
Supplementary information

Assessing progress towards sustainable development over space and time

In the format provided by the authors and unedited

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Assessing progress towards sustainable development over space and time

Supplementary Tables

Table S1. Indicators selected for each of the 17 SDGs*

Sustainable Development Goals	Indicators	SDG target (Upper bound)	Indicator sources	Data sources
● Goal 1. End poverty in all its forms everywhere	■ Proportion of population covered by insurance (endowment, unemployment, and medicare)	100%	Author constructed	China Statistical Yearbook, Yearbook of China's Insurance ^{1,2}
	■ Proportion of population with access to basic services such as education and insurance	100%	Author constructed	China Statistical Yearbook, Yearbook of China's Insurance ^{1,2}
	■ Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population	0	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook on Environment, China Statistical Yearbook ^{1,3}
	■ Direct economic loss attributed to disasters in relation to global gross domestic product (GDP)	0	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook on Environment, China Statistical Yearbook ^{1,3}
	■ Proportion of local governments that adopt and implement disaster risk reduction strategies in line with national disaster risk reduction strategies	100%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook on Environment ⁴
	■ Ratio of reservoir capacity to precipitation	88.6%	Author constructed	China Statistical Yearbook, China Water Statistical Yearbook ^{1,5}

● Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	■ Prevalence of malnutrition among children under 5 years of age	0	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Health Statistical Yearbook ⁶
	■ Volume of production (farming/pastoral/forestry) per capita (rural population)	15,669.17; 1,941.67; 10,075.44. (Yuan per capita)	Author constructed	China Rural Statistical Yearbook, China Population & employment Statistics Yearbook ^{7,8}
	■ Cereal yield (t/ha)	8.6	2018 SDG Index and Dashboards report	China Statistical Yearbook ¹
	■ Actual yield as % of potential or water-limited potential yield	100%	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Statistical Yearbook, Zhong et al 2015 ^{1,9}
	■ Number of agricultural extension workers per 1,000 farmers	2.94	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Statistical Yearbook on Science and Technology, China Population & employment Statistics Yearbook ^{7,10}
	■ Crop water productivity	0.95 kg/m ³	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Statistical Yearbook, China Water Statistical Yearbook ^{1,5}
	■ Percentage children born with low birth weight	0%	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Health Statistical Yearbook ⁶
	■ Cereal yield growth rate (%)	27%	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Statistical Yearbook ¹
	■ Irrigation access gap (%)	0%	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Agriculture Yearbook ¹¹
	■ Proportion of land for agriculture use	89.8%	Author constructed	China Statistical Yearbook ¹

● Goal 3. Ensure healthy lives and promote well-being for all at all ages	■ Maternal mortality ratio	3.4/100,000	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Health Statistical Yearbook ⁶
	■ Proportion of births attended by skilled health personnel	100%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Health and Family Planning Statistical Yearbook ¹²
	■ Under-five mortality rate (per 1,000 live births)	2.6	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	1% National Population Sample Survey (2005, 2015), The Fifth National Census, The Sixth National Census ¹³⁻¹⁶
	■ Neonatal mortality rate (per 1,000 live births)	1.1	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Health Statistical Yearbook ⁶
	■ Number of new HIV infections per 100,000 uninfected population	0	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Health Statistical Yearbook ⁶
	■ Tuberculosis incidence per 100,000 population	0	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Health Statistical Yearbook ⁶
	■ Malaria incidence per 100,000 population	0	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Health Statistical Yearbook ⁶
	■ Hepatitis B incidence per 100,000 population	0	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Health Statistical Yearbook ⁶
	■ Death rate due to road traffic injuries (per 100,000 people)	3.2	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	Yearbook of China Transportation & Communications, China Statistical Yearbook ^{1,17}
	■ Expenditures on health as a share of total household income (urban population)	10.6%	Author constructed	China Statistical Yearbook ¹

	■ Health worker density	1.12/100	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Health Statistical Yearbook ⁶
	■ Percentage of population without effective financial protection for health care	0%	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Statistical Yearbook ¹
	■ Antenatal care coverage	100%	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Health Statistical Yearbook ⁶
	■ Post-natal care coverage (visit rate)	100%	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Health Statistical Yearbook ⁶
	■ Annual consumption of vegetables by rural population (kg/year/person)	172.16	Author constructed	China Statistical Yearbook ¹
	■ Percentage of health facilities meeting service specific readiness requirements (women and children care agencies)	2.5%	Author constructed	China Health Statistical Yearbook ⁶
	■ Total net official development assistance to medical research and basic health sectors as a proportion of government expenditure budget	9.7%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	Finance Yearbook of China ¹⁸
	■ Health care rate for children under 7 years old	100%	Author constructed	China Health Statistical Yearbook ⁶
● Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	■ Participation rate of youth and adults in formal education and training in the previous 12 months	24.6%	Author constructed	Educational Statistics Yearbook of China, China Statistical Yearbook ^{1,19}
	■ Proportion of population achieving at least a fixed level of proficiency in functional literacy skills	100%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	Educational Statistics Yearbook of China, China Statistical Yearbook ^{1,19}
	■ Number of computers per school: (a) primary; (b) lower secondary; and (c) upper secondary education.	199.9; 262.8; 571.4	Author constructed	Educational Statistics Yearbook of China ¹⁹

	■ Proportion of teachers in: (a) pre-primary; (b) primary; (c) lower secondary; and (d) upper secondary education who have got a bachelor degree or above	100%	Author constructed	Educational Statistics Yearbook of China ¹⁹
	■ Net primary enrolment rate (%)	100%	2018 SDG Index and Dashboards report	Educational Statistics Yearbook of China ¹⁹
	■ Population with tertiary education (%)	52.2%	Author constructed	China Statistical Yearbook ¹
	■ Number of people who have never attended school (%)	0	Author constructed	China Statistical Yearbook ¹
	■ Computer to pupil ratio in primary and secondary education	0.22; 0.33; 0.74	Indicators and a Monitoring Framework for the Sustainable Development Goals	Educational Statistics Yearbook of China ¹⁹
	■ Proportion of youth and adults with internet	100%	Author constructed	China Statistical Yearbook ¹
	■ Government expenditure on education (% total government expenditure)	19.75%	Author constructed	Finance Yearbook of China ¹⁸
● Goal 5. Achieve gender equality and empower all women and girls	■ Proportion of seats held by women in parliaments (national and provincial people's congress in China)	50%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	the National People's Congress of the People's Republic of China ²⁰
	■ Share of women among owners or rights-bearers of agricultural land	50%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Population & employment Statistics Yearbook ⁷
	■ Ratio of female to male sterilization rate	1	Author constructed	China Population & Employment Statistic Yearbook ⁷
	■ Ratio of female to male illiteracy rate	1	Author constructed	China Population & Employment Statistic Yearbook ⁷
	■ Ratio of male to female employment rate	1	Author constructed	China Population & Employment Statistic Yearbook ⁷
	■ Percentage of women without jobs	0	Author constructed	China Population & Employment Statistic Yearbook ⁷

● Goal 6. Ensure availability and sustainable management of water and sanitation for all	■ Popularity rate of sanitary toilet in rural area	100%	Author constructed	China Rural Statistical Yearbook ⁸
	■ Water-use efficiency (Water consumption per GDP)	0.0024 m ³ /Yuan	Author constructed	China Statistical Yearbook ¹
	■ Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	12.5%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook ¹
	■ Ratio of water footprint (Green and blue water footprint) to crop yield production	8.2 kg/m ³	Author constructed	China Statistical Yearbook ¹
	■ Water use per capita	2,280.8 m ³ per capita	Author constructed	China Statistical Yearbook ¹
	■ Ratio of marine protected area to marine area with established rights	59.35	Author constructed	China Marine Statistical Yearbook ²¹
● Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all	■ Ratio of renewable energy production to the total final energy consumption	1.64	Author constructed	China Energy Statistical Yearbook ²²
	■ Energy intensity measured in terms of primary energy and GDP	0.31 ton standard coal per 10,000 Yuan	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Energy Statistical Yearbook, China Statistical Yearbook ^{1,22}
	■ Rate of primary energy intensity change	-25.6%	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Energy Statistical Yearbook, China Statistical Yearbook ^{1,22}
● Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	■ Annual growth rate of real GDP per employed person	29.3%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook ¹
	■ Resource (water, energy) consumption per GDP	0.0023 m ³ /Yuan; 0.043 KWh/Yuan	Author constructed	China Energy Statistical Yearbook, China Statistical Yearbook ^{1,22}
	■ Fatal and non-fatal occupational injuries treatment per 10,000 employed persons	71.2	Author constructed	China Statistical Yearbook ¹

	■ Tourism direct GDP as a proportion of total GDP	6.27%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	Yearbook of China Tourism Statistics, China Statistical Yearbook ^{1,23}
● Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	■ Passenger and freight volumes, by mode of transport (railway, highway, water transport)	4.33; 47.56; 1.24; 19.47; 44.0; 17.85; (per capita)	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	Yearbook of China Transportation & Communications, China Statistical Yearbook ^{1,17}
	■ Manufacturing value added as a proportion of GDP	57.2%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook ¹
	■ Manufacturing employment as a proportion of total employment	46.8%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Population & employment Statistics Yearbook ⁷
	■ Proportion of small-scale industries in total industry value added	60.6%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Industry Statistical Yearbook ²⁴
	■ CO ₂ emission per unit of value	0 kg/Yuan	Author constructed	China Statistical Yearbook, Shan. et al. 2018 ^{1,25}
	■ Research and development expenditure as a proportion of GDP	3.7%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook on Science and Technology, China Statistical Yearbook ^{1,10}
	■ Researchers (in full-time equivalent) as a proportion of total population	1.56%	Author constructed	China Statistical Yearbook on Science and Technology, China Statistical Yearbook ^{1,10}
	■ Industrial Enterprises' Research and development expenditure as a proportion of GDP	5.48%	Author constructed	China Statistical Yearbook on Science and Technology, China Statistical Yearbook ^{1,10}
	■ Proportion of population covered by a mobile network	100%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook ¹

