

SOIL CLASSIFICATION FOR THE NEEDS OF SPATIAL PLANNING IN CROATIA

KLASIFIKACIJA TLA ZA POTREBE PROSTORNOG PLANIRANJA U HRVATSKOJ

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ABSTRACT

In Croatia, as everywhere else, the most productive soils should be conserved and protected from being reassigned for other purposes. Building settlements, highways, roads, airports, harbours, sports facilities in the Republic of Croatia causes an annual loss of about 6700 ha of agricultural land. Since most damage is incurred to the most fertile agricultural soils, Croatian legal acts (Agricultural Land Act, Official Gazette 66/2001, Spatial Planning Act, Official Gazette 30/94, Content and Criteria Rulebook, Official Gazette... 106/98) stipulate the need to preserve better agricultural soils by avoiding non-agricultural land use as well as the obligation of soil classification and designing bases according to the land suitability classes.

Pursuant to the said regulations, no building should be undertaken on highly valuable agricultural soils, which under the FAO classification (FAO, 1976, Brinckman and Smith, 1972) correspond to S1 suitability class, valuable agricultural soils (S2 suitability class), and other agricultural soils (S3 suitability class). Construction may freely proceed on the other agricultural and forest soils, belonging to the lower classes of land suitability or unsuitability (currently or permanently unsuitable soils). The said standards also classify forest soils into three groups: forest soils for forestry management purposes (F1), forest soils with a protective role in terms of soil conservation (F2), and forest soils for special purposes - national parks, nature reserves, etc. (F3).

The paper provides examples of soil classification for the needs of designing the spatial plan of the Lika-Senj County, where the thematic maps

have to be made on a scale of 1:100000 and in the Lepoglava municipality on a scale of 1:25000, because the applicable Law postulates these criteria for land evaluation at these levels.

Key words: soil classification, spatial planning, Croatia

SAŽETAK

U Hrvatskoj, kao i drugdje, postoji potreba čuvanja najplodnijih tala od neopravdane prenamjene. Izgradnjom naselja, cesta, puteva, aerodroma, luka, sportskih objekata u Republici Hrvatskoj gubi se godišnje oko 6700 ha poljoprivrednog zemljišta. Najčešće to ide na uštrb najplodnijih poljoprivrednih tala, stoga je u našim normativnim aktima (Zakon o poljoprivrednom zemljištu, N.N. 54/94, Zakon o prostornom planiranju, N.N. 30/94, Pravilnik o sadržaju i mjerilima..., N.N. 106/98) određena potreba čuvanja boljih poljoprivrednih tala od izvanpoljoprivredne potrošnje i obveza razvrstavanja tala i izrada podloga prema klasama pogodnosti tla. Prema navedenim propisima, izgradnja se ne bi smjela obavljati na osobito vrijednim poljoprivrednim tlima, što prema FAO klasifikaciji (FAO, 1976, Brinckman i Smith, 1972) odgovara P1 klasi pogodnosti, potom vrijednim poljoprivrednim tlima (P2 klase pogodnosti) te ostalim poljoprivrednim tlima (P3 klase pogodnosti). Izgradnja se nesmetano može usmjeriti prema kategoriji ostalih poljoprivrednih i šumskih tala, koja pripadaju nižim klasama pogodnosti ili nepogodnosti (privremeno i trajno nepogodna tla). Tla šuma su također prema navedenim normativima klasificirana u tri grupe i to: tla šuma za gospodarske namjene (Š1), tla šuma koja imaju zaštitnu ulogu u smislu konzervacije tla (Š2) i tla šuma posebne namjene - nacionalni parkovi, parkovi prirode i sl. (Š3).

U radu se iznose primjeri razvrstavanja tala za potrebe izrade prostornog plana Županije ličko-senjske, gdje je obveza izrada tematskih karata u mjerilu 1:100000 i na razini općine Lepoglava u mjerilu 1:25000, jer Zakon propisuje ta mjerila za vrednovanje tala na tim razinama.

