OPPORTUNITIES FOR ACHIEVING A GEOGRAPHIC INFORMATION SYSTEM FOR "ARBORETUM SYLVA" DENDROLOGIC COLLECTION

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Abstract

Making information systems and databases related to various activities in the forestry sector are important objectives that can optimize management decisions and streamline the production process.

Scientific, effective, thorough organization of activities within Arboretum Sylva dendrologic collection from Gurahonț, Arad needs the accomplishment of a computer system and data base for the dendrologic park within a complex management programme.

To achieve the information system there are necessary raster and/or vector-type data related to the spatial positioning of the dendrologic collection and a number of attributes on the dendrologic collection and its specific activities.

Field information needed for the case study were collected in 2014, by using for this purpose GNSS technology, specialized programs for data processing and obtaining the final product, field data collection on dendrologic collection and its specific activities and descriptive data of the records from the dendrologic park. The results can be found in digital or analogical form, under the form of thematic maps and/or tabular records that characterise completely, unitary and complex the specific of the activities from the dendrologic collection.

Key words: dendrologic collection, arboretum, system, database, attributes, raster data, vector data, analogue product, digital product

INTRODUCTION

Geographic Information Systems generically named GIS are now referred to as the possibility to streamline the various activities taking place in different time periods, requiring technical solutions that depend on progress of technological information. (Chezan et all, 2006) Setting up databases related to information systems complements the objectives designed to optimize the required technical solutions. Current existence of logistics needed for data collection and processing for spatial positioning, by differentiated working methods (Adam et all, 2004), undoubtedly facilitate the achievement of information systems and related databases. (Crainic, 2011)

Although the data period and implicitly of the raster-type products is considered history (Detrekoi, 2009), in some applications these products can be used with high efficiency. The usage of vector data involves the spatial positioning, with different working technologies (GNSS technology, conventional technology, and combined technologies), (Tămâioagă Gh, Tămâioagă D., 2007) implicitly the checking and processing of field data acquired in various ways.

Consequently, the parallel use of raster data and vector data can streamline in some situations the spatial positioning and the achievement of spatial information system and the corresponding database.

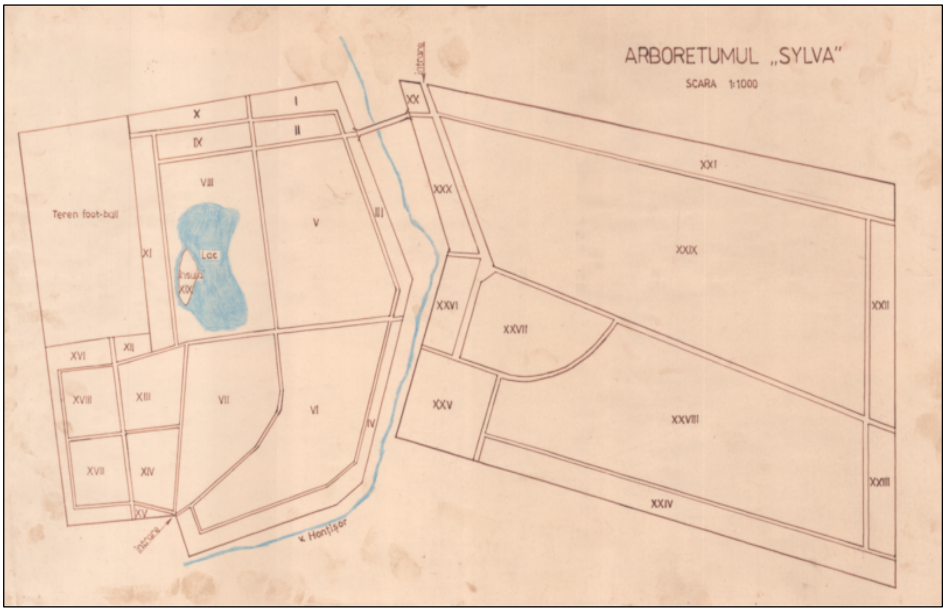


Photo.1- Plan of “*Arboretum Sylva”* dendrologic collection

MATERIAL AND METHOD

The case study was conducted within Arboretum Sylva dendrologic collection from Gurahonț, Arad County, in 2014. The used research methods are: bibliographic documentation, itinerary observation, site observation, experiment, simulation.

