Supplementary materials

1. Calculation of economic value and ecosystem service value coefficients

1.1. Economic value coefficients

The economic coefficient for each LULC type is defined as GDP per unit area (10^6 yuan/km^2) [1, 2]. In this study, the economic coefficients were obtained from the economic data (agricultural output value, forestry output value, pasture output value, fishery output value, etc.) in the Anhui Statistical Yearbook (2020), combined with the formulas presented in Table S1. This value was then used to set the function for economic benefits (E_1 (x)) for the target year of the plan. (Table 3).

Table S1. Economic value coefficients for each LULC

LULC type	Formula representation	Economic value coefficient (10^6 yuan/km^2)
Cropland	Agricultural output value/Area of cropland	326
Forestland	Forestry output value/Area of forestland	121
Grassland	Pasture output value/Area of grassland	2292
Water area	Fishery output value/Area of water area	739
Construction land	Secondary and tertiary industries output value/Area of construction land	23,315
Unused land	The economic benefits can be ignored	0

1.2. Ecosystem service value coefficients

The average grain production in the study area was determined to be 583,357 kg/km^2, based on data from the Anhui Statistical Yearbook (2020) and the National Compendium of Cost and Benefit Information on Agricultural Products. The average grain price was calculated at 2.247 yuan/kg, reflecting the average price of the three major grain crops in the study area: rice, wheat, and maize. The economic value of the ecosystem service equivalent factor, which is set at 1/7 of the market value of the average grain yield in the study area for that year [3], was estimated at approximately 187,233 yuan/km^2. This value was then used to derive the coefficient of ecosystem service value for the target year of the plan [3] (Table 2).

2. Ecosystem services assessments

2.1. Water yield

The InVEST model's water yield module was employed to evaluate the water yield in the study area. The formulas used for these calculations are provided below:

$$Y(x) = \left(1 - \frac{AET(x)}{P(x)}\right) \times P(x) \quad (1)$$

where $Y(x)$ is the annual water production of grid cell x (m^3), AET(x) is the average annual evapotranspiration of grid cell x (mm), and $P(x)$ is the annual precipitation of grid cell x (mm). The precipitation and evapotranspiration data in this study were obtained from the Resource and Environmental Science Data Center of the Chinese Academy of Sciences (http://www.resdc.cn). Based on previous studies, the precipitation data from 2020 was used as a proxy for 2030 [4, 5]. Plant Available Water Consumption (PAWC) was calculated based on soil data provided by ISRIC and through an empirical formula proposed by Zhou [6]. Root limiting layer depths were referenced from Chinese bedrock depth data determined by Yan et al. [7]. The seasonal constant Z was set at 7.8 with reference to previous studies [8]. All other parameters were based on previous studies [9]. The biophysical tables for each LULC type are shown in Table S2.

Table S2. Biophysical parameters for each LULC class in the water yield evaluation

LULC type	**Root depth (mm)**	**Evapotranspiration Coefficients (K_c)**	**Vegetation (1-Yes; 0-No)**
Cropland	2000	0.65	1
Forestland	3500	1.00	1
Grassland	2400	0.65	1
Water area	1	1.10	0
Construction land	1	0.30	0
Unused land	1	0.50	0

2.2. Carbon sequestration

The carbon stocks in the ecosystems of the study area were evaluated using t he carbon storage module of the InVEST model. Carbon storage (CS) is directly as sociated with the carbon content of four major carbon pools within the ecosystem: above-ground biomass, below-ground biomass, soil carbon, and dead organic matte r [10]. The calculation formula is as follows:

$$CS = \sum_{i=1}^{6} S_i \times \left(C_{above_i} + C_{below_i} + C_{soil_i} + C_{dead_i}\right) \quad (2)$$

where CS represents the total carbon stock (t), i denotes the number of each land class, S_i is the total area of land class i (km^2), C_{above_i} is the above-ground biogenic carbon density (t/km^2), C_{below_i} is the below-ground biogenic carbon density (t/km^2), C_{soil_i} is the soil carbon density (t/km^2), and C_{dead_i} is the dead organic carbon density (t/km^2). The carbon density data for each pool were sourced from the carbon density dataset of terrestrial ecosystems in China (2010s) [11], as well as research conducted by Wang et al. [12] (Table S3).

Table S3. Biophysical parameters for each LULC class in the carbon sequestration evaluation

LULC type	C_{above}	C_{below}	C_{soil}	C_{dead}
Cropland	18.87	12.46	86.76	2.41
Forestland	36.34	7.27	120.76	3.35
Grassland	17.37	20.85	105.85	2.94
Water area	0	0	81.10	0
Construction land	16.15	3.23	72.92	0
Unused land	2.26	9.03	14.66	0

2.3. Soil retention

Soil retention services in the CLB were simulated and evaluated using the Sediment Delivery Ratio (SDR) module of the InVEST model. The soil retention capacity was assessed using a generalized soil loss equation, which is calculated as follows:

$$SDR = R \times K \times LS \times (1 - P \times C) \quad (3)$$

where *RKLS* represents potential soil erosion [t/(km^2·a)], *USLE* represents actual soil erosion [t/(km^2·a)], and *SDR* represents soil retention [t/(km^2·a)]. *R* is the rainfall erosivity factor [(MJ·mm)/(km^2·h·a)], *K* is the soil erodibility factor [(t·km^2·h)/(MJ·mm·km^2)], *LS* is the slope length factor (dimensionless), *P* represents soil and water conservation measures (dimensionless), and *C* is the vegetation cover and management factor (dimensionless). The *R*, *K*, and *LS* factors were calculated based on rainfall, soil, and elevation data, while the *C* and *P* factors were primarily derived from previous studies conducted in similar regions [13-15]. Specific parameters are detailed in Table S4.