	■ Number of patents granted per million people	3,327.3	Author constructed	China Statistical Yearbook ¹
	■ Number of scientific and technical journal articles (per million people)	2,200	2018 SDG Index and Dashboards report	China Statistical Yearbook on Science and Technology ¹⁰
	■ Mobile broadband subscriptions (per 100 inhabitants)	100	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Statistical Yearbook, China Statistical Yearbook on Science and Technology ^{1,10}
	■ Patent applications accepted per million people	5,485.5	Author constructed	China Statistical Yearbook ¹
	■ Proportion of the population using the internet (%)	100%	2018 SDG Index and Dashboards report	China Statistical Yearbook ¹
● Goal 10. Reduce inequality within and among countries	■ Fatal and non-fatal occupational injuries treatment per 10000 employed persons	71.2	Author constructed	China Social Security System Development Report, China Statistical Yearbook, Yearbook of China's Insurance ^{1,2,26}
	■ Wages as a proportion of GDP	30.6%	Author constructed	China Statistical Yearbook ¹
	■ Share of women among owners or rights-bearers of agricultural land	50%	Author constructed	China Population & employment Statistics Yearbook ⁷
	■ Proportion of seats held by women in parliaments (national and provincial people's congress in China)	50%	Indicators and a Monitoring Framework for the Sustainable Development Goals	The National People's Congress of the People's Republic of China ^{1,20}
● Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	■ Passenger volumes (per capita)	179.2	Author constructed	China Statistical Yearbook ¹
	■ Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population	0	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook on Environment, China Statistical Yearbook ^{1,3}
	■ Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters (% GDP)	0	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook on Environment, China Statistical Yearbook ^{1,3}
	■ Ratio of industrial solid waste generated to the waste regularly collected and utilized	0.91	Author constructed	China Statistical Yearbook ¹
	■ Percentage of urban population below minimum living guarantee	0	Author constructed	China Statistical Yearbook ¹

	■ Road traffic deaths per 100,000 population	3.2	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Statistical Yearbook, China Civil Affairs' Statistical Yearbook ^{1,27}
● Goal 12. Ensure sustainable consumption and production patterns	■ Resource (e.g., water, energy) consumption per capita	171.86 m ³ per capita; 628.75 kg standard coal per capita; 557.79 kwh per capita.	Author constructed	China Energy Statistical Yearbook, China Statistical Yearbook ^{1,22}
	■ Hazardous waste generated per capita	0	Author constructed	China Statistical Yearbook on Environment, China Statistical Yearbook ^{1,3}
	■ Industrial solid waste generated per capita (kg/year/person)	0	Author constructed	China Statistical Yearbook on Environment, China Statistical Yearbook ^{1,3}
	■ Percentage of industrial wastewater that receives treatment (%)	100%	Author constructed	China Statistical Yearbook on Environment, China Statistical Yearbook ^{1,3}
	■ People affected by disasters per 100,000 population	0	Author constructed	China Statistical Yearbook on Environment, China Statistical Yearbook ^{1,3}
	■ Wastewater generated per capita	0	Author constructed	China Statistical Yearbook ¹
	■ Solid waste discharged in kg/person/year	0	Author constructed	China Statistical Yearbook ¹
● Goal 13. Take urgent action to combat climate change and its impacts	■ CO ₂ emissions per capita (tCO ₂ /person)	0	Author constructed	China Statistical Yearbook, Shan. et al. 2018 ^{1,25}
	■ GHG emissions intensity of forest areas (GtCO ₂ eq/ha)	0	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Forestry Statistical Yearbook, Shan. et al. 2018 ^{25,28}
	■ Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population	0	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook on Environment, China Statistical Yearbook ^{1,3}
	■ Rate of primary energy intensity change	-25.6%	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Energy Statistical Yearbook, China Statistical Yearbook ^{1,22}

	■ CO ₂ emissions intensity per GDP	0	Author constructed	China Statistical Yearbook, Shan, et al. 2018 ^{1,25}
● Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	■ Ratio of marine protected area to marine area with established rights	59.35	Author constructed	China Marine Statistical Yearbook ²¹
	■ Ratio of wastewater discharged at ocean to marine areas with established rights	0	Author constructed	China Marine Statistical Yearbook ²¹
	■ Personnel in R&D in the field of ocean study (per million inhabitants)	377.7 per million	Author constructed	China Marine Statistical Yearbook ²¹
● Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	■ Forest area as a proportion of total land area	63.0%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Forestry Statistical Yearbook, China Statistical Yearbook on Environment ^{3,28}
	■ Wetland area as a proportion of total land area	53.4%	Author constructed	China Statistical Yearbook on Environment, China Statistical Yearbook ^{1,3}
	■ Proportion of land that is degraded over total land area	0	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook on Environment ³
	■ Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems as a proportion of GDP	3.28%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Forestry Statistical Yearbook, China Statistical Yearbook ^{1,28}
	■ Afforestation area as a percent of forest area	26.5%	Author constructed	China Statistical Yearbook on Environment ³
	■ Proportion of total water resources used	12.5%	Indicators and a Monitoring Framework for the Sustainable Development Goals	China Statistical Yearbook ¹
	■ Government expenditure on environmental pollution control as a proportion of GDP	3.1%	Author constructed	China Statistical Yearbook on Environment, China Statistical Yearbook ^{1,3}
● Goal 16. Promote peaceful and inclusive	■ Primary government expenditures as a proportion of original approved budget	100%	Global indicator framework for the Sustainable Development Goals and	Finance Yearbook of China ¹⁸

societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels			targets of the 2030 Agenda for Sustainable Development	
	■ Proportions of female in public institutions (national and local people's congress)	50%	Author constructed	the National People's Congress of the People's Republic of China ²⁰
	■ Proportions of positions (population groups) in public institutions (national and local legislatures, public service, and judiciary) compared to national distributions	1	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	the National People's Congress of the People's Republic of China ²⁰
● Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	■ Total government revenue as a proportion of GDP	18.6%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook, Finance Yearbook of China ^{1,18}
	■ Foreign direct investments (FDI) proportion of total domestic budget	54.4%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook, Finance Yearbook of China ^{1,18}
	■ Foreign direct investments (FDI) as a proportion of total GDP	4.99%	Author constructed	China Statistical Yearbook, Finance Yearbook of China ^{1,18}
	■ Proportion of individuals using the internet	100%	Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development	China Statistical Yearbook ¹
	■ Government health and education spending (% GDP)	20.7%	2018 SDG Index and Dashboards report	Finance Yearbook of China, China Statistical Yearbook ^{1,18}
	■ The percentage share of tax revenues in a country's gross domestic product (GDP).	30.4%	2018 SDG Index and Dashboards report	Finance Yearbook of China, China Statistical Yearbook ^{1,18}
	■ Expenditure on social security and employment (% total government expenditure)	20.1%	Author constructed	China Statistical Yearbook, Finance yearbook of China ^{1,18}

* Lower bound for all indicators is the value consistent with the 2018 SDG Index and Dashboards report or close to the value of the bottom 2.5th percentile of performances. If the place of the bottom 2.5th percentile is located between two consecutive integers, the larger (smaller) integer is used as the place for the lower bound when a larger indicator data value represents better (worse) performance.

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Table S2. Provinces included in each region of China. The 6-regions division is derived from The Data Center for Resources and Environmental Sciences of the Chinese Academy of Science (<http://www.resdc.cn/data.aspx?DATAID=276>).

Regions	Northeast China	Northwest China	North China	Central South China	East China	Southwest China
Provinces	Heilongjiang Jilin Liaoning	Xinjiang Gansu Qinghai Ningxia Shaanxi	Inner Mongolia Beijing Tianjin Hebei Shanxi	Henan Hubei Hunan Guangxi Guangdong Hainan	Shanghai Jiangsu Zhejiang Anhui Jiangxi Shandong Fujian	Tibet Sichuan Chongqing Guizhou Yunnan

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Table S3. Scores for SDGs at (a) national and (b) subnational levels over time

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Table S3 (a)

China	SDG1	SDG2	SDG3	SDG4	SDG5	SDG6	SDG7	SDG8	SDG9	SDG10	SDG11	SDG12	SDG13	SDG14	SDG15	SDG16	SDG17
2000	43.6	36.5	60.6	44.4	54.1	39.8	40.4	32.6	21.9	21.4	62.2	79.0	75.2	51.2	27.0	67.2	15.9
2001	47.2	38.2	60.9	46.4	54.4	40.6	43.0	36.7	22.0	21.3	62.8	82.6	71.0	51.2	26.6	62.6	17.1
2002	46.5	38.3	58.5	35.4	54.4	42.3	37.8	35.4	23.5	21.8	60.6	82.7	68.2	51.1	29.3	69.2	18.5
2003	44.9	36.1	58.8	35.9	54.4	40.2	33.3	34.1	23.3	20.6	59.1	81.3	62.6	40.8	30.1	66.0	21.2
2004	49.1	41.8	58.4	37.1	51.9	37.0	38.2	36.5	23.8	21.0	63.6	83.7	68.5	34.0	33.2	59.9	24.1
2005	47.7	43.4	58.3	37.5	51.6	38.5	38.9	38.2	26.4	21.5	63.3	82.0	66.9	34.1	33.6	65.6	25.4
2006	49.2	44.6	59.5	39.4	49.8	38.6	44.0	38.9	28.2	21.6	63.7	81.4	69.1	34.4	32.2	65.5	27.3
2007	51.3	43.9	61.4	43.9	46.5	39.7	50.5	44.7	30.0	18.1	66.4	81.6	73.6	34.3	32.6	63.1	33.9
2008	41.6	45.8	62.8	44.8	49.9	41.2	54.6	44.5	32.4	24.3	57.9	80.6	73.2	34.4	34.5	71.1	34.6
2009	54.3	44.6	68.3	45.4	49.5	41.3	45.6	39.6	35.0	25.0	67.7	80.8	67.5	35.4	34.9	73.8	34.7
2010	53.5	45.4	69.1	47.7	47.9	44.0	52.8	42.1	37.6	25.4	67.5	81.0	72.0	36.0	37.3	65.1	34.3
2011	56.8	47.4	70.2	51.8	47.8	43.9	51.4	44.3	39.3	27.5	69.2	69.5	70.5	36.8	35.0	61.3	34.7
2012	59.6	48.1	71.6	55.3	48.6	45.1	51.6	43.1	42.3	29.6	72.2	71.5	72.8	35.7	36.5	72.1	36.1
2013	58.2	48.4	73.2	55.1	56.5	45.6	52.8	41.3	44.1	43.3	70.9	69.9	70.3	35.8	36.7	73.9	36.7
2014	62.2	48.3	74.9	55.5	54.5	45.9	54.5	41.0	44.9	43.3	75.3	71.7	73.5	35.9	36.9	74.7	36.7
2015	64.3	49.7	76.3	57.3	51.2	47.0	54.8	41.9	47.3	46.8	76.8	72.1	74.7	36.4	36.3	72.2	37.3

