Supplementary material for manuscript **egusphere-2025-2606**
"From grid to ground: How well do gridded products represent soil moisture dynamics in natural ecosystems during precipitation events?"
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June 4, 2025

Contents

S1   Description of in situ soil sites

The following section provides a detailed description of the soil profiles at the sites where the soil moisture sensors are installed. For each site, we present a photograph of the soil profile, a schematic representation of the soil horizons with their respective moist Munsell color, a description of each horizon, and the percentage of silt, clay, and sand. This information is available in the Chilean Soil Profile Database (ChSPD_V2; (Seguel et al., 2024)), and the corresponding site ID from the database is also provided.

S1.1   SM01 (ChSPD ID: 13640)
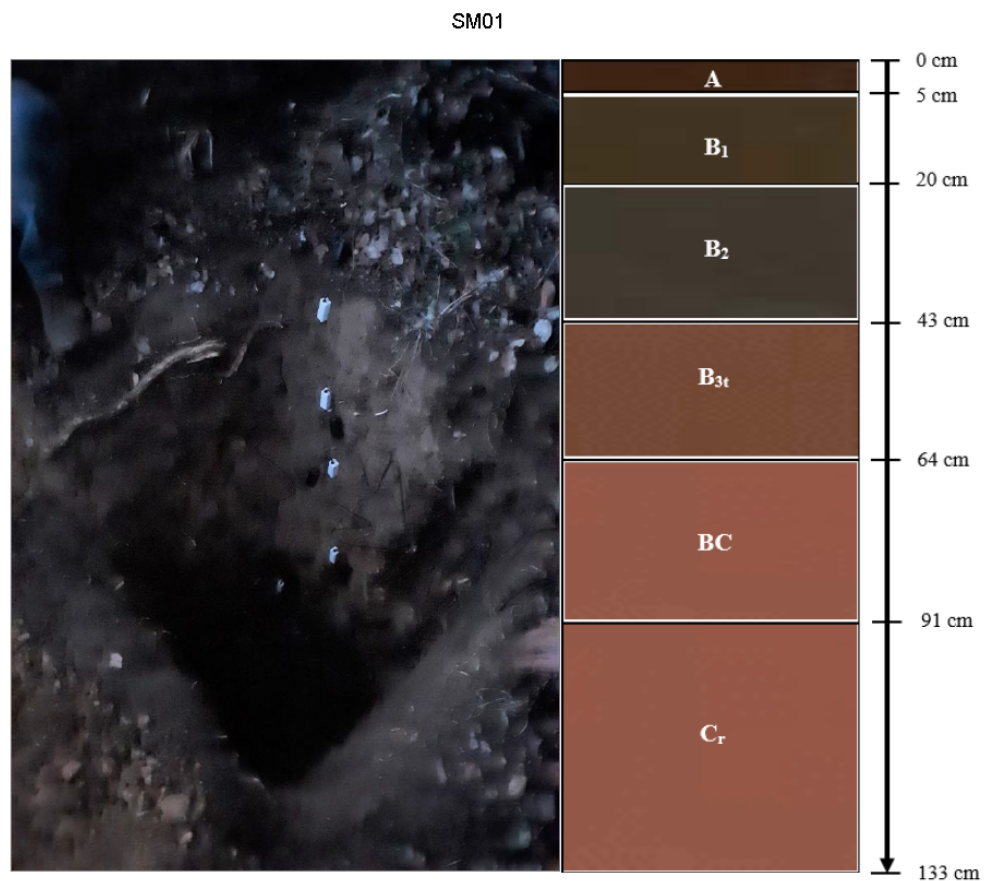
Figure S1.1: Photograph and schematic of the soil profile at the native forest site, SM01.

Table S1.1: Soil properties of SM01 (ChSPD ID: 13640)

Depth (cm)	Description	Clay (%)	Silt (%)	Sand (%)	Textural Class
0–5 (A)	Very dark brown (7.5YR 2.5/3); loam to sandy loam; slightly sticky and slightly plastic; strong fine subangular blocky structure in ∼50% and strong fine granular structure in ∼50%; abundant fine and medium roots; abundant fine pores; abrupt linear boundary.	13.60	23.22	63.17	SaL
5–20 (B1)	Dark brown (10YR 3/3); sandy clay loam; slightly sticky and moderately plastic; strong fine and medium subangular blocky structure; abundant fine roots, common medium roots; abundant fine and medium pores, few coarse pores; clear linear boundary.	20.34	19.53	60.12	SaCL
20–43 (B2)	Very dark grayish brown (10YR 3/2); sandy clay loam; moderately sticky and moderately plastic; moderate fine and medium subangular blocky structure, weak coarse blocks; common fine and coarse roots, few medium roots; common fine pores, few medium and coarse pores; ∼10% weathered rock; clear linear boundary.	22.43	20.59	56.99	SaCL
43–64 (B3t)	Yellowish red (5YR 4/6); sandy clay loam to clay loam; moderately sticky and very plastic; weak fine and medium subangular blocky structure; few fine and coarse roots, common medium roots; common fine and medium pores, few coarse pores; abundant cutans; ∼10% fine angular gravel, ∼30% weathered rock; clear linear boundary.	29.63	15.53	54.84	SaCL
64–91 (BC)	∼50% weathered rock; red (2.5YR 5/6); sandy clay loam to clay loam; slightly sticky and moderately plastic; weak fine and medium subangular blocky structure, tending to massive; few fine and coarse roots; abundant fine pores, common medium pores; clear linear boundary.	26.64	13.53	59.83	SaCL
91–133+ (Cr)	∼60% weathered rock; red (2.5YR 5/6); sandy clay loam; slightly sticky and moderately plastic; massive structure; few fine roots; abundant fine pores, common medium pores; ∼20% fine angular gravel.	25.61	14.55	59.83	SaCL

SaCL: Sandy Clay Loam, SaL: Sandy Loam

S1.2 SM02 (ChSPD ID: 13641)

Table S1.2: Soil properties of SM02 (ChSPD ID: 13641)

Depth (cm)	Description	Clay (%)	Silt (%)	Sand (%)	Textural Class
0–14 (A1)	Very dark brown (10YR 2/2); sandy loam; slightly sticky and slightly plastic; moderate fine and medium subangular blocky structure, strong fine granular; abundant fine roots; common fine pores, abundant medium pores, few coarse pores; ∼10% fine gravel; clear linear boundary.	11.28	21.74	66.97	SaL
14–41 (A2)	Very dark brown (7.5YR 2.5/2); sandy loam; moderately sticky and slightly plastic; strong fine subangular blocky structure, moderate coarse subangular blocks; common fine, medium, and coarse roots; abundant fine and medium pores, common coarse pores; ∼20% fine and medium angular gravel; clear wavy boundary.	10.17	20.54	69.29	SaL
41–67 (B)	Yellowish red (5YR 4/6); sandy clay loam to clay loam; moderately sticky and moderately plastic; weak fine subangular blocky structure, tending to massive; few fine and medium roots; abundant fine pores, common medium pores; ∼10% fine angular gravel, ∼40% medium and coarse angular gravel; clear wavy boundary.	23.80	17.80	58.41	SaCL
67–115 (C1)	Substrate with ∼30% weathered rock, ∼20% fine, medium, and coarse gravel, and ∼20% stones of 30 cm in diameter; variegated, dominated by very pale brown (10YR 8/4), with fine matrix in brown (7.5YR 4/4); sandy clay loam to clay loam; moderately sticky and moderately plastic; massive structure; few fine roots; abundant fine pores, common medium pores; diffuse linear boundary.	27.43	13.92	58.65	SaCL
115–125+ (C2)	Substrate with ∼40% weathered rock, ∼20% fine, medium, and coarse gravel, and ∼20% stones of 30 cm in diameter; yellowish red (5YR 5/6); clay; moderately sticky and very plastic; massive structure; few fine roots; abundant fine pores.	46.85	17.25	35.90	C

C: Clay; SaCL: Sandy Clay Loam; SaL: Sandy Loam
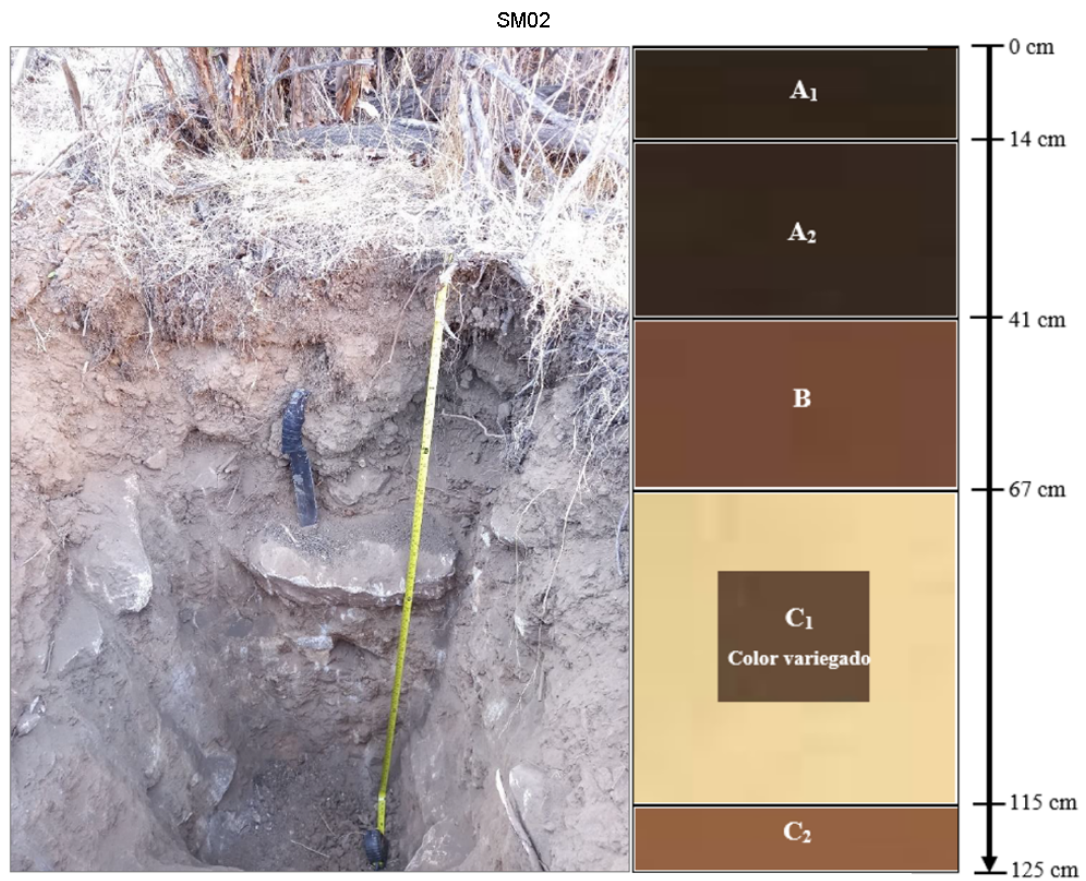
Figure S1.2: Photograph and schematic of the soil profile at the shrubland site, SM02.

