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AN OVERVIEW OF SUSTAINTABLE USES OF PLANT WASTE

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Abstract

There are all kinds of residues, from either plant processing or harvesting and although some of them can be integrated into the soil in order to enrich its nutritious content for further crops, there are a large number of uses for the seemingly unimportant parts left. From fodder to water filtering systems, plant residues have a variety of uses, some more surprising than others, and they contribute to the sustainability of crops and ecosystems to a larger extent than commonly known.

***Key words**: bioeconomy, plants waste, valorization.*

INTRODUCTION

There are several sources of plant waste: crop harvesting, weed management, autumnal leaf drop, pruning, fruit thinning, etc. Although the vast majority of these byproducts are discarded, they can be used sustainably in several ways. The main uses are as fertilizer, compost and biofuel, but there are other, innovative uses such as construction, packaging, basketry, crafting, water filtration systems and art.

MATERIALS AND METHODS

Use of plant waste as fertilizer

It is typical to leave the leaves, pods, roots, stalks and stubble of herbaceous cultures in the field, post harvest. These residues can be incorporated into the soil through tillage. Rye, wheat, corn are great examples of this. As far as green manure is concerned, the weeds that grow between rows can be harrowed and left on the ground to decompose.

Use as animal fodder

Stover, the leaves and stalks of field crops such as corn, sorghum and soybean has been used as fodder since time immemorial. Straw, which makes about half of the yield of cereal crops such as barley, oats, rice, rye and wheat can be used in the mix fed to cattle and other raised animals.

Use of plant waste as compost

Post-harvest residues as well as process residues can be used to produce compost by adding them to other composted materials which include products of fruit thinning, damaged fruit, etc in order to achieve a carbon: nitrogen ratio of 30:1 (Ayesha, 2017). Another use when it comes to compost is mushroom compost preparation as straw can be successfully used for their substrate.

Use in basketry

Straw that is coiled and bound together can be made into baskets through a technique knows as lip work. Other materials that can be used in basketry are: pine needles, various plant stems, tall grasses and fine wooden splints which can the result of harvesting or processing of different plant cultures.

Use in bedding

Crop residue, specifically straw, can be used both for human and animal bedding. For animals it is used as such, while for humans it can be used as a mattress filling, also known as palliasse.

Use as biofuel, biogas and biomass

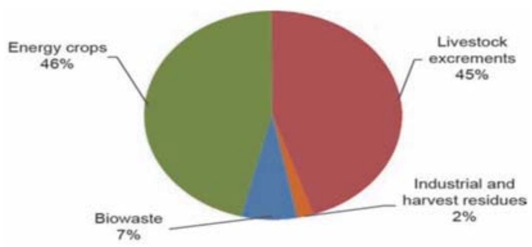

Figure 1. Feedstock of biogas (Achinas, 2017)

Straw can be used for the production of biobutanol and straw briquettes can be used instead of coal. It can also be used to feed a biogas plant. As far as biomass is concerned, crop residues can be used as pellets or as bales of straw.

Use as construction material

Straw has been used for millennia to bind clay and concrete. It is still being used as such in many parts of the world and it is required in the production of cob, which is gaining more and more popularity in the building process of ecofriendly constructions. Straw can also be used as bales in construction, either plastered with earth or not. “It was also found that nearly all plastered bales tested had higher strengths than would be required in typical residential construction” (Vardy, 2006). Wheat straw can be combined with polymers to make composite lumber and they represent a class of materials initally developed to provide an alternative to mineral oil-based plastics (Vaisanen, 2016). Straw can also be used to make enviroboard. Thatching can use straw to create a waterproof roof with good insulation properties.

Use in crafts

Belarusian straw dolls are made using straw, corn dollies require corn husks, straw can be used for marquetry, painting and plaiting as well as scarecrows and to make Japanese traditional cat houses. Hats can be made using straw as well. Another use of straw is in rope making. Koreans wear Jipsin, sandals made of straw. In some parts of the world people wear straw shoes at home or for special events. Targets in archery are made of compacted and bound straw.

Use in horticulture

Straw can be used as protective layer in various cultures such as cucumber, strawberry, etc. Straw can be used as an insulator for sensitive trees and shrubs. Straw and woodchip can be used in mulching, which improves weed control processes, helps retain water in soil and can thus increase yield (Teame, 2017).

Use in packaging

Straw makes a good packing material and it can even be mate into mats that are sealed in plastic sheets. Wheat straw is used in compostable food packaging and will biodegrade in a composting environment.
Recently, biofibers have become more and more attractive because they can be used in food packaging and in the biomedical sciences; these polymers can replace the use of petroleum-based synthetic polymers due to their safety, low production costs, and biodegradability (Mostafa, 2018).

Use in making paper

Rice straw can be used as an alternative raw material to obtain cellulosic pulp. It was done by using classic reagents as soda (with anthraquinone and parabenzoquinone as aditives), potassium hydroxide and the Kraft process; the holocellulose, α-cellulose and lignin contents of rice straw are similar to those of pine and other trees , as well as other plant waste materials such as olive tree prunings, wheat straw and sunflower stalks. (Rodrigues, 2008).

Use in water filtration

Figure 2. Rice husk water filtration system (Viana, 2016)

Activated carbon and rice husk were successfully applied for the removal of Fe(III) and Mn(II) ions from El-Umum drain water, Alexandria coast, Egypt. "Langmuir and Freundlich adsorption isotherms were applied with good results. The rice husk was the best, as controlled from Xm and KF values" (Masoud, 2016).

Use in art

Plant waste was used and blended the contemporary trends of floral art with innovative ideas to raise awareness about suitability and environmental challenges (GCU, 2016). Thus fresh flowers, dry flowers, T-shirt painting and poster painting were all areas where plant waste was used to create beautiful arrangements.

Use in color, flavor and polyphenol extraction

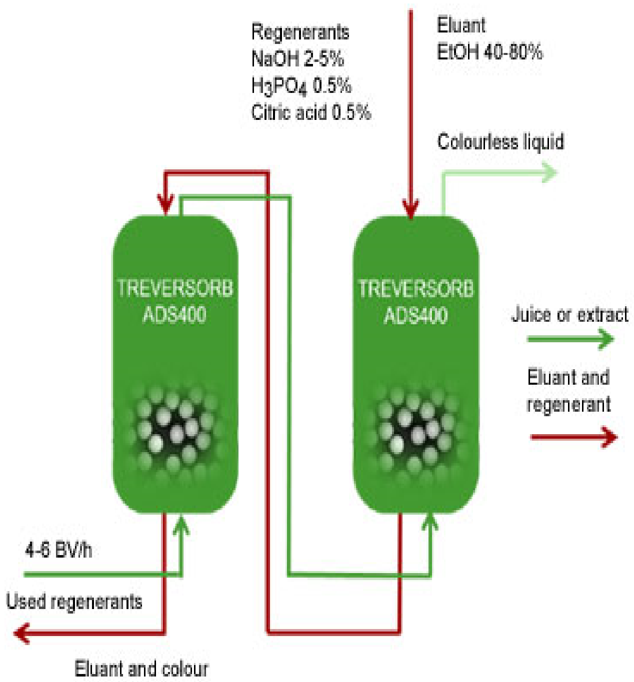

Figure 3. Extraction of color, polyphenols and flavor (http://www.chemra.com/nutrition/colour-flavour-extraction.html)

In the case of many cosmetic products and processing of agricultural products, there is a large amount of waste that contains vast amounts of valuable substances such as color, flavors and polyphenols, known for their antioxidant properties. Among these important substances, polyphenols are the major plant compounds that have a large antioxidant activity, but they also display other biological properties such as anticarcinogenicity, antimutagenicity, antiallergenicity and antiaging activity. And there is increasing interest in recovering these substances from agricultural waste (Moure, 2001).

CONCLUSIONS

Although plant waste has been primarily used as either compost, biofuel or fertilizer, new innovative uses open up new possibilities for sustainable uses of plant waste such as arts, insulation, water filtration, extraction of valuable biomolecules and bioplastic.

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STUDY ON THE RECYCLING OF ZN-C AND ALKALINE BATTERIES AND THE REUSE OF MICROELEMENTS IN AGRICULTURE

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Abstract

The purpose of this study was to research the possibilities of recycling Zn-C and alkaline batteries as well as the possibilities of recovering the component microelements, determining their ability to be reused in agriculture as fertilizers to combat the deficiency of microelements in corn crops. To carry out this study, we dismanted several types of batteries, we established the rate of metal, plastic, paper and residue.We determined the composition of residue and the possibility of using it in agriculture.

Key words*: corn crops, microelements,recycling, residue, Zn-C batteries.*

INTRODUCTION

Tons of Zn-C batteries are discarded every year in the world without being recycled. Because batteries contain a series of heavy metals and toxic chemicals, if they are disposed with household rubbish, they lead to soil and water contamination. The zinc-carbon dry cell container is a zinc box provided with a layer of aqueous NH4Cl or ZnCl2 paste impregnating a paper layer separating the zinc box from a mixture of carbon (graphite) and manganese oxide (MnO2) -packed around a carbon rod.

Manganese (Mn) is an essential plant mineral nutrient, playing a key role in several physiological processes, particularly photosynthesis. Manganese deficiency is a widespread problem, most often occurring in sandy soils, organic soils with a pH above 6 and heavily weathered, tropical soils. It is typically worsened by cool and wet conditions. Numerous crop species have been reported to show high susceptibility to Mn deficiency in soils, or a very positive response to Mn fertilization. The impact of Mn deficiencies on these crops includes reduced dry matter production and yield, weaker structural resistance against pathogens and a reduced tolerance to drought and heat stress. In cereals, Mn deficiency can cause pale green or yellow patches in younger leaves. Mn contributed greatly to plant tolerance of different environmental stress factors such as winter hardiness, salinity and drought.

Zinc is an essential microelement to the growth and normal development of crops, the impact of this element's deficiency on plant growth and subsequently on its productivity is very high. Zinc has an important role in corn crop because: it stimulates synthesis of growth hormones and proteins; it occurs in the production of chlorophyll and carbohydrate metabolism; it supports calcium transport within plants; it is necessary in cell proliferation processes; it determines the growth of leaves and internodes as well as the process of grain formation.

Symptoms of zinc deficiency at corn are: the presence of a white or yellowish band in the central of the leaves, weak development of the root system, slow growth, small leaves, short intervals, late blooming and up to a 40% reduction of production.

The availability of zinc is affected by several factors including: organic matter content of soil, soil pH, soil conditions, soil compaction and the quantity of phosphorus in soil.

The study of the accumulation of micronutrients according to the stage of plant development plays a great importance for subsidizing fertilizer application strategies and the minimum quantity for maintaining soil fertility. Corn plants accumulate nutrients as follows: Zn> Mn> Cu> B.

Figure 1. Deficiency of Zn at corn crop

The total amount of nutrients required to produce one ton of corn is: 0.0009 kg B; 0.019 to 0.02 kg Cu; 0.042 to 0.046 kg Mn; 0.100 to 0.194 kg Zn (Mousavi et. al., 2012).
According to a study carried out on the research site of Azad-Isfahan Islamic University on the evaluation of the effects of microelement's spraying on cereals, it was concluded that spraying microelements at plant height was effective (Safyan et. al, 2012).
The purpose is to correct or prevent Zn and Mn using the elements extracted from recycled Zn-C batteries.

MATERIALS AND METHODS

Because the municipal solid wastes are treated mainly by landfill, incineration and composting the components from disused battery permeate to soil or water, lead to polluting and jeopardizing the ecological environment. Nowadays, as we know the system for recycling battery is still not perfect, so what we can do to prevent pollution is recicle alkaline and Zn-C batteries, by recovering and reusing microelements.
To carry out this study we use: elelectronic balance Precisa model XT 120A, drying stove model Merrmet, Mixer mill 200, Pellet press PP 25, X-ray fluorescence spectrometry (XRF) using a Quant'X ARL spectrometer (Thermo Scientific, USA).
The batteries were dismantled, separated and was weighed each component (metal, plastic, paper, residue), were left in the drying stove and crushed into the mill to obtain fine granulation, were made pills (adding of Bindemittel) on the Pellet press and analyzed at XRF.

Table 1. Types of batteries and its content

Name of battery	Tipe of battery	Heavy metal added	Positive electrode	Negative electrode
Duracel	alkaline	No	MnO2	Zn
Toshiba	alkaline	Pb,Ni	MnO2	Zn
Eveready	alkaline	No	MnO2	Zn
Varta	alkaline	No	MnO2	Zn
Huatai	alkaline	No	MnO2	Zn
Aerocel	alkaline	No	MnO2	Zn
Panasonic	Zinc carbon	No	MnO2	Zn

RESULTS AND DISCUSSIONS

Global development must entail it an increased attention battery recycling management at the end of its duration of use.
If, in the past, most alkaline and zinc-carbon batteries were dumped or incinerated, nowadays we have ecological options for recovering valuable raw materials and for keeping environment safe of heavy harmful metals.
We chose many types of battery, we weighed and dismantled them and separated each components. After that we weighed the metal, plastic, paper and residue. At some of them we could not separated the paper as well as it should been done because of the electrolyte.
The percent of plastic is highest than the others batteries on Panasonic battery and lower than the others on Huatai battery. Also on Panasonic battery the percent of metal that represents the case is highest than the others and on Huatai battery percent of metal that represents the case is lower than the others.
During a several days, we work in the labs of 1 December 1918 University to carry out this study. We put the samples of residue on watch glass and left them in the drying stove until they had constant weight. Next we crushed them into the mill to obtain a fine granulation so we could mixt them with Bindemittel as follow: we added to 5 g of Eveready and 5 g of

Duracel 2,5 g of Bindemittel, to 5 g of Toshiba, Huatai and Aerocel we added 1,5 g of Bindemittel, to 5 g of TDK , Varta we added only 1 g of of Bindemittel and to 3 g of Panasonic, Eastpower and 2,4 g of GP we did not added something. From the samples with Bindemittel we made pills on the Pellet pressand the ones without we put them in capsules and analized it all on XRF.

Table 2. Types of batteries and its contents

Name of battery	Average weight of battery (g)	Average weight of plastic (g)	Average weight of metal (g)	Average weight of residue (g)
Duracel	32,7244	0,9906	9,4421	19,7877
Toshiba	8,4525	0,4809	3,0815	4,2030
Eveready	16,8509	0,2283	5,1233	11,4993
Varta	17,1859	0,3100	4,5814	12,2945
Huatai	8,3820	0,1130	1,9716	6,2974
Aerocel	7,1056	0,1544	3,8732	3,1139
TDK	16,3141	0,4791	5,7340	10,1010
Eastpower	12,2179	0,5586	3,8077	7,8516
Panasonic	28,8117	1,1237	11,7934	14,4978

Table 3. Content of positive electrods

Name of battery	Mn(g)	Zn(g)	C(g)
Duracel	13.05	6.23	78.85
Toshiba	22.95	6.57	62.53
Eveready	13.42	4.66	79.52
Varta	18.12	10.69	68.85
Huatati	17.54	7.15	69.55
Aerocel	23.6	4.09	96.1
TDK	18.89	15.42	66.28
Eastpower	10.41	13.28	73.51
Panasonic	17.33	9.51	65.19

The main component of residues is carbon followed by Manganese and Zinc. We want to recover Manganese and Zinc and apply them as fertilizer for corn crops. Except for Toshiba battery the others batteries can be used in agiculture.

CONCLUSIONS

After the research we have made we conclude that we can use batteries as fertilizer to corcrops except Toshiba that contains Pb and Eastpower that contains almost one percent of Al and one of Fe. This metal could pollute the environment and lately our lives.

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STUDY ON THE IMPACT OF ASBESTOS ON THE ENVIRONMENT AND ON THE POPULATION OF ALBA IULIA

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Abstract

The purpose of this paper is to identify with the help of the Geographic Information System the surfaces covered with asbestos plates in the city of Alba IuliaConsidering the relatively large areas covered with asbestos-containing materials, we assessed the impact on the environmental factors water, air, soil and population.The results confirm that the population of Alba Iulia is predisposed to lung cancer, asbestosis, mesotheliomaits pastures and meadows, the important number of cow stock and possibilities to produce ecological milk.

Key words*: evolution, milk production, NW Region, Romania, trends.*

INTRODUCTION

We intend to identify in this study all the buildings in Alba Iulia covered with asbestos plates in 2008 and to assess their impact on the environment and the population of this city.

Asbestos is a fibrous mineral with very good resistance to high temperatures and high durability. According to legislation in the field of health and safety at work, the term asbestos designates the following fibrous silicates: actinolite of asbestos; grinding (asbestos) of asbestos; asbestos antofilite; chrysotile; asbestos; tremolith of asbestos. (http://legislatiamuncii.manager.ro/a/9857/ssm-ce-este-azbestului-si-care-sunt-efectele-lui-asupra-sanatatii-lucratorului.html)

In Europe since 1990 there are regulations restricting the use of asbestos, so the amount of asbestos used has decreased from 5 million tons to 2 million tons

Since 2005, the European Commission has banned the use and marketing of products containing asbestos.

In Romania, pursuant toArticle 12 (1) of H.G 124/2003, all activities relating to the marketing and use of asbestos and products containing asbestos since 1 January 2007 are forbidden in order to protect the health of the population and the environment. In 2006 it was modified this H.G 734/2006 specifying that asbestos can be used up to the end of its life cycle.

According to the Asbestos Occupational Exposure Limitations Guide issued by the National Public Health Institute, asbestos fibers in the air can be inhaled and reach the lungs, causing diseases such as asbestosis, mesothelium, lung cancer and other cancers. Limit values of asbestos concentration in the air are 0.1 fibers / cm^3 air (0.1 f / cc) weighted average with time - 8 hours (TWA = time weighted average) respirable fractions ν sampling and determination is done only by laboratories empowered by the Ministry health. (Meteş, 2000).

According to Annex 2 of H.G 124/2003, products containing asbestos and which must be specially considered and prohibited for marketing and use are: toys, materials or preparations for application by spraying, finished products marketed to the population in the form of powders, smoking articles such as pipes or cigarette lighters, catalytic filters and insulating devices incorporated in catalyst heaters using liquefied gas, varnishes and paints, liquid filters, road cover if the fiber content its asbestos exceeds 2%, mortar, protective coatings, fillers, seals, jointing compounds, mastics, glues, powders and decorative finishes

The working techniques for planning the demolition and removal of structures containing asbestos include:

a) Ways of remediation of asbestos-containing material (softening, collection, use of hand held devices, closing in bags, labeling, etc.).

b) Ways of access to the asbestos structure.

c) Description of the material demolition procedure: flushing both sides with a low pressure pump before removal and before dismantling (to be attached the documentation of the products used and the pump data sheet).

d) Disassembly methods avoiding fragmentation of the material, collecting any parts that have ricocheted or broken pieces.

e) Description of the ground transportation system of there moved material.

f) Form and location of the material before being sent to the warehouse: according to the legislation in force.

g) Description of how to fix the premises: daily cleaning or as many times as necessary. (Balzamo et. all, 2007)

Asbestos-containing wastes can be disposed of in hazardous waste and non-hazardous waste landfills with separate cells for the storage of asbestos waste (Meteș, 2000).

Although there is an enormous amount of asbestos-containing products at national level, there are only two hazardous waste landfills that provide services to third parties, including for asbestos-containing waste. These cover complex waste management activities including take over, transport, temporary or final storage, processing etc (Ionescu, 2011).

Asbestos removal techniques are: Wetting for thermal insulating materials or for asbestos-containing materials on impermeable surfaces; controlled dry deposition involving local aspiration or coating of insulated components as well as cutting and removal of a complete section (S.L.I.C, 2006).

MATERIALS AND METHODS

According to our study in the city of Alba Iulia, in 2008 there was an area of 177225 m^2 covered with asbestos tiles. Figure 1 shows buildings covered with construction materials containing asbestos.

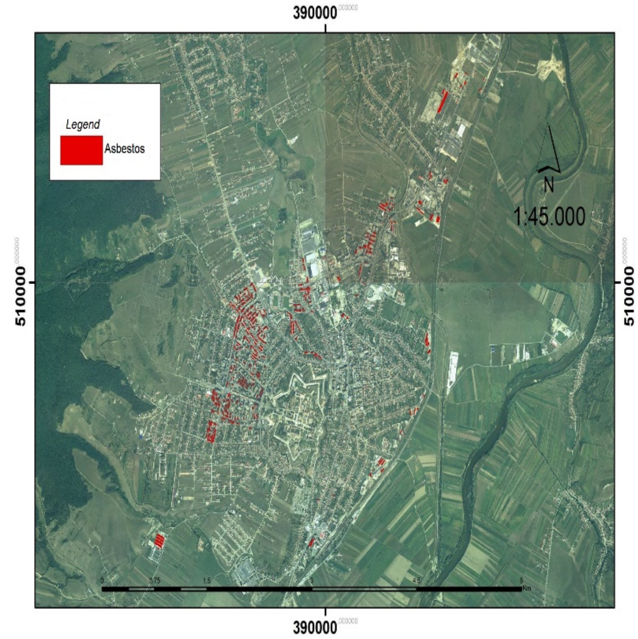

Figure 1. Areas covered with asbestos

Due to precipitation, wind, hail, freeze-thaw phenomenon, asbestos-cement tiles can degrade, and asbestos fibers can be broken up by being dispersed into the atmosphere in water or on the ground.

As regards the assessment of the impact of asbestos on environmental factors, it was found that this pollutant could affect air quality by dispersing asbestos fibers into the atmosphere, soil quality due to asbestos waster eaching the soil, and water quality either due to water pipes produced from asbestos or because of the rain that washes the asbestos roofs. Of the environmental factors water, air, soil the most affected factor is air due to the properties of asbestos.

The assessment of the air assessment score is -54, which means that asbestos is a major negative impact on the air. The results of the overall impact assessment are presented in the table 1.

Population is the major factor affected by the irrational use of asbestos. Inhabited asbestos fibers reach the lungs causing various health problems for which no cure has yet been found. The result of the asbestos impact assessment confirms that the population of Alba Iulia is prone to lung cancer, asbestosis and mesothelioma.

Table 1. Results on the assessment of the impact of asbestos

The impact of asbestos							
Categories of impact / Environmental factors	A1	A2	B1	B2	B3	SE	CI
The water	1	-1	3	2	2	-7	-A
The ground	1	-1	3	2	2	-7	-A
The air	3	-2	3	3	3	-54	-C
The population	4	-3	3	3	3	-108	-E
Rating score						-176	-E

Since the effects of inhalation of asbestos fibers may occur between 15 and 40 years, depending on factors such as smoking, age, duration, and inhalation, it is very difficult to quantify the number of people affected within a certain period of time

CONCLUSIONS

In the city of Alba Iulia, according to the study, was an area of 177225 m^2 covered with asbestos plates in 2008, one year after according to H.G. 124/2003 on the prevention, reduction and control of environmental pollution with asbestos is prohibited all activities related to the marketing and use of asbestos and products containing asbestos.

Using the Rapid Impact Assessment Matrix (RIAM) it has been demonstrated that asbestos-containing construction materials can affect the quality of air, soil, water, and especially the health of the population.

By inhalation, asbestos fibers reach the human body where after a period of time they can cause different types of cancer for which treatment has not yet been found.

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GET IN BUSSINES WITH THE PLANTS WASTE

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Abstract

All over the world, especially in countries with a very strong tradition in cultivating medicinal plants, production of bio-products based on natural compounds leads to the transformation of plants in large quantities of waste, mostly unexploited. The majority of the wastes are underutilized and may cause severe environmental problems if not properly handled. Lack of cheap technological solutions for biochemical and organic remediation that could achieve gradual adaptation to environmental standards of generating pollution entities and macro-entities is the main obstacle that hampers implementation of European environmental directives. Valorization of these compounds from plants waste not only reduces environmental concerns but also improves sustainability and economic competitiveness of agro-food industries. The present paper represents a short review of the possible ways of valorization of plants waste such as lavender, mint and sage into value - added by – products.

***Key words**: lavender, mint, sage, valorisation, waste.*

INTRODUCTION

Several experiments have been carried out over time to highlight the relative performance of waste in many areas, but the interest of the researchers has focused considerably on the sustainable valorisation of plant waste, especially medicinal and aromatic plants.

The aim of the present work is a review using public domain literature on the sustainable valorisation of vegetable waste such as lavender waste (Figure 1), sage waste (Figure 2) and mint waste (Figure 3), a set of herbal and medicinal herbs with multiple applications.

Lavender (*Lavandulaangustifolia L., Lavandula latifolia L.*) , Mentha (*Menthapipperita L., Menthaarvensis L.*) and Sage (*Salvia Officinalis L.*) are part of the Lamiaceae family and lately in Romaniathe crops of these plants have grown.

Phenolic compounds are bioactive compounds with essential benefits, especially in health, therefore vegetal waste is maximal exploited to recover the entire phenols using as many as possible green extraction techniques.

Figure 1. Lavandulaangustifolia L. waste (stems and leaves) (left) and herbal (flower) (right)

Figure 2. Salvia officinalis L. waste (stems)

Figure 3. Menthapiperita L. waste (stems)

EXTRACTION AND IDENTIFICATION METHODS OF TARGETED COMPOUNDS FROM SELECTED PLANT WASTE

Essential oil of lavender leafy stems (*'Blue River'* and *'Ellegance Purple'* varieties) (Adaszyńska-Skwirzyńska et al., 2014) was extracted by hydrodistillation (Deryng's apparatus) and studied by Gas Chromatography-mass spectrometry (GC-MS) (Agilent 6890, Column HP-5MS 30m, 0.25mm, 0.25μm) in order to identify the chemical composition (main compounds are borneol, caryophyllene oxide, epibicyclosesquiphellandrene, eucalypt-tol, linalool,geraniol acetate and β-pinene), the total flavonoids content (expressed as mg quercetin equivalents / 100g dry weight and extracted with acetone, HCl, ethyl acetate as extraction solvents) by spectrophotometer and sesquiterpene acids (valerenic and acetoxyvalerenic acids using methanol as extraction solvent) by HPLC Chromatography (Shimadzu chromatograph, SPD-M20A detector, UV-Vis). Also, total phenolics (Folin–Ciocalteu reagent) and flavonoids (aluminium chloride method) content from lavender leafy stalks (*Lavandulaangustifolia* - 'Blue River' and 'Ellagance Purple) was identified by UPLC-ESI-MS device (Adaszyńska-Skwirzyńska et al., 2017).

Méndez-Tovar et al. (2015)conducted a study of determination of total phenolics content (Folin–Ciocalteu method) and antioxidant activity (1,1-Diphenyl-2-picryl-hydrazylhydrate (DPPH) and ferric reducing antioxidant power (FRAP) methods) from *Lavandulalatifolia* waste material obtained after removing the essential oils through distillation and from spike lavender waste; using HPLC (Agilent Technologies 1200 series /DAD/ ZORBAX Eclipse XDB-C18 column (150 mm × 4.6 mm i.d., 5 μm)).

In *Lavandulaangustifolia* waste extract with 70% ethanol, performed by ultrasound-assisted extraction method (VWR, Malaysia; 45 kHz, 30 W); was elaborate protein identification by Kjeldahl method with automated nitrogen analyzer (UDK152 VelpScientifica); total polyphenol and flavonoid content (Folin-Ciocalteu method and Al(NO3)3 reagent for flavonoids); and antioxidant activitiy (DPPH, FRAP, ORAC (Oxygen Radical Absorbance Capacity) and HORAC (Hydroxyl Radical Averting Capacity)) (Vasileva et al., 2018).

Has been reported that lavender (*Lavandulaangustifolia L.*)wastes from essential oil industry (steam distilled lavender - SDL) and subcritical CO2 extraction of lavender (CO2-L) showed high antioxidant activity (ORAC, DPPH, FRAP and HORAC methods), polyphenol and flavonoid content (Agilent 1220 HPLC system/ Agilent TCC18 column /5 μm/ 4.6 mm x 250 mm) and aroma metabolites (Gas Chromatograph Agilent GC 7890/detector Agilent MD 5975/column HP-5ms (30 m/0.32 mm /0.25 μm) (Slavov et al., 2018).

The *Menthaarvensis* waste (distilled lignocellulosic biomass) obtained after essential oils extraction by distilation, was analysed regardingcrystallinity by XRD (X-Ray Diffraction - Rigakudiffractometer/CuKα radiation/40 kV/130 mA); devolatilization by TGA (Thermal Gravimetric Analysis - PerkinElmer instrument, Pyris Diamond TG/DTA) and chemical analysis by FTIR (PerkinElmer make, FT-IR spectrum GX), ICP-MS (PerkinElmer, Optima 530 V) and CHNS (PerkinElmer Elementar CHNS analyzer). More, was developed a new process for the identification and separation of cellulose, hemicellulose and lignin(Prakash et al., 2018).

Sage (*Salvia officinalis L.*) by-product exploitation as sage herbal dust, obtained in filter tea processing, is considered sage waste. This sage waste was the aim of Pavlić et al.

(2018, 2017) studies to analyse essential oil and lipid extracts obtained by hydrodistillation, maceration, Soxhlet extraction, ultrasound-assisted (UAE - EUP540A, Euinstruments, France), microwave-assisted (MAE), subcritical water extraction (SWE - 4848BM, Parr Instrument Company, USA) and supercritical fluid extraction (SFE - HPEP, NOVA, Swiss, Effretikon). They worked for indentification compounds as volatile compounds, terpenes (camphor, γ-terpinene, (+)-limonene, geraniol, eucalyptol, α-terpineol, carvacrol, α-pinene, β-pinene, eugenol, α-thujone, linalool and methyl chavicol, viridiflorol, epirosmanol), polyphenol content (Folin-Ciocalteu method) and total flavonoids (aluminum chloride colorimetric method) through GC–MS (Agilent GC890N - Agilent MS 5759/HP-5MS column 30 m/0.25 mm/0.25μm) and GC-FID (Gas Chromatography with Flame-Ionization Detection).

POSSIBLE APPLICATIONS OF COMPOUNDS SEPARATED FROM SELECTED PLANT WASTE

The essential oils from the lavender leafy stem hasantimicrobial activity (against *Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus aureus and Enterococcus faecalis*) and sedative action (Adaszyńska-Skwirzyńska et al., 2014).Spike lavender waste is a source of natural antioxidants (Méndez-Tovar et al., 2015). Vasileva et al. (2018) investigated *Lavandulaangustifolia* waste effects in bread preparation, functionalization and shelf life.

In the distilled biomass from *M. arvensis* was found a very good glucose content (with *Cellic CTec2* and *T. reesei* enzymes), but also xylose, galactose, mannose and arrabinose (Prakash et al., 2018).

According to Khammour et al. (2018), waste mint is useful even to increase thermal stability characteristics of plywood panel adopting a new adhesive formulation of urea formaldehyde resin, seen by TGA and DSC (Differential Scanning Calorimetry).

Furthermore,Ainane et al. (2014) applied mint waste to bio-adsorb methylene blue from aqueous solution, phenomena characterised by FTIR spectroscope (Vertex 70).

Antioxidant activity proovedsage herbal dust in lipid extracts, determined by DPPH, ABTS (2,2'-azino-bis(3-ethylbenzothiazo-line-6-sulphonic acid)) and FRAPis mainly due to the high content of polyphenols. Moreover, antimicrobial activity tested against gram-positive bacteria as *Staphylo-coccusaureus* ATCC 25923, *Staphyloco-ccussaprophyticusw*, *Bacillus cereus* ATCC11778,*Bacillus cereusw*, *Listeriaivanovii* ATCC 19119, *Listeria monocytogene-sw*, *Enterococcus faecalis* ATCC 19433, *Enterococcus faecalisw* (w- wild strain). Both activities were recorded in extracts obtained by SFE, MAE, UAE, maceration and hydrodistillation (Pavlić et al., 2017).

Antimicrobial and antioxidant activity identified to these plant wastes can be regarded as potential biopreservative agents.

CONCLUSIONS

Medicinal and aromatic plants as lavender, mint and sage have a variety of benefits, therefore the waste obtained after the main usage of them became very valorised due to the fact that are still full of important compounds which can be used in areas as food (addition in foodstuffs), dietary supplements, pharmaceutical purpose, cosmetics, perfumery or other industries.

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SUSTAINABLE WATER USE IN BULENT ECEVIT UNIVERSITY FACULTY OF ENGINEERING

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Abstract

Water is a vital compound to sustain our lives. On the other hand, it is a scarce resource. The consumption of water has increased over recent decades. Therefore, sustainable water consumption becomes a key concern. Turkey is a water deficit country and prevention of excessive water usage is quite important. In this study, we focused on the water consumption prevention methods in Bülent Ecevit University. Three years water consumption values have been analysed in Faculty of Engineering. The effect of installing "Pedal Controlled Lavatory Faucets" on water saving were investigated. This water saving equipment was in use between May 2016 and September 2017. Water consumption valueswere calculates as 2.61, 3.47 and 2.01 m3/capita/year for 2015, 2016 and 2017 respectively. Results showed that Pedal Controlled Lavatory Faucets decreased the amount of water used in the faculty buildings.

***Key words**: Bülent Ecevit University Engineering Faculty, sustainability, water consumption,water saving.*

INTRODUCTION

Water is a vital compound for humans and all living creatures. We use water to sustain our daily life such as for drinking, cleaning and cooking etc. Also, water is used in industry, in agriculture and in dairy farms (Robinson et al., 2016; Maryam and Büyükgüngör, 2017). Unfortunately, water is a scarce compound and only a few percent of global water is available as freshwater (Amr et al., 2016; Distefano and Kelly, 2017). Over the recent decades, there has been an increasing trend in water consumption as a result of many factors like increasing population of cities, effects of climate change, growing demand of water in industries, economic development and especially wrong water politics. High water consumption brings about dried lakes or rives and lowering of water table in aquifers (Udimal et al., 2017). All these results will create water scarcity; affect food security and economic development (Distefano and Kelly, 2017). Therefore, sustainable water usage becomes a key concern. The term "sustainable water use" includes security of water resources, water conservation, water reuse, water harvesting, efficient and sustainable use of water and even making purchase decisions for buying a product with a low water foot-print (Amr et al., 2016; Arfanuzzaman and Rahman, 2017; Kang et al., 2017; Maryam and Büyükgüngör, 2017).

Water-deficit country can be defined as if per capita water use is between 1000 and 3000 m3 annually (Yüksel, 2015). Today, Turkey is a water-deficit country with 1519 m3/person/year water consumption (Maryam and Büyükgüngör, 2017). In the near future (2030), depending on the population growth, water availability will drop to 1120 m3/person/year. So, it is important to use water resources efficiently and prevent excess water demands.

Universities are one of the biggest institutions with large water consumption rates. In this paper, we focused on water conservation at Engineering Faculty of Bülent Ecevit University campus. In materials and methods part, information about study area is given and pedal controlled sinks are briefly described. The volumes of water consumption before and after installation of pedal controls are given in results and discussion section. Finally, in conclusion part, this paper finishes with a few suggestions for further water conservation methods.

MATERIALS AND METHODS

Study Area

Bülent Ecevit University is in the city of Zonguldak, Turkey. Main campus is located at the latitude of 41.450829 and the longitude of 31.762459 (Figure 1). The history of university reaches till 1924, when the university was founded as the Vocational School of Mining and Mine Foremen. The former name of the university was "Zonguldak Karaelmas University" during the period of 1992 and April 2012. Today, it is a state university, which consists of 14 faculties, 3 graduate schools, 9 vocational high schools and 1 conservatory.

The Engineering Faculty is in Farabi Campus (main campus) of Bülent Ecevit University. Engineering Faculty has a building of 31316 m2 interior area. The Faculty has been offering education and training services in 30 classes, 7 computer laboratories and 38 education & research laboratories. Faculty is composed of 12 departments, which are Computer, Biomedical, Environmental, Electrical-Electronics, Geomatics, Food, Civil, Geological, Mining, Mechanical, Mechatronics and Metallurgical Engineering. There exists 160 academic and 44 administrative staff in the faculty.

Figure 1. Bülent Ecevit University Google Earth satellite image (2018)

The number of students shows an increasing trend among the years. There were 3962 student in 2015-2016 academic year and 4463 students in 2016-2017. In 2017-2018 academic year, there are 4732 students in engineering faculty.

Pedal Controlled Lavatory Faucets

At May 2016, in our university, ordinary lavatory faucets of wash basins at Electrical-Electronics, Mechanical, Mining and Civil Engineering departments were changed with pedal controlled lavatory faucets in order to save water. Water flow is controlled by pressing the pedal. When person removes his foot from pedal water flow is cut off (Figure 2). With pedal controlled system, one can use water without wasting it. The unit price of pedal was 178 Turkish Liras (TL) and 10 pedals were installed.

Figure 2. Pedal controlled lavatory faucets

RESULTS AND DISCUSSIONS

Based on the last three years, the amounts of water used are shown in Table 1. Grey shaded cells in the table indicate the period, when pedal controlled lavatory faucets were used. Faculty of Engineering used 10873, 16177 and 9921 m3 of water yearly in 2015, 2016 and 2017 respectively. As discussed in previous section, the number students at the faculty were rising. On the other hand, with the installation of these water saving devices the rate of water usage was decreased. There was a sudden climb in water consumption at July-August period of 2016. During these months, there were a summer school at the university and a lot of students came from other universities to take summer courses. Also, during summer season, the temperature was very hot that results in more water consumption. Moreover, water used for cleaning during these months should also be taken into account. That is why; water usage had reached the highest among the last three years. Starting from September of 2016, the amount of water used had decreased despite the increasing number of students till September of 2017. At this time, the construction of new faculty building was finished and all departments except from Mining Engineering moved to the new building. New faculty building unfortunately does not have pedal controlled lavatory faucets to save water. Also, lots of water was used for cleaning of new building just before the new academic year. These explain 3092 m^3 water consumption during September-October period of 2017.

According to our data, the amount of water usage per capita shows a decreasing trend. In order to calculate per capita water consumption values, total yearly consumption is divided by total number of people (students + academic staff + administrative staff).

2015: (10873 m^3/year) / (3962+160+44) = 2.61m^3/capita/year

2016: (16177 m^3/year) / (4463+160+44) = 3.47 m^3/capita/year

2017: (9921 m^3/year) / (4732+160+44) = 2.01 m^3/capita/year

As it is seen from these values; despite the increasing number of students, there is a large decline in the amount of water consumed. Decreasing water consumption proves the success of the pedal system in terms of water saving.

Table 1. Water Consumption Values

	Water consumption (m^3)		
Bill Period	2015	2016	2017
January-February	1,390	4,032	1,203
March-April	1,683	2,745	1,572
May-June	1,552	2,840	1,562
July-August	2,533	4,125	1,037
September-October	2,374	1,425	3,092
November-December	1,341	1,010	1,455
TOTAL	10,873	16,177	9,921

CONCLUSIONS

Recently, the lack of sufficient resources, increasing water demand and rapid population growth has increased the importance of water management. Water resources management should be performed with in the effective and sustainable framework. Water saving is an integral part of this framework. This requires education starting from early ages. Water saving consciousness should be given to children from a young age and children should grow up by adopting this consciousness.

The aim of this study is calling attention to water saving by producing new projects and enhancements. As a result; by the aid of Pedal System, serious reduction is observed at usage of water. Because this system is used for trial scale, new faculty building does not have pedal controlled lavatory faucets. Installing this system in the new building in the light of examined results will be an important method to save water. Water saving equipments should be installed all of the buildings in university so that our university will be a good example for society in terms of sustainable water usage.

For sustainable water use in university campuses, rainwater harvesting on top of the buildings is another opportunity. The average annual amount of rain in Zonguldak is 1219 mm. There is a quite potential to save water in rain harvesting. Taken into consideration of the climatic conditions of Zonguldak Province, rainwater can be stored with simple arrangements which are made at the buildings. It is a great advantage for the user that the rainwater is clean, the water is not paid for, and the system recovers its own cost in a few years. The use of rainwater in toilet flushes and garden irrigation by establishing harvesting system will further reduce the amount of water used.

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SECTION 02
SUSTAINABLE DEVELOPMENT OF RURAL AREA

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ACCESSION OF EUROPEAN FUNDS UNDER THE NATIONAL PROGRAM OF RURAL DEVELOPMENT (2014-2020) FOR THE FOUNDATION OF A ZOOTECHNICAL FARM BARATEAZ VILLAGE FROM TIMIS COUNTY

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Abstract

Common Agricultural Policy (CAP) is the means of promoting agriculture in Europe and one of the oldest EU policies. It was created in 1962 and reformed successively in 1992, 2003 and 2013. The European Agricultural Fund for Rural Development is a financing instrument for the Common Agricultural Policy, which funds the National Rural Development Program, supporting the strategic development of rural areas in Romania. The National Rural Development Program 2014 - 2020 is the program that gives grants from the European Union and the Government of Romania for the development of rural areas in Romania. The main rural development priorities for the 2014-2020 financial programming period are: • modernizing and increasing the viability of agricultural holdings by strengthening them, opening up and processing agricultural products; • encouraging rejuvenation of farmers' generations by supporting the setting up of young farmers; • the development of basic rural infrastructure as a prerequisite for attracting investment in rural areas and creating new jobs and implicitly for the development of rural areas.• Encourage the diversification of the rural economy by promoting the creation and development of SMEs in non-agricultural sectors in rural areas; • promotion of the fruit sector, as a sector with specific needs, through dedicated subprograms; • Encourage local development under the responsibility of the community through the LEADER approach. LEADER cross-cutting competence improves competitiveness, quality of life and diversification of the rural economy, and combating poverty and social exclusion. The European funds provided to Romania for agriculture, which can be obtained through the Agency for Rural Investment Financing, contribute to rural development. They help farmers set up new farms or develop the existing ones, representing a very important benefit because the grants are non-refundable.

Key words: *Agency for Payments and Intervention for Agriculture, Agency for Rural Investment Financing, National Rural Development Program, Common Agricultural Policy, Special Accession Program for Agriculture and Rural Development, Sheep Farm.*

INTRODUCTION

The rural area in Romania is currently formed from the administrative surface of the 2688 communes existing in the country, which bring together the country's rural population, according to Law 2/1968 on administrative-territorial organization (Stanciu, 2015). Communes are made up of one or more villages, with a total of 12,751 villages in rural areas.The Common Agricultural Policy brings about 20 million euros in agriculture and rural areas in Romania in 2014-2020.

It is very important for our country because 44% of the population lives in rural areas.

Romania has the most agricultural holdings in the European Union, with about one million farmers in the country living in the country. Romania owns over 7.6% of the agricultural area used in the European Union, the agricultural sector being very important and expanded.

The Romanian village still needs the modernization, by the end of 2016, only 49.1% of the population had access to the sewage system and 47.7% to the sewage treatment networks, mostly by the Romanians living in the urban area (Suster et al., 2013).

The Common Agricultural Policy supports these needs of Romania: ensuring the stability and growth of the agri-food sector, as well as the development of rural Common Agricultural Policy through investments in infrastructure and in rural areas.

The Ministry of Agriculture and Rural Development has the role of developing, implementing and monitoring policies and strategies in the areas of agriculture, sustainable forest management and rural development, ensuring the modernization and development of sectorial activities, and ensuring transparency and efficiency in the use the funds allocated are represented on the territory by the Directorates for Agriculture and Rural Development in each county, which have under the Office of Pedological and Agrochemical Offices (specialized technical body of http://www.madr.ro/).

During the pre-accession period Romania was developed according to a set of European Community Regulations, the National Program for Agriculture and Rural Development, this is the basic document that contributed to the implementation of the acquis of the community.

The National Plan for Agriculture and Rural Development was based on an ex-ante evaluation which took into account the Administrative System of the Special Accession Program for Agriculture and Rural Development of April 2000. During the pre-accession period, the emphasis in agriculture and rural areas has been on the priorities identified precisely by this program, such as: improving the structures of processing and marketing of agricultural and fishery products, food quality control, as well as veterinary and phytosanitary control, improving the infrastructure for rural development and agriculture, developing the rural economy and human resources.

These are the premises from which the 11 Accession Programs of the Special Accession Program for Agriculture and Rural Development have been developed.

Each Special Accession Program for Agriculture and Rural Development financing has been implemented on the basis of technical data sheets contained in the National Program for Agriculture and Rural Development, which also includes the available financial allocations.

With Romania's accession to the European Union, Romania follows the principles of the Common Agricultural Policy as regards agriculture and rural development, which is a set of rules and measures aimed primarily at increasing productivity, guaranteeing a level of living equitable to the population of agriculture, stabilizing markets, guaranteeing security of supply, securing the consumer with supplies at reasonable prices.

According to the Council of Europe Regulation no. 1290/2005 on the financing of the common agricultural policy, two European funds for agriculture were created:

- EAGF - European Agricultural Guarantee Fund - to finance marketing measures;

-EAFRD - European Agricultural Fund for Rural Development - to finance rural development programs;

The European Agricultural Fund for Rural Development is accessed starting in March 2008, after the approval of the National Rural Development Program.

Starting from Council Regulation no. 1698/2005 of 20 September 2005 on support for rural development through the European Agricultural Fund for Rural Development, the National Strategic Plan for Romania, which is the basis for the implementation of the National Rural Development Program for 2007-2013, was created (Mateoc et al., 2013).

Thus, the National Program for Rural Development 2007 - 2013 (NRDP), elaborated by the Ministry of Agriculture and Rural Development, details the concrete way in which the investments from the European funds for agriculture and rural development are financed.

The European Agricultural Fund for Rural Development is implemented in the first financial programming period (2007 - 2013) through the National Rural Development Program 2007 - 2013 and in the second financial programming period (2014-2020) through the National Program for Rural Development 2014-2020.

The Ministry of Agriculture and Rural Development has set up two agencies to manage the absorption of European funds:

• The Agency for Payments and Intervention for Agriculture is a Romanian agency operating under the Ministry of Agriculture, Forests and Rural Development, established in 2004 (Figure 1). Since 1 January 2007, Agency for Payments and Intervention for Agriculture has been running European funds to implement support measures financed from the European Agricultural Guarantee Fund. Subsidies are granted in the form of direct payments per hectare managed by the Integrated Administration and Control System and in the framework of market measures for the implementation of trade mechanisms under the Common Agricultural Policy (http://www.apia.org.ro/).

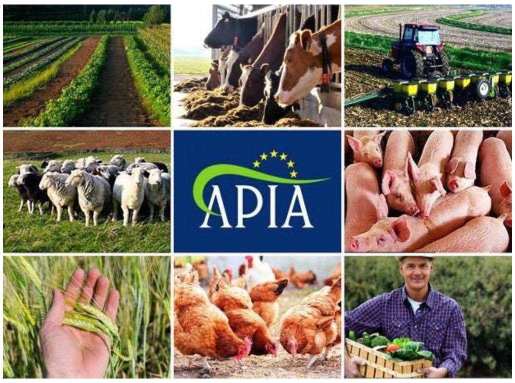

Figure 1. Agency for Payments and Intervention for Agriculture Logo

• The Agency for Rural Investment Finance was set up by the Romanian Government in February 2006, through the reorganization of Special Accession Programme for Agriculture and Rural Development Agency in Romania and received operating accreditation at the end of 2007. At that time, the institution was called the Paying Agency for Rural Development and Fisheries. Agency for Rural Investment Financing ensures the technical and financial implementation of the European Agricultural Fund for Rural Development and has fully taken over the implementation and monitoring of the Special Accession Programme for Agriculture and Rural Development.

The Payments Agency for Rural Development and Fisheries has also ensured the continuation of the Special Accession Program for Agriculture and Rural Development (SAPARD) until its completion in 2009 (Feher et al., 2013).

In July 2014, the name of the institution was changed to the Agency for Rural Investment Financing.

The County Offices for Rural Investment Financing are located in each county, subordinated to the Ministry of Agriculture and Rural Development. So here you can get all the information you need and you will be able to submit both the project and the post-project payment requests.

The National Program for Rural Development was created for a wider spread of the information on the access to European funds and for the grouping of the organizations and administrations involved in rural development.

Each European member state creates a National Rural Network to promote access to European funds that will contribute to rural development.

The National Rural Network is an important link at the level of the all the European member states between the administrations and the national organizations involved in the implementation of the Rural Development Program actions, including the Local Action Groups on the LEADER approach.

The roles of the National Rural Networks focus on promoting networking and information exchange on the Regional Development Program at regional, national and EU level. These activities include the organization of events and the production of communication material. National Rural Networks have an important role in disseminating good practice.

The National Rural Networks are part of the European Rural Development Network and regularly participate in meetings or events atEuropean level to share experiences and information (http://www.rndr.ro/).

MATERIALS AND METHODS

The National Rural Development Program (2014-2020) grants non-reimbursable funds for the economic development of rural areas in Romania. The technical and financial implementation of the projects is ensured by the Rural Investment Financing Agency, which provides the local public authorities, processors, farmers and entrepreneurs in the rural area with the following financing measures for the economic development of the area (http://www.pndr.ro/):

Measure 4 - Investments in physical assets comprising the following sub-measures:

Sub-measure 4.1 - Investments in agricultural holdings;
Sub-measure 4.1 - Investments in agricultural holdings (ITI-Danube Delta);
Sub-measure 4.1a - Investments in orchards;
Sub-measure 4.1a - Investments in orchards (ITI-Danube Delta);
Sub-measure 4.2 - Investment for processing / marketing of agricultural products;
Sub-measure 4.2 - Investments for the processing / marketing of agricultural products (ICI area - Danube Delta);
Sub-measure 4.2a - Investments in the processing / marketing of products in the fruit sector;
Sub-measure 4.2a - Investments in the processing / marketing of products in the fruit sector (ITI-Danube Delta);
Sub-measure 4.3 - Investments for the development, modernization or adaptation of agricultural and forestry infrastructure;
Sub-measure 4.3 - Investments for development, modernization or adaptation of agricultural and forestry infrastructure (ITI-Danube Delta).
Measure 6 - Development of farms and businesses:
Sub-measure 6.1 - Support for setting up young farmers;
Sub-measure 6.1 - Support for the installation of young farmers (ITI-Danube Delta);
Sub-measure 6.2 - Support for setting up non-agricultural activities in the rural area;
Sub-measure 6.2 - Support for setting up non-agricultural activities in the rural area (ITI-Danube Delta);
Sub-measure 6.3 - Support for the development of small farms;
Sub-measure 6.3 - Support for the development of small farms (ITI-Danube Delta);
Sub-measure 6.4 - Investments in the creation and development of non-agricultural activities;
Sub-measure 6.4 - Investments in the creation and development of non-agricultural activities (ITI-Danube Delta);
Sub-measure 6.5 - Scheme for small farmers;
Measure 7- Basic Services and Village Renewal in Rural Areas
Sub-measure 7.2-Investments in the creation and modernization of the basic infrastructure at small scale;
Sub-measure 7.2-Investments in the creation and modernization of the basic infrastructure at small scale (ITI-Danube Delta);
Sub-measure 7.6-Investments associated with the protection of cultural heritage;
Sub-measure 7.6-Investments related to the protection of cultural heritage (ITI-Danube Delta);
Measure 8 - Investing in forest areas development and improving forest sustainability:
Sub-measure 8.1-Impounding and creation of wooded areas;
Measure 9 - Support for the establishment of producer groups in the agricultural sector:
Sub-measure 9.1-Establishment of producer groups in the agricultural sector;
Sub-measure 9.1a - Establishment of producer groups in the fruit sector;
Measure 16-Support for agricultural and fruit-growing cooperation:
Sub-measures 16.4 and 16.4a - Support granted for horizontal and vertical cooperation between actors in the agricultural supply chain and fruit sector (https://portal.afir.info/informatii_generale_pndr_investitii_prin_pndr_sm_6_1_instalare_tineri_fermieri?amp;lang=RO).

RESULTS AND DISCUSSIONS

Next, I will present the steps taken by the farmer Cupea Aron to access European grants non-reimbursable by measure 6- development of farms and enterprises, sub-measure 6.1 - support for the installation of young farmers.

The beneficiary of the project is a student at the University of Agricultural Sciences and Veterinary Medicine of Banat from Timisoara, Faculty of Animal Husbandry and Biotechnologies, specialization Animal Husbandry.

The European Union has a series of programs designed to encourage young people to do business in the agricultural sector, both for the installation and investment in agricultural holdings, the maximum eligibility age being 40 years for Sub-measure 6.1 - Support for setting up of young farmers (Alecu et al., 2006).

Measure 6 - Development of farms and businesses, Sub-measure 6.1-Support for the installation of young farmers is the most accessible sub-measure within the National Rural Development Program (2014-2020), the year 2018 being the last one in which farmers can access funds through this program.

The aim of this sub-measure is to increase the number of young farmers who start farming activities for the first time and to encourage young people and rural families to settle in rural areas, which will have a positive effect on the national economy in general.

