Supplementary Material

CONTENTS:

Table S1 LDD processes in coastal China.

Slope of LDDI	Z value	LDD Types
Slope ≤ −0.0005	Z ≤ -1.96	Significant degradation
Slope ≤−0.0005	-1.96 < Z <1.96	Slight degradation
-0.0005 <Slope <0.0005	-1.96 < Z <1.96	Nonsignifificant change
Slope ≥ 0.0005	-1.96 < Z <1.96	Slight development
Slope ≥ 0.0005	Z >1.96	Significant development

Slope ≤ −0.0005	Z ≤ -1.96	Significant degradation
Slope ≤−0.0005	-1.96 < Z <1.96	Slight degradation
-0.0005 <Slope <0.0005	-1.96 < Z <1.96	Nonsignifificant change
Slope ≥ 0.0005	-1.96 < Z <1.96	Slight development

Table S2 The change in effects of human activities on LDD.

Slope of Residual	Significance Level	LDD Types
Slope ≤ −0.0005	P ≤ -1.96	Significant decrease
Slope ≤−0.0005	-1.96 < P <1.96	Slight decrease
-0.0005 <Slope <0.0005	-1.96 < P <1.96	Nonsignifificant change
Slope ≥ 0.0005	-1.96 < P <1.96	Slight increase
Slope ≥ 0.0005	P >1.96	Significant increase

Table S3 Classification standard of LDD types.

Types	LDDI's Change Trend	Significance Level of Regression Model between LDDI and Climate Factors	Significant Level of Residual's Slope
Development induced by CC	Significant increase	$p < 0.05$	$p > 0.05$
Degradation induced by CC	Significant decrease	$p < 0.05$	$p > 0.05$
Development induced by HA	Significant increase	$p > 0.05$	$p < 0.05$
Degradation induced by HA	Significant decrease	$p > 0.05$	$p < 0.05$
Development induced by CC and HA	Significant increase	$p < 0.05$	$p < 0.05$
Degradation induced by CC and HA	Significant decrease	$p < 0.05$	$p < 0.05$
Natural development	Significant increase	$p > 0.05$	$p > 0.05$
Natural degradation	Significant decrease	$p > 0.05$	$p > 0.05$

Table S4 Pearson correlation coefficients between LDDI and different extreme temperature indices.

	LDDI	FD	SU	TR	TXx	TNx	TXn	TNn	TN10p	TX10p	TN90p	TX90p	WSDI	CSDI	DTR
LDDI	1.00	-0.52**	0.29	0.50**	0.28	0.25	0.25	0.28	-0.63**	-0.44**	0.63**	0.43*	0.30	-0.45**	-0.35*
FD	-0.52**	1.00	-0.35*	-0.34*	-0.53**	-0.31	-0.13	-0.30	0.63**	0.55**	-0.64**	-0.63**	-0.41*	0.41*	0.09
SU	0.29	-0.35*	1.00	0.11	0.10	0.20	0.04	0.18	-0.57**	-0.51**	0.46**	0.54**	0.34*	-0.34	-0.10
TR	0.50**	-0.34*	0.11	1.00	0.53**	0.56**	-0.12	-0.01	-0.69**	-0.27	0.72**	0.52**	0.29	-0.74**	-0.46**
TXx	0.28	-0.53**	0.10	0.53**	1.00	0.47**	0.10	0.23	-0.54**	-0.21	0.60**	0.54**	0.36*	-0.39*	-0.31
TNx	0.25	-0.31	0.20	0.56**	0.47**	1.00	-0.11	0.05	-0.66**	-0.26	0.67**	0.55**	0.32	-0.58**	-0.34
TXn	0.25	-0.13	0.04	-0.12	0.10	-0.11	1.00	0.66**	-0.06	-0.26	0.05	-0.07	-0.09	0.21	0.17
TNn	0.28	-0.30	0.18	-0.01	0.23	0.05	0.66**	1.00	-0.25	-0.15	0.26	0.18	0.12	0.06	0.01
TN10p	-0.63**	0.63**	-0.57**	-0.69**	-0.54**	-0.66**	-0.06	-0.25	1.00	0.63**	-0.82**	-0.68**	-0.36*	0.81**	0.44**
TX10p	-0.44**	0.55**	-0.51**	-0.27	-0.21	-0.26	-0.26	-0.15	0.63**	1.00	-0.44**	-0.38*	0.02	0.53**	-0.06
TN90p	0.63**	-0.64**	0.46**	0.72**	0.60**	0.67**	0.05	0.26	-0.82**	-0.44**	1.00	0.78**	0.54**	-0.56**	-0.49**
TX90p	0.43*	-0.63**	0.54**	0.52**	0.54**	0.55**	-0.07	0.18	-0.68**	-0.38*	0.78**	1.00	0.75**	-0.44*	-0.05
WSDI	0.30	-0.41*	0.34*	0.29	0.36*	0.32	-0.09	0.12	-0.36*	0.02	0.54**	0.75**	1.00	-0.17	-0.12
CSDI	-0.45**	0.41*	-0.34	-0.74**	-0.39*	-0.58**	0.21	0.06	0.81**	0.53**	-0.56**	-0.44*	-0.17	1.00	0.35*
DTR	-0.35*	0.09	-0.10	-0.46**	-0.31	-0.34	0.17	0.01	0.44**	-0.06	-0.49**	-0.05	-0.12	0.35*	1.00

