
9th Ecosystem Services Partnership World Conference
Mainstreaming Ecosystem Services in Policy-Making in China
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Research Center for Eco-Environmental Sciences
Chinese Academy of Sciences
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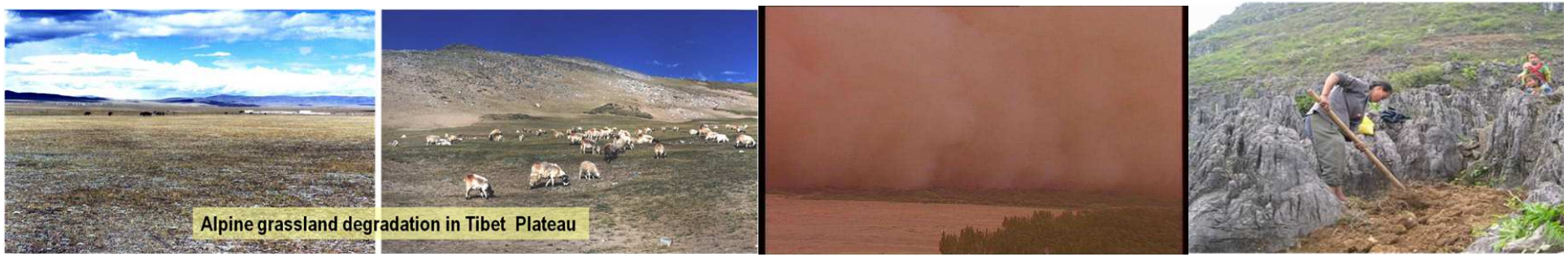
Mainstreaming ecosystem services

- Background
- GEP accounting methods and cases
- China ecosystem survey and assessment
- Mapping ecosystem services of China
- Linking ecosystem services to policy-making

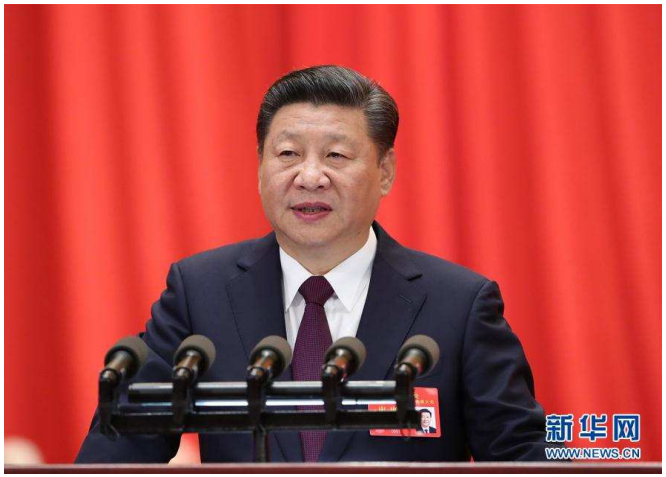
Background

China's environment is facing increasing challenges from

- ✧ Huge population: 1.38 billion
- ✧ Fast urbanization: Urban rates 57 % in 2016, 36% in 2000
- ✧ Massive natural resource exploitation
  - Coal mining: 3.7 billion tons
  - Fresh water withdrawn: 326.3 billion M^3
- ✧ Ecosystem service decline and wildlife habitat lost
  - Soil erosions and and rocky desertification,
  - Frequency of sandstorm, flooding
- ✧ Vicious-circle of ecosystem degradation and poverty



Background



In both 18th and 19th National Congress of the Communist Party declared China's Dream

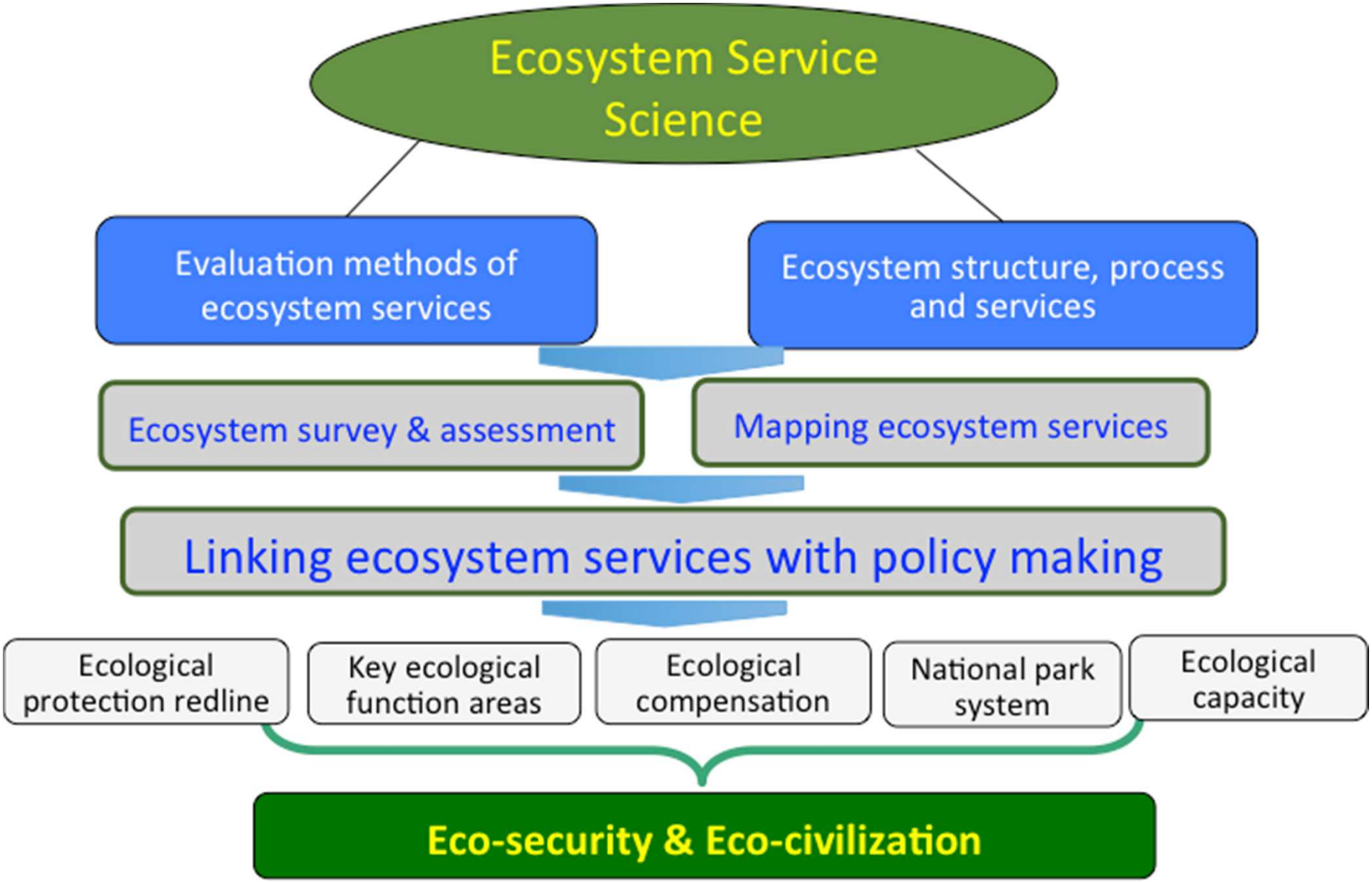
✧Harmonizing people and nature

✧Building the ecological civilization of the 21st century

Key issues: how to coordinate conservation and development ?

- ✓ Where we must protect to ensure sustainable supply of ecosystem services?
- ✓ How to achieve natural capital conservation & poverty alleviation?
- ✓ How to evaluate the development achievements, not only GDP?

Background

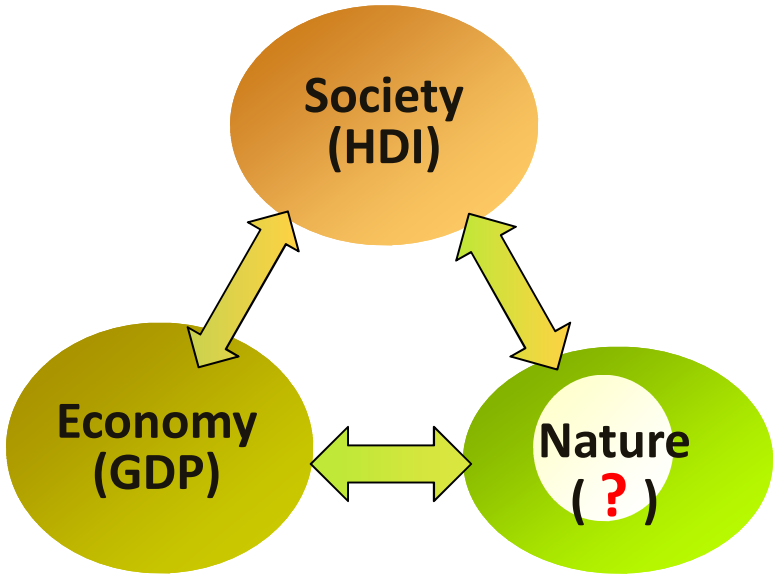

Ecosystem Service Science
Evaluation methods of ecosystem services
Ecosystem structure, process and services
Ecosystem survey & assessment
Mapping ecosystem services
Linking ecosystem services with policy making
Ecological protection redline
Key ecological function areas
Ecological compensation
National park system
Ecological capacity
Eco-security & Eco-civilization

Gross ecosystem product

Background

Region is a coupled nature-economic-social system

- Economy: GDP is widely used to measure economic system performance.
- Society: HDI(Human development index) is used to measure social development status based on health, education and living-standard since 1991.
- Nature: currently we do not have widely used index to measure its contribution to human wellfare.



Concept of GEP

Gross Ecosystem Product, GEP

- Gross Ecosystem Product (GEP) is the total value of final ecosystem goods and services supplied to human well-being in given region annually, like a county, or a province, a county.
- Ecological asset (EA) is the natural asset that provides ecosystem goods and services.
- Ecosystems:
  - Natural ecosystem: forests grasslands, wetland, desert, marine, …
  - Managed ecosystem: cropland, orchards, aquaculture farms, urban green-space, …
  - Wildlife,

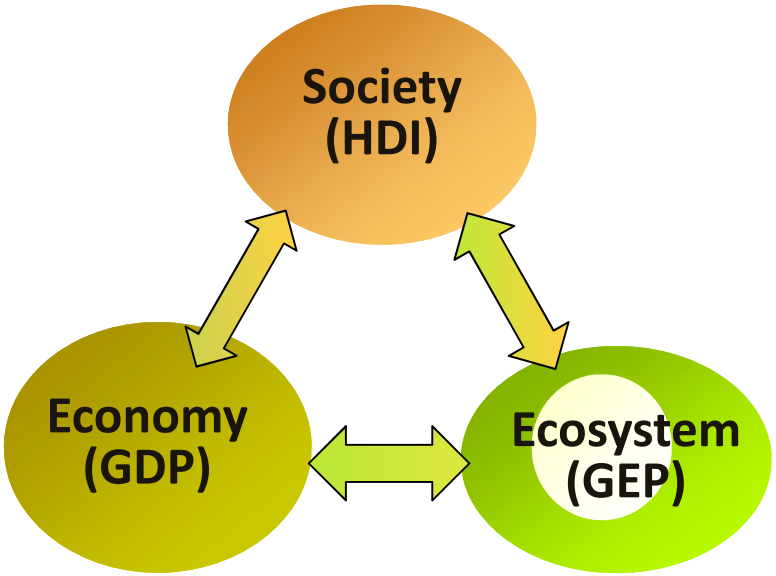
Concept of GEP

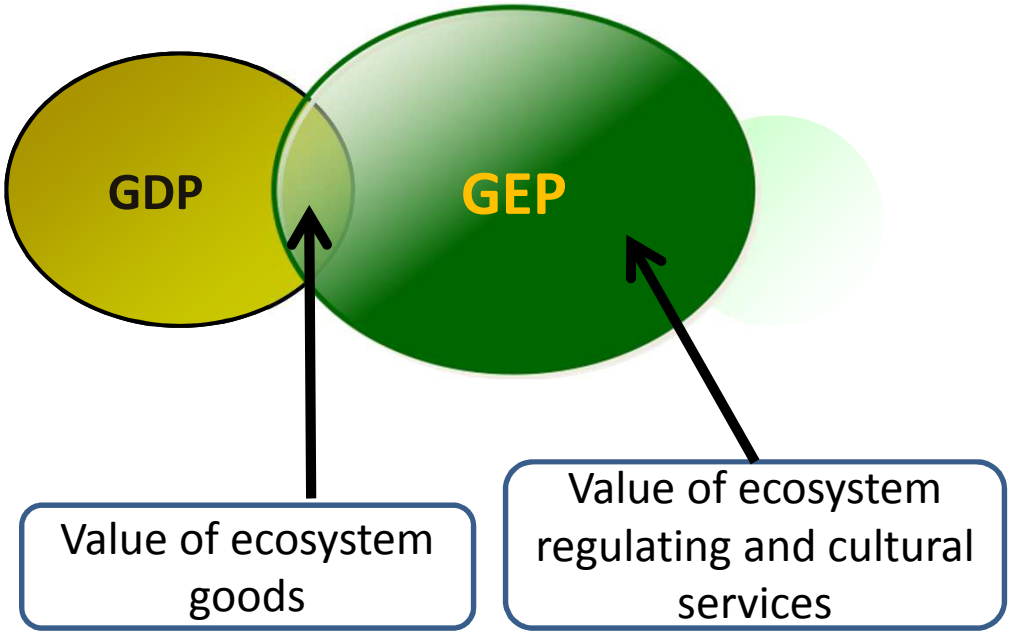
Purposes of GEP accounting

- ✧ Assessment/description of ecosystem status
- ✧ Evaluation of the contribution of ecosystems to human welfare
- ✧ Assessment of effectiveness of conservation efforts
- ✧ Evaluation of performance of local governments or communities in natural conservation, particularly in China
- ✧ Reveal the ecological linkages among regions
  - ✓ Ecological dependency
  - ✓ Ecological supporting

