

Table S1. Data sources and preprocessing procedures.

Data name	Years	Spatial resolution	Sources and data preprocessing
Land use data-set	2018	1km	Obtained from the Resource and Environment Data Cloud Platform (http://www.resdc.cn/)
	2000, 2005, 2010	30m	Geospatial Data Cloud platform (http://www.gscloud.cn/)
Meteorological data	2010~2018	1km	provided by China Meteorological Data Service Center (http://data.cma.cn/en/) and interpolated to grid data with ArcGIS
Elevation, slop, aspect	2018	1km	The soil type map of Guanzhong Region is extracted from 1:1,000,000 soil data set of China. DEM is downloaded from Geospatial Data Cloud (http://www.gscloud.cn/).Slop and aspect are derived from DEM with ArcGIS.
Socio-economic spatial data	2018	1km	Collected from the Statistics Yearbook. And interpolated to grid data with ArcGIS

Table S2. The parameter of 12 land use scenarios of Guanzhong Region in 2050.

Scenario	Parameter	Development Goals
Business As Usual (BAU)	Scenario 1	RCP 2.6 The lowest scenario. The population growth rate, GDP and technical development level is still in a low level, and advocate bioenergy utilization and restore vegetation.
	Scenario 2	RCP 4.5 Medium emission scenario. Considering the economic development factors, by adjusting the energy structure and supporting the use of clean energy technologies, as to reduce greenhouse gas emissions.
	Scenario 3	RCP 6.0 A stabilization scenario. The total radiative forcing is stabilized after 2100, by employing a range of technologies and strategies for reducing greenhouse gas emissions.
	Scenario 4	RCP 8.5 A comparatively high greenhouse gas emissions. High population, with lowest rates of technological innovate and energy intensity improvements, leading in the long term to hige energy demand and GHG.
Ecological Protection (ELP)	Scenario 5	RCP2.6 & ELP scenario Base on the RCP2.6 climate scenario, this scenario adopt the China's Grain for Green Program. In the high slope areas, consider planting forested land and grassland instead of cultivated land.

Rapid Urban Development (RUD)	Scenario 6	RCP4.5 & ELP scenario	Base on the RCP4.5 climate scenario, the same as above.
	Scenario 7	RCP6.0 & ELP scenario	Base on the RCP6.0 climate scenario, the same as above.
	Scenario 8	RCP8.5 & ELP scenario	Base on the RCP8.5 climate scenario, the same as above.
	Scenario 9	RCP2.6 & RUD scenario	Base on the RCP2.6 climate scenario, the city central areas continuously expend, lead to increasing construction land area.
	Scenario 10	RCP4.5 & RUD scenario	Base on the RCP4.5 climate scenario, the same as above.
	Scenario 11	RCP6.0 & RUD scenario	Base on the RCP6.0 climate scenario, the same as above.
	Scenario 12	RCP8.5 & RUD scenario	Base on the RCP8.5 climate scenario, the same as above.

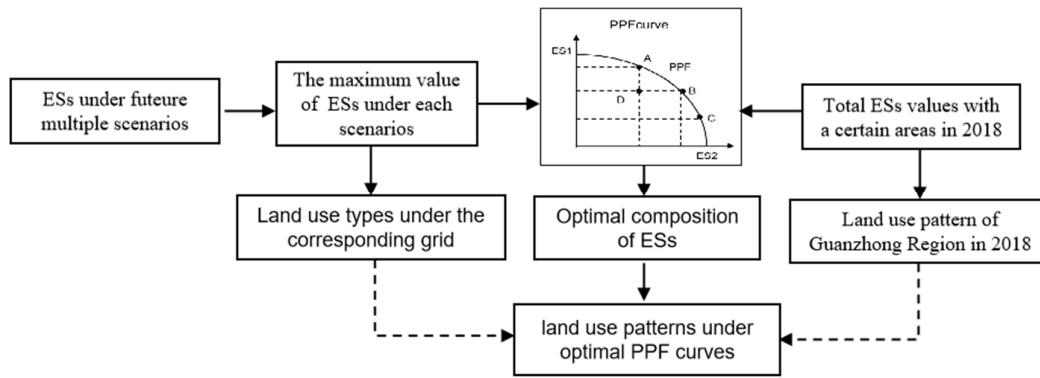


Figure S1. The flowchart of ecosystem service optimization.

