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RESEARCH ARTICLE

Determining the driving mechanism of ecosystem services provided by cropland in China

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SUPPLEMENTARY MATERIALS

1 Cropland ecosystem services evaluation

Based on grain production statistics, grain production was spatially assigned to cropland using wholly positive NDVI values in agricultural district units. Then, we selected the Water Yield model (for water retention service), the Sediment Delivery Ratio model (for sediment retention service), the Carbon Storage model (for carbon storage service), and the Nutrient Delivery Ratio model (for water purification service) to evaluate the corresponding ecosystem services in China's cropland.

1.1 Grain production

Grain production is essential for both food security and regional sustainability[1]. A significant linear correlation is revealed between NDVI and grain production[2]. Based on grain production statistics, grain production was spatially assigned to cropland using wholly positive NDVI values in agricultural district units, with production data obtained from National Bureau of Statistics, as:

$$G_i = G_{sum} \times \frac{NDVI_i}{NDVI_{sum}} \quad (1)$$

where, G_i (t) is the grain production of the i th cropland grid, G_{sum} (t) is the total grain production of the study area, $NDVI_i$ is the annual NDVI value of the i th cropland grid and $NDVI_{sum}$ is the sum of NDVI value for cropland.

1.2 Water retention

Water retention indicates the water reserved in ecosystems over a given period of time[3]. Water retention was expressed as evapotranspiration and runoff subtracted from precipitation as:

$$WR_i = Y_i - Runoff_i \quad (2)$$

$$Y_i = (1 - \frac{AET_i}{P_i}) \times P_i \quad (3)$$

$$Runoff_i = P_i \times C_i \quad (4)$$

where, for each pixel i, WR_i (mm·yr^{-1}) is water retention, Y_i (mm·yr^{-1}) is the annual output of water, P_i (mm·yr^{-1}) is the annual precipitation, AET_i (mm·yr^{-1}) is the actual annual evapotranspiration, $Runoff_i$ (mm·yr^{-1}) is the annual average runoff, and C_i is the runoff coefficient.

1.3 Soil retention

Soil retention was estimated using the the revised universal soil loss equation as:

$$D_i = R_i \times K_i \times LS_i \times C_i \times P_i \quad (5)$$

$$SR_i = R_i \times K_i \times LS_i \times (1 - C_i \times P_i) \times SDR_i \quad (6)$$

$$SDR_i = \frac{SDR_{max}}{1 + \exp\left(\frac{IC_0 - IC_i}{k}\right)} \quad (7)$$

where, D_i is the annual soil loss, SR_i is the soil retention, R_i (MJ·mm·(ha·h)$^{-1}$) is the rainfall erosivity, K_i (t·ha·h·(MJ·ha·mm)$^{-1}$) is the soil erodibility, LS_i is the slope length-gradient factor, C_i is the crop-management factor and P_i is the support practice factor. SDR_i is determined by the connectivity index IC, SDR_{max} is the highest theoretical SDR, while the calibration parameters IC_0 and k determine the shape of the relationship between SDR and IC.

1.4 Carbon storage

The carbon storage and sequestration model in the InVEST model was used to evaluate carbon storage as:

$$C_{total} = C_{above} + C_{below} + C_{soil} + C_{dead} \quad (8)$$

where, C_{total} is the total carbon storage, and C_{above}, C_{below}, C_{soil}, and C_{dead} are the aboveground carbon stock, underground carbon stock, soil carbon storage and dead organic matter carbon stock, respectively.

1.5 Water purification

The Nutrient Delivery Ratio model can evaluate the nutrient retention ability of an ecosystem, providing a proxy for water purification function. The nitrogen export value is selected as the indicator for evaluating water purification. Higher nitrogen export represents lower water purification capacity[4]. The calculations were:

$$X_{export_{tot}} = \sum_i X_{export_i} \quad (9)$$

$$X_{export_i} = load_{surf,i} \times NDR_{surf,i} + load_{subs,i} \times NDR_{subs,i} \quad (10)$$

where, X_{export_i} and $X_{export_{tot}}$ are the nutrient export at the pixel and watershed scales, respectively, $load_{surf,i}$ and $load_{subs,i}$ are nutrients transported by surface and shallow subsurface runoff, respectively, NDR is nutrient delivery ratio for a pixel i, $NDR_{surf,i}$ is nutrients transported by surface flow, and the $NDR_{subs,i}$ is the subsurface flow of nutrients.