Concept of GEP

- GDP, HDI, and GEP

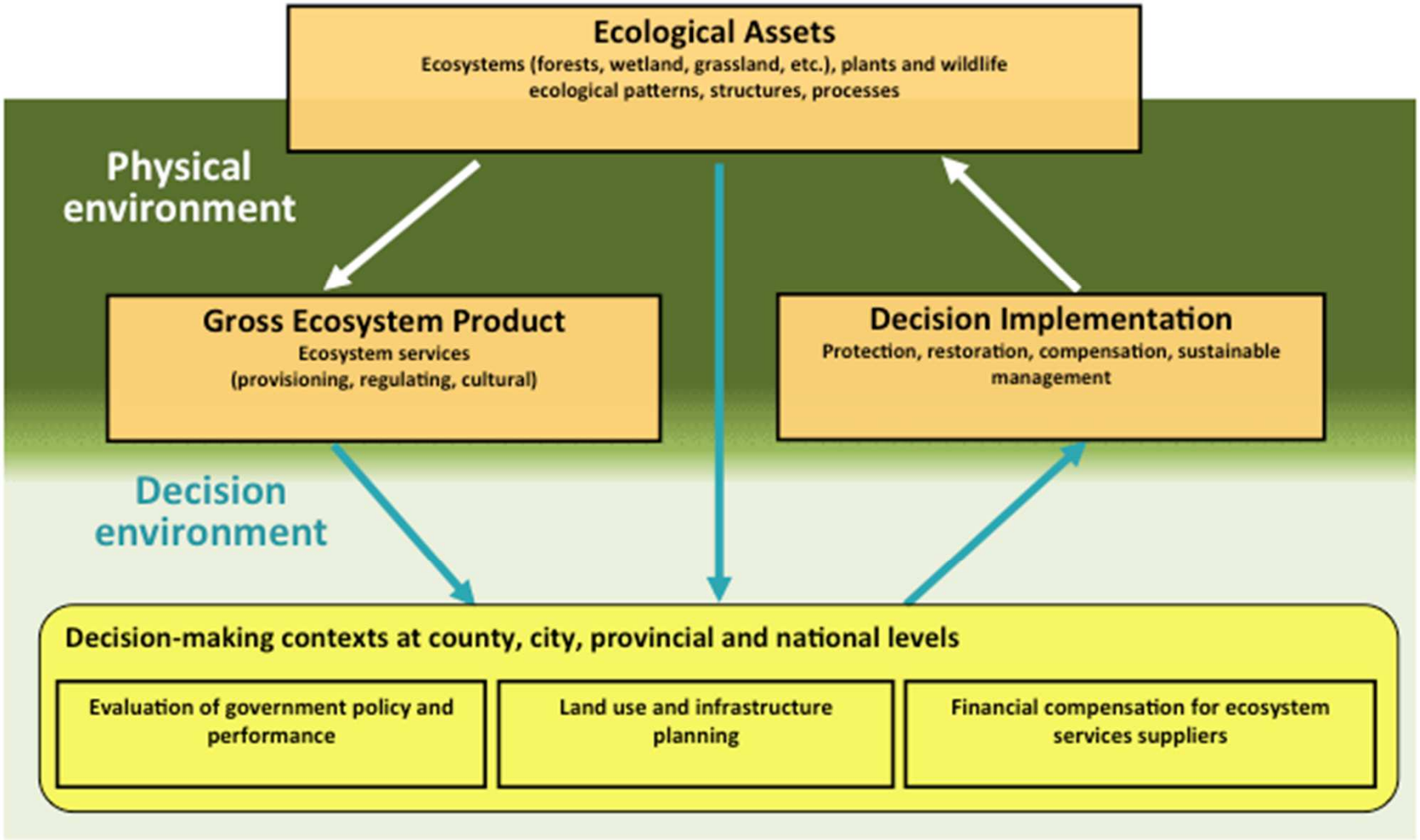




- GEP, GDP and Green GDP
  - ✓ GEP, The goods and services provided by ecosystems.
  - ✓ GDP, the goods and services provided by economic systems.
  - ✓ Green GDP, the GDP minus natural and environmental costs,

Concept of GEP

GEP accounting and policy implementation

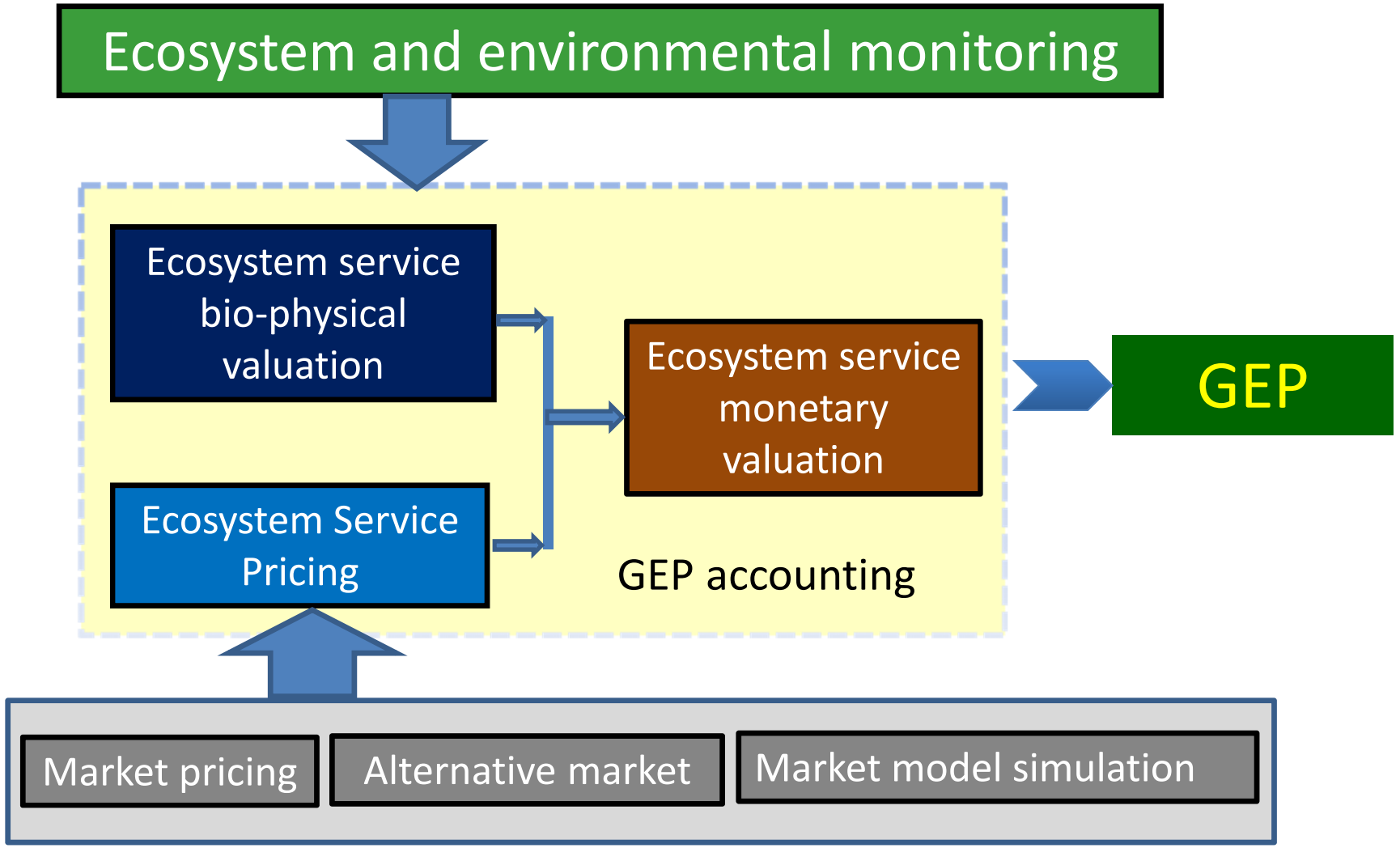


GEP accounting methods

The principle of GEP accounting

- ✧ Use value of ecosystem services
  - ✓ Direct use value: food, bio-energy, water resource,
  - ✓ Indirect use value: water retention, soil retention, pollutant purification, climate regulation
- ✧ The value of final eco-services
  - ✓ Ecosystem goods, regulating services, cultural services
- ✧ The bio-physical value accounting
  - ✓ Amount of food production, amount of water retention, amount of soil retention,
- ✧ The monetary value accounting
  - ✓ The economic value of ecosystem services

GEP accounting methods



GEP accounting methods

- **Accounting of economic values of ecosystem services**
  - ✓ GEP: the total economic value of ecosystem provision (EPV), Ecosystem regulating services (ERV) and cultural services (ECV) in the given area annually.

$$\mathrm{GEP} = EPV + ERV + ECV$$

$$\mathrm{GEP} = \sum_{i=1}^{n} EP_i \times P_i + \sum_{j=1}^{m} ER_j \times P_j + \sum_{k=1}^{l} EC_k \times P_k$$

GEP accounting methods

Ecosystem services

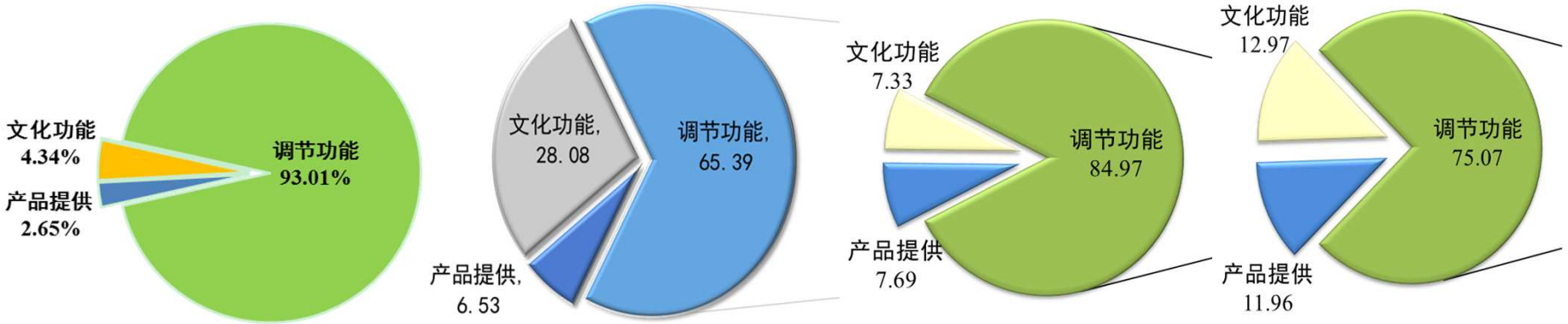
Categories	Goods and services (examples)
Ecosystem goods	Food: grain, vegetable, fruits, meat, milk, egg, fish,
	Materials: wood, fiber, water, genes,
	Energy: bio-energy(fuelwood), hydro-power, wind energy,
	Others: medicine, seedling, ornament
Regulating services	Regulation services: water conservation, soil conservation, carbon sequestration, climate regulating, pollutant purification, pollination,
	Protecting services: sand storm prevention, flooding mitigation, pest control,
Cultural service	Aesthetic services: recreation and ecotourism
	Cultural value: knowledge, education, arts, spirit