Ključne riječi: klasifikacija tala, prostorno planiranje, Hrvatska

INTRODUCTION

Soil is an important natural resource and common wealth of each nation. Its use, protection and disposal are regulated by law in the Republic of Croatia. The problem of soil conservation and protection from non-agricultural use is present in all regions of Croatia. Hence, the conservation and protection of soil constitutes an unavoidable requirement of rational land management. About 6700 ha of agricultural land is lost in Croatia every year, which is a lot with respect to the overall area of the country, its population and proportion of agricultural soils. Statutory regulations highlight the need of conserving good agricultural land and preventing its permanent loss by construction of towns, roads, airports, harbours, sports facilities, exploitation of sand, stone, brick and pottery clay, surface excavations, and solid and liquid waste dumps.

Regulations pertaining to soil conservation and protection from unappropriate use have undergone many changes in the Republic of Croatia. The latest Agricultural Land Act (Official Gazette 66/2001) stipulates that any switch of the purpose of agricultural land into non-agricultural must comply with the spatial planning documents.

Cadastre capability evaluation of soil for this purpose has been abandoned in Croatia. Instead, soil classification for land documents is based on three categories that should be protected: S1 - highly valuable agricultural soils, S2 - valuable agricultural soils, and S3 - other agricultural soils. Other agricultural soils (pastures, meadows, low-quality plough-land, karst orchards and vineyards, etc.) are allotted to the category of other agricultural soils and forest soils (SF). Unfortunately, the guidelines do not provide the criteria for this classification.

Further, forest soils are evaluated on the basis of the forestry management and ecological or protective role of forests into categories: F1-forest soils for forestry management purposes, F2-forest soils where forests have a protective role in terms of conservation and prevention of erosion, and F3 -forest soils for special purposes, such as national parks, nature reserves, endemic forests, etc.

Since there are no statutory regulations on the method of classification for land evaluation (Bogunović et al., 1999, 2000 and 2001, Bogunović and Husnjak, 2000a and b, and Husnjak and Bogunović, 2001), the authors applied the basic elements of the FAO land classification, which was accepted as a

possible solution by the spatial planners. For this reason, two examples of land evaluation are given in further text: at the regional (county) level and at the municipality level (as the smallest spatial-political entity in our administrative system).

MATERIAL AND METHODS

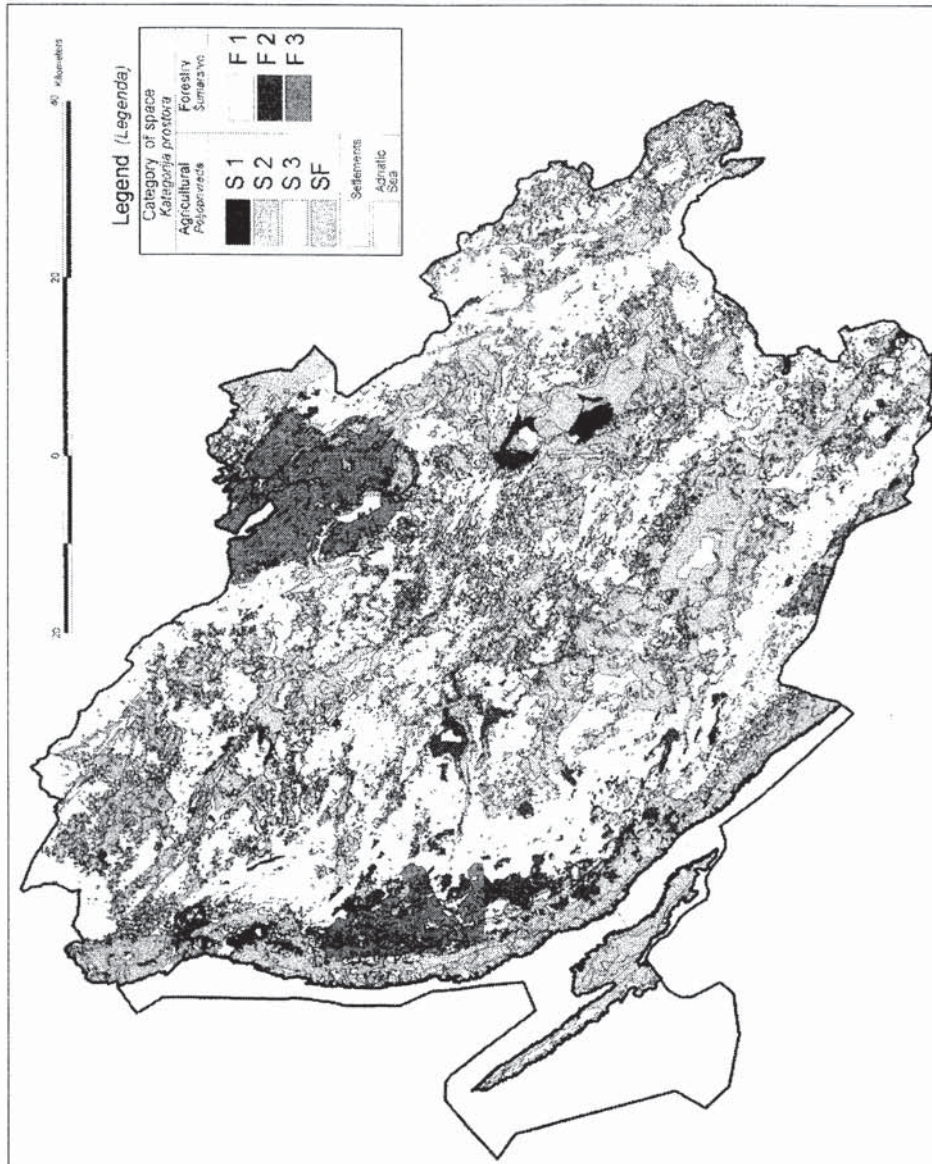
Classification is based on the data from the Basic Soil Map of the Republic of Croatia, scale 1:50000. The map is digitalized and is the basis for targeted interpretation and classification of soils. Forests are separated pursuant to military maps, scale 1:50000 and 1:25000. Manual digitalization with the CalComp digitalizer was applied initially, while maps scanned by Microstation program have been used lately. Criteria of agricultural land classification are applied in accordance with the FAO classification (1976), based on recommendations given by Brinkman and Smith (1972).

