by conversion to nitrate (NO3-).

The obtained results show a very good absorption of nitrate in the water system, the NO3 concentration being the lowest, compared to the hydroponic system where the concentration was higher (Figures 4, 5).
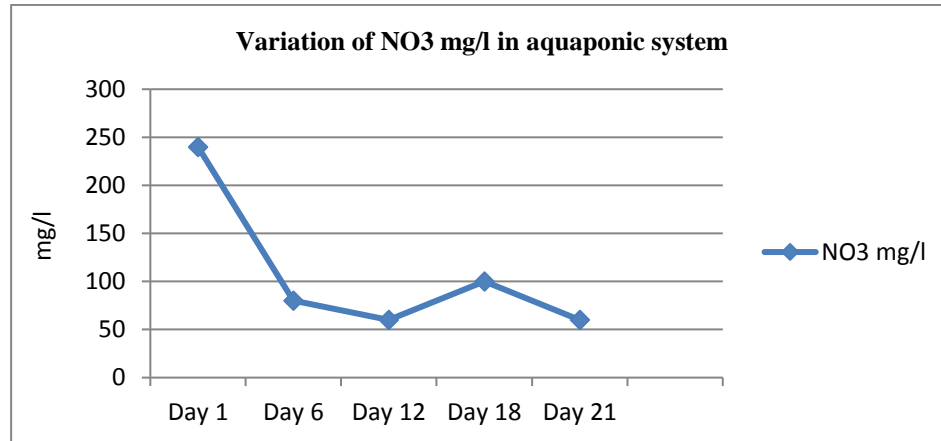
Variation of NO3 mg/l in aquaponic system

Figure 4. Evolution of nitrates in the aquaponic system

Variation of NO3 mg/l in hydroponic system
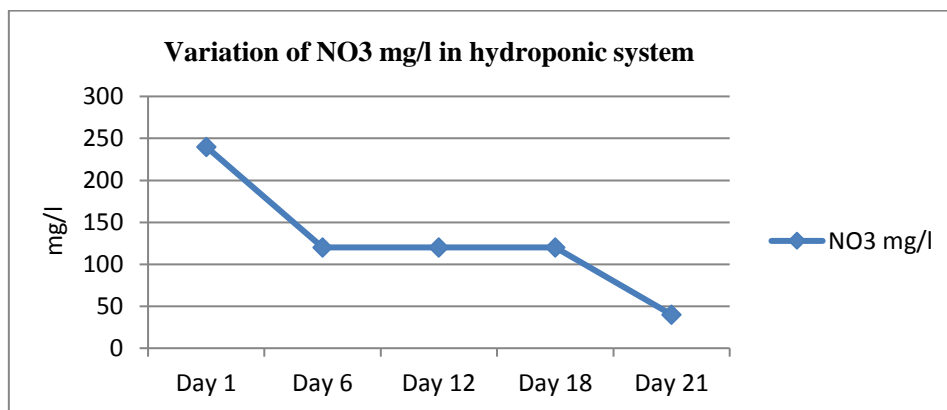
Figure 5. Evolution of nitrates in the hydroponic system

In the cultivation of lettuce in the hydroponic system, the corresponding CE is about 2.5 to 2.6 dS / m-1 (Costa et al., 2001; Gondin et al., 2010). However, EC values for hydroponic systems vary between 1.5 and 2.5 dS / m-1. A high EC value prevents the absorption of nutrients by increasing osmotic pressure, while the lower EC can seriously affect the health and yield of plants (Samarakoon et al., 2006). The EC values recorded in this study were between 2.23 and 2.67 dS / m-1. In aquaponic systems, EC has higher values due to a low rate of water replacement, promoting greater growth and accumulation of solution ions. However, due to continuous recirculation of water, the conditions become satisfactory for

plant cultivation.

Ph and electrical conductivity were monitored at 3 days (from 3 in 3) to maintain values between 6.5-8.5 pH and 1.9-2.2 dS / m-1, thus preventing saline stress in plants during periods of high perspiration and reduction the growth rate due to the low availability of mineral nutrients (Table.1).

On inert substrates, the highest amount of P available in a nutrient solution is when the pH is slightly acidic (pH 5). In alkaline and very acidic solutions, the P concentration decreases to pH = 5, 100% of P is present as $H_2PO_4^-$; this form is converted to HPO_4 at pH 7.3 (pKa2), reaching 100% at pH 10.
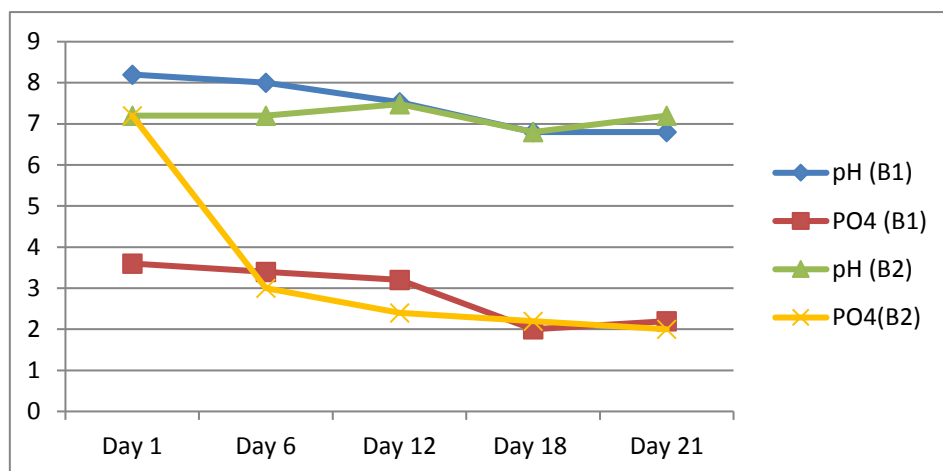
Figure 6. Evolution of PO4 by pH

Comparing the two cultivation systems, similar results were obtained for the number of leaves, with average values of 1-2 leaves per plant at 3 days and an average increase of 2-2.5cm.

Regarding the dry matter of the lettuce leaves cultivated in the two systems, the highest value was obtained for the aquaponic system of 46.3% compared to the hydroponic system of 28.8% and the lettuce in the soil with the lowest dry substance 24.6%

Thus, at pH values between 6.5-8.4 pH and CE between 1.37-1.43 dS / m-1, for aquaponic, the nitrate concentration decreased from 240mg / l to 60mg / l and phosphates from 3.6-2.0mg / l, which results in a good absorption of the roots of the lettuce plant, compared to the hydroponic system where the concentration of nitrates and phosphates was higher. In the hydroponic system, lettuce had an average growth of 2 cm. at 3 days, and in the aquaponic lettuce had an average growth of 3 cm. within 3 days.

CONCLUSIONS

The fundamental component of the hydroponic system is the nutritional solution. Moreover, precise control of the nutrient supply of the plant is the main advantage of the soilless culture. In addition, adjusting the pH, root temperature among other factors leads to increased yield and quality.

Hydroponics is a versatile technology, suited to both village production systems, extreme ecosystems such as deserts, mountain regions or Arctic communities.

In addition to economic advantages, the waterworks system involves reducing the impact on the environment through the recirculation and reuse of nutrients, water conservation, cogeneration and improving the quality of life.

In conclusion, this study highlights the fact that, for lettuce, the aquaponic system helps absorb nutrients and increase biomass, compared with the addition of micro and macronutrients in a hydroponic system that has improved growth speed and has reached a commercial size over the same time span.
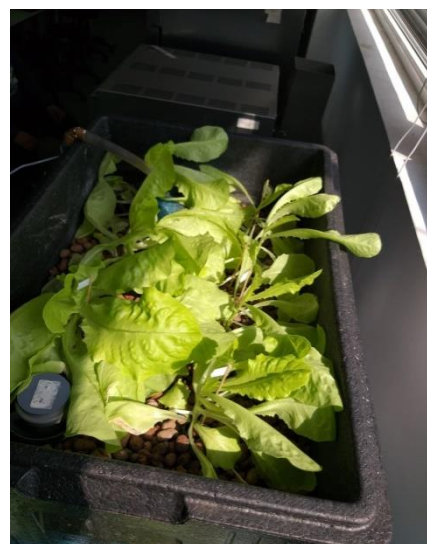
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MOBILE AIR QUALITY MEASUREMENT USING UNMANNED AERIAL VEHICLE AROUND CITY CENTER

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Abstract

The aim of this study is to determine the air pollution occurring in city centers or it's around by means of Unmanned Aerial Vehicle (UAV) equipped with some of the sensors. Today, the air quality in the city centers is realized via stationary air measuring stations located at the determined points of the city. This method provides very safe data depending on the number of stations that make measurement. However, when the city centre is rugged and the measurement period is considered, it is clear that it is not an efficient method. In this study, a more useful measurement method will be produced by using an UAV which is also a practical method to solve this problem. It is planned to measure some of the air pollutants such as CO_2, CO, NO_2, CH_4, and some meteorological parameters such as temperature and pressure, using a modular UAV system to be designed in the study. Due to the advantages of the modular design system, a practical measurement can be carried out for different gases if required.

Keywords: Air quality, city center, mobile, UAV, vertical temperature.

INTRODUCTION

UAVs are used in the field of agriculture, mining, media, search and rescue operations, military, health, transportation, engineering, and environmental. If they are used in the field of agriculture for civil goal, UAVs can be used for diseases detection in plant, weed flora detection, sensitive chemical practice, check of animals, water stress, and growing crops-maturity detection. Thanks to the advantages provided by UAVs, their usage in agriculture is increasing day by day (Türkseven et al., 2016). The UAV system can carry a high-resolution camera. The camera is used for taking photos of forestland sources, ways, flow canals and provide to evaluate these photos (Gülci et al., 2017).

In search and rescue operations, fast coverage of problematic field in the disaster area, the detection of casualty and provide assistance are very important issues. Methods are developed for mapping of disaster area via UAVs. The image map is used for detection of people. According to experimental results, UAV can be used in research and rescue operations (Yavuz et al., 2016).

The target identification and diagnosis in real time is one of the most important skills required for security forces in order to achieve success in the military operations (Ergün and Sönmez). In a military application, the UAVs can be sent to dangerous areas before soldiers and the danger or the enemy can be detected. At the same time, target detection can be made by night vision and thermal cameras carried by UAVs.

In the field of the health sector, UAVs are used for blood and pathology samples transportation between two hospitals. This method was developed by the EOC hospital group in Switzerland (Mion, 2018). The other use of UAVs is to transfer devices for first-aid to reduce delay occurring due to traffic density.

UAVs are used in many areas of engineering, for example, in the field of civil engineering, UAVsare used for conducting bridge inspections by optimizing an unmanned aerial system (Cho, 2018).

One of the areas where UAVs are used is environmental studies. In areas such as the detection, sampling, and analysis of environmental pollution that occur by natural and unnatural means, the regions where people cannot reach physically can be reached with UAVs.

For example, the extent of the environmental disaster caused by volcanic eruptions and the detection of pollutants in the resultant gas and particle structure can be made with UAVs. Again, the volcanic activity, seismic tremor and gas emissions, the impending explosive activities occur in the peak crater area of the volcano, and the new technology UAVs are used to understand the mobility of these events. Air pollution results from the combination of high emissions and unfavourable weather. Air quality has hazardous effects on health, ecosystems, heritage, and climate. Due to sensitive to climate change, air quality is strongly dependent on weather (Holman, 1999; Akimoto, 2003; Patric, 2008; Frumkinand Hess, 2008; Carvallo et al., 2009).

Air pollutants such as nitrogen oxides (NOx), Sulphur dioxide (SO2), volatile organic compounds (VOCs), methane, ozone, particulate matter (PM) have both natural and anthropogenic sources. Particulate matter (PM) includes sulfate, nitrate, organic carbon, elemental carbon, soil dust, and sea salt. The first four components are mostly present as fine particles less than 2.5 mm diameter (PM2.5), and these are of most concern for human health. Sulfate, nitrate, and organic carbon are produced within the atmosphere by oxidation of SO2, NOx, and NMVOCs. Ozone is produced in the troposphere by photochemical oxidation of CO, methane, and NMVOCs. Carbon particles are also emitted directly by combustion (Jacob and Winner, 2009).

Although air pollution in major cities tends to increase during the build-up phase due to levels of sulfur dioxide and soot, in recent decades, however, the increasing traffic in the cities has switched the attention to CO, nitrogen oxides, organic compounds and small particles (Fenger, 1999).

Air quality instruments for quantitative measurements of gas pollutants can be separated into sensors and measurement systems. Some of the gas or particle analyser methods for real-time measurements include UV fluorescent, chemiluminescent, IR techniques and Beta gauge absorbing. Devices for measurement systems are usually very bulky, cost-intensive and require long warm-up time (several minutes to an hour) and long response time. Sensors' detection is mainly based on electrochemical measurement principles. Although sensors have typically a limited response time, limited accuracy, often show signal drift and a limited lifetime, they are more practical than the measurement systems (Winegar and Keith, 1993; Bucholtz, 1997; Degner and Ewald, 2018).

Air quality standards for health protection for some of the pollutants are given in Table 1 (EU, 2017).

Table 1. Air Quality Standards for The Protection of Health of The EU Ambient Air Quality Directions for NO_2, SO_2, O_3

Pollutant Averaging Period	µg/m^3	ppb$_v$
NO$_2$ 1 hour average	200	105
annual average	40	21
Alert (3h, 100km^2)	400	209
SO$_2$ 1 hour average	350	131
1 day average	125	47
Alert (3h, 100km^2)	500	188
O$_3$ 1 hour average	180	90
8 hour average	120	60
Alert threshold	240	120

In this study some of the gases (CO, NH$_3$, NO$_2$, CH$_4$, CO$_2$, vb.) that cause air quality problem or cause greenhouse gas effects can be detected or sampled by using an UAV carrying sensors at the background, at the stack or at the stack level dispersion area, at the area that is not easy to sample the air or the area that is harmful to human health.

MATERIALS AND METHODS

A) Properties of UAV

Figure 1. A prototype of the UAVe

The designed UAV prototype is shown in Figure 1. Due to its ability, the UAV will have 2 km coverage and it also stays approximately 15 minutes in the air without power supply. Image around the city area will be taken with the camera and will be saved to the SD card. The UAV also has a GPS that detects the location. The load carrying capacity of the UAV will be approximately 2.8 kilograms. It will be used Li-Po battery and this battery property: 11.1volt, 5200 mAh etc. It will be used brushless motor (4 pieces and peace of 52 g) at UAV. Revolutions per minute of this motors 960KV and have long lived. It was preferred to "Naza m lite" as a flight control card. The data will be saved to SD card while UAV is flying. Graphics will be analyzed when UAV land down. The UAV's block diagram is shown in Figure 2.
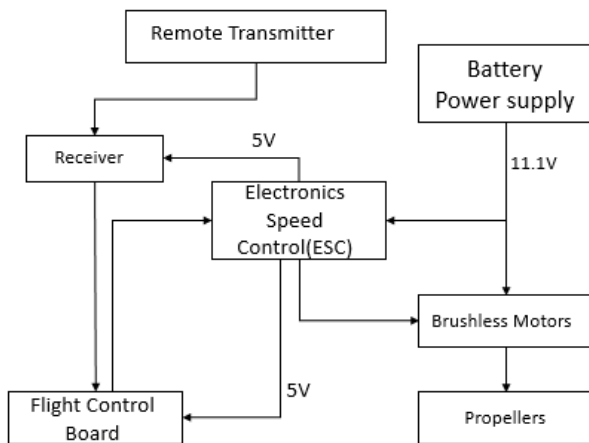
Figure 2. UAV block diagram

B) Multichannel Gas Sensor Components for Air Sampling (MGSC)

The block diagram of gas sensing is given in Figure 3.
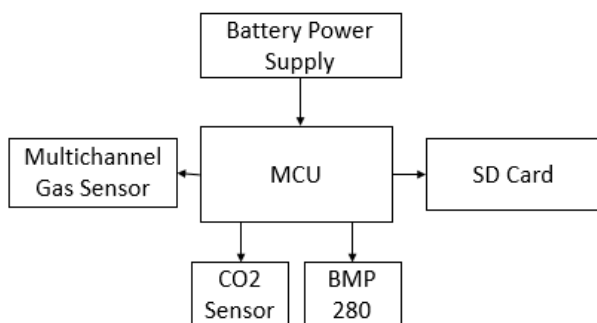
Figure 3. The system of gas sensing block diagram

"Grove Multichannel Gas Sensor (GMGS)" will be used for pollutant gases in the air and "Ccs811 Sensor Module" will be used for CO2

with the UAV. In addition, BMP 280 sensor module will be used for vertical pressure and temperature measurement with the UAV. GMGS can detect many types of harmful gases and thanks to 3 channels three gases can be detected simultaneously. Therefore, with this sensor, the concentration of more than one gas will be analysed at the ambient air. With this multiple channels of the sensor, the detectable gases include Carbon monoxide (CO) 1-1000 ppm, Nitrogen dioxide (NO2) 0.05-10 ppm, Hydrogen (H2) 1-1000 ppm, Ammonia (NH3) 1-500 ppm, Methane (CH4) >1000 ppm. GMGS's sensitivity is between 1.2-50 ppm (URL(1)) and BMP 280 sensor, for temperature between -40 and +85 ∘C with an accuracy between +/- 1 ∘C URL(2).

C) Methods

Many different methods have been developed for ambient air quality measurement. One of the methods developed for mobile air quality measurement application is the mobile vehicle measurement method. Due to the advantages of this method, air pollution measurement is carried out with the aid of gas sensors placed on buses and cars travelling to different points of the city. The data collected from different points in the city are transmitted to a single centre and the air quality maps of the cities are produced using the data (Carvalho and Lopes, 2009).

Another method for air quality measurement is the fixed point measurement method that the most used traditional air quality measurement method. The data can be obtained by means of air quality measurement stations or the sensors placed in a fixed point station (Liu et al., 2011). The aim of this project is to determine the air quality of the region by measuring the concentration of some of the air pollutant using a UAV equipped with the sensors. The UAVs provide excellent potential for air quality data collected at elevated height with a spatial and temporal resolution. It is also aimed to reduce the measurement process and costs for air quality studies in cities or its surrounds. As the system is modular, different analyses can be made by using different sensors.

In the measurements that will be made using an UAV, the data will be produced for both air quality and some meteorological parameters.

The data will be recorded to the SD card on the system and the air quality levels of the measured areas will be analysed.

RESULTS AND DISCUSSIONS

In this study, real studies could not be done in the field. However, preliminary experimental studies have been carried out for some gas measurements. The results are given in Table 2. For gas measurements, the unit is in ppm. The last two columns of the table show the average and standard deviation of the measurements. When the results are examined, the mean and standard deviation are very low. This shows that the accuracy of the measurement is high, and the sensor has the feature to be used in the gas measurements in the field.

The temperature and pressure values are shown in the Table 3. They were obtained at different altitude without sensor not being placed in the drone.

Table 2. Preliminary results

H2	CH4	CO	NO2
1,96	6885,45	8,36	0,06
1,96	6885,45	8,36	0,06
1,96	6606,61	8,27	0,06
1,92	6606,61	8,27	0,06
1,92	6606,61	8,27	0,06
1,944	**6718,146**	**8,306**	**0,06***
0,019596	**136,6031**	**0,044091**	**0****

*: Arithmetical average **: Standard deviation

Table 3. Measurement results: Temperature, Pressure

ApproxAltitude	0 m	11.23 m
Temperature	11.08 ∘C	12.90 ∘C
Pressure	101679.75 Pa	101573.63 Pa

CONCLUSIONS

Pollutant gases and some of the meteorological parameters will be measured using a UAV equipped with the sensors for an air quality study. The main point of this study is to measure air quality with some meteorological parameters spatially and temporarily using the UAV in a mobile manner. The method can be used not only in city centres or its surrounds but also in the areas where heavy traffic occurs and the environment that is dangerous for human health. It might also be used for air pollution sampling, measurement of stack gases in industrial areas, or gas detection in forest fires.

ACKNOWLEDGMENTS

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STUDY OF THE RADIOACTIVE POLLUTION OF TAILINGS DUMPS AND OF THE SLAG AND ASH PONDS IN THE JIU VALLEY

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Abstract

Jiu Valley is an important mining area. With the exploitation of surface coal, a number of radioactive elements are also brought. These radioactive elements are found in both coal and tailings resulting from the extraction and processing of coal. Radioactive elements are also present in slag and ash resulting from burning due to the fact that they do not burn. In this paper we intend to study the radioactive pollution of tailings dumps and of the slag and ash ponds in the Jiu Valley.

Keywords: radioactivity, slag and ash, tailing.

INTRODUCTION

Jiu Valley is an intramontane depression located on the Jiu River. It is known for its natural riches, exploited for coal. The mountains that belong to it are in the Retezat-Godeanu group of the Southern Carpathians. The main cities in this area are Petrosani, Vulcan, Petrila, Aninoasa, Lupeni, Uricani.
The industrial exploitation of the coal deposit began with 1881. The exploitation of the carboniferous deposits continued over the years, developing a mono-industrial area, the predominant economic activity being the exploitation and processing of coal.
Over time, the mining activity has been greatly reduced, many mining area have been put into conservation or closed down.
The storage of the waste resulting from the exploitation and preparation of coal was made in tailings dumps. These dumps are present in all the localities of the Jiu Valley. Also in the Jiu Valley there is also a Thermoelectric Power Plant which works with the coal extracted from the coal mining operations.
Among the strongest pollutants of the environment are the energy and mining industries. They are responsible for both: air pollution, water and soil pollution. The preparation of useful minerals, including coal, leads to the storage of large areas of tailings.

With the exploitation of the coal deposits, a series of radioactive elements are brought to the surface. These radioactive elements are found both in the tailings resulting from the exploitation and preparation, as well as in the slag and ash resulting from its burning. The radioactive elements do not burn and they are accumulated in the resulting slag and ash.

MATERIALS AND METHODS

The coal contains natural radioactive isotopes in natural concentrations which by combustion result in their concentration in the combustion products. Radioactive isotopes in the combustion products, which escape into the atmosphere, diffuse under the influence of atmospheric currents and are gradually deposited on the soil, water and vegetation. These can cause their radioactive contamination.
Radioactive pollution produced must not be neglected as a continuous pollution. The population living in the areas affected by the radioactive pollution produced by the thermoelectric power plants receives additional dose of 300-500μSv / year.
The radioactive 40K isotope of potassium and radioactive elements in the uranium and thorium series are the main elements that give the natural radioactivity of the rocks. The

gamma radiation energies emitted by these radioactive elements are distinct for each element. Potassium radiates energy gamma radiation of 1.46 MeV, while the uranium and thorium series emit gamma radiation with different values (Stanci and Stanci, 2013; Tataru et al., 2015).

Table 1. Content in radioelements in coal and ash in Romania

Types of coal		Average content in radioelements	
		Ra [Bq/g]	Unat [ppm]
Pit coal	Petroşani (Oligocen)	0,038	4
Thermal Power plant Paroseni	Slag and ashes ponds	0,14	13

Research has been carried out in Romania on the radioactivity of coal in some carboniferous basins. Researches were also made for the coal exploited in the Jiu Valley and the slag and ashes from the combustion of coal in the Thermal Power plants (Inişconi, 2015) (Table 1).

In this paper we aim to study the radioactive pollution produced by the storage of tailings from the exploitation and preparation of coal, and from the coal-burning.

RESULTS AND DISCUSSIONS

In order to determine the radioactive pollution of the atmosphere on the tailings dumps and the slag and ash ponds in the Jiu Valley, measurements of the dose rate of the radiation emitted were made.

The radiation levels α, β, and γ were analyzed both at the surface of the slag and ash ponds and the surface of the tailings dumps in the Jiu Valley.

Measurements were made using the Geiger Gamma Scout Radiation Detector. The Gamma-Scout is equipped with a Geiger-Muller counter that detects alpha, beta and gamma radiation.

The measurements were carried out on the Lupeni Preparation Pond, which was established for the purpose of depositing the tailings resulted from the preparation of coal and the slag and ash pond Caprisoara Valley at Paroseni Thermal Power Plant.

The average cosmic stock level recorded in the area unaffected by slag and ash ponds at the dose measurement for the tailings ponds of the Paroseni Thermal Power Plant is 0.08 μSv / h.

The average dose level recorded near the Caprisoara Valley pond of Paroseni Thermal Power Plant is 0.38 μSv / h (Figure 1).
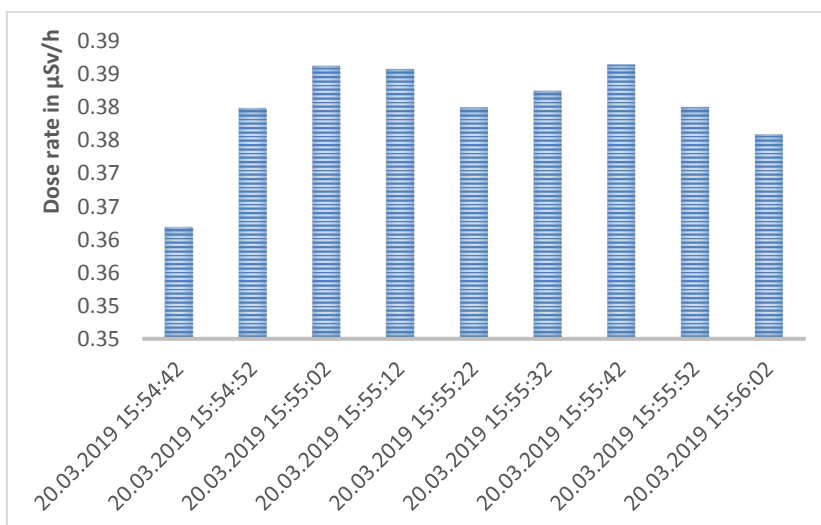

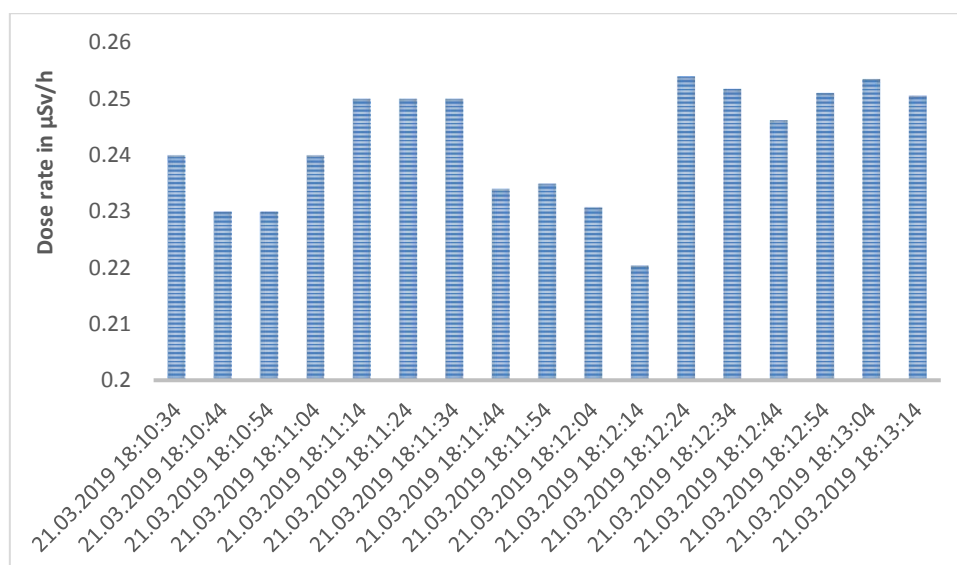Figure 1. The value of the dose level recorded on the Caprisoara Valley of the Paroseni Thermal Power Plant

Figure 2. The value of the dose level recorded on the Lupeni Preparation dump

The mean dose level recorded on the Lupeni Preparation dump is 0.25 µSv / h (Figure 2).

The Caprisoara Valley tailings ponds of the Paroseni Thermal Power Plant have an average radiation dose of 0.3 µSv / h and the Lupeni Preparation dump 0.17 µSv / h. These values represent the difference between the recorded value and the value of the cosmic fond (Figure 3).
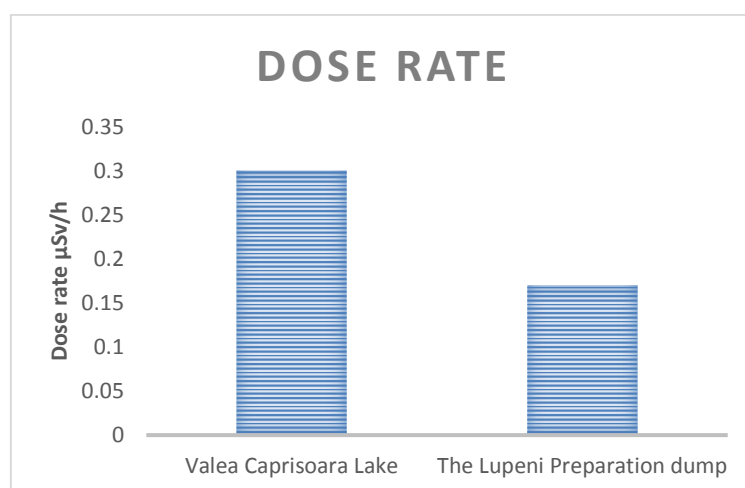

Figure 3. Dose values recorded without cosmic fund level

The high dose value recorded on the Caprioara Valley slag and ash pond is due to the fact that radioactive elements accumulate in slag and ash.

In both cases the recorded radiation level can have negative effects on the fauna and flora in the affected areas.

CONCLUSIONS

Radioactive elements are brought to the surface with the exploitation of coal deposits in the Jiu Valley.

Radioactive elements are found both in extracted coal and in tailings from coal mining and preparation.

The radiation dose recorded for the Lupeni Preparation dump is more than 3 times the natural background in the non-polluted area, and for the Caprioara Valley pond of the Thermal Power Plant Paroseni is 4.5 times higher.

The higher radiation dose recorded on the slag and ash pond of Paroseni Thermal Power Plant. This value is higher due to the fact that the

burning of the radioactive elements does not burn and accumulates in slag and ash.

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SECTION 02
WATER RESOURCES MANAGEMENT

NITROGEN CONTROL IN SEWAGE TREATMENT PLANTS

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Abstract

Purification technologies have been rapidly evolving lately due to the large number of applications that have been made, both for city and industrial wastewater use. An important direction of evolution is related to the development of monitoring devices for the operation of sewage treatment plants. Applications that tracked performance parameters and quality indicators highlighted optimal exploitation technologies and technologies that ultimately led to increased efficiency and lower costs.
In purification, the critical process indicator is "nitrogen"; reducing and framing this indicator within the limits imposed by legislation implying the inclusion of all quality indicators. The development of continuous nitrogen monitoring devices has allowed the purification, nitrification and denitrification processes to be balanced, and the development of appropriate operating and adjustment programs. The control of the ammoniacal and nitrate nitrogen treatment is the best option for optimizing the operation of the treatment plants.
In the material are presented the process philosophies and the results obtained from the regulation of the functioning of the nitrogen treatment plants
Continuous monitoring and regulation ensures the reduction of impacts on water resources.

Keywords: admissible limits, nitrogen control, water resources.

INTRODUCTION

Wastewater treatment plants are important objectives in water management systems. Their efficient operation ensures the protection of the water sources and the increase of the water reuse. In the context of the increase of the water demand it is necessary to rehabilitate new objectives, the rehabilitation to ensure a degree greater purification.

Figure 1. Waste water treatment plant Glina

Short history
In the evolution of the technologies in the water treatment plants were pointed out the directions:
• Developing and optimizing processes
• Reactive reagents
• Equipment, reliable and efficient equipment
Initially, the treatment plants were developed into mechano-biological pathways capable of reducing suspended matter and carbon.
Along with these pollutants, all other water quality indicators, including nutrients, nitrogen and phosphorus, are also reduced.
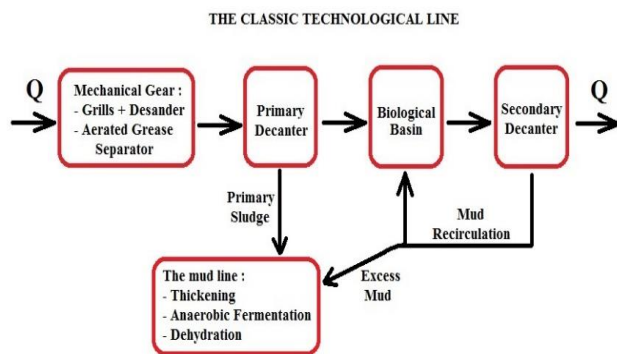
MATERIALS AND METHODS

THE CLASSIC TECHNOLOGICAL LINE

Figure 2. The classic tehnological line

Classical technology has not ensured the limitation of water pollution, as eutrophication processes have continued.
It was considered that the main indicator that influences the eutrophication process is phosphorus. For the reduction of phosphorus precipitation / coagulation processes have been proposed in the primary decantor and / or the secondary decanting biological reactor. The proposed technological variant involves the recirculation on the technological flow of important quantities of phosphorus and slurry recirculation of mud and sludge line. To eliminate the disadvantages, schemes were proposed with phosphorus precipitation in a final step.
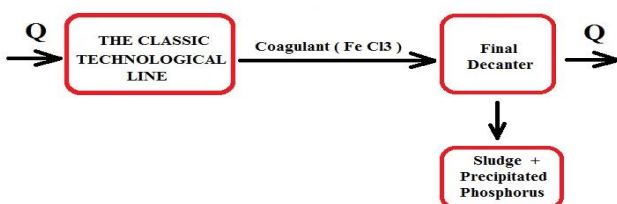
Figure 3. The classic technological line of the coagulant

The phosphorus balance for water sources and the malfunctioning of the treatment plants show that there are sufficient stocks and sources of phosphorus to ensure the development of eutrophication processes. In this context, there has been an increase in the amount of nitrogen purging, assurance and reduction.
Nitrogen reduction is especially accomplished in nitrification and denitrification processes. The organic bonded nitrogen is reduced in flocculation processes, but this represents about 20% of total nitrogen. Reduced nitrogen, ammonia, nitrate, nitrite, about 20 % is bacterially assimilated, and the largest share is metabolate.
NH_4 Nitrification / O_2, Bacteria = NO_2 = NO_3 = Denitrification / $O_2 \downarrow$ Bacteria = N $\uparrow$
The logical succession of biological processes is nitrification -ditrification. The so-formed files did not function properly due to limitations:
-blocking the dentification process due to carbon deficiency
- carrying out the denitrification process and in the secondary decantor with the sludge flotation and entrainment of the slurries in the purified water.
The elimination of these disadvantages was achieved by:
- Ultimate aeration bottoms
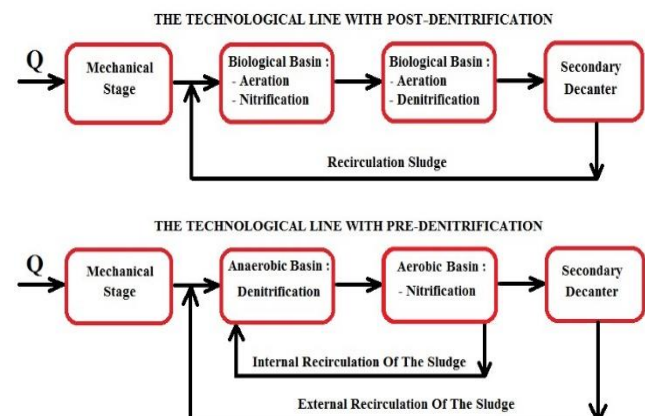- pre-legalization technology plant

Figure 4. The tehnological line with post-denitrification

Ensures the post-containment of the denitrification blocking in the secondary decantor and efficiently uses the water used in the water. The main disadvantage of the chain is that of high recycling volumes, about 100%

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of each of 8-10 mg / l of NH4. To reduce recirculation, various architectures based on successive or sequential phases have been developed.

For the sizing of biological basins the carbon / CBO5 / processing / unprocessed carbon rates were determined. The exploitation has highlighted that the critical process indicator is nitrogen, but in the present design norms that provide for clear design prescriptions in this respect.

The paper presents in situ a pilot plant for the rate of nitrogen processing in the active mud treatment plant.

RESULTS AND DISCUSSIONS

DETERMINATIONS OF THE PROCESS INDICATORS, NITROGEN, IN THE FUNCTIONING STORAGE STATIONS (STATION WITH AMONIACAL REDUCTION FILTER WITH PREDENITRIFICATION)

Figure 1 shows the aeration control in a carousel-type biological basin based on NH4 concentration. Measurements were made in the pre-nitrification treatment plant and sequential biological basin. The automation program allowed the regulation of the processes according to the concentrations of ammoniacal and nitrate nitrogen. A sequential type of technological flow was observed, in the evolution graph a evolution in the mirror, ammoniacal-nitrate nitrogen according to the base of the developed process:

-aeration, reduction of ammoniacal nitrogen involves the accumulation of nitrates;

- without aeration, so denitrification, nitrate reduction but ammoniacal nitrogen accumulation.
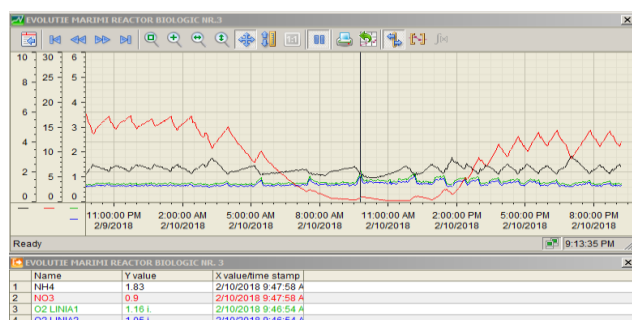
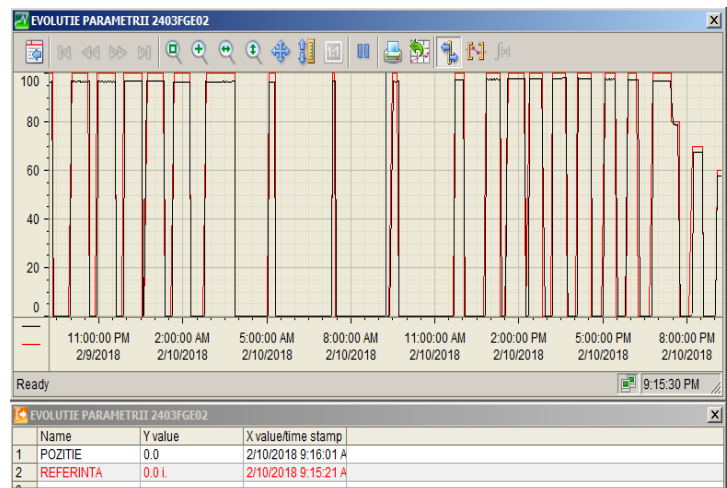Figure 5. Evolution of nitrogen concentration values in the biological basin exploited timed with NH4 limits imposed

Figure 6. The degree of opening of the aeration valves corresponding to the NH4-timed operation

And in this situation, the low dissolved oxygen level below 1 mg / l is observed with nitrification and increases in consumption of reducing substances (NH4).

