

THE GEOMORPHOLOGY OF THE CURVATURE SUB-CARPATHIANS BASED ON DATA FROM FOREST MANAGEMENT PLANS

Cristiana Marcu^{1*}, Lucian Constantin Dincă²

¹ “Marin Drăcea” National Institute for Research and Development in Forestry, Voluntari, Romania

² “Marin Drăcea” National Institute for Research and Development in Forestry, Brasov, Romania



Abstract

The geomorphology of a vast territory can be analyzed based on data from forest management plans as these characterize the part of a territory occupied by forests. In addition, these plans are extremely detailed for small surfaces, on only a few hectares. Based on these aspects, the present article studies the geomorphology of the Curvature Sub-Carpathians by considering a large number of data from forest management plans realized for state forests located in this area. The data includes relief, field configuration, field aspect, slope and altitude. Field configuration is 90% undulated, while the average altitude is of 600 m. The slopes range between 20° and 30°, amounting to 70%, while the ones larger than 40° represent 6% of the studied territory in Pascov (604 ha), Vintilă Vodă (422 ha), and Cislău Forest Districts (400 ha).

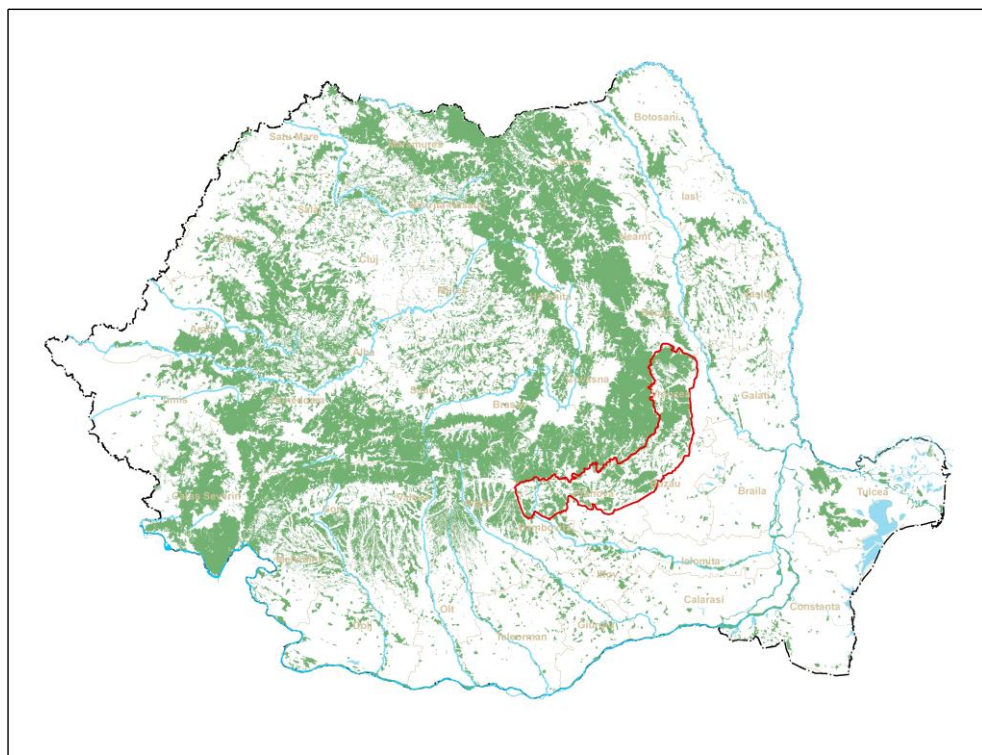
Keywords: altitude, field aspect, forest management plans.

1. INTRODUCTION

The Curvature Sub-Carpathians are located in the central-southeast part of Romania, in the Sub-Carpathians' medium sector, between Dâmbovitei and Trotusului Valleys. The interior margin differentiates them from the Curvature Carpathians, while the Romanian Plain borders them on the exterior (Figura 1). The maximum altitude is of 996 m in Magura Odobesti, while the minimum altitude is under 100m, at the contact with the Romanian Plain. On average, the altitude reaches 500m. The Curvature Sub-Carpathians are a relatively new unit, their evolution being strongly connected to the Carpathian's evolution. As such, they were formed during the last folding phases from the Alpine orogenesis, during the Neozoic. The structure is much folded, presenting a succession of synclines and anticlines. This structure, in two bands under the shape of concentric arches, generates two geomorphologically distinct areas: the internal Sub-Carpathians and the external Sub-Carpathians (Ielenicz, M et al 2003). The climate is temperately continental, while the geographic position allows the presence of arid east influences, transition influences and relief fragmentation. The depressions play a shelter role, both toward the west circulation as well as against the Crivitz from northeast. An increase in temperatures is recorded during spring, as a result of the foehn phenomenon which infiltrates from the depression areas. As such, the area has a hill climate, characterized by average temperatures of 6-10°C, precipitations of 600-800 mm/year and even over 800mm/year on high hills. The East Wind, with a steppe character is representative for