Table S3. Land uses areas of each scenario in 2050 in Guanzhong Region (km²).

	Cultivated land	Forested land	Grassland	Water	Construction land	Bared land
Scenario1	21796.49	17603.23	12835.81	473.61	1156.53	4.38
Scenario2	20715.23	13597.44	17841.97	473.32	1187.50	49.56
Scenario3	18925.26	15659.83	15736.02	378.08	3095.66	68.86
Scenario4	16501.45	17062.35	18142.17	471.80	1628.99	57.49
Scenario5	19909.98	18479.53	13807.09	478.45	1165.94	4.38
Scenario6	21262.98	17715.03	12678.89	426.13	1738.99	6.67
Scenario7	17361.87	16316.43	16598.15	384.23	3111.46	68.86

Scenario8	15041.06	17650.19	18985.94	471.60	1634.56	57.49
Scenario9	21262.98	17715.03	12678.89	426.13	1738.99	6.67
Scenario10	20400.61	13632.30	17541.06	430.48	1762.03	61.26
Scenario11	17451.60	15776.89	15480.39	315.20	4764.52	37.27
Scenario12	16374.42	16991.38	17720.56	440.60	2229.92	59.89

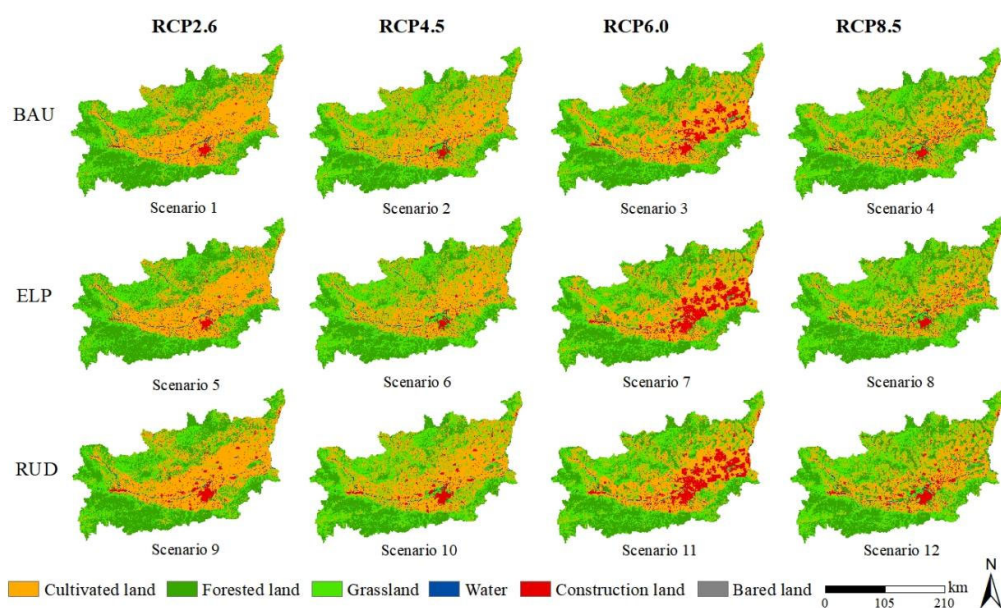


Figure S2. Land use spatial pattern changes under the multiple scenarios in 2050 of Guanzhong Region.

Table S4. The average value of four ecosystem services under multiple scenarios in 2050.

	CS (t/km2)	HQ	SC (t/km2)	FS (t/km2)
Scenario 1	1 457.95	0.59	7 053.43	334.65
Scenario2	1 439.85	0.59	7 059.60	327.25
Scenario3	1 343.28	0.58	7 043.61	297.33
Scenario4	1 448.20	0.61	7 018.11	271.74
Scenario5	1 460.19	0.61	7 029.84	311.42
Scenario6	1 450.66	0.60	7 032.54	307.09
Scenario7	1 357.41	0.59	7 018.47	279.57
Scenario8	1 480.07	0.62	6 995.24	271.74
Scenario9	1 432.27	0.60	7 054.48	327.17

Scenario10	1 409.08	0.59	7 053.31	321.81
Scenario11	1 283.61	0.57	7 032.93	273.61
Scenario12	1 416.60	0.60	7 012.92	268.70