Sub-measure 6.1 aims to develop rural areas by supporting young farmers and improving management, increasing the competitiveness of the agricultural sector, and supporting the process of modernization and compliance with environmental, hygiene and animal welfare requirements and safety at work;

Beneficiaries of this sub-measure may be: young farmers according to the definition in art. 2 of R (EU) No. 1305/2013, who establishes himself as the sole head of the agricultural holding and the legal entities in which a young farmer within the meaning of art. 2 of R (EU) No. 1305/2013 which establishes with other young farmers and exercises effective long-term control over management decisions, benefits and financial risks within the holding (Stanciu, 2013).

The non-reimbursable support under the sub-measure is up to EUR 50,000, which will be granted in two tranches, namely: 75% of the amount of support to receive the financing decision and 25% of the amount of support within three years of receiving the decision funding.

List of documents required for the preparation of the Submeasure 6.1:

• grant application;

• business plan for the development of the exploitation;

• Centralized table issued by the City Hall, signed by the authorized persons according to the law, (containing the sum of the lease contracts at the date of the Financing Certification), with the rentals for the categories of use;

• other documents demonstrating the right to use the building (lease / concession contract) valid for at least 10 years from the date of signing the financing contract. In the case of works on the building, the act of ownership is mandatory;

• documents required for livestock, poultry and beehives: extracted from the holding register issued by the National Sanitary Veterinary and Food Safety Authority/ Directorate Veterinary and Food Safety Authority/Constituency Veterinary updated at 30 days before the application for funding that results: livestock owned, bird and bee families and the date of first registration of the applicant in the holding, together form the movement National Sanitary Veterinary and Food Safety Authority/ Directorate Veterinary and Food Safety Authority

• the copy of the agricultural register;

• declaration on the income from agricultural activities imposed on income rules (form 221) which is a mandatory document to be submitted when submitting the application for funding;

• Copy of the identity document for the legal representative of the project;

• the current registration certificate issued by the Trade Register Office according to the legislation in force;

• knowledge in the agricultural field acquired through participation in training programs;

• a declaration of responsibility for fulfilling the selection criterion for native breeds / varieties up to the time of the second support payment;

• certificates for registration in the Unique Identification Registry;

• surface declaration;

In the application for financing the project are mentioned the following: details of the location where the young farmer's plant will be built and the economic size of the farm determined on the basis of total standard production.

The installation of the farmer as a manager of a zoo technical farm was carried out in the village of Barateaz, Satchinez commune, Timis County. Satchinez is a commune in Timis County, consisting of the villages of Barateaz and Hodoni. Satchinez is located in the north of Timis County, about 25km from Timisoara. It’s bordered north with Gelu, to the east with Barateaz, Calacea and Carani, southeast with Hodoni, and southwest with Biled.

The project aims at creating a sheep farm of 15300,098 S.O. Standard Output in the town of Barateaz, Satchinez, Timis County.
The economic size of the farm is determined on the basis of Standard Production (S.O. - Standard Output), expressed in euro (Reg. 1.242 / 2008), of the agricultural holding. SO is calculated by multiplying the area, respectively the number of animals on the holding, by the coefficients of each crop and species.
The economic size of the farm is the sum of all S.O. per hectare of crop and per animal head. Total Standard Production excludes direct payments and production costs from calculation (Tiberiu et al., 2013).
The purpose of the investments supported under this sub-measure is to support the setting up of young farmers for the first time as heads / leaders of an agricultural holding.
According to the business plan, the applicant proposes to start a zoo technical sheep farm. Total number S.O. is 15300,098 of which livestock 15090, 53 of which sheep 15090,53.
Calculation of the standard production value is: meadows and permanent pasture 0,8 hectares (261,96 euro per hectares in 2010) resulting in 209,568 S.O. and sheep: lambs, sheep of one year or more for breeding, sheep to be reformed: 299 sheep (50.47 euro / animal in 2010) resulting in 15090,53 S.O. , having a total of 15300,098 S.O. , the support amount being 40000 euros.
So the applicant fulfils the minimum requirements for support:
• falls within the category of micro-enterprises;
• owns an agricultural holding with the size between 12,000 and 50000 S.O. (15300,098);
• has professional skills and competences;
• presents a business plan for the development of agricultural activities within the agricultural and zoo technical holding for which he requests support;
• the applicant will retain his / her domicile in ATU (Administrative Territorial Unit) where the holding is registered;
• the beneficiary has its registered office in administrative-territorial unit where the holding is registered;
• the applicant is not part of a paid job;
• The fulfilment of the business plan will start no later than 9 months from the date of the decision to grant support;
• the applicant undertakes to become an active farmer within 18 months of the end of the installation;
• the beneficiary demonstrates the increase in the economic performance of the holding by marketing its own production at a minimum of 20% of the value of the first tranche of payment;
• the applicant undertakes, in the event that the work is to be employed in the administrative territorial unit in which the holding is registered or in the neighbouring area, including the nearest town, until the end of the monitoring period.
The business plan includes the objectives that the farmer has proposed for the development of the farm and the management of the activities he undertakes.
The Beneficiary falls within the category of eligible applicants under Sub-measure 6.1 - Support for the installation of young farmers, being registered and authorized as an Individual Enterprise in accordance with the provisions of the Government Emergency Ordinance no.44 / 2008, as subsequently amended and supplemented.
The land area of the farm is 0.8 hectares in the area of Barateaz, Satchinez commune, Timiscounty, as it appears in the documents from Agency for Payments and Intervention for Agriculture and the copy of the Agricultural Register, attached to the financing file.
The land is leased for a period of 5 years, the surface is 0.8 hectares representing pastures in the area of Barateaz (http://www.dajtm.ro/).
The farmer owns the following animals: 299 sheep’s for breeding. Which are only one breed, namely turkans.
The process of setting up the young farmer has begun and is under way at the time of Submitting the application, following the following steps:
• registration of the farmer with the Trade Register Office as a micro-enterprise with an activity in the agricultural field;
• submission and registration of financing request accompanied by the business plan and the required documents, as well as the annexed documents;
• the young farmer's installation is considered completed when the business plan is correctly

implemented (when the second instalment is granted);
The business plan specifies the following aspects that the beneficiary must observe:
• the legal form of the applicant is an individual enterprise, and the objective of activity is sheep breeding, according to CAEN code 0145 Breeding of sheep and goats.
• the application is in Timis county, as it appears in the documents from Agency for Payments and Intervention for Agriculture and the copy of the Agricultural Register, attached to the application file.
• the applicant also owns the following animals: 299 sheeps for breeding (Figure 2), these are of one breed, namely turkans.
• the holding was registered at The National Sanitary Veterinary and Food Safety Authority on the name of Cupea Aron, Individual Enterprise (http://old.ansvsa.ro/?pag=599&jud=Timis).
• the detailed fulfilment of the required objectives required for the correct implementation of the business plan: marketing of own production at least 20% of the value of the first support tranche.
• the shelters are provided through the premises at the applicant's disposal, namely: a stable for sheep.

Figure 2. Reproduction of sheep

Thus, in the business plan are mentioned the acquisitions and objectives that the farmer must achieve:
• Increase by 51 sheep, from own breeding until year 2;
• Acquisition of 2 hectares of arable land for the cultivation of alfalfa, cattle feed in Barateaz or neighboring localities, subject to availability;• maintaining the beneficiary's residence in the village of Barateaz, Satchinez commune, Timis county;
• Making a manure storage facility in accordance with the rules in force to avoid infiltration of nitrite and nitrate compounds in the groundwater;
• purchase of a cereal milling mills for the production of sheep feed;
The farmer proposes to sell the lambs, the quantity sold for the minimum number of 6000 euros during the maximum period of 33 months is approximately:
• Second year : 8750 kg lambs;
• Third year : 8750 kg of lambs;
• First year : 7475 kg of lambs;
The shelter is provided through the premises available to the applicant, namely: a sheep stable (Figure 3).
Its technical and functional characteristics are:
• location in the village of Barateaz, Timis county;
• fencing: wooden fence;
• stables area: 400 m^2;
• number of stables: 350;
•stable consisting of: plank walls, fiberglass roof;
The provision of the necessary feed for the animals on the holding is done by purchasing the necessary products from private persons and companies.

Figure 3. Sheep stable

Feeding animals on the holding takes place according to the following prescriptions from the tables 1-4 showed below.
• sheep farming systems: closed system;
• meat processing: outside the farm;
• water system: own water source;
• feeding system: according to the rules;
• waste disposal system: manual and pasture-dependent disposal;
• microclimate assurance: electric lighting and natural lighting, natural ventilation through ventilation holes;
• reproductive animals: artificial sowing;
•medical Assistance provided by veterinary office Satchinez.

Table 1. Daily sheep rates

Flour from hay and alfalfa	12,50	50%
Flour barley	6,00	24%
Sunflower scrap	2,45	9,80%
Wheat bran	2,45	9,80%
Inactive fodder beer	1,00	4,00%
Dicalcium phosphate	0,50	2,00%
Salt	0,10	0,40%
Total	25,00	100,00%

Table.2 Daily Food Quantity

Fodder	Winter	Summer
	Pregnant Sheep's	Sheep's in lactation
Rough	1,5	0
The green table	0	10
Succulents	2,5	-
Nutret concentrate prepared in the household	0,3	0,3
Salt	0,1	0,1
Hay	0,1	0

Table 3. Preparation of concentrated food for lambs

Flour from hay and alfalfa	22,20	55,50%
Flour barley	11,04	27,60%
Sunflower scrap	3,00	7,50%
Wheat bran	2,00	5,00%
Inactive fodder beer	1,00	2,50%
Dicalcium phosphate	0,60	1,50%
Salt	0,16	0,40%
Total	40,00	100%

Table 4. Daily sheep's feed

Fodder	Live weight		
	15-25 Kg	25-35 Kg	35-40 Kg
Green meadows	3,2	4,9	0
Concentrate food prepared in the household	0,3	0,15	1,8

The agricultural products come from 0.80 hectares of meadows and from the acquisition from private persons or companies of cereals, salt, dicalcium phosphate, monocalcic. Starting with year 2, the applicant will cultivate 2 hectares of arable land that he will purchase, with alfalfa to ensure the need for feed for sheep. The crop plan was set up so as to obtain at least the feed base necessary for the sheep on the holding. As a farmer, he will only buy the products he does not produce on his own farm, such as salt, dicalcium phosphate, monocalcic, as well as the cereals needed to feed the sheep.
Sheep processing takes place outside the farm, meat animals (lambs) are sold alive to private persons or companies . Milk will be used strictly for lambs to grow.
The project involves the development of a sheep breeding (299 sheep) in the area of Barateaz, Satchinez, Timis county. With regard to purchases, the beneficiary proposes to pay the price of feed and services rendered by third parties for animal husbandry.
In order to increase farm incomes, the farmer will increase up to second grant with a supplementary number of animals, respectively up to 350 sheep, which will lead to the increase of the number of lambs. The overall objective is to improve the management, to increase the competitiveness of the agricultural sector, to confirm the requirements of environmental protection, hygiene and animal welfare and safety at the workplace, and to facilitate the young farmer

in starting agricultural activities with the grant received.

The specific objective includes the following: increase in revenue in the target year from zero as a result of the increase in production, sale at least 20% of own production of the value of the first grant and manure management according to the environmental norms.

The operational objective is to maintain the residence in rural areas in the ATU where the holding is located.

The principle of agricultural potential targeting the potentially determined areas based on specialized studies: the project is implemented in an area with medium potential for the production of closed meat sheep, processing being made outside the farm.

According to the study of the National Research and Development Institute for Pedology, Agrochemistry and Environmental Protection, Barateaz (Satchinez) is a closed system for processing sheep meat, processing outside the farm in an area with medium potential. The applicant is required to present in the second grant of financing, certificates of origin for 100% of the number of animals in the holding (sheep).

Other objectives proposed by the applicant through the business plan: management of the agricultural holding consisting of planning, organization and control of activities and resources. Consciously a continuous information will help him lead the farm in good conditions, the farmer Cupea Aron will participate in various seminars, exhibitions and conferences in the zoo technical domain.

The financing file also includes a centralized table issued by the City Hall, signed by the persons authorized by law (containing the sum of the lease contracts at the date of the Financing Certification), with the rentals for use categories and documents demonstrating the right to use of the building (lease/ concession contract) valid for at least 10 years from the date of signing the financing contract. In the case of works on the building, the act of ownership is obligatory.

Another stage has been to obtain from the Sanitary Veterinary and Food Safety Directorates the register of animals in the agricultural holding, thus presenting a concrete situation regarding the details of the animals that the farmer possesses.

A copy of the farm records was attached to the financing dossier as well as a statement on the income from agricultural activities imposed on income rules (Form 211), a mandatory document necessary to be presented.

Other necessary documents were: the certificate of registration issued by the Trade Register Office according to the legislation in force, the diploma certifying the agricultural knowledge gained through participation training programs, a declaration on own responsibility regarding the fulfilment of the criterion of selection regarding the local breeds /varieties up to the moment of granting the second support tranche, certificates for registration in the Unique Identification Register and a statement of the surface.

These are all the documents that the beneficiary needs in order to obtain the unbleamed financing under the sub-measure 6.1 Installation of young farmers.

CONCLUSIONS

The development of rural space is an activity of vital importance for a country, both through the size of the rural area, expressed by the area it owns, and by the share of the employed population in various activities.

European legislation defines rural space as the territory consisting of agricultural space for crops and livestock farming, non-agricultural areas and people living in this environment.

Young farmers are given opportunities to set up agricultural farms or to develop them by accessing the European non-reimbursable funds or a percentage of co-financing of the project by the beneficiary.

Accessing European funds by farmer Cupea Aron was a success. The farm set up by the beneficiary brings profit, the business figure being rising from the month to the month. All this was not possible without accessing European grants, so the program achieves its goal through the economic development of the rural area.

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EXECUTION OF A SPECIALIZED STUDY IN ORDER TO DRAW UP THE DOCUMENTATION FOR THE REALIZATION OF THE PASTORAL ARRANGEMENT IN VARADIA COMMUNE, CARAS - SEVERIN COUNTY

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Abstract

The permanent meadows in our country have a spread of about 4.9 million hectares, Romania occupying the fifth place in Europe after France, Great Britain, Spain and Germany. The meadows in our country, which represent 33% of the agricultural area, constitute a part of the national wealth, which is of major importance for the size of the foraging resources and their quality, as well as for the other functions having a beneficial effect on the protection and the beauty of the environment. Meadows are an essential element of sustainable farming systems, whichmeet the demands of healthy and high-quality food. In addition to the decisive role of providingfeed foranimal feed, meadows have an important role in rural development and the reflected environment through: conservation of biodiversity, improvement of soil fertility, symbiotic fixation nitrogen, hydrological balance, prevention of floods and landslides, carbon sequestration, landscape quality and important cultural heritage. Sustainable development is a complex process that runs through and below human intervention, aimed at the development of society, its materialization being based on the fact that the sustainable development of the whole is ensured by the sustainable development of to each part of human activity. Management of the meadow belonging to a locality is the way in which the management of a meadow is ensured, and the organization and exploitation of the permanent meadows (according to Government Emergency Ordinance – OUG No. 34/2013), respectively (O.U.G. no. 34/2013). The guidelines for optimal management of different types of pastures are also dependent on the specific objectives and their main points are: timing and cutting technique, number of grazing animal feed per hectare in different types of meadows, chemical impurities depending on the type of soil , the presence of weeds or invasive species.

Key words: *settlement, management, animals, production, shepherd.*

INTRODUCTION

The study for the realization of the pastoral arrangement includes the presentation of the issues under all the relations that concern the pastoral economy and presents the possibilities for improvement of the meadows throughout its validity.
It contains a specialized technical-scientific documentation for the elaboration of prospective plans in relation to the actual production possibilities of the pastoral fund. The way of management of the meadows belonging to a locality is the way in which the management of a meadow, namely the organization and exploitation of the permanent meadows (according to the Emergency Ordinance of the Government – OUG No. 34/2013), is ensured.
All problems and their solutions will have to be included in the "pastoral plans" of the permanent meadows, as well as by the local public administration's compliance with the obligations stipulated by the law in this field
In Romania, the legislation on the use of pastures is represented by the Law (OUG) no.34 / 2013, in which the areas cannot be reduced and they operate only on the basis of a management plan. Also very important for farmers, the rental period is 7 to 10 years,

which creates an increased responsibility for farmers and also gives them the opportunity to use the funds received through APIA to increase soil fertility and fund management pastoral as his own.

Pasture management and the environment are now integrated into rural policies in Europe. Meadows are an essential element of sustainable farming systems that meet the demands of healthy, high-quality food demand. In addition to the decisive role of animal feed, meadows has an important role in rural development and the environment, reflected by: biodiversity conservation, soil fertility improvement, symbiotic nitrogen fixation, hydrological balance, flood and landslide prevention, carbon sequestration, landscape quality and important cultural heritage.

For these reasons, proper management in mountain pastures is important for maintaining a continued use of this ecosystem to provide a source of life in rural communities. Permanent meadows are very important, they have been part of traditional farming for a long time. In the last ten years, Romanian farmers, for the purpose of applying correct forms of meadow and animal feed management, are looking for financial support from the European society. The partnership between agriculture and nature protection has to face many challenges related to meadows management (Barliba, 2011).

MATERIALS AND METHODS

The pastoral arrangement aims to apply correct management of meadows administered by the U.A.T. Local Council. Varadia, this is a multifunctional objective that ensures elements such as:

-applying a proper management practice, eliminating under and over grazing,

- the elimination of continuous grazing that causes erosion processes, soil shedding, green mass production depreciation and lowering of the quality;
- stopping the proliferation of non-fodder species, weeds, invasive and toxic species;
- stopping the growth of shrub vegetation;

-stopping erosion processes;

- increase of pastoral value of meadows, increase in production and load with UVM / ha;
- increasing the welfare of rural communities in the high and pre-mountain hills where the main source of income is agro-zootechnical.

From an ecological point of view, a rational and controlled exploitation of these meadows leads to an increase in the biodiversity of the vegetal carpet and the protection and soil degradation.

The meadows surveyed were located in the Varadia and Mercina localities, located in the South-West of Caras-Severin County, on the border with Serbia, on the banks of the Caras River. In the commune it enters a secondary road, which departs from the road Timisoara-Oravita, near the village of Greoni (www.primariavaradiacs.ro.).

Varadia commune covers an area of 7345 ha, of which 6499 ha represents the agricultural land (Figure 1).

Figure 1. Orthophotomap

The area of the commune falls into the Oravita depression, which is the southernmost low relief area on the Carpathian region of the western part of the country, being a hilly and flattened region, mainly on the river basin of the Caras river.

From climatic point of view, it is temperate-continental moderate with an average annual temperature of 11.5°C and the average multiannual precipitation value is 680.00 mm (Meteorological Station Varset, Serbia) oscillating according to the relief, with lower values in the meadow area and higher in the piedmont hills.

(https://sites.google.com/site/comunavaradia/)

The climate of Varadia commune corresponds to the phytochemical area in which, with determined Mediterranean local influences, both the circulation of hot air masses coming from the South (Mediterranean) and the geomorphological units (usually slopes with different degrees of inclination and exhibitions miscellaneous).

The commune's area is located in the Forest Area, below the sessile area. The Quercus robur and the quercus frainetto predominate in the meadows and the lower fields and Quercus petraea (sessile) on the higher terrains (Bostan et al., 2014).

The characteristic note in all forest remains is the presence of thermophilous species, among which Tilia tomentosa (lime). There are also species such as Fraxinus excelsior (lime) Fraxinus excelsior (ash) si Fraxinus ornus (flowering ash), Acer campestre (maple) and Acer tataricum, Pirus piraster (wild hair) Cerasus avium (Cherry tree) Rosa canina (brier) Prunus spinosa.

On some eroded verses and on skeletal soils there are species such as Ailanthus glaudulosa, Botriochloa ischaemum, Poa pratensis, Fragaria viridis (strawberries).

The meadows are developing associations Agrostis capillaris (the grass of the field), Elymus asper (lyme grass), Botriochloa ischaemum, Cynosurus cristatus, Festuca pratensis (fescue), Xeranthemum annum, Setaria glauca, Rubus caesius (blackberry), Cirsium arvense (pelamid), Cynodon dactylon (thick pir).

Altitude, exhibition and slope of U.A.T. Varadia, are rendered according to the Amenajistic Meadow Units, being between 95-115m high, with predominantly south-western exposure and 1-3% line slopes (Figure 2).

For the floral characterization of the meadows the phytosociological (geobotanic) method and the double meter method were used to determine the production and loading with the animals. Repeated mowing method was used in pasture cages (Dragomir et al., 2005). Determination of pedo-agrochemical characteristics of soils for meadows in order to establish the fertilization plan was carried out by OSPA Timis.

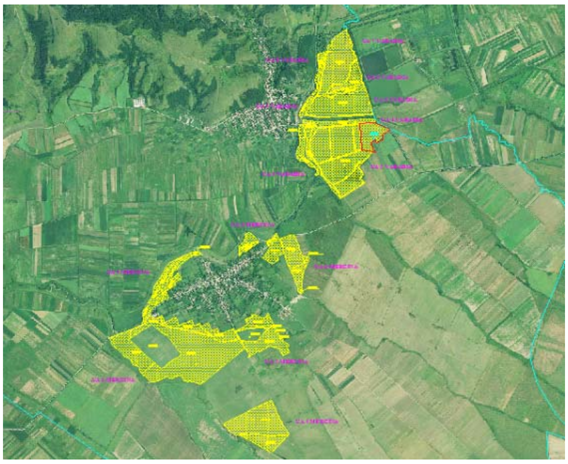

Figure 2. U.A.T. Varadia parcels of settlement

Each of the two methods used is designed to analyze, identify and rank plant associations as fundamental units of the vegetal carpet and is based on the use of a digital scale of visual appreciation of abundance. Stages of application: land recognition, location of reveals, determination of surface size, observation.

The essential part of the lifting is the elaboration of the floral inventory, or the phytosociological report, which, besides the list of species encountered, must also reflect the structural features of the vegetation expressed in percentage or by the use of conventional numerical scales.

The collection of data to identify the different types of plant communities (associations) was envisaged, in this sense phytosociological study methods (geobotanic method and double meter method) were used.

The vegetation analysis aims at identifying the influence of abiotic factors, but also the evolution of vegetation in terms of anthropogenic influence, namely the management of exploitation and the presence or absence of care work on the respective surface (Marriott et al., 2004).

The way of management of a permanent meadows area influences the direction of evolution of the floristic structure and its vegetation dynamics.

RESULTS AND DISCUSSIONS

On the UAT meadows surface Varadia is practiced grazing continuously and extensively free type. It has not been observed on any of the meadows surfaces the realization of rational pasture (by rotation) on parcels clearly delineated by conventional or electric fences. Also, no grazing has been observed that respects different lunar times for restoring the vegetal carpet.

Continuous (free) grazing - according to this system, the animals are allowed to grazing in spring pasture until late autumn, so-called selective grazing is practiced.

The practice of this system is associated with areas where green mass production is small, unevenly distributed over grazing cycles; the summer drought period leads to a decrease in production in cycles three and four.

Under the current conditions, from the meadows vegetation study, we do not recommend parcels through permanent fencing due to fragmentation of the terrain, the incline of the sea, and the production of meadows is too small to justify economically.

However, in the next few years, after all the meadows improvement works are done, some meadows with flat land conformation can be traced back to a rational pasture (Figure 3).

Figure 3. UAV View of the area

Practicing rational pasture by the division of pasture bodies into plots (8-12 parcels), delimited with an electric or permanent fence. Where this is not possible, we recommend practicing a rational grazing without straining, using the natural boundaries (forest ridge, canal, access roads) as parcel limit. Returning on the same surfaces after a period of 25 -30 days.

Grazing with the animals in front by a shepherd that allows them to advance only to the extent of sufficient planting.

Herd management on a certain route, which changes from time to time, so the animals are not in the same place, but grazing on different places on the same day and on other days.

Thus, U.A.T. permanent meadows Varadia located in the subcolinated Plain area according to the "Classification of the meadows in Romania" (Marusca et al., 2014) ,are located in the immoral area, Subsoil of oak forests, thermophilic submesophiles, spreading in the low and high plains of Muntenia and Oltenia, pine monks in Banat and Crisana, at altitudes between 100 - 200 m, these meadows are installed on loessoid deposits, clays, gravel, T = 9 - 10,5oC, P = 500 - 700 mm Hg, on soils of the clay-clay chernozem type (Samfira e al., 2011).

In the case of these meadow areas, the following meadow types and subtypes have been identified and classified according to the methodology in force:the series of meadows - Festuca valesiaca, Festuca rupicola (West of Romania), the dominant type of meadows is Festuca valesiaca + Festuca rupicola, subtypes of meadows Festuca rupicola + Agrostis capillaris + Botriochloa ischaemum, meadow, has a width that varies between 20 m in the East and 900-2000 m, in the West part of the territory, to this formation is added the meadow of the Mercina river, relatively narrow, even if at the confluence with the river Caras is width somewhat larger, ranging from 100 to 200 m.

Thus, U.A.T. permanent meadows Varadia located in the meadow area according to "The typological classification of the meadows in Romania" (Samfira et al., 2007), are classified as meadows and depressions, spreading in the Romanian Plain (Buzaului, Ialomita), Siret Alluvial Plain, Western Plain (Banat, Crisana), Plateau of Moldavia, local in Transylvania, alluvial soils, vertisols, salinized or leached, solonts and aquisalids, on surfaces of 50000 ha.

In the case of these meadow areas, the following meadow types, types and subtypes have been identified and classified according to the methodology in force: Meadows series: Dechampsia caespitosa - Puccinelia limosa, dominant meadows type Festuca arundinacea + Beckmania eruciformis, Festuca arundinacea subtype + Botriochloa ischaemum + Beckmania eruciformis.

Table 1. The main types of permanent meadows of U.A.T. Varadia and their bonitation through Pastoral Value

Nr. crt.	Nr. tarla	Nr. parcell	Meadow type and subtype/ Pastoral Value	S ha
1.	Ps 1102	30411	Types of meadows: Festuca arundinacea + Beckmania eruciformis, Subtypes of meadows: Festuca arundinacea + Botriochloa ischaemum + Beckmania eruciformis. VP = 47,36	3.07
	Ps 101	30407		0.88
	TOTA L UA1 VARADIA			3,95 ha
2	Ps 101	30408	Types of meadows: Festuca valesiaca – Festuca rupicola, Subtypes of meadows: Festuca rupicola + Agrostis capillaris + Botriochloa ischaemum VP = 42,15	1.60
	Ps 1102	30400		2.98
	Ps 1108	30399		9.02
	Ps 1107	30401		45.32
	TOTAL UA 2 VARADIA			58,92 ha
3.	Ps 100	30406	Types of meadows: Festuca valesiaca – Festuca rupicola, Subtypes of meadows: Festuca rupicola + Agrostis capillaris + Botriochloa ischaemum VP = 42,15	4.06
	TOTAL UA 3 VARADIA			4,06 ha
4.	Ps 98	30409	Types of meadows: Festuca arundinacea + Beckmania eruciformis, Subtypes of meadows: Festuca arundinacea + Botriochloa ischaemum + Beckmania eruciformis. VP = 47,36	1,28
	TOTAL UA 4 VARADIA			1,28 ha
5.	Ps 98	30404	Types of meadows: Festuca valesiaca – Festuca rupicola, Subtypes of meadows: Botriochloa ischaemum + Thymus zygoides + Calamagostris villosa, VP = 67,16	21.27
	Ps 95	30405		2.15
	TOTAL UA 5 VARADIA			23,42 ha
6.	Ps 95	30402	Types of meadows: Festuca valesiaca – Festuca rupicola, Subtypes of meadows: Botriochloa ischaemum + Thymus zygoides + Calamagostris villosa, VP = 67,16	5,84
	TOTAL UA 6 VARADIA			5,84 ha
7.	Ps 93	30403	Types of meadows: Festuca valesiaca – Festuca rupicola, Subtypes of meadows: Botriochloa ischaemum + Thymus zygoides + Calamagostris villosa, VP = 67,16	21,85
	TOTAL UA 7 VARADIA			21,85 ha
8.	Ps 93	30410	Types of meadows: Festuca arundinacea + Beckmania eruciformis, Subtipul de pajiste: Festuca arundinacea + Botriochloa ischaemum + Beckmania eruciformis. VP = 47,36	2,18
	TOTAL UA 8 VARADIA			2,18 ha
9.	1260	30425	Types of meadows: Festuca valesiaca – Festuca rupicola, Subtypes of meadows: Agrostis capillaris + Botriochloa ischaemum + Lolium perenne VP = 58,16	6.89
	1262	30422		21.35
	TOTAL UA 1 MERCINA			28,24 ha
10.	Ps 1283	30182	Types of meadows: Festuca valesiaca – Festuca rupicola, Subtypes of meadows: Agrostis capillaris + Botriochloa ischaemum + Lolium perenne VP = 58,16	10.19
	Ps 1277	30181		4.77
	Ps 1274	30179		4.87
	Ps 1279	30420		0.08
	Ps 1281	30417		0.03
	Ps 1281	30421		0.21
	TOTAL UA 2 MERCINA			20,15 ha
11.	Ps 1273	30185	Types of meadows: Festuca valesiaca – Festuca rupicola, Subtypes of meadows: Agrostis capillaris + Botriochloa ischaemum + Lolium perenne VP = 58,16	4.71
	Ps 1287	30180		1.42
	Ps 1287	30183		4.82
	Ps 1265	30174		51.08
	Ps 1265	30173		12.00
	TOTAL UA 3 MERCINA			74,03 ha
12.	Ps 1049	30418	Types of meadows: Festuca arundinacea + Beckmania eruciformis, Subtypes of meadows: Festuca arundinacea + Botriochloa ischaemum + Beckmania eruciformis. VP = 47,36	3.87
	Ps 1049	30419		3.36
	Ps 1231	30423		1.44
	Ps 1231	30424		2.05
	Ps 1231	30426		0.32
	TOTAL UA 4 MERCINA			11,04 ha
13.	Ps 1221	30430	Types of meadows: Festuca arundinacea + Beckmania eruciformis, Subtypes of meadows: Festuca arundinacea + Botriochloa ischaemum + Beckmania eruciformis.. VP = 47,36	0.72
	Ps 1221	30427		2.64
	Ps 1221	30429		0.56
	TOTAL UA 5 MERCINA			3,92 ha
14.	Ps 1197	30416	Types of meadows: Festuca valesiaca – Festuca rupicola, Subtypes of meadows: Agrostis capillaris + Botriochloa ischaemum + Lolium perenne VP = 58,16	0.11
	Ps 1206	30432		3.57
	Ps 1208	30415		0.54
	Ps 1209	30431		7.90
	Ps 1260	30425		4.61
	TOTAL UA 6 MERCINA			16,73 ha

Setting the grazing period:

One of the most important parts of pasture management is the grazing period (Sheath et al., 2001).

Meadow areas can be grazed using the following categories of animals: sheep, goats and cattle, and mowing to produce hay.

The duration of the grazing season for U.A.T. permanent meadows Varadia, must be respected as follows:
For pastures grazed by cattle, grazing will take place over a period of 145-150 days, for the period 1 May to 30 October (it must be concluded three weeks before the first frost days), 180-190 days.
For pastures grazed by sheep, grazing will take place for a period of 145-150 days, for the period 20 April-30 October (it must be completed three weeks before the first frost days) and 190-200 days.
The animal food load on a meadow or the grazing capacity is expressed in UVM (large beef unit) / ha. It is a tool for correlating the actual production of a animal food surface.
The grazing capacity and the optimal animal food load per hectare are calculated, for each Amenajistic Unit, in accordance with the methodology laid down in Order 544/2013, art. 8.
The actual grazing capacity (UVM/ha), depending on the available green meal production, the grass rate and the daily grass consumption during the grazing season (180-190 days).
The grazing capacity was established in accordance with the Guidelines for the preparation of pastoral arrangements and according to the rules of the Ministry of Agriculture and Rural Development, established by Order no. 544/2013 on the methodology for calculating the optimal animal food load per hectare ofmeadows, which entered into force on 28.06.2013.
Determination of grazing load:
For permanent meadows in UA.T. Varadia, Varadia locality comprising UA 2 and UA 3 Varadia, with an estimated available production of 7000 kg / ha green weight, a 90% use ratio, a daily green weight of at least 50 kg / day / 1UVM and the duration 190-day grazing season:
CP = (P.d. x C.f.) / (C.i. x Z.p. x 100),in whichCP = (7000 x 90) / (50 x 190 x 100) = 0,66 UVM/ha/an.
Under the conditions of the value of CP = 0,66 UVM / ha, the number of animals, by species and age categories, which can be planted per hectare of pasture is:
-0,66 dairy cows;
-0,73- 0,80 cattle of all ages;
-2,17- 3,3 young cattle under one year;
-4,90 sheep or goats of all ages;
-0,80 horses of all ages;
-0,91- 0,99 youth cabal;
(Dorin et al., 2002).
To improve the U.A.T. Varadia is recommended to combat unconsumed species of pasture animals, repeated mowing and releasing the land from vegetal remains.
This operation is mandatory after each grazing cycle, and especially before the unwanted species can harvest, thus avoiding their proliferation.
Mandatory, in the spring before entering the animals on the pasture, mowers are cleared.
The fertilization of meadows is done by the following methods: organic fertilizers, by dragging, which represents a way of fertilization of meadows that run directly with animals and with chemical fertilizers.
On the U.A.T. Varadia gassing areas there isn't a water source for animals. Small springs with low flow rates that are dry in dry periods are present. No UAT water drills have been noticed for the animal's water supply. For animal welfare, it is important to ensure water supply on the pasture.
The arrangement depends on the water source. The most appropriate is the use of natural water sources (rivers, springs, wells). It is known that yields from animals are greatly influenced by the quality and quantity of water.
Generally, animals drink plenty of water, the quantities consumed are conditioned by several factors. Thus, the heavier the animals and the higher the milk yield, the more water they consume. Also, water consumption is closely related to the ingested dry substance content. Typically, for 1kg SU ingested, cattle need 4-5l of water, and sheep and horses of 2-3l of water.
When watering is done in rivers, a portion of the river should be arranged where the animals have access without beingendangered by injuries. That portion should be crushed to prevent it.
If water is fed into permanent water gutters from springs, (whose flow must be higher than the water consumption of animals), the site must be paved and laid down with a slope also to prevent landslide.
All gullies (gutters) are also made when watering is made from fountains. When

building water-drinkers, some elements need to be taken into account to ensure that the watering is carried out in good condition and as quickly as possible.
Within the U.A.T. Varadia does not exist for all source water bodies in the form of wells or jungle fountains.
It is recommended to organize water sources by collecting springs or drilling wells on meadows where there is no water source, annual water source check: wells, natural water sources; before the animals enter the pasture, the gutters must be repaired and disinfected; the annual source of water (gutters) serving the lawns; drilling fountains where appropriate.
At each meadow there must be an access road on which automated and mechanized means can circulate in order to perform in the spring-summer-autumn season all necessary transports, including the walking of animals to and from the pasture .
Zoo pastoral constructions are required for staff serving the animals, they can be used to build residential buildings attached to other zoo pastoral buildings, stables, stables, summer camps, huts, or special sanctuaries (Figure 4.).

Figure 4. Zoo pastoral constructions

Such types or models of dwellings or shelters may vary from one floor to another, by area, by the number of people to live in, and by the type and number of animals serving them. It is desirable that such dwellings retain architectural integrity of the local specificity.
Sheepfolds are buildings where milk and cheese are prepared, and where shepherds live during the summer.
The construction is placed near the water source or consider the possibility of bringing water to the sheepfold by piping or drilling fountains. The location of the stall is also linked to the existence of an access way, road or trail. From the sheepfold, as far as possible, be a wide view of the pasture body. The ditch rests with its back to the dominant wind and north or northeast, northwest cellar, because it is necessary in this room to be constantly cool, not to be in direct sunlight. At the sheath and around it a great cleanliness is always required (Tarau et al., 2002).
The activity of the sheep-milking sheepfold is related to the so-called lathe, the milking facility and the separation of the milking sheep from the non-milking sheep.
It is considered that the fixed lathe system is not good because it is too much in one place to completely destroy the vegetation and to grow only the nitrofile weeds.
The lathe must also be moved every other 2-4 days to another place, all the meadows near the stallion being fertilized by dragging, by moving the lathe.
For workers working to improve the meadows, shelters are built, taking into account the number of years in which work will be done with an increased number of workers and the destination to be given shelter (it will remain as such or become a warehouse, shelter for bullocks, bullocks or cows before calving.
Generally, in the plain / hill area, dwellings for humans are not arranged in the meadows, workers working on the meadow in the return to their village homes in the evening. Exceptions are the shepherds who stay overnight with the heard.
The arrangement of the wardrobes, shelters, dwellings and shelters for careers, where necessary and desired, is recommended, redevelopment and disinfection of the stables, summer camps, where appropriate, the setting up of the lathe (for milking purposes).

CONCLUSIONS

This paper presents a model of pastoral arrangement for meadows managed by a Local Council in Caras Severin County, which was built for an area of 275.61 hectares.
For mountain meadows, the most important function is the productive function in a direct relation to the animal food load per hectare, but these functions are related to other aspects such

as: meadows biodiversity management, mountain subsidence, climate change. For these reasons, proper management in mountain pastures is important for maintaining a continued use of this ecosystem to provide a source of life in rural communities.

Over the past ten years, Romanian farmers have been working to implement correct forms of meadows management and increase the guidelines for optimal management of different types of pastures also depend on the specific objectives and have as main points: timing and cutting technique, the number of grazing animal food per hectare in different types of meadows, the chemical imputation depending on the type of soil, the presence of weeds or invasive species such as Pteridium aquilinum, the presence of specific fauna.

The management plan with all its components can further improve the stability of meadow ecosystems, increase plant and animal production and also increase the prosperity of the rural community.

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SECTION 03
CADASTRE

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GRAPHIC ASPECTS OF 3D MAPS PRESENTATION

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Abstract

The paper aimed the rapid development of computer technology over the past decades which allows cartographers to manipulate large sets of high resolution data more or less easily. To generate 3D maps, there are a large number of input indices that influence the map creation process. There are a wide variety of graphical aspects for 3D map authors. In the framework of 3D map generation process, we can distinguish different graphic groups. The graphical aspects of modeling define the basic and semantic object structures in the database, and the graphic aspects of symbolism indicate the appearance of objects in form, color, style and other visual features. Finally, the graphical layout of the layout arranges all settings for the final scene view with the 3D map on different output media.

Key words: *cartography, 3D maps, DTM, computer graphics, visualization, coordinates.*

INTRODUCTION

Today, the availability of digital geo-data is increasing rapidly throughout the world, a trend that undoubtedly will continue for the foreseeable future. Among the large geo-data sets available to cartographers are digital terrain models, as well as accurate topographic and thematic data sets about countless physical, social, and economic phenomena. In addition to their geographic coverage and thematic content, geo-data sets generally are available in vector and raster formats. To complement the growing availability of data, rapid development of computer technology during the last several decades permits cartographers to handle large high-resolution data sets more or less easily (Haeberling, 1999).

Maps and map-related representations, such as perspective representations, are now produced digitally (Figure 1). Digitally rendered work represents a significant advance over the pre-digital era when perspective representations were mainly sketched by hand and printed on paper, and physical 3D models were constructed from plaster and wood.

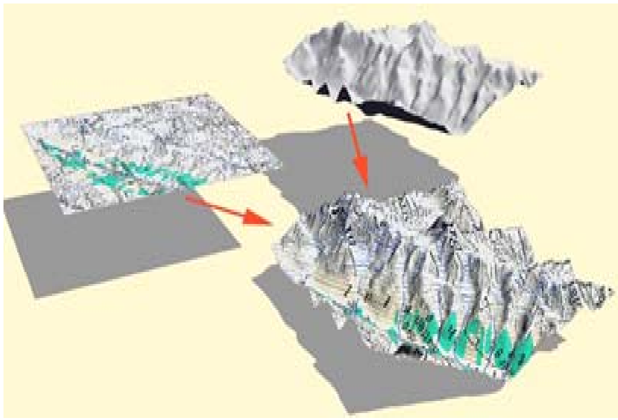

Figure 1. A simple perspective view model (front) made from a rasterised thematic data layer (middle left) and a digital terrain model DTM visualised in 3D (back) (© Federal Office of Topography, Wabern)

MATERIALS AND METHODS

Maps are cartographic products represent the spatial variety of the natural and socio-economic phenomena and present 2 aspects:

- mathematical: scale, map projections, co-ordinate system
- geographical : visualize geo-information

The 3D map is a digital, mathematical defined, three-dimensional virtual representation of the Earth surface, objects and phenomena in nature and society. Represented objects and phenomena are classified, designed and visualised according to a particular purpose.

Disadvantages of 3D maps:

- Higher hardware and software requirements
- Difficulties in 3rd coordinate collection
- Large amounts of data and complex visualization
- Lack of standardized symbol system
- High 3D production price

Advantages of 3D maps:

- Multiple geometric representation
- High realistic representation of the real world
- Photo-realistic buildings and objects representation
- User friendly and easy for understanding models (attractive and more informatively products)
- More applications and users

Contents of 3D maps:

- Main content
- Secondary content
- Additional content

Main content:

- large topographic or landscape objects (Figure 2.)
- roads
- buildings
- geodesic points

Figure 2. Large topographic or landscape objects (relief bodies)

Secondary content traffic signs:

- facilities
- transport elements and information signs (Figure 3)
- trees

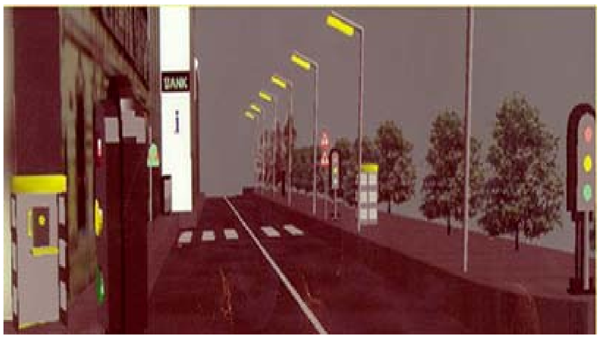

Figure 3. Transport elements and information signs

Additional content:

- quality and quantity information about objects:fence, roof, street, parcel
- created as a textural database (Figure 4)

Figure 4. Basic texture

Sources for 3D map:

- paper topographic or cadastral maps
- photogrammetric or surveying data
- digital 2D map
- topographic information, measurements, architecture drawings etc.
- digital or paper photos (Figure 5)
- 3D symbol system

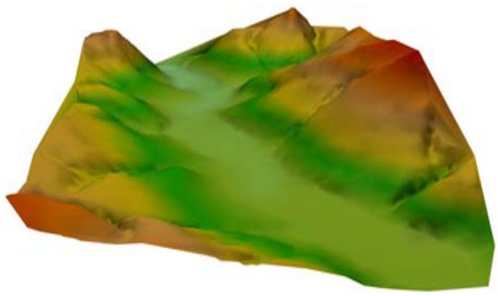

Figure 5. Digital map

Mathematical basis:

- Scale – source 2D paper or digital map
- 2D view in “top”, “front”, “left”, ….
- Perspective projection
- Spatial orthogonal 3D co-ordinate system XYZ (Figure 6)

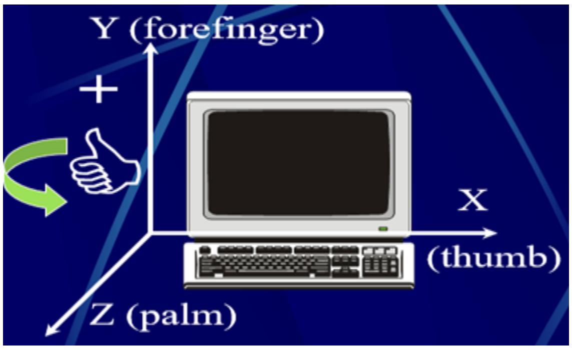

Figure 6. Spatial orthogonal 3D co-ordinate system XYZ (local)

Generalization

- Automatic : formal selection, smooth and filtration, according formal criteria
- Dynamic : for animation presentation and track out the development of the phenomena in the space and time
- Interactive : complex of the traditional, automatic and time generalization

RESULTS AND DISCUSSIONS

The By harnessing geo-data and computer technology, cartographers can create entirely new kinds of perspective representations. These new perspective representations include images and animations presented on two-dimensional media, and true 3D representations that can only be visualised interactively using special equipment (Figure 7). In this paper I will discuss perspective views, the most basic variety of 3D representation.

Figure 7. Perspective view of the Lake of Constance, Switzerland created by draping an orthophoto onto a digital terrain model (Dobler, 2001)

Computer generated perspective views, such as Lake Constance shown in Figure 7, are often simply referred to as "3D maps". Although this term is not found in the cartographic literature, there are specific reasons why it should be used. "3D", because we perceive the presented landscape with our human-perception system in a three-dimensional perspective way, even when the landscape is depicted on two-dimensional media. And, "maps", because these products integrate and display spatially-arranged phenomena on the surface of a DTM in accordance with cartographic symbolisation and generalisation conventions. Nevertheless, although they possess cartographic characteristics, 3D maps should be considered a map-related representation, not a map in the classic sense.

The design process

Before analysing the many graphic cues and resources that influence the look of 3D maps, we should first examine the design process. By doing so, we will have a better understanding of how to apply these cues and resources in the design of 3D maps. We will also understand how they affect overall representation, and how they interact effectively with other graphic cues and resources (Figure 8).

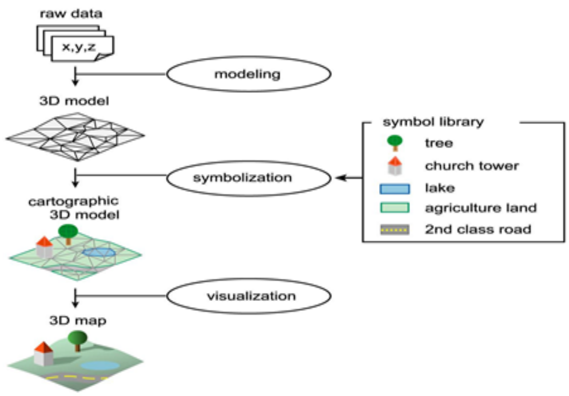

Figure 8. Schematic design process for 3D map (Terribilini, 2001)

The first step of the design process is data modelling. The original data are analysed, and, depending on the circumstances, converted to another format and file structure, upon which subsequent 3D map design processes depend. The geometric and semantic aspects of the objects in the data are reshaped, aggregated, and/or classified in the format required with the specific software used for designing and producing 3D maps. Symbolisation is the next step. This step involves determining the graphic appearance of the DTM section as well as topographic and thematic objects. In other words, we define the legend for the 3D map. It must be noted that a physical image has not yet been created at this stage of the design process. The last step is visualisation. Parameters are chosen for creating the image and completing the scenery that will become the final 3D map.

General considerations on graphics

For generating 3D maps, there are a great number of input cues that influence the map creation process (Kraak, 1988). Taken together these cues are known as "graphic aspects" (or "design aspects"). The different kinds of maps and map creation steps require many graphic aspects to be distinguished by cartographers. Graphic aspects are groups of parameters that exert different effects on the arrangement or appearance of the objects within the map. With them, it is possible to design and control all map features, including how features should appear in the perspective view. Every graphic aspect includes one or more graphic variables. A starting point for understanding graphic variables is Bertin's "visual variables"for graphics and maps (Bertin, 1998). For this discussion, however, it is necessary to enlarge Bertin's list to include sub-variables within variables. A graphic variable is a design factor, which directly affects a focussed map object in a unidimensional way.

Graphic aspects of modelling

Before analysing the first step in the creation process, we must first be aware of the three types of objects the map model is based on:

• DTM objects are normally rectangular sections of a large data set. This data set describes the earth's surface numerically by a huge amount of terrain points.

• Topographic objects may be classic vector objects, external 3D objects, or mostly raster objects, such as textures. Not only single objects, but also object groups with a specific characteristic in their appearance and, perhaps, behaviour. They are the result of aggregation within the modelling process.

• Orientating objects are already defined features that assist the map user with extracting geo-information from the map. They complete the model of a 3D map. For example, co-ordinate lines or labelling objects are absolutely necessary to express the accurate geo-positioning and the notations of map objects.

Regarding the geometric shape of objects, the user has some possibilities to determine the original outlines of the objects in different manners. Simplification of the shape can be accomplished by eliminating vertices or creating polylines instead of curves, or by determining the object's shape for later application of a level-of-detail mechanism. Positioning concerns include whether the object will obey its geo-referenced position or its referenced position in relation to neighbouring objects.

Thematic objects need to be adjusted to facilitate harmonious data classifications. The semantics of objects is yet another consideration in the modelling process. Changing thematic attributes or spatio-temporal dependencies, typically done in an attributes table, connects all objects to the appropriate data base.

Graphical aspects of symbolisation

The best method for determining the appearance of objects within a 3D map can be found within the group of graphic aspects for symbolisation. It is comparable to the map legend creation process on classic (2D) maps. Groups of graphic aspects include:

- aspects for object positioning;
- aspects strongly affecting the graphic appearance within the map;
- aspects responsible for controlling the interactive behaviour of objects, including the behaviour between single objects and groups;
- aspects determining the appearance of orientation features by selecting graphic attributes.

In general, there are millions of possible setting combinations in each group. And every variation within the full range of characteristic has its own effect. The reader will quickly recognise that the first two aspect groups (object position and graphical appearance) match Bertin's list of visual variables.

Position: One of the most important characteristics for geo-related representations is the exact position on earth of every object, including the geographic extent of the landscape being digitally represented. Positioning information could be represented in form of numeric or graphical co-ordinates, either in geographical co-ordinates (latitude/longitude) or a country-specific reference system. In the future, all geo-data must also contain absolute or relative height position for 3D representational purposes. Because 3D terrain occasionally occludes other objects, resetting some position parameters of objects or object groups may be necessary for optimal viewing within the 3D scene.

Shape: The graphic aspect of shape determines the impact of abstraction, generalisation, and the degree of homogeneity within the entire 3D scene.

Size: Choosing the proportional parameters of an object changes the character of the object itself. For example, by simply adjusting vertical exaggeration, a landscape can be made to appear flat or dramatically mountainous (Figure 9).

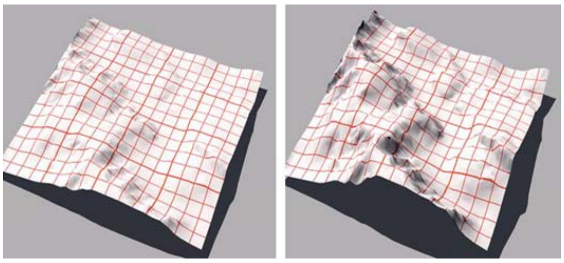

Figure 9. DTM modelled with vertical exaggeration factors: 100% (left) and 200% (right)

Colours and brightness: Cartographers are able to choose the colour and brightness of every object with thousands of variations (Figure 10). Today, thanks to sophisticated software, map aesthetics are no longer dependant on the manual skills of the map's author – although good design sense remains an essential prerequisite.

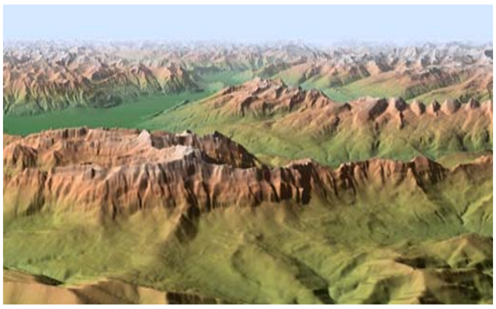

Figure 10. A panorama of the Säntis mountains, Switzerland, created from coloured hypsometric tints applied to a DTM (Atlas of Switzerland, 2000)

Thanks to digital technology, today's cartographers have a wide variety of textures and patterns to choose from in designing the surface of objects.

Textures and patterns: Can be created by simply draping raster images on the objects, or they can be produced using sophisticated computer techniques such as bump mapping or fractalising (Figure 11).

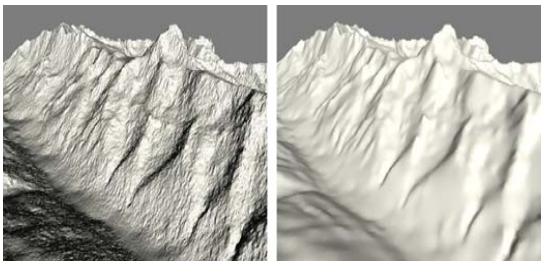

Figure 11. DTM modelled with different surface structure: high fractal depth (left), smoothed (right)

Orientation: This aspect is the only classic visual variable from Bertin's list. Orientation has minimal importance in the design process of 3D maps, particularly when choosing the orientation aspect of objects and patterns. Because innumerable orientation possibilities exist for viewing a 3D map – determined by adjusting camera parameters in a 3D application – orientation can not be considered a differentiating variable.