INVESTIGATION RESULTS

Investigation results and land classification for the needs of spatial planning are based on land information provided by the GIS technology. Pedological data were digitally processed using the ArcInfo program, and the data are suitable for detailed processing, quick retrieval and interpretation. Digital processing offers multiple options of using these data for various purposes. Thus, besides direct data for the needs of spatial planning, other data are also provided for their direct use for soil improvement and for future land use.

According to the original data and the results of the analysis of the Lika-Senj County, agricultural land, including degraded soils and pastures subject to overgrowing, accounts for 207189 ha or 39% of the total county area. Forests cover 327536 ha or 61% of the total county area. According to quality evaluation, agricultural soils have been classified into four categories for the needs of spatial planning. Their distribution is given in the enclosed reduced map of land suitability for agriculture, intended for spatial planning, Figure 1.

Figure 1. Land capability map for spatial planning of Licko senjska county
Slika 1. Bonitetna karta za prostorno planiranje Županije ličko-senjske



S1 category, the best soils classified by the Spatial Planning Act as highly valuable agricultural soils, covers only 5,656 ha or 2.7% of total agricultural land. This includes the best soils of this County, which cover only a part of Kravsko Polje with eutric cambisols in association with rendzinas and luvisols. Under the FAO land classification (1986); Brinkman and Smith (1972), these soils belong to the S1 land suitability class. Pursuant to the spatial planning standards, these soils should be strictly protected from being converted to other purposes.

S2 category, valuable agricultural soils, includes 16,322 ha or 7.9% of total area. These are mainly soils of other Karst fields, such as Gacko, the largest parts of Ličko and Kravsko, Koreničko, Lapačko, Otočacsko, Plaško, Gračacsko fields and the wider area of Sadilovac and Drežnik. This also includes the Isle of Pag syncline around the old Novalja. Several soil types are found here: from medium deep eutric cambisols to rendzina, luvisols, colluvial and other soils on quaternary and fluvio-glacial accumulations. This category is the second important in terms of prevention of soil conversion to non-agricultural purposes.

S3 category of other agricultural soils includes 58,153 ha or 28% of total agricultural land. These soils can be tilled despite their highest constraints in terms of acidity, depth, skeletal structure, slope, occurrence of erosion, drainage and stagnation of precipitation water. Typologically, the soils are: dystric cambisols, luvisols, calcocambisols, pseudogley and skeletal rendzina.

The fourth or *SF category, a combination of other agricultural and forest soils*, accounts for the largest part of the Lika-Senj County. It covers a total of 127,058 ha, or 61% of agricultural land. This fact is one of the reasons why the Lika-Senj County belongs to the poorest regions of our country. These are mountain soils covered with pastures, meadows, and less frequently abandoned plough-fields and small wild-growing forests. These soils are suitable for natural pasturing of bovine cattle and small stock.

