Supporting Information for

**Supporting Information Ⅰ: Tables**

**Table S1.** Date sources and estimation methods of four EFs

|  |  |  |  |
| --- | --- | --- | --- |
| EFs | Estimation Method | Input Parameters | Datasets and reference |
| Water Containment | Based on the water balance method, WC is estimated as follow,$$WC=(Pre−Runoff−AET)×A$$$WC$: the volume of the water containment (m3),$Pre$: the annual precipitation(mm),$Runoff$: the Surface runoff (mm),$AET$: the actual evapotranspiration (mm),$A$: the regional or pixel area (m2).The surface runoff is calculated as follow,$$Runoff=Pre×α$$$α$: the coefficient of surface runoff. | Land use data (MCD12Q1)Actual evapotranspiration data (MOD16A2GF) | USGS website https://earthexplorer.usgs.gov/ |
| surface runoff coefficient | (Gong et al., 2017;Hu et al., 2018;Yuan et al., 2020) |
| Precipitation data | Sichuan Meteorological Bureau |
| Soil retention | The soil retention (SR) is calculated as follow (Fu et al., 2011; He et al., 2019),$$SR=R×K×L×S×\left(1−C×P\right)$$$$R=\sum\_{i=1}^{12}1.735×10^{(1.5log\_{10}\frac{Pre\_{i}^{2}}{Pre}−0.08188)}$$$$K=0.1317×\left\{0.2+0.3exp^{\left[−0.0256SAN\left(1−\frac{SIL}{100}\right)\right]}\right\}×\left(\frac{SIL}{CLA+SIL}\right)^{0.3}×\left(1−0.25×\frac{C\_{org}}{C\_{org}+exp^{3.72−2.95C\_{org}}}\right)×\left(1−\frac{0.7×SN\_{a}}{SN\_{a}+exp^{−5.51+22.9SN\_{a}}}\right)$$$$SN\_{a}=1−\frac{SAN}{100} L=\left(\frac{β}{22.13}\right)^{m} β=\frac{DEM}{sin\left(θ\right)}$$$$m=\left\{\begin{array}{c}0.5 θ\geq 9\\0.4 9>θ\geq 3\\0.3 3>θ\geq 1\\0.2 θ<1\end{array}\right.$$$$S=\left\{\begin{array}{c}10.8×sin\left(θ\right)+0.03 θ<9\\16.8×sin\left(θ\right)−0.05 θ\geq 9\end{array}\right.$$$$C=\left\{\begin{array}{c}1 FVC=0\\0.6508−0.3436×ln\left(FVC\right) 0<FVC\leq 0.783\\0 FVC>0.783\end{array}\right.$$$$P=0.2+0.03γ$$$R$: the rainfall-runoff erosivity factor (MJ·mm/(ha·h)),$Pre\_{i}$: the monthly mean precipitation (mm),$Pre$: the annual mean precipitation (mm),$K$: the soil erodibility factor (t·ha·h/(ha·mm·MJ)),$SAN$: the percentage of the sand in the soil (%),$SIL$: the percentage of the silt in the soil (%),$CLA$:the percentage of the clay in the soil (%),$C\_{org}$: the percentage of the organic carbon in the soil (%),$L$: the slope length factor,$S$: the slope gradient factor,$β$: the mean slope length (m),$m$: the variable changing with the slope,$θ$: the mean percent slope (%),$C$: the vegetation cover factor,$FVC$: the vegetation coverage,$P$: the erosion control factor,$γ$: the percentile slope gradient. | Land use data (MCD12Q1) | USGS website https://earthexplorer.usgs.gov/ |
| MODIS EVI data(MOD13A1) |
| DEM data |
| Precipitation data | Sichuan Meteorological Bureau |
| Soil attribute data | Data Center for Resources and Environmental Sciences,Chinese Academy of Sciences http://www.resdc.cn |
| Carbon storage | NPP (net primary productivity) is estimated using the CASA model,$$NPP=SOL×0.5×FPAR×ε$$$$ε=Tg\_{1}×Tg\_{2}×W\_{g}×ε\_{max}$$$SOL$: total solar radiation, estimated using the Ångström-Prescott model based on sunshine hours ($MJ∙m^{−2}∙month^{−1}$),$FPAR$: the absorption fraction of photosynthetically active radiation by vegetation canopy, calculated using NDVI data,$ε$: the actual light use efficiency ($g C∙MJ^{−1}$),$Tg\_{1} and Tg\_{2}$: temperature stress coefficients ($g C∙MJ^{−1}$),$Wg$: the water stress coefficient,$ε\_{max}$: the maximum light use efficiency ($g C∙MJ^{−1}$). | Land use data(MCD12Q1) | USGS website https://earthexplorer.usgs.gov/ |
| MODIS EVI data(MOD13A1) |
| Evapotranspiration data (MOD16A2GF) |
| Sunshine hours data | Sichuan Meteorological Bureau |
| Temperature data |
| Maximum light use efficiency | (Zhu et al., 2007;Su et al., 2022) |
| Habitat quality | Habitat quality (HQ) is computed as follow,$$HQ\_{xj}=H\_{j}\left(1−\left(\frac{D\_{xj}^{z}}{D\_{xj}^{z}+k^{z}}\right)\right)；$$$$D\_{xj}=\sum\_{r=1}^{R}\sum\_{y=1}^{Y\_{r}}\left(\frac{w\_{r}}{\sum\_{r=1}^{R}w\_{r}}\right)r\_{y}i\_{rxy}β\_{x}S\_{jr}$$*j*=1, 2, …, n: the *j*th land use type,*r*=1, 2, …, R: the *r*th threat,*y*=1, 2, …, Yr: the *y*th grid on the *r*th threat data,*Hj*: the habitat suitability of the *j*th land use type,$D\_{xj}$: the total threat index of the grid $x$ of the land use $j$,*wr*: the relative weight of the threat factor *r*,*ry*: the value of the threat factor on the grid *y*,*βx*: the threat accessibility of the grid x,*Sjr*: the sensitivity of the *j*th land use to the threat factor *r*,*z*: scaling parameters,*k*: the half-saturation constant,*irxy*: the impact coefficient of threat *r* in the grid *y* on the grid *x*. | Land use data (MCD12Q1) | USGS website https://earthexplorer.usgs.gov/ |
| Sensitivity data | (Terrado et al., 2016; Zahra et al., 2018; Rimal et al., 2019; Zhao et al., 2022) |
| Threat data |