GEP accounting in

Qinghai, Qiandongnan and Eshan, Pingbian

GEP accounting of pilot areas

Areas	GEP (billion yuan)	Provisioning services (billion yuan)	Regulating services (billion yuan)	Cultural services (billion yuan)	GEP/GDP	GEP density (million yuan/km²)	Per capita GEP (yuan/person)
Qinghai Province	1714.83	45.38	1595.04	74.41	7.09	2.37	291,637.2
Qiandongnan Autonomous Prefecture	413.63	27.00	270.48	116.16	5.1	13.63	118,676.2
Pingbian County	18.08	1.39	15.36	1.33	7.02	9.49	115,891.0
Eshan County	15.78	1.89	11.84	2.05	2.53	8.00	103,848.7



GEP accounting of pilot areas

The value of regulating services accounted for 93.01% of the GEP in Qinghai Province in 2015

Services	Indicators	Quantification		Value (billion yuan)	Total (billion yuan)
		Quantification	Unit		
Water conservation	Amount of water conservation	638.72	10^8 m^3	517.36	517.36
Soil retention	Amount of soil retention	3.91	10^8 m^3	6.99	28.38
	Reduction of nitrogen non-point source pollution	0.08	10^8 t	14.58	
	Reduction of phosphorus non-point source pollution	0.02	10^8 t	6.81	
Sand fixation	Amount of sand fixation	11.74	10^8 t	33.19	33.19
Flood mitigation	Amount of lakes flood mitigation	48.04	10^8 m^3	38.91	60.75
	Amount of reservoirs flood mitigation	11.60	10^8 m^3	9.40	
	Amount of swamps flood mitigation	15.36	10^8 m^3	12.45	
Air purification	Amount of sulfur dioxide absorption	93.63	10^4 t	1.18	1.25
	Amount of nitrogen oxide absorption	4.92	10^4 t	0.06	
	Reduce the amount of industrial dust	2.11	10^4 t	0.003	
Water purification	Reduction in the amount of COD emission	220.39	10^4 t	3.09	3.86
	Reduction in the amount of total nitrogen emission	17.08	10^4 t	0.3	
	Reduction in the amount of total phosphorus emission	17.08	10^4 t	0.48	
Carbon sequestration -oxygen release	Amounts of carbon sequestration	0.2567	10^8 t	9.91	23.57
	Amounts of oxygen release	0.1867	10^8 t	13.66	
Climate regulation	Energy consumption of plant transpiration	6534.60	10^8 kwh	346.33	917.82
	Energy consumption of water surface evaporation	10782.81	10^8 kwh	571.49	
Biological control	Area of pests and diseases occurrence	0.29	10^8 mu	8.85	8.85
Total				1,595.04	1,595.04

GEP accounting of pilot areas

The value of regulating services accounted for 65.39% of the GEP in Qiandongnan Prefecture

Services	Indicators	Quantification		Value (billion yuan)	Total (billion yuan)
		Quantification	Unit		
Water conservation	Amount of water conservation	137.26	10^8 m^3	111.183	111.183
Soil retention	Amount of soil retention	24.84	10^8 m^3	9.043	32.642
	Reduction of nitrogen non-point source pollution	0.09	10^8 t	16.087	
	Reduction of phosphorus non-point source pollution	0.03	10^8 t	7.513	
Flood mitigation	Amount of lakes flood mitigation	0.02	10^8 m^3	0.014	13.409
	Amount of reservoirs flood mitigation	16.54	10^8 m^3	13.395	
Air purification	Amount of sulfur dioxide absorption	45.27	10^4 t	0.57	0.594
	Amount of nitrogen oxide absorption	1.71	10^4 t	0.021	
	Reduce the amount of industrial dust	1.17	10^4 t	0.002	
Water purification	Reduction in the amount of COD emission	1.98	10^4 t	0.028	0.035
	Reduction in the amount of total nitrogen emission	0.15	10^4 t	0.003	
	Reduction in the amount of total phosphorus emission	0.15	10^4 t	0.004	
Carbon sequestration -oxygen release	Amounts of carbon sequestration	0.15	10^8 t	5.817	13.84
	Amounts of oxygen release	0.11	10^8 t	8.023	
Climate regulation	Energy consumption of plant transpiration	1689.63	10^8 kwh	89.391	94.972
	Energy consumption of water surface evaporation	105.29	10^8 kwh	5.581	
Biological control	Area of pests and diseases occurrence	0.12	10^8 mu	3.801	3.801
Total				270.475	270.475

GEP accounting of pilot areas

The value of regulating services accounted for 84.97% of the GEP in Pingbian County

Services	Indicators	Quantification		Value (billion yuan)	Total (billion yuan)
		Quantification	Unit		
Water conservation	Amount of water conservation	9.99	10^8 m^3	8.099	8.099
Soil retention	Amount of soil retention	0.26	10^8 m^3	0.465	1.809
	Reduction of nitrogen non-point source pollution	0.0052	10^8 t	0.916	
	Reduction of phosphorus non-point source pollution	0.0015	10^8 t	0.428	
Flood mitigation	Amount of reservoirs flood mitigation	0.0153	10^8 m^3	0.012	0.012
Air purification	Amount of sulfur dioxide absorption	2.32	10^4 t	0.03	0.031
	Amount of nitrogen oxide absorption	0.09	10^4 t	0.001	
	Reduce the amount of industrial dust	0.06	10^4 t	0.0001	
Water purification	Reduction in the amount of COD emission	0.08	10^4 t	0.001	0.001
	Reduction in the amount of total nitrogen emission	0.01	10^4 t	0.0001	
	Reduction in the amount of total phosphorus emission	0.01	10^4 t	0.0002	
Carbon sequestration -oxygen release	Amounts of carbon sequestration	0.0070	10^8 t	0.269	0.64
	Amounts of oxygen release	0.0051	10^8 t	0.371	
Climate regulation	Energy consumption of plant transpiration	85.51	10^8 kwh	4.532	4.748
	Energy consumption of water surface evaporation	4.08	10^8 kwh	0.216	
Biological control	Area of pests and diseases occurrence	0.0007	10^8 mu	0.022	0.022
Total				15.362	15.362

GEP accounting of pilot areas

The value of regulating services accounting for 75.07% of the GEP in Eshan County

Services	Indicators	Quantification		Value (billion yuan)	Total (billion yuan)
		Quantification	Unit		
Water conservation	Amount of water conservation	4.34	10^8 m^3	3.518	3.518
Soil retention	Amount of soil retention	0.21	10^8 m^3	0.384	1.469
	Reduction of nitrogen non-point source pollution	0.004	10^8 t	0.74	
	Reduction of phosphorus non-point source pollution	0.001	10^8 t	0.345	
Flood mitigation	Amount of reservoirs flood mitigation	0.26	10^8 m^3	0.214	0.214
Air purification	Amount of sulfur dioxide absorption	2.94	10^4 t	0.037	0.0381
	Amount of nitrogen oxide absorption	0.11	10^4 t	0.001	
	Reduce the amount of industrial dust	0.07	10^4 t	0.0001	
Water purification	Reduction in the amount of COD emission	0.18	10^4 t	0.002	0.0026
	Reduction in the amount of total nitrogen emission	0.01	10^4 t	0.0002	
	Reduction in the amount of total phosphorus emission	0.01	10^4 t	0.0004	
Carbon sequestration -oxygen release	Amounts of carbon sequestration	0.0055	10^8 t	0.212	0.505
	Amounts of oxygen release	0.004	10^8 t	0.293	
Climate regulation	Energy consumption of plant transpiration	105.45	10^8 kwh	5.589	6.092
	Energy consumption of water surface evaporation	9.49	10^8 kwh	0.503	
Biological control	Area of pests and diseases occurrence	0.0001	10^8 mu	0.003	0.003
Total				11.843	11.843

GEP change of pilot areas

Areas	Services	2015	2010	2000	2000-2015 Change rate (%)
Qinghai Province	Provisioning services (billion yuan)	45.38	43.09	14.15	126.3
	Regulating services (billion yuan)	1595.04	1467.29	1331.89	7
	Cultural services (billion yuan)	74.41	21.31	3.3	1490.7
	GEP (billion yuan)	**1714.83**	**1531.69**	**1349.34**	**13.1**
Qiandongnan Autonomous Prefecture	Provisioning services (billion yuan)	27.00	11.91	5.38	254.13
	Regulating services (billion yuan)	270.48	244.65	203.12	8.49
	Cultural services (billion yuan)	116.16	32.92	0.42	19272.18
	GEP (billion yuan)	**413.63**	**289.48**	**208.93**	**60.62**
Pingbian County	Provisioning services (billion yuan)	1.39	0.97	0.42	133.23
	Regulating services (billion yuan)	15.36	13.77	11.23	6.47
	Cultural services (billion yuan)	1.33	0.45	0.08	1668
	GEP (billion yuan)	**18.08**	**15.19**	**11.73**	**19.73**
Eshan County	Provisioning services (billion yuan)	1.89	1.19	0.72	84.1
	Regulating services (billion yuan)	11.84	10.92	10.37	-2.54
	Cultural services (billion yuan)	2.05	0.64	0.07	3001.52
	GEP (billion yuan)	**15.78**	**12.74**	**11.16**	**19.13**

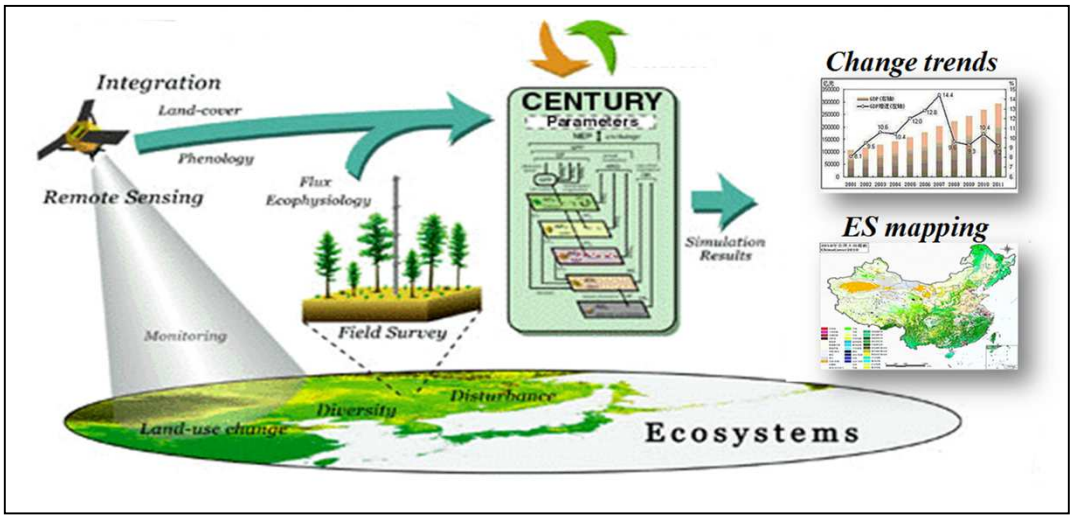
- 2000-2015, GEP of the studied areas were increased.
- Regulating services value increased : Qinghai, Qiandongnan and Pingbian;
- Regulating services value decreased : Eshan.

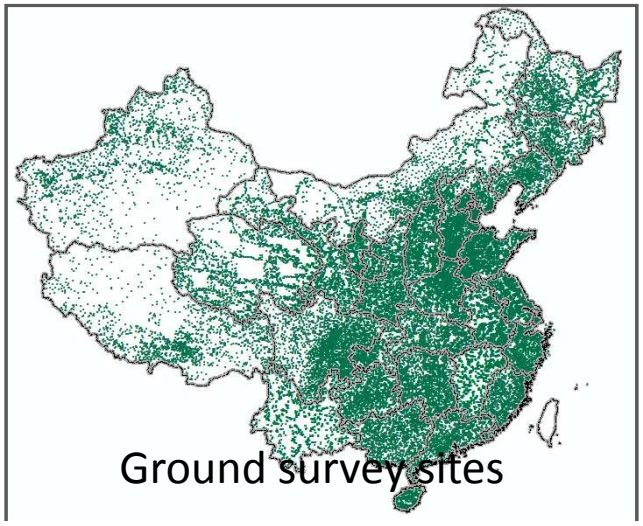
Mainstreaming ecosystem services

China ecosystem survey and assessment

China ecosystem survey and assessment

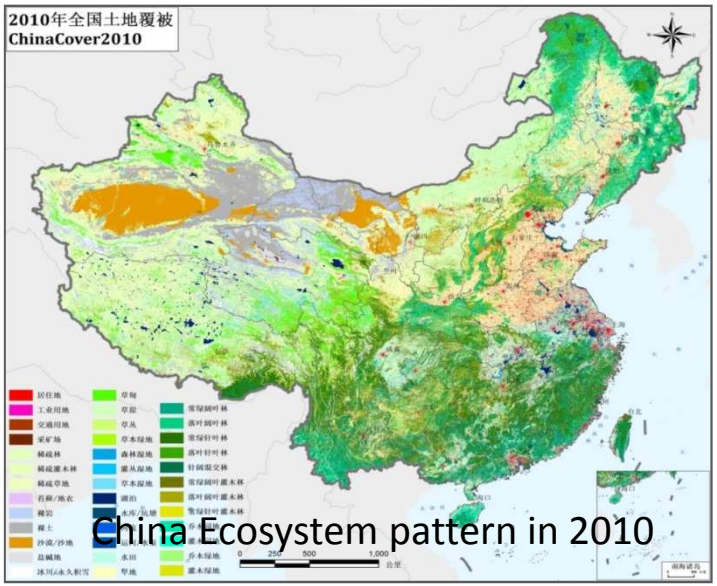
- Scales: Provincial (31)—Regional—National scales
- Remote sensing data: 21,808 images for 2000, 2005, 2010,2015
- Ground survey sites: 114,500
- Model: InVEST and others
- Goals: Build an overall image of ecosystem status of China
  - ✓ Ecosystem distribution and patterns
  - ✓ Ecosystem quality and their changes
  - ✓ Ecosystem services and their changes
  - ✓ Identify crucial areas for ecosystem services



