

Figure S1. The Sen trend (a) and the Mann-Kendall test (b) of ET, GPP, and LAI in different climate zones from 2001 to 2015.

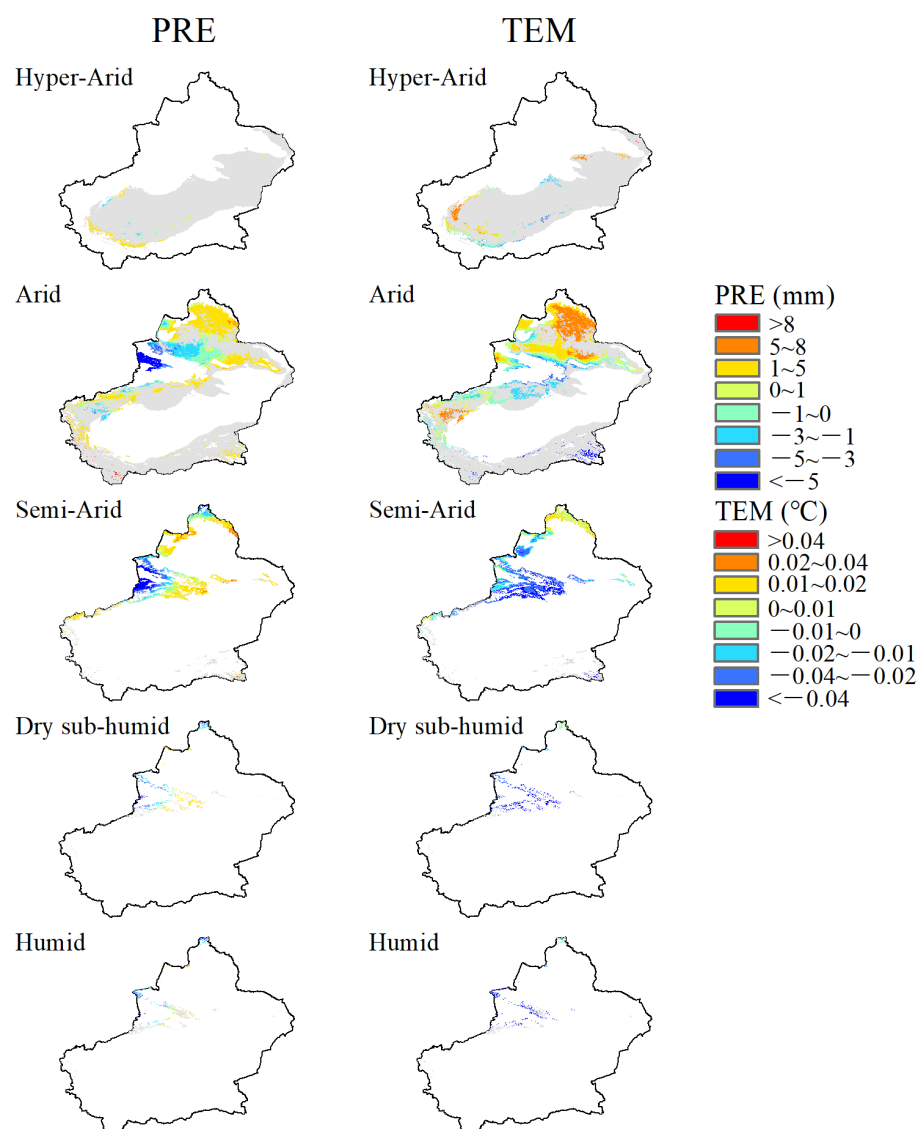


Figure S2. The Sen trend of PRE and TEM in different climate zones from 2001 to 2015.