1.6 Statistical analysis

To facilitate comparisons, the results of selected ecosystem services representing different units are standardized from 0 to 1 for all five years. Positive indicators normalization is with reference to equation (11), and negative indicators are normalized based on equation (12).

$$E_n = \frac{E_i - E_{min}}{E_{max} - E_{min}} \quad (1)$$

$$E_n = \frac{E_{max} - E_i}{E_{max} - E_{min}} \quad (2)$$

where, E_n is the normalized ES value; E_i is the original ES value for grid i; E_{max} is the maximum value of ES, and E_{min} is the maximum value of ES.

Table S1 Data requirement for the InVEST model

Data	Type	Data source	Note
Land use/land cover	Raster	Resources and Environment Science and Data Center[5]	LULC in 2000, 2005, 2010, 2015, and 2020. Resolution is 1 km
Digital elevation model	Raster	Geospatial Data Cloud	Resolution is 1 km
Annual average precipitation	Raster	Resources and Environment Science and Data Center[6]	Time is in 2000, 2005, 2010, 2015, and 2020. Resolution is 1 km
Reference evapotranspiration	Raster	Institute of Tibetan Plateau Research Chinese Academy of Sciences[7]	Time is in 2000, 2005, 2010, 2015, and 2020. Resolution is 1 km
Soil	Raster	Harmonized World Soil Database version 1.2 (HWSD)[8]	Resolution is 1 km
Normalized difference vegetation index	Raster	Earth Data[9]	Time is in 2000, 2005, 2010, 2015, and 2020. Resolution is 1 km
Sown area	xlsx	China Statistical Yearbook	–
Grain yield	xlsx	National Bureau of Statistics	–
Nine agricultural regions	Shp	Resources and Environment Science and Data Center[10]	–

Table S2 Critical parameter settings in the biophysical table

LULC_desc	Water retention				Soil retention		Water purification			Carbon sequestration			
	root_depth	Kc	LULC_veg	Mean runoff coefficient	usle_c	usle_p	load_n	eff_n	crit_len_n	C_above	C_below	C_soil	C_dead
Paddy field	2100	0.70	1	34.7%	0.20	0.29	15.5	0.45	30	2.00	1.00	10.00	0.00
Dry land	2000	0.65	1	49.69%	0.20	0.10	15.5	0.40	30	3.00	2.00	8.00	1.00

Note: Data sources from InVEST library, Yang et al.[11], Hu et al.[12], Liang et al.[13], and Bai et al.[14]. LULC_desc: descriptive name of various land use types. root_depth: the maximum root depth for vegetated land use classes. Kc: plant evapotranspiration coefficient for each LULC. LULC_veg: a flag to distinguish bare land from vegetated land, 1 for vegetated land and 0 for others. Mean runoff coefficient: the ratio of runoff volume to rainfall volume over a specific time period. usle_c: cover-management factor for the USLE, varying from 0 to 1. usle_p: support practice factor for the USLE, varying from 0 to 1. load_n: load of nitrogen for each LULC. eff_n: the maximum retention efficiency of nitrogen for each LULC, varying from 0 to 1. crit_len_n: the maximum distance at which nutrients are trapped by each LULC. C_above: carbon density of above-ground biomass for each LULC. C_below: carbon density of underground biomass for each LULC. C_soil: carbon density of soil for each LULC. C_dead: carbon density of dead matter for each LULC.

