

## **Analysis of existing road network in order to plan and configure a rationally managed one in Greek mountainous area**

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### **Extended abstract**

The difficult soil-climatic and forest conditions, those exist in the mountain forests of Greece, cause a number of difficulties in the planning, tracing, construction and management of forest roads networks. While the form and structure of the various management systems vary from country to country, depending on the specifications, requirements and technical capabilities, the centrepiece of their philosophy remains the same: the main components of the concept of management is the rational assessment and planning.

The most complicated decisions from the operational point of view managers of the Mediterranean mountainous forests have to make are associated with their efforts to evaluate ex-ante, ex post or on-going works, such as road network and/ or activities in the context of sustainable multiple use forest management.

From the moment that we can exploit it a forest can be easily converted from a natural treasure to a financial source. Forest's exploitation occurs in times by the means and methods we have at our disposal; and we exploit it so as to serve purposes according to the needs of times.

Forest opening-up is the total number of installations and works whose goals are:

1. The access to isolated forests areas.
2. The transport of staff, means, materials and machineries which are meant for exploitation, cultivation and protection of forest.
3. The skidding, move and transport of wood from stump landing area to consumption and elaboration areas.

This was the definition of opening up some years ago. Nowadays we have to add the circulation of visitors and travellers in the forest. The opening-up must satisfy, the following demands:

1. The access to every stand and department of forest.
2. The transport of means (machineries, tools, materials), which are used for exploitation of forest as well as for construction of technical works, control of torrents, utilization of mountainous pasture and areas and construction and function works of development and culture.
3. The extraction of products especially wood and their transportation from stump landing area to consumption and elaboration areas.
4. The approach of labourers in areas where forest works take place.
5. The transport of staff who deal with the protection and supervision of the forest.
6. The gathering and elaboration of wood to forest road (allocation of areas where the wood is gathered).
7. The exploitation of forest in functions which are mentioned to tourism and recreation as well as agricultural exploitation of the land found into forest areas.
8. Space order and division of forest in frame of forestry plan.
9. The aquatic economy.
10. The public transportation of people who live in mountainous areas.
11. The defense of the country.

The above demands from the opening-up have as a goal the economic development of an area. According to Leibundgut, silviculture followed everywhere the road construction and a forest is economic and exploited only by a good road network.

This paper aims through the presentation of the existing situation, the optimization of road network and transport conditions of the wood to meet the modern requirements of logging.

The under study forest area is included between geographical coordinates  $-2^{\circ}29'30''$  and  $2^{\circ}45'18''$  longitude from the meridian of Athens and the parallel  $39^{\circ}49'40''$  and  $40^{\circ}03'20''$  latitude. The total area is 16,095.24 ha without the valley of Vallia Calda (warm valley in the Vlach language), which is part of Pindos National Park and 20.154,64 ha with this one.

Data of the geographic position, area, forest boundaries, geological, climatic and forest management conditions are come from the management plan of the complex. For the study of the amelioration of skidding and wood transportation were compared the existed road network with the theoretical model. In order to calculate the optimum road density has been used the sinking fund method. This method refers to the economic result of the investments which are available for the construction of forest roads. For this purpose the following parameters have been determined in relation to the road density and after the investigation of the local data:

Calculations of optimum road density based mainly on model calculations of Kroth. Followed the comparison of the existing road density  $D_{ex}$  with the optimum theoretical  $D_{th}$  and the optimum economical road density  $D_{ec}$  and the  $D_{max}$  one.

Data of forest complex are the following:

1. Harvesting  $3.56 \text{ m}^3/\text{year/hectare}$ .
2. Road construction cost  $27.44 \text{ €/m}$ .
3. Road maintenance cost  $0.17 \text{ €/m}$ .
4. Fixed skidding costs  $5.35 \text{ €/m}^3$ .
5. Variable skidding costs  $0.85 \text{ €/m}$ .
6. Years of depreciation: 30 years
7. Interest rate: 3%.
8. Network correction factor  $c_{net} = 1.3275$ .
9. Factor of sinuosity, Mean skidding distance correction factor  $c_{offr} = 1.98$ .

The data analysis of figure 5 gives the optimum theoretical ( $D_{th}$ ) and optimum economical ( $D_{ec}$ ) road density for the under study forest complex that are 20.72 and 25.98 meters per hectare respectively.  $D_{max}$  is 65.88 meters per hectare.

The theoretical optimum road density is lower than the existing road density ( $D_{ex}$ ), which is 25.424 meters per hectare, but the economical optimum road density is a little bit higher. If we accept the social and protective role of forests and roads, except transportation of timber, it serves all other functions of the forest then we can accept the size of the existing road density with some improvements where they need and maybe we must construct a few kilometres of tractor roads in order to help the logging process with tractors because we have lack of animals and specialized forest workers.

The road opening up has been quantified in the forest complex but should be pursued and the qualitative improvement of road net due to the construction of sub grade, since almost 56% of the roads are dirt roads.

The construction of pavement for forest roads will lead to improved passability of the roads, resulting in one hand the road network to be operational for longer period with a view to transport the wood and other terms, except dryness term and on the other hand forest road net to suffer less damages and require less maintenance.

1. The holding of the skidding by modern means and new methods, according to both the silicultural point of view, as well as the technical requirements.
2. The creation for both the skidding and for the transportation of timber very favourable conditions from technical, environmental and economic point of view, which substantially affect the extent and intensity of forestry operations.
3. The favourable movement of forest workers for better utilization, better supervision and better protection of the forest.
4. The easy transporting of materials and equipment for holding forestry field operations.
5. It will contribute to the sustainable tourism because there are traditional villages with stone bridges, examples of traditional architecture that stand unscathed by time; to wander through the unparalleled beauty of the unique ecosystem of Vallia Calda National Park; to enjoy the

snow at Vasilitsa, one of the most modern ski resort in Europe, and experience the thrill of rafting down the Aliakmonas and Venetikos rivers.