The logistics used for the case study is represented by: the park’s plan in analogical format, TrimbleR3 GPS receivers, GPS TrimbleR4 receiver, data collection program (Trimble Digital Field book), satellite data recorded by the permanent station GNSS from Gurahonț, program to process satellite data (Trimble Total Control), program for coordinates’ transformation within the national reference system (TransDatRO4.01), graphical reporting program, program data (MapSys7.0), computer and peripherals. (Staşac, 2014)

RESULTS AND DISSCUSIONS

To achieve the geographic information system and the data base of the corresponding “Arboretum Sylva” dendrologic collection, we used the park’s plan in analogic format, (Corcodel et all, 2004) which was scanned and geo-referenced in the national reference system through a Helmert transformation, (Sabău, Crainic, 2006) by using for this purpose four common points, with known coordinates in both coordinate systems (coordinate system of the working program and national reference system) - table 1.

Table 1

Inventory of points used to geo-reference the raster corresponding to the plan

No. pct.	X(m)	Y(m)	Z(m)	Observations
1000	533000.660	296154.387	168.102	Points determined by the method RTK with GNSS technology, the receiver TRIMBLE R4
1001	532759.565	296094.267	190.791	
1002	532995.896	295816.092	170.711	
1005	533202.726	295915.980	165.038	

Photo.2-Raster imported from working program MapSys7.0

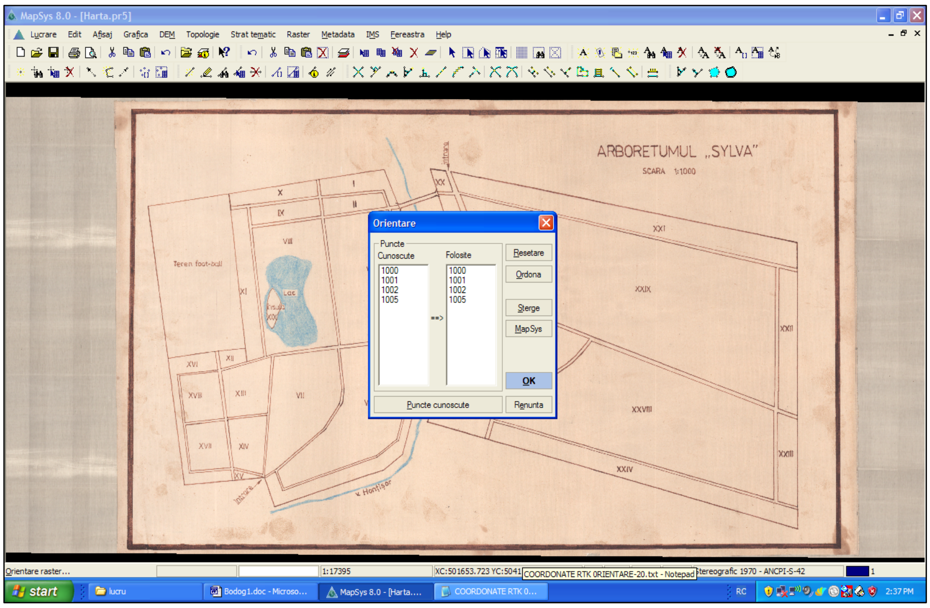
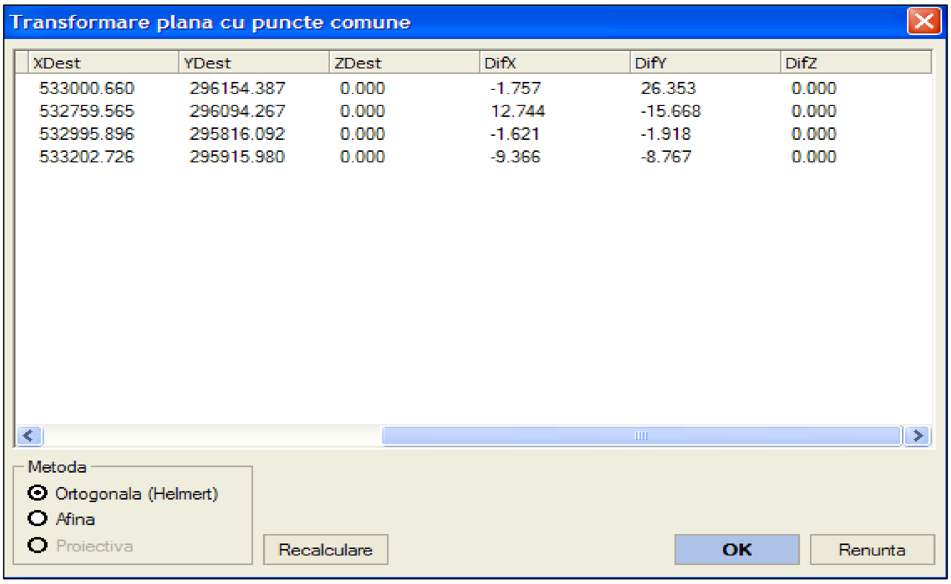


