

## FOREST TOPOGRAPHIC FEATURES USE FOR SILVIC WORKS BY USING THE ACTUAL MEASURING TECHNOLOGIES FOR DATA PROCESSING

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**Abstract:** *The paper presents the influence and application of modern topography approaches in the forest, the most effective methods that can increase forest productivity of cadastral work. Forests, by the economic functions of protection, in all kind of ownership, are a wealth of international and national interest of all mankind and thus benefiting our society. For this purpose it is necessary to ensure sustainable forest management by establishing specific measures of administration, care, rational exploitation and regeneration.*

*Whatever form of ownership, strategy implementing economic value, social and ecological forest is an attribute of state.*

*While respecting property rights, forests in Romania are administered and managed in a single system, aiming at the recovery continues, the benefit of current and future generations, the ecological functions and socio-economic*

*The paper content is based on the results achieved from the work of Topographic and altimetry survey of a forest parcel, with registration in the land book register for owners situated in the area of Dâncu Mare, Hunedoara county.*

### 1. Introduction

The geopolitical and socio-economical evolution from the second half of the XX Century and the beginning of the XXI Century generate a vital problem of mankind: in what manner the civilization can be develop without affecting the Planet balance?

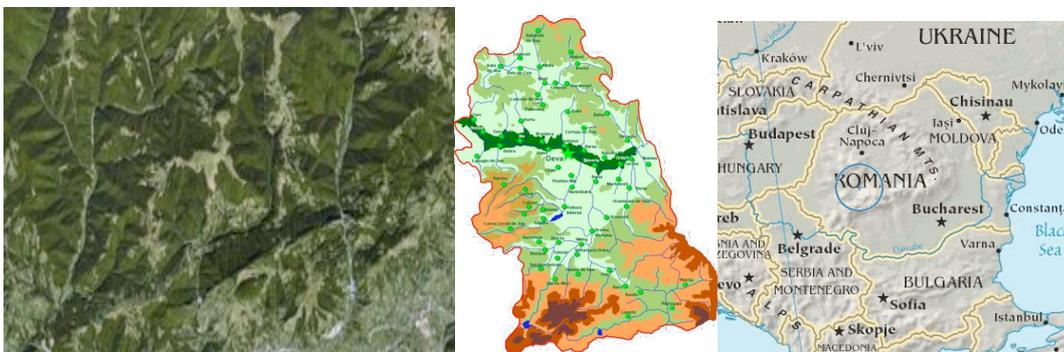
The forests, by the economical and environmental protection functions, despite the propriety form represent an international and national wealth for our society and in the same time for worldwide benefit. For these reason it is necessary to ensure a sustainable management of forests by establishing a certain set of rational exploitation and regeneration steps. Whatever the ownership is, the strategy of economical, social and ecological exploitation of forests is the state target. Considering and taking into account the propriety right, the management and administration of Romanian forests is done unitary foresighting a continuous capitalization in the benefit of the actual and future generations by maintaining and improving the ecological and economic-social functions.

Since the beginning, we must mention that the European Union did not mention special regulations regarding the forest administration leaving in this way the possibility of self management. The juridical act of silvic and forest administration of Romania is the Government Ordinance 96/1998, improved with the last modification added by the 120/2004 and 247/2005 law.

## 2. Material and method

Hunedoara County is situated in the West-Central part of Romania, on the middle stream of Mures river and its main tributary Strei river and in the upper stream area Jiul and Crisul Alb. Having this position, we can say that is situated at the intersection of four major roads: Mures and Banat, Olt (through the Defileul Jiului) and Tarii Crisurilor (over the mounting hill in Valea Crisului Alb).

Having a surface of 7011 km<sup>2</sup> (2,9% from the country territory), Hunedoara county is neighboring in South with Gorj county, at West with Caras-Severin and Timis, at North-West with Arad at North-East with Alba and at South-East with Valcea (figure 1).



**Figure 1.** Administrative-territorial limits of Hunedoara County

The administrative-territorial limits most often follows the sweep of high areas, mountains being the main element of his relief. Orastie lane is bordered by Metaliferi mountains and Sureanu mountains and is having a hilly nature towards the South containing terraces and flood plains towards North side. Mures Gorge is stretch on county territory between Deva and Zam localities, being a lane depression made by a succession of gorges and pools.

The relief of Timis county is various, most of the area being mountainous. Along the county area several distinctly relief units can be highlighted such as: mountainous tracts, upland depressions and depression lanes. The relief fragmentation amplitude is large, around 140m in the West of Mures Valley and over 2500 m in Retezat Mountains and Parang Mountains (2509 m Peleaga Peak and 2518m Parangu Mare Peak)

### 2.1 Edaphic factors

As a result of relief ratios and of petrography complexities of mountains area and also of the groundwater role in soil genesis along the county a large diversity of soils can be observed by founding all kind soil type from Romania.

