Figure S1: The lithostratigraphic map legend adopted and translated to Englih from Geological Map of mainland Portugal at 1:1 000 000 scale produced by the National Laboratory of Energy and Geology [58, 59, 62]. The original can be found in https://geoportal.lneg.pt/media/p4wft3w5/cgp1m_2010.pdf.(accessed on 22 of May of 2023).

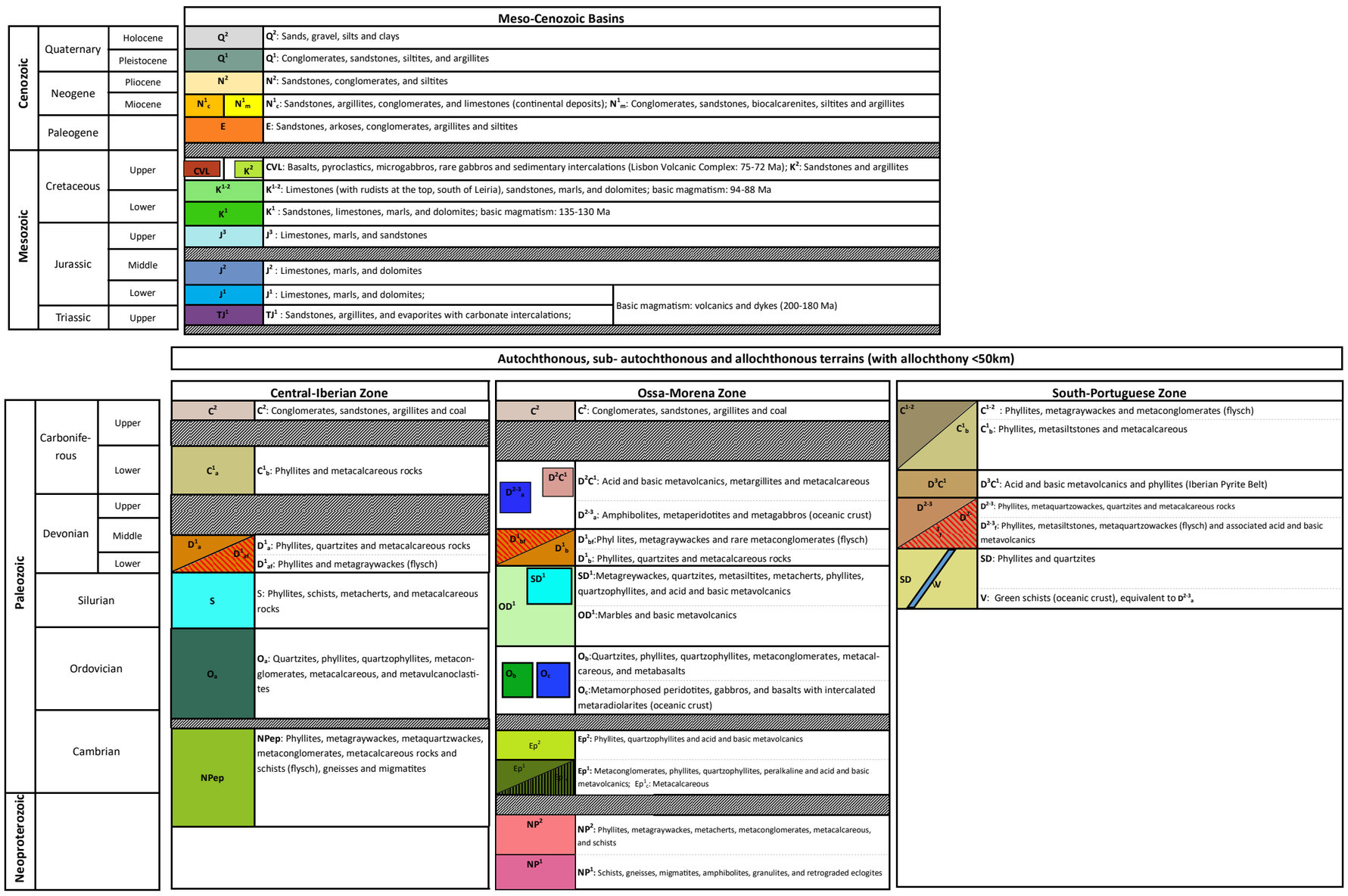


Table S1: Summary of number of features representing lithology (Singlefeature and Multifeature) per Age and per Geotectonic Zone and correspondent Area, used to assess the lithological diversity of mainland Portugal. Source: Geological Map of Portugal at 1:1 000 000 scale [59].

Geotectonic Zone	Age	Multifeature (nº)	Singlefeature (nº)	Area (Km^2)
Meso-Cenozoic Basins	Holocene	1	115	3986.9
	Pleistocene	1	188	2191.8
	Pliocene	1	173	6628.1
	Miocene	2	151	4463.9
	Paleogene	1	115	2903.5
	Upper Cretaceous	1	25	165.0
	Upper Cretaceous	1	26	436.9
	Lower Cretaceous	1	38	466.7
	Cretaceous	1	59	1199.8
	Upper Jurassic	1	43	2690.2
	Middle Jurassic	1	40	1000.9
	Lower Jurassic	1	45	669.4
	Upper Triassic to Lower Jurassic	1	46	544.5
	100-72 Ma	2	8	38.5
Total	13	16	1072	23399.2 (28%)
Central-Iberian Zone	Lower Carboniferous	1	1	17.1
	Lower Devonian	2	16	379.5
	Silurian	1	42	401.3
	Ordovician	1	93	1761.9
	Ediacarian to Cambrian	1	96	10782.8
	320-310 Ma	2	119	6284.9
Total	6	8	367	19627.5 (23%)
Central-Iberian Zone and Ossa-Morena Zone	Upper Carboniferous	1	12	68.0
	490-470 Ma	4	68	1190.3
	310-290 Ma	6	153	12507.8
	360-310 Ma	1	23	1151.5
Total	4	12	256	14917.6 (18%)
Galicia-Trás-os-Montes Zone	Silurian-Devonian	2	11	343.0
	Ordovician to Devonian	6	68	5076.0
	Proterozoic-Cambrian	4	18	387.1
Total	3	12	97	5806.1 (7%)
Ossa-Morena Zone	Middle Devonian to Lower Carbonic	2	7	196.5
	Lower to Middle Devonian	1	3	319.3
	Lower Devonian	1	9	36.9
	Ordovician to Lower Devonian	1	14	425.9
	Upper Ordovician to Lower Devonian	1	43	1945.1
	Ordovician	2	30	728.7

	Upper Cambrian	1	21	1279.2
	Lower Cambrian	2	31	692.1
	Neoproterozoic	2	64	1967.5
	360-310 Ma	2	62	2175.9
	310-290 Ma	2	10	534.0
Total	11	17	294	10301.1 (12%)
South-Portuguese Zone	Lower Carboniferous	1	2	44.9
	Carboniferous	1	21	7064.6
	Upper Devonian to Lower Carboniferous	1	30	652.1
	Middle Devonian to Lower Carbonic	2	35	855.1
	Upper Silurian to Lower Devonian	2	12	932.7
Total	5	7	100	9549.3 (11%)
Intrusive and phyllonian magmatic rocks	100-72 Ma	1	3	78.3
	230-72 Ma	1	20	48.3
Total	2	2	23	126.6 (0%)
Soma(Total)	44	74	2209	

