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DIFFICULTIES AND SOLUTIONS IN ASSIMILATION OF WOOD FROM TEMPORARILY INACCESSIBLE FOREST EXPLOITATION BASINS IN THE EASTERN BULGARIA

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Abstract

There are a number of problems within the temporarily inaccessible and hardly accessible forest exploitation basins, as the lack of a road network, lack of information about how many inaccessible basins are there, where are they located and what kind of a road network should be necessary for their exploitation. The present paper deals with the state of the inaccessible and hardly accessible forest exploitation basins in the Eastern Bulgaria (total 53) situated on the territory of the Regional Forestry Directorates (RFD) of Varna, Shumen, Sliven, and Burgas). The draft-traces of the new forest roads that should be constructed within the forest basins. The road locations have been adjusted and different variants of technological schemes, appropriate for the different working conditions and types of cutting were proposed. The total area and the resource, as well as the provided uses have been determined. The expenses required for logging have been calculated, as well as the expenses for road construction. The expected incomes, outcomes, and the prime costs of the wood planned for harvesting were calculated as well. The mountainous orography and the low density of the forest-road network within the basins provided opportunity for a choice between two types of machines to be used (a specialized tractor and a short cable systems), or a combination of both.

Key words: forest-road network, inaccessible or hardly accessible forest basins, logging, technological scheme.

Introduction

The analysis of terrain characteristics and their influence on different production stages is of crucial importance for the entire study necessary in a given forest region where wood harvesting technologies are comprised. It is also important particularly in the assessment of the available forest road network and for the planning of the tractor roads (Kramer 2001). The road network density should be 25 $m \cdot ha^{-1}$ in the hardly accessible mountain areas. Such density is enough for using of mobile cable lines. Meanwhile, after introducing the cable lines, the construction of tractor forest roads will be reduced. It should be taken into consideration that technology is the most harmful to the forests, as the resulting consequences and the ecological damages are undoubtedly great (Pičman and Pentek 1999). What should be provided, before planning of a haulage by tractors on steep slopes, is the assessment of the probability of erosion and the possibility for the use of alternative cable systems (Schiess 1999).

The availability of a network of forest roads on steep terrains will stimulate the use of mobile cable lines (FAO 1999). According to FAO (1998), the cable systems are less limited by the slope and more by the terrain shape. They are the most appropriate for areas where the slopes are between 30 % and 100 %. In the future, the cable lines of a length from 200 to 400 m will prevail, as well as the fan-shaped installation of cable lines in areas where it will be possible, depending on the conditions. According to the assessment of the actual state of wood harvesting, the one that will be done using cable lines should be developed further to keep its competitiveness in the difficult conditions of the mountain areas (Trzesniowski 1998).

The purpose of this study was to establish the state of the temporarily inaccessible basins, also known as “closed basins“ in the Eastern Bulgaria, and the possibilities of the utilization of the wood harvested there.

Materials and Methods

This study focuses to the temporarily inaccessible basins, the forest-road network related to the them, technical means and technologies used in the logging in the Eastern Bulgaria. It is of particular interest to study whether the above mentioned technical means and technologies are appropriate for the wood harvesting and transportation within the basins.

The methodological scheme addresses several questions: 1) The state of the forest exploitation conditions; 2) The state and the characteristics of the basic production stocks which are at disposal of wood harvesting forest companies; 3) The technology and organization of the work.

