

Design and laying out of roads and paths in Greece for better management and development of the forest area

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Abstract:

The forest covers everyday many human needs (e.g. recreation, walking, hiking, mountaineering, training, sports, etc.). These activities are achieved through the use of paths, which are now well developed and have taken the form of a network. During the past they constituted shaped ways by pedestrians and animals in order to join places that have for man any particular interest.

Today, with technology development, in their mapping and surveying was given to them great importance, because they serve as mentioned above many activities and at the same time constitute an ecological form of road, friendlier to the environment than other classic routes.

In consequence, depending on the regions we want to approach, potential users, the length, the degree of difficulty and their shape, we distinguish the paths in various categories (paths of big corridors, mountaineering paths hiking trails, peripatetic paths, educational paths and in combinations of paths). Greece except from the national trails contains also parts of two international paths (E4, E6).

The design and laying out of paths is judged essential because it constitutes important tool of sustainable management. In order to laying out of the paths and the production of maps can be used several devices and instruments such as the Global Positioning System (GPS) and the electronic compass - finder (TruePulse 360° B).

These devices provide us with enough information about the terrain and they contribute to the creation of topographical activities in order to develop the area as it appears in this paper. The study area is a typical semi mountainous area in the Macedonia region.

The results of the measurements are presented in GIS, where the final shape of the path is appeared, and the points of measurement are given in tables. The mapping can be extended and the results of the surveying can be included in a printed or electronic map data in order to be used by stakeholders.

Keywords: paths, surveying, mapping, electronic compass.

1. Introduction

Path is a friendly form of road on the forest environment. Therefore it would be good to map the entire route network in Greece. So it would be easier to manage but also to highlight areas of the country.

The proposed mapping of paths can start from the national network of paths and continue with other routes of interest, aiming the maximum flow of information (e.g. for the development of eco-tourism, development and management of recreation, skidding with animals) and generally

serve the various needs of users of trails. The results of these mapping can be included in a printed or electronic material for use by stakeholders. The lists of points' coordinates of each route will be available so that they are used as waypoints to a GPS receiver and guide a walking tour, etc. While the accurate digital mapping of the paths can be the basis for the production of multimedia products for the acquaintance of future visitors to the area's natural, historical and tourist features [1,2].

The design and layout of trails, is a device that helps greatly to the "educational experience", while

minimizing impacts on ecosystems, keeping visitors and nuisances in specific areas [3]. Creating routes of environment interpretation is important because it is a tool that contributes greatly to the promotion of the paleontological findings and is a mean of promotion “live” and immediate. Simultaneously, the setting out of paths helps to the protection of them after it is achieved the control of the visitors in the protection area, organizing the tours, and minimize the damages to the findings.

Each trail network should not only take into account the paleontological value of each region and the ecological and aesthetic value, to propose a route network to the visitor that offers multiple levels of information and recreation. The paths should allow visitors to be informed about the history of the natural evolution of the last million years, while enjoying the beauty of modern natural history of each area [4, 5].

The proposed routes must meet a wide range of visitors and interest. Developing a network of paths, incorporating existing trails should be designed to unify different elements of the environment, both ecologically and culturally, and to highlight appropriate them while making easier the environmental education and visitor information.

Even the design and construction of trails can serve schools and people with disabilities and enables the possibility of visitors traffic with “environmentally friendly” means [5,6](such as bicycles, horses, mules, etc.).

The growing turnout of visitors and the modern conditions of safety and recreational in woodland, create the needs for reformation and promotion of new trails. The restoration and enhancement of ambulatory paths considered as intervention which does not alter the character of an area and its natural environment [7]. It is a complementary activity and a continuous rendering of services, as well as is the link to the various sectors of developing the local economy.