S1.3 SM04 (ChSPD ID: 13910)

Table S1.3: Soil properties of SM04 (ChSPD ID: 13910)

Depth (cm)	Description	Clay (%)	Silt (%)	Sand (%)	Textural Class
0–14 (A)	Very dark brown (10YR 2/2); sandy loam; slightly sticky and slightly plastic; strong fine and medium subangular blocky structure; common very fine and fine roots; common fine pores, abundant medium pores, few coarse pores; ∼10% fine angular gravel, ∼10% coarse angular gravel; clear linear boundary.	19.22	27.91	52.87	SaL
14–33 (B)	Dark brown (7.5YR 3/3); sandy clay loam; moderately sticky and moderately plastic; strong fine and medium subangular blocky structure, moderate coarse blocks; abundant fine roots, few medium roots; abundant fine pores, common medium pores; common cutans; ∼10% fine gravel and ∼30% medium gravel; clear linear boundary.	29.78	23.95	46.28	SaCL
33–62 (BC)	Substrate with ∼20% fine gravel and ∼40% medium and coarse gravel; dark brown (7.5YR 3/3); sandy clay loam to clay loam; moderately sticky and very plastic; strong fine and medium subangular blocky structure, moderate coarse blocks; few fine roots, abundant medium roots, common coarse roots; abundant fine pores, common medium pores; clear linear boundary.	31.38	22.27	46.35	SaCL
62–84 (C1)	Substrate with ∼20% fine gravel, ∼40% medium and coarse gravel, and ∼20% weathered rock integrated into the horizon; very dark grayish brown (10YR 3/2); sandy clay loam; slightly sticky and moderately plastic; moderate fine subangular blocky structure; few fine roots; abundant fine pores, common medium pores; clear linear boundary.	20.63	16.84	62.52	SaCL
84–115+ (C2)	Substrate with ∼20% fine gravel, ∼20% medium and coarse gravel, and ∼40% weathered rock; dark bluish gray (GLEY 2 5PB 4/1); sandy loam; slightly sticky and slightly plastic; strong fine subangular blocky structure, weak medium and coarse blocks; few fine roots, common coarse roots; abundant fine pores, few medium pores.	12.07	22.89	65.04	SaCL

SaCL: Sandy Clay Loam; SaL: Sandy Loam
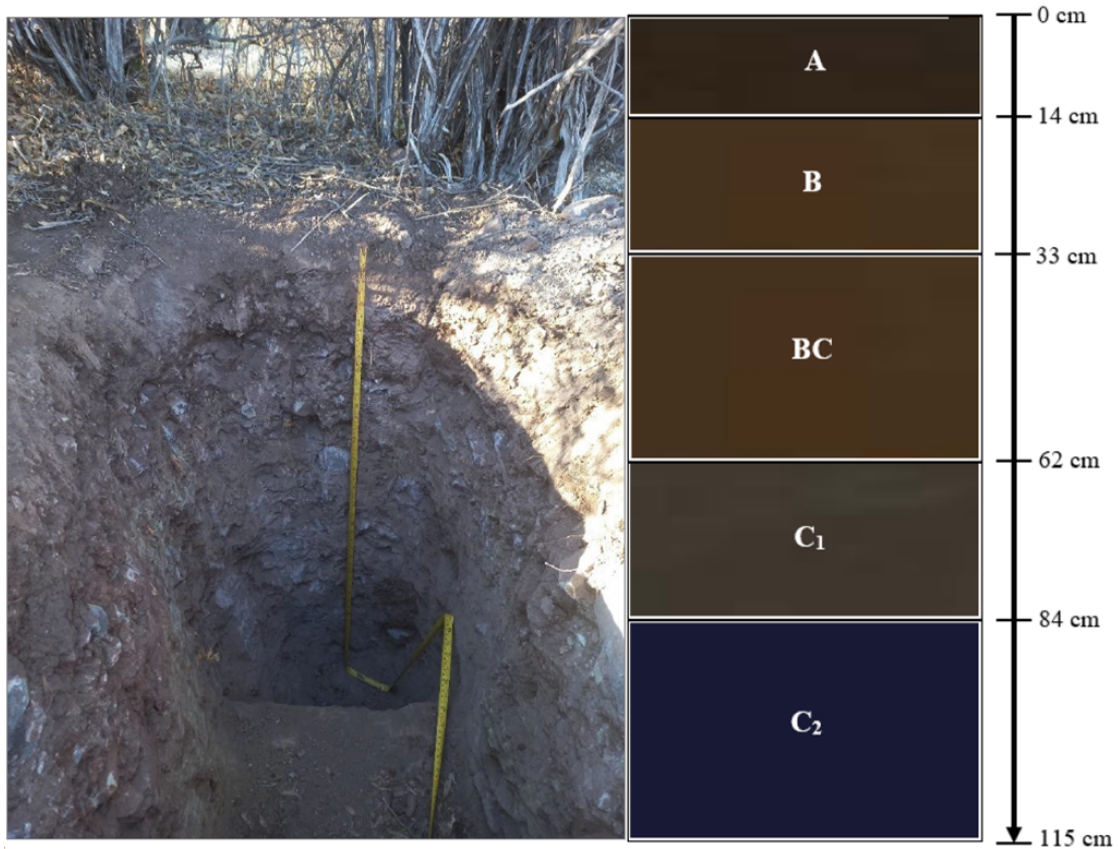
Figure S1.3: Photograph and schematic of the soil profile at the shrubland site, SM04.

S1.4 SM05 (ChSPD ID: 13911)

Table S1.4: Soil properties of SM05 (ChSPD ID: 13911)

Depth (cm)	Description	Clay (%)	Silt (%)	Sand (%)	Textural Class
0–5 (A)	Very dark brown (10YR 2/2); loam to sandy loam; slightly sticky and slightly plastic; strong fine granular and strong fine subangular blocky structure; abundant fine and medium roots, common coarse roots; abundant fine and medium pores, few coarse pores; 10% fine gravel, ∼20% medium gravel; abrupt linear boundary.	10.05	27.22	62.74	SaL
5–20 (B)	Very dark grayish brown (10YR 3/2); sandy loam; slightly sticky and slightly plastic; strong medium and coarse subangular blocky structure; abundant fine and medium roots, few coarse roots; abundant fine pores, common medium pores, few coarse pores; ∼10% fine gravel, ∼40% medium and coarse gravel; clear linear boundary.	11.90	34.87	53.23	SaL
20–75 (BC)	Substrate with ∼10% fine gravel, ∼40% medium and coarse gravel, and ∼10% pebbles; very dark gray (10YR 3/1); sandy loam; slightly sticky and slightly plastic; moderate fine subangular blocky structure, weak medium blocks; abundant fine, medium, and coarse roots; abundant fine pores, common medium and coarse pores; diffuse linear boundary.	15.00	32.87	52.13	SaL
75–120+ (C)	Substrate with ∼80% fine, medium, and coarse gravel, pebbles, and stones ranging from 2 to 30 cm in diameter; variegated, dominated by very dark gray (10YR 3/1); sandy loam; slightly sticky and slightly plastic; weak fine subangular blocky structure; abundant fine and medium roots, few coarse roots; abundant fine pores, common medium pores.	14.89	28.55	56.56	SaL

SaL: Sandy Loam
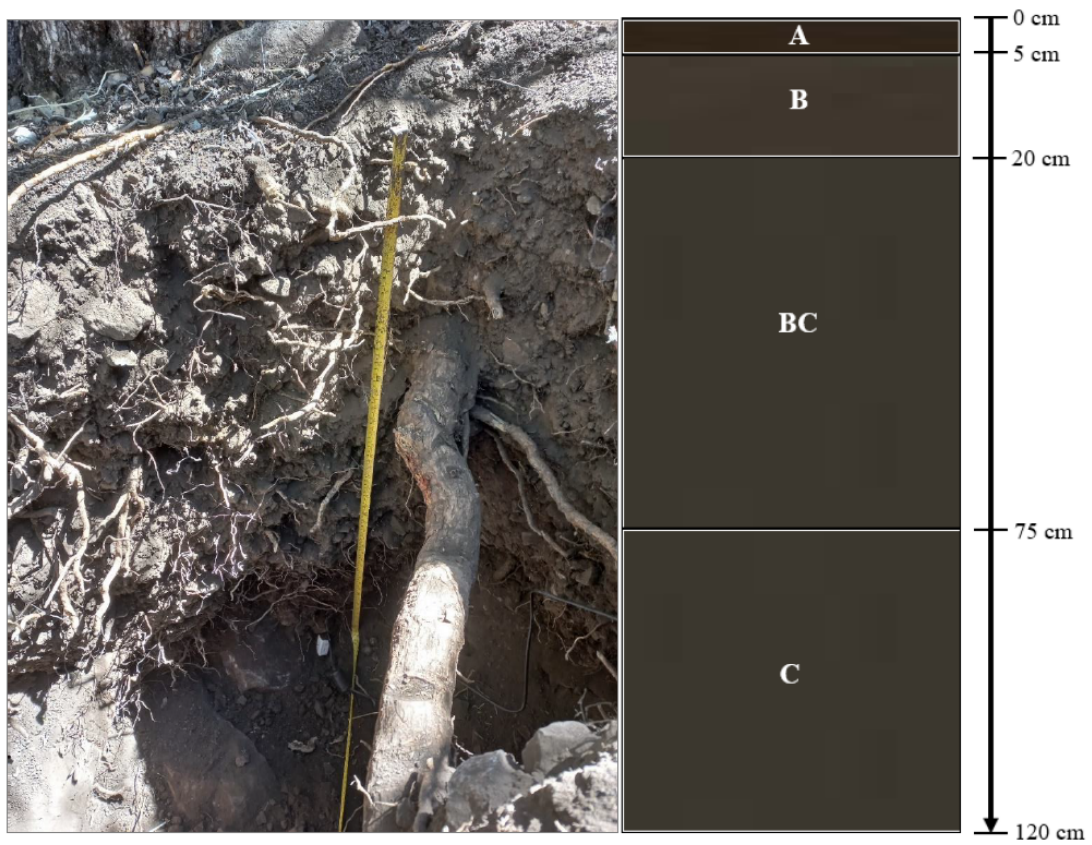
Figure S1.4: Photograph and schematic of the soil profile at the shrubland site, SM05.