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Table S3 (b)

	Provinces	SDG1	SDG2	SDG3	SDG4	SDG5	SDG6	SDG7	SDG8	SDG9	SDG10	SDG11	SDG12	SDG13	SDG14	SDG15	SDG16	SDG17
2000	Beijing	74.7	55.3	77.4	41.7	38.3	33.4	41.9	61.5	43.8	43.7	74.8	85.4	76.7	25.8	29.7	64.0	24.4
	Tianjin	61.9	43.6	68.3	41.3	27.9	17.9	29.9	47.8	27.9	18.2	72.4	86.0	63.4	54.5	33.6	54.9	41.3
	Hebei	48.5	33.6	63.0	44.5	52.5	18.0	33.2	26.5	18.6	15.5	64.0	80.7	67.2	33.6	24.7	63.7	10.4
	Shanxi	41.0	26.9	61.7	40.8	33.5	34.2	14.7	27.6	15.0	17.2	48.5	62.3	53.5		43.2	58.6	18.0
	Inner Mongolia	30.7	44.3	60.1	30.4	40.7	32.7	19.4	22.7	8.8	14.2	38.9	73.1	54.4		30.5	55.3	5.8
	Liaoning	54.9	45.5	72.4	35.8	37.5	30.3	17.8	39.5	19.9	23.5	56.4	74.0	58.4	35.0	35.1	52.3	24.3
	Jilin	43.1	52.0	63.6	38.0	19.6	41.5	36.1	34.5	13.4	14.4	56.3	78.0	65.2		40.7	45.5	16.7
	Heilongjiang	39.3	44.3	66.3	34.5	33.3	41.4	33.9	23.7	15.4	11.8	60.0	79.1	65.0		44.2	50.2	11.4
	Shanghai	76.1	41.3	72.3	41.3	28.8	43.9	56.9	67.2	34.0	20.1	77.6	82.2	54.3	68.7	43.4	74.1	37.6
	Jiangsu	51.1	45.4	67.2	44.3	52.1	28.3	43.0	32.2	24.7	21.7	70.8	83.5	70.7	34.7	34.0	59.0	19.4
	Zhejiang	42.6	41.5	66.6	41.8	45.2	40.7	38.4	39.3	28.9	21.6	61.8	83.9	69.3	35.0	45.0	48.3	11.4
	Anhui	39.9	41.5	50.8	37.6	50.6	42.3	28.0	24.7	12.8	14.5	62.7	82.5	57.1		36.7	53.8	11.9
	Fujian	43.5	41.1	62.2	43.6	43.1	36.5	53.8	30.2	21.3	14.2	61.4	81.8	70.6	34.7	43.5	50.7	19.3
	Jiangxi	38.3	43.3	57.4	37.8	42.3	42.3	38.5	19.3	13.0	17.2	45.8	78.0	62.1		44.7	37.1	9.8
	Shandong	46.6	47.3	67.7	42.5	54.1	35.8	49.7	35.2	19.2	18.1	66.5	87.5	76.7	35.9	36.0	57.6	11.6
	Henan	43.2	37.7	58.4	42.1	51.6	42.7	38.4	27.5	17.7	15.4	61.3	82.7	65.2		34.7	60.2	7.6
	Hubei	44.8	44.0	60.6	38.3	46.8	46.0	51.6	26.5	15.6	18.0	62.6	79.7	63.7	1.3	37.5	65.2	10.6
	Hunan	43.0	45.6	60.1	36.5	44.8	40.5	61.6	35.7	15.4	19.7	61.6	79.1	77.9		39.1	58.8	10.1
	Guangdong	55.5	37.2	60.9	38.1	43.4	50.3	40.2	52.7	26.3	25.5	72.7	87.5	74.5	68.0	40.3	62.2	18.1
	Guangxi	36.9	33.0	52.4	40.7	48.9	35.4	53.6	29.4	12.1	21.5	56.9	75.0	66.6	33.5	42.4	52.5	8.3
	Hainan	42.0	35.0	47.7	38.4	48.7	32.8	46.5	37.2	11.2	27.1	63.2	78.6	61.4	47.4	43.3	54.8	14.9
	Chongqing	36.3	40.0	57.7	33.7	49.3	40.8	42.0	28.3	13.4	15.6	57.9	69.7	57.9		42.8	53.0	17.8
	Sichuan	38.6	39.4	56.8	31.8	56.3	40.5	54.6	33.1	15.3	21.5	57.1	75.0	70.8		43.0	59.3	9.8
	Guizhou	31.9	38.7	43.1	33.4	50.4	32.9	26.2	24.6	9.1	21.3	51.1	58.1	50.7		40.8	64.8	11.6
	Yunnan	32.0	41.0	48.0	30.5	58.0	37.3	61.0	31.6	11.7	24.7	50.5	60.3	70.6		42.3	65.0	10.7