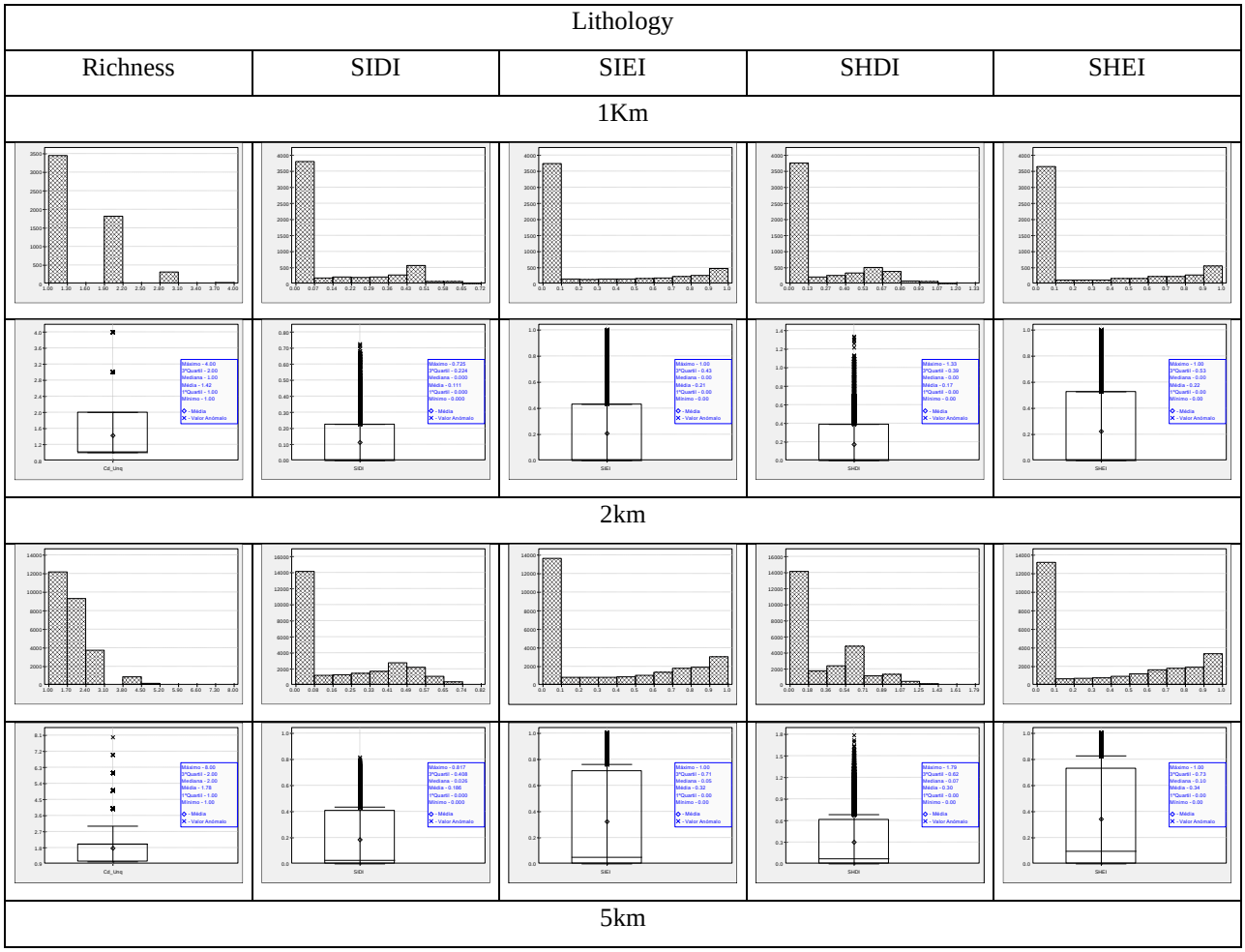
Table S2: Summary of classes and number of features per class within the distinct hierarchical levels of information. Number of classes (NC) and number of features per class (NF), used to assess the geomorphological diversity of mainland Portugal. Total number of features: 686. Source: geomorphological units map of mainland Portugal at 1:500 000 scale (Figure. 2b).

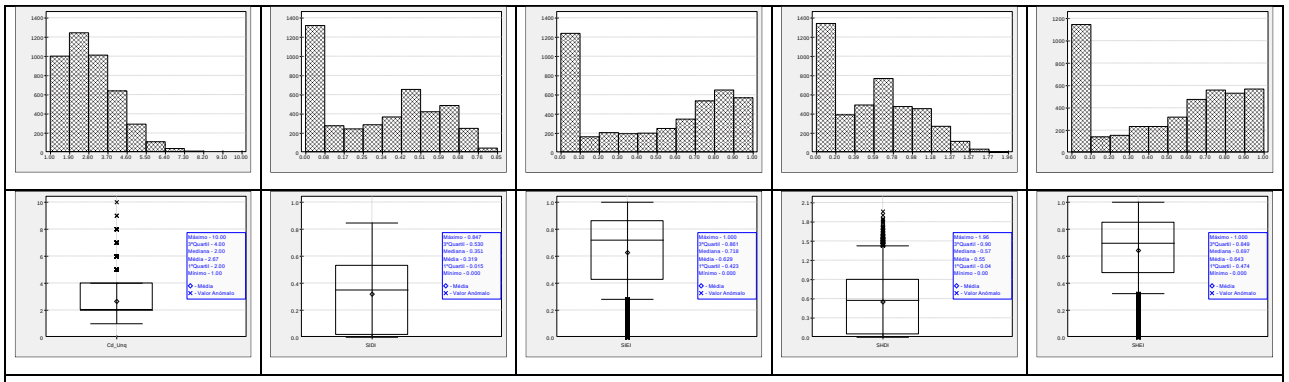
First Level: 4 classes	**Second Level: 12 classes**				
classes	**classes**		**NF**	**NC3**	
1 Hesperian Massif	1.1	NW Iberian Plateaus and Mountains	**259**	24	**Third level: 72 classes (686 forth level features)**
	1.2	Central Mountain Range	25	3	
	1.3	SW Iberian Plateaus and Hills	138	15	
2 Slightly deformed Mesozoic Basins	2.1	Lusitanian Basin	68	14	
	2.2	Algarve Basin	7	2	
3 Cenozoic Basins	3.1	Lima, Cávado and Douro Rivers Estuaries	11	1	
	3.2	Mondego River Estuary	1	1	
	3.3	Cenozoic Basins of Baixo Tejo and Alvalade	54	5	
	3.4	Cenozoic Douro Basin	1	1	
	3.5	Cenozoic Guadiana Basin	1	1	
4 Coastal Plains	4.1	Coastal Plains	96	3	
	4.2		25	2	

Table S3: Mode, Multiplicity of mode and correspondent % of Richness, SIDI, SIEI, SHDI, and SHEI, used to assess the lithological diversity of mainland Portugal. Source: Geological Map of Portugal at 1:1 000 000 scale [59].

Lithology															
Cell_Km (L)	N filled	Richness			SIDI			SIEI			SHDI			SHEI		
		Multiplicity Mode	%	Mode	Multiplicity Mode	%	Mode	Multiplicity Mode	%	Mode	Multiplicity Mode	%	Mode	Multiplicity Mode	%	Mode
30	150	23	15.2	8	3	2.0	0	3	2.0	0	3	2.0	0	3	2.0	0
25	212	25	11.7	6	9	4.2	0	9	4.2	0	9	4.2	0	9	4.2	0
20	315	43	13.7	4	12	3.8	0	13	4.1	0	13	4.1	0	13	4.1	0
15	536	86	16.0	4	37	6.9	0	37	6.9	0	37	6.9	0	37	6.9	0
10	1156	234	20.3	3	114	9.9	0	114	9.9	0	114	9.9	0	114	9.9	0
5	4366	1248	28.6	2	1002	23.0	0	1002	23.0	0	1002	23.0	0	1002	23.0	0
2	26390	12193	46.3	1	12193	46.3	0	12193	46.3	0	12193	46.3	0	12193	46.3	0
1	104222	67147	64.6	1	67147	64.6	0	67148	64.6	0	67147	64.6	0	67148	64.6	0

Table S4: Histograms and boxplots of Richness, SIDI, SIEI, SHDI, and SHEI used to assess the lithological diversity of mainland Portugal. Outliers were identified by $Median \pm 1.25 \times IQR$. Data were processed in Andad 7.12 (CVRM/IST, 2000). Source: Geological Map of Portugal at 1:1 000 000 scale [59].





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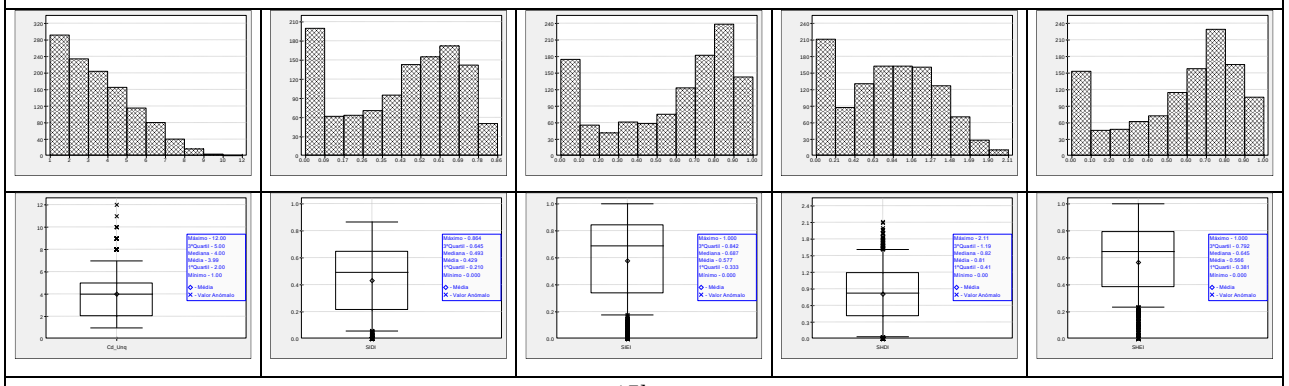

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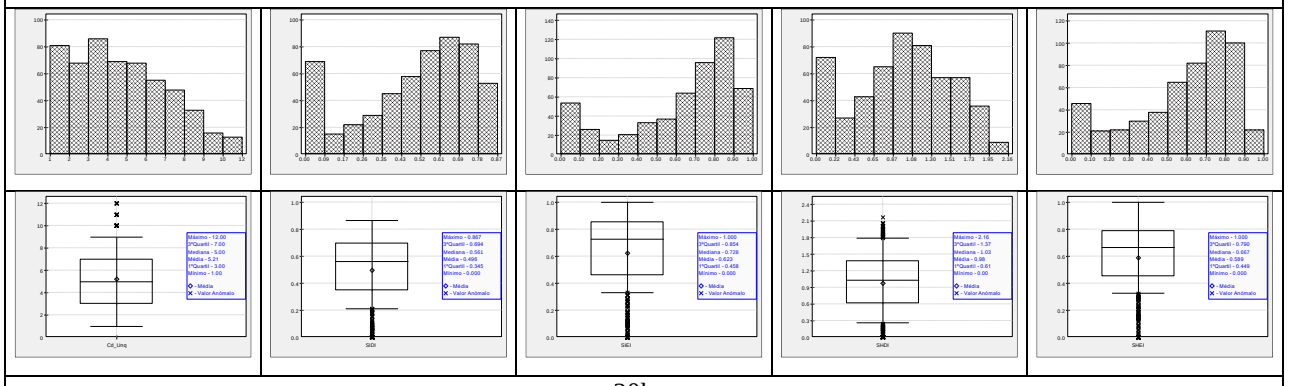

