

THE DISTRIBUTION OF THE ECOLOGICAL SUITABILITY FOR GRAPE GROWING IN HUȘI WINE GROWING CENTRE, DEPENDING ON THE LOCAL VARIATION OF THE GEOMORPHOLOGICAL FACTORS

DISTRIBUȚIA FAVORABILITĂȚII ECOLOGICE PENTRU CULTURA VIȚEI DE VIE ÎN CENTRUL VITICOL HUȘI, ÎN FUNCȚIE DE VARIAȚIA LOCALĂ A FACTORILOR GEOMORFOLOGICI

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Abstract. *The paper presents the results of a study regarding the distribution of the geomorphologic factors' suitability for grape growing in Husi wine-growing centre - Husi vineyard. The research is based on a complex methodology that uses the satellite images, the GIS technology, the ecological evaluation system of the vineyards and the cartographic technique. The results shows that, regarding the geomorphologic suitability for grape growing, 48.1% of the Husi wine-growing centre area has ecological potential for white table wines, sparkling wines and distilled from wine, 35.8% for high quality white wines and red table wines, and 14.3% for high quality red wines and aromatic wines.*

Key words: grapevine, vineyard, environmental factors, solar radiation, GIS.

Rezumat. *În lucrare sunt prezentate rezultatele unui studiu privind distribuția spațială a favorabilității factorilor geomorfologici pentru cultura viței de vie în centrul viticol Huși-podgoria Huși. Cercetarea folosește o metodologie complexă, care implică utilizarea imaginilor din satelit, prelucrarea acestora cu ajutorul tehnologiei GIS, evaluarea favorabilității factorilor geomorfologici cu ajutorul unui sistem de bonitare ecologică și cartografierea distribuției spațiale a favorabilității factorilor în cadrul arealului. Rezultatele relevă faptul că, din punct de vedere a favorabilității factorilor geomorfologici, 48.1% din suprafața centrului viticol Huși prezintă potențial ecologic pentru producerea vinurilor albe de masă, vinurilor materie primă pentru spumante și vinurilor materie primă pentru distilate învechite din vin, 35.8% pentru producerea vinurilor albe de calitate și roșii de masă, 14.3% pentru producerea vinurilor roșii de calitate și vinurilor aromate.*

Cuvinte cheie: vița de vie, podgorie, factori ecologici, radiație solară, SIG.

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INTRODUCTION

Researches whose results are presented in this paper are part of a broader study, whose goal is to create the map of environmental suitability for the grapevine cultivation in Husi vineyard. The study is based on a new, modern methodology, that use *Geographic Information Systems* (GIS), tools of informational technology recently introduced in viticulture research (Pythoud K., 2006). Husi vineyard center analysis shows that GIS-based methodology provides a detailed image of local variation of ecological factors in the vineyard area and, moreover, allows to set the map of the spatial distribution of environmental suitability for the grapevine in a vineyard (Irimia L.M, Patriche C.V., 2010, 2011).

MATERIAL AND METHOD

The study started from the satellite image of Husi vine growing centre. Based on this image was developed the digital elevation model (DEM), that was then resampled from the original 90m resolution to 10m, by bilinear interpolation, to render appropriately the surface configuration (SRTM - USGS, 2004). Digital elevation model was used to derive land slopes and exhibition. The suitability of slope gradient and orientation were evaluated using the system of ecological evaluation of vineyards (Irimia L. et al., 2009). The influence of these two geomorphologic factors was assessed by evaluation notes and plotted on the map of the vineyard area by suitability classes.

RESULTS AND DISCUSSIONS

Husi vineyard center has an area of 2139 hectares and includes the vineyards and the potential vineyard lands from *Rusca, Schit, Ochi, Dobrina, Lohan, Corni, Dric, Recea, Galbena* (Figure 1). The landscape is represented by hills with an altitude of 80-400 m and slopes with slope of 16-39%, affected by erosion and stabilized landslides. Plantations are established on the slopes of the natural amphitheater that surround the Husi town and on the hills that make the transition to east, from the amphitheater to the valley of the Prut River.



Fig. 1 - Satellite image of Husi wine-growing centre

Local variation of geomorphologic factors in Husi wine-growing centre.

The arrangement of hills that form the amphitheater Husi (*Lohan* to north, northeast and northwest, *Dobrina* to west, *Schit* to south) and un-uniformity of their slopes causes a significant local variation of the slopes orientation and slope inclination.