Forest areas prevail in this County and occupy 60% of its total area. The largest part of forests or 83% are used for forestry management purposes (F1), 5.1% of forests have a protective function (F2), while special-purpose forests (F3) in national parks of the Plitvice Lakes, Paklenica and North Velebit cover 12% of the area, Table 1.

Table 1. Area categories of the Lika-Senj county according to land use
 Tablica 1. Površina kategorija prema načinu korištenja za Ličko-senjsku županiju

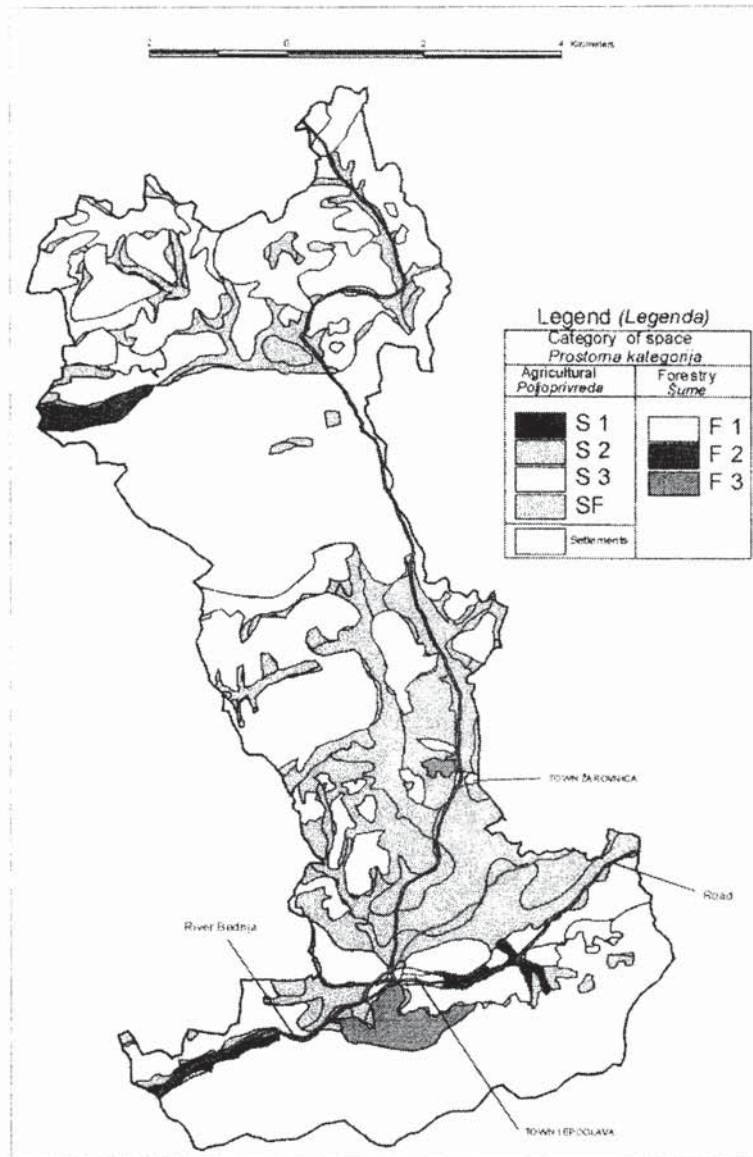
Area Category					
Agriculture			Forest		
Category	ha	%	Category	ha	%
S1	5656.3	2.73	F1	271421.8	82.87
S2	16322.1	7.88	F2	16772.5	5.13
S3	58152.8	28.07	F 3	39341.8	12.0
Total	80131.2	38.68	Total	327536.1	100
SF	127058.3	61.32			
Grand Total	207189.5	100			

The second example addresses land classification for the needs of spatial planning at the municipality level. The example involves the classification of soils in the municipality of Lepoglava. It is mandatory that soil classification should be based on a pedological sketch at a scale of 1:25000, where system units are presented independently or in associations. Naturally, also pedological investigations done for this purpose must comply with the standards for making soil maps at this scale. The map for this purpose (Figure 2) presents the distribution of soils in the municipality of Lepoglava at a reduced scale. Forests are separated on the map because they are, for the spatial planning purposes as already mentioned, divided into three categories according to their actual function. Table 2 shows, without comment, how this looks in the municipality of Lepoglava.