S1.5 SM07 (ChSPD ID: 13644)

Table S1.5: Soil properties of SM07 (ChSPD ID: 13644)

Depth (cm)	Description	Clay (%)	Silt (%)	Sand (%)	Textural Class
0–4 (O1)	Black (10YR 2/1); abundant litter on the surface, this layer thins out away from the canopy of the *Lithraea caustica* (litre); abrupt linear boundary.	–	–	–	–
4–12 (A1)	Very dark brown (10YR 2/2); loam to sandy loam; non-sticky and slightly plastic; strong fine granular structure; abundant fine roots; abundant fine pores, common medium and coarse pores; clear linear boundary.	5.65	19.42	74.94	SaL
12–21 (A2)	Dark brown (7.5YR 3/2); loam to sandy loam; slightly sticky and slightly plastic; weak fine and medium subangular blocky structure in ∼30% and strong fine granular structure in ∼70%; abundant very fine and fine roots, common medium roots; abundant fine pores, common coarse pores; ∼20% medium angular gravel; abrupt linear boundary.	6.84	23.02	70.14	SaL
21–38 (AB)	Dark brown (7.5YR 3/2); sandy loam; moderately sticky and moderately plastic; strong fine and medium subangular blocky structure; common fine and medium roots, abundant coarse roots; common fine and coarse pores, abundant medium pores; ∼20% fine angular gravel, ∼40% coarse angular gravel; gradual linear boundary.	10.96	23.23	65.81	SaL
38–67 (Bt1)	Dark brown (7.5YR 3/2); sandy loam to sandy clay loam; moderately sticky and very plastic; strong fine subangular blocky structure; few fine, medium, and coarse roots; common fine pores, few medium and coarse pores; cutans observed on aggregate faces; ∼40% coarse angular gravel and ∼20% weathered rock; clear linear boundary.	16.71	21.10	62.19	SaL
67–90 (Bt2)	Dark brown (7.5YR 3/3); sandy clay loam; moderately sticky and very plastic; strong medium subangular blocky structure; few fine and medium roots; common fine and medium pores, few coarse pores; cutans observed on aggregate faces; ∼20% fine, medium, and coarse angular gravel and ∼30% weathered rock; diffuse linear boundary.	24.77	18.52	56.71	SaCL
90–133 (BC)	∼50% weathered rock within the horizon; dark reddish brown (5YR 3/4); sandy loam; moderately sticky and moderately plastic; weak fine subangular blocky structure, tending to massive; few fine roots; abundant fine pores, common medium pores; ∼20% fine angular gravel; abrupt linear boundary.	14.82	23.50	61.68	SaL
133–145+ (C)	∼60% weathered rock within the horizon; dark brown (7.5YR 3/4); sandy loam to loamy sand; slightly sticky and slightly plastic; massive structure; no roots; common fine and medium pores; ∼20% fine, medium, and coarse angular gravel.	7.34	14.89	77.76	LoSa

SaCL: Sandy Clay Loam; SaL: Sandy Loam; LoSa: Loamy Sand
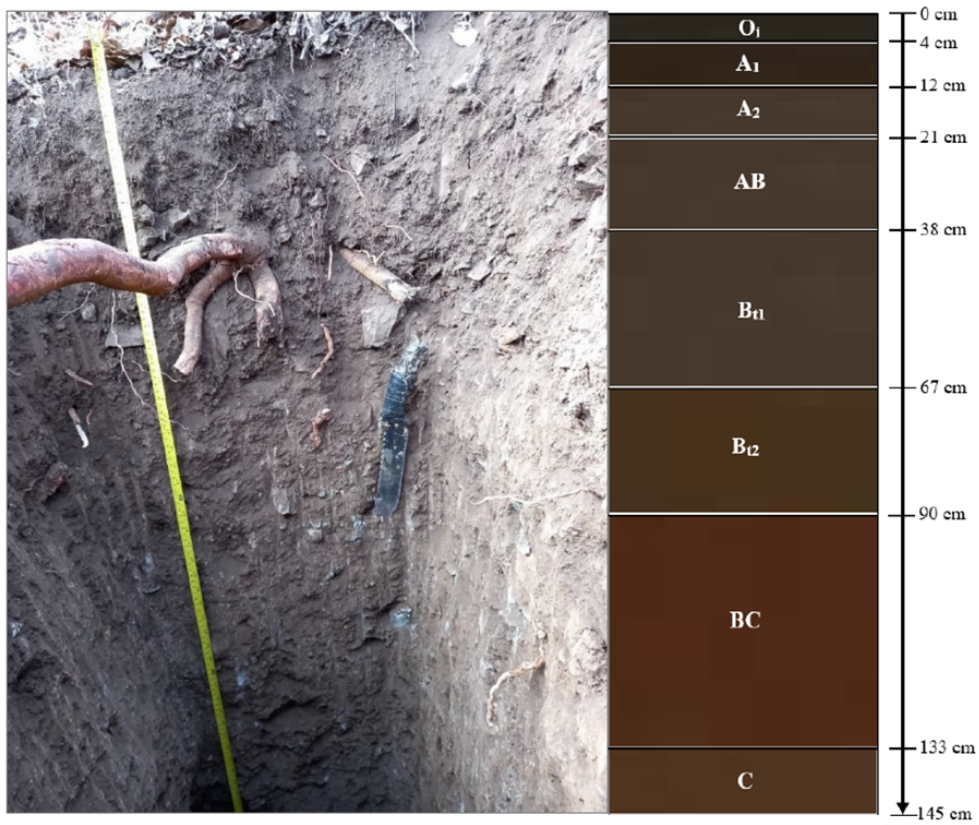
Figure S1.5: Photograph and schematic of the soil profile at the shrubland site, SM07.

S1.6 SM15 (ChSPD ID: 13667)

Table S1.6: Soil properties of SM15 (ChSPD ID: 13667)

Depth (cm)	Description	Clay (%)	Silt (%)	Sand (%)	Textural Class
0–4 (Oi)	Senescent litter from the autumn leaf fall of *Nothofagus glauca* trees. Common presence of thin branches from dead tree material; clear linear boundary.	–	–	–	–
4–7 (Oa)	Very dark brown (10YR 2/2); highly decomposed organic material; sandy loam; abundant fine roots; abundant fine and medium pores; clear linear boundary.	6.50	18.41	75.09	SaL
7–23 (A)	Dark brown (10YR 3/3); sandy loam; slightly sticky and slightly plastic; strong fine granular structure; abundant fine roots, few medium and coarse roots; abundant fine pores, few medium pores; ~10% fine gravel; clear linear boundary.	6.50	18.41	75.09	SaL
23–50 (Bw1)	Strong brown (7.5YR 5/6); sandy loam; moderately sticky and moderately plastic; moderate fine and medium subangular blocky structure; common fine roots, few medium and coarse roots, abundant very coarse roots; abundant fine pores, common medium pores; few fine and coarse gravel; gradual linear boundary.	6.45	20.41	73.14	SaL
50–80 (Bw2)	Strong brown (7.5YR 5/6); sandy clay loam; moderately sticky and moderately plastic; moderate medium and coarse subangular blocky structure; few fine roots, common medium roots; abundant fine and medium pores; few medium and coarse gravel, few pebbles; clear linear boundary.	23.84	16.59	59.57	SaCL
80–130 (BC)	Substrate with ~40% rocks and ~30% fine gravel; light yellowish brown (10YR 6/4); sandy loam; slightly sticky and moderately plastic; massive structure; very few fine and medium roots; abundant fine pores, few medium pores; gradual linear boundary.	21.48	15.34	63.18	SaL
130–170+ (C)	Regolith, highly weathered; yellowish brown (10YR 6/6); sandy clay loam; moderately sticky and moderately plastic; massive structure; very few fine roots, few medium roots; abundant fine pores, few medium pores; yellowish red iron masses (7.5YR 6/8) increasing with depth, from less than 5% at the top of the horizon to more than 40% at the bottom.	26.84	18.58	54.57	SaCL

SaCL: Sandy Clay Loam; SaL: Sandy Loam

SM15
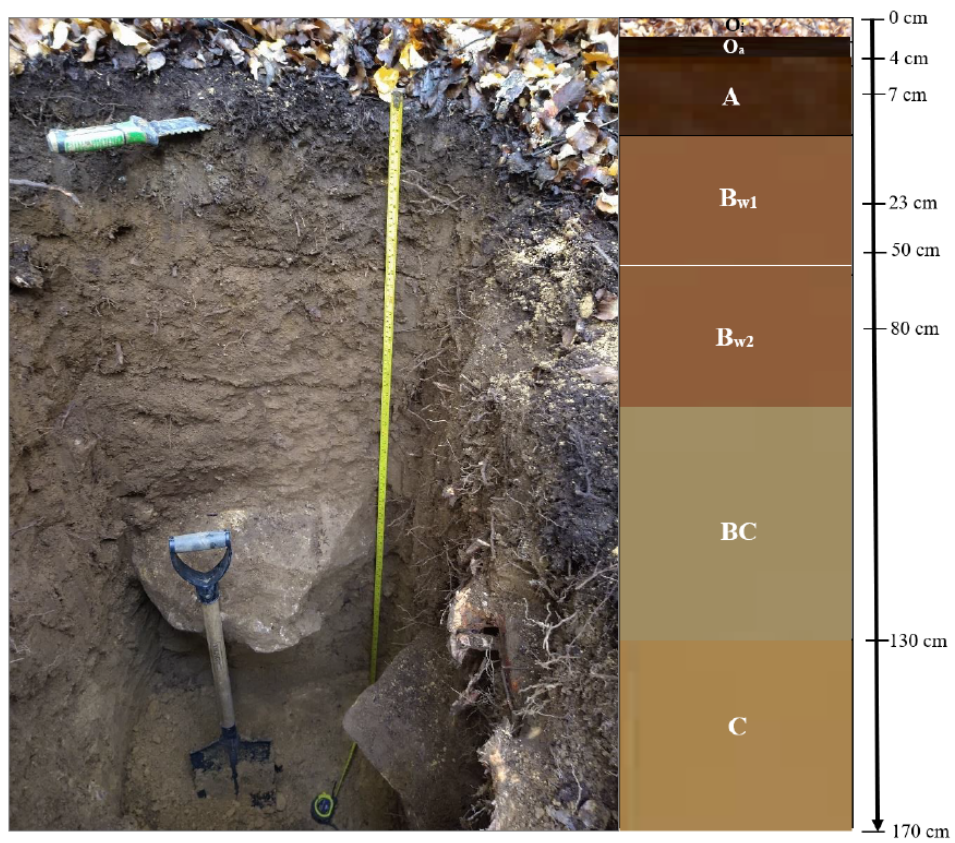
Figure S1.6: Photograph and schematic of the soil profile at the native forest site, SM15.