	Tibet	41.1	38.1	39.4	15.7	53.0	36.6		21.0	8.8	48.4	46.9	76.2	76.0		25.8	33.4	8.4
	Shaanxi	41.6	41.0	56.2	38.2	47.3	41.4	43.0	29.7	22.2	17.9	50.4	74.0	66.6		43.5	54.1	11.4
	Gansu	35.9	24.0	45.9	31.1	51.8	29.9	23.6	23.7	12.3	27.3	43.0	79.8	60.0		26.2	49.0	6.5
	Qinghai	32.5	31.7	47.0	20.9	50.6	51.3	76.4	14.8	11.6	30.5	52.0	79.8	67.6		39.6	55.5	12.1
	Ningxia	27.2	42.4	55.8	32.2	34.4	12.8	24.3	14.6	10.2	27.5	32.8	57.2	40.0		42.1	37.4	12.3
	Xinjiang	47.0	43.5	52.6	40.2	50.2	34.8	30.6	23.9	9.6	22.9	59.6	65.6	67.1		19.8	65.3	6.8
	Beijing	82.1	51.9	78.3	55.1	41.1	36.0	64.6	67.9	56.3	46.9	75.8	81.5	90.3	22.3	23.5	68.9	36.9
	Tianjin	69.7	49.9	68.9	48.8	42.2	29.4	72.3	44.4	40.2	26.8	74.3	81.5	75.8	52.5	28.2	58.6	39.5
	Hebei	54.2	37.4	65.0	46.3	48.8	20.9	27.7	32.2	21.1	21.1	67.6	84.7	60.7	33.3	22.7	62.3	14.8
	Shanxi	46.1	31.7	59.8	46.5	45.1	31.8	25.5	40.3	18.8	22.3	51.4	61.9	57.6		28.1	61.6	13.4
	Inner Mongolia	50.9	52.3	60.6	35.0	39.8	38.3	35.1	35.7	17.0	19.3	57.1	70.9	63.8		29.5	57.3	10.3
	Liaoning	61.9	45.4	74.2	39.4	36.1	36.8	34.2	52.3	28.0	33.9	61.3	82.5	72.5	34.8	40.8	52.3	37.6
	Jilin	56.2	54.6	65.3	38.2	29.8	50.0	35.6	40.4	20.7	25.8	54.2	85.8	68.9		41.6	57.8	31.6
	Heilongjiang	55.1	47.5	66.2	38.8	38.8	42.7	21.1	38.6	22.3	28.1	63.8	88.6	66.4		39.4	52.9	17.0
	Shanghai	77.5	44.3	69.0	47.8	38.7	38.0	76.7	46.3	47.5	23.6	73.5	71.8	59.2	35.8	40.2	76.4	46.1
	Jiangsu	56.5	46.7	65.4	45.5	54.9	26.2	32.2	37.9	34.0	35.0	75.0	84.6	66.9	34.7	27.5	65.6	34.3
	Zhejiang	41.8	44.7	64.5	50.4	49.8	46.6	44.8	36.9	38.4	31.6	59.7	76.3	63.0	34.8	45.6	47.7	24.0
	Anhui	35.9	42.0	48.3	39.1	52.3	41.8	39.4	37.6	18.3	26.8	52.3	83.4	63.0		35.3	63.1	15.2
	Fujian	32.8	42.6	60.8	46.9	43.8	41.4	42.3	30.6	31.1	28.1	51.9	78.4	55.0	34.8	48.3	56.0	27.2
	Jiangxi	37.7	44.8	56.7	41.1	46.6	45.9	49.0	33.3	21.2	23.2	39.6	79.8	66.8		45.4	41.0	17.0
	Shandong	54.0	53.3	67.8	44.4	51.3	37.5	26.5	39.1	29.1	26.0	73.5	88.4	62.5	35.8	33.7	58.3	24.3
	Henan	53.8	43.0	56.8	44.2	49.5	45.0	33.3	36.5	21.9	18.5	66.3	89.4	68.5		32.1	59.9	14.2
	Hubei	44.4	44.9	62.2	40.5	49.4	47.1	50.5	41.2	22.8	23.9	53.7	76.5	55.6	1.0	37.6	61.1	21.7
	Hunan	40.4	46.7	61.9	37.9	47.8	44.8	31.9	29.6	21.0	21.3	53.5	77.9	53.7		39.9	58.6	13.6
	Guangdong	56.9	37.4	60.4	50.6	46.9	37.4	64.8	45.9	35.3	35.8	74.4	80.7	87.1	34.6	40.4	54.5	26.4
	Guangxi	40.6	33.8	57.1	42.6	49.2	39.7	57.6	30.8	18.1	22.0	56.8	75.9	71.0	33.4	42.5	57.3	17.4
	Hainan	25.4	32.1	44.7	46.2	43.1	52.9	67.1	45.8	17.0	18.7	42.3	76.8	73.3	33.7	45.1	48.5	26.5
	Chongqing	36.7	43.1	56.2	37.8	53.2	44.3	40.3	39.8	25.0	29.0	53.1	64.3	56.7		43.5	51.6	21.7
	Sichuan	44.5	42.9	57.9	34.5	55.7	42.6	62.6	34.7	23.4	26.6	60.0	83.6	77.0		41.5	62.2	13.7
	Guizhou	38.0	41.0	48.7	40.8	53.9	36.3	37.0	39.1	12.6	27.2	50.5	65.2	54.5		40.2	71.7	13.5
	Yunnan	38.7	38.2	53.7	36.7	58.2	44.6	47.1	42.7	16.0	37.3	49.3	77.8	58.3		42.6	73.9	11.0
	Tibet	44.1	33.4	35.0	21.3	53.1	40.9	30.5	11.0	65.6	49.5	78.8	77.4			26.8	40.3	7.7
	Shaanxi	45.9	44.0	60.2	44.6	46.5	40.6	40.6	36.5	27.6	27.5	46.3	85.2	71.8		38.6	48.5	16.7
	Gansu	52.4	27.7	48.3	38.5	48.4	37.4	45.2	25.5	17.6	30.6	53.8	83.9	76.6		27.0	54.0	16.4
	Qinghai	42.4	31.8	50.3	30.4	53.3	55.8	58.7	18.6	16.0	35.2	31.0	51.4	62.2		33.8	39.8	19.4
	Ningxia	51.9	47.3	58.5	40.0	42.6	17.8	22.5	21.2	15.2	31.0	53.4	67.7	59.1		26.7	36.4	17.6
	Xinjiang	56.0	48.4	52.8	43.9	55.2	35.7	31.0	13.1	14.0	30.8	54.6	68.8	72.9		16.0	65.6	9.1
	Beijing	87.2	49.5	80.7	69.1	42.2	40.2	56.1	56.4	65.1	57.7	84.4	81.6	80.1	100.0	28.8	65.7	41.8
	Tianjin	76.9	44.4	77.8	55.0	44.1	34.7	45.1	63.6	50.7	50.2	79.2	78.4	47.0	49.4	31.7	62.4	39.5
	Hebei	53.9	41.5	72.9	51.7	51.3	24.7	47.1	36.8	30.1	34.8	66.7	73.1	62.2	26.7	25.3	69.7	24.5
	Shanxi	50.3	41.3	68.0	53.3	46.5	34.9	35.8	45.4	28.2	42.5	58.2	65.4	54.6		37.1	21.3	26.5
	Inner Mongolia	51.8	58.1	69.6	45.5	42.3	41.4	36.2	36.9	31.2	28.5	56.6	58.7	51.6		31.6	61.6	25.0
	Liaoning	65.3	52.9	77.6	47.1	38.5	43.0	45.1	47.1	43.5	40.6	65.5	70.8	69.5	37.3	42.8	58.4	54.7
	Jilin	47.4	63.3	74.8	45.5	39.8	57.2	43.9	40.2	33.0	32.4	45.2	71.0	67.8		41.9	62.4	29.5
	Heilongjiang	59.8	57.5	75.3	43.5	43.5	49.6	44.9	40.7	29.7	45.1	63.8	81.1	75.7		43.9	62.7	24.7
	Shanghai	85.1	45.2	71.5	59.6	47.5	40.4	65.1	45.7	59.5	48.0	79.5	74.2	57.0	50.9	34.0	76.1	46.4
	Jiangsu	64.6	48.7	74.9	57.4	54.8	35.2	48.3	38.8	53.0	41.3	79.5	72.1	58.4	34.7	30.7	30.2	41.8
	Zhejiang	63.5	48.3	71.8	60.7	53.9	50.5	52.8	49.9	55.6	53.0	78.9	75.8	77.0	34.7	47.4	25.5	30.3
	Anhui	54.5	47.6	60.2	44.0	52.3	46.1	51.1	38.0	32.5	35.7	69.4	83.2	73.8		38.7	68.0	28.4
	Fujian	54.7	47.4	68.1	56.6	45.1	48.7	54.4	37.3	43.9	38.6	71.9	76.1	73.8	2.3	47.7	56.1	36.7
	Jiangxi	37.0	45.3	70.0	47.6	38.6	55.7	50.6	38.9	32.4	23.7	44.6	76.2	68.5		49.2	35.8	30.9
	Shandong	58.5	54.5	74.3	54.4	54.2	38.1	43.6	38.9	41.9	36.1	75.3	77.1	60.3	32.7	32.1	63.6	29.0
	Henan	58.4	48.1	68.8	51.6	55.2	47.8	47.8	30.4	31.0	32.2	69.7	83.7	70.1		33.7	70.5	19.9
	Hubei	56.5	46.0	71.7	46.3	50.4	54.6	63.9	42.0	34.9	29.5	61.7	76.6	63.8		40.0	54.5	28.2
	Hunan	50.9	48.2	69.8	45.3	49.9	51.3	61.4	37.8	33.1	34.8	62.9	78.9	75.6		45.3	58.7	20.9
	Guangdong	64.2	41.9	68.6	59.7	48.6	47.0	48.1	40.1	48.9	41.5	80.4	77.7	76.4	33.6	41.4	22.5	30.9
	Guangxi	45.1	33.9	68.4	49.6	48.0	42.1	56.7	30.4	27.5	27.1	60.1	68.4	60.5	33.6	59.5	66.9	25.7
	Hainan	37.3	40.1	64.7	51.3	40.3	44.4	50.8	50.9	22.8	20.7	50.3	75.8	71.7	2.6	44.5	59.0	41.8
	Chongqing	51.3	47.3	69.5	48.9	56.4	49.6	53.2	44.7	36.3	46.4	67.7	71.4	68.5		47.7	49.2	34.2

	Sichuan	42.0	48.6	68.1	42.9	57.6	51.7	70.7	38.6	33.9	36.4	51.7	76.3	71.1		44.0	60.6	28.7
	Guizhou	34.5	43.2	61.2	48.5	54.1	43.8	56.7	28.4	21.2	33.9	45.3	65.7	56.8		43.6	67.2	25.4
	Yunnan	30.9	39.3	66.8	47.0	60.2	48.5	66.0	36.6	22.4	38.7	40.9	73.3	61.7		46.6	76.4	28.7
	Tibet	47.8	37.5	44.9	31.9	48.2	52.2		35.7	16.6	59.7	53.3	70.2	71.3		33.5	44.9	23.6
	Shaanxi	44.1	48.4	72.5	52.9	49.2	46.0	40.0	35.2	38.1	35.6	54.2	78.8	64.3		42.1	66.5	26.9
	Gansu	30.8	39.1	62.8	46.6	47.4	42.3	51.1	25.8	24.1	35.2	30.8	65.1	56.9		31.1	66.9	23.9
	Qinghai	34.5	42.3	56.7	41.0	54.6	61.4	82.4	27.3	27.4	42.1	31.2	44.8	71.7		36.3	59.4	37.8
	Ningxia	56.0	51.7	71.5	52.5	42.2	34.3	25.4	24.7	25.4	32.6	58.9	61.8	45.5		36.0	50.0	21.2
	Xinjiang	54.5	46.6	62.9	50.9	56.5	51.6	41.6	34.2	23.7	42.0	48.8	63.0	69.3		22.6	66.5	23.1
	Beijing	85.1	50.9	82.0	77.2	38.3	40.9	48.4	59.0	70.7	59.7	97.2	79.4	83.4	100.0	34.2	70.4	47.2
	Tianjin	75.9	46.2	79.9	61.5	51.0	35.1	46.0	43.4	64.1	46.9	91.0	77.5	65.4	49.5	27.9	72.1	40.7
	Hebei	58.0	45.4	77.0	60.8	51.5	28.2	40.9	38.9	37.9	41.8	72.5	68.9	64.5	33.9	27.4	73.8	27.4
	Shanxi	56.4	38.0	74.8	59.9	39.5	35.2	26.2	43.2	32.5	52.6	68.2	61.1	59.4		38.6	31.1	34.9
	Inner Mongolia	57.1	61.9	75.0	52.7	43.1	51.1	37.8	28.1	37.1	33.2	66.8	54.3	51.2		38.4	67.0	26.3
	Liaoning	72.1	59.6	79.2	56.4	48.4	35.1	44.1	49.0	45.4	59.0	72.1	63.1	68.4	39.6	33.8	72.8	37.9
	Jilin	66.9	63.6	81.5	51.9	48.3	53.0	50.8	54.9	41.6	56.7	70.4	75.6	74.9		39.0	64.5	26.2
	Heilongjiang	64.6	66.8	79.5	49.4	41.8	53.3	40.4	40.0	33.5	46.5	73.9	81.3	73.7		42.9	64.3	26.1
	Shanghai	87.5	45.5	78.5	68.9	36.1	38.7	46.4	59.8	65.7	54.3	97.5	74.6	69.5	43.8	35.6	72.3	47.4
	Jiangsu	64.9	52.5	79.1	67.2	52.4	40.2	48.4	39.8	67.3	49.5	84.7	72.3	73.7	37.3	30.3	39.4	40.4
	Zhejiang	69.5	46.4	78.6	70.5	52.2	52.8	53.9	49.3	68.8	56.3	81.8	72.4	76.4	36.1	49.3	33.6	34.2
	Anhui	58.6	52.7	74.0	55.6	50.1	50.6	45.6	34.4	46.3	43.5	75.5	76.6	74.2		46.3	48.6	30.9
2015	Fujian	59.5	53.0	73.0	63.6	46.1	60.1	68.4	34.8	55.5	46.1	80.7	77.9	83.2	49.8	52.5	69.4	32.2
	Jiangxi	59.6	50.5	73.2	58.3	42.4	73.4	48.0	36.4	39.0	39.0	70.6	78.7	75.7		51.6	60.9	29.9
	Shandong	68.3	59.8	80.0	65.3	56.0	34.8	42.2	35.9	50.3	41.5	81.5	65.8	71.4	37.0	29.2	73.6	27.7
	Henan	66.1	54.8	76.0	59.3	55.9	42.3	47.6	28.3	38.8	39.4	77.9	81.8	78.9		28.7	72.8	22.4
	Hubei	68.4	52.3	77.0	51.6	52.2	57.8	70.1	33.9	45.1	36.5	77.0	79.2	77.4		42.0	62.4	32.2
	Hunan	60.9	53.2	75.1	53.6	50.5	55.6	53.9	39.9	39.4	40.6	72.4	78.5	75.7		53.1	70.2	24.6
	Guangdong	70.6	43.0	73.1	68.0	48.0	48.9	56.7	42.3	60.7	47.1	86.9	75.4	81.5	38.0	43.6	37.5	36.9
	Guangxi	58.1	40.0	73.6	60.9	51.9	50.6	70.7	37.7	33.3	37.1	74.2	80.1	78.9	35.4	62.7	75.6	29.2
	Hainan	63.7	45.6	71.8	59.4	45.0	51.1	45.9	44.4	28.2	32.3	74.7	84.6	75.0	43.6	44.4	71.7	51.5
	Chongqing	70.8	49.5	79.0	57.0	53.8	54.0	55.2	47.0	45.3	54.2	86.2	82.2	79.5		45.1	70.0	39.8
	Sichuan	60.5	52.7	78.7	54.5	56.0	57.3	82.6	37.8	41.2	42.8	70.5	82.7	81.7		42.6	67.9	31.9
	Guizhou	57.3	46.3	69.9	59.8	54.1	49.8	64.8	36.9	32.5	42.1	72.7	77.6	75.7		47.3	74.9	30.5
	Yunnan	53.6	43.7	74.8	53.7	62.7	52.0	86.4	39.3	30.4	43.2	62.2	73.1	79.0		48.6	77.5	31.1
	Tibet	37.3	52.5	56.8	40.1	55.1	56.6		53.1	23.1	55.3	46.0	63.4	76.6		41.7	62.3	54.7
	Shaanxi	58.8	54.6	80.0	61.6	50.7	44.6	42.5	34.2	47.8	46.1	77.3	79.1	72.2		43.3	39.3	39.6
	Gansu	53.6	41.1	75.3	53.6	43.3	42.7	53.4	34.6	29.8	45.5	61.1	72.2	67.6		29.5	71.1	30.6
	Qinghai	55.6	40.6	66.5	49.1	48.2	65.3	72.6	27.3	34.2	35.7	61.4	29.2	69.8		39.6	68.9	31.3
	Ningxia	65.4	53.3	80.5	58.9	32.0	40.2	31.8	27.7	33.0	36.9	71.7	54.0	51.3		34.9	61.6	30.4
	Xinjiang	58.8	54.0	67.7	58.9	54.8	56.8	29.8	31.7	29.7	49.4	61.8	45.9	57.5		27.6	68.5	33.6

