Supplementary Table S1. Detailed Risk-of-Bias Assessment for all 106 Studies Included in the Systematic Review. Risk-of-Bias categories were assigned based on Sampling clarity (description of sampling design) and Analytical transparency (clarity of analytical procedures). Studies were classified as low, moderate, or high risk of bias following an adapted qualitative framework informed by ROBIS guidelines

No.	Authors / Year	Methodological approach	Sampling clarity	Analytical transparency	Overall risk of bias
1	Takács et al., 2021	Field assessment, longitudinal analysis	Moderate	High	Low
2	Mesele et al., 2024a	Comparative ecological analysis	Moderate	High	Low
3	Kocsis et al., 2025	Field experiments, soil analysis	High	High	Low
4	Shojaeezadeh et al., 2024a	Remote sensing, modelling	Moderate	High	Low
5	Mesele et al., 2024b	Comparative soil analysis	Moderate	High	Low
6	Kovács et al., 2025	Field experiment, microbiological analysis (sequencing), statistical analysis	High	High	Low
7	Thiébeau & Bertrand, 2020	Field experiment, soil analysis	High	High	Low
8	Szalai et al., 2016	Field-scale monitoring	Moderate	Moderate	Moderate
9	Kocsis et al., 2020	Modelling, yield analysis	Moderate	High	Low
10	Nagy & Soos, 2025	Policy and conceptual analysis	Low	Moderate	High
11	Kotroczó et al., 2023	Long-term field experiment	High	High	Low
12	Batjes, 2002	Database analysis	Moderate	Moderate	Moderate
13	Benedek et al., 2012	Field experiment, soil sampling, laboratory chemical analysis	High	High	Low
14	Jakab et al., 2016	Laboratory and field analysis	High	High	Low
15	Shojaeezadeh et al., 2024b	Predictive modelling	Moderate	High	Low
16	Harta et al., 2021	Field sampling, soil biological analysis, statistical comparison	High	High	Low
17	Nyandi et al., 2025	Field experiment, spectral analysis	High	High	Low
18	Ocwa et al., 2023	Literature review	Low	Moderate	High
19	Maqsoom et al., 2020	RUSLE model, GIS, remote sensing	Moderate	High	Low
20	Falloon et al., 1998	Modelling, GIS	Moderate	Moderate	Moderate
21	Nabayi et al., 2023	Field trials	High	High	Low
22	Morgan et al., 2025	Data fusion, remote sensing	Moderate	High	Low
23	Zhang et al., 2023	Field experiment	High	High	Low
24	Alsafadi et al., 2020	GIS-based multi-criteria analysis	Moderate	High	Low
25	Kabato et al., 2025b	Review	Low	Moderate	High
26	Tölgyesi et al., 2020	Field soil sampling under vegetation patches, laboratory	High	High	Low

No.	Authors / Year	Methodological approach	Sampling clarity	Analytical transparency	Overall risk of bias
		chemical analysis, statistical comparison			
27	Tomchuk et al., 2018	Economic and analytical methods	Moderate	Moderate	Moderate
28	Eldridge et al., 2024	Global dataset analysis	Moderate	High	Low
29	Bouzouidja et al., 2021	Field soil sampling, laboratory analysis, simplified performance assessment methodology	High	High	Low
30	Meena et al., 2025	Field soil sampling, laboratory SOC fractionation, carbon stock estimation, comparative land-use analysis	High	High	Low
31	Nagy, 2007	Field trials	High	High	Low
32	Abd Ghani et al., 2023	Experimental study	High	High	Low
33	Schils et al., 2018	Modelling, comparative analysis	Moderate	High	Low
34	Süle et al., 2024	Conference analysis, national overview	Moderate	Moderate	Moderate
35	Bankó et al., 2021	Long-term field experiment, laboratory analysis	High	High	Low
36	Kocsis et al., 2021	Modelling, yield response analysis	Moderate	High	Low
37	Németh, 1995	Soil chemistry analysis, policy context	Moderate	Moderate	Moderate
38	Tóth, 2001	Integrated land evaluation modelling	Moderate	High	Low
39	Szilassi, 2017	GIS, landscape analysis	Moderate	High	Low
40	Kocsis et al., 2016	GIS, statistical modelling	Moderate	High	Low
41	Lóczy et al., 2020	GIS-based assessment, ecosystem service evaluation	Moderate	High	Low
42	Mics et al., 2013	Ecological analysis	Moderate	Moderate	Moderate
43	Al-Graiti et al., 2022	Laboratory and field analysis	High	High	Low
44	Szesztay, 2001	Policy environmental analysis	Low	Moderate	High
45	Várallya, 1989	Field observations, conceptual analysis	Low	Low	High
46	Fokom et al., 2013	Field experiment	High	High	Low
47	Gábor, 1998	Geographical analysis	Moderate	Moderate	Moderate
48	Csomós et al., 2024	Spatial analysis, statistical modelling	Moderate	High	Low
49	Kassai & Tóth, 2020	Digital soil mapping, GIS	Moderate	High	Low
50	Henits et al., 2022	Sentinel-2 remote sensing	Moderate	High	Low
51	Magda, 2007	Statistical analysis	Moderate	Moderate	Moderate
52	Szabó et al., 2016	Landsat image analysis	Moderate	High	Low
53	Nagy et al., 2021	Field measurements, remote sensing indices	High	High	Low
54	Gelencsér et al., 2010	WEPP and USLE models	Moderate	High	Low