Recreation paths are for people. They allow us to go back to our roots. Paths help humans make sense of a world increasingly dominated by automobiles and pavement. They allow us to come more closely in touch with our natural surroundings, to soothe our psyches, to challenge our bodies, and to practice ancient skills. Keep this in mind when designing, constructing, and maintaining paths. Although many paths have some purely utilitarian value, their aesthetic and recreational qualities are important to

most people. A well-crafted path is unobtrusive, environmentally sensitive, and fun. Human psychology also plays a role. A useful path must be easy, obvious, and convenient. Paths exist simply because they are an easier way of getting someplace. Of course, many paths, such as wilderness trails, dirt bike routes, or climbing routes, are deliberately challenging with a relatively high degree of risk. All paths are not created equal. Each is ideally designed, constructed, and maintained to meet specific requirements. These specifications relate to the recreational activities the path is intended to provide, the planned level of difficulty, the amount of use expected, and physical characteristics of the land. Ecological and esthetic considerations are also important [8, 9].

The paths in a forest are the key in the hands of the visitor. Following them the visitor gets familiar not only with the beauties of the forest but also with the appropriate ways to protect the forest from damages which may result from reactional use.

The right connection of paths with the route network of the forest is the best guide for the visitors concerning the spots which may have aesthetic interest [10]. As in the case of roads the deigning construction of paths in the forests have to ensure the visitor with security, comfort and completeness of aesthetic satisfaction. For these reason during the design and construction of paths, it should be [6,7]:

Avoided large inclinations which may harass the visitors. Ensured a stunning view full of impressing and breathtaking composition of landscapes. Offered during the route, a variety of vegetation, joy of meeting several animals and birds and projection of impressing geomorphic shapes.

Inspirited the feeling of security so the visitors can feel safe and protected from any danger such as wild animals and poisonous plants

Paths designed on slopes offer to visitors of forests easier conditions of recreation. The special features of the construction of paths affect in a significant degree their use from the visitors as well. There are frequent cases, especially in mountainous areas, where can be observed path shortcuts caused from their visitors [4]. These happens when the design and the construction of paths do not please the visitor or when the slope make them feel tired.

During the construction the paths in the forest have to:

Have width 0, 40 - 0,80 m

2. Be covered with gravel in thickness of at least 5 cm
3. Be often constructed stony terraces in cases of large inclinations
4. Be constructed roads with rocks or tree trunks or rails, in cases that the cover is not possible
5. Create obstacles in many spots with the installation of bumps or tree trunks or bunch of soil or shrubs, so that paths cannot be passed.

Contrary to what happens on the roads, where the driver has to follow them even then is pleased or not, with the design and construction, the visitor in the woods can make his own design of paths because it is possible to see it as the best solution. For these reason it is believed that visitors should be left the design first on their own to ensure the normal construction of paths, later. These solution, though is not exactly the right one, since the visitor of the forest does not know where are the sights and the spots of the forest that can be sensitive. That's why the better design and construction of paths can ensure the valuable protection of the visitor and the forest as well.

Last but not least, a network of paths in the forest has to be followed by a sign spot system. In this way the design and the construction of paths will be more reliable, since the appropriate sign spot system will give to the visitors the right information for the forest area.

2. Materials and Methods

2.1 Research area

As a research area was chosen the Forest complex Vria-Ritini of the prefecture Pieria in Greece. It's located in a mountainous area named Pieria Mountains (Figure 1). The forest complex is in the highest north-east area. The forest complex of Vria-Ritini is 4600 ha and is located between $4^{\circ} 14' 12''$ – $40^{\circ} 17' 06$ and $-1^{\circ} 32' 50''$ - $-1^{\circ} 21' 56''$.