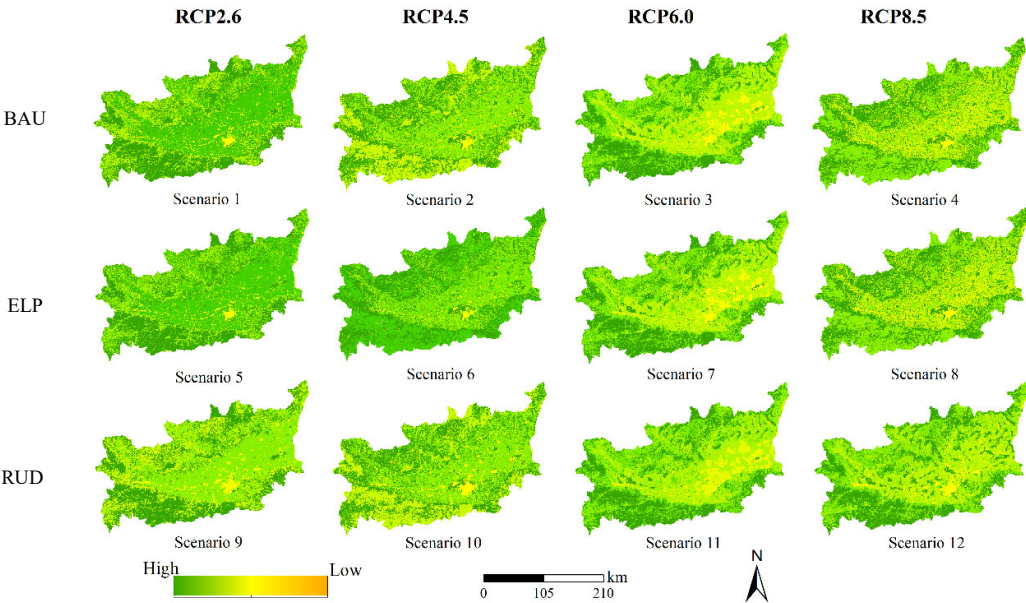


Figure S3. Carbon sequestration of each scenario in 2050 in Guanzhong Region.

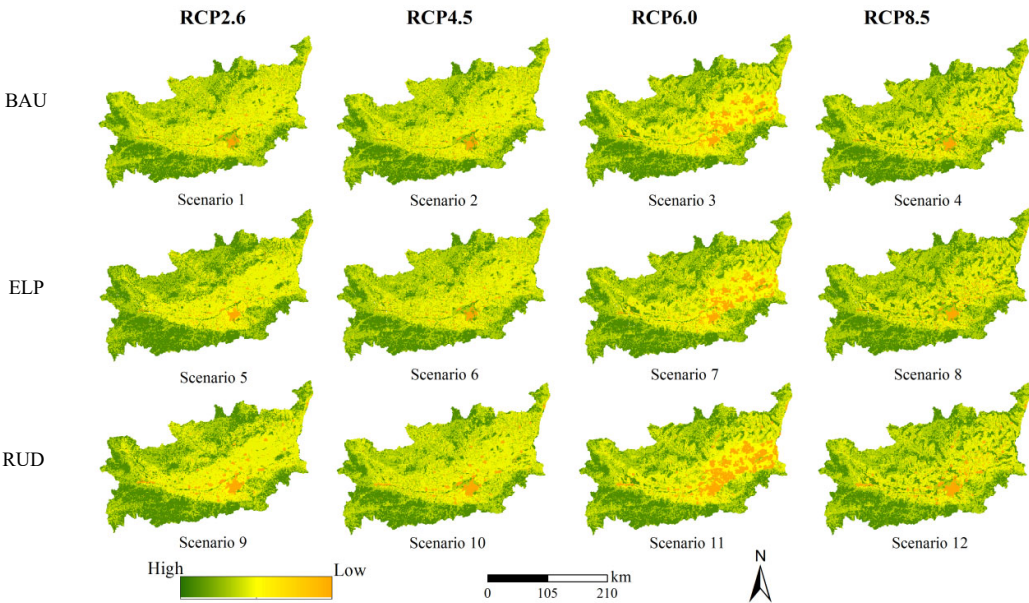


Figure S4. Habitat quality of each scenario in 2050 in Guanzhong Region.