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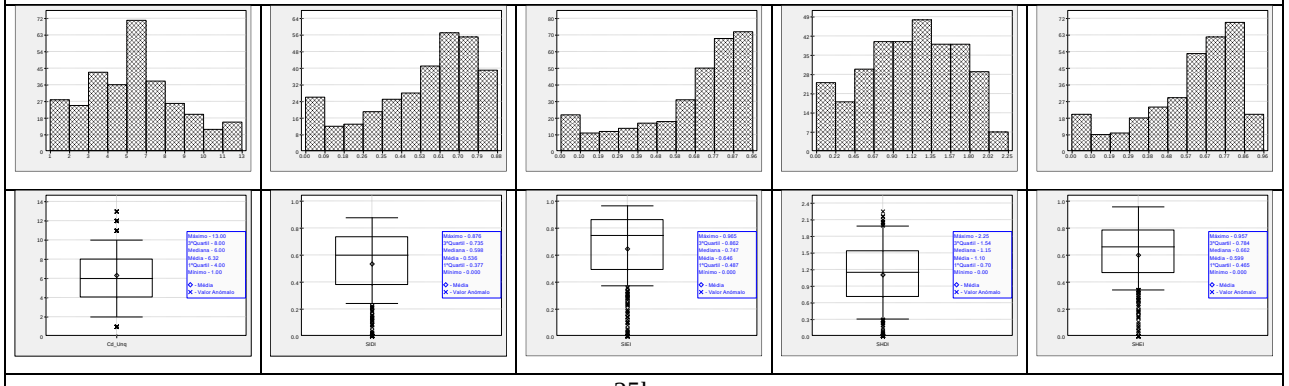

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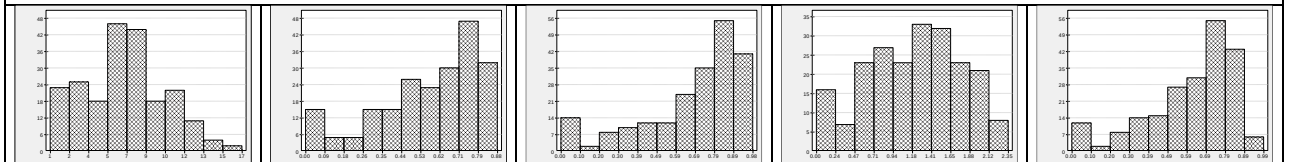


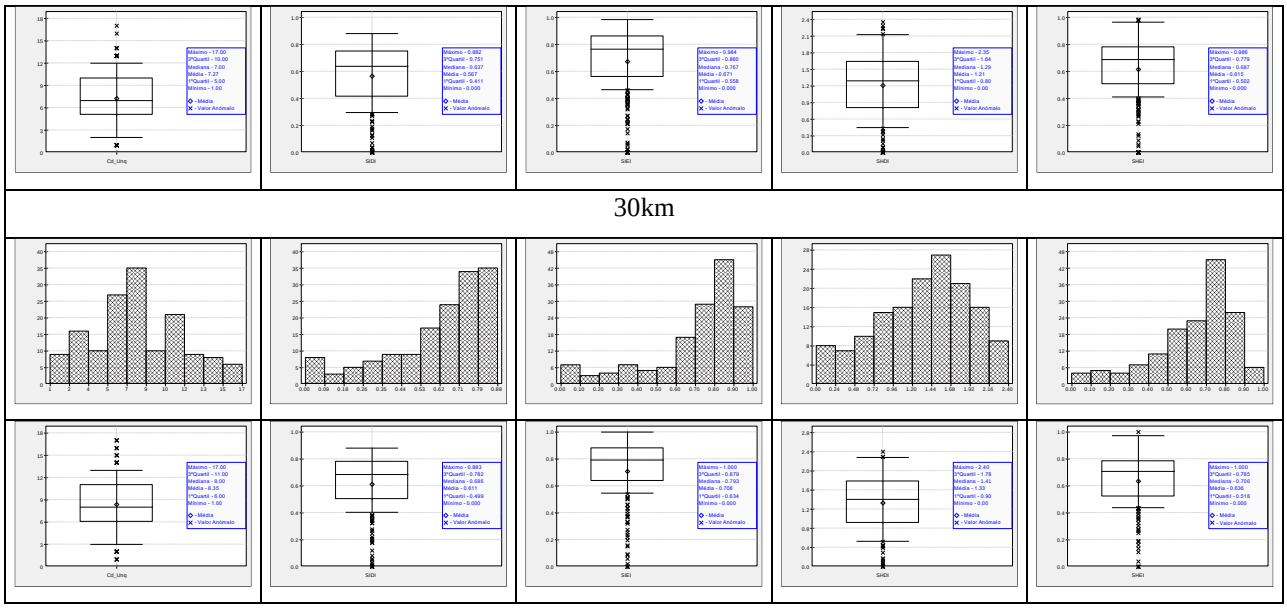
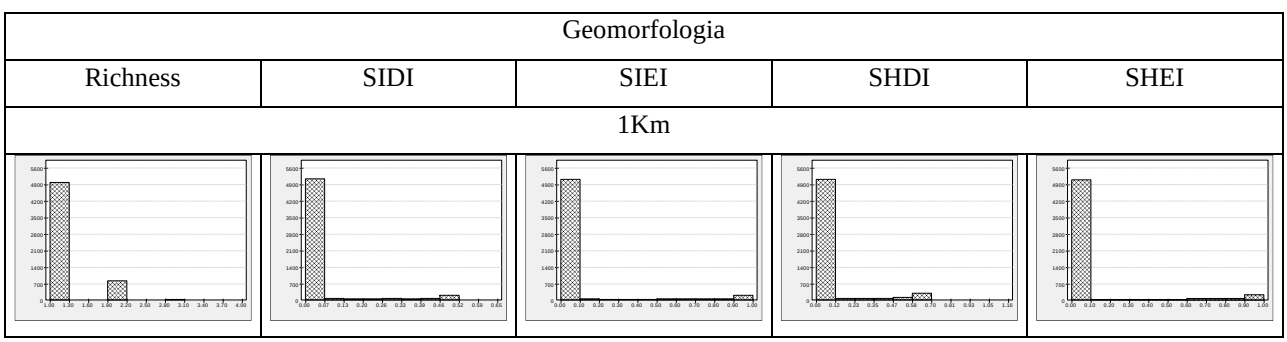
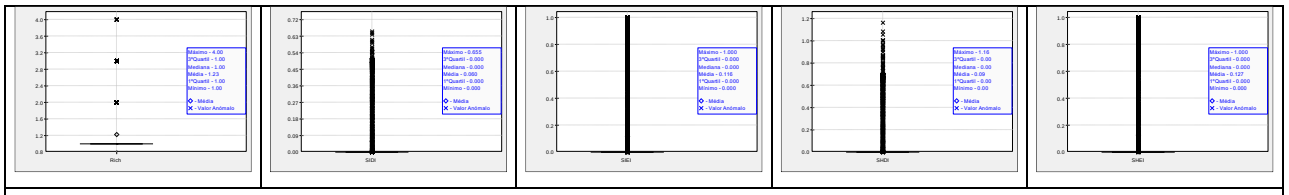


Table S5: Mode, Multiplicity of mode and correspondent % of Richness, SIDI, SIEI, SHDI, and SHEI used to assess the geomorphological diversity of mainland Portugal. Source: geomorphological units map of mainland Portugal at 1:500 000 scale (Figure 2b).

Geomorphology																
Cell_Km (L)	N filled	Richness			SIDI			SIEI			SHDI			SHEI		
		Multiplicity Mode	%	Mode	Multiplicity Mode	%	Mode	Multiplicity Mode	%	Mode	Multiplicity Mode	%	Mode	Multiplicity Mode	%	Mode
30	150	16	10.7	6	6	4.0	0	6	4.0	0	6	4.0	0	6	4.0	0
25	212	22	10.4	8	12	5.7	0	12	5.7	0	12	5.7	0	12	5.7	0
20	315	39	12.4	4	15	4.8	0	15	4.8	0	15	4.8	0	15	4.8	0
15	536	90	16.8	3	38	7.1	0	38	7.1	0	38	7.1	0	38	7.1	0
10	1156	249	21.5	2	151	13.1	0	151	13.1	0	151	13.1	0	151	13.1	0
5	4366	1627	37.3	2	1353	31.0	0	1353	31.0	0	1353	31.0	0	1353	31.0	0
2	26390	16309	61.8	1	16309	61.8	0	16309	61.8	0	16309	61.8	0	16309	61.8	0
1	104222	82317	79.0	1	82317	79.0	0	82317	79.0	0	82317	79.0	0	82317	79.0	0

Table S6: Histograms and boxplots of Richness, SIDI, SIEI, SHDI, and SHEI used to assess the geomorphological diversity of mainland Portugal. Outliers were identified by $Median \pm 1.25 \times IQR$. Data were processed in Andad 7.12 (CVRM/IST, 2000). Source: geomorphological units map of mainland Portugal at 1:500 000 scale (Figure.2b).