Table S3 Validation of the InVEST model

Study model	Study year	Study scopes	Types of ESs	Value	References
InVEST	2000	Qinghai	SR (million t)	5555.94	This study
InVEST	2005	YRB	SR (million t)	6710.79	This study
InVEST	2010	China	SR (million t)	366802.08	This study
InVEST	2015	China	SR (million t)	261825.07	This study
InVEST	2020	Qinghai	SR (million t)	5708.43	This study
InVEST	2000	Qinghai	SR (million t)	3456.00	[15]
InVEST	2005	YRB	SR (million t)	7634.80	[16]
The USLE	2010	China	SR (million t)	214640.00	[17]
InVEST	2020	Qinghai	SR (million t)	3462.00	[15]
InVEST	2000	China	WY (billion m^3)	2891.15	This study
InVEST	2005	China	WY (billion m^3)	3005.17	This study
InVEST	2010	China	WY (billion m^3)	3166.56	This study
InVEST	2015	China	WY (billion m^3)	2791.76	This study
InVEST	2020	China	WY (billion m^3)	3192.19	This study
–	2000	China	WY (billion m^3)	2656.20	Water Resources Bulletin of China
–	2005	China	WY (billion m^3)	2698.20	Water Resources Bulletin of China
–	2010	China	WY (billion m^3)	2979.76	Water Resources Bulletin of China
–	2015	China	WY (billion m^3)	2690.08	Water Resources Bulletin of China
–	2020	China	WY (billion m^3)	3040.70	Water Resources Bulletin of China
InVEST	2000	Qinghai	CS (million t)	1985.91	This study
InVEST	2015	Shanghai	CS (million t)	10.52	This study
InVEST	2020	Qinghai	CS (million t)	1997.56	This study
InVEST	2000	Qinghai	CS (million t)	1728.00	[15]
InVEST	2014	Shanghai	CS (million t)	2.96	[14]
InVEST	2020	Qinghai	CS (million t)	1825.00	[15]
InVEST	2000	XJRB	WP (million kg)	10.83	This study
InVEST	2015	XJRB	WP (million kg)	13.20	This study
InVEST	2000	XJRB	WP (million kg)	6.66	[13]
InVEST	2015	XJRB	WP (million kg)	8.16	[13]

Note: WY means Water Yield; XJRB means the Xiangjiang River Basin; and YRB means the Yellow River Basin.

2 PLS–SEM parameter evaluation

Table S4 Sources of variables used in model construction

Latent variable	Observed variable	Abbreviation	Data source
Climate	Evapotranspiration	ET	Institute of Tibetan Plateau Research Chinese Academy of Sciences
	Precipitation	PRE	Resources and Environment Science and Data Center
	Temperature	Tempt	National Tibetan Plateau Data Center[18]
Human activity	Gross domestic product	GDP	Resources and Environment Science and Data Center[19]
	Human footprint	HFP	[20]
	Night light index	NTL	[21]
	Population density	POP	Resources and Environment Science and Data Center[22]
	Proportion of paddy	Paddy	Resources and Environment Science and Data Center[23]
Soil	Soil bulk	BULK	Harmonized World Soil Database version 1.2 (HWSD)
	Soil pH	PH	Harmonized World Soil Database version 1.2 (HWSD)
	Soil sand	SAND	Harmonized World Soil Database version 1.2 (HWSD)
Terrain	Elevation	DEM	Geospatial Data Cloud
	Slope	Slope	Based on DEM data by Slope Tool in ArcGIS
Vegetation	Enhanced vegetation index	EVI	Earth Data[24]
	Fractional vegetation cover	FVC	Global resources data cloud[25]
	Leaf area index	LAI	Earth Data[26]

Table S5 VIF of the measurement model

Driving factor	2000	2005	2010	2015	2020
BULK	8.510	8.530	8.531	8.521	7.805
CS	1.000	1.000	1.000	1.000	1.000
DEM	1.417	1.410	1.409	1.407	1.450
ET	5.277	5.744	5.489	4.865	5.526
EVI	7.503	5.429	5.223	5.763	4.455
FVC	6.293	4.973	4.566	4.904	3.648
GDP	2.279	2.901	3.824	2.773	4.703
HFP	1.613	2.028	1.946	1.634	1.803
LAI	1.734	1.514	1.621	1.740	1.651
NTL	1.848	1.977	2.529	2.169	2.889
PH	1.577	1.561	1.561	1.552	1.493
POP	1.957	2.758	3.813	2.307	6.337
PRE	3.179	3.066	2.406	3.039	3.223
Paddy	1.093	1.134	1.101	1.072	1.086
SAND	7.420	7.467	7.467	7.466	6.849
Slope	1.417	1.410	1.409	1.407	1.450
Temp	9.486	9.907	8.293	8.694	9.841