Note: ** indicates significant correlation at the 0.01 level; * indicates significant correlation at the 0.05 level.

Table S5 Pearson correlation coefficients between LDDI and different extreme precipitation indices.

	LDDI	Rx1day	Rx5day	SDII	R10	R20	CDD	CWD	R95p	R99p	PRCPTOT
LDDI	1.00	0.05	0.02	0.41*	0.46**	-0.05	-0.15	0.31	0.44*	0.04	0.30
Rx1day	0.05	1.00	0.56**	0.45**	0.48**	0.67**	0.06	0.04	0.62**	0.73**	0.29
Rx5day	0.02	0.56**	1.00	0.50**	0.55**	0.62**	-0.16	0.22	0.63**	0.71**	0.46**
SDII	0.41*	0.45**	0.50**	1.00	0.73**	0.41*	0.07	0.44**	0.76**	0.56**	0.64**
R10	0.46**	0.48**	0.55**	0.73**	1.00	0.37*	0.01	0.30	0.84**	0.53**	0.68**
R20	-0.05	0.67**	0.62**	0.41*	0.37*	1.00	0.10	0.07	0.56**	0.81**	0.30
CDD	-0.15	0.06	-0.16	0.07	0.01	0.10	1.00	-0.25	-0.10	-0.08	-0.18
CWD	0.31	0.04	0.22	0.44**	0.30	0.07	-0.25	1.00	0.28	0.20	0.55**
R95p	0.44*	0.62**	0.63**	0.76**	0.84**	0.56**	-0.10	0.28	1.00	0.72**	0.70**
R99p	0.04	0.73**	0.71**	0.56**	0.53**	0.81**	-0.08	0.20	0.72**	1.00	0.51**
PRCPTOT	0.30	0.29	0.46**	0.64**	0.68**	0.30	-0.18	0.55**	0.70**	0.51**	1.00

Note: ** indicates significant correlation at the 0.01 level; * indicates significant correlation at the 0.05 l

Table S6 Summary of the planned timeframe, aims, and objectives of major Chinese sustainability programmes.

