#### Supplementary 2. InVEST models

The InVEST (Version.3.3.3) suite of tools has been developed to enable decision-makers to assess trade-offs within and among ecosystem services and to compare the consequences of different future change scenarios, for example those related to land use or climate [11]. For this study, we selected the water yield model (for water yield service), and the carbon storage and sequestration model (for carbon sequestration service), to evaluate the corresponding ecosystem services in Taihu Lake Basin (TLB).

Supplementary information 2.1 Water yield (WY) model

Annual water yield for pixel  on land use/land cover (LULC),  (mm/yr), is estimated based on mean annual precipitation and the Budyko curve:



where  (mm/yr) is the actual annual evapotranspiration for pixel  on LULC$ $ and  (mm/yr) is the annual precipitation for pixel .

For vegetated LULC, the evapotranspiration portion of the water balance, , is based on an expression of the Budyko curve proposed by Fu [12] and Zhang[13]:



where  is potential evapotranspiration and  is a non-physical parameter that characterizes the natural climate-soil properties.

Potential evapotranspiration, , is defined as:



where is the reference evapotranspiration from pixel  and $k\_{ij}$ is the vegetation evapotranspiration coefficient associated with the pixel $i $on LULC $j:$





whereis a non-physical parameter that characterizes the natural climate-soil properties; is a dimensionless constant, ranging from 1 to 30, that captures the local precipitation pattern and hydrogeological characteristics;  (mm) is the volumetric plant-available water content; 1.25 is the minimum value of ; is the evapotranspiration coefficient for pixel on LULC;  (mm/yr) is the reference evapotranspiration for pixel ; and $PAWC$ (mm) is the plant-available water capacity.

For non-vegetated LULC (e.g., water, construction land), the actual annual evapotranspiration is computed directly from the reference evapotranspiration and has an upper limit defined by the precipitation:



where is the evapotranspiration coefficient for pixel on LULC ;  (mm/yr) is the reference evapotranspiration for pixel  , and  (mm/yr) is the annual precipitation for pixel .

SupplementaryTable 1 Biophysical tables used in the water yield model

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| lucode | LULC | Kc | pawc | ro\_depth | LL\_veg |
| 1 | agriculture | 0.6 | 0.5 | 700 | 1 |
| 2 | woodland | 1 | 0.4 | 6300 | 1 |
| 3 | grass | 0.65 | 0.35 | 1350 | 1 |
| 4 | shrub land | 0.85 | 0.4 | 6300 | 1 |
| 5 | wetland | 0.8 | 0.6 | 6300 | 0 |
| 6 | water | 1 | 0.6 | 1000 | 0 |
| 7 | construction | 0.3 | 0.05 | 9 | 0 |

Supplementary information 2.2 Carbon storage and sequestration (CSS) model

Using maps of land use and land cover types and data on the amount of carbon stored in carbon pools, this model estimates the net amount of carbon stored in a land parcel over time:

$$C\_{total}=C\_{above}+C\_{under}+C\_{soil}+C\_{dead}$$

where $C\_{total}$ is the total amount (Mg/hm2) of carbon storage; and $C\_{above}$, $C\_{under}$, $C\_{soil}$, and $C\_{dead}$ represent the amount (Mg/ hm2) of carbon stored in aboveground biomass, belowground biomass, soil, and dead organic matter, respectively,.

Supplementary Table 2 Biophysical tables used in the carbon sequestration model

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| lucode | LULC | Cabove | Cunder | Csoil | Cdead |
| 1 | agriculture | 5 | 1 | 25.6 | 0 |
| 2 | woodland | 36.93 | 10 | 42.4 | 40 |
| 3 | grass | 6 | 0.75 | 18.2 | 5.2 |
| 4 | shrub land | 9.303 | 2 | 25.6 | 3 |
| 5 | wetland | 1 | 0 | 33 | 0 |
| 6 | water | 0 | 0 | 0 | 0 |
| 7 | construction | 0 | 0 | 21 | 0 |

#### References

[1] Li T; Wang H; Fang Z; Liu G; Zhang F; Zhang H, Li X. 2022. Integrating river health into the supply and demand management framework for river basin ecosystem services. *Sustainable Production and Consumption 33*:189-202.

[2] Xia F; Yang Y; Zhang S; Yang Y; Li D; Sun W, Xie Y.2022. Influencing factors of the supply-demand relationships of carbon sequestration and grain provision in China: Does land use matter the most? *Science of The Total Environment 832*:154979.

[3] Deng C; Liu J; Liu Y; Li Z; Nie X; Hu X; Wang L; Zhang Y; Zhang G; Zhu D *et al*.2021. Spatiotemporal dislocation of urbanization and ecological construction increased the ecosystem service supply and demand imbalance. *Journal of Environmental Management 288*:112478.

[4] Larondelle N, Lauf S.2016. Balancing demand and supply of multiple urban ecosystem services on different spatial scales. *Ecosystem Services 22*:18-31.

[5] Meng S; Huang Q; Zhang L; He C; Inostroza L; Bai Y, Yin D.2020. Matches and mismatches between the supply of and demand for cultural ecosystem services in rapidly urbanizing watersheds: A case study in the Guanting Reservoir basin, China. *Ecosystem Services 45*.

[6] Yang S; Wang H; Tong J; Bai Y; Alatalo JM; Liu G; Fang Z, Zhang F.2022. Impacts of environment and human activity on grid-scale land cropping suitability and optimization of planting structure, measured based on the MaxEnt model. *Science of The Total Environment 836*:155356.

[7] Li J; Jiang H; Bai Y; Alatalo JM; Li X; Jiang H; Liu G, Xu J.2022. Indicators for spatial–temporal comparisons of ecosystem service status between regions: A case study of the Taihu River Basin, China. *Ecological Indicators 60*:1008-1016.

[8] Shen Z-J; Zhang B-H; Xin R-H, Liu J-Y. 2022. Examining supply and demand of cooling effect of blue and green spaces in mitigating urban heat island effects: A case study of the Fujian Delta urban agglomeration (FDUA), China. *Ecological Indicators 142*.

[9] Lauf S; Haase D, Kleinschmit B.2016. The effects of growth, shrinkage, population aging and preference shifts on urban development—A spatial scenario analysis of Berlin, Germany. *Land Use Policy 52*:240-254.

[10] Zhou Y; Li J, Pu L.2022. Quantifying ecosystem service mismatches for land use planning: spatial-temporal characteristics and novel approach-a case study in Jiangsu Province, China. *Environmental Science and Pollution Research 29*(18):26483-26497.

[11] Richard Sharp RC-K, Spencer Wood, Anne Guerry, Heather, Tallis TR. 2016. InVEST+VERSION+User's Guide: The Natural Capital Project, Stanford University, University of Minnesota, The Nature Conservancy, and World Wildlife Fund..

[12] Fu B. 1981. On the calculation of the evaporation from land surface *Chinese Jouenal of Atmospheric Sciences 5*:23-31 (in Chinese).

[13] Zhang L; Hickel K; Dawes W; Chiew F.2004. Western A, Briggs P: A rational function approach for estimating mean annual evapotranspiration. *Water Resources Research 40*:W02502.