Special graphic aspects: The graphic appearance of many objects can be designed with special graphic aspects. These effects are easily created with most of the modern software, although Bertin did not take them into account in his discussions. Among the possible applications, map objects can be given transparent surfaces, which allows objects on the map surface to be seen through overlying elements (Figure 12).

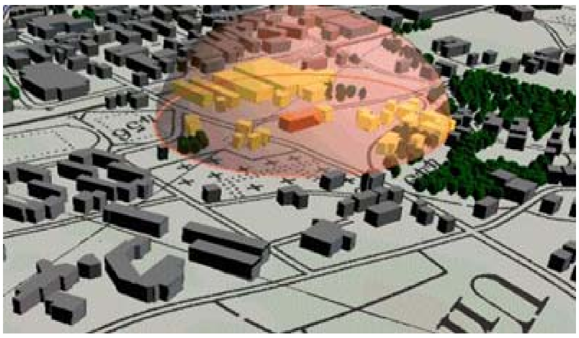

Figure 12. Example of a transparent surface put over a city model, complemented with special effects in colours (Pfund, 2002)

In another possible application, for use with contours and other lines, all line characteristics

– thickness, style, pattern, and amount of smoothing – can be chosen in advance. This technique gives cartographers enormous variety to represent linear or contoured objects (Figure 13).

Figure 13. A portion of the "Mount Hood Visualization" showing differing graphical styles applied to linear vector objects (Dobler, 2002)

Object animations and movements: In interactive and animated map scenes, objects can be modelled and defined by changing graphic or positional attributes. Objects can also easily be created by changing their size or shape. Or they can be determined with changing colours or textures when selected or clicked on screen. Interactive map design is more a question of computer programming and less a methodological or cartographic focus. Only with the advent of modern computer technology, map objects can be set in motion easily. Not only are simple displacements from point-to-point feasible, but other movements such as rotation, which serve to attract the user's complete attention are possible.

Orientation elements

Another category of graphic aspects are orientation features, which we also define by their graphic appearance in the symbolisation process (Figure 14).

Orientation features include:

• Labelling and co-ordinates (the cartographer must decide the type and special appearance of the labelled objects, and it is necessary to determine how we introduce a co-ordinate reference system. Co-ordinates could be displayed in billboards, or with additional numerical notes in information boxes)

• Scale information (information about scale is essential to the map reader. This information can be conveyed by a graphical scale bar or by using subtle measuring tools)

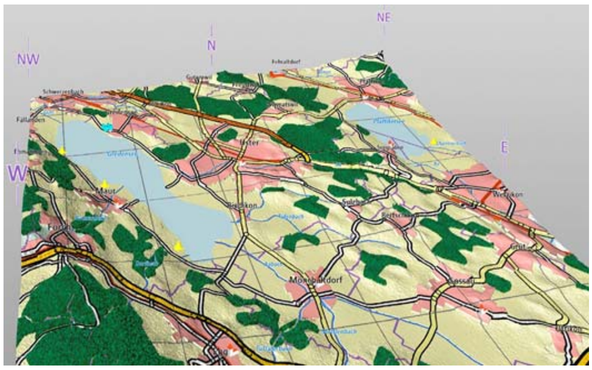

Figure 14. A topographic 3D map of the Greifensee area, Switzerland containing orientation features – labels, compass points, and co-ordinate lines. (Federal Office of Topography, Wabern)

Structuring the model

Together with the choice of projection laws, the cartographer must decide the level-of-detail in a 3D model, which is inversely related to computer processing speed (Figure 15). An implemented mechanism significantly affects the efficiency of the rendering procedures for on-screen display or final image creation.

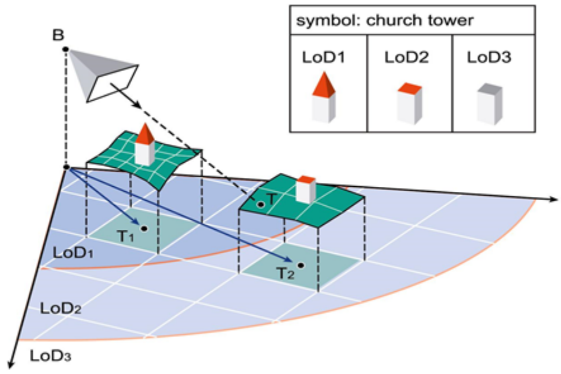

Figure 15. Level-of-detail concept depending on the camera distance (Terribilini, 2001)

Camera settings

In the visualisation process, options or values for the static or moving camera are specified via the input dialogs of the software. Important graphic aspects include the settings for the camera position and the camera geometry.

The actual position is determined by the two plane spatial co-ordinates, x and y, and the height, z. If these values are given in geographical co-ordinates or in a reference specific system for the model, the resulting

position depends on the visualisation system used by the software.
Important: for every 3D representation, the complete set of co-ordinate values must be known to create useful views.To specify camera geometry, it is necessary to fix the viewing direction as horizontal component, the viewing angle (tilt angle) as vertical component, and, of course, the field of view. To complete the geometry elements, we also need to know the position of the target point – in the central perspective mode – and the potential rotation angle along the pitch axis. Finally, although it is not a true camera parameter, usually a magnification factor can be chosen to frame an enlarged portion of the map for rendering.
To move the camera, special dynamic variables need to be considered – for example, the ground speed for positioning or the acceleration and deceleration components of the movement. These settings are important for creating movies and other animations that depict 3D maps.

Lighting and illumination

Lighting and illumination aspect groups offer a large numbers of variations, especially for the representation of scenery (Figure 16).

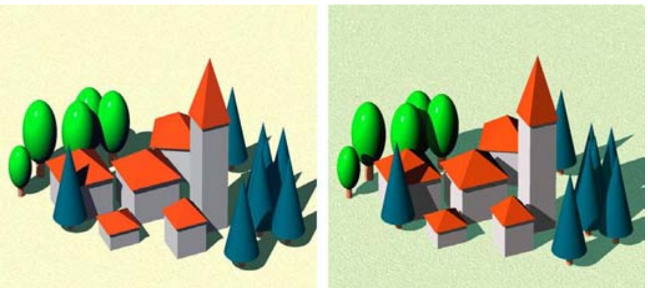

Figure 16. Different effects of light geometry and intensity in a 3D model scene: steeper light incidence and white light (left), flatter light incidence and more yellow light (right)

The type of lighting must be chosen very carefully because of the overall impact on all integrated objects. Whether a model is illuminated with direct light (similar to that of the sun), ambient light, or artificial light (using directional light, spot lights, or reflected light), the effects are entirely different. And, like camera geometry, the light geometry, consisting of position, angle, and direction variables, is an important consideration. The horizontal direction and wave angle of the light beams also influence illumination within the entire map scene. As for bundled light beams, the angle of the cone enables more naturalistic cast shadows of objects in the final rendered image.

Shading and shadows

As mentioned earlier, shading aspects give life to a 3D map. Landscape cognition is strongly influenced by the interaction between lighting and shading. Without the combined effects of light and shadow, and the intermediate shades between these extremes, the 3D scene would not be perceived as virtual landscape. When making detailed views, minor shadows cast by objects and the terrain could have great beneficial impact (Figure 17). The effective appearance of shading in the rendered image depends on different mathematical algorithms. And like the aspect group of lighting, different grades of intensity and sharpness can be used to create more informative and intuitive representations.

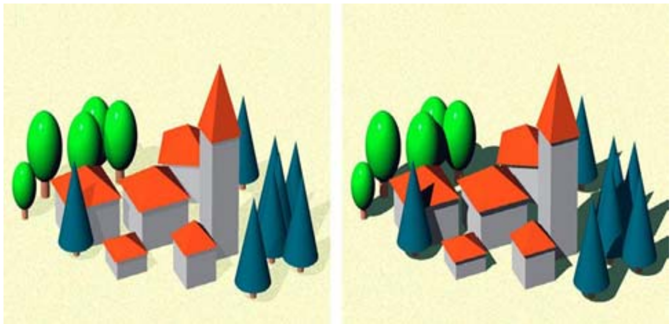

Figure 17. Different effects of shadow modelling in a 3D model scene: cast shadow intensity 10% (left), cast shadow intensity 100% (right)

Atmospheric and environmental effects

The last group of graphic aspects, atmospheric and environmental effects, allows for simulation of atmospheric and environmental effects in 3D visualisations (Figure 18). These effects give us a bridge to perceive 3D maps in a more naturalistic depiction, rather than as an abstracted map representation (Terribilini, 2001).

Figure 18. Section of a topographic 3D map of the Ticino Mountains, Switzerland with integrated atmospheric sky and haze effects (Terribilini, 2001)

CONCLUSIONS

For the authors of 3D maps, a large variety of graphic aspects exist. And, as in the generation process for 3D maps, we can distinguish different groups of graphic aspects. Graphic aspects of modelling define the basic object structures and semantics in the data base. Graphic aspects of symbolisation designate the appearance of objects in form, colour, line-style, and other visual characteristics. Finally, the graphic aspects of visualisation arrange all the settings for the final display of the 3D map scene on different output media (Figure 19). With each graphic aspect, a large number of variables can be differentiated. A specific variable represents a unidimensional input with two or more possibilities of variations. Every aspect with its variables and sub-variables has a different impact on the 3D map. If or how much we consider the single aspect is dependent on the use and the content of the map.
Unfortunately, for map makers today, cartographic theory and principles about 3D map design are almost nonexistant. To create informative and sophisticated 3D maps, design guidelines should be formulated based on cartographic principles and research. Using these guidelines as a starting point, map authors can organise their conceptual thoughts and even drafts for 3D maps. However, the guidelines should not stipulate strict design rules. Every 3D map is unique. The design aesthetics of the map author should not be limited unduly. The aim of 3D map design guidelines is to give cartographers additional stimuli to generate informative and useful representations, ultimately benefiting the map user.

Figure 19. Topographic 3D map out of the Internet application "Mount Hood Visualization" (Dobler, 2002)

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CARTOGRAPHIC ANALYSIS OF MEADOWS FOR IMPLEMENTATION OF A PASTORAL SETTLEMENT

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Abstract

In order to achieve a pastoral settlement is necessary to do an initial cadastral assessment of all land in the category of use, pastures and meadows which are owned by the public and private property .
The cadastral evaluation of the pastoral arrangement took into account the technical works and the existing installations, indicating the place of disposition in stereographic coordinates 1970 and determining the surface of the meadow or parts of the meadow, with the presentation of the name, area, neighbourhoods and boundaries.
Also, for a good approach to the issue of pastoral arrangements, it was necessary to study all the documentation underlying the property right, including the meadow sketch or the cadastral plan.
The division of meadows into lands and exploitation units has been done using the geographic and topographical aspects of the meadows and depending on the access routes and the natural boundaries imposed by the land.
The analysis of altitude and meadows exposure was done using the Global Mapper application by generating the topographical plan on the layout of grasslands and a level curve plan. There has also been a 3D model of the area where UAs are arranged for viewing meadows locations in a mountainous area.

Key words: *meadows, topographic plans, 3D model, UAT, global mapper.*

INTRODUCTION

"Pastoral settlement" means the "documentation containing the technical, organizational and economic measures necessary for the improvement and exploitation of the meadows", in accordance with the grassland management objectives stipulated in the "Methodological Norms for the implementation of the Government Emergency Ordinance no. 34/2013 on the organization, management and exploitation of permanent meadows and amending and supplementing the Land Fund Law no. 18/1991 ", (art.1, lit. a of HG no.1064 11/12/2013).

This paper presents a model of pastoral settlement for meadows managed by a Local Council in Caras Severin County, which was built for an area of 275.61 hectares.

The cadastral evaluation of the pastoral arrangement took into account:

- the documentation underlying the property right, including the meadows sketch or the cadastral plan;
- determining the area of the meadow or the parts of the meadow, with the description of the name, surface, neighbourhoods and borders;
- description of the geographical and topographical situation of the meadow or of the various units where the meadow consists of several portions;
- establishing access routes;
- dividing the meadows into exploitation units and landings for different species;
- the technical works and installations which are used and indicating the location (Barliba et al., 2013).

So far, settlement management has been achieved either through renting / concession contracts to users (individual persons or legal entities registered in the National Register of holdings carrying out agricultural activities specific to the settlement utilization category) or by the management of settlements holders - holders of the right to property. (Ritt, 2002).

MATERIAL AND METHODS

Varadia town is a border village situated in the South-West of Caras-Severin County and is crossed by the county road DJ 573 A which connects the city of Resita with the West side of the county, respectively with Gradinari commune, DN 57 and the town of Oravita (Figure 1).

Figure 1. Varadia locality

The connection to the Varadia commune centre is on the communal road DC 66 and to the village of Mercina on the county road DJ 573 A, which then continues to Iam village.

The village is bordered on the north with Forotic commune, towards the East with Gradinari commune and Oravita town, towards the South is neighbouring the villages Racasdia and Vrani, and towards the West with Serbia. Varadia commune covers an area of 8707 ha, of which 8547 ha represents the agricultural land.

Land balance was made in accordance with the parcel record taken from the Varadia City Hall, drawn up in accordance with the existing topographical basis elaborated for Law 165/2013; the area of permanent meadows under the administration of the Varadia Local Council is 275.61 hectares. This area was also reported to the Caras Severin County Council.

The parcel situation of the meadows included in U.A.T. Varadia for advising on the realization of the pastoral arrangement according (Barliba and Cojocaru, 2010) to the evidence taken from Varadia Town Hall is shown in table 1.

Table 1. The parcel situation of U.A.T. Varadia according to Law 165/2013, Annex 5 (evidence taken from Varadia Town Hall)

No.	No. Cadastre Sector	No. field	Cadastre No.	S -ha-
1	6	Ps 1273	30185	4.71
2	6	Ps 1287	30180	1.42
3	6	Ps 1287	30183	4.82
4	6	Ps 1283	30182	10.19
5	6	Ps 1277	30181	4.77
6	6	Ps 1265	30174	51.08
7	6	Ps 1265	30173	12.00
8	6	Ps 1274	30179	4.87
9	6	Ps 1279	30420	0.08
10	6	Ps 1281	30417	0.03
11	6	Ps 1281	30421	0.21
12	6	Ps 1260	30425	6.89
13	6	Ps 1262	30422	21.35
14	7	Ps 1102	30411	3.07
15	7	Ps 101	30407	0.88
16	7	Ps 101	30408	1.60
17	7	Ps 1102	30400	2.98
18	7	Ps 1108	30399	9.02
19	7	Ps 1107	30401	45.32
20	7	Ps 1221	30430	0.72
21	8	Ps 100	30406	4.06
22	10	Ps 95	30402	5.84
23	10	Ps 93	30403	21.85
24	10	Ps 98	30404	21.27
25	10	Ps 98	30409	1.28
26	10	Ps 95	30405	2.15
27	10	Ps 93	30410	2.18
28	21	Ps 1049	30418	3.87
29	21	Ps 1049	30419	3.36
30	21	Ps 1231	30423	1.44
31	21	Ps 1231	30424	2.05
32	21	Ps 1221	30427	2.64
33	21	Ps 1221	30429	0.56
34	21	Ps 1231	30426	0.32
35	22	Ps 1197	30416	0.11
36	22	Ps 1206	30432	3.57
37	22	Ps 1208	30415	0.54
38	22	Ps 1209	30431	7.90
39	22	Ps 1260	30425	4.61
Total U.A.T. Varadia 275.61 hectars				

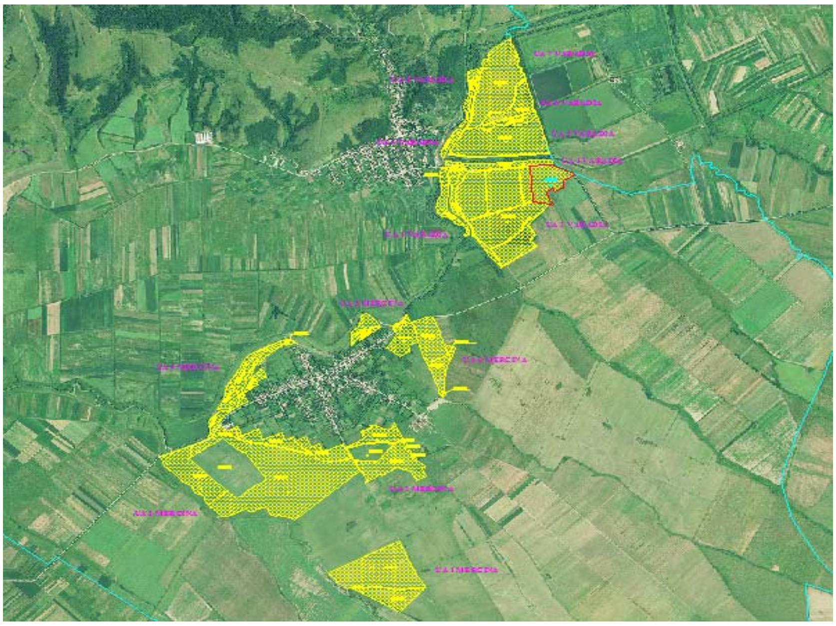

Figure 2. Placing of meadows areas in U.A.T. Varadia, Caras Severin County

The Surface Situation complies with Law No.165 of 16.05.2013 (Annex 5) and has been made available to the working group by Varadia City Hall in DXF format as well as Tabular in Excel format.

As cartographic material for the topographical analysis of the land, cadastral plans from the area and the orthophotomap for U.A.T. were purchased from O.C.P.I. Caras_Severin, respectively the situation of the records made up to the moment of drafting the settlement.

The plans that led to the identification and topographical determination of the meadows are:

- Aero photogrammetric planes of the orthophotomap type edited virtually and updated.
- Topographical and cadastral plans (Leu et al., 2003) and maps purchased from the O.C.P.I. Caras Severin (Figure 2).

The following sections of plans and maps were used on analog and raster support:

- Topographical maps on the scale 1: 50 000: L-34-103-D; L-34-104-C.
- Topographical maps on the scale 1: 25 000: L-34-103-D-b; L-34-103-D-d; L-34-104-C-a; L-34-104-C-c.
- Cadastral plans on a scale 1: 5 000:
- L-34-103-D-b-4-II; L-34-103-D-b-4-IV.
- L-34-103-D-d-2-I; L-34-103-D-d-2-II; L-34-103-D-d-2-III; L-34-103-D-d-2-IV.
- L-34-104-C-a-1-I; L-34-104-C-a-1-II; L-34-104-C-a-1-III; L-34-104-C-a-1-IV.
- L-34-104-C-a-2-III.
- L-34-104-C-a-3-I; L-34-104-C-a-3-II; L-34-104-C-a-3-III; L-34-104-C-a-3-IV.
- L-34-104-C-a-4-I.
- L-34-104-C-c-1-I; L-34-104-C-c-1-II; L-34-104-C-c-1-III; L-34-104-C-c-1-IV.
- L-34-104-C-c-2-I; L-34-104-C-c-2-II; L-34-104-C-c-2-III.
- L-34-104-C-c-3-I; L-34-104-C-c-3-II.
- L-34-104-C-c-4-I.

During the research phase to analyze the U.A.T. Several satellite images processing software was used as well as thematic maps on the studied area, as follows: Global Mapper; ArcGIS, WinGIS;

During the entire process satellite images of the orthophotomap type (with the extension ".tif" and ".sid") made by the Landsat satellite system were used, namely Landsat 5, with a spatial resolution of: 0,8 m panchromatic; 4 m multispectral; 1 m pan-sharp

RESULTS AND DISCUSSIONS

Among the topographic factors, in the study of monitoring the meadow layout units will be recorded the following components:

- **Geographic coordinates** (Latitude / Longitude) determined by GPS, the coordinates being recorded in the WGS84 projection system and converted in the STEREO 70 system (Barliba et al., 2008).

- **shape of relief** - component of the topographic factors, based on the following scale:- plateau.
- **the slope position** of the meadows using the following scale:
- slope base; - the lower third of the slope; - the middle third of the slope;
- the upper third of the slope; - the tip of the slope.

- the slope shape influences the climate regime, mainly by changing the thermal and hydric regime. For its quantification, scales were used on five relief forms, namely:
- concave; - concave-straight; - straight;
- convex; - convex-straight
- **slope** was determined by satellites as well as by plans, by specific tilt-determining programs.
- **the altitude** was determined using rectangular coordinates transposed on orthophotomap. Altimetry processing on topographic planes by specific altitude rendering programs was implemented with the AutoCAD program, respectively TopoLT, from three-dimensional coordinates (x, y, z). The values are expressed in meters, shape 0m being determined by the 1970 Black Sea Stereographic projection and being verified on the ground by GPS (Novac, 2011).
- **the exhibition** was determined on processed plans and is expressed in degrees by cardinal points and intermediate cardinal points with a beach of 15 0.

The administrative unit must not exceed 100 ha, except if there is a UA with the same cadastral number of more than 100 ha;

Analysis of altitude and meadows exposure was done using the Global Mapper application. At the same time, using this application, the layout of the meadows was generated on a topographic plane (Figure 3), on a plane with level curves (Figure 4). After elaborating all the necessary plans, a 3D model (Figure 5) of the area has been made where the UAs are arranged for an overview of the meadows with a view to their location in a mountain area.

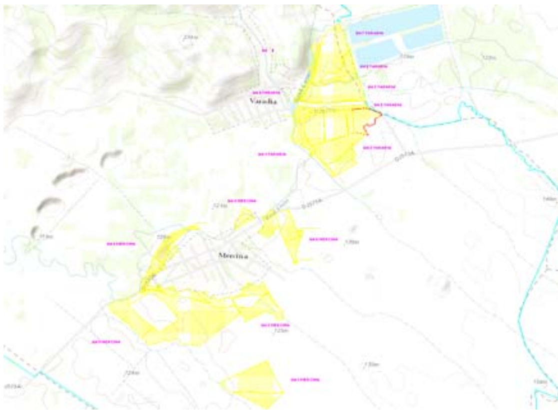

Figure 3. The layout of the meadows on the topographic plane, Varadia locality

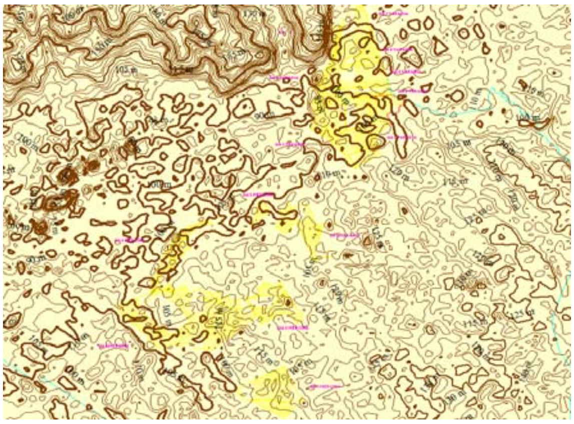

Figure 4. Layout of the U.A.T. Varadia after Level Curves (5 m equidistance)

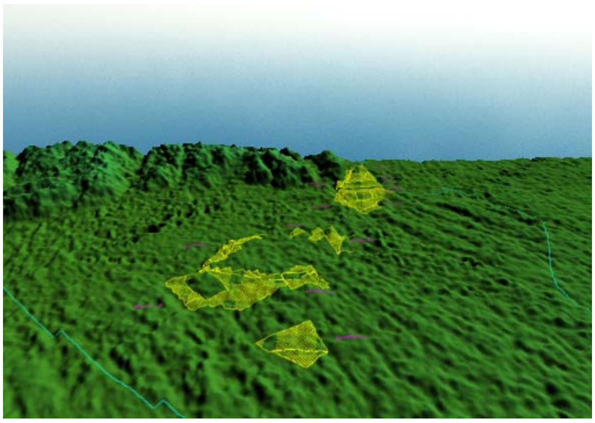

Figure 5. Layout of the U.A.T. Varadia on 3D relief

The parcel composition of the Amenajistic Units (UA-meadows), for Varadia locality is presented. U.A.T. Varadia was made taking into account the natural boundaries of the land and the infrastructure so that each meadow body would be compact. The following table contains (Table 2) the cadastral number, the pasture / meadow area identified by the topographical number and the cadastral sector to which it belongs under Law 165 - Annex 5.

Table 2. Areas centralization of U.A.T. Varadia

No.	Amenajistic Unit (meadow body)	Area hectares
1	UA 1 VARADIA	3.95
2	UA 2 VARADIA	58.92
3	UA 3 VARADIA	4.06
4	UA 4 VARADIA	1.28
5	UA 5 VARADIA	23.42
6	UA 6 VARADIA	5.84
7	UA 7 VARADIA	21.85
8	UA 8 VARADIA	2.18
TOTAL VARADIA LOCALITY 121.50 hectares		
1	UA 1 MERCINA	28.24
2	UA 2 MERCINA	20.15
3	UA 3 MERCINA	74.03
4	UA 4 MERCINA	11.04
5	UA 5 MERCINA	3.92
6	UA 6 MERCINA	16.73
TOTAL MERCINA LOCALITY 154.11 hectares		
TOTAL U.A.T. VARADIA 275.61 hectares		

In this case, a UA1 Varadia meadows block (Figure 6) with an area of 3.95 ha is represented as an example.

In the U.A.T. Varadia, Amenajistic Units (UA) or meadows bodies were numbered with Arabic numerals, downstream upstream, on hydrographical basins and from left to right, in the meadow body constituted according to the following criteria:

- natural limits of land (peaks, valleys), and in the absence of artificial boundaries (roads);
- the maximum permissible surface area of an Amenajistic Meadow Units (UA) is maximum 100 ha. There were no exceeds in our 14 UAs.
- dimensioning of parcels was done only cadastral being taken over after the situation Law 165/2013, Annex 5.

Figure 6. UA 1 **(**meadow body) for VARADIA locality

CONCLUSIONS

The pastoral meadows are compactly arranged, they have been easily identified due to the fact that the land was embanked.

The new assigned cadastral numbers have certain limits in the field, and the field checks made by the survey have shown that the surface of the documents coincides with the real field.

Thus, the realization of this work represents a good management of the pastures in that area which leads to a rational use of the meadows and grazing in the area that will not affect the natural ecosystem. Managing rural activities is a very important factor that contributes to the sustainable development of the area in question and is therefore essential for the city hall and public administration. At the same time, the town hall has a specific situation of the pastures that it owns and can concede pastures to the grazing farmers.

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CREATING A WEB GIS APPLICATION WHICH PRESENTS A TOURISTIC MAP OF TIMISOARA

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Abstract

This paper presents a digitized map of the city of Timisoara based on the exposure of the main locations by adding them to the map with a geographical position (latitude, longitude), a name and a symbol that differentiates them from each other. In addition to the attributes listed above, each point of interest also includes a description that helps platform users find out more. Spatial analysis is the process of examining, modelling and interpreting the results. After spatial analyses, information about a set of geographic data can be extracted or created. Spatial data processing is performed on the basis of algorithms using the special operations of these data categories. In GIS there are four main types of spatial analysis: spatial overlay and continuity analysis, linear analysis and raster analysis. With this spatial analysis feature, GIS software is different from CAD software. Thus, the interactive map created through the ArcGIS Online program is very useful for the city of Timisoara both for residents and tourists, especially as Timisoara was designated the European Capital of Culture in 2021.

Key words*: ArcGIS Online, analysis, GIS, raster, vector, Timisoara.*

INTRODUCTION

The city of Timisoara is situated at the intersection of the parallel of 45 ° 47 ' north latitude, with the 21 ° 17' east longitude meridian, being in the northern hemisphere as a mathematical position at nearly equal distances from the north pole and the equator. The local time of the city (considered by the meridian) is in advance 1h 25' 8" to the meridian time 0, Greenwich, but is late with 34'52" than the time Romania's official time (Eastern Europe Time).
Timisoara is located at an average distance of about 550 km to the capital of Romania - Bucharest and about 170 km to Belgrade and 300 km to Budapest, the capitals of the two neighbouring countries Serbia and Hungary.

The purpose of the paper is to create a mobile web map of the city of Timisoara with various points of interest (eg hotels, monuments, etc.) on the basis of which can be realized and various useful spatial analyses for the tourists who will visit the city of Timisoara as well as for local users. Also, this map will be especially important in the context in which the multiculturalism of Timisoara and the fact it was designated as European cultural capital in 2021 and thus the number of tourists will be steadily increasing.

MATERIALS AND METHODS

GIS is an information system that is capable of owning and using data describing locations on the Earth's surface (geographic data). A GIS is a powerful set of tools which collect, record, transform, and visualize space data of the world (Moscovici et al., 2015).

A GIS must perform the following functions or operations: capture and input of geographic data, geographic data processing, geographic data management (Grecea et al., 2013).

In this paper, to achieve the proposed objectives, were used the GIS solutions offered by ESRI Romania, namely:

- For data organization and preliminary processing was used the Desktop solution - ArcGIS v. 10.5
- ArcGIS Online cloud platform was used to build the GIS Web app (Herbei et al., 2010).

The workflow to accomplish this application is described in the following figure:

Figure 1. Workflow

The most important feature of a GIS and a GIS application is its ability to perform spatial analysis, to process spatial (geographic) data in order to obtain information about the studied area (Barliba et al., 2017).

Spatial analysis is the process of the examination and interpretation of model results. After spatial analyses, information about a set of geographic data can be extracted or created.

Spatial data processing is performed on the basis of special algorithms using the operations of these data categories. (Grecea and Moscovici, 2015)

In GIS there are four main types of spatial analysis: spatial overlay and continuity analysis, linear analysis and raster analysis. With this spatial analysis feature, GIS software differentiates from CAD software (Mason, 2015).

Vector spatial analyses can also be grouped into 4 categories (Herbei, 2015) such as:

- vector analysis based on extraction;
- vector analyses based on overlapping;
- vector analyses based on proximity analyses;
- vector analyses based on statistics.

The ArcGIS Online application is an ESRI-based GIS mapping platform that is stored on the cloud and allows the use and creation of a map, a GIS web application that contain spatial data and layer analysis. Creating the GIS web application is make using dedicated software such as JavaScript and HTML5 that are directly implemented on the ArcGis Online, platform without which the program can't work (Herban et al., 2012).

RESULTS AND DISCUSSIONS

This paper presents a web map of Timisoara based on the exposure of the main locations by adding them to the map with a geographic position (latitude, longitude), a name and a symbol that differentiates them from each other. In addition to the attributes listed above, each point of interest also includes a description that helps platform users find out more.

In order to achieve the interactive map proposed by ESRI's ArcMap application, the following steps were taken:

Step 1

The first step is to acquire on the ground the geographical coordinates of the targeted objectives using specific devices and create a spatial database containing several Microsoft excel files, each file having as attributes name, description, latitude, longitude, website . As shown in the figures below is presented a list of databases containing xlxs (Figure 2). As an example, we presented the contents of the GIS database for transport in Timisoara (Figure 3) and the GIS database for accommodation (Figure 4).

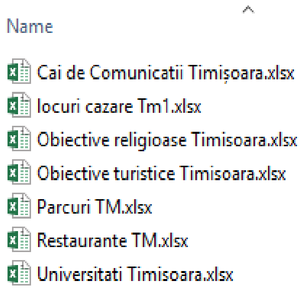
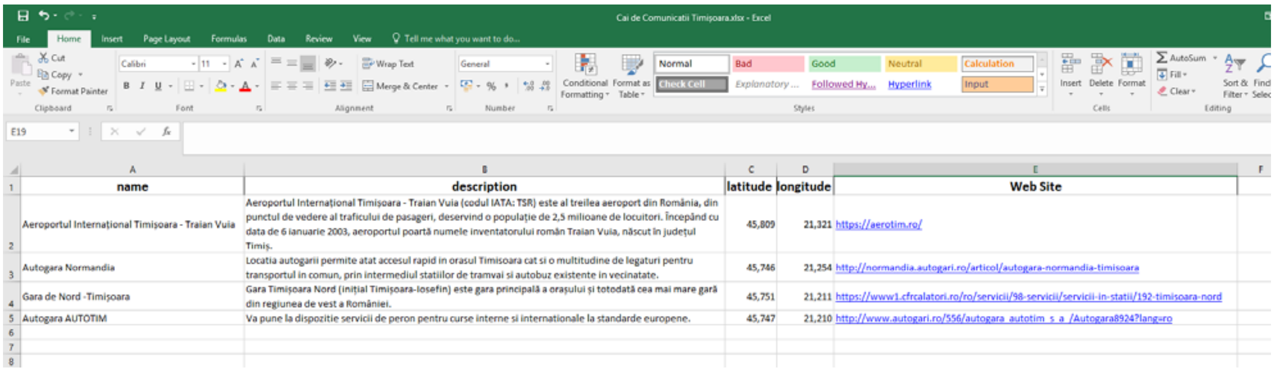
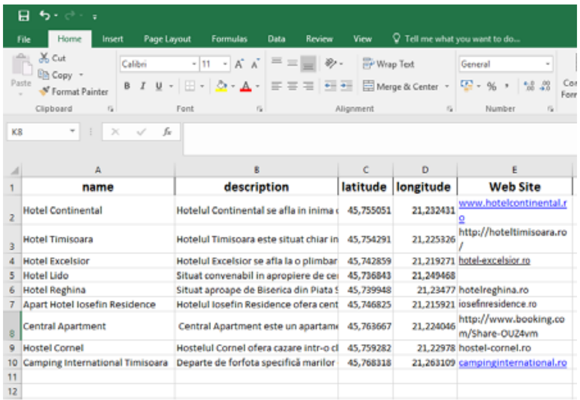


Figure 2. Excel files list



name	description	latitude	longitude	Web Site
Aeroportul Internațional Timișoara - Traian Vuia	Aeroportul Internațional Timișoara - Traian Vuia (codul IATA: TSR) este al treilea aeroport din România, din punctul de vedere al traficului de pasageri, deservind o populație de 2,5 milioane de locuitori. Începând cu data de 6 ianuarie 2003, aeroportul poartă numele inventatorului român Traian Vuia, născut în județul Timiș.	45,809	21,321	https://aerotim.ro/
Autogara Normandia	Locatia autogarii permite atat accesul rapid in orasul Timisoara cat si o multitudine de legaturi pentru transportul in comun, prin intermediul statiilor de tramvai si autobuz existente in vecinatate.	45,746	21,254	http://normandia.autogari.ro/articol/autogara-normandia-timisoara
Gara de Nord -Timișoara	Gara Timișoara Nord (inițial Timișoara-Iosefin) este gara principală a orașului și totodată cea mai mare gară din regiunea de vest a României.	45,751	21,211	https://www1.cfrcalatori.ro/ro/servicii/98-servicii/servicii-in-statii/192-timisoara-nord
Autogara AUTOTIM	Va pune la dispozitie servicii de peron pentru curse interne si internationale la standarde europene.	45,747	21,210	http://www.autogari.ro/556/autogara_autotim_s_a_/Autogara8924?lang=ro

Figure 3. GIS Transport Database in Timisoara



name	description	latitude	longitude	Web Site
Hotel Continental	Hotelul Continental se afla in inima	45,755051	21,232431	www.hotelcontinental.ro
Hotel Timisoara	Hotelul Timisoara este situat chiar in	45,754291	21,225326	http://hoteltimisoara.ro/
Hotel Excelsior	Hotelul Excelsior se afla la o plimbar	45,742859	21,219271	hotel-excelsior.ro
Hotel Lido	Situat convenabil in apropiere de ce	45,736843	21,249468	
Hotel Reghina	Situat aproape de Biserica din Piata	45,739948	21,23477	hotelreghina.ro
Apart Hotel Iosefin Residence	Hotelul Iosefin Residence ofera cent	45,746825	21,215921	iosefinresidence.ro
Central Apartment	Central Apartment este un apartam	45,763667	21,224046	http://www.booking.com/Share-OUZ4vm
Hostel Cornel	Hostelul Cornel ofera cazare intr-o c	45,759282	21,22978	hostel-cornel.ro
Camping International Timisoara	Departe de forfota specifică marilor	45,768318	21,263109	campinginternational.ro

Figure 4. GIS Database Accommodation in Timisoara

Later was performed the conversion of Excel files with XLSX extension into files with the CSV extension (Comma delimited).

The CSV file was created in Microsoft Excel and had the following structure:

name (for name is used name, title, name-short, name-long). Name of the points that are on the map (eg.: Polytechnic University of Timisoara);

description (for description is used description, caption, snippet, comment) - Description of points on the map (eg 5-storey building and attic);

longitude (for longitude is used lon, long, longitude, x, xcenter)

latitude (for latitude is used lat, latitude, y, ycenter)

Website (A hyperlink can be entered for the website) (Herbei and Sala, 2014).

After the file has been reopened, the xlxs file has been saved (Save as ...) with the CSV (Comma delimited) extension.

Then we stored all csv files in a new folder (Figure 5).

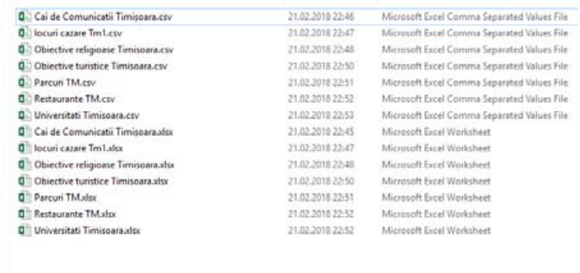


Figure 5. CSV files list

After authenticating on the ArcGIS online platform and opening a new map, were created CSV files as a theme layer (Figure 6). In the main menu of this platform we find a variety of options available for data editing, such as creating labels (Figure 7) or changing the symbols (Figure 8).

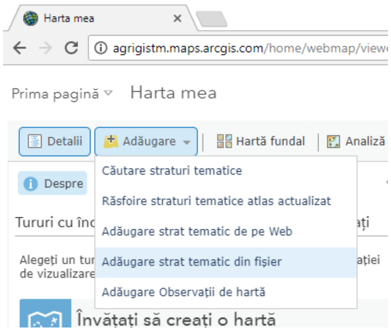


Figure 6. Insert CSV file

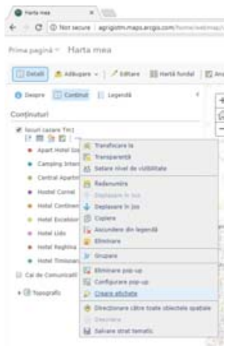


Figure 7. EsriArcMap options

Figure 8. Highlight symbols on the map

In order to a better highlight of the points of interest on the map, the ArcGis online application allows us to enter symbols for each point of interest (Figure 8). For example, for transport locations, you can individually enter a symbol based on its type, namely a plane for the airport and a train for the train station. All of this leads to better mapping for future users (Gridan, 2016).

In the beginning we introduced the specific symbols for the points of interest that includes the terrestrial communication routes, namely, the airport was symbolized by an airplane, a railway station with a train and, respectively, bus stations with a bus (Figure 9). This makes it easy to differentiate between them and helps many users to recognize those points at first sight without reading their name or description (Herbei and Nemes, 2012).

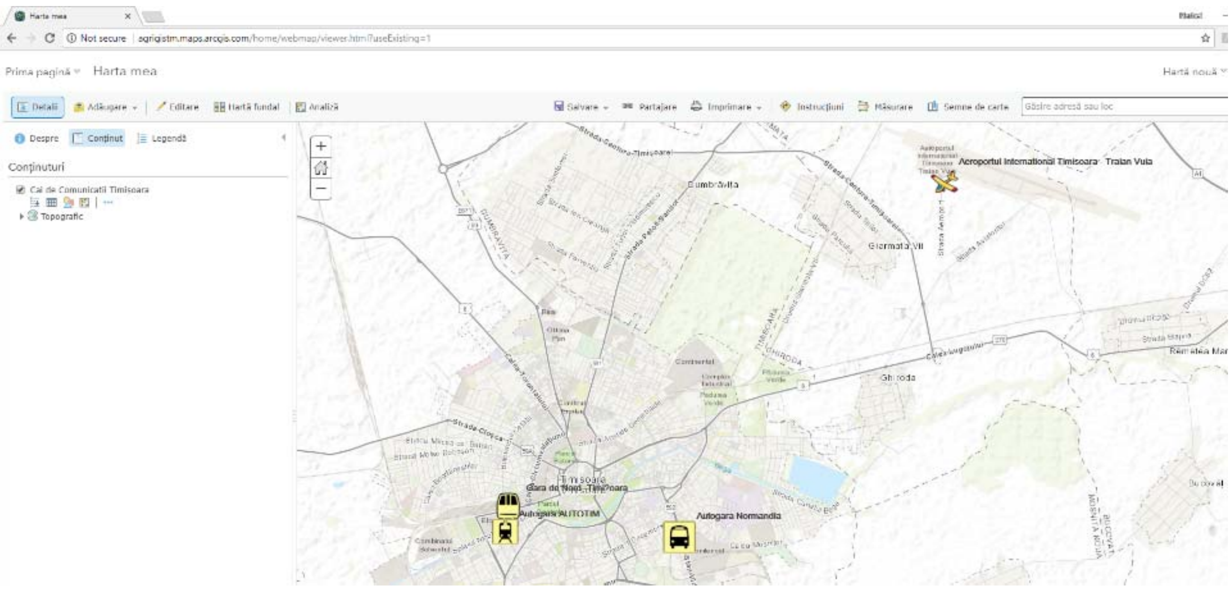


Figure 9. Examples of transport related symbols

Afterwards, an overall view of the city was achieved by zooming in on all the important points (universities, restaurants, terrestrial communications, religious objectives, landmarks) on the map created in ArcGIS Online (Figure 10).

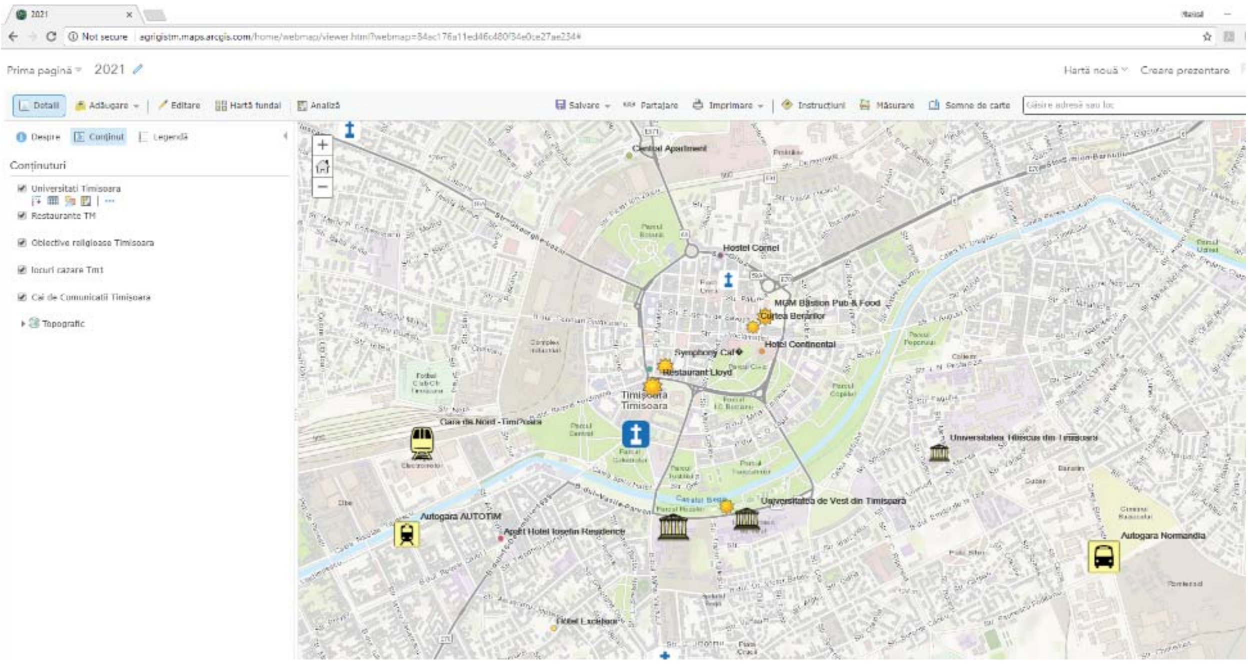


Figure 10.General map of Timisoara

The images below show how the app allows us to display only a category of points of interest such as universities (Figure 12) or restaurants (Figure 11).

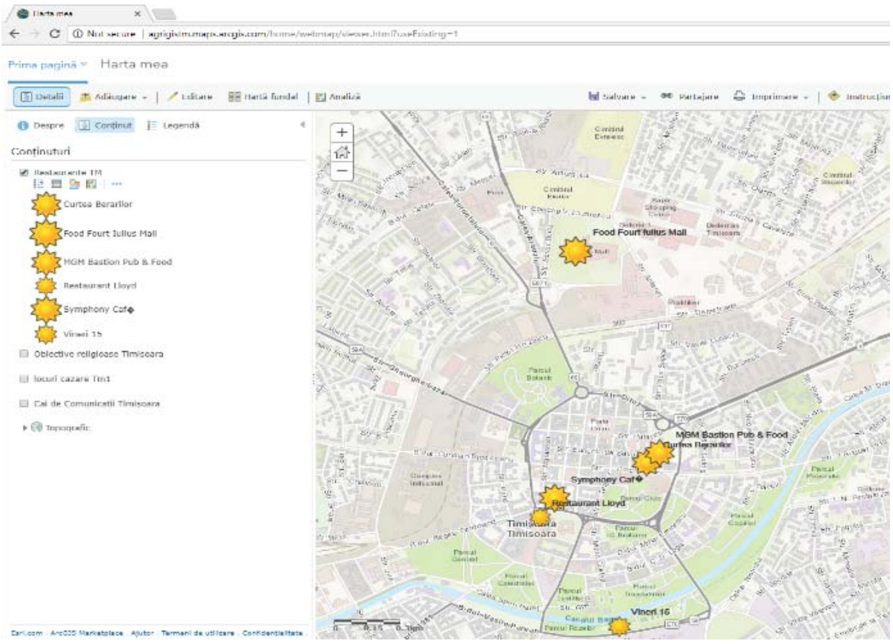


Figure 11.Highlights Restaurants & Pubs

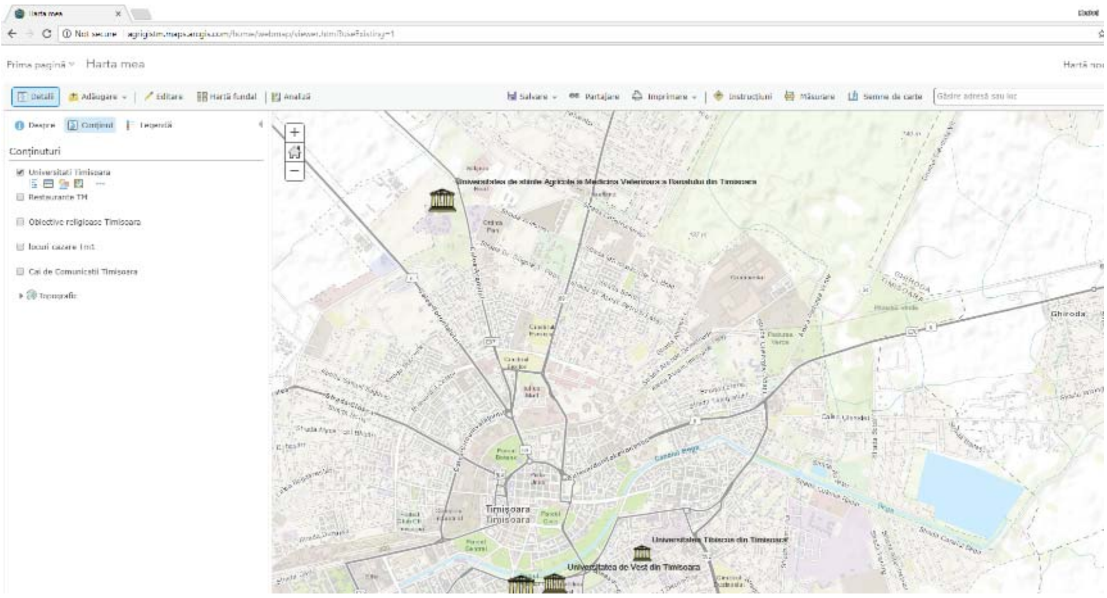


Figure 12.Highlights Universities

Each point of interest is based on multiple attributes and can be accessed by users by clicking on the icon. Thus the app opens a new window where information is presented including the description of the object and the geographical coordinates. (Figure 13).

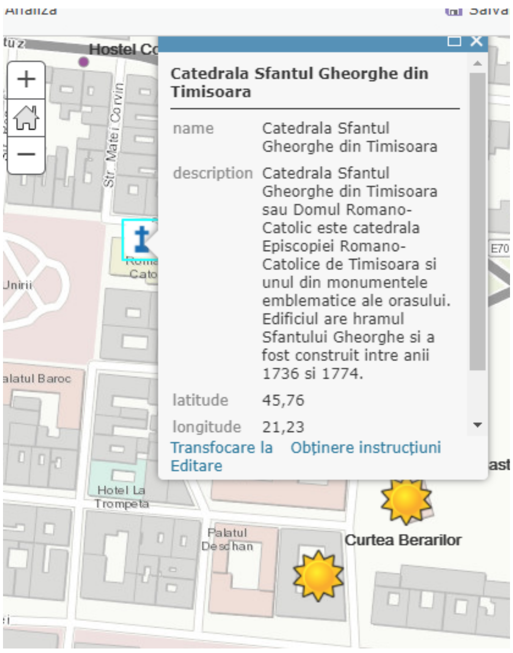


Figure 13. Point of Interest Information

Step 2

The second step presented in this paper is exemplified by spatial analysis. It is possible to highlight routes between 2 points of interest (on foot and by car with time display) as well as buffer analyses by which the locations near a target point can be determined having a distance entered by the user (Figure 14).

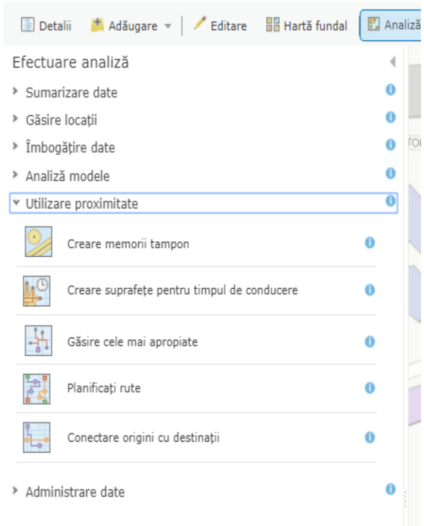


Figure 14. Spatial analysis menu

To begin with, we showed a spatial buffer analysis by looking for other points of interest within 0.5 km of the Metropolitan Cathedral (Figure 15). All these analyses can be of great help to the public institutions, including to the city hall, and so they can locate and verify the legality of the location of these points of interest. In this case, there is a about the symbolic cathedral in the city and are some restrictions for neighbouring buildings (such as high volume music in nearby pubs, so the city hall can easily verify these aspects with this application.)

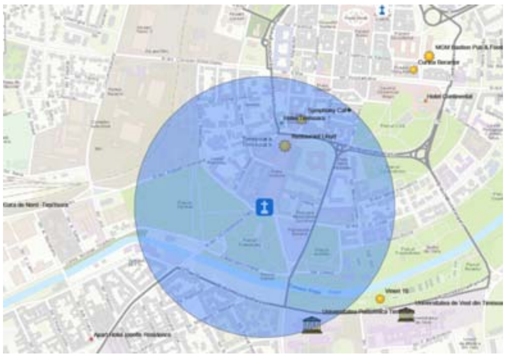


Figure 15. BUFFER analysis to the Metropolitan Cathedral

Another example is the proximity analysis that we have highlighted through the closest ways to reach the places of accommodation and I took as an example North Train Station, Autotim Bus Station and Normandia Bus Station. Thus, the closest accommodation places for Normandia Bus Station are Hotel Lido and Hotel Reghina; to the North Train Station being Hostel Cornel, Hotel Timisoara and Hotel Continental; to the Autotim Bus Station is ApartHotelIosefin Residence and Hotel Excelsior (Figure 16).We have also created some routes created by us through the "Plan Route" interface in the ArcGIS Online (Figure 17).

