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FOREST CADASTRE AND ENVIRONMENTAL IMPACT ASSESSMENTS IN THE SERVICE OF FOREST MANAGEMENT PLANNING

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Abstract

The main concern of a forester is to be able to collect and maintain accurate and detailed data in order to cope successfully with current needs but also to anticipate future situations. Generally speaking, the Cadastre is a tool for planning, rationalization and development of the country and environmental protection. The development of mountain areas consists of the development of anthropogenic influences, which – like every form of economic development – is usually accompanied by negative environmental impacts. Thus it is necessary to define the criteria considering Environmental Impact Assessment (EIA). The aim of this paper is to investigate and to clearly demonstrate the contribution of forest cadastre and EIA in Forest Management Planning. Forest cadastre, which is a special cadastre, should be in line with the technical specifications of the National one. The total cost is not just techno-economic, but also environmental, all of which constitutes the cost of the work. We must develop practical and objective methods in order to assess the environmental impacts in alternative solutions in order to determine the location that makes the work compatible with the natural environment. There can be no development and rational management of the forest without a forest cadastre. On the other hand, however, most of the country's forests are degraded and of low productivity and most of them play a protective role. So the EIA is essential for the planning of any work.

Key words: compatible construction, Environmental Impact Assessments, Forest cadastre, Forest Technical Works, rational management.

Introduction

Forest ecosystem produces many goods and services without the intervention of human management. But ever since human began to administrate forests intensively, the relationship between goods and production has changed. The current on forests and forest land has a direct impact on the system of human society which will increase further in coming years. Indeed, the effort to regenerate and create forests today (artificial or natural) will bear fruit after 60–70 years when the climatic conditions will have deteriorated. Concern

of the forester is to be able to collect and maintain accurate and detailed data and information in order to enable him to cope successfully with current needs but also anticipate future situations.

In order to design a specific forest policy and one rational development planning and a successful decision making; an accurate knowledge of the real condition of forests in our country and the consequences of any attempt to use them is considered to be necessary.

In general, the Cadastre is a tool for planning, rationalization and development of the country and for the protection of the environment. Regarding the zoning planning, it is a strategic tool for sustainable development, with respect to the environment.

The development of mountain areas is related with anthropogenic influences, like any form of economic development, and is usually followed by negative environmental impacts. The peculiarity lies in the fact that this anthropogenic action often degrades the natural and constructed environment, which is also a raw material for its development. Thus it is necessary to define the general principles of zoning planning in mountain areas and the criteria governing Environmental Impact Assessments (EIA).

Environmental Impact Assessment is a thorough and documented scientific work and research aiming to assess the effects of certain public and private projects on the environment, in order to obtain a balanced development of national space which will become an easy and effective effort to prevent pollution and environmental degradation by evaluating the direct and indirect impacts of projects and activities (Source: N. 1650/1986).

The vast majority of onshore natural environment of Greece is forests and woodlands. The most effective tool available today to enhance the definition and future management of these areas are the forest maps.

On these maps:

- The boundaries of forests and forest areas in general of every region are accurately surveyed.

- The grass and other areas not covered by forest law are surveyed.

-The boundaries of all other areas which are currently used for other purposes (agricultural land, settlements, etc.) are surveyed.

These maps are approved by the proper public services, and when approved, it gets posted, so that every citizen can make any objections to any patch of land has any different view.

Once finalized their form, these are official public documents, available both to citizens as well as to anyone else might be interested. The "Forest Cadastre" established by the Law 248/1976.

The effort failed in the process, for three main reasons:

1. The crews did not have the means or the know-how which are currently available (no orthophotomaps, appropriate hardware and software, etc.).

2. The design that was made did not allow the rapid development of the project (those crews did in fact cadastre, which elaborated the same time and the titles of property owners who have parcels within or on the edges of forests lands).

3. The maps would be held by civil servants, a situation which leads to delays and cutbacks in recruitment, spe-

cific working hours, constant changes of Heads, Directors, Ministers, etc.

The last major effort which was made in our country concerning the preparation of forest maps is under the studies of the National Cadastre.