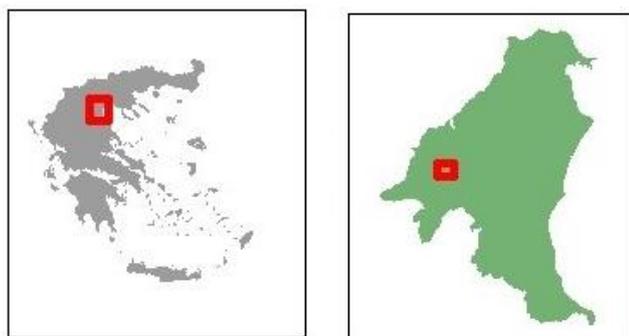


Figure 1: Research area

2.2 MATERIALS

The instrument that was used in order to survey

part of the paths was the electronic compass - finder True Pulse Laser Technology 360° B and the geodetic GPS LEICA VIVA GS15 (Figure 2). The electronic compass – finder on a tripod always shots to the reflector that is mounted on the height of the observer's eye. The target height is remaining fixed until the end of the measurements. The 360 laser rangefinder has an integrated compass that allows us to measure azimuth and provides an extra onboard solution called missing line. This is a simple 2-shot routine that instantly calculates the distance, inclination and azimuth direction value between any two remote points. For downloading data into any compatible data collector, we can use the standard RS232 serial port or Bluetooth®.



Figure 2: True Pulse Laser Technology 360° B and GPS LEICA VIVA GS15

Results

The elevation and improvement of the path automatically helps to highlight the natural environment of the study area. The course has been carefully traced so that the visitor can walk through secure places and not to disturb the surrounding environment (old terraces etc.). The study does not foresee cutting and pruning of trees, while there are signs for paving, aiming to improve the Aesthetics, the view, but above all the sense of security that the visitor must feel while walking along the path.

In general, the course of the path and the selection of the positions of the complementary works were based on:

- Safe passage
- Continuous and uninterrupted visual contact with the aquatic element and the wider natural environment, as well as the protection of the entire area
- The emergence of the natural beauty of the area with works and constructions that will not alter the natural environment and will be adapted to the whole aesthetics of the landscape

- The pleasant and comfortable stay of the visitors in the area.
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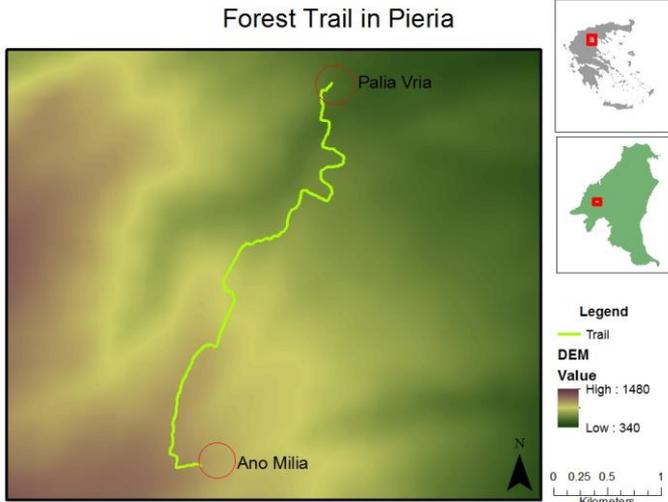


