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MOUNTAIN AREA CHARACTERIZATION BASED ON DEM AND SLOPE BY REMOTE SENSING

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Abstract:

Remote sensing is very useful in the study and characterization of terrestrial areas based on satellite images and specific indices. The present study aimed to characterize an area using remote sensing facilities. The study considered ATU Lupsa, Alba County, Romania, an area with mountainous area specificity. DEM (Digital Elevation Model) and SLOPE parameters were used to analyze and characterize the area considered in the study. Land areas with different soil types were identified in terms of texture, Clayey loam texture (CLt), Clay texture (Ct), Sandy clay texture (SCt), Sandy loam - clayey texture (SLCt), and Varied texture (Vt). The studied area was classified based on DEM and SLOPE parameters into ten classes. Multivariate analysis (PCA, CA) was used to explain the variance in the results set and the correlation of DEM and SLOPE classes with soil types. In the case of the DEM parameter, PC1 explained 57.044% of variance, and PC2 explained 25.803%. In the case of the SLOPE parameter, PC1 explained 41.406% of variance, and PC2 explained 37.572% of variance. Cluster analysis (CA) grouped the DEM (Coph.corr. = 0.982) and SLOPE (Coph.corr. =0.781) classes based on similarity. The highest level of similarity in the case of DEM was recorded between classes DC4 and DC5, with the SDI value = 60.28, and in the case of SLOPE it was recorded between classes SC4 and SC5, with the SDI value = 99.87. The recorded results provide important information for management decisions for the area considered.

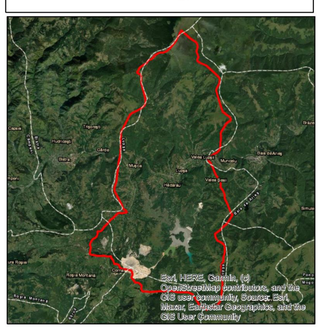
• Introduction

DEM and SLOPE data have been used in land characterization, classification, clustering and segmentation studies to highlight land conditions, stability and vulnerability areas.

The present study aimed to characterize a mountainous area, represented by ATU Lupsa, Alba County, Romania, based on DEM and SLOPE parameters generated through remote sensing technique.

• Material and method

The study area was represented by ATU Lupsa, Alba County, Romania. ATU Lupsa is located in Alba County, in the historical region of Transylvania, Romania. The commune includes 23 villages in its administrative structure: Bârdești, Bârzan, Curmătură, După Deal, Geamăna, Hădărău, Holobani, Lazuri, Lunca, Lupșa, Mănăstire, Mărgaia, Mușca, Pârâu-Cărbunări, Pițiga, Poșogani, Șasa, Trifești, Văi, Valea Holhorii, Valea Lupșii, Valea Șesii și Vința.



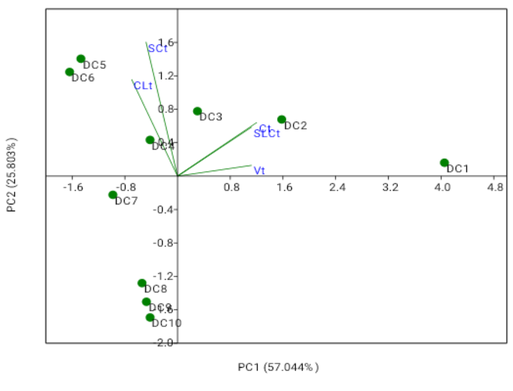
• Results and discussions

The analysis of the study area based on DEM and SLOPE parameters, corroborating the surface occupied by different soil types by textural class (CLt, Ct, SCt, SLCt, and Vt) resulted in the surface data (ha) presented in table 1 (DEM parameter classes) and table l2 (SLOPE parameter boxes).

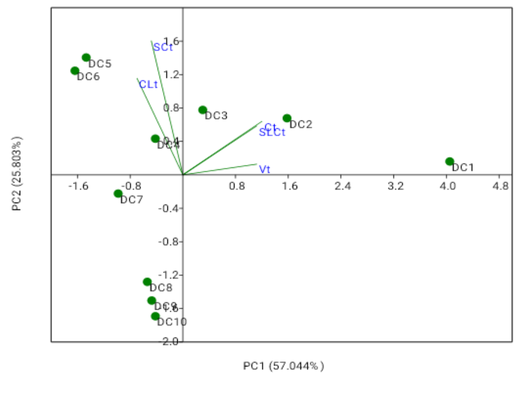
DEM Class	CLt	Ct	SCt	SLCt	Vt	Area
	(ha)					
DC1	0	186.08	292.13	268.54	458.29	1205.04
DC2	0	99.2	1082.94	300.99	39.19	1522.32
DC3	0	69.31	1551.11	143.9	0.22	1764.54
DC4	0.46	42.78	1547.92	37.93	0	1629.09
DC5	19	23.53	1509.44	0	0	1551.97
DC6	20.63	5.95	1373.73	0	0	1400.31
DC7	6.45	0	977.26	0	0	983.71
DC8	0	0	492.05	0	0	492.05
DC9	0	0	322.35	0	0	322.35
DC10	0	0	179.92	0	0	179.92
Grand Total	46.54	426.85	9328.85	751.36	497.7	11051.3