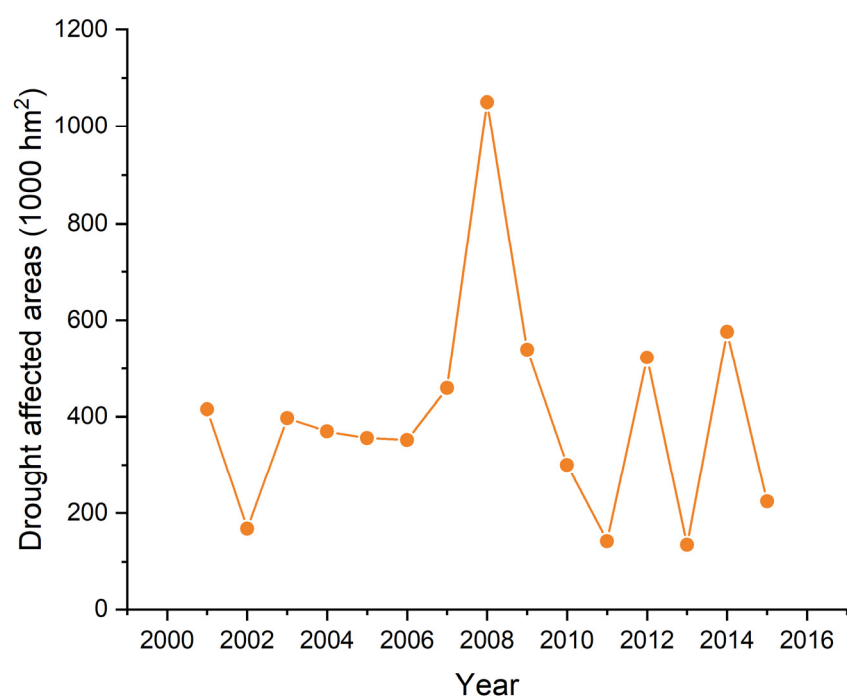


Figure S3. The drought affected areas in Xinjiang from 2001 to 2015.