Using the graphs of the evolution of ammoniacal and nitrate concentrations results in processing rates.
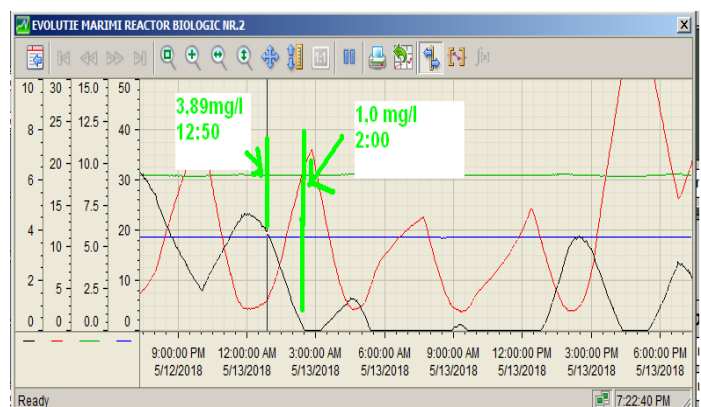

Figure 7. Detail of the evolution of nitrogen in the treatment plant for the determination of the ammoniacal nitrogen processing rate

From the detailed analysis of the results of the nitrogen processing rates (see graphs 2 and 3) according to the analyzed situations, the ammoniacal nitrogen processing rates of 2.9 mg / day of ammoniacal nitrogen and 2.5 mg / hour are obtained. Nitrification rate: 2.9 mg / l in about 70 minutes, 0.04 mg / min, 2.5 mg / hour. It is mentioned that the processing rate is calculated by neglecting the quantities entering and leaving the biological reactor, which can reach about 4mg / h or 4g / h and a reactor.
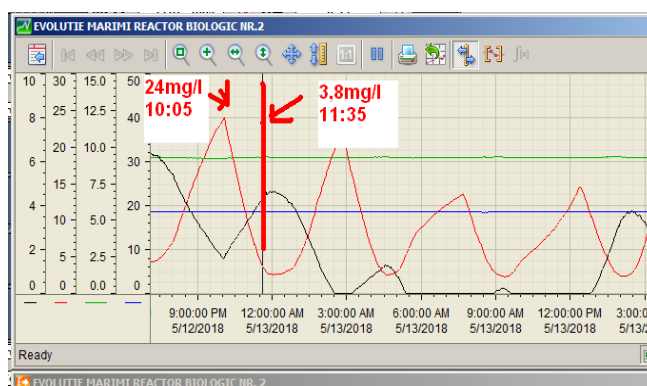
Figure 8. Amoniacal nitrogen details in nitrate
processing fat stations

Denitrification rate: 20.2 mg / l in 90 minutes,
13.5 mg / l (3.2 mg / l N-NO3).

In the installations in operation there may be errors in the deteminations due to the irregularities of the flows and of the nitrogen concentrations. In the case analyzed the complexity of the station and the process may involve errors in the determination of the pollutant processing rates. Under these conditions, isolation of biological basins and of some pilot installations.

DETERMINATIONS ON PILOT STATIONS

A biological reactor primed was isolated in a ministerial purification plant fed with raw water until reaching an initial concentration in ammoniacal nitrogen. The biological reactor was automatically aerated according to the O_2 concentration and determined at different moments the concentrations and the evolution ammoniacal nitrogen. In Table 1 are presented the results obtained which show the rate of nitrogen processing and reduction of the O_2 requirement.

To highlight the nitrification rate, a SBR biological pool was isolated and the NH4 concentrations after the crude water feed.

Table 1

Hour	O_2(mg/l)	NH_4(mg/l)
14.30	2.1	1.78
14.45	2.8	1.43
15.00	3.3	1.38
15.15	3.7	1.12
15.30	Automatic	0.95
15.45	Automatic	0.77
16.00	Automatic	0.65
16.15	Automatic	0.31

In the case of the biological reactor, the NH4 concentration decrease correlation and O2 concentration increase at constant aeration. In this case the rate of nitrification was about 0.9 mg / h. An analysis on other types of stations showed average processing rates of 1.5 mg / l x h for active mud concentrations of 3000-4000 mg / l. Process rates depend on the amount and quality of active sludge.

CONCLUSIONS

Process optimization in wastewater treatment plants involves modern process technologies that allow for the adoption of various operating scenarios.

Monitor process indicators and determine correlations between them, ensure optimal process control and reduce energy consumption Monitoring and centralizing the results on the existing exploitation sites ensures the creation of databases and finally the adoption of procedures and normative designs close to the field requirements.

The obtained determinations have shown anthony nitrogen reduction rates of 0.9 mg / l x h in the pilot plant, and in the treatment plant approx. 2.9mg / l x h, and in case of denitrification of 2.5 mg / l. It is proposed to analyze several operational situations and to make design prescriptions related to the nitrogen indicator, which is also the critical purification indicator.

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SECTION 03
CADASTRE

STEPS OF REALIZING A 3D MAP OF THE CAMPUS OF THE POLYTECHNIC UNIVERSITY OF TIMISOARA USING THE ARCGIS ONLINE SOFTWARE

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Abstract

3D maps offer much more than analogic maps. While on a classic map we look at a city and just imagine what that city looks like, 3D maps give us the opportunity to see this. 3D maps are currently the best solution to visit the major cities of the world if you can not afford to do it in the true sense of the word. The purpose of the paper is to create a 3D digital map of the campus of the Polytechnic University of Timisoara and for that was used the ArcGIS Online software which is a GIS mapping platform developed by ESRI in order to accomplish this work.

Keywords: ArcGIS Online, ESRI Software, 3d Digital Map

INTRODUCTION

With the passage of time the maps evolved as much as possible. Since its inception the maps have had the role they have today, more precisely to help people to orient themselves, but the maps also had the role of delimiting hunting and agricultural areas. From the old paper maps we came to 3D maps today (Herbei and Nemes, 2012).

The 3D perspective of maps is provided by many GPS applications such as Google Maps and Google Earth, which is one of the viewing modes that these applications provide us.

When we say the word map, we think of a paper with countries, reliefs, roads and much more (Grecea and Moscovici, 2014).

3D maps are not the same because they offer much more than normal maps. While on a classic map we look at a city and just imagine what that city looks like, 3D maps give us the opportunity the hole city in digital way.

Basically, this type of map view allows us to travel virtually and visit a lot of cities around the world (Herban et al., 2012).

Typically, 3D map mode can be accessed using the Street View feature that allows you to visit a city using your mouse. But Street View is just one of the 3D ways you can walk around the world's big cities (Herbei, 2015).

So 3D maps are currently the best solution to visit the big cities of the world if you do not afford it to do it in the true sense of the word.
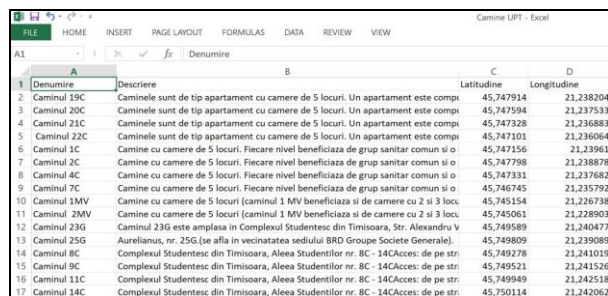
MATERIALS AND METHODS

The ArcGIS Online application is made by ESRI and represents a GIS mapping platform that is stored in the cloud services and allows the user to create a map contained in a GIS web application that includes layer analysis and spatial data (Barliba et al., 2017) .

Developing the GIS web application is made using specialized software, such as HTML5 web protocol and JavaScript, that are linked directly to the ArcGis Online platform, without which the program can not work correctly (Herbei et al., 2010).

RESULTS AND DISCUSSIONS

To complete the interactive map and the ESRI ArcGIS Online application, the following steps were taken:

1)The first step is to obtain on the ground the geographic coordinates of the targets using specific devices and create a spatial database containing multiple Microsoft Excel files, each file having the name, description, latitude, longitude, website with the 3D image link loaded on the www.flickr.com, as well as attributes. In this paper, the campus map was embedded in 3 CSV files (Accommodation, Faculties and Administrative Buildings) (Barliba et al., 2018).
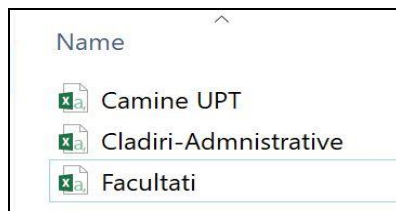

Figure1. ArcGIS Ribbon

Figure 2. ArcGIS Ribbon

Step 2: After authenticating on the ArcGIS online platform (Figure 3) and opening a new map, CSV (Comma Delimited) files were loaded as a theme layer (Figure 4).
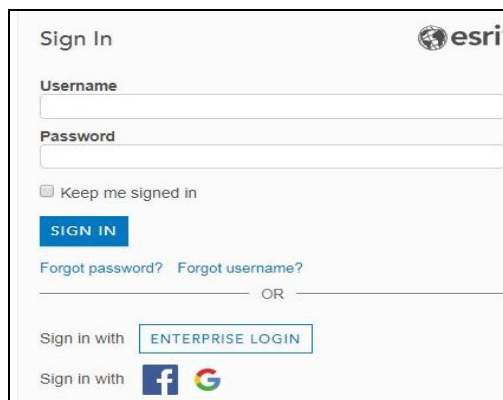

Figure 3. Sign in menu in ArcGIS Online

Figure 4. ArcGIS Ribbon

Figure 5. Add dedicated layer from the file

After inserting the CSVs (Figure 5), the fields for the coordinate file (latitude, longitude) were selected (Figure 6).
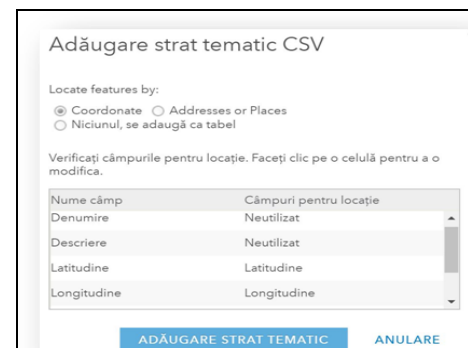

Figure 6. Selection of coordinated fields

In the main menu of this platform, we find a variety of options available for editing data, such as creating labels or changing symbols (Figure 7).
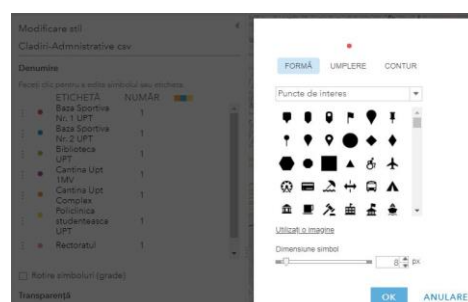

Figure 7. Introduction of symbols

In the two images below it is a comparison of the points of interest marked before (Figure 8) and after (Figure 9) the POIs name.
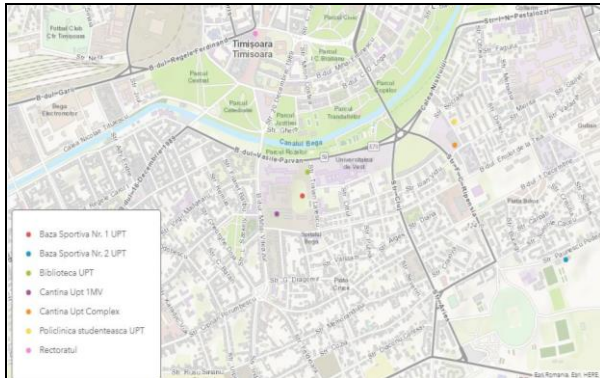

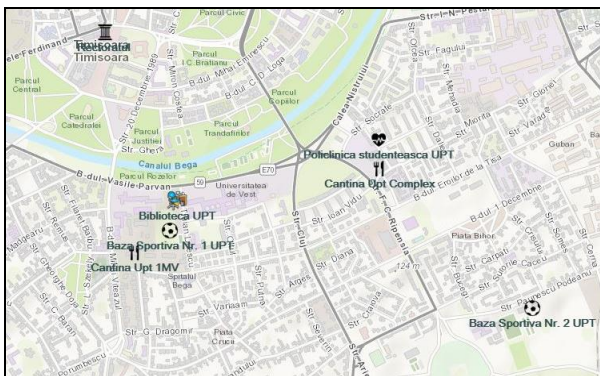Figure 8. Map before editing POIs

Figure 9. Map after editing POIs

Each POI is based on multiple attributes and can be accessed by users by clicking on the icon.

Thus, the application opens a new window where information, including object description, website, and 3D photo are presented (Figure10).

Figure 10. POIs information window

The Polytechnic University of Timisoara (UPT) is a higher technical education institution in Timisoara, Romania, founded in 1920. In 2011, it was ranked in the first category in Romania, that of the advanced research universities and the University is a member of the Romanian Alliance of the Technical Universities (ARUT), which includes the most important technical universities in Romania. Polytechnic University of Timisoara is one of the largest technical universities in Central and Eastern Europe. The study programs offered are organized according to the Bologna system in three cycles: Bachelor, Master, PhD. UPT comprises 10 faculties with 15 000 students. The teaching staff consists of approximately 700 teachers working in 25 departments, while administrative and auxiliary staff numbers around 900 staff. **The UPT campus** is located in several areas of Timisoara, including the central area and the student area, and includes 10 faculties and many administrative buildings (university canteens, the library, etc.) and 17 student accommodations (Figure 11).

Figure 11. The campus map

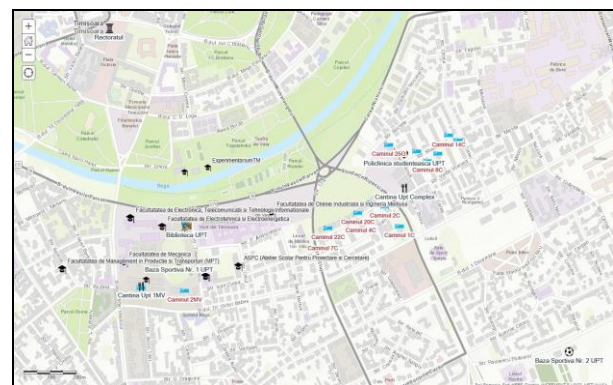**UPT Faculties** are the following: Faculty of Architecture, Faculty of Automation and Computers, Faculty of Industrial Chemistry and Environmental Engineering, Faculty of Civil Engineering, Faculty of Electronics and Telecommunications, Faculty of Electrotechnics and Power Engineering, Faculty of Production and Transport Management, Faculty of Mechanics, Faculty of Communication Sciences (Figure 12).
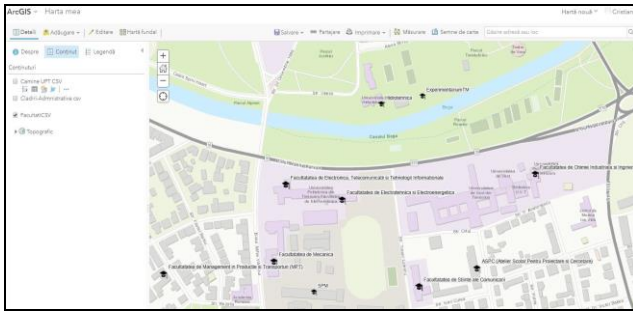
Figure 12. The faculties map

The Faculty of Civil Engineering in Timisoara is one of the oldest faculties of the Polytechnic University of Timisoara. It has a rich tradition, being founded in 1941(Figure12). It offers students training in the fields of civil engineering, geodesic engineering and installation engineering. There is also in the same building (Figure 14) the Faculty of Architecture (4th-6th floor) and the Faculty of Communication Sciences (3rd floor).
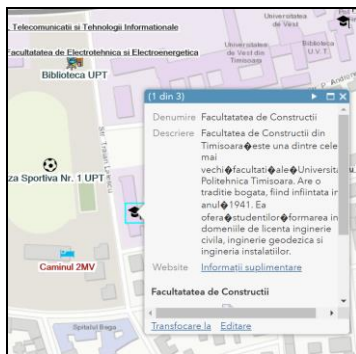
Figure 13. Description of the faculty

Figure 14. 3D image of the building

Faculty of Automation and Computers from Timisoara is one of the newest faculties of the Polytechnic University of Timisoara. It offers students the training as a specialist engineer in automation and computers with various specializations (Figure 15). As specialists for the license we find CTI (Computer and Information Technology) and IS (System Engineering). Also within the Electro building

(Figure 16) are the Faculty of Electronics, Telecommunications and Information Technologies.

Figure 15. Faculty information window

Figure 16. 3D image of the building

The administrative buildings of the UPT are: Rectorate, Central Library, the two sports centers (Sports Center No. 1 and Sports Center No. 2), Policlinica and the 2 canteens (Canteen 1MV, Central canteen) (Figure17).

Figure 17. Administrative Buildings

Sports Center No. 2 includes (Figure 19): swimming pools (indoor with sauna and gym equipment and outdoor), sports hall (tennis, basketball, volleyball), tennis courts (bitumen

and tartan), basketball courts, football fields, multifunctional building (Figure 18).

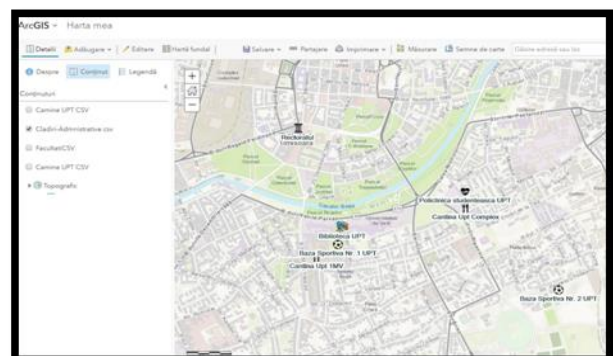Figure 18. 3D model of sport centre

Figure 19. Sport centre map information

The Central Library of the Polytechnic University is a relatively new building (Figure20) of the Polytechnic University of Timisoara and includes numerous reading rooms and technical collections of books (Figure 20). During the period 1948-2014 he worked in the ensemble of the Piarist High School. Since it was located in the center of Timisoara, but far from some faculties, the library had specialized branches at the faculties of Chemistry, Electro, Mechanics and Construction.

Figure 20. Library
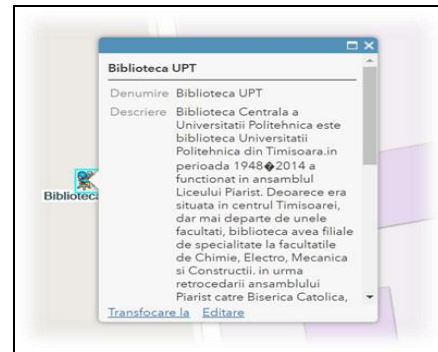
Figure 21. Library map information

The university hostels accommodate approximately 5,500 students in 2000 student rooms from the 16 buildings, all of which are equipped with internet connection, cable TV, refrigerator and new furniture. There are both 5 person accommodation in a room in an apartment module, as well as 2 persons in the room and also studios with en suite facilities (Figure 22).
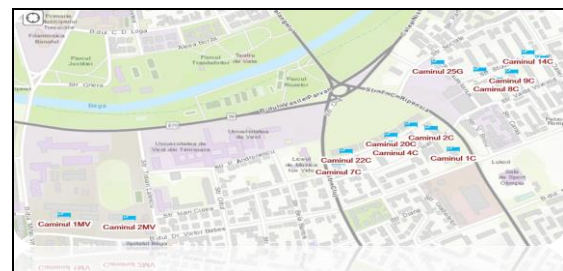
Figure 22.Student accommodation maps

The 8C, 9C, 11C, 14C student accommodation (Figure 23) have double rooms, a shared sanitary group on each level, internet, kitchen and laundry space. They are located in Student Complex in Timisoara, Studentilor Alley no. 8C - 14C with access to the Sportivilor Alley and Aurelian, Alexandru Vaida Voievod or Dalia streets (Figure 24).

Figure 23. Accommodation information

Figure 24. Accommodation 3D view

CONCLUSIONS

So with the help of the online platform I managed to present a 3D digital image (Figure 25) that I have marked all the points of interest that are included in the campus of the Polytechnic University of Timisoara. All these have as primary purpose a good organization and orientation in the campus both for the students of the first years of study but also for the persons who visit the University.

Figure 25. Final campus map

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***http://www.esri.ro/software/arcgis/arcgisonline/features

THE USE OF UAV AND GIS TECHNOLOGY FOR OBTAINING THE DIGITAL MAP OF UASVM CLUJ-NAPOCA CAMPUS

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Abstract

The purpose of this project is to build a digital map of the UASVM Cluj-Napoca's campus, in order to help students from the freshman and the visitors because it has a large area of about 23 ha and a number of 15 buildings. We made use of the UAV photogrammetric method, which has advantages such as very short mapping times and reduced costs compared to aerial photogrammetry, using the aircraft. Based on the cartographic data obtained by UAV photogrammetric methods, the necessary paper drawing elements were taken.. In the first phase, we obtained the map using ArcGIS Desktop. Using the data that we obtained from this program we published the ArcGIS Online map where pop-ups were added to each building in order to fit each and every building on the university's website so anyone with access to the Internet can access it from their smartphone.

Keywords: ArcGIS Online, digital map, geodatabase, UA.V

INTRODUCTION

With the development of the computing technique, the method of photogrammetric measurements has also evolved. Starting from the need for low implementation and maintenance costs, a more efficient technology has been developed not only economically but also from a quality stand point. The UAV can therefore be seen as a supplement or substitute for terrestrial photogrammetry and related fields such as topography or cadastre. Compared with other technologies, the UAV technology provides very large coverage (100 ha / hour) and with an average centimeter accuracy, depending on the product you need to be done.

UAV photogrammetry can be perceived as a new instrument or branch of classic photogrammetry. UAV opens up new insights into recordings made from small to medium distances, but also introduces new alternatives (https://www.ipartner.ro/media/files/pdf/ro_uav_uav.pdf).

Using photogrammetric measurements as support for classical topographical measurements in order to obtain the topographic plans for urban areas, ArcGIS Online provides the means to create maps and interactive applications that can be shared with specific groups or with all users. Users benefit from ready-to-use content, applications, and map templates. It does not matter if you use desktops, browsers, smartphones or tablets. ArcGIS Online includes a gallery of basic maps and tools that allow you to add data and make customized maps for different purposes (http://www.esri.ro/~/media/esri-Romania/Files/Pdfs/ONLINE%20%20151.pdf) The pop-up windows contain descriptive information about the spatial objects in each thematic layer on the map. A pop-up contains a header and attribute information based on the columns and rows of your data. Pop-up windows are displayed when you click on a spatial object on the map. You can change how the information is displayed in the pop-up window by changing the title and specifying the fields to display.

MATERIALS AND METHODS

In order to obtain the orthophotomap, a Phantom 4 Pro drone (Figure 1) was used, incorporating a 20 MPcamera with a 1 inch sensor, Drone Deploy for the flight planning, two Trimble R10 GPS receivers, one of which was mounted on a base point previously determined using static methods. In order to achievemaps we used ArcGIS Desktop and ArcGIS Online.

Figure 1. Phantom 4 Pro D

RESULTS AND DISCUSSIONS

The technological process of obtaining digital orthophotomap consists of several stages. The first one consists on marking the ground control points (Figure 2), which is a practical method by which the position of the terminal in the aero-photographed area is visible on the photogrammetry image by fixing visible markings around the point terminal (Toderaș, 2007) and determining using the GPS the X, Y, Z coordinates of the control points determined using GNSS technology. The next stage is flight planning with the help ofDrone Deploy application. A frontal overlap of 75% and 65% lateral overlap was established and the average flight altitude was 100m. The launch of the drone was done in front of the ICHAT building, being the highest point. To prevent possible accidents we had to enable obstacle avoidance mode. The estimated flight time was 15min 15sec covering an area of 31 ha and an estimated number of 245 photograms (Figure 3).
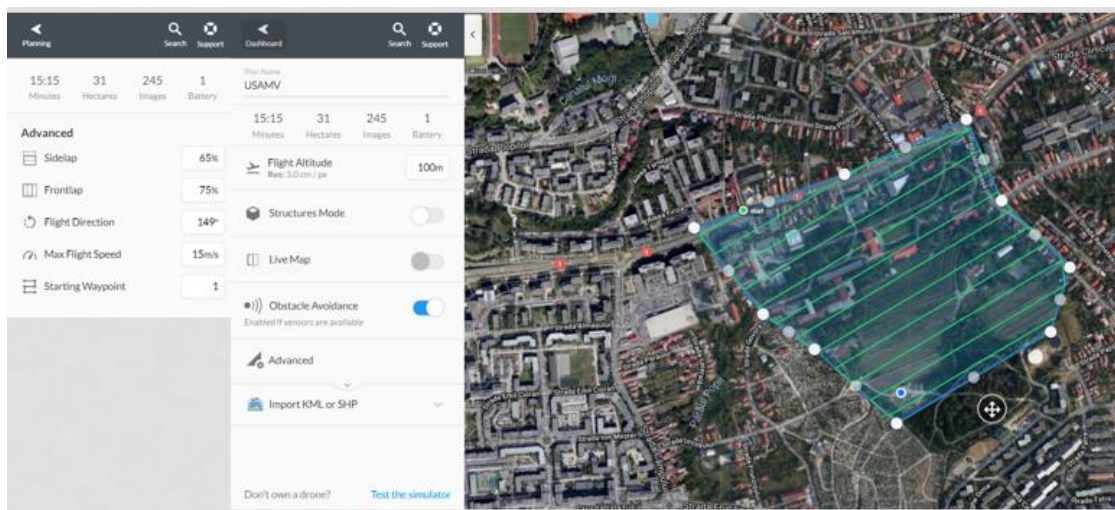

Figure 2. Ground control point

Figure 3. Flight plan

In the next step we used Agisoft PhotoScan, which is an advanced image-based 3D modelling solution aimed at creating professional quality 3D content from still images. Based on the latest multi-view 3D reconstruction technology, it operates with arbitrary images and is efficient in both controlled and uncontrolled conditions. Photos can be taken from any position, providing that the object to be reconstructed is visible on at least two photos. Both image alignment and 3D model reconstruction are fully automated. (https://www.agisoft.com/pdf/photoscan-pro_1_4_en.pdf)

In this program, the photogrames alignment was made in block. Then the checkpoints were marked on each photo. Next, we determined the compensation error as RMSE (Root Mean Square Error).

$$\sigma_0 = \pm \sqrt{\frac{[vv]}{r}}$$

r – redundancy of compensation

$$r = 3(n'_R + n'_L) - (7n_M + 3_{n_L})$$

Where:

n_M – number of Stereomodels from the block;

n_L – number of Link points;

$n`_R$ - number of total appearances of reference points on n_M models;

n'_L – number of points of view in the model

Root Mean Square Errors in landmark, link and control points are calculated as follows:

$$e = \pm \sqrt{\frac{v_{X_R}^2 + v_{Y_R}^2 + v_{Z_R}^2}{3n'_C}}$$

$$e = \pm \sqrt{\frac{v_{X_L}^2 + v_{Y_L}^2 + v_{Z_L}^2}{3n'_L}}$$

$$e = \pm \sqrt{\frac{v_{X_C}^2 + v_{Y_C}^2 + v_{Z_C}^2}{3n'_C}}$$

Table 1. Average square errors in landmarks

Label	XY error (m)	Z error (m)	Error (m)	Projections	Error (pix)
101	0.009	-0.004	0.010	11	0.549
102	0.005	-0.001	0.005	10	0.318
103	0.022	-0.006	0.023	6	0.269
104	0.013	-0.026	0.030	8	0.277
105	0.017	0.016	0.024	15	0.265
106	0.007	0.007	0.010	14	0.158
107	0.011	0.009	0.014	13	0.375
108	0.027	0.009	0.029	10	0.205
109	0.018	-0.020	0.027	4	0.273
110	0.024	0.008	0.025	7	0.204
111	0.018	-0.006	0.019	23	0.226
112	0.041	-0.013	0.043	14	0.223
113	0.013	-0.001	0.013	11	0.450
114	0.012	0.003	0.013	22	0.174
115	0.026	0.010	0.028	11	0.421
116	0.016	0.001	0.016	12	0.430
Total	**0.020**	**0.011**	**0.023**		**0.312**

Generating the digital elevation model is done based on dense points cloud (Figure 4). The digital elevation model. The altitude of the campus ranges between 341m and 427m (Figure 5).
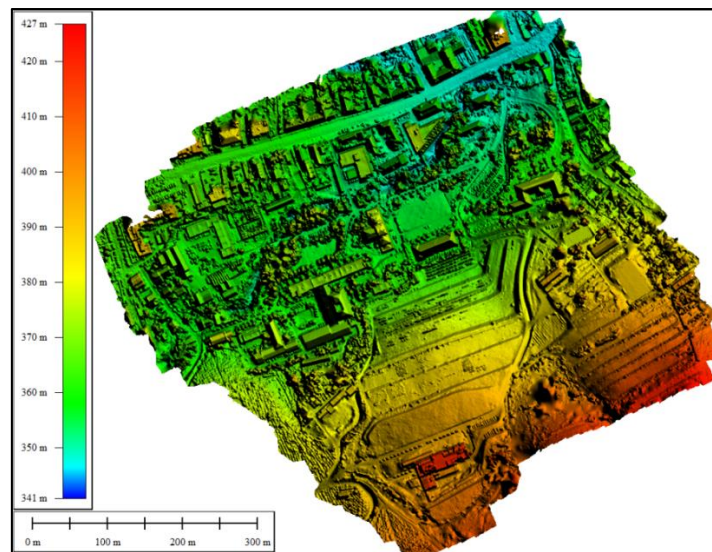
Figure 4. Point cloud

Figure 5. Digital elevation model

From the Emergency Department, we came in possession of the buildings' analogue plans. Buildings are located in the UASMV's campus in Cluj-Napoca. These planes were verified by measurements using a Leica Disto. We found them compliant, we vectorized them and took the names of each room (Figure 6).
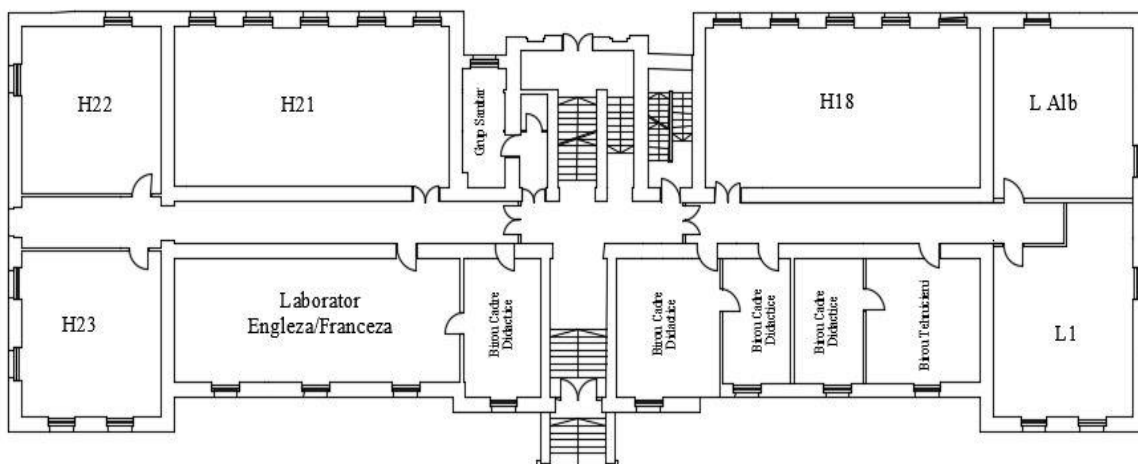
Figure 6. Analogue plan

The UASVM campus digital database is made in ArcCatalog (Figure 7) using the geodatabase vector format and the Stereographic 1970 coordinate system. The related data set contains thematic layers of the campus's focal points, namely: buildings, amphitheaters, parking spaces and sports areas.

Figure 7. ArcCatalog Database

The vectorization of this map was made in ArcMap on the basis of the obtained orthophotoplan, with a resolution of 4.86 cm / pixel. The map digitization has been made of polygon and point type to create pop-ups. Thematic layers contain symbols representative of each objective (Figure 8).

Figure 8. UASVM Campus Digital Map

In ArcGIS Online an interactive map will be made available to a broad audience that includes the UASVM campus digital database, based on the UAV-based campus im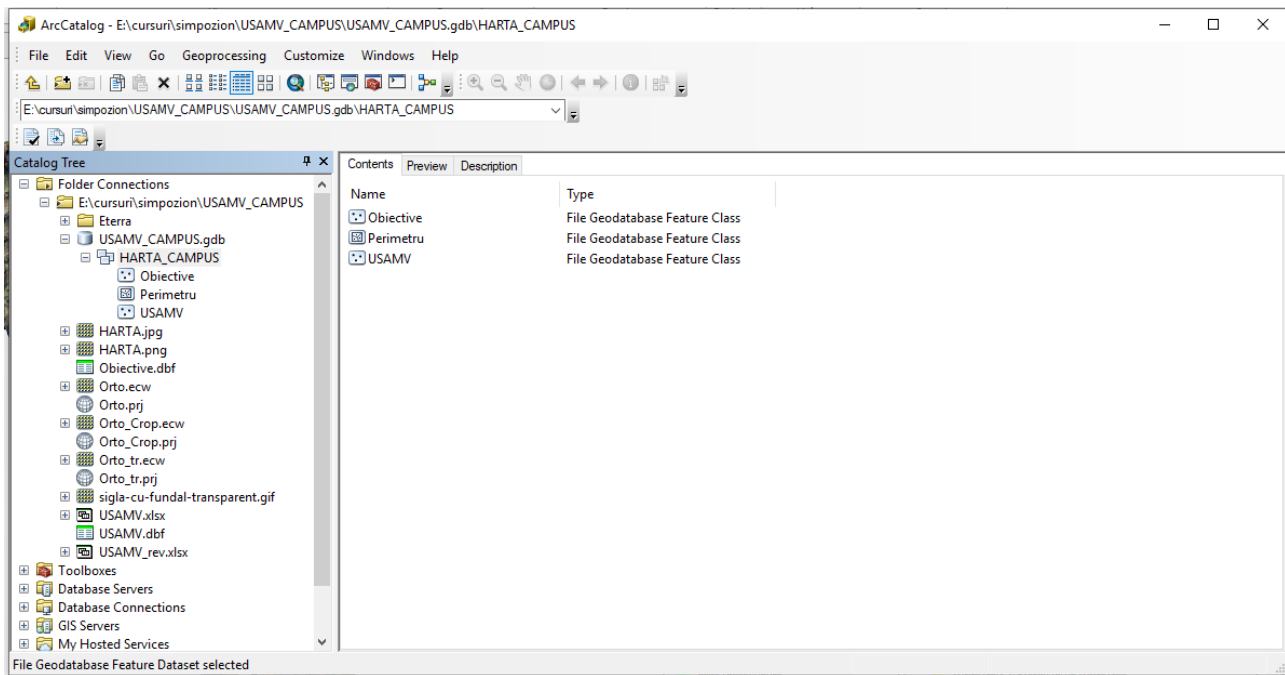age, there will be thematic layers for students/visitors, and pop-ups with information allowing students to view lecture/laboratories hierarchies and also parking spaces, amphitheaters where conferences and events take place, and sports areas. Pop-up windows give life to the attributes associated with each thematic layer of spatial objects on the map. Each spatial object on the map corresponds to a pop-up window that contains a list of attributes and values that contain information about its structure, presentation image, and the corresponding floor reports as well as links to each image (Figure 9).
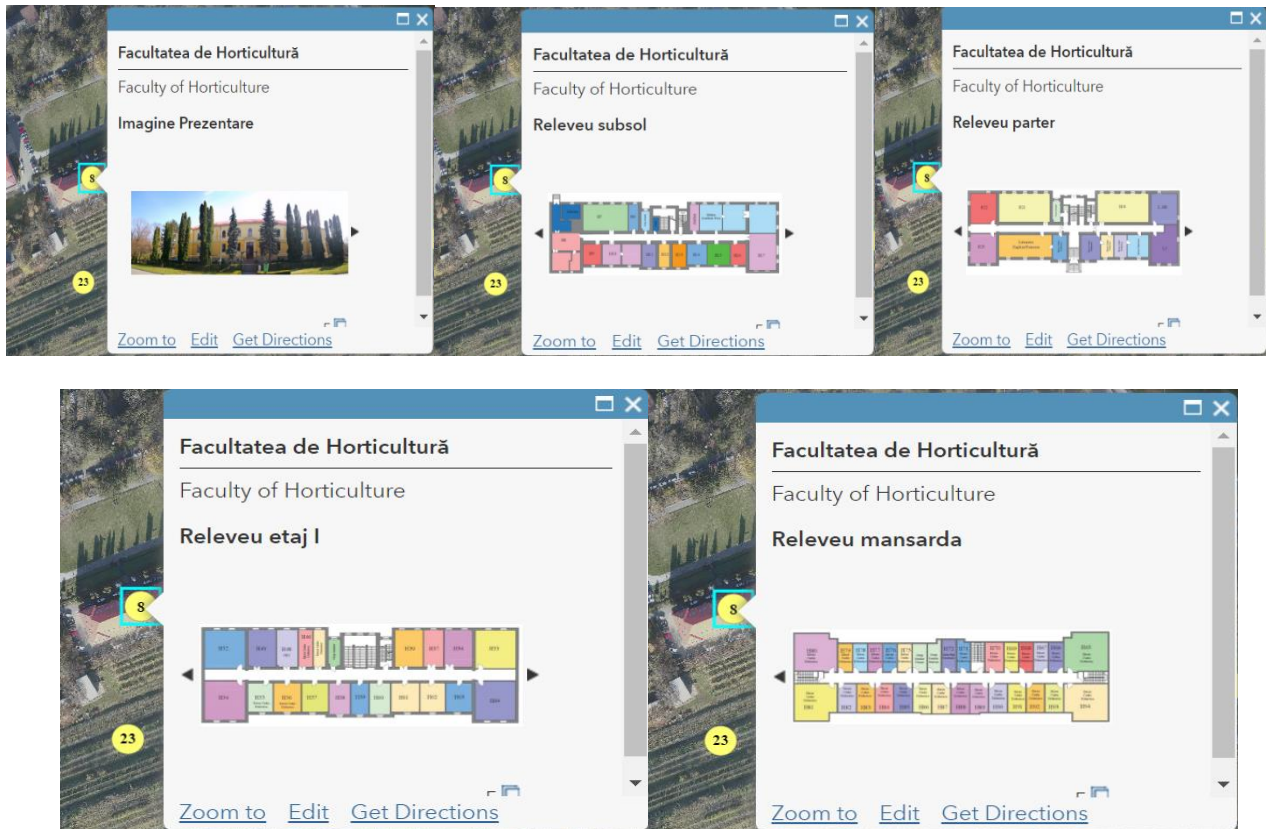
Figure 9. Pop-up windows

CONCLUSIONS

The main advantage of the photogrammetric method is the very short reception time and low cost. Also, a very large volume of data (points cloud, orthophotomap, digital elevation model) is obtained. The GIS Online application has the advantage that the digital map can easily be accessed through a link by any interested person.