In this context it is indicated that apart from the purely cadastral information in open cadastre, it can be registered at any time in the future along with additional information as a tool to pursue particular objectives of rationalization and development of the country.

The success of an integrated cadastral system depends on the successful meeting of the objectives of forest land protection, forest environment and on how much it would provide secure information useful in all areas of forestry activities and for the rational development of forestry policy.

The implementation of these require the establishment of cadastral offices, which will be accommodated by the organization, collection and processing of information by creating data bank and land information system.

The term bank means the gathering, in an organized way, of all technical, legal and economic (forestry) data for each cadastral unit.

Land Information System (LIS) is a unified geodetic reference system consisting of the collection, updating, processing, distribution and integration of data among themselves and with other systems that contain land data (e.g. Environmental), so that is a decision support tool, both for legal, administrative and financial issues, and design and development that the bank is part of the system.

A G.I.S. (Geographical Information System) is an integrated system of collection, storage, management, analysis and performance information relating to events taking place in geographical space.

The management of cadastral information, and related topics, such as inventory, mapping and forest management with the current state of technology of computers are relatively easy to place. The digital topographic charts and tables represent the digital file, which should follow the standards of digital data transfer in a Geographic Information System (GIS). The file generated by digitizing with certain standards of accuracy and resolution and proved to be accurate by putting the produced to the original map.

The D.T.M. and GIS have a wide range of applications in forestry operation with main representative the cadastre as well as environmental impact assessments (EIA), etc.

The aim of this paper is to investigate and to clearly demonstrate the contribution of forest cadastre and EIA in Forest Management Planning.

Material and Methods

Regarding the creation of forest maps of a region

a. Usage and interpretation of the available aerial photographs (starting from 1945 aerial photographs, which are the oldest available aerial photographs covering almost the entire country and recent aerial photographs (A/P) according to the requirements of National Cadastre and comparison of those with the past ones in order to find differences in borderlines).

b. Extensive earthly inspections on the spot are taken place in order to in-

vestigate on the ground, the results of the interpretation.

c. Take into account and survey all final administrative acts issued by public services and identify particular plots of land (e.g. land declared to be reafforested, forest lands allocated for agricultural use, etc.) and finally.

d. With the help of Geographic Information Systems (GIS) process all this information and create the corresponding maps (in both printed and digital form), and also create the corresponding databases. All these are now assigned to each parcel of land that is characterized by the parameters (for example, traditionally forest lands, traditionally agricultural areas, land that was in the past forests and then changed use, etc.).

Finally, it should be pointed out that once the forest maps of an area are drawn up, at the same time the best and most modern topographic base that can be available to a scientist is available for this area (Digital Terrain Model and orthophotomaps-scale 1:5000) (Figure 1) in order to manage these specific areas (to organize the fire protection, to design in space and time the individual contributions, etc.).

Therefore, the old and the current dispute could have wide swath of forest land up to 30 meters. Next step is to quest for ways to reconcile the results of the previous and current situation and focus on the most recent borderlines whose application to land is more accurate, easier and "causes fewer reactions". Even for the boundaries alignment which in bushy vegetation reaches five meters at the expense of forest land.

Regarding EIA

Steps in the Environmental Impact Assessment are:

- Analysis of the environmental effects of the opening.
- Analysis of the criteria affecting the design and construction of individual forest road.
- Analysis of the criteria for impacts of road construction absorption.
- Evaluation of the criteria using terrain measurements data, photogrammetry and photointerpretation assessments and GIS.
- Grading the criteria with objective score, namely any factor that affects the impact of highly rated (100) when it does not affect at all.
- Assessment from a number of alternatives that has the highest percentage score and met the compatibility coefficient of work with the environment.

For the achievement of the research goals we used:

Digital orthophotomap of the research area and the respective digital terrain model (DTM) that resulted from the photogrammetric process of a pair of aerial photographs in a digital photogrammetric station were used. So the digitization of the land uses and the forest road network make possible and finally the inference reliable measurements regarding to the accurate estimate of the area for each land use and the length of the existing forest road network (Drosos et al. 2006).

The last management plan of the forest from which we utilized factors such as harvesting, management form, the already existing forest species, tree age etc.

