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Land study of the logging yard Pârva Reca with G.P.S and data processing in G.I.S.

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Abstract By applying a modern technology, land study in the logging activities can be done using GPS (The Global Positioning System). The analysis and processing of the data, the representation of the characteristics of the forest yard on the plans and all related calculations can be done in GIS (Geographic information Systems).
Designing the collection routes can be done in GIS after the browsing of the land with an G.P.S. receiver and after discharge and G.I.S. commissioning of data collected. In the same mode it can proceed for the determination of the enclaves, homogeneous surfaces, roads, limits of the exploitation swaths etc. All these, methodology of work, results, plans of the forest yard "Pârva Reca" with afferent details and conclusions of this study are presented in this article.

Key words

exploitation yard, forest exploitation, Global Positioning System, Geographical Information System

Study of land in forest exploitations, in terms of complexity, influences the overall activity of logging, the proposed technological solutions depends directly on this study, which will influence further, indirect the operating expenses expected in the technical and economic project.

In the classic system, the study of the land is made in particular by topographic methods, which is a precise method, but which require large volumes of work, and therefore execution time larger and more personnel.

Need to implement modern and expeditious methods for the study of land, as is the method presented in this article, comes from a large number of operators on the market and hence the need to meet their requirements, in terms of drafting the technical-economic projects for the auctioned parties.

This need arises from the fact that the production process in the logging, in terms of forestry, is limited in time. This process requires the compliance with operating rules forestry. In economical terms, the production process request the establishment of an optimal technological solution, to obtain the assortments of wood with the minimal cost.

In terms of logging, as a forestry science, the land's study must be done with a perfect accuracy, because this study is the basis on which will build all logging activity.

The reduction of the ecological damage in logging, requires the transfer of activities into a large extent in outside of the regenerated areas. This can be done entirely by creating the digital plans in the GIS, where will be represented the arrangement of the regeneration. Similarly, for better planning of works, it can be represented in GIS the enclaves of forest, homogeneous surfaces, collection routes. We can do all these after their scrolling in the land with an GPS receiver.

Material and Method

The materials used in the present study can be divided into two categories: the materials used for the collection of the data in the land and the materials that are necessary for the phase of the processing data from the office.

Thus, for the phase from the field, for data collection and storage, we chose to use a GPS receiver, Trimble brand, with which we have covered the points and routes necessary for the technological design.

In the office phase, the processing of the data downloaded from the GPS receiver was made with an P.C. and an G.I.S. Soft, ArcGIS in our case. The scanners and printers were also used, as appropriate, to achieve the physical plans of the logging yard.

The method used in the land phase consisted in the browsing of the necessary elements to design the logging yard. The browsing has been done along of these elements for collecting routes or in another case, on the boundaries of the elements, through the defined points (of the contour change). Thus was determined the characteristics of the elements as shown in the following.

Having available the returned plans, was not necessary the browsing of the limits in the management unit or as appropriate, of the logging yard limits.

Determination of the regeneration surfaces from the logging yard was made by browsing in the points of the contour change of these surfaces, and by storage of these points in the GPS receiver.

The homogeneous surfaces were determined not depending of the regeneration surfaces, but depending on terrain characteristics. Determination of homogeneous surfaces was made by storing in the GPS receiver, of the points that falls areas having the same characteristics (inclination and flow direction).

Recording of the routes that are browsed by the operator is used for determining with the GPS receiver, of the routes used to design the ways of collecting, the roads and their materializing in the land. The recording of the routes covered by operator can be done automatically by setting the receiver on a function that stores the position at different time intervals preset by the user.

Positioning of the woodpiles was made by recorded, in the GPS receiver, of the singular points located at the basis of homogenous surfaces, along the collection routes. In the same manner, was determined, the position of primary platform located at the basis of the logging yard near the forest road.

In the field study, to determine the technological solutions in the logging yard "Parva Reca", the office phase has a special role, because the main measurements were transferred here. In the field is done only the determining of points with the GPS receiver.