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UAV PHOTOGRAMMETRY IMPLEMENTATION TO ENHANCE LAND SURVEYING IN CADASTER

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Abstract

The use of Unmanned Aerial Vehicles (UAVs) for surveying is now widespread and operational for several applications – quarry monitoring, archeological site surveys, forest management and 3D modeling for buildings, for instance. UAV is increasingly usedby land surveyors especially for kinds of projects. It is still ambiguous whether UAV can be applicable for smaller sites and property division. Therefore, the objective of this project is to extract an orthophotomap, which can be used later by the land surveyor engineer in the field of cadaster, to vectorize correctly a topographic plan of the studied area. In order to achieve the correct result, the orthophotomap was created using a UAV, and more specific TRIMBLE UX5 HP. The flight schedule was prepared in the office with "Aerial imaging Desktop" software, and for the processing of the resulted photos was used "TBC - Trimble Business Center" software. Both of the softwares are provided by Trimble, the manufacturer of the UAV. The main problems associated with using a UAV are the level of precision and the visualization of the whole area. The results indicated that the precision is quite satisfactory with a maximum error of 5.33 cm for the rest of the model.

Keywords: *Cadaster, Land Survey, Orthophotomap, TRIMBLE, Unmanned Aerial Vehicles (UAV).*

INTRODUCTION

Innovation in topography and land surveying is to aim to acquire more data with higher accuracy. Computer developments were a key change in that regard. Nowadays, utilizing UAVs could lead to another quantum leap in the surveying profession. Topographic plans are widely used in a variety of applications and at various sites. These plans involve several levels of accuracy depending on the client's needs.

Digital photogrammetry is the science of using computers to obtain the dimensions of photographed objects. It involves the analysis of one or more existing photograms / photograms with specialized photogrammetry programs to determine spatial relationships.

Planimetric photogrammetry was born with the discovery of photography in France with the first terrestrial photogrammetric elevations. It was followed by the analog collection method, then the analytical method (which is still used with accurate results) and the digital method. The digital method revolutionized photogrammetry (Preoţescu and Nedea, 2017). Digital photogrammetric stations completely solve the problem of collecting and processing the digital data needed in any areas.As a ground-based field science, photogrammetry serves to draw up maps and topographical plans, but is widely used in other spheres of activity such as architecture, cadaster, police investigations, or even medicine (plastic surgery) (Vîlceanu, 2013). Also, if used in the background of intelligent cadastral vector data, can improve the details of thematic maps as well as action plan maps (Moscovici et al., 2015). It also helps to monitor land cover changes (Herbei et al., 2016). All methods based on both UAV and satellite techniques are very often used in the analysis and characterization of the terrain and the vegetal cover (Gitelson 2004, Thenkabail et al., 2007, Sala, 2011).

Usually, projects that require crucial safety conditioning for construction, such as high-speed railways, landing strips, investigating building deformations or tunnel inspections, require plans with high accuracy, where just a

few millimeters (mm) of deformation are highly significant. For many topographical surveys, the data are acquired with a total station. A total station is surveying equipment that consists of an electromagnetic measuring instrument and electronic theodolite. It is also integrated with a microprocessor, electronic data collector and storage system. The instrument can be used to measure horizontal and vertical angles as well as the slope distance from the object to the instrument. The redundant measures with total stations allow accuracy to within millimetres to be achieved. Furthermore, their automatic operation enables more data to be acquired in a limited period of time. Over one day a land surveyor can acquire up to 2,000 points. Since the process is repetitive it can easily involve errors. The survey then has to be georeferenced using different techniques based on the nature of the terrain and the available instruments. Usually, the most efficient technique used is a global navigation satellite system (GNSS) receiver with areal-time kinematic (RTK) network. This allows control points to be obtained with a high precision. Once the field survey is completed, the data are transferred to CAD software to generate the plan. Eventhough codification in the field enables automatic drawing, it usually involves some errors, and the post-treatment process usually takes several hours to obtain the final product.

According to (Colomina and Molina, 2014), UAV photogrammetry has witnessed rapid development in the past few years. This can be attributed to the accessibility of drones and a major development of Structure from Motion software. Before UAVs, aerial photogrammetry involved planes or helicopters and metric cameras. It encompassed complex and various processes due to the heights to which the aircraft soared and the expensive cost of metric cameras and flight hours. It now offers an affordable access to precise aerial mapping (Fraser, 2015). According to (Küng, 2011), the developments of UAVs in recent years along with the improvements in Structure from Motion (SFM) software and computer vision enhanced the production of photogrammetry. They made it accessible with centimetric-al precision even with bad positioning systems on-board the aircraft. This precision is approximately within the same range as the existing technologies for most land surveying purposes. Application requiring millimetric precision is still out of the range of possibilities for UAVs. UAVs are becoming more and more affordable, and the ultra-light and user-grade cameras on-board also offer very good resolution for low-altitude photogrammetric work. Moreover, UAVs are becoming easier to use with automated flight planners and automatic obstacle detection.

MATERIAL AND METHOD

The principle of data acquisition using the photogrammetric method aims to obtain physical and environmental information about the physical objects and the environment remotely without physical contact with them by recording, measuring and interpreting metric photographic images called photograms. The obtaining of a photogram is done by photogrammetric cameras either located on the ground (ground photogrammetry) or placed on board airborne platforms (Vîlceanu, 2013).
Photogrammetry is suitable for the following functions:
   •ensuring orthoimages;
   • both in local systems and in regional systems
   • creating digital models of height (allowances) of the land;
   • creating 3D models of objects;
   • direction and inclination of geological strata;
   • determining the position of the points. (Vîlceanu, 2013)
The development of an orthophotomap begins with the planning of the flight plan for the area of interest. For this stage, we need to know the scale of the desired orthophotomap in order to calculate the flight height, as well as the longitudinal and lateral overlap of the images. In parallel with the aerial image acquisition operation, control points for calibration of the final image could be determined. This is mandatory with the UAVs which do not have integrated a GPS system (Herbei, 2015).
The main advantage in using unmanned flight equipment (drones, UAV), represents the availability and flexibility of the execution of a project, whom are clearly superior to the use of

classic flight equipment (airplane, helicopter). The surfaces that can be covered with such equipment are in the range of tens of up to hundreds of hectares.

Aerial photography is useful both for regular monitoring of an area of interest (landslides, reservoirs, ponds, etc.), as well as for supporting topographic and cadastral works on extended surfaces (general cadastre, agricultural and systematic cadastre etc.).

➢ UAV system – Trimble UX5 HP

The drone or the unmanned aerial vehicle (UAV) is a generally small unmanned aircraft that is remote-controlled: based on a predefined flight plan/route or with a remote control.

This kind of gear is equipped with different type of sensors, GPS (is not a mandatory feature) and has a high-resolution or infrared camera with the help of which it records a large number of photographs. The resulted photographs can be georeferenced using ground control points, ultimately obtaining a high-resolution orthophotomap. Also, with the help of specialized software, the digital model of the ground or a "cloud of points" can be obtained, later to be used in deferent field analysis, or even to obtain a 3D model of the studied area.

In the current study, the UAV used is a TRIMBLE UX5 HP (Figure 1) .

Figure 1. UAV TRIMBLE UX5 HP

The Trimble UX5 HP hardware features are listed in Table 1.

Table 1. Hardware specifications

Type	Fixed wings
Weight	2.9 kg
Wingspan	1m
Wing surface area	34 dm²
Size	100cm X 65cm X 10.5cm
Battery	14,8 V; 6600mAh
Camera	36MP
GNSS Receiver	L1/L2 GNSS
Controller	Trimble Tablet Rugged PC

➢ High precision mapping and surveying solution

The Trimble® UX5 HP Unmanned Aircraft System (UAS) is an easy to use, fully automated, high precision system capable of capturing aerial photography with resolutions down to 1 cm. Featuring Trimble Access™ Aerial Imaging field software and Trimble Business Center office software, this complete system provides an intuitive workflow that allows you to quickly create the highest quality orthomosaics and 3D models for applications such as survey grade mapping, power line monitoring, field leveling, site and route planning, progress monitoring and asset mapping.

➢ Superior Image Acquisition and Accuracy

The UX5 HP delivers precise data by integrating a high-performance Trimble GNSS receiver and a superior camera. Post-Processed Kinematic (PPK) GNSS technology is used to establish very accurate image locations in absolute coordinate systems, eliminating the need for ground control. As a result, less time is spent in the field and high precision results can be achieved even in the most inaccessible areas. With PPK, georeferencing aerial data is more robust and accurate than RTK, providing a superior level of reliability and accuracy. Use either your own base station or work with data from reference stations to georeference your deliverables with the highest accuracy possible. The Trimble UX5 HP features an industry-leading 36 MP full-frame sensor camera

capable of capturing sharp, high resolution images. The camera achieves a leading level of image resolution - orthomosaics down to 1 cm GSD and point clouds up to several thousands points per square meter.

➢ Configure for the Job

No one project is ever the same, that is why you can select a camera and lens combination that match your project needs. You have the flexibility to choose between a near infrared or RGB sensor system, and a selection of lenses. The lenses include a 35mm lens for high accuracy, a 15mm wide angle lens for increased flight coverage or a 25mm lens delivering both accuracy and increased flight coverage.

➢ Trusted Performance

The Trimble UX5 HP is an extremely safe and durable system, made from impact resistant foam, that can withstand extreme temperatures, winds up to 65 km, and light rain—making it ideal for use in conditions that most unmanned aircrafts struggle to operate in.

➢ Intuitive Workflows with Trimble Access

The Trimble Access Aerial Imaging application loaded onto the Trimble Tablet Rugged PC operates the UX5 HP and is a single software tool for planning your aerial missions, performing pre-flight checks and monitoring your flights. Now you can map corridors, cover disconnected areas in a single flight, import multiple map layers, fly irregular shaped areas and heights, plan or change multiple takeoff and landing locations during flight, and perform flight simulations to confirm the plan. The export functionality gathers all required data into a single file that can be imported into Trimble Business Center.

➢ Valuable Photogrammetry Deliverables

Optimized to process data from the Trimble UX5 HP, the Trimble Business Center Photogrammetry Module creates impressive deliverables. With a single drag-and-drop, imported GNSS information, base station or reference station data, and onboard images are processed in Trimble Business Center to produce a scaled orthoimage, point clouds, Triangulated Irregular Network (TIN) models and contour maps of the area flown. These can then be used in planning a project, calculating volumes, excavation planning, drainage planning and many other functions. Alternatively, Inpho UASMaster provides the power user or photogrammetrist with the right set of tools to use the full potential of aerial data. With feature based seamline-finding, terrain editing capabilities, state-of-the-art DTM generation, classification and filtering, even the most challenging projects can be processed.

➢ Performance specifications – Trimble UX5 HP system:

- maximized image footprint without compromising resolution, obtained with a custom wide-angle lens and APSC-type sensor.
- maximized coverage per flight and per hour due to large image footprint, sharp turning capability and high cruise speed.
- reversed thrust technology for a short and steep landing circuit.
- powerful propulsion system for steep climbs and high altitude flights.
- high airframe service life due to wing robustness and maintainability.
- short setup time with automated procedures in Trimble Access field software.
- self-check and failsafe procedures for safe operation.
- one-button export to Trimble Business Center to create deliverables.
- optimized data accuracy when processed with Trimble Business Center or Trimble Inpho UASMaster.
- high Precision GNSS receiver to georeference deliverables accurately and easily.

➢ Software description- Trimble Access Aerial Imaging application

Allows:
- project management
- mission planning with option for multiple flights
- automated pre-flight checks

- automatic take off, flight and landing
- autonomous camera triggering
- automated fail-safe routines
- user-controlled fail-safe commands
- automated data consistency checks
- export to Trimble Business Center, Trimble UASMaster and a generic format for image processing

RESULTS AND DISCUSSIONS

The study area is located in the town of Birchis, Arad County (Figure 2) and is part of the of the territorial administrative unit Birchis.

Figure 2. Study area

This project has been divided into 3 stages:

> **Part 1, in the office, with the following objectives:**

1. Identification of the area of interest
2. Flight preparation: The area of interest, after identification on Google Earth, was divided in flight sectors (each of maximum 20-21 minutes, including take-off and landing)

(Figure 3 and Figure 4). For each flight sector, the desired altitude and the precision of the orthophotomap were set (Figure5), and after checking the battery charging status, control tablet battery charging status, GPS battery charging status, the UAV is prepared for takeoff.

> **Part 2, "In situ", with the following objectives:**

3. Travelling to the area of interest
4. Establishment in the area of interest of the take-off and landing site (Figure 5) (take-off requires a free area of approximately 3 m in width and 25 m in length, and for landing a free area of approximately 25 m width and 50 m long isnecessary, as flat as possible and without any objects or obstacles that could damage the drone's body in case of contact)
5. Half an hour before the actual take-off, the Survol Service is notified by phone in order to register the flight and the UAV used and the operator.
6. A flight point is established in the flight area, in which, using the GPS, measurements are conducted with the static method throughout the flight (measurements necessary to increase the accuracy in orthophotograph processing).
7. Introducing the points, take-off and landing directions, and wind direction in the field in the tablet's flight software (Aerial Imaging).
8. Once the drone is ready (charged batteries inserted, take-off and landing points set), the PreFlight Check List is initiated (a series of steps to be taken for safe take-off)

9. After the launch of the drone, the actual flight is automatically performed by the Aerial Imaging flight program of the tablet connected to the UAV, and the operator constantly checks the drone's status displayed on the screen of the control tablet (altitude, battery level, recorded pictures, minutes flown, flight minutes left, speed and direction of the wind, and his assistant constantly observes the movement of the drone and the possible obstacles in the air to warn the drone operator (helicopters, light aircraft, other drones, hot air balloons, etc.)
10. Once the air corridors are finished, the UAV automatically announces the operator through the tablet thatit prepares to land, and the operator and his assistant ensure that the landing area is free of obstacles and confirm the landing.
11. Once it has reached the ground, the UAV prepares the download (the flight path file is downloaded), the recorded pictures and the static measurement from the GPS (if they were measured)
12. The flight termination is announced at the Survol Service and the equipment is gathered.
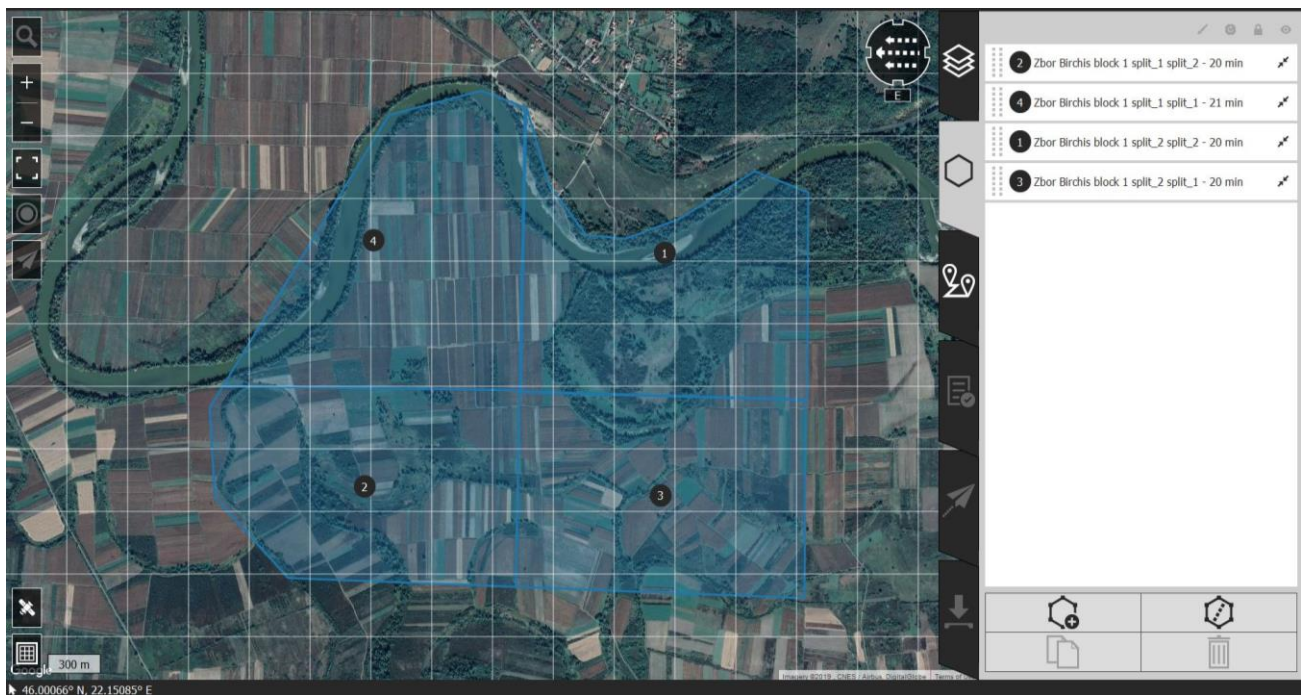

Figure 3. Flight Specification
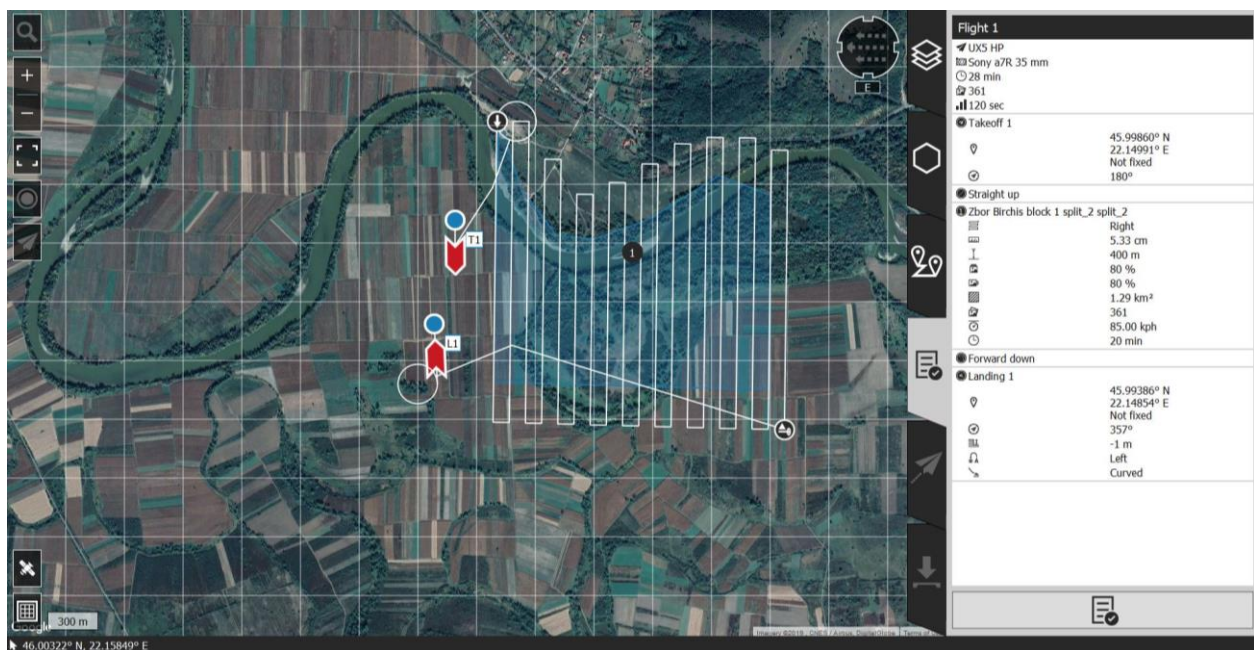
Figure 4. Flight area divided in flight sectors

Figure 5. Flight check-list for each sector

➢ **Part 3:   of the Office, with the following objectives**

Using the TBC program (Trimble Business Center) the flight is processed. The processing is an automatic operation.The operator must only insert into the software the parameters of the flight performed, the flight file, the pictures and the static measurement (if it was necessary to be done). The final product (Figure 6) consists of 4 orthophotomaps which can be inserted into any CAD software program and used as support for the project for which the flight was thought.
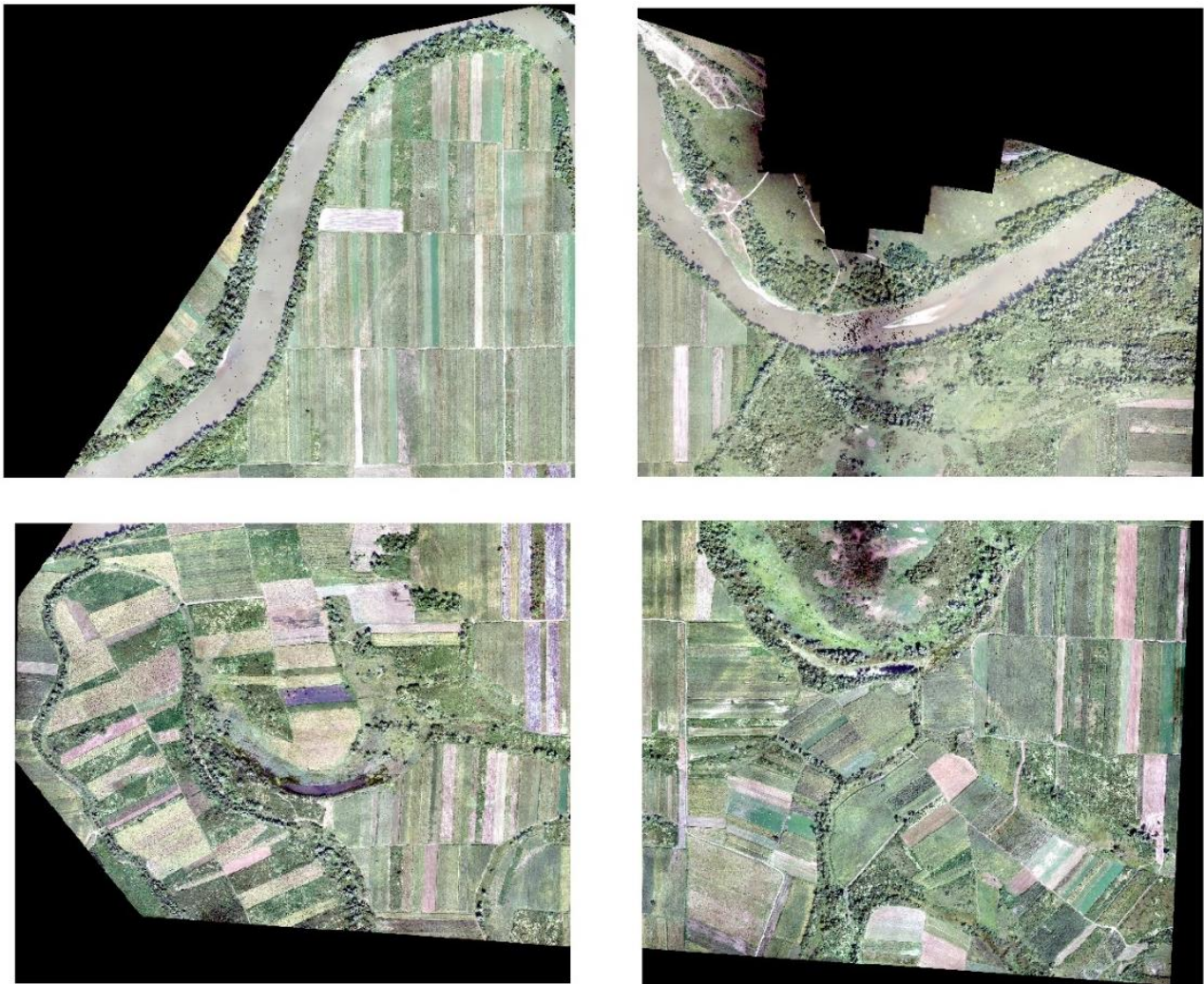
Figure 6. Final product (4 orthophotomap)

In the Birchis project, the flight altitude used was 400 m, the lens used were 35 mm, thus resulting in an accuracy of otofotoplan of 5.33 cm per pixel, because 400 m altidute respectively 6 cm per pixel provides the requirements of the conditions required in the specification (Table 2).

Tabel 2. Area coverage table

Hight	GSD	Area / Flight	GSD	Area / Flight	GSD	Area / Flight
	15 mm Lens		25 mm Lens		35 mm Lens	
75 m	2.4 cm	1.4 km²	1.5 cm	0.8 km²	1.0 cm	0.6 km²
100 m	3.3 cm	1.9 km²	1.9 cm	1.2 km²	1.4 cm	0.8 km²
120 m	3.9 cm	2.4 km²	2.3 cm	1.4 km²	1.7 cm	1.0 km²
150 m	4.9 cm	3.1 km²	2.9 cm	1.8 km²	2.1 cm	1.2 km²
300 m	9.8 cm	6.5 km²	5.8 cm	3.7 km²	4.2 cm	2.7 km²
750 m	25 cm	16.1 km²	14.6 cm	9.3 km²	10.5 cm	6.3 km²
For a 5:1 aspect ratio of a single rectangular flight block, at 80% lateral overlap, including 5 min of traveling time from take-off to the first waypoint and from the last waypoint to the landing.						

The final product, in this case a single orthomosaic (Figure 7) created from the 4 resulted orthophotomaps was realized with the TBC (Trimble Business Center) software. A mosaic is a combination or merge of two or more images (Herbei, 2018). In this project, alternative GPS measurements were not necessary, because how we have presented above, the Trimble UX5 HP system is manufactured with an integrated GPS, and thus the 4 resulted orthophotomaps do have the spatial reference, more exactly geographical coordinates.

Figure 7. Orthomosaic of the studied area

CONCLUSIONS

The main object of this research was to determine whether UAVs can be operated at any type of site. But at the end, the results in terms of precision are acceptable, since the level of precision only depends on pixel size.

So, in order to create more accurate models, the challenge seems to be more the amount of data needed to manage and the acquisition speed of ground control points. Indeed, the level of precision reached can be achieved with a total station. However, this level cannot be reached using an RTK GNSS receiver. Actually, in certain conditions and with the latest developed technologies, a precision of about 1.0–2.0 cm may be reachable. Utilizing a total station, the model can be created with more precision.

The other innovation that may lead to facilitating this type of measurement isnormalizing the process for land surveyors and drone operators to work together. Such a process would allow the land surveyor to have easy access to safe flight and quality data. Actually, the land surveyor flying the drone will lead to depletion and loss of his time in planning the flight in considering several issues: weather conditions and administrative work, for instance, while the drone operator can plan all of these tasks while respecting the land surveyor's requirements in terms of resolution and overlap.

ACKNOWLEGMENTS

from B.U.A.S.M.V. "King Michael I of Romania" Timisoara.

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MULTITEMPORAL ANALYSES OF AGRICULTURE IN A REGION IN SOUTH-EAST OF ROMANIA

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Abstract

The main source of food comes from agriculture, depending on the factors of environment, light, temperature, water, air, soil, plants grow and develop. One way of efficiently monitor the development process of the plants is remote sensing. Using free-of-charge data, such as Sentinel-2, we can compare the condition of the harvest in different years with the help of the various indices computed from the many satellite bands, bands in the visible spectrum with a resolution of 10 m and the invisible spectrum, resolution shifting between 20 and 60 m.
In this study, we want to focus on climate change and how it affects the condition of crops using satellite data for three consecutive years in the same area. Lack of precipitation and abnormal temperatures for certain periods of the year can affect crops and reduce food quality and quantities.

Keywords: crops, food, monitoring, remote sensing, satellite, Sentinel-2A.

INTRODUCTION

Agriculture is dealing with the production of plant and animal products, fiber and various useful materials through the systematic cultivation of certain plants.

In our area of interest, the population main occupation is agriculture; most of the families have smaller or larger areas of land in their property or in the lease.

They cultivate annually, wheat, corn, barley and others, hence they get to feed their animals but also benefit from the harvest.

As we know, for the plant to grow they need certain temperature and precipitations, in the past years these indices have changed.

The temperatures are higher and the precipitations are absent.

Figure 1.Wheat harvest ©Wikipedia

MATERIALS AND METHODS

Considering our multitemporal study we used optical images, Sentinel-2, from three different years, 04 December 2016, 11 November 2017 and 28 October 2018, with 20% cloud coverage.

Sentinel-2 is a European wide-swath, high-resolution, multi-spectral imaging mission.

Sentine-2 has 13 spectral bands, 10 m resolution bands: B2: blue, B3: green, B4: red B8: Near Infrared, 20 m resolution bands: B5: Vegetation Red Edge, B6: Vegetation Red Edge, B7: Vegetation Red Edge, B8A: Vegetation Red Edge, B11: Short Wave Infrared, B12: Short Wave Infrared and 60m resolution bands: B1: Coastal Aerosol, B9: Water Vapour and B10: Short Wave Infrared-Cirrus.

Thus, we have used different band combination and indexes to compare and analyse different spectral response from different years of the same area.

We started with the natural colour combination of the bands R:B4 B:B3 G:B2, in addition we used the two indexes the Normalized

Differential Vegetation Index and the Chlorophyll Index Green.

"This most known and used vegetation index is a simple, but effective VI for quantifying green vegetation. It normalizes green leaf scattering in the Near Infra-red wave length and chlorophyll absorption in the red wavelength.

Values description: The value range of an NDVI is -1 to 1. Negative values of NDVI (values approaching -1) correspond to water. Values close to zero (-0.1 to 0.1) generally correspond to barren areas of rock, sand, or snow. Low, positive values represent shrub and grassland (approximately 0.2 to 0.4), while high values indicate temperate and tropical rainforests (values approaching 1)." (© Sentinel Hub by Sinergise)

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

As for the Chlorophyll Index green, is known that the plant absorption is different from one spectral reflectance to another. Green leaves absorb more than 80% of incident light and in the NIR they are minimum sensitive to pigment content.

$$CIgreen = \frac{NIR}{GREEN} - 1$$

We manage to do the bands combinations and the index with the open-source software Snap.

Snap has different toolboxes for Sentinel-1, Sentinel-2, Sentinel-3, SMOS and Proba-V, is a very useful tool.

In addition to our results we added the temperature and precipitation date from https://rp5.ru/, Fetești weather station, 1 September- 31 October 2016, 1 September- 31 October 2017, 1 September- 31 October 2018.

RESULTS AND DISCUSSIONS

For the first set of images we only did a visual analysis.

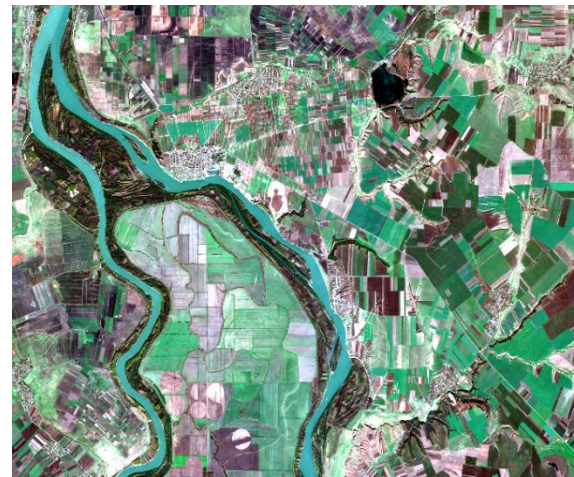Figure 2. Natural colour image of Sentinel 2, 04.12.2016

Figure 3. Natural colour image of Sentinel 2, 12.11.2017

Figure 4. Natural colour image of Sentinel 2, 28.10.2018

The first assumption was that the 2016 year and 2017 year have big cultivated areas, but there is a huge difference between these two yeas and the year 2018, to be more accurate we analyzed the NDVI and the CI green indexes for each image.

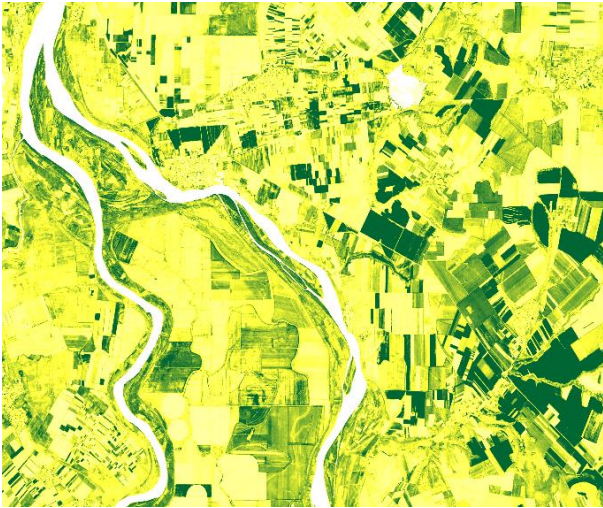Figure 5. Normalized Differential Vegetation Index, 04.12.2016

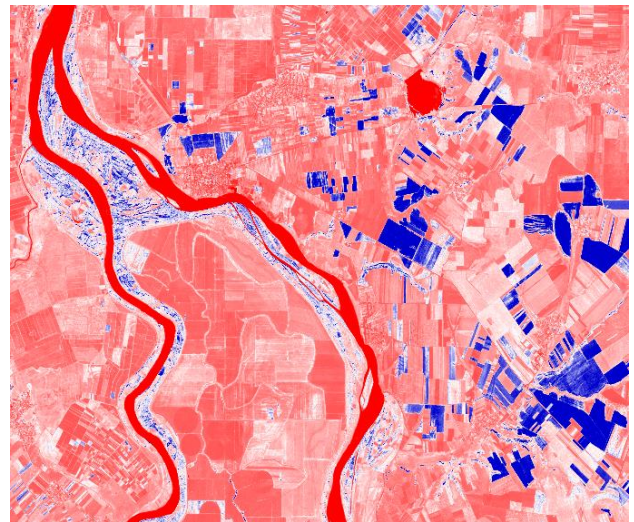Figure 6. Normalized Differential Vegetation Index, 12.11.2017
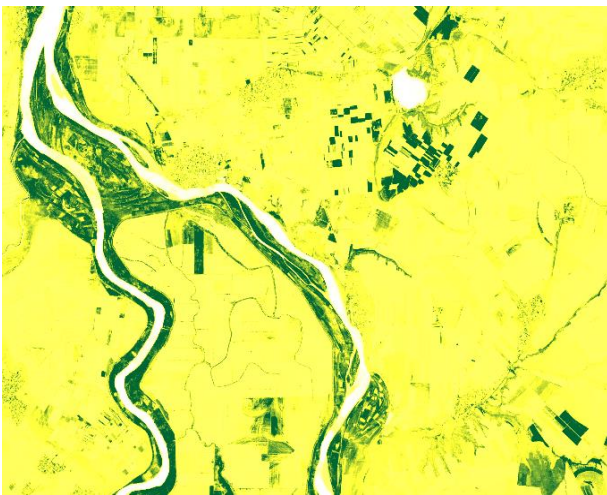

Figure 9. Chlorophyll Index Green,12.11.2017

Figure 7. Normalized Differential Vegetation Index, 28.10.2018
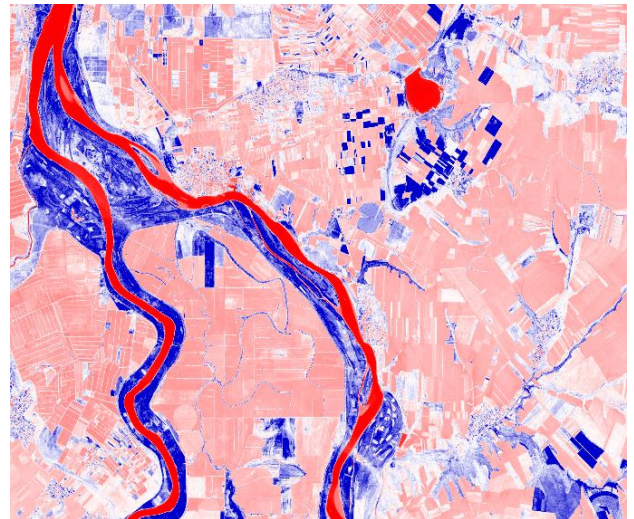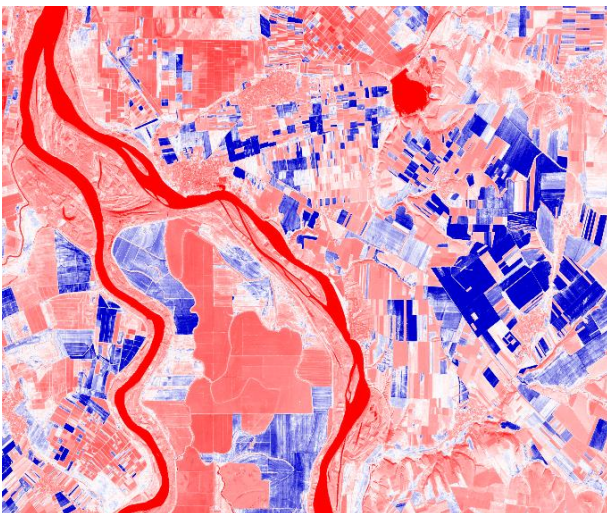

Figure 10. Chlorophyll Index Green, 28.10.2018

As we can see in the figures 5, 6 and 7 the NDVI ensure us that the image from 2018 has less cultivated areas than images from the other years.

To be more precise, the blue area from figures 8, 9 and 10 represents the crop area.

In the Figure 10, year 2018, the blue area next to the red one represents the forest next to the river, not to be confused with the cultivated area.

Figure 8. Chlorophyll Index Green, 04.12.2016

The difference between the year 2018 and the other ones is that we can see exactly the area occupied by the forest.

The year 2016 in association with the year 2017 has more blue areas, so the amount of harvest was bigger.

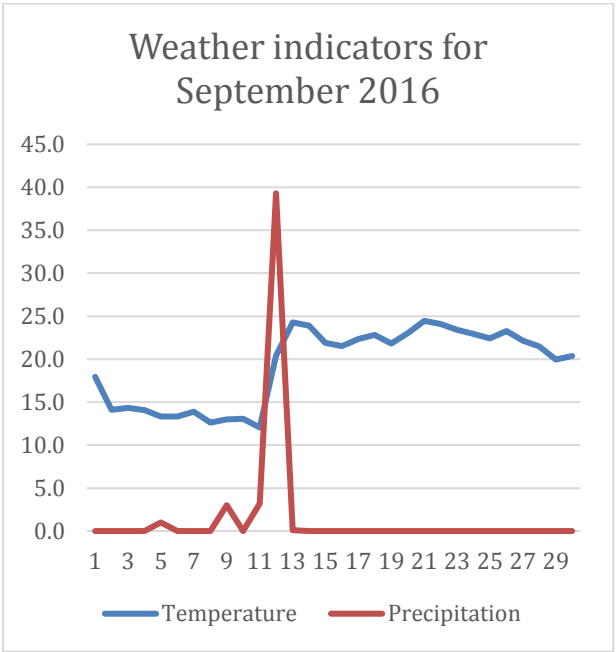To clarify why the cultivated areas are diminishing will use precipitation and temperature data.

