Supplement of SOIL, 11, 1109–1130, 2025
https://doi.org/10.5194/soil-11-1109-2025-supplement

Supplement of

Soil organic carbon projections and climate adaptation strategies across Pacific Rim agro-ecosystems

Chien-Hui Syu et al.

Correspondence to: Shih-Hao Jien (shjien@nchu.edu.tw)

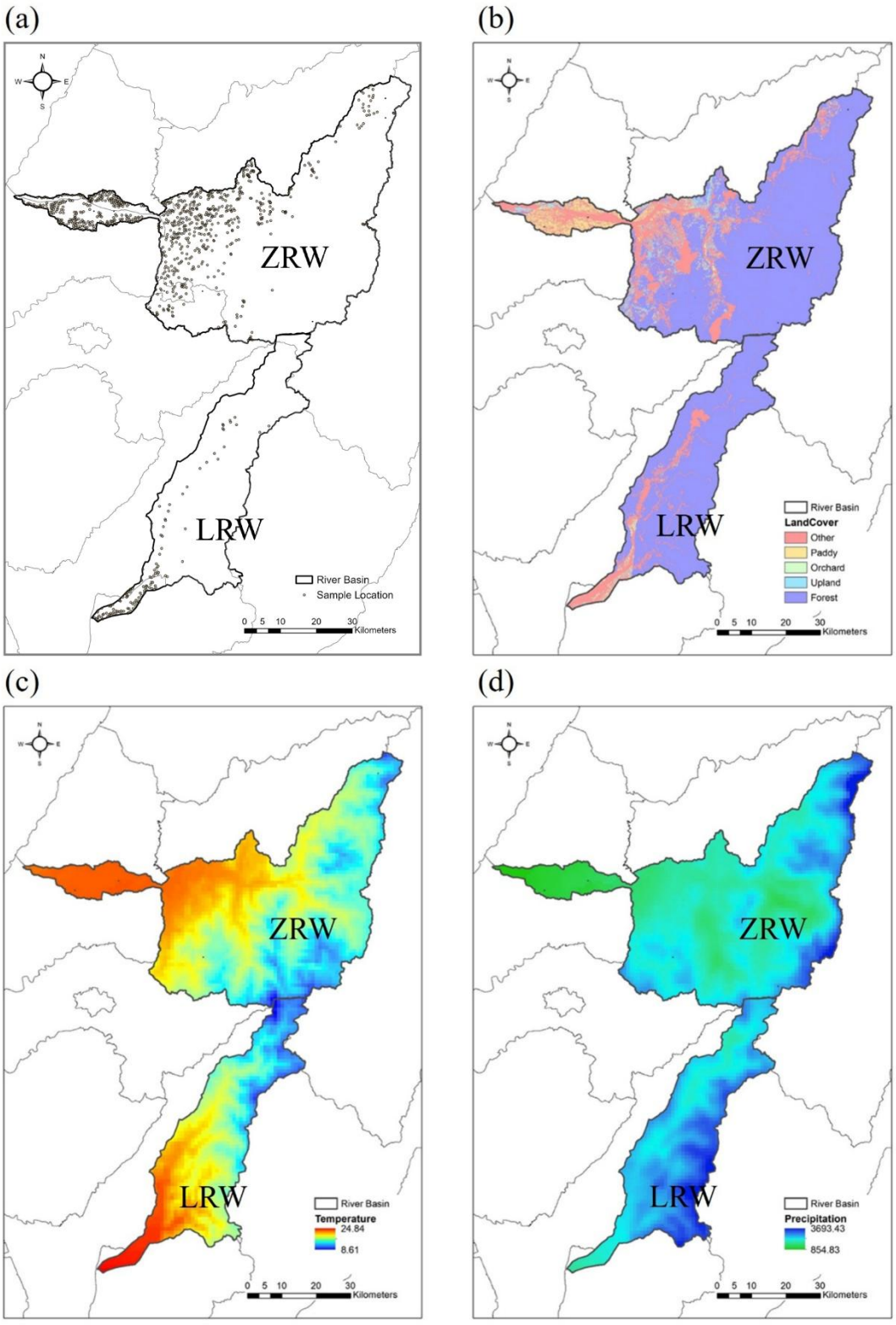

Fig. S1. The sampling sites (a), land cover (b), mean annual temperature (c), and total annual precipitation (d) of the Zhuoshui River watershed (ZRW) and the Laonong River watershed (LRW).