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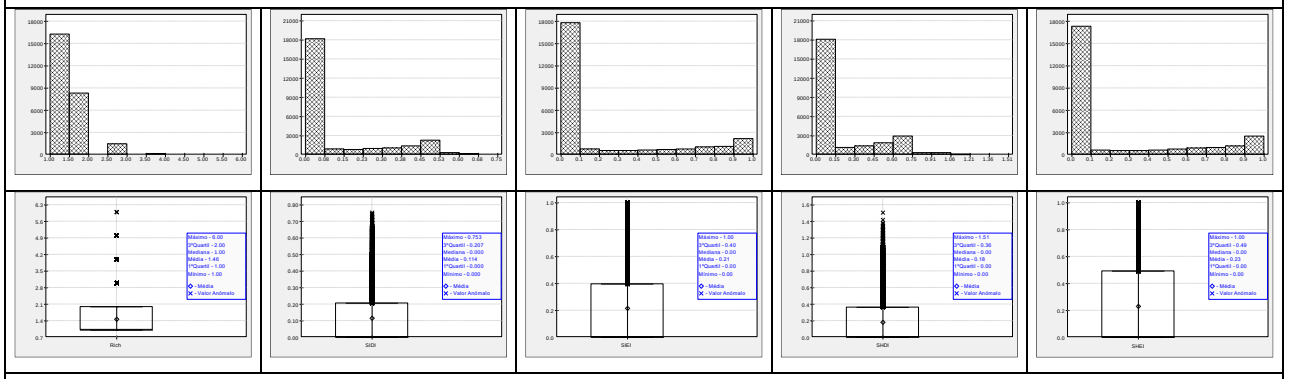

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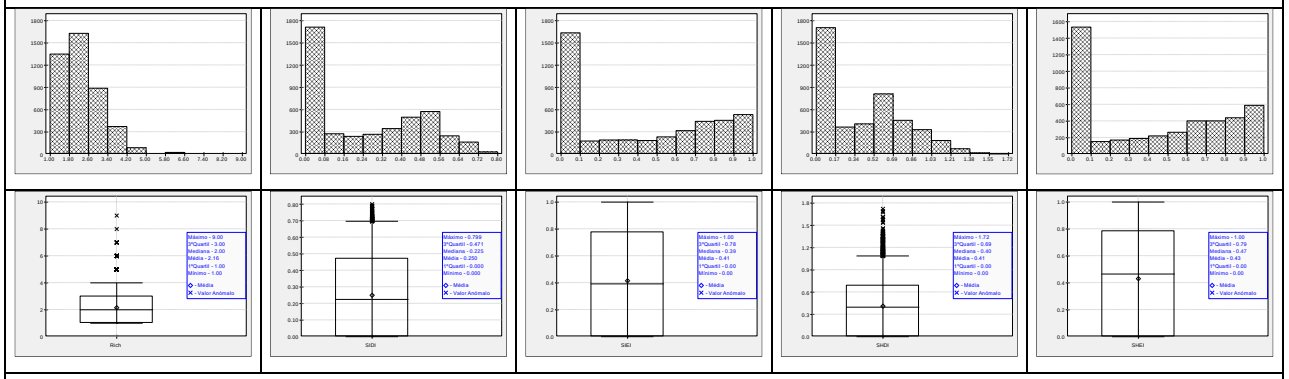

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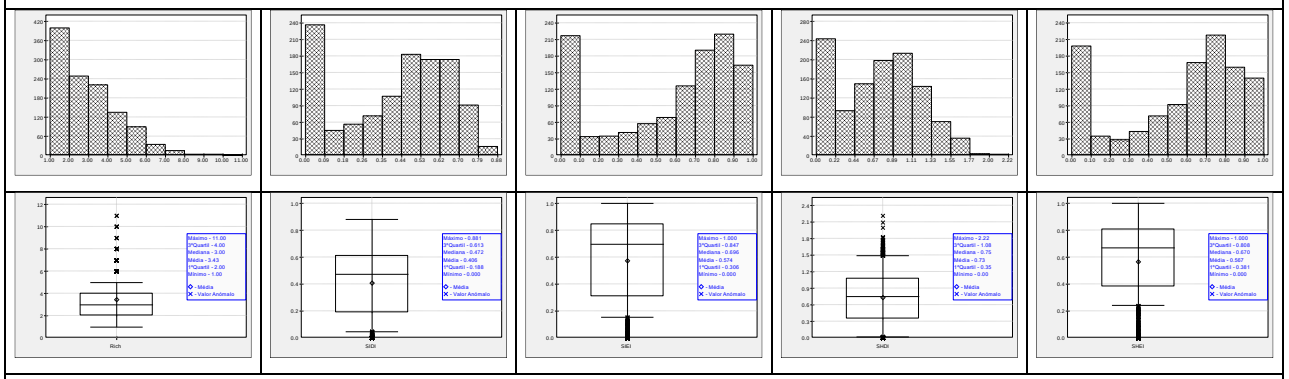

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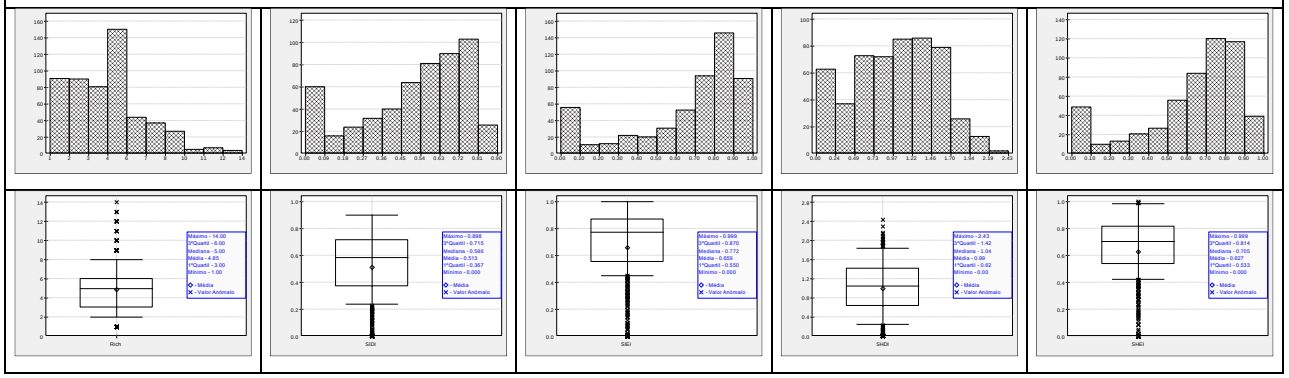

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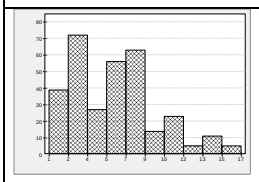
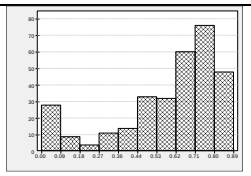
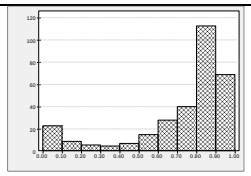
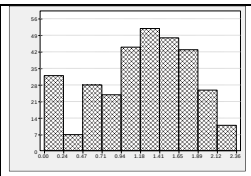
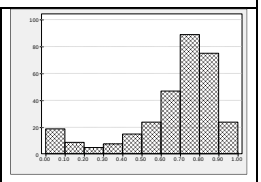
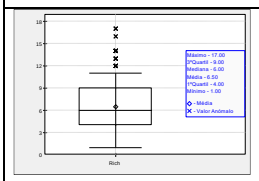
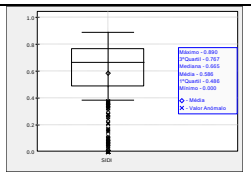
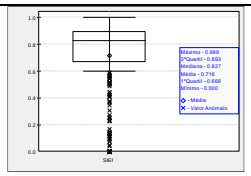
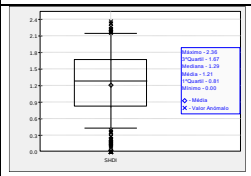
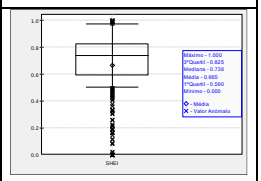