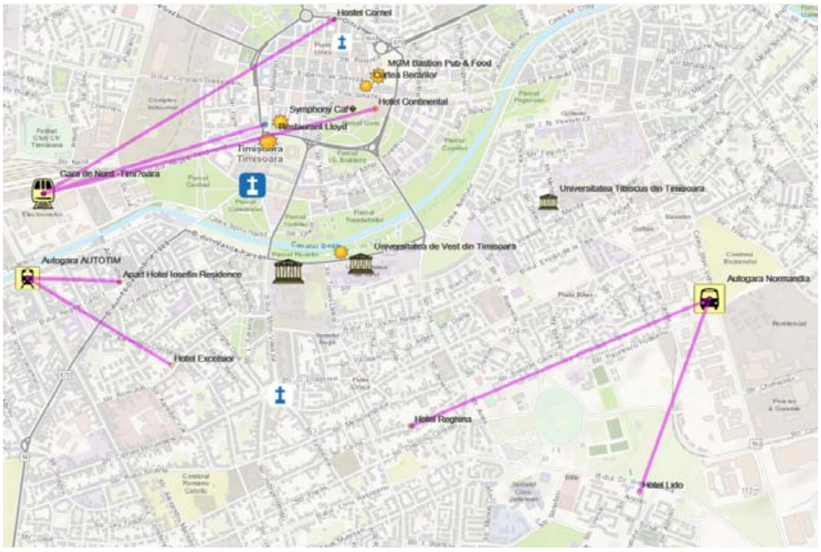


Figure 16. Proximity analyses- Closest locations

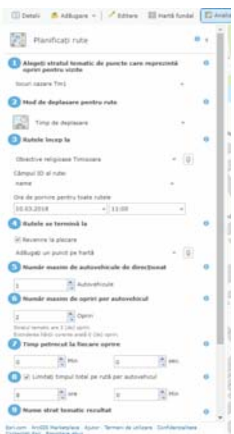


Figure17. Route Planning Menu

Among these routes are two types of walking routes such as the route from Metropilitan Cathedral to the Timisoara Hotel (Figure 18), a route that is planned through a pedestrian zone and the route from Timisoara Hotel to Unirii Square (Figure 19).

Figure 18. Pedestrian route

Figure 19. Pedestrian route

Also, there were several routes that can be traveled by the car, among which we mention the route from Timisoara Hotel to the Autotim Bus Station (Figure 20) which is the shortest and includes the same the list of turns that it has to make the driver of the car.

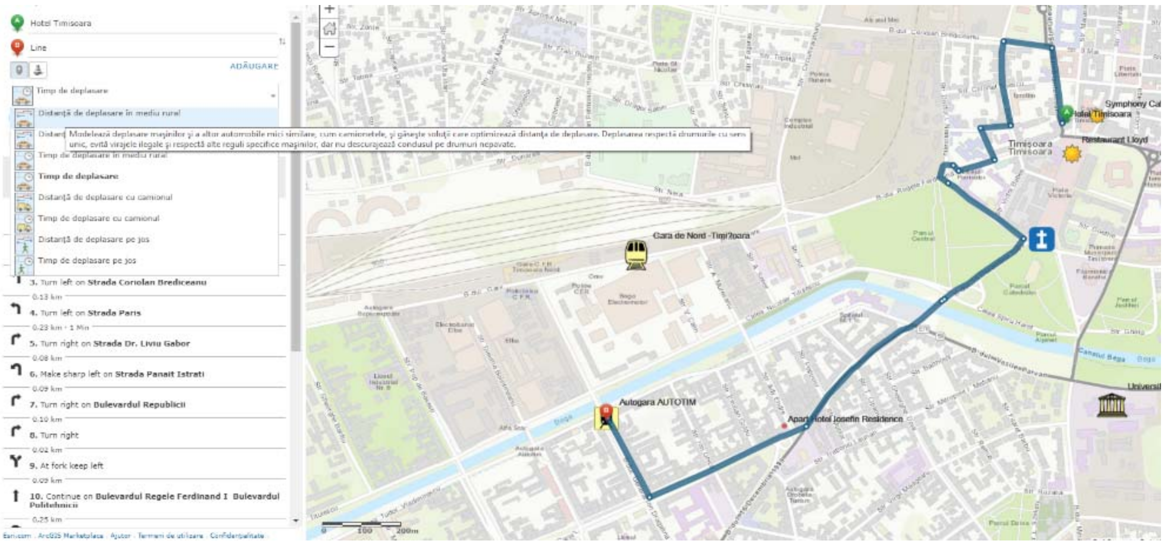


Figure 20. Car routes

The final step of this paper is to create a web GIS application by uploading the map online and making it available to users (tourists, public institutions, etc.) to help them in their activities (Figure 21) (Mason et al., 2015).
Here is the final form of the map uploaded in the online environment (Figure22).

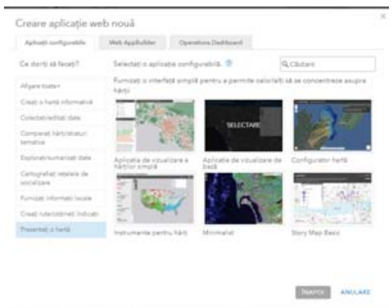


Figure 21. Web application creation

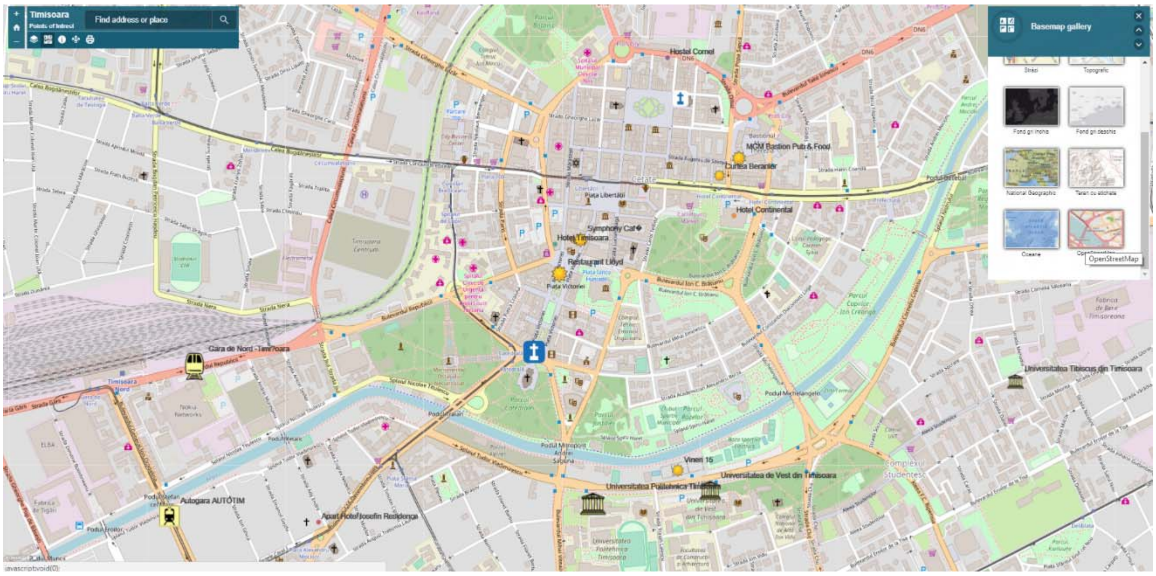


Figure 22. Web GIS Map

CONCLUSIONS

Through this paper, it was created an interactive map using the ArcGIS Online program that presents a mobile and advanced solution of how to use a map. Thus this map is very useful for the city of Timisoara both for residents and for tourists, especially as Timisoara was designated the European Capital of Culture in 2021.

Also points of interest from all the areas of interest for tourists such as transport means (railway stations, airports, bus stations), accommodation for all budgets (hotels, hostels, apartments and camps), universities, important tourist attractions in the city (museums, central markets), restaurants and cafes. Also are included the spatial analyses by which the routes from point A to point B are created, as well as the search for the range of interest of the neighbouring objectives. All this leads to a better management of the activities that can take place in the city, as well as a simple overview of the city for tourists. This map may be updated whenever necessary because there may be changes in the field, some points of interest may have temporarily changed location and so the application allows us to improve the map without recreating it from scratch.

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TOPOGRAPHIC WORKS FOR THE ACHIEVEMENT OF A 3D SURVEY

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Abstract

First priority to the realization of the survey, a topographic elevation is required, which aims to place the study object in STEREO coordinates 1970. The object of the study is located in Timisoara, within the campus of the University of Agricultural Sciences and Veterinary Medicine of Banat, & quot ;King Mihai I of Romania & quot;. The concept of 3D SURVEY is the way to be able to relate and expose a measurement of a building made in the first phase on a pencil paper, in a 3D model with exact dimensions and a stackable scale from the beginning To achieve this model, you must follow certain steps that are in line with the legislation in force and the technical way of achieving them, as provided in the cadastral documentation. The purpose of this 3D review is first and foremost the accurate and accurate understanding of the architectural style in the area where the study was made. The work was needed to update the USAMVBT heritage to make a real inventory of all campus buildings. The present paper presents only a section of a larger work, which includes, besides the rectorship building, the buildings of all the faculties, the canteen and the other utilities on the campus.

***Key words**: 3D survey, Autocad, Archicad, Romania, STEREO coordinates 1970.*

INTRODUCTION

The concept of 3D surveying is an easy way, but with a strong character to create a first-contact, empirical, with the architectural object. The surveying shouldn't be just a drawing exercise, a mechanical reproduction of the architectural object, but also an instrument allowing its understanding, both physical and structural parts (Bârliba et al., 2006; Bârliba et al,. 2005) .

By definition, the survey is a representation, obtained by measuring and drawing on a scale, in plan, sections and views, of a set of buildings, of a building and / or a sub-assembly thereof (building elements, decoration, fixed furniture, technical equipments).

Surveys goal:

- Making technical documentation as accurate and complete as possible.
- Modeling / remodeling of an architectural object.
- Creating a virtual tour of each object.

MATERIALS AND METHODS

In order to achieve a survey, we need to go through two stages:

- Realization of topographic elevation.
- Drawing and measuring the object, if it exists.
- Transpose the sketch and measurements to a certain scale in electronic format.

Design information systems are computer systems capable of holding a database (structural elements, mechanical elements, mechanical and hydraulic elements) being enough to select them from the toolbar and apply them to the workspace.

In this work were used the computer systems of design AutoCAD 2013, respectively ArchiCAD 2018 (Bârliba et al,. 2010; Bârliba et al., 2016).

A total Leica TS02 station (Figure 1) was used to perform the measurements, a Leica GPS1200 + GPS (Figure 3) and a distofrom ,Leica DISTO D2 (Figure 2).

Figure 1. Leica FlexLine TS02 Total Station

Figure 2. Leica DISTO D2 Laser Distance Measure

Figure 3. Leica GPS1200+

RESULTS AND DISCUSSIONS

For the realization of this project measurements have been made with the consent of the management, within the campus of the University of Agricultural Sciences and Veterinary Medicine of Banat, Timisoara (Figure 4).

Figure 4. University of Agricultural Sciences and Veterinary Medicine of Banat, Timisoara

The following steps detail how to make a 3D surveying using the above mentioned devices and programs.

- Step 1. Choosing / Selection of study object.

The headquarters of the University of Agricultural Sciences and Veterinary Medicine of Banat, in Timisoara, was chosen, namely the rectorship

- Step 2. Making topographical lift

For the coordinate location of the subject in STEREO 1970, the surveying is done, which was performed by determination of the two GPS dots, a Leica GPS1200 +, and the actual measurement was performed with a Leica total station TS02 (Figure5) (Boş et al., 2015; Calinovici and Bârliba, 2003; Teresneu and Ionescu, 2014; Leu. et al., 2003; Neuner, 2001).

Figure 5. Topographic elevation

With the topographic lifting and its downloading into the AUTOCAD design software, the contour of the building is determined and a coordinate table (Table1) can be made by which anyone can locate the building.

Table 1. Coordinate table

X	Y
482909.1905	205984.5440
482914.7438	206017.3273
482917.7394	206016.8623
482919.2192	206025.3919
482879.5809	206031.9955
482878.8058	206027.3081
482873.8425	206028.2874
482871.0712	206011.6524
482894.4397	206007.7592
482891.0318	205987.3422

- Step 3. Studying the structure and architectural style of the construction

It is a building with a modern architectural style with height regime P + 1E (ground floor + one floor) and basement. The walls are made of masonry, inside a semi-circular staircase that connects the three levels. Upstairs the end of the corridor ends with a bridge that connects with the Faculty of Agriculture. From the rectorship building there is also a "Aula Magna" type hall for the projects sustained within the University.

- Step 4. Drawing and measuring itself.

After making a hand drawing of each level with all its structural elements, using the disto we measure each distance (Figure 6).

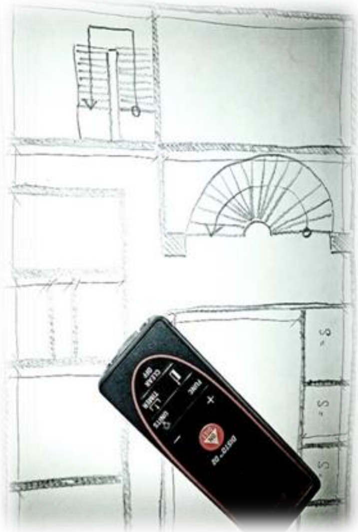

Figure 6. Sketch made by hand at the time of measurement

- Step 5. Creating the 2D surveying in Electronic Format.

Using the AUTOCAD 2013 design system, using a line system, we will create the drawing we made on the field, on a binary scale (Figure 7).

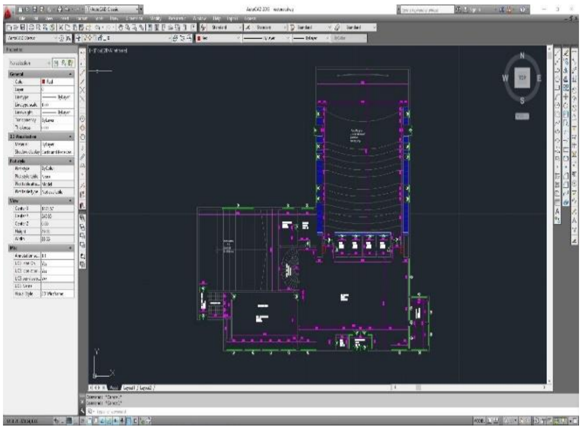

Figure 7. Surveying 2D using AUTOCAD 2013

- Step 6. Creating the actual 3D surveying

Based on the above drawing, we will build the third dimension using the ARCHICAD 2018 design software. (Websites of AutoCAD, Microstation, DK Meters software developers, etc. (ex:www.bossinti.com/ - surfer 7).

We will export the drawing from AUTOCAD in a common format supported by both DXFs, then we will import the file into ARCHICAD and we will start building on existing drawing using toolbar elements (walls, doors, windows, poles, etc.). .) that we apply to the workspace above the drawing (Figure 8 and Figure 9).

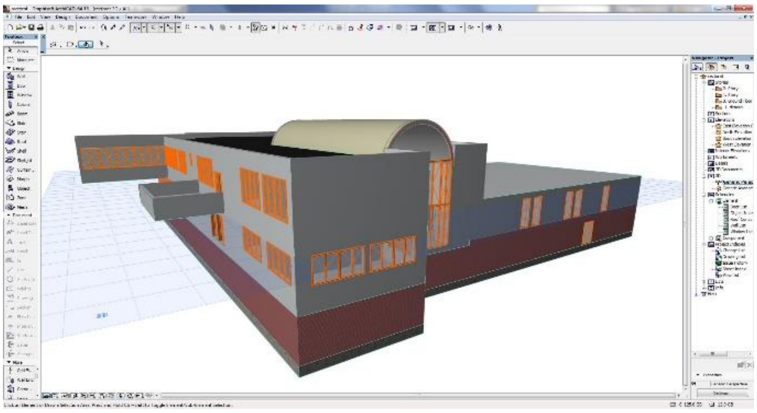

Figure 8. The final result of 3D Revealed in ARCHICAD

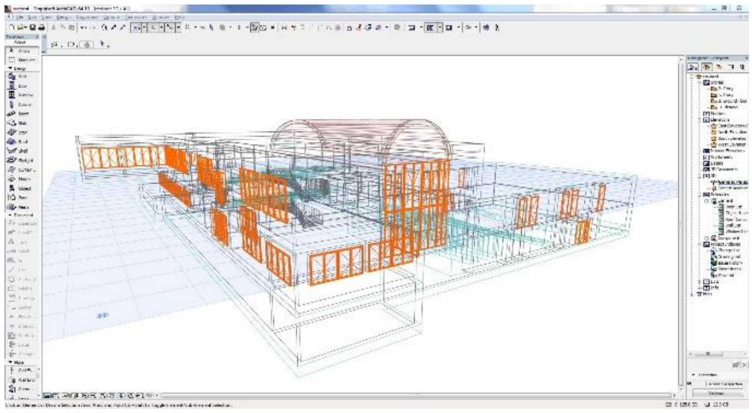

Figure 9. The final result of the 3D Revealed realized in ARCHICAD

CONCLUSIONS

This project consists in deepening the techniques representation by learning the revelation technique (sketches, measurements, drawing on scale), learning architectural design conventions (representation in plan, section, view), learning the principles of architecture graphics (clarity and coherence of the drawing, pagination, writing).

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MAPS AND SATELLITE IMAGES –TOOLS FOR AN EFFECTIVE MANAGEMENT OF THE HISTORIC CENTER OF SIGHISOARA, AN UNESCO WORLD HERITAGE SITE

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Abstract

Mapping has had an essential role in history, bycapturing and transmitting models and visions of nature and social relationships. The emergence of the first maps was related to the need for orientation of the first humans and the need to delimit hunting and cultivated areas. The first aerial photographacquired from a balloon above Paris, brought a great evolution of the knowledge of the territory. We now have various images captured by a multitude of satellites, providing valuable Earth observation information.
This study focuses on the Sighisoara area in order to create a geodatabase, containing maps and pictures from 1918 to the present. We used Sentinel 1, Sentinel 2 imagesfrom Copernicus Open Access Hub platform, and Landsat 8 images from Earth Explorer platform, free of charge. Image processing is made with SNAP (Sentinel Application Platform) software available for free;for Sentinel 1 images we applied a noise reduction filter, a geometric correction (geocoding based on a digital elevation model) and then cropping of the image. The Sentinel 2 and Landsat 8 optical images were used to create natural color image red-green-blue combinations of spectral bands, which were initially resampled and cropped. All the products obtained have been integrated into a geodatabase using the QGISprogram, also available for free, all data being kept for future use.

Key words: *cultural heritage,Earth observation, maps,photography images, satellite.*

INTRODUCTION

The Historic Centre of Sighisoara was included on the World Heritage List (WHL) in 1999 at the 23rd Session of the World Heritage Committee. Sighisoara (Figure 1) is a remarkable example of a small fortified city in a border area between the Latin culture of Central Europe and the Byzantine, Orthodox culture of Southeastern Europe.

Figure 1. The Sighișoara Citadel

The Historic Centre of Sighisoara is defined as the most representative medieval city in Transylvaniaas it has preserved unchanged the organization of urban space.
The monitoring of the cultural heritage brings fresh information about areas of interest and it enables comparisons of the current and past stages.
One of the monitoring methods was the map, a horizontal plane representation of the surface, generalized and shrinked according to a certain scale, and based on a cartographic projection.
We now have a wider range of information from satellite sensors, advanced processing programs, and everything in a very short time.
This study was carried outto create a geodatabase, containing maps and pictures from 1918 to the present. We used Sentinel 1, Sentinel 2 imagesfrom Copernicus Open Access Hub platform (https://scihub.copernicus.eu/dhus/#/home), and Landsat 8 images from Earth Explorer

platform (https://earthexplorer.usgs.gov/), free of charge.

MATERIALS AND METHODS

Sentinel-1 is the first of the Copernicus Program satellite constellation conducted by the European Space Agency (ESA) (https://www.esa.int/ESA).

This space mission is composed of two satellites, Sentinel 1A and Sentinel 1B, that carry a C-band Synthetic Aperture Radar (SAR) instrument which provides a collection of data in all-weather, day or night.

Currently, both Sentinel 1-A and 1-B have been launched. The first satellite, Sentinel 1A was launched on 3 April 2014, while Sentinel 1B was launched on 25 April 2016. Both satellites lifted off from the same location in Kourou, French Guiana, and each on a Soyuz Rocket.

There are a wide range of applications for the data collected via the Sentinel-1 mission. A part of these uses include marineand land monitoring, emergency response due to environmental disasters, and economic applications.

Sentinel-1 mission includes C-band imaging operating in four exclusive imaging modes with different resolution (down to 5 m) and coverage (up to 400 km). It provides dual polarisation capability, very short revisit times and rapid product delivery. For each observation, precise measurements of spacecraft position and attitude are available.Sentinel-2 is an Earth observation mission developed by ESA as part of the Copernicus Programme.

It consists of two identical satellites built by Airbus DS, Sentinel-2A and Sentinel-2B, withtwo additional satellites being constructed by Thales Alenia Space.

Sentinel-2 carries an optical instrument payload that samples 13 spectral bands: four bands at 10 m, six bands at 20 m and three bands at 60 m spatial resolution. The orbital swath width is 290 km.

The twin satellites of Sentinel-2 provide continuity of SPOT and Landsat -type image data, contribute to ongoing multispectral observations and benefit Copernicus services and applications such as land management, agriculture and forestry, disaster control, humanitarian relief operations, risk mapping and security.

With its 13 spectral bands, 290 km swath width and high revisit frequency, Sentinel-2's MultiSpectral Instrument (MSI) supports a wide range of land studies and programmes, and reduces the time required to build a European cloud-free image archive. The spectral bands of Sentinel-2 provide data for land cover/change classification, atmospheric correction and cloud/snow separation.

Landsat represents the world's longest continuously acquired collection of space-based moderate-resolution land remote sensing data. Four decades of imagery provides a unique resource for those who work in agriculture, geology, forestry, regional planning, education, mapping, and global change research. Landsat images are also invaluable for emergency response and disaster relief.

As a joint initiative between the United States Geological Survey (USGS) and the National Aeronautics and Space Administration(NASA), the Landsat Project and the data it collects support government, commercial, industrial, civilian, military, and educational communities throughout the United States and worldwide.

The Landsat project is an integral part of the Remote Sensing Missions component of the USGS Land Remote Sensing (LRS).

On July 23, 1972, launch of the Earth Resources Technology Satellite (ERTS-1), which was later renamed Landsat 1. The launches of Landsat 2, Landsat 3, and Landsat 4 followed in 1975, 1978, and 1982, respectively.

When Landsat 5 launched in 1984, no one could have predicted that the satellite would continue to deliver high quality, global data of Earth’s land surfaces for 28 years and 10 months, officially setting a new Guinness World Record for "longest-operating Earth observation satellite." Landsat 6 failed to achieve orbit in 1993.

Landsat 7 successfully launched in 1999 and, along with Landsat 8, which launched in 2013, continues to provide daily global data. Landsat 9 is planned to launch in late 2020.

Figure 2.Landsat missions

The Sentinel 1 and Sentinel 2 images were downloaded from the Copernicus Open Access Hub platform (https://scihub.copernicus.eu/dhus/#/home). The Sentinel 1 image was downloaded as a Ground Rand Detected (GRD)Level-1 product that represents a detected, multi-looked image projected to ground range using an Earth ellipsoid model.For data identification and download, the area of interest was delineated (Figure 3) and then different search criteria such as the season of acquisition (Figure 4), in our case summer of 2017.

Figure 3. Extent of the area of interest

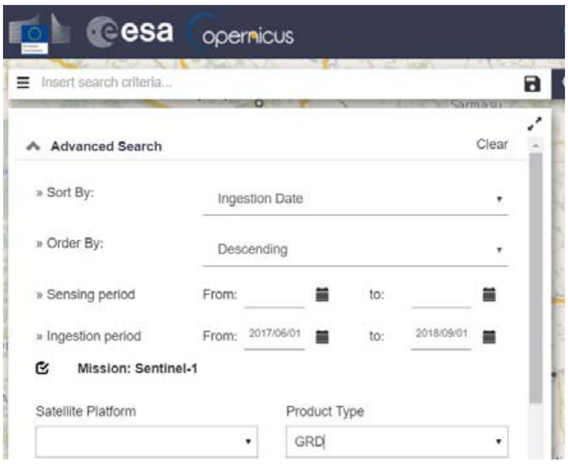

Figure 4. Advanced search criteria for Sentinel-1 images within the Copernicus Open Access Hub

Sentinel 2 image has a search criteria depending on the clouds coverage of the image, in our case a coverage ofmaximum 10% was imposed (Figure 5).

Figure 5. Search criteria for Sentinel-2

The Landsat 8 image was downloaded from the Earth Explorer platform (https://earthexplorer.usgs.gov/). The first image search criterion was the area of interest and then the acquisition time (Figure 6).

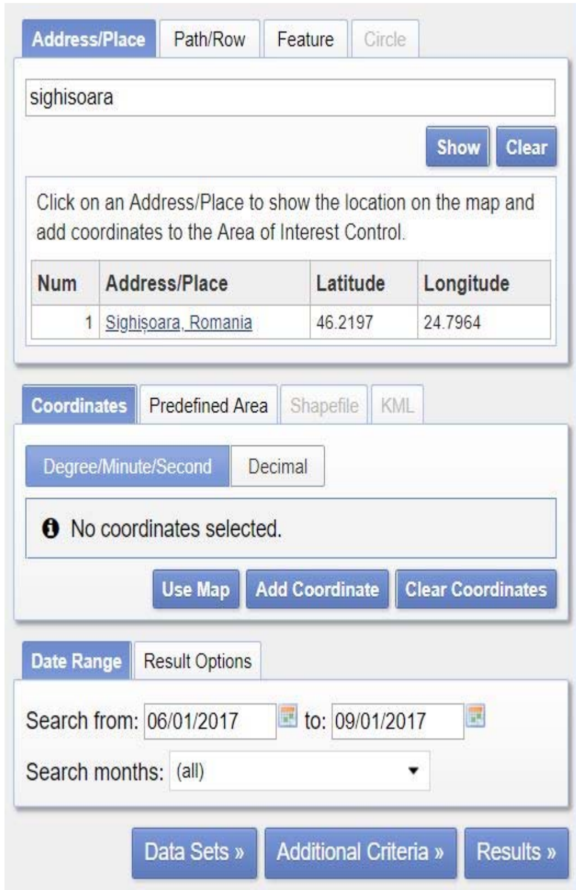

Figure 6. First selection criteria for Landsat images within the Earth Explorer platform

From the Data Sets section we can choose the satellite mission that acquired the image (Figure 7).

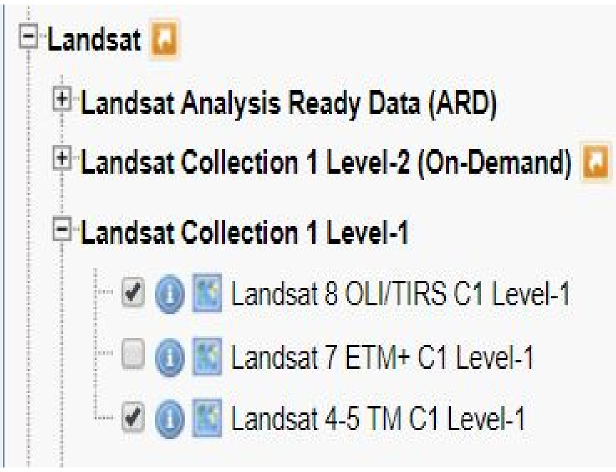

Figure 7. Part of Landsat collections available in Earth Explorer, as search criteria

A final criterion is cloud cover, in our case a maximum of 10%.(Figure 8).

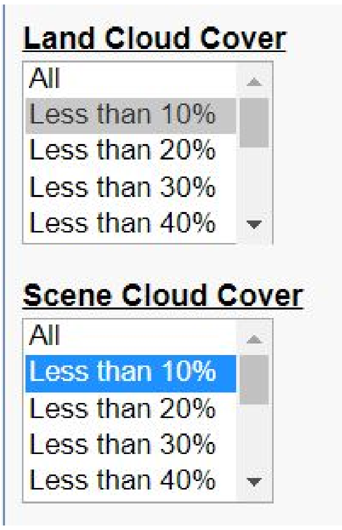

Figure 8. Land and scene cloud cover as search criteria for Landsat images in Earth Explorer

The Sentinel-1 images were filtered to reduce the speckle noise (Figure 9).

A Refined Lee filter was applied with an edge threshold of 5000. Next, the Sentinel-1 image was geocoded (Figure 10) using the Range Doppler orthorectification method that enables the correction of the topographic distortions in SAR imagery based on a Digital Elevation Model (DEM).The Shuttle Radar Topographic Mission (SRTM) DEM with the spatial resolution of 3 arc seconds is automatically downloaded by SNAP for the area of interest. Finally, the image were cropped in order to cover only Sighisoara and its close surroundings (Figure 11).

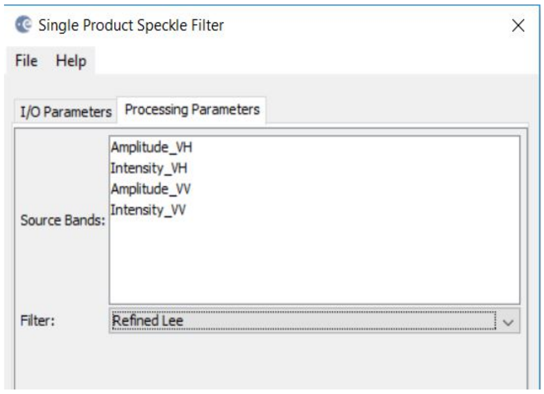

Figure 9. Speckle filtering of the Sentinel-1 image using the Single Product Speckle Filter in SNAP

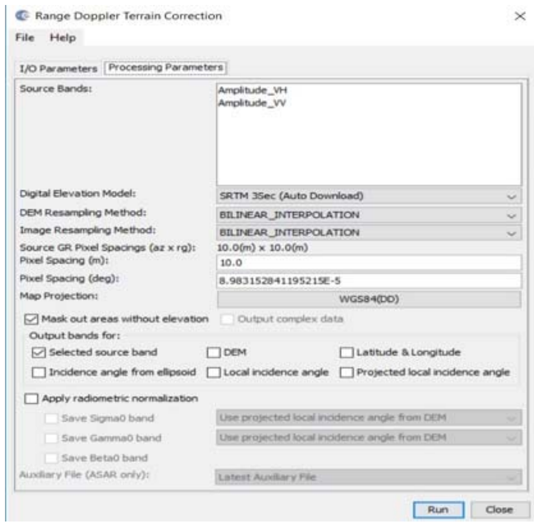

Figure 10. Terrain correction using the Range Doppler method implemented in SNAP

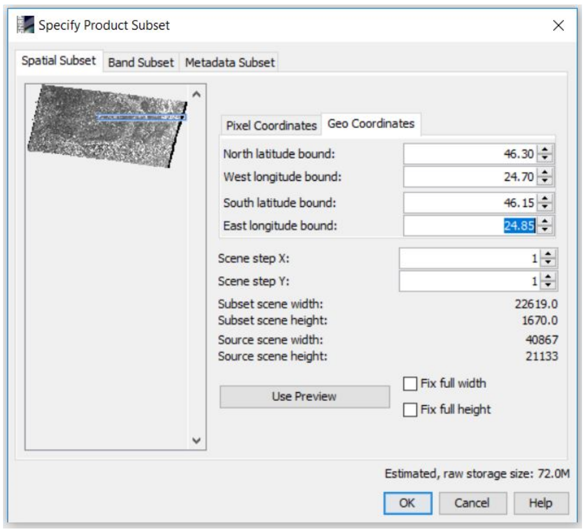

Figure 11. Subset of the Sentinel-1 image using geographic coordinates

The image was exported to the GeoTiff format for use in QGIS – a free and open source software (Figure 12).

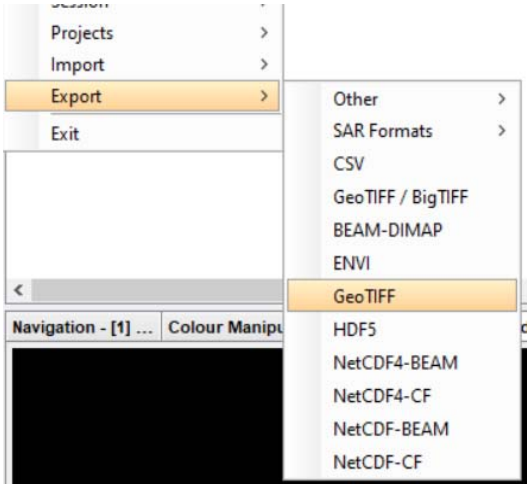

Figure 12. Export of the geocoded Sentinel-1 image from the DIMAP format to GeoTiff

For the Sentinel-2 and Landsat images, the same processing steps have been applied; the images were opened in the SNAP program and then resampled (Figure 13), so all the bands have the same spatial resolution.
The they were cropped and exported in GeoTiff format using the same aproach like in the case of Sentinel-1 images.

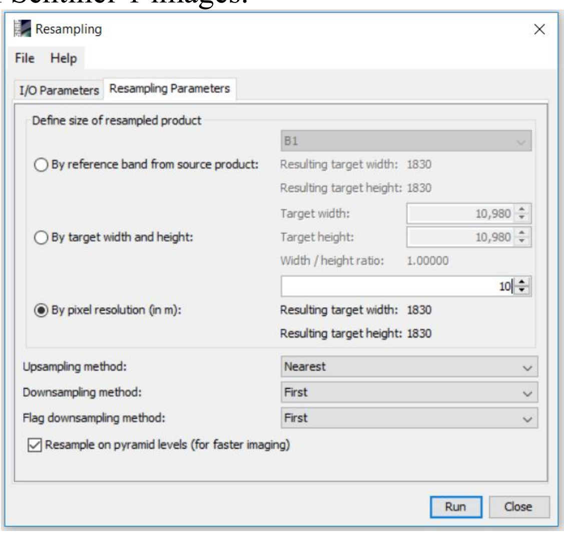

Figure13. Resampling of the Sentinel-2 spectral bands

In the case of optical images, we want to get a combination in natural colors, using the red-green-blue (RGB) spectral bands. For the optical images of this study (both Sentinel-2 and Landsat-8) the combinations consist of the following: red-band 4, green-band 3 and blue-band 2 (Figure 14).

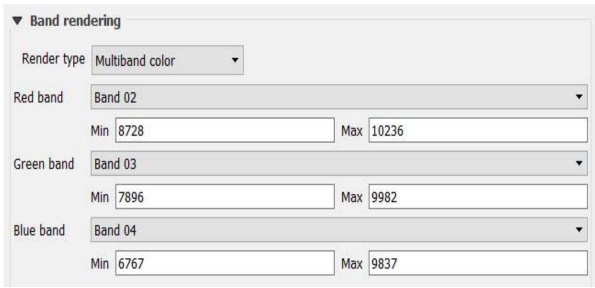

Figure 14. RGB composition for natural colors

We used the SNAP http://step.esa.int/main/download/) and QGIS (https://qgis.org/en/site/forusers/download.html) programs for image processing, available for free. SNAP is a program for satellite imagery acquisition with various satellites, in our case Sentinel-1, Sentinel-2 and Landsat 8. The QGIS program was used to create products of combined raster and vector layers, namely the processed SNAP images with the location vectors of localities, national and communal roads, railways, administrative boundaries and water bodies.

RESULTS AND DISCUSSIONS

The Sentinel-1 image was acquired using the Interferometric wide-swath (IW) mode with a spatial resolution of 5 × 20 meters.
The Sentinel-2 image was resampled to have a 10-meter spatial resolution for all the spectral bands. It has the following spectral bands: band1 costal aerosol, band 2 blue, band 3 green, band 4 red, band 5 vegetation red edge, band 6 vegetation red edge, band 7 vegetation red edge, band 9 water vapor, band 10 SWIR-Cirrus, band 11 SWIR, band 12 SWIR (SWIR - Short Wavelenght Infrared).
The Landsat 8 image was also resampled for a 30-meter resolution, with the following spectral bands: band1 costal aerosol, band 2 blue, band 3 green, band 4 red, band 5 near infrared, band 6 SWIR, band 7 SWIR, band 8 panchromatic, band 9 cirrus, band 10 Thermal Infrared, band 11 Thermal Infrared.
In order to have a better view of the evolution of technology we have added the oldest map we have been able to find (Figure 15).

Figure 15. The historic map of Sighisoara(1918)

(© http://www.geo-spatial.org/)

The available vector layers were overlaid on the Sentinel-1 image that enables a detailed view of the morphological features in the area of interest (Figures 16, 17 and 18).The image acquired by the Sentinel-1 satellite on 04.06.2017 along with position vectors allocated to national and communal roads are represented in Figure 16.

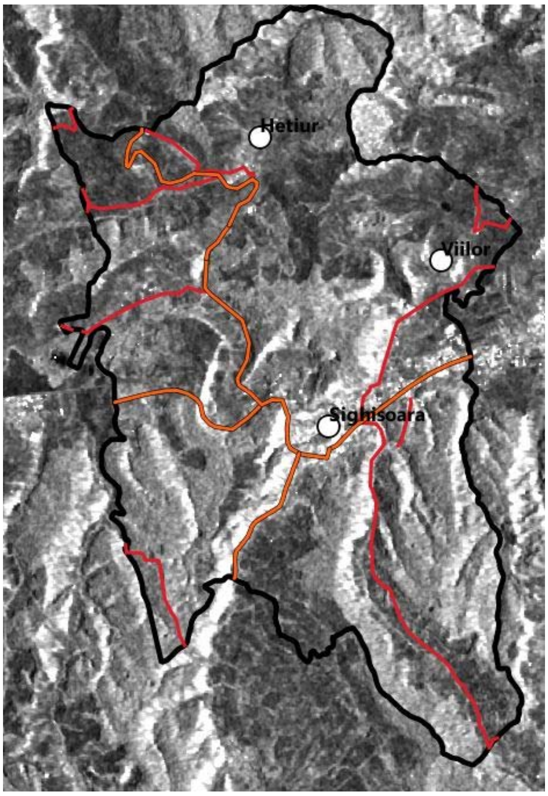

Figure 16. Road vector lines (in red) and administrative boundary (in black). Background: Sentinel-1 image (© ESA 2017).

The image acquired by the Sentinel-1 satellite on 04.06.2017 along with position vectors allocated to railways are represented in Figure 17.

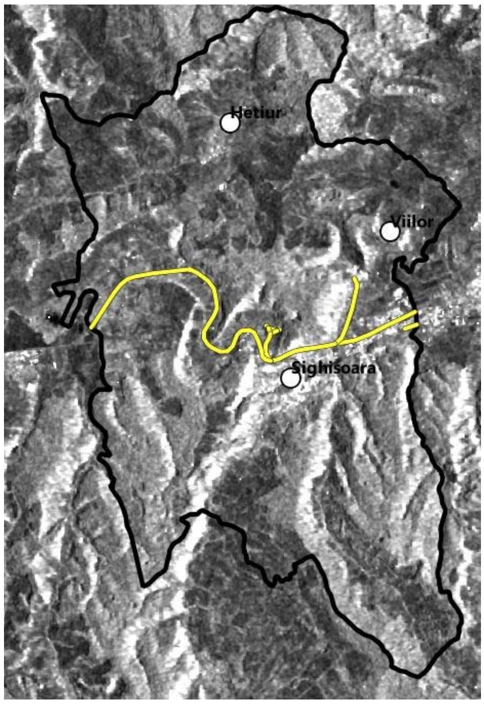

Figure 17. Railway vector lines (in yellow) and administrative boundary (in black). Background: Sentinel-1 image (© ESA 2017).

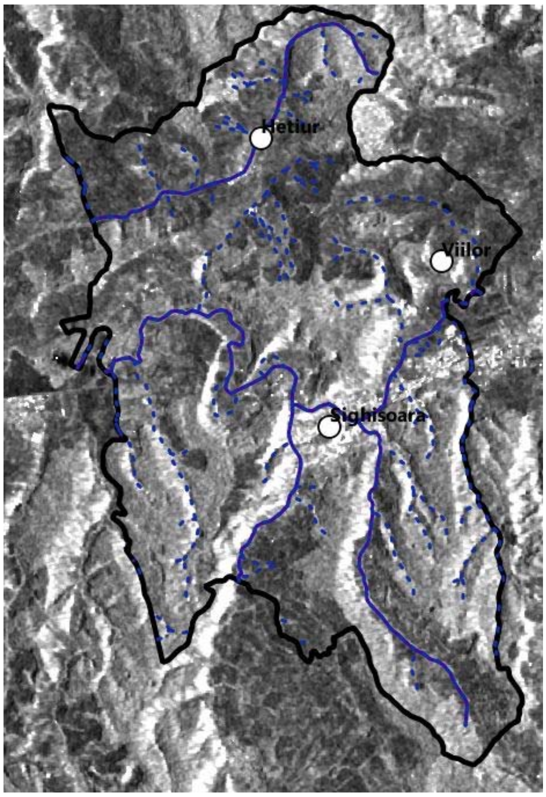

Figure 18. River vector lines (in blue) and administrative boundary (in black). Background: Sentinel-1 image (© ESA 2017).

Figures 19 and 20 illustrate the optical images that cover the area of interest, namely Landsat-

8 and Sentinel-2, the latter offering more details given the higher spatial resolution.
Sentinel 1 and Sentinel 2 images were downloaded with The Copernicus Open Access Hub (https://scihub.copernicus.eu) and we used QGIS for representation of national and communal roads,railways and rivers.
The Copernicus Open Access Hub provides complete, free and open access to Sentinel-1, Sentinel-2 and Sentinel-3 user products, starting from the In-Orbit Commissioning Review (IOCR) phase.
Copernicus is the European Union's Earth Observation Programme, looking at our planet and its environment for the ultimate benefit of all European citizens.
It offers information services based on satellite Earth Observation and in situ (non-space) data.
The image acquired by Landsat 8 satellite on 21.07.2017 covering the Sighisoara area is illustrated in Figure 19.

Figure 19. Landsat-8 image covering Sighisoara (© USGS/NASA Landsat 2017)

The Landsat 8 satellite images the entire Earth every 16 days in an 8-day offset from Landsat 7. Data collected by the instruments onboard the satellite are available to download at no charge from EarthExplorerwithin 24 hours of acquisition.
Landsat 8 carries two push-broom instruments: The Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS).
The spectral bands of the OLI sensor provides enhancement from prior Landsat instruments, with the addition of two additional spectral bands: a deep blue visible channel (band 1) specifically designed for water resources and coastal zone investigation, and a new shortwave infrared channel (band 9) for the detection of cirrus clouds.
The TIRS instrument collects two spectral bands for the wavelength covered by a single band on the previous TM and ETM+ sensors.
The image acquired by the Sentinel-2 satellite on 28.06.2017 covering the Sighisoara area is illustrated in Figure 20.

Figure 20. Sentinel-2 image covering Sighisoara(© ESA 2017)

Figure 21. Aerial image (from 2010) of the Sighisoara area (©http://geoportal.gov.ro/Geoportal_INIS/)

CONCLUSIONS

The management of the cultural heritage may be supported by geospatial information derived from different sources of data (cartographic maps, aerial photographs, satellite images, etc.). The maps or other types of cartographic products have evolved, from the traditional map elaborated in 1918 that provided basic information to the satellite-derived products that offer detailed information of great diversity. During the present study, we used images acquired at different times by Sentinel-1, Sentinel-2, and Landsat 8satellites, thus enabling a multi-sensor, multi-spectral and multi-temporal in-depth analysis of Sighisoara and its surroundings.

All the vector and raster data was projected into the same cartographic system and was used to create a complex geodatabase.

ACKNOWLEDGEMENTS

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LUNAR LASER RANGING EXPERIMENT - A JOURNEY TO THE MOON AND BACK

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Abstract

The Moon has played an important role throughout the development of human civilization. It is the only permanent natural satellite of Earth and the closest astronomical object in the universe. Between the years of 1969 and 1971 the American and Soviet space programs left a total of five retroreflectors on the lunar surface. Astronomers have been able to use powerful lasers and telescopes to perform highly accurate measurements of the distance to these artifacts. The data that have been collected have led to significant improvements in the understanding of some aspects regarding the Earth-Moon system. Lunar Laser Ranging (LLR) has influenced astronomy, lunar science, gravitational physics, geodesy, geodynamics and numerous other fields. The purpose of this research is to state the historical development of Lunar Laser Ranging, what is involved in this process, the scientific accomplishments and the importance of this experiment for future explorations.

Key words: *Apollo missions, Earth-Moon distance,Lunar Laser Ranging, retroreflector.*

INTRODUCTION

The Moon has always been fundamental to the understanding of the universe.The first attempt to determine the distance to the Moon was made over 2000 years ago by the ancient Greeks.In order to do that, they had to measure the Earth.

Eratosthenes, the Greek philosopher,discovered that during the summer solstice the Sun shone directly down a well in the city of Syene at noon and, at the same time, it was not shining straight down in Alexandria. He was able to measure that angle.

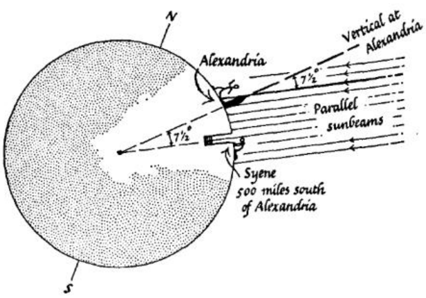

Figure 1. How Eratosthenes estimated the size of the Earth

The legend says that he paid someone to walk the distance between the two cities in order to find the distance between them. But probably he just used the numbers found by earlier surveying missions.

Once he knew the distance and the angle, he calculated the Earth's circumference with the use of geometry. His result was very close to the actual dimension. It was the first time humans had determined a scale to the Universe. Once the dimension of Earth was known, other distances could be found. For example, during a lunar eclipse, the shadow of the Earth is cast on the Moon. The curve of the Earth's edge can be seen as the shadow moves across the Moon. Simply by knowing the Earth's size, and with the use of geometry, we can determine the distance to the Moon. Also, the phases of the Moon depend on the angles and distances between the Earth, Moon, and Sun.

Using the size of the Earth as a stepping stone, Aristarchus of Samos was able to calculate the distances to the Moon and the Sun as well as their sizes. The accuracy of his measurements was not the best, but his methods were important, and they were used later by great thinkers like Ptolemy and Hipparchus to

increase the accuracy of size and distance measurements.
Aristarchus developed an ingenious method to calculate the Earth-Moon distance by using the principle of parallax. The term comes from Ancient Greek παράλλαξις (parallaxis), which means ‘alteration’. It is defined as the effect whereby an object seems to have different positions or directions when viewed from different agles.

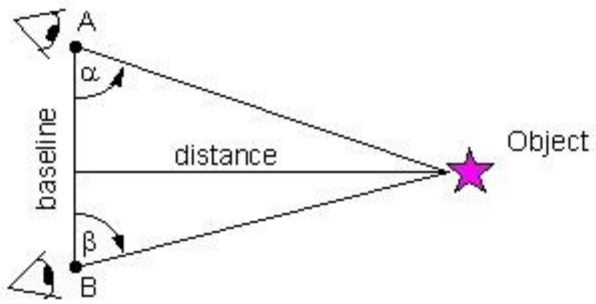

Figure 2. A representation of the principle of parallax

For example, because humans have binocular vision, when we look at a nearby object, the left eye sees it at a slightly different angle than the right eye. The brain overlays the images and gives us the sense of distance to that object. This is called depth perception. The focused object seems to alter its position relative to more distant objects. That shift is called parallax. The amound of shift is given by the distance between your eyes and the distance to the object.You can determine the distance to the object if you know the distance between your eyes. If the object is closer, it shifts more; if it is farther, it shifts less.
The Moon is beyond the limit of our eyes. If we want to measure the distance to the Moon using parallax, we need a bigger baseline than the few centimeters between our eyes.

MATERIALS AND METHODS

R. H. Dicke, professor at Princeton University, and a few of his colleagues, started in the late 1950’s the lunar laser ranging experiment in the gravitational research program. They had in mind to use a very dense artificial satellite orbiting in high altitude, to search for possible slow changes in the gravitational constant G by precision tracking. Another method they thought of was to place retroreflectors on the satellite and pulsed searchlight illumination from the Earth. This method would determine the angular motion with reference to the stars. With the creating of the first ruby laser in the 1960, it became more and more clear that the accuracy of laser range measurements to retroreflectors placed on satellites would be greatly improved.
Within the Apollo project and the Ranger missions in 1962, there was a proposal to place a retroreflector on the moon’s surface, to allow the Earth-Moon distance to be measured using laser ranging. In May of the same year, Louis Dijour Smullin and atmospheric physicist Giorgio Fiocco announced that they managed to reflect ruby laser pulses from the moon.This type of measurements was also declared by the Russians who later reported successful results using a Q-swithced ruby laser.Although the experiment was a success, because of the irregular surface and the curvature of the Moon, the accuracy of the measurements was limited to 200 meters.
By retrieving light from these retroreflectors on the Moon, there is the benefit that the signal would be retuned much more intensive than it would from the natural surface of the Moon. The bigger advantage would be that, being a well defined point on the surface of the Moon, there would be a short return pulse and allow point-to-point ranging accuracy at the level of centimeters.
A corner-reflector is an ultra-precision version of the reflector-type optical mirror used on bicycles and traffic stop-signs. It would send any beam of light directed toward it directly back to the source. Each corner-cube or retroreflector does for the three-dimensional world of light what the corner of a billiard table does for the two-dimensional world of billiards. The advantage of this type of mirror is that it only needs to be placed, but not precisely oriented, on the lunar surface in order for it to reflect pulses of laser light directly back to Earth.
So you could just drop one on the surface of the moon. And that is what they did. They encapsulated in silicone a retroreflector, offcentered it so when thrown from a spacecraft it would set itself facing upward and remain a mark on the Moon for laser ranging. This allowed the distance and the variations of the distance to be accurately calculated by

measuring the 2.5 seconds light traveled to the Moon and back.

During the Apollo 11 mission, astronauts Aldrin and Armstrong set up an array of retroreflectors on the lunar surface. Just a little over a week after the Apollo 11 array had been deployed on the lunar surface, acquisition took place and the first precision Earth-Moon distance measurement using a short-pulsed ruby laser was made by a group of workers at the Lick Observatory in California.

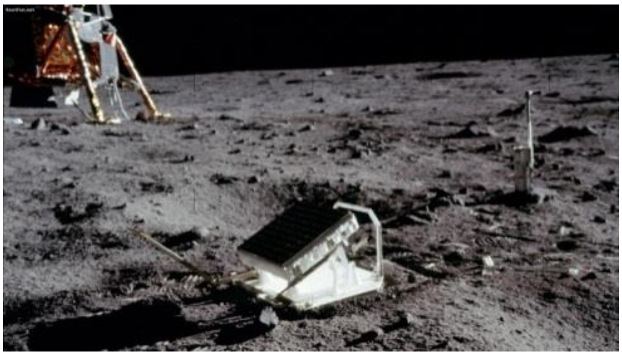

Figure 3. Photography of the reflector array placed by Apollo 11

This success, which included the first ten-meter Earth-Moon distance measurement, showed that all parts of the experiment were operating well.

Four additional reflector panels have been placed at other locations on the lunar surface since 1969. The first was a French-built package of 14 glass corner reflectors, each 11 cm on an edge, carried to the moon by the Soviet spacecraft Luna 17 in November 1970. The package was mounted on the eight wheeled lunar exploration vehicle Lunokhod 1.

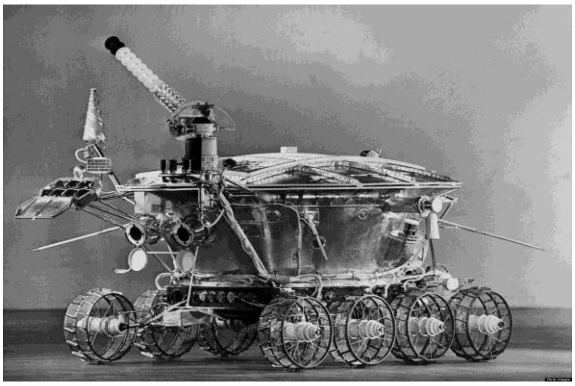

Figure 4. Photography of Lunokhod 1

The next two lunar reflector arrays were carried on the Apollo 14 and Apollo 15 missions. The retroreflectors used in both arrays were similar to those employed for Apollo 11. The overall design of the Apollo 14 array is similar to that for Apollo 11, except for some modifications of the supporting pallet to minimize weight, and the number of corner reflectors is the same.

The Apollo 15 array contains 300 corner reflectors mounted in a hexagonal close packed arrangement in order to minimize the size and the weight. The overall dimensions are 104 cm by 61 cm. A major purpose in making the array larger was to permit regular observations with simple ground equipment for groups of investigators who are interested mainly in obtaining geophysical information, and who therefore do not have to observe more than one reflector. An additional advantage in using the Apollo 15 array is that observable lunar surface features located nearby simplify the guiding of the telescope.