**Table S2.** The average runoff coefficients and maximum light use efficiency of different landscape types

|  |  |  |
| --- | --- | --- |
| Land use type | Average runoff coefficient (%) | Maximum light use efficiency ($g C∙MJ^{−1}$) |
| Evergreen broadleaf forests | 4.65 | 0.985 |
| Evergreen needleleaf forests | 4.52 | 0.389 |
| Mixed forests | 3.52 | 0.720 |
| Deciduous broadleaf forests | 2.70 | 0.692 |
| Deciduous needleleaf forests | 0.88 | 0.485 |
| Closed shrublands | 4.26 | 0.429 |
| Open shrublands | 19.20 | 0.429 |
| Woody savannas | 3.87 | 0.542 |
| Savannas | 3.94 | 0.542 |
| Grasslands | 8.20 | 0.542 |
| Cropland/Natural vegetation Mosaics | 2.40 | 0.542 |
| Water Bodies | 0.00 | 0.000 |
| Permanent wetlands | 0.00 | 0.542 |
| Barren | 3.31 | 0.542 |
| Croplands | 2.40 | 0.542 |
| Urban and Built-up lands | 75.00 | 0.542 |

**Table S3.** Habitat types and their sensitivity to threats

|  |  |  |
| --- | --- | --- |
| Land use type | Habitat suitability | Sensitivity |
| Cropland/Natural vegetation Mosaics | Barren | Croplands | Urban and Built-up lands |
| Evergreen broadleaf forests | 1 | 0.6 | 0.35 | 0.6 | 0.4 |
| Evergreen needleleaf forests | 1 | 0.6 | 0.35 | 0.6 | 0.4 |
| Mixed forests | 1 | 0.6 | 0.35 | 0.6 | 0.4 |
| Deciduous broadleaf forests | 0.9 | 0.6 | 0.35 | 0.6 | 0.4 |
| Deciduous needleleaf forests | 0.9 | 0.6 | 0.35 | 0.6 | 0.4 |
| Closed shrublands | 0.85 | 0.6 | 0.1 | 0.6 | 0.5 |
| Open shrublands | 0.7 | 0.6 | 0.2 | 0.6 | 0.55 |
| Woody savannas | 0.8 | 0.8 | 0.7 | 0.8 | 0.5 |
| Savannas | 0.7 | 0.8 | 0.75 | 0.8 | 0.65 |
| Grasslands | 0.7 | 0.8 | 0.75 | 0.8 | 0.65 |
| Cropland/Natural vegetation Mosaics | 0.3 | 0 | 0.5 | 0 | 0.6 |
| Water Bodies | 0.8 | 0.7 | 0.6 | 0.7 | 0.7 |
| Permanent wetlands | 0.85 | 0.75 | 0.6 | 0.75 | 0.65 |
| Barren | 0.2 | 0.1 | 0 | 0.1 | 0.7 |
| Croplands | 0.3 | 0 | 0.5 | 0 | 0.6 |
| Urban and Built-up lands | 0 | 0 | 0 | 0 | 0 |

**Table S4.** Threat factors data

|  |  |  |  |
| --- | --- | --- | --- |
| Threat type | Maximum distance of influence (km) | Weight | Decay form |
| Cropland/Natural vegetation Mosaics | 1 | 0.3 | linear |
| Barren | 2 | 0.5 | exponential |
| Croplands | 1 | 0.3 | linear |
| Urban and Built-up lands | 8 | 1 | exponential |

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