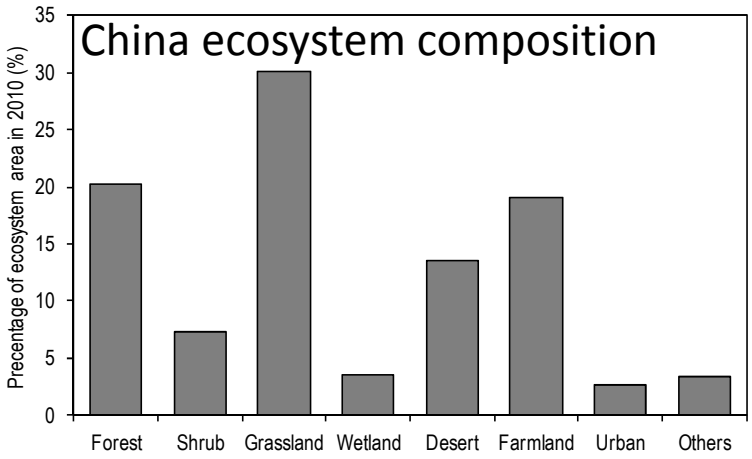


China ecosystem patterns and changes

China ecosystem composition and patterns



China Ecosystem pattern in 2010

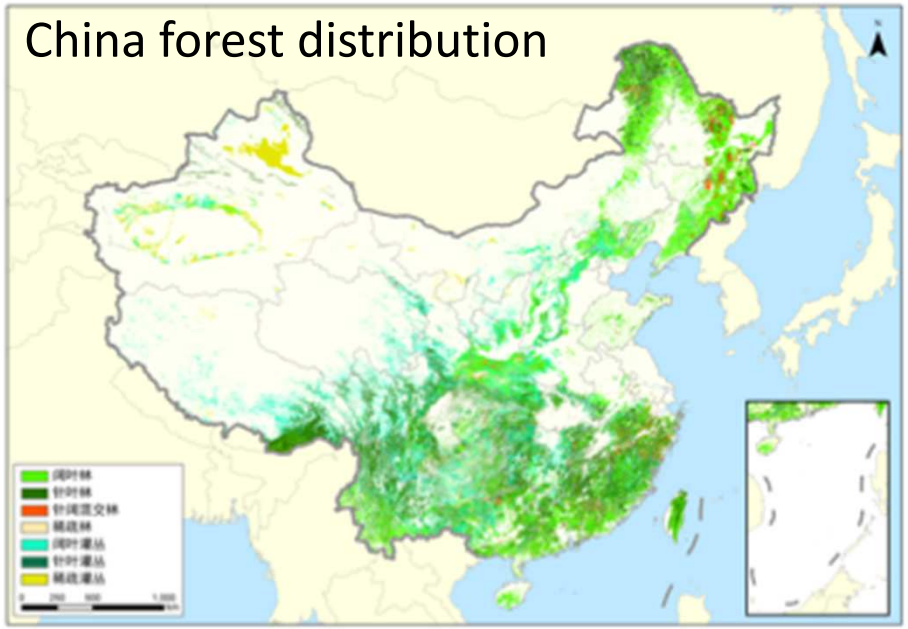


Ecosystem types	Areas (km^2)	Percentages (%)
Forests	190.83	20.17
Shrubs	69.23	7.32
Grassland	283.68	29.98
Wetland	35.61	3.76
Desert	127.73	13.50
Cropland	181.59	19.19
Urban	25.41	2.69
Others	32.02	3.38

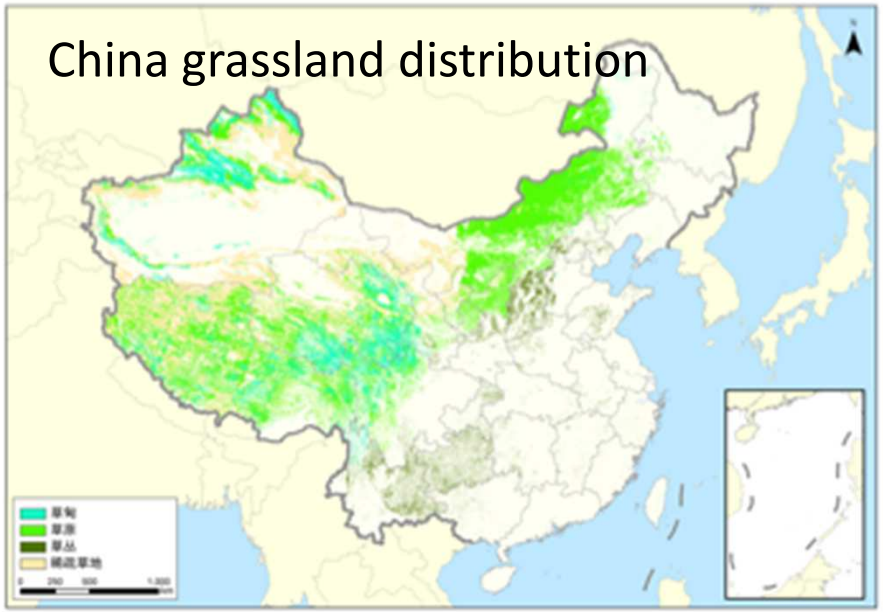
Grassland, forest, cropland and desert were made of 82.8% of total area of China

China ecosystem patterns and changes

Forest and grassland ecosystem distribution and changes



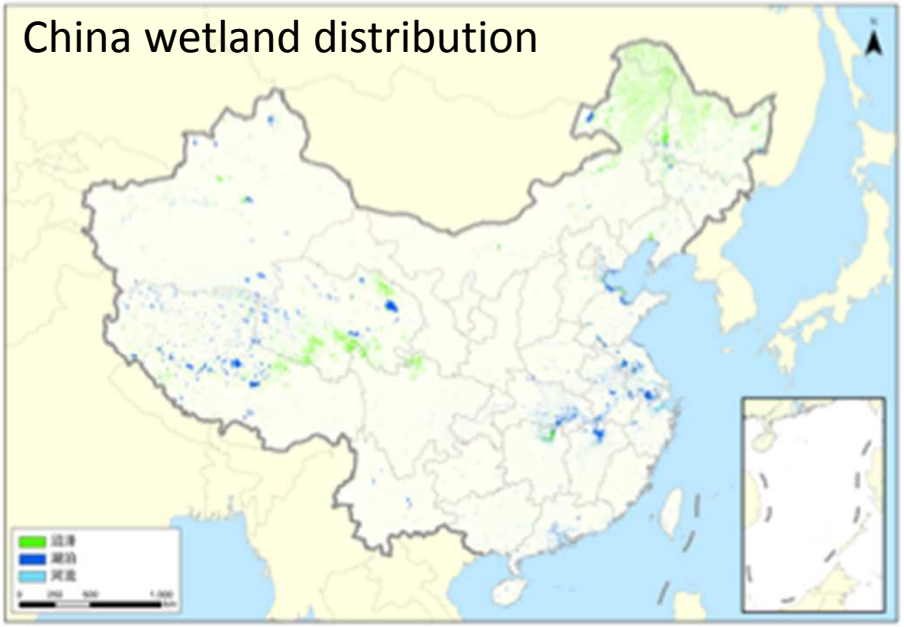
Forest increased 29.1×10^3 km^2 (+1.5%) during 2000-2010.



Grassland decreased 16.3×10^3 km^2 (-0.56%) during 2000-2010.

China ecosystem patterns and changes

Wetland and cropland ecosystem distribution and changes

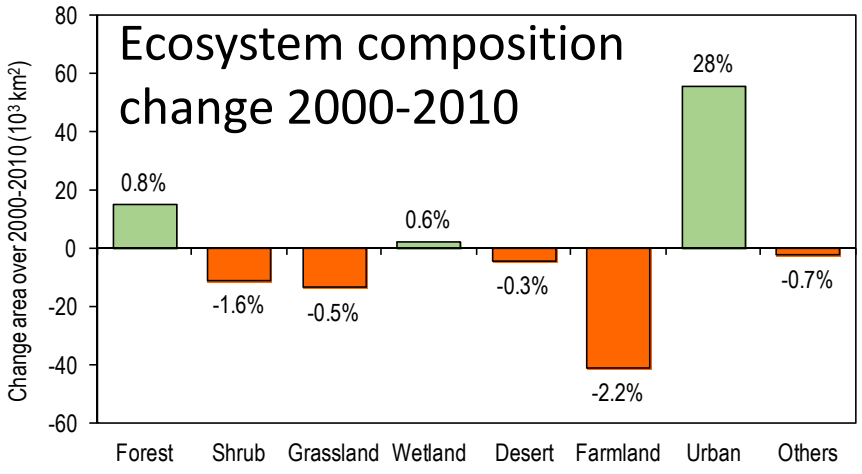


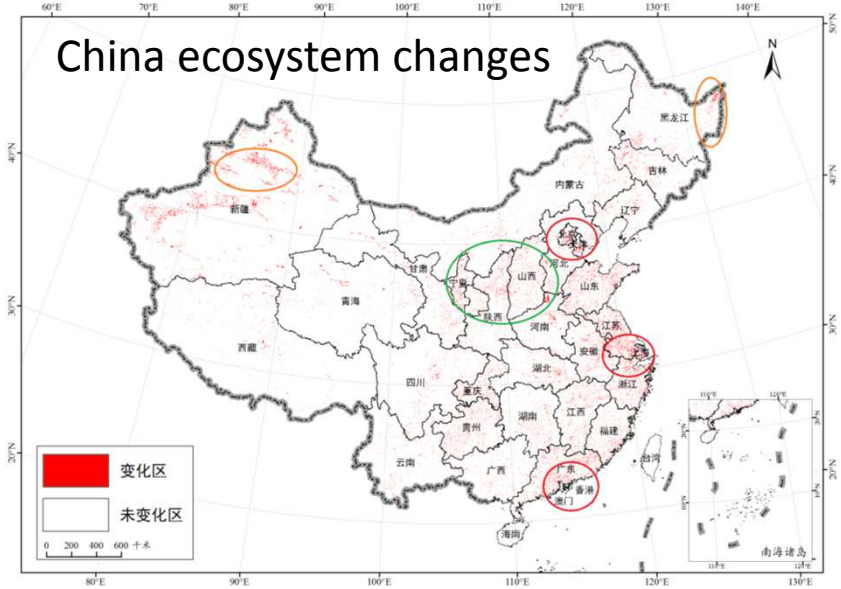
- Areas of lake and reservoirs increased 3663.6 km^2
- Marsh decreased 4801 km^2 during 2000-2010.

Cropland decreased 48.2x10^3 km^2 (-2.6%) during 2000-2010.