No.	Authors / Year	Methodological approach	Sampling clarity	Analytical transparency	Overall risk of bias
55	Pásztor et al., 2018	Sequential classification, digital soil mapping	Moderate	High	Low
56	Szabó et al., 2002	Database compilation	Moderate	High	Low
57	Pinke et al., 2024	Statistical modelling	Moderate	High	Low
58	Deszső et al., 2020	Field sampling, modelling	High	High	Low
59	Keller et al., 2006	Geochemical analysis	High	High	Low
60	Keller et al., 2020	Field observation	Moderate	Moderate	Moderate
61	Gulacsi & Kovács, 2018	MODIS remote sensing	Moderate	High	Low
62	Government of Hungary, 2020	National reporting framework	Low	Moderate	High
63	Szatmári et al., 2020	Digital soil mapping	Moderate	High	Low
64	Kocsis et al., 2020	Statistical analysis	Moderate	High	Low
65	Balogh et al., 2025	GIS and historical analysis	Moderate	High	Low
66	Tóth et al., 2021	Statistical modelling	Moderate	High	Low
67	Lemenkova, 2012	GIS analysis	Moderate	High	Low
68	Szilassi et al., 2006	Field sampling	High	High	Low
69	Kertész, 2016	Environmental analysis	Moderate	Moderate	Moderate
70	Chen et al., 2012	Remote sensing, GIS	Moderate	High	Low
71	Joshi & Nagare, 2009	Remote sensing	Moderate	High	Low
72	Lászlók, 2012	Policy and spatial analysis	Moderate	Moderate	Moderate
73	Erdei et al., 2022	GIS	Moderate	High	Low
74	Nagy et al., 2020	Spatial analysis	Moderate	High	Low
75	Csorba et al., 2004	Literature review	Low	Moderate	High
76	Németh et al., 2021	Remote sensing	Moderate	High	Low
77	IIASA, 2012	Database development	Moderate	High	Low
78	Wojtaszek, 2019	Remote sensing	Moderate	High	Low
79	Lennert et al., 2020	GIS modelling	Moderate	High	Low
80	Ministry of Agriculture, 2017	Policy framework	Low	Moderate	High
81	Szabó et al., 2019	Remote sensing	Moderate	High	Low
82	Negovanović et al., 2020	GIS analysis	Moderate	High	Low
83	Mika et al., 2002	Statistical analysis	Moderate	High	Low

No.	Authors / Year	Methodological approach	Sampling clarity	Analytical transparency	Overall risk of bias
84	Centeri et al., 2010	Field measurements	High	High	Low
85	Bozsik & Koncz, 2018	Statistical analysis	Moderate	Moderate	Moderate
86	Mustafa, 2016	GIS analysis	Moderate	High	Low
87	Laborczi et al., 2016	Classification trees	Moderate	high	Low
88	Várallyay, 2006	Environmental analysis	Moderate	Moderate	Moderate
89	Centeri et al., 2001	Field experiments	High	High	Low
90	Bidló et al., 2012	Field sampling	High	High	Low
91	Pásztor & Fodor, 2010	GIS modelling	Moderate	High	Low
92	Rieder et al., 2018	Experimental plots	High	High	Low
93	Birkás et al., 2012	Field analysis	High	High	Low
94	Velmurugan & Garcia, 2009	Remote sensing, GIS	Moderate	High	Low
95	Ács et al., 2015	Modelling	Moderate	High	Low
96	Szatmári et al., 2024	Space-time modelling	Moderate	High	Low
97	Kovács et al., 2022	Spatial analysis	Moderate	High	Low
98	Pásztor et al., 2007	Database review	Moderate	High	Low
99	Opršal et al., 2016	GIS modelling	Moderate	High	Low
100	Waltner et al., 2020	GIS analysis	Moderate	High	Low
101	O'Donnell & Manier, 2022	Modelling	Moderate	High	Low
102	Csikós et al., 2023	Earth observation	Moderate	High	Low
103	Szilassi et al., 2010	GIS-based spatial analysis, field data integration, case study approach	High	High	Low
104	Matasov et al., 2020	Historical data analysis, spatial modelling, GIS-based analysis	Moderate	High	Low
105	Vári et al., 2022	Conceptual framework development, national-scale assessment, stakeholder engagement	Low	Moderate	High
106	Dadgar, 2018	Field sampling, laboratory soil analysis, regression modelling	High	High	Low

Gábor, 1998 – Translation from Hungarian: "A Borsodi-dombság tájföldrajzi jellemzése"