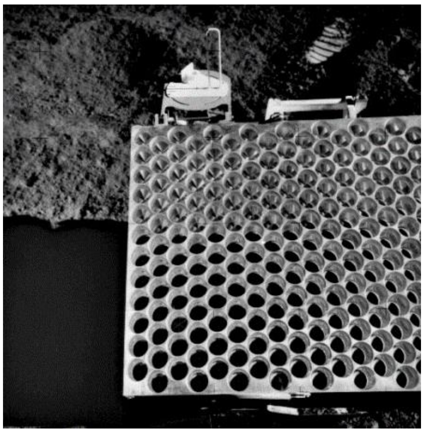

Figure 5. Photography of the reflector array placed by Apollo 15

The fifth reflector package was carried to the Moon by Luna 21. It is a French-built package similar to that carried by Luna 17, and it is mounted on Lunokhod 2.

The three Apollo reflectors form a large triangle on the lunar surface with sides of 1250, 1100, and 970 km. The complex angular motions of the moon about its center of mass can be separated with high accuracy from the range changes due to center of mass motion by differential range measurements to the different reflectors.

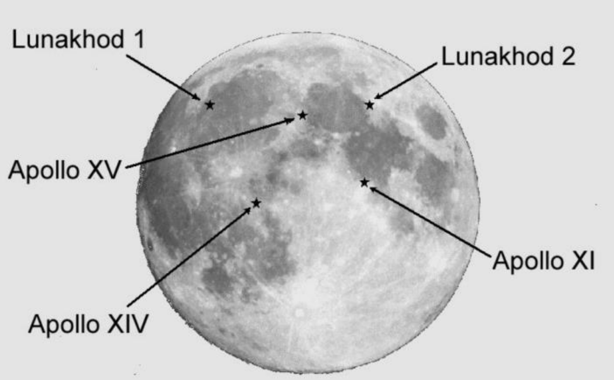

Figure 6. Distribution of the reflectors on the lunar surface

Three reflectors are needed to triangulate the Moon's position, four are needed to understand its tidal distortions, but a fifth would reveal insights about the Moon's more subtile movements.

Since 1970 there were few LLR observing stations. The first one was McDonald Observatory (2.7-m telescope) near Fort Davis, Texas (USA). It was fully dedicated to lunar ranging and ceased operation in 1985 after maintaining routine activities for more than 15 years. The transition was made in the mid-1980s to the McDonald Laser Ranging Station (0.76-m telescope) on two sites (Saddle and Mt. Fowlkes): MLRS1 (1983-1988) and MLRS2 (since 1988) which share lunar and artificial satellite ranging facilities.

Figure 7. McDonald Laser ranging station (Fort Davis, Texas)

In the 1980s, two other stations have carried out Lunar Laser Ranging. The Haleakala Observatory on Maui, Hawaii (USA) produced high quality data over a few years around 1990. Since 1982, the CERGA station (Centre d'Etudes et de Recherche en Geodynamique et Astronomie) has been operating at the 'Observatoire de Cˆote d'Azur' (OCA) on the 'Plateau de Calern' near Grasse (France), with a 1.54-m Cassegrain telescope which replaced its Rubis laser by a YAG in 1987.

Figure 8. CERGA Laser ranging station (Plateau de Calern, Caussols, France)

Occasionally some other artificial-satellite stations have performed successfully LLR observations such as in Australia and in Germany.

One of the lasers used in measuring the distance to the Moon is located in Southern New Mexico, called APOLLO (Apache Point Observatory Lunar Laser-ranging Operation). This laser is mounted on a telescope wich has amirror of 3.5 m, with a diameter of 3.5 m and a weight of more than 2000 kg. Using the wide aperture of the telescope, there was a big increase of returned photons per pulse unlike previous Lunar Laser Ranging facilities wich recorded an average of 0.01 photon return per pulse. This greatly increased the accuracy of the measurements to 1 mm.

RESULTS AND DISCUSSIONS

The Moon is thought to have formed about 4.51 billion years ago, not long after the Earth. There are four major scientific theories regarding the origin of the Moon: fission – the Moon is a piece detached from the rapidly moving Earth; co-formation (also known as the "Sister Planet" theory) – the Moon was formed of a cloud of particles from around the Earth; capture – the Moon was initially formed as an independent planet, then it was captured by the gravity of Earth; collision - the Earth-Moon system was formed of the blasted material resulted from a planetary collision with the Earth.

The data gathered from measuring the distance between the Earth and the Moon reveals that the maximum distance to the Moon reached until now is 406,720 km, and the minimum distance is 336,375 km. The average distance to the Moon is 384,400 km. This distance varies because the Moon revolves around the Earth, and it has an elliptic orbit.

The Moon orbits the Earth at a speed of approximately 3,683 km/h, and travels a distance of 2.290.000 km around the Earth. Its average diameter is of 3,476 km, roughly the size of Africa. The mass of the Moon is $7{,}342\times10^{22}$ kg and the mean density 3,344 g/cm^3. The surface temperature of the Moon varies from 117°C (during the day) to -173°C (during the night).

The results of the lunar laser ranging experiments have been plentiful and impressive. Firstly, these rangers have defined the Moon's orbit orders of magnitude better than before. Also, careful observations of the Moon's movement have shown that its center has a different axis of rotationthan of the outer layers. This subtlety reveals that the Moon's core must be liquid.

The lunar laser ranging experiments have also confirmed Einstein's theory of relativity. Measurements of the Moon's orbit match relativistic predictions exactly. The results have not been limited to the Moon either. Through the tracking of reflector arrays on the Moon, the exact locations of the telescope stations are also determined. These data have revealed details of the Earth's rotation, precession, tides, as well as movement of tectonic plates.

A method of improving the Lunar Laser Ranging Experiment could be the one of determining the lunar surface temperature simoultaneously. This measurement could be accomplished by using a powerful Infrared Radiometer at the same time with the process of measuring the distance to the Moon.

The Infrared Radiometers measure the temperature of an object or an environment without touching the surface. Their function is based on the thermal radiation of objects, a universal property that is missing only in the case of inert gases or close to the absolute zero value of the temperature.

At lower temperatures, the object radiates in a natural, but invisible way, in infrared. When the temperature rises, the object becomes red, then yellow, and, at a very high temperature, bright white.

All the objects emit and absorb electromagnetic radiations. The emitted radiation has a continuous spectrum and a specific distribution of energy depending on the temperature. The receivers used in measuring those frequencies are called radiometers.

An important parameter is the brightness of the electromagnetic radiation. In infrared, the brightness increases at the same time with the temperature. After reaching the maximum level, it suddenly decreases leaving a glow in the visible area which can be seen in the case of high temperature objects.

A radiometer is a sensitive receptor that measures the radiation of an object in a certain frequency band.

Infrared radiometers are often called infrared thermometers due to the fact that the temperature is the desired parameter to be measured, even though the sensors detect radiation.

If it would be included into the distance measurement process used in Lunar Laser Ranging Experiment, it would help keeping a better track of the temperature of the Moon, which would lead to better Moon observations.

CONCLUSIONS

Lunar Laser Ranging data analysis provides an excellent method for determining parameters of the Earth-Moon system, including the Earth orientation parameters. The expected increased data density and improved accuracy in the future will permit higher understanding of the Earth, the Moon and the Earth-Moon system, answering old questions and revealing new phenomena to be explored. The diversity of problems to which information from this experiment is applicable staggers the imagination. All five reflectors placed on the Moon are still operational and will allow further scientific exploration in the future.

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SHORT REVIEW OF THE BENEFITS OF USING DRONES IN AGRICULTURE

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Abstract

This article is an overview of the impact of drones in precision agriculture based on information from studies made on this topic. The research includes the improvements drones has made in the agriculture, by making the work more efficent and easing it at the same time. Another thing about using drones is that the financial part is getting better, without losing the quality of the work.The subject of this research is in a continuous growth, more and more farmers are using it nowdays.As a conclusion, precision farming is getting better due to technology, with the number and quality of production increasing.

***Key words**: agriculture, drones, farming, precision.*

INTRODUCTION

Nowdays, precision farming and technology have become indispensible, especially when considering their impact on the Romanian farms. Precision agriculture is the future and the progress of the Romanian farms. More and more farmers use the latest technology in the field (G.P.S, automatic devices, sensors, monitoring and control system, etc.) to ease their work and to obtain remarkable results by using resources that are distributed in a control manner.

No precision agriculture can fuction without G.P.S. Manual and automatic control has attracted more and more Romanian farmers who need fast and efficient field works. G.P.S can be placed on all equipment, from tractors to harversting machines, and from sprinklers to drones. Drones can be highly used in controlling everything that happens in the field, particulary at harverstingtime.The idea was lunched in the 1980's, but the present-day technology allows its application in a way that was previously unconceived of.

This project is the result of the work carried out by Cortney Robinson, secretary of the SC 16 technical subcommittee of the ISO/TC 20 technical committee, and responsible for the aircrafts currently known as drones.

MATERIALS AND METHODS

To characterize the utilisation of drones in precision agriculture, we followed these indicators: speed, quality, precision, the farmers opinions, the way these had developed, and what softwares they use.

The information we brought were taken from statistics, articles, interviews, and again opinions from farmers that are using drones in precision agriculture.

RESULTS AND DISCUSSIONS

Precision agriculture refers to the way farmers manage crops to ensure efficiency of inputs such as water and fertilizer, and to maximize productivity, quality, and yield. The term also involves minimizing pests, unwanted flooding, and disease.

Drones allow farmers to constantly monitor crop and livestock conditions by air to quickly find problems that would not become apparent in ground-level spot checks. For example, a farmer might find through time-lapse drone

photography that part of his or her crop is not being properly irrigated.
Agricultural drone technology has been improving in the last few years, and the benefits of drones in agriculture are becoming more apparent to farmers. Drone applications in agriculture range from mapping and surveying to cropdusting and spraying.
The process of using a drone to map or survey crops is a relatively straightforward one. Many newer agricultural drone models come equipped with flight planning software that allows the farmer to draw around the area he needs to cover. Then, the software makes an automated flight path and, in some cases, even prepares the camera shots.
As the drone flies, it automatically takes pictures using onboard sensors and the built-in camera, and uses GPS to determine when to take each shot. But if your drone does not have these automatic features, then one person needs to fly the drone while the other takes the photos.

Figure 1. An agricultural drone package

Precision Agriculture is doing the right thing, at the right place, at the right time. Knowing the right thing to do may involve all kinds of high tech equipments and fancy statistics or other analysis. Doing the right thing however starts with good managers and good operators doing a good job of using common tools such as planters, fertilizer applicators, harvesters and whatever else might be needed. (Colvin and Kerkman, 1999).
Demographic and economic research perspectives have given a great deal of attention in recent years to the adoption of precision agriculture. However, very little attention has been given to the perceptions and attitudinal reasons for farmers to adopt these technologies. While economic benefit is the primary reason given by producers to adopt precision agricultural technologies, other attitudes play roles in the adoption decision.
Drones are affordable, requiring a very modest capital investment when compared to most farm equipment. They can pay for themselves and start saving money within a single growing season.
Operation is relatively simple, and getting easier with every new generation of flight hardware. They're safe and reliable. They are easy to integrate into the regular crop-scouting workflow; while visiting a field to check for pests or other ground issues, the drone can be deployed to collect aerial data. Yet, the real advantages of drones are not about the hardware; the value is in the convenience, quality and utility of the final data product.

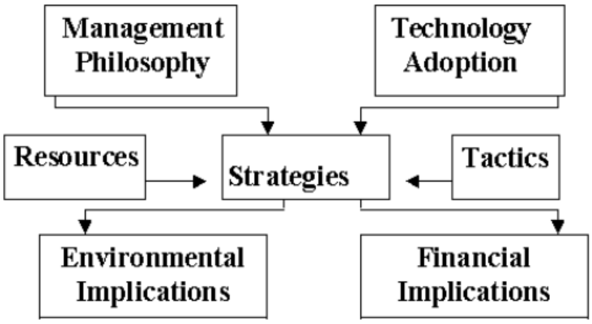

Figure 2. Factors that influence the choice of strategy

Spraying with a drone helps the farmers to reduce the cost and at the same time the precision is bigger than the spraying made manually.
Spraying by agriculture drones is estimated to save up to 90% of water usage for irrigation and could save between 30% to 50% of chemicals in crop spraying. Spraying by agriculture drones is estimated to save up to 90% of water usage for irrigation and could save between 30% to 50% of chemicals in crop spraying. Remote controlled agriculture drones expose operators to fewer chemicals. Agriculture drones are estimated to improve efficiency by between 40 times to 60 times

compared to manual labour, and up to 5 times faster than tractor application of pesticides.
On the one hand, these figures show the general interest of the agricultural community, and on the other hand, they themselves increase this interest. Such a “self-heating” market indicates that it will only grow. And maybe even an unexpected expansion will take place leaving those who are sceptical of the technology behind.The infographic provides that many farmers are actually implementing these modern aerial tools.

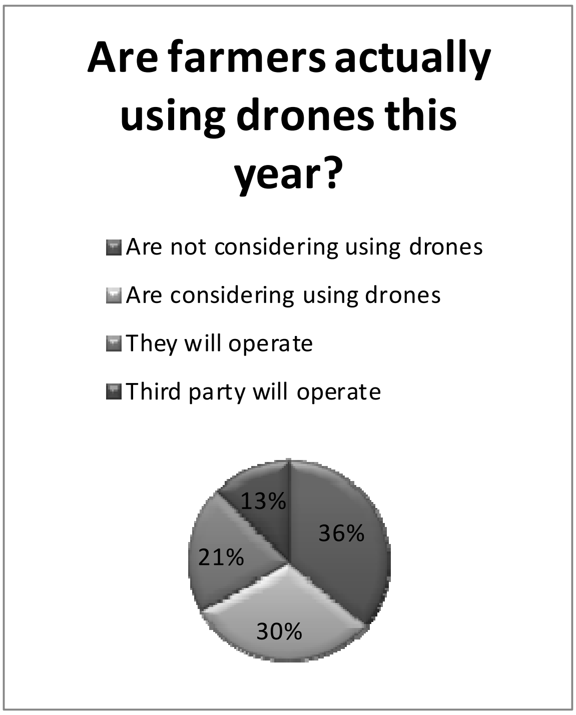

Figure 1. The percentage representation for the usage of drones by farmers

Key takeaways of the poll:
Most farmers are operating their own drones.The trend is going in the right direction – 30% said they are not using drones now, but will consider for next year;There is still some work to do for the drone industry: 36% say that they are not using drones and have no plans to do so.Of the farmers who said that they do use drones, about 64% said they will operate the drone themselves. The remaining said that they will hire a 3rd party professional operator.The 36 percent of respondents who are not using drones – and don’t plan to – indicate that the industry is still in its infancy. As drone use becomes more widespread, and the drones and data platforms easier to use and more familiar, those numbers could change rapidly.

The trend is good news for the drone industry. Agriculture is one of the top vertical markets for drones, with a strong and a broad range of available tools. The drone industry claims a “triple bottom line” for agriculture. Drones provide an inexpensive method of getting data; and the data can easily be used to both cut expenses and increase yields. Drone projects scale across many different sizes and types of operations. Consequently, agriculture has been one of the fastest growing sectors for commercial drones.
The use of drones, in agriculture is growing rapidly. But practical applications for drones on the farm and ranch are expanding faster now than ever before.

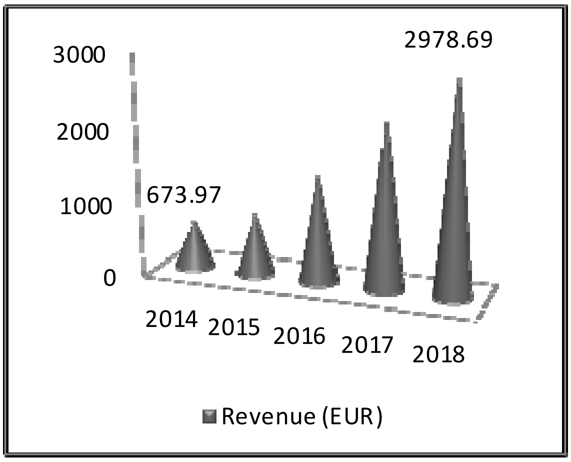

Figure 2. Evolution of market for drones

The results of the Zion Research analysis are somewhat restrained and state that by 2018 the market for drones will increase to $2.978 billion. But, regardless of the financial results, all analysts agree that the agricultural drone market is expecting significant growth.

CONCLUSIONS

Technological evolution of devices with G.P.S including drones has revolutionized classic agriculture with a bigger precision that influenced the quality and quantity of agrarian production, resulting what we call nowdays precision farming.
Remote sensing technology plays an important role in precision agriculture and it is application in the precision agriculture introduces new opportunities for improving agricultural practices.

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UNIVERSITY MAP TOUR

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Abstract

The paper aimed to present a GIS map with photos, text or links to the objectives of the BUASVM Timisoara campus stored in the Story Maps web application. This map can be viewed in real-time on a desktop, tablet, and even on a mobile smartphone by anyone.

***Key words**: ArcGIS Online,Story Maps, University Campus, Web Map.*

INTRODUCTION

Esri Story Maps represents a simple way, but with a strong character of informing people of any story we want to share, which implicates the use of maps, locations and geographic coordinates. Esri Story Maps are web applications that allow developers to combine maps with text, stunning images and multimedia content, including video. Applications are designed to be attractive and usable by anyone, which makes them excellent for education and mobilization, or to the general public or a specific audience.
The most popular and common stories maps are the following (https://storymaps.arcgis.com/en/):

- Story Map Tour: represents a sequence of photos or videos that users can follow in order;
- Story Map Cascade: creates a full-screen scrolling experience;
- Story Map Journal: Create a detailed narrative, organized in sections with one or more maps, text and images.
- Story Map Series – Tabbed: shows a series of maps trough a set of tabs.
- Story Map application uses intuitive geographic information as means of organization and presentation of events.

MATERIALS AND METHODS

Geographic information systems are computer systems capable of holding and using data describing places on the Earth's surface (Herbei, 2015).
In this work it was used ESRI platform, which includes the ArcGIS desktop solution and the ArcGIS Online cloud solution, based on existing account at BUASVM TM. ArcGIS Online is a complete cloud-based mapping platform (http://www.esri.com/software/arcgis/arcgisonline). The story map can be only make with ArcGIS Online, a scalable and secure software service hosted by Esri (Figure 1).

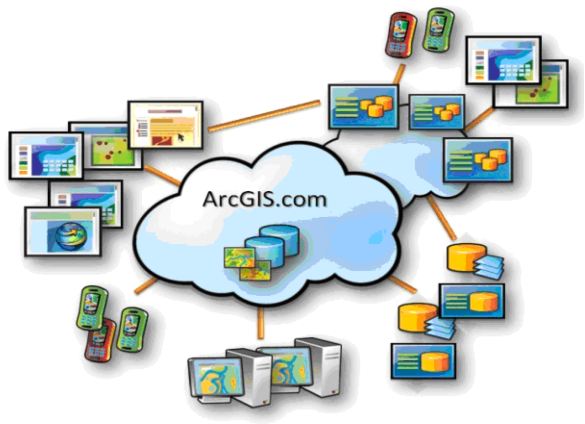

Figure 1. Description of the ArcGIS Online platform

When shooting geocoded maps applied in the story maps was used a drone DJI Phantom 4 (Herbei et. al., 2017) and a mobile phone operatingiOS system.

RESULTS AND DISCUSSIONS

The Story Map application templates are hosted in ArcGIS, so there's nothing to download or install when you create a story map. You simply launch the interactive builder for the app you want to use as an author and publish your story.

For the mobile application (Barliba et. al., 2017) which create story campus map were made geocoded photos,to every objective within the campus, following the route showed in the Figure 2.

To achieve story map application we proceed through the steps shown in the following diagram (Figure 3).

Figure 2. Area of the campus marked on the map through a dotted line

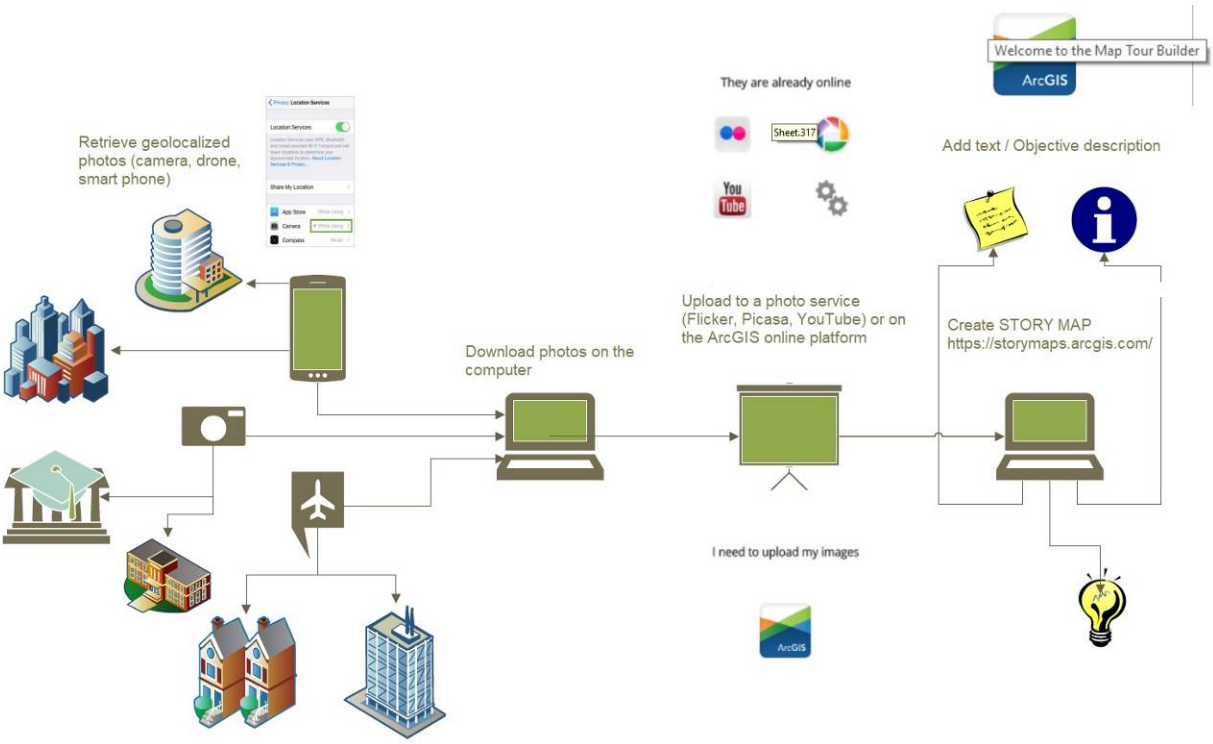

Figure 3. Workflow for making a Story Map

The following steps detail how we geotag the images we upload from the camera or smartphone and how to reorganize the marked photos to make a story using the features available on ArcGIS Online.

The examples of these steps are presented below:

Step 1. Acquisition of geocoded images. I've enabled location services on my mobile phone. On Iphone, this is done in the Settings>Privacy> Location Services> Camera (Figure 4).

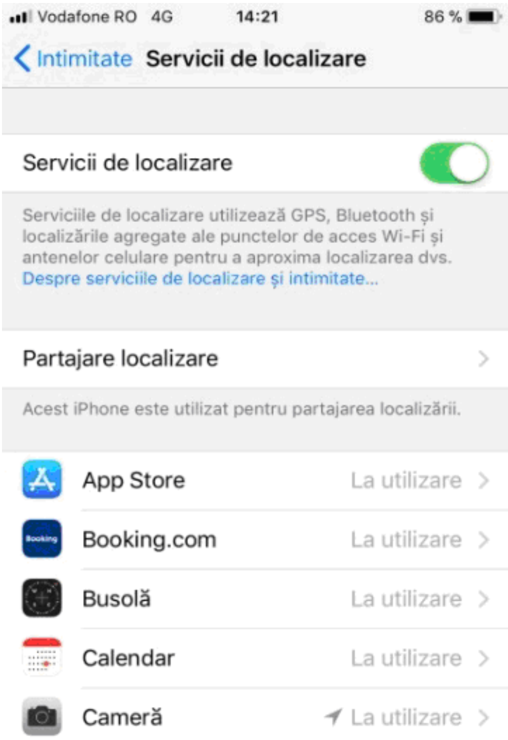

Figure 4. Set up location settings on your mobile phone

They were taken 20 photos, which along with links and / or textual information about the point of interest were uploaded into the story map application.I mademy images sizes appropriate for how they will be used in my story map. So using a 5MB photo in a web appor an especially poor quality one used as a thumbnailis never a good idea.

Step 2. Creating the story map application in ArcGIS online.

First of all I logged into ArcGIS Online (AGOL) and added any layers to the base-map that I wish to be present in Story Map (Figure 5).

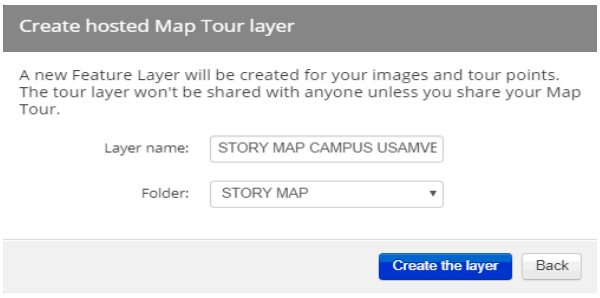

Figure 5. Create hosted Map Tour layer

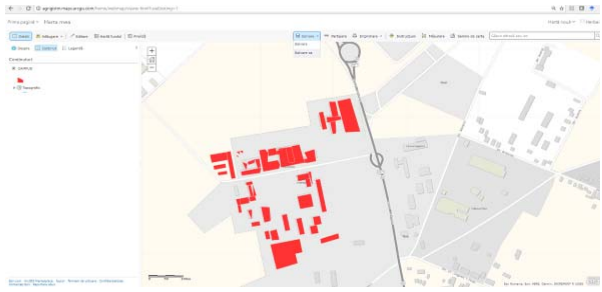

Figure 6. Map application

Step 3. Saving map created AOL (ArcGIS Online) and share them to other users (Figure 7).

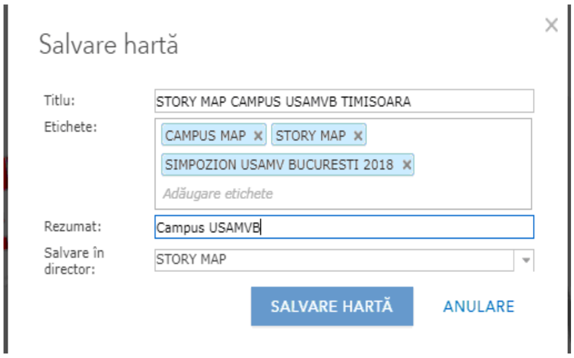

Figure 7. Save map – Including title, tags and summary

After we saved the map, we shared it and choose who can see it (group or everyone) and then press the button create web application (Figure 8).

Figure 8. Sharing the Web Map

Step 4. Create web application

Of the many applications that this platform provides us we've used Story Map Tour (Figure 9).

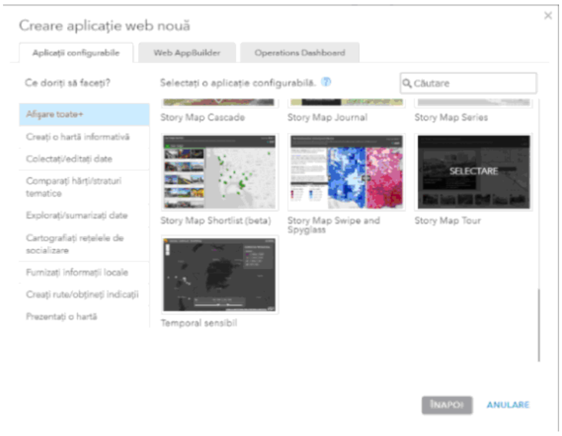

Figure 9. Make a web application- Story Map Tour

Step 5. Upload individual photos

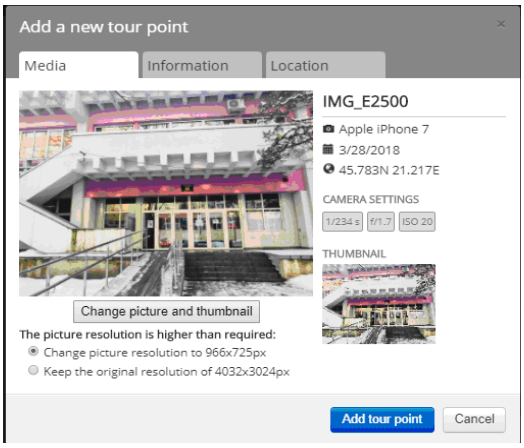

Figure 10. Uploading photo

After loading a photo (Figure 10), some parameters can be edited, for example: Title of the picture, objective description in the picture (Figure 11), manually setting the location of the picture, in the case of a non-geocoded photograph (Figure 12).

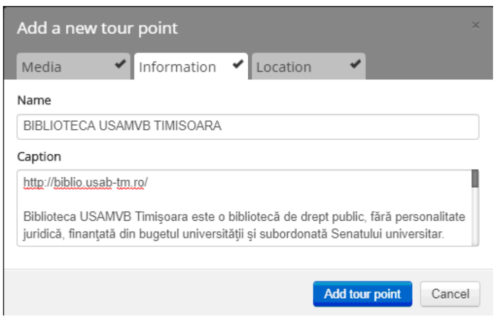

Figure 11. Adding informative text

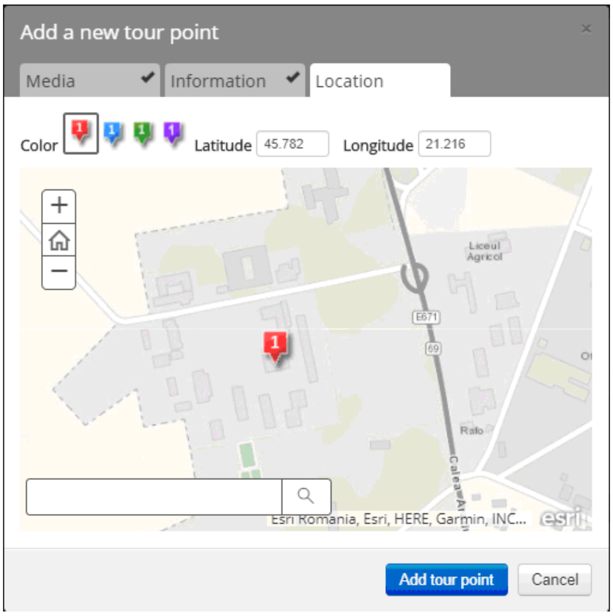

Figure 12. Photo location and manual setting for non-geotagged photos

For each point of interestwould be loaded 2 photos. One picture will be set as a thumbnail and the other one in the caption section. In order to attach some links to the objective as title (Figure 13) I have used the following syntax: BibliotecaCentralaBUASVM Timisoara.

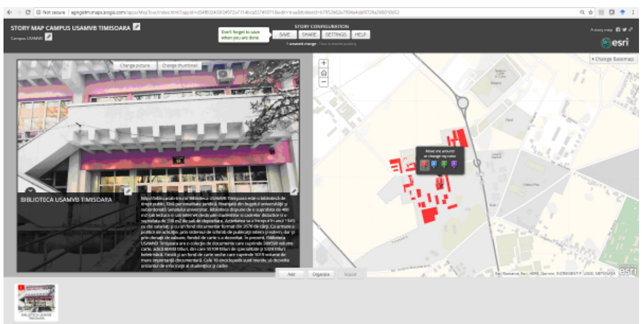

Figure 13.The title of the photo and the informative text for each photo

The same processwas use for the other objectives of university campus. In Figure 14 and Figure 15 is presented the general map of the campus with all the objectives displayed and represents the final result of the Story Map.

Figure 14. Main BuildingBUASVM

Figure 15. BUASVM Campus

CONCLUSIONS

This application is useful to all students, teachers or campus visitors of BUASVM Timisoara because it includes everything is necessary for them to discover the campus starting with photos for an easy orientation and ending with the description of each point of interest. All of this makes this application an advance and updated GIS solution of story map tour.The link for this Story Map is: http://agrigistm.maps.arcgis.com/apps/MapTour/index.html?appid=d34f802403f24972a7114bca53749371

It's a real-time application, can be used on any mobile device, phone, tablet or PDA which has an internet connection.

It can also be upgraded at any time but only by the administrator or by the people who have been granted access to the application editing.

In the following pictures is presented the entire campus with all 6 Faculties from our University (Figures 16-21) and the Orthodox Church (Figure 22).

Figure 16. Faculty of Agriculture

Figure 17. Faculty of Horticulture

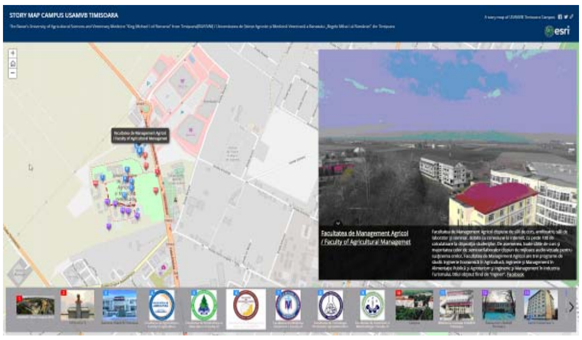

Figure 18. Faculty of Agricultural Management

Figure 19. Faculty of Veterinary Medicine

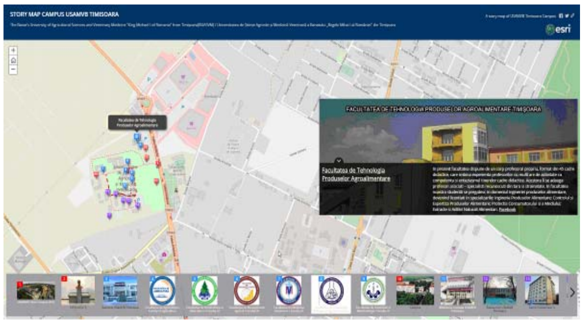

Figure 20. Faculty of Food Processing Technology

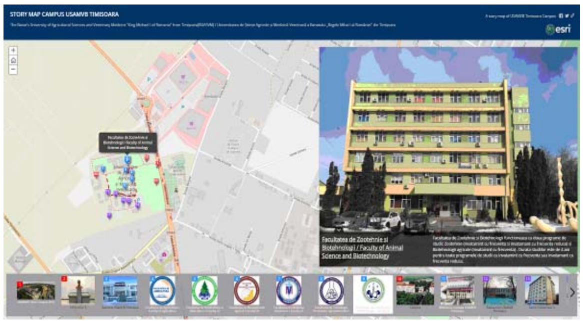

Figure 21. Faculty of Animal Science and Biotechnologies

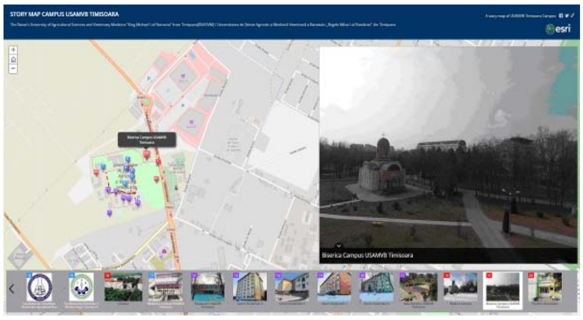

Figure 22. The Church from the Campus

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www.usab-tm.ro

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COMPLEX STUDY OF ZANOAGA-BRAN ZONE FROM ROMANIA

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Abstract

The main purpose of the study is to effectuate a complete GIS analysis to design a fun park located within the Bucegi Natural Park. The objectives that achieve this goal are given by the complex study of the area of interest and include: topographic measurements that take into account the surface proposed for the planning and topographical measurements on the torrential hydrographic network for realizing the natural flood risk maps. The study will include the way of realizing the support network based on which was made the land measurement, both planimetric and altimetric for the elaboration of the topographic plan and the three-dimensional model of the terrain. The closed-loop method on the starting point was used, combined with the radius method. The study of the torrential hydrographic network of the area of interest envisages the elaboration of some calculations based on topographicalmeasurements made on the river valley, and its elements. This will result in the situation of the network in case of natural disasters and the management of the risk situations by estimating and quantifying the possible damages. All the steps listed above are based on the preparation of the GIS surface analysis project, which in turn will represent the basics of designing a fun park.

Key words*: topographical measurements,torrents study,GIS analyses, fun park.*

INTRODUCTION

Terrestrial surveys have an important and while-ranging role throughout the globe. They represent the basic support for designing and constructing any study of the Earth's surface. The main purpose of the study is to prepare a complete GIS analyze for the setting up of a theme park located in the Bucegi Natural Park. The objectives that lead to the achievement of this goal are given by the complex study of the area of interest and include: topographic measurements that take into account the surface proposed for the planning and topographical measurements on the torrential hydrographic network for drawing natural flood risk maps. The study area is located in the protected and management area of the Bucegi Natural Park, which is also located on the administrative territory of Brasov County, more precisely in Bran Valley. The land area concerned show the western limit of the park, which is structural-tectonic and morpho-hydrographic, comprising a rich hydrographic network made up of streams as well as different eypes of roks. By identifying the cartographic basis of the land it was found that it lies on the surface of the trapezes L-35-87-D-b-1-I and L-35-87-D-b-1-II (Figure 1).

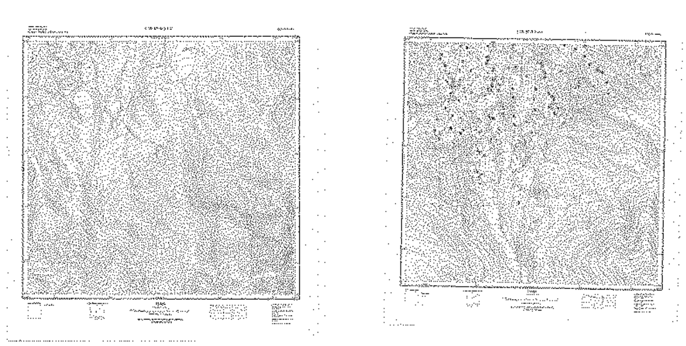

Figure 1. Trapeze L-35-87-D-b-1-I and trapeze L-35-87-D-b-1-II

The total area of land in the Bucegi Natural Park under study is approximately 38.000 sqm which covers a 1,4 km perimeter, out of which

14.000 sq m have been granted to meet the proposed objectives in view of carrying out topographical measurements for the purpose of setting up a park of entertainment. The remaining area of 24.000 square meters of land was allocated to the hydrographic network study of the area, covering both the riverbeds and the water of the river and its slopes.

MATERIALS AND METHODS

The chosen methods of work were influenced mostly by relief forms in the area, the land being at the entrance to the park and on it there are different types of rocks, trees with an average height of 30 meters and a stream.
For the start of the field works, the first stage was to raise the land level where the entertainment park is to be designed.
For designing the support network, the points were chosen to meet the following conditions:
• Points are accessible
• Location of points near construction and forest vegetation has been avoided to reduce the multi-path effect
• Points were not located under high-voltage lines, nor near electromagnetic wave emitters
• For a cut of angle of more than 15°, there are no obstacles that could block the signal
• For the kinematic method PDOP, it must not exceed a value of 5
After selecting the location of these points, they were materialized on the ground and signaled in advance, and then, with the aid of the GPS device, namely the ComNav T300, measurements were made to establish the position of these points in the National Stereographic System 1970 (for X, Y) and the Black Sea 1975 (for Z).
The next step will be to design the levels collection network, which must be located so that all the details of the land can be collected from the points of the network. Thus, the method of turning closed on the starting point, combined with the radius method, was chosen.
As with the support network, the points are judiciously chosen taking into account the conditions:
• Visibility between station points, but to the points of the lifting network at least two points of the lift network.
• Location of the station points has been made so that there is visibility to all interested details.
• "Discarded stations" were also carried out, which were determined by double erasure, allowing the detailing of the details if they cannot be targeted at the main stations.
• For the density of the network, the configuration and the location of the site were taken into account, using a number of stations that comply with the technical norms: 1 pct / km^2 at lowland, 1 pct / 2 km^2in the hill area and 1 pct / 5 km^2 in the mountain.
• The points have been placed so that they are free from traffic, they are not destroyed and the protection of the device and the operator has been ensured.
Once selected, these points were marked and signalled (Figure 2). The measurements were started and consideration was given to raising every detail that consisted of trees, rocks, forest roads, vestibules, stream and its elements and as well as other elements that helped to replicate the geometry of the terrain.
In order to raise the river valley (Figure 3), stations were thrown along it and the ridge of water, the riverbeds, the slopes between which is included and other details that help to obtain its 3D model.
The equipment used for the measurements was the Leica TCMR 1103+ total station with a 3-second angular accuracy.

Figure 2. Location point station;

Figure 3. Raising the river valley

RESULTS AND DISCUSSIONS

After completing the above-mentioned stages of the field, we passed to the office stages. These stages consist of processing the data collected from the field with which it will draw up its location plan.
The measurements were exported from the GPS and the total station with help programs and transferred to the computer, after which the semi rigid reading compensation was performed. Compensated points were reported using the AutoCAD 2013 program, at a 1: 500 scale, from which both the 3D surface model and its location plan, which includes all the details found in the field.
The basin level curves were also drawn (Figure 4). The second stage includes the study of the torrential hydrographic network of the area of interest (Munteanu et al., 1979; Munteanu et al., 1993). The study envisages the elaboration of some calculations based on the topographical measurements performed on the river valley, as well as its elements, measurements presented in the field stage. This will result in the situation of the network in case of natural disasters and the management of the risk situations by estimating and quantifying the possible damages. Natural flood risk maps are documents on the basis of which the state or local government bodies manage crisis situations caused by actual or potential floods (Ionescu, 2006; ***, 2003;***2005).
From a geological point of view, the territory was formed in the lower to middle cretacic and consists of conglomerates and limestones arranged on a foil crystalline support, as well as depressions formed by crystalline nuclei, foil limestone blocks and embedded in conglomerates, sandstone and marl , constituting themselves in the geological substrate on which the soils were formed(***, 1960; ***, 1983).
By presenting a medium and even low erosion resistance, such rocks favour beginning of erosion and amplify torrential transport.

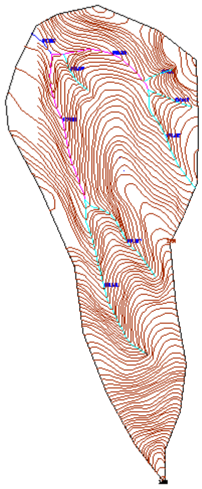

Figure 4. The underground river basin studied

With the measurements made with the total station but also with the use of the basic plans L-35-87-Db-1-I and L-35-87-Db-1-II and the ortofotoplan 530-442 were determined the elements representing basin morphometry. The basic morphometric parameters of the basin were determined with AutoCAD:

- The surface, which shows the dimensions of the basin and therefore it is found that we have to deal with a small hydrographic basin, ie with a hydrographic basin with a pronounced predisposition to the torrentiality, knowing that there is a chance of its uniform covering by a rain;
- The perimeter is presented in tandem with the surface;
- The average length of the basin;
- The shape of the basin, which is determined by means of three coefficients:
  - The coefficient of Gravelius;
  - Circularity report;
  - Extension ratio;
- Minimum, maximum and average altitude;
- The height of the basin;

- Basin slope;
- Length of slopes in the basin;

The following hydrographic morphometry elements were determined: the hydrographic order, which according to the Strahler system, the studied hydrographic basin contains segments of order I, II and III, the length of the bed and the mean slope of the main bed.
Also, the maximum liquid flow rate was calculated by indirect methods, i.e. by methods that take into account the rain that is at the origin of the flood and the characteristics of the basin that are involved in the formation and propagation of the flood (Clinciu and Lazăr, 1999). Maximum flow was calculated by two methods, namely:

- Rational formula: the flow is calculated taking into account the average rainfall intensity, the average drainage coefficient on the basin and the surface of the basin;
- Hourly rain formulas: for the calculation of the flow we refer to: the surface of the basin, the average drainage coefficient, the maximum hourly precipitations, the districts on Romania Territory and a sub unitary exponent on the territory of Romania;

In order to determine the water level at any point on the hydrographic network, the topographical measurements were checked in the cross sections at three points per each bed area. The GIS program, HEC-RAS, has been used, which, based on the spatial development of the hydrographic network (Figure 6) and the cross-sections (Figure 5), has made an overall view of this network (Tereşneu, 2005; Tereşneu et al., 2006). For each section, two or three points were taken on the bed and three points on each bank. Further, the following steps were taken:

- Digitization of the hydrographic network;
- Entering data specific to each cross-section taken from the field by the total station;
- The introduction of the liquid flow values calculated for each river bed area;
- Define the corresponding junctions (the points of confluence) and the lengths of the arcs intersecting at the respective points;
- Specification of the normal depth condition in the calculation section;
- Triggering the water level simulation across the hydrographic network;
- Analysis of each riverbed sector ;

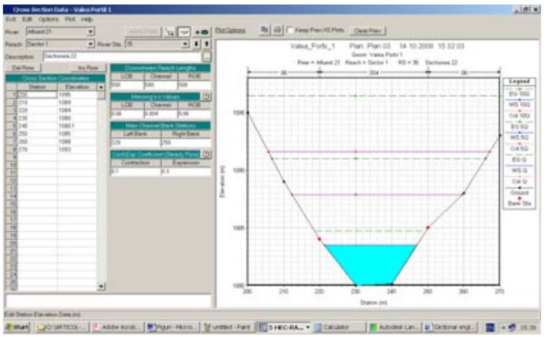

Figure 5. Water level figured in a cross section

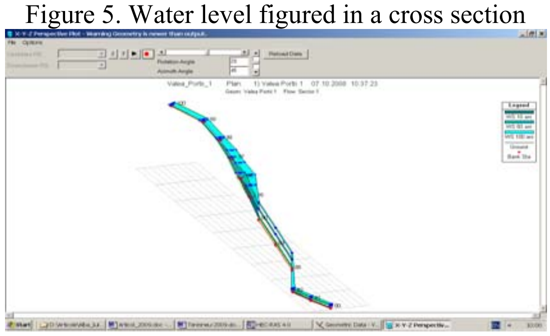

Figure 6. Space development of the runway of the river;

Therefore, the determination of the morphometric parameters of a river basin and the maximum flow rate forecast within it is accomplished in AutoCAD with a much lower effort than the classical one, and in addition it ensures a higher accuracy and a good quality of results.
Knowing the value of the maximum liquid flow rate and having certain metric measurements on the downstream hydrographic network (at least three cross-sections), using the HEC-RAS program, the water level can be obtained at each point of the bed, and it is possible to draw up the map of natural flood risk for the respective area, a document on the basis of which the state or local government bodies can manage the crisis situations caused by actual or potential floods.

In conclusion, all the above-mentioned stages, both the field and the office ones, are based on the elaboration of the GIS project related to the surface in question. This complex study will represent the basics of designing a fun park within the Bucegi Natural Park.

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THE IMPLEMENTATION OF THE GIS PROJECT FOR THE REGINA MARIA- BRAN PARK AND THE PRESENTATION OF THE REFURBISHMENT SOLUTIONS

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Abstract

The paper aims at mapping the surface for the purpose of implementing the GIS project for the Regina Maria Park, located in Bran, Brasov County, and the presentation of the refurbishment solutions. This paper provides the topographic documentation necessary for the design and the realization of the GIS complex project. In order to achieve this goal, several objectives and stages were followed. For obtaining all the measurement there was used the closed-loop roadside method combined with the radiation method. Additionally, there were made measurements on the field through which all the topographic details existing in the study area were radiated for the purpose of obtaining the topographic plan by which the existing situation in the field was redeemed. The necessary data for the GIS project were also collected from the field. The data obtained from the measurements that took place on the field was processed using specialized software and compensated through different methods. Using these final data all the necessary drawn pieces for completing the paper were obtained. Through the specialized programs, the complex database for the GIS project was created. Achieving these objectives aims at realizing and presenting the solutions for the refurbishment of the Regina Maria – Bran park.

Key words: *GIS, geo-topographic measurements, redevelopment.*

INTRODUCTION

Regina Maria Park is situated in Bran, which belongs to Brasov County. It is located in the central area of Bran and represents a wonderful place to walk, built and named in memory of the Queen Mary.
The main purpose of this paper is the realization of the project that comprises the redevelopment of the park and presenting the solutions. For obtaining this project it is necessary to prepare the GIS project by means of measuring methods and geo-topographic projection.
Concerns about the arrangement of parks, green spaces in general existed since ancient times, some ancient peoples having a special cult for this. The paper contains data on the area in the study, field data collected using complex measurements that were possible to be realized with specific equipment.
Finally, the work contains drawn pieces from the measurements, the GIS project and the park redevelopment solutions.

MATERIALS AND METHODS

The Regina Maria park area, belongs to the commune of Bran, in the county of Brasov, Romania (Figure 1).

Figure 1. Location of the commune of Bran

The direct measurement method was done by fieldwork using GNSS equipment and the total station. The method of data processing is done

by offsetting it in a classical manner and through the Leica Geo Ofice and Toposys programs.
GIS methods are applied through georeferencing the plans, GIS analysis and through AutoCad, ArcGis, ArcInfo programs.

RESULTS AND DISCUSSIONS

To achieve the final goal, there were followed certain phases characteristic of the topographic domain, both specific measurements and complex methods that allow obtaining complete and precise parts.
The identification of the existing cartographic basis in the area was carried out by research on the cadastral plans, maps and the orthophotomap. These exist on the cartographic basis of the cadastre, which provides information of the area that is under study.
In this project, for the identification of the surface studied, the trapezoid was used at the scale of 1: 5,000 from 1973, namely the trapeze L-35-87-Bc-4-IV, which was georeferenced in order to overlap the measurements on the existing plans, on the trapeze (Figure 2).

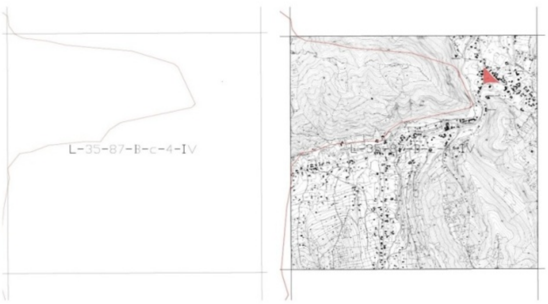

Figure 2. Trapeze and georeferenced trapeze

For an updated image of the land in the area of interest, we also have the orthophotomap (Figure 3), which has a great amount of visual information. This contains the geometric qualities of a plan (Vorovencii, 2010). In order to carry out the measurements, the ground was analyzed and depending on the situation on there, the measurement method and the necessary equipment were established. Thus the closed-loop method was combined with the radiation method.

Figure 3. Overlap on orthophotomap

During the completion of this paper, for the construction of the lifting network needed to draw up the topographical plan, there was created in the first stage a local support network with arbitrary coordinates. These points were materialized on the ground and placed so that on these points they will lean later station points used in the work for the elevation plan. The determination of that network was done using GPS (Global Positioning System) means using ROMPOS services and also through the pure, cinematic procedure in real time RTK (Chițea and Hanganu, 2013). In order to determine the support network, the existence of 2 permanent GNSS stations, within the RN-GPS network, were identified: Sinaia, Sfantu Gheorghe.
The GNSS equipment used in the work is the Leica GPS900 and the RX900 receiver (Figure 4).

Figure 4. The GNSS equipment Leica GPS900

In the second stage of the field measurements, there were established the points of the lift network and materialized on the ground so that

from these points it is possible to recording all topographical details in optimal conditions and to obtain a complete plan.
Direction points are selected directly on the ground after the points of the support network have been identified beforehand. To select the position of the traverse points, a number of principles must be considered (Iacobescu and Barnoaiea, 2010).
Both the points of the support network and the lifting network were materialized on the ground using metallic and appropriately flagged bolts, painted in red.
The Leica TCRM 1103 plus was used to build the lift network, this total station is high-quality equipment that uses advanced technology that allows measurements to be performed easily (Figure 5).

Figure 5. Total station Leica TCRM 1103 plus

The traversing starts at point 1 of the support network of the known coordinates. At this point, has been stationed and the angle 0 was set by means of a visa to the point 2 of the lift network then taken back to the point 7. The derailment continued in the topographical sense. The traversing closed at the starting point, station 1 (Figure 6).