The most encountered soil types are from the Cambisols Class such as:

- brown-eumezobazic (found throughout the woodland area and also in the South part of Zarand Mountains and on the one side of the lower third of Strei River)

- brown-acid soil (spread in the mountains of the Southern Carpathians).

It can also be found:

- brown-luvic soil (having a large spread, from the mountain area through the depression area (Petrosani and Hateg Depression), including the foothills of Orăștie, Hunedoara and the South-East side of Zarand Mountains;

- albic luvisol (having proliferation mostly in the depression area of Hațeg, North part of Poiana Rusca Mountains and at a large surface along the White River).

In the mountain area we can also find:

- Rendzinic and pseudorendzina soil, and in the highest places podzolic soil and black acid soil;

## 2.2 The forestry found of the County

The public forestry found area administrate by Deva Forest Division exceed 220.000 ha. If we ad at the public forestry found the area of private propriety forester found the percentage of county forest covering is around 44%. The wooded area per capita is around 0.57 ha giving this way the fifth place on the country rankings.

## 2.3 The species composition of forests

Reflecting mainly the climatic conditions, the forest composition is characterized by a high number of species. (figure2)

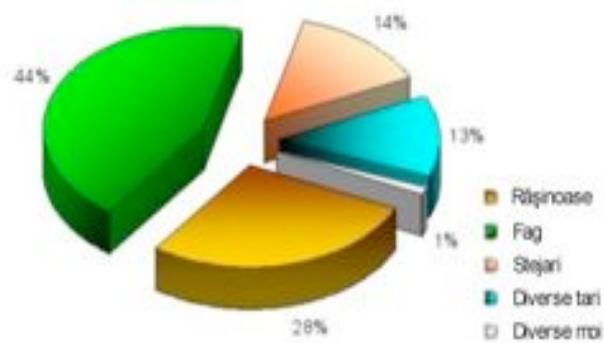


Figure 2. The species composition of forests

## 2.4 Spruce stands

Spruce stands are found in high mountain regions, being situated between the upper limit of the forest and the upper limit of beech forests. Towards the upper limit of spruce forests zambra (*Pinus cembra*) and sylvan pine (*Pinus sylvestris*) can be saw.

## 2.5 Mixed pine and beech

Mixed pine and beech are woods situated between the upper limit of beech and lower limit of the pine in the areas of middle mountains and lower mountains having heights between 600 (800) m – 1250 (1400) m. Mixed pine and beech can also appear on South slopes in spruce stands floor, and on North slopes or around valleys descend in the zonal strip of beech.

The vegetation is mostly composed by beech, pine and fir, often associated with pure stand. As the most common accompanying species we longer meet mountain elm, mountain maple, ash, linden, birch, aspen and oak. They are dense forests, which usually floor is missing or poorly developed shrub.

## 2.6 Beech

Occupy large areas and have a compelling value and especially productive, protective. As accompanying species can occur: spruce, fir, pine sylvestris, black pine of Banat, hornbeam, elm, field maple, linden, maple, oak.

## 2.7 Oaks

These forests consist of a large number of species and coppice and herbaceous stratum are much better represented than in other forest formations.

## 2.8 Hills with oaks

Basic species are oak, and as mixed species: hornbeam, linden, maple, elm, ash, maple, etc.

## 2.9 Hilly area

Comprising villages Mărtinești, is situated in the South-West of Transilvania, at South side of Mureș river and DN 7, Arad-Sibiu, recently modernized, the ramifications of Sebeș-Alba Iulia-Cluj, and also at the South of railway Teiuș-Simeria. Ranging from Orăștie to Deva on DN 7, at 7 km the left branch is asphalt county road to villages Mărtinești and, towards, Călanului area and Valea Streiului — with villages as Grid, Boșorod, Chitid — to Hațeg and Valea Jiului. Nearby, North-West area is Turdas, known for the inviting communal vestiges discovered at a place called The Meadow. At East remains the city Orastie old historical and cultural center. (figure 3).



Figure 3. Framing plan with working area

The subject of the paper consist in the strictly delimitation of territory with forest vegetation from the Martinesti administrative territory, that is belonging to the Gradiste Forestry Department, UP-176 and UP-178c identically with Pd 1333 from figure 4.