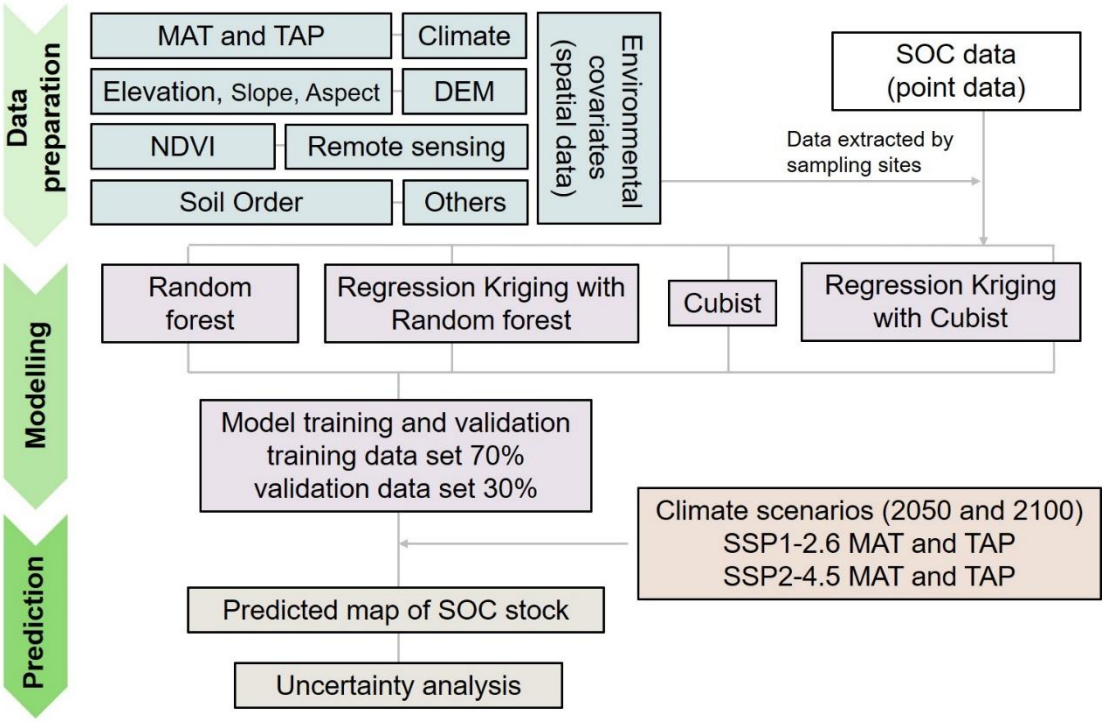

Fig. S2. Methodology flow chart of data preparation, modelling, and prediction developed in this study