The nature of the relief in the Eastern Bulgaria is rather variable. The northern slopes of the main ridge are steep and rough, especially in its western part. The southern slopes have also very steep ridges. The terrain in the river watersheds is mountainous, consisting of short but steep ridges and slopes. The remaining part of the territory situated on the spurs of the main ridges is of a semi-mountainous nature, with rounded and vaguely outlined ridges, sharply cut glens and steep inclined slopes. The aspect of the terrain eastward presents clearly outlined ridges and plain-type flat uplands, passing into a hilly nature, outlined by slopes, being almost plain, delineated by plane ridges, and at short distances only, to the seaside, inclined and steep slopes dip downward. Strandzha is generally low mountain. It is slightly folded to the sea. There are numerous low and rolling ridges, part of which rise more evidently and are better delineated, along with a number of glens, thus rendering complex and rough character of the terrain. The orography in this part is broken and hilly, while in the interior part of Strandzha, the relief is of hilly-mountainous nature, with smooth ridges and deeply cut glens. Numerous secondary ridges, cut by smaller and larger glens, deeply incised into the terrain, descend from westward to eastward, rendering a highly rough character of the orography.

Results and Discussion

There are several parameters of the locality affecting strongly the mechanization of wood harvesting. Of particular importance are the slope of the terrain and orography of the locality (roughness etc.) resulting in

hardly accessible basins. Tractors and animal haulage power are used in smoother terrains while cable lines and animal haulage power are applied in steeper ones.

No good economical results can be achieved without establishment of a modern forest road network and without mechanization of the technological processes in the plantations. The density of the forest road network is particularly important, because it is still too scarce in Bulgaria, mostly due to the mountainous character of our forests.

The reduced use in Bulgarian forests is partly due to the scarce and insufficient road network within the temporarily inaccessible basins, and this, together with the unsteady market of wood are the main reason of not harevesting 500,000 m^2 of the planned volume annually.

Table 1 shows the types and the number of the machines in the Regional Forestry Directorates in Eastern Bulgaria. It can be seen that in RFD Burgas the haulage was done mostly by animal power (76 %) and recently, due to the lacking market of coarse wood, the animal power use reached even 90 % at some moments. The horse power haulage in the RFD Varna was approximately 40 %, followed by the use of tractors – 24 %, and the remaining part of wood in the cutting areas was loaded by hand. The RFD in Shumen was characterized by the highest use of mechanized haulage – 85 %, while in the RFD Sliven the use of animal power haulage was concentrated in the lower altitudes – 85 %. In the upper mountainous regions, i.e. within the Balkan Range, it was only about 18 %.

The tractors used were “Universal-651” and some single “LKT–80/81”. The cable systems were “TBC–500” and “Koller-K-300”, and the loading was done predominantly by Shipka hydraulic cranes. “DT–75” and “C–100” tractors were used as bulldozers for the maintenance of forest roads.

Temporarily inaccessible forest-exploitation basins in the Eastern Bulgaria

The total area, stock and the use were determined within the temporarily inaccessible forest exploitation basins. The costs for cutting and haulage, for tractor roads, incomes and profit, as well as the prime cost expected for wood to be harvested were calculated (Table 2). Besides,

Table 1. Total number of the used basic machines for logging in the Eastern Bulgaria.

Regional Forestry Directorates	Tractors, no	Cable line systems, no	Loaders, no	Bulldozers, no
Varna	12	–	22 and 8 cranes mounted on trucks	6
Shumen	36	1	26 and 4 cranes mounted on trucks	13
Sliven	30	2 (1 for discontinuous operation)	18 and 7 cranes mounted on trucks	10
Burgas	21	1 (for discontinuous operation)	16 and 2 cranes mounted on trucks	4
Total	99	4 (2 for discontinuous operation)	82 and 21 cranes mounted on trucks	33

Table 2. Forest exploitation basins of a temporary inaccessibility in the Eastern Bulgaria.