Figure 6. The traverse

The compensation of the data was done by the following methods: classical and rigorous.
The classic, empirical compensation method is a simple and convenient one, but it is less precise, it is accomplished through several steps consisting of offsetting the coordinates of the points according to the non-closings on the guidelines and the relative coordinates of the points. In order to achieve the classic compensation, we use calculation formulas.
The rigorous compensation method is done automatically by Toposys software which allows the processing and compensation of all types of measurements used in geodesy for topping up local geodetic networks. In this, the primary data can be entered as: coordinate lists - fixed points, which contains: horizontal and vertical / zenith angles and distances, quota lists or level differences lists.
This compensation is carried out in several stages.
By means of the two compensations the final coordinates of the traversing points are obtained.
To create the GIS project in the design software used, AutoCAD, it is necessary to create a new project and set the working mode and certain settings related to points, text and so on.
After making these settings, all the points resulting from the measurements are imported, and through the layers, the drawn elements are individualized.
The drawing is then digitized in ArcGIS by linking the corresponding field to the associated layer.
Topology creation and error correction will be done in ArcInfo.
After completing the project in ArcGIS by vectoring, i.e. completing the plan with the details that could not be radiated in the field, the database containing information about the existing graphic entities will be filled in, or additionally fields may be added, deleted or modified.
The GIS software is designed to create, manage, analyze and display all geographic reference information (Tereşneu and Ionescu, 2011) The GIS product allows us to view, understand, query and interpret from a geographical point of view. The GIS analysis determined the areas occupied by the tree crown projections, the alleys surface, the

number of specimens requiring crowning, the area of the green areas and the areas occupied by the constructions (Tereşneu, 2012).
Finally, the redevelopment is intended to be a major one. In the center of the park is planned to set up a space for organized outdoor concerts, to supplement the number of banks, to introduce many examples of gladita, decorative plants, playground for children, shops, etc.

CONCLUSIONS

The objective on which this work is structured is the realization of the GIS project, which can be used to get and present the solutions for the refurbishment of the park. In order to achieve this objective, measurements of elevation of the topographic details were made on the ground and compensations were made for the precise data of the final data used for the GIS project.

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AGRICULTURAL LAND COVER CLASSIFICATION USING RAPIDEYE SATELLITE IMAGERY

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Abstract

Remote sensing is of great interest for the study and characterization of the vegetation and of the agricultural crops, in order to monitor them and to develop predictable patterns regarding the evolution of the crops and also for the purpose of the decision making process in real time. This paper aims to perform a qualitative and quantitative analysis between the supervised and unsupervised methods of classification of satellite imagery. In this context, a Rapid Eye satellite image was used at a 5m resolution taken from the www.planet.com platform from May 2016, which underwent complex preprocessing and processing operations to retrieve useful information about to the vegetal cover. The studied area is within the Experimental Didactic Station of BUSAMV Timisoara. Supervised classification was based on the Maximum Likelihood algorithm and the unsupervised was based on the ISO DATA algorithm. The Rapid Eye scene was process with ArcGIS v. 10.5 software.

***Key words**: Algorithms, Classification, ISODATA, Maximum Likelihood, Remote sensing.*

INTRODUCTION

All methods based on satellite techniques are very often used in the analysis and characterization of the terrain and the vegetal cover (Gitelson 2004, Thenkabail et al., 2007, Herbei et al., 2015, Sala, 2011).

The characterization of the vegetal cover can be done both on the basis of the specific absorption, reflectivity and emitting properties (Sala et. al., 2016), as well as on the basis of certain indices calculated from the spectral information contained in the satellite imagery (Thenkabail et al., 2002, Huang et al., 2013, Herbei et al., 2015).

The classification of satellite imagery, based on analysis and group distribution of pixels with similar spectral properties for brightness value, provides high image analysis accuracy and implicitly represented areas (Akgün et al., 2004).

The constellation of five RapidEye satellites differs from other geospatial satellite providers in their unique ability to acquire daily high-resolution, high definition image data (https://www.satimagingcorp.com/satellite-sensors/other-satellite-sensors/rapideye/).

RapidEye imaging capabilities can be applied to a range of industries such as agriculture, forestry, oil and gas exploration, engineering and construction, governments, cartography and mining. The RapidEye system collects 4 million square kilometers of data per day at a nominal ground resolution of 6.5 meters. Each satellite has been designed for a mission life of at least seven years. All five satellites are equipped with identical sensors and are located in the same orbital plane. The satellite images that form the basis for generating action plan maps, if used in the background of intelligent cadastral vector data, can improve the details of thematic maps as well as action plan maps. It also helps to monitor land cover changes (Smuleac et. al., 2013) that can be identified by detailed procedures for detecting changes and implemented within the GIS mapping project (Smuleac et. al., 2016).

Because the RapidEye system was designed to serve the agricultural and forestry markets, the Red Edge tape was chosen as part of the RapidEye Spectral Band Set. Over the years, several studies have confirmed the value of the

Red Edge band. The red band is located spectrally between the red band and the NIR band without overlapping. In a typical spectral response of green vegetation, the red ribbon covers the spectrum portion where the reflection increases drastically from the red portion to the NIR plateau.

The RapidEye multispectral system acquires images in 5 spectral bands, each with a different pixel resolution (or GDS ground sampling distance) of 6.5 m at the top, as shown in the following table:

Table 1: RapidEye Satellites Spectral Bands

Band	wavelength
Blue	440-510nm
Green	520-590nm
Red	630-685nm
Red Edge	690-730nm
Near-Infrared	760-850nm

Many studies have suggested that the Red Edge band is capable of providing additional information to identify plant types, nutrition and health, and to characterize plant coverage and abundance among other characteristics (Kross et. al., 2015, Herbei and Sala, 2016).

MATERIAL AND METHOD

The study area is located in the western part of Romania, in Timisoara and represents a part of the BUSAMV Timisoara Experimental Station (Figure 1), which we want to study. The land spreads over approximately 1,300 ha.

From the www.planet.com database a Rapid Eye scene was downloaded at a 5m resolution from May 2016 and contains the 5 spectral bands: Red, Green, Blue, Red Edge and NIR. This scene was analyzed in a digital environment (ArcGIS 10) (Herbei, 2015), and underwent complex mathematical operations (Herbei and Sala, 2014).

This research has used technology based on satellite imagery for classification of land cover.

By classifying satellite imagery, the analyst tries to classify the features of objects or phenomen in a satellite image using visual interpretation elements to identify homogeneous pixel groups that represent different features or classes of field coverage in the area of interest.

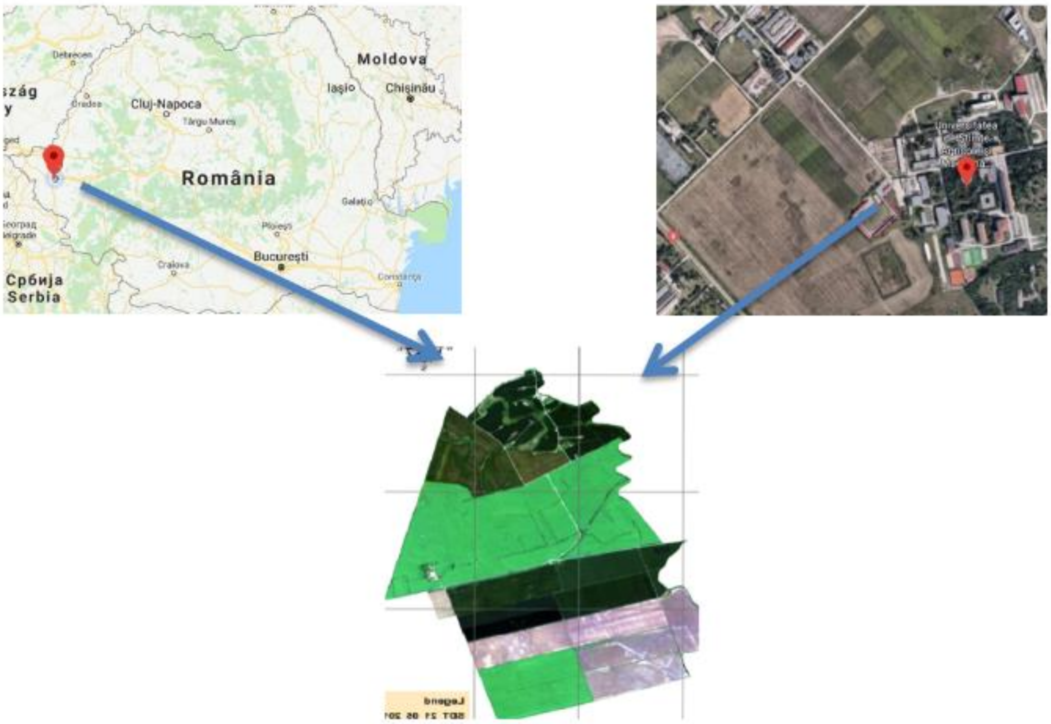

Figure 1. Area of interest

In the classification of digital images (Kokalj and Oštir, 2007), the spectral information represented by digital numbers in one or more spectral bands is used, and each pixel is framed based on this spectral information, the main objective being to assign all the pixels in the image to certain classes or themes, for example: water, coniferous forest, deciduous forest, corn, wheat, etc (Kumar, 2004).The spectral classification aims at objectively mapping areas of the image that have radiometric (reflective and / or emissivity) similar characteristics. Depending on the purpose and the required accuracy, two types of classification are used:

• unsupervised (automated by statistical means)

• supervised (spectral classes are associated with some characteristics identified by photointerpretation on the image) (Iosub, 2012).

In the supervised classification of digital image, field object objects are known in advance on certain restricted areas of the image (areas called test areas or sites). These areas fall into patterns, and then rules are developed to be extended to the unknown portions of the image. In other words, the user identifies some areas on the image that are characteristic of each set of established details.

Maximum likelihood classification, equation (1), assumes that the statistics for each class in each band are normally distributed and calculates the probability that a given pixel belongs to a specific class. Unless you select a probability threshold, all pixels are classified. Each pixel is assigned to the class that has the highest probability (that is, the maximum likelihood). If the highest probability is smaller than a threshold you specify, the pixel remains unclassified (Richards, 1999).

$$g_i(x) = \ln p(\omega_i) - 1/2 \ln\left|\sum i\right| - \\ -1/2(x - m_i)^{\gamma} \sum_i^{-1} (x - m_i) \qquad (1)$$

where:

i = class

x = n-dimensional data (where n is the number of bands)

p(ωi) = probability that class ωi occurs in the image and is assumed the same for all classes

|Σi| = determinant of the covariance matrix of the data in class ωi

Σi-1 = its inverse matrix

mi = mean vector

1.1.1. Unsupervised Classification

In this approach, the computer analyzes all the spectral signatures of all the pixels in the image and identifies areas with pixels that have similar values. The user may impose classification criteria (number of classes, number of iterations) to allow for homogeneous and differentiated groups.The algorithms underlying the automatic classification depend primarily on the spectral characteristics of the pixel, unlike the size, texture and shape, which are the characteristics of the objects on which the visual interpretation is based.

The **ISO DATA** algorithm, developed by Geoffrey and Hall (1965), uses the minimum spectral distance formula for cluster formation and clustering, based on the Euclidian distance equation (Swain and Davis, 1978; Melesse and Jordan, 2002).

$$SD_{xyc} = \sqrt{\sum_{i=1}^{n}(\mu_{ci} - X_{xyi})^2} \quad (2)$$

where:

n - number of bands,

i - band number;

c - particular class

X_{xyi} - data file value of pixel x, y in band i;

μ_{ci} - mean of data file values (digital numbers) in and i for the sample the class c;

SD_{xyc} - spectral distance from pixels x, y to the mean of class c.

RESULTS AND DISCUSSIONS

For the analysis of the territory and the vegetal cover, the classification process involved the grouping of pixels in the composition of digital images in terrain coverage classes in relation to the spectral properties. The analysis of the territory and the structure of the agricultural crops was based on the Rapid Eye satellite images and the ArcGIS 10 software. Maximum Likelihood and ISODATA algorithms were used for this purpose.

The present study used satellite imagery obtained with the RapidEye satellite system. The first map is made by combining three spectral bands, 3-2-1 (Red-Green-Blue).

This color composition is the closest to real colors, those perceived by the human eye. Ensures easy recognition of environmental components, for example, healthy vegetation is green, roads are gray (Figure 2).

It is noticed that there are more shades of green on the plot, indicating that there are several types of crops. Green tones depend on vegetation reflection (Rouse et. al., 1974). This combination of bands is, however, inadequate in the analysis of vegetation due to the absence of an infrared band in which the vegetation has the maximum reflection.

The second map is derived from the combination of Spectral Strips 5-3-2 (NIR-Red-Green). It's a false-color image which makes the colors on the image no longer match those perceived by the human eye for certain environmental components. For example, vegetation is easily detected, which is identified by different shades of red, depending on the plant type.

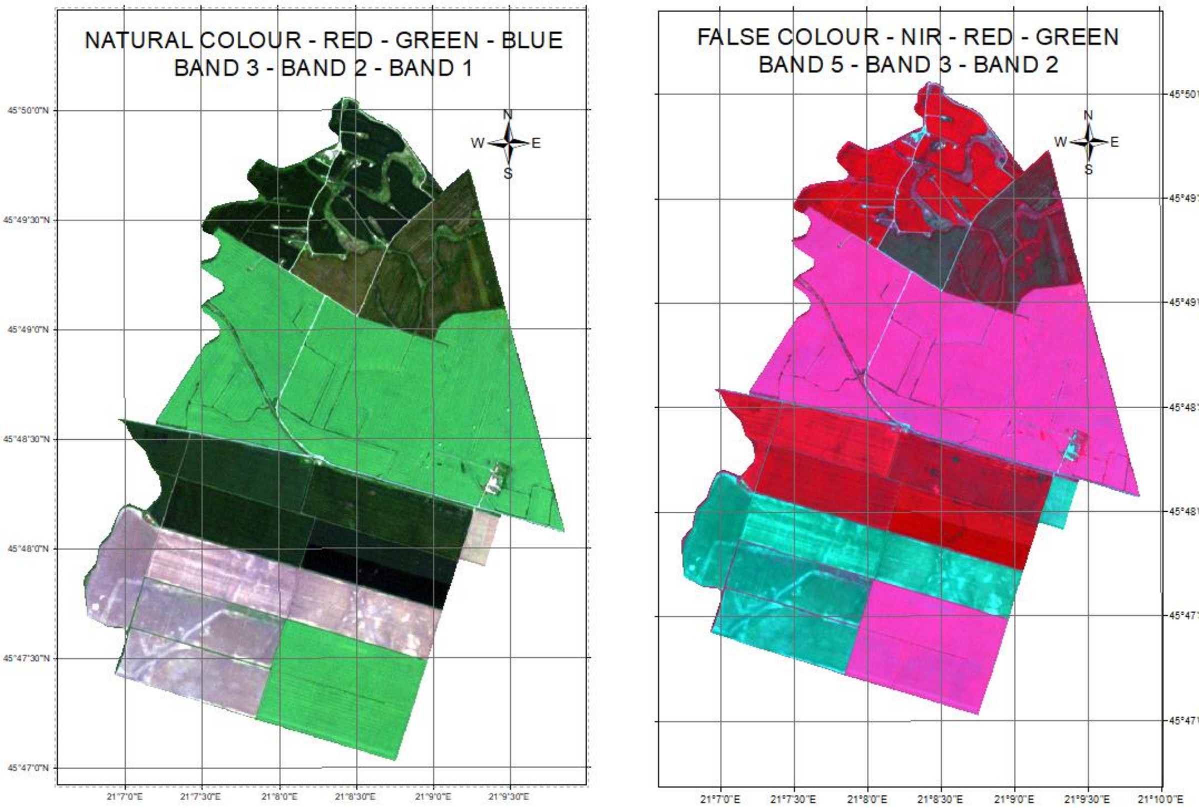

Figure 2. The Study Area in natural colors and false-colors

Because vegetation has maximum reflectivity in the infrared, the description of the area of interest through the two classification methods (supervised and unsupervised) is based on the false-color satellite image obtained by combining the 5-3-2 bands.

For the supervised classification of the satellite image, the Maximum Likelihood algorithm will be used in the paper. This algorithm is based on two principles:

- The cells of each class within the multidimensional space are normally distributed;
- Bayes decision making theorem.

The tool considers both class signature variations and covariances when assigning each cell to one of the classes represented in the signature file. Assuming that the distribution of a class sample is normal, a class can be characterized by the average vector and covariance matrix.

Considering these two characteristics for each class of cells, the statistical probability is calculated for each class to determine cell membership in the class.When specifying the default equal option for apriority weighting, each cell is assigned to the class at which it is most likely to be a member.

Once class statistics are defined, image samples are ranked according to distance from classroom. Each sample is assigned to the class with the minimum distance. The distance itself is reduced according to the maximum rule of Bayes probability.

Practically, the Maximum Likelihood algorithm:

- It's based on probability
- Assume that all classes have a normal distribution (Gaussian)
- Spectral variance and co-variance is denoted for each class
- Classes can be statistically modeled using an average vector or co-variance matrix
- Each pixel is assigned to the class with the highest probability of membership

Three stages are distinguished in the supervised classification process:

- training stage - in which the selection of the features best describing the object / phenomenon (Figure 3)
- the stage of the actual classification (decision stage) - in which the appropriate method of comparison of the training elements (from the previous stage)
- Conformity assessment of the classification (final stage).

The training stage is the stage in which areas of interest are selected, groups of pixels with homogeneous geographic features (construction, water, forests, etc.) and a digital number with close values, of great importance in terms of quality classification.

Areas of interest are created by manual digitization, forming polygons of representative pixel groups with a best distribution within the image (to highlight some qualitative differentiations that may occur within a class).

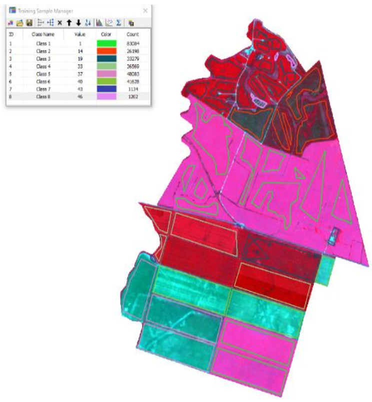

Figure 3. Supervised classification – Training stage

The analyst's experience and analytical capacity are very important, and these traits depend on the final outcome of the classification.

Once areas of interest have been established, classification can be made based on specific algorithms (Figure 4).

The "decision", as this stage is called, refers to the choice of the optimal algorithm, on which the quality of the result obtained depends.

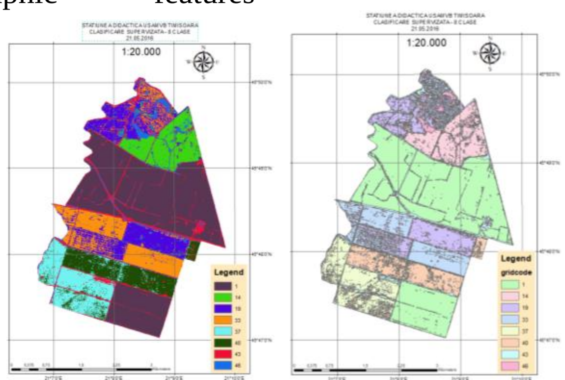

Figure 4. Supervised classification – Raster and vector

In this paper, for the unsupervised classification of maps obtained through the RapidEye satellite system, the ISODATA classification algorithm was used.This ISODATA algorithm does not require prior knowledge of the area studied by the operator. It also does not need to know the number of clusters because the algorithm divides and merges the clusters according to user-defined threshold values for the parameter, and the

algorithm runs more iterations on the computer until the thresholds are reached.
This algorithm works in the following way:

- Cluster centers are randomly placed and pixels are allocated based on the shortest distance from the center method;
- The standard deviation in each cluster and the distance between the cluster is calculated by the centers
- The next iteration is done with the new cluster centers.
- Other iterations are performed up to:

• Intermediate mean distance drops below the threshold defined by the user,
• average change in center the distance between iterations is less than the threshold, or reached
• the maximum number of iterations is reached

Clusters associated with less than the minimum number of pixels specified by the user are deleted and the single pixels are either reclassified and placed in another class, or ignored and named as unclassifiable.
Practically, when the Iterative Self Organizing Data Analysis algorithm (ISODATA) is used the standard deviation for clusters is calculated and after n iterations:
• Classes can be combined
• Classes can be divided
• Classes can be deleted
After each iteration, the percentage of pixels remaining in the same class is calculated (Figure 5).

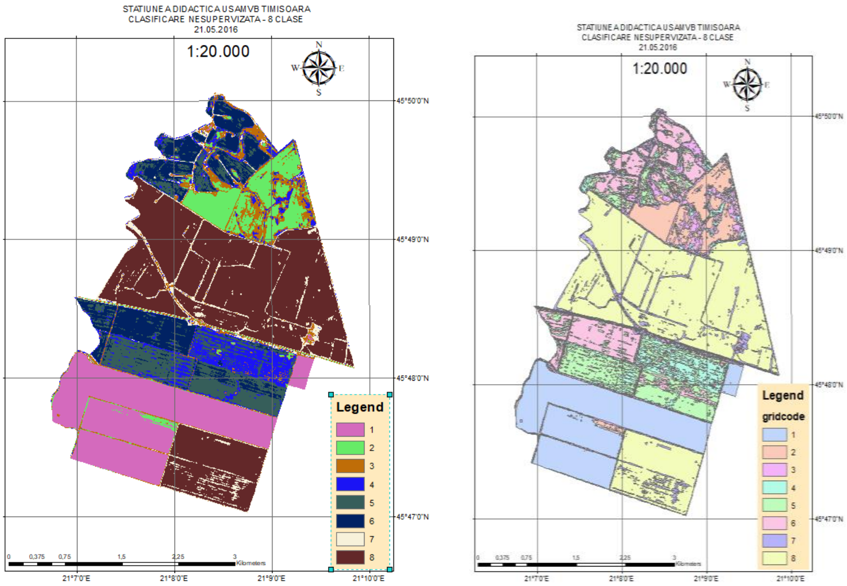

Figure 5. Unsupervised classification – Raster and vector

CONCLUSIONS

The imaging analysis based on Rapid Eye satellite imagery through supervised and unsupervised methods has made it easier to classify land and crops in the studied area with high precision. Methods can be promoted and used to monitor crops and land use.
From the analysis of the satellite imagery through the methods used, the surfaces of the cultures in the Didactic Resort of the BUSAMV Timisoara were obtained with high precision. The crop structure and cultivated areas are shown in the Figure below.
Following the classifications, there is a difference in the measured area (Figure 6, Figure 7).

Row Labels	Sum of ARIA
1	497,7480015
14	109,8061976
19	179,4067289
33	158,1682415
37	128,9554513
40	117,4336492
43	90,58742947
46	47,40246185
(blank)	
Grand Total	1329,508161

Row Labels	Sum of ARIA
1	253,5776361
2	94,65912859
3	80,77551468
4	89,43129845
5	138,5263703
6	124,8246733
7	65,48850607
8	482,2618484
(blank)	
Grand Total	1329,544976

Figure 6. Supervised and Unsupervised areas in hectares

Unsupervised classification has the following advantages and disadvantages:
Advantages:

- Does not require knowledge of the analyzed region
- Human errors are minimized

- Pixels are spectrally separated
- The analyst has control over the number of classes, iterations, etc.

Disadvantages:

- The grades obtained do not accurately reflect the categories in the field
- Limited control over class identity
- Spectral properties of classes can change over time

Supervised classification has the following advantages and disadvantages:

Advantages:

- Class identity control
- Specific classes with certain identities
- The grades obtained reflect the categories in the field
- Classification errors can be detected

Disadvantages:

- The analyst requires classification
- Regions of interest are generally related to field information and not to spectral properties
- Interstitial regions may not be representative
- Getting the regions of interest calls for time.

For security, it is necessary to analyze and process digital images to make pixel corrections in line with field reality, with some alterations being generated by the climatic conditions at the time of taking the images.

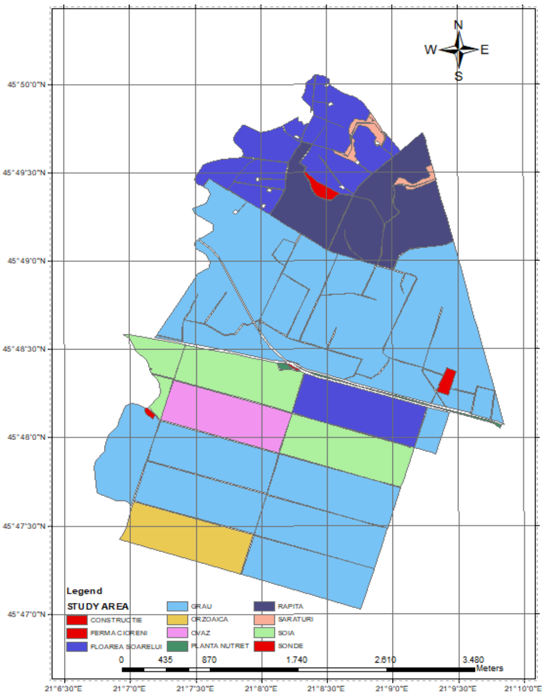

Figure 7. Structure of crops and cultivated areas

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ACQUISITION AND PROCESSING OF DATA FOR THE IMPLEMENTATION OF THE SYSTEMATIC CADASTER IN ORAVITA AREA

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Abstract

The purpose of this paper is to highlight the importance of carrying out the systematic cadastre on the territory of Romania and to present the steps that need to be taken in order to be able to register systematically. Systematic cadastral work is the identification, measurement, description and registration of buildings in technical documents, their representation on cadastral plans and the storage of data on computer media, identification of proprietor, owners and other owners of real estate in order to register in the land register and identify the owners, the holder and other owners of buildings, for registration in the Land Book. The cadastre determines the position of the building boundaries based on measurements. The beginning of the systematic registration works shall be established by order of the ANCPI General Director, published in the Official Gazette of Romania, Part I.

Key words*: Cadaster, Land Registry, Systematic Registration, Total Station.*

INTRODUCTION

Systematic registration is the process by which the real situation of all real estate’s located on the territory of Romania is transposed into a unitary information system, aiming at efficient management of the information (Herbei, 2015) about them. The information regarding the buildings on the territory of the Romanian State, which are transposed into the information system are of a technical, economic and legal nature. Information of a technical nature (Herbei and Sala, 2016) is obtained by determining the position, configuration and surface of the buildings, their destination and use category as well as the constructions. The economic information is obtained on the basis of the technical elements of the buildings in order to establish a real value of their taxation. Legal information concerns the identification of the owners or holder of all real estates and the inclusion in the land book of property rights, other real rights. The process of systematic registration is carried out at the level of the administrative-territorial units, by cadastral sectors (Popescu, 2015).The main stages of the systematic registration process are:

Organizing and conducting a national and local advertising campaign that involves informing at national and local level on the importance of systematic registration (Popescu, 2016).

The accomplishment of the works prior to the systematic registration process, supposes the constitution at the level of each territorial office of the databases gathering existing information regarding the buildings in the ATU. Carrying specialized works in the systematic registration process allows for the correction of the technical and legal data of the buildings. The technical documents of the systematic registration process are drawn up:

a) Alphabetical Index of Owners (Figure 3);
b) Cadastral Registry of Buildings;
c) Cadastral plan (Figure 10).

4. The publication of the technical documents of the systematic registration process is aimed at displaying the technical documents of the systematic registration process.
5. The finalization of the technical documents resulting from the systematic registration process and the opening of the land books is the most important stage. As a result of this

process, the documents evidencing the registration in the cadastral and real estate advertising system of the real estate’s will be generated (O.U.G. 35/28.06.2016).

MATERIALS AND METHODS

The address of the buildings belonging to Sector 2 Oravita AUT is located in the outskirts of Brosteni, AUT Racasdia, Caras-Severin County (Figure 1). The detailed buildings in the paper are part of the landmark. The type of the work, which belongs to Sector 2 Oravita AUT presents the cadastral technical documentation "systematic registration works within the PROGRAMUL NATIONAL DE CADASTRU SI CARTE FUNCIARA, in the implementation of the O.U.G. no. 35 / 28.06.2016 and of the Order of ANCPI General Director no.819 / 28.07.2016".Land recognition was performed and the boundaries of sector 2 were identified, reconciling the points in the geodetic network.

For this sector, following the identification of building boundaries on existing and on-site plans, we made topographic measurements using two well-known points purchased with the LEICA GS08 PLUS GPS:

-1780 (x = 399275,687; y = 232469,352; z = 147,140) point V

- P2 (x = 399081, 355; y = 232409, 083) a station base in the database.

The topographic elevations were performed with the LEICA TS02 station, stationed with the apparatus at the known point 1780 from which point P2 was targeted. Also by using of the round-trip polygonation, other station points were determined near the building from which the contours of the sector and of the buildings were raised by the horizon tour method.

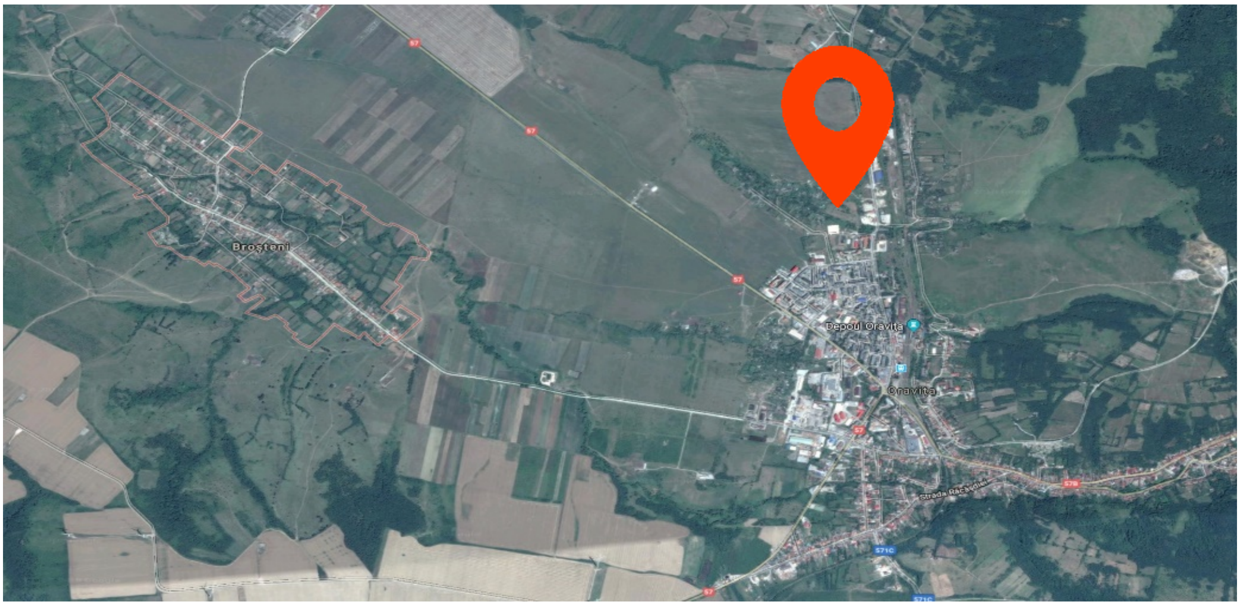


Figure 1. Location of UAT Oravita

RESULTS AND DISCUSSIONS

By presenting the operations, the information campaign was held and meetings (with the support of the mayor of Oravita, Caras-Severin) with the owners of the property rights on the buildings were organized.

In order to be able to carry out the systematic registration works in the cadastral sector 2, with the involvement of the representative of the AUT Oravita, the owners (the holder) were identified; copies were taken from the property documents and identity documents (Racovicean and Doandeş, 2008). Where this was the case, copies of the death certificates of the persons holding titles from the local authority were taken.

We conducted the study of analogue and digital data taken from AUT Oravita:

- The Oravita AUT limit and the limit of the urban assets of this UAT (Figure 2);
- Limit of cadastral sectors;
- The orthophotoplan corresponding to the cadastral sector (Figure 5);
- Cadastral plan at 1:10000 scale;
- Layout of landing (Figure 6, Figure 7 ,

Figure 8 , Figure 9 , Figure 10 , Figure 11);

- Data relates to the national geodetic network (planimetry, altimetry);
- Extracts of land books;
- Copies of owner-occupied contracts;
- Existing RGI PADs;
- PDF files in the property titles database;

Data taken from the AUT Oravita regarding the buildings to which the owners have not been identified and according to Lg. 7/13.03.1996 they are provisionally registered in the property of Oravita (O.U.G. 35/28.06.2016).

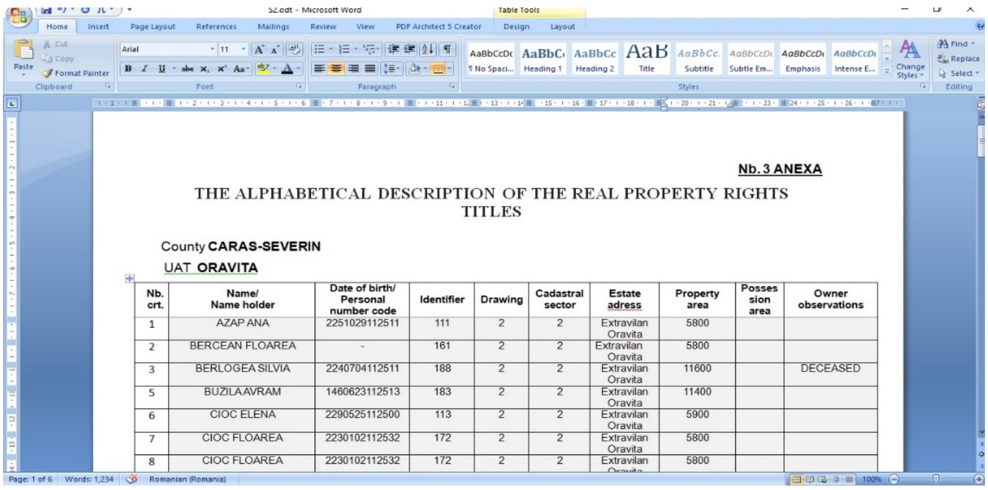
We integrated these data and compiled .CGXML files (.cgxml files contain information from the e-Terra application database) (Figure 4).

Property documents and identity papers have been scanned and stored in PDF files.

After that the building records were presented to the owners for signing.

In the final phase the OPISUL alphabetical of the real estate in the sector (Figure 3) was drafted and the cadastral plan for sector 2 was drawn up, followed by the overall cadastral plan of the UAT Oravita (Figure 6, Figure 7).

Figure 2. The Oravita AUT limit and the boundary of the urban areas



Nb. 3 ANEXA

THE ALPHABETICAL DESCRIPTION OF THE REAL PROPERTY RIGHTS TITLES

County **CARAS-SEVERIN**

UAT **ORAVITA**

Nb. crt.	Name/ Name holder	Date of birth/ Personal number code	Identifier	Drawing	Cadastral sector	Estate adress	Property area	Possession area	Owner observations
1	AZAP ANA	2251029112511	111	2	2	Extravilan Oravita	5800		
2	BERCEAN FLOAREA	-	161	2	2	Extravilan Oravita	5800		
3	BERLOGEA SILVIA	2240704112511	188	2	2	Extravilan Oravita	11600		DECEASED
5	BUZILA AVRAM	1460623112513	183	2	2	Extravilan Oravita	11400		
6	CIOC ELENA	2290525112500	113	2	2	Extravilan Oravita	5900		
7	CIOC FLOAREA	2230102112532	172	2	2	Extravilan Oravita	5800		
8	CIOC FLOAREA	2230102112532	172	2	2	Extravilan	5800		

Figure 3. The Oravita AUT limit and the boundary of the urban areas

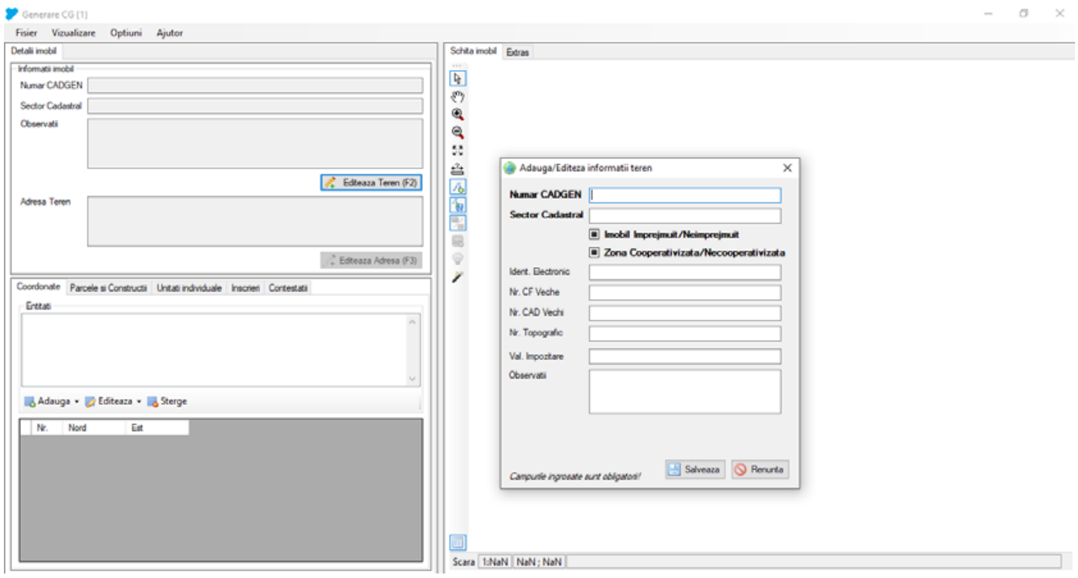


Figure 4. The program that provides CGXML files

The WEB CADGEN application is part of the IT toolkit for data migration from the General Cadastre into the integrated cadastre and land registry system e-Terra. The cadastral plan is a graphical representation (sketch, drawing) showing the boundaries, cadastral numbers and other land data and capital buildings located on the ground.

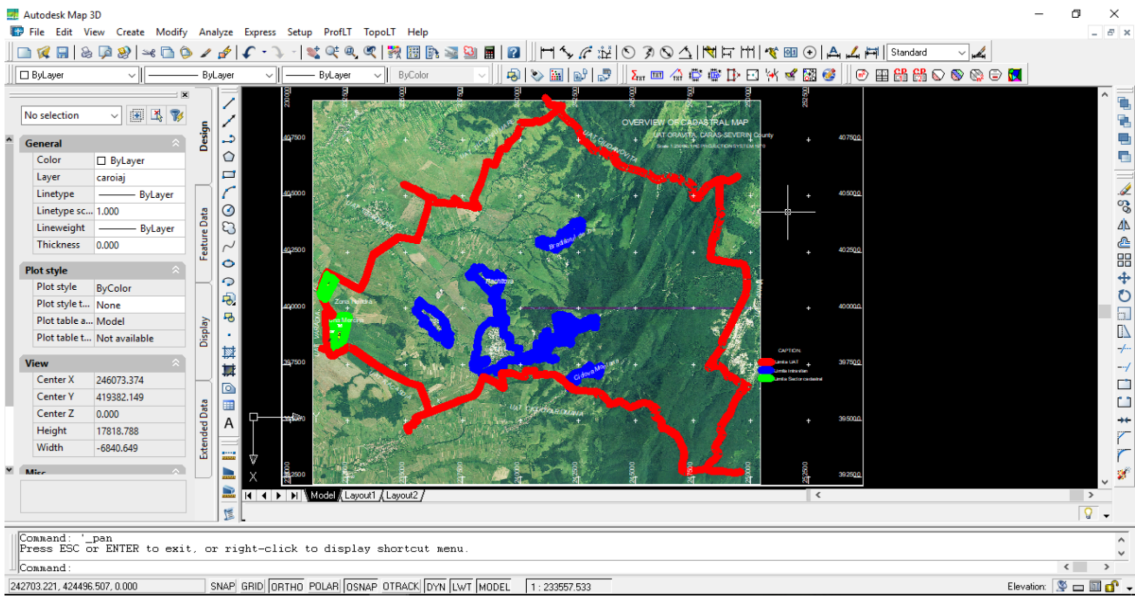


Figure 5. Cadastral plan for all Oravita AUT

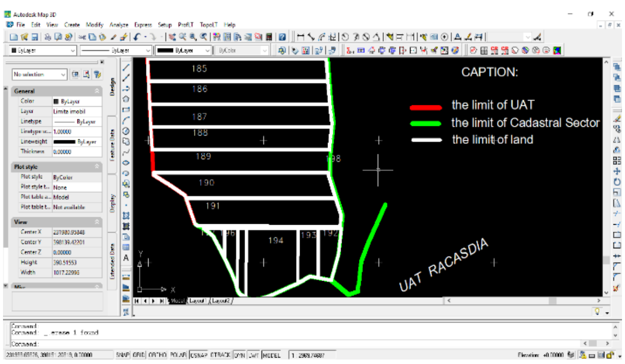


Figure 6. Cadastral plan for sector of the Oravita AUT

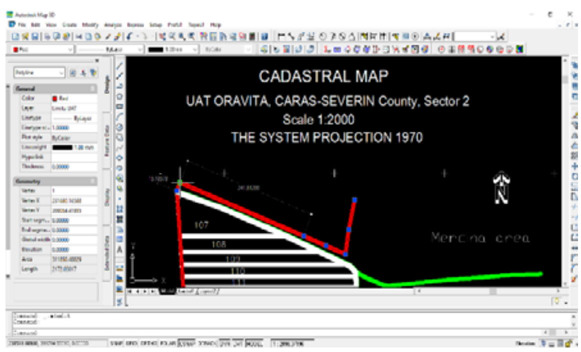


Figure 7. Cadastral plan for sector of the AUT

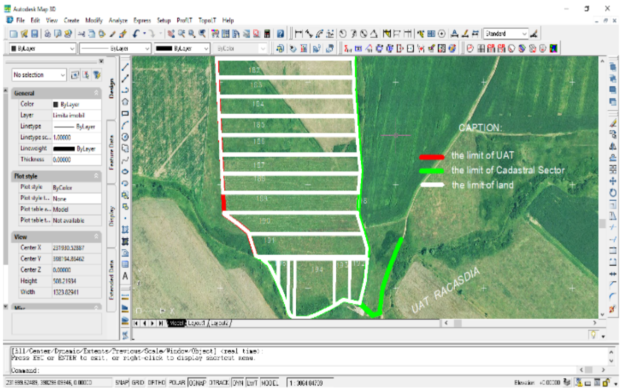


Figure 8. The limits of the parcels (AutoCAD)

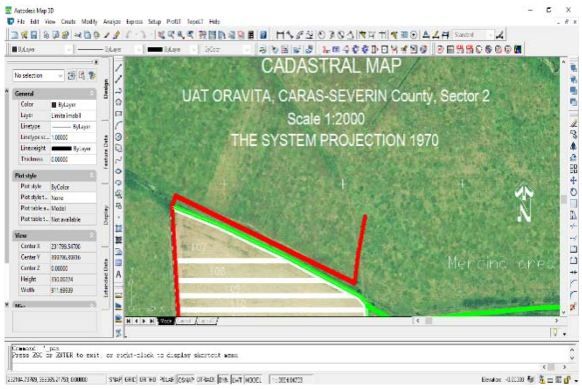


Figure 9. The caption of the map (AutoCAD)

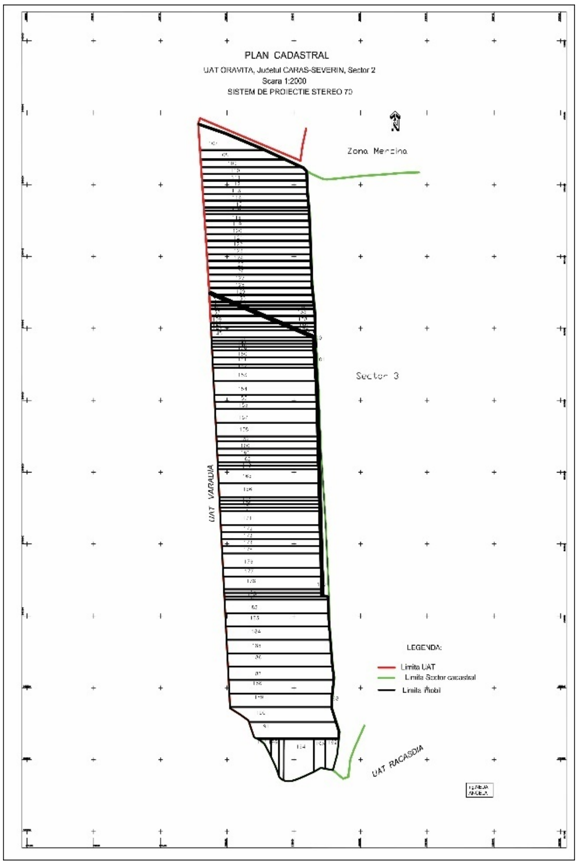


Figure 10. Cadastre map (Sector 2)

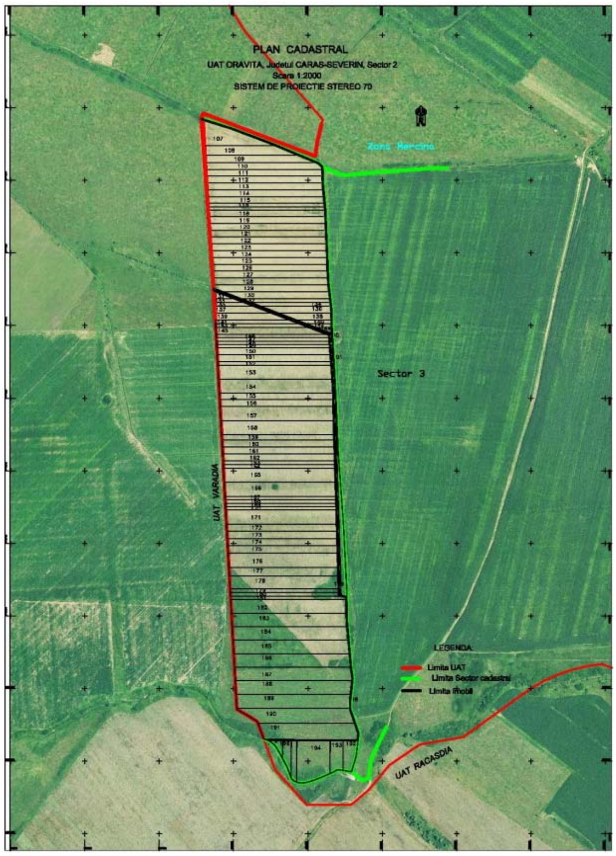


Figure 11.Cadastre map (Sector 2) with Orthophotoplan

CONCLUSIONS

The systematic property registration system has a major economic role in acquiring data on property ownership, use and value.

The cadastre and real estate advertising system is evidence of real estate rights, thus providing economic, social and environmental benefits.

The modern system of systematic registration uses information technology (IT) supported by a software platform. This national property management system reduces the cost of real estate transactions, provides real estate security and helps accelerate the development of public or private investment.

ACKNOWLEDGEMENTS

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***Ordinul nr. 534/2001 al ministrului administraţiei publice, privind aprobarea Normelor tehnice pentru introducerea cadastrului, modificat;

***Ordinul nr. 601/2008, al directorului general al A.N.C.P.I. privind aprobarea Protocolului-cadru de colaborare încheiat între Agenţia Naţională de Cadastru şi Publicitate Imobiliară şi unităţile administrativ-teritoriale pentru realizarea cadastrului;

*** Ordinul nr. 844/2010, al directorului general al A.N.C.P.I., Ordin pentru aprobarea Regulamentului privind înscrierea din oficiu în cartea funciară după finalizarea lucrărilor de cadastru;

*** Manual pentru „Procesul de înregistrare sistematică pentru proiectul pilot" – ANCPI – 2009;

*** Ordinul 700/2014 modificat, pentru aprobarea Regulamentului privind conţinutul şi modul de întocmire a documentaţiilor cadastrale în vederea înscrierii în cartea funciară

*** Ordinul 979/2016 privind aprobarea Specificaţiilor tehnice de realizare a lucrărilor sistematice de cadastru pe sectoare cadastrale în vederea înscrierii imobilelor în cartea funciară, finanţate de Agenţia Naţională de Cadastru si Publicitate Imobiliară

*** O.U.G. nr. 35/28.06.2016 privind modificarea și completarea Legii cadastrului și a publicității imobiliare nr. 7/1996

*** Ordinului Directorului General al ANCPI nr.819/28.07.2016" privind desfășurarea lucrărilor de inregistrare sistematică a imobilelor pe sectoare cadastrale (conform prevederilor oug nr. 35/2016).

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COMPARATIVE TOPO-GEODETIC STUDIES OF SOME POINTS PLACED IN THE UASVM CLUJ-NAPOCA CAMPUS USING A TOTAL STATION AND GPS RECEIVERS

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Abstract

The present paper was intended to carry out a study on precision obtained by classical measurements and satellite measurements. In this regard, the total station LEICA TCR805 and the TRIMBLE R10 GPS receiver were used. The instrumental observations were made in a leveling network, which had as its known elements the coordinates of a point and orientation, located in the premises of the UASVM Cluj-Napoca. In the case of classical measurements, we did not have control elements on the polygonal route taken into study, but measurements and calculations on the same route at another date were performed to verify the positioning accuracy of the points. The positioning of the polygon route was also achieved by the Rompos-RTK method. By comparing the coordinates obtained by the two methods we obtained the maximum differences on X = -0.076 m, on Y = 0.029 m and the linear deviation mt = 0.117.

Key words*: comparative study, GPS, leveling network, total station.*

INTRODUCTION

Global Navigation Satellite Systems (GNSS) are systems that allow high precision of positioning in a geocentric reference system at any point on or near the terrestrial surface using Earth's artificial satellites.

Absolute Differential Positioning (RTK) is a positioning technique that determines the position of a receiver, usually mobile, based on direct satellite observations and some (differential) real-time corrections from another fixed receiver, also called as reference receiver or base receiver. A modern version allows generation of these corrections based on a network of reference stations (receivers), such as ANCPI's ROMPOS service. The pseudodistances measured by the mobile receiver are corrected based on the differential corrections obtained from the base receiver, and then an absolute (spot) positioning occurs. These differential corrections improve positioning precision.

In Romania there are 74 permanent GNSS stations, disposed at an approximate distance of 70 kilometers (Figure 1).

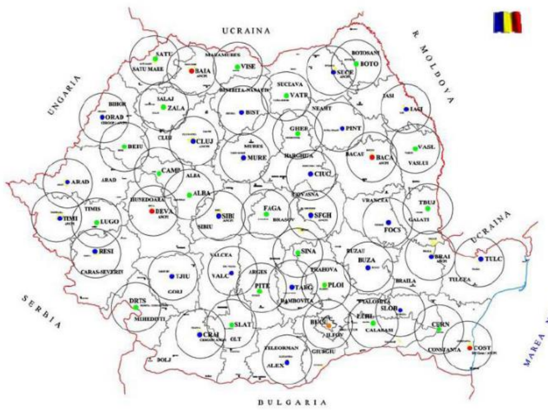

Figure 1. National Network of GNSS Stations

The objective of this paper is to compare the precisions obtained by classical measurements and satellite measurements. In this respect, was achieved in the UASVM Cluj-Napoca campus, a polygonal route supported on the coordinates of a point with far target.

MATERIALS AND METHODS

For the realization of the polygonal route, it was started from point 300 with a target to point 309. The coordinates of the starting points were previously determined from the triangulation network of Cluj-Napoca. On the polygon route shown in the Figure 2 were measured the azimuth directions and the distances on which the coordinates of the points were calculated. Since no control elements were available on the guideline and coordinates, as it was a floating polygonal track for point position control, the measurements and calculations were performed at another time.

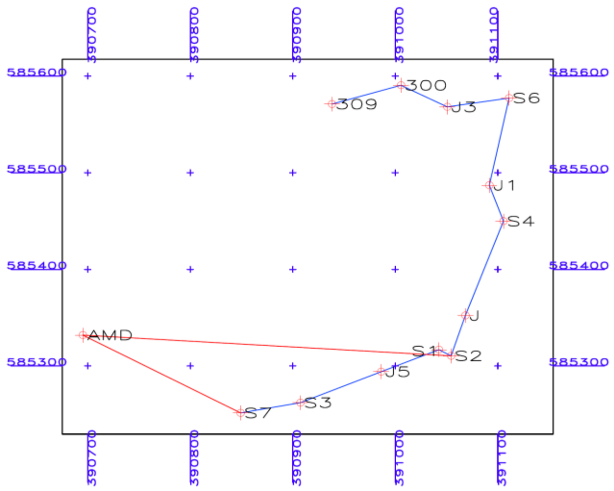

Figure 2. The polygonal route

The period analyzed in this study was 1990-2010.
For making the classical measurements was used a Leica TCR805 (Figure 3) total station and for the GPS measurements was used a Trimble R10 GPS receiver (Figure 4).
Leica TCR805 total station:
- is a total high precision station produced by one of the world leaders in topography measurement technology.
- is part of the new generation of topographic instruments, having in principle determined distances based on electromagnetic wave measurements.
- the advanced technology of the total station allows the collection, storage and transfer to a PC of azimuth directions, zenith directions and distances.
Being the smallest and easiest integrated receiver in its class, TrimbleR10 has an ergonomic design for operators to work as easily as possible.
Trimble HD-GNSS PROCESSING ENGINE: this amazing technology transcends traditional / uninitialized traditional techniques for a more accurate estimation of error estimates than currently provided by traditional GNSS technologies:

- Trimble Surepoint technology: provides shorter measurement times, high accuracy and more control over measurement quality.
- xFILL technology: With this technology, continuous measurements can be continued even when the ROMPOS network is lost.
- Trimble 360 - Receiver Technology: With Trimble 360, R10 receives signals from all existing GNSS constellations planned for the future.