Sustainability programmes	Planned timeframe	Aims and objectives
Shelterbelt Development Program—Three North	1978–2050	Control the expansion of sandy/desertified land, and mitigate wind erosion of sand/soil and dust storms in northern China via forest plantation, mountain closure, and sandy area regeneration.
Soil and Water Conservation Program—National	1983–2017	Control soil erosion; improve farmers' livelihoods; and improve agricultural production, ecology, and the environment by combining prevention, protection, control, repair and ecological regeneration, and utilizing appropriate scientific, engineering, plantation and cultivation measures.
Shelterbelt Development Program—Five Regions	1987–2020	Arrest environmental deterioration in the Yangtze River, Pearl River, their coastal areas, the Plain, and the Taihang Mountains via artificial plantation, mountain closure, aerial seeding, improving low-yielding forest and establishing shelterbelts.
Comprehensive Agricultural Development Program	1988–2020	Raise rural quality of life, incomes and food security through land reform, land management, ecological construction, agricultural infrastructure and industry development, and production/efficiency gains using science and technology.
Soil and Water Conservation Program—Yangtze	1989–indefinite	Reduce sedimentation and improve the health of the Yangtze River, ensure the safe operation of the Three Gorges Reservoir, and enhance regional economic and social development by controlling soil erosion in the upper reaches.
National Land Consolidation Program	1997–2020	Increase the area of cultivated land and revenues via consolidation (reorganizing and merging fragmented and underused land), reclamation, constructing high-quality cropland, and improving land use and management.
Natural Forest Conservation Program	1998–2020	Halt logging/deforestation and protect natural forests for ecological/carbon benefits via mountain closure, aerial seeding and artificial planting. Create new business opportunities for traditional forest enterprises; create forest management jobs and relocate redundant forestry workers.
Grain for Green Program	1999–2020	Prevent soil erosion, mitigate flooding, store carbon, and improve livelihoods by increasing forest and grassland cover on cropped hillslopes and converting cropland, barren hills and wasteland to forest.
Fast-growing and High-yielding Timber Program	2001–2015	Remedy the decline in timber supply and meet domestic demand for forest resources without affecting natural forests via the establishment of fast-growing and high-yielding timber plantations.
Forest Ecosystem Compensation Fund	2001–2016	Conserve natural forests and protect species and ecosystems via restoration, protection, and management of forests that have important ecological, biodiversity conservation, and sustainable economic and social value.
Sandification Control Program—Beijing/Tianjin	2001–2022	Reduce desertification and dust storms, and improve the environment in the Beijing/Tianjin area via reforestation, grassland management, and water conservation, relocating affected people and establishing basic governance of desertified lands.
Wildlife Conservation and Nature Protection Program	2001–2050	Conserve key wild animal and plant species and natural ecosystems by expanding the number and area of nature reserves, and promoting sustainable development.
Rocky Desertification Treatment Program	2008–2020	Curb rocky/karst desertification, improve the environment, and increase incomes by protecting and establishing vegetation, promoting sustainable land-use, farmland construction, water conservation and relocating poor people.
Grassland Ecological Protection Program	2011–2020	Mitigate grassland degradation by grazing prohibition and enhancing grassland vegetation coverage/biomass. Increase herder incomes by promoting the sustainable development of pastoral areas.
Cultivated Land Quality Program	2015–2030	Enhance food security and the quality, safety and ecological sustainability of agricultural production by addressing soil acidification, salinization, nutrient imbalances, pollution, biota, fertility and shallow topsoil.

Note: the above statistics derived from: https://www.nature.com/articles/s41586-018-0280-2#citeas.

Table S7 Ratio (%) of land cover conversions from 1985 to 2015

		2015								Total transfer out
		Cropland	Forest	Shrub	Grassland	Water	Barren	Impervious	Wetland	
1985	Cropland	-	18.61	0.06	5.11	5.26	0.06	34.13	0	63.24
	Forest	14.50	-	0.78	0.19	0.11	0.002	1.14	0	16.72
	Shrub	0.32	3.03	-	0.18	0	0	0.001	0	3.53
	Grassland	4.49	6.83	0.25	-	0.17	0.04	0.71	0	12.50
	Water	1.06	0.16	0	0.02	-	0.03	1.07	0	2.34
	Barren	0.18	0.002	0	0.02	0.31	-	0.33	0	0.84
	Impervious	0.14	0.003	0	0	0.68	0.01	-	0	0.83
	Wetland	0.002	0	0	0	0.001	0	0	-	0.00
	Total transfer in	20.69	28.64	1.09	5.52	6.53	0.15	37.38	0.00	
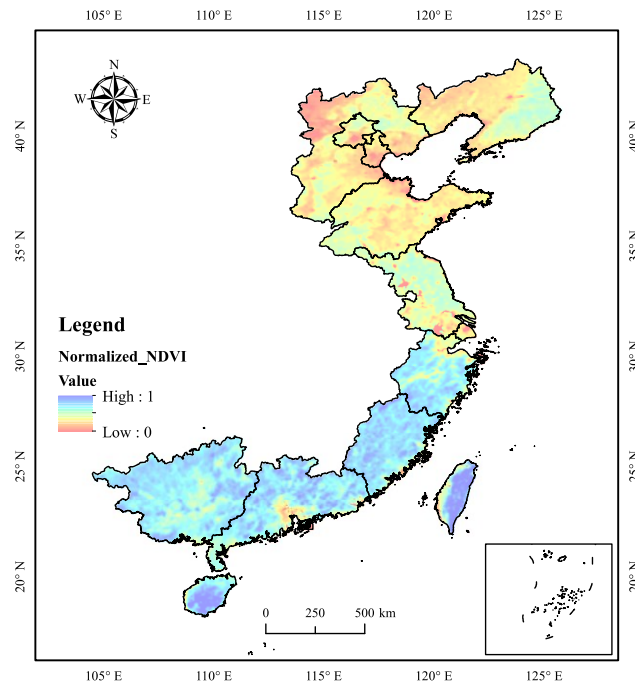
Figure S1 Multi-year average of normalized NDVI values.
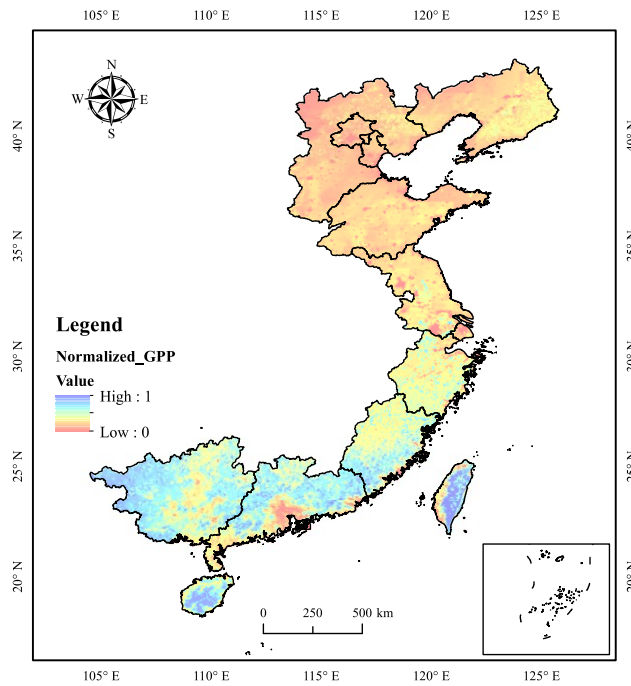
Figure S2 Multi-year average of normalized GPP values.