Regional Forestry Directorates (RFD) and the related State Forestry Services	Numbers of the basins	Total area, ha	Total resources, m^3	Provided use, m^3	Total costs provided for wood exploitation, BGN	Technological schemes. Primary transport with	Working conditions
RFD Varna							
Staro Oryahovo	1	651.0	165,210	13,045	460,810 (226,000)	Tractors and animal hauling power.	Inaccessibility due to deep gullies, missing roads.
Tsonevo	5	1,363.1	229,265	36,415	2,675,620 (1,041,000)		
RFD Shumen							
Smyadovo	5	1,887.4	240,785	44,200	1,283,000 (330,000)	Specialized tractors and cable way system.	Steep terrains where deep gullies are available.
Varbitsa	1	760	116,730	15,428	1,481,910 (80,000)		
RFD Sliven							
Tvarditsa	16	1,865.9	271,320	36,978	3,182,450 (2,663,000)	Specialized tractors and cable way system.	Old cart-ways available therein, in a bad condition.
Kotel	9	2,124.4	530,340	63,840	1,954,051 (390,000)		
Ticha	3	1,169.0	331,615	46,220	1,795,000 (500,000)		
RFD Burgas							
Tsarevo	3	1,450.7	284,665	56,933	1,418,237 (194,530)	Tractors and animal hauling power.	An area of a difficult accessibility within an inter-border facility.
Zvezdets	2	5,972.8	256,685	31,340	1,125,305 (397,165)	Specialized tractors, cable way system and animal hauling power.	A highly rough terrain, missing roads, non kept old roads, missing bridges.
Malko Tarnovo	8	2,214.1	471,280	42,815	1,087,430 (145,500)		
Total	53	19,457.7	2,897,895	387,214	16,463,813 (5,967,195)		

Note: There are costs provided for road building and repair, indicated in the brackets.

the traces of both the old forest roads and the new ones that have to be constructed for taking the wood from the temporarily inaccessible basins, have been plotted on the forestry map. The mapping of the traces was done after visiting each basin, considering also the old forest motor-car roads, used tractor and carts, the old traces of cable lines, minimal damage during the road construction and the services of the entire basin (including all the forestry activities undertaking like wood harvesting, afforestation, forests fires and others). At last, all that has been done taking into account the costs required for projecting and construction. A model scheme for exploitation of basins is shown in Figure 1.

After examining the target basins, further analysis will be required to adjust where the construction of new roads would be profitable considering the forest-exploitation conditions, planned volume and also the requirements for close-to-nature management and biodiversity conservation.

the density of the hydrographic network. The most capital-consuming construction and repairment works are the excavations in rocky soils by blasting, concrete laying and construction of facilities and road coverage.

The average cost per 1km forest road varies within a very large range, depending on the terrain conditions (terrain category) and the road slope. If the terrain conditions are subdivided in three categories as a function of the cross inclination of the terrain, the limits within which the cost of 1 km forest road changes, may be considered appropriate, as presented in Table 3.

Table 3. Prices determined for the construction of 1 linear meter of a truck forest road in Bulgaria (data resulted from practice).

Average transverse slope of the terrain	Road category	Width of the road coverage + road bed, m	Limits of costs, BGN
up to 15°	ground	3–4	2–10
	stabilized	3–5	60–80
15° – 30°	ground	3–4	10–20
	stabilized	3–5	100–140
more than 45°	ground	3–4	20–40
	stabilized	3–5	150–200

Note: In extremely difficult conditions where a breach of rocky soils is to be done and props (retaining walls) and others are to be erected, the costs may increase with 40 %.

Infrastructure Required

It should be mentioned that there are uncovered roads (earth roads). In some cases and places their foundation could be stabilized using quarry materials or admixing mineral substances.

The cost of the forest roads depends mostly on the inclination of the terrain and

At the moment, the project design of forest roads within the “closed basins“ is highly restricted. There are a few RFDs where roads are fully or partially constructed based on a preliminarily elaborated project. In the majority of cases there are only temporary motor-car roads to be constructed.