Table S4. Biophysical parameters for each LULC class in the soil conservation evaluation

LULC type	***C***	***P***
Cropland	0.150	0.2
Forestland	0.006	1.0
Grassland	0.060	1.0
Water area	0.000	0.0
Construction land	0.010	0.0
Unused land	0.700	0.0

2.4. Water purification

The Nutrient Delivery Ratio (NDR) module of the InVEST model was used to simulate and assess water quality purification services in the CLB. The model employs a mass balance approach to estimate nutrient loads based on the land use of each raster and its nitrogen nutrient loading rate. It then calculates the nutrient transport rate to determine the nutrient input from each raster to the river. Higher nitrogen nutrient outputs (NE) indicate weaker water quality purification functions. The calculation formula is as follows:

$$X_{exp,x} = load_{surf,x} \times NDR_{surf,x} \tag{4}$$

where $X_{exp,x}$ denotes the nitrogen nutrient output (kg/a) of grid cell x, $load_{surf,x}$ represents the surface nitrogen nutrient loading (kg/a) of grid cell x. This loading is derived from the loading coefficient (Load_n) of the LULC type, adjusted for the local runoff potential index. Additionally, $NDR_{surf,x}$ indicates the surface nitrogen nutrient transport efficiency of grid cell x, which is calculated using the nitrogen interception rate (Eff_n) and the retention distance (Crit_ len_n), with adjustments made for local topography. The local runoff potential index was characterized using precipitation data, while topography was represented by DEM data. Based on the similarity of the watershed's natural environment and referencing existing research findings [16–19], the nitrogen output loading coefficient (Load_n), nitrogen retention rate (Eff_n), and retention distance (Crit_len_n) were determined for each LULC type. The specific parameters are presented in Table S5.

Table S5. Biophysical parameters for each LULC class in the water purification evaluation

LULC type	Load_n (kg/hm²·year)	Eff_n	Crit_len_n (m)
Cropland	31.63	0.50	25
Forestland	6.55	0.80	280
Grassland	6.55	0.80	280
Water area	0.00	0.02	10
Construction land	18.21	0.05	10
Unused land	19.26	0.05	150

2.5. Landscape Aesthetic

Cultural services are often defined as the "non-material benefits" that individuals derive from ecosystems, encompassing aspects such as cultural diversity, spiritual and religious values, and aesthetic values [20]. A substantial body of research has assessed the value of cultural services through various approaches, including aesthetics, traditional culture, and economics [21]. Generally, landscape aesthetics models align well with the ecosystem services (ES) concept, particularly when landscape characterization variables are selected to connect underlying ecosystem processes and conditions [22]. In this study, Landscape Aesthetic (LA) was utilized as an indicator to evaluate the cultural service value associated with different land use types. This value was quantified according to the ecosystem service value system proposed by Xie et al. [3], with specific coefficients presented in Table S6.

Table S6. Landscape Aesthetic value coefficients (10^6 yuan/km^2)

Cropland	Forestland	Grassland	Water area	Construction land	Unused land
1.1234	17.3661	11.0469	35.3876	0.1873	0.9362

2.6. Habitat quality

Habitat quality was evaluated using the Habitat Quality Module of the InVEST model. The assessment of habitat quality in the study area was conducted by calculating both the degree of degradation and habitat suitability using the following formulas:

$$Q_{xj} = H_j \times \left[1 - \left(\frac{D_{xj}^z}{D_{xj}^z + k^z}\right)\right] \quad (5)$$

where Q_{xj} denotes the habitat quality index of raster x in land use type j, H_j represents the habitat suitability of land use type j, D_{xj} indicates the threatened degree of raster x in land use type j, k is the half-saturation constant, which is generally set to half of the maximum degraded raster value, and in this study, it was set to 0.5 [23, 24]. Additionally, z is a constant valued at 2.5. The threatened degree D_{xj} is calculated by the following formula:

$$D_{xj} = \sum_{r=1}^{R} \sum_{y=1}^{Y_r} \left(\frac{w_r}{\sum_{r=1}^{R} w_r}\right) r_y i_{rxy} \beta_x S_{jr} \quad (6)$$

where r represents the threat factor, y denotes the total number of raster associated with threat r, Y_r indicates the number of rasters in a specific group associated with threat factor r, w_r is the weight of threat factor r, r_y is the value of the threat factor of raster y, i_{rxy} denotes the threat factor for raster y, r_y signifies the degree of threat to raster x, β_x reflects the accessibility level of raster x, and S_{jr} indicates the sensitivity of land use type j to threat factor r. The configurations for suitability and sensitivity to stress factors were informed by previous studies [25–27] (Table S7 and S8).

Table S7. Threats and their maximum distance of influence and weights

Threats	Max distance	Weight	Decay
Cropland	4	0.6	exponential
Construction land	8	0.4	exponential
Unused land	6	0.5	linear

Table S8. The sensitivity of habitat types to each threat

LULC type	Habitat	Cropland	Construction land	Unused land
Cropland	0.3	0.0	0.8	0.4
Forestland	1.0	0.6	0.4	0.2
Grassland	1.0	0.8	0.6	0.6
Water area	0.7	0.5	0.4	0.2
Construction land	0.0	0.0	0.0	0.1
Unused land	0.6	0.6	0.4	0.0

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