	Cropland	Forest	Shrub	Grassland	Water	Barren	Impervious	Wetland
Deg_{sig}	5.59	3.2	0.18	0.47	12.06	14.3	10.69	31.13
Deg_{sli}	1.33	2.76	0.2	0.19	3.62	2.74	2.49	0.63
Non_{sig}	20.21	28.49	4.44	18.9	37.65	53.39	30.7	56.92
Dev_{sli}	4.73	5.5	3.58	1.74	4.82	5.11	5.42	0
Dev_{sig}	68.14	60.06	91.6	78.7	41.86	24.46	50.7	11.32

Figure S3 The proportion of different LDD change types among different LULC types. (Deg and Dev represent land degradation and land development, respectively. Sig, Sli, and Non$_{sig}$ represent LDD changes with significant, slight, and no changes. Values less than 0.00001 are represented as 0.)

Ratio of area transfer loss (%)

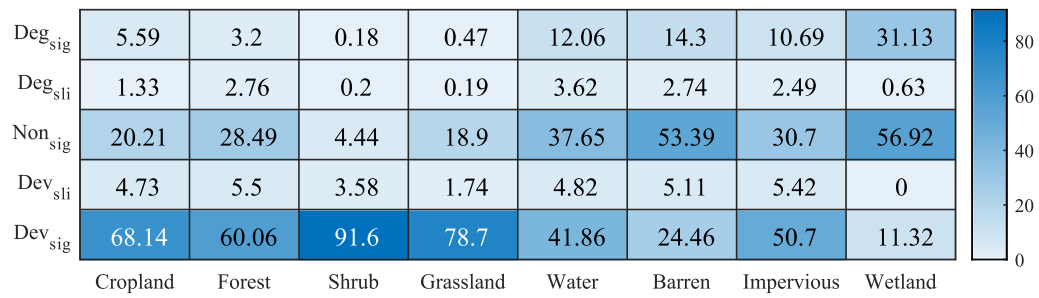|	FJ	GX	GD	HN	TW	ZJ	SH	JS	SD	HB	TJ	LN
Cropland	58.18	40.4	68.53	48.86	60.67	73.74	96.62	84.61	76.46	61.27	80.1	55.61
Forest	35.63	37.31	25.1	46.67	30.46	22.61	0.11	4.17	3.87	2.24	1.18	9.98
Shrub	0.41	18.52	0.49	0.33	0.5	0.11	0	0	0.01	1.96	0.01	0.06
Grassland	3.02	2.71	2.06	2.11	0.98	0.29	0.01	1.76	12.79	32.54	3.64	29.86
Water	1.85	0.74	3.12	1.19	6.09	2.59	3	6.65	1.81	0.89	9.72	2.47
Barren	0.29	0	0.22	0.65	0.21	0	0.07	1.81	3.05	0.56	1.99	0.87
Impervious	0.63	0.32	0.47	0.19	1.09	0.66	0.2	1.02	2.02	0.54	3.35	1.13
Wetland	0	0	0	0	0	0	0	0	0	0	0	0.02