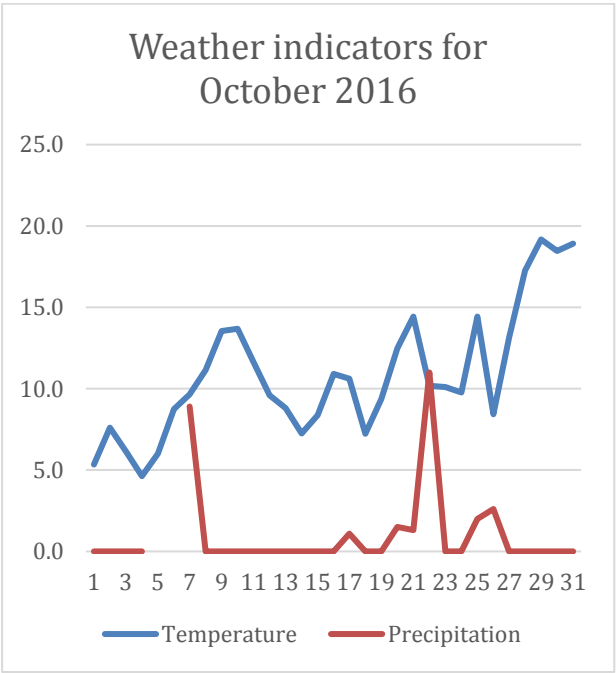Figure 11.Weather indicator for September 2016

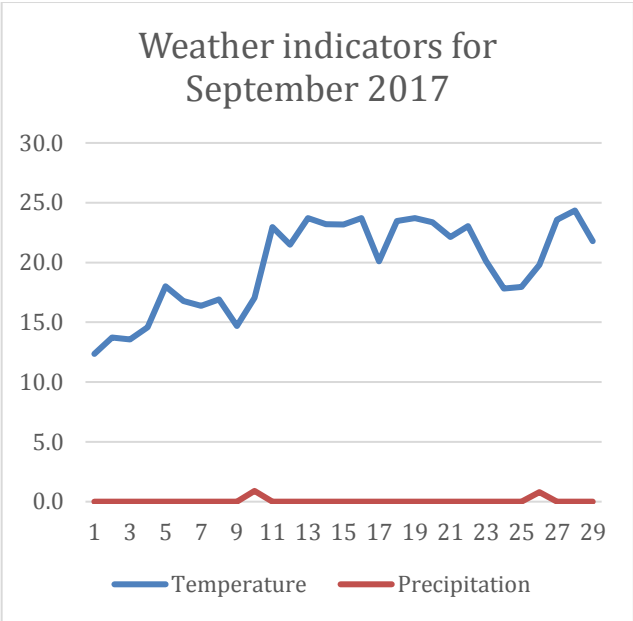Figure 12. Weather indicator for October 2016

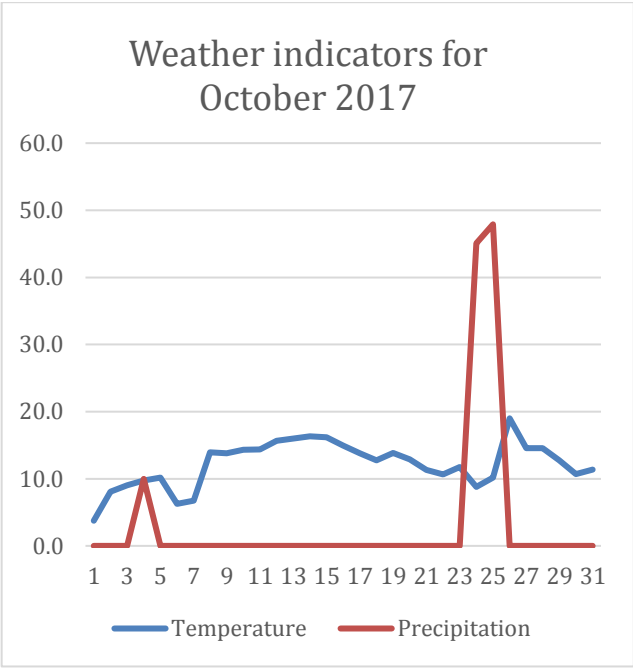
Figure 13. Weather indicator for September 2017

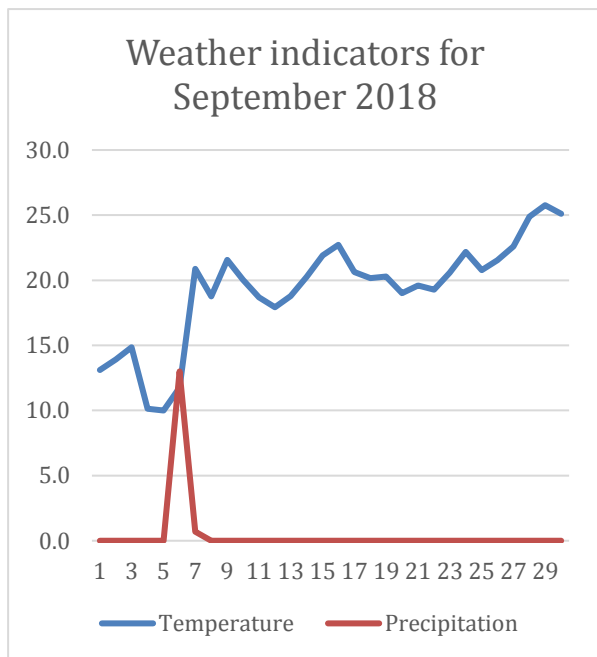Figure 14. Weather indicator for October 2017

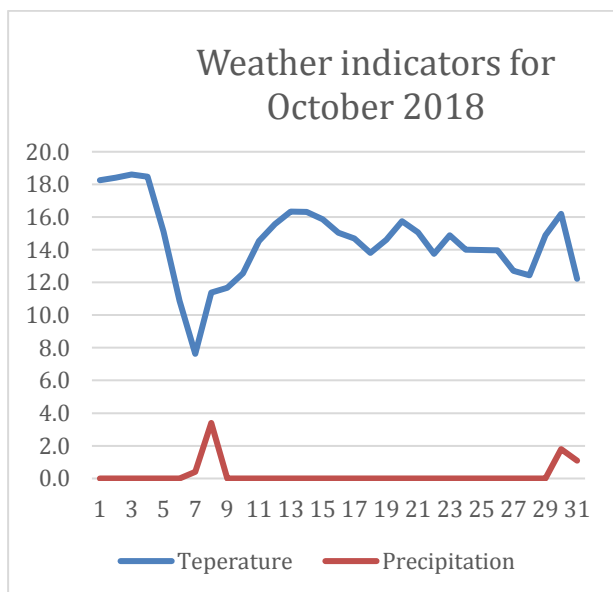Figure 15. Weather indicator for September 2018

Figure 16. Weather indicator for October 2018

It is recommended that farmers start seeding on September 24, but they often prefer to do so in early October. After sowing, plants need water, so rains are welcome.

As we can see in Figures 11 and 12, in September we have a pick for the precipitation and one in late October, so plant have the optimum environment, for year 2016, but year 2017, as seen in figures 13 and 14 has higher temperature than usual and only one pick of precipitation and late October.

In Figure 15, we have higher temperature than usual and almost no precipitation, same for the Figure 16, that is the motive why the crops are smaller in the year 2018.
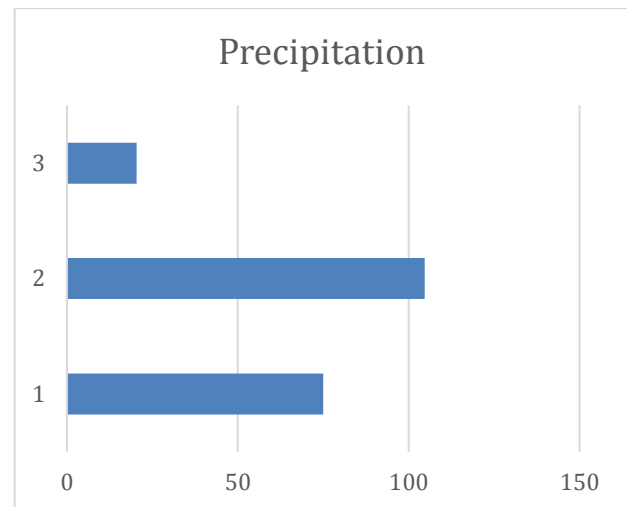
Figure 17. Total rainfall in September- October period

Figure 17 gives us a bigger view, and answers more precisely why is that big difference between these three years.

CONCLUSIONS

Weather is one of the most important factors for agriculture, plants are very sensitive to change, and need a certain amount of precipitation and a certain temperature to reach maturity. If the agricultural production reduces, it will also reduce the food portion for humans and animals and putting us in risc.

ACKNOWLEDGEMENTS

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The Copernicus Open Access Hub is a web-based system designed to provide EO data users with distributed mirror archives and bulk dissemination capabilities for the Sentinels products:

https://scihub.copernicus.eu/dhus/#/home

The European Space Agency (ESA) is Europe's gateway to space. Its mission is to shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens of Europe and the world:http://www.esa.int/ESA

The weather information was downloaded from rp5 archives https://rp5.ru/Arhiva_meteo_%C3%AEn_Fete%C5%9Fti

ANALYSIS OF LAND SURFACE TEMPERATURE IN THE TIMIŞOARA CITY USING LANDSAT 8 SATELLITE IMAGES

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Abstract

The monitoring of large areas by using satellite technique is very useful in the context of sustainable development and efficient and secure management. Satellite methods and techniques are increasingly used in studying and monitoring land and vegetation. There is very useful spectral information with great precision in characterizing large areas of land. This study is used for analyzing and determining how one of the most important parameters that could be obtained based on satellite images and the spectral frequency spectrum of the thermal surface in the thermal area, which is named the surface temperature of the ground. The studied area was Timisoara, and the LST parameter was determined using a specialized GIS software based on images from Landsat 8. Landsat 8 is an American Earth Observation Observatory launched on February 11, 2013 and an infrared thermal sensor TIRS) with two thermal bands. Starting from Landsat 8 satellite images and bands 10 and 11, the information spectrum describing the studied area was extracted and mathematical algorithms were processed, the LST parameter was determined to characterize the studied area. This study is also used to analyse how the soil surface temperature is determined based on Landsat 8 satellite imagery and a terrain surface response spectrum. To detect certain temperature categories of a surface or object, the radiation emitted by this electromagnetic spectrum is measured with thermal infrared.

Keywords: Indices, LST, NDVI, NDBI, Timisoara.

INTRODUCTION

Remote sensing is the science and technology of obtaining information (Tentu, 2018) on the Earth's surface from a distance (without coming into contact with it) by using electromagnetic radiation.

Remote sensing could be defined in more detailed form as "a field technique" that deals with the detection, measurement, recording and visualization in the form of images of electromagnetic radiation emitted by objects and phenomena from Earth or the Universe from a distance.

Remote sensing is an activity of detecting, measuring, recording and viewing in the form of electromagnetic images of radiation emitted by objects and phenomena from Earth or the Universe from a distance without having direct contact with them (Barsi et al., 2007).

Remote sensing, regardless of the nature of the applications, whether passive or active, uses electromagnetic radiation to obtain body images at a certain altitude (airplane, satellite, balloon, helicopter) because in this way the image could be used as maps and plans (Moscovici et al., 2015), the interpretation of objects is optimal and easy (Moldovan et al., 2017).

The electromagnetic spectrum is a physical model that shows us known and measured electromagnetic radiation, depending on their wavelength and specific energy level, representing the total electromagnetic radiation of the universe. The spectrum presents a number of areas where electromagnetism radiation is delineated based on wavelength. Remote sensing applications are limited to producing images, impossible to obtain spectral areas.

The present investigations aimed mainly at the study of the NDVI and NDBI indices, as well as a LST parameter for the Timisoara City area during 2013-2018.

Starting from the Landsat 8 satellite images (Herbei et al., 2016), spectral information which characterizing the studied area was extracted. Spectral information was expressed

using spectral bands based on which the NDVI and NDBI vegetal cover characterization indices were calculated (Herbei, 2015).

The aim of the present paper is to highlight the efficiency of remote sensing and satellite technologies, rather than the acquisition of terrestrial surface data and their interpretation, so that the results obtained serve as many fields of activity (Preoțescu and Nedea, 2017).

MATERIAL AND METHOD

Timişoara is the municipality of Timiş County, Banat, Romania. It is located in the west of Romania, close to the borders with Hungary and Serbia, on the Bega River, geographically at approximately equal distances to Bucharest (541 km), Vienna (549 km) and Sofia (509km).
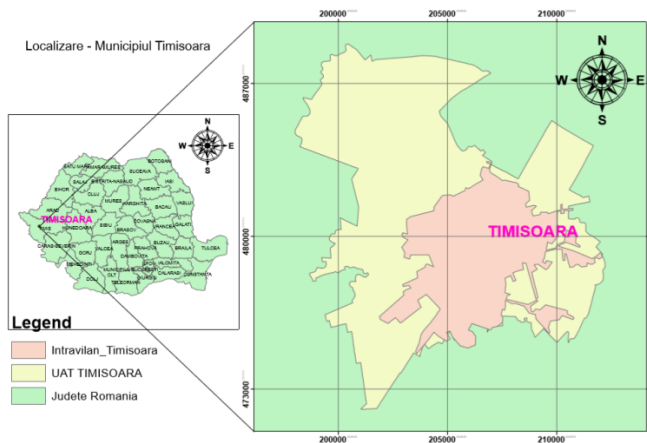

Figure 1.The Study Area – The city of Timisoara

The LANDSAT program offers repetitive multi-spectral data acquisition of the Earth's surface on a global basis.

The information of Landsat is the longest record of the continental surfaces of the Earth, as seen from space.

LANDSAT 8 was lunched on February 11, 2013 (former Landsat Data Continuity Mission - formerly Landsat Data Continuity Mission, LDCM). Landsat 8 collects data and images uses in agriculture, education, business, science and geography. Landsat 8 system has two important tools: Operator Land Imager (OLI) Operational Terrestrial Device, Infrared Thermal Sensor - Infrared Thermal Sensor (TIRS). The TIRS instrument collects two wavelength spectral bands covered by a single TM sensor and previous ETM + sensor bands.

These performance factors improve signal-to-noise (SNR) over a 12-bit dynamic range (this translates to 4096 grey levels in the image, compared to only 256 grey levels in the previous 8-bit tools).Signal-to- allows a better characterization of the state and the conditions of the land cover. The products are delivered as 16-bit images (55,000-grays scale) (Pantea and Lacusteanu, 2017).

The Landsat 8 remote-sensing images that were used in this study were downloaded free of charge from the https://earthexplorer.usgs.gov/ portal. These images have a spatial resolution of 30 m and a temporal resolution of 16 days (Herbei, 2018).

The spectral bands, the wave length of the Landsat 8 bands and the resolutions of them are shown in Table 1.

Table 1. Spectral Band Descriptions - LANDSAT 8

Bands	The wavelength (micrometers)	Resolution
Band 1 Ultra Blue (coast / aerosol)	0.435 - 0.451	30
Band 2 - Blue	0.452 - 0.512	30
Band 3 - Green	0.533 - 0.590	30
Band 4 - Red	0.636 - 0.673	30
Band 5 - Near Infrared (NIR)	0.851 - 0.879	30
Band 6 - Shortwave Infrared (SWIR) 1	1.566 - 1.651	30

Band 7 - Shortwave Infrared (SWIR) 2	2.107 - 2.294	30
Band 8 - Panchromatic	0.503 - 0.676	15
Band 9 - Cirrus	1.363 - 1.384	30
Band 10 - Thermal Infrared (TIRS) 1	10.60 - 11.19	30
Band 11 - Thermal Infrared (TIRS) 2	11.50 - 12.51	30

Landsat 8 scenes were processed using ERDAS Image software, which haspre-processing and post-processing tools for remote sensing images(https://landsat.usgs.gov/using-usgs-landsat-8-product).

ERDAS Image allowed the calculation of the vegetation indices used in this study: NDVI and NDBI, as well as the LST parameter calculation based on TIR thermal bands 10 and 11.For calculating the LST parameter, we developed an automated calculation model in ERDAS.

Landsat 8 provides band metadata, such as thermal constant rescaling factor value, etc., which can be used to calculate LST.

From the file containing the Landsat scene information that is used with the MTL extension we will extract the following information that we will need in the LST calculation:

Example: Landsat Scene 8 on August 7,2018
LANDSAT_SCENE_ID="LC81860282018219LGN00"
WRS_PATH = 186,   WRS_ROW = 28
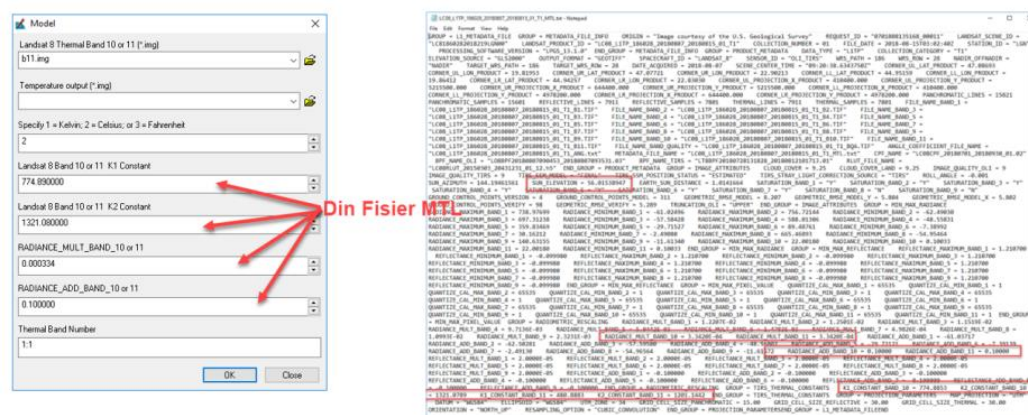DATE_ACQUIRED = 2018-08-07
SCENE_CENTER_TIME="09:20:38.6343750Z"

Figure 2. Landsat 8MTL scene

Table 2. Metadata file description

	Existing name in Metadata file (* .mtl)	**Band 10**	**Band 11**
Radiance Multiplier the radiance rescaling factors Band-specific multiplicative rescaling factor	RADIANCE_MULT_BAND_10 RADIANCE_MULT_BAND_11	3.3420E-04	3.3420E-04
Radiance Add the radiance rescaling factors Band-specific additive rescaling factor	RADIANCE_ADD_BAND_10 RADIANCE_ADD_BAND_11	0.10000	0.10000
K1 the thermal constants needed to convert thermal band data to TOA brightness temperature	K1_CONSTANT_BAND_10 K1_CONSTANT_BAND_11	774.8853	480.8883
K2 the thermal constants needed to convert thermal band data to TOA brightness temperature	K2_CONSTANT_BAND_10 K2_CONSTANT_BAND_11	1321.0789	1201.1442
θ_{SE} Local sun elevation angle. The scene centre sun elevation angle in degrees is provided in the metadata	SUN_ELEVATION	56.01538947	

➢ **LST**

One of the most important parameters that could be obtained based on satellite imagery are based on the spectral spectrum of thermal surfaces. There are several procedures developed for extracting temperature information from satellite imagery; differences are dictated by the specificity of each type of image (Valor and Caeselles, 2005).

Most methods of obtaining LST involves transforming the value of the digital number (DN) into reflectance values, applying the necessary corrections (atmospheric) and finally achieving the temperature of the reflector one (Weng et al., 2004).

LST (Surface Temperature) is the surface temperature of the earth that is in directly contact with the measuring instrument (usually measured in Kelvin). LST is the surface temperature of the earth crust where the heat and sunlight are absorbed, reflected and reframed. LST is changing once with the change of climatic conditions and other human activities where exact prediction becomes a challenge (Sobrino et al., 2008).

Average spatial resolution data, such as LANDSAT and SPOT data, is suitable for terrestrial coverage or regional scale mapping. LANDSAT 8 carries two sensors, namely the Imager Operator Terminal (OLI) and Thermal Thermocouple (TIRS). OLI collects the data at a 30m spatial resolution with eight bands visible in infrared and near infrared and short infrared, with short frequency electromagnetic spectrum and a panchromatic resolution of additional 15m (Sobrino and Raissouni, 2000).

Below are the steps you need to take to determine the LST parameter (Sobrino et al., 2004).

➢ *Conversion from Digital Number in Top Of Atmosphere [Lλ]*

The conversion of DN in TOA can be achieved using the following formula

$$L_\lambda = GAIN \times DN + BIAS$$

where:

$L\lambda$ - Top Of Atmosphere spectral radiance [Watts/($m^2 \times srad \times \mu m$)]

DN – Digital Number - Quantized and calibrated standard product pixel values

GAIN is the gain value for a specific band (RADIANCE_MULT_BAND_x, where x is the band number)

BIAS is the bias value for a specific band (RADIANCE_ADD_BAND_x, where x is the band number)

➢ *Conversion to TOA Reflectance*

Converting the data of thermal bands OLI and TIRS in Digital Number DN in Top Of Atmosphere reflectance using the parameters of radiance rescaling that are found in the meta-data file of the product Landsat 8. For the Band 10 and 11, in order to convert DN to TOA, is used the following formula:

$$\rho'_\lambda = M_\rho \times DN + A_\rho,$$

where:

ρ'_λ- TOA planetary reflectance, without correction for solar angle. Note that $\rho\lambda'$ does not contain a correction for the sun angle;

M_ρ - Band-specific multiplicative rescaling factor from the metadata (REFLECTANCE_MULT_BAND_x, where x is the band number);

DN - Quantized and calibrated standard product pixel values (DN);

A_ρ - Band-specific additive rescaling factor from the metadata (REFLECTANCE_ADD_BAND_x, where x is the band number).

$$L_{10} = 0.0003342 \times DN_{band_{10}} + 0.1$$
$$L_{11} = 0.0003342 \times DN_{band_{11}} + 0.1$$

TOA reflectance with a correction for the sun angle is:

$$\rho_\lambda = \frac{\rho'_\lambda}{\cos(\theta_{SZ})} = \frac{\rho'_\lambda}{\sin(\theta_{SE})}$$

where:

ρ_λ- TOA planetary reflectance

θ_{SE} - Local sun elevation angle.The scene center sun elevation angle in degrees is provided in the metadata (SUN_ELEVATION);

θ_{SZ} - Local solar zenith angle: $\theta_{SZ} = 90 - \theta_{SE}$.

➢ *Conversion to Apparent Brightness Temperature – AT [T]*

This conversion is made based on Planck's law. Data from TIRS band are converted from spectral radiance to brightness temperature by using thermal constants that are found in metadata file downloaded from portal http://earthexplorer.usgs.gov.

A simplified formula was used by Schott and Volchok,1985; Markham & Barker,1986; Irish, 2003.

$$T = \frac{K_2}{\ln(\frac{K_1}{L_\lambda} + 1)}$$

where:

T - Apparent Brightness Temperature [GRADE KELVIN];

Lλ (L10 or L11) - Top Of Atmosphere spectral radiance[Watts ÷ (m2 × srad × μm)

K1 - Band-specific thermal conversion constant - calibration constants - from the metadata (K1_CONSTANT_BAND_10 or K1_CONSTANT_BAND_11)

K2 - Band-specific thermal conversion constant - calibration constants - from the metadata (K2_CONSTANT_BAND_10 or K2_CONSTANT_BAND_11)

For this study, Apparent Brightness Temperature was calculated for the Band 10 and 11, thus the result was converted from degrees Kelvin to Celsius:

$$T_{10} = \frac{1321.08}{\ln(\frac{774.89}{L_{10}} + 1)}$$

$$T_{10}[K] = T_{10} - 273.15[C]$$

$$T_{11} = \frac{1201.14}{\ln(\frac{480.89}{L_{11}} + 1)}$$

$$T_{11}[K] = T_{11} - 273.15[C]$$

> ### *Calculating the Normalized Differential Vegetation Index (NDVI)*

The Normalized Differential Vegetation Index (NDVI) is a standardized vegetation index that is calculated using Near Infra-Red (Band 5) and Red (Band 4).

$$NDVI = \frac{NIR - R}{NIR + R} = \frac{B5 - B4}{B5 + B4}$$

where:
RED = DN values in the RED band
NIR = DN in the Near-Infrared band

> ### *Calculation of Land Surface Emissivity*

(LSE) − ε
Land Soil Emissivity (LSE) is the mean emissivity of an element of the Earth's surface calculated from NDVI values.

$$P_V = \left[\frac{NDVI - NDVI_{MIN}}{NDVI_{MAX-}NDVI_{MIN}}\right]$$

where:
PV = Proportion of vegetation
NDVI = The DN value in the NDVI image
NDVI min = The minimum DN value in the NDVI image
NDVI max = Maximum DN value in the NDVI image

In practice, due to the choice of a typical soil value, it is a more critical issue due to the higher variations in soil emissivity compared to vegetation, LSE is calculated as follows:

$$\varepsilon = m \times P_V + n = 0.004 \times P_V + 0.986$$

where:
E = emissivity of the isoleucine surface
PV = Proportion of vegetation

> ### *Calculation of Land Surface TEMP − LST*

Soil surface temperature (LST) is the radiation temperature that has been calculated using atmospheric surface brightness, temperature, wavelength of light emission, soil surface emissivity.

$$LST = T / \left[1 + (w * \frac{T}{p}) \ln e\right]$$

where:
T - the apparent brightness temperature,T10 or T11, w - the radiation wavelength emitted [mm], $p = h \times c/s[1,438 \times 10^{-2}]mK$
h -Planck's constant $(6,626 \times 10^{-34} Js)$
s - Boltzmann constant $(1,38 \times 10^{-23} J/K)$
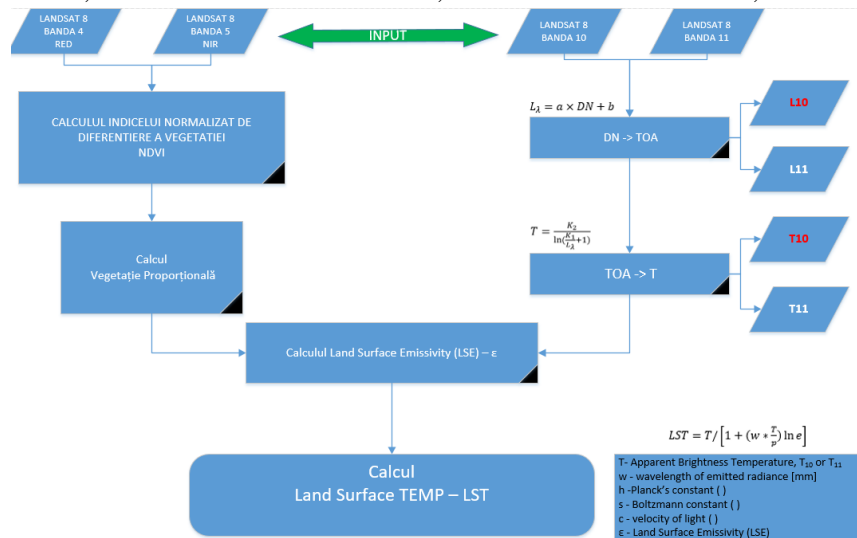c - velocity of light $(2,998 \times 10^8 m/s)$
ε - Land Surface Emissivity (LSE)

Figure 3. Logical Scheme of Calculating –LST

> ### *Normalized Difference Vegetation Index (NDVI)*

The Normalized Difference Vegetation Index (NDVI) is a non-linear transformation of the Visible (RED) and Near Infrared (NIR) bands being defined as the dividend distribution difference divided by their amount.

NDVI is a unit of measurement of vegetation density and density and is associated with biophysical parameters such as biomass, foliar surface index (LAI), used very often in crop growth patterns, percentage of vegetation coverage, photosynthetic activity of vegetation. Generally, NDVI values are between -1.0 and 1.0, negative values indicating clouds or water, and positive values close to 0 indicating uncovered soil, high positive NDVIs indicate rare vegetation (0.1-0, 5) to dense vegetation (> 0.6).

Indirectly, NDVI is used to estimate the effects of precipitation over a certain period of time, to estimate the vegetation status of different cultures and to the quality of the habitat as a habitat for different pests, pests and diseases.

> ### *Normalized Difference Built Index(NDBI)*

The NDBI values varies depending on the spectral signals in the middle infrared band (high reflectance of soil moisture, vegetation, rocks, including building materials) and the near infrared band (Reflectance Sea and chlorophyll).
The values are between -1 and +1.
The NDBI is calculated using the formulas:

$$NDBI = \frac{IR - NIR}{IR + NIR}$$

where:
NDBI - Normalized Difference Built Index
NIR-Near infrared band
IR –Infrared band

RESULTS AND DISCUSSIONS

In order to calculate vegetation indices and to extract spectral information, ERDAS Image v. 11 software and ArcGIS v.10.5 software were used.
To calculate the LST parameter, we developed an automated calculation model in ERDAS Image using the Afferent Toolbox analysis tools
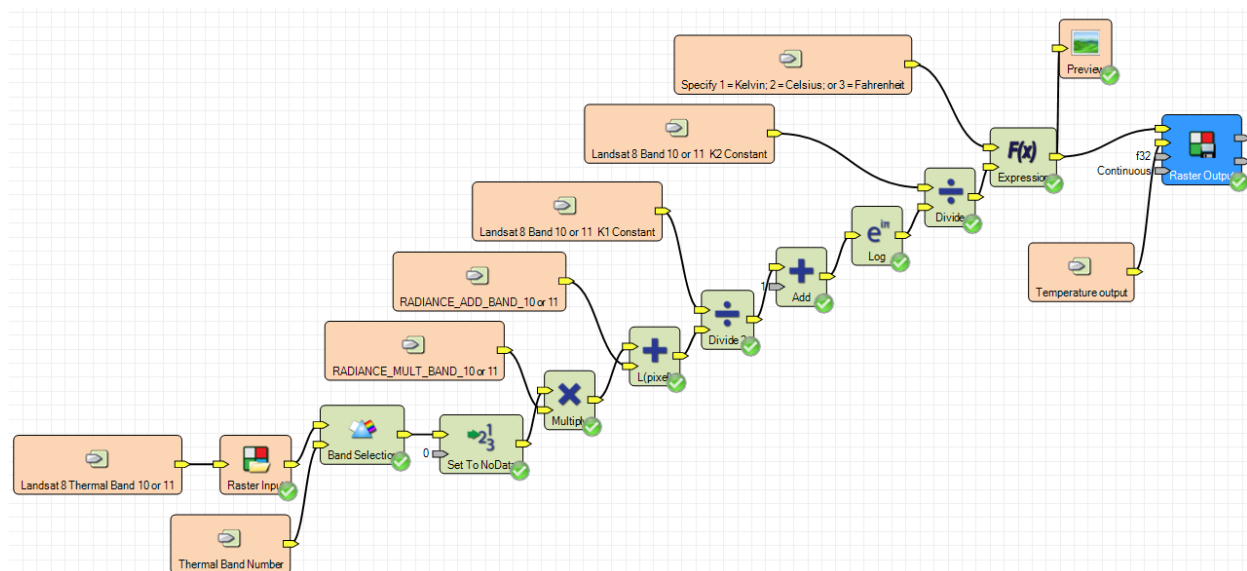.

Figure 4. LST Spatial Model

Figure 5. The Model Interface
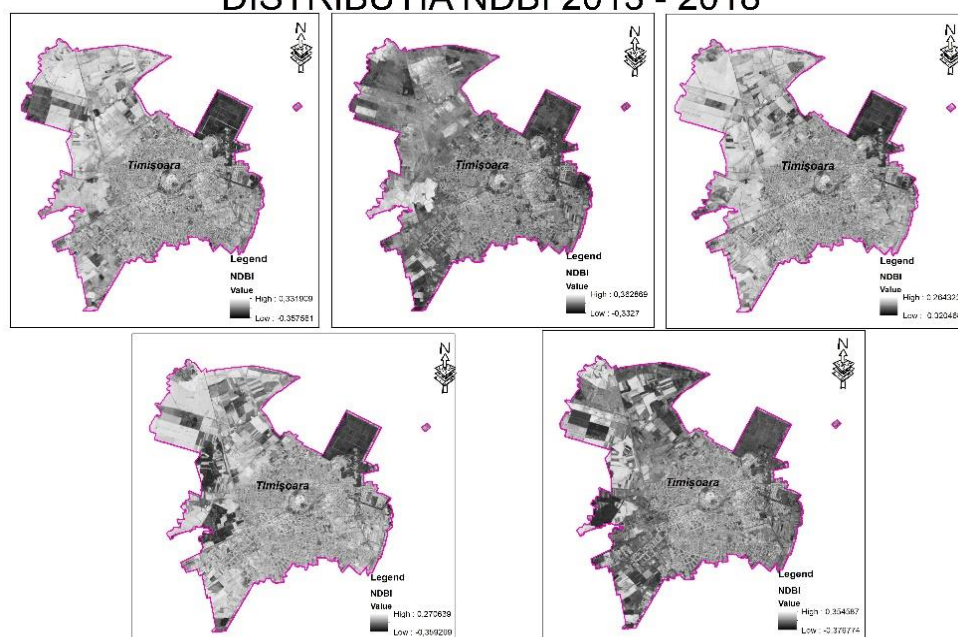

Figure 6. NDBI Distribution

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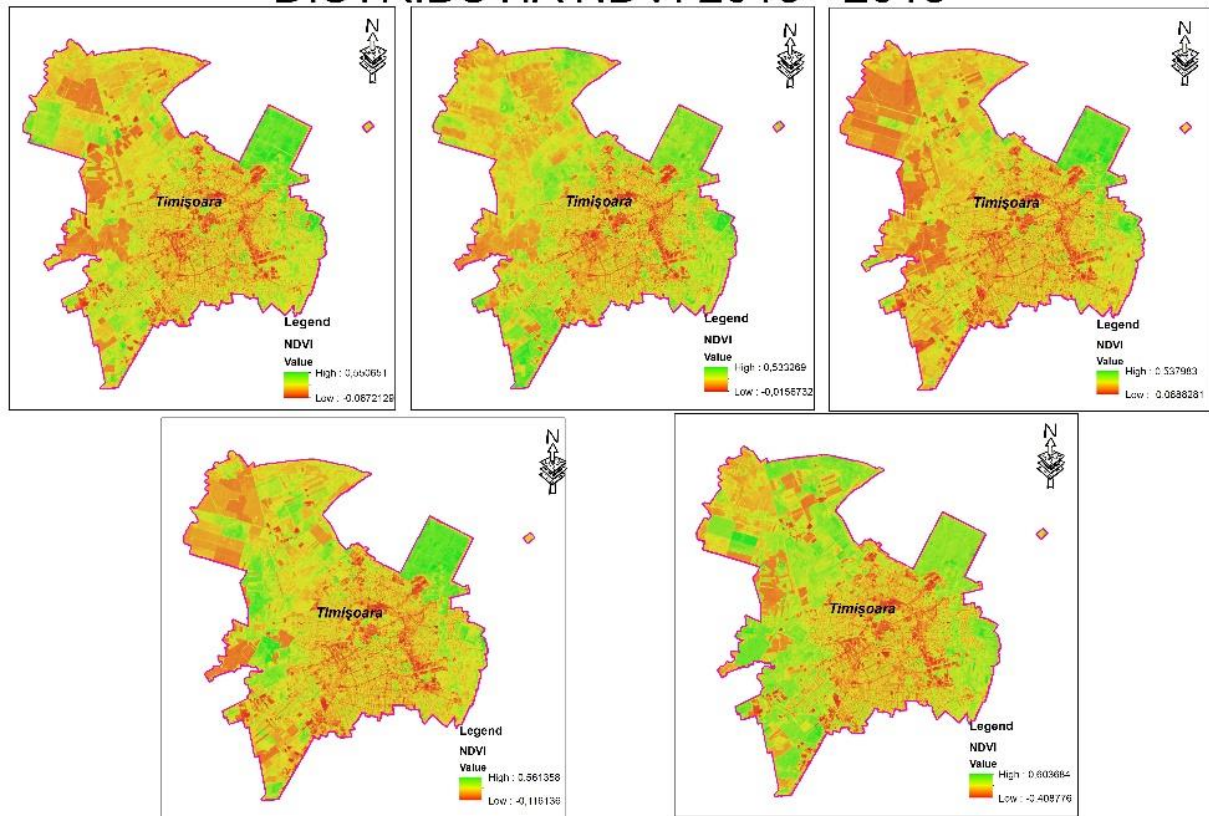
DISTRIBUTIA NDVI 2013 - 2018

Figure 7. NDVI Distribution
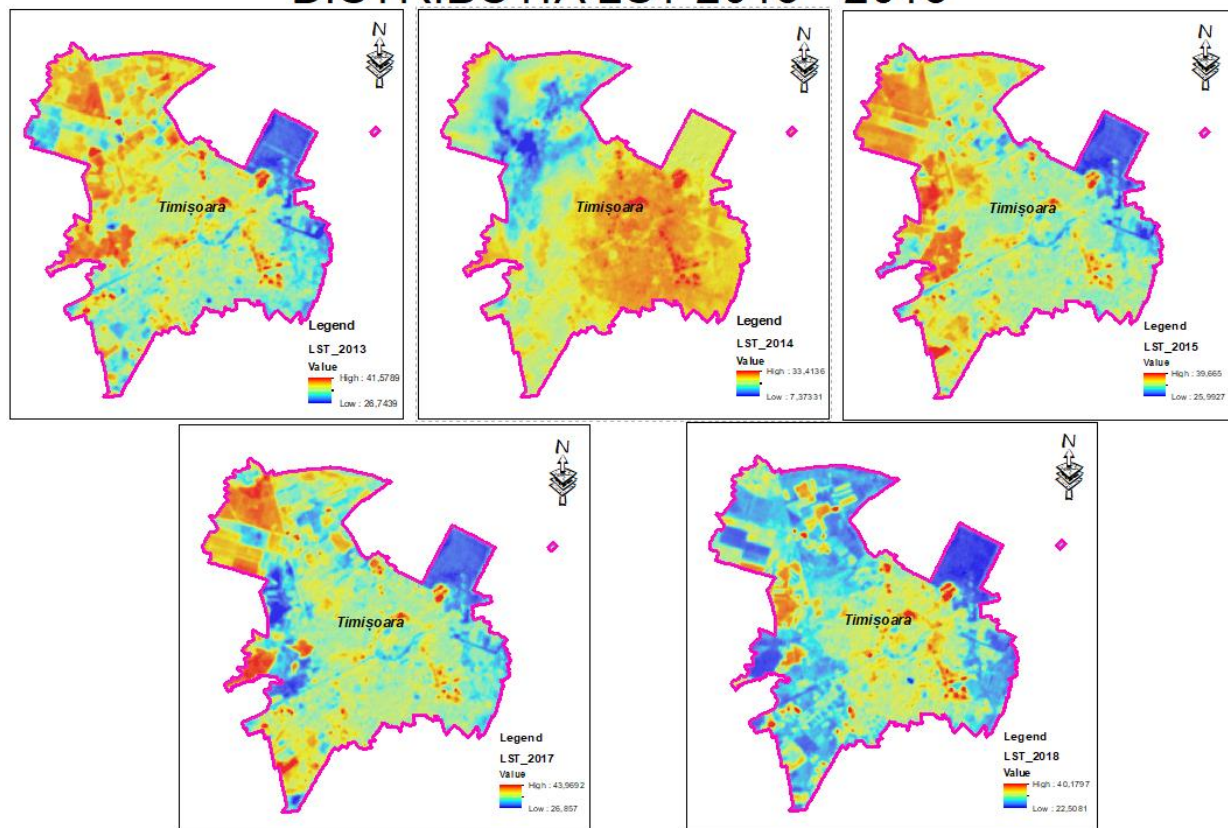
DISTRIBUTIA LST 2013 - 2018

Figure 8. LSTDistribution

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The highest temperature in 2013 was:41,57890 and the lowest was:26,74390.

The highest temperature in 2014 was:33,41360, and the lowest was:7,373310.

The highest temperature in 2015 was:39,6650, and the lowest was:25,9920.

The highest temperature in 2017 was:40,7790, and the lowest was:24,5630.