Figure 4. Trimble R10 GNSS Receiver

The data, collected from Ministry of Agriculture and Rural Development, have been statistically processed and interpreted, building the trend line and setting up the forecast based on simulation models for the period 2012-2015.

RESULTS AND DISCUSSIONS

For the realization of the polygonal route, it was started from point 300 with a target to point 309 (Figure 5). The coordinates of the starting points were previously determined from the triangulation network of Cluj-Napoca. The coordinates of the points obtained using the total station are presented in Table 1.
To determine the GPS coordinates of the polygonal route points, the ROMPOS RTK method was used using RTCM0022-CLUJ station.
Note that GPS receivers determine geodetic coordinates based on pseudo-distances

determined by the constellation NAVSTAR and GLONASS.
The values obtained are presented in Table 2.

Table 1. Comparative coordinates obtained on the two measurements made

	23.03.2017 Total Station 1			27.03.2017 Total Station 2		
Point no.	x	y	z	x	y	z
309	585570,980	390938,250	356,180	585570,980	390938,250	356,180
300	585590,473	391005,560	356,850	585590,473	391005,560	356,850
J3	585568,131	391050,678	362,842	585568,145	391050,676	362,837
S6	585577,346	391111,011	369,389	585577,387	391111,010	369,391
J1	585486,974	391091,699	378,294	585487,014	391091,733	378,296
S4	585449,783	391105,500	382,275	585449,829	391105,553	382,273
J	585352,139	391068,311	392,622	585352,163	391068,418	392,621
S2	585310,390	391054,361	398,014	585310,402	391054,492	397,959
S1	585316,823	391042,552	394,837	585316,824	391042,681	394,779
J5	585293,971	390986,129	394,376	585293,924	390986,275	394,318
S3	585261,910	390907,388	390,602	585261,805	390907,561	390,524
S7	585251,296	390849,067	386,703	585251,148	390849,248	386,622

Table 2. Coordinates determined using the GNSS technology

	GPS coordinates		
Nr. Punct	x	y	z
309	585570,980	390938,250	356,180
300	585590,473	391005,560	356,850
J3	585568,083	391050,706	362,851
S6	585577,290	391111,020	369,400
J1	585486,957	391091,721	378,323
S4	585449,790	391105,520	382,300
J	585352,133	391068,364	392,667
S2	585310,390	391054,440	398,000
S1	585316,811	391042,619	394,804
J5	585293,966	390986,204	394,364
S3	585261,884	390907,492	390,570
S7	585251,280	390849,170	386,660

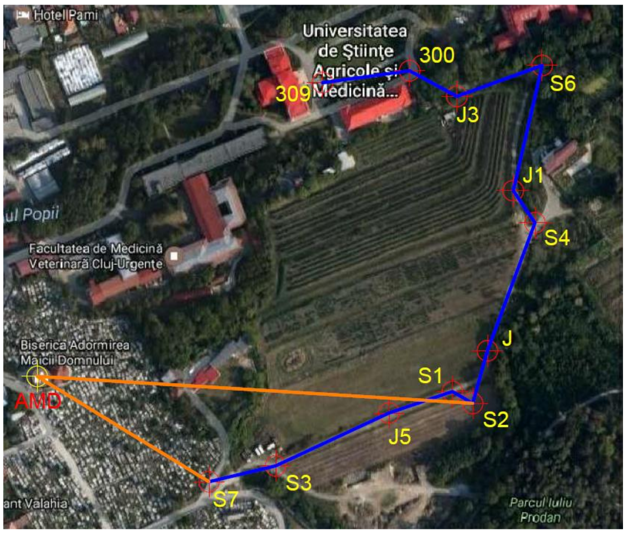

Figure 5. The polygonal route transposed on the map of the area of interest

In the graphs we can see the differences of the coordinates determined with GPS and classic technology with the total station. The largest difference on the x coordinate is at the S6 point of -7.6 cm, on the y coordinate at the J3 point of 2.9 cm, and on the level the highest difference is found at the J point of 4.6 cm.

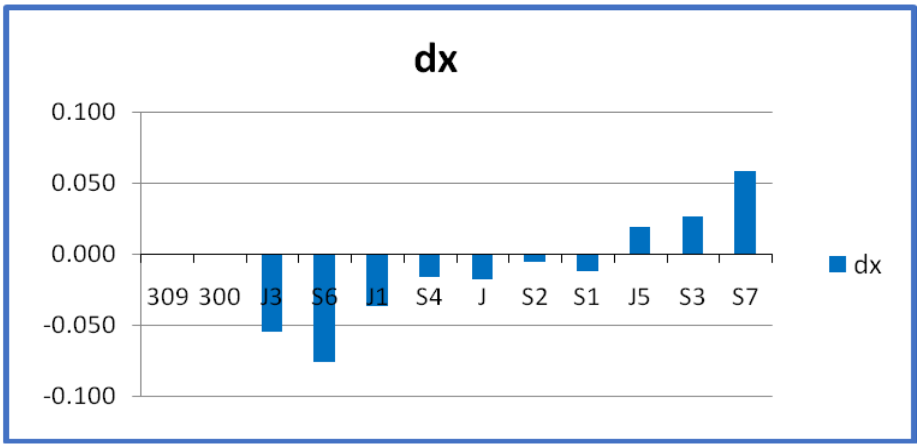

Figure 6. Differences on the X coordinates

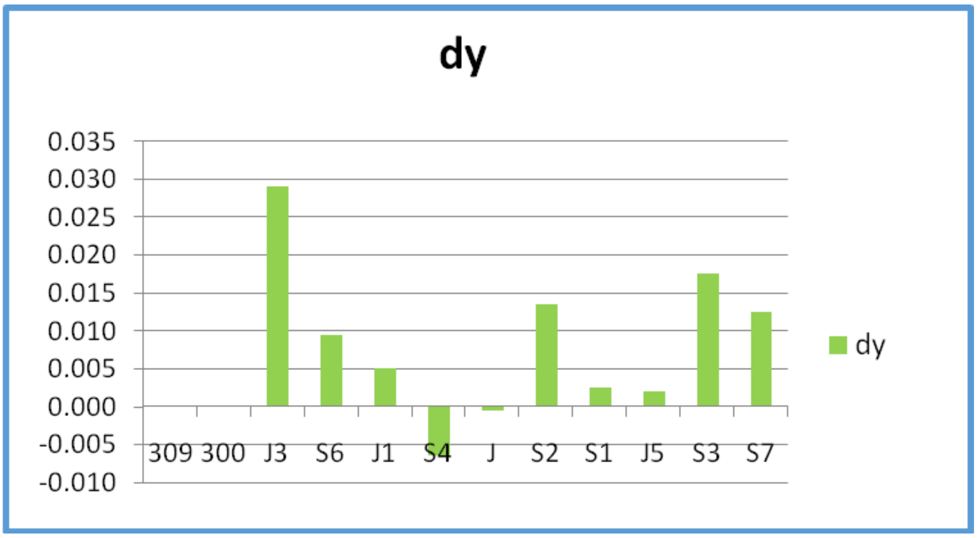

Figure7. Differences on the Y coordinates

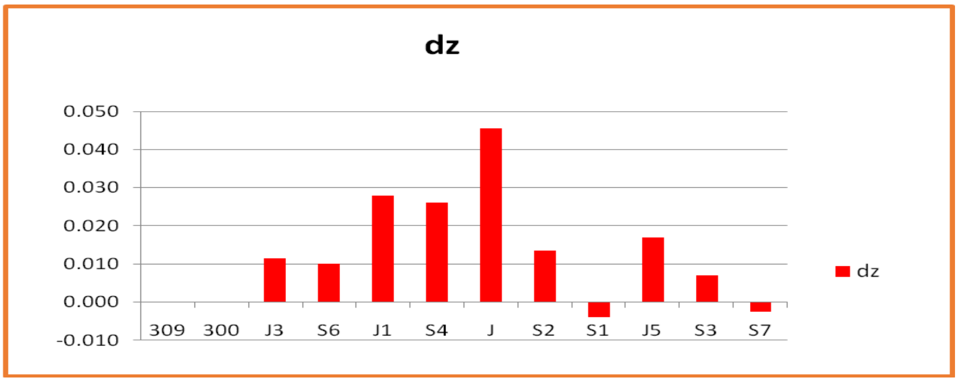

Figure 8. Differences on the Z coordinates

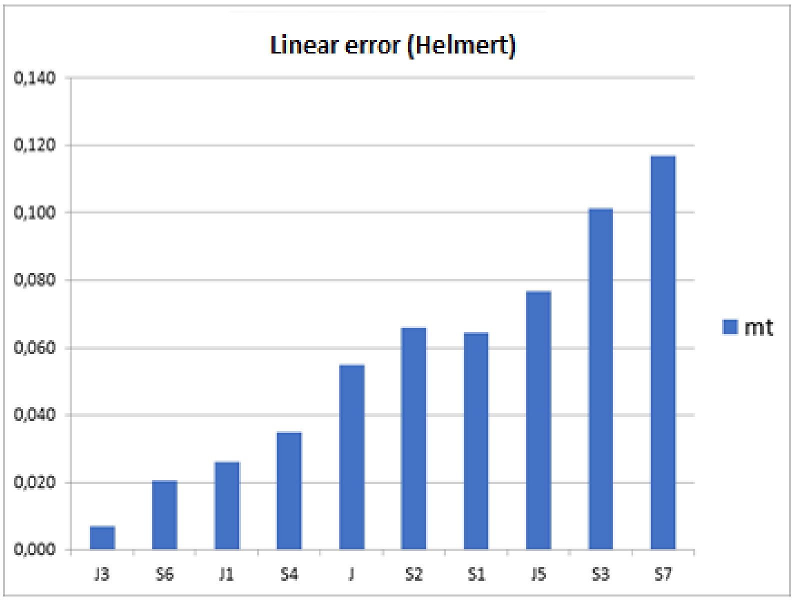

Figure 9. Linear error

It can be seen from the graph (Figure 9) that the linear error increases approximately proportionally to the distance from the starting point to the final point.

The work also compared the orientation from the last point of the polygon route to the AMD point, point on the “Adormirea Maicii Domnului” Church from Mănăştur. The difference between the calculated orientation from the S7 point obtained by the classical method and the AMD point coordinates is 9 minutes and 73 seconds. The difference between the calculated S7 point coordinates from GPS and AMD is 6 minutes and 79 seconds (Tables 3-5).

Table 3. Calculating the directions and distance from the last point of polygonation to a point in the triangulation network

Point	X	Y	D	□
s7	585251,148	390849,249		
AMD	585331,865	390695,169		
Δ	80,717	-154,080	173,941911	330,7205
s7(GPS)	585251,280	390849,170		
Δ	80,585	-154,001	173,8109612	330,6911

Table 4. Difference between the calculated coordinate and the calculated angle according to the angles measured

$d\theta_{7,AMD}=\theta^m-\theta^c=$	-0.0973^g	FLOAT

Table 5. Difference between the calculated orientation from the coordinates of the two triangulation points and the calculated orientation from the coordinates of the GPS point and the coordinates of a triangulation point

$d\theta_{7,AMD}=\theta^c-\theta^c=$	-0.0679^g	GPS-CLASSIC

CONCLUSIONS

From Figure 9 it is noted that the linear error of the points in the floating polygonal path increases in proportion to the distance from the starting point to the final point.

Between the coordinates of the points of the lifting network established by GPS technology and classical technology, there are significant differences. In this sense it is indicated that the starting and closing orientation is calculated from the coordinates of the points established with the same technology.

In view of the high accuracy achieved in the case of GPS elevations and the reduced period of time in making the lift route, it is advisable to always use GPS technology in the case of "clear sky".

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THE USE OF TOPO-GEODESIC METHODS AND GIS MEANS FOR THE REALISATION OF THE GREEN CADASTRE FOR THE CITY OF TARGU SECUIESC

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Abstract

The aim of this paper is to highlight the facilities that geographic information systems make available to users for the inventory and management of green spaces. The Beginning of this study was pointed by the topographical measurements being done across the city of Targu Secuiesc targeting all the green areas of the city (trees, shrubs, hedges, parks, squares, street alignments, green spaces within public institutions, green spaces between condominium areas, playgrounds, monuments, statues and so on.). After obtaining the topographic data, they were processed and compensated by various methods in order to obtain the basic map. The basic map once obtained was entered into a GIS application through which data was gathered from the field.There were taken informations from the field about trees, shrubs and hedges such as species, diameter, viability, coronation, height, protection, but also the use of the areas within each zone: roads, green areas, floral arrangements, buildings, parking lots. These data were entered into the GIS application where the corresponding database was created. The areas on the map were encoded according to the use and the attributes of each zone were added, such as: name, postal number, address, area. The final result is a GIS database in the form of an interactive map that contains all the information required for an evidence of green spaces and beyond, which also highlights the current situation of green fields in the city of Tg. Secuiesc. Finally, a series of GIS analyzes have been made to highlight both the characteristics of green spaces in this city (size, distribution, status, distribution per inhabitant etc.), parking lots and the potential of GIS to clarify organizational, management and administration problems.

Key words*: topo-geodesig measurements, green cadaster, GIS, Romania, green spaces register.*

INTRODUCTION

The authorities of the local public administration have the obligation to keep records of the green areas in the localities, by setting up the local registers of the green spaces, which they update whenever modifications occur (Art.1. The technical norm for the elaboration of the local register of the green spaces).

The purpose of greenfield records is to organize their rational use, effective regeneration and protection, to exercise systematic control of qualitative and quantitative changes, and to provide information on green spaces. (Law 24 of 2007 updated and republished). The local register of the green areas in the localities within incorporated area is constituted as a component of an information system of systematically evidence and inventory of the lands in the urban area of the localities, defined as green spaces according to the law (Art. 7. Technical Norm for the elaboration of the Local Register of Green Areas). GIS stands for Geographic Information System and it is a computer software designed to store, process and make available geographic data. The main purpose of such a system is in addition to the input, storage and editing information of geographic, demographic, environmental etc. nature (Dimitriu, 2007). The information system for green spaces is carried out as a result of the identification, measurement, inventory and mapping of the defined green areas, as well as the collection of specific data on the tree species and the existing vegetation, with the determination of the qualitative and quantitative indices (Welch et al., 2002). The information system of green fields represents a set of graphical and textual databases, designed in a unitary way, independently maintained and exploited together (Art.14. The technical norm for the elaboration of the Local Register of Green Areas).

Under the administrative, economical, social and technical-scientific aspect, the urban green spaces are a component of the public works system designed to serve the urban population, providing the city with the most suitable facilities for recreation and comfort. An essential element of the human habitat, green space exploits the biological and aesthetic potential of vegetation, harmonizes architectural ensembles, hygienises and freshens the urban environment, reducing its aggression on the inhabitants of the city (Adams and Muja, 1994). At the same time, cities, as they grow more, adding a larger number of inhabitants and building a visible polluting industry, exert more pressure on the surrounding vegetation, which it gradually degrades (Adams and Muja, 1994). So, with the development of cities and implicitly of industry, green spaces have become less and less important, being neglected or even used for purposes other than those for which they were created (Figure 1). With the drop in interest in green spaces, problems have arisen in terms of air quality, citizens' quality of life, and landscaping issues.

Dinamica suprafeței spațiilor verzi urbane în România (1980–2006)

	Anul									
	1980	1990	1995	1997	2000	2002	2003	2004	2005	2006
Spații verzi (km^2)	169,62	220,81	212,50	208,58	201,24	201,84	205,97	201,22	200,98	202,69

Sursa: Anuarul Statistic al României (1980–2006), INS, București.

Figure 1. The dynamics of green urban space in Romania

In this way, Romania's accession to the European Union had to take into account the standards given by the European Union regarding the green spaces of 26mp green space per inhabitant. In this way, there have been a series of regulations regarding the protection and creation of green spaces for the alignment of Romania with the standards. More specifically, OUG no. 114/2007 amending and supplementing OUG no. 195/2005 on Environmental Protection and Law no.24 / 2007 on the Regulation and Management of green areas in urban areas with related norms, MDTR Order no. 1466/2010 - The local register of green spaces within the built-up areas, which regulates the preparation of the green space register for each locality in order to obtain a clear evidence of the green spaces.

MATERIALS AND METHODS

In order to achieve a real and accurate record of the green spaces in the locality, both topo-geodetic means and GIS tools (mobile devices / applications / books) were used, as well as analyzes, to highlight the results of the paper. The areas concerned were only the areas of the public utility: the town hall, hospitals, schools, churches, condominiums, cemeteries, parks, boulevards etc.

The first method used is the topographical survey method which involved making topographical measurements with the help of GPS technology and a total station in order to obtain the basic plan of the city. The measurements were made by combined polygnometric traverse and the framing into the national geodesic network was done using the GPS technology.

The second method used was the method of data processing. In this method data compensation was done both by the classical method and by the smallest square method specific to Topsys program. The precision of the measurements was within the limit prescribed by the law so it was possible to proceed to the next step.

Another method used was the method of observing and collecting field data. This method involved stepping up the land and taking over details about tree/shrub with a mobile device and a dedicated application. The data taken were: species, height, diameter, crown, protection, viability. Correct identification of the species has been done with guidance catalogs for determining the species. Besides this, information on area use has been identified and was taken over. In addition to the green areas, the following uses were targeted: alleys, floral lots, playgrounds, waters, monuments, buildings, yards, parking lots, sports ground, fitness area etc.

In addition to the above-mentioned methods, specific GIS methods have also been used:

georeferencing of cadastral plans, vectoring of useful data, and GIS specific analyses (Tereşneu, 2006, 2008).

These methods are necessary to highlight the results of the work in order to identify any gaps and to act where it is needed.

RESULTS AND DISCUSSIONS

After carrying out the green space assessment work, we have a GIS database with precise information on both green spaces and other categories, as well as trees, constituting the green space register. This register consists of 54 maps (400x720 mm), which comprehend the entire surface evaluated at a scale of 1:1000 (Figure2).

Figure 2. The map no. 20 from the Green Zones Register

The GIS database allows us to carry out various analyzes in viewing and managing the items of interest. Thus, we can determine, for example, the areas for each category of use that we are interested in, especially for green spaces (Figure 3).

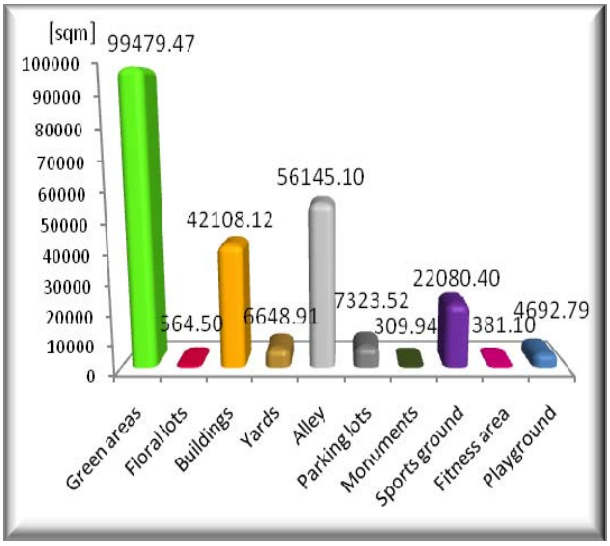

Figure 3. Classification by type of use

This graph shows the clear situation of the surfaces in the field depending on the type of use. The classification did not take into account the roads but only the alleys, which is why the green areas with a total area of 99479 sqm. The second place in the classification is taken by the alleys with a total area of 56145 sqm. This category includes alleys within parks and pedestrian areas within condominiums and along roads. The third place in the ranking is held by the buildings with an area of 42108 sqm , which includes public buildings (town hall, hospital, school, library, church, etc.) as well as apartment blocks or other constructions of public interest. The classification continues with the sports grounds (22080 sqm), parking lots (7324 mp), yards (6649 mp), playgrounds (4693 mp), floral arrangements (564 mp), fitness facilities (381 mp), and lastly monuments and statues (310 mp).

In addition to the areas of use, the GIS database also has records of trees and shrubs, each of which is characterized by different attributes such as: order number, species, diameter, height, crown, protection, viability. So there has been a classification of the most common 10 trees and shrubs (Figure 4.).

It is easy to note that the most common tree on the surface of the studied locality is Acacia (Salcam) (Robiniapseudacacia) being present in 1096 specimens, followed by Molid (Picea Albies) and Tuia (Thuja occidentalis). We notice that we have a "TAIAT" element in a total of 349 copies. These are trees that existed at the time of the measurements, but were cut off until the data was taken from the field, or are just points that show that the tree has not been completely eliminated from the ground (show root existence).

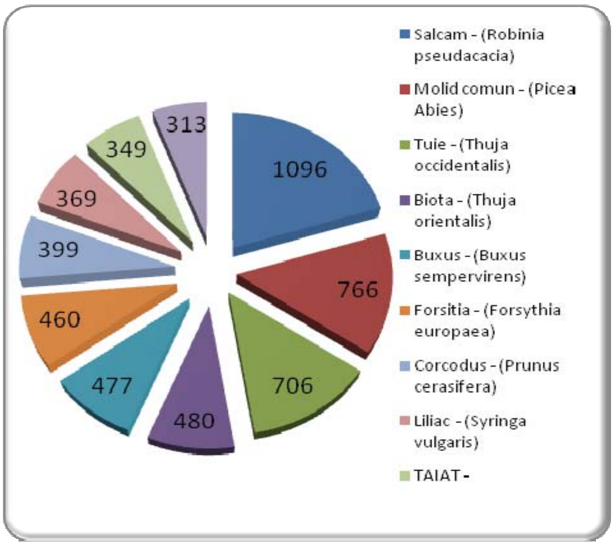

Figure 4. The most common 10 species of trees/shrubs by number

These classifications were made taking into account the observations from the entire area of the locality, but such classifications can also be made for certain areas or individually for different buildings, depending on the point of interest (Figure 5, Figure 6).

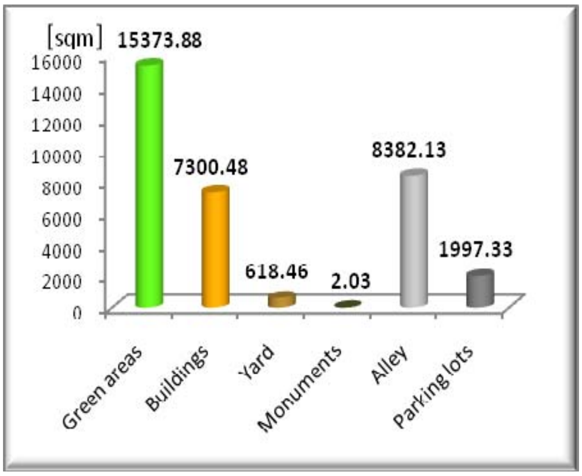

Figure 5.Municipal hospital of Tg.Secuiesc - Classification by type of use

In this case, it is obvious that we will no longer meet all categories of use and a very large number of trees. These individual building classifications are of great use because it is possible to analyze a point of interest, eliminating unnecessary data and shortening working time.

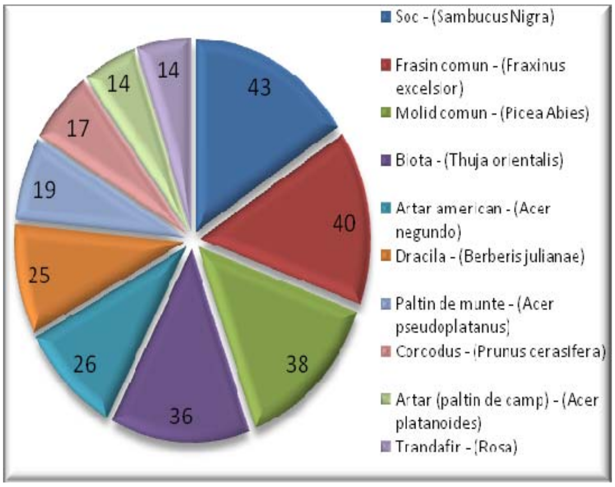

Figure 6. Municipal hospital of Targu Secuiesc - The most common 10 species of trees/shrubs by number

Following the realization of the green spaces in the public domain, a total area of green areas of about 26 hectares was built up in the intravilan of Targu Secuiesc.

By OUG no. 114/2007 amending and supplementing OUG no. 195/2005 on the Protection of the environment, stipulates the obligation of the local public administration authorities "to ensure from the intravilan land an area of green space of minimum 20 sqm / inhabitant, until 31 December 2010, and at least 26 sqm / inhabitant, until 31 December 2013 " (Article II, paragraph (1)). In order to achieve this goal, the mayoralties of some localities must identify the unproductive or damaged land to be arranged as green spaces. (Technical Standard for the elaboration of the Local Register of Green Areas). If we take into account the area of the green spaces of 261 239.089 sqm and report it the number of inhabitants of the city 18,491 (2011- Wikipedia) will determine the area of green space for each person.

Area of green spaces = 261 239.089 sqm

Population: 18,491 (2011- Wikipedia)

14.1279 sqm / inhabitant

Considering the legislative requirements regarding the area of green space for each inhabitant (min 26 sqm / inhabitant) and comparing this required by the law with the area of green space for the inhabitants of Tg. Secuiesc (about 14 sqm / person) we find that there is a difference of about 12 sqm, which determines us to say that the green area of the locality satisfies just over half of the area required by the law.

Notwithstanding this, if we compare the data on green areas in 1989 (Figure 7), we notice that the area of green spaces per person shows an increase, which prompts us to believe that the area of the green areas is constantly increasing and moving to the value required by law.

Year	*Sqm/individual*	*Area(ha)*
1989	9.7	23
2017	14	26

Figure 7. Comparison betwen the green areas in 1989 and 2017

For the creation of new green spaces, an identification of non-productive areas that can be transformed into green spaces was made in this evidence.
Four non-productive areas were identified (Figure 8) with the areas of 16947 sqm, 110345 sqm, 4139 sqm and 2242 sqm. If these surfaces will be refurbished and their use will be changed as green spaces, the area of green spaces will increase by 133,673 sqm reaching a value of approximately 40 ha, in this manner the area of green space per person will reach the value of 21.4 mp/inhabitant approaching the value imposed by law.
About 10221 trees and shrubs are evaluated within the GIS database. They are characterized by data-attributes through which a tree situation can be realized in the whole locality but also within the interest areas (parks, schools,etc.).
Thus we have a clear situation regarding the age classes (Figure 9) of the trees and their viability (Figure 10). Such situations are extremely useful for the management of green areas, trees and shrubs. There could be easily identified trees that are old or no longer fit (Figure 11) and requiring care or even cutting, so that unpleasant events can easily be avoided and the status of the trees can be under control.

Figure 8. Non-productive areas

Moreover, in the database we create trees that are protected or preserved by law. Their identification is instantaneous by assigning attribute data and coordinates to define the position of the point, which helps to manage them appropriately (Figure 12).

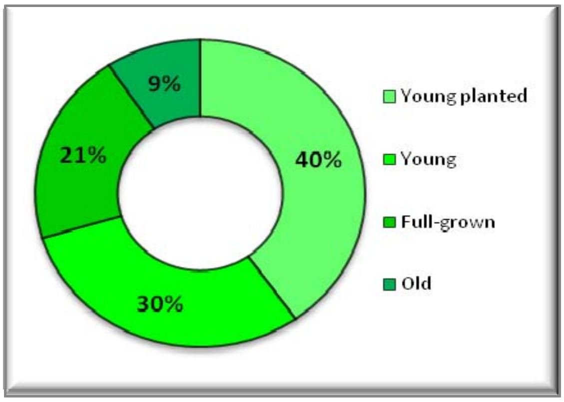

Figure 9.The classification of trees / shrubs by age

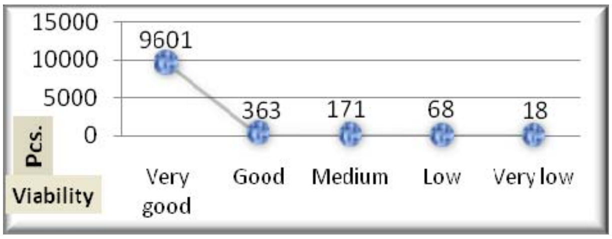

Figure 10. The classification of trees / shrubs by viability

Figure 11. The position on the map of the trees in an inappropriate condition

Species	Height	Crown	Diameter	Viavility	Age	ID no.	X North	Y East
Castanporcesc - Aesculushipo castanum	30	15	110	1	4	2756	500403.976	588361.743
Castanporcesc - Aesculushipo castanum	20	9	100	1	4	7791	500602.366	587745.156
Salcam - Robiniapseud acacia	30	10	90	1	4	2706	500414.540	588462.811

Figure 12. Data defining protected trees

CONCLUSIONS

The use of geographic information systems in the field of green space planning and management proves to be extremely useful because through a permanent and constant updating of the database, there are available useful information in real time and various analyzes and simulations can be made.

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THE USE OF VEGETATION INDICES IN THE CONTEXT OF PRECISION AGRICULTURE

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Abstract

The main purpose of this research is to study the dynamics of an agricultural parcel based on spectral information obtained from Rapid Eye satellite images between May to September 2016. The dynamics of vegetation was differently expressed by the NDVI, SAVI and MSAVI2 indices determined based on spectral information. Starting from the Rapid Eye satellite imagessomespectral information characterizing the studied areas were extracted, based on spectral bands. R, G, B, Red Edge, NIR. Three vegetation indices (NDVI, SAVI and MSAVI2) have been computed and interpreted.

Key words: *Remote sensing, vegetation indices, NDVI, SAVI, MSAVI2.*

INTRODUCTION

The continuous development of human society in the last decades has also implied the rapid progress of some techniques and technologies oriented towards the quantitative and qualitative knowledge and evolution of the environmental components (Sala, 2011), as well as the designing of the most efficient systems for processing, organizing and storing the obtained information (Gitelson, 2004). All of these can be obtained by remote sensing (Herbei et. al., 2014 Herbei and Sala, 2016).

Remote sensing is the technical field that deals with the detection, measurement, recording and visualization in the form of images of electromagnetic, radiation issued by objects and phenomena from Earth or the Universe from a distance without having direct contact with them (Kokalj and Oštir, 2007; Kumar, 2004).

Remote sensing (Herbei, 2015), regardless of the nature of the applications, whether passive or active, uses electromagnetic radiation to obtain body images at a certain altitude (airplane, satellite, helicopter) because in this way the image can be used to obtain maps and plans, the interpretation of objects is optimal and easy (Richards, 1999).

The electromagnetic spectrum is a physical model that shows the known and measured electromagnetic radiation, depending on their wavelength and specific energy level, representing the total electromagnetic radiation present in the Universe (Jensen, 1996).

The spectrum shows a series of areas where electromagnetic radiation is delineated based on the wavelength. Remote sensing applications are limited to producing images that are impossible in certain spectral areas (Lillesand, and Kiefer 1994).

The Rapid Eye satellite system was successfully launched on August 29, 2008 from the Kazakhstan Baikonur Cosmodrome (Planet Team, 2017). Rapid Eye built by MacDonald Dettwiler will provide image users with a data source that contains an unparalleled combination of over-surface coverage, frequent revision intervals, high-resolution and multispectral capabilities (Table 1, Spectral Bands of the Rapid Eye Satellite Sensor).

Table 1. RapidEye Satellites Spectral Bands

RapidEye - bands	Wavelength (nanometer)	Use	Rezolution (meter/pixel)
B1- Blue	440-510	Batimetricmapping, differentiation of thesoilandvegetation of the conifer type	5
B2 - Green	520-590	Highlighting top vegetation, whichisuseful for evaluatingplantvigor	5
B3 - Red	630-685	Differentiateplants in vegetation	5
B4 - RedEdge	690-730	Coverthe part of thespectrumwherethereflectivityincreasesdrasticallyfromtheredportiontothe NIR spectrum	5
B5 - NIR	760-850	Highlightsbiomassandshorelines	5

MATERIAL AND METHOD

This study was carried out within the teaching camp of the Banat University of Agricultural Sciences and Veterinary Medicine, „ King Michael I of Romania", Timisoara being studied the surrounding agricultural lands (Figure 1). To compute the indices for the agricultural land satellite images were used (Herbei et. al., 2015), captured in 2016 from the following months May, July and September, which were obtained from the www.planet.com portal (Figure 2).

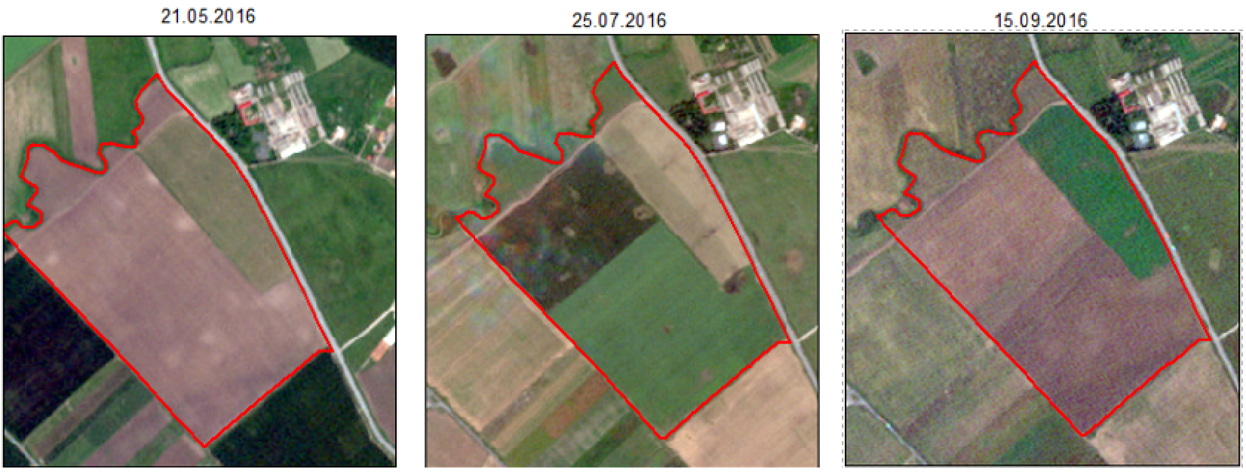

Figure 1. Natural Colour Map of Study Area (Red – Green - Blue)

Figure 2. False Colour Map of Study Area (Nir – Red - Gren)

The vegetation indexes are mathematical formulas that obtain a result with a numerical value between -1 and 1. The indices can study different domain areas such as hydrological, cartographic, forestry and agriculture.

The **Normalized Difference Vegetation Index** (NDVI) was proposed in 1974 by Rouse et. aland is an index of plant "greenness" and is one of the most commonly used vegetation indices. Vegetation indices are based on the observation that different surfaces reflect different types of light differently. Photo synthetically active vegetation, in particular, absorbs most of the red light that hits it while reflecting much of the near infrared light.
Vegetation that is dead or stressed reflects more red light and less near infrared light. Likewise, non-vegetated surfaces have a much more even reflectance across the light spectrum (Carlson and Ripley, 1997).
By taking the ratio of R and NIR bands from a satellite image, an index of vegetation "greenness" can be computed. NDVI is calculated on a per-pixel basis as the normalized difference between the R and NIR bands from an image (Huete and Jackson, 1987).
The formula for calculating the NDVI index is:

$$NDVI = \frac{(NIR - RED)}{NIR + RED}$$

where NIR is the near infrared band value for a cell and RED is the red band value for the cell. NDVI can be calculated for any image that has a red and a near infrared band. The biophysical interpretation of NDVI is the fraction of absorbed photo synthetically active radiation (Huete and Jackson, 1988).
Many factors affect NDVI values like biomass, total plant cover, plant photosynthetic activity, plant and soil moisture or plant stress. Because of these things, NDVI is correlated with many agricultural and ecosystem attributes (e.g., net primary productivity, canopy cover, bare ground cover). Vegetation indices like NDVI make it possible to compare satellite images over time to look for significant changes (Huete et. al., 1999). The output of NDVI is a new image. And the image pixels can range from -1.0 to +1.0. Higher values signify a larger difference between the red radiation and near infrared radiation recorded by the sensor.
Low pixel values mean there is little difference between the red signals and near infrared signals. This happens when there is little photosynthetic activity, or when there is just very little NIR light reflectance (water reflects very little NIR light).

The Soil Adjusted Vegetation Index (SAVI), proposed in 1988 by Hueteand is structured similarly to the NDVI index, but with the addition of a soil brightness correction factor.
Adjusting for the influence of soils comes at a cost to the sensitivity of the vegetation index. Compared to NDVI, SAVI is generally less sensitive to changes in vegetation (amount and cover of green vegetation), and more sensitive to atmospheric differences.
The formula for calculating the SAVI index is:

$$SAVI = \frac{NIR - RED}{(NIR + RED + L)} * (1 + L)$$

where NIR is the reflectance value of the near infrared band, RED is reflectance of the red band, and L is the soil brightness correction factor. The value of L varies by the amount or cover of green vegetation: in very high vegetation regions, L=0; and in areas with no green vegetation, L=1. Generally, an L=0.5 works well in most situations and is the default value used. When L=0, then SAVI = NDVI.

The Modified Soil-Adjusted Vegetation Index (MSAVI2) is the soil-adjusted vegetation index that attempts to approach a portion of the NDVI limitation when applied in areas with a high surface area of exposed soil.MSAVI has been used in a number of rangeland studies where it has often been correlated to field data on vegetation cover (Senseman et al. 1996, Chen 1999), biomass and/or leaf area index (Phillips et al. 2009), and as an input layer for mapping land cover or vegetation classes. One significant limitation of the MSAVI is that it sacrifices some overall sensitivity to changes in vegetation amount/cover to correct for the soil surface brightness. MSAVI may not be as sensitive to vegetation change as another index like NDVI. MSAVI would also be more sensitive to differences in atmospheric conditions between areas or times. MSAVI requires only a red and a near infrared band to calculate.The formula for calculating the MSAVI2 index is as follows:

$$MSAVI2 = \frac{\left(2 * NIR + 1 - \sqrt{(2 * NIR + 1)^2 - 8 * (NIR - RED)}\right)}{2}$$

RESULTS AND DISCUSSIONS

In order to calculate the vegetation indices and for the extraction of spectral information, the ERDAS Image v. 11 (Figure 3), ArcGIS v. 10.5 and PAST 3 (Hammer et. al., 2017) software was used (Figures 4, 5, 6).

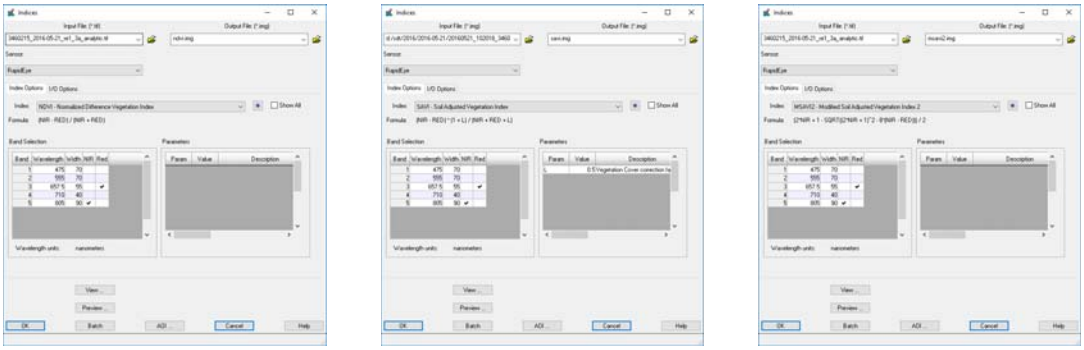

Figure 3. The calculating NDVI, SAVI and MSAVI2 in Erdas Imagine

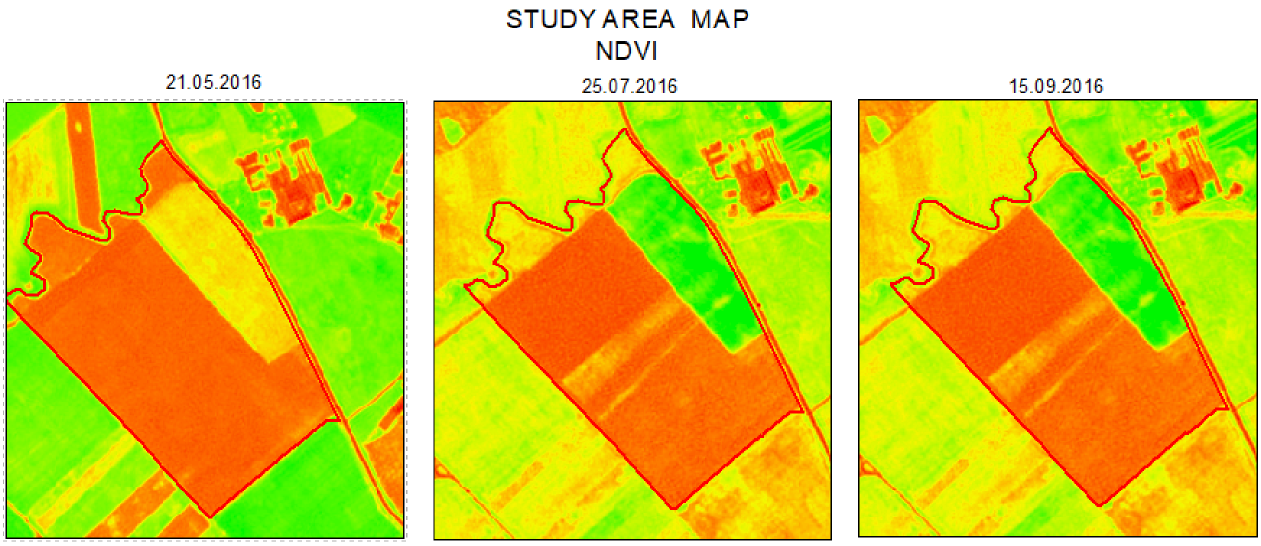

Figure 4. The NDV Map of Study Area

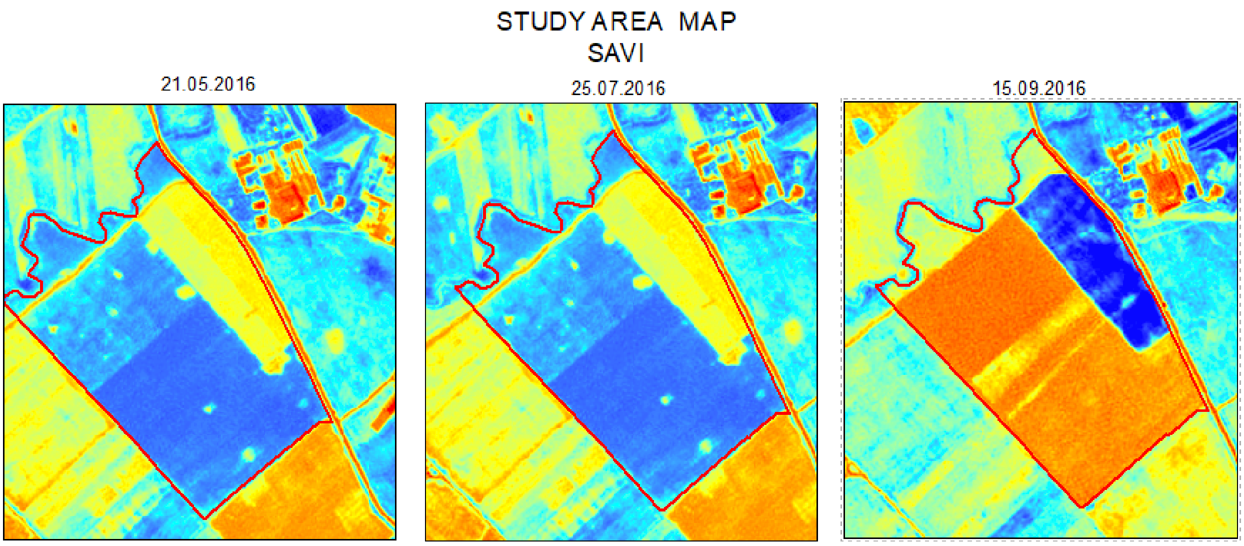

Figure 5. The SAVI Map of Study Area

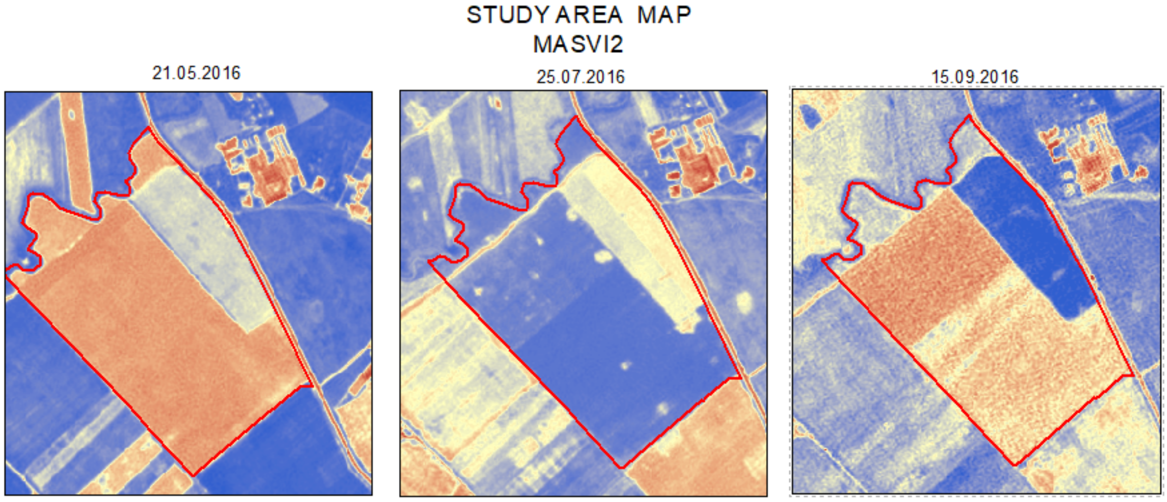

Figure 6. The MSAVI2 Map of Study Area

The NDVI recorded an upward slope, as shown in Figure 5, from the beginning of the study period, May to July, when it recorded the maximum value (NDVI = 0.63425), after which the distribution of this index followed a downward slope until September (Figure 7).

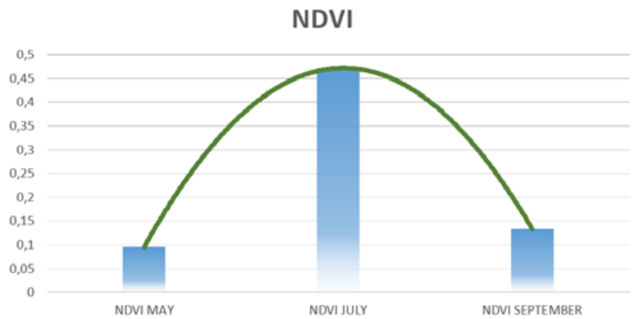

Figure 7. NDVI distribution

SAVI recorded a downward slope (Figure 8) from the beginning of the study period, May to September, when it had a minimum value (Figure 8).

Figure 8. SAVI distribution

MSAVI 2 recorded an upward slope (Figure 9) from the beginning of the study period, May to July, when it recorded the maximum value after which the distribution of this index followed a downward slope until September (Figure 9). \Correlations (Senseman et. al., 1996) were also made between the NDVI, SAVI, and MSAVI 2 indices.

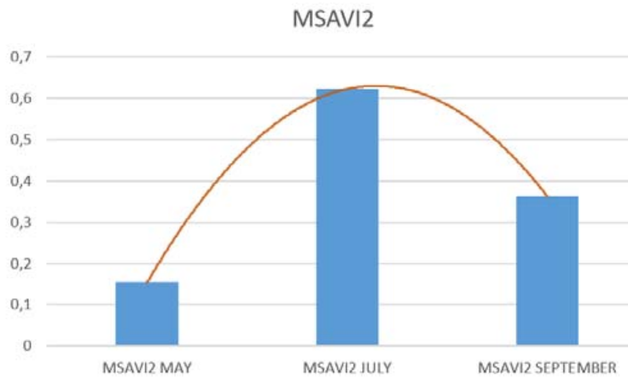

Figure 9. MSAVI2 distribution

Data analysis revealed a high correlation identified in the month of Septemberfor indices NDVI, SAVI and MSAVI2 with the characteristics from the satellite spectral signal, presented in band Red Edge (Tables 2, 3, 4).

Table 2. Correlation for the SAVI, NDVI, MSAVI 2 indexes – May

	NDVI	SAVI	MSAVI2	RE
NDVI MAY	1			
SAVI MAY	-0,688473948	1		
MSAVI2 MAY	0,994456853	-0,725387998	1	
RE MAY	0,551566314	-0,61284423	0,570965	1

Table 3. Correlation for the SAVI, NDVI, MSAVI 2 indexes – July

	NDVI	SAVI	MSAVI2	RE
NDVI JULY	1			
SAVI JULY	1	1		
MSAVI2 JULY	0,997148	0,997148	1	
RE JULY	0,859869	0,859876	0,832352	1

Table 4. Correlation for the SAVI, NDVI, MSAVI 2 indexes – September

	NDVI	SAVI	MSAVI2	RE
NDVI SEPTEMBER	1			
SAVI SEPTEMBER	1	1		
MSAVI2 SEPTEMBER	0,97312	0,973118915	1	
RE SEPTEMBER	0,977537	0,977538436	0,913709	1

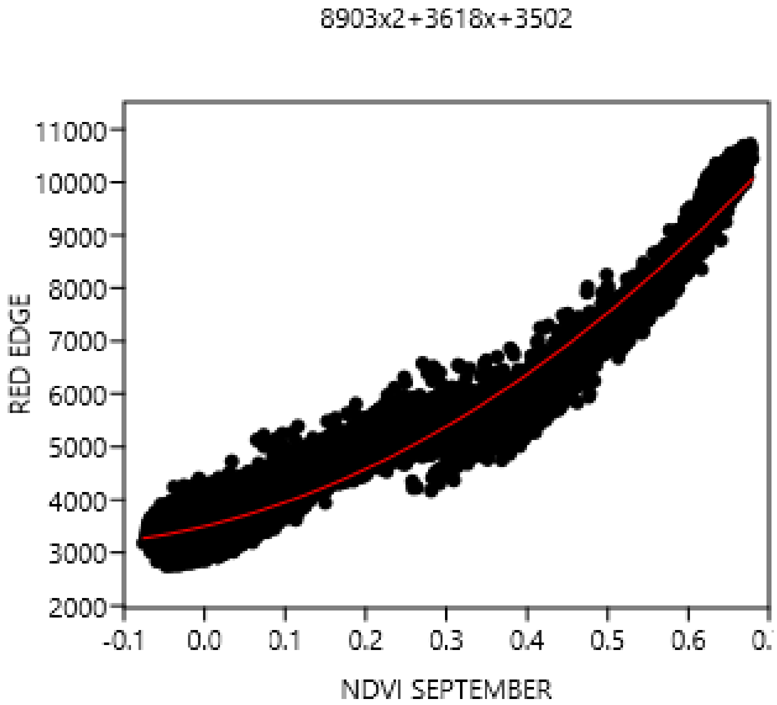

Figure 10. The graphic correlation of theRed Edge band with NDVI

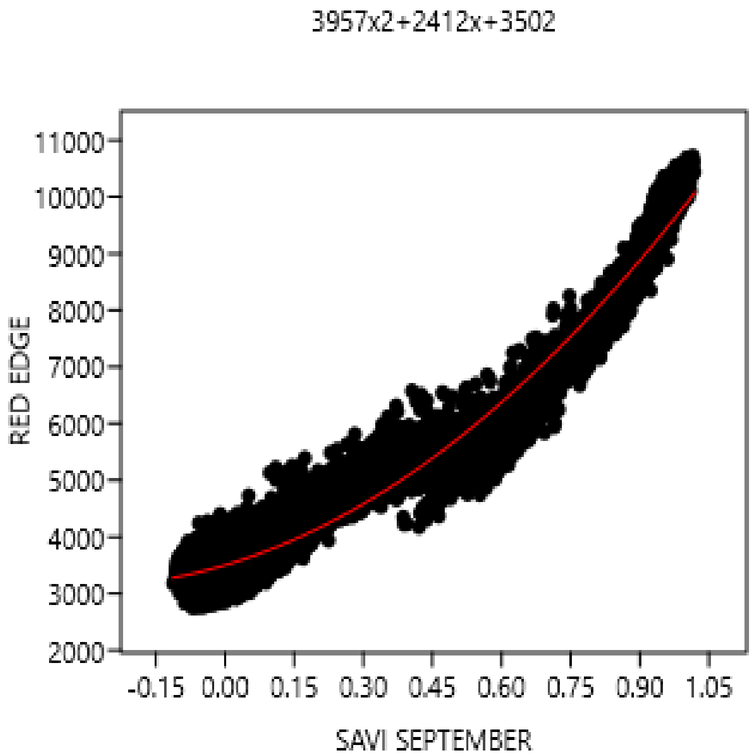

Figure 11. The graphic correlation ofthe Red Edge band withSAVI

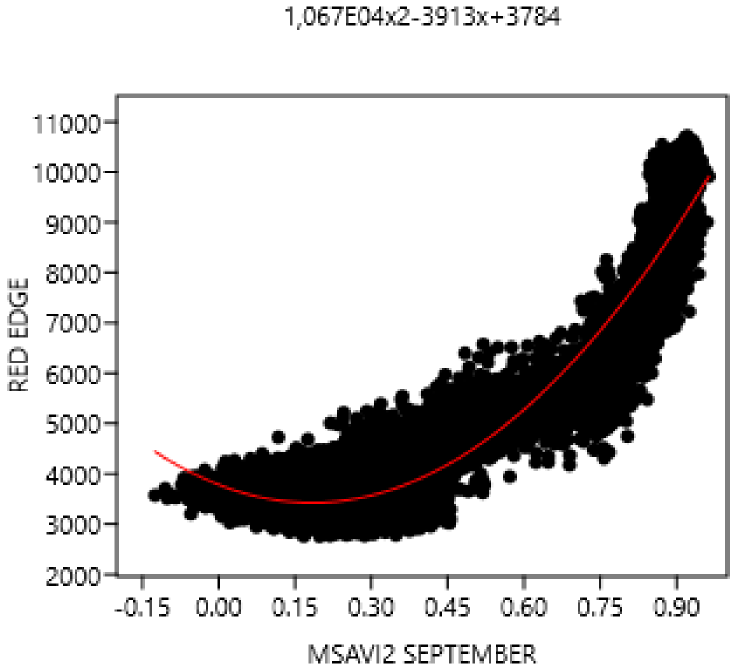

Figure 12. The graphic correlation of the Red Edge band withMSAVI2

It can be seen from the graphs above that the best correlations between the indices (NDVI, SAVI and MSAVI 2) and the Red Edge tape were found in the last month of study, September.