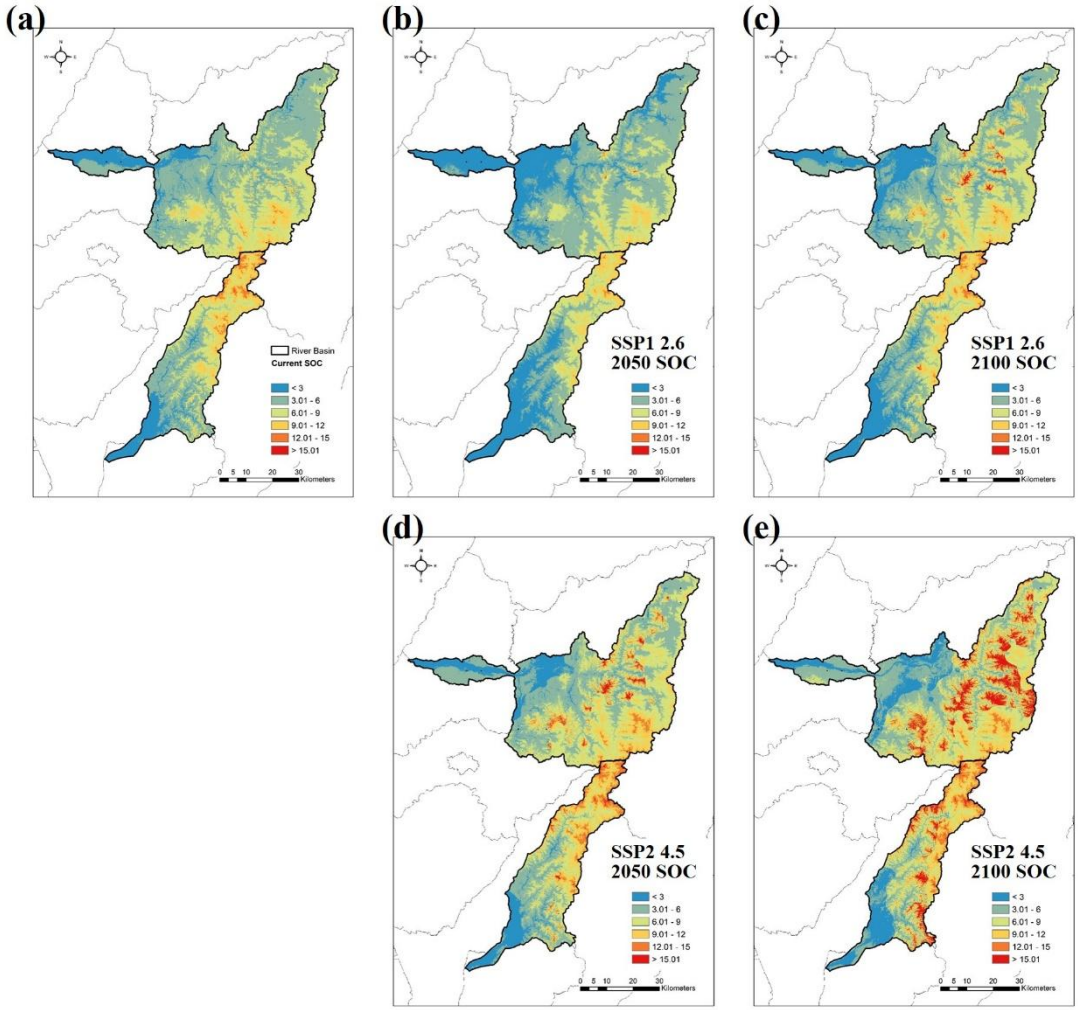

Fig. S3. Spatio-temporal distribution of SOC stock under different emission scenarios in mid-century and end- century at Zhuoshui and Laonong River watersheds: (a) SOC stock in 2020 (baseline); (b) SOC stock under SSP1-2.6 in 2050; (c)SOC stock under SSP1-2.6 in 2100; (d) SOC stock under SSP2-4.5 in 2050; (e) SOC stock under SSP2-4.5 in 2010