The calculation of the distances, areas, perimeters and the implementation of the situation plans, were made during the office phase, with a PC and ArcGis Software, with which the collected data were processed.

When processing data, the first step is the preparation of the returned plans. In this case we had the digital plan of the Production Unit IV Valea Mare and default the plan of the management unit 46 F, covering the logging yard. The plan is in STEREO 70 projection system, no need to scan and no need to bringing the plan in this projection system. If the digital plans are not in the projection system STEREO 70 is necessary to determine the coordinates of the trapezoids corners, to bring the plans into the desired projection system and then is needed assigning new coordinates to the trapezoids corners.

Data processing starts with downloading the data collected with the GPS receiver using the data cable. The second step is to export the data in a format compatible with ArcGIS (*. DXF for example), and then, bringing in the workspace the exported data and the plan (by overlap). Follow the design itself (limits of logging surfaces, the primary platform, tractor roads, etc.) and preparing a site plan and also, calculating the characteristics of each layer in terms of area, distance and perimeter.

To achieve the activities after office phase is necessary to export the necessary data for materializing in the field of logging surfaces limits, tractor roads, primary platform etc.). Exporting is done in a compatible format with the GPS receiver. After this is done the loading of the data into the receiver and the translation of them into the field to mark the limits of logging surfaces and to picketing the tractor road.

Results

Execution of the site plan was made by completing the restored plan taken from Moldova Nouă Forestry. Thus, each layer was represented separately in the site plan, their display can be achieved or not by a simple click. Each layer was designed separately, giving him a name and selecting the type of objects stored: point, line or polygon. A layer can store only one type of objects. After the realising of each layer, follow the editing on the site plan of regenerated areas, of homogenous surfaces, collection routes, woodpiles and primary platform. All these, was made using the determined points on the field. According to field observations on the angle between the direction of flow of homogeneous surfaces and their lower limit, have been stored and represented on the site plan the flow directions for each homogenous surface. All this was stored in a layer with line type objects.

Once realized plans we can calculate in GIS surfaces areas, respectively the length of the determined elements. In the table 1 are presented the dimensional characteristics of management unit, enclaves, regenerated areas, exploited areas. In the table 2 are presented the length of collection routes (Table 2).

Table 1

Characteristics of determined elements

Determined elements	Surface	Measure unit
Management unit 46 f	14,2776	ha
Enclaves	0,7989	ha
Surface of forest	13,4787	ha
Regenerated areas	8,5057	ha
Exploited areas	4,973	ha

Table 2

The length of collection routes

No CRT	The route	The length (m)
1.	A – B	245,663941
2.	B – C	264,619947
3.	C – D	289,006591
Total		799,290479

In the following are presented the management map of production unit no. IV of Moldova New Forestry, the satellite image of studied area, the general map of management unit 46 F and situation plans for every layer in part, in line with the determined elements (Fig. 1-11).