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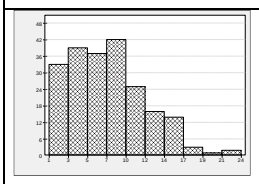
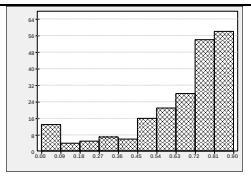
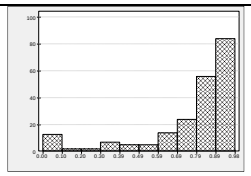
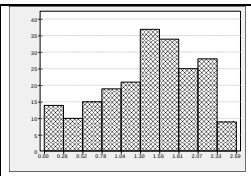
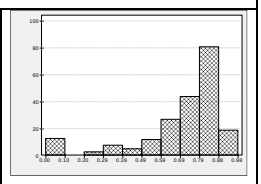
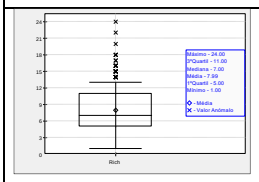
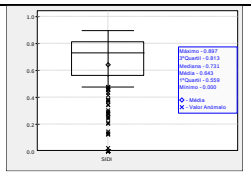
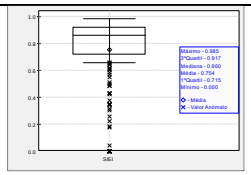
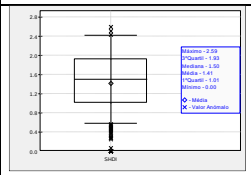
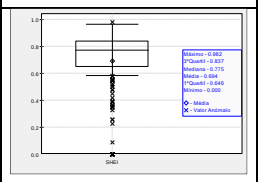

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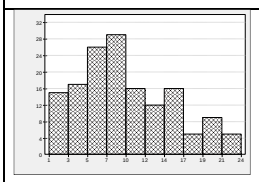
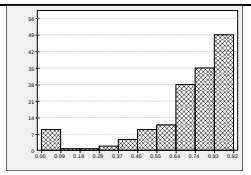
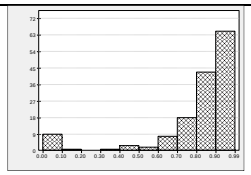
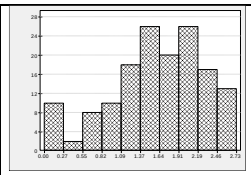
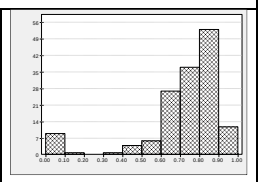
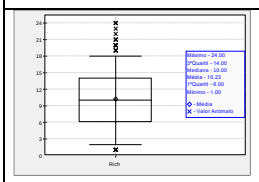
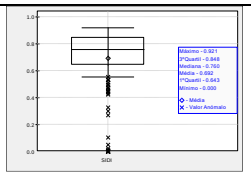
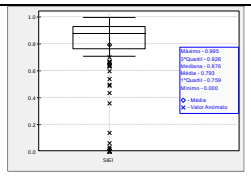
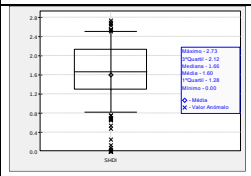
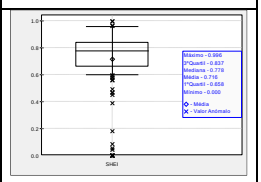
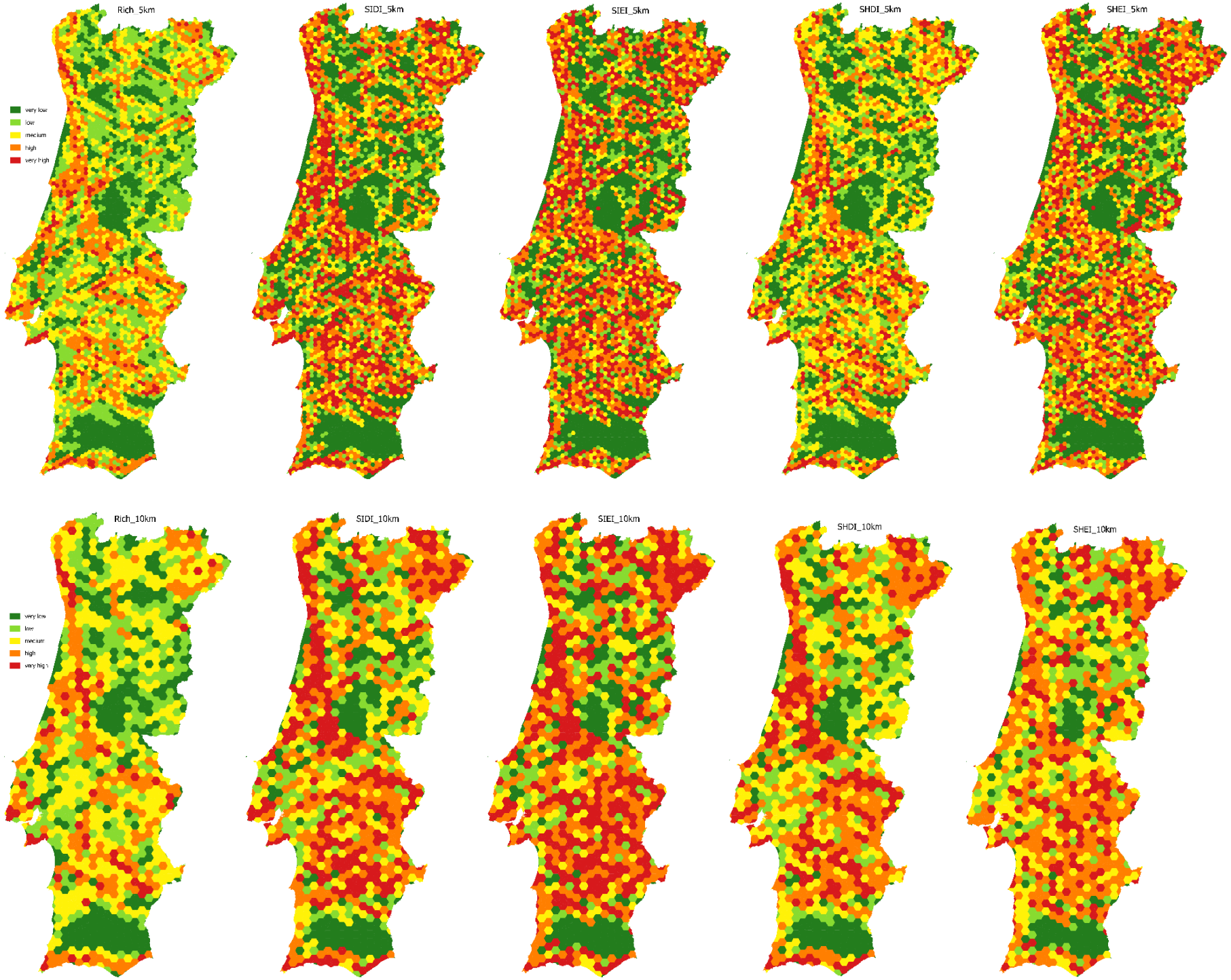
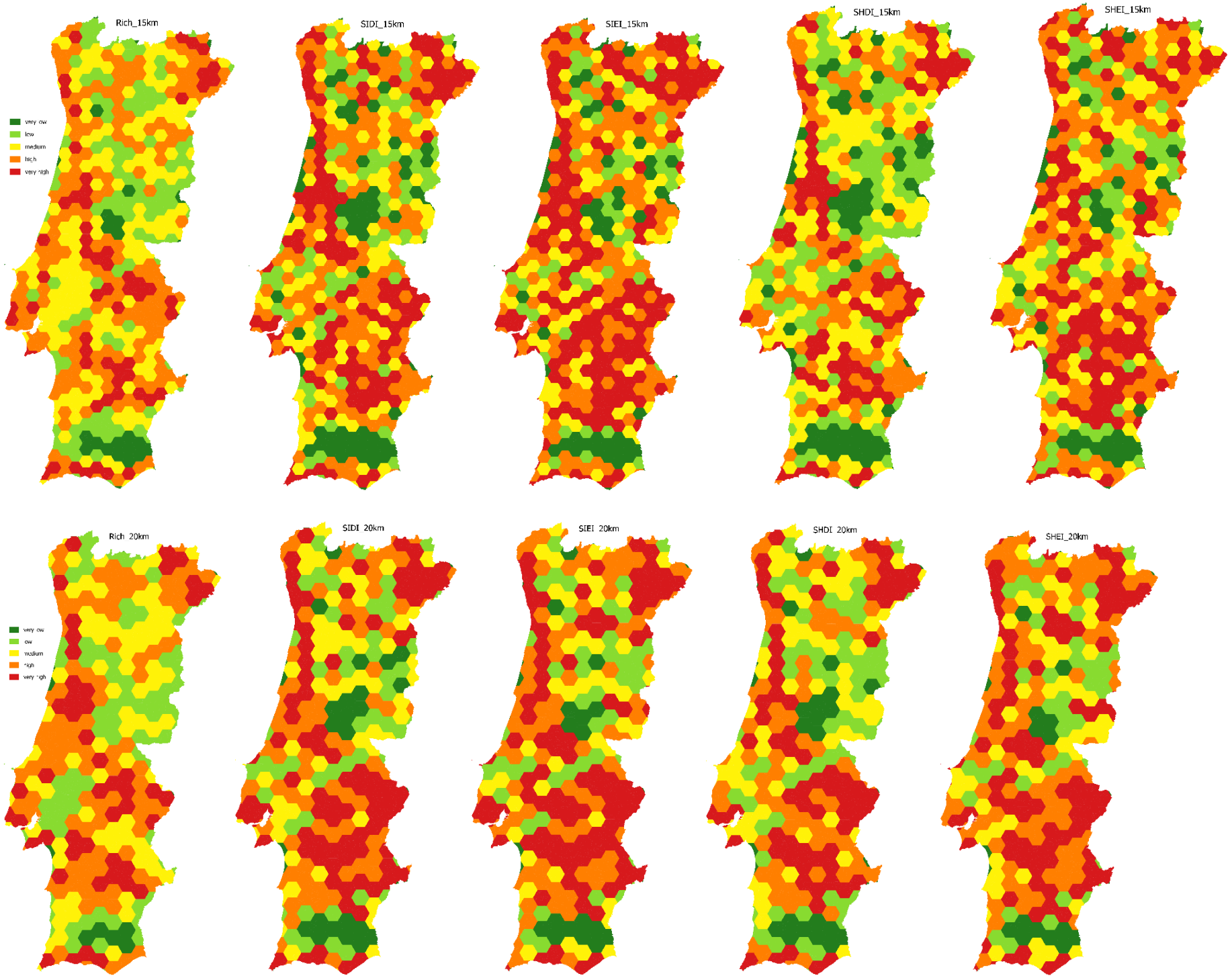











Figure S2: Bivariate analysis with Pearson and Spearman correlation coefficients between Richness, SIDI, SIEI, SHDI, and SHEI, along eight distinct cell sizes, regarding geology and geomorphology datasets used to assess the lithological and geomorphological diversity of mainland Portugal.