S1.7 SM10 (ChSPD ID: 13927)

Table S1.7: Soil properties of SM10 (ChSPD ID: 13927)

Depth (cm)	Description	Clay (%)	Silt (%)	Sand (%)	Textural Class
0–10 (A1)	Very dark grayish brown (10YR 3/2); sandy loam; slightly sticky and slightly plastic; strong medium subangular blocky and strong fine granular structure; abundant fine roots; abundant fine and medium pores, few coarse pores; ∼20% coarse angular gravel; abrupt linear boundary.	8.84	31.58	59.57	SaL
10–26 (A2)	Dark brown (10YR 3/3); sandy loam; slightly sticky and slightly plastic; strong fine subangular blocky structure; abundant fine, medium, and coarse roots; abundant fine and medium pores; ∼10% fine and medium gravel; clear linear boundary.	6.74	31.58	61.68	SaL
26–83 (B1)	Dark brown (10YR 3/2); sandy loam; slightly sticky and slightly plastic; weak fine and moderate medium and coarse subangular blocky structure; abundant fine, medium, and coarse roots; abundant fine, medium, and coarse pores; clear linear boundary.	6.61	28.49	64.91	SaL
83–125 (B2)	Dark yellowish brown (10YR 3/6); sandy loam; slightly sticky and moderately plastic; strong fine and medium subangular blocky structure; few fine roots, abundant medium roots, common coarse roots; abundant fine pores, common medium pores; ∼30% fine and medium gravel, ∼20% coarse gravel; diffuse linear boundary.	11.15	21.01	67.84	SaL
125–205+ (BC)	Dark yellowish brown (10YR 3/6); sandy loam; slightly sticky and slightly plastic; moderate fine and medium subangular blocky structure, tending to massive in some areas; very few fine and medium roots; abundant fine pores, common medium pores; ∼50% of the horizon composed of coarse gravel, stones, and boulders.	8.95	20.45	70.60	SaL

SaL: Sandy Loam
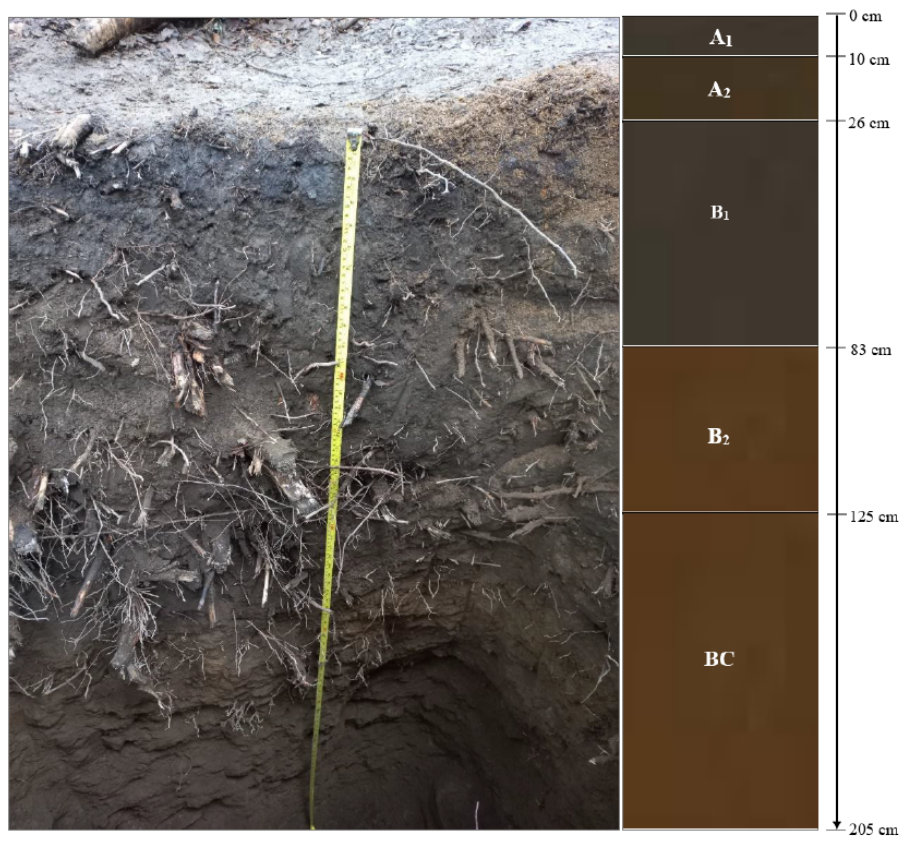
Figure S1.7: Photograph and schematic of the soil profile at the native forest site, SM10.

S1.8 SM11 (ChSPD ID: 13928)

Table S1.8: Soil properties of SM11 (ChSPD ID: 13928)

Depth (cm)	Description	Clay (%)	Silt (%)	Sand (%)	Textural Class
0–10 (A)	Black (10YR 2/1); sandy loam; slightly sticky and slightly plastic; strong medium subangular blocky and strong fine granular structure; abundant fine roots; abundant fine and medium pores, few coarse pores; ∼20% coarse angular gravel; abrupt linear boundary.	6.97	27.44	65.59	SaL
10–30 (C1)	Substrate with ∼60% coarse gravel, stones, and pebbles within the horizon; dark brown (10YR 3/3); sand; non-sticky and slightly plastic; single grain structure; abundant very fine and fine roots; abundant fine and medium pores; ∼20% fine and medium angular gravel; gradual linear boundary.	4.49	7.35	88.16	Sa
30–65 (C2)	Substrate with ∼50% coarse gravel, stones, and pebbles; variegated, dominated by dark yellowish brown (10YR 3/6); loamy sand; slightly sticky and slightly plastic; single grain structure; few fine roots; abundant fine and medium pores; abrupt linear boundary.	4.48	9.36	86.17	LoSa
65–80 (2Ab)	Dark brown (10YR 3/3); sandy loam; slightly sticky and slightly plastic; strong medium and coarse subangular blocky structure; few fine and medium roots; abundant fine and medium pores; common fine iron masses; clear wavy boundary.	6.22	35.95	57.83	SaL
80–120 (2Bc)	Black (GLEY 1 2.5/N); sandy loam; slightly sticky and slightly plastic; moderate fine, medium, and coarse subangular blocky structure; very few fine and medium roots; abundant fine and medium pores; common fine iron masses.	8.24	33.61	58.15	SaL
120+	Water table emerges at this depth.	–	–	–	–

SaL: Sandy Loam; LoSa: Loamy Sand; Sa: Sand
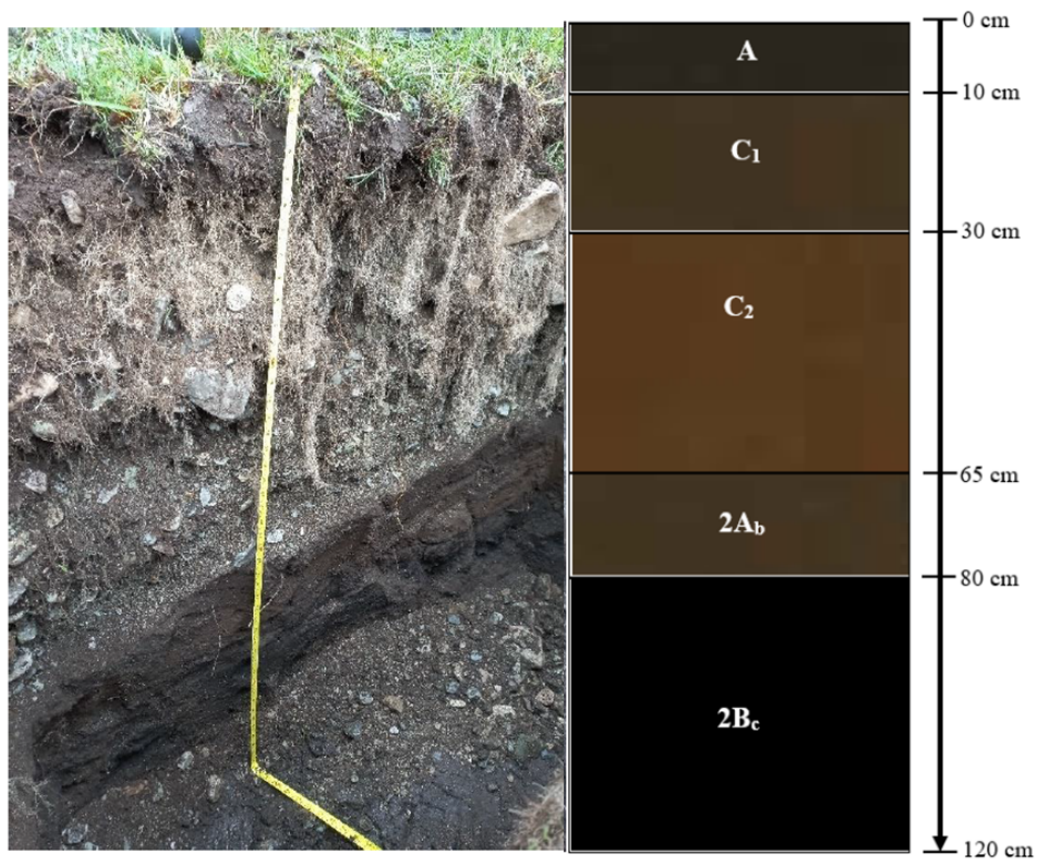
Figure S1.8: Photograph and schematic of the soil profile at the grassland site, SM11.

S1.9   SM12 (ChSPD ID: 13929)

Table S1.9: Soil properties of SM12 (ChSPD ID: 13929)

Depth (cm)	Description	Clay (%)	Silt (%)	Sand (%)	Textural Class
0–18 (A)	Black (10YR 2/1); sandy loam; slightly sticky and slightly plastic; strong fine subangular blocky and moderate fine granular structure; abundant fine, medium, and coarse roots; abundant fine, medium, and coarse pores; clear linear boundary.	5.15	34.19	60.65	SaL
18–40 (B1)	Very dark brown (10YR 2/2); sandy loam; slightly sticky and slightly plastic; strong fine and medium subangular blocky structure; abundant fine, medium, and coarse roots; abundant fine and medium pores, common coarse pores; clear linear boundary.	5.80	34.58	59.62	SaL
40–67 (B2)	Dark yellowish brown (10YR 3/4); sandy loam; slightly sticky and slightly plastic; moderate to strong fine and medium subangular blocky structure; common fine, medium, and coarse roots; abundant fine pores, common medium and coarse pores; clear linear boundary.	8.34	20.52	71.14	SaL
67–88 (BC)	Variegated, dominated by yellowish brown (10YR 5/8); loamy sand; slightly sticky and slightly plastic; single grain structure, tending to form weak medium subangular blocky aggregates; few fine and medium roots; abundant fine and medium pores; clear linear boundary.	4.58	9.58	85.84	LoSa
88–100 (2B)	Dark yellowish brown (10YR 3/6); sandy loam; slightly sticky and slightly plastic; moderate fine and medium subangular blocky structure; few fine roots, common medium roots; abundant fine and medium pores; ~40% fine and medium gravel; abrupt linear boundary.	4.76	27.72	67.52	SaL
100–104 (2BC)	Variegated, dominated by dark yellowish brown (10YR 3/4); loam; slightly sticky and moderately plastic; massive structure; no roots; few fine pores; ~50% fine and medium gravel; abundant fine iron masses; abrupt linear boundary.	9.38	41.98	48.64	L
104–132 (3B)	Dark yellowish brown (10YR 3/4); sandy loam; slightly sticky and slightly plastic; weak fine subangular blocky structure; no roots; common fine and medium pores; abrupt linear boundary.	7.93	37.07	55.01	SaL
132–210+ (4Bb)	Dark yellowish brown (10YR 3/4); sandy loam; slightly sticky and slightly plastic; strong medium and coarse subangular blocky structure; few fine, medium, and coarse roots; abundant fine pores, few medium pores.	7.19	35.48	57.33	SaL