Photo.3-Implementation of common points to achieve geo-referenced raster

The common points that were used for transformation were positioned spatially with GNSS technology, GPS system, by fast static method, (Boş, Iacobescu, 2007, 2009) the final coordinates being obtained by transformation in the national system with the application TransDatRO4.01.



XDest	YDest	ZDest	DifX	DifY	DifZ
533000.660	296154.387	0.000	-1.757	26.353	0.000
532759.565	296094.267	0.000	12.744	-15.668	0.000
532995.896	295816.092	0.000	-1.621	-1.918	0.000
533202.726	295915.980	0.000	-9.366	-8.767	0.000

Photo.4-Accurate indicators of common points' transformation

Precision indicators of transformation are shown in photo 4 and 5.

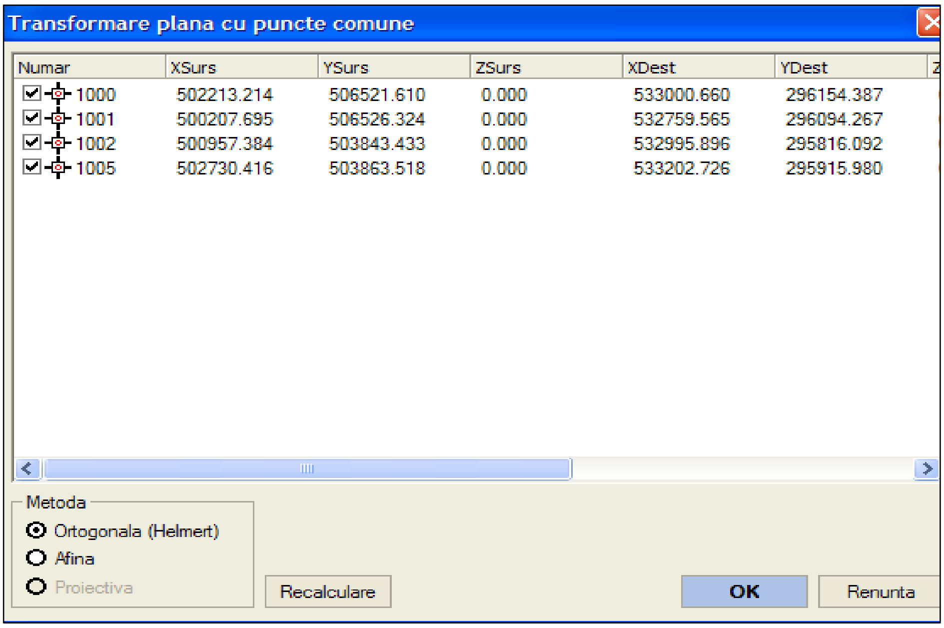


Photo.5-Accurate indicators of common points' transformation

Following the geo-reference process, the raster is oriented according to the national reference system - Photo. 6.