Table S6 Factor loading of the measurement model, 2000 and 2005

Latent variable	Observed variable	2000					2005				
		CS	GP	WP	SR	WR	CS	GP	WP	SR	WR
Climate	ET	0.806	0.804	0.799	0.785	0.804	0.818	0.809	0.814	0.805	0.817
	PRE	0.898	0.899	0.903	0.912	0.900	0.894	0.901	0.897	0.904	0.895
	Temp	0.961	0.960	0.958	0.953	0.959	0.960	0.957	0.958	0.955	0.959
ES	CS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Human	GDP	0.657	0.703	0.711	0.727	0.684	0.664	0.732	0.734	0.751	0.693
activity	HFP	0.636	0.703	0.714	0.738	0.663	0.686	0.759	0.757	0.776	0.710
	NTL	0.487	0.531	0.550	0.572	0.519	0.527	0.571	0.583	0.600	0.549
	POP	0.705	0.765	0.770	0.785	0.736	0.810	0.870	0.865	0.875	0.834
	Paddy	0.797	0.718	0.703	0.668	0.761	0.762	0.657	0.659	0.628	0.726
Soil	BULK	0.886	0.880	0.882	0.865	0.877	0.886	0.883	0.883	0.864	0.880
	PH	0.757	0.767	0.763	0.787	0.770	0.754	0.759	0.759	0.785	0.763
	SAND	0.743	0.733	0.736	0.710	0.729	0.745	0.739	0.739	0.712	0.735
Terrain	DEM	0.995	0.999	0.994	0.816	1.000	0.994	0.999	0.995	0.828	0.999
	Slope	0.624	0.507	0.630	0.928	0.545	0.631	0.573	0.624	0.919	0.582
Vegetation	EVI	0.937	0.950	0.940	0.926	0.929	0.911	0.938	0.916	0.892	0.901
	FVC	0.892	0.912	0.897	0.877	0.881	0.883	0.916	0.891	0.863	0.872
	LAI	0.851	0.823	0.845	0.869	0.865	0.845	0.793	0.834	0.870	0.858

Table S7 Factor loading of the measurement model, 2010 and 2015

Latent variable	Observed variable	2010					2015				
		CS	GP	WP	SR	WR	CS	GP	WP	SR	WR
Climate	ET	0.839	0.825	0.841	0.834	0.836	0.782	0.765	0.789	0.781	0.785
	PRE	0.889	0.900	0.888	0.893	0.893	0.905	0.916	0.901	0.906	0.904
	Temp	0.950	0.944	0.950	0.948	0.947	0.954	0.948	0.956	0.953	0.954
ES	CS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Human activity	GDP	0.738	0.803	0.786	0.813	0.753	0.659	0.704	0.699	0.715	0.661
	HFP	0.681	0.761	0.736	0.766	0.694	0.650	0.728	0.703	0.730	0.655
	NTL	0.613	0.672	0.660	0.690	0.624	0.634	0.671	0.670	0.689	0.633
	POP	0.786	0.850	0.834	0.857	0.802	0.675	0.734	0.720	0.739	0.681
	Paddy	0.768	0.663	0.696	0.647	0.749	0.795	0.713	0.734	0.700	0.791
Soil	BULK	0.884	0.881	0.878	0.862	0.877	0.889	0.887	0.887	0.865	0.887
	PH	0.757	0.761	0.766	0.788	0.768	0.749	0.752	0.752	0.784	0.752
	SAND	0.742	0.737	0.733	0.708	0.730	0.750	0.747	0.747	0.713	0.747
Terrain	DEM	0.995	0.992	1.000	0.816	1.000	0.998	0.989	0.997	0.781	1.000
	Slope	0.619	0.642	0.549	0.927	0.563	0.596	0.659	0.474	0.947	0.543
Vegetation	EVI	0.920	0.948	0.922	0.903	0.912	0.934	0.956	0.937	0.914	0.930
	FVC	0.882	0.918	0.886	0.862	0.872	0.897	0.927	0.901	0.872	0.891
	LAI	0.853	0.796	0.849	0.878	0.866	0.854	0.802	0.848	0.885	0.861

Note: All factor loadings passed significance.