SaL: Sandy Loam; LoSa: Loamy Sand; L: Loam
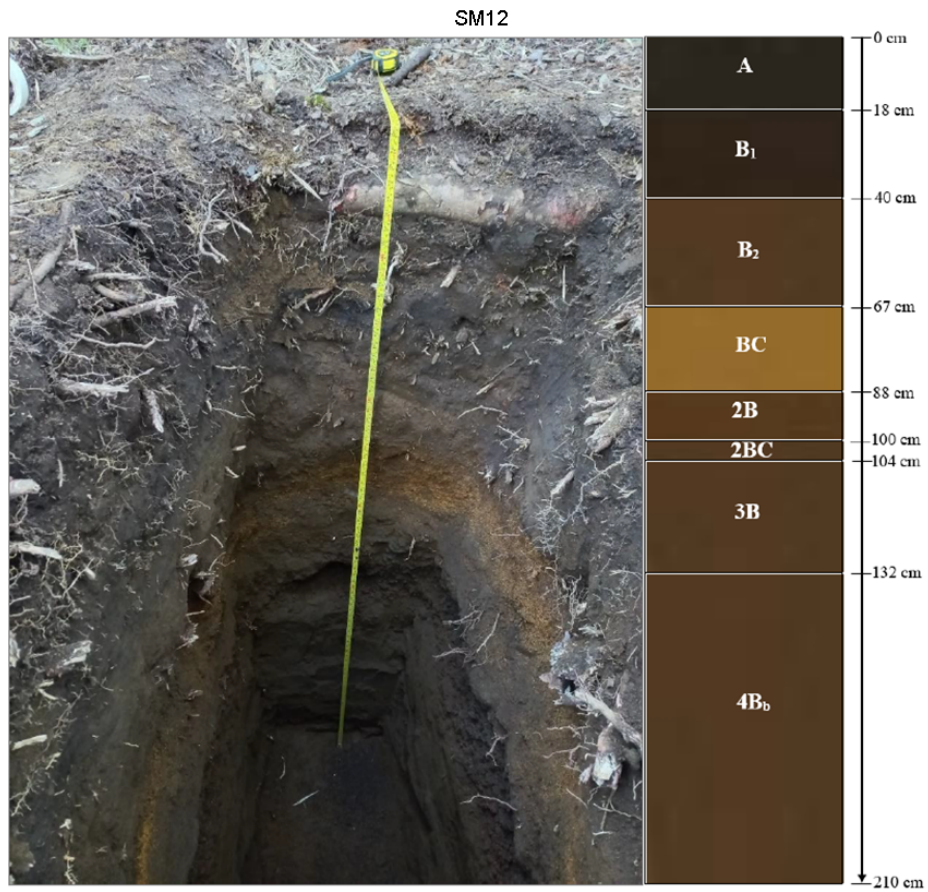
Figure S1.9: Photograph and schematic of the soil profile at the native forest site, SM12.

S1.10 SM14 (ChSPD ID: 13931)

Table S1.10: Soil properties of SM14 (ChSPD ID: 13931)

Depth (cm)	Description	Clay (%)	Silt (%)	Sand (%)	Textural Class
0–8 (A1)	Black (10YR 2/1); sandy loam; slightly sticky and slightly plastic; moderate fine and medium subangular blocky and moderate fine granular structure; abundant fine and medium roots, common coarse roots; abundant fine and medium pores; ∼10% fine gravel; clear linear boundary.	6.80	33.57	59.63	SaL
8–20 (A2)	Very dark brown (10YR 2/2); sandy loam; slightly sticky and slightly plastic; strong fine and medium subangular blocky structure; abundant fine and medium roots, few coarse roots; abundant fine and medium pores; gradual linear boundary.	4.71	40.27	55.02	SaL
20–38 (B)	Very dark grayish brown (10YR 3/2); sandy loam; slightly sticky and slightly plastic; moderate fine and medium subangular blocky structure; abundant fine and coarse roots, common medium roots; abundant fine and medium pores; abrupt linear boundary.	6.79	35.62	57.59	SaL
38–48 (BC)	Dark yellowish brown (10YR 4/4); loamy sand; non-sticky and slightly plastic; strong fine and medium subangular blocky structure; common fine and medium roots; abundant fine pores, common medium pores; ∼20% fine and medium gravel; abrupt linear boundary.	4.52	18.10	77.38	LoSa
48–64 (C1)	Substrate with ∼50% medium and coarse gravel and stones ranging from 20 to 30 cm in diameter; dark yellowish brown (10YR 3/4); sand; non-sticky and non-plastic; single grain structure; common fine roots; abundant fine pores; abrupt linear boundary.	2.43	5.26	92.31	Sa
64–125+ (C2)	Substrate with ∼80% medium and coarse gravel, with an increase in stones ranging from 30 to 50 cm in diameter starting at 80 cm depth; variegated, dominated by dark grayish brown (10YR 4/2); sand; non-sticky and non-plastic; single grain structure; very few fine roots; abundant fine pores.	2.42	1.21	96.37	Sa

SaL: Sandy Loam; LoSa: Loamy Sand; Sa: Sand
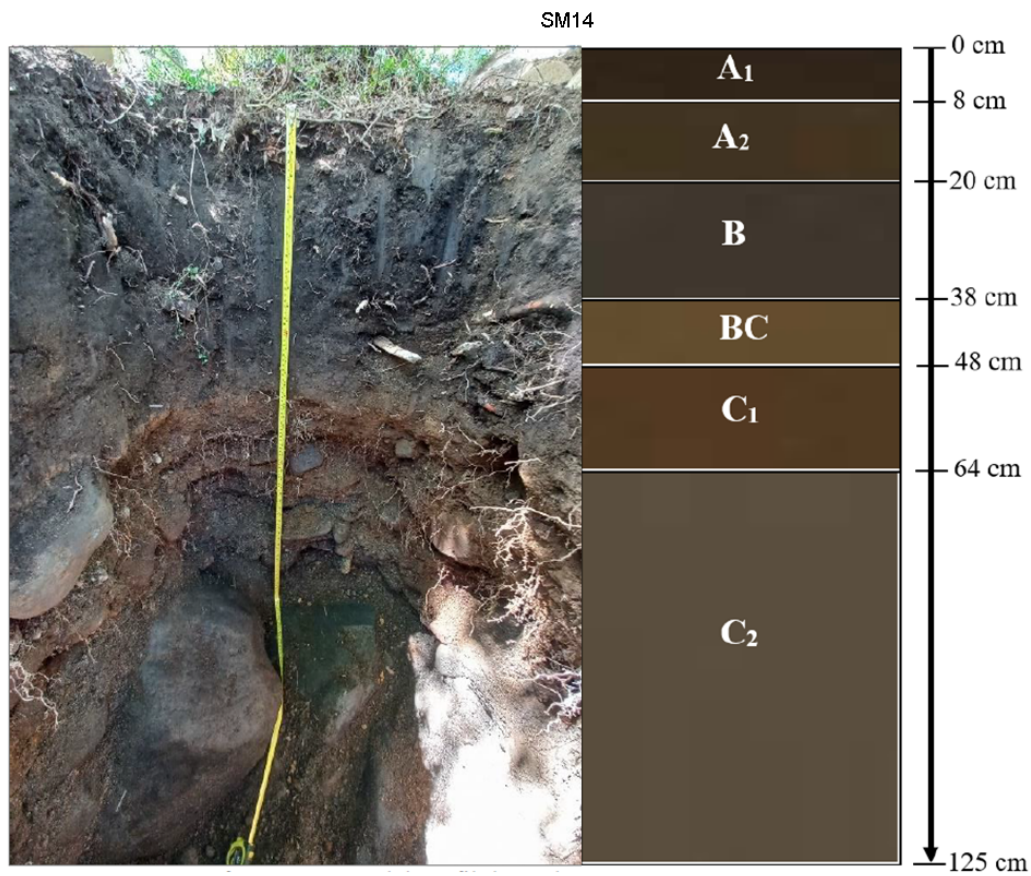
Figure S1.10: Photograph and schematic of the soil profile at the native forest site, SM14.

S2 Time series of SSM, RZSM and P

This section presents the time series of surface soil moisture (SSM), root zone soil moisture (RZSM), and precipitation (P) for each study site during the 2022–2023 period. In addition, performance metrics are provided to evaluate the agreement between gridded products and in situ measurements for both SSM and RZSM. Metrics include the unbiased root mean square error (ubRMSE, m³/m³), percentage bias (PBIAS, %), Pearson's correlation coefficient (r), Kling-Gupta efficiency (KGE), and Spearman correlation coefficient (ρ). In the tables, metrics for SSM are presented directly, while the corresponding values for RZSM are indicated in parentheses.

S2.1 SM01
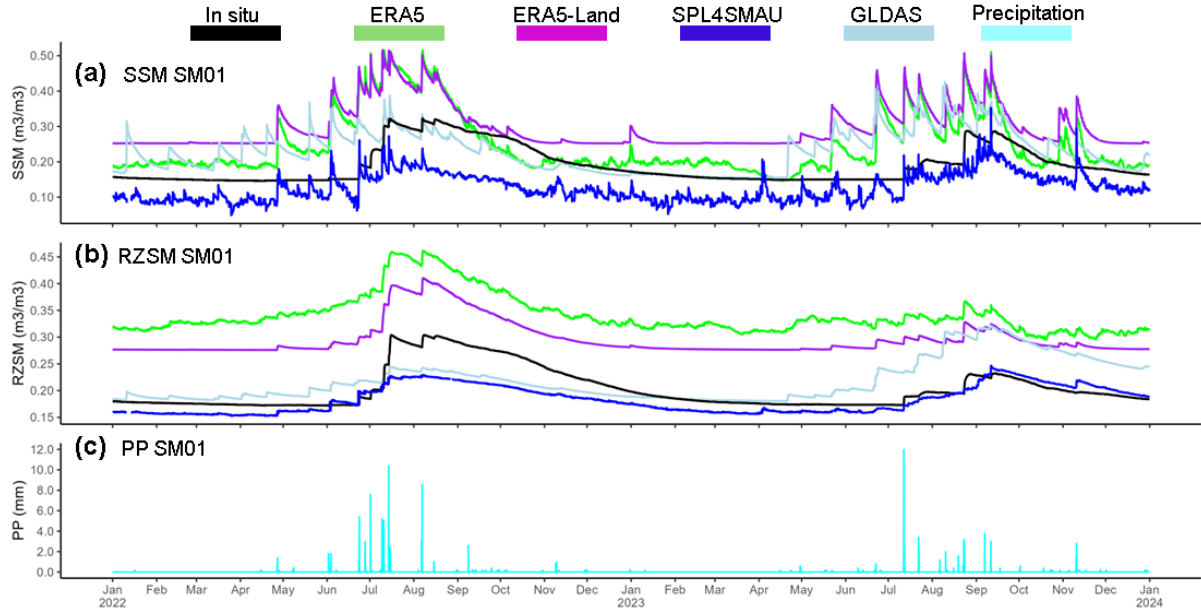
Figure S2.1: Time series for the 2022–2023 period: (a) Surface soil moisture (SSM), (b) Root zone soil moisture (RZSM), and (c) Precipitation (P) for SM01 (native forest in PRB).