Note: Since some provinces do not have marine areas and lack data for indicators of SDG 14, there are no scores for these provinces' SDG 14. Also, because Tibet lacks data for indicators of SDG 7, there is no score of SDG 7 for Tibet.

Table S4. Scores for SDGs of developing and developed regions over time

	Regions	SDG1	SDG2	SDG3	SDG4	SDG5	SDG6	SDG7	SDG8	SDG9	SDG10	SDG11	SDG12	SDG13	SDG14	SDG15	SDG16	SDG17
2000	Bottom 5 developing provinces	35.6	35.0	45.8	30.3	52.4	34.4	41.1	26.1	10.8	28.6	49.7	69.9	64.8	33.5	35.5	52.9	9.1
	developing provinces	37.0	37.6	50.1	31.6	50.7	38.9	47.1	25.8	12.2	24.7	52.8	74.4	65.9	33.5	38.1	52.9	9.9
	developed provinces	53.8	44.3	67.5	40.1	41.1	35.0	39.1	42.8	25.5	22.1	65.3	82.5	66.9	43.6	37.1	57.8	21.3
	Top 5 developed provinces	61.3	45.4	70.4	42.1	38.4	32.8	42.0	49.6	31.8	25.1	71.5	84.2	66.9	43.7	37.1	60.0	26.8
2005	Bottom 5 developing provinces	42.8	34.8	48.6	36.0	52.6	39.8	46.7	33.7	15.1	36.6	52.0	76.3	67.6	33.4	35.8	59.4	13.2
	developing provinces	41.5	38.2	51.8	36.3	51.9	43.0	47.6	32.2	17.5	31.6	49.6	75.8	66.1	33.4	37.5	56.2	14.5
	developed provinces	58.4	46.9	67.0	46.4	44.5	36.8	49.3	43.7	35.7	30.7	67.7	79.7	69.6	35.6	35.8	59.6	30.7
	Top 5 developed provinces	65.5	47.5	69.2	49.5	45.3	35.2	58.1	46.7	43.3	32.8	71.7	79.1	71.0	36.0	33.0	63.5	36.2
2010	Bottom 5 developing provinces	37.8	38.6	60.8	44.7	51.6	45.8	57.6	31.4	22.4	38.9	46.1	68.5	61.4	33.6	42.9	64.4	25.5
	developing provinces	40.8	42.5	62.9	44.4	51.1	49.5	60.8	33.7	27.1	36.7	49.0	70.2	66.8	33.6	42.8	60.5	27.4
	developed provinces	67.2	49.1	73.5	56.5	47.1	41.9	49.5	45.5	49.3	43.6	75.1	74.3	65.1	41.7	36.8	52.2	37.6
	Top 5 developed provinces	75.5	47.2	75.3	60.4	48.5	40.2	53.5	50.9	56.8	50.0	80.3	76.4	63.9	53.9	34.5	52.0	40.0
2015	Bottom 5 developing provinces	52.0	44.7	70.1	53.6	53.4	50.3	68.8	40.3	29.8	44.7	63.2	73.3	75.6	35.4	46.0	72.3	35.2
	developing provinces	55.5	47.3	71.8	53.9	51.4	55.4	64.2	37.7	34.9	42.5	66.7	71.2	75.5	35.4	46.3	67.8	32.5
	developed provinces	71.1	51.9	77.8	65.1	47.2	43.8	49.2	44.1	58.6	49.4	84.0	71.3	72.4	47.9	37.5	60.8	37.1
	Top 5 developed provinces	76.6	48.3	79.6	69.1	46.0	41.5	48.6	50.2	67.3	53.3	90.4	75.2	73.7	53.3	35.5	57.6	42.0

31 Note: Bottom 5 developing provinces are Guizhou, Gansu, Yunnan, Tibet, Guangxi; Other developing provinces include Anhui, Jiangxi, Sichuan, Qinghai,
32 and Henan; Top 5 developed provinces are Zhejiang, Jiangsu, Beijing, Shanghai, Tianjin; Other developed provinces include Fujian, Shandong, Guangdong,
33 Liaoning, and Inner Mongolia. SDGs scores shown in the table are average scores of corresponding provinces.

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Table S5. Change in SDG scores for 31 provinces in China between 2000 and 2015

	SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7	SDG 8	SDG 9	SDG 10	SDG 11	SDG 12	SDG 13	SDG 14	SDG 15	SDG 16	SDG 17	SDG Index scores
Provinces																		
Anhui	18.7	11.3	23.1	18.0	-0.6	8.3	17.6	9.7	33.5	28.9	12.8	-5.9	17.1		9.6	-5.2	19.0	13.5
Beijing	10.5	-4.3	4.6	35.5	0.0	7.5	6.5	-2.5	26.9	16.0	22.4	-6.0	6.6	74.2	4.4	6.4	22.8	13.6
Chongqing	34.6	9.5	21.4	23.2	4.4	13.2	13.2	18.7	31.9	38.6	28.3	12.6	21.7		2.2	17.0	22.0	19.5
Fujian	16.0	11.9	10.8	19.9	2.9	23.6	14.6	4.6	34.2	31.9	19.3	-3.9	12.6	15.1	9.0	18.7	12.9	14.9
Gansu	17.7	17.1	29.4	22.4	-8.5	12.8	29.8	10.9	17.6	18.2	18.1	-7.7	7.7		3.3	22.1	24.2	14.7
Guangdong	15.1	5.8	12.2	29.8	4.6	-1.4	16.5	-10.4	34.4	21.6	14.2	-12.1	7.0	-30.0	3.3	-24.7	18.8	6.1
Guangxi	21.2	7.0	21.2	20.2	2.9	15.2	17.1	8.2	21.2	15.6	17.2	5.1	12.3	1.9	20.4	23.1	20.9	14.7
Guizhou	25.4	7.7	26.7	26.4	3.8	16.9	38.6	12.2	23.4	20.8	21.6	19.5	24.9		6.5	10.1	18.9	19.0
Hainan	21.8	10.6	24.0	21.0	-3.7	18.3	-0.7	7.3	17.0	5.2	11.6	6.0	13.5	-3.9	1.1	16.9	36.6	11.9
Hebei	9.5	11.8	13.9	16.4	-1.0	10.2	7.7	12.4	19.3	26.3	8.5	-11.8	-2.7	0.3	2.6	10.1	17.1	8.9
Heilongjiang	25.3	22.5	13.2	14.9	8.5	11.9	6.5	16.2	18.1	34.7	13.8	2.2	8.7		-1.4	14.1	14.7	14.2
Henan	22.9	17.2	17.6	17.2	4.3	-0.4	9.2	0.8	21.0	24.0	16.6	-0.9	13.6		-5.9	12.6	14.8	11.5
Hubei	23.6	8.3	16.4	13.3	5.4	11.9	18.5	7.4	29.5	18.5	14.5	-0.4	13.6		4.5	-2.9	21.5	15.3
Hunan	17.9	7.6	15.0	17.1	5.8	15.1	-7.7	4.1	24.0	21.0	10.8	-0.7	-2.2		13.9	11.3	14.4	10.5
Inner Mongolia																		13.7
Mongolia	26.4	17.6	15.0	22.3	2.4	18.4	18.4	5.4	28.2	18.9	27.9	-18.7	-3.2		7.8	11.7	20.5	
Jiangsu	13.9	7.1	12.0	23.0	0.4	11.9	5.4	7.5	42.6	27.8	13.9	-11.2	3.0	2.6	-3.7	-19.5	21.0	9.4
Jiangxi	21.3	7.2	15.8	20.5	0.1	31.1	9.5	17.1	25.9	21.7	24.8	0.7	13.5		7.0	23.8	20.2	16.3
Jilin	23.8	11.7	17.8	13.9	28.7	11.5	14.7	20.4	28.1	42.3	14.0	-2.4	9.7		-1.7	19.0	9.5	16.3
Liaoning	17.2	14.0	6.7	20.6	11.0	4.8	26.3	9.5	25.4	35.5	15.7	-10.9	9.9	4.6	-1.4	20.5	13.7	13.1
Ningxia	38.2	10.9	24.7	26.7	-2.4	27.3	7.5	13.1	22.8	9.4	38.9	-3.2	11.3		-7.2	24.3	18.1	16.3
Qinghai	23.1	9.0	19.5	28.2	-2.3	14.0	-3.8	12.5	22.6	5.2	9.4	-50.6	2.2		0.0	13.5	19.2	7.6
Shaanxi	17.2	13.7	23.8	23.4	3.4	3.3	-0.5	4.5	25.6	28.2	26.9	5.0	5.7		-0.1	-14.9	28.2	12.1
Shandong	21.7	12.5	12.3	22.8	1.9	-1.1	-7.5	0.7	31.1	23.5	14.9	-21.6	-5.3	1.0	-6.7	16.0	16.1	7.8
Shanghai	11.3	4.2	6.3	27.5	7.3	-5.2	-10.5	-7.4	31.7	34.2	20.0	-7.6	15.2	-24.9	-7.8	-1.7	9.8	5.9
Shanxi	15.4	11.1	13.1	19.0	6.0	0.9	11.4	15.6	17.5	35.4	19.8	-1.2	5.9		-4.6	-27.5	16.8	9.7
Sichuan	21.9	13.3	21.9	22.8	-0.4	16.8	28.0	4.7	25.8	21.2	13.3	7.8	10.9		-0.4	8.7	22.1	14.9
Tianjin	14.0	2.6	11.5	20.2	23.1	17.2	16.1	-4.4	36.2	28.7	18.6	-8.5	2.0	-5.0	-5.7	17.2	-0.6	10.7
Tibet	-3.8	14.4	17.4	24.4	2.0	20.0	0.0	32.1	14.3	7.0	-0.9	-12.8	0.6		15.9	28.9	46.3	13.7
Xinjiang	11.8	10.4	15.1	18.6	4.6	22.0	-0.8	7.8	20.2	26.4	2.2	-19.7	-9.6		7.8	3.2	26.8	9.2
Yunnan	21.6	2.7	26.8	23.1	4.8	14.8	25.4	7.7	18.7	18.5	11.7	12.7	8.4		6.3	12.5	20.4	14.7
Zhejiang	26.9	5.0	12.0	28.7	7.0	12.1	15.5	10.1	40.0	34.7	20.0	-11.5	7.2	1.1	4.3	-14.7	22.8	13.0

Table S6. Factors influencing temporal patterns of scores of SDGs 6, 8, 9 and 15 at the national level. For each SDG the sample size n=16. The number in table represents the multiple regression coefficients of variables, while the number within parentheses indicates p value. Two-sided Pearson test was applied. *, ** denotes significance at 0.05, and 0.01 level, respectively (see methods in Supplementary Methods).

Factors influencing SDG 6	Government's investment in water conservancy projects as a proportion of GDP	Number of researchers in water conservancy per million people	Reservoir capacity as a proportion of precipitation	Percentage of industrial wastewater satisfying the hygienic requirement
Coefficient	$1.36 \times 10^{-1**}$ (< 0.001)	-1.68×10^2 (0.104)	-9.22×10^{-1} (0.986)	1.41×10^1 (0.248)

Factors influencing SDG 8	Industrial GDP per capita	Energy consumption per capita	Total import and export GDP as a proportion of GDP	Government's expenditure for social security and employment as a proportion of GDP
Coefficient	3.80×10^1 (0.303)	1.58 (0.737)	$1.98 \times 10^1*$ (0.033)	$5.05 \times 10^2*$ (0.014)

Factors influencing SDG 9	Government's expenditure for industry development and transportation as a proportion of GDP	Length of road per capita	Number of scientific and technological publications per million people	Number of laborers per capita
Coefficient	-2.71×10^2 (0.259)	-5.54×10^2 (0.633)	$3.03 \times 10^4**$ (< 0.001)	$1.68 \times 10^3**$ (< 0.001)

Factors influencing SDG 15	Artificial afforestation area as a proportion of land area	Ratio of forest area to land area	Official investment in protecting forestry as a proportion of GDP	Number of researchers in forestry per million people
Coefficient	2.49×10^2 (0.447)	-2.32×10^{-1} (0.744)	$2.40 \times 10^3*$ (0.020)	$2.63 \times 10^2*$ (0.020)

Table S7. Factors influencing spatial differences in the scores of SDGs 6, 8, 9 and 15 at the provincial level in 2015. For each SDG sample size $n = 31$. The number in table represents the multiple regression coefficients of variables, while the number within parentheses indicates p value. Two-sided Pearson test was applied. *, ** denotes significance at 0.05, and 0.01 level, respectively (see methods in Supplementary Methods).

Factors influencing SDG 6	Government's investment in water conservancy projects as a proportion of GDP	Number of researchers in water conservancy per million people	Reservoir capacity as a proportion of precipitation	Percentage of industrial wastewater satisfying the hygienic requirement	Ratio of forest area to land area
Coefficient	1.30×10^2 * (0.016)	-3.04×10^3 (0.724)	-9.245 (0.414)	-8.84×10^{-1} (0.894)	3.15×10^{-1} ** (0.002)

Factors influencing SDG 8	Industrial GDP per capita	Energy consumption per capita	Total import and export GDP as a proportion of GDP	Government's expenditure for social security and employment as a proportion of GDP
Coefficient	-5.75×10^{-1} (0.743)	-8.36** (0.009)	1.69×10^1 ** (0.002)	1.34×10^2 (0.127)

Factors influencing SDG 9	Government's expenditure for industry development and transportation as a proportion of GDP	Length of road per capita	Number of scientific and technological publications per million people	Number of laborers per capita
Coefficient	4.27×10^1 (0.827)	-1.40×10^{-1} (0.346)	6.98×10^{-1} ** (<0.001)	2.14×10^1 (0.308)

Factors influencing SDG 15	Artificial afforestation area as a proportion of land area	Ratio of forest area to land area	Official investment in protecting forestry as a proportion of GDP	Number of researchers in forestry per million people
Coefficient	9.36×10^1 (0.598)	3.58×10^{-1} ** (<0.001)	3.02×10^2 ** (<0.001)	-8.73×10^3 (0.515)

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Supplementary Discussion

The Supplemental Discussion elaborates on several points from the Discussion and Methods, including the drivers of the changes in the SDG Index scores and SDG scores at the national level and provincial level, the policy implications of our findings, future research directions, the indicator selection criteria, and data limitations.

Factors affecting SDG scores at the national level over time and SDG scores at the provincial level.

China’s SDG Index score increased over time at the national level (Figure 1). At the national level, factors such as governmental support, and science and technology development may promote national progress in sustainable development (Table S6). For example, we found that the government’s investment in water conservancy projects as a proportion of GDP significantly and positively affected the score of SDG 6 at the national level (Table S6). Total import and export GDP as a proportion of GDP significantly and positively affected the score of SDG 8. The number of scientific and technological publications per million people and number of laborers per capita positively and significantly affected the score of SDG 9. Official investment in protecting forestry as a proportion of GDP and the number of researchers in forestry positively and significantly affected the score of SDG 15.

Most of the factors that significantly affected temporal dynamics of SDG scores at the national level also significantly influenced SDG scores at the provincial level. At the provincial level, government’s investment in water conservancy projects as a proportion of GDP also positively and significantly affected the score of SDG 6 (Table S7). Total import and export GDP as a proportion of GDP also had a significant positive relationship with the score of SDG 8. The number of scientific and technological publications had positive impacts on the score of SDG 9. Official investment in the terrestrial protection program had significant and positive impacts on the score of SDG 15.

Government’s investment in water conservancy projects can promote construction of large and medium-sized water conservancy projects, wastewater treatment and recycling and water supply engineering project, hydropower projects and other water infrastructure ²⁹. Therefore, the provinces with higher investment in water conservancy tend to have a higher score for SDG 6. Trade can facilitate capital accumulation, upgrade industrial structure, promote technology progress and transfer, and technological progress and motivate institutional advancement ³⁰. Promoting trade can help achieve a higher score for SDG 8. Science and technology development can promote industry structure upgrading, resource use efficiency and productivity, and reduce pollution. Therefore, the number of scientific papers had positive impacts on the score of SDG 9. Official investment in protecting forestry, mainly including afforestation, wetland protection and restoration, desertification prevention and control and ecological compensation, can promote the China’s score of SDG 15 ³¹.