The method, which would be applied, should be practical, effective and easy to

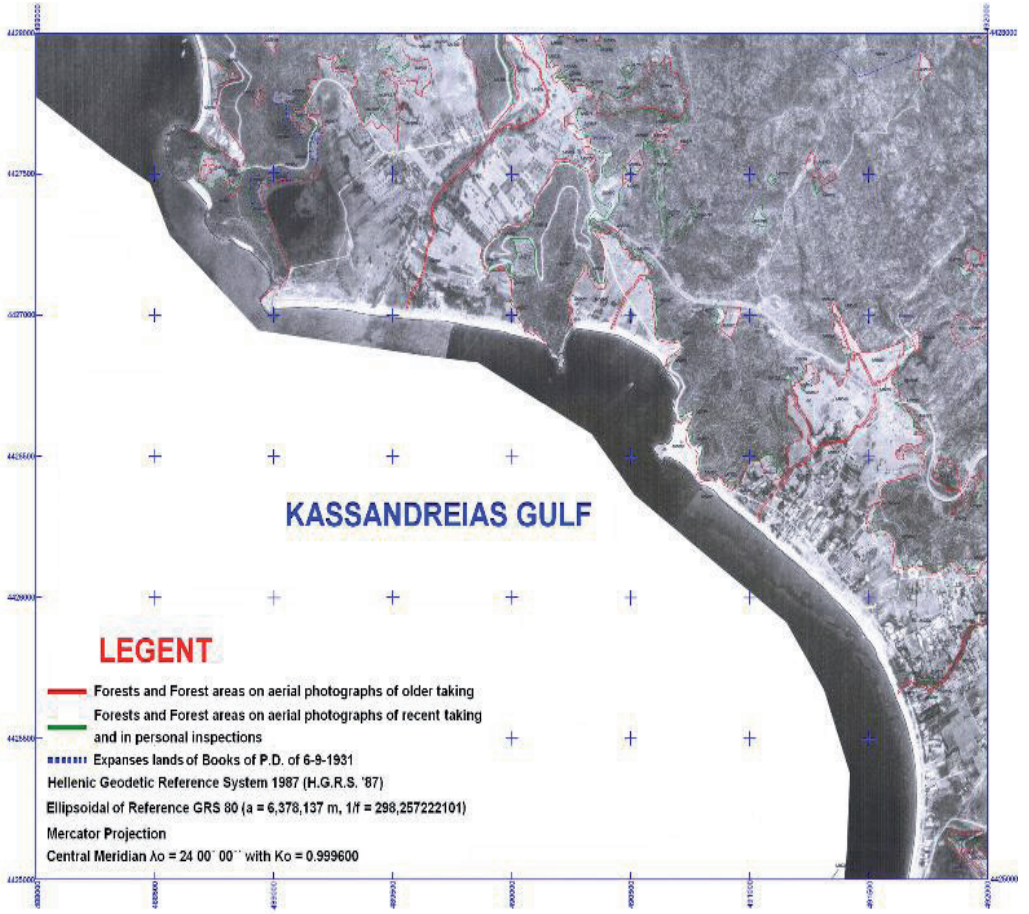

Fig. 1. Digital Orthophotomap of Toroni in Chalcidice Prefecture.

use. For this reason we have set a number of absorbency and intensity criteria.

The grading of these criteria depends on the following principle:

We accepted a situation as ideal (=100%) for the forest protection by road construction. The percentage of deviation from this ideal situation will be subtracted from 100%. The result will be the grading of the criteria.

In order to define the intensity of the human impact of the existing forest opening-up works and the exploit of the forest to the natural environment, we used respective criteria (Buwal 1990, Mader 1990, Heinimann 1994, Doukas 2004). At the same time, the absorbency and intensity criteria and their weights came from a questionnaire sent to specialist scientists (Giannoulas 2001). More specifically, the intensity criteria were used are shown in Table 1.

The next parameter studied was the capacity of the forest ecosystem to ab-

Table 1. Criteria of intensity and absorbency.