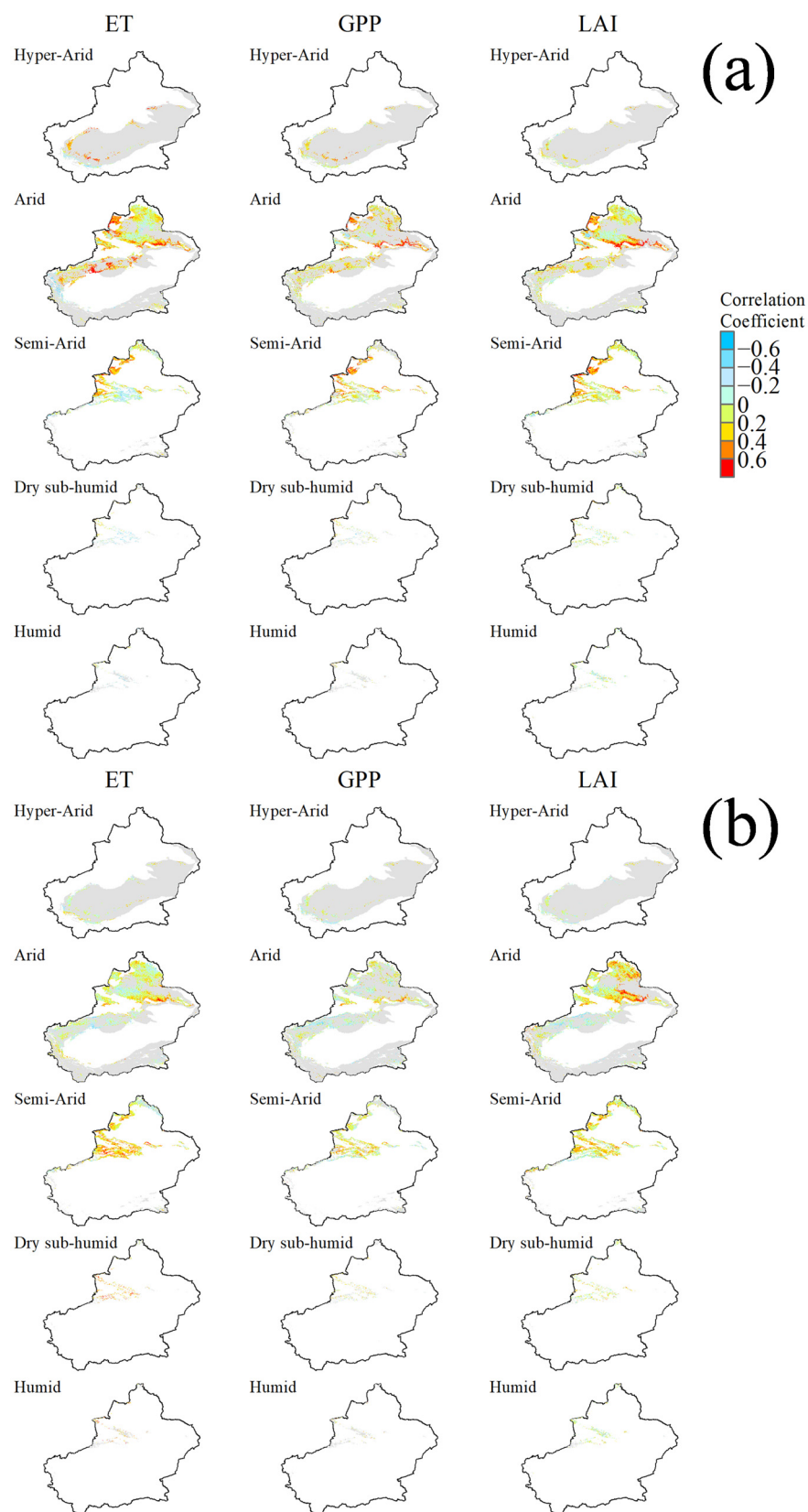


Figure S4. Spatial pattern of the correlation between precipitation (a), temperature (b), and ecosystem indicators (ET, GPP, and LAI) in different climate zones from 2001 to 2015.