China ecosystem patterns and changes

Changes of ecosystem composition and pattern





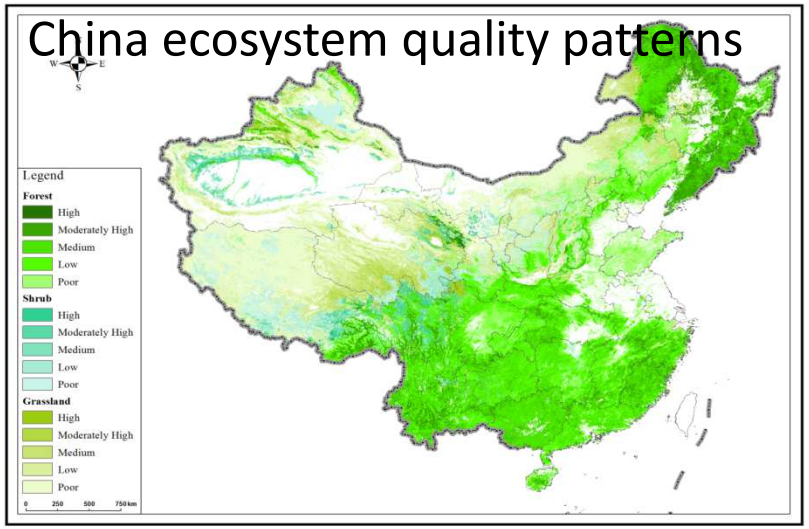
Urbanization regions: Yangtze river delta, Jing-Jin-Ji, Zhujiang river delta, Liaodong peninsula, Shangdong peninsula

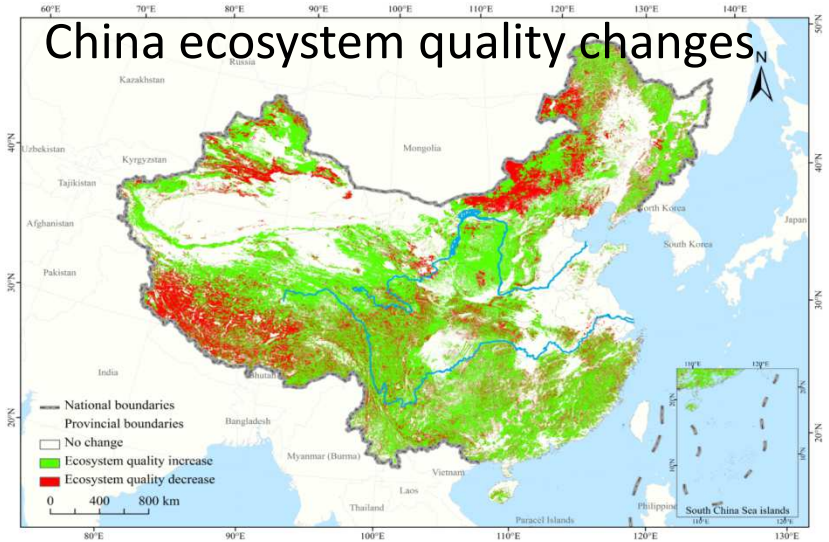
Cropland expansion region: North-eastern plain, DaxinganLing, in North-eastern China, Oasis surroundings in Xingjiang, Coastal regions in northern Jiangsu.

Forest restored regions: Loess Plateau, the surroundings of Sichuan Plain, Zhejiang, Guizhou, Chongqing

China ecosystem quality and changes

Ecosystem quality and changes in China



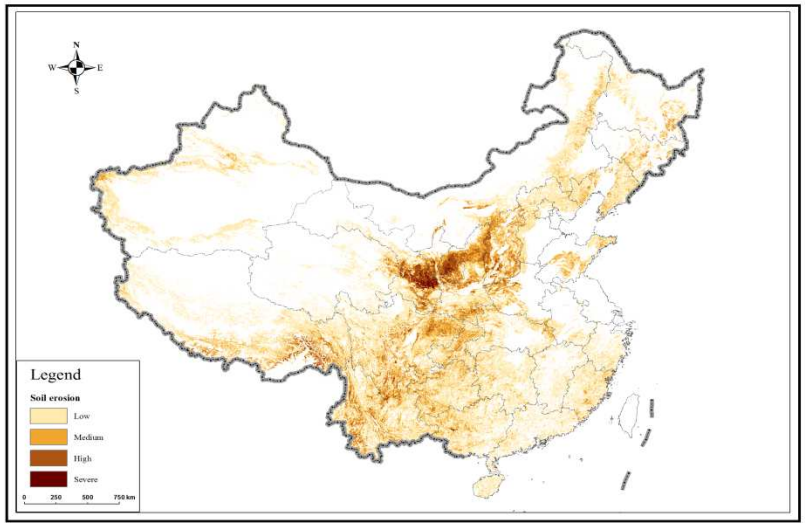


Quality grades	Forests	Grassland
Excellent	5.8%	5.5%
Good	14.8%	12.0%
Fair	35.4%	14.3%
Poor	27.3%	22.7%
Bad	16.8%	45.5%

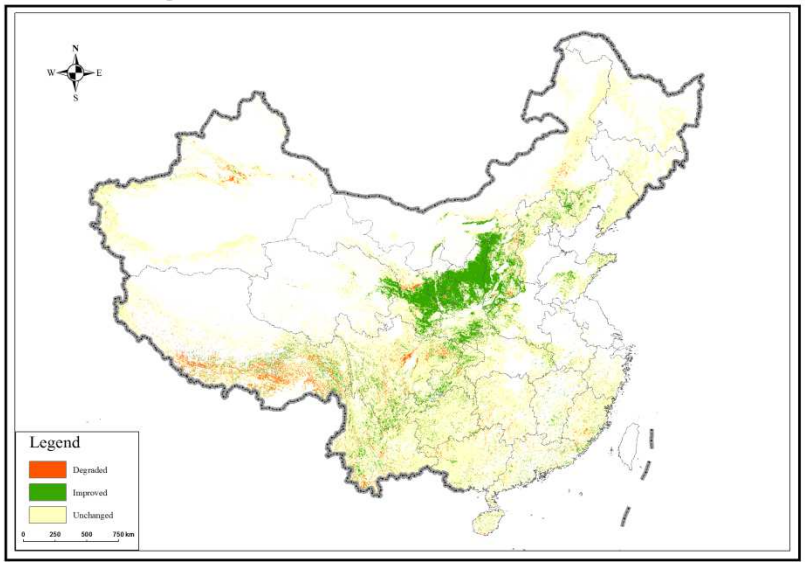
- 72.3% forest ecosystem quality improved
- 50.3% grassland ecosystem quality improved

Changes in ecological problems

Spatial pattern of soil erosion



Changes of soil erosion



Soil erosion

✧Soil erosion affected 1.73 million km^2, 18.0% of the land in 2010.

- mainly distributed in Loess Plateau in North China, mountainous areas in northwest China

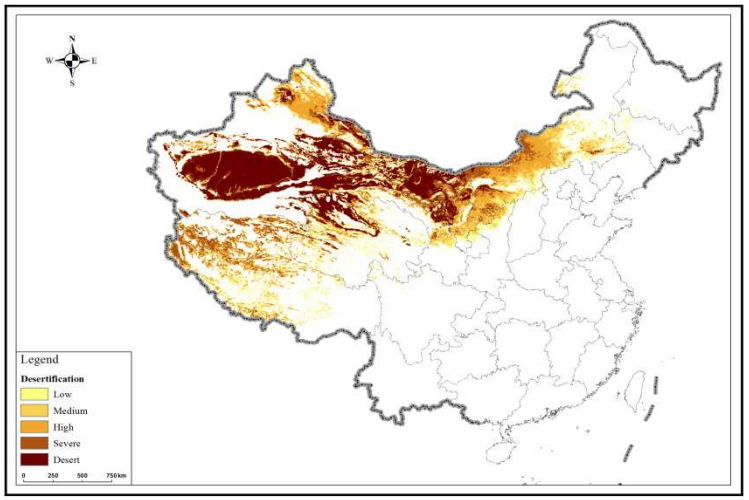
✧From 2000 to 2010, soil erosion areas decreased by 10,030 km^2 (or 5.6 %).

✧Soil erosion exacerbated in some areas.

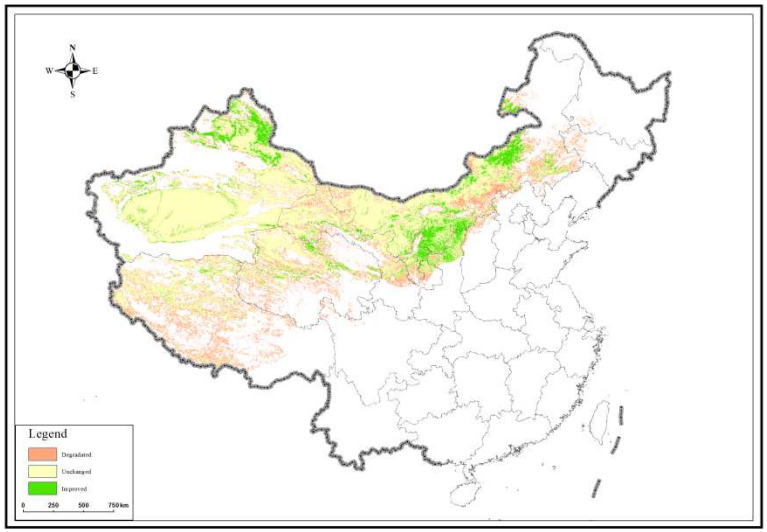
- Qionglai-Minshan Mountains, South Tibet Plateau, South Yunnan

Changes in ecological problems

Spatial pattern of desertification



Changes of desertification

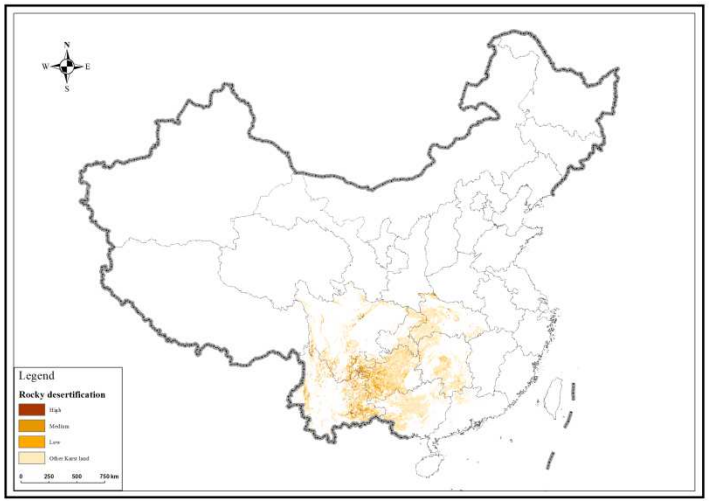


Desertification

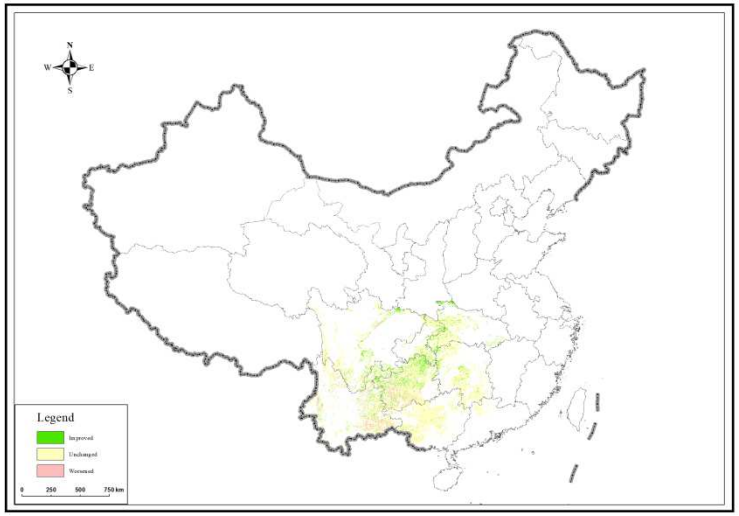
- ✧ Desertification affected 1,820,000 km^2 (or 19.0%) of the land in 2010.
  - Mainly distributed in Xinjiang, west Inner Mongolia, and the north Tibet Plateau.
- ✧ From 2000 to 2010,desertification land decreased by 11,610 km^2 (6.0%).
- ✧ Desertification worsened
  - Mainly in middle Inner Mongolia in north China, west Tibet in west China.

Changes in ecological problems

Spatial pattern of rocky desertification



Changes of rocky desertification



Rocky desertification

✧Rocky desertification land affected 95,600 km^2 of the karst land in south and southwest China in 2010.

✧mainly distributed in west Guizhou, east Yunnan.

✧From 2000 to 2010, rocky desertification land decreased by 4,700 km^2(4.7%).

✧Desertification improved in middle and north Guizhou, and northeast Yunnan, but worsened in south Guzhou, and southeast Yunnan.