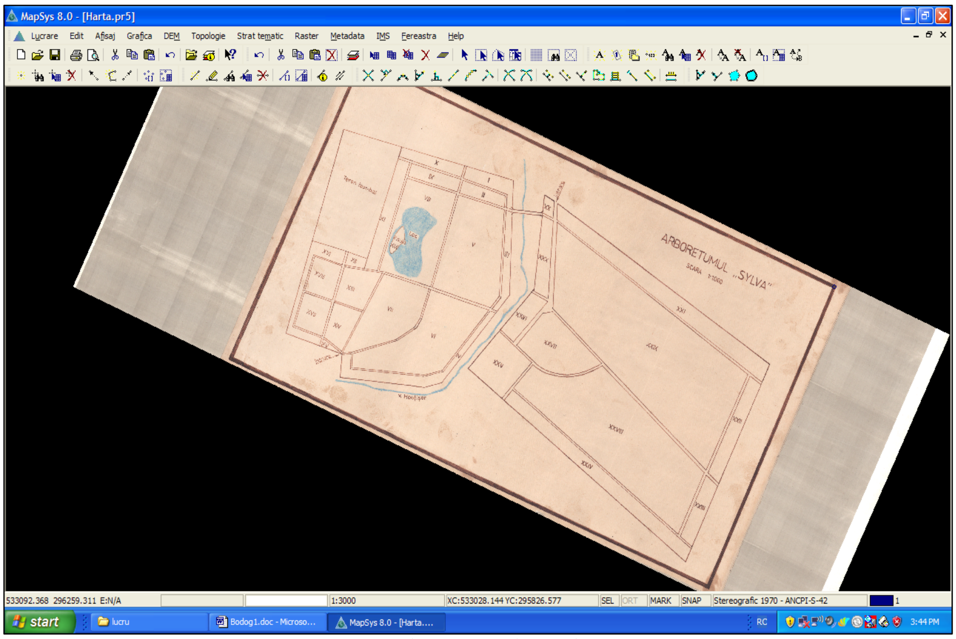


Photo.6-Oriented raster

Consequently, within the plan (2D reference system), the raster points may be arranged with a relatively high precision, depending on the accuracy of the implementation of the plan, and implicitly on the accuracy obtained when geo-reference process. (Photo 7 and 8)