	Geology				Geomorphology			
Grid size	**Rich_SIDI**		**Rich_SIEI**		**Rich_SIDI**		**Rich_SIEI**	
	Pearson	**Spearman**	**Pearson**	**Spearman**	**Pearson**	**Spearman**	**Pearson**	**Spearman**
1	0.824394		0.77162		0.819814		0.794794	
2	0.81293	0.926524	0.714791	0.870561	0.796133	0.963367	0.741049	0.950468
5	0.791511	0.851006	0.632267	0.662659	0.76693	0.85291	0.62557	0.724578
10	0.766553	0.799447	0.592692	0.55243	0.764156	0.810793	0.575326	0.528057
15	0.745437	0.764636	0.583943	0.530307	0.774543	0.844843	0.602292	0.596859
20	0.717223	0.738608	0.576988	0.546155	0.732449	0.830201	0.526431	0.485601
25	0.739971	0.749057	0.579883	0.550428	0.735432	0.860638	0.585124	0.643729
30	0.734176	0.778669	0.582563	0.582683	0.717525	0.85844	0.515493	0.545695
Grid size	**Rich_SHDI**		**Rich_SHEI**		**Rich_SHDI**		**Rich_SHEI**	
	Pearson	**Spearman**	**Pearson**	**Spearman**	**Pearson**	**Spearman**	**Pearson**	**Spearman**
1	0.867661		0.785048		0.859166		0.820146	
2	0.866679	0.940093	0.708616	0.854841	0.843799	0.967069	0.756633	0.946903
5	0.866379	0.891258	0.587897	0.600718	0.836172	0.885801	0.599391	0.684633
10	0.85757	0.863251	0.519296	0.45016	0.853228	0.874242	0.498603	0.422473
15	0.839943	0.841698	0.496735	0.409462	0.875492	0.89658	0.508418	0.438581
20	0.828329	0.824687	0.499033	0.415851	0.857743	0.895421	0.403611	0.283459
25	0.851707	0.838025	0.484197	0.396418	0.872621	0.919941	0.489823	0.439335
30	0.858205	0.856064	0.493604	0.443142	0.881731	0.926151	0.403872	0.311188
Grid size	**SIDI_SIEI**		**SIDI_SHDI**		**SIDI_SIEI**		**SIDI_SHDI**	
	Pearson	**Spearman**	**Pearson**	**Spearman**	**Pearson**	**Spearman**	**Pearson**	**Spearman**
1	0.988173		0.993819		0.994741		0.995151	
2	0.976071	0.982318	0.99056	0.997222	0.987829	0.996473	0.993373	0.999297
5	0.958191	0.932921	0.983442	0.992097	0.96528	0.958671	0.9869	0.993054
10	0.95653	0.914585	0.976693	0.987024	0.950248	0.888082	0.978301	0.984639
15	0.962256	0.921604	0.973293	0.984432	0.955819	0.908887	0.971325	0.988668
20	0.973627	0.952616	0.970885	0.983404	0.940446	0.834313	0.962128	0.98492
25	0.959778	0.935127	0.967507	0.981249	0.965864	0.926868	0.956602	0.98279
30	0.964558	0.936068	0.961551	0.982935	0.931337	0.833134	0.943419	0.979884
Grid size	**SIDI_SHEI**		**SIEI_SHDI**		**SIDI_SHEI**		**SIEI_SHDI**	
	Pearson	**Spearman**	**Pearson**	**Spearman**	**Pearson**	**Spearman**	**Pearson**	**Spearman**
1	0.978997		0.971129		0.988827		0.9849	
2	0.959842	0.972777	0.944386	0.972392	0.978294	0.994487	0.969837	0.99429
5	0.92571	0.894325	0.901153	0.897691	0.939926	0.933974	0.920136	0.93297
10	0.912539	0.852569	0.886128	0.858648	0.904532	0.815052	0.879683	0.82194
15	0.916901	0.850412	0.889839	0.861127	0.900941	0.804118	0.876554	0.857172
20	0.934093	0.877893	0.897558	0.903739	0.871175	0.692304	0.835799	0.765966
25	0.902965	0.836859	0.880194	0.87403	0.913822	0.791658	0.866898	0.864472
30	0.910798	0.850246	0.879099	0.881892	0.860017	0.666926	0.79768	0.758669
Grid size	**SIEI_SHEI**		**SHDI_SHEI**		**SIEI_SHEI**		**SHDI_SHEI**	
	Pearson	**Spearman**	**Pearson**	**Spearman**	**Pearson**	**Spearman**	**Pearson**	**Spearman**
1	0.995645		0.967037		0.996065		0.985364	
2	0.99434	0.998024	0.931162	0.962108	0.995363	0.999652	0.965856	0.992019
5	0.990538	0.989561	0.867607	0.858083	0.992112	0.994083	0.896568	0.907385
10	0.986109	0.979064	0.839702	0.796745	0.986868	0.977305	0.830456	0.750981
15	0.984225	0.973847	0.842527	0.78737	0.981297	0.958997	0.818364	0.75139
20	0.970839	0.983937	0.819279	0.863735	0.977581	0.946316	0.757897	0.619212
25	0.979627	0.956571	0.822214	0.7688	0.979848	0.943281	0.809277	0.720787
30	0.977738	0.960415	0.830666	0.793578	0.978156	0.928415	0.717883	0.584414

Figure S3: Maps expressing lithological diversity, richness and evenness of mainland Portugal through five indices (Richness, SIDI, SIEI, SHDI, SHEI) along eight cell sizes (1km, 2km, 5km, 10km, 15km, 20km, 25km, 30km). Each map represents five classes (very low, low, medium, high, very high) based on the Jenks natural breaks classification.


Rich_5km
SIDI_5km
SIEI_5km
SHDI_5km
SHEI_5km
very low
low
medium
high
very high
Rich_10km
SIDI_10km
SIEI_10km
SHDI_10km
SHEI_10km
very low
low
medium
high
very high


Rich_15km
SIDI_15km
SIEI_15km
SHDI_15km
SHEI_15km
very ow
low
medium
high
very high
Rich_20km
SIDI_20km
SIEI_20km
SHDI_20km
SHEI_20km
very ow
ow
medium
high
very high