Spatio-temporal patterns of SDG Index scores at the provincial level

In 2000, eastern China had a higher SDG Index score than western China, which lagged behind other regions in socioeconomic development. One reason for the difference in sustainable development between western and eastern China is the difference in policy implementation between the two regions. At the beginning of the Chinese reform and opening-up policy, the Chinese government focused on facilitating economic development more in east-coastal areas than in inland areas³². As a result, social services in eastern China, such as education and health care, became more advanced than those in western China³². Additionally, eastern China has a relatively flat terrain (majority of terrain is plain), making it more favorable for transportation³³; and its climate conditions (e.g., precipitation) are more favorable for agriculture³⁴. Historically these advantages made eastern China more developed than western China. Recent patterns of economic and social development have promoted further technological advances in eastern China³⁵. Conversely, western China faces unfavorable conditions for agricultural development such as frequent droughts and a shorter frost-free period. The primary terrain in western China is plateau and basin³⁵. Its topography and far distance from the coast make transportation difficult and have restricted urbanization and socioeconomic development in the region. For these reasons, eastern China is more conducive to industrial and agricultural development. Today, western China's industrialization level is the lowest in the nation, and the poverty rate is much higher than that in eastern China³⁵.

Western China's ecological assets also have limited development in the region. In the 2000s, the ecologically fragile areas in western China accounted for 82% of the nation's ecologically fragile areas³⁶. Many of the region's ecosystems such as grassland, desert, mountain, and karst are highly vulnerable to human activities³⁶. Anthropogenic forces have resulted in severe environmental deterioration with land desertification, soil and water loss, grassland degradation, sandstorms, and flooding³⁶. In 2000, deserts in western China accounted for 95% of China's total desert area³⁷, and western China's forest coverage was only 5.7% -- much lower than the national forest cover of 13.4%³⁸. In particular, northwest China faces the most severe desertification and water shortages in the nation³⁹. Despite making up almost a third of China's total land area, northwest China's water resources only account for 10.7% of national water resources⁴⁰.

To alleviate the disparity in development between regions, the Chinese government implemented the "Western Development Strategy" in 1999 to improve environmental and socioeconomic conditions in western China³². During 1999-2015, the "Western Development Strategy" provided significant improvements in development. The Chinese government's fiscal transfers allocated to western China increased from 29% in 1999 to 39.4% in 2010⁴¹. From 2001 to 2010, the average annual growth rate of the state budget for investment in fixed assets in western China was 30.8%, which was much greater than that in other regions⁴¹. In 2014, the growth rate of industrial value added in western China surpassed that of eastern China^{41,42}. The growth rate of GDP, per capita disposable income of farmers, and investment in fixed assets were all higher than the corresponding values at the national level⁴². Significant progress in development was made in southwestern China. This region is abundant in natural resources – hydraulic, mineral and plant – which provided a strong foundation for socioeconomic development⁴³. The average

GDP growth rate of southwestern China during 2006-2013 was the fastest among the economic zones of China ⁴⁴. The average GDP growth rate of southwestern China during 2000-2010 was 11.6%, which was higher than the nation's 9.7% during the same period ⁴⁵. This rapid economic development also improved local social services such as education and health care.

Under the "Western Development Strategy", both infrastructure development and ecological conservation in western China have significantly improved ⁴⁶. Important infrastructure projects such as the Qinghai-Tibet railway, West-East Electricity Transmission Project, West-East Natural Gas Pipeline, and a number of communication networks have been constructed to support economic development ⁴⁶. The Chinese government has also implemented several conservation programs and established nature reserves to conserve forest ecosystems such as Natural Forest Conservation Program ^{47,48}. The government carried out integrated management ecological projects such as the Ecological Protection and Construction of Sanjiangyuan Nature Reserve in Qinghai, the pilot project of comprehensive management of rocky desertification in karst area. These programs enhanced grassland ecosystem protection and restoration, improved desert ecosystems, and promoted soil and water conservation ⁴⁷. These projects have yielded promising outcomes. For example, the Natural Forest Conservation Program has significantly increased forest cover in western China ⁴⁷.

The improvement of the SDG Index score in northeastern China fell behind other regions after 2010 in terms of its socioeconomic development and environmental conservation. In 2015, Prime Minister Li Keqiang acknowledged that development conditions in northeastern China were worrisome ⁴⁹. The region's economic growth rate was the lowest among the nation's four economic regions ⁴⁹. In 2014, Liaoning, Jilin and Heilongjiang's GDP growth rates were 5.8%, 6.5% and 5.6% ⁵⁰, which ranked third, fourth, and second from the bottom, respectively. Northeastern China entered the planned economy stage (when allocation and investment of capital goods and economic and production were determined by the government ⁵¹) the earliest and exited the stage latest compared to other regions. This hindered the development of a market economy ⁵⁰. Northeastern China is also the country's leading developer of heavy industry (e.g., steel, oil, machinery manufacturing, and mining), resulting in greater resource scarcity and environmental problems during urbanization than other regions ⁵². The heavy industry in northeastern China is highly resource consumptive and inefficient, with high waste and pollution production ⁵³. Economic development that results in excessive resource consumption and environmental pollution is not sustainable. Over the last several decades, severe water pollution, soil and water erosion, air pollution, desertification, and more frequent and intense droughts have hobbled northeastern China ⁵³. For example, industrial wastewater volume in northeastern China has increased annually ⁵⁴. In Liaoning Province, annual industrial wastewater discharge increased by 163.9 million tons from 2010 to 2011⁵⁴. Northeastern China's development is also hindered by population loss, low fertility, and an aging population ⁴⁹. The number of people (especially young people) lost to other regions increased from 0.4 million in 2000 to 2.2 million in 2010 ⁴⁹. People older than 65 made up only 6.6% of total population in 2000 (lower than the national level) ⁵⁵, but this percentage increased to 9.1% in 2010 (higher than the national average level and also higher than the international criteria (7%) for evaluating aging societies) ⁵⁵.

There are at least two reasons for why developed provinces made less improvement in their SDG score than developing provinces. The first reason is that developed provinces face environmental challenges such as intensive resource consumption and severe environmental pollution during

the development process³. Developed provinces did not historically rely on renewable energy, so electricity from renewable energy only accounted for an average of 8% of their total electricity production in 2015³. In Shanghai, for example, this percentage was lower than 1%. On the other hand, electricity generated from renewable energy in developing provinces accounted for an average of 67% of the total electricity production in 2015³. In Tibet and Yunnan, this percentage was higher than 90%³. Further, water consumption in developed provinces increased nearly sevenfold between 1999 and 2014³, and water pollution presents a serious challenge to these provinces. For example, their annual wastewater discharge increased by 3.3 billion tons from 2000 to 2015³, and annual industrial solid waste grew by 67 million tons from 2005 to 2015³. Second, developed provinces face more severe social challenges such as the potential for gender inequality to increase³. The expansion of the market economy provides considerable economic benefits to developed provinces, but also exacerbates gender inequality. During China's planned economy stage (1952-1992), workers' employment allocation and salaries were determined by the Chinese government, which was engineered to result in a small gender wage gap. Yet with a market economy, corporations were given more autonomy, and women faced increased inequality in the workplace^{56,57}. For instance, in 2000 the employment rate was 82.5% for men and 71.5% for women, but in 2010 the employment rate was 78.2% for men and 63.7% for women⁵⁶. Gender disparity in income has also grown over time⁵⁶. The ratio of average female income to average male income has decreased from 77.5% in 2000 to 67.3% in 2010⁵⁶.

There are several possible explanations for the decrease in the scores of SDGs 14, 12 and 5 at the national level. First, areas with good water quality in the ocean decreased over time²¹, and increasing wastewater and polluted water from industrialization and urbanization were discharged into the ocean, harming marine biodiversity and hampering China's progress toward achieving SDG 14. Second, increasing industrial waste – including solid waste, air pollution, and growing fertilizer application in agriculture – may explain the decrease in SDG 12's score³. Third, China's transition from a planned economy to a market economy can account for, in large part, the decrease in SDG 5 (Achieve greater equality) because the market economy exacerbated gender inequality⁵⁶ as explained above.

The spatial heterogeneity of SDG scores at the provincial level varied across different SDGs and changed over time (Extended Figure 5). On average, the scores of SDG 14 had the highest spatio-temporal heterogeneity across the provinces, while the scores of SDG 3 had the lowest spatio-temporal heterogeneity. Eastern provinces have marine areas while western provinces do not have. There are large variations in marine areas across provinces. That is why the scores of SDG 14 had high heterogeneity. Progress in health care reform and promotion of health insurance across the whole nation led to low heterogeneity in SDG 3.

Implications for policy

The SDG agenda was committed to by national governments through international treaties and national policies, but assessments should also be conducted at the subnational level for two reasons. First, there are great variations in SDG Index performances across provinces. Even at the goal level, for different SDGs there are provincial differences in SDG performances. Second, provinces perform differently from the nation as a whole. Our results indicate that the SDG index

scores at the provincial level ranged from 47.0 to 66.1 in 2015 (Table S3) while the SDG index score for China as whole was 55.4 in 2015. As none of the provinces have achieved any of the 17 SDGs, all provinces require further efforts to achieve them.

Tracking the spatio-temporal pattern of SDG progress is essential if policy is to achieve sustainable development and for balancing progress across regions and across SDGs. Spatio-temporal assessment helps identify spatial patterns in SDG performances over time. Results from our study show that some provinces experienced large increases in SDG progress while others experienced small increases or even decreases in SDG progress, and that these differences varied across SDGs. To be effective, policies must evolve over time and be attentive to the spatio-temporal patterns of SDG progress.

For China, policies could be made to address the decrease in progress on SDGs 14, 12 and 5. For SDG 14, we recommend pollution control and restricted access in certain marine areas. Expanding marine protected areas and strengthening protections in existing areas would also facilitate progress toward SDG 14. To achieve SDG 12, greater investments could be dedicated to conserving water and energy used in commodity production and consumption. To promote sustainable production and consumption patterns, China also needs to treat and recycle more waste and better manage pollution, such as by constructing more waste collection and treatment systems to improve the efficiency of using nitrogen fertilizer. For SDG 5, the government could improve legislation and policy to strengthen the protection of women's and children's rights (e.g., grant women the right to extended maternity leave). The government could also guarantee women's political rights and increase the participation of women in decision-making and management.

