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CURRENT WORKING TECHNOLOGIES FOR DRAFTING FOREST MANAGEMENT PLANS

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ABSTRACT

This paper identifies the technology and working methods used to develop drafts of forest management plans, with therequired activities – executed using modern technologies and existing equipment – being indicated. Each operation in the drafting is described in detail, including the working technologies, organisation of the workplaces, training units, measurement units, instruments and equipment, working conditions with specific influence factors, and elements that contribute to the updating of working methodologies in the drafting and increase labour productivity.

Keywords: *time rule, production norm, forest management planning, forest management plans*

Keywords: *thinnings, optimal structure, function, forest management objectiv*

INTRODUCTION

In the last three decades, major changes have been made in forest management planning that have been closely linked to developments recorded across several areas, especially calculation techniques, the theory of relational databases, database management systems, geographic information systems (GISs) and the evolution of equipment, software, etc.

The entire process of data collection and the development of forest management plans is part of a normal process of adapting to the realities of the moment andremovingnovel elements from various fields of activity.

For the processing of field data, specific software products have been developed and adapted in tandem with developments in computing techniques. In 1992, an informatics product – AS – Forest management plans version 3.3 – was developed, which carried out the computer-aided design of forest management on IBM PC-compatible computers. It was configured in MS-DOS version 4.1, which could be used on a personal computer.This was a redesign of the previous version (3.2) that could be used on a Junior microcomputer (Seceleanu, 1992).

This product was used as long as it was possible to operate using existing operating systems (from 1992 to 2005),up to the appearance of Windows 95. When the operating system became incompatible with the forest management planning software, the software had to be redesigned to be compatible with the operating systems existing after 2005. As a consequence, the informatics product AS2007 – Forest management plans was produced, developed for Visual Fox Pro. This was compatible with Windows 95 through Windows Vista (Lazar et al., 2009). The facilities provided by this new software enabled a developed database to be obtained, which could contain a greater number of reports, with the direct consequence of shortening the period of development of forestry management plans.

Also, GIS studies based on accumulated knowledge have, since 2001, enabledthe archiving of GIS databases in forest management plans; the first plan

developed using GIS was in Brăneşti Forest District (FD). The forestry maps obtained using the GIS technique for the plan were made using digitisation in Autocad MAP, the topologies used ArcInfo Workstation and the GIS side using ArcView 3.1 C512 (Achim, 2013). The GIS database included spatial information taken from the maps used in forest management and descriptive information taken from the field.

The implementation of GIS in forest management planning has provided several benefits, including reducing the time needed to produce and update the maps, reducing the time involved in updating the database, obtaining accurate and standardised information andallowing quick access to information.

Based on these technology-influencing aspects, we here present the current working technologyfor developing forest management plans, which has replaced the classic technology used before the introduction of GIS techniques.

The need to identify the existing operations results from the need to update time and production norms, whichhave direct implications for increasing productivity in the management planning stage.

MATERIAL AND METHOD

In order to identify the activities carried out by personnel during the drafting of forest management plans, and to study the work time in such a way that the recorded data would lead to the development of time and production norms for developing forest management plans, it was necessary to use appropriate technical methods. Thus, for the identification of activities related to this phase, observation and photography of the working day were employed. The photography involved two steps – preparation and photograph-taking.

The preparation involved choosing the workersabout whom the observations were to be made, and explaining to them the purpose and importance of the observations.They had to work at a normal pace, following their working methodology, and completea working conditions sheet. The photography involved recording an entire activity being performed by the chosen worker during regular work hours.

Each activity was recorded on photograph sheets, using a clock and a timer to record the times and duration of each work element.

The observations were made,using the subunits of the National Institute for Research and Development in Forestry ‘Marin Drăcea’, in Braşov, Craiova, Bistriţa, Roman, Timisoara, Pitesti and Oradea (Fig. 1).

In all the subunits of the institute, there are specialised, collective workers who carry out forest planning, and it was intended that all of them would be involved in the implementation of the project. In this way, the representativeness of the results was ensured at the national level.

RESULTS AND DISCUSSIONS

Eight operations were indentified inthe activity of drafting forest management plans, as compared to nine (according to the previous procedures that existed before implementing the GIS system) (Table 1).