this area. Crivitz appears during the cold season, coming from East or Northeast (Velcea, V. 1982). The main vegetation under 500 m altitude is represented by sessile oak, Hungarian oak, Turkish oak and pedunculate oak in the inferior part, while holm appears in the superior part. Other broad-leaved species are also present: hornbeam, elm, and linden. The oak-common beech level is present between 500-700m, while the common beech level appears at over 700 m. The azonale vegetation from around valleys is composed of: cane, reed, sedge and clusters of willow, poplar and alder. Forests from this area are an important source for mushrooms (Dincă et al., 2011), medicinal plants (Vasile et al., 2015), forest fruits (Constandache et al., 2016), game species (Ciontu et al., 2018), and non-wood forest products (Tudor et al., 2019).

The soils are strongly connected to the rock material, climate and vegetation (Târziu et al., 2002; Spârchez et al., 2013). As such, Luvisols are present and favoured by the cold and humid climate. The presence of common beech forests favours eutric cambisols (Spârchez et al., 2017) and dystric cambisols (Edu et al., 2013). Podzol (Spodosols) can be found on the highest hills, while Hydromorphic soils develop in depressions. Halomorphic soils are present near salty springs, while fluvisols are located in meadows. These soils are favorable for the development of forest vegetation (Enescu et al., 2019; Oneț et al., 2019; Crișan et al., 2020).



*Figure 1. Romania – Curvature Sub-Carpathians
(Forest Map of Romania Based on Forest Ecosystem Types)*

2. MATERIALS AND METHODS

This study uses data from forest management plans realized for state forests located in the Curvature Sub-Carpathians (managed by RNP Romsilva). As such, data from 10 forest districts

were analysed, leading to a vast database that ensures a good statistic representability of results. The total surface occupied by stands from this area is of 87.605 ha.

The calculations and graphics were realized in Excel.

The following elements were analysed: relief category, field configuration, field aspect, field slope and altitude.

3. RESULTS AND DISCUSSIONS

As it was expected, the relief from the Curvature Sub-Carpathians is by far a slope relief (over 90%) (tab.1). Slopes are also characteristic for the Southern Carpathians (Dincă et al., 2020a) and Banatului Mountains (Dincă et al., 2020b).

Table 1. Relief categories from the Curvature Sub-Carpathians

Relief category	Surface (ha)
High meadow	13.9
Low plain	7.3
Average plain	6.2
Slope	59120.5
Inferior slope	4196.8
Average slope	17664.9
Superior slope	6091.8
Chine	13.3
Plateau	49.9
Terrace	275.5
Gully	153.3
Valley bottom	12.3

Field configuration in the forest area is mainly rippled, while fragmented fields occupy 20% of this area and plain fields only 1% (fig. 2).

As it can be observed, stands are distributed based on the field aspect (figure 3), with a more concentrated distribution of stands on the south, southwest and east direction. All these aspects are strongly correlated with the slopes' field aspect.

The field slope of forests located in the Curvature Sub-Carpathians is rendered in Figure number 4. Most forests are located on fields with the following slopes: 20%, 30% and 40%. However, numerous fields have intermediary slopes (32%, 28%, 38% etc), a fact that proves that the actual field slope was recorded.