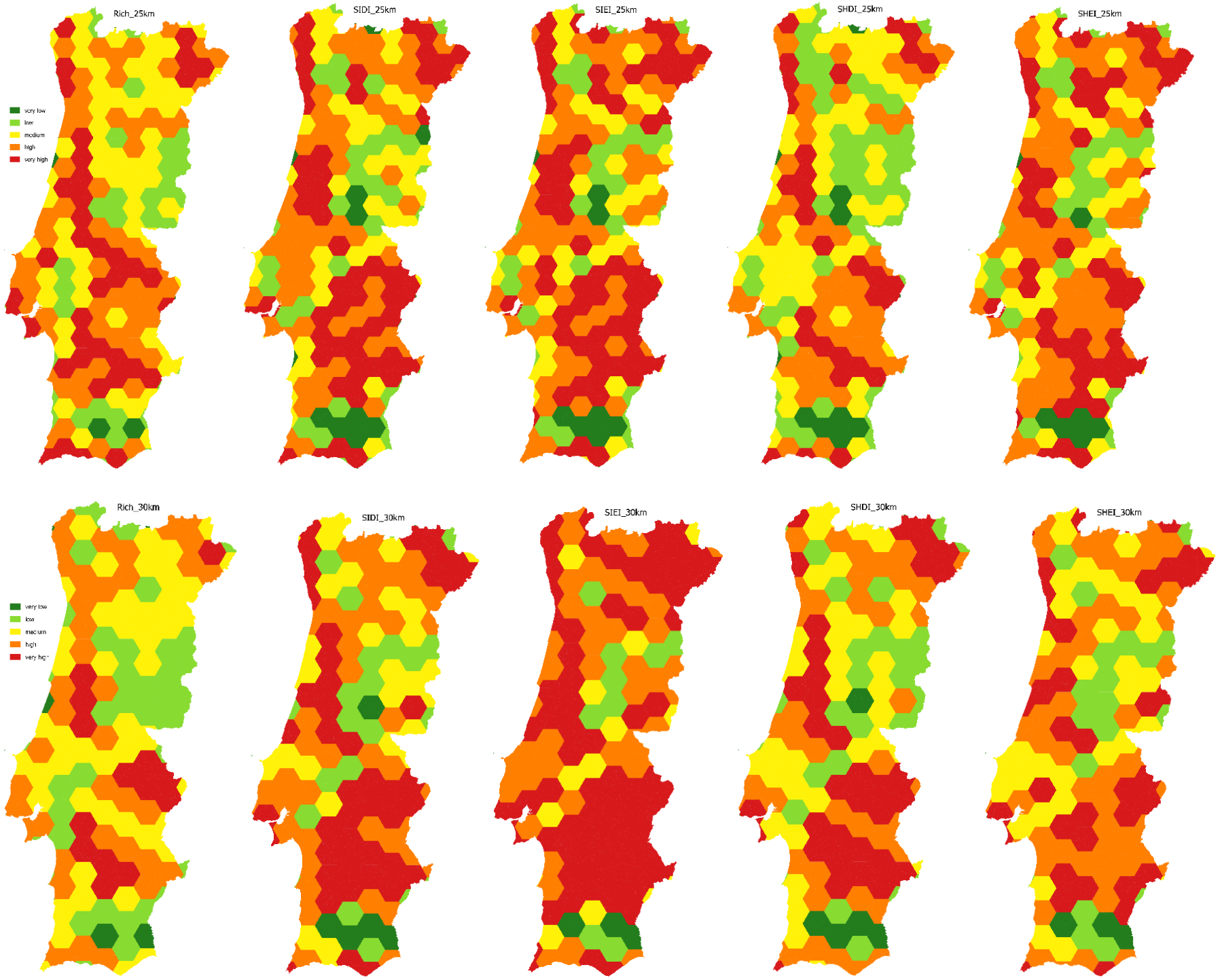
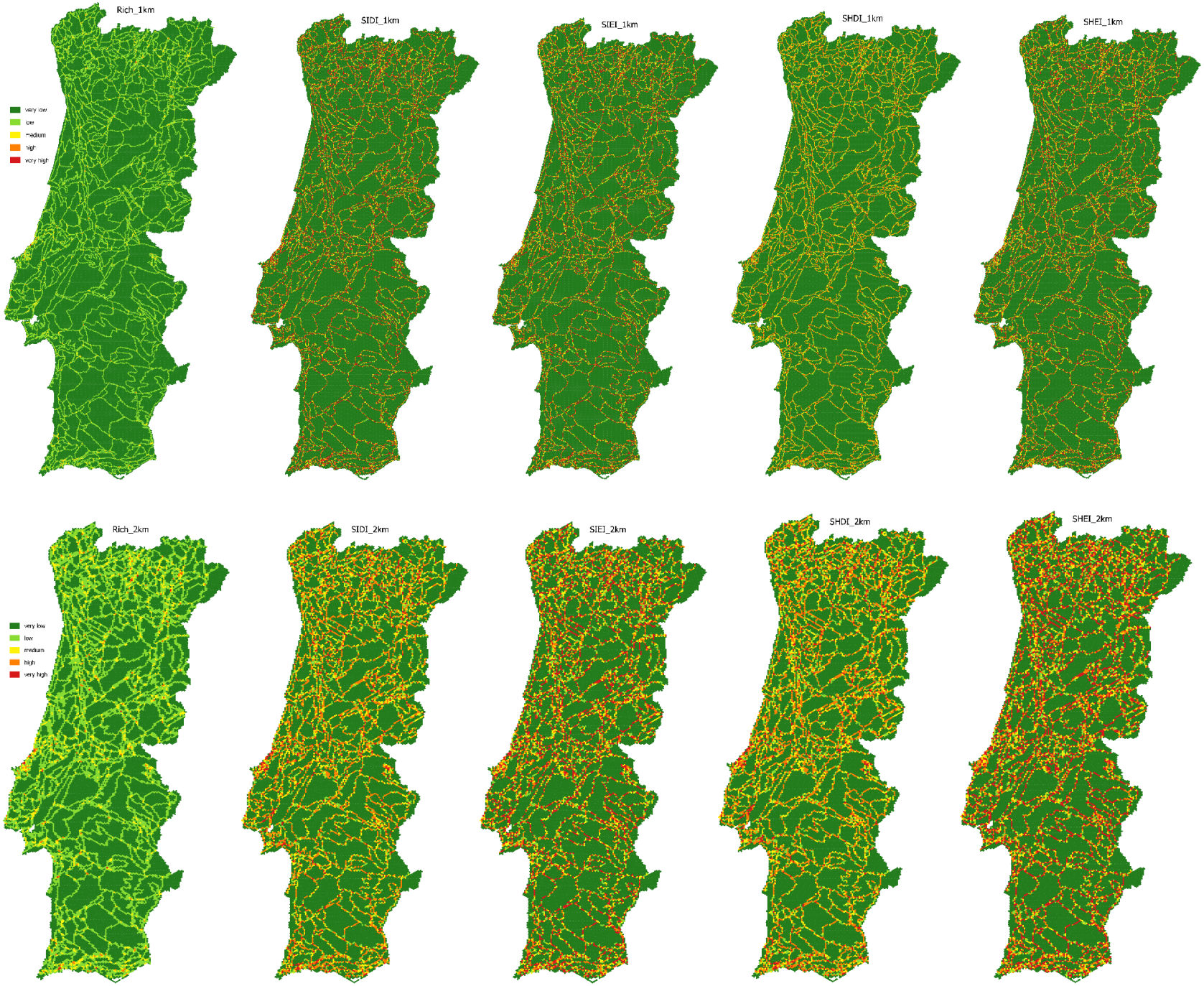
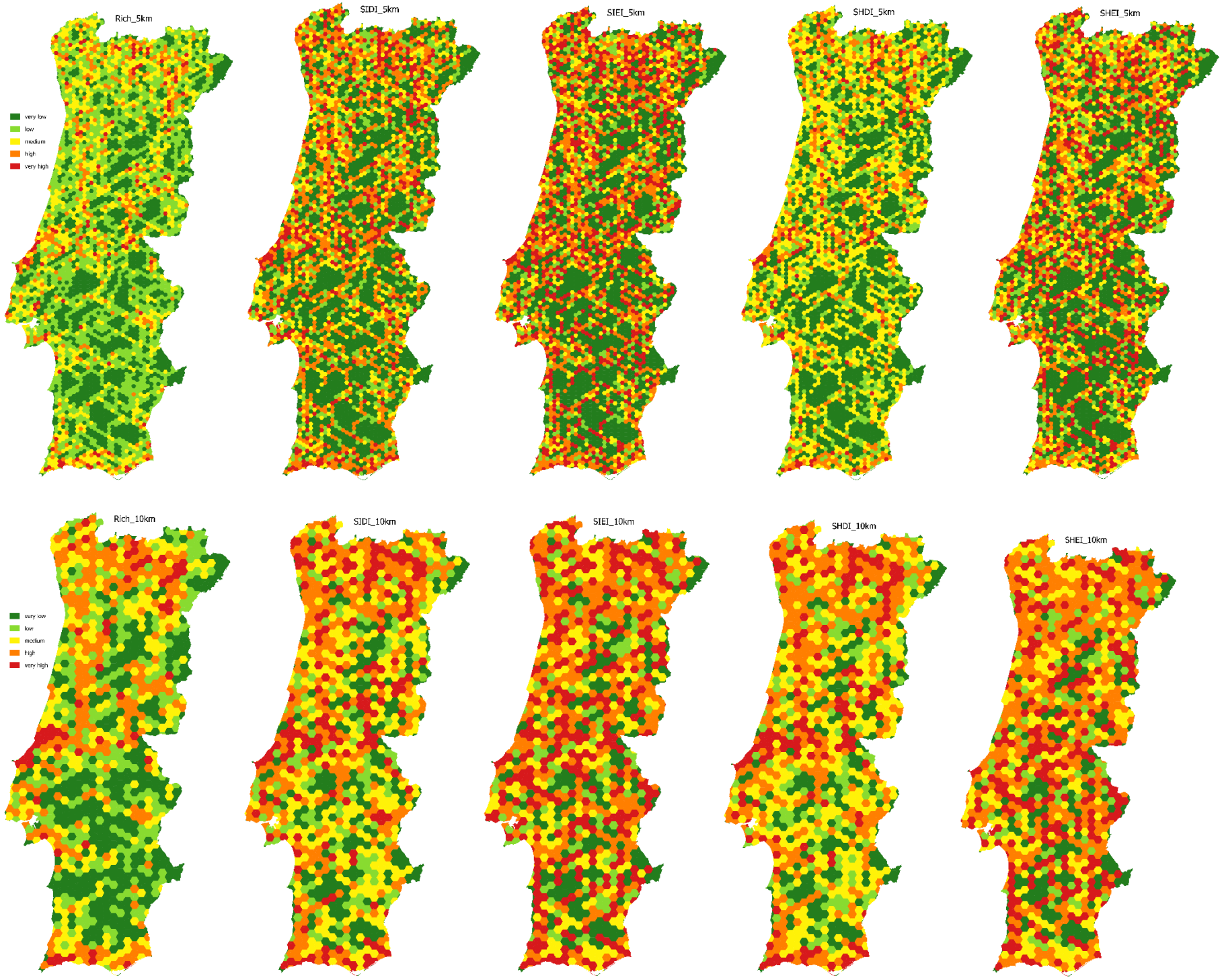
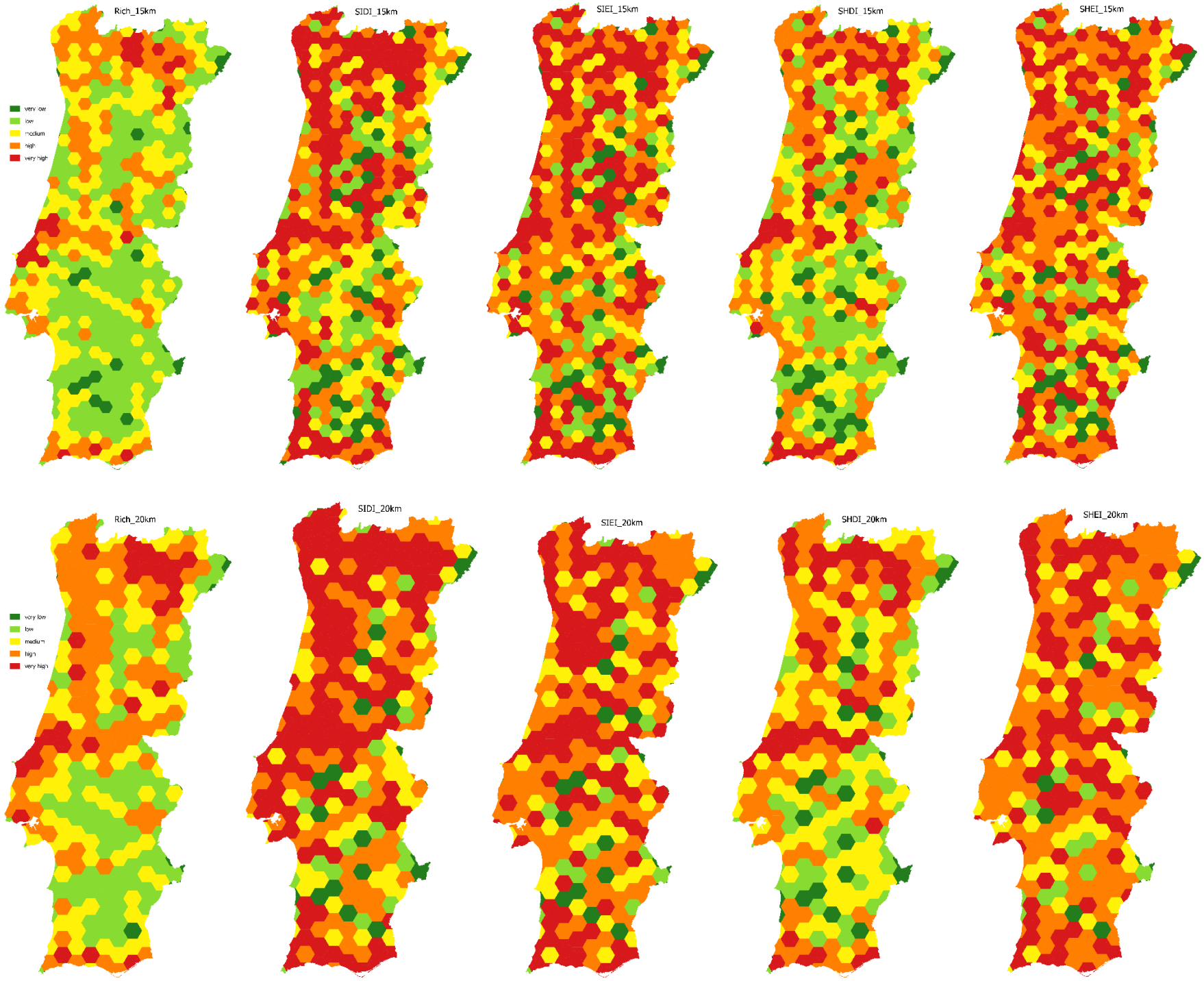
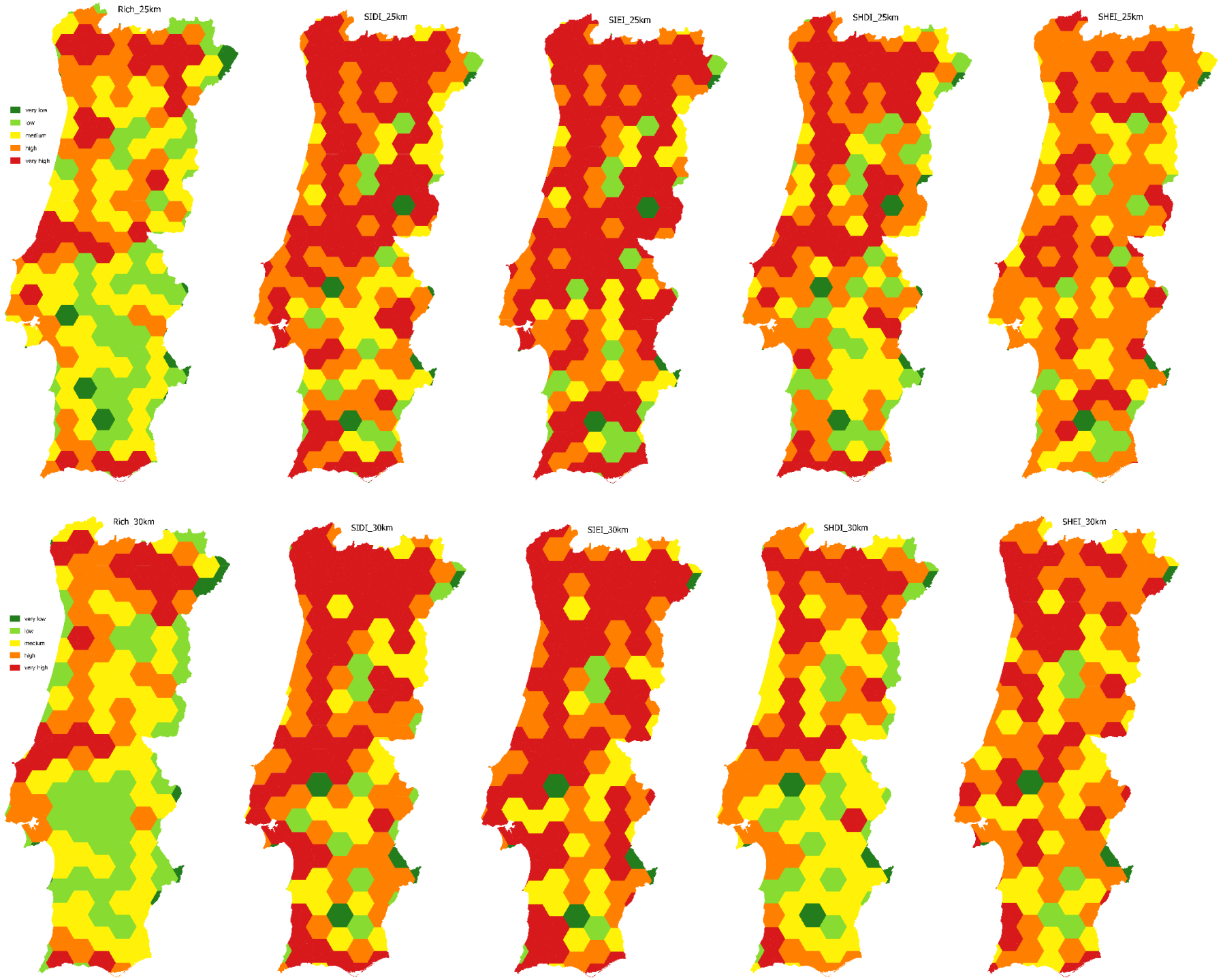