INTENSITY				
	Criteria	**Grad, %**	**Weights**	**Sum**
1	Road density			
1.1	Skidding with draught or load animals		3	
1.2	Skidding with mechanical means or combination from animals and mechanical means		3	
2	**Percentage of tractors use in opening up**		2	
3	**Percentage of opening up**		3	
4	Skidding direction		1	
5	**Traffic frequency and motor vehicle types**			
5.1	Exceeding percentage of traffic frequency		2	
5.2	Exceeding percentage due overloading		2	
6	Forest roads' categories		2	
7	**Position of roads**			
7.1	Distance of water flows		3	
7.2	Distance of forest boundaries		3	
7.3	Problematic (unstable) soils		3	
	Total			
	Average value $C_I = \sum(I \times W_I) \times (\sum W_I)^{-1}$			
ABSORBENCY				
	Terrain conditions			
	Forestry criteria			
1	Kind of coverage		3	
2	Forestry species		3	
3	Management form		3	
4	Age		3	
5	Tree height		3	
6	Productivity		3	
	Topographical criteria			
7	Slope of ground		2	
8	Exposition		2	
9	Relief		2	
	Social criteria			
10	**Distance from**			
10.1	Tourist recreation area		1	
10.2	National road network		1	
10.3	Railway		1	
10.4	Archaeological site		1	
10.5	Adjacent big city		1	
10.6	Adjacent village		1	
10.7	European path		1	
10.8	Natural or artificial lake or river		1	
	Total			
	Average value $C_A = \sum(A \times W_A) \times (\sum W_A)^{-1}$			

sorb the impact of the works. By absorbency, we mean the extent to which the effect will be absorbed by the ecosystem with time, as well as the number of the recipients of the effect.

The absorbency criteria are divided into 3 categories: 1st forestry criteria, 2nd topographic criteria and 3rd social criteria. The weights of the criteria are: three (3) for the forestry criteria, two (2) for the topographical criteria and one (1) for the social criteria (Table 1).

The final grading of intensity (I) for each criterion is provided by the product of each criterion value multiplied by its weight coefficient in order to find the barycentric mean. Similarly, the absorbency (A) of the forest ecosystem is calculated by each criterion value multiplied by the respective weight coefficient with a view to find the barycentric mean.

The value (%) that estimates the impact of intensity (I), which is not negative, is multiplied by the respective weight coefficient (W_I) and is divided by the sum of the weight coefficient values so as to extract the barycentric mean:

$$C_I = \sum(I \times W_I) \times (\sum W_I)^{-1} \quad (1),$$

where $\sum(I \times W_I)$ and $\sum W_I$ are the sum of the estimate impact of intensity multiplied with the respective weight coefficient (W_I) and the sum of the weight coefficient values, respectively, for matrix as size %.

Likewise, the absorption (A) of the forest ecosystem is multiplied by respective weight coefficient (W_A) and is divided by the sum of the weight coefficient values with a view to extract the barycentric mean:

$$C_A = \sum(A \times W_A) \times (\sum W_A)^{-1} \quad (2),$$

where $\sum(I \times W_A)$ and $\sum W_A$ are the sum of the absorption's estimate multiplied with the respective weight coefficient (W_A) and the sum of the weight coefficient values, respectively, for matrix as size %.

The rates C_I and C_A represent the indexes concerning the compatibility degree of the forest opening-up works with the natural environment.

Results and Discussion

1. Analogical forest maps should be gradually replaced by digital. In the meantime, however, the training of personnel in the forest service on the creation of a digital silvicultural map that will come from the digitization of the existing silvicultural map would be appropriate. Also, we should bring on the cadastral boundaries from photogrammetric process and field inspections, to make better use from employees and citizens that have become accustomed to the use of traditional silvicultural map.

2. The cadastral data held on Cadastral offices are not only technically and legally, but also additional information as a tool to pursue particular objectives and organizational development of the country. Particularly for forests and woodland forest maps, these are themselves a centralized information material of the forest ecosystem. The rational management, the readjustment, the protection of these data in the context of a multidimensional cadastre as intended to be the "National Digital Cadastre" is a forestry subject. The sheer volume of valuable data and information gathered from the forest service for all areas of the country under forest cadastre can be better and more effective if

added to the proprietary data bases of cadastral offices.

