

Economics of agriculture

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## SEPARATION BETWEEN AGRICULTURAL AND FORTESTRY LAND

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### Introduction

*In the past two decades, the multidisciplinary research of land area has been current. The problem of these researches is exceptionally complex and it requires a disciplined and continuous work of different professionals (soil surveyors, geologists, soil scientists, phytocoenologists, climatologists, typologists, ecologists, statisticians, socio-demographers, economists, etc.) in the aim to find out and utilize the reliable parameters for the definition of land area by quantity and quality. The final target is that such a defined land area is optimally utilized both from the social and from the economic aspects.*

**Key words:** *clas amenities, bare land, afforestation, information system*

### Material and methods

In forestry, the multidisciplinary evaluation of land is especially significant because the interests of forestry are interwoven, but often in collision, with the interests of agriculture, watershed management, electric power industry, traffic, town planning, wildlife management, etc. In the forestry of Serbia, the marked problem is that of bare land separation (regardless of the ownership) for forestry and agricultural production in hilly-mountainous regions.

Long-term planning for afforestation in this field is not possible due to spatially undefined plots. As this usually leads to mistakes when afforestation is done, we started identification and mapping of bare land in hill-mountain region of Raska (Sjenica,

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Tutuin, Raska and Novi Pazar) based on orographic, climatic, geological, soil science, Phytocoenological, erosion, socio-demographic and economical criteria. This kind of analysis gains more and more importance having in mind the change of attitude regarding area planing and moving its creation to local autonomy level.

## Results and discussion

The criteria for the assessment of land suitability in forestry and agriculture are different. So, a land can be very productive if it is assessed by forest tree growth, but it can be extremely unsuitable for agriculture.

The classification applied in this paper is based on the international Framework for Land Evaluation (FAO, 1976), with the basic structure:

- suitability order, reflects the type of suitability
- suitability class, reflects the degree of suitability within the order
- suitability sub-class, reflects the type of restriction
- suitability unit, reflects the smaller differences within the sub-class.

**Suitability order** shows whether a land area is suitable or unsuitable for the intended use. There are three orders of suitability designed on the maps:

- **s u i t a b l e (P)** denotes the land area where the intended use is profitable and justifies the investments in afforestation, there are neither damage to land resources nor harmful effects of any kind,

- **u n s u i t a b l e (N)** denotes a land area which does not sustain the intended use,

- **s u i t a b l e c o n d i t i o n a l y (PU)** denotes a land area where economic return cannot be expected, so that the investments in afforestation are not justifiable, but still the establishment of forests, with all the multiple beneficial functions, is necessary (e.g. for the protection of spring area, erosion control, recultivation of spoil heaps, etc.)

**Suitability class** of a land area shows the degree of suitability and it is denoted by an Arabic numeral. According to FAO classification (1976), there are three classes in the order "suitable", and two classes in the order "unsuitable".

- **h i g h l y s u i t a b l e (P1)** denotes a land area which has no significant limitations for forestry or the limitations are minimal, so that they do not decrease the productivity i.e. the profit, and do not increase the input above the acceptable level (maximum value of the established discount rate for the land use),

- **i n t e r m e d i a t e l y s u i t a b l e (P2)** denotes a land area which has limitations in the use for forestry, which decrease the productivity or the profit below the profit which is expected in the class "highly suitable",

- **m a r g i n a l l y s u i t a b l e (P3)** denotes a land area which has serious limitations which endanger its use for forestry, so that the productivity or the profit are decreased, requiring investments which can only exceptionally be justified,

- **t e m p o r a r i l y u n s u i t a b l e (N1)** denotes a land area which has serious limitations which can be overcome with time, but which cannot be corrected with the present knowledge and acceptable price. The limitations are such that, at the moment, they prevent the successful land use,

- permanently unsuitable (N2) denotes a land area which has serious limitations, so that it excludes completely the possibility of successful land use for forestry.

Three major limitations are denoted on the maps.

The restricting factors are defined in the ecological, socio-demographic, economic and financial analyses of a land area:

#### a) **Ecological definition of land area**

Orographic, climatic, geological, soil, plant community, and erosion characteristics of the land are defined:

- **Orographic characteristics (o)**. Orographic characteristics are analyzed in detail for the areas intended for forestry. The appraisal depends on the gradient (n), aspect (e), and elevation (v). By the digitalization of the areas suitable for forestry, the combinations of factors are made possible. The cartographic presentation shows the areas with identical values of the "potential of local temperature" and "local temperature factor".

- **Climatic characteristics (k)**. In the previous papers, the analysis of climate was mainly used as a supplement to the researched ecological factors, without any crucial relationship. Mass decline of forest cultures caused by unfavorable climatic factors indicates that climate should be paid much more attention to, and if it is not a dominant factor, it is an equally important one in land appraisal. Consequently, the analysis of climatic factors deviates from the classical approach (so far used in forestry). Mean monthly minimum and mean monthly maximum air temperatures are analyzed, as well as mean monthly relative air humidity, noon relative air humidity, monthly rainfall, rainfall intensity in the vegetation period and rainless spells which also include the days with precipitation less than 1.0 mm, which was decisive in the survival of cultures.

- **Geological and pedological characteristics (g, z)** are determined by the detailed reconnaissance of the terrain and digging soil profiles, in order to observe the essential characteristics of the soil and parent rock: soil depth (d), skeletal soil (sk), parent rock (g), as well as other morphological characteristics which affect land productivity. Of course, the profiles are cut at the characteristic locations and forms of relief.