Table S8 CR and AVE of the measurement model, 2000

Driving factor	CS		GP		WP		SR		WR	
	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE
Climate	0.919	0.793	0.919	0.792	0.918	0.790	0.916	0.786	0.919	0.792
ES	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Human activity	0.794	0.441	0.816	0.474	0.821	0.481	0.828	0.493	0.807	0.459
Soil	0.839	0.637	0.837	0.633	0.838	0.634	0.832	0.624	0.836	0.631
Terrain	0.809	0.690	0.753	0.628	0.811	0.693	0.866	0.764	0.772	0.648
Vegetation	0.923	0.799	0.925	0.804	0.923	0.801	0.920	0.794	0.921	0.796

Table S9 CR and AVE of the measurement model, 2005

Driving factor	CS		GP		WP		SR		WR	
	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE
Climate	0.921	0.797	0.920	0.794	0.921	0.796	0.919	0.792	0.921	0.796
ES	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Human activity	0.822	0.485	0.844	0.525	0.846	0.527	0.851	0.537	0.832	0.502
Soil	0.839	0.636	0.838	0.634	0.838	0.634	0.831	0.623	0.837	0.632
Terrain	0.811	0.693	0.786	0.664	0.808	0.689	0.866	0.765	0.790	0.668
Vegetation	0.911	0.774	0.915	0.783	0.912	0.777	0.907	0.765	0.909	0.770

Table S10 CR and AVE of the measurement model, 2010

Driving factor	CS		GP		WP		SR		WR	
	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE
Climate	0.922	0.799	0.920	0.794	0.923	0.799	0.922	0.797	0.922	0.797
ES	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Human activity	0.842	0.518	0.867	0.568	0.861	0.555	0.870	0.575	0.848	0.528
Soil	0.838	0.635	0.837	0.633	0.836	0.631	0.831	0.622	0.836	0.630
Terrain	0.806	0.687	0.815	0.698	0.775	0.651	0.865	0.762	0.781	0.658
Vegetation	0.916	0.784	0.919	0.792	0.916	0.785	0.912	0.776	0.914	0.781

Table S11 CR and AVE of the measurement model, 2015

Driving factor	CS		GP		WP		SR		WR	
	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE
Climate	0.914	0.780	0.911	0.774	0.915	0.783	0.913	0.780	0.914	0.781
ES	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Human activity	0.814	0.469	0.835	0.504	0.832	0.498	0.839	0.511	0.816	0.471
Soil	0.840	0.638	0.839	0.637	0.840	0.637	0.832	0.624	0.839	0.637
Terrain	0.796	0.675	0.822	0.706	0.735	0.610	0.858	0.753	0.772	0.648
Vegetation	0.924	0.802	0.925	0.806	0.924	0.803	0.920	0.793	0.923	0.800

Table S12 CR and AVE of the measurement model, 2020

Driving factor	CS		GP		WP		SR		WR	
	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE
Climate	0.912	0.777	0.908	0.769	0.911	0.775	0.911	0.775	0.912	0.776
ES	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Human activity	0.849	0.529	0.867	0.567	0.864	0.562	0.870	0.575	0.853	0.537
Soil	0.839	0.636	0.837	0.633	0.837	0.633	0.830	0.621	0.836	0.631
Terrain	0.812	0.694	0.838	0.727	0.753	0.628	0.870	0.770	0.776	0.652
Vegetation	0.909	0.770	0.913	0.778	0.911	0.773	0.905	0.760	0.909	0.769

Table S13 The PLS-SEM path coefficients, 2000

Variable	Path	Path coefficient				
		CS	GP	WP	SR	WR
Climate	→ ES	–0.166***	0.448***	–0.471***	0.144***	0.661***
	→ Soil	–0.463***	–0.468***	–0.471***	–0.489***	–0.470***
	→ Vegetation	0.238***	0.192***	0.237***	0.306***	0.231***
Human	→ Climate	0.603***	0.568***	0.560***	0.542***	0.585***
activity	→ ES	–0.649***	0.160***	–0.149***	0.027***	0.199***
Soil	→ ES	0.162***	0.133***	0.026**	0.027***	–0.174***
	→ Vegetation	–0.459***	–0.456***	–0.458***	–0.448***	–0.463***
Terrain	→ ES	–0.009	0.001	–0.263***	0.670***	0.027***
	→ Human activity	–0.453***	–0.461***	–0.451***	–0.359***	–0.459***
	→ Vegetation	–0.153***	–0.213***	–0.154***	0.008	–0.177***
Vegetation	→ ES	–0.042***	0.535***	–0.182***	0.153***	–0.015**

Note: *** means $p < 0.001$, ** means $p < 0.01$.

