

Ecosystem service assessment models and the input parameters

Water yield

Table S1. The biophysical table in the WY module.

Land use type	Lucode	Root_depth	Kc	LULC_veg
Paddy land	11	300	1.02	1
Dryland	12	400	0.728	1
Closed woodland	21	3000	0.922	1
Shrubland	22	2000	0.9	1
Sparse woodland	23	1500	0.867	1
Other woodland	24	1500	0.867	1
High-cover grassland	31	500	0.867	1
Medium-cover grassland	32	500	0.867	1
Low-cover grassland	33	500	0.867	1
River and water channel	41	1	1	0
Lake	42	1	1.1	0
Reservoir and pond	43	1	1.1	0
Beach land	46	1	0.3	0
Urban land	51	1	0.45	0
Rural resident	52	1	0.45	0
Other construction land	53	1	0.45	0
Marshland	64	300	1	1
Bare land	65	1	0.5	0
Bare rocky land	66	1	0.5	0

Soil conservation

Table S2. The biophysical table in the SC module.

Land use type	Lucode	Usle_c	Usle_p
Paddy land	11	0.2	0.15
Dryland	12	0.2	0.15
Closed woodland	21	0.05	1
Shrubland	22	0.15	1
Sparse woodland	23	0.3	1
Other woodland	24	0.3	1

High-cover grassland	31	0.15	1
Medium-cover grassland	32	0.3	1
Low-cover grassland	33	0.5	1
River and water channel	41	0	1
Lake	42	0	1
Reservoir and pond	43	0	1
Beach land	46	0.6	1
Urban land	51	0.99	1
Rural resident	52	0.99	1
Other construction land	53	0.99	1
Marshland	64	0.6	1
Bare land	65	1	1
Bare rocky land	66	1	1

Carbon storage

Table S3. Carbon pools in the CS module.

Land use type	Lucode	C_above	C_below	C_soil	C_dead
Paddy field	11	5.42	1.96	146.24	0
Dryland	12	3.64	0	33.46	13
Closed woodland	21	31.92	6.38	146.82	2.96
Shrubland	22	8.1	1.62	91.7	3.48
Sparse woodland	23	8.1	1.62	91.7	3.48
Other woodland	24	35.03	7.01	142.58	3.75
High-cover grassland	31	2.75	7.37	44.03	4.07
Medium-cover grassland	32	2.21	5.37	27.41	3.04
Low-cover grassland	33	1.66	3.36	10.79	2
River and water channel	41	0	0	0	0
Lake	42	0	0	0	0
Reservoir and pond	43	0	0	0	0
Beach land	46	0	0	0	0
Urban land	51	0	0	0	0
Rural resident	52	0	0	0	0
Other construction land	53	0	0	0	0
Marshland	64	4.23	0	146.26	0
Bare land	65	0	0	0	0
Bare rocky land	66	0	0	0	0

Habitat quality

Table S4. Maximum influence distance and weight of each stress factor.

Threat	Max_dist	Weight	Decay
Paddy field	1.5	0.6	exponential
Dryland	1.5	0.6	exponential
Urban land	6	0.8	exponential
Rural resident	2.5	0.4	exponential
Bare land	2	0.1	exponential
Major railway	2.5	0.6	linear
Major road	2.5	0.6	linear

Table S5. Habitat adaptability of land use type and its sensitivity to each stress factor.