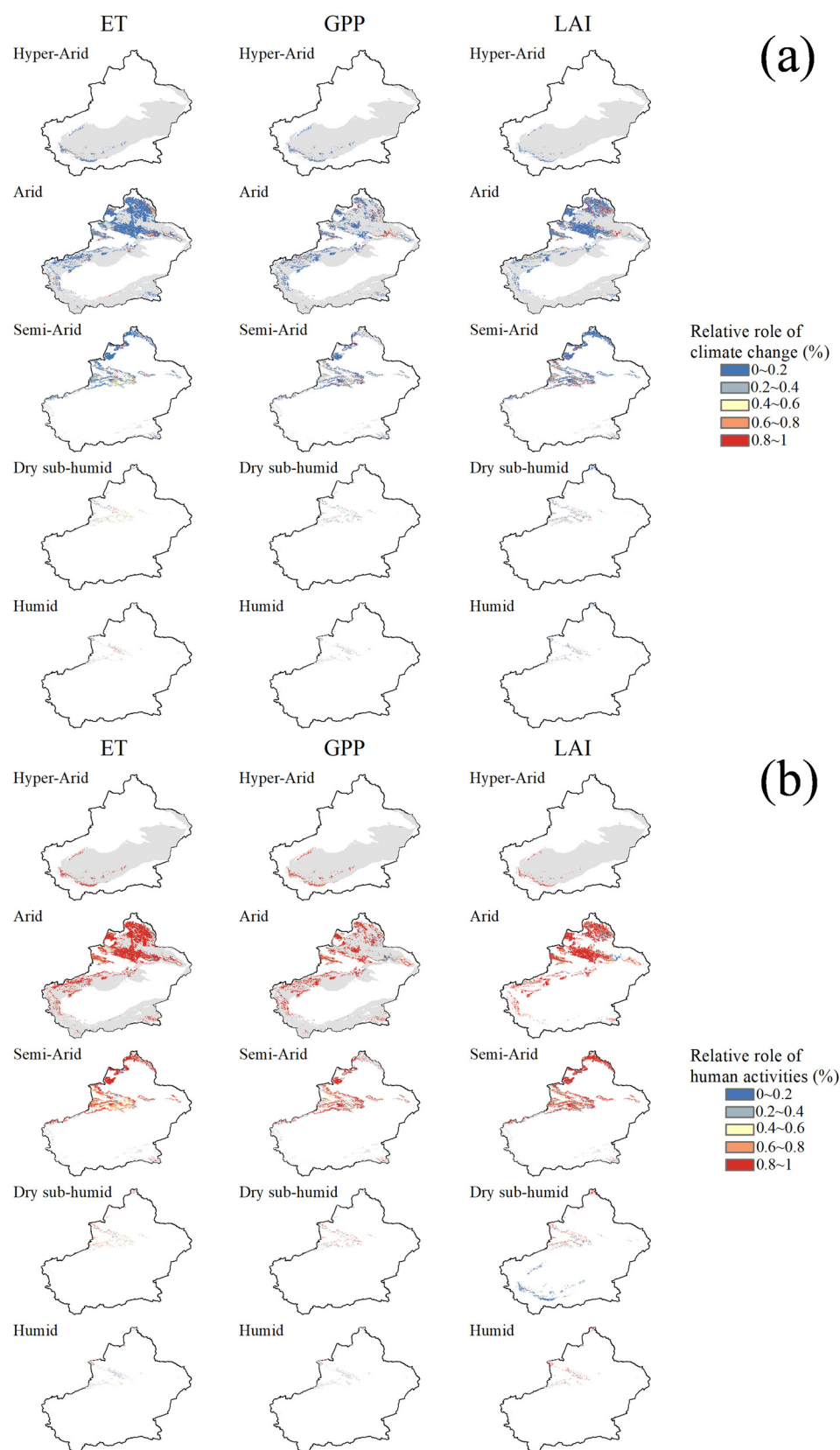


Figure S5. Spatial distribution of the relative role of climate change (a) and human activities (b) on the variation of the ecosystem indicators (ET, GPP, and LAI) in different climate zones from 2001 to 2015.

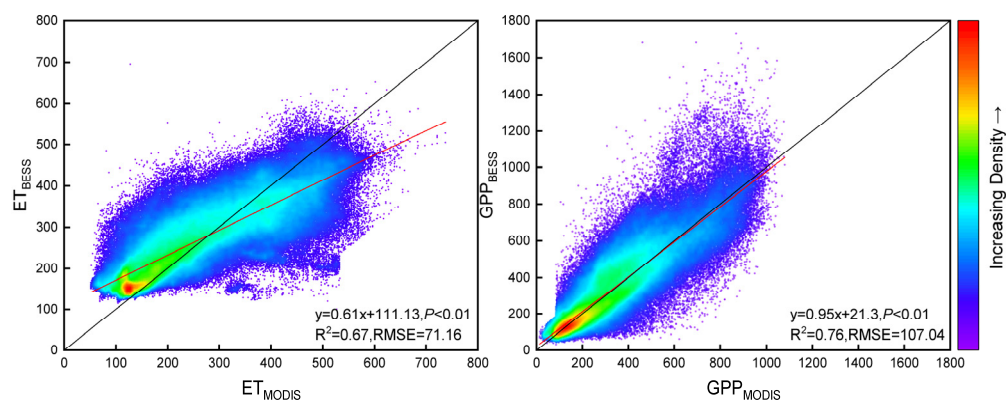


Figure S6. Relationship between satellite-driven data (MODIS) and the BESS model in Xinjiang.