Table S2.1: Performance metrics for SSM (RZSM) at SM01. Metrics include ubRMSE, PBIAS, r, ρ and KGE.

Product	ubRMSE	PBIAS	r	KGE	ρ
ERA5	0.070 (0.027)	-24.1 (68.9)	0.56 (0.71)	0.45 (0.14)	0.34 (0.79)
ERA5-Land	0.057 (0.020)	58.8 (46.3)	0.52 (0.85)	0.22 (0.34)	0.29 (0.92)
SPL4SMAU	0.036 (0.026)	-34.9 (-9.8)	0.68 (0.70)	0.51 (0.60)	0.06 (0.08)
GLDAS-Noah	0.057 (0.044)	20.3 (11.2)	0.39 (0.30)	0.35 (0.29)	-0.37 (-0.68)

S2.2   SM02
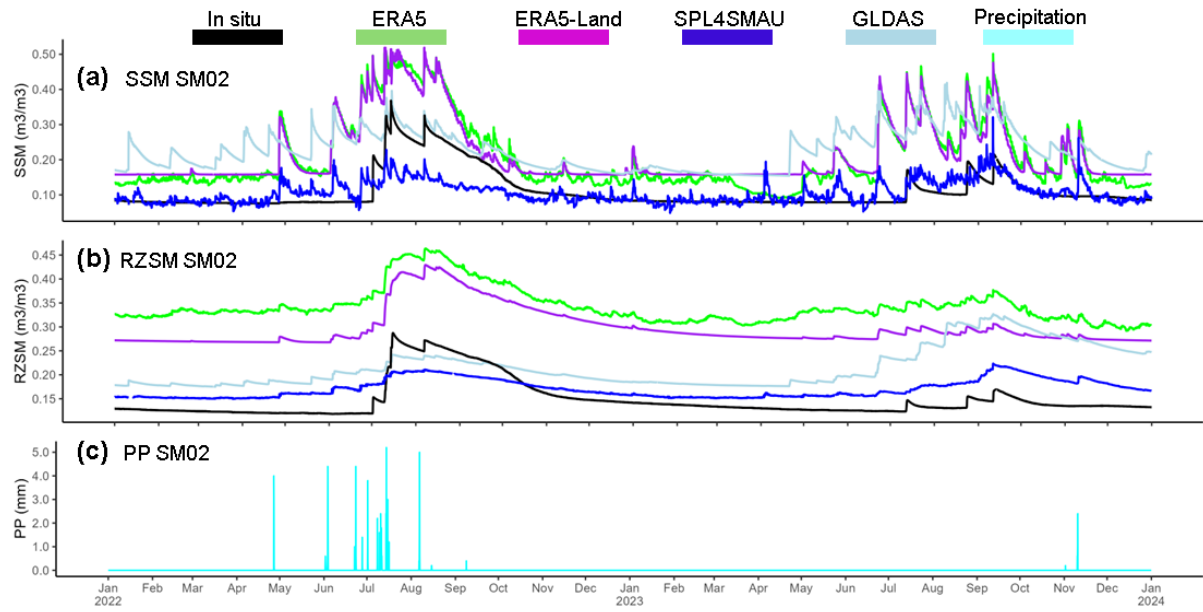
Figure S2.2: Time series for the 2022–2023 period: (a) Surface soil moisture (SSM), (b) Root zone soil moisture (RZSM), and (c) Precipitation (P) for SM02 (shrubland in PRB).

Table S2.2: Performance metrics for SSM (RZSM) at SM02. Metrics include ubRMSE, PBIAS, r, ρ and KGE.

Product	ubRMSE	PBIAS	r	KGE	ρ
ERA5	0.073 (0.022)	-49.0 (133.7)	0.71 (0.81)	0.43 (-0.47)	0.31 (0.68)
ERA5-Land	0.064 (0.017)	99.5 (102.8)	0.70 (0.90)	-0.05 (-0.15)	0.37 (0.97)
SPL4SMAU	0.041 (0.029)	-3.8 (16.0)	0.60 (0.63)	0.43 (0.30)	0.06 (0.04)
GLDAS-Noah	0.054 (0.051)	108.7 (52.2)	0.45 (0.18)	-0.32 (-0.01)	-0.31 (-0.62)

S2.3   SM04
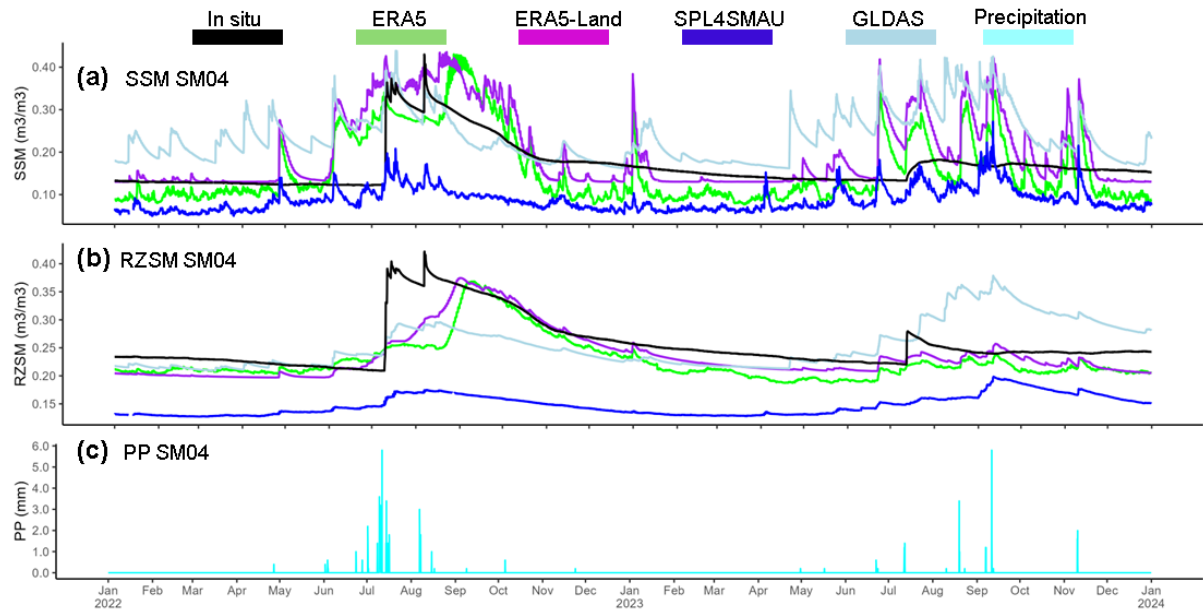
Figure S2.3: Time series for the 2022–2023 period: (a) Surface soil moisture (SSM), (b) Root zone soil moisture (RZSM), and (c) Precipitation (P) for SM04 (shrubland in PRB).

Table S2.3: Performance metrics for SSM (RZSM) at SM04. Metrics include ubRMSE, PBIAS, r, ρ and KGE.

Product	ubRMSE	PBIAS	r	KGE	ρ
ERA5	0.066 (0.034)	4.8 (-10.8)	0.58 (0.65)	0.41 (0.64)	0.37 (0.74)
ERA5-Land	0.070 (0.032)	21.8 (-7.2)	0.60 (0.73)	0.37 (0.72)	0.36 (0.93)
SPL4SMAU	0.045 (0.040)	-48.6 (-42.4)	0.43 (0.41)	0.25 (0.22)	-0.06 (-0.24)
GLDAS-Noah	0.063 (0.052)	40.9 (2.5)	0.29 (0.25)	0.15 (0.24)	-0.29 (-0.53)

S2.4 SM05
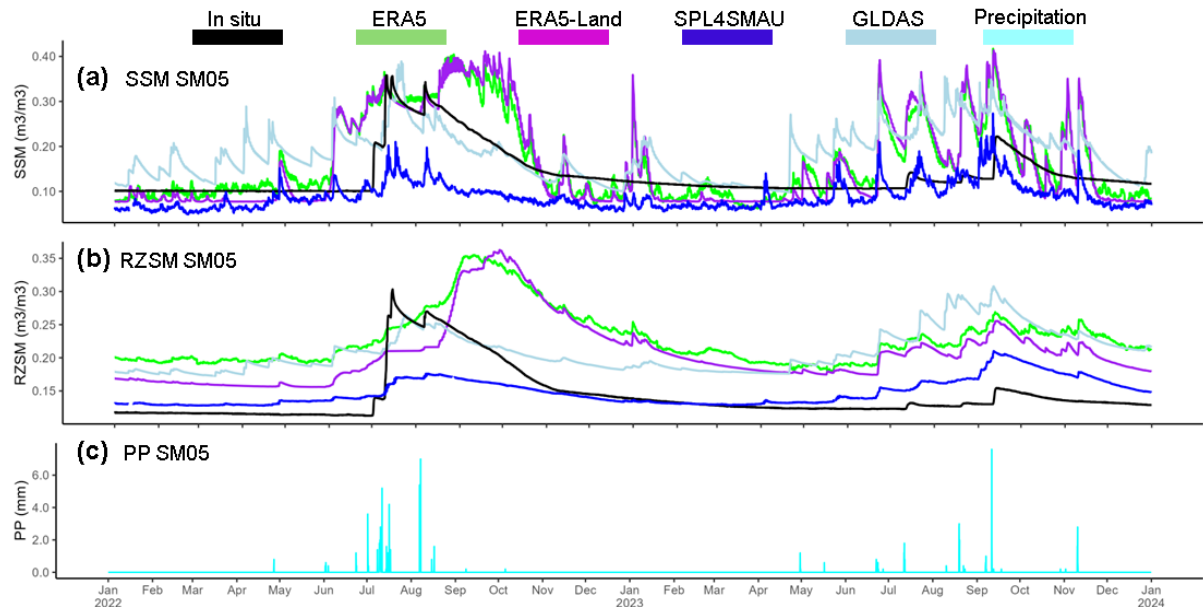
Figure S2.4: Time series for the 2022–2023 period: (a) Surface soil moisture (SSM), (b) Root zone soil moisture (RZSM), and (c) Precipitation (P) for SM05 (shrubland in PRB).