The scores of SDGs 15, 14, 17, and 10 lagged behind those of other SDGs in 2015 (the latest year with available data). They deserve special attention for improvement. Despite some progress in SDG 15, persistent problems such as desertification and biodiversity loss have contributed to its weaker performance relative to other SDGs. The government can promote sustainable management of forests, and substantially increase afforestation and reforestation. For example, the Chinese government can further strengthen the National Forest Conservation Program, which has had significant positive impacts on forest coverage and ecosystem services^{48,58}. For SDG 14, we recommend promoting pollution control of industrial enterprises, and implementing strict standards for waste management in coastal areas of provinces with low SDG scores such as Fujian and Shanghai. The government can also expand marine protected areas and strengthen protection in existing marine protected areas in provinces such as Jiangsu and Guangxi. To promote progress in SDG 17, we suggest continual government support for the Belt and Road Initiative, an international cooperation initiative by China involving major development of global trade routes and transnational oil and gas pipelines and land transportation infrastructure, particularly with Asia, Africa, and Europe⁵⁹. So far, China and 64 other countries with approximately one-third of the economy and two-thirds of the population in the world are participating in the initiative, which aims to promote efficient trade and integration of markets for diversified and more balanced sustainable development between participating countries. Furthermore, the inter-ministerial coordination mechanism for implementing the sustainable development agenda, which was initiated in 2016 with 43 participating government departments,

could be strengthened to more effectively promote sustainable development policies within China and across countries. For SDG 10, to reduce inequalities such as the rural-urban gap during marketization^{56,60}, the government can accelerate the effective provision of social security services, and expand support and protection for migrant workers and other personnel. Also, the government can develop criteria for basic public services that should be provided throughout the nation, which could help narrow the gap in service levels between urban and rural areas, regions and people. National policies can be implemented to bridge the gap in sustainable development between northern and southern China, similar to the Western Development Strategy that successfully promoted development in western China. At the provincial level, policies could improve sustainable development in the provinces with the lowest SDG scores in 2015 such as Shanxi, Ningxia, Inner Mongolia, Xinjiang, and Qinghai, which are all located in northern China. This would help close the gap in sustainable development across different provinces. For these provinces, the SDGs in which they performed most poorly could be prioritized and improved. These include SDGs 7, 16, and 9 for Shanxi; SDGs 8, 17, 7 for Ningxia; SDGs 17, 8, and 10 for Inner Mongolia; SDGs 15, 9 and 7 for Xinjiang; and SDGs 8, 12, and 17 for Qinghai.

Future research directions

Future research could focus on the spillover effects of one region's actions on the sustainable development of other regions within China as well as on spillover effects across national borders⁶¹. As one example of a spillover effect within China, resource consumption by the more than 21 million residents in Beijing can exacerbate water scarcity and food insecurity in neighboring Hebei province since Beijing mainly relies on resources from Hebei province to support its development. In particular, the virtual resources consumed in commodity production are transferred via interregional commodity trade, which allows the receiving region to conserve local resources for other needs⁶². Interregional trade dynamics can shape trade partners' sustainable development. For example, interprovincial virtual water trade within China generally increases water stress in water-exporting provinces⁶². Other virtual resources such as land and energy, and pollutants such as CO₂ and nitrogen, are also transferred or displaced between regions by interregional trade⁶². Furthermore, spillover effects across national borders can affect the sustainable development of China and other countries. For example, after implementing the Natural Forest Conservation Program⁴⁸, China imported a substantial amount of timber from other countries including Brazil, Indonesia, Chile, Malaysia, and the United States, which promotes reforestation in China but increases deforestation in the exporting countries⁶³. Many countries export food to China, which enhances China's food security. And developed countries outsource manufacturing industries to China. These flows of manufacturing industries contribute to high GDP growth, but also cause more environmental problems in China such as air pollution which can even affect the air quality in other nations through atmospheric transport⁶⁴. China is also the largest global virtual water importer through international food trade, meaning that China can save its domestic water for food production, which can help ensure both national water sustainability and food security. These distant interactions shape global sustainable development, which calls for holistic and in-depth analyses⁶¹.

Future research can also address trade-offs and synergies between SDGs, which help reveal complex mechanisms and consequences of sustainable development⁶⁵. Achieving the SDGs requires all relevant stakeholders to work together and manage the synergies and trade-offs

among different management and governance sectors (e.g. food, health, water, and energy). By identifying positive synergies and negative trade-offs, integrated approaches can help enhance sustainability pathways by promoting higher efficiency, lower costs and more coherent policies⁶⁶. Cross-sectoral integration can help increase cooperation and reduce conflicts among SDGs, increase the efficiency and effectiveness of policy, reduce conflicts between policies, and lower costs in addressing multiple SDGs simultaneously⁶⁶.

Future research assessing complex impacts of policies on sustainable development is also needed. For example, the newly proposed “Two-Child” policy may present both challenges and opportunities for China’s sustainable development⁶⁷. Greater population size can pose threats to SDGs related to food security, water scarcity, human health etc., as various natural resources and provision of public services can be strained. However, the policy can also create more job opportunities related to childbearing in the short term⁶⁷, and expand the labor force available for economic development in the long term. One potential way of assessing complex impacts of policies such as the “Two-Child” policy on sustainable development is to use models to simulate different scenarios to assess how, and project when, SDGs may be achieved⁶⁸. Future studies can integrate models across multiple sectors such as land, energy, climate, water, infrastructure, and the economy⁶⁶.

Indicator selection and data limitations

We chose the SDG indicators with the most available data in our study to ensure the reliability of the results. But there are also some data limitations. For a few indicators, complete data for a particular year were not available at the provincial level or the national level. In those instances, we used data at the year closest to the studied year in our analysis. For example, for the indicator “Death rate due to road traffic injuries”, we used data in 2001 at the provincial level because no provincial data were available for 2000. The 2018 SDG Index and Dashboards Report also encountered similar problems in data availability in its national level analysis and addressed them in the same way. Furthermore, increasing the number of indicators can decrease the uncertainty (Extended Figure 2). Despite the limitations, our paper provides a solid basis for developing a set of standard indicators to better assess the progress toward SDGs across space and time. Due to the lack of available time series data at the global level⁶⁹, currently it is not feasible to conduct the analysis of temporal patterns of the progress toward sustainability across provincial to national and global levels. Once the relevant data for an adequate number of SDG indicators over time become available, future studies can evaluate the progress toward SDGs across local to global levels to compare the relative status of their sustainable development performance, and to help promote sustainable development worldwide.

Supplementary Methods

For each SDG, we chose as many indicators as feasible from the official list of SDG indicators and the 2018 SDG Index and Dashboards Report based on data availability at both the provincial and national levels and the availability of the indicators across organizational levels and temporal scales. Analyses at national and subnational levels have the same indicators. All selected indicators have available data at both national and subnational (provincial) levels (see

Supplementary Table S1). For instance, some of potential indicators for SDG 6 (Ensure availability and sustainable management of water and sanitation for all) include “freshwater withdrawal as a proportion of available freshwater resources,” “degree of integrated water resources management implementation,” “proportion of transboundary basin area with an operational arrangement for water cooperation,” and “change in the extent of water-related ecosystems over time.” Data are available for freshwater withdrawal at the national and provincial level for China. However, “degree of integrated water resource management implementation” and “extent of water-related ecosystems” were not clearly defined, and the indicator “proportion of transboundary basin area with an operational arrangement for water cooperation” could not be used because not all provinces have transboundary basin areas and there is no database documenting this indicator’s information. We therefore selected “freshwater withdrawal as a proportion of available freshwater resources” as one of the indicators for SDG 6 since this indicator has available data at both national and subnational (provincial) levels. In a similar way, we selected the other indicators for SDG 6 as well as indicators for other SDGs from the full lists of potential indicators. We compiled a set of 119 SDG indicators at both the national level and provincial level over time, which is much greater than the 88 indicators used in the 2018 SDG Index and Dashboards Report to assess China’s SDG performance in a single year only. The distribution of the numbers of indicators across SDGs in our paper is similar to those in 2018 SDG Index and Dashboards Report. We have also done uncertainty analysis based on the 119 SDG indicators. The detailed results from uncertainty analysis are shown in Extended Data Figure 2. We also performed a sensitivity analysis to explore the sensitivity derived from decreasing and increasing the original values of SDG indicators by 10%. These results are shown in Extended Data Figure 3.

By following Ouyang et al. (2016), we have run correlation analysis and multiple general linear regression models to explore the significant factors influencing China’s SDG score at the national level over time⁴⁸. We have done this for SDGs 6, 8, 9, and 15 based on data availability for plausible influences on these SDGs (Table S6), and emphasize that these are exploratory analyses based on small samples. Certainly further research, after more data become available, is warranted. We also ran correlation analysis and multiple general linear regression models to identify the significant factors influencing spatial differences in SDG scores at the provincial level. To be consistent with the analysis at the national level, we have done this for SDGs 6, 8, 9, and 15 (also based on data availability) (Table S7). We chose provinces in 2015 (the latest year with available data) to conduct the spatial driver analysis.

Based on indicators that overlapped between our paper and the 2018 SDG Index and Dashboards report, we compared the result about China’s SDG Index score relative to the rest of world over time (Extended Data Figure 4). The dynamics for China’s SDG Index scores from 2000-2015 and a boxplot showing the distribution of SDG Index score of other 156 countries in one year are shown in Extended Data Figure 4. Dates for indicator values used in 2018 SDG Index and Dashboards report range from 2012 to 2018. The 2018 SDG Index and Dashboards report did not specify which year’s SDG Index score for the countries it calculated, therefore we placed the boxplot after 2015 but without specifying the year. As Extended Data Figure 4 shows, China made progress toward these overlapping SDGs from 2000 to 2015. China’s SDG Index score in 2015 was 71.8 based on overlapping indicators and our paper’s data.

This study presents the first assessment of the spatio-temporal pattern of sustainable development at national and subnational levels. It provides a foundation for future analyses to incorporate even more SDG indicators for an even more complete representation of progress in sustainable development and to explore interactions such as synergies and tradeoffs among SDG indicators.

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