Table S14 The PLS-SEM path coefficients, 2005

Variable	Path	Path coefficient				
		CS	GP	WP	SR	WR
Climate	→ ES	–0.185***	0.222***	–0.418***	0.133***	0.647***
	→ Soil	–0.470***	–0.478***	–0.475***	–0.490***	–0.474***
	→ Vegetation	0.229***	0.182***	0.221***	0.302***	0.229***
Human	→ Climate	0.614***	0.568***	0.566***	0.550***	0.598***
activity	→ ES	–0.605***	0.210***	–0.202***	0.044***	0.190***
Soil	→ ES	0.197***	0.097***	0.034***	0.036***	–0.171***
	→ Vegetation	–0.414***	–0.405***	–0.413***	–0.410***	–0.416***
Terrain	→ ES	–0.006	–0.078***	–0.243***	0.667***	–0.024***
	→ Human activity	–0.479***	–0.484***	–0.478***	–0.389***	–0.485***
	→ Vegetation	–0.188***	–0.238***	–0.196***	–0.020*	–0.200***
Vegetation	→ ES	–0.017**	0.636***	–0.183***	0.156***	–0.059***

Note: *** means $p < 0.001$, ** means $p < 0.01$, * means $p < 0.05$.

Table S15 The PLS-SEM path coefficients, 2010

Variable	Path	Path coefficient				
		CS	GP	WP	SR	WR
Climate	→ ES	–0.242***	–0.070***	–0.480***	0.138***	0.664***
	→ Soil	–0.471***	–0.481***	–0.473***	–0.485***	–0.478***
	→ Vegetation	0.220***	0.184***	0.200***	0.286***	0.220***
Human	→ Climate	0.573***	0.520***	0.534***	0.506***	0.564***
activity	→ ES	–0.582***	0.178***	–0.157***	0.058***	0.177***
Soil	→ ES	0.164***	0.122***	0.046***	0.031***	–0.145***
	→ Vegetation	–0.426***	–0.419***	–0.427***	–0.430***	–0.427***
Terrain	→ ES	0.011*	–0.273***	–0.171***	0.637***	–0.060***
	→ Human activity	–0.455***	–0.450***	–0.457***	–0.359***	–0.460***
	→ Vegetation	–0.201***	–0.220***	–0.231***	–0.023**	–0.215***
Vegetation	→ ES	–0.031***	0.671***	–0.136***	0.152***	–0.063***

Note: *** means $p < 0.001$, ** means $p < 0.01$, * means $p < 0.05$.

Table S16 The PLS-SEM path coefficients, 2015

Variable	Path	Path coefficient				
		CS	GP	WP	SR	WR
Climate	→ ES	–0.228***	–0.285***	–0.541***	0.228***	0.667***
	→ Soil	–0.481***	–0.494***	–0.478***	–0.494***	–0.481***
	→ Vegetation	0.188***	0.164***	0.150***	0.286***	0.180***
Human	→ Climate	0.605***	0.567***	0.571***	0.554***	0.602***
activity	→ ES	–0.618***	0.167***	–0.176***	0.022***	0.193***
Soil	→ ES	0.140***	0.047***	0.072***	–0.036***	–0.198***
	→ Vegetation	–0.430***	–0.426***	–0.428***	–0.418***	–0.430***
Terrain	→ ES	–0.009	–0.376***	–0.087***	0.636***	–0.012**
	→ Human activity	–0.440***	–0.435***	–0.445***	–0.325***	–0.446***
	→ Vegetation	–0.214***	–0.215***	–0.271***	0.017	–0.233***
Vegetation	→ ES	–0.047***	0.642***	–0.111***	0.146***	–0.083***

Note: *** means $p < 0.001$, ** means $p < 0.01$.

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