Table S2.4: Performance metrics for SSM (RZSM) at SM05. Metrics include ubRMSE, PBIAS, r, ρ and KGE.

Product	ubRMSE	PBIAS	r	KGE	ρ
ERA5	0.070 (0.034)	-20.7 (62.0)	0.63 (0.64)	0.49 (0.21)	0.38 (0.81)
ERA5-Land	0.083 (0.044)	22.8 (47.5)	0.60 (0.52)	0.20 (0.31)	0.37 (0.76)
SPL4SMAU	0.044 (0.034)	-36.1 (4.2)	0.51 (0.44)	0.38 (0.25)	0.07 (-0.18)
GLDAS-Noah	0.054 (0.039)	35.8 (49.8)	0.45 (0.33)	0.30 (0.04)	-0.15 (-0.46)

S2.5   SM07
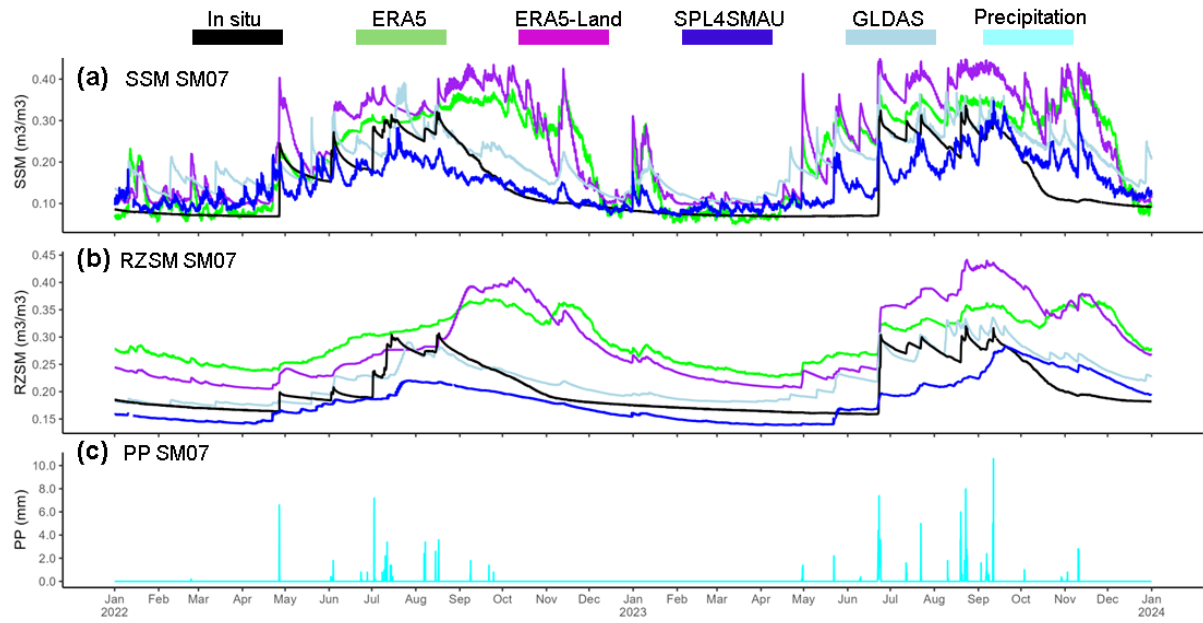
Figure S2.5: Time series for the 2022–2023 period: (a) Surface soil moisture (SSM), (b) Root zone soil moisture (RZSM), and (c) Precipitation (P) for SM05 (shrubland in MRB).

Table S2.5: Performance metrics for SSM (RZSM) at SM07. Metrics include ubRMSE, PBIAS, r, ρ and KGE.

Product	ubRMSE	PBIAS	r	KGE	ρ
ERA5	0.087 (0.040)	-37.5 (45.7)	0.60 (0.59)	0.43 (0.31)	0.11 (0.26)
ERA5-Land	0.088 (0.053)	82.9 (42.3)	0.66 (0.65)	0.09 (0.44)	0.27 (0.40)
SPL4SMAU	0.055 (0.035)	2.6 (-10.6)	0.71 (0.64)	0.56 (0.62)	0.55 (0.61)
GLDAS-Noah	0.051 (0.027)	46.6 (11.2)	0.75 (0.78)	0.29 (0.69)	0.32 (0.37)

S2.6 SM15
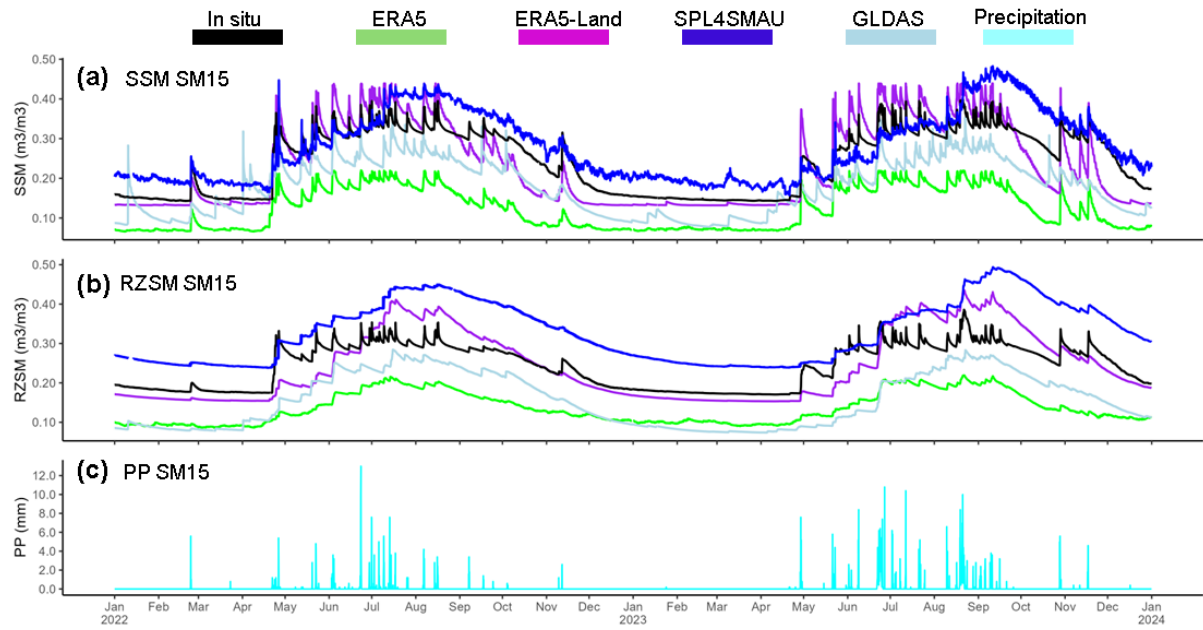
Figure S2.6: Time series for the 2022–2023 period: (a) Surface soil moisture (SSM), (b) Root zone soil moisture (RZSM), and (c) Precipitation (P) for SM05 (native forest in CRB).

Table S2.6: Performance metrics for SSM (RZSM) at SM15. Metrics include ubRMSE, PBIAS, r, ρ and KGE.

Product	ubRMSE	PBIAS	r	KGE	ρ
ERA5	0.051 (0.035)	99.0 (-44.5)	0.77 (0.77)	-0.04 (0.41)	0.81 (0.57)
ERA5-Land	0.065 (0.057)	-3.6 (-0.7)	0.78 (0.76)	0.57 (0.38)	0.85 (0.79)
SPL4SMAU	0.057 (0.052)	10.5 (32.4)	0.75 (0.72)	0.73 (0.57)	0.68 (0.65)
GLDAS-Noah	0.046 (0.035)	-28.7 (-35.9)	0.82 (0.83)	0.64 (0.13)	0.61 (0.60)

S2.7 SM10
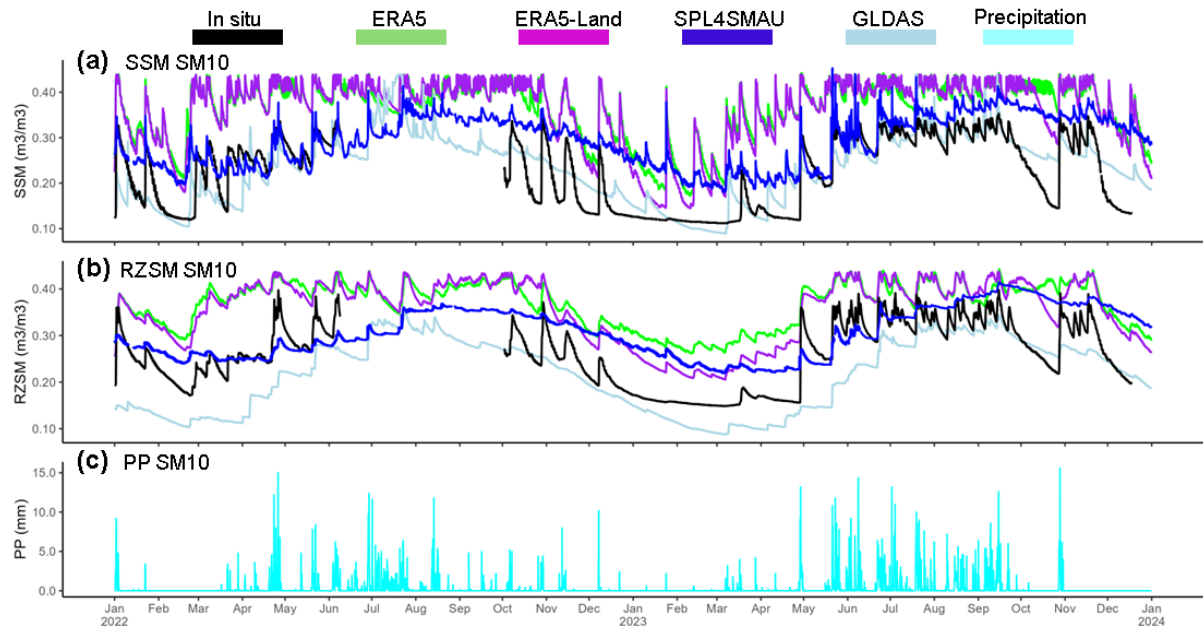
Figure S2.7: Time series for the 2022–2023 period: (a) Surface soil moisture (SSM), (b) Root zone soil moisture (RZSM), and (c) Precipitation (P) for SM10 (native forest in TRB).

Table S2.7: Performance metrics for SSM at SM10. Metrics include ubRMSE, PBIAS, r, ρ and KGE.