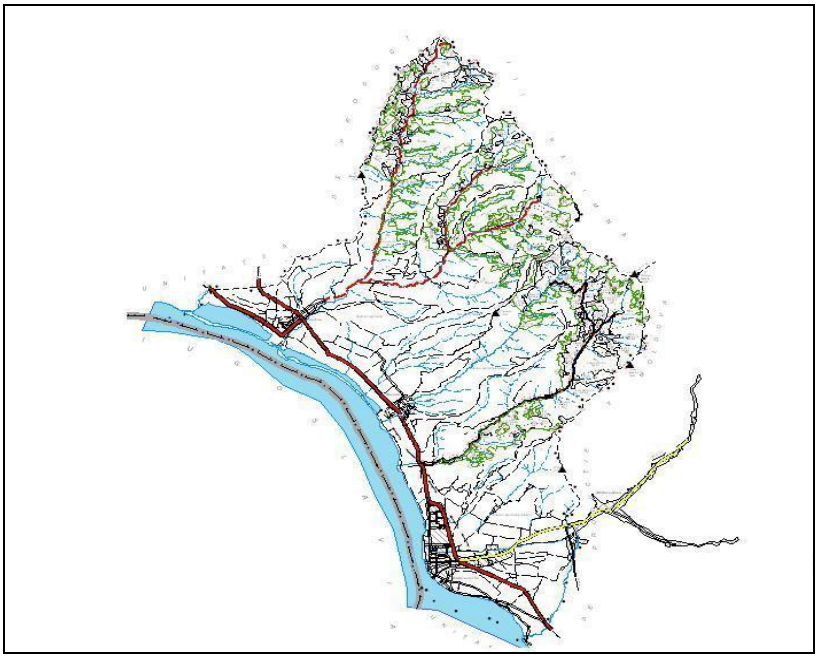

Fig. 1 – Management map of Production Unit IV Valea Mare, O.S. Moldova Noua

Fig. 2 – Satellite image of studied area (Google Earth)