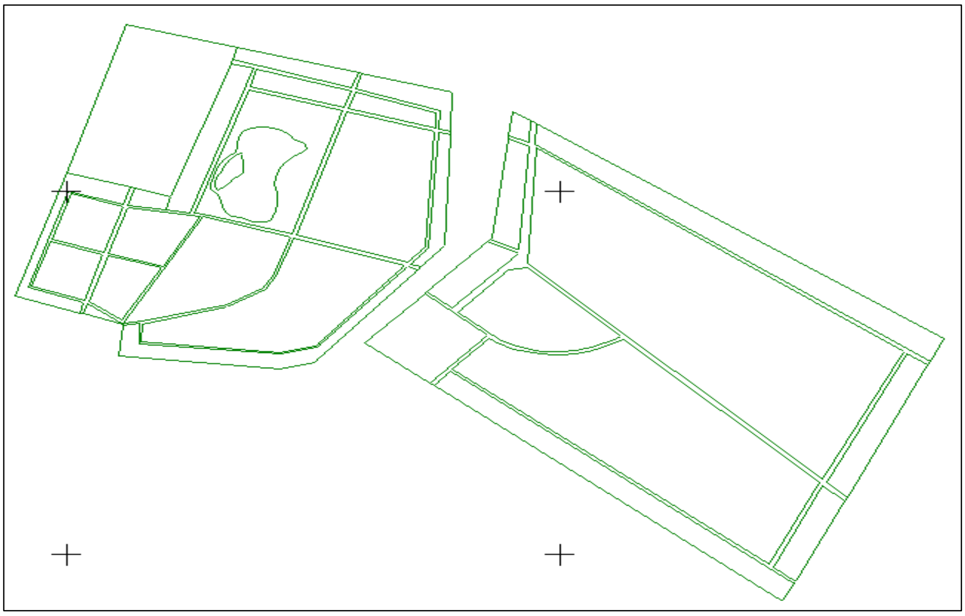


Photo.7-Obtained vector

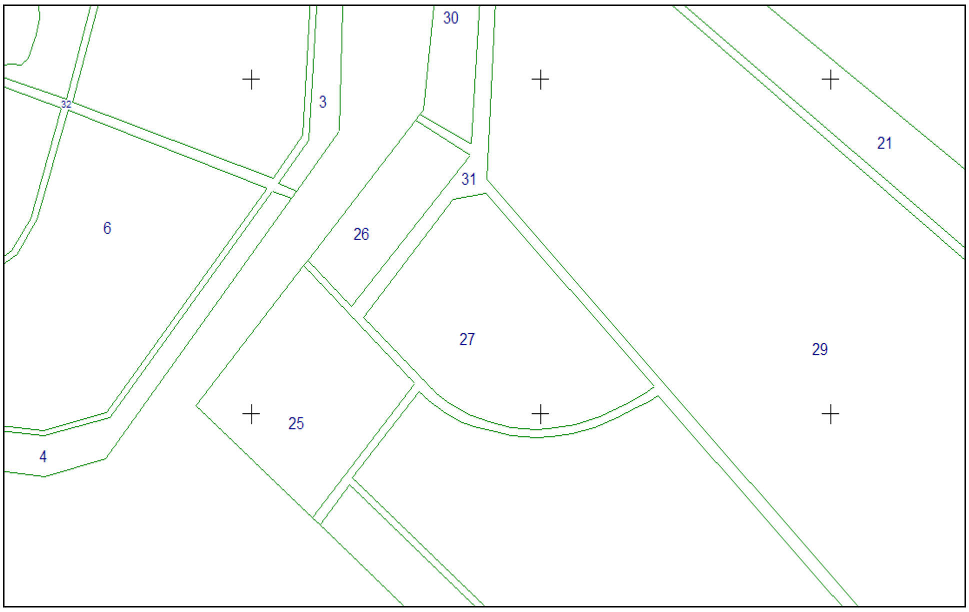


Photo.8-Vector with identifiers

Through the process of vectorization, vector elements (vector) are generated based on the current raster image (Marton, 2007), requiring geo-referencing.

Photo.9-Thematic map of land users in Arboretum Sylva

Attributes that were collected from analogue material - drawing on the ground that the park and covers: plots, uses, copies designed to be included in the reserve, which vegetate currently specimens and specimens that no longer exists.

These attributes were loaded into the database fields' topological current layer by taking the text elements, within the current layer topological objects.

The window that appears when calling menu consists of two columns. In the **Name** column displays the name of the database fields' topological current layer and in the **Layer** column is inserted the corresponding field attributes retrieved from the database.

Entering the double layer is done by selecting the appropriate line in the table.

Posing multilayer source with a single operation attributes can be collected from different layers.

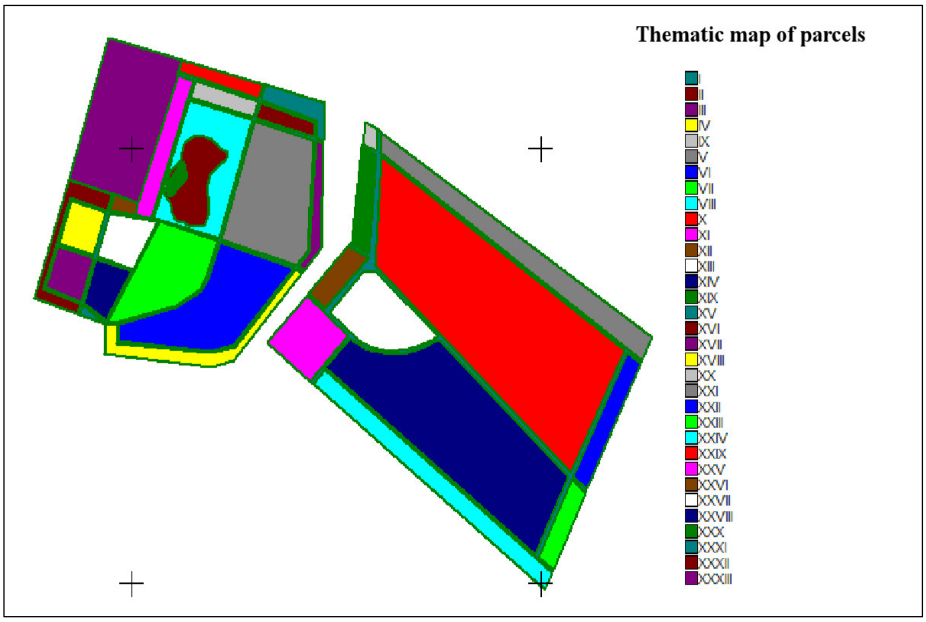


Photo.10-Thematic map parcels in Arboretum Sylva

For this case study, the main attributes are collected specimens in the collection dendrologic Sylva Arboretum.