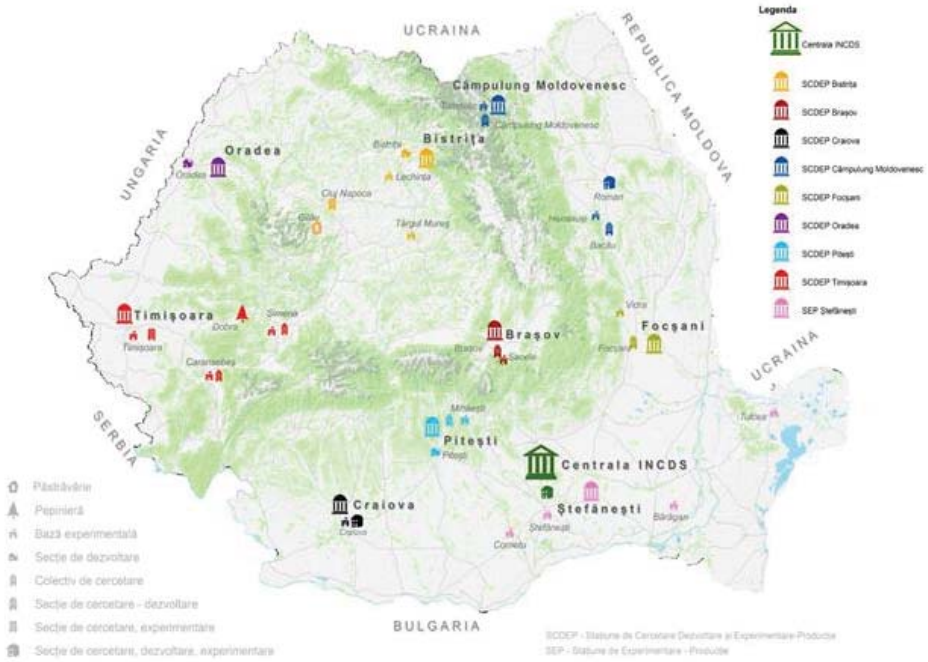

Fig. 1 Subunits of the National Institute for Research and Development in Forestry 'Marin Drăcea'

Table 1

Operations indentified for drafting forest management plans (numbered points in the second column are referred to in the text below by their numbers)

Classic writing, work operations	Current writing, work operations	
Drafting forest management plans	Drafting forest management plans	Works using GIS techniques
1. Graphical reports, classic technology	1.Graphical reports, modern (digital) technology	
2. Cubic calculations, classic technology, manual calculations or dedicated software	2. Cubic calculations, modern technology, dedicated software	
3. Transposition the parcel and subparcel from the old plans to the new ones using photography or photocopying	3. Transposition the parcel and subparcel from the old plans to the new ones using scanning and vectorising	
4. Assemble reports on the basic plans using classic methodology	4. Assemble reports on the basic plans using modern (digital) methodology	

5. Classical method using a planimeter	-	Analytical determination of surfaces
6. Draw the old map, classically	-	Developmaps using GIS techniques
7. Automated data processing using the AS3 – Forestry software product	5. Automated data processing using the AS2009 –Forestry software product	
8. Draft the forest management plan on Yield Management Unit (YMU), writethe manuscript	6. Preparationfor the second Conference on Forest Planning	
	7. Draft the forest management plans on YMU, write on PC	
9. Guidance for, and reception and approval of, the forest management plan draft	8. Guidance for, and reception and approval of, the forest management plan draft	

Below are brief descriptions of each indentified operation, and the differences between the classic technology and that used after the implementation of GIS.

1. Graphical reports are currently producedin the office by a technician or engineer, using GPS equipment, a PC computer and printer. The unit of measurement is 1000 reported points. In the classic system of drafting forest management plans, the graphical reports were produced by a designer or technical designer, using a spacer, a rapporteur, millimetre paper and calc paper, and the unit of measurement was also 1000 reported points (Ministry of Forest Waters and Environmental Protection - MFWEP, 1999). The current working technology is radically different and improved due to changes in field data collection equipment and the replacement of topographic compasses with GPS technology.

Observations for the graphical reports were made in 19 forestry areas/experimental bases (Table 2), where:

- the production units (YMUs) had different surface sizes (from 935.3 ha to 6352.65 ha);
- the layout units had different surface sizes, to illustrate the diversity of situations;
- the YMUs in which a variable number of field measurements were carried out also captured the quantity of work performed per territorial unit;
- various specialised software packages, compatible with the GPS equipment, wereused for the measurements;
- topographic measurements were made using Trimble and Garmin GPS devices.