Slopes orientation. In relation to the climatic characteristics of this region, placed at the northern limit of the wine-growing areas, and so scarce in heliothermic resources, the slopes range from very suitable (S, SE, SW), up to bad (NW, NE) and unsuitable (N) for grape-growing (Figure 2a).

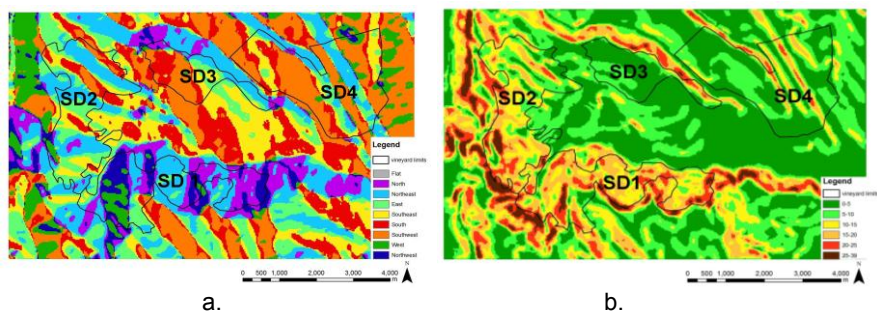


Fig. 2 - Spatial distribution of slope orientation (a) and slope gradient (b) in Huși wine-growing centre, Husi vineyard

In relation to the suitability of slopes orientation for grape growing, in Husi wine-growing center were identified four areas with different ecological characteristics:

- **SD1** area, with a surface of 554.3 ha, where slopes exhibit predominant (77.74%) is N NE and NW. This area includes *Rusca*, *Schit* and *Ochi* lands;

- **SD2** area, with a more balanced distribution of the slopes orientation: 34.33% with S, SE and SW orientation; 27.48 % with E and V orientation; 37.77 % with N, NW and NE orientation. This surface area is 570.69 hectares and includes lands *Dobrina*, *Lohan* and *Corni*

- **SD3** area with 264.42 hectares and predominantly (62.10%) S, SE and SW orientation of the slopes. This area includes *Dric* land, located in the NE of the center Husi vineyard;

- **SD4** area, that has the most favorable exposition of slopes: 70.27% of area has S, SE and SW orientation. This area covers an area of about 749.7 hectares and includes lands *Recea* and *Galbena*.

Slope inclination is extremely variable, with values between 0 and 39% (Figure 2b). In **SD1** more than half of the area (56.60%) is represented by slopes with a 15-39% inclination. In the **SD2** subdivision the slope is more favorable for grapes, the slopes with middle inclination, by 10-15%, totaling 53.78%. In the **SD3** subdivision predominate (60.34%) flat terrain, favorable for productive varieties. In **SD4** subdivision, that includes *Recea* and *Galbena* lands, has 50.76% flat terrains and 42.69% middle inclination slopes.

The spatial distribution of suitability classes for the slopes orientation and slope inclination. The suitability of these two factors for the cultivation of vines was evaluated using *ecological system of evaluation of vineyard areas* (ESEV) and mapped through GIS technology.

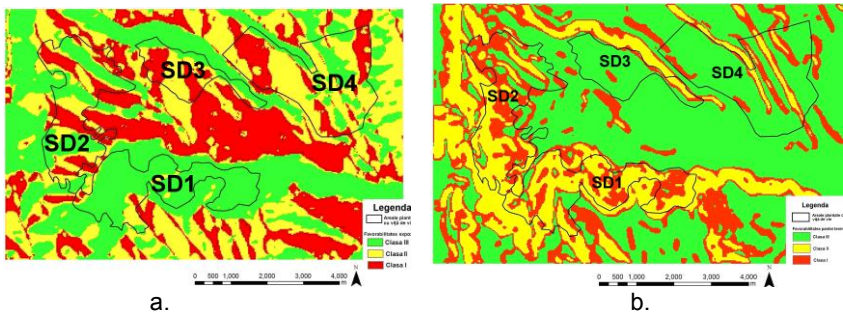


Fig. 3 - Spatial distribution of suitability classes for slopes orientation (a) and slopes inclination (b) in Huși wine-growing centre – Huși vineyard.

Distribution of classes of favorability for slopes orientation (Figure 3a). According to *ecological system of evaluation of vineyard areas*, the I suitability class includes S and SE slopes, II class includes E and SW slopes, and III class includes W slopes. In Husi growing center 42.8% of the area (917.5 hectares) falls into class III of favorability, 35.1% (750 ha) in II class and 22% (470 ha) in I class (Table 1). The worst is the SD1 area (*Rusca, Schit, Ochi*) with 87.3% of the area included in III suitability class, and the most favorable SD3 area (*Dric land*) with 33.96% of the surface included in the I suitability class.