Changes in ecological problems

Wildlife habitat lost

✧Natural forest decreased 10.3%

✧Marsh decreased 3.1%

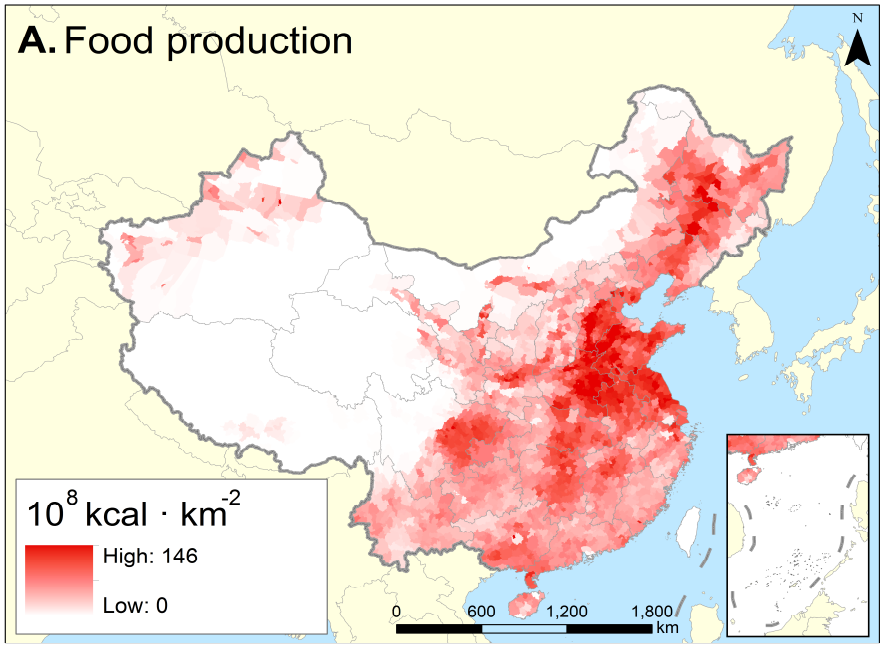
✧Natural coastal line decreased 10.7%, and coast wetland deceased 14.%

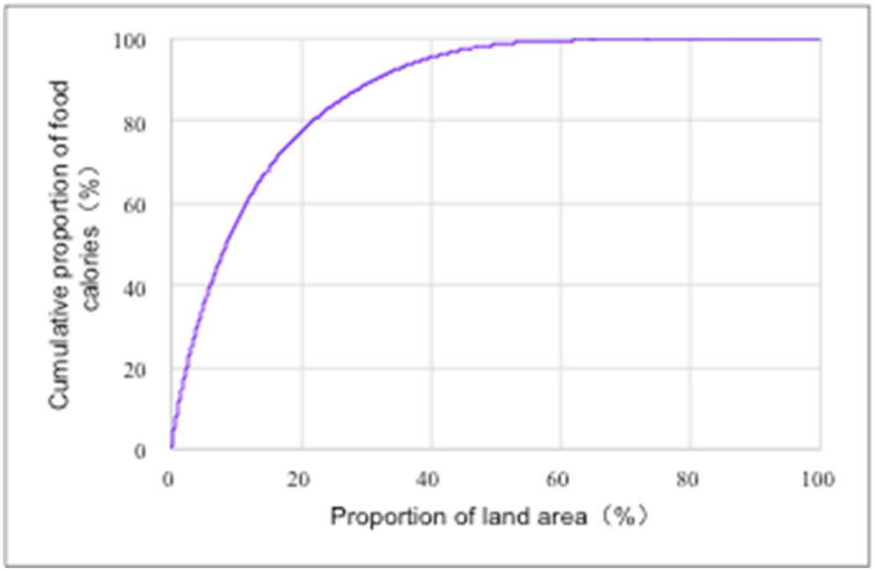
Mainstreaming ecosystem services

Mapping ecosystem services of China

- Food production
- Water retention
- Soil retention
- Sand storm prevention
- Carbon sequestration
- Flood mitigation
- Biodiversity conservation

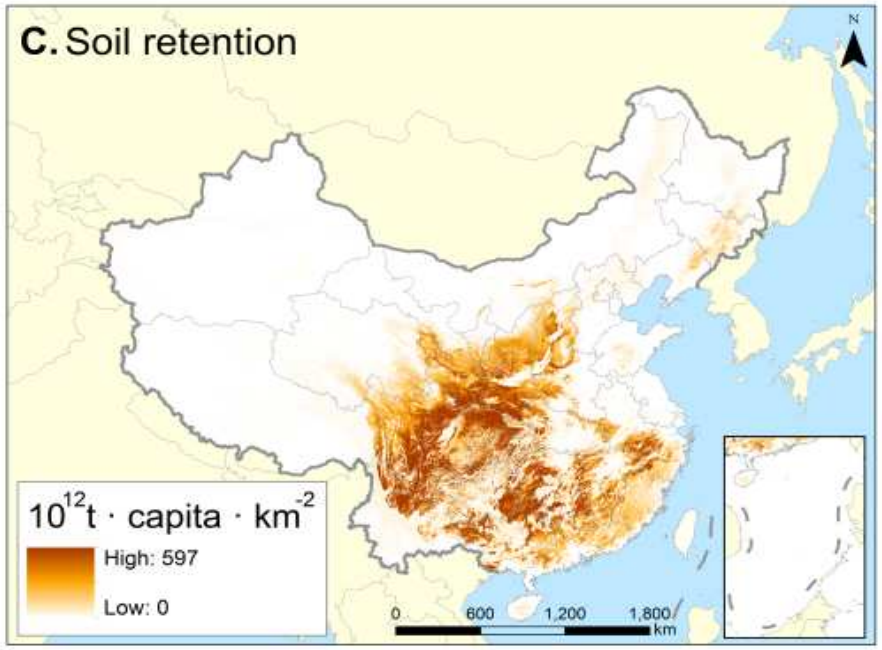
Ecosystem service pattern in China

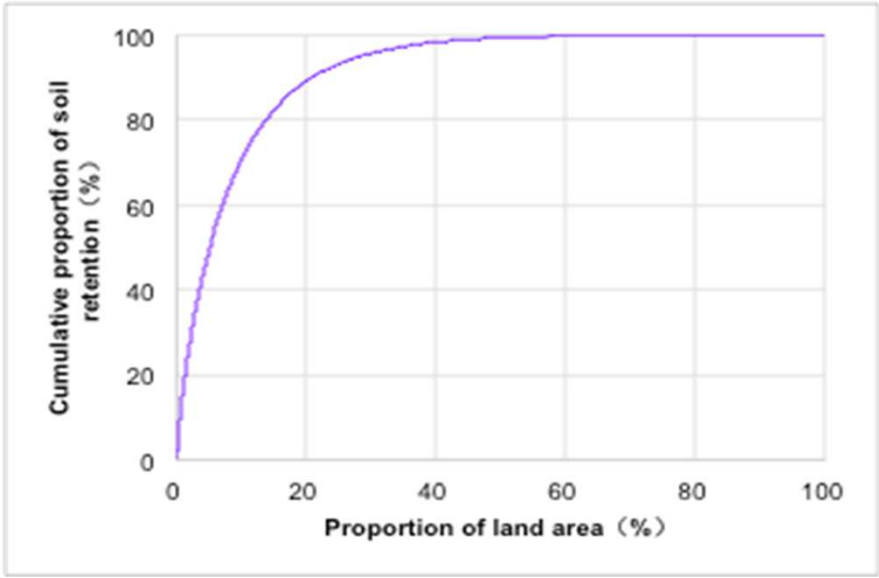




Importance of food production	Area ($10^4 km^2$)	Area proportion (%)
Very high	80.86	8.54
High	94.71	10.01
Medium	121.74	12.86
Normal	649.25	68.59

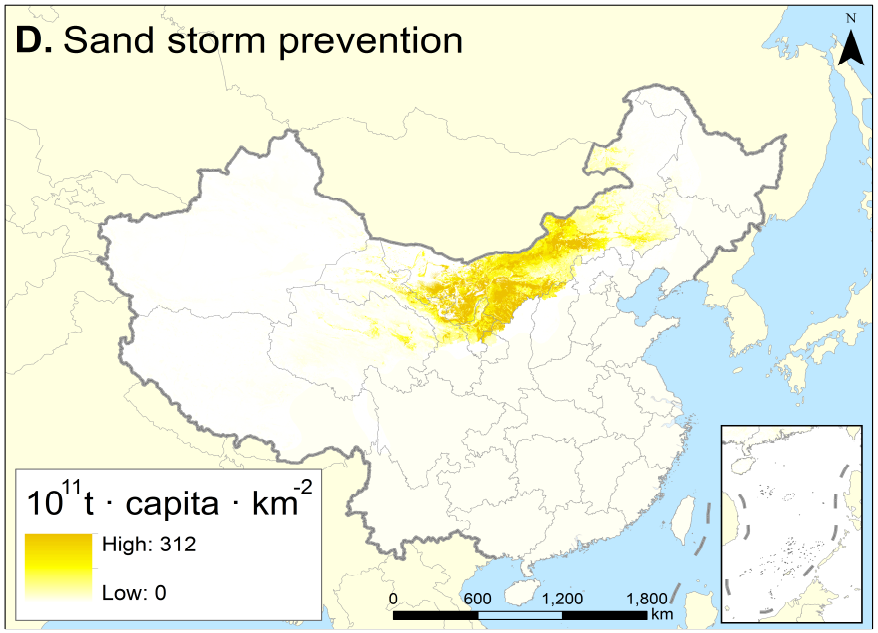
Ecosystem service pattern in China

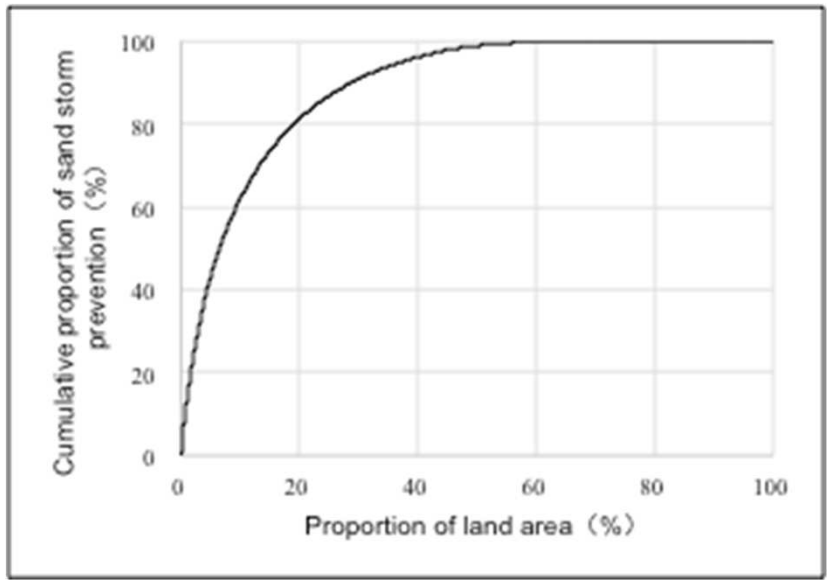




Importance of soil retention	Area (10^4km^2)	Area proportion (%)
Very high	63.82	6.73
High	76.43	8.06
Medium	104.82	11.06
Normal	702.66	74.14

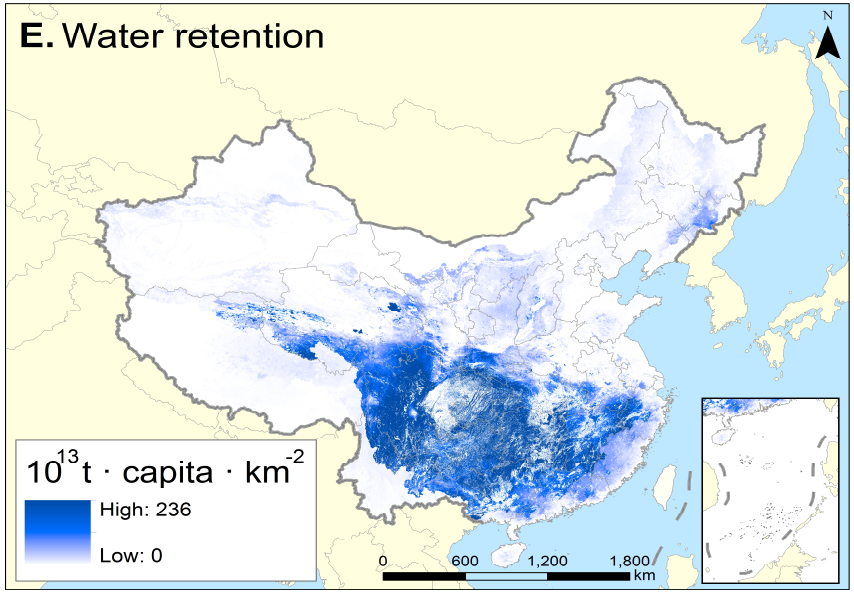
Ecosystem service pattern in China

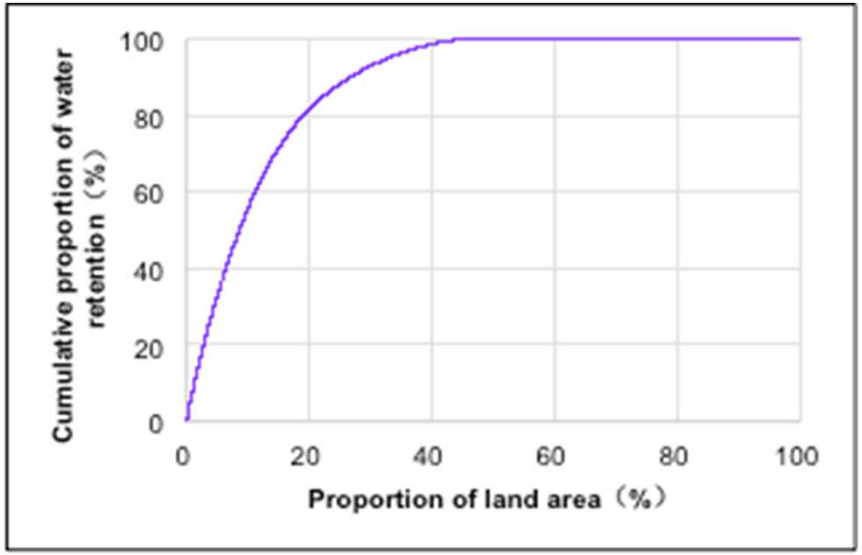




Importance of sand storm prevention	Area (10^4km^2)	Area proportion (%)
Very high	30.61	3.24
High	44.08	4.66
Medium	60.67	6.42
Normal	809.69	85.68