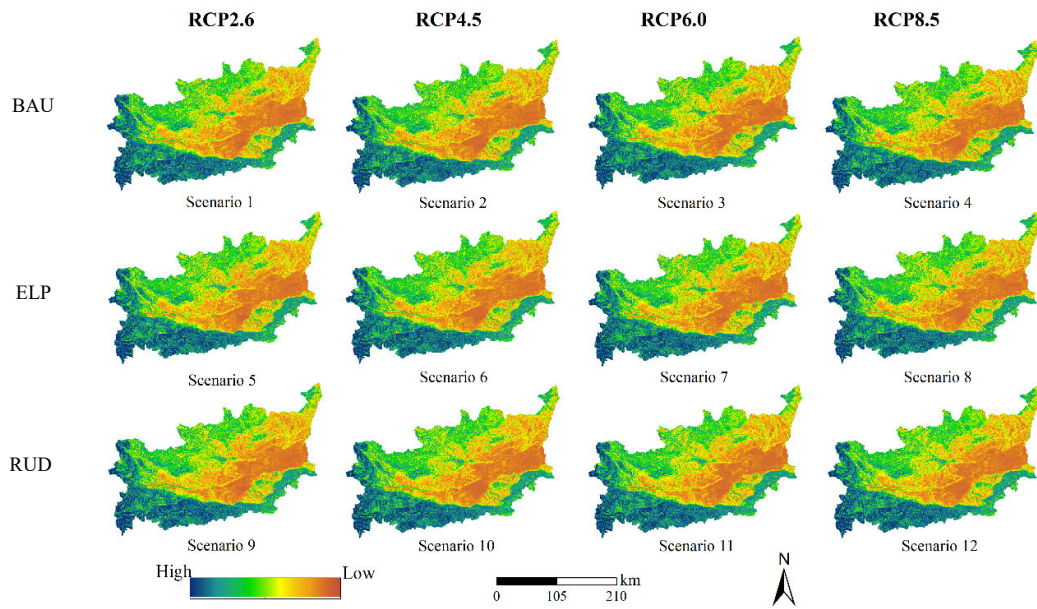


Figure S5. Soil conservation of each scenario in 2050 in Guanzhong Region.

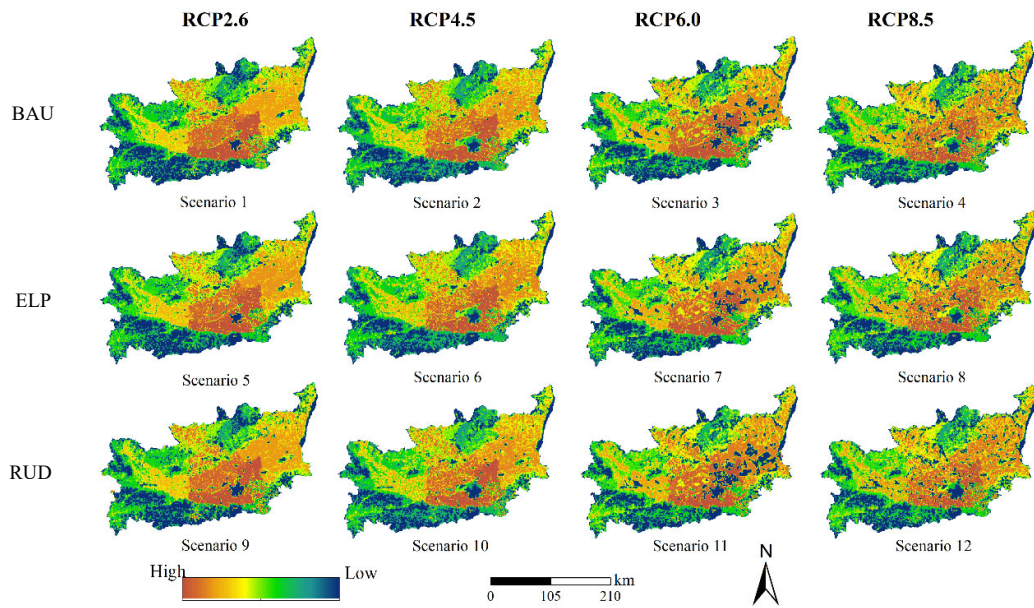


Figure S6. Food supply of each scenario in 2050 in Guanzhong Region.