The highest temperature in 2018 was:37,2220, and the lowest was:20,4800.

The average values obtained for the 5 years of the studied we are shown in the following table:

Table 3. Average values from 2013 - 2018

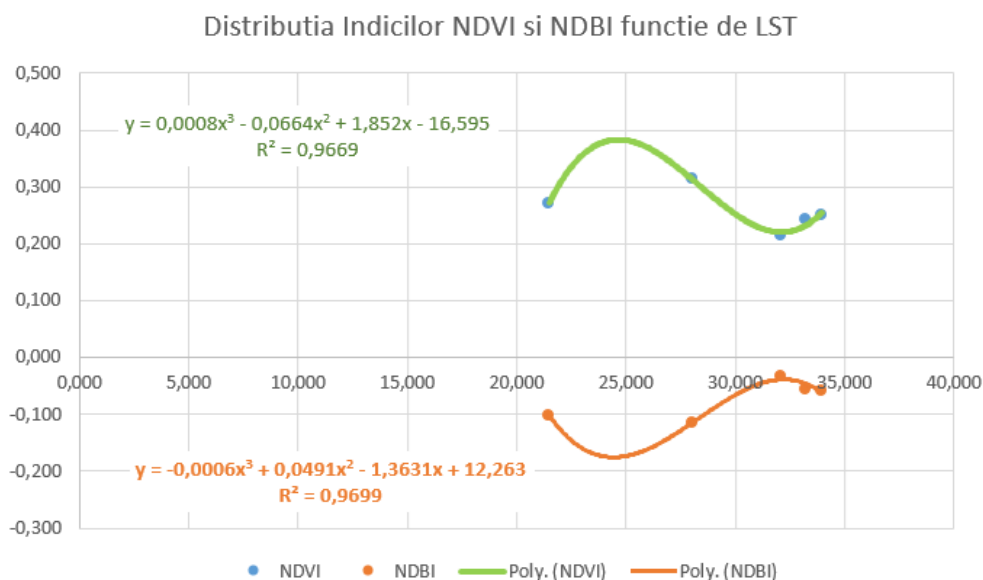|	2013	2014	2015	2017	2018
LST	33,171	21,478	32,060	33,958	28,002
NDVI	0,242	0,271	0,214	0,250	0,315
NDBI	-0,055	-0,102	-0,033	-0,058	-0,116

Figure 9. The distribution of NDVI and NDBI

CONCLUSIONS

Satellite images contain many information due to spectral bands in the visible and near-infrared areas, but also to the multispectral, panchromatic or stereo imagery. The analysis of this information is essential in interpreting the patterns and analysis of vegetation indices. It is also very important to analyse the changes that exist over a long period of time.

This theme was chosen on the basis of discovering and using new software and technologies in the field of land surveying and cadastre. The importance of the subject is given by the efficiency of these methods of collecting information on the Earth's surface from a large distance, without coming in contact with the intended objectives. Also, the results obtained from these processes are more promising both in terms of quantity and quality in terms of the generated information.

ACKNOWLEGMENTS

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http://earthexplorer.usgs.gov/

DESIGN AND MANUFACTURE OF POCKETQUBE FOR LOW EARTH ORBITAL (LEO)

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Abstract

The project aims to design and produce a 5x5x5 cm pocketqube satellite that will be positioned in low earth orbit (500 km). The satellite will transfer the data obtained by the sensors and the camera to the earth. The satellite will be produced to serve for about 3 years on the earth's orbit. The satellite will include the Power Sub-System (EGS), the Built-in Computer Sub-System (MIS), the Communication Sub-System (HS), the Orientation Identification and Control Sub-System (YBKS) and the Useful Load Subsystem (FAS). All of the systems will be designed and produced in the laboratories of Zonguldak Bülent Ecevit University. A ground station will be established within our university for communication with the satellite. The data to be obtained via the ground station will be shared over the internet. The presented study explains the proposed system design of the pocketqube.

Keywords: communication, observation, pocketqube, satellite, space.

INTRODUCTION

Due to the long-term and high cost of space work, satellites with a lower budget (Twiggs and Kuroki, 2002) and shorter time were needed. For this reason, the first cube satellite (CubeSat) standard emerged in 1999 with the initiative of Stanford and California Polytechnic Universities in the United States. Satellites with a length of 10 cm (Chester et al., 2014) and a weight of less than 1 kg are defined in the cube satellite standard. Today, according to the desired science payload, one unit (10x10x10 cm3), two units (10x10x20 cm3) and three units (10x10x30 cm3) new cube satellite dimensions have been developed. Works on Cube satellites have been rapidly increasing in the last 10 years due to their low cost and short production time. Nowadays, as cube satellites are sent to asteroids and different planets in line with the different mission (Li et al., 2017), they are launched to test observation and different science payload in the low earth orbit.

The most critical factor that determines the cost of satellite works is the dimensions of the designed satellite. With the development of technology, it is preferred to produce smaller sized satellites to reduce these costs. As a result, pocket satellite (PocketQube) standard with a lower cost and size (5x5x5 cm) than cube satellites has emerged. Pocket satellites are available in a Pico satellite class with dimensions ranging from 250 g to 1000 g (5 cm and multiples) in dimensions 1P, 2P, 3P (Soriano et al., 2016; Baldacchino et al., 2017). The satellites developed in the pocket satellite standard are preferred because of the low cost of communication systems and task load testing in space studies.
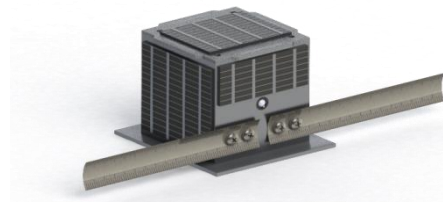

Figure 1. A pocketqube design

MATERIALS AND METHODS

When we look at the materials used in today's spacecraft, we often see materials that have special properties such as kevlar, and alloys

made of aluminum, as well as materials whose mechanical properties are increasing and at the same time light. The ASTM E1997-15 standard sets an example for the studies in this area (ASTM, 2015).

After the design of the body, the design and production of sub-systems are in progress. Among these subsystems, the useful science payload subsystem has a prominent place. Up to now, they have been designed to perform tasks such as pocket satellites, signal spectrum noise analyzes, communication system tests sent to low earth orbit. Launched pocket satellites send these data to the ground station using sub-systems in the orbit where they are located (Dudas and Gschwindt, 2016). It provides orientation detection and control subsystem in order to ensure that the pocket satellites placed in a particular orbit are balanced in orbit (Baldacchino et al., 2017). A passive control systemis generally preferred due to the size of the pocket satellites (Rawashdeh, 2010). The communication sub-system in the pocket satellite is realized by communicating with the ground station. Communication with the ground station is provided by the antenna included in this subsystem (Zack et al., 2014). The pocket satellites take their energy directly from the sun through solar panels and charge the battery. Thus, it is ensured that it can work for long periods in space conditions (Li et al., 2017; Olaszi et al., 2015). The electrical power subsystem controls the control of the energy system of the pocketqube. The effectiveness of the power control system in space conditions is a critical and efficient use of solar energy is required (Olaszi et al., 2015). In the design and production of other components, studies are concentrated in the point of communication and task load test. The pocket satellites are composed of different subsystems. The pocket satellite to be constructed within the scope of this project will consist of 5 sub-systems connected.

SUBSYSTEMS OF POCKETQUBE
The pocket satellites are composed of different subsystems. The pocket satellite to be constructed within the scope of this project will consist of 5 sub-systems connected.
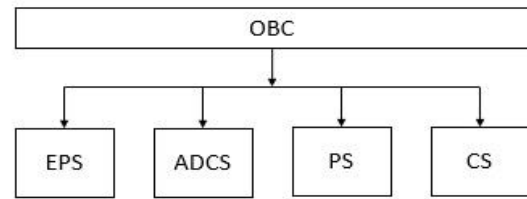The Pocketqube block diagram is shown in

Figure 2.

Figure 2. Pocketqubeblock diagram

1) Electrical Power Subsystem (EPS)
2) On Board Computer (OBC)
3) Communication Subsystem
4) Attitude determination and control subsystem
5) Payload Subsystem

1) Electrical Power Subsystem
This sub-system is an electronic board which makes the necessary power supply of the satellite by making necessary transformations of the energy taken from the solar panels. There will be a maximum power point monitor (MPPT) charge integrator capable of converting energy from the sun to the energy efficient, a flow monitor for controlling the current value of the electricity transmitted to the satellite, a rechargeable battery for storing an integrated and energy to monitor the charge-discharge status of the battery. This sub-system, which meets the general electricity need of the pocket satellite and allows it to be spent efficiently, will charge the battery of the pocket satellite by using the solar power with the maximum power point viewer.

On-Board Computer
This sub-system is an electronic card with a low power consumption microcontroller, a safety timer integral and a DC-DC voltage regulator. Built-in Computer Sub-System will supply DC-DC voltage regulator and control and stabilization of all satellite subsystems via RS-485 digital communication protocol. Data will be stored in a Ferroelectric Memory (FRAM) to minimize data loss. The system state can be controlled from outside by adding indicators that indicate different situations for instant control and error analysis. The system that will control all subsystems will be designed with appropriate algorithm design and will be done by the Joint Test Action Group (JTAG) industry standard.

2) Communication Subsystem

Communication Subsystem Consists Of A Microcontroller, 433 Mhz Rf Transmitter Module, Power Amplifier, And A Quarter-Wave Antenna.

It is the electronic card which sends the measurements and other data made by the pocketqube to the ground station in a telemetry package format. All data collected by Pocketqube will be sent to the communication subsystem with RS-485 communication protocol by On-Board Computer. The received data will be converted to a Radio Frequency (RF) transmitter module by converting it into a specific telemetry format with a microcontroller in this subsystem. All data received by the communication subsystem will be backed up using a FRAM memory to minimize the potential for loss. The RF transmitter module will send all data received to its output by making appropriate signal modulations. With the power amplifier at the RF module output, the signal will be amplified approximately three times and transmitted to the antenna. Two-piece antenna shall be designed with 180° difference between them and two-way data transmission shall be provided.

3) Attitude determination and control subsystem (ADCS)

The attitude determination and control system (ADCS) will be used to determine, control and direct the movement of the pocketqube in various orbits.

ADCS has two functions. The first is the damping of the rotational movements that occur during the orbit after the launch, and the second is the attitude of the pocketqube in the desired direction.

The pocketqube will remain a fixed attitude throughout the mission. ADCS systems are divided into two as active and passive. The decision to use the passive or active control system is based on the purpose of the mission and the stability of the attitude, the needs of the settlement and the response time. Passive ADCS system is used where long response time is acceptable, does not require precise orientation control and energy resources on the satellite are limited.

Pocketqubethe size of (5x5x5 cm) of power to be produced due to the small size will be proportional to the surface area of the solar panels placed on pocketqube.

Due to the small amount of Pocketqube surface area, the energy it will produce will be limited. Therefore, the orientation of the pocketqube will be achieved by using the passive magnetic stability system. The main features of the passive magnetic stability system are that they are cheap, simple and reliable.

4) Payload Subsystem

Payload subsystem consists of a microcontroller, magnetic meter, accelerometer, gyroscope and temperature sensor, a 640x480 resolution camera.

It is an electronic board which can make measurements and takes pictures from the environment through sensors and camera on the subsystem. Photos will be taken with the camera located in the payload subsystem. At the same time, data from the magnetic meter, accelerometer and gyroscope sensors will be analysed and the movements of the pocketqube position and current conditions will be analyzed.

Precise outside temperature measurements will be made with the temperature sensor. Data obtained by sensors and photo microcontroller will be transferred to OBC via RS-485 communication protocol.

CONCLUSION

The design of the pocketqube, which will be designed and produced, is intended to serve as an image capable of taking images under the conditions of low earth orbit (500 km). With the realization of the project, a much lower cost Pocketqube design will be realized in a short time compared to large satellites in the spacefield. In the field of The Pocketqube, the basic infrastructure will be established and academic and technological outputs will be achieved.

ACKNOWLEDGEMENTS

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A MOBILE GIS APLICATION FOR THE INVENTORY OF SOME OBJECTIVES FROM THE BUASVM TIMISOARA CAMPUS

Vasilică GEMĂNARU

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Abstract

This study wants to present the way to achieve a useful geodatabase in managing the objectives inventory projects within USAMVBT campus, namely: pillars, banks, trees, barriers, parking spaces, roads, hydrants. It is an assembly of information collected using specific methods and procedures, then properly processed by programs and finally finishing with a database (GIS). The purpose of this paper is creating a geodatabase that includes all the objectives of the University of Agricultural Sciences and Veterinary Medicine of Banat "King Mihai I of Romania" in Timişoara. This inventory will be made using state-of-the-art GNSS and GIS technology, attributes will be taken from the ground, and an on-line GIS map will be created that it can be continually updated and it will allow monitoring of objectives to protect them.

Keywords: Digital cartography, GIS, GNSS, Inventory, Mobile GIS

INTRODUCTION

Humanity has experienced an intense economic and social development in the last decades, many rural settlements undergoing strong transformations turning them into urban settlements. The main basis of transformations is how to use land, more exactly in the area of urban green spaces.

The term "GIS" comes from Geographic Information System. This system is used to create, to store, to analyze and to process spatially distributed information through a computerized process. GIS technology has a wide range of uses in scientific fields such as cartography, route planning, environmental impact studies, transportation. A Geographic Information System (GIS) allows us to view, to query, to analyze and to interpret data in order to understand relationships, patterns and trends (Herbei, 2015).

Organizations and industries benefit of GIS. Currently, the interest in in economic and strategic value of GIS is steadily increasing (Grecea et al., 2013). The special features of GIS is how to organize managed information (Grecea at al., 2012). Thus, there are two types of information, namely a graphical one, which indicates the spatial distribution of the studied elements, and another in the form of a database to store the attributes associated with these elements (Moscovici et al., 2015).

A GIS stores two types of information:
- Features;
- Attributes.

A GIS map has various tools for:
- Updating with new data collected from the field by topographical methods, GNSS methods (Popa, 2018), photogrammetric methods (Pantea and Lacusteanu, 2017), (Preoţescu and Nedea, 2017) or data from other areas (Moldovan et al., 2017);
- Data display in various ways (Herbei and Nemes, 2012);
- Spatial data analysis to create new information (Tentu, 2018).

Geographic data to be used in a GIS and acquisition from land or analogue data related to a territory are organized on several thematic layers (Grecea and Moscovici, 2014).

A layer is a collection of details that have the same themes (eg. rivers, roads, settlements, etc.). The GIS Implementation Project begins, like any other design activity, with the correct

understanding of intentional goals and progresses, with more detail, because the information is collected and structured (Herbei, 2018). Designing is a process that defines objectives and it identifies, analyzes and evaluates different solutions, and adopts an implementation plan. The project allows decision makers to have an overview and an instrument to control the status of work at any time during their deployment. Any GIS project must comply the INSPIRE guidelines introduced for uniformity of collection and storage of geospatial data of the field. The project also offers the possibility to include all technical aspects related to the spatial database, both as a whole and as to the interdependence of its components. Expenditure on design actually means savings during implementation and, in the absence of a project, problems can become insurmountable (Mason and Girard, 2015).
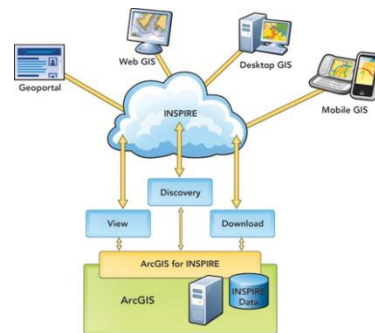

Figure 1. GIS & INSPIRE

MATERIALS AND METHODS

The purpose of this work is to realization a Mobile GIS application that will allow the acquisition of some objectives of interest from the USAMVB Campus Timisoara. This application may be useful for decision-makers the University for inventory and monitor items of interest (networks, parking spaces, barriers, etc.).
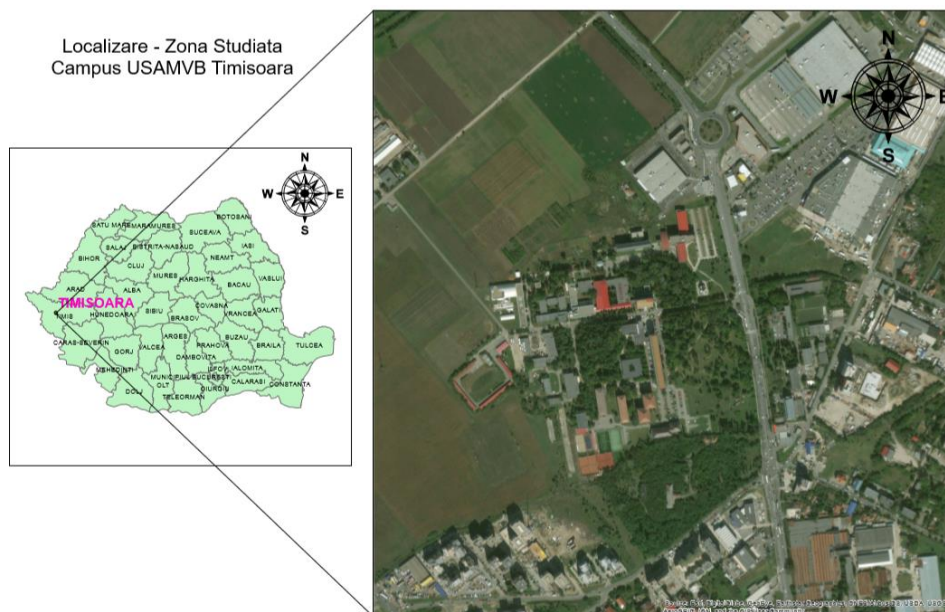

Figure 2. Study area

Description of Geodatabase
Geodatabase is a component of ArcGIS software and is used to define and access geographic objects called GeoObjects. Geodatabase includes spatial data, attributes, and behavioral elements. In another way, a Geodatabase can be defined as a "recipient" containing data collections. A Geodatabase offers a common framework for accessing and managing geospatial data in ArcGIS work environment. A Geodatabase allows the distribution of the functionality of a GIS on any desktop platform, server or mobile and also allows the storage of GIS data in a centralized location to ensure easy access and management.

Creating a Geodatabase is a process that involves going through several steps, namely:
- Designing of Geodatabase;
- Creating an empty Geodatabase;
- Creating a Geodatabase structure;
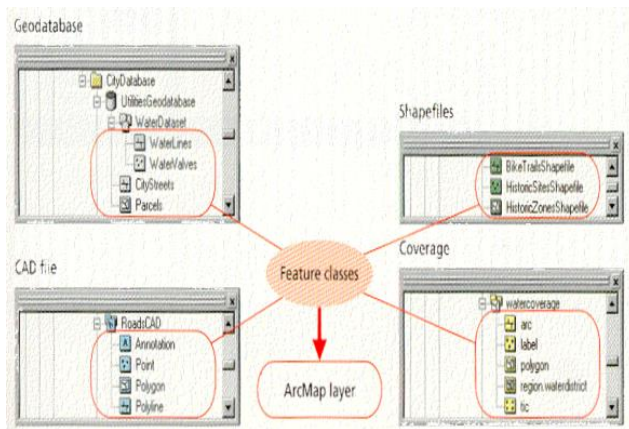- Uploading spatial data.

Figure 3. The structure of a Geodatabase

A Geodatabase has the following functions:

- storing complex collections of different types of data in a centralized location;
- applying complex rules and relationships to geospatial data;
- integrating spatial data with other IT databases;
- multiple simultaneous access to data by multitasking;
- maintaining the integrity of spatial data;
- defining advanced geospatial network models (ex. topologies, networks).

There are three types of Geodatabase with the following features:

- Personal geodatabases:
  - Some readers, one writer
  - Microsoft Access database-format - .mdb
  - Storage of 2 Gb of data
- File geodatabases
  - More readers, one writer per feature dataset, stand-alone feature class, or table.
  - A file geodatabase is a file folder that holds its dataset files.
  - Storage of 1Tb of data
- Enterprise geodatabases = multiuser geodatabases
  - Multiuser: many readers and many writers
  - DBMS

Advantages of using GDB are:

- Relations between layers: feature datasets
- Labels: saved as annotation feature class
- Drop-down lists
- Domains for attribute values
- Field Properties: more parameters (eg. Default value for a field)
- Surface and perimeter: automatic calculation if objects edited

The database project fully describes its architecture. The project also offers the possibility to include all technical aspects related to the spatial database both as a whole and as regards the interdependence between its components.

Forwards, a File Geodatabase will be created in the ArcGIS work environment. Fields will be created and class of features will be added, then fields of various types will be added.

After configuring the database model, a map will be created in ArcMap and then a service will be posted to ArcGIS Online account. This service will be uploaded to a map and used on the ground through a Mobile GIS application.

RESULTS AND DISCUSSIONS

Within this project, which involves the inventory of some interest objectives of the USAMVB Campus Timişoara, the following work process follows:

1. **Prepare the model for data acquisition**
2. **Sharing the model**
3. **Acquisition (collection) of field data using ZENO Collector (Leica Zeno 20 and ESRI Collector)**
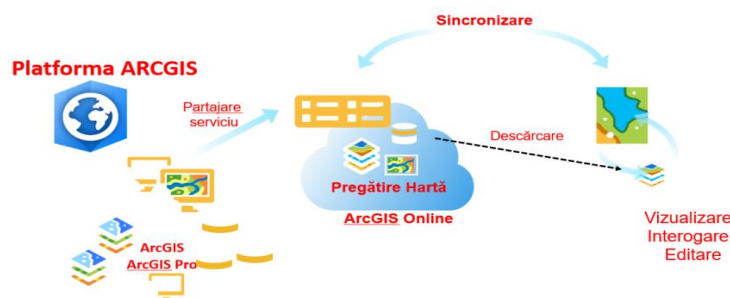

Figure 4. ArcGIS platform

1. Prepare the model for data acquisition

- *What data do we collect from the field?*
- *What attributes we want the data to be collected?*
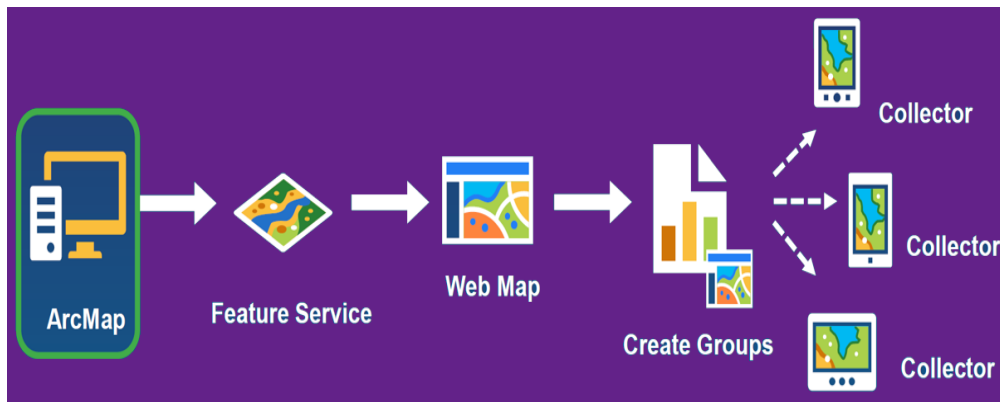- *Realization the spatial database.*

Figure 5. Workflow 1

Preparing the model involves following the following steps:

Create a Geodatabase in ArcMap

A Geodatabase it organizes and stores the collected data in a spatial database. Most specifically, a Geodatabase stores the characteristic classes. For the creation of a Geodatabase you have to follow the best steps:

- You have to start the application ArcMap and open the "Register" folder (right)
- You have to right click in the "Register" window, in the folder where you want to create the Geodatabase and you have to choose the New-File Geodatabase option and then you have to rename the database by user.

The definition of databasedomains

Fields have been created for the following features:

- Hydrant type
- Utility network type
- Parking place
- Trees condition
- Bench condition
- Road type
- Pillar type
- Parcels
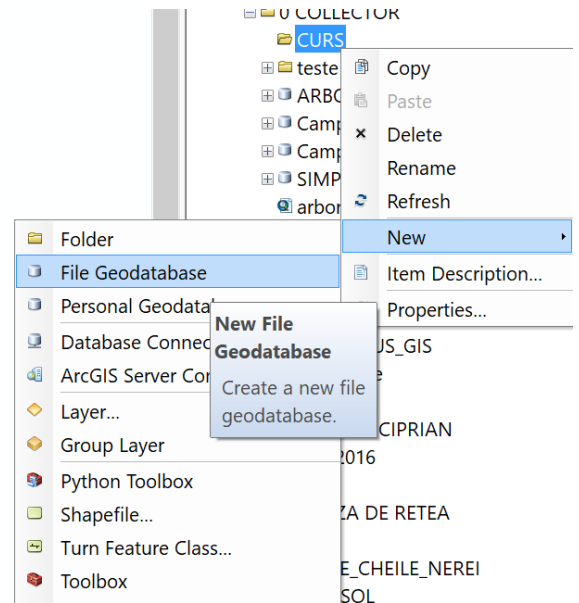
Figure 6. Creating a file Geodatabase

For example, in order to inventory of objectives, from the field the following information will be collected:

- Bench condition (painted, unpainted, damaged, good condition)
- Parking place (parking for teachers, parking for visitors)
- Pillar type (lighting pillar, pillar for electrical energy, others)
- The parcel (parcel of land, parcel of lawn)

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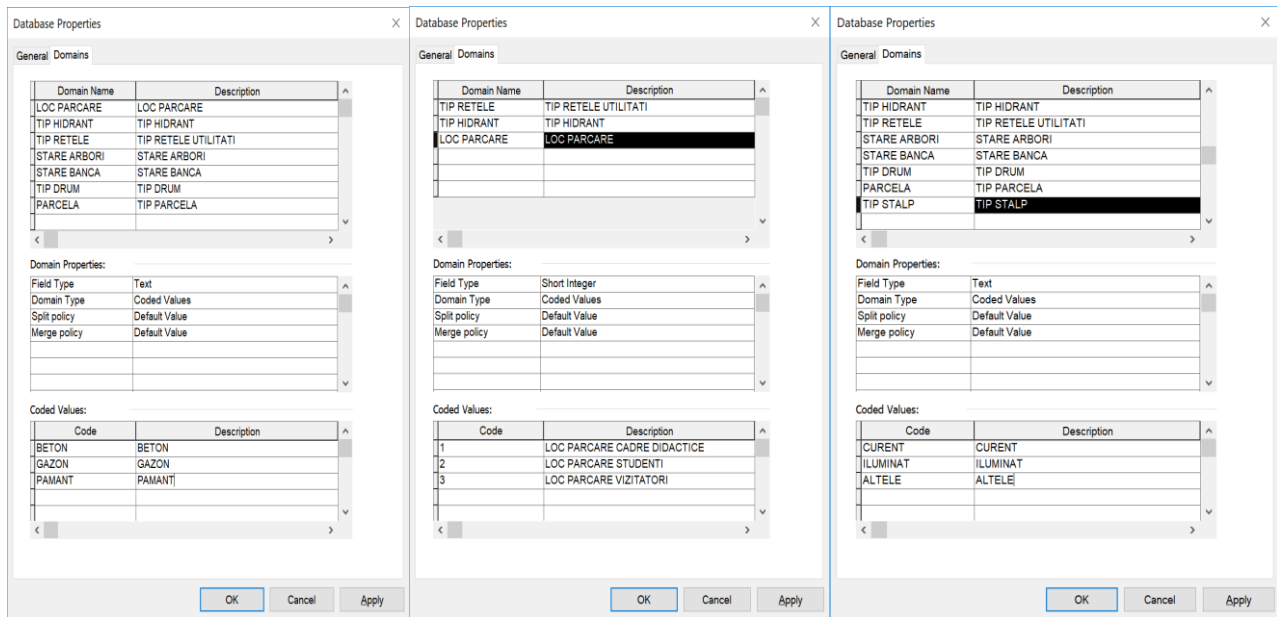
Figure 7. Examples for definition of fields

🍀 *Creation of features class (point, line or polygon)*

The next step is creating a feature class to be populated with collected information. The feature class are similar to a box in which information is stored, which have the same characteristics, meaning, the same geometry (point, line or polygon) or the same attributes.
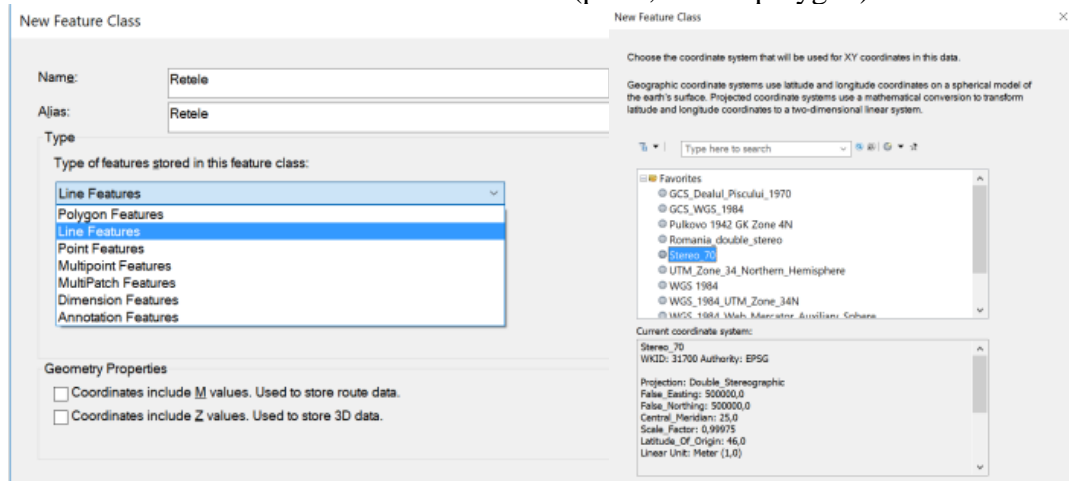
Figure 8. Example of creating a feature class – Type: Line

🍀 *The setings of fields*

The fields are essential part of the model. This provides the structure of information which will be collected from the field and offers rules for the types of information collected about a feature.
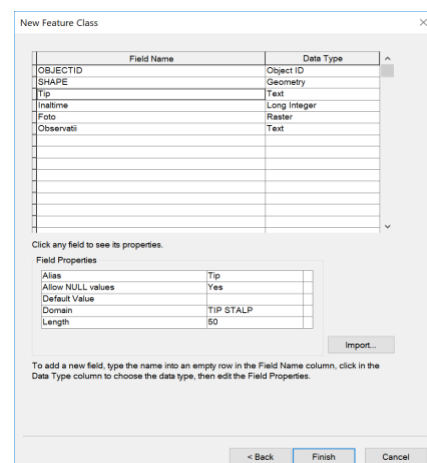
Figure 9. Example of creating fields for a feature class

✚ *The simbology of data*

Forwards we have to define how to view and symbolize the map data, which will be done with the collected data from the field.
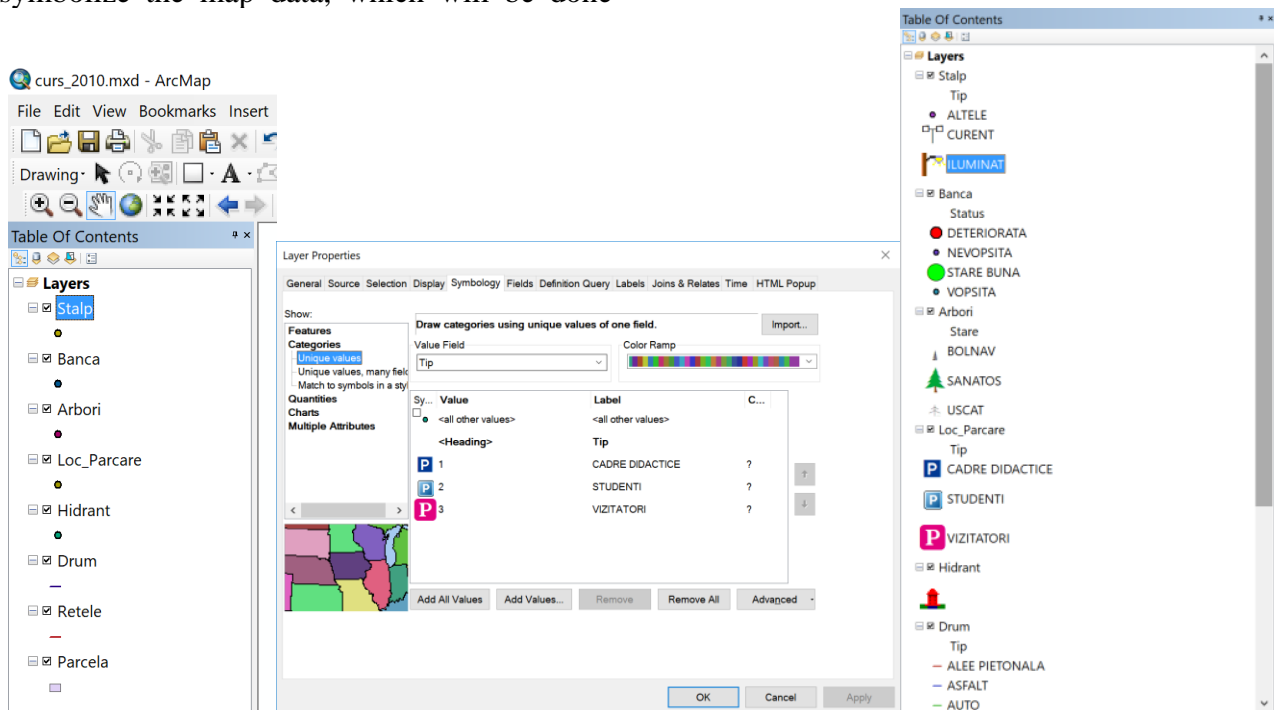
Figure 10. Simbolyzing the layers

2. Sharing the map

For the data can be used on the field, these must be shared. The data can be transmitted either to a ArcGIS server or to the ArcGIS Online account.
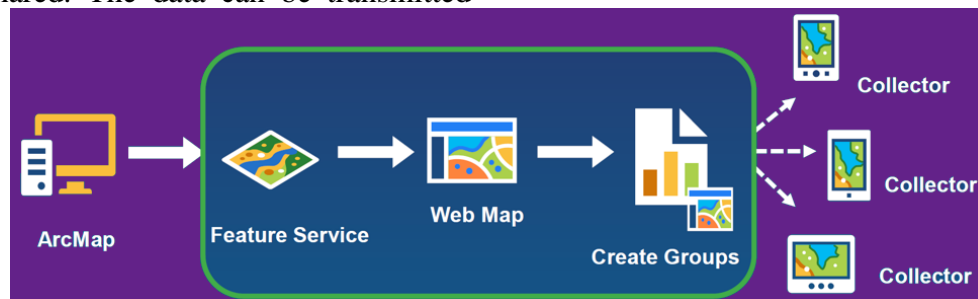
Figure 11. Workflow 2
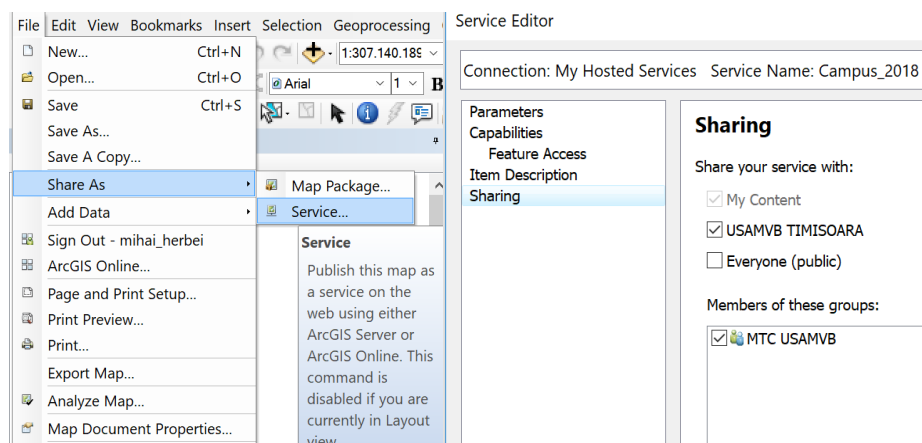
Figure 12. Data sharing

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After the sharing process have been done it will be created a map which will be used in the field in order to collect the necessary data and information. The map will be done starting from a base map over which a new layer will be added with the objectives which will be inventoried. It can be configured the data collection mode and the settings of the collection application can be customized.

In the end, the created map will be distributed to field users who will collect and populate the data with field information. To use the map by field users, this one needs to be shared. This is done with the "Share" button. In this moment the map can be populated with field information by the users.
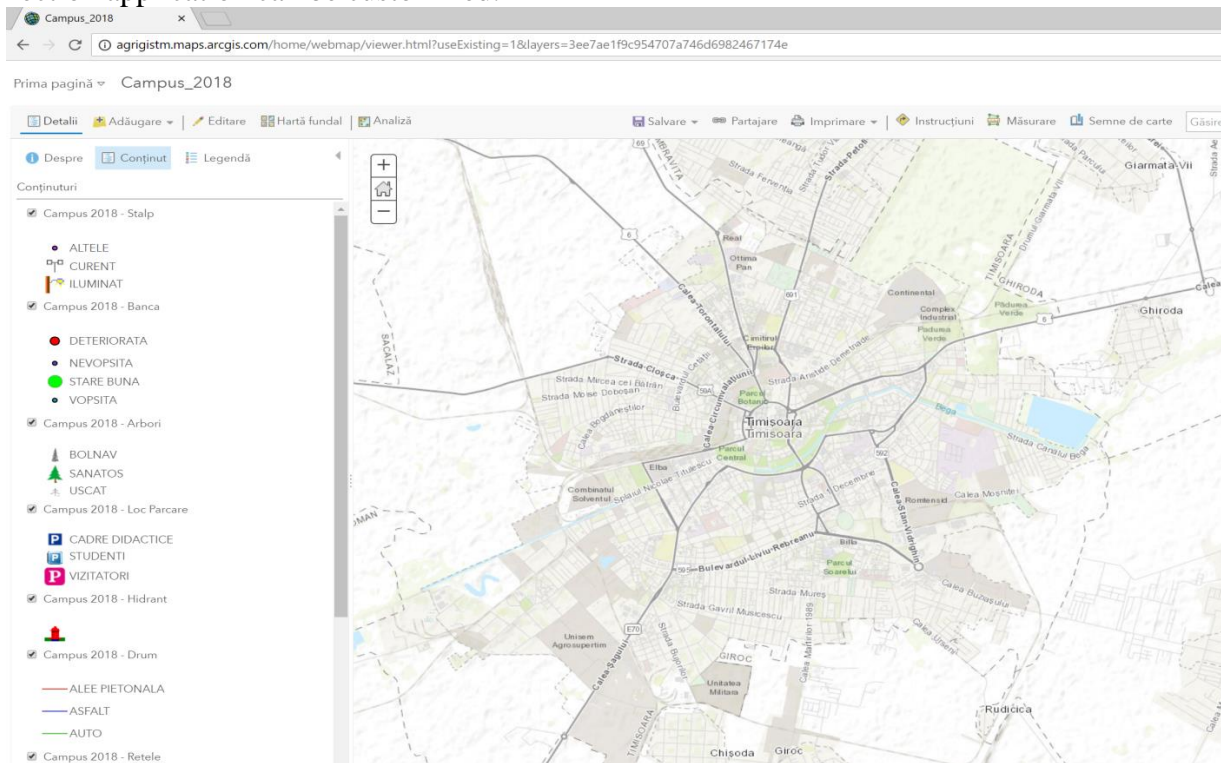
Figure 13. Displaying the map in ARCGIS online

3. Acquisition (collection) of GIS data using ZENOCollector (Leica Zeno 20 and ESRI Collector)

Within this project was used a high precision GIS instrument, namely Leica Zeno 20. The Leica Zeno 20 is a high precision GNSS receiver based on the ANDROID Operating

System, dedicated to the acquisition of GIS data from the field.