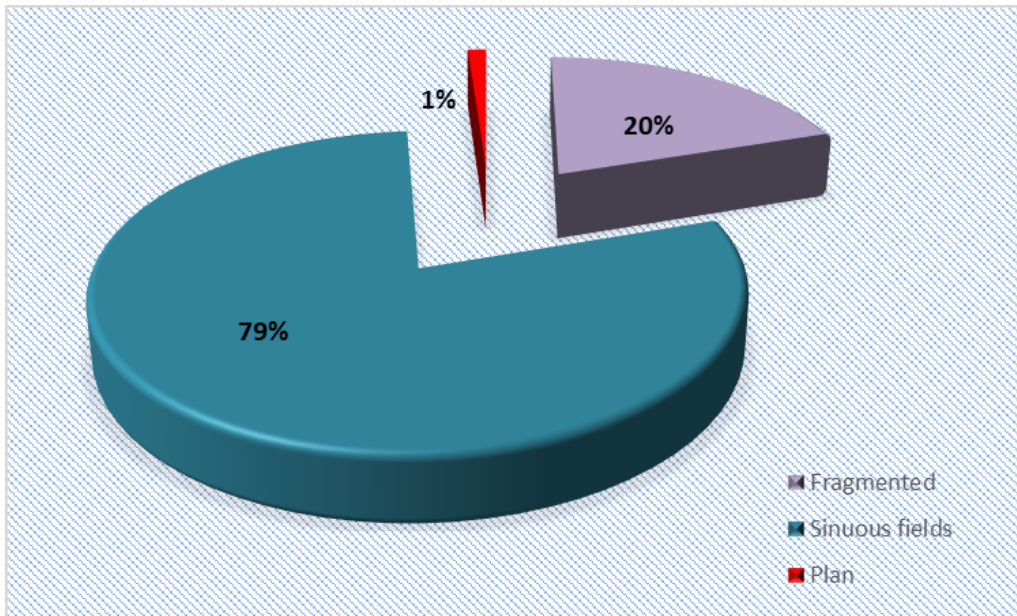


Figure 2. Field configuration in the Curvature Sub-Carpathians

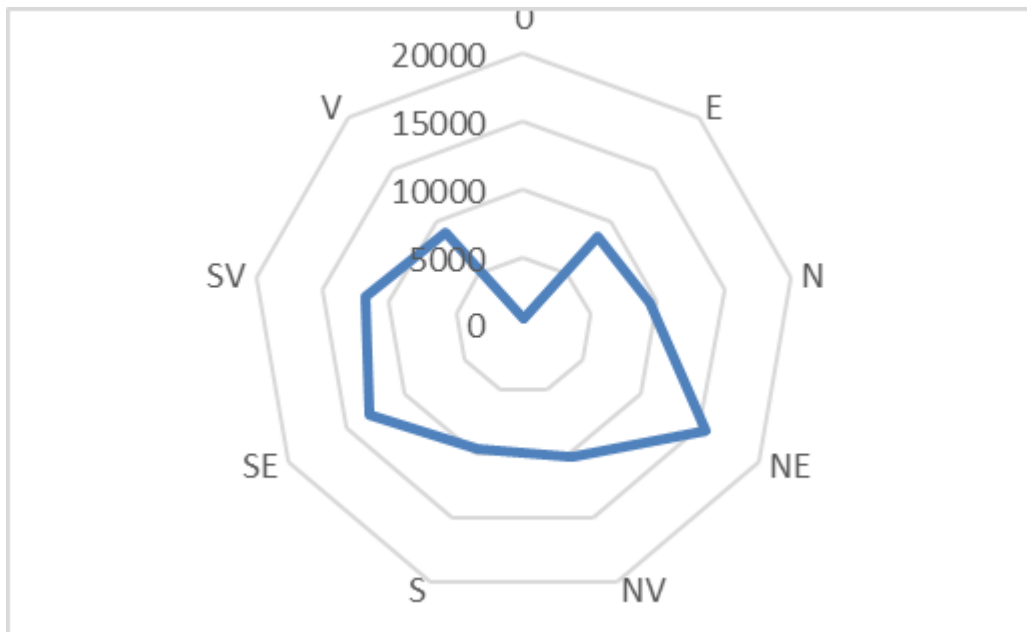


Figure 3. Field aspect in the Curvature Sub-Carpathians

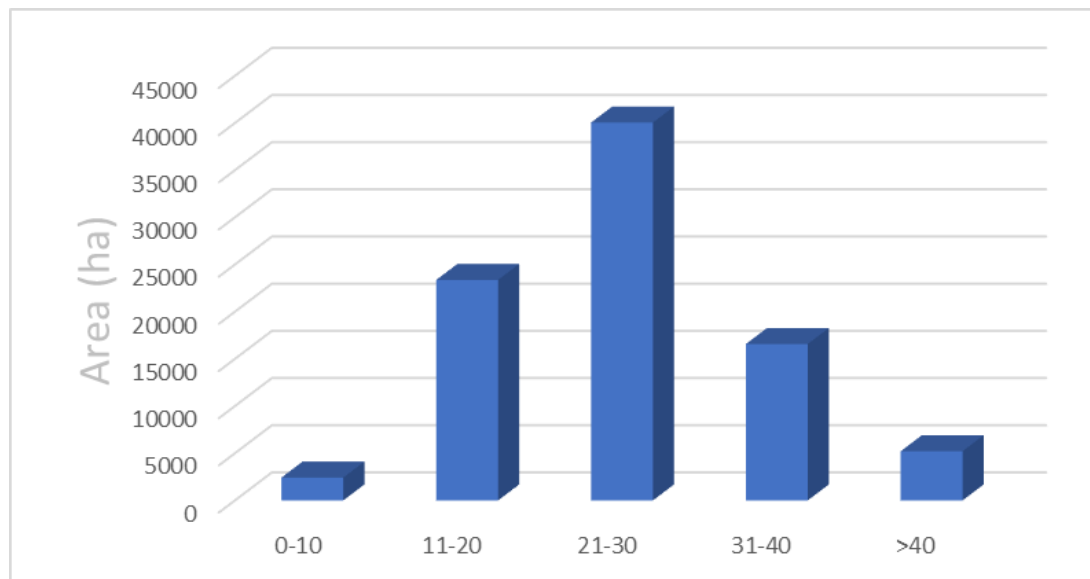


Figure 4. Field slopes in the Curvature Sub-Carpathians

On slope categories, the situation is as follows (tab. 2):