According to the general principles of soil class determination, all the soils are classified into eight classes. Special attention is devoted to the soils of V, VI, VII, and VIII classes.

- **Phytocoenological characteristics (f)** - are derived from the data on the existing vegetation. The map of potential vegetation is used as a key for the choice of tree species for afforestation.

- **Erosion processes (e)**. The description of present forms of erosion is given with the proposal for their control, as well as the recommendations for further activities from the standpoint of soil conservation.

### b) Socio-demographic objectives of land area

Socio-demographic factors (d). The data on the population size are collected. The economic structure of the population is analyzed, and especially the share of agricultural population in the total population. Special emphasis is given to migration processes, their scope and aspects. The range of livestock number (s) is also analyzed per species, categories and sectors of ownership. The review of animal husbandry production is also given. The data are collected and processed on the structure of harvest and the average yield of agricultural crops. Also, the physical scope of current plant production (from ploughland, gardens, orchards, meadows and pastures) is also calculated. In this way, it is determined if the change of land use will cause the disturbance of the relations in the physical scope of agricultural production.

### c) Economic and financial objectives of land use

The economic and financial analyses are a significant part in the separation of agricultural and forest land, in the aim of its optimum utilization. By the applied system of land capability appraisal, economic and financial analyses participate in the formation of suitability classes (indirectly, suitability order) which confirms the high significance of this analysis. First of all, a detailed financial analysis should be made: to determine the internal rate of yield and the term of return of the investment funds for all the alternative forms of production. In this respect, the comparison of agricultural production and the production of forest assortment is made, as an alternative aspects of economy on the soils of the fifth, sixth, and seventh class of fertility. Also, the evaluation of multiple benefits is also undertaken. The data base on seed sources in the region of Serbia serves for the choice of seed sources which can be utilized for the production of nursery stock for afforestation. The aim is such an organization of work which aims at the production of seedlings for the particular site, and with the optimum afforestation method. The database on the established forest plantations is a significant support in the choice of tree species, i.e. provenance's, for the afforestation of the particular site.

### Experts sistem for relevant decision about optimal land use

Main dates that are relevant for land use decision should be :

Agriculture	Land capability class I -V (using space)
Landscape	National beauty, landscape regional importance
Natural protection	National parks, Regional natural parks, Nature reserve, Natural monuments, Memorial monuments, Open natural space monuments surrounding, Park-forests, etc.
Recreation/ tourism	Tourist paths, Scenery points, ski-paths, climbing paths, meadows, fields, etc.
Water flow region	Water flows, wells, main rivers, accumulations, channels, etc.
Infrastructure	Urban regions, roads, power electricity, etc.
Social-economic information's	Population trends, district, lends-registry, forestry-management regions, management unit, etc.
Forestry	Existing forests (shape, kind, mixture, function, condition)

The most of following information systems are based on use of GIS tehnology.

Creating database of seeds stands on the region in Serbia has for aim on object selection, which can be used like base for plant production for afforestation. That enables work organization on plant production for the residence, which is already known with a choice of optimal technique of afforstring. Also creating databases of risked forestry cultures, will represent significant tries choice, in reference to provenance, for afforstring certain residence. The expert system that has been developed will enable preparation for afforestation, and, now for the first time, move from declarative to operative organization of work – plant production from seed gained from already known seed stand (known provenance) for residence of known characteristics, and with choice of plants optimal production methodology and afforestation technology. There's the group of limits in experts systems for afforestation. Picture No 1 shows the plan of expert system for afforestation. GIS technology gives high possibilities of producing new information for combined data base of different levels, which enables optimal use of territories in hill-mountain territory-to become real. The space models can be used for predicting direct or indirect results, before giving final decision about using expanse. Applying the shown method on the territory of Sjenica, Tutin, Raška and Novi Pazar, the following condition, regarding the possibilities for land use in forestry, is found.

*Table 1 Limitation of Expert system for afforestation*

Land for afforestation	In existing forests, with special permission for planting
Limited land for planting	Part of bony class VIII, urban lands
Risk regions	National parks, regions with great importance for natural sciences, natural monuments, national beauty, land capability class I-IV
Potential regions	Important places for natural sciences, Regions with landscape importance in regional meaning
Priority regions	Rest regions

*Table 2 Possibility of land use in forestry*

Suitability class	Community			
	Sjenica	Tutin	Raška	N. Pazar
	Hectare			
Class "highly suitable"	37	192		
Class "intermediately suitable"	5241	8242	2636	1944
Class "marginally suitable"	4821	6397	8684	8533
Class "temporarily unsuitable"	3140	3140	6321	3316
Class "permanently suitable"	2044	463	160	264
Class "intermediate and marginally suitable"	3953	664	638	311
Class "marginally and temporarily suitable"				195

## Conclusion

Some very important issues, regarding improvement of afforestation in Serbia are brought up. The priority goals are: changing the use of some agricultural land for the sake of preserving ecological balance, improvement of afforestation and construction of long-term production capabilities of existing and new forests, contemporary biological works solving the problem of water supply etc.. The important is valuations on existence of numerous conflict situations in space using (waiting for the solution) that are made because space-using regime was not existing. Some notice are strictly imperative, like for instance the evaluation that Serbia has not too much space for accumulations and that filling up of accumulations must be prevented with up-to-time biological work, since this will provide water supply and national survival. The development of Serbia in years to come is conditioned to changing the politics regarding afforestation of bare land and melioration coppice and degraded forests.

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SCHEME 1: INFORMATION SYSTEM