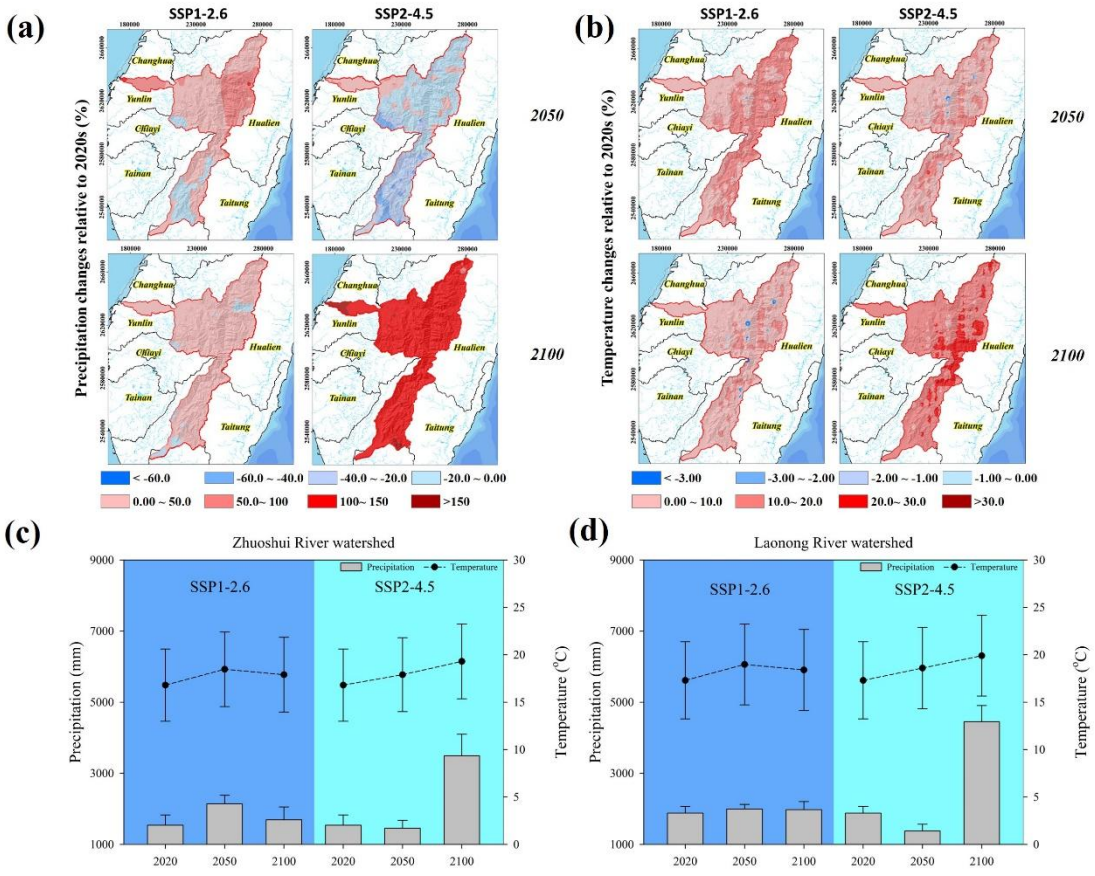

Fig. S4. Distribution of precipitation (a) and temperature (b) in 2050 and 2100 under different emission scenarios based on CMIP6 data; and the average value of temperature and precipitation of ZRW (c) and LRW (d) under different emission scenarios in 2020, 2050, and 2100.

Table S1. Summary of baseline SOC and projected changes under SSP scenarios with associated sources of uncertainty

Climate scenarios	Baseline SOC (kg m^{-2}) ± spatial CI	Central projected change (%)	± CF	± climate model spread (%)	± climate models (%)	± equilibration (%)	Final combined uncertainty (%)
SSP1-2.6	5.75 ± 2.54	-20.2	± 19.8	± 8.00	± 3.20	± 10.0	-20.2 ± 23.8
SSP2-4.5	5.75 ± 2.54	14.6	± 19.8	± 8.26	± 5.48	± 10.0	14.6 ± 24.3

Table S2. Calculation of SOC stocks under different CF percentages at each different land positions

Landscape types	CF = 0%	CF = 20%	CF = 40%	CF = 60%
		----------kg/m^2----------		
Plain areas	2.29 ± 0.66	1.83 ± 0.53	1.37 ± 0.40	0.92 ± 0.26
Upland areas	3.78 ± 1.16	3.03 ± 0.92	2.27 ± 0.69	1.52 ± 0.47
Mountain areas	7.03 ± 2.39	5.62 ± 1.92	4.21 ± 1.43	2.81 ± 0.96
Ensemble	5.75 ± 2.54	4.63 ± 2.13	3.47 ± 1.59	2.31 ± 1.06

Table S3. Uncertainties of projection of different SOC stock predicted models

Year	Climate scenarios	Predicted models	SOC storage (kg/m^2)		CV(%)	SOC storage Baseline (kg/m^2)	Central projected change (%)	± climate model spread (%)
			Baseline (2020)	2050				
2020		Cubist	5.75 ± 2.54	-	10.0	-	-	-
		Random Forest (RF)	6.36 ± 2.27			-	-	-
		Gradient Boosting Machines (GBM)	5.21 ± 1.93			-	-	-
2050	SSP1	Cubist	-	4.59 ± 2.35	10.0	5.75 ± 2.54	-20.2%	± 8.00%
		Random Forest (RF)		5.08 ± 1.78			-11.7%	
		Gradient Boosting Machines (GBM)		4.16 ± 1.48			-27.7%	
	SSP2	Cubist		6.59 ± 3.12	10.5		14.6%	± 8.26%
		Random Forest (RF)		6.86 ± 2.45			19.3%	
		Gradient Boosting Machines (GBM)		5.59 ± 2.06			2.78%	