Besides, the construction of forest road network should be planned further

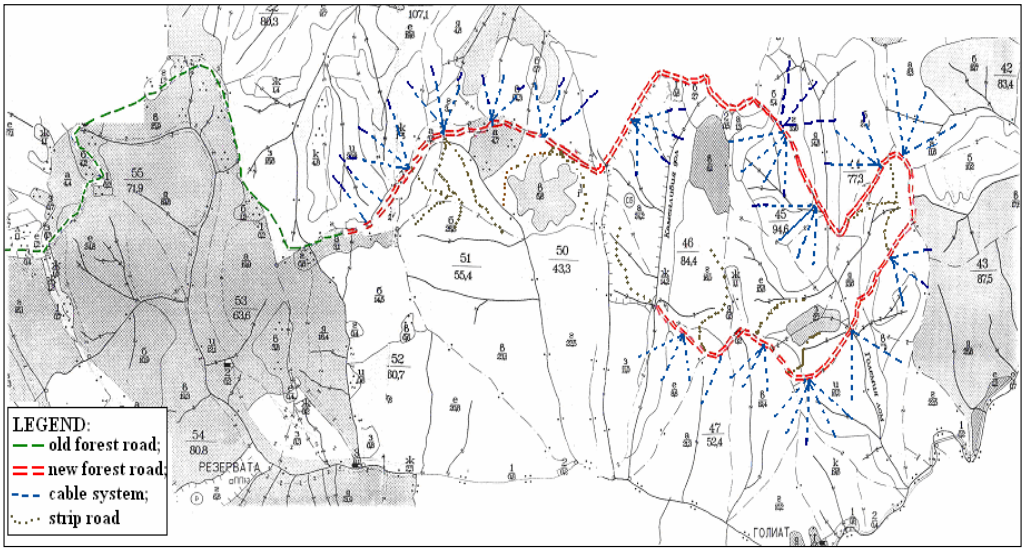

Fig. 1. Map of one of the temporarily inaccessible basins.

in conformity with the technology selected during the second phase of the wood harvesting, particularly within steep enough forest areas where cable lines are to be introduced. Presumably, a different approach should be applied to the procedure of the forests exploitation and to the different parameters implemented to the analysis and selection of the best traces for forest roads.

Conclusions

1. The lack and the worsened state of the technical equipment, technologies and organization of the work resulted in fragmentation increased number of the cutting areas, hence resulting in the extension of the distances for haulage, decrease of the unit volume and the cut mass, raise of the production costs etc., which directly affect the level of development of the wood harvesting branch.

2. At the moment, the forest-road network density is unable to guarantee efficient conditions for a stable management of the forests and forest wood production.

3. There is a need of construction of new forest roads, thus providing adequate access to the temporarily inccessible basins, or repairment of the old roads, including the adjacent facilities, in order to reach a forest road network density more than 7–8 m•ha^{-1}. At very first time, it would be enough for the use of mobile cable systems of a length up to 800 meters, in a combination with the specialized tractors for haulage of the harvested wood.

References

FAO 1998. A Manual for the planning, design and construction of forest roads in steep terrain. Draft. FAO, Rome, 188 p.

FAO 1999. Environmentally sound forest operations in Slovenia for whom? by R. Robek

and J. Marence: 89–94. In Proceedings of the FAO/Austria Meeting on Environmentally Sound Forest Operations for Countries in Transition to Market Economies. Ort/ Gmunden, Austria, 20–27 September 1998. FAO, Rome.

Kramer B.W. 2001. Forest road contracting, construction, and maintenance for small forest woodland owners. Research Contribution 35, Forest Research Laboratory, Oregon State University, Corvallis, 79 p.

Pičman D., Pentek T. 1999. The use of new technologies in opening up of forests. In Proceedings on the International Scientific Conference Emerging Harvesting Issues in Technology Transition at the End of the Century, Opatija, September 27 – October 1, 1999: 1–11.

Schiess P. 1999. A watershed and transportation plan for the North Hoodsport Block. Techn. Report, College of Forest Resources, University of Washington. Department of Natural Resources, Engineering Division, Olympia, 179 p.

Trzesniowski A. 1998. Wood transport in steep terrain. Seminar on Environmentally Sound Forest Roads and Wood Transport, Romania: FAO, 1996: 405–422.