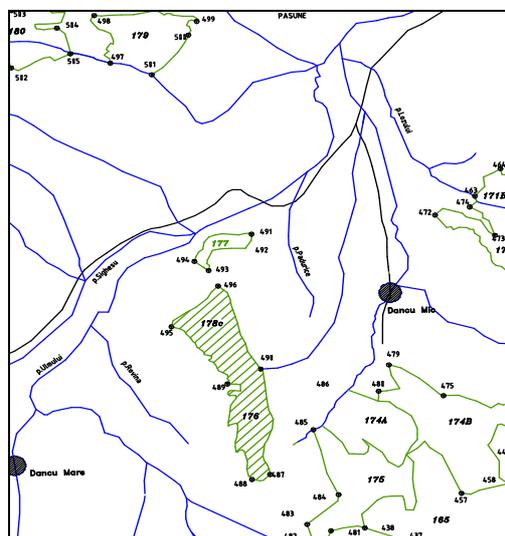


Figure 4. UP 178 C and UP 176, Scale 1: 20 000

The study area is situated in the administrative territory of Martinesti being delimited by well defined geometrical elements (rivers, land without forestry vegetation, roads and administrative territorial limits, etc.) with names according to the situation plans from figure 5.

From juridical point of view the real estate is registered into the land register book at the position CF 182, having the topographic numbers 6576-6579.

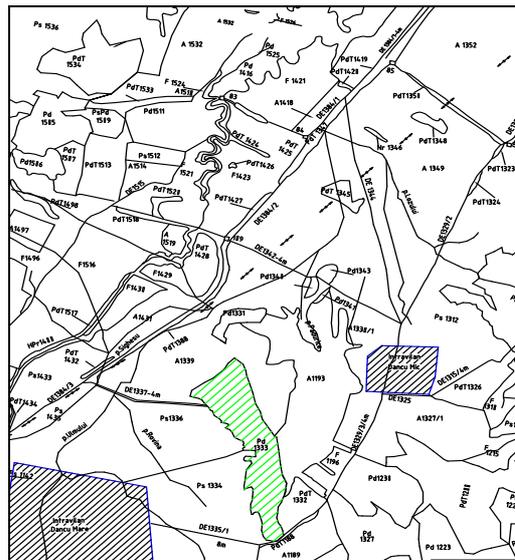


Figure 5. Framing plan, Scale 1: 20000

### 3. Out coming results

#### 3.1 Topo-Cadastral operations.

For measure and topographic delimitation of the land the starting point of the whole operation was the 4<sup>th</sup> range landmark named Dealul Dancu Mare having the coordinates as follows X=473103.000 m Y=353099.700 m H=626.769m, having the bearing towards to Dancu Mare Church. By using this starting point and the total station TRIMBLE 3300 DR, a tachimetric traverse has been developed.

After choosing the station points, the horizontal angles, distances and height differences has been measured. In order to obtain the necessary data for drawing the cross profiles, after identifying the characteristic points, by using adequate reflectors the horizontal distances and the height differences were measure. Due to the landscape characteristics, specific points of cross profiles having appropriate visibility were use as station points.

In order to prepare the documentation, after the field measurements, the recorded data stored into the total station were transferred into the computer memory by using specific software of total station such as Data Transfer together with Recept.exe software. After data transfer into computer the file named masuratori.dat was obtained.

Processing the measured data in order to obtain the points coordinate was effectuate by using the TOPOSYS 4.4 software. TOPOSYS software, is a mainly based on computing and processing the outcome data from the topographic and geodesic field measurements, using statistic methods of errors sorting and data compensation. TOPOSYS effectuate also the necessary calculus for establishment of the reference information for the geodesic position in certain projecting systems and reference systems.

The information management is made in data bases named **Projects**, and computational operations are made in working units named **Works**. A project can include several works that have same reference information such as geodesic points, users, instruments, reference ellipsoids. Each working session include information concerning: points, field measurements, altimetry, transformations and a register that include the effectuated operations. The graphic interface of the software allows the coordinates visualization, the existing observation for the current working session, the preview of the points number and the ellipse errors. The procedure of data saving on the hard-disk is the following: for each new project a MDB Access database having the name of the project is created together with a folder having the same name. For each working session create in the current project folder a new folder having the name of the work is saved were the log files and configuration files are saved.

The TOPOSYS software allows the user to process and the balance of all kinds of field measurements use by geodesic engineers to improve the local geodesic networks.

Primary data:

- list of coordinate – fix points
- list of horizontal and vertical/zenithal angles and distances measurements
- list of heights
- list of heights differences

These values can be manually input, imported from ASCII files or downloaded from the total station memory in specific formats. The measured distances can be horizontal or slope distances.

*Approximate coordinates computation approaches*

- forward intersection
- resection (free station)
- traverse/traverse networks
- tachymetry as a approximate point coordinates determination method
- tachymetry as a detail points determination method

*Planimetric and altimetric network balance approaches*

- close network
- free network
- network with measured coordinates

The planimetric or altimetry network balance can be done by using the less square approached.