Land use type	Lu-code	Habitat	Urban land	Rural resident	Paddy land	Dry land	Bare land	Major railway	Major road
Paddy field	11	0.3	0.5	0.35	0	1	1	0.5	0.5
Dryland	12	0.3	0.5	0.35	1	0	1	0.5	0.5
Closed woodland	21	1	0.9	0.7	0.5	0.6	1	0.6	0.8
Shrubland	22	0.7	0.6	0.4	0.3	0.4	1	0.6	0.7
Sparse woodland	23	0.6	0.8	0.6	0.5	0.6	1	0.5	0.6
Other woodland	24	0.4	0.8	0.6	0.5	0.6	1	0.4	0.5
High-cover grassland	31	0.7	0.6	0.45	0.4	0.45	1	0.1	0.15
Medium-cover grassland	32	0.6	0.65	0.5	0.45	0.5	1	0.15	0.2
Low-cover grassland	33	0.4	0.7	0.55	0.5	0.55	1	0.2	0.25
River and water channel	41	1	0.8	0.6	0.5	0.6	1	0.4	0.45
Lake	42	0.9	0.85	0.65	0.55	0.65	1	0.45	0.5
Reservoir and pond	43	0.9	0.9	0.7	0.6	0.7	1	0.5	0.55
Beach land	46	0.6	0.9	0.75	0.65	0.75	1	0.55	0.6
Urban land	51	0	0	0	0	0	0	0	0
Rural resident	52	0	0	0	0	0	0	0	0
Other construction land	53	0	0	0	0	0	0	0	0
Marshland	64	0.6	0.8	0.6	0.5	0.6	1	0.6	0.7
Bare land	65	0	0	0	0	0	0	0	0
Bare rocky land	66	0	0	0	0	0	0	0	0

Logistic-CA-Markov model validation

Table S6. ROC values of the suitable probability distribution of land use types in 2000 and 2010 in the Qingjiang Watershed.

Land use type	2000	2010
Arable land	0.8771	0.8581
Forest land	0.9551	0.9539
Grassland	0.9263	0.9289
Waterbody	0.9768	0.9748
Built-up land	0.9588	0.9493
Unused land	0.9041	0.9260

Table S7. Kappa coefficients of the validation module in 2010 and 2018 in the Qingjiang Watershed.

Kappa coefficient	2010	2018
Kstandard	0.8895	0.9011
Kno	0.9262	0.9346
Klocation	0.9617	0.9361
KlocationStrata	0.9617	0.9361

Multiscale geographically weighted regression

Table S8. Diagnostic results of VIF among independent variables from 1990 to 2018 in the Qingjiang Watershed.

VIF	Topography			Climate		Vegetation	Socio-economy		
	Elevation	Slope	Terrain	Precipitation	Temperature	NDVI	Land use type	GDP	POP
1990	1.624	1.538	1.863	1.331	1.480	1.003	1.043	2.242	2.101
2000	1.600	1.530	1.857	2.441	3.078	1.002	1.041	3.222	3.024
2010	1.655	1.555	1.864	1.111	1.287	1.003	1.016	1.728	1.647
2018	1.342	1.047	1.237	4.561	1.318	2.047	5.266	1.465	1.701

Table S9. The results of factor detector and the factors of each ES used in MGWR in 2018 in the Qingjiang Watershed.

Factor	Abbrevia- tion	WY		SR		CS		HQ	
		Factor	Selected	Factor	Selected	Factor	Selected	Factor	Selected
Elevation	ELE	0.149	1	0.017	0	0.019	1	0.001	0
Slope	SLO	0.003 ^a	0	0.187	1	0.029	1	0.060	1
Terrain	TER	0.047	0	0.078	1	0.012 ^a	0	0.030	1
Precipitation	PCP	0.588	1	0.019	1	0.003	0	0.006 ^a	0
Temperature	TMP	0.109	1	0.012	0	0.007	0	0.011	0
NDVI	NDVI	0.044	0	0.008	0	0.043	1	0.027	1
Land use type	LAND	0.317	1	0.013	1	0.429	1	0.527	1
GDP	GDP	0.170	1	0.019	1	0.008 ^b	0	0.027	0
POP	POP	0.068	0	0.019	1	0.012	1	0.034	1

The a in the factor column indicates $P > 0.05$; b indicates $P > 0.01$; unmarked numbers indicate $P < 0.01$. 1 in the selected column means that this factor is selected; 0 means that this factor is not selected.

Table S10. Comparison of fitting results between OLS and MGWR models in 2018.

Factor	OLS			MGWR		
	R ²	Adj. R ²	AICc	R ²	Adj. R ²	AICc
WY	0.187	0.185	11,094.193	0.776	0.737	7131.788
SR	0.234	0.232	10,844.974	0.564	0.519	9328.458
CS	0.510	0.506	9041.328	0.999	0.998	7876.265
HQ	0.522	0.520	9043.224	1.000	1.000	4679.515