Table 2. Area categories of the municipality of Lepoglava according to land use
 Tablica 2. Površina kategorija prema načinu korištenja za općinu Lepoglava

Area Category					
Agriculture			Forest		
Category	ha	%	Category	ha	%
S1	59.0	2.11	F1	3505.0	96.63
S2	348.0	12.42	F2	64.0	1.78
S3	998.0	35.63	F3	58.0	1.59
Total	1405.0	50.16	Total	3627.0	100
SF	1396.0	49.84			
Grand Total	2801.0	100			

Figure 2. Land capability map for spatial planning of Lepoglava municipality
Slika 2. Bonitetna karta za prostorno planiranje općine Lepoglava



To conclude this part, it should be stressed that soil separation at the semi-detailed reconnaissance level (scale 1:100,000) does not provide sufficiently detailed data for the explicit need of defining the soil purpose. Therefore, the objection is addressed to spatial planners at the county level that the obligations arising from the primary spatial plans are not adequate for the needs of detailed defining of land use at the municipality level.

CONCLUSION

For the needs of spatial planning, agricultural and silvicultural areas in the Republic of Croatia are classified into seven (7) categories. Regulations for spatial planning for counties stipulate designing a pedological sketch at the semi-detailed reconnaissance level (scale 1:100000), while municipality plans should be made at a scale of 1:25000. Results from the Lika-Senj County point to the very small participation of highly valuable agricultural land of S1 category. Participation of valuable agricultural land of S2 category is somewhat higher as participation of agricultural land of S3 category. The highest participation of all is that of the category of other agricultural and forest soils (SF). This is in a way the common category for abandoned plough-fields subjected to overgrowing, pastures, forest soils and forests.

Classification of forests for forestry management purposes (F1), protective (F2) and special-purpose (F3) is strictly defined by legal and forest-management regulations and is not influenced by soil quality, however they may be used for all purposes. The same criteria are given for the production of maps and land classification at the municipality level.

LITERATURE

- Brinkman, R. and A. J. Smyth** (Eds.) (1972): Land evaluation for rural purposes. Summary of an Expert Consultation, Wageningen, The Netherlands, 6-12 October 1972. Int. Inst. For Land reclamation and Improvement, Wageningen, Publ. No. 17. Bogunović, M., Ž. Vidaček, S. Husnjak, M. Sraka, Mihalić Aleksandra (1999.): Bonitetno vrednovanje, zaštita i gospodarenje tlima Brodsko-posavske županije, Zavod za pedologiju Agronomskog fakulteta, Zagreb.

- Bogunović, M., S. Husnjak** (2000.a): Primjena GIS tehnologije na primjeru višenamjenskog vrednovanja prostora Brodsko-posavske županije. *Agronomski glasnik* 1-2, 55-69.
- Bogunović, M., S. Husnjak** (2000b): Evaluation of Land Brodskog Posavlja for Multipurpose use in GIS Tehnology. International Conference GIS Croatia 2000, Zagreb. Proceedings, pp 433-442.
- Bogunović, M., Ž. Vidaček, S. Husnjak, M. Sraka, Aleksandra Mihalić** (2000.): Višenamjensko vrednovanje zemljišta Karlovačke županije, Zavod za pedologiju, Agronomski fakultet, Zagreb, 142 str.
- Bogunović, M., S. Husnjak, I. Šimunić** (2001.): Vrijednosti tla u Lici. *Časopis Vila Velebita* br. 3 (95), str. 10-13.
- Husnjak, S., M. Bogunović** (2001): Possibility of Preparing Thematic Maps through Developing of the Geographic Information System (GIS). Proceedings of the 20th International Cartographic Conference, Beijing China, Vol. 3, pp 1581-1589.
- xxx FAO (1976): A framework for land evaluation. *Soil Bull.* No. 32, FAO, Rome and ILRI, Wageningen, Publ. No. 22.
- xxx Zakon o prostornom planiranju, N.N. 30/94.
- xxx Pravilnik o sadržaju, mjerilima kartografskih prikaza, obaveznim prostornim pokazateljima i standardu elaborata prostornih planova, N.N. 106/1998, Zagreb.
- xxx Zakon o poljoprivrednom zemljištu, N.N. 66/2001.

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