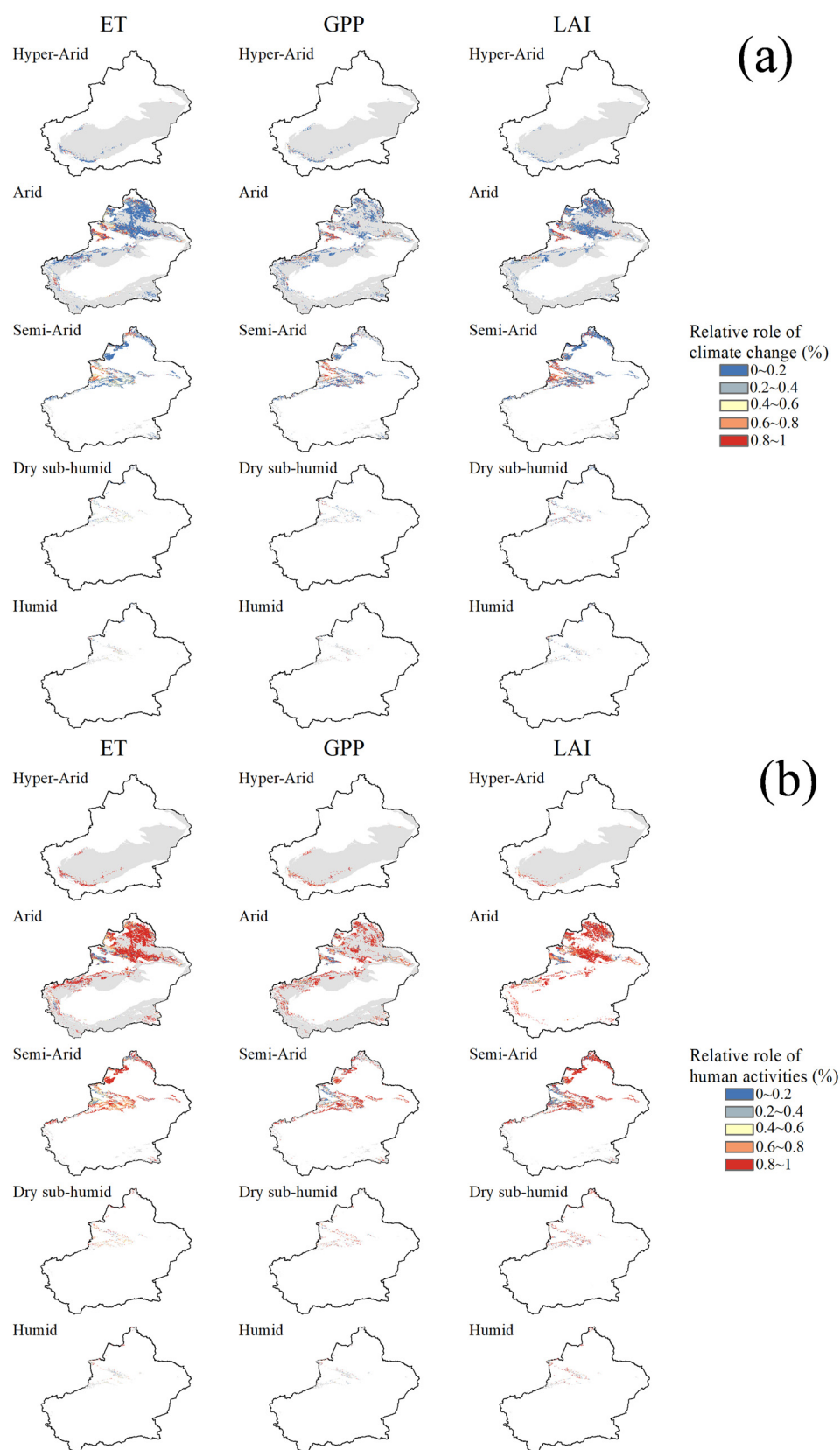


Figure S7. Spatial distribution of the relative role of climate change (a) and human activities (b) on the variation of the ecosystem indicators (ET, GPP, and LAI) in different climate zones during the optimum precipitation accumulation period from 2001 to 2015. Note: PRE used the optimum precipitation accumulation period.

Table S1. Summary of the data

| Data type | Data source | Temporal-spatial resolution | Purpose of use |
|------------------------------------|---|-----------------------------|---|
| Land cover data | European Space Agency | 500 m | Land use in the study area |
| DEM | The website of geospatial data cloud | Year/500 m | Covariates in Interpolation of Climate Data |
| Temperature and Precipitation data | China Integrated Meteorological Information Sharing System | Daily/Site | Important climate variables |
| BESS GPP、ET | Research Institute of Agriculture and Life Sciences, Seoul National University, Republic of Korea | 8 day/ 1 km | Important Ecosystem Indicators |
| MODIS LAI | National Aeronautics and Space Administration | 8 day/ 500 m | Important Ecosystem Indicators |
| Aridity Index | Trabucco (CMCC) and Robert Zomer (ICRAF) | 500 m | Division of climate zones |

Table S2 Percentage of areas with Inter-annual variations of ecosystem indicators.

| Climate zones | Percentage of area with decreasing trend (%) | | | Percentage of area with increasing trend (%) | | |
|---------------|--|-----|-----|--|-----|-----|
| | ET | GPP | LAI | ET | GPP | LAI |
| Xinjiang | 73 | 41 | 44 | 27 | 56 | 59 |
| Hyper-Arid | 40 | 9 | 19 | 60 | 81 | 91 |
| Arid | 66 | 35 | 35 | 34 | 65 | 65 |
| Semi-arid | 90 | 59 | 73 | 10 | 27 | 41 |
| Dry sub-humid | 91 | 44 | 65 | 9 | 35 | 56 |
| Humid | 88 | 32 | 59 | 12 | 41 | 68 |