Product	ubRMSE	PBIAS	r	KGE	ρ
ERA5	0.059 (0.042)	-37.1 (40.1)	0.66 (0.78)	0.01 (0.33)	0.61 (0.77)
ERA5-Land	0.062 (0.043)	56.7 (35.2)	0.68 (0.79)	0.26 (0.52)	0.64 (0.82)
SPL4SMAU	0.064 (0.057)	25.0 (14.9)	0.57 (0.58)	0.36 (0.46)	0.58 (0.59)
GLDAS-Noah	0.050 (0.049)	1.5 (-18.2)	0.76 (0.76)	0.73 (0.55)	0.58 (0.62)

S2.8   SM11
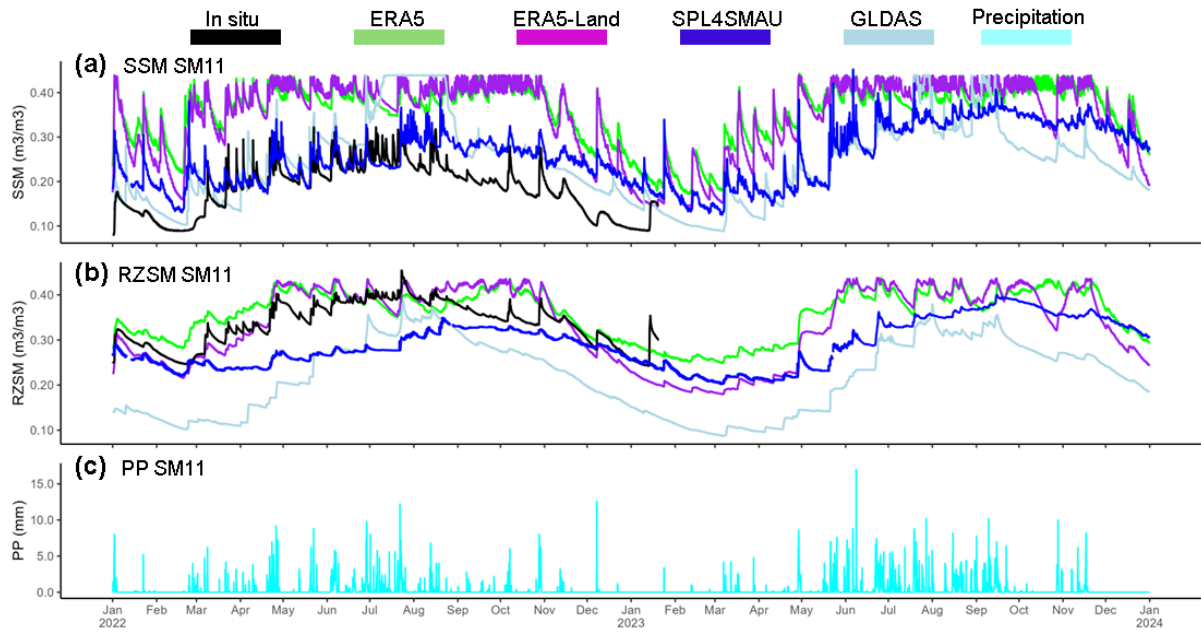
Figure S2.8: Time series for the 2022–2023 period: (a) Surface soil moisture (SSM), (b) Root zone soil moisture (RZSM), and (c) Precipitation (P) for SM11 (grassland in TRB).

Table S2.8: Performance metrics for SSM (RZSM) at SM11. Metrics include ubRMSE, PBIAS, r, ρ and KGE.

Product	ubRMSE	PBIAS	r	KGE	ρ
ERA5	0.052 (0.035)	-49.4 (8.0)	0.61 (0.69)	0.08 (0.67)	0.38 (0.48)
ERA5-Land	0.060 (0.048)	92.1 (1.9)	0.69 (0.78)	0.01 (0.35)	0.41 (0.62)
SPL4SMAU	0.051 (0.044)	29.2 (-17.1)	0.48 (0.44)	0.33 (0.41)	0.25 (0.51)
GLDAS-Noah	0.055 (0.045)	35.9 (-33.2)	0.79 (0.82)	0.54 (-0.5)	0.16 (0.47)

S2.9 SM12
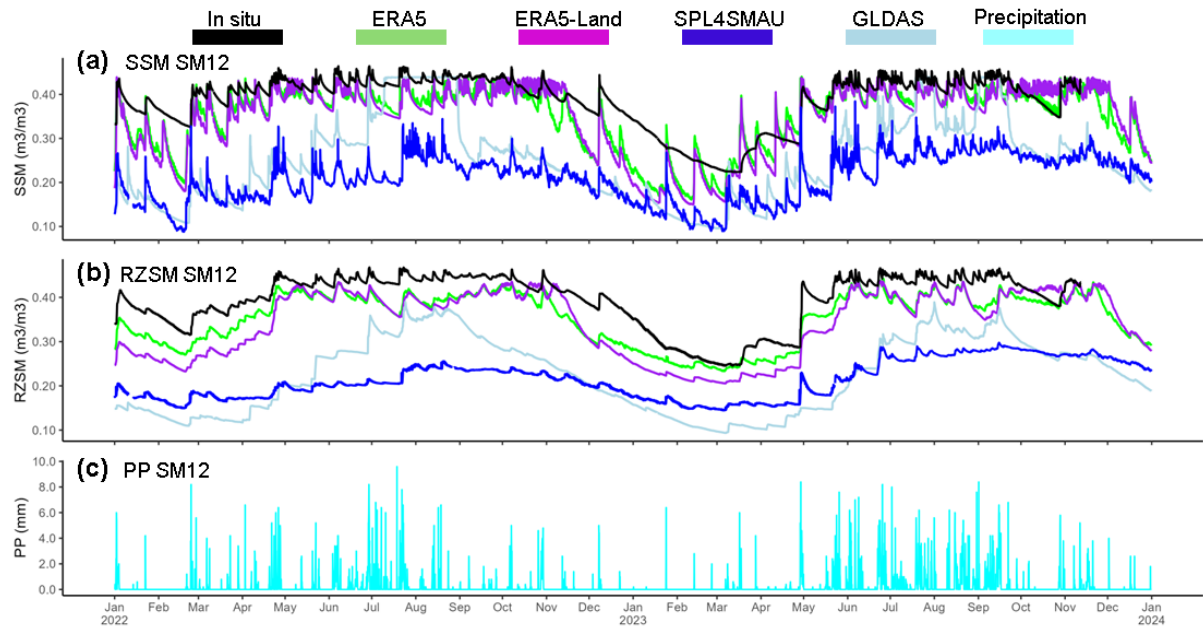
Figure S2.9: Time series for the 2022–2023 period: (a) Surface soil moisture (SSM), (b) Root zone soil moisture (RZSM), and (c) Precipitation (P) for SM12 (native forest in TRB).

Table S2.9: Performance metrics for SSM at SM12. Metrics include ubRMSE, PBIAS, r, ρ and KGE.

Product	ubRMSE	PBIAS	r	KGE	ρ
ERA5	0.048 (0.032)	9.4 (-10.3)	0.75 (0.85)	0.61 (0.79)	0.76 (0.88)
ERA5-Land	0.055 (0.045)	-10.0 (-13.5)	0.73 (0.80)	0.37 (0.47)	0.69 (0.74)
SPL4SMAU	0.046 (0.045)	-47.7 (-47.0)	0.65 (0.66)	0.04 (0.31)	0.42 (0.33)
GLDAS-Noah	0.065 (0.052)	-35.4 (-42.5)	0.69 (0.77)	-0.49 (-0.47)	0.44 (0.57)

S2.10 SM14
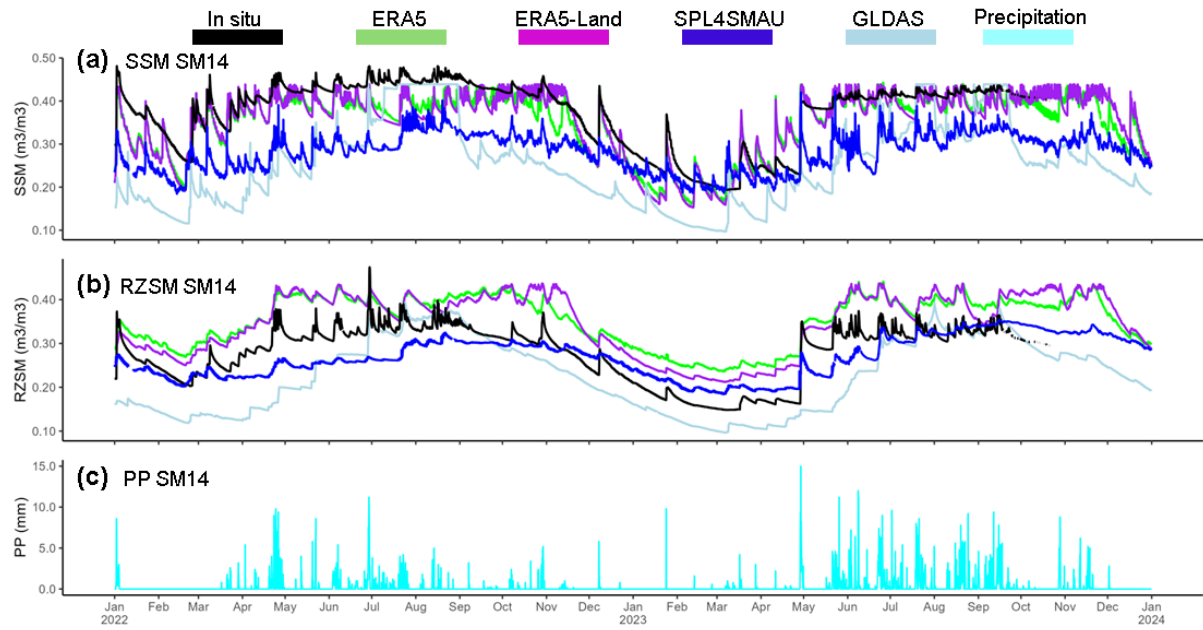
Figure S2.10: Time series for the 2022–2023 period: (a) Surface soil moisture (SSM), (b) Root zone soil moisture (RZSM), and (c) Precipitation (P) for SM14 (native forest in TRB).

Table S2.10: Performance metrics for SSM (RZSM) at SM14. Metrics include ubRMSE, PBIAS, r, ρ and KGE.

Product	ubRMSE	PBIAS	r	KGE	ρ
ERA5	0.049 (0.033)	7.1 (25.8)	0.78 (0.85)	0.77 (0.60)	0.71 (0.81)
ERA5-Land	0.053 (0.041)	-6.3 (23.6)	0.76 (0.81)	0.72 (0.68)	0.68 (0.73)
SPL4SMAU	0.054 (0.046)	-26.5 (-6.4)	0.71 (0.68)	0.55 (0.60)	0.53 (0.52)
GLDAS-Noah	0.065 (0.053)	-32.9 (-18.5)	0.71 (0.77)	0.07 (0.32)	0.46 (0.62)

References

Seguel, O., Galleguillos, M., Dinamarca, D., Pfeiffer, M., Pérez-Quezada, J., Zambrano-Bigiarini, M., Zamorano, C., Fustos, I., and Casanova, G.: ChSPD Chilean soil profile database V2 (Version 2), https://doi.org/10.5281/zenodo.13870760, data set, 2024.