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THE EVALUATION OF ENVIRONMENTAL EFFECTS IN FOREST ROAD CONSTRUCTION

In the developed country, forest activity required by GIS (Geographic Information System) data base. A lot of country using by remote sensing techniques were prepare country maps, land classification maps and location maps. The advanced technology has been extensively used in the majority study areas of forestry. The usage of remote sensing data is one of them and they are used for inventory, planning, controlling or another purpose in forestry. However, it is also known that the satellite images can serve to plan the forest road network.

Keywords: Environmental effects, Forest road, GIS, Remote sensing data, Turkish forestry.

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Оцінка впливу на довкілля будівництва лісових доріг

У розвинутих країнах питання лісогосподарської діяльності вирішуються з використанням GIS (географічних інформаційних систем). У багатьох країнах, де застосовується обладнання дистанційного зондування, отримані цифрові карти місцевості. Передова геоінформаційна технологія широко використовується в наукових дослідженнях, пов'язаних з лісовим господарством. Дані дистанційного зондування та супутникові знімки є одним із інформаційних джерел для виконання лісовпорядкувальних робіт, планування та управління лісовим господарством.

Ключові слова: вплив на довкілля, лісова дорога, GIS, дані дистанційного зондування, лісове господарство Туреччини.

Introduction

Engineering practices on forest road building are challenged by the task of minimizing the impact on forest environment. In some studies, there is evidence that improvements in planning and locating forest roads reduce the negative effects on the forest environment. Poorly placed access road can affect forest productivity by taking forest area out of production, damaging residual trees and seedlings, removing nutrients from the site, and by compacting, rutting, and eroding the soil. Adjacent areas can be affected by associated changes in the hydrology condition of the site. Water can run in the ruts, loosening and transporting soil particles, which may eventually drain into local streams, potentially increasing the stream turbidity and affecting the water resources. Even though these impacts are unavoidable but their frequency and extent can be significantly reduced by a stable forest road network.

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In the developed country, forest activity required by GIS (Geographic Information System) data base. A lot of country using by remote sensing techniques were prepare country maps, land classification maps and location maps.

The forest area in Turkey is about 20.7 million hectare. Remote sensing is necessary for truly, fast, and reliably achieving data about these lands and changing day by day. The techniques of remote sensing are;

- Provide large perspective to different branches.
- The data collected by sensors can be easily showed and presented.
- The data is evaluated by computer and transformed to a map.
- The remote sensing data is directly analyzed.
- The data groups can be evaluated in digital form or display form by using manual methods.
- After the data is used, it is easily stored and achieved.
- The circulation of data between all societies is easily realized in the coordinate system works.

Geographical Information System (GIS), as a result of the improvement in computer technology, has become effective tools, especially for planning works in large areas. GIS transforms the data collected from different sources to suitable form. Therefore a lot of analyzes can be realized directly via remote sensing data.

The planning of forest road network needs evolutions of a lot of data about area. This is difficulty realized by using classical method. However, data isn't also evaluated in these methods.

GIS introduced into the planning of forest roads in the early 1990's. In the first studies, it was aimed to get the data which can be used as a criterion in the forest transport plans from geographic database and then to effectively and correctly.

1. The importance of forest road and Environmental effects

Forest road network planning have been effected from a lot of factors such as ecological conditions of region, forest type, settling area economical condition, market request for forest product, condition forest transport vehicles topographical attribute, forestry exploitations goals etc. Computer and mathematic models usage have required for successful planning process which have a complex structure.

As stated in the conference of UNCED (United Nations Conference on Environment and Development), usage of renewable resources of nature is the fundamental factor of improvement depending on environment. The transport is necessary for effectively benefiting from these resources. Therefore, the buildings of new roads those are accepted by public and are not dangerous for environment have become necessary.

Opening forest to management makes the application of a rational forestry, which is more productive and suitable for aim, possible. Therefore, one of the most important tools needed is forestry roads. The forest road is never an installation connecting two points. This is a very important installation which provides benefiting from all compartments.

Forest road provide about 15 million cubic meter fundamental forest product transporting every year, in our country. In addition to, forest road have a part in forest protection, cadastral survey, forest maintenance, erosion working and afforest working.

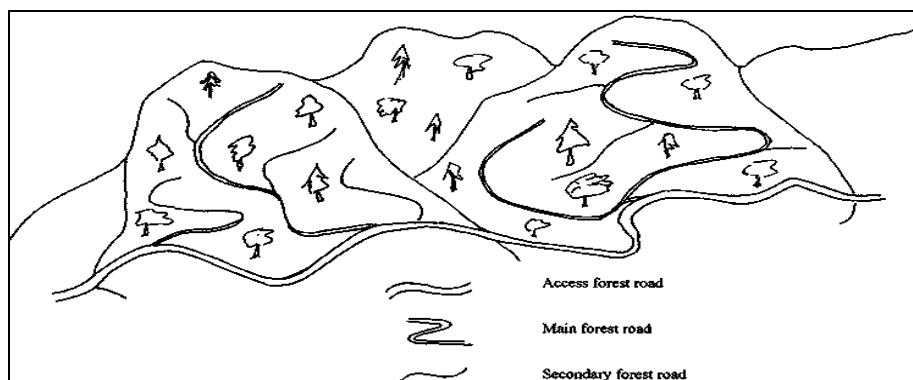


Figure 1. The distribution of forest road in mountain region

The determination of forest road route is the most important and the most difficult stage of forest road planning. Determine a wrong road route; during prepare the forest road planning, caused technical and economic problems when road construction. In addition to chose a wrong road route negative affected natural environment and may appear maintenance problems at near future.