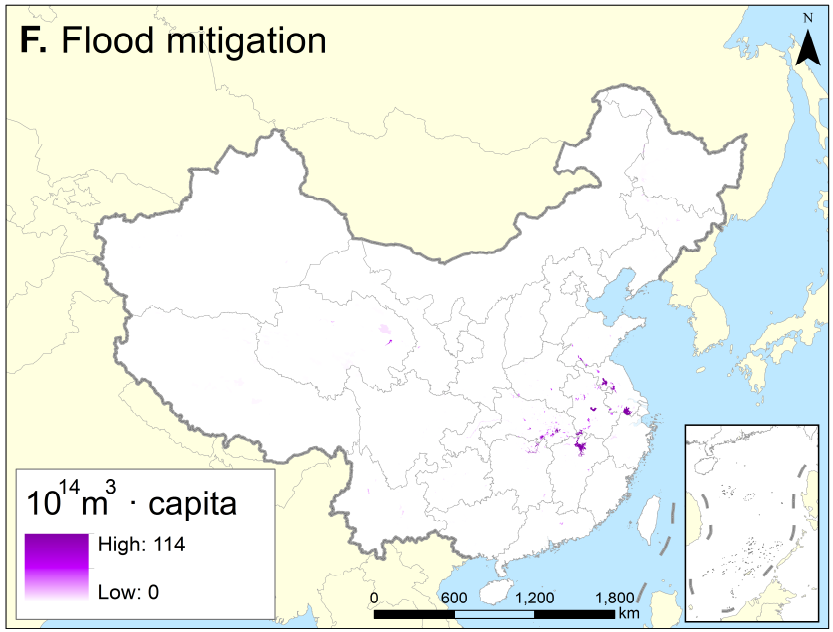
Ecosystem service pattern in China

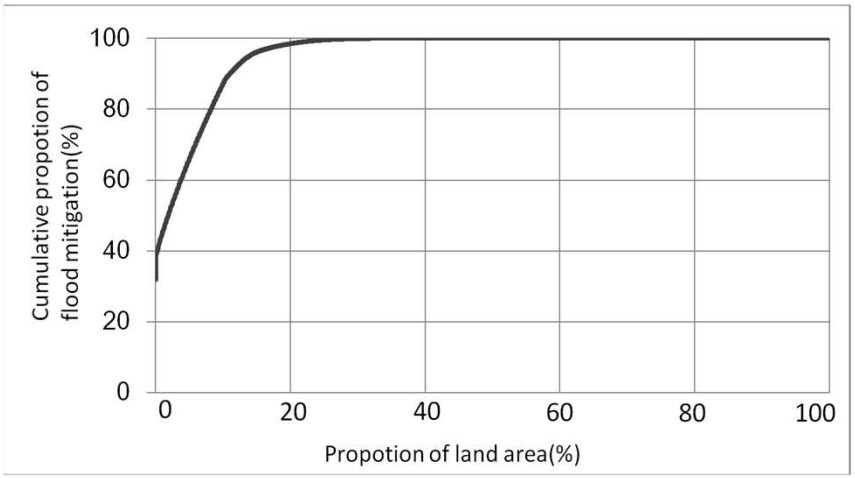




Importance of water retention	Area (10^4km^2)	Area proportion (%)
Very high	151.77	16.04
High	101.57	10.74
Medium	80.17	8.48
Normal	612.49	64.75

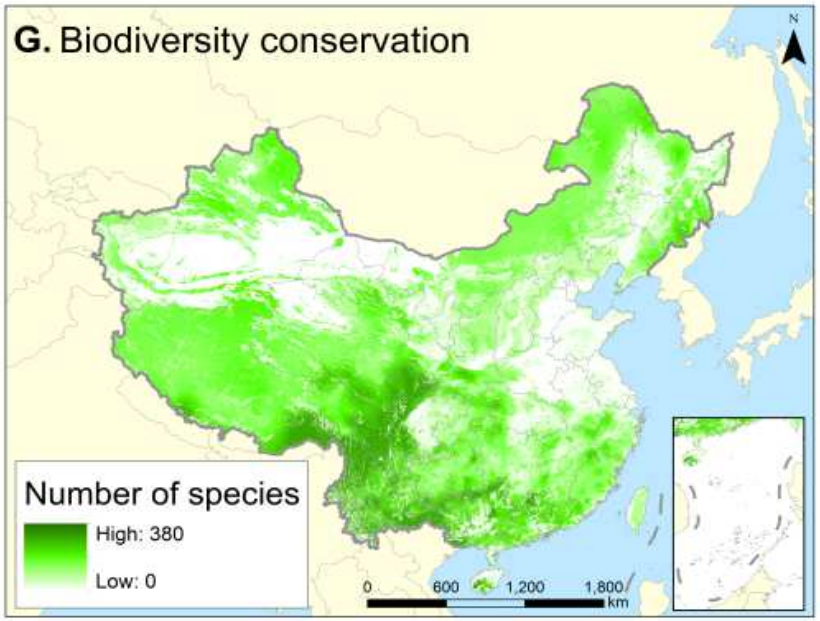
Ecosystem service pattern in China

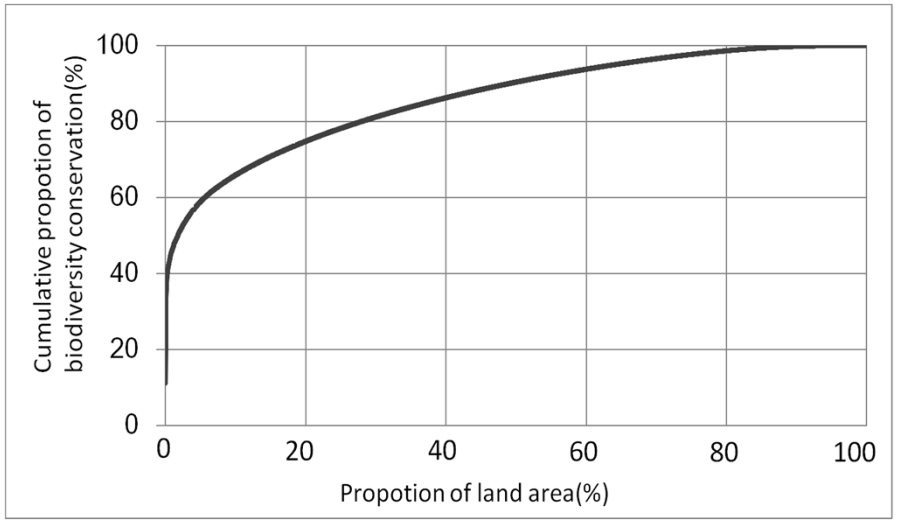




Importance of flood mitigation	Area (10^4km^2)	Area proportion (%)
High	27.43	2.90
Normal	918.37	97.10

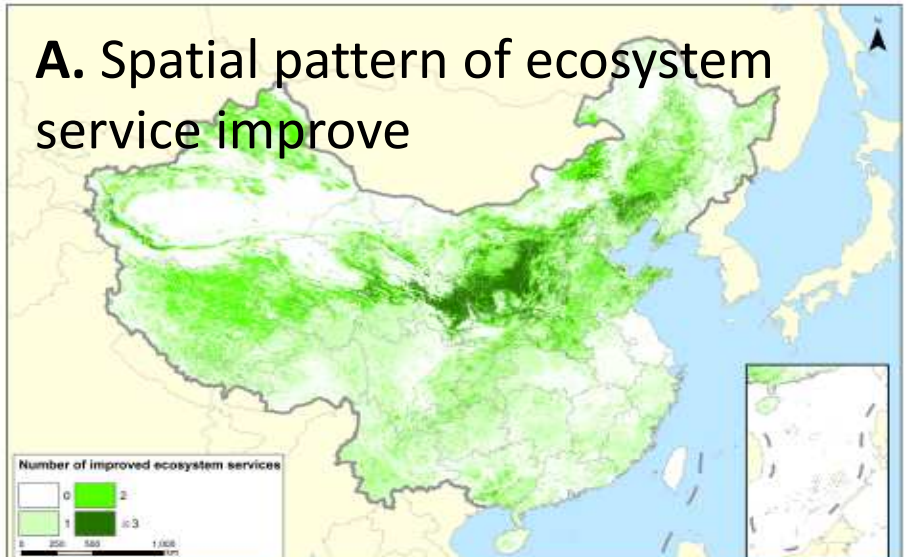
Ecosystem service pattern in China

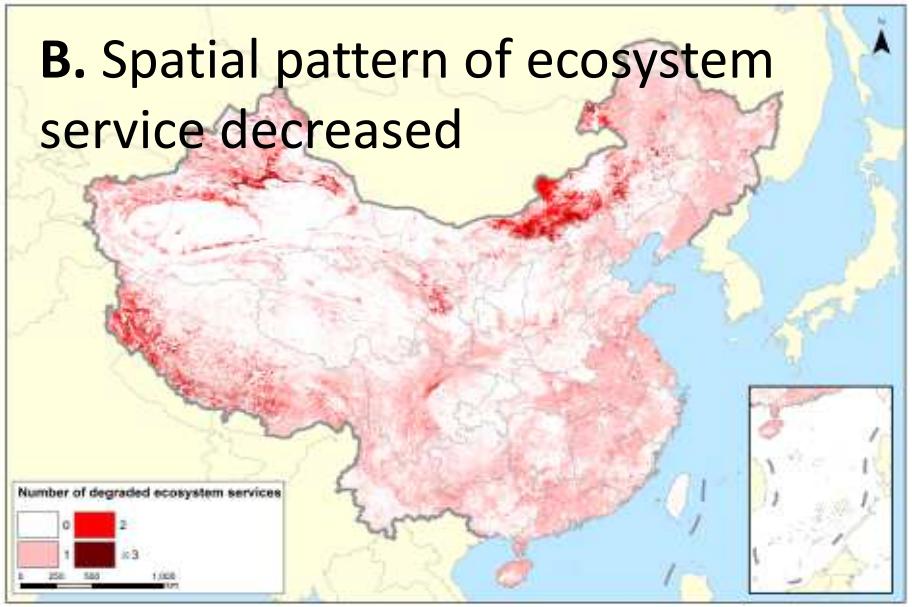




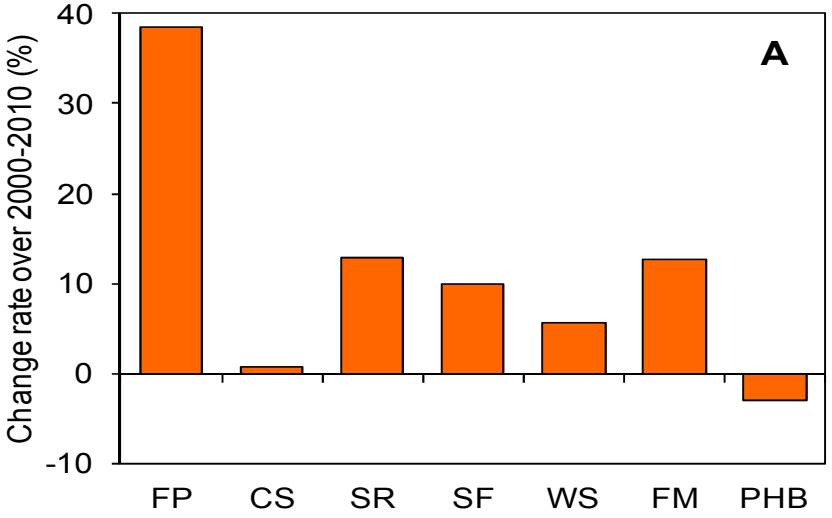
Importance of biodiversity conservation	Area（10^4km^2）	Area proportion（%）
Very high	200.84	21.23
High	107.60	11.37
Medium	288.76	30.52
Normal	348.81	36.87