Table 2

Elements of YMU characterisation observed for the graphical reports

No	INCDS (NIRDF)	Observed data from forest district's forest management plans								
		Forest district/	Yield management unit (no.) (UP)	Surface of Yield management unit (ha)	No. forest management units (ua)/Yield management unit (UP)	Surface of average forest management unit /PU	No. of measured and reported points	No. of measured ua's	Tip of device used for measurement	Software
1	Braşov	Maneciu	IV	3274,18	321	10,2	1082	246	Garmin 64S	Softuri specializate
2	Braşov	Azuga	I	935,3	190	4,92	1300	152	Garmin 64S	Softuri specializate
3	Braşov	Fagaras	II	3115,09	365	8,53	1440	107	Garmin 78S	Softuri specializate
4	Bistriţa	Mălini	I	2951,52	209	14,12	1855	78	GPS Garmin	Softuri specializate
5	Bistriţa	Cluj	III	935,61	193	4,85	4260	132	GPS Garmin	Softuri specializate
6	Bistriţa	Dragomirești	II	3696,78	624	5,92	6030	151	GPS Garmin	Softuri specializate
7	Craiova	Orşova	I	2245,88	254	8,84	1986	180	Garmin	Softuri specializate
8	Craiova	Orşova	V	4339,25	348	12,47	2294	210	Trimble	Softuri specializate
9	Craiova	Orşova	VI	3144,54	295	10,66	2302	190	Garmin	Softuri specializate
10	Craiova	Drăgănești Olt	I	1084,6	498	2,18	910	323	Trimble	Softuri specializate
11	Craiova	Drăgănești Olt	II	1323,91	455	2,91	956	315	Trimble	Softuri specializate
12	Oradea	Dobrești	VI	1211,82	307	3,95	304	16	Garmin	Softuri specializate
13	Oradea	Târgu Lăpuș	I	2381,98	763	3,12	7928	426	Garmin	Softuri specializate
14	Oradea	Ilia	II	2665,93	617	4,32	1908	96	Garmin	Softuri specializate
15	Roman	Brăila	IX	704,2	132	5,33	728	32	GPS Garmin	Softuri specializate
16	Roman	Bârlad	I	1228,57	415	2,94	2200	88	GPS Garmin	Softuri specializate
17	Roman	Tomnatic	I	6352,65	728	8,75	5380	269	GPS Garmin	Softuri specializate
18	Timișoara	Păltiniș	I	2812,54	372	7,56	2423	372	Garmin Montana 650	Softuri specializate
19	Timișoara	Valea Mare	II	2290,98	288	7,95	3781	288	Garmin Montana 650	Softuri specializate
20	Pitesti	Rusca	XIII	1217,02	370	3,29	1225	185	GPS Montana	Softuri specializate
21	Pitesti	Amaradia	III	3647,26	689	5,29	1382	50	GPS Montana	Softuri specializate
22	Pitesti	Curtea de Arges	IV	1683,83	407	4,14	1123	47	GPS Montana	Softuri specializate
	Total			**43513,8**	**8840**		**52797**	**3953**		

2. Cubic calculations are performed in the office by a designer (technician or engineer) using a PC, specialised software, a field notebook, a notebook with the centralisation of the sheet points and a printer.The unit of measurement used is the number of development units. In the classic system of

drafting forest management plans, cubic calculations were performed manually by a technician, using a field notebook, a notebook with the centralization of the sheet points and a sheet of cubic calculations. The unit of measurement was also the number of development units (MFWEP,1999).The technology has been much improved by using specialised software.

Observations for the cubic calculations were made in 19 forestry areas/experimental bases (Table 3), and:

- the observations were made in 21 YMUs in different geomorphological areas of the country;
- the observations were carried out in forestry units where the trees were inventoried by statistical land integral procedures (wire by wire);
- the standscomprised a variable number (1–5) of species, so that the influencing factors having a significant impact on the calculation of the time and production normscould be identified, analysed and selected;
- forestry units made up of a variable number of trees were analysed;
- a single specialised software was used for the automated calculation of the volumes of the inventoried trees;
- observations were made on a total of 704 stands, with the total number above 420000 trees.

Table 3

Elements characterisingthe YMUs observed for use in the cubic calculations

No	INCDS (NIRDF)	Observed data from forest district's forest management plans									No. of forest management units that were subject to observations (photographed)
		Forest district/	Yield management unit (no.) (UP)	Surface of Yield management unit (ha)	No. forest management units / Yield management unit	Average area of forest management unit (ha)	No. of inventoried stands / Yield management unit	No. tree species / inventoried forest management units and in which observations were made	No. trees / inventoried forest management units and in which observations were made	IT product (software) used for volume calculations	
1	Braşov	Azuga	VI	2070,7	205	10,1	13	1-2	40-500	Program cubaj specializat	13
2	Braşov	Maneciu	V	924,18	135	6,85	29	1-2	200-400	Program cubaj specializat	29
3	Braşov	Fagaras	II	3115,09	365	8,53	35	1-3	100-1200	Program cubaj specializat	35
4	Bistriţa	Mălini	I	2951,52	209	14,12	31	4	29820	Program cubaj specializat	31
5	Bistriţa	Cluj	III	935,61	193	4,85	16	9	18768	Program cubaj specializat	16
6	Bistriţa	Dragomireşti	II	3696,78	624	5,92	71	9	25970	Program cubaj specializat	71
7	Craiova	Orşova	III	3536,23	646	5,474	54	1	158	Program cubaj specializat	54
								2	8072		
								3	14568		
								4	18636		
								5	1443		
8	Craiova	Orşova	VII	3534,34	318	11,114	37	1	389		37
								2	5810		