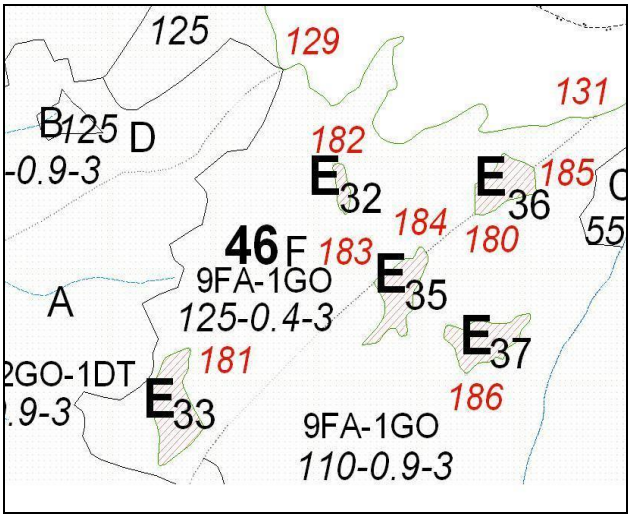

Fig. 3 – General map of management unit 46 F

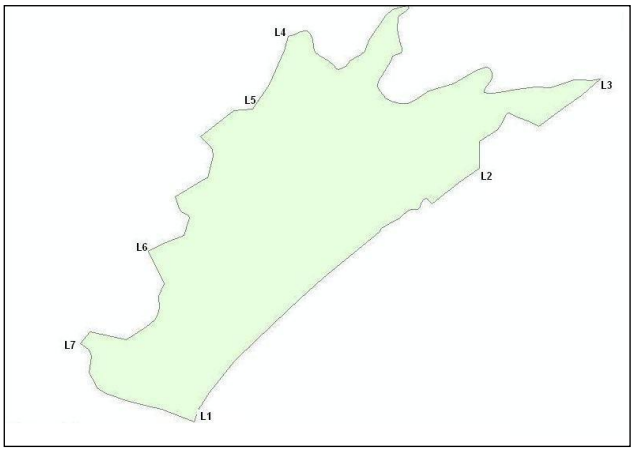

Fig. 4 – Plan with the limits of management unit 46 F

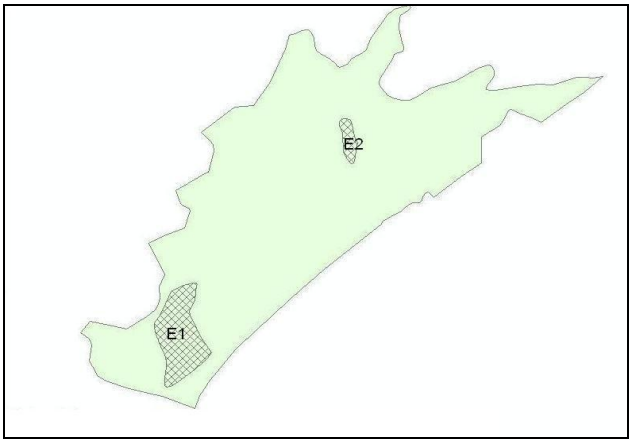

Fig. 5 – Plan completed with existing enclaves

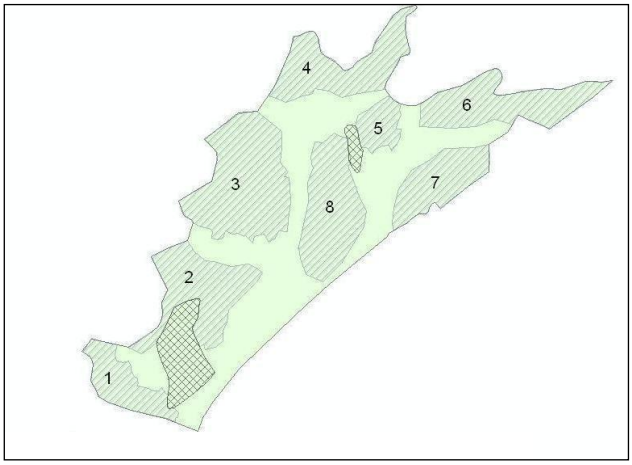

Fig. 6 – Plan completed with regenerated areas

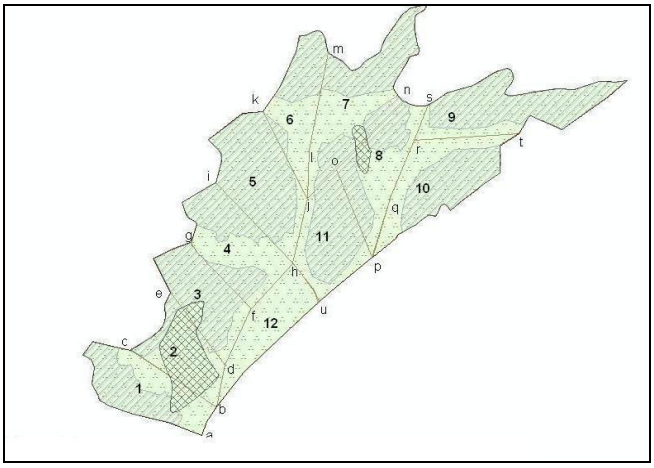

Fig. 7 – Dividing of logging yard in homogenous surfaces

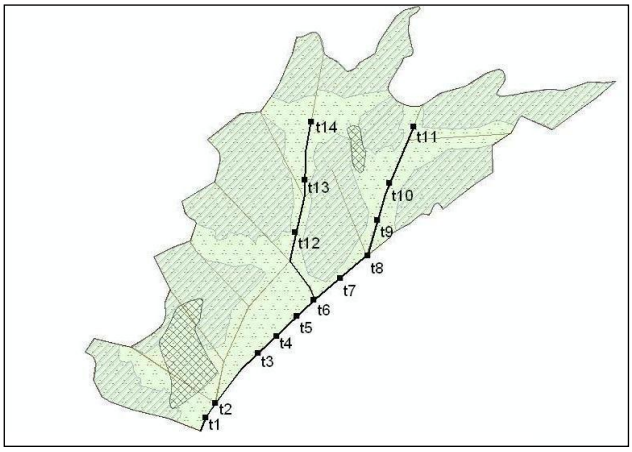

Fig. 8 – Representation of collection routes

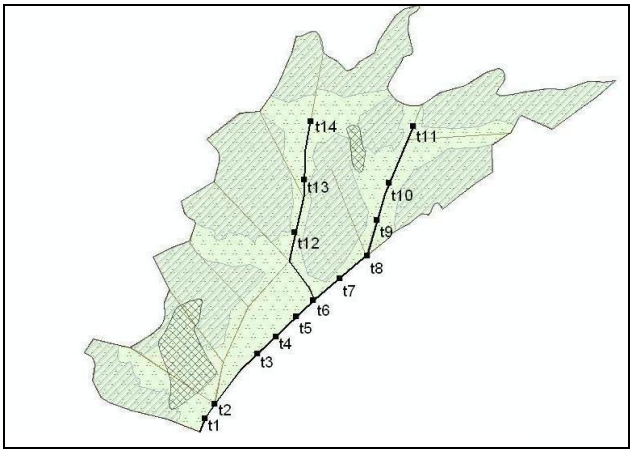

Fig. 9 – Representation of the woodpiles

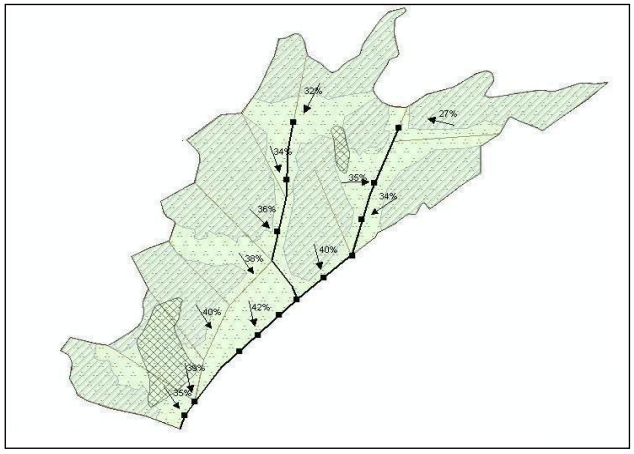

Fig. 10 – Flow direction and slope of homogeneous surfaces

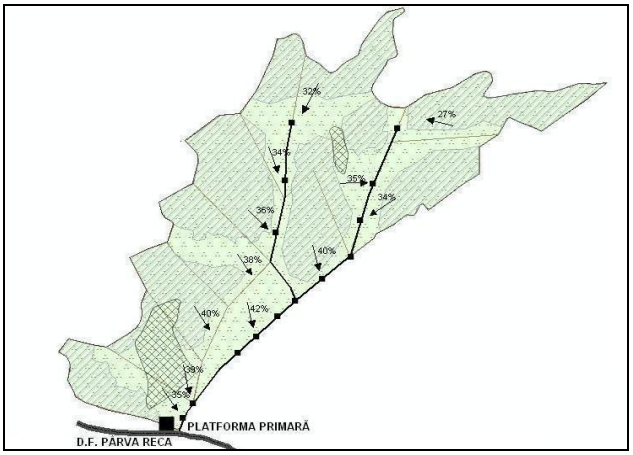

Fig. 11 – Complete plan of logging yard

Conclusions

It may be noted that studying the land using GPS in the field phase and using GIS for data processing in the office phase represent a modern method in which the two components GPS and GIS is complement each other, resulting an accurate and expeditious review of the land to establish technological solutions for logging.

Data collected with the GPS receiver are processed using GIS software, having as result the realising of site plans and the calculations required. Field activities, subsequent of the office phase, are designed in GIS and by using the GPS receiver are transposed into the field.

Expeditiously of this method can meet the demands of the large number of market operators. Data collection and the transfer from GPS to GIS and vice versa are very fast and the design is computer aided.

In terms of logging, the representation in GIS of the site plans, according to measurements performed with the GPS receiver, facilitates the design of collection routes, circumscribe the regeneration areas in the content of the logging yard, thus easing the transfer of all operational activities to outside of the regenerated areas. Homogeneous surfaces were also designed in GIS, from measurements made. Picketing of the road of tractor and marking of limits, was made in GIS and the data was loaded into the GPS receiver to materializing on the land.

Looking at this article, it can be concluded that the study of land with GPS and representation and its processing in GIS, represent a expeditious, complex and necessary method to establish the operational technological solutions for logging, under current conditions.

Each logging yard could be assessed in terms of exploitation conditions, in an easily and expeditiously manner so that the value of standing timber to be set depending on the circumstances, things that are expected in the future.

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