Table S3 Percentage of areas with the positive correlation between ecosystem indicators and climate variables.

| Percentage of area with the positive correlation (%) | Ecosystem indicators & temperature | | | Ecosystem indicators & precipitation | | |
|--|------------------------------------|------|------|--------------------------------------|------|------|
| | ET | GPP | LAI | ET | GPP | LAI |
| Climate zones | | | | | | |
| Xinjiang | 68.2 | 53 | 63.5 | 70.5 | 75.8 | 68.3 |
| Hyper-Arid | 51.5 | 43.9 | 41.8 | 70.4 | 76.2 | 69.4 |
| Arid | 61.4 | 46.6 | 63.4 | 77.1 | 77.1 | 69.7 |
| Semi-arid | 86 | 68.3 | 70.3 | 59.5 | 75.2 | 72.1 |
| Dry sub-humid | 93.7 | 71.6 | 57.9 | 31.3 | 53.9 | 47.2 |
| Humid | 94.8 | 73.6 | 51.2 | 35.1 | 57.5 | 36.9 |

Note: The area of the negative correlation is 1 minus the area of the positive correlation.

Table S4 The contribution of climate change and human activities to the variation of ecosystem indicators.

| Residual analysis | Relative contribution of climate changes (%) | | | Relative contribution of human activities (%) | | |
|-------------------|--|------|------|---|------|------|
| | ET | GPP | LAI | ET | GPP | LAI |
| Climate zones | | | | | | |
| Xinjiang | 19.1 | 23.8 | 23.2 | 80.9 | 78.2 | 76.8 |
| Hyper-Arid | 16.5 | 19.9 | 12.4 | 83.5 | 80.1 | 82.7 |
| Arid | 16.2 | 23.7 | 20.7 | 83.8 | 76.3 | 79.3 |
| Semi-arid | 23.5 | 24.6 | 26.4 | 76.5 | 75.4 | 73.6 |
| Dry sub-humid | 37.2 | 31.8 | 28.7 | 62.8 | 68.2 | 71.3 |
| Humid | 43.8 | 30.6 | 23.8 | 56.2 | 69.4 | 76.2 |

Table S5 Cultivated areas and cotton yield in southern Xinjiang and the number of livestock in the Ili region.

| Year | Cultivated areas (1000 hectares) | Cotton yield (ha) | Number of livestock (10000 heads) |
|------|-------------------------------------|----------------------|--------------------------------------|
| 2001 | 113.7 | 479770 | 628.5 |
| 2007 | 1305.4 | 591540 | 643.8 |
| 2015 | 1693.4 | 1230490 | 663.9 |

Note: The data were obtained from the “Xinjiang Statistical Yearbook”.

Table S6 Average correlations between ecosystem indicators and precipitation accumulated over various lengths of time in the entire Xinjiang.

| precipitation accumulation periods | ET | GPP | LAI |
|--|-------|-------|-------|
| Accumpre_4_5 | 0.45 | 0.47 | 0.38 |
| Accumpre_4_6 | 0.63* | 0.74* | 0.61* |
| Accumpre_4_7 | 0.7* | 0.71* | 0.58* |
| Accumpre_4_8 | 0.73* | 0.78* | 0.65* |
| Accumpre_4_9 | 0.66* | 0.75* | 0.6* |
| Accumpre_4_10 | 0.67* | 0.72* | 0.57* |
| Pre_Year | 0.385 | 0.553 | 0.373 |

Note: Accumpre_A_B represents the cumulative precipitation from month A to month B. Pre_Year represents the annual precipitation.

Table S7. Average correlations between ecosystem indicators and precipitation accumulated over various lengths of time for each pixel in Xinjiang.

| precipitation accumulation periods | ET | GPP | LAI |
|--|------|------|------|
| Accumpre_4_5 | 0.16 | 0.17 | 0.15 |
| Accumpre_4_6 | 0.21 | 0.23 | 0.21 |
| Accumpre_4_7 | 0.26 | 0.25 | 0.23 |
| Accumpre_4_8 | 0.28 | 0.28 | 0.25 |
| Accumpre_4_9 | 0.26 | 0.27 | 0.22 |
| Accumpre_4_10 | 0.25 | 0.25 | 0.21 |
| Pre_Year | 0.16 | 0.19 | 0.14 |