Zeno Collector is a portable tool that combines Collector for ArcGIS application, produced by ESRI company, with the precision of a geodetic instrument, Zeno 20, produced by Leica Geosystems company.
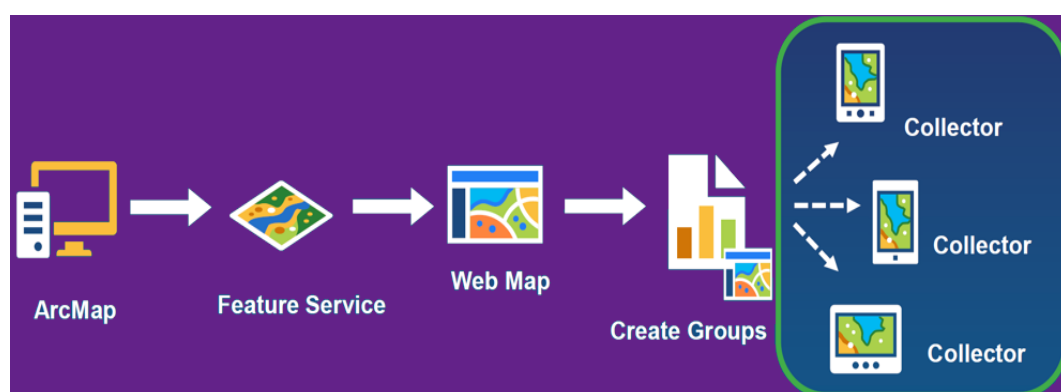
Figure 14. Workflow3

Figure 15. Description of Leica Zeno 20

On Leica Zeno 20 it was downloaded the ESRI Collector application and we sign in with the University Esri account. We Open the WEB Map created before for navigation and GIS data aquisition. The map can be downloaded for working offline.
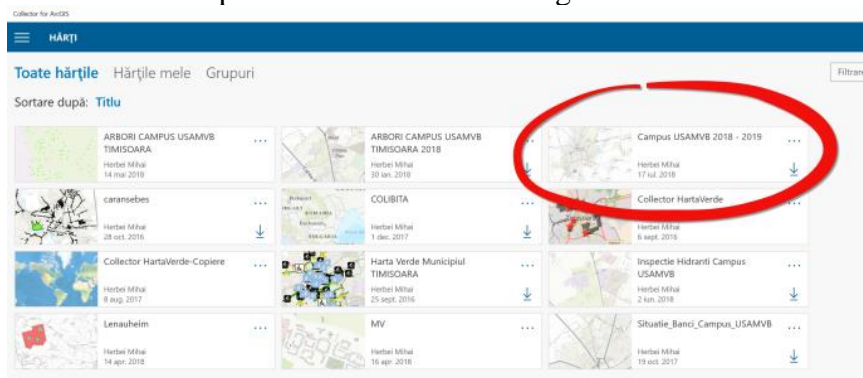
Figure 16. Open the map in the collector application
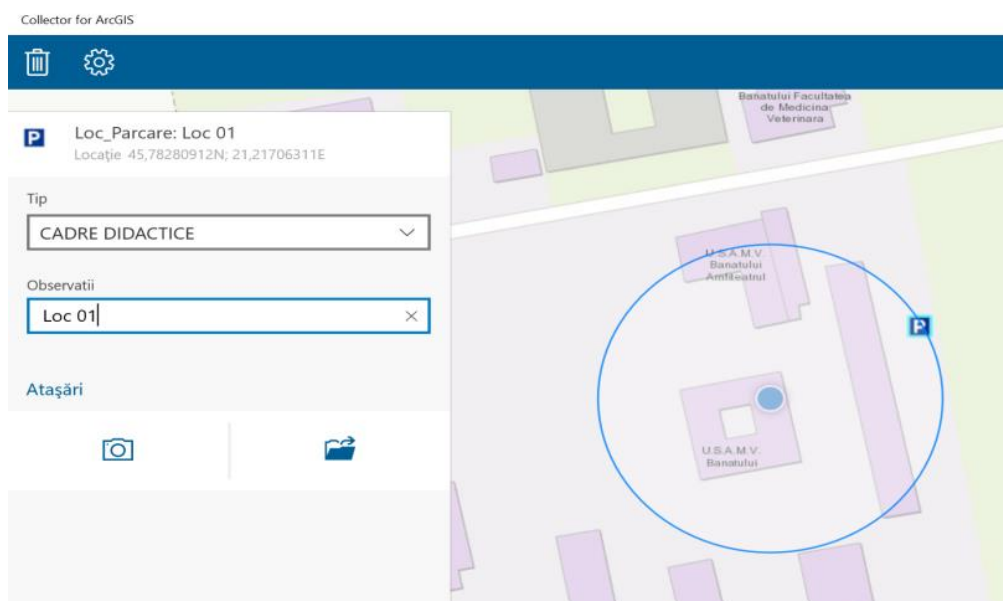
Figure 17. Example of Data Acquisition in ESRI Collector- Parking space

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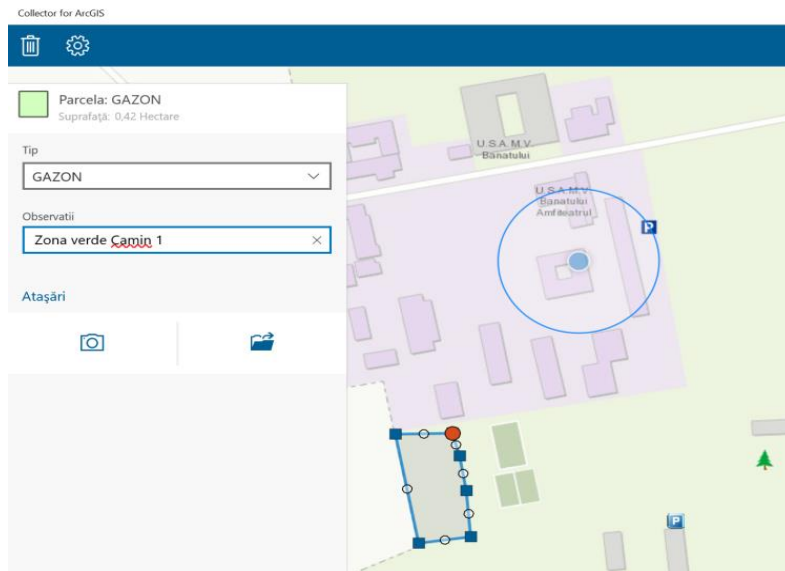
Figure 18. Example of Data Acquisition in ESRI Collector–Parcel
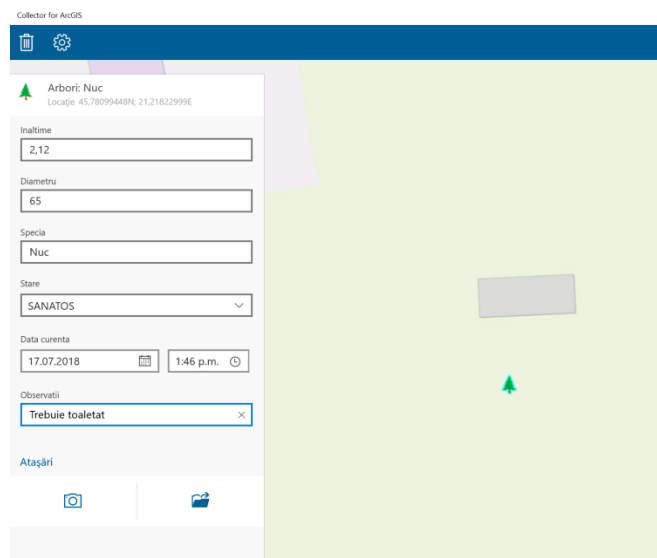
Figure 19. Example of Data Acquisition in ESRI Collector–Trees
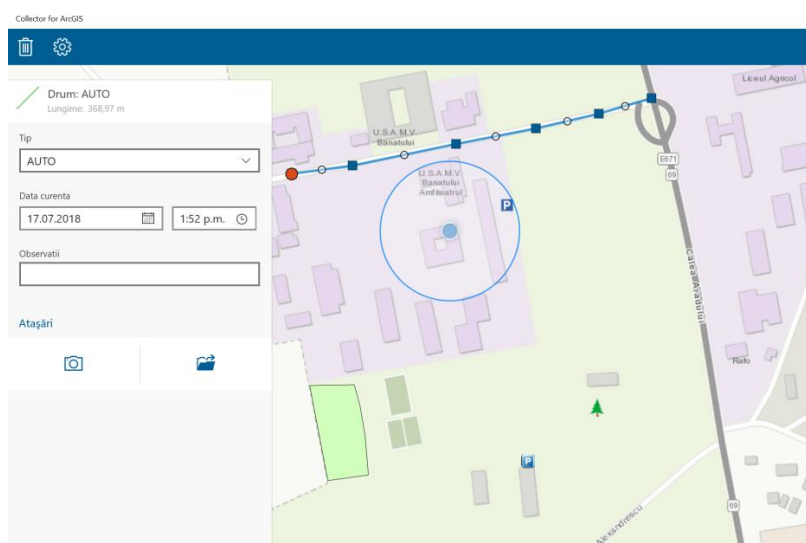
Figure 20. Example of Data Acquisition in ESRI Collector Roads

CONCLUSIONS

Thanks to this project, we can invent all the objectives in the USAMVB Timisoara campus.
By creating this database anyone can access the online site and use this work.
These data helps to improve and beautify the USAMVBT teaching park and the environment.
The purpose of the collected data is to represent the material needed to perform the various queries essential to the detailed analysis.

ACKNOWLEGMENTS

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CREATING THE 3D MODEL OF THE " DECEBALUS PER SCORILO" STATUE USING DIGITAL PHOTOGRAMMETRIC APPLICATIONS

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Abstract

The paper presents the current state of development of digital photogrammetry, the processing of photogrammetric images that are done manually or automatically in the digital environment, in order to elaborate the 3D model of a lens. Digital photogrammetric processing is based on object characteristics, which are visible in images. The main purpose in automatic digital photogrammetry is to extract the geometric characteristics of the identified objects.
AgiSoft PhotoScan is an autonomous photogrammetric and advanced 3D image modeling software used to create professional and quality 3D models. Agisoft is a state-of-the-art program used to reconstruct 3D objects from multiple images. The totally automated workflow allows all users to process thousands of aerial or terrestrial images without the need for advanced modeling knowledge using a computer. This way you can get final products, which consist of professional photogrammetric data.

Keywords: AgiSoft PhotoScan, Digital photogrammetry, 3D model.

INTRODUCTION

Evolutionally, planimetric photogrammetry began with the discovery of the photograph and the first terrestrial photogrammetric elevations. The analog collection method was followed, then the analytical method still performing and the digital method respectively.

Photogrammetric technologies, as well as remote sensing technologies, are modern and very useful methods for studying large areas of land and are increasingly used in terrestrial measurements.

The digital method revolutionized photogrammetry. Digital photogrammetric stations completely solve the problem of collecting and processing the digital data needed in any of the above mentioned areas. Contrary to the first two methods, these types of devices do not analyze analogue (positive or negative) pictures, but digital images (Barliba et al., 2013).

As a ground-based field science, photogrammetry serves to draw up maps and topographic plans, but is widely used in other spheres of activity such as architecture.

The principle of data acquisition using the photogrammetric method aims to obtain physical and environmental information without physical contact with physical objects and the environment by recording, measuring and interpreting metric photographic images called photograms. Reproduction of photograms is done using photogrammetric cameras, grounded (ground photogrammetry) or located on airborne platforms.

Photogram is a special photo that is a central projection from a mathematical point of view. On it can be made accurate measurements, mathematical relations can be established between the points on the photographed terrestrial surface and their correspondences on the photographic image (Stoian et al., 2009). Fotogrammetry is the technique of measuring objects (2D or 3D) on photograms: photos = light; grammar= description; metron = measure.

With photogrammetry, plans and topographic maps are obtained from photograms. Photograph is a photographic (or digital) image of the terrain.

MATERIALS AND METHODS

AgiSoft PhotoScan is an autonomous photogrammetric and advanced 3D image modeling software used to create professional and quality 3D models. Agisoft is a state-of-

the-art program used to reconstruct 3D objects from multiple images. This program uses arbitrary images and is effective both under user-controlled conditions and under unruly conditions. Photos can be taken from any position, provided that the object to be rebuilt is visible in at least two of them. Image alignment and reconstruction 3D models are fully automated. The program allows alignment of imported images without the need for special shooting conditions or the use of targets. Enables automatic dense cloud generation, textured polygonal patterns, true georeferencedortho-geosynthetics, and Digital Surface Model (DSM) / Digital Terrain Model (DTM) from static images (Agisoft PhotoScan User Manual, 2006).

Based on Agisoft's state-of-the-art technology, it enables very fast processing, while delivering very precise results (up to 3 cm precision for aerial photographs and up to 1 mm for short-range photos).

Agisoft PhotoScan is capable of processing thousands of photos, but all operations are done locally, making Agisoft an ideal solution for processing sensitive data. The software package has a project-based linear workflow that is intuitive and can be easily controlled even by a non-specialist.

The recently developed software has been focused on the use of automatic feature extraction features for image orientation and photointerpretation of various forms (constructions, architectural models). The implementation of these objectives should allow the 3D model of objects in photos to be extracted using photogrammetric processing methods (Herbei et al., 2015).

The advantages of the described application are: the practical utility of the specialized program, which results in the 3D model of the lens, using the photogrammetry and the specific equipment, obtaining very precise and detailed results, the software offers an automated process with intuitive workflow, a large network processing and easy PDF sharing.

Motion Structures (SFM) refers to the process of determining the three-dimensional structure of the scenes, based on the changes in time. As a reference model, he studies how the human vision can perceive the concept of "space," and by analogy tries to find the appropriate

numerical methods for a computing system. The current method of building monitoring involves geo-topographic measurements. These consist of making determinations, at regular intervals, of the representative points that make up the objective studied. These points, in addition to being heterogeneous samples, do not take into account the interaction of the construction with the adjacent land. This is where SfM stands out, because based on the concept of geo-photogrammetry, it offers not only high precision and efficiency but also a larger volume of data, starting from digital images methods (Herbei et al., 2016).

The principles on which this discipline is based are:the land connection is based on previously measured control points;the mathematical relationship that supports this link is known as the principle of collinearity and is part of the perspective laws; the assumption that camera recording is a central projection; the focal plane of the camera is a rigid one; the rays of light passing through the lens are not deviated.

RESULTS AND DISCUSSIONS

The process of image processing with the Agisoft PhotoScan software includes the following main steps: uploading photos to PhotoScan, diminishing uninterested parts, aligning photos, cloud generation, 3D mesh generation, texture generation, 3D model generation, export of results methods (Herbei et al., 2015). As far as the field stage is concerned, a total of 65 photos from different locations were executed in one session. The data processing and modeling step, using the specialized program described above, consisted of following working steps:

1. Import photos with the "Add photos" command (Figure 1).
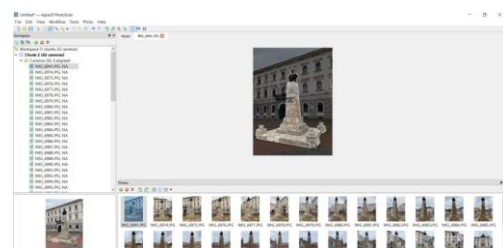
Figure 1. Importing photos and highlighting

the historic monument

2. The marking of the historical monument's area consisted of establishing representative photos for processing. In this sense, the program allowed full-screen processing, with the disadvantage that the cloud of points obtained will be very dense, and will contain elements around the artifact that are not important for processing. Also, the processing time will be very high, so it is preferable for the images to be cropped using the "Intelligent scissors" tool. Selected points were selected on the contour of the object and the Invert selection and Add selection commands were used to remove the parts of the image that were not useful to us (Figure 2).

3. The photos were merged using the "Align photos" command in the program's "Workflow" menu to get the cloud of points, choosing the 10,000,000-point high precision option to find the position and orientation of each camera (Figure 3).
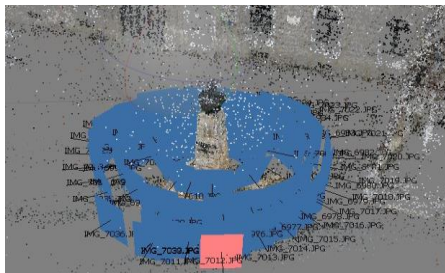
Figure 2. Triangulation of photos
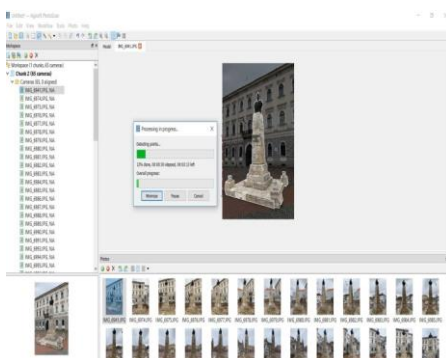
Figure 3. Orientation of cameras

4. The dense point cloud was built using the Building dense point cloud command, based on the camera's estimated positions, the program computing in-depth information for each room, information that was combined into a single cloud of points (Figure 4). PhotoScan tends to produce additional dots that are nearly the same density or even more dense (Figure 5).
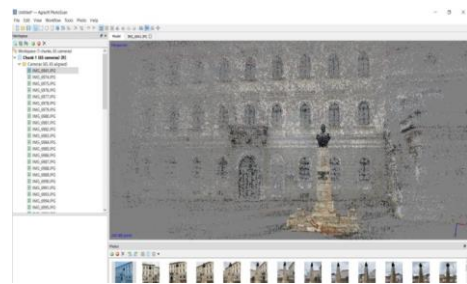
Figure 4. Dotted cloud

Figure 5. Dense cloud of dots

5. Building the cloud geometry was done by the "Build Mesh" command (Figure 6).
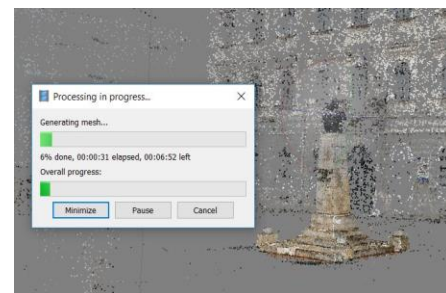
Figure 6. Building the cloud geometry of points

For the reconstruction of the dot cloud geometry, the "arbitrary" surface setting method was used (Figure 7).

Figure 7. Resulting modelling

6. The final model consisted of exporting the 3D model obtained in dxf files in 3ds format

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(3D Studio) and wrl format Cortona 3D (Figure 8).
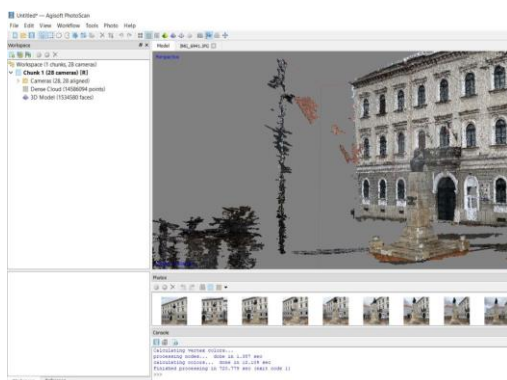
Figure 8. Final Model

Model Comparisons – Reality

In the figures below (Figures 9 - 10), the details obtained from the processing process using AgiSoft PhotoScan software.

Figure 9. Before the photo processing process

Figure 10.The result obtained from processing the photo using the Agisoft PhotoScan software

CONCLUSIONS

The 3D model of the statue was obtained from the processing of photographs taken with a 24 megapixel Nikon D 610 digital camera and a Tamron 24-70 lens. AgiSoft PhotoScan, which was used to create 3D imagery, is an advanced image-based 3D modeling solution used to create professional and quality 3D content. AgiSoft PhotoScan is a standalone software that performs photogrammetric digital imaging and generates 3D spatial data for use in GIS applications, documenting cultural heritage, and producing visual effects. Based on state-of-the-art 3D reconstruction technology from multiple images, this product uses arbitrary images and is effective both under user-controlled conditions and under unruly conditions. The development of modern programs for "patter recognition" or "image understanding", in other words, of modern digital photogrammetry, has enabled the automation of functions for extracting object characteristics from images. In conclusion, the totally automated workflow allows all users to process thousands of aerial or terrestrial images without the need for advanced modeling knowledge using a computer. This way you can get final products, which consist of professional photogrammetric data.

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EVOLUTION OF PRIVATE AREAS IN THE NORTH SIDE OF HERĂSTRĂU PARK

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Abstract

This paper aims at discussing about the evolution, throughout the years of private areas in the North side of Herăstrău Park in order to highlight the changes brought by urbanization and housing in this area. This paper will focus on the quantitative aspect of the problems derived from these aspects .The World Health Organization recommended 50 m2 of green space per capita, whereas the Government Emergency Ordinance no.114/2007 implies that the local authorities have the obligation to ensure at least 26 m2/capita. This numbers are not achieved in Bucharest due to different factors, one of them being the conversion of public spaces from parks into private spaces (Tudora et.al., 2018, p.120). One of such affected parks is Herăstrău, the largest park of Bucharest, listed in The National List of Cultural Heritage (code 47 B-I-s-B-17874). Even though the park is officially acknowledged as heritage, the park has suffered a decline of its surface due to the extension of private buildings and built areas. These are due to numerous causes that go from unfollowed regulations to misinterpretations of the law and more (Mexi et.al., 2018, p.3).

Keywords: public parks, cultural heritage, urbanization, Herăstrău Park, Romania.

INTRODUCTION

According to European Directive Habitats, each European Member State is committed to ensure the maintenance or restoration of natural habitats and of wild fauna and flora of Community interest in a favourable conservation status, to help maintain biodiversity. (European Council Directive 92/43 EEC on the conservation of natural habitats and of wild fauna and flora). After joining the European Union in 2007, Romania has committed to maintain a favourable conservation status of terrestrial and marine species and habitats of national and European importance, as provided in the Government Emergency Ordinance no.57/2007 (Badea et. al., 2015, p. 2).

Also, The World Health Organization recommended the availability of a minimum of 9 m2 of green space per individual with an ideal UGS (urban green space) value of 50 m2/capita. Whereas the Government Emergency Ordinance no. 114/2007 announced the obligation of local authorities to ensure each inhabitant with at least 26 m2 of green space within the urban area. These numbers are not achieved in Bucharest due to different factors, one of them being the loss of urban green space because of their conversion into built ones.

Looking at the qualitative side of this case, recent medical studies (Barton et al., 2017; Irvine et al., 2013) are showing that a low quantity of planted spaces is affecting the health of wellbeing of the citizen living in these kinds of urban conditions.

Regarding its environmental performance, Bucharest is situated on the 28th place, below the European average, as shown in the charter below (Figure 1).

Figure 1. European Green City Index for 2018 (source:https://www.siemens.com/entry/cc/features/greencityindex_international/all/en/pdf/report_en.pdf)

Although numerous examples can be given when discussing about the topic of public green spaces transformed into built areas (see, for example, the case of Tineretului Park – Colesca et al., 2011; Circului Park –Kelcey et al., 2011;Mogoşoaia Estate–Răducan et al., 2014; and many other similar ones), we will focus on the way how the historical park Herăstrău was affected by such improper interventions, thus reducing both its surface, damaging its overall image and also, extensively, reducing its landscaping and cultural value.

During the 1930s, important interventions were made on the site where the Herăstrău exists nowadays as to cover the marsh and eliminate mosquitos and other insects that were causing health and sanitary problems in Bucharest (Donescu et al., 1936). Also, the riverbed that used to water the marsh was reorganized and landscaping works were begun.

Herăstrău was initially conceived along the Kiseleff road and later included in the green barrier of the capital, planned to be developed along the Colentina chain of lakes (Popescu-Criveanu et. al., 2018). In a 1935 regulatory plan, Herăstrău is one of the parks of Colentina river along with Băneasa, Floreasca, Tei and Plumbuita. Being the largest park of the Capital with a total surface of 187 ha, its lake having 77 ha, Heăstrău is now facing a reduction in its planted space which was never planned.

The Herăstrău Park was built in three stages. The first one consisted in planning the West side for the Bucharest Month Festival held in 1936 and the second one in designing the South side for the Bucharest Month held in 1939. The third stage consisted in planning the East side for a Sports Festival for Communist countries organized in 1953. The West and South sides were designed for restfulness and culture, whereas the East side was associated with water sports (Tudora et al., 2018).

Despite being national heritage and listed since 1992 in The National List of Cultural Heritage (http://www.cultura.ro/sites/default/files/inline-files/LMI-B.pdf), Herăstrău had suffered numerous significant changes throughout the years. These changes are represented by inappropriate insertions of vegetal decorations, blocked perspectives, the absence of boat traffic on the lake to name a few.

Besides all of the mentioned, one of the main problems which the park is facing nowadays is the growth of built areas within its limits. Restaurants, terraces, clubs, tennis fields, kiosks are some examples of buildings which occupy historical green spaces –intrinsic and indissociable components of the historical listed monuments. Besides the diminishing of the cultural, landscaping and historical value of the park, the reduction of its planted spaces – be them lawns or small arboretums - the constant loss of greens paces over built ones is contributing to furthering back the Capital from the goals set by international and European standards and regulations.

MATERIALS AND METHODS

This research regarding the evolution of private areas in the North side of The Herăstrău Parkand the implicit decrease of its green territories was undertaken out of scientific curiosity and it is based on bibliographical and archival references, in situ observations, historical map comparison and visual analysis of satellite plans. Because of poor access to some of the areas, the calculation of surfaces presented in this paper is sometimes estimated. This research is aimed at emphasizing some of the preliminary results of a wider research regarding public (heritage) parks. The final results will be published by the end of the research.

RESULTS AND DISCUSSIONS

The history of the site emphasizes the fact that private spaces were never meant to extend. Initially a few private areas existed, but they were an integrated part of the park.

It is also important to mention that around 1940, four sport facilities were built: The Aviation's Club″, The Royal Romanian Yacht Club″, Bucharest Yacht Club″ and Metropola″. These clubs were grouped and were not interrupting the general state of the park. Before 1990, the only private spaces added to the sport clubs were "Herăstrău Hotel″and "Dinamo Club″ (Tudora et. al., 2018). This fact emphasizes a moderate and well management of the built spaces which is no longer practiced.

Private built areas appeared after the 90's on the west and south of the peninsula, disrupting the original landscape relationship between the lake and the shore (Figure 2). The sport fields (mainly tennis and football fields) which exist nowadays are not a historical characteristic of the Herăstrău Park. Initially, the east side was designed for water sports such as yachting, canoeing and boating.
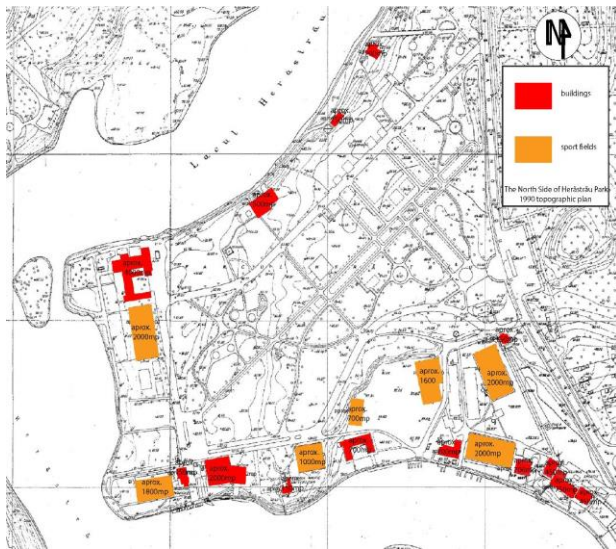

Figure 2. Refined aerial view of the private areas from the North Side of Herăstrău Park-1990 topographic plan

Legend: red – buildings; orange – sport fields.
Nowadays, 10 hectares from North-East Side are no longer administrated by the Administration of Lakes, Parks and Recreation of Bucharest (A.L.P.A.B.) (Popescu - Criveanu et. al., 2018). Most of the pontoons from the east side of the peninsula have been transformed into private terraces. These private constructions tend to be as close to water as they can, in order to manage a small business by preventing people's access to the water (Figure 3). Thus, a significant amount of public space is lost due to the constant growth of built areas.

To the existing restaurants are added private car parks, which also reduce the public green surface of the site. The phenomenon of losing green public space not only has an impact over the way the park is being used for by the people, but also it breaks the laws which protect this site.

In an Urban Zoning Plan (P.U.Z) conducted in 2001(http://regver.pmb.ro), Herăstrău was marked as the 83rd protected area from

Bucharest with a maximum coeficient of protection needed. This document forbids any constructions that are not relatable to the conservation and restauration of the site.

Figure 3. Refined aerial view of the private areas from the North Side of Herăstrău Park -2019

(source: authors – analysis over satellite images from Google Maps)

Legend: red – buildings; orange – sport filed; light purple – private playground; dark purple – area not administrated by A.L.P.A.B.

The fact that private buildings continued to be built in this park is due to the use of derogatory P.U.Z.s˝ by the contractors. Because of this, changes such as expansion of already built spaces or for building new ones were permitted.

Having taken all of these factors into consideration, we calculated the total of private surface which exist in Herăstrău to show how much green public space have been lost. The estimative results are based on historical map comparison and AutoCAD measuring of satellite plans and are shown in the charts below.

From the1990 topographic plan, we calculated 22.000 m2 of private area which existed at that time in the North Side of Herăstrău, representing only 2% of the total surface of the park (Figure 4). In 2019, by using refined plans from Google Maps, we estimated 128.000 m2 of private area in the North Side, translated into 10% of the total surface of the park. The Law no. 24/2007 referring to green spaces, limits the private built area at a maximum of 10% of the park's surface. Taking into account that the West Side and South Side of the park are also abundant of private built areas, it is obvious that this law is being broken.
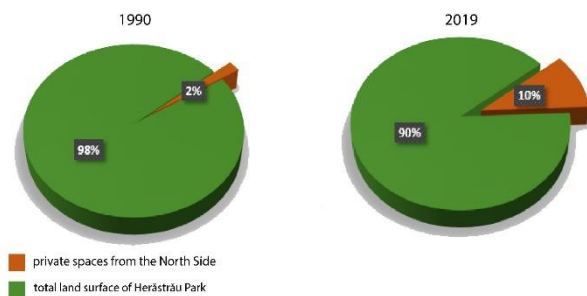
Figure 4. Comparison between the percentage of private areas in 1990 and 2019
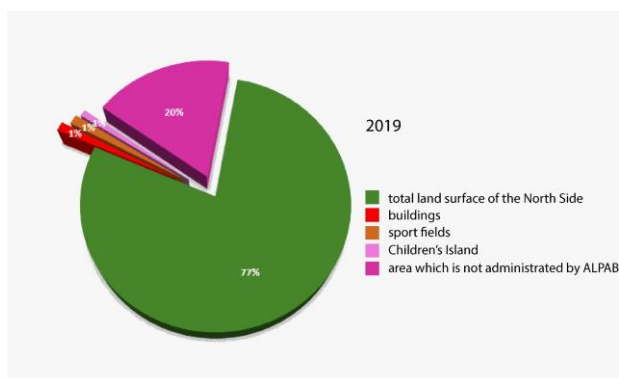
Figure 5. The actual state of the North Side of Herăstrău (source: authors)

Referring only to the North Side of Herăstrau, we translated the private built area into 23% of its total surface (Figure 5). Almost a quarter of this zone is represented by built areas, sport fields and private playgrounds. The private enclave which is no longer administrated by A.L.P.A.B remains the most significant amount of lost land surface.

CONCLUSIONS

Herăstrău Park, as well as other heritage or non-heritage parks and gardens are facing many threats and that of the reduction of their planted space in favour of urbanization, housing or other is one of them. For Herăstrău

and others alike, more research on this topic and other complementary ones must be done in order to create quality strategies for their protection. Researches such as this, more detailed and focusing on complementary issues and threats should and have to be done in order to lead to good quality restoration projects. Few such researches have been done for some parks (Tudora et. al., 2018; Popescu - Criveanu et. al., 2018), including Herăstrău, but so far have not lead to any visible result. Also, most probably, a restoration plan for Herăstrău and for other similar heritage parks should be made, but this is a topic to be discussed in another paper.

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IDENTIFICATION OF CRITICAL AREAS ON POWER LINES USING LIDAR AND ARCGIS PRO SOFTWARE

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Abstract

Transmission line corridor clearance management plays a critically important role in power line risk management and is an important task of the routine power line inspection of the grid company.
Airborne Light Detection and Ranging (LIDAR) technology brought a new reformation for measurement technology, and the airborne LIDAR technology provides a new way for power line inspection. Compared with the traditional measurement system, airborne LIDAR measurement system has its unique technical advantages, which can directly obtain the power line corridor point cloud and get the high precision of 3D spatial information, then obtain the whole information of the 3D power lines corridor.
This study proposes an extraction method of critical areas from power lines using LIDAR point cloud data.
The corridor monitoring mainly includes the inspection of the overhanging trees in the corridor and the existence of the bird's nest and other routes, this study, introduce the working principle and application of LIDAR system in power line inspection. LIDAR system's advantage is that can accurately restore the 3D spatial information of line corridors, and then we can get along the more accurate and more comprehensive information of the line and route area.

Keywords: critical areas, LIDAR, power lines, Romania, 3D.

INTRODUCTION

Unmanned aerial vehicles (UAVs) as alternative platforms for laser scanning provide a good choice to overcome the aforementioned issue. Currently, many researches have been done, from preliminary schematics and prototypes of UAV-borne LiDAR systems to more comprehensive systems (Lin, 2011).

The UAV obtain high-precision 3D point cloud data which is equipped with LIDAR system, and then carry out line model reconstruction and hazard detection. The application of LIDAR technology in power line inspection is greatly promoted.

The UAV technology has evolved very much and this can be utilized in power line inspection for the development of the power sector inspection technology.

On this line the UAV power line inspection has a lot of conveniences, such as low inspection cost, small investment in equipment, automation, quick result, etc.

The management of power line corridors is very important and is mainly focused on identifying issues of the overhanging trees in the corridor and the existence of the bird's nest, identifying the trees which could fall and contact the power lines structure.

Therefore, using this systems, UAV and LIDAR can solve any problems such as safety or high technical requirement. For instance, the corridors of power lines can be keep clearance, between conductor and vegetation.

Thus, 3D power line model can easily provide a multifaceted analysis for the risk management of power-line keeping safety and saving time and cost (Chaput, 2008).

From the dense point clouds generated from UAV-LIDAR systems with high range accuracy could provide 3D power line models which can generate semantic information.

MATERIALS AND METHODS

A. Data

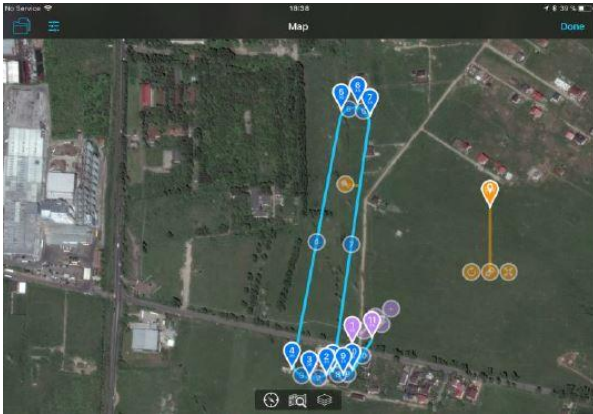The LIDAR points cloud was obtained using UAV System DJI MATRICE M600 PRO – LIDAR SCOUT SENSOR.

Figure 1. Flight planning

For this study we used the ArcGIS PROsoftware application. The main component of SCOUT System is LIDAR sensor. This is Velodyne VLP-16 Puck Lite which can capture between 300.000 and600.000 points on seconds.

The quality of the LIDAR cloud point, such as position accuracy and point density are very important. Usually the performance of algorithm for classification and modeling power line depends on the quality of the LIDAR measurements.

The point cloud post-processing flow is figured below.
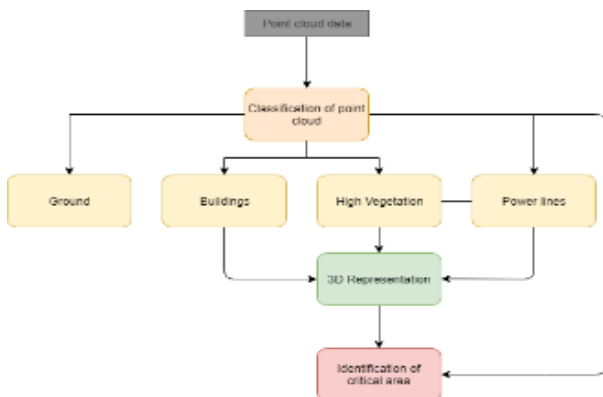
Figure 2. Post – processing flow

B. Initial classification

The raw LiDAR point cloud data and is shown in Figure 3. First of all I classified the LIDAR point cloud data. In order to classify the data according to the ASPRS (American Society for Photogrammetry and Remote Sensing) standards, it will first classify noise points, ground points, points corresponding to their constructions, vegetation and their electrical lines (non ground points).Because the automatic classification of ground points does not integrate all the points of the ground, the user is required to part of these points manually classify them. Prior to their manual classification, the Auto-Classify Non-Ground Points are automatically classified. This classification involves identifying the points that belong to the buildings, the points that define the vegetation (small, medium or high), the points that define the areas with water, etc. as well as points that are framed as noise. Assisted Classification is done by selecting points belonging to a particular class of objects and assigning the corresponding class according to ASPRS specifications.
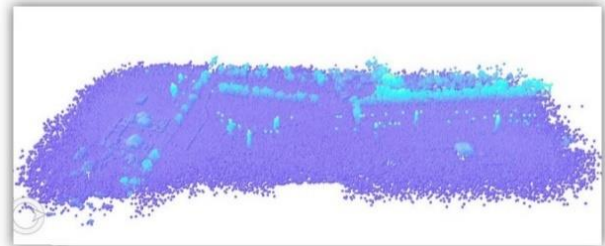
Figure 3. Unclassified point cloud
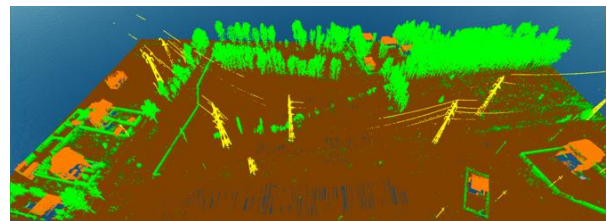
Figure 4. Classified point cloud

C. Extracting 3D Buildings and Trees

In raw LIDAR data, both ground and non-ground objects, such as low vegetation, high vegetation, buildings, and vehicles, generate backscatter (Meng et al., 2009).