*Measurement weights*

- according to the measured distance
- normalized
- unitary

*Calculus that allows the geodesic reference establishment of the digital cadastral plan include the following items:*

- STEREO 70 stereographic projection system
- GAUSS-KRUGER projection system
- points coordinates transformation
- plane and spatial coordinates transformations

These operations are executed using different types of ellipsoids

*The outcome data are:*

- list of approximate coordinates
- list of field measures
- list of compensate coordinates
- precision parameters: the weight unit average square error, the coordinates average square errors and the ellipse error data.
- DXF AutoCAD files containing the points disposal, sights and ellipse error
- ASCII files

The traverses were rigorous compensate by using the less square method, using the indirect weight measuring method – ensure by TOPOSYS software. The out coming data obtained consist in point coordinates computed on Stereographic 70 projecting system having the accuracy according to the Technical Standards imposed by the General Cadastre.

As a result of data processing using TOPOSYS software the following list of coordinates and precision parameters were obtained.

Coordinate system : Stereo 70  
Measuring unit for bearings : Centesimal

Type of vertical angle : Zenithal  
The distance measuring method: Horizontal  
Sea level reduction : No  
Scale coefficient : 1.000000

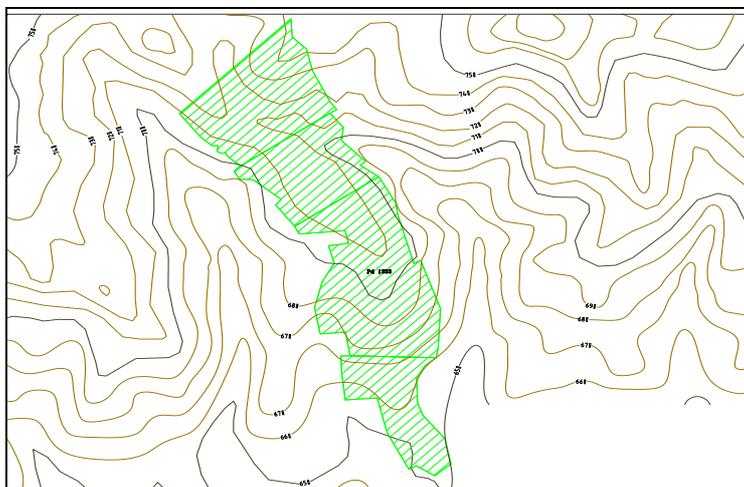
Traverse  
First station point :1000 knowing point, with bearing  
Last station point :1021 , knowing point with no bearing  
Computing points :19  
Total length [m] :3885.4216

Close bearing error [gr]: 0.0000  
Bearing correction [gr]: 0.0000  
Unclosing coordinate error X[m]: -4.184  
Unclosing coordinate error Y[m]: -3.435

#### 4. Conclusions

As a result of data processing in order to obtain the points coordinate by using the specific functions of TOPOSYS software, by point coordinate data export, by heights export and by DXF file export the graphic result of the measured area can be plot. Furthermore to improve and to finalize the digital plan of the measured area the AutoCAD 2009 software is use. The following documentation is obtained:

- Situation and delimiting plan Pd 1333 – Administrative territorial area MARTINEȘTI, scale 1:4000
- Points coordinate inventory STEREO 70 projecting system;
- Part of Cadastral Plan - Administrative territorial area MARTINEȘTI - scale 1: 5000
- Part of Forestry Management Plan, GRĂDIȘTE UP 178 C and UP 176 - scale 1:20000
- Framing plane - scale 1:20000
- Situation plan with heights - 1: 5000 (figure 6)



**Figure 6.** Plan containing level curves, Scale 1:5000

The measured limits materialized in field by landmarks and red paint on trees, for each forest block are the following:

Parcel # 1 – Pd 1333/1 - a body of 8600 mp, terrain covered with forestry vegetation confined in the North and East part by A 1339 , at South by Pd 1333/2 and at West by Ps 1336.

Parcel # 2 – Pd 1333/2 - a corp of 5700 mp, terrain covered with forestry vegetation having as boundary in the South the DE 1335/2 exploitation road

Parcel # 3 – Pd 1333/3 - a corp of 12000 mp , situated in the East neighborhood of Dâncu Mare locality

Parcel # 4- Pd 1333/4 - is situated in the pasture over Dâncu Mare locality, in the South-West area with the access nearly to the village cemetery. The parcel is situated on the area controlled by Gradiste Silvic

District, at the limit with Simeria Silvic District in the area named Dumbrava Poenii. The parcel has the surface of 5000 mp

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