Changes of ecosystem service pattern in China



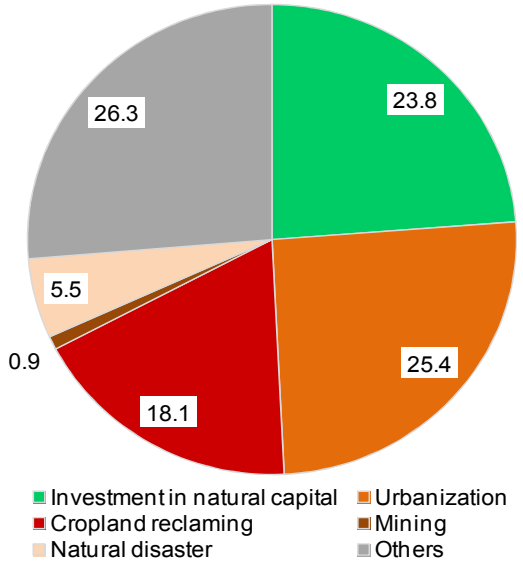


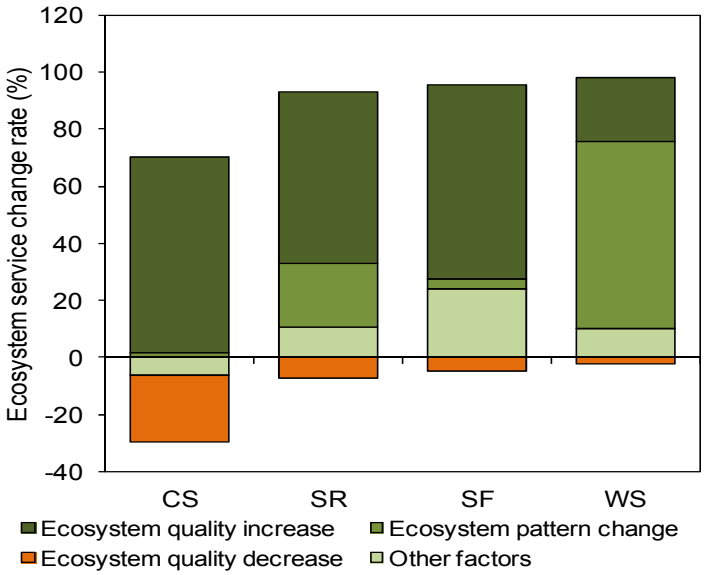
All ecosystem services evaluated increased between 2000 and 2010, with the sole exception of habitat provision for biodiversity.



FP: Food production, CS: Carbon sequestration, SR: Soil retention, SF: Sand fixation, WS: Water supply, FM: Flood mitigation, PHB: provision of habitat for biodiversity.

Driving forces of ecosystem changes in China





Driving forces of ecosystem composition and pattern changes

- Urbanization
- Ecosystem conservation and restoration
- Cropland reclaiming
- Mining
- Natural disasters

Driving forces of ecosystem service changes

- Ecosystem pattern changes
- Ecosystem quality changes

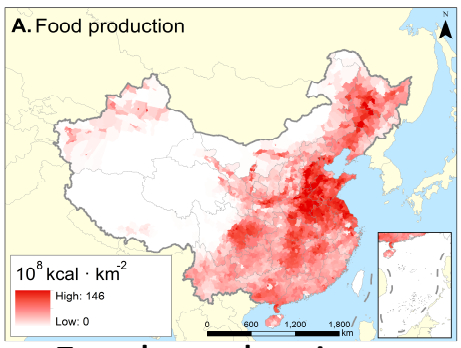
Mainstreaming ecosystem services

Linking ecosystem services to policy making

- Identify crucial areas of ecosystem services
- Figure out conservation gabs
- Initiate and supporting new conservation policy

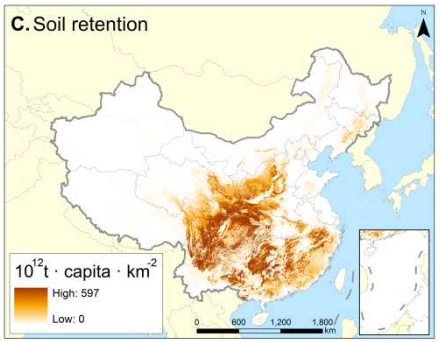
Ecosystem service mapping

Spatial pattern of ecosystem services

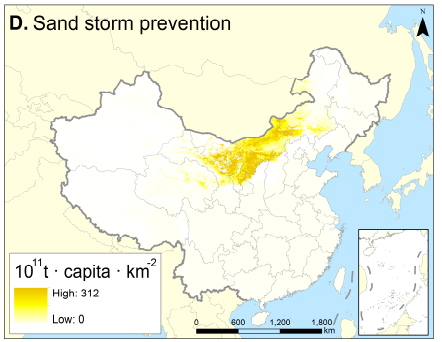


Food production

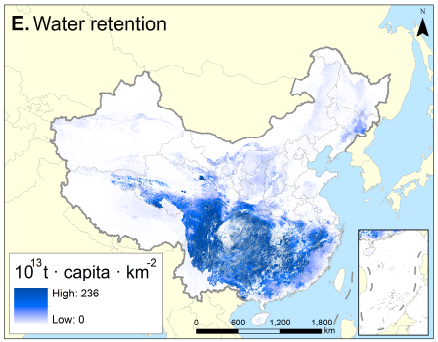
Carbon sequestration



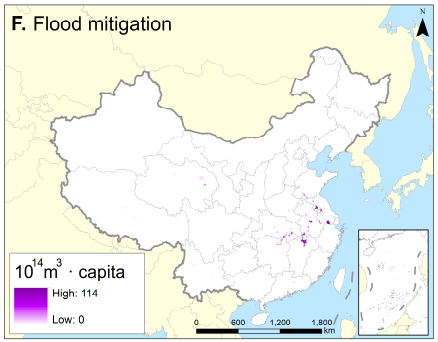
Soil retention



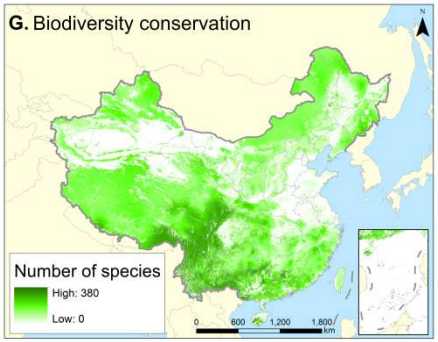
Sand storm prevention



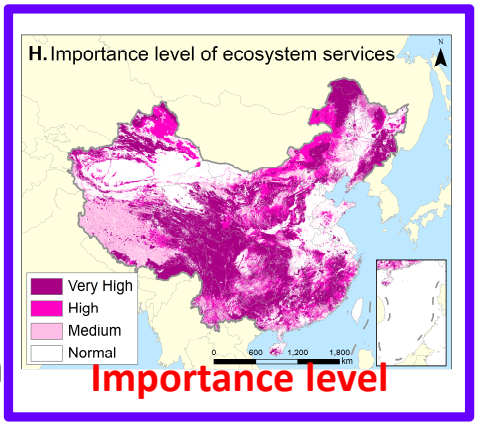
Water retention



Flood mitigation



Biodiversity conservation

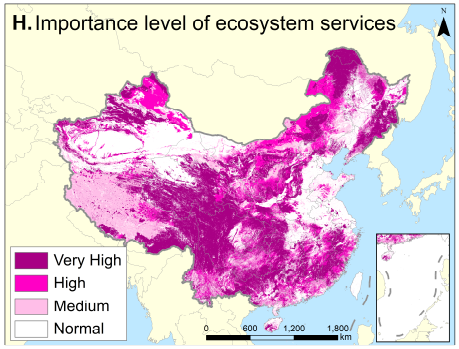


Importance level

We translated biophysical supply of ecosystem services into importance of service provision by weighting supply by the number of people affected.

Linking ecosystem services to policy making

Identify crucial areas of ecosystem services in China

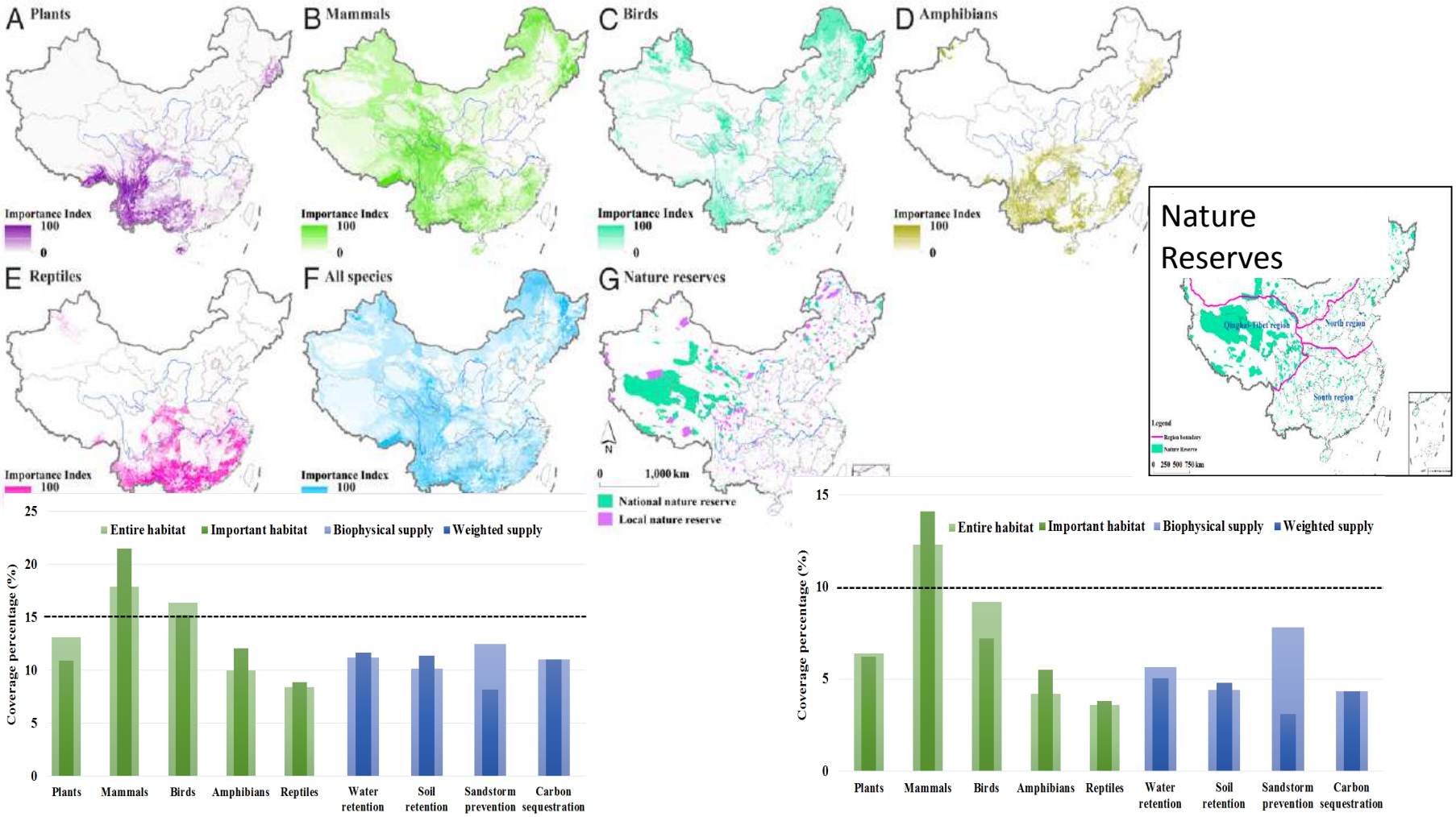


Importance	Land area		Soil retention	Water retention	Sand storm prevention	Biodiversity conservation
	10^4km^2	%	%	%	%	%
Very high	343.6	35.8	66.3	60.8	37.3	51.8
High	204.6	21.3	22.0	21.8	27.0	24.1
Medium	161.2	16.8	9.1	11.9	19.2	19.2
Normal	246.8	25.7	2.5	5.4	16.5	4.9

✧ The table showed that about 35% land with high level of ecological importance provide about 60% of ecosystem regulating services.

Linking ecosystem services to policy making

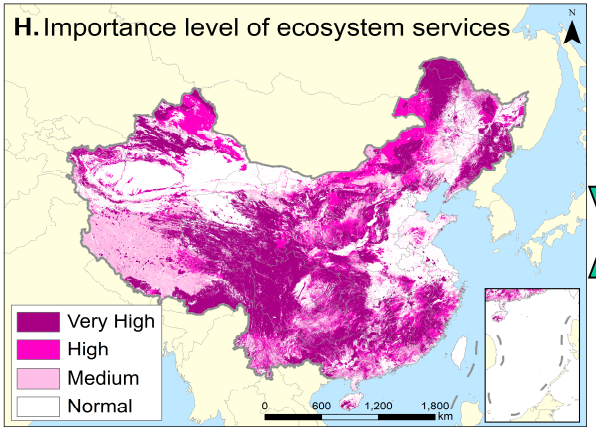
Figure out conservation gabs