Rich_25km
SIDI_25km
SIEI_25km
SHDI_25km
SHEI_25km
very low
low
medium
high
very high
Rich_30km
SIDI_30km
SIEI_30km
SHDI_30km
SHEI_30km
very low
low
medium
high
very high

Figure S4: Maps expressing geomorphological diversity, richness and evenness of mainland Portugal through five indices (Richness, SIDI, SIEI, SHDI, SHEI) along eight cell sizes (1km, 2km, 5km, 10km, 15km, 20km, 25km, 30km). Each map represents five classes (very low, low, medium, high, very high) based on the Jenks natural breaks classification.




Rich_5km
SIDI_5km
SIEI_5km
SHDI_5km
SHEI_5km
very low
low
medium
high
very high
Rich_10km
SIDI_10km
SIEI_10km
SHDI_10km
SHEI_10km
very low
low
medium
high
very high


Rich_15km
very low
low
medium
high
very high
SIDI_15km
SIEI_15km
SHDI_15km
SHEI_15km
Rich_20km
very low
low
medium
high
very high
SIDI_20km
SIEI_20km
SHDI_20km
SHEI_20km


Rich_25km
SIDI_25km
SIEI_25km
SHDI_25km
SHEI_25km
very low
low
medium
high
very high
Rich_30km
SIDI_30km
SIEI_30km
SHDI_30km
SHEI_30km
very low
low
medium
high
very high