CONCLUSIONS

The study has enabled thecharacterization of vegetation stages on agricultural crops based on high-precision satellite imagery. In this research were calculated 3 vegetation indexes and the relation of the Red Edge band from Rapid Eye with NDVI, SAVI and MSAVI2. For the evaluation of the level of correlation there have been used adequate mathematical functions and extracted values of the correlation coefficients r and p which represent the level of the correlation and the accuracy of the results.The high level of correlation between Red Edge and NDVI, SAVI and MSAVI2 recommends assessing these indices with specific meaning about vegetation status, based on these values, in the case that their determination was not possible in the field.

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ASSESSMENT OF AGRICULTURAL LAND BY GIS TECHNOLOGIES

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Abstract

The assessment of agricultural land is an essential prerequisite for land organisation and use. Our goal is to create a bonitation map for the area subject to this study; natural bonitation is a quantitative measurement of the conditions which favour plant growth. The focal point of this evaluation is the land located in two villages from Fărcașa Township, Maramureș County, Romania. Forests, pastures and hay fields are already categorised as Class VI. Using the .tiff image of the area under study as starting point, we will create a geographic information system whereby, at the end, following an analysis of the space involving inquiries and joining, the plots of land can be assessed and categorised within a certain suitability class for field crops. The environmental conditions to be considered for this classification are related to geography, climate, hydrography and the physical and chemical features of the soil.
This study also covers an assessment of the degree of base saturation and pH of the soil. Moreover, we will select the most suitable plot of land for field crops, based on the parameters used in this study, which were measured based on the samples taken from each land plot. The outcome will be presented as a map used for the evaluation of agricultural land.

Key words: *natural bonitation, , plots, analysis, soil samples.*

INTRODUCTION

The goal of this project is to create a bonitation map; natural bonitation is a quantitative measurement of the conditions which favour plant growth. The land subject to evaluation is located in Fărcașa Township, Maramureș County, Romania. Starting from the .tiff image of the area under study we created a geographic information system whereby, at the end, following an analysis of the space involving inquiries and joining, the surrounding plots of land can be assessed and categorised within a certain class. Forests, pastures and hay fields are already categorised as class VI.
The environmental conditions to be considered for this classification are related to geography, climate, hydrography and the physical and chemical features of the soil.
For the purpose of this study we used the following parameters:

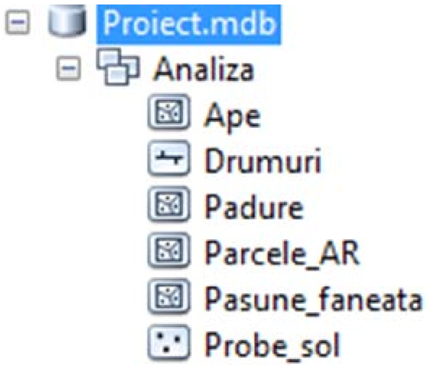
- Average yearly temperature;
- Average annual rainfall;
- Slope;
- Humus reserve;
- Texture;
- pH;
- Gleying;
- Salinization;
- Degree of base saturation.

The land plots will be assessed both according to pH and to the degree of base saturation. Moreover, we will select the most suitable plot of land for field crops, based on the above parameters determined by examination of the samples taken from each land plot. The results will be presented as a bonitation map.

TOOLS AND METHOD

To achieve our goal, we used ArcGIS10.2. Based on the .tiff image of the area under study we created a geographic information system

following several steps. In broad lines, we georeferenced the image in the Stereographic Projection 1970, which was the most important work phase, we created the database Personal Geodatabase in ArcCatalog, Feature DataSet and the Feature Classes as points, lines and polygons.
Thus we obtained the 6 feature classes required for analysis shown in Figure 1.



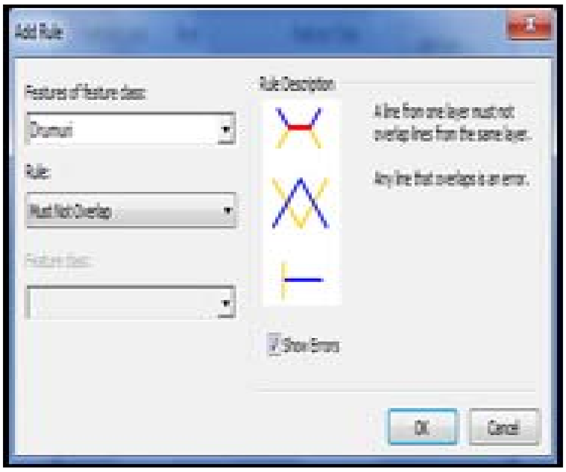


Figure 1. Database created in ArcCatalog

To digitize the image we used the Editor toolbar, we edited each feature class and also completed the related feature tables. We used Save Edits to save the edits and close the edit session. The result of digitation, completion of the feature table and symbol assignation by type of road is reflected in Figure 2.

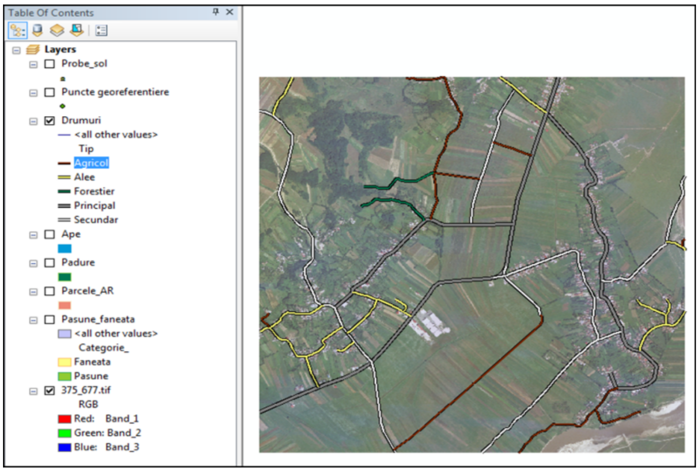
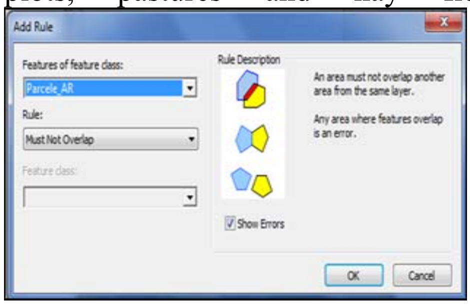


Figure 2. Digitation of the line feature class - Roads

To ensure an accurate digitation process, we applied 3 topological rules:

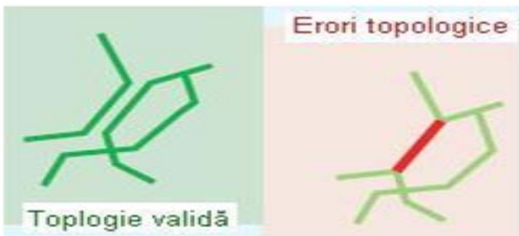
- The rule applied to polygon vector entities

1. Must Not Overlap- for agricultural plots, pastures and hay fields

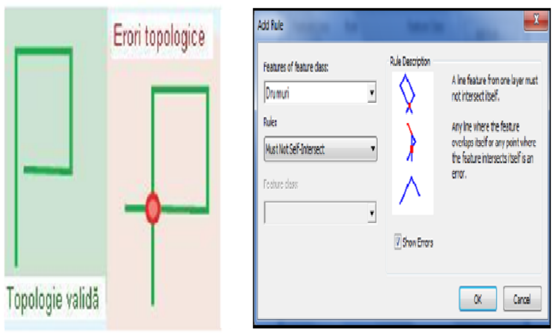


- Rules applied to line vector entities:

2. Must Not Overlap



3. Must Not Self Intersect



Following the validation of topology according to Figure 3, editing errors are shown in red. These should be corrected.

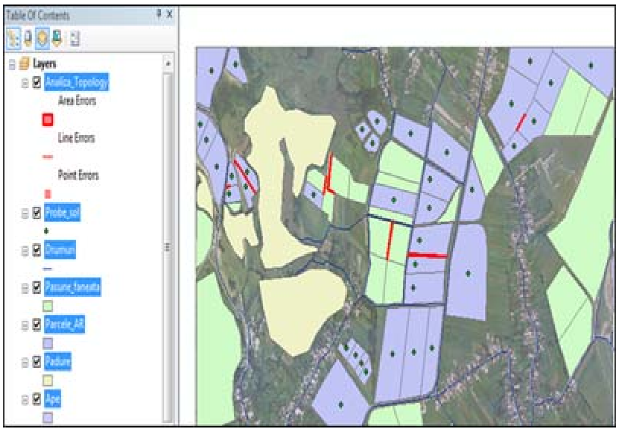


Figure 3. Editing errors following the validation of topology

RESULTS AND DISCUSSIONS

In order to obtain a detailed record of all land plots (data obtained relying on relevant samples from each plot) we made connections between the feature tables of hay fields and pastures using the Join and Relates command; these connections pointed to an owner of both agricultural land and hay fields, according to Figure 4.

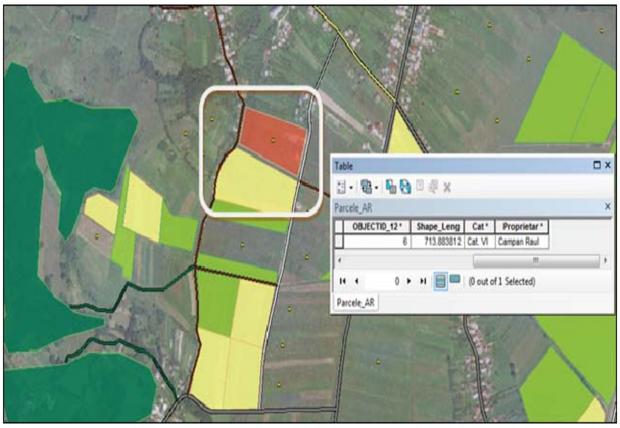
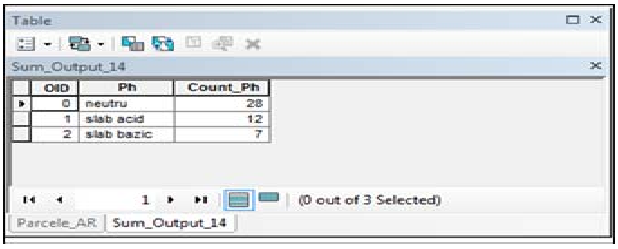


Figure 4. Highlight of the owner of both agricultural land and hay fields

Moreover, by means of the **Summarize** unction we evaluated the land in terms of pH, and noticed that most plots thus measured have neutral pH (Figure 5), which is ideal for our purposes since crops behave best at neutral pH values.



Table

Sum_Output_14

OID	Ph	Count_Ph
0	neutru	28
1	slab acid	12
2	slab bazic	7

(0 out of 3 Selected)

Parcele_AR Sum_Output_14

Figure 5. Feature table resulted following pH measurement

By means of a selection by attribute (Selection, Select by Attributes) we have identified the most productive plots, having humus reserves above 650, as shown in Figure 6.

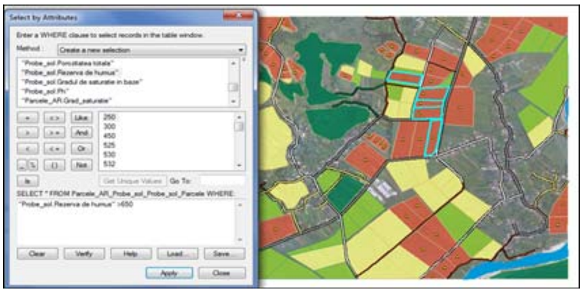
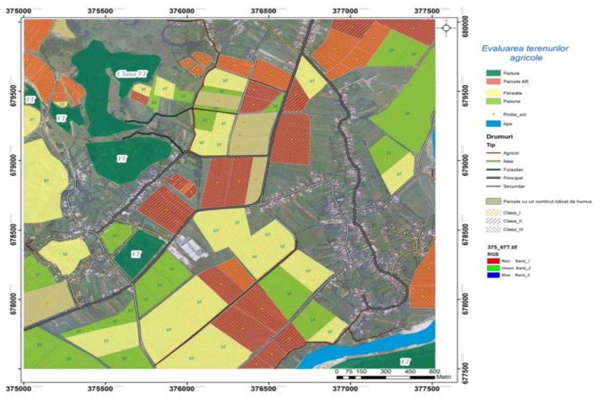


Figure 6. The most productive land plots

The final bonitation map created in Layout View:



CONCLUSIONS

Relying on a single image of a plot of land we managed to generate a bonitation map, to establish its most suitable crops and uses and, at the same time, we studied the land plots in the surveyed area in order to accomplish our research objectives.

Moreover, the study helped identify the plots of land with the most productive potential, based on the bonitation parameter humus reserve, since humus is the best indicator of soil fertility, as measured by the soil samples taken from each plot.

This project was first and foremost aimed to highlight the purpose and usefulness of bonitation. The soil used for agriculture loses part of its properties, for which reason it is recommend to track its alterations in time so as to achieve a balanced agricultural approach, not harmful to the natural fertility potential of soil.

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DO WE NEED CADASTRE?

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Abstract

We have done this project to present the current and historical situation of a cadastral system in several countries on the European continent. The countries we have chosen to include in the work are countries from the former communist bloc and countries of Western Europe. In the paper I approached the location of the respective countries by placing them on the continent through important geographic elements and neighbours. The period of communist regime domination in the analyzed countries, but also the development of the Western countries on a cadastral plan during the same period was another objective. Another point of interest was the state of completion of the cadastre in these countries, as well as agencies that have under their control cadastre in each country. The result of this paper led to the comparison of the cadastre system in Romania, a post-communist country, with the cadastral situation and history in other European countries, both communist and Western.

Key words*: cadastre, history, Europe.*

INTRODUCTION

Measurement of the earth is much older than we would be tempted to assign to it at first glance, it has its origin and evolved in parallel with the evolution of the relationship between man and nature. The human-nature connection has embraced multiple aspects during the historical, but at either of them we can see the increasing connection of man with the earth and its resources. The first notions strictly related to the term of ownership of land appear at the end of the 4th millennium before our era in Mesopotamia, called the country between the Tigris and the Euphrates (the territory of Mesopotamia coincides with Iraq today). The land was considered to be the property of the state; it was worked by the free peasants who paid to the king, the state, victories and various taxes in nature in the form of a "royal tribute."Over time, in Mesopotamia have established and great land properties, kingdom areas, temples, and a true aristocracy of senior state officials. Both the king's and the temple's servants provided a record of the cadastre, according to which the mandatory services were also provided. The great owner was, of course, the king who issued the oldest set of social, administrative, political, and legal rules, which was called 'Hammurabi's Code'. It included, among other "laws", the right to possess or inherit the land within the patriarchal Sumerian family. Today the need for cadastre is very high. The wealth of a country lies in its population and territory. If a country does not know and does not administer its territory properly, it is not a prosperous country.

Motto: "The cadastre should be a real guarantee of property and a certainty of the independence of everyone." (Napoleon, 1807)

MATERIALS AND METHODS

NORWAY

Location

Norway is a country located in Northern Europe on the western and northern part of the Scandinavian Peninsula, bordering the North Sea to the southwest and the Skagerrak inlet to the south, the North Atlantic Ocean (Norwegian Sea) in the west and the Barents Sea to the northeast. Norway has a long land border with Sweden to the east, a shorter one with Finland in the northeast and a still shorter border with Russia in the far northeast. Norway has a very elongated shape, one of the longest and most rugged coastlines in the world, and some 50,000 islands off the extremely indented coastline. Mainland Norway (fastlands-norge) covers 13° latitude, from 58°N to more than 71°N, (Svalbard north to 81°N), and covers the longitude from 5°E in Solund to 31°E in Vardø (Jan Mayen to 9°W, Kvitøya to 33°E).Norway is one of the world's most northerly countries, and one of Europe's most mountainous countries with large areas dominated by the Scandinavian Mountains. The contiguous area is slightly smaller than Vietnam and slightly larger than New Mexico (324,220 km^2). With Svalbard and Jan Mayen included, the area is slightly larger than Japan (385,199 km^2).

History Initially land in Norway was slowly occupied by individuals clearing the forests for farming, leaving tracts land in communal ownership. Later a large proportion of land came into ownership of the church, and later the king. From 1650 the king started to sell out land, a process that lasted for almost 200 years. At the end of the 19th century 80 % of properties were in private ownership In general most land below the tree line is in private ownership. In total there are currently 2,4 million registered properties (titles). The average farm size is about 20 ha arable land and 50 ha forest. About 80 % of the families live in one family house on a freehold or leasehold parcel. Major parts of the mountain areas are owned by the state. Leasehold is a common form of land tenure, frequently and mainly used for secondary homes (holiday homes).The national GAB-register embraces properties, addresses and buildings, and currently contains nationwide some 3 million properties, 2 million addresses and 3,6buildings. All the municipalities in Norway report directly to the GAB database. The Norwegian Authority on Cadastre and Mapping is responsible for the GAB-register Formal registration of private properties started in the medieval times, but the current legislation and system came into practise during last century, much based on the German 4 system. However, a proper cadastre based on professional surveying and mapping of boundaries only existed in the bigger cities until 1980. Until the Law on the cadastre came into force in 1980, new parcel boundaries in rural areas were set out and described by appointed laymen, with simple sketches registered in the Land Register only. The low standard in documenting boundaries has resulted in a larger number of boundary disputes than in other corresponding European countries. In bigger cities local cadastres, based on professional geodetic surveying and mapping, have been in existence since last century. The first known property register in Norway dates from about 1250, implemented for raising tax to the crown and for drafting men for military service. Only later the need to protect private rights in land became an important issue for registration. Using land as security for mortgage loans became common following the general economic development in the last 100 years (Mjøs, 2012).

The current cadastral situation The modern Cadastre has hitherto played no important role in taxation. However, following a 2006 law amendment an increasing number of municipalities are introducing local taxes on property, largely depending on data contained in the Cadastre. The Cadastre plays an increasingly important role for various branches of the public sector, particularly in the municipalities, providing basic information on land and buildings needed for calling up charges on municipal services for water, sewage, renovation, etc, and for land use planning and construction activities. Data about parcel boundaries and about who owns land, play an ever more important role in land use planning, land management, environmental protection, for fair distribution of subsidies to farmers etc. **Public restrictions** on land use and on the use of buildings are widely implemented through zoning and other forms of public planning. For banks and investors, as well as for the average persons who is seeking a property for himself, information about the public restrictions are now as important as information about private legal rights.. The new Law on the Cadastre coming into force from 2008 points out that the Cadastre, and not the

Land Register, shall contain information about public restrictions. The focus on land administration has somewhat changed over time, from taxation, to protecting private rights and facilitating the use of land as security for loans, and finally to facilitating public land management. However, it must be underlined that widespread and secured private ownership to land has never been disputed as a major factor for economic and social development in Norway. Today all properties in Norway are registered.

The cadastre institution Norwegian Mapping Authority is a Norwegian public enterprise under the Ministry of Local Government and Regional Development (2014). The head office is located at Hvervenmoen at Hønefoss in Ringerike municipality. The State Mapping Authority has been the agency's name since 1986 and is still the name used in official contexts, but from March 2012 it is the short form Mapping Authority used in communication outward.The Mapping Authority will ensure that timely, legally-established information from the public is available and is readily available to Norwegian society at all times. The Mapping Authority is the state's authority within map, geodata and public property information, and is also the country's registration authority. The area of responsibility includes Norway's land, coastal and sea areas, including the coast around Svalbard and Jan Mayen. Mapping activities are organized into four divisions: The geodesy division; The Land Division; The property division; The naval division.

SWEDEN

Location

Located in northern Europe, in the eastern part of the Scandinavian peninsula, Sweden is bordered on the west and northwest by Norway, on the northeast by Finland, on the east by the Baltic Sea and its arm, the Gulf of Bothnia, On the southwest, Sweden is separated from Denmark by the Skagerrak, Kattegat, and Ôresund straits that connect the Baltic and the North Seas. The fourth largest country in Europe, Sweden has an area of 449,964 square kilometres (173,731 square miles), slightly larger than California. The area also includes 39,030 square kilometres (15,070 square miles) of inland water pools, mostly lakes. The capital city of Stockholm is situated in the southeast, on waterways and islands between Lake Malaren and the Baltic Sea.

History

The Swedish cadastral system has a long history. During the 15th and 16th century Sweden became a centralized state with a powerful monarchy, who needed land information for tax purposes. The first registers were made in the 16th century and land has been registered since this time. Registration quickly became a part of the procedures tied to purchases and mortgaging. The National Land Survey was established at this time (1628).
Parceling reforms and the aristocracy's loss of privileges were important steps in the 18th century. The Swedish system for land registration, which has been complete since the beginning of the 20th century, is quite simple and straight forward. In essence it is very similar to the Torrens system.

In the 1930s, work to establish a comprehensive and coherent national map in one national geodetic system was started. From the beginning, these maps were based on aerial photography, photo mosaics and later orthophotos. The maps were named economic maps and were produced in scales from 1:5,000 to 1:20,000. Cadastral boundaries were transferred from the old village maps to the new system by mainly photo interpretation of the boundaries and comparison with the old maps. There were no attempts to calculate new areas for the property units in that period. This mapping programme finished in 1978 and is now maintained and complemented with land use plans, regulation and other features of importance for land use rights. Another important development was that the original cadastral books with its division of the village into real properties that also started around the 1600s were used by the State church for recording the population, births, deaths and places of residence. Such records have been maintained over the years. In present times, they have been taken over by the Tax Authority. In this way, all the people living in Sweden are connected to real property in a continuously updated census. Such records provide important data for use in land information and social data for public as well as private planning and administration. In the 1960s, the Swedish government attempted to modernise the cadastral books in the Property Register with the proposal to computerise the Property Register. One of the main advantages was seen in the possibility of combining information in the Property Register with the Population Register through the property designation, thus making spatial analysis a support for physical and economic planning. For this purpose, each real property was assigned a central coordinate in the national system. This was actually one of the pioneer works which later led to the development of Geographic Information System (GIS). The decision to computerise the Property Register and Land Register was taken in 1968 and 1970 respectively. After the system was developed, Sweden became the first county to implement it with legal force in 1975. The system was completed for the whole of Sweden in 1995.

After pilot projects, the gradual implementation of the so called LDBS began in 1976 and it whas finished in 1995 (Ericsson, 1996).

The current cadastral situation

Today all properties in Sweden are registered. A new legislation for multi-dimensional real property formation (3D Cadastre) came into force in Sweden on January 1 2004. The act is considered to be the most important basic change that has taken place in Swedish cadastral legislation during the past 30 years. 3D properties are just like ordinary properties created in a cadastral procedure. Åre has a long history as one of the main winter resorts in northern Europe. During the last years Åre has seen a boom in housing and commercial development unparalleled in its previous history. In the spring of 2008 when this presentation is being prepared, there are seven 3D projects completed or in various stages of progress in Åre. All but one are situated in the town centre within a few hundred metres distance. This fact is mainly due to the intense development, steep terrain, high land values and importance of close access to service and infrastructure. Commercial developers have specifically requested 3D property formation in all cases. The seven 3D projects focus on new or renovated buildings. The purpose is usually to separate holiday apartments from commercial property. A common desire from developers is to have a clear division between commercial enterprise and private holiday makers. Critical issues in cadastral procedures involving 3D property include allocation of boundaries, technical infrastructure, balancing the need for property regulations against less formal agreements, data conversion and editing and also communication in the process. The opinions from involved developers and property owners so far are very positive.

The concept of 3D property expanded in 2009by the addition of condominium (apartment) ownership. 3D property is therefore still a rather new form of land management, but there has been an increased interest in 3D property and ownership apartments, although the demand has not been as high as initially expected. The use of 3D property formation in land management is still to be seen as a supplement to the traditional 2D property formation. During 2013, 202 property units and ownership apartments were formed, which is 1.1 % of the total number of new property units (including joint property units and joint facilities) registered in the real. Implementing the concepts of BIM (Building Information Modelling) into and to develop a nation's 3D cadastre by adding information on buildings and building surfaces is a method of improving the use and visualisation possibilities of a cadastre, e.g. by making database queries on legal boundaries associated with building details, such as that a 3D legal boundary surface follows the outer surface of a building in which the legal basic property unit is located.

3D property formation has been successfully introduced and has proved to be a useful tool to the commercial property market. (Choon and Hussin, 2015)

The cadastre institution After 1st June 2008, Lantmäteriverket has been entrusted with the cadastral registration of real properties and rights to them in Sweden. It is responsible for cadastral surveys, property formation acts, registration of properties, rights and encumbrances through its local offices and for dealing with any related information about the real property. Furthermore, Lantmäteriverket also deals with developers and manages the Property Register, the Mortgage Deeds Register, the Real Property Price Register and the Register of Joint Property Management Associations.

REPUBLIC OF MOLDOVA

Location

The Republic of Moldova is a state located in south-eastern Europe, bordering Romania to the west, Ukraine to the north, east and south. The Republic of Moldova is a state without direct access to the sea, but it has an exit to the Danube on a strip of 430 meters at its southern extremity, through which it has potential access to the Black Sea. The capital of the Republic of Moldova is Chisinau. In the process of dismemberment of the Soviet Union, the Republic of Moldova declared independence on 27 August 1991. On 29 July 1994 the first constitution of Moldova was adopted.

History

In Moldova the development of the cadastral system is related to the name of Gheorghe Asachi, who in 1814 founded in Iaşi, next to the Princely School a class of engineering and frontier in Romanian language, where geodesy and topography were studied. In the Tsarist period, the cadastral development belongs to the name of Mihail Ozmidov, who is also the author of the famous architectural plan of Chisinau in 1817.

As a cadastral engineer, Mihail Ozmidov manifested himself in the elaboration of the estates projects, the planning of the land borders in accordance with the Regulation of the administrative-territorial organization of Bessarabia adopted in 1818.

Reforms of Stolipin in 1861-1868 have set the stage for land-use inventory and valuation operations thanks to the liberation of the peasants from under slavery and the development of the land market. During the period 1818-1840, on the territory of Bessarabia there are "Land Books" which provided for the precise identification of the goods to be registered.

In the period after the Second World War in the RSSM there is no proper cadastral system. For the most part, it was due to the nationalization and exclusive ownership of the state over land. Land registration during this period was done in state land books. Land registration of land in a single national system was introduced only in 1955. Subsequently, the cadastre of agricultural land, cadastre of water and forest cadastre were created. Along with these cadastral systems, it works technical inventory offices, what they had to do record and registration of buildings.

After the proclamation of independence of the Republic of Moldova (August 27, 1990), the REFORM period began in all branches of the national economy. The first attempts in the field of cadastre were: the adoption by the Parliament of the Republic of Moldova of a series of legislative acts, which regulate the process of transferring the real estate property and the cadastre of the real estate. The adoption of the new legislative framework on property regimes (Law on Privatization, Law on Property, Land Code), confirmation by the Constitution of the Republic of Moldova of the right to private property on land has served as a basis for reforming real estate relations, mass redistribution heritage, transferring it to private property.

Following the thorough study of the experience of the European countries in the field of cadastre, the Law on cadastre of real estate, which provides for a real estate registration system and rights, which corresponds to the current requirements? A new stage in the development of the cadastral system in the Republic of Moldova was determined by the adoption in 1998 of the Real Estate Cadastre Act, having previously been recognized and acquired the ownership of the land on other real estate, the purpose being the development of the real estate market in the conditions of a functioning market economy, based on private ownership of them.

Thus, a new cadastral system has been created in the Republic of Moldova, which brought together in a unique system the registration of land, buildings and other real estate, patrimonial rights, strikes and other legal acts and relationships, the object of which are real estate, subject to registration.

The actual implementation of the cadastre began with the signing on June 8, 1998, of the credit agreement with the International Development Association in the amount of 15.9 million US dollars. For this purpose, the State Program for the creation of the real estate cadastre was elaborated, the first stage (1998-2003) provided for the creation of the legislative framework, acceleration of the ownership process, information of the population, training of the cadres, creation of cadastral system and of course the massive primary registration of real estate. Substantial aid to the implementation of the Project was given by the donors. These are the generously offered donations from Sweden, Switzerland, France, Norway, Japan, which is estimated at 6.7 million US dollars. These funds were used predominantly to finance Swedish high-quality consultancy services "Swedesurvey", procurement of computer equipment, geodetic equipment, etc. According to the credit agreement, the government's contribution amounted to US $ 4.0 million.

At the realization of the first stage of the Program decisively contributed the First Cadastre Project, whose implementation has created a unique system of registration of real estate and rights on them. The privatization of the land was promoted, which boosted the development of the real estate market. Of the specific objectives of the Project was the guarantee of the state. Apart from the issues related to the creation of the cadastre infrastructure, the elaboration of the legislative base, the training of the cadres, the information of the population and many others, the main purpose was the identification of the real estate, their registration and their ownership rights. In this respect, the objective has not only been fulfilled, but has also been substantially overcome. Thus, it was initially planned to record 530 thousand of real estate. Subsequently, at the initiative of the Office for Implementation of the First Cadastre Project, Moldova has been able to receive help from USAID.

The current cadastral situation

Prior to 1 July 2006, 4 406 755 real estate assets were recorded in the republic, including 3 953 380 by massive method, from the state account. Of the total assets, about 67% are agricultural land, 23% - individual housing houses with related land, about 8% - apartments and 2% - other types of properties. Although the massive primary registration plan, approved by the Government Decision no.1030 of October 12, 1998 "Some measures regarding the creation of the real estate cadastre", was exceeded about 8 times, accounting for about ¾ of all the respective properties, for the completion of these works and the creation of a modern database of real estate in the republic also require human, financial, organizational resources.

There are also problems with the registration of real estate, which are more than the insufficient funds, which were previously allocated in the implementation of the First Cadastre Project, which is in the process of finalization. All the more that after the completion of the cadastral works, the creation of the cadastre in Moldova and a modern information base, the impetus for the relations with the banks and other economic agents, the cadastral system will turn from the consumer of money into a "financial producer". The Government of the Republic of Moldova has approved an additional action plan which foresees the finalization of the state program for the creation of the real estate cadastre for the period 2007-2011.

At present, from 1 550 localities in the Republic of Moldova, 950 localities are registered and cadastrated. (22.03.2018)

The cadastre institution

The National Agency for Geodesy, Cartography and Cadastre, nowadays called the Agency of Land Relations and Cadastre of the Republic of Moldova, was created in 1994 by a presidential decree for the elaboration and implementation of the coordinated conception of cadastre creation and management in the republic.

BULGARIA

Location

Bulgaria is a southern European country situated on the Balkan Peninsula. It borders with Romania to the north, Serbia and the Republic of Macedonia to the west, Greece and Turkey to the south, and east to the Black Sea. With a territory of 110,994 km², Bulgaria is the 14th largest country in Europe.

History

It is assumed that during the Roman Empire, when Moesia and Thrace were Roman provinces, the present Bulgarian territory was subjected to the cadastre. It is believed that during the census, the land borders of the villages of Thrace were established and marked with stone signs. The hypothesis is based on two uniform inscriptions in the villages of Plovdiv in Stroevo and Kaloyanovo and an inscription in the village of Orizovo in Stara Zagora.

The necessity of the cadastre was taken into account immediately after the liberation of Bulgaria from Ottoman domination. This was possible after the Russo-Turkish war that took place between 1877-1878 resulted in the emergence of the Third Bulgarian State, became independent in 1908.

In 1880, the Regional Assembly approved the Cadastre Law of Eastern Rumelia, which is mainly a guide for the introduction of land books.

In the next 20 years, three unsuccessful attempts were made to introduce a land cadastre into the country. Circumstances that in one way or another prevented this are:

- the indefinite state of ownership in the post-release era;
- turbulent political events in the country, unification, the Serb-Bulgarian war, the abdication of Prince Alexandru I Battenberg in 1886, the 1887 uprising, etc.;
- lack of budget funds;
- lack of competent cadastral specialists at that time;
- Insufficient understanding of the issue by the authorities.

In 1907, at the order of the Minister of Finance, a draft law on the cadastre was drafted, which was adopted by the National Assembly in December of the same year and was promulgated on 11.01. 1908.

In 1909, the Ministry of Commerce and Agriculture submitted a draft law to the National Assembly extended for the real estate cadastre, which was immediately adopted.

According to the Cadastre Act of 1908, the cadastre follows the physical and legal determination of the real estate property. The Cadastre Act of 1908 provides for cadastral measurements of the country's land and cities. This law remains unapplied mainly because of the lack of money is cancelled by the law of the land register and the unification of 1941. With the end of the year 1909, the work on the register of Bulgaria have ceased as a result of the Balkan War, Inter-Aliat War and the First World War. After a period of approximately 20 years since the end of the First World War, during which there was no important action to legally solve the cadastre, in 1941 the National Assembly adopts a draft law for cadastre and land unification, paid by the Ministry of Agriculture and State Property. The law is promulgated in the Official Gazette on June 13, 1941. The cadastral measurement is based on state triangulation and levelling elaborated by the Institute of Geographical State and is carried out according to the standards of the Central Measurement Council.

According to the Cadastre and Land Unification Act, a total cadastre of about 700 villages, with a total area of about 1 500 000 hectares, including 417 villages with a total area of nearly 500 000 hectares, has been completed after accession South Dobrogea in Bulgaria.

The law on cadastre and land consolidation is abrogated by the act of repealing all laws issued before 1944 by the National Assembly on 20 November 1951.

Between 1950 and the entry into force of the Law on the Unification of the Cadastre of the Republic of Bulgaria, on January 1, 1980, the cadastral material is regulated by the Law on the Planned Building and the Law on Territorial and Urban Development.

In the subsequent period up to 1969, even if the existence of the term 'cadaster' at operational level dominates the term "Geodetic topographic plan" or just "geodesic plan" - as in the "Guidelines for Surveying Surveying and Geodetic Plans of the Settlements" issued in 1954 by the Geodesy and Cartography Office (GGLC) since then. These plans are present and the cadastral components in addition to the topographical and geodesic, but does not take into account the limits and frontier but more on commercial and industrial installations, railway lines and facilities, roads and paths, hidrografie and equipment hydrographic basins, bridges and VIADUCTS, planting and soil, the shape of the earth, and other data. They are designed to serve primarily as a basis for designing urban plans and regulating construction and public works of settlements. The Law on the Territorial and Urban Structure, promulgated in the Official Gazette, no. 29 of 1973, which repealed the Law on Settlement Planning, does not contain provisions for the elaboration of cadastral plans.

In 1972, the Council of Ministers adopted a decision of drafting a draft law on the cadastre for the Bulgarian People's Republic. As a result of this decision, was set up at the Ministry of Forests and Nature Conservation cadastral department for the land fund and the Ministry of Agriculture and Food Industry, Forestry and Water Resources Department, with the idea of adding later information about settlements, buildings, natural resources, demographics and the quality of the natural environment and creating a Unified Cadastre as a computer system.

The Ministry of Construction and Architecture organized through the Geodesy and Cartography Center the elaboration of the basic terms for the establishment of a Single Cadastre of the Bulgarian People's Republic. The basic positions were adopted by the State Council Operational Office through Protocol no. 28 of 3 November 1975 and on the basis of this document the draft law was drafted. The Law on the unitary cadastre of the Republic of Bulgaria was adopted by the Seventh National Assembly on 27 April 1979 and was promulgated on 4 May 1979 and entered into force on 1 January 1980.

The Law on Holding and Use of Agricultural Land is the first in a series of restitution laws. It was adopted by the Great National Assembly on 22 February 1991 and was promulgated in the Official Gazette on 1 March 1991. On November 25, 1997, the law on the restitution of forests and forest lands is promulgated. The new constitutional provisions on restored property of agricultural and forest lands, forests and many properties in settlements create conditions for activating the real estate market, which leads to an increase in the need for loans and an increase in the number of mortgages. The need for maximum safety guarantees for rights holders is increasing, thus creating a favourable investment environment.

The current cadastral situation

Of the approximately 11,000,000 square kilometres of the entire area of Bulgaria, the Agency for Geodesy, Cartography and Cadastre (AGKK) succeeded in its 17 years of activity - between 2001 and 31 December 2017, to cover only 36,3 % of the country's base (4,032 million hectares).

Because of this delay, the Parliament recently adopted, for the sixth time, a legislative text to

suspend the statute of limitation of state and municipal property. Simply for 17 years, the state and municipalities did not know what properties they have because they are not yet cadastral.
The authorities promise that by 2019 the cadastral area of Bulgaria will grow from 36.6% to about 97%, all this increase taking place only in two years. This was declared by the Executive Director of the Agency for Geodesy, Cartography and Cadastre, Mr. Mihail Kirov, adding that the already difficult part of Bulgaria's cadastre has already been overcome.

The cadastre institution

The Agency of Geodesy, Cartography and Cadastre is an executive agency, is a legal entity based in Sofia and with departments in the field of geodesy, cartography and cadastre managing all the other territorial administrative units.

The Agency was established in 2000, after the adoption by the Council of Ministers of decree no. 169 of 14 August 2000 and promulgation in the Official Gazette no. 69 of 22 August 2000 of the Structural Regulations of the Cadastre Agency.

ROMANIA

Location

Romania is a state located in south-eastern central Europe, on the lower course of the Danube, north of the Balkan Peninsula and on the north-western shore of the Black Sea. It covers almost the entire Danube Delta area and the southern and central part of the Carpathian Mountains. It borders Bulgaria on the south, Serbia to the southwest, Hungary to the northwest, Ukraine to the north and east, and the Republic of Moldova to the east, and the Black Sea shore is to the southeast. It has a total area of 238,397 km² and a population of 19.71 million (2016).

History

The works for the introduction of the cadastre and land books were carried out in different ways in the Romanian provinces, depending on the historical circumstances, starting with the nineteenth century, as follows:
- Transivania, Banat and part of Bucovina the specific works started with the Austro-Hungarian system, starting with 1794 and continuously after 1850 under the form of "concrete cadastre" (it consists of the delimitation, description and representation of the boundaries of the localities, the boundaries of the lands, of the hydrographic networks and of the communication ways)
- in Muntenia and Moldavia, starting with 1831 and 1832, attempts were made to introduce the cadastre by the first frontier engineers trained at lasi by Gh. Asachi (from 1813) and in Bucharest by Gh. Lazar (from 1818);
- in the rest of the country, the cadastre is made after the First World War, with the agrarian reform.

In 1919, the "Cadastre and Technical Works Division" was established, whose activity was limited to the measurement of the estates and their partition for property acquired after the First World War. The measurements were made in local reference systems, with differences in accuracy and content, as there is no homogeneous geodetic network. For the execution of the cadastre, technical cadres were prepared at the Topography School (1919) near the Cadastre Department.
An important step was taken in 1930 by the adoption of the stereographic projection system, the result of the collaboration between the Cadastre Department and the Army Geographical Institute.
The reference point for this field of activity was the "Law for the organization of cadastre and land books", no. 23/1933, which regulates for the first time the way of organizing and realization of the land cadastre, starting from the unitary geodetic networks and elaborating cadastral plans and registers after the first technical and economic norms.
It began with the execution of the cadastral works in Muntenia and Dobrogea, then in Moldova and Oltenia, simultaneously with the updating of the existing ones in Transylvania, Banat and Bucovina.
Regarding real estate publicity, it was thoroughly organized through the "Law for the unification of the provisions regarding the land books", no. 15/1938. The works started in the

former Ilfov County and in the communes subordinated to Bucharest, which were to be used as a model for the rest of the country, could not be terminated due to the war and were interrupted in 1941 when they were executed for only 54 communes (65% of total volume). The experience of technicians from other provinces has been used, new instructions were included in the "Technical Norms (1943) and since 1940 engineers have been trained in the cadastral department of the Polytechnic School in Bucharest.

After the Second World War, measurements and parcels were carried out for the temporary impoverishment of the peasants, without the cadastre institution being financed by the communist power.

In 1949 the collectivization of agriculture was decided, and the law and cadastral measurements became obsolete for the totalitarian regime.

To record and track the dynamics of agricultural land belonging to state units, is being legislated since 1955 the organization and execution of "land records", a system that served to combine agricultural surfaces during the period of collectivization of agriculture and which contributed to the immobilization of real estate rights.

Between 1955 and 1968, topographic plans were made at a scale of 1: 10,000 by photogrammetry for 13 million hectares and registers of land records by the Superior Council of Agriculture.

Since 1968, the Law no.12 on the protection, conservation and use of agricultural land stipulates among other things the introduction of land cadastre throughout the country. It is constantly used the old evidence and disinformation on agricultural surfaces, because of the premeditated ignorance of the idea of cadastre by totalitarian political leadership.

Land inventory started in 1968 continuously and after 1974 through Law no.59, annual balance of the land fund was drawn up, but the legal circulation of land was limited to their acquisition only by legal inheritance. The entire field of land surveys was subject to the regulations by Decree no. 305/1972 on geodetic, topographic and cartographic activity, as well as the use of data and documents resulting from this activity.

From the cartographic documentation drawn up since 1965, one should mention the basic topographic plan at the stairs 1: 5000 and 1: 2000 which, unfortunately, could not be updated at appropriate intervals, although it covers about 90% of the country's territory. This has proved to be useful for economic sectors that have large areas of land (agriculture, forestry, communication paths, systematization of localities), but also for providing graphical support for cadastral works by deriving its content.

Changes in recent years are primarily linked to the general legislative framework on the legal status of the land, the public and private property, the acquisition of property rights and the legal circulation of land.

General regulations in the field of property appear in the Romanian Constitution, adopted in 1991, in the Local Public Administration Law no.69 / 1991, amended and completed, in the Civil Code and in the Civil Procedure Code.

Over the past decade normative acts have been promulgated, which constitute the basis of the right of property: Law no. 169/1997, which includes legal norms related to the public and private property on the lands, to their legal regime, the protection and improvement of the lands, Government Decision no. 834/1991 on the establishment and valuation of land owned by state-owned commercial companies, the Law on the legal circulation of land no. 54/1998, the Law for the restoration of the right to property on agricultural and forestry lands no. 1/2000. Law 18/1991 led to the restoration of the Romanian peasants' property rights to a limited area of their land, that is, only 10 hectares on sites decided by law enforcement committees.

Law 1/2000, also called the Lupu Law, whereby the land returned to the peasants expanded to 50 hectares, but the issuance of property titles was a tricky process.

Law 400/2002 - Restoring the right to property on agricultural and forest land, initiated by Viorel Hrebenciuc.

Law 247/2005 on the restitution of agricultural land and forestry land through which the return rule was established on the former locations.

Starting with Law 18 from 1991 to 2007, 11 normative acts - laws and emergency ordinances - were adopted to regulate land ownership. (Manea ‘Course’)

The current cadastral situation

The National Cadastre and Land Book Program runs between 2015 and 2023 and is implemented by the National Agency for Cadastre and Real Estate Advertising ("ANCPI") and its territorial offices on the entire surface of Romania, at UAT level, based on cadastral documentation. This program aims to have until 2023 the cadastre of the entire surface of Romania.

On 25.03.2018 the number of buildings managed by the integrated cadastre and land registry information system is 10 921 813 buildings, a total of about 40 million estate located in Romania. This results in a percentage of approximately 27.30% of the total number of buildings.

The cadastre institution From 1990 until 1996 the agency was named the Office of Cadastre and Organization of the Agricultural Territory (OCAOTA). From 1997 to 2004, the agency operated under the name of the National Office of Cadastre and Cartography (ONGC).
Since 2004, the National Agency for Cadastre and Real Estate Advertising (ANCPI) is responsible for the cadastre in Romania, and at the county level there is the Office for Cadastre and Real Estate Advertising (OCPI). Within the National Agency for Cadastre and Real Estate Advertising (ANCPI), the Cadastre and the Land Book function in the same institution.

RESULTS AND DISCUSSIONS

The analysis of existing cadastral systems in the world with the cadastral system in Romania aims at highlighting the current state of cadastre in our country as well as the necessity of accelerating the application of the systematic cadastre. Based on this idea, we have four countries in our study, two of which are part of the former communist regime, namely Bulgaria and the Republic of Moldova and two other developed countries, namely Sweden and Norway.
We were able to see a first overview of the fact that on the cadastral plan the developed countries started to deal with this problem well ahead of the others. This is seen in the most developed of these, namely Sweden, which began about four centuries ago to be concerned about this idea.
The need to apply the cadastre is generally due to people's desire to know their property limits, but also to the need of the state to apply taxes to those properties. Both the former communist countries and Sweden have introduced the initial cadastre of the desire to tax property. Norway is an exception to this principle because it has been turning to this idea just in the last century. Not even now Norway does not charge on properties across the entire area of the country this being achieved only in certain administrative units. It expects the charge to be made nationally. Both our country and the Republic of Moldova, two former communist countries, resemble Norway and Sweden by the fact that the cadastral office is in the same institution with the land book, but Bulgaria has not opted for this system. The location of real estate is a factor that does not favour the development of cadastre in our country, on the contrary it is made difficult. This is because Romania after 1990, when the restitutions began, the land was not returned to the previously owned land and most importantly it was that only a precept was given back. Besides this, the territory was not united and was scattered in several locations. Just after about a decade the land returned to the former sites and all together, but it was a difficult process which did not have a desired finish.
We have noticed that this is not found in neighbouring Bulgaria which has a very good settlement of the retroceded lands, which is observable from the studied cadastral plans. Another similarity we have discovered in the countries presented and our country, besides the land book, is the space database of each country. These bases are under the name:
Eterra in Romania, Geospatial Data Fund in the Republic of Moldova, Cadastral administrative information system in Bulgaria, Geonorge in Norway and Land data bank system in

Sweden.I notice that it is based on the same principle, providing the same data to the public, such as cadastral number, address, surface, etc.

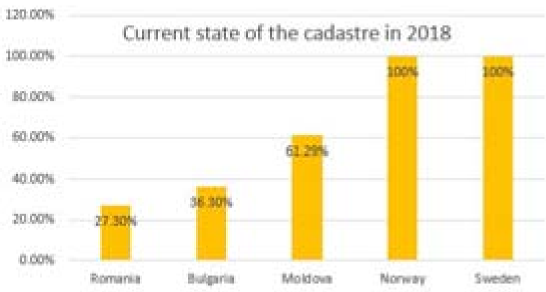

Figure 1. Current state of the cadaster in 2018

In the above graph (Figure 1) we can see a cadastral statistics in each of the five countries studied by us. The graph shows that Romania would be the country with the smallest cadastral area among all four other countries. In our opinion, this is not a good comparison because in front of the other former communist countries the Republic of Moldova and Bulgaria, Romania has the largest area of territory.

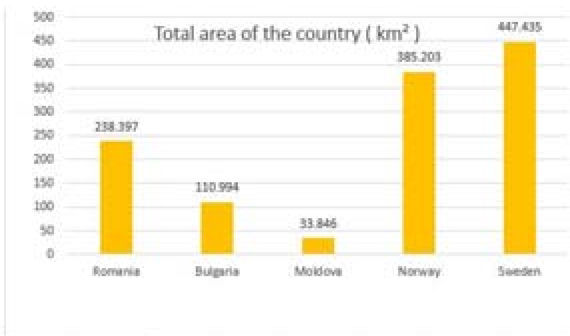

Figure 2. Total area of the country (km²)

In this graph (Figure 2) we can see exactly what I said above, namely that Romania is the state with the largest area of territory between the Republic of Moldova and Bulgaria. From these charts we have concluded that Romania currently has approximately the same percentage of cadastre as the former communist countries, taking into account the ratio between the total land area and the cadastral area. Sweden and Norway leave no room for interpretation, and it is extremely easy to see that the abbeys have a higher net area than Romania and the other two countries, but also the cadastre completed on the whole territory.

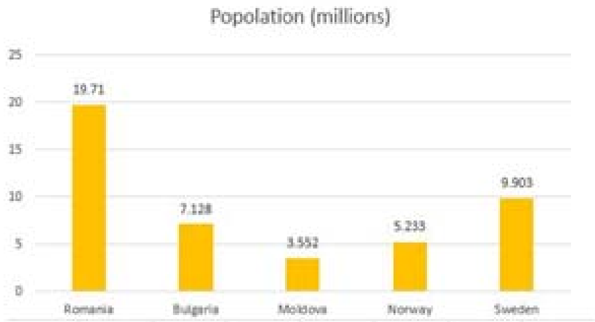

Figure 3. Population (millions)

Another thing that can be considered a very important factor is the population (Figure 3). We realized that Romania, a country of medium size among the analyzed ones, still has the largest number of inhabitants. In our opinion this is a very important aspect because a country is rich in the area it occupies and its number of inhabitants. The number of inhabitants also represents the income a country has, but this is reflected in the chart below.

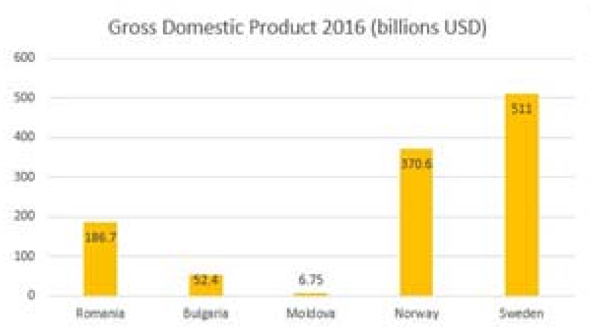

Figure 4. Gross Domestic Product 2016 (billions USD)

This is the gross domestic product of each analyzed country (Figure 4), and we can very easily notice that Romania, a medium-sized country with the largest population of all analyzed, has a rather low budget. We believe that this reflects another criterion that makes cadastration difficult enough, namely very low incomes in relation to its surface and population.

CONCLUSIONS

Following our survey of cadastre, on the five states, namely Romania, Bulgaria, the Republic of Moldova, Sweden and Norway, we can say that Romania is at an average level of cadastre from the point of view of former communist countries, but at a very low level as the European country. This must change and Romania will enter the developed countries.A first step would be cadastration at low precision, but with rapid results, based on aerial photograms, and in the future there will be interference where much higher accuracy is required.Completion as quickly as possible would lead to an increase in the country's tax budget, which would favor the future financing of future cadastre projects.

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