Non-ground points need to be identified and filtered out from LIDAR data before Digital Terrain Model interpolation. Likewise, ground points need to be eliminated before extracting non-ground objects, such as vegetation and buildings to generate Digital Surface Model.

The proposed building extraction algorithm has been implementing by using "Extract roof form Tools". Utilizing the DTM, DSM, nDSM and the building footprints we obtained information from building like flat roof form, roof height,

area of buildings. Finally, for generating the 3D building we run the "Apply Symbology from Layer" tool.
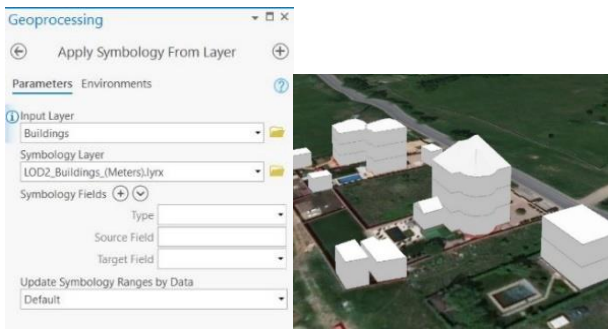
Figure 5. Parameters and 3D buildings

This paper proposes two methods for representing 3D trees.

First of all, we used the "Extract Values to Points" Tool, setting by input parameters the point features and the Normalized Digital Surface Model.

As shown in Figure 6, the trees do not have the values in the attribute table and they are representing with the same height, it is not the real height.

Figure 6. D trees (results of first method)

The second way on which we use to represent trees is by running the "Tool for Create 3D Trees". Thus, we set up by input the LAS Dataset and then we introduce the parameters for Vegetation Class Codes, Minimum canopy height and Maximum canopy height, Digital Terrain Model and the Point Spacing.

The result of this method is better than the other.
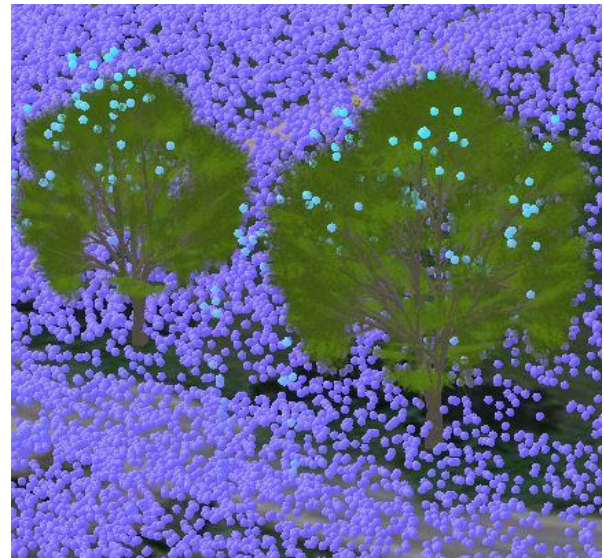
Figure 7. 3D trees (the second method)

RESULTS AND DISCUSSIONS

Extracting Transmission Line Spans and tower models

In this section, the transmission line spans and the tower models were extracted from point cloud dataset. The first step for reconstructing power lines is to extract a power line candidate point that indicates a possible presence of power lines. This step would be greatly helpful for reducing scene complexity.

Then we continued this process by following the steps from 3D Tools for Power Lines. In this sense created the transmission line and the distribution lines setting the Voltage, Conductor parameters, Tower Configuration, Pole Configuration etc.

The second step in this process is creating the Sway surface that represents the area where the spans can swing. Hence, by setting the maximum angle where the power lines can swing and using the 3D lines that were created before, we will obtain the Sway surface areas that represent a protection area for power lines.

The aim of this study is to identify in a semi-automatic mode the areas where the vegetation can is too close on the power lines. For detecting the critical areas we measured the distance measure between power line and the trees in the cases where we visual identified the possible anomaly. In this paper we considered the anomaly the areas where we measured the distances less than 2 m. T his areas was marked by a point namely "Critical point" and then to

view the entire problem area we generated a 3D buffer for all the "Critical point".
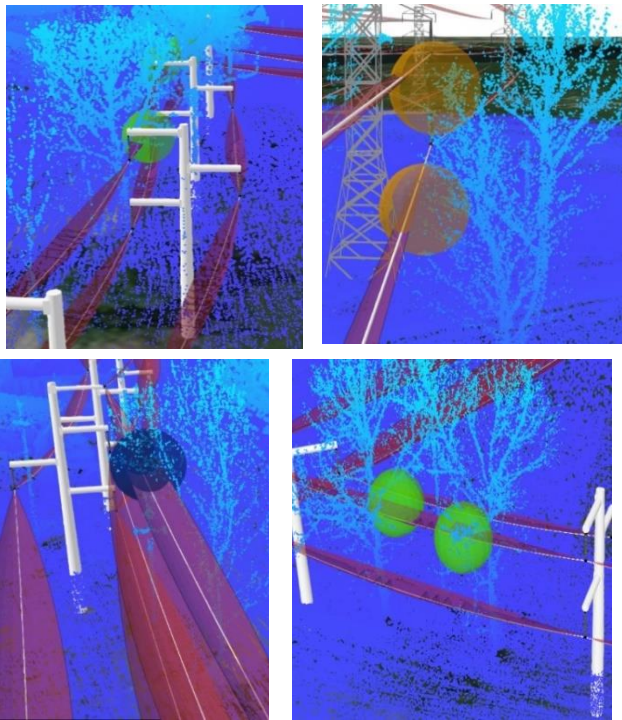
Figure 8. Critical areas

This experiment was implemented to validate the capability and accuracy of the proposed method for the identification anomaly on power lines using point cloud dataset.

The inspected area is located in a semi-residential region, there are few buildings and also few electrical power lines. Further research work should mainly focus on this method to increase automatic detection of critical areas on transmission lines.

CONCLUSIONS

This paper presented an efficient workflow for identifying the critical areas on power lines using LIDAR. There are a number of conclusions that can be drawn from the information presented in the case study compared to the classic realistic representation and monitoring procedures.

At present, the mentions automatic detection refers to the identifying the problems on a Transmission line using Locate by Proximity method. This process takes full advantage of the LIDAR 3D, developing the accuracy and reducing human labour in the identification process. This method for automatic detection of critical area can determine automatically the points which are in the Catenary Surface. Unfortunately, using this point cloud we cannot implement this automatic method because we need to have a very dense point cloud dataset.

The entire project and the results can be visualize in the applications on the ArcGIS Onlinehttps://bit.ly/2SXx7nv

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PREPROCESSING AND IMAGE COORDINATES ENHANCEMENT IN ANALYTICAL FOTOGRAMMETRY

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Abstract

The paper aimed to present the main steps necessary to determine photo-coordinates and the process to correct them for systematic errors, such as radial distortion, refraction and earth curvature which is also known as image refinement. Image preprocessing is a technique which is used to enhance raw images received from aerial photo-cameras, placed on drones, airplanes, satellites or other aircrafts for various engineering applications with a good accuracy. Photogrammetric original data obtained are usually geometrically distorted due to the acquisition system and the movements of the platform. So, we inserted the diapositives into the measuring system (e.g. stereo-comparator or analytical plotter) and measured the fiducial marks in the machine coordinate system. Then, we compute the transformation parameters with a similarity or affine transformation. The transformation establishes a relationship between the measuring system and the fiducial coordinate system, and translates the fiducial system to the photo-coordinate system. Finally, we corrected photo-coordinates for radial distortion (by linearly interpolating with the values given in the calibration certificate) and other systematic errors.

Keywords: Analytical photogrammetry, image processing, systematic errors.

INTRODUCTION

Photogrammetry is the science of obtaining reliable information about objects and of measuring and interpreting this information.
The photo-coordinate system serves as the reference for expressing spatial positions and relations of the image space. It is a 3D cartesian system with the origin at the perspective centre. Digital aerial cameras have only become available in about the last 15 years and have now replaced film cameras in many parts of the world. Their design must satisfy the need to produce high quality images and also provide a wide coverage of the terrain surface. Modern digital aerial cameras continue to be improved as new digital imaging technologies are developed.

MATERIALS AND METHODS

The coordinates and parallaxes of the midpoint M, which will become the origin of the coordinate system for the measured values, are calculated on the basis of the coordinates (x',y'') and the parallax (Δx'',Δy') of the reference indices as presented in Table 1.

Table 1. Calculation of Reduced Coordinates

Point	x' (mm)		y'' (mm)		x'' (mm)		y' (mm)	
number	x'	x' barred	y''	y'' barred	Δx''	Δx'' barred	Δy'	Δy' barred
1	392.605	-105.036	392.433	105.902	292.142	0.177	292.251	0.180
2	603.715	106.074	391.752	105.221	292.138	0.173	291.886	-0.185
3	602.674	105.033	180.629	-105.902	291.783	-0.182	291.889	-0.182
4	391.571	-106.070	181.311	-105.220	291.798	-0.167	292.257	0.186
M	497.641		286.531		291.965		292.071	
3172	499.602	1.961	205.127	-81.404	355.843	63.878	297.289	5.218
5022	479.156	-18.485	229.035	-57.496	355.582	63.617	297.604	5.533
22	478.194	-19.447	226.142	-60.389	355.428	63.463	297.626	5.555
5213	521.820	24.179	249.887	-36.644	354.971	63.006	297.048	4.977
217	531.936	34.295	230.615	-55.916	353.331	61.366	296.862	4.791
3173	563.317	65.676	199.377	-87.154	353.467	61.502	296.167	4.096
14	585.306	87.665	297.341	10.810	358.677	66.712	296.608	4.537
229	548.957	51.316	274.841	-11.690	357.390	65.425	296.747	4.676
5211	501.866	4.225	273.162	-13.369	354.991	63.026	297.223	5.152
13	477.058	-20.583	334.984	48.453	358.820	66.855	296.965	4.894
5234	558.006	60.365	323.908	37.377	362.578	70.613	296.747	4.676
1172	484.513	-13.128	391.328	104.797	365.410	73.445	296.275	4.204

Coordinates of the stereogram are calculated with the following formulas:

$$x' = \bar{x}' \qquad\qquad x'' = \bar{x}' - \Delta \bar{x}''$$

$$y' = \bar{y}'' + \Delta \bar{y}' \qquad\qquad y'' = \bar{y}''$$

So, we can see in Table 2 the gross image coordinates of the fiducial 4 marks and other 12points on a stereo-photo (Popescu, 2016).

Table 2. Gross image coordinates of the fiducial 4 marks and other 12 points on a stereo-photo

Point	Photogram F'		Photogram F''	
number	x' (mm)	y' (mm)	x'' (mm)	y'' (mm)
1	-105.036	106.082	-105.213	105.902
2	106.074	105.036	105.901	105.221
3	105.033	-106.084	105.215	-105.902
4	-106.070	-105.034	-105.903	-105.220
3172	1.961	-76.186	-61.917	-81.404
5022	-18.485	-51.963	-82.102	-57.496
22	-19.447	-54.834	-82.910	-60.389
5213	24.179	-31.667	-38.827	-36.644
217	34.295	-51.125	-27.071	-55.916
3173	65.676	-83.058	4.174	-87.154
14	87.665	15.347	20.953	10.810
229	51.316	-7.014	-14.109	-11.690
5211	4.225	-8.217	-58.801	-13.369
13	-20.583	53.347	-87.438	48.453
5234	60.365	42.053	-10.248	37.377
1172	-13.128	109.001	-86.573	104.797

The relationships used for the orientation, correction and reduction of coordinates measured at the main point are of the form:

$$x_i^c = a_0 + a_1 x_i^{'} + a_2 y_i^{'} + a_3 x_i^{'} y_i^{'}$$
$$x_i = x_i^c - x_P$$
$$y_i^c = b_0 + b_1 x_i^{'} + b_2 y_i^{'} + b_3 x_i^{'} y_i^{'}$$
$$y_i = y_i^c - y_P$$

Table 3. Correction equations for x (for photo F')

a1*10-2	a2*10-2	a3*10-4	I*10-2
-1.05036	1.06082	-1.11425	-1.06008
1.06074	1.05036	1.11416	1.06008
1.05033	-1.06084	-1.11423	1.06008
-1.06070	-1.05034	1.11410	-1.06008

Table 4. Correction equations for y(for photo F')

a1*10-2	a2*10-2	a3*10-4	I*10-2
-1.05036	1.06082	-1.11425	1.06008
1.06074	1.05036	1.11416	1.06008
1.05033	-1.06084	-1.11423	-1.06008
-1.06070	-1.05034	1.11410	-1.06008

Table 5.Calculation of transformed coordinates

Point	Measured coordinates		Corrected Coordinates	
number	x' (mm)	y' (mm)	x (mm)	y (mm)
3172	1.961	-76.186	2.344	-76.506
5022	-18.485	-51.963	-18.327	-52.292
22	-19.447	-54.834	-19.281	-55.181
5213	24.179	-31.667	24.447	-31.682
217	34.295	-51.125	34.718	-51.163
3173	65.676	-83.058	66.449	-83.041
14	87.665	15.347	87.939	15.828
229	51.316	-7.014	51.572	-6.793
5211	4.225	-8.217	4.280	-8.239
13	-20.583	53.347	-20.921	53.471
5234	60.365	42.053	60.372	42.500
1172	-13.128	109.001	-13.704	109.401

Table 6. Correction equations for x (for photo F'')

a1*10-2	a2*10-2	a3*10-4	I*10-2
-1.05213	1.05902	-1.11422	-1.06008
1.05901	1.05221	1.11430	1.06008
1.05215	-1.05902	-1.11425	1.06008
-1.05903	-1.05220	1.11431	-1.06008

Table 7. Correction equations for y (for photo F'')

a1*10-2	a2*10-2	a3*10-4	I*10-2
-1.05213	1.05902	-1.11422	1.06008
1.05901	1.05221	1.11430	1.06008
1.05215	-1.05902	-1.11425	-1.06008
-1.05903	-1.05220	1.11431	-1.06008

Table 8. Calculation of transformed coordinates

Point	Measured Coordinates		Corrected Coordinates	
number	x'' (mm)	y'' (mm)	x (mm)	y (mm)
3172	-61.917	-81.404	-61.872	-81.969
5022	-82.102	-57.496	-82.224	-58.024
22	-82.910	-60.389	-83.024	-60.933
5213	-38.827	-36.644	-38.863	-36.937
217	-27.071	-55.916	-26.993	-56.252
3173	4.174	-87.154	4.470	-87.517
14	20.953	10.810	21.005	10.914
229	-14.109	-11.690	-14.133	-11.794
5211	-58.801	-13.369	-59.004	-13.627
13	-87.438	48.453	-88.011	48.375
5234	-10.248	37.377	-10.421	37.493
1172	-86.573	104.797	-87.370	104.970

Correction for radial distortion causes off-axial points to be radially displaced. A positive distortion increases the lateral magnification while a negative distortion reduces it. Distortion values are determined during the process of camera calibration. They are usually listed in tabular form, either as a function of the radius or the angle at the perspective center. For aerial cameras the distortion values are very small. Hence, it suffices to linearly interpolate the distortion.

ri (mm)	20	40	60	80	100	120	140	148
Δri (μm)	3	6	2	0	-4	-8	2	9

$$\Delta r_i = a_1 r_i + a_2 r_i^3 + a_3 r_i^5 + a_4 r_i^7 + \ldots$$

Δr = movement in the plane between the real and corrected position of the point P in the object space;

$$r_P = \sqrt{x_P^2 + y_p^2}$$

$$c_x = -\frac{\Delta r}{r} x' \qquad c_y = -\frac{\Delta r}{r} y'$$

$$x_i = x_i' + c_{xi} \qquad y_i = y_i' + c_{yi}$$

c_x, c_y = corrections;
x_i, y_i = corrected coordinates;
The coefficients are determined by the minimum squares method.

A (8,4) A^T (4,8)   l (8,1)

$$N = A^T \times A \qquad N(4,4) \qquad N^{-1}(4,4)$$

$$X = N^{-1} \times A^T \times l \qquad X(4,1)$$

$$a_1 = \cdots * 10^{-2}$$
$$a_2 = \ldots * 10^{-5}$$
$$a_3 = \ldots * 10^{-9}$$
$$a_4 = \ldots * 10^{-13}$$

In Table 9 are presented the equations of correction and in Tables 10 and 11 are presented the computing of corrected coordinates for both photos.

Table 9. Equations of correction

a1*10-2	a2*10-5	a3*10-9	a4*10-13	l*10-3
0.200	0.080	0.003	0.000	0.003
0.400	0.640	0.102	0.016	0.006
0.600	2.160	0.778	0.280	0.002
0.800	5.120	3.277	2.097	0.000
1.000	10.000	10.000	10.000	-0.004
1.200	17.280	24.883	35.832	-0.008
1.400	27.440	53.782	105.414	0.002
1.480	32.418	71.008	155.536	0.009

Table 10. Calculation of corrected coordinates (F')

Point	Initial Coordinates		Corections				Corrected Coordinate	
number	x' (mm)	y' (mm)	r (mm)	Δr (μm)	cx (μm)	cy (μm)	x (mm)	y (mm)
3172	2.344	-76.506	76.542	0.538	-0.016	0.538	2.344	-76.505
5022	-18.327	-52.292	55.411	4.110	1.359	3.879	-18.326	-52.288
22	-19.281	-55.181	58.453	3.776	1.246	3.565	-19.279	-55.178
5213	24.447	-31.682	40.018	4.751	-2.902	3.761	24.444	-31.678
217	34.718	-51.163	61.830	3.327	-1.868	2.753	34.716	-51.160
3173	66.449	-83.041	106.354	-6.218	3.885	-4.855	66.453	-83.046
14	87.939	15.828	89.353	-2.578	2.537	0.457	87.942	15.828
229	51.572	-6.793	52.017	4.403	-4.365	0.575	51.568	-6.793
5211	4.280	-8.239	9.284	1.590	-0.733	1.411	4.279	-8.238
13	-20.921	53.471	57.418	3.897	1.420	-3.629	-20.920	53.468
5234	60.372	42.500	73.831	1.139	-0.931	-0.656	60.371	42.499
1172	-13.704	109.401	110.256	-6.706	-0.834	6.654	-13.705	109.407

Table 11. Calculation of corrected coordinates (F")

Point	Initial Coordinates		Corections				Corrected Coordinates	
number	x" (mm)	y" (mm)	r (mm)	Δr (μm)	cx (μm)	cy (μm)	x (mm)	y (mm)
3172	-61.872	-81.969	102.699	-5.600	-3.374	-4.470	-61.876	-81.973
5022	-82.224	-58.024	100.636	-5.197	-4.246	-2.997	-82.229	-58.027
22	-83.024	-60.933	102.984	-5.653	-4.557	-3.345	-83.028	-60.936
5213	-38.863	-36.937	53.616	4.276	3.099	2.946	-38.860	-36.934
217	-26.993	-56.252	62.393	3.245	1.404	2.925	-26.992	-56.249
3173	4.470	-87.517	87.631	-2.148	0.110	-2.146	4.470	-87.519
14	21.005	10.914	23.671	3.648	-3.237	-1.682	21.002	10.912
229	-14.133	-11.794	18.408	2.983	2.290	1.911	-14.131	-11.792
5211	-59.004	-13.627	60.557	3.506	3.416	0.789	-59.001	-13.626
13	-88.011	48.375	100.429	-5.155	-4.518	2.483	-88.015	48.377
5234	-10.421	37.493	38.915	4.730	1.267	-4.557	-10.420	37.489
1172	-87.370	104.970	136.573	-1.253	-0.801	0.963	-87.371	104.971

This correction applies when the coordinate systems are used in the design plan; the displacement of the points is radial to the main point and is negative in the radial direction to it.
If we consider:

R = 6370000m;
H$_{of\ flight}$ = 2800 m;

$$r_P = \sqrt{x_P^2 + y_p^2}$$

$$\Delta r_i (mm) = \frac{H(m) * r_i^3 (mm)}{2R(m) * c_k^2 (mm)}$$

$$c_X = \frac{\Delta r_i}{r_i} x_i'$$

Then: $x_i = x_i' + c_x$

$$c_y = \frac{\Delta r_i}{r_i} y_i'$$

$y_i = y_i' + c_y$

Table 12. Calculation of corrected coordinates for F'

Point	Initial Coordinates		Curvature correction				Corrected Coordinates	
number	x' (mm)	y' (mm)	r (mm)	Δr (μm)	cx (μm)	cy (μm)	x (mm)	y (mm)
3172	2.344	-76.505	76.541	4.275	0.131	-4.273	2.344	-76.509
5022	-18.326	-52.288	55.407	1.621	-0.536	-1.530	-18.326	-52.290
22	-19.279	-55.178	58.449	1.903	-0.628	-1.797	-19.280	-55.179
5213	24.444	-31.678	40.013	0.611	0.373	-0.483	24.444	-31.679
217	34.716	-51.160	61.827	2.253	1.265	-1.864	34.717	-51.162
3173	66.453	-83.046	106.361	11.470	7.166	-8.956	66.460	-83.055
14	87.942	15.828	89.355	6.801	6.693	1.205	87.949	15.830
229	51.568	-6.793	52.013	1.341	1.330	-0.175	51.569	-6.793
5211	4.279	-8.238	9.283	0.008	0.004	-0.007	4.279	-8.238
13	-20.920	53.468	57.415	1.804	-0.657	1.680	-20.921	53.469
5234	60.371	42.499	73.830	3.836	3.137	2.208	60.374	42.502
1172	-13.705	109.407	110.262	12.779	-1.588	12.680	-13.706	109.420

Table 13. Calculation of corrected coordinates for F"

Point number	Initial Coordinates		Curvature correction				Corrected Coordinates	
	x" (mm)	y" (mm)	r (mm)	Δr (μm)	cx (μm)	cy (μm)	x (mm)	y (mm)
3172	-61.876	-81.973	102.704	10.327	-6.222	-8.243	-61.882	-81.981
5022	-82.229	-58.027	100.641	9.717	-7.939	-5.603	-82.236	-58.033
22	-83.028	-60.936	102.990	10.414	-8.395	-6.161	-83.037	-60.942
5213	-38.860	-36.934	53.612	1.469	-1.065	-1.012	-38.861	-36.935
217	-26.992	-56.249	62.390	2.315	-1.002	-2.087	-26.993	-56.251
3173	4.470	-87.519	87.633	6.415	0.327	-6.407	4.470	-87.525
14	21.002	10.912	23.667	0.126	0.112	0.058	21.002	10.912
229	-14.131	-11.792	18.405	0.059	-0.046	-0.038	-14.131	-11.793
5211	-59.001	-13.626	60.554	2.117	-2.062	-0.476	-59.003	-13.626
13	-88.015	48.377	100.434	9.657	-8.463	4.652	-88.023	48.382
5234	-10.420	37.489	38.910	0.562	-0.150	0.541	-10.420	37.489
1172	-87.371	104.971	136.574	24.284	-15.535	18.665	-87.386	104.990

RESULTS AND DISCUSSIONS

The photo-coordinate system serves as the reference for expressing spatial positions and relations of the image space. It is a 3-D cartesian system with the origin at the perspective center. depicts a diapositive with fiducial marks that define the fiducial center FC. During the calibration procedure, the offset between fiducial centre and principal point of autocollimation, PP, is determined, as well as the origin of the radial distortion, PS. The x, y coordinate plane is parallel to the photograph and the positive x−axis points toward the flight direction. Positions in the image space are expressed by point vectors. For example, point vector p defines the position of point P on the diapositive. Point vectors of positions on the diapositive (or negative) are also called image vectors.

CONCLUSIONS

A mono or stereo comparator is used to measure the image coordinates which form the basic input into the next adjustment. Precision of stereocomparators and mono comparators (e.g., Zeiss, Kern etc.) provide an accuracy at the level of 1-2 μm. Analytical stereoplotters in comparator mode can also be used to measure the image coordinates providing 3-5μm accuracy. It is recommended to observe each point at least twice and to observe the fiducial marks. For example, for analytical aerotriangulation, it is also necessary to transfer points from one image to another when using a mono comparator. However, if the points are targeted on the ground, point transferring is not required.

In order to compensate for systematic errors such as lens distortion, atmospheric refraction and the digital camera scale bias and improve the collinearity equation model, distortion or additional parameters, $(\Delta x_p, \Delta y_p)$, are introduced into the basic collinearity equations as (Ebadi, 2006):

$$x_i - x_o + \Delta x_p = -c \frac{m_{11}(X_i - X_O) + m_{12}(Y_i - Y_O) + m_{13}(Z_i - Z_O)}{m_{31}(X_i - X_O) + m_{32}(Y_i - Y_O) + m_{33}(Z_i - Z_O)}$$

$$y_i - y_o + \Delta y_p = -c\,k_y \frac{m_{21}(X_i - X_O) + m_{22}(Y_i - Y_O) + m_{23}(Z_i - Z_O)}{m_{31}(X_i - X_O) + m_{32}(Y_i - Y_O) + m_{33}(Z_i - Z_O)}$$

where $(\Delta x_p, \Delta y_p)$, are functions of several unknown parameters and are estimated simultaneously with the other unknowns in the equations. A complete recovery of all parameters (exterior orientation, object space coordinates, interior orientation, and additional parameters) is possible under certain conditions without the need for additional ground control points. This approach is called a "self calibrating bundle block adjustment" and it is very used in many applications of analytical photogrammetry.

ACKNOWLEDGEMENTS

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3D MODELING OF BUILDINGS USING DRONES

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Abstract

The Unmanned Aerial Vehicle (UAV) technology has gained great attention in recent years. It is viewed as a low-cost alternative for local large scale aerial mapping and other applications requiring the modeling of a relative small area only. In this paper we present the eBeeX UAV from SenseFly used in acquisition of aerial images and the Pix4DMapper software for data processing for generating a 3D model of a hotel from Spain. The data used in this project are available on https://www.sensefly.com/education/datasets/.
Data management in cases where the number of images is high is also very important. The use of UAVs is also advantageous because it may be used for tasks requiring quick response, including in the case of the inspection and monitoring of buildings.
It is demonstrated that the UAV system for low altitude aerial photogrammetry can be used in the construction of 3D building production, and the technology solution in this paper offers a new, fast and technical plan for the 3D expression of the city landscape, fine modeling and visualization.

Keywords:3D reconstruction, eBee SenseFly, photogrammetry, Pix4D software, UAV

INTRODUCTION

Virtual globe visualization software such as Google Earth is becoming increasingly popular, both on desktop and mobile platforms. It enables many applications in the fields of navigation, tourism, but also city and land planning. In addition of displaying detailed 2D vectorial and raster maps on top of digital elevation models, modern virtual globes have the ability to render 3D building models (Kung et al., 2018).

Aerial photography has a long history of applications in cartography. It has a very large range of applications and can be used to minimize work on the ground. Photogrammetry in turn is a standard tool often used for large scale mapping applications. This technique enables the user to obtain 3D data of the zone of interest, and eventually may also be used to produce orthophotos. Photogrammetry has also seen an increase in the use of UAVs (Unmanned Aerial Vehicles) for smaller scale cartography. Their use is also advantageous because it may be used for tasks requiring quick response, including in the case of the inspection and monitoring of buildings (Murtiyoso et al., 2017).

Three-dimensional simulation and virtual reality are two forms of "digital city" and in the building forms both of them are required establishing 3D model. Building modeling method is mainly divided in two ways, which are high precision and fast modeling for building group and fine modeling for one building to update the building area. Nowadays, the advanced technology of remote sensing and photographic measurement technology is an important means of 3D building modeling (XieFeifei et al., 2012).

Because of the limitation of flying high, photography posture and timeliness, fixed orbit satellite remote sensing and mannedaerial photography in middle and high altitude can only get the information of the height and top textures of some buildings, which are hard to meet the requirement of 3D data rapid access and update for city building (Wu , 2003; Li Chengming, 2008, Popescu et al., 2017).

MATERIALS AND METHODS

The area near Playa Bonita was once used by the U.S. Army as a military base, but in recent years has undergone a surge of development. The beach itself is somewhat rocky but borders a calm section of the Pacific Ocean. This dataset was collected in a single flight by an eBee X (Figure 1) carrying a senseFly S.O.D.A. 3D camera (Figure 2).

Figure 1. eBee X UAV by SenseFly

The eBee X is a fixed-wing drone designed to boost the quality, efficiency and safety of data collection, it has a camera to suit every job, the accuracy and coverage to meet every project's requirements, and can work virtually every type of site.

The eBee X can meet the exacting requirements of every project. Its unique Endurance Extension unlocks a maximum flight time of 90 min—for vast coverage of up to 500 ha (1,235 ac) at 400 ft*—while its High- Precision on Demand helps you achieve absolute accuracy of down to 3 cm (1.2 in), without GCPs.

The eBee X suits every job thanks to its range of groundbreaking cameras. These include the new senseFly S.O.D.A. 3D, for stunning 3D reconstructions of vertical environments, the best-in-class senseFly Aeria X RGB photogrammetry camera and the senseFly Duet T for creating geo-accurate thermal maps.

The senseFly S.O.D.A. 3D mapping camera is a unique innovation - a professional drone photogrammetry camera that changes orientation during flight to capture three images (2 oblique, 1 nadir) every time, instead of just one, for a much wider field of view. It is optimised for quick, robust image processing with Pix4Dmapper.

Figure 2. 3D mapping camera by SenseFly

Specifications of the camera: Sensor: 1″, RGB lens: F/2.8-11, 10.6 mm (35 mm equivalent: 29 mm), RGB resolution: 5,472 x 3,648 px (3:2), Exposure compensation
±2.0 (1/3 increments), RGB shutter: Global Shutter 1/30 − 1/2000s, White balance: Auto, sunny, cloudy, shady, ISO range: 125-6400, RGB FOV: Total FOV: 154°, 64° optical, 90° mechanical.

RESULTS AND DISCUSSIONS

As Technical data of resulting fight: the ground resolution was 4.5 cm (1.77 in)/px, the coverage was 1.19 sq. km (0.38 sq. mi), the flight height was about 170 m (557.7 ft) and the obtained number of images was 550 (Figure 3).
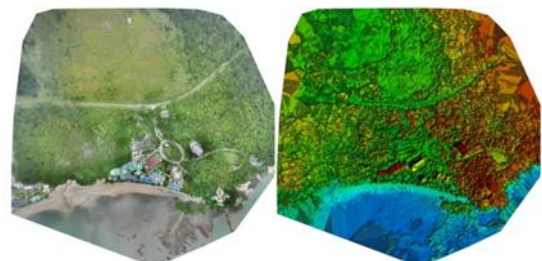

Figure3. Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.
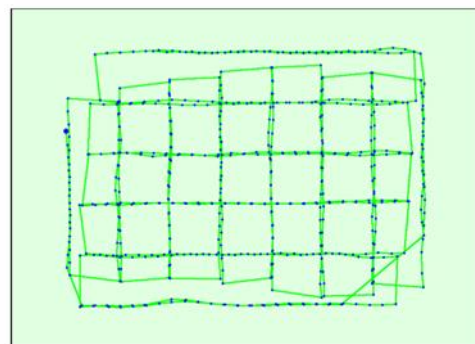

Figure 4. Top view of the initial image position.

The green line follows the position of the images in time starting from the large blue dot. Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Red dots indicate disabled or uncalibrated images. Dark green ellipses indicate the absolute position uncertainty of the bundle block adjustment result (Figure 4).
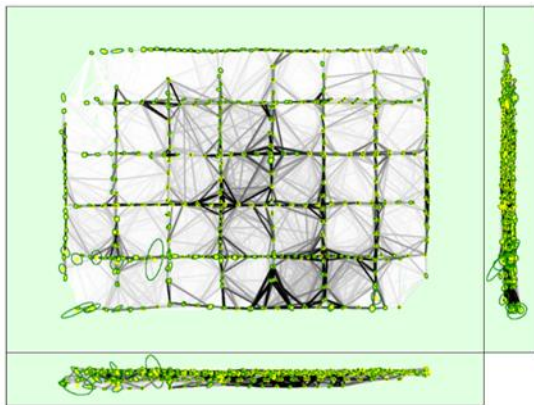
Figure 5 The network of vectors

Computed image positions with links between matched images.

The darkness of the links indicates the number of matched 2D key points between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty of the bundle block adjustment result (Figure 5).

Figure 6. 3D view of vectors grid model

In figure 6 we can see the grid model of vectors which joins the center of every pixel.
In the next picture (Figure 7) it can be seen the vertex of every center of the images.
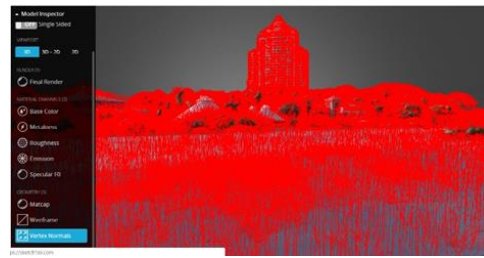

Figure 7. 3D view of vertex

Picture number 8 shows the 2D and 3D shows the place of every image and each pixel that was used in composing the 3D model of the area.
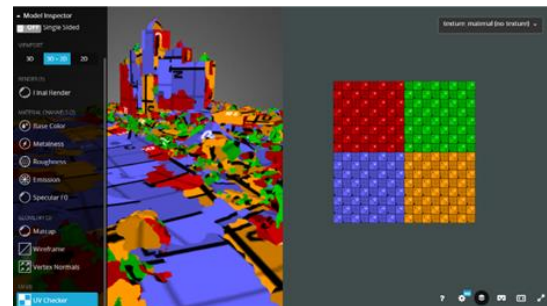

Figure 8. 2D and 3D view of pixel position

As a final result it can be seen in figures 9 and 10 in sketch fab*. It is a platform where you can upload 3D models to publish and share.
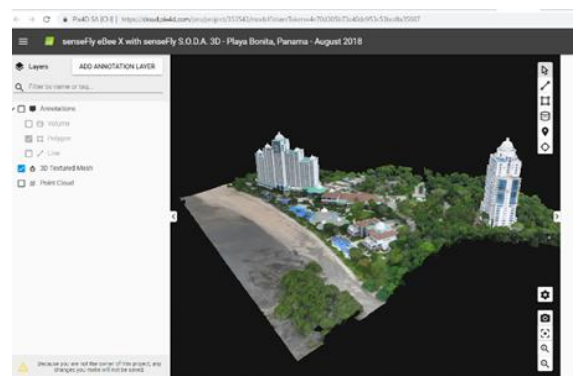

Figure 9. 3D view of the area Playa Bonita

This view it is available on Pix4DCloud

Figure 10. Final 3D view of the area Playa Bonita

CONCLUSIONS

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 (Erghelegiu et al., 2018).

The UAV is nevertheless a suitable solution for the surveying and recording of historical buildings because it is able to take images from points of view which are normally inaccessible to classical terrestrial techniques (Murtiyoso et al., 2017).

The Pix4D offers a 15-day free trial, after which a monthly subscription can be made. The image processing is made in a cloud, after which the orthomosaic can be downloaded as a .tiff image or other format.

The composition of the orthophotomap can be made in many softwares, but the fastest is Pix4D's cloud-based processing online, making it very accessible because it is not necessary to have a computer with high-performance features such as a plaque video dedicated to very expensive.

ACKNOWLEDGEMENTS

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THE PRECISION OF ORTHOPHOTO MAPS MADE AFTER THE DRONE FLIGHT

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Abstract

The present paper consists in carrying out a study on precision in cadastral works by means of the comparison between orthophoto map and terrestrial measurements for a district in a locality in Brasov county.
For this study, terrestrial measurements were made using GNSS technology and photogrammetric measurements using Dji Phantom 4 with the help of which a series of images were taken and processed with special software resulting orthophoto of the studied area. Finally a statistical analysis was carried out, calculating a series of statistical indicators whose results provide information on the accuarcy between the measured elements and those resulting from the vectorization of the orthophoto map.

Keywords: *Dji Phantom 4, GNSS, orthophoto.*

INTRODUCTION

The purpose of this essay is to verify the accuracy of the orthophoto map resulted from the drone's flight, as compared to the terrestrial measurements made in a locality in Braşov County.
In order to achieve this goal , the following objectives were considered:
-Identification of land and the mapping base;
-Measurements made by terrestrial methods;
-Flying the drone and drawing the orthophoto map;
-Comparison between the orthophoto map and the terrestrial methods;
-Presentation of the results from the comparative analysis;

Figure 1. Image with the area studied

The studied area: a neighbourhood from Bunloc which belongs to Săcele, Braşov county. The surface resulting from measurements is 43718.539 sqm , in which a number of 8105 points was included.

MATERIALS AND METHODS

For this essay the following research methods were used :
a. RTK (Real Time Kinematic) Real time positioning with GNSS equipment for the GPS measurements, this being a modern alternative of the cinematic method, ensuring high accuracy, in short time and high economic efficiency;
b. Photogrammetic methods from which the cloud point and the orthophoto map have resulted , using the Dji Phantom 4 type drone with which data was taken over an area of approximately 5 hectares;
c. Mathematical statistics methods that compared the results obtained by the 2 methods mentioned above;

RESULTS AND DISCUSSION

As for the terrestrial measurements, 8105 points were positioned using the GPS Stonex S9 III. In fact, several steps were required to position these points. Firstly, with the help of satellites, the signals were collected by the permanent GPS station. In the second stage the calculation of the deducted corrections from the station coordinates and those transmitted by the ephemerides took place, resulting in spatial coordinates (x, y, z) by applying the corrections resulting from the initial measurements.

In order to achieve photogrammetric measurements, a number of 15 targets homogeneously on the whole surface of the studied field were materialized on the ground by photogrammetric surveys. After the ground targets were materialized, their coordinates were determined using GNSS technology. The Dji Phantom 4 drone was planned and set beforehand . The flight was made at an altitude of 80 m in conditions of maximum visibility, the drone was raised from target number 2. Seeing the entire land with the drone, what we are interested in is that from this action resulted a total of 381 photographs that have been processed with the 3D Survey software in order to obtain the orthophoto map of the studied area.

Figure 3. Dji Phantom 4

For the preparation of orthophoto map the following steps were taken:
-Creating a new project and import the photos;
-Calculation of orientation parameters of the camera;
-Achieve image orientation using Ground Control Points;
-Reconstruction of the cloud of points;
-Classification of points in the field;
-Calculation of digital terrain model(DSM);
Finally, following the steps mentioned above the orthophoto map resulted and was exported from 3D Survey and imported into AutoCAD Land 2009 and vectorised points. Thus, differences were made on x,y and directly for 465 points,410 segments and 77 surfaces.

Figure 2. GPS Stonex S9

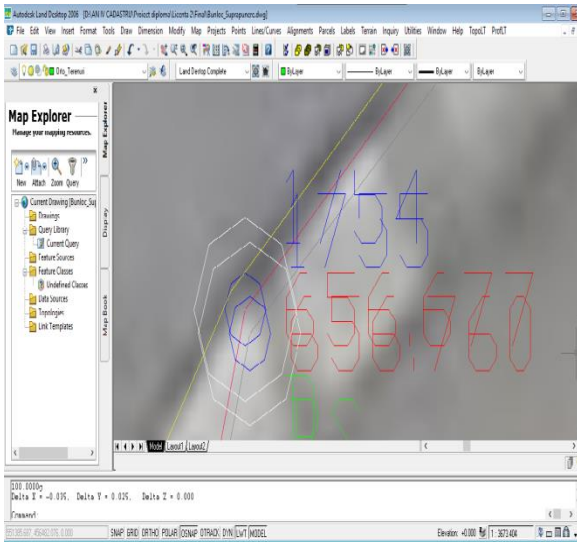
Figure 4. Orthophoto of the studied area

Figure 5. Calculation of the differences per x, per y and directly between the measured and vectorised point 1754

On based difference resulted between points, segments and surfaces of the measuring and orthophoto map were calculated a series of statistical indicators whose results can be seen in the tables below.