Table 2. Slope categories from the Curvature Sub-Carpathians

Surface (ha)	Slope (°)				
	0-10	11-20	21-30	31-40	>40
	2416	23.366	40043	16.572	5.208

The most representative slopes range between 20° and 40°, while small surfaces are identified for fields with large slopes. A similar situation is also present in the Southern Carpathians (Dincă et al., 2020c)

Fields with very big slopes (>40°) occupied by forests in this Carpathian chain are present in the following forest districts: Pascov (604 ha), Vintilă Vodă (422 ha), and Cislău (400 ha).

Trees installed on slopes with an inclination of 30° represent the largest percentage (fig. 3). In regard with the distribution of field on slope categories, a good correlation can be observed between it and the surfaces occupied by forest vegetation. The largest percentage of trees is found in the 30° and 25° range, correlated with the 21-30° slope, followed by the stands situated on slopes with a 40° inclination.

The altitudes where forests are present in the Curvature Sub-Carpathians range from 190 m up to 996. Their average is represented by 590 m.

The most representative altitudes are rendered in Figure number 5.

Most stands are situated at 300-700 m. The largest surfaces with altitudes over 900 m are recorded in Văleni (1987 ha), Cislău (1632 ha), Dumitrești (1466 ha), Vintilă Vodă (1268 ha) and Vidra Forest Districts (757 ha).

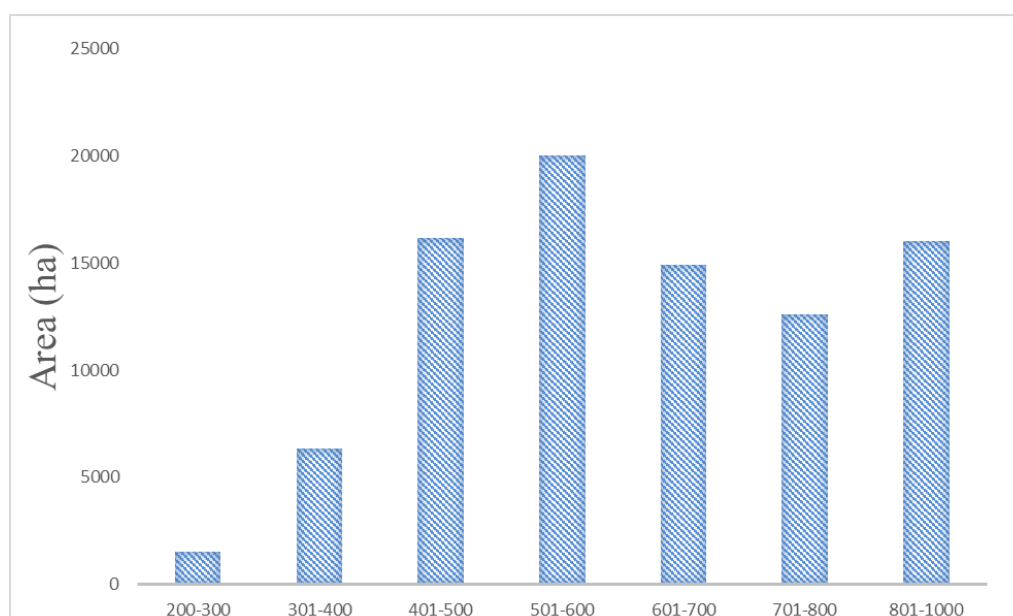


Figure 5. Altitude in the Curvature Sub-Carpathians

4. CONCLUSIONS

Parcel descriptions from forest management plans include a geomorphological characterisation of fields on small surfaces (a few hectares). Their cumulative analysis allows for appreciating a field's geomorphology on a large scale.

A south, southeast arrangement can be seen from a field aspect point of view. The ten forest districts from the Curvature Sub-Carpathians have small slope surfaces with an inclination of more than 40°. A considerable forest percentage is situated in areas with 20°- 30° slopes. Soils are strongly connected to the rock material, climate and vegetation, and for this study they are mainly luvisols, followed by eutric cambisols and dystric cambisols. Podzols are present on hills, hydromorphic soils develop in depressions, halomorphic soils are identified in areas with salty springs, while fluvisols are present in meadows.

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