SLOPE Class	CLt	Ct	SCt	SLCt	Vt	Area
	(ha)					
SC1	0	55.44	197.11	92.13	269.88	614.56
SC2	0.82	47.54	730.15	140.04	40.12	958.67
SC3	1.93	51.76	1358.24	185.36	26.9	1624.19
SC4	4.44	44.93	1612.74	163.03	21.95	1847.09
SC5	6.11	43.86	1534.96	100.46	24.33	1709.72
SC6	8.49	51.7	1333.18	47.79	24.43	1465.59
SC7	11.57	47.94	1109.62	16.36	22.8	1208.29
SC8	8.53	38.39	792.75	4.16	26.14	869.97
SC9	4.14	30.17	497.19	2.03	24.28	557.81
SC10	0.51	15.12	162.91	0	16.87	195.41
Grand Total	46.54	426.85	9328.85	751.36	497.7	11051.3

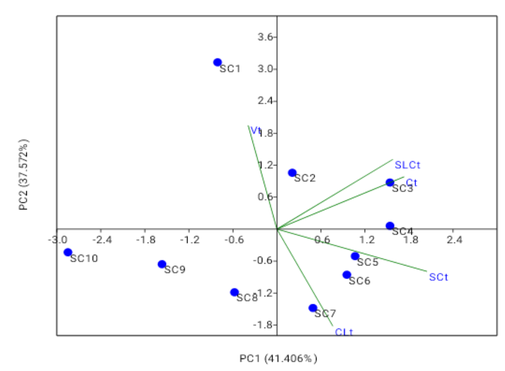
PCA diagram in relation to DEM parameter



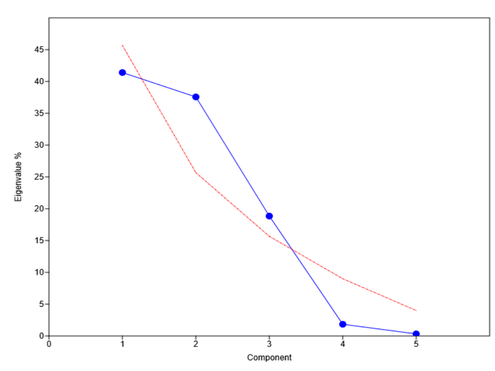
Graphical representation of the Component – Eigenvalue interaction in the case of DEM classes



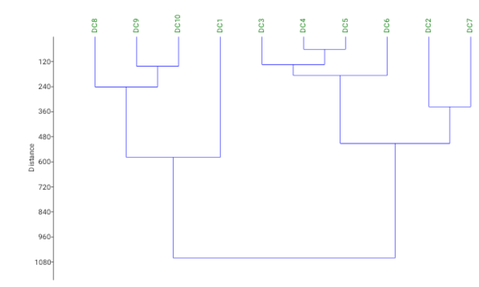
PCA diagram in relation to the SLOPE parameter



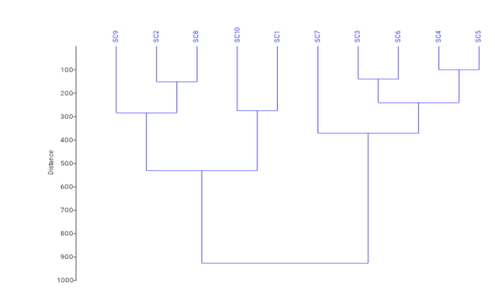
Representation of the Component Eigenvalue interaction in the case of SLOPE classes



. Cluster dendrogram for DEM parameter



Cluster dendrogram for the SLOPE parameter



• Conclusions

- Multivariate analysis (PCA) explained the variance in the experimental dataset and showed the correlation of DEM and SLOPE classes with soil texture types across the land surfaces recorded in the study area.
- Cluster analysis grouped the DEM and SLOPE classes based on similarity, in relation to the land surfaces or soils of a certain texture, classified in each class.
- The results provided by this study recommend the development of research for the area considered, the diversification of characterization indices, in order to provide information and solutions for management decisions.