Figure 3: Designed Trail

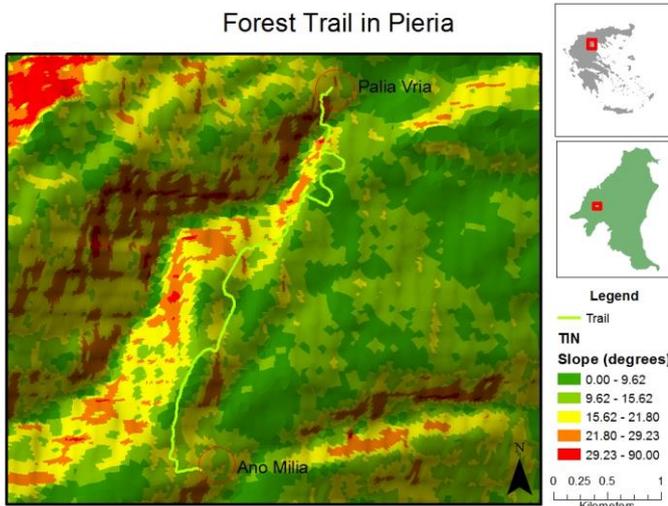


Figure 4: Slope of Trail

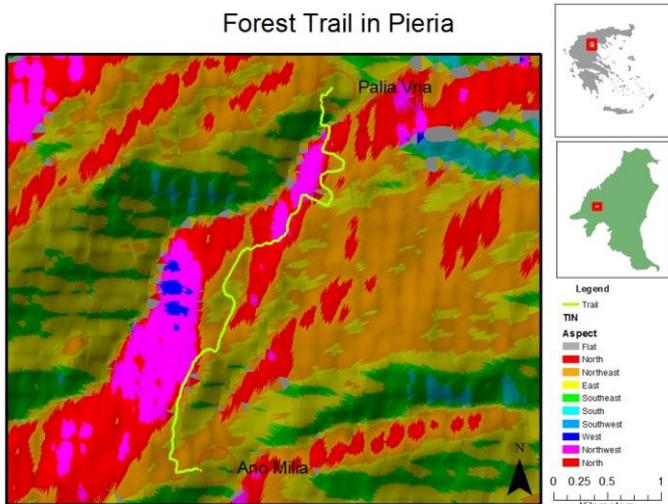


Figure 5: Aspect of Trail

Forest Trail in Pieria

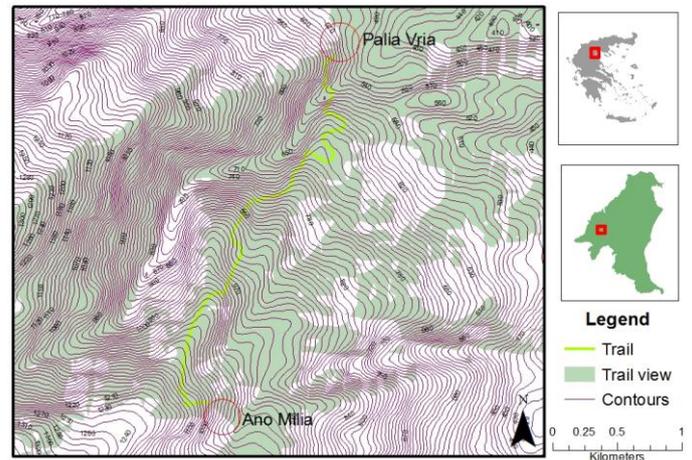


Figure 6: Trail view with contours

Forest Trail in Pieria

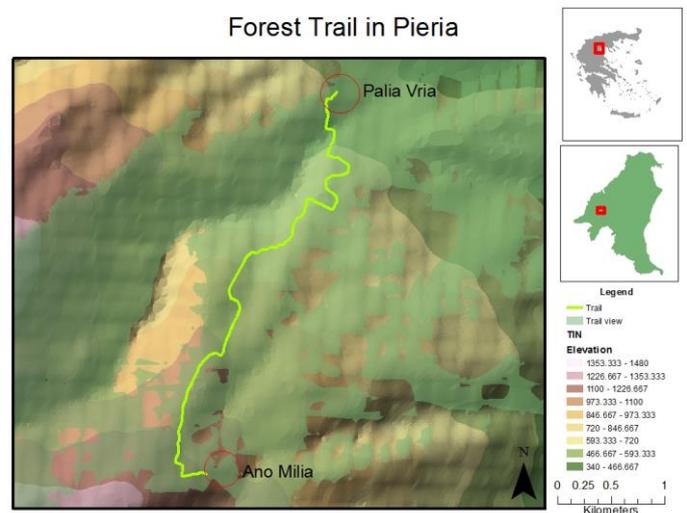


Figure 7: Trail view with elevation

Discussion

Mapping the entire Greek route network in an electronic digital form will acquaint visitors to the natural and historical beauty of Greek country. Also, through organised tours, tourists get the opportunity to enjoy themselves and learn about the Greek cultural value and historical treasures. Any attempt of altering, reconstructing or redesigning the already existing trails should be done in a respectful and friendly way towards the environment serving both the needs of potential visitors as well as the needs of natural life. Human is an integral part of nature and vice-versa. By constructing new paths and preserving the old ones we embrace nature, soothe our souls, connect with our past and challenge our technological future.

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Mapping and Environmental Impact Assessment Studies and on contribution of UAVs to forest roads surveying.

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