In the 19 plots were inventoried analysed a number of 2195 copies which grows in relatively appropriate conditions and a total of 252 specimens were dried.

Thematic layers are graphical representations of topological object attributes. In terms of graphical representations can be of full colour, shading, symbol or bitmap.

Classification thematic attributes can be uniformly, individual or ranges. Thematic representations are saved immediately after generation in the form of thematic files then can be loaded in any combination.

Thematic representations may be made for any topological objects (polygon, line, point).

Fields of attributes on which is the representation must be created after generation topology table corresponding topological layer.

Fields of attributes can be done through specific functions menu topology, manually or using external applications.

Attributes can be text or numeric. Once created, thematic representations can be updated anytime, if changes have been made in the topology object.

NR	IDLN	IDTX	NRCAD	SUPRAFATA	PERIMETRUL	Z	FOLOSINTA	PARCELE
1	10	-1		-58178.1481	944.25	0.000		
2	10	58	4	2309.0200	494.40	0.000	Parc	IV
3	15	88	34	9566.4124	411.15	0.000	Teren sport	XXXIII
4	-15	86	32	3926.4180	999.49	0.000	Alei	XXXI
5	16	70	16	1570.8840	382.27	0.000	Parc	XVI
6	18	55	1	1089.7665	185.67	0.000	Parc	I
7	19	64	10	983.8865	183.88	0.000	Parc	X
8	28	57	3	1002.9439	250.52	0.000	Parc	III
10	32	56	2	769.0413	139.53	0.000	Parc	II
12	33	59	5	7892.6164	360.08	0.000	Parc	V
13	-37	62	8	4143.4575	350.57	0.000	Parc	VIII
15	38	63	9	946.7289	155.00	0.000	Parc	IX
17	42	65	11	2004.2176	293.17	0.000	Parc	XI
18	44	66	12	326.3282	75.40	0.000	Parc	XII
20	49	72	18	1424.8165	151.50	0.000	Parc	XVIII
22	52	67	13	1806.4446	172.34	0.000	Parc	XIII
24	61	60	6	7516.1967	421.88	0.000	Parc	VI
26	73	61	7	4990.2849	303.17	0.000	Parc	VII
28	80	71	17	1431.8628	151.78	0.000	Parc	XVII
30	84	68	14	1421.6682	155.33	0.000	Parc	XIV
31	85	69	15	122.6825	64.19	0.000	Parc	XV
32	93	73	19	296.4447	77.07	0.000	Parc	XIX
34	-96	87	33	2636.0262	228.26	0.000	Lac	XXXII
37	101	83	29	26927.0701	774.25	0.000	Parc	XXIX
39	104	82	28	18292.5162	638.49	0.000	Parc	XXVIII
40	105	81	27	4155.8114	261.11	0.000	Parc	XXVII
42	108	80	26	1274.0977	163.09	0.000	Parc	XXVI
43	-108	85	31	4852.9435	1297.23	0.000	Alei	XXXI
44	127	-1		-73947.4230	1159.68	0.000		
45	127	79	25	2996.0414	219.03	0.000	Parc	XXV
46	188	84	30	1403.6208	212.05	0.000	Parc	XXX
47	193	74	20	258.4505	68.02	0.000	Parc	XX
48	201	75	21	5820.0011	669.23	0.000	Parc	XXI
49	204	76	22	2044.0892	281.41	0.000	Parc	XXII
50	208	77	23	1359.8514	190.01	0.000	Parc	XXIII
51	212	78	24	4562.9298	604.32	0.000	Parc	XXIV

Photo 11 - Database related information system

CONCLUSIONS

The achievement of spatial information systems with raster-type data implies the existence of some products in analogical precision format (plans, maps, etc.) and at a corresponding scale.

Vector-type data obtained with modern positioning technologies can ensure the development of spatial information systems and associated databases with high accuracy and precision.

Vector-type data are obtained relatively more difficult compared to the vector-type ones, given the working technologies (positioning).

Geo-reference precision of the raster is higher if the common points used for geo-referencing (transformation) are positioned with GNSS technology, GPS system.

The usage of raster and vector type data to achieve GIS databases and corresponding databases is a very good solution in the situations where the infrastructure has some shortcomings.

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