3. The national spatial planning of land uses, assumes that given the nature of the lands in this country, and based on this character designed and adopted for future use. For this reason, one of the most valuable "tools" of the final boundary is and the forest maps.

4. Apart from their contribution to the national land use planning is an important contribution of the cadastre and in protecting the natural environment:

i. The forest maps are the only means available to the Greek government to map and protect its land assets.

Features mentioned that the only essential property statements made by Greek government in the studies to date cadastral survey were based on forest maps.

ii. The preparation of forest maps in a region practically means the end of all underground transactions and all the corruption that can exist today in the forest or non-identification of individual areas of this region. Everyone knows now (officially proclaimed) the nature of each area and it does not change and deteriorate with any kind of promise or interventions.

iii. The existence of forest maps in an area stopped most of the suffering, and the continued litigation in this matter, both citizens and all relevant services.

iv. Finally the forest maps are an explicit constitutional obligation of the state, both by the Constitution of 1975 and the Constitutional Review of 2000. Nevertheless, we continue to be here for 34 years (since the passage of Law 248 of 1976) the only EU country in which there is currently no forest cadastre (Register, forest maps, borderline), for its entire territory.

In the era of revolution of knowledge/technology, when knowledge rapidly is considered to be old and new one is created "in the blink of an eye", the importance of the parameter "lifelong learning" in the effort to link research to production is obvious. An education with more theoretical training in many fields and more practice in technology, which enables foresters to be more flexible, efficient and competitive in the Greek market on close, is necessary. It is wrong to reduplicate uncritically standards which are effective in other countries.

A key consideration for any industry scientist is to survey and study the parameters affecting the link between research and production activities in every country.

Specifically with regard to the forest engineer there are two items that require linking research to production, i.e. continuous education:

- Forest cadastre and
- Environmental impact assessment on Forest works, particularly in opening up and road construction.

Therefore, sufficient knowledge of technology is required, both on technical training, and subsequently at the Cadastral office in order to create land data bank.

Regarding the EIA, it should be noted that the writing out of EIA in accordance with EU directive is mandatory in every assessment project, that changing land use. The total project cost is no longer just technical, economic and environmental, all of which constitutes the total cost of the project.

We therefore propose practical and objective methods for assessing the environmental impact of alternative solu-

tions in order to determine the location that makes the project compatible with the natural environment.

The most important benefit, however, expected to result from the development and dissemination of EIA, is the public awareness towards environmental problems. The process of approval of a study published causes of environmental problems, and discussion about them. Dealing with environmental problems train a social class conscious, and ultimately leading to improved EIA why the authors should meet the criteria of informed consumers.

It is important, however, to stress that while the proper use of the concept of EIA only benefits may have on the site, misuse can cause various problems. For example, the risk that EIA a bit of a pointless bureaucratic process is important. Still, there is a risk to use EIA by interests that want to thwart any development project. By far the operation of the institution has reported several weaknesses, which are believed to be eliminated in the future.

The designer of environmental impacts should be targeted, that ultimately provide protection to the natural environment because the source – the basis for economic sustainable development, social improvement and prosperity.

Furthermore, it should be reassured that certain principles for the rational construction of Forest works will be maintained, but this will not damage the environment; on contrary, it will contribute to a sustainable management and development of forest areas.

Environmental protection should begin on the basis of established principles of forestry and nature protection, the premeditation and continued in the design and construction and not for the first time after construction or during construction of a project.

The various criteria and the review procedure described above constitute a useful manual on forestry practice that tries to interpret the overall effect of an opening up network in the environment, so that the opening up can be conducted as friendly as possible to the environment.

Development has been the flag of every country in the world. But what development is meant? We meant the residential development or the qualitative one or by the way the touristic development or sustainable one?

In order to achieve the suitable development necessary land planning use and forest cadastre (forest maps) is needed, meaning the essential foundation for development and instrument of land policy exercise. The aim of the cadastre should be the encouragement with respect to the environment with the help of land use maps and zoning plan, in order not to cut the branch (Forests and woodlands, ecosystem) on which the development sits.

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