The recognizing of forest road contraction land, planning forest road network take a time job and expensive. However, it is possible that directly analysis on the remote sensing data. Thanks to this many data are read and evaluated over the only single image. There are a lot of routes among the mean control points in which a road have to pass. Thus, it is necessary to select the most suitable route by investigating all possible routes.

All factors effecting the forest road planning should be collected in one stratum and taken into consideration with all together in order to plan, an efficient road layout. As traditional method, the terrestrial methods such as geological or geophysical have been still used to obtain data regard to road route space. On the other hand, the satellite images, as an alternative to terrestrial method, can provide to analyze of the planning elements all together, during road planning. Thus, it can be determined and mapped the landslide areas, wetland area, wet-ground areas, unstable areas, the sensitive areas to erosion on flood. In this way, the positive and negative cardinal points can be rationally fixed to preferable road route. The forest road network plans according to data obtained from remote sensing data can be drafted at least time as productive.

2. The usage of remote sensing data and GIS at seeing damage during forest road construction

The advanced technology has been extensively used in the majority study areas of forestry. The usage of remote sensing data is one of them and they are used for inventory, planning, controlling or another purpose in forestry. However, it is also known that the satellite images can serve to plan the forest road network.

To rapidly give information about larger areas in the world is one of the advantages of remote sensing. Areas that can not be entered due to the difficulty of working conditions are much easily studied by means of it. This data is rather frequently used in geology applications. The application areas of remote sensing increasing day by day are below: Geomorphology; Agriculture and forestry; Erosion observation; Biologic productivity; Ensuring of drinking water and irrigation; Ma-

nagement of costal area; Biomass determination; Meteorology; City planning; Land cover and land usage.

The main querying coverage that includes fundamental data can be achieved by adding data coverage to satellite images.

The usage of satellite images in road planning proud following advantages:

- The works of road route that is necessary for road project be comes easily;
- Road route is easily determined without bothering owners of properties in lands to be planned;
- It gives much more information than a map and other documents. Therefore, if there are hesitant situations in the later works, the information desired is achieved without going to lands;
- It is about 30-40 % more economic than traditional method;
- The artistic places and other constructions can be detected most certainly from images without going to lands;
- Since fewer people works in the stages of exploration and application, the cost of the transport planning lessens to some extend;
- The measurement and the studies can be realized for both changing road route and projecting of other constructions in four seasons and also under all weather conditions;
- It can be measured by predicting probable damages which future road will give to environment.

When the forest road planning is prepared, the most of technical principles can be easily determined remote sensing data. Forest land can be easily bordered by using remote sensing data. Additionally, the lands having difficulties in road building and slope degrees can be also easily determined via this method.

It is possible to determine most appropriate route of the road by counting the damages which road will give to environment during the forest road project, construction and after construction by means of remote sensing data.

3. Results and suggestions

It is very important that the satellite images are convenient for evaluation in every respect and integrated information is conserved without losing its value to be refused in periodical researches. A good forest road network planning is necessary for benefiting from forest continuously and forest preservation.

The renewal of forest road network planning must be completed depending on current information to rationally manage forest. The determination of the criterions helping this aim and the usage of remote sensing data in the preparation of project according to these criteria are useful from the point of view of time and cost.

During planning a forest road, the most suitable road route needing less constructions, such as pipe, culvert, ford and bridge, can be preferred in present road routes by using GIS. Therefore, the most suitable road route from the point of view of technique, economic and ecology is formed.

During the forest road construction, a lot of environmental damage is formed. While forest road route planning, land state determined by remote sensing data without going to working area. Thus, damage is at least.

A lot of information can be collected on the same stratum. Thus, a lot of information not to be evaluated on classic map can be read and evaluated altogether. However the factors wanted can be calculated via data base already formed.

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IMPLEMENTING REDUCED-IMPACT LOGGING (RIL) TO ADVANCE SUSTAINABLE FOREST MANAGEMENT (SFM) IN THE UKRAINIAN CARPATHIANS

Inappropriate logging and road building techniques continue to be one of the greatest obstacles to sustainable forest management (SFM) in the mountain forests of western Ukraine. Harvesting schedules and techniques should be based on the applications of modern mathematical programming techniques determined by available equipment, site, the allowable cut and the cutting budget over multiple rotations or cutting cycles. Reduced-Impact Logging (RIL) is primarily associated with SFM and precision timber harvesting in tropical countries. To a large extent, these RIL technologies are utilized as a matter of routine operations in temperate countries and represent nothing new. Nonetheless, the differences between industrialized countries with a developed forest product industry and countries with transition economies like Ukraine are substantial and the parallels with developing countries make a preliminary examination of the applicability of RIL worthwhile.

According to the conceptual framework of RIL, SFM requires the implementation of silvicultural practices that reduce the site disturbance caused by commercial timber harvesting. RIL is made up of three elements: 1) planning 2) training, and 3) appropriate technology. Functional aspects of RIL and its appropriateness in the Carpathian Mountains that are examined in cursory detail include: road building, costs, training and supervision,