Table S4. Uncertainties of projection of different CMIP6 climate models

Year	Climate scenarios	Climate model (Country)	SOC storage (kg/m^2)		CV(%)	SOC storage Baseline (kg/m^2)	Central projected change (%)	± climate model spread (%)
			Baseline (2020)	2050				
2020		MIROC6 (Japan)	5.75 ± 2.54	-	3.69	-	-	-
		NIMS-KMA(Korea)	5.69 ± 2.24			-	-	-
		BCC (China)	6.09 ± 2.98			-	-	-
2050	SSP1	MIROC6 (Japan)	-	4.59 ± 2.35	4.21	5.75 ± 2.54	-20.2%	± 3.20%
		NIMS-KMA(Korea)		4.52 ± 1.79			-21.4%	
		BCC (China)		4.89 ± 2.33			-15.0%	
	SSP2	MIROC6 (Japan)		6.59 ± 3.12	5.22		14.6%	± 5.48%
		NIMS-KMA(Korea)		5.96 ± 2.55			3.65%	
		BCC (China)		6.45 ± 2.93			12.2%	

Table S5. Change percentage of extreme climate indices at different landscape types in 2020, 2050, and 2100 under different emission scenarios at Zhuoshui River watershed compared with baseline value (2020)

ZRW	2050				2100			
	T	L	U	M	T	L	U	M
CDD (%)								
SSP1-2.6	-10.0	-26.8	-28.9	4.00	-6.70	-35.2	-26.3	8.00
SSP2-4.5	20.0	-42.3	0.00	36.0	-20.0	-60.6	-28.9	-12.0
CWD (%)								
SSP1-2.6	9.09	140	40.0	-7.69	-9.09	140	30.0	-7.69
SSP2-4.5	9.09	60.0	20.0	-7.69	-9.09	60.0	0.00	-15.4
R95p (mm)								
SSP1-2.6	892.6	897.0	709.0	990.5	584.9	274.4	547.2	627.0
SSP2-4.5	260.8	0.000	112.0	346.5	1785	986.4	1699	1889
R99p (mm)								
SSP1-2.6	2069	666.7	1919	2163	1770	1320	1773	1820
SSP2-4.5	1324	800.3	1172	1436	3535	2552	3625	3588
TNx (%)								
SSP1-2.6	29.8	0.64	5.63	42.6	21.9	-1.50	3.82	31.6
SSP2-4.5	44.1	11.3	18.5	57.9	40.8	9.86	16.8	53.7
TXx (%)								
SSP1-2.6	22.3	1.36	1.66	33.0	15.8	1.00	2.81	22.7
SSP2-4.5	17.7	1.71	4.68	24.7	16.4	4.51	4.10	22.7

T: Total areas; L: lowland areas; U: upland areas; M: mountainous areas;
CDD: Consecutive dry days; CWD: Consecutive wet days;
R95p: Very wet-day precipitation; R99p: Extremely wet day precipitation;
TNn: minimum value of daily minimum temperature; TXx: maximum value of daily maximum temperature

Table S6. Change percentage of extreme climate indices at different landscape types in 2020, 2050, and 2100 under different emission scenarios at Zhoushui River watershed compared with baseline value (2020)

LRW	2050				2100			
	T	L	U	M	T	L	U	M
CDD (%)								
SSP1-2.6	-3.70	38.2	-9.70	-8.00	22.2	52.9	22.6	16.0
SSP2-4.5	40.7	20.6	29.0	44.0	-7.41	-14.7	-16.1	-4.00
CWD (%)								
SSP1-2.6	44.4	30.0	85.7	20.0	44.4	-20.0	85.7	30.0
SSP2-4.5	44.4	20.0	85.7	30.0	22.2	10.0	57.1	10.0
R95p (mm)								
SSP1-2.6	1326	1358	1137	1491	139.1	0.000	12.24	211.1
SSP2-4.5	68.13	0.000	0.000	106.5	1096	452.5	1083	1142
R99p (mm)								
SSP1-2.6	2865	203.8	2917	2904	1574	904.4	1581	1635
SSP2-4.5	1475	1335	1601	1422	3744	3921	4169	3525
TNx (%)								
SSP1-2.6	32.9	7.61	4.95	48.5	1.43	-0.98	3.72	0.44
SSP2-4.5	46.9	6.90	17.7	64.1	45.5	2.59	16.4	62.6
TXx (%)								
SSP1-2.6	20.6	5.01	0.76	31.5	15.4	-3.59	-0.48	24.5
SSP2-4.5	17.5	5.15	0.83	26.6	17.2	1.40	0.04	26.8

T: Total areas; L: lowland areas; U: upland areas; M: mountainous areas;
CDD: Consecutive dry days; CWD: Consecutive wet days;
R95p: Very wet-day precipitation; R99p: Extremely wet day precipitation;
TNn: minimum value of daily minimum temperature; TXx: maximum value of daily maximum temperature