Table 1.The calculate statistical indicators for differences on the points

Differences	Mean (m)	Median (m)	Minim (m)	Maxim (m)
Δx	0.004	0.004	-0.160	0.123
Δy	-0.0003	0.001	-0.127	0.117
Δ direct	0.047	0.040	0.010	0.200

Table 2. The calculate statistical indicators for differences on the segments

Difference	Mean (m)	Median (m)	Minim (m)	Maxim (m)
Δx	0.014	0.001	-0.255	1.467
Δy	-0.019	-0.001	-1.906	0.457
Δ direct	-0.007	-0.010	-2.200	0.190

Table 3. The calculate statistical indicators for differences on the surfaces

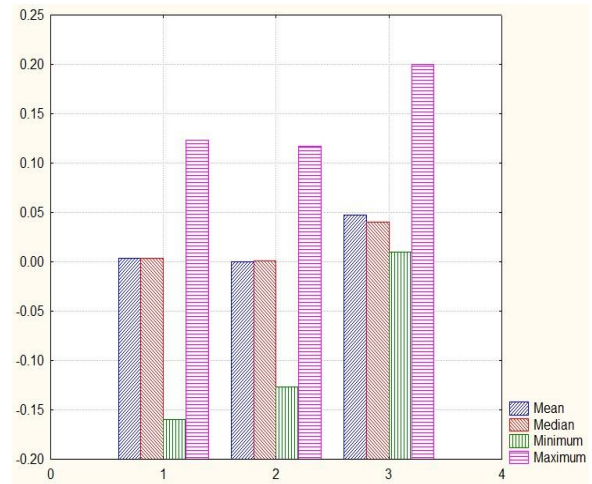| Difference	Mean (m)	Median (m)	Minim (m)	Maxim (m)
Difference on surfaces	0.011	-0.220	-6.663	4.601

Figure 6. Distribution of arithmetic mean, median, minimum and maximum based on the points
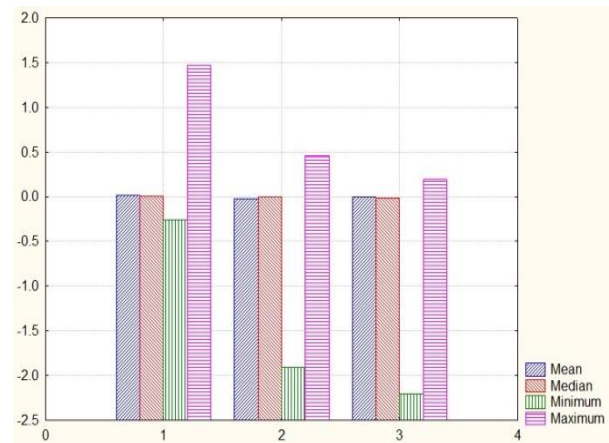

Figure 7. Distribution of arithmetic mean, median, minimum and maximum based on the segments
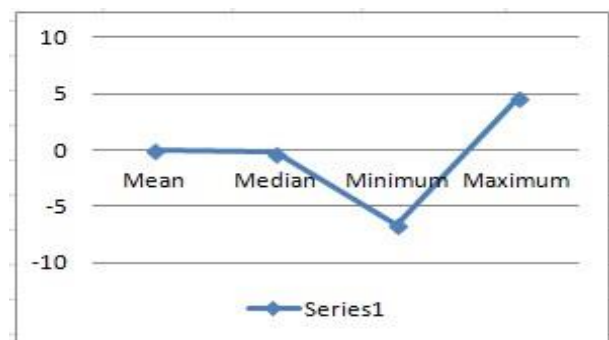

Figure 8. Distribution of arithmetic mean, median, minimum, maximum based on the surfaces

By interpreting the values in the figures presented above, it can be noticed that the positioning accuracy of the points is relatively good. Each of the above statistical indicators provides some information regarding the positioning accuracy of the points. For example, if we take into account the arithmetic mean value the best accuracy (-0.0003) occurs in the case of y differences and the worst accuracy (-0.047) occurs in the case of the resulting direct differences. In the case of segment differences in terms of median value, the best accuracy (-0.010) occurs at the measured difference directly and the worst accuracy (0,001) occurs in the case of x differences.

CONCLUSIONS

In conclusion, within this essay was presented the applicability of UAV (Unmanned Aerial Vehicle) technology in cadastral work making a comparative analysis between orthophoto map and terrestrial measurements. It can be noticed that the differences between the two measuring technologies: Dji Phantom 4 drone and the Stonex S9 III GPS are small registering on average a difference of:0.04 m per x , -0.0003 per y and 0.04 m on the direct distance within the points difference. For segments an average of 0.014 m per x , -0.019 per y and -0.007 on the direct distance was obtained.

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UPGRADE FROM ARCGIS 10.3 TO ARCGIS PRO

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Abstract

The paper aimed to present the evolution of ArcGIS from ArcGIS 10.3 to ArcGISPro. Similar to ArcMap, ArcCatalog, ArcScene and ArcGlobe, ArcGIS Pro is an application that belongs to ArcGIS for Desktop and is included in with the ArcGIS 10.3 for Desktop product. ArcGIS Pro by Esri improves the GIS experience by assisting ArcGIS for Desktop to perform faster and is used to create and analyze data in 2D and 3D. The brand new 64-bit desktop application is an essential upgrade for the ArcMap in developing and analyzing spatial data.
Projects: ArcGIS Pro transforms all entries into projects, maintaining organized and standardized work. This project feature is comprised of a vast number of project templates catering for a wide variety of needs. Data visualization: ArcGIS Pro contains a rich library of maps and layer types. With its new 64-bit support system, multiples maps and layers can be viewed simultaneously. Even better, these maps and layers can be viewed in 2D and 3D.

Keywords: ArcGIS, Geoprocesing, GIS, Spatial data.

INTRODUCTION

A geographic information system (GIS) is a framework for gathering, managing, and analyzing data. Rooted in the science of geography, GIS integrates many types of data. It analyzes spatial location and organizes layers of information into visualizations using maps and 3D scenes. With this unique capability, GIS reveals deeper insights into data, such as patterns, relationships, and situations—helping users make smarter decisions.

Prior to the ArcGIS suite, Esri had focused its software development on the command lineArc/INFOworkstation program and several Graphical User Interface-based products such as the ArcView GIS 3.x desktop program. Other Esri products included MapObjects, a programming library for developers, and ArcSDE as a relational database management system. The various products had branched out into multiple source trees and did not integrate well with one another. In January 1997, Esri decided to revamp its GIS software platform, creating a single integrated software architecture.

ArcGIS Pro is a free application however; it is only accessible for clients that have the ArcGIS for Desktop license and are current on maintenance. The three main stages of starting up are the installation, authorization and updates:

Download and install ArcGIS Pro: Download ArcGIS Pro and any other necessary application, for example the Offline Help. Install the ArcGIS Pro application first and then work through the other downloads.

Authorization of ArcGIS Pro: Launching the ArcGIS application for the first time will prompt the Sign In box to appear. Key in the credentials obtained the organization in charge via ArcGIS online or the ArcGIS Portal.

Updating ArcGIS Pro: ArcGIS Pro is enabled with auto-updates depending on the regularity of the new patches.

MATERIALS AND METHODS

ArcGIS Pro is a ribbon-based application. Many commands are available from the ribbon at the top of the ArcGIS Pro window; more advanced or specialized functionality is found on panes that can be opened as needed. ArcGIS Pro allows you to store multiple items, such as maps, layouts, tables, and charts, in a single project and work with them as needed. The application also responds contextually to your

work. Tabs on the ribbon change depending on the type of item you're working with.

The interface of ArcGIS 10.3 as presented in Figure 1 and the new interface of ArcGIS PRO presented in Figure 2.
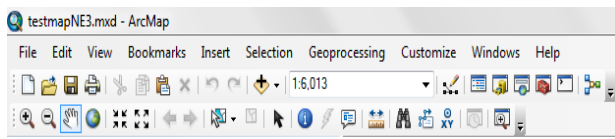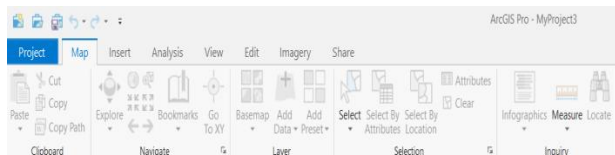

Figure 1. ArcGIS 10.3

Figure 2. ArcGIS PRO

Now we will present you the new improvements of the new ArcGIS version.

ArcGIS Prohelps you organize and manage the resources related to a work project. To do this, it uses a project file (.aprx) as its basic file type. An ArcGIS Pro project may contain maps, scenes, layouts, data, tools, and other items. It may contain connections to folders, databases, and servers. Content can be added from online portals such as your ArcGIS organization or the ArcGIS Living Atlas of the World (Figure 3).
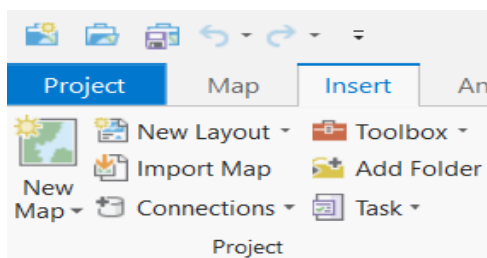

Figure 3. Insert Tab

Here we are going to present how Georeferencing works in the newest version of ArcGIS (Figure 4).
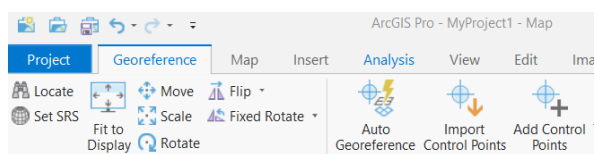

Figure 4. Georeference tab

Auto Georeference automatically compute control points between the source layer and other visible reference raster layers in the map.

The generated control points are based on spectral signatures so it is meant for aerial and satellite imagery, where the source and the reference targets are similar in nature terms of geographic location, time, season, image orientation, image scale and band combination. Import Control Points you can import control points from a file (Figure 5).
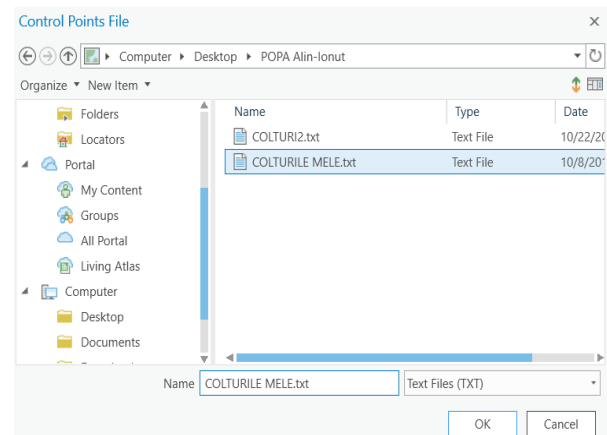

Figure 5. Import Control Points

Add Control Points to align the source layer to the reference layers. First click at a location on the source layer you are georeferencing, then click at the corresponding location on the reference layer (Figure 6).
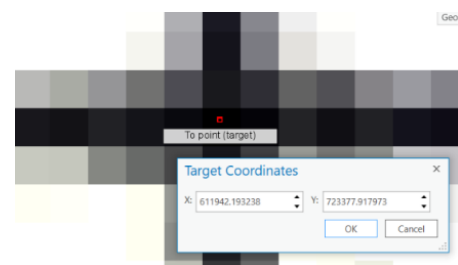

Figure 6. Add Control Points

Control Point Table

The Control Point Table and the Review group are used to check the quality of the control points. The Control Point Table provides information regarding the control point pairs that have been created. Each row represents a control point pair and lists the starting coordinates, adjusted coordinates, and residual error. The sum of the errors is presented in the root mean square (RMS) error.

With this update there is a new way to create a Feature Class.

Feature classes are homogeneous collections of common features, each having the same spatial

representation (such as points, lines, or polygons) and a common set of attributes (for example, a line feature class for representing road center lines). The four most commonly used feature classes are points, lines, polygons, and an notation (Figures 7 and 8).
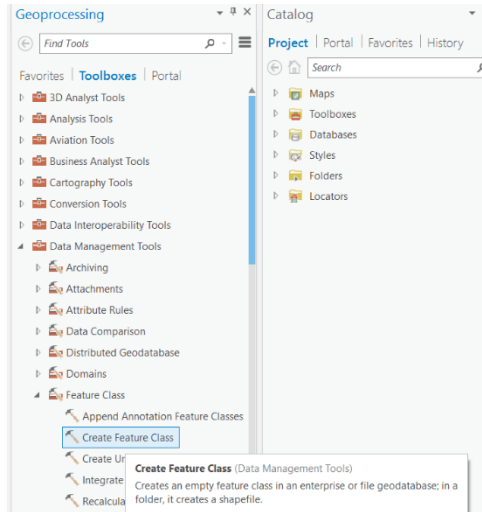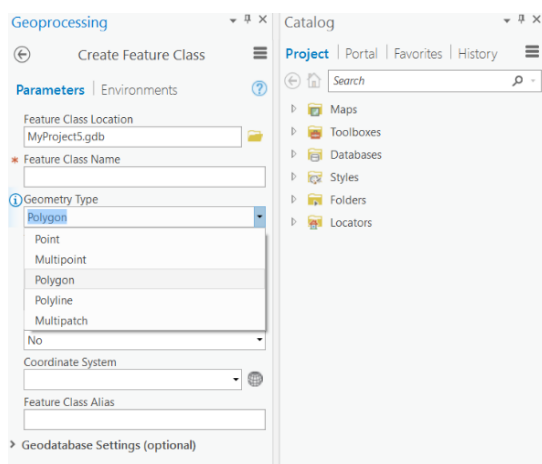

Figure 7. Create feature class (1)

Figure 8. Create feature class (2)

RESULTS AND DISCUSSIONS

ArcGIS Pro is a truly 64-bit desktop application that takes advantage of your modern hardware for maximum performance and smooth map and 3D scene displays. It has a vibrant, contextual interface that serves you with the right tools at the right time, and anyone who has spent time looking for tools knows, this is fantastic. You can now do exciting new things like design and edit in 2D and 3D in one place, work with multiple displays and layout designs, and publish finished web maps directly to ArcGIS Online or Portal for ArcGIS. ArcGIS Pro can

work side-by-side with ArcMap so there is no need to pick one over the other. The fundamental principle is you do the heavy work with the power of desktop software yet you can easily connect to people within your organization or throughout the world. This way, your work, co-workers, stakeholders, clients and the public are all at your fingertips. Lastly, because ArcGIS Pro is a central and integrated part of the ArcGIS platform, you get the scalability you need to be individually successful and drive success for your organization.

Sharing your work is an important part of ArcGIS Pro. You can share everything from entire projects to maps, layers, and other components of your work. You can share maps from your project as web maps. Web maps can be reused within ArcGIS Pro as well as across the ArcGIS platform, and they can be viewed in browsers and on mobile devices (Figure 9).
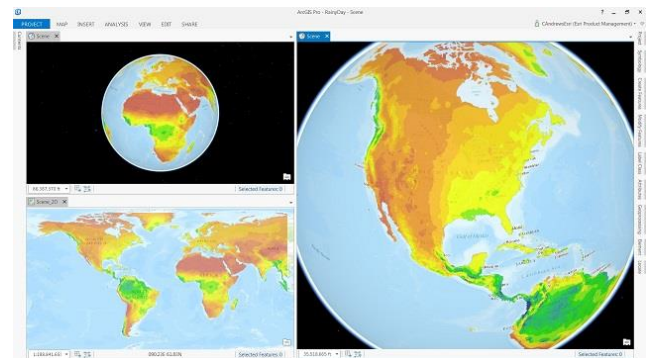
Figure 9. Sharing work

ACKNOWLEDGEMENTS

CONCLUSIONS

This paper presented the changes brought by the new version of ArcGIS.
With the release of the ArcGIS PRO version, we have a new and interactive interface that can help us access the tools needed for data processing faster.

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USING GNSS TECHNOLOGY IN CADASTRAL DELIMITATION ACTIVITY AND MAKING THE TOPOGRAPHIC SUPPORT NECESSARY FOR THE ELABORATION P.U.Z.

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Abstract

The paper aimed to present the realization of an urbanistic plane in area Rădoaiei rivulet from Şinca Nouă and a cadastral delimitation between the Territorial-Administrative Units of Şinca Nouă and Codlea from Braşov county using GNSS technology. The data processing has been achieved with specific methods thus resulting the topographical plan on the area discussed above. Using the measurements a comparative study of the boundary's coordinates has been achieved, utilizing specific softs. Thus, a differences between using satellite registrations in simple frequency (carrier wave L1), and in double frequency (combination of carried waves L1 and L2) resulted.

Keywords: cadastral delimitation, GNSS technology, satellite, topographical plan.

INTRODUCTION

The present paper aims to provide topo-geodesic measurements and drafting the topographic support in order to make the Regional Urban Planning (P.U.Z.) for the area near the Rădoaei rivulet from Şinca Nouă Place, Braşov County. Also, in this project are presented aspects related to the use of GNSS technology for the determination of border points coordinates and those at the limit within the build-up area belonging to Territorial-Administrative Unit of Codlea, from Braşov County. This activity took place within the operation of cadastral delimitation in the County mentioned above, which is neighbored in the west side with the Territorial-Administrative Unit of Şinca Nouă, where is located the land object to topographic measurements for this project. Based on the data gathered for this operation, a comparative study was made for the coordinates of border points determined using satellite registrations in simple frequency (carrier wave L1), and in double frequency (combination of carried waves L1 and L2).

The study area covers Codlea Municipality, located in the North-West of Ţării Bârsei, at the foot of Măgura Codlea (1291,5 m), at 15 km from Braşov Municipality and neighbored with the following Territorial-Administrative Units: to the East with Hălchiu and Ghimbav, to the South with Râşnov and Vulcan, to the West with Holbav and with Şinca Nouă, and to the North with Dumbrăviţa, and with Şinca Nouă Place which is located at the foot of Făgăraş Mountains, on Şinca valley, at the altitude of 537m, at a distance of 50 de km from Braşov Municipality.

Figure 1. Territorial administrative units: Şinca Nouă, Codlea

METHODS AND EQUIPMENT

For the elaboration of direct measurements it was used a high-tech device manufactured by Leica Geosystems such as: the total station Leica TC405 and GNSS equipment Leica GPS12 model.The measurement method using the total station was the traversing method combined with the cancellation method (polar coordinates) and with GNSS technology, static measurement method.

The applications of modern GNSS technology in this project were the following:

- the positioning of thickening network, which contributed to the land survey, in order to obtain the topographic support for the elaboration of Regional Urban Planning for the area near the Rădoaei rivulet from Şinca Nouă Place;

- the determination of coordinates of border points and those on the limit within the build-up area of Codlea Municipality.

The data processing was made by compensating the measurements covering the following methods:

- classical method,
- rotation method and scale application,
- using TopoSys program.

Also, it was used the Mathematical Statically Method for the comparative study of coordinates of border points by using satellite registrations in simple and double frequency.

RESULTS AND DISCUSSIONS

In order to achieve the final objective, there were followed the stages specific to topography, making specific measurements and using complex methods which allow us to obtain complete and accurate results. Firstly the cartographic base was identified starting from cadastral map nomenclature at 1:50.000 scale for Şinca Nouă Place, the orthophotos 517-467 and 517-469 which are overlapping to the land in subject and the nomenclatures of topographic plans for the interest area, namely L-35-75-C-d-2-II and L-35-75-C-d-2-IV,all of them at 1:5000 scale .

The measurements provided on field contributed to the elaboration of topographic plan, more precisely, the execution of an upward network made of 3 combined traverses, including 11 new station points. In order to determine the planimetric coordinates of station points, it was used the planimetric traversing method supported at edges by known coordinate points and sides with known orientations, and for the determination of quotas of these points, it was used the traversing method of trigonometric leveling at edges on points with known quotas, provided simultaneously with the planimetric traversing.
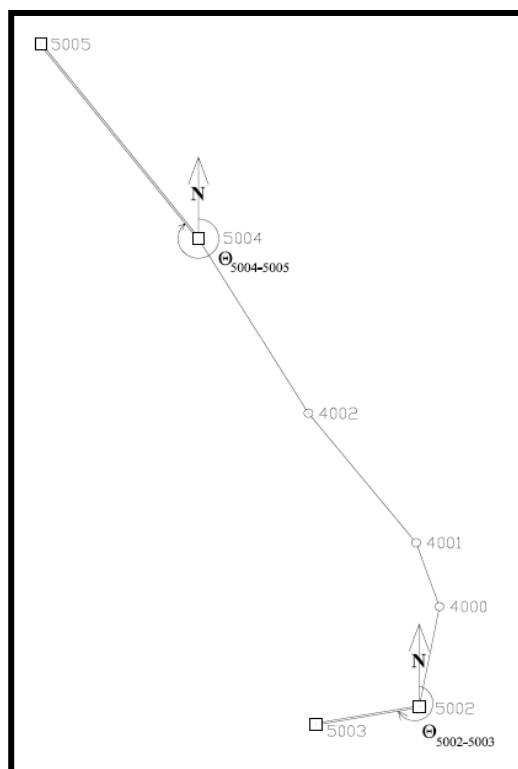

Figure 2. The roadblock I

The operation was made with the local station Leica TC405, whereby it was provided the land survey of details using the method of polar coordinates. The purpose was to cancel as much as possible the details for the elaboration of a topo plan, able to display as much as accurate as the situation in field.
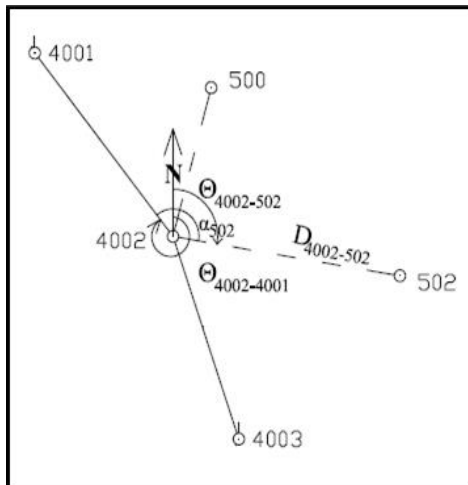

Figure 3. The land survey of details

Data processing and the calculation of coordinates of new traversing points weres made using three methods: classical method, rotation method and scale application method, and by using TopoSys program (related to accuracy).

The points which contributed to the enclosure into the geodesic thickening network have been determined with GNSS technology, using the static measurement method. The operation is based on GNSS stations from the national geodesic network located in Sfântu Gheorghe and in Făgăraş.

The operation for cadastral delimitation of the Territorial-Administrative Unit of Codlea from the Territorial-Administrative Unit of Şinca Nouă was provided by using GNSS technology which insured a high accuracy and an increased efficiency of determinations, and they implied the cover of land in October – November, establishing the border points and the points on the limit within the build-up area, their marking with bollards and the determination of coordinates. So, 82 bollards have been placed on the limit within the build-up area and 102 bollards on the border of the Territorial-Administrative Unit of Codlea.

Figure 4. Bollards located on the ground

As we can notice from the previous chart, the differences between the coordinates of border points determined with the processing of satellite registrations in the two variants (setting LEICA Geo Office software for Frequency parameter value L1, and L1+L2) are very small.

The final objective of these works is the elaboration of a topographic plan. This piece was made with AutoCAD – Autodesk Land Desktop 2005 program, being present in both digital and analogical format at 1:1000 scale.

The comparative study of the coordinates of determined border points have been obtained using satellite registrations in simple frequency (carrier wave L1), and in double frequency (the combination of carrier waves L1 and L2). The post-processing of data gathered with GNSS sensors in the two variants was made with LEICA Geo Office program. For the first processing variant was chosen the frequency L1, and for the second variant was chosen the combination of frequencies L1+L2. It is important to mention that the rest of parameters have been set identically for both variants of processing. Following this action two sets of coordinates have been obtained for each border point, whereby were distinguished the differences between the two satellite registrations.

In the following table is presented an excerpt of the coordinates obtained by using satellite registrations in simple and double frequency, but also the differences between them, for a number of 20 border points.

Table 1. Extract coordinates obtained using single and double frequency satellite recordings

Point Nr.	L1			L1+L2			Differences		
	X [m]	Y [m]	H [m]	X [m]	Y [m]	H [m]	ΔX [m]	ΔY [m]	ΔH [m]
B1	464949.608	536445.641	555.836	464949.609	536445.639	555.834	-0.001	0.002	0.002
B2	465312.762	536649.946	551.889	465312.761	536649.947	551.899	0.001	-0.001	-0.010
B3	465819.784	536636.683	548.931	465819.782	536636.682	548.915	0.002	0.001	0.016
B4	466069.684	536199.734	549.331	466069.683	536199.732	549.305	0.001	0.002	0.026
B5	466219.717	536140.378	548.183	466219.718	536140.378	548.214	-0.001	0.000	-0.031
B6	466374.508	535963.232	547.203	466374.507	535963.232	547.206	0.001	0.000	-0.003
B7	466560.594	536182.444	546.278	466560.592	536182.442	546.275	0.002	0.002	0.003
B8	467111.316	536455.741	542.946	467111.318	536455.740	542.961	-0.002	0.001	-0.015
B9	464409.600	535384.237	560.401	464409.601	535384.237	560.409	-0.001	0.000	-0.008
B10	464077.158	535984.329	560.952	464077.159	535984.330	560.974	-0.001	-0.001	-0.022
B11	464907.741	536437.055	555.584	464907.744	536437.055	555.600	-0.003	0.000	-0.016
B12	467243.100	536243.347	542.538	467243.102	536243.347	542.547	-0.002	0.000	-0.009
B13	465648.584	533959.690	574.423	465648.585	533959.691	574.425	-0.001	-0.001	-0.002
B14	465368.357	533794.172	571.431	465368.356	533794.173	571.431	0.001	-0.001	0.000
B15	465125.607	534284.728	558.238	465125.607	534284.728	558.244	0.000	0.000	-0.006
B16	464581.542	534083.077	562.896	464581.543	534083.077	562.897	-0.001	0.000	-0.001
B17	464426.818	534459.430	562.151	464426.817	534459.433	562.152	0.001	-0.003	-0.001
B18	463655.500	534376.392	565.894	463655.504	534376.385	565.910	-0.004	0.007	-0.016
B19	462974.824	534204.285	570.318	462974.824	534204.285	570.320	0.000	0.000	-0.002
B20	462919.372	534572.331	571.124	462919.373	534572.332	571.123	-0.001	-0.001	0.001

The graph below shows the distribution of the differences obtained on the X, Y and H coordinates on the size classes.
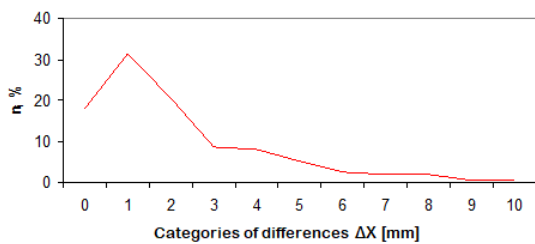

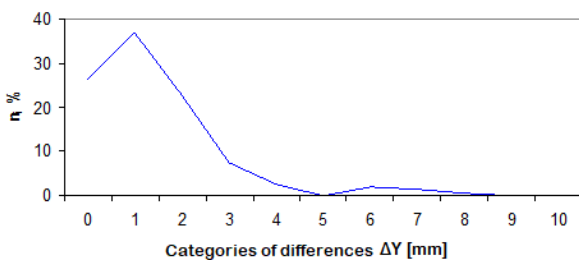Figure 5. Percentage distribution of differences ΔX

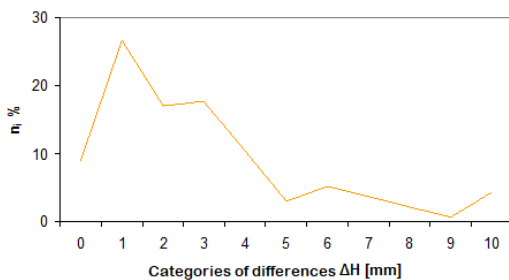Figure 6. Percentage distribution of differences ΔY

Figure 7. Percentage distribution of differences ΔH

As can be seen from the previous graphs, the differences between the coordinates of the boundary points determined by the processing of the satellite recordings in the two variants (by setting the L1 and L1 + L2 values in the LEICA Geo Office software for the Frequency parameter) are very small.

The works have as final objective the drafting of the topographic plan. This piece was created with the help of AutoCAD - Autodesk Land Desktop 2005, both in digital and analogue format at 1: 1000 scale.
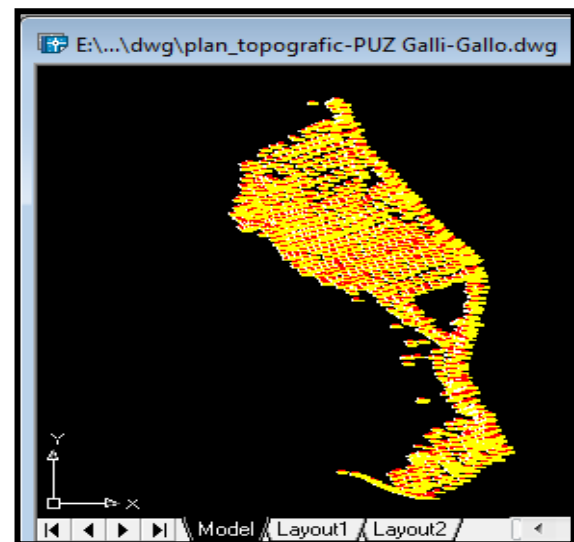

Figure 8. The imported points window

CONCLUSIONS

In conclusion, all the stages covered, both on field and in office, have led to a full achievement of the papers' purpose. On the one side, choosing the appropriate topographic

devices and methods, was made the topographic plan which satisfies the project's requests for the elaboration of Regional Urban Planning of Codlea Municipality. On the other side, the comparative study of the two variants for determining the points coordinates with GNSS technology emphasized the differences of the two types of registration, being recommended the use of sensors in double frequency.

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THE USE OF GPS TRACKING IN 3x3 BASKETBALL TRAINING FOR MONITORING AND IMPROVING ATHLETS PERFORMANCE

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Abstract

The paper aim is to show a novel technique for tracking and monitoring the physical activity of the players in 3x3 basketball sport using a GPS system, due to the fact this particular sport is considered nowadays is one of the most spreaded urban team activity. In order to establish the best way for basketball players to improve their endurance and thus obtain better performance during the game we used for the first time in Romania a Polar monitor chest for measurement heartbeat. The results showed that 3x3 basketball game is significantly more anaerobic than the traditional 5v5 one, and even if the first one is shorter in terms of time the relative intensity is twice higher than of traditional 5v5 basketball.

Keywords: gps, statistics, performance, basketball.

INTRODUCTION

Nowadays, this basketball discipline is considered the number one urban team sport. From the first official event at the 2010 Youth Olympics Games to the Olympic inclusion starting from the Tokyo 2020 Games, FIBA has had an ambitious vision for the game. This was possible because as in 1932, when Romania was part of the eight fonding members of FIBA and now we can say without mistaking that Romania has struggled for 3x3 basketball to become Olympic sport, being the only country that has promoted basketball 3x3, a discipline with a great impact among young people, attracting thousands of athletes annually on the streets.

The research is to develop basketball 3x3 specific preparation recommendations and training plans based on the findings of this study. The objective of this paper was to scientifically prove the physical and physiological characteristics of 3x3 versus the traditional 5v5 basketball as well as to lay a scientific ground for training recommendations. For that purpose the players were subjected to a series of basketball specific performance tests being equipped with heart rate monitors and GPS units in-game during the competition.

MATERIALS AND METHODS

Basketball is an intermittent, court-based team sport comprised of repeated high intensity movements such as change of direction, accelerations and decelerations interspersed with periods of low to moderate intensity activity. Athletes also perform regular maximal efforts during competition including extensive high intensity shuffling, sprinting and jumping (Edwards et al., 2018).

During the practice, players were asked to wear a personal Global Positioning System (GPS) Garmin Vivo sport device, for registering the standard variables of distance (m) and meters covered per minute of game time (m/min). Heart rate was measured continuously during play through personal chest transmitters using a Belt Polar Heart Rate h10 system. The data was analyzed for peaks and average heart rate during the effort (b/min).

We have tested the technology on 8 male athletes and 8 female althletes during the practice and games on a official court. The

official court size is 15 meters in width and 11 in length long with 1.5 meter boundaries.

RESULTS AND DISCUSSIONS

The player movement information is used by teams for training purposes, to get a better understanding of players movements and therefore maximize training results.

The first suggestion that GPS could be used to assess the physical activity of humans followed some 40 years later. There was a rapid uptake of GPS technology, with the literature concentrating on validation studies and the measurement of steady-state movement. The first attempts were made to validate GPS for field sport applications in 2006 (Aughey, 2011).

While GPS has been validated for applications for team sports, some doubts continue to exist on the appropriateness of GPS for measuring short high-velocity movements. There is extensive information on the activity profile of athletes from field sports in the literature stemming from GPS, and this includes total distance covered by players and distance in velocity bands. Global positioning systems have also been applied to detect fatigue in matches, identify periods of most intense play, different activity profiles by position, competition level, and sport. More recent research has integrated GPS data with the physical capacity or fitness test score of athletes, game-specific tasks, or tactical or strategic information.

The future of GPS analysis will involve further miniaturization of devices, longer battery life, and integration of other inertial sensor data to more effectively quantify the effort of athletes.

A recent report of traditional basketball describes average heart rates of ~171 beat/min, which was 91% of the maximal heart rate recorded during play. Additionally, during on-court playing periods, 75% of playing time was at or above 85% of maximal heart rate. The average heart rate response during play for 3x3 is 83% of the average peak heart rate obtained from players during competition or testing (Figure 1, Figure 2).
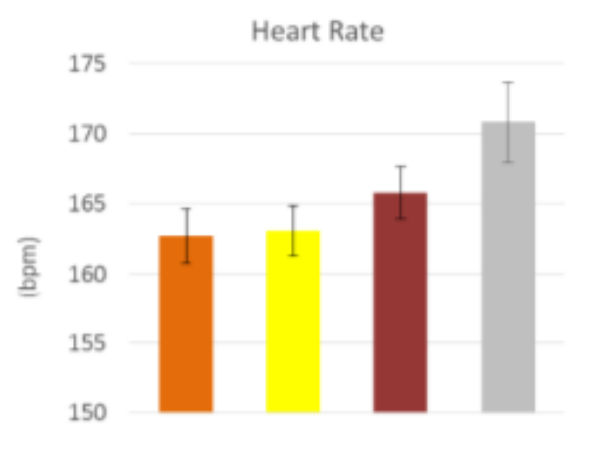
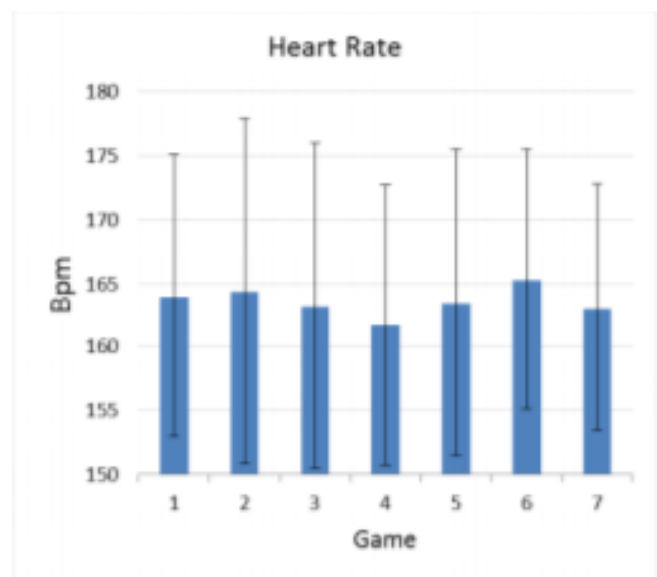

Figure 1. Heart rate during the practice

Figure 2. Heart rate during the game

Therefore, although the absolute heart rate response from 3x3 players is lower than that of traditional basketball, given that there is less distance travelled during play the relative intensity as a proportion of maximal is similar to that of traditional basketball. This is a unique characteristic as it demonstrates that the requirement to meet the game demands of fast changes in direction, in a small competition space is high.

The average heart rate response during male 3x3 was not different at our practices levels, and only marginally higher at professional competitions. Compared to the heart rate responses recorded from literature, heart rate during all levels of 3x3 are significantly lower.

No differences were observed for heart rate response over increased number of games, and this may be due to the wide variation in responses to game demands. This indicates that

as the number of games increases, that heart rate may not provide a clear indication of fatigue.

For female players, the average heart rate responses from the games were significantly higher than those from the practices, and those published from literature. Similar to male responses, there were no differences in heart rate as the number of games increased, and both show wide variation.

Male 3x3 players are generally shorter and heavier and more closely resemble forwards from traditional basketball, while female players are similar to the characteristics of guards at national and international level.

There was a significant difference in the change of direction profile for male players. Males tend to make a greater number of fast changes in direction to the left. The reasons for this are not achievable in this analysis. For female players, the volume of fast changes of direction is lower than males, and it appears the main change of direction is to the right, but not only for practice. This coincides with the other physical and physiological data, in that the female game is less explosive than males.

The acceleration and deceleration profile for females is similar to that of males, displaying that there are a greater number declaration events, particularly in the low and medium range, with no difference for high speed accelerations and decelerations. Surprisingly, the volume of high speed accelerations and decelerations are similar between males and females, which appears to be a unique aspect of 3x3.

Figure 3. An illustration representing athletes

during the game

As 3x3 can be considered as predominantly anaerobic exercise, players compete in a confined court area increasing the relative movement intensity compared to traditional basketball. Increased high intensity accelerations and decelerations from change of direction movements contribute to this difference. This also demonstrates a dissociation between displacement (distance covered) and intensity in the demands to play 3x3 i.e. although there is less total distance covered and the metres covered per minute of game time is low, the actions described drive a high physiological response.

The ability to perform short, repeat efforts comprising multiple changes in direction in a confined court space is complex and multifactorial. The importance of both aerobic and anaerobic energy pathways has been shown in traditional basketball, and likewise in our analysis of 3x3. Additionally, lower body strength and neuromuscular power are key contributors to performance in repeat effort and change of direction activities.

Acceleration and deceleration profiles during male and female 3x3 are gender specific, with females lower in volume and speed, while both genders complete more deceleration activities during a game. The relative intensity of male competition is twice that of traditional basketball (Montgomery, 2016).

CONCLUSIONS

Our work can be extended in many directions. We can include performance features extracted from official games, where the player is exposed to the highest physical and psychological stress or we can investigate the "transferability" of our approach from a club to another.

The majority 3x3 players have differing physical and physiological characteristics compared to players from traditional basketball.

ACKNOWLEDGEMENTS

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