Ratio of area transfer gain (%)

	FJ	GX	GD	HN	TW	ZJ	SH	JS	SD	HB	TJ	LN
Cropland	34.37	35.36	24.39	47.24	26.19	20.53	2.22	9.02	12.04	9.88	4.09	24.97
Forest	35.03	51.03	37.84	43.17	21.19	20.73	0.38	1.27	8.59	30.17	2.21	30.22
Shrub	0.12	5.08	0.1	0.02	0.31	0.01	0	0	0	1.17	0	0
Grassland	0.49	0.48	0.49	0.34	0.54	0.08	0.03	0.03	3.66	21.24	0.24	7.08
Water	3.86	2.57	8.85	2.79	3.54	8.03	4.45	19.84	10.13	2.33	17.46	3.96
Barren	0.09	0.01	0.08	0.05	0.03	0.01	0.01	0.01	0.67	0.13	0.37	0.09
Impervious	26.03	5.48	28.24	6.39	48.2	50.61	92.92	69.83	64.91	35.09	75.63	33.68
Wetland	0	0	0	0	0	0	0	0	0	0	0	0

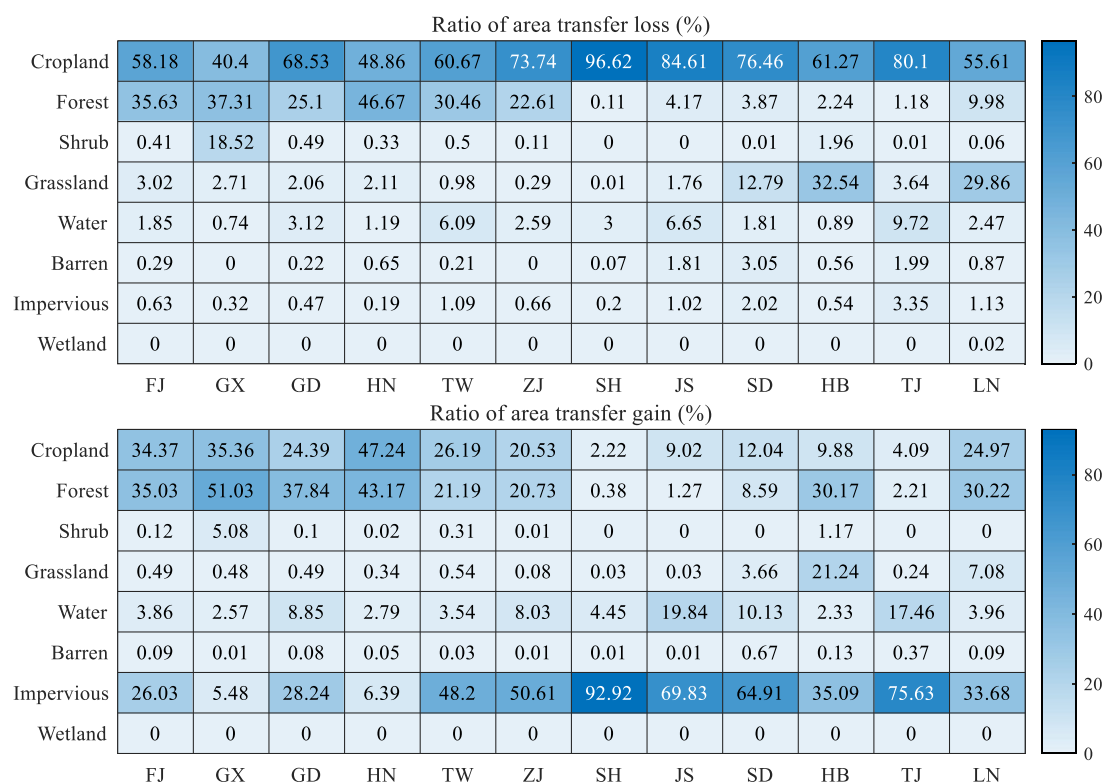**Figure S4** Heat map of the ratio (%) of LULC types transfer out and transfer in different provinces.