The less favourable for grapevine is SD1 area (*Schit, Rusca* and *Ochi* lands), with 87.3% of surface included in the third class of ecological suitability, and the most favorable SD3 area (*Dric land*), with 33.96% of surface included in the first class of ecological suitability.

Table 1

**The spatial distribution of suitability classes for slopes orientation
in Husi wine-growing centre**

Ecological suitability	SD1		SD2		SD3		SD4		TOTAL	
	ha	%	ha	%	ha	%	ha	%	ha	%
Third class (III)	483.9	8.3	227.1	39.8	62.6	23.6	143.8	19.1	917.5	42.8
Second class (II)	57.96	10.4	178.9	31.3	111	42.3	402.1	53.6	750.9	35.1
First class (I)	12.42	2.24	164.6	28.8	89.8	33.9	203.7	27.1	470.6	22.0
Total	554.3	100	570.6	100	264	100	749.7	100	2139	100

The distribution of the suitability classes for slopes inclination (Figure 3b). 45.6% (977.2 ha) from Huși wine-growing area fit in to the third suitability class (III); land of second class and first class have equal weight, approximately 27% of the total (Table 2).

Table 2

The spatial distribution of suitability classes for the slopes inclination in Husi wine-growing centre

Ecological suitability	SD1		SD2		SD3		SD4		TOTAL	
	ha	%	ha	%	ha	%	ha	%	ha	%
Third class (III)	46.4	8.37	131	23.0	228.0	86.2	571	76.1	977.2	45.6
Second class (II)	313	56.6	202	35.4	13.05	4.93	48.9	6.53	578.4	27.0
First class (I)	194	35.0	236	41.4	23.31	8.81	129	17.2	583.4	27.2
Total	554	100	570	100	264.4	100	749	100	2139	100

The spatial distribution of geomorphological factors suitability for vines in Husi wine-growing center. 48.1% of the land planted with vines in Husi wine-growing center fall in terms of geomorphological factors favorability in the third (III) suitability class (Table 3).

Table 3

The spatial distribution of the suitability of geomorphological factors in Husi wine-growing centre

Ecological suitability	Nota	SD1		SD2		SD3		SD4		TOTAL	
		ha	%	ha	%	ha	%	ha	%	ha	%
Third class	5	28	5.0	25	4.5	34	12	86	11	174	8.1
	6	293	52	150	26	117	44	315	42	876	40
Second class	7	180	32	156	27	105	39	225	30	668	31
	8	26	4.8	54	9.6	0	0	22	2.9	104.1	4.8
First class	9	24	4.4	120	21	7.8	2.9	91	12	244.2	11.0
	10	0.8	0.1	62	10	0	12	8.0	11	70.8	3.3
Total	-	554	100	570	100	264	100	749	100	2139	100

The least favorable for vine cultivation is **SD1** area (*Schit*, *Rusca* and *Ochi* lands), where the northern slopes orientation, limiting for the vines, is associated with higher slopes inclination, that require terracing (Figure 4). Land from second suitability class that have the potential to produce white and red table wines, represents 35.8% of the area. Land in first class of geomorphologic suitability and appreciated by 9-10 points, represent only 14.3% from the total Huși wine-growing area (Table 3). The most favorable for grape-growing are **SD2** (with 31.9% of surface in the first class of of geomorphologic suitability) and **SD4** (with 23.6% surface in the first class of geomorphologic suitability).

CONCLUSIONS

1. 48.1% of the Husi wine-growing area fall, in terms of geomorphologic suitability, in the third class, that reveals the ecological potential for *white table wines*, *sparkling wines* and *wines for distillates*.

2. 14.3% of the Husi wine-growing area enter, in terms of geomorphologic suitability, in the first class, that indicate the ecological potential for *white quality wines*, *red quality wines* and *aromatic wines*.

3. The most favorable for the wine varieties is **SD2** area, that includes *Dobrina* and *Lohan* lands, 31.9% (182.61 ha) from its surface being represented, in terms of geomorphologic suitability, by terrains from the first class of suitability.

4. Unfavorable for wine grapes varieties is SD1 area, that includes *Schit*, *Rusca* and *Ochi*, where 57.98% (321.8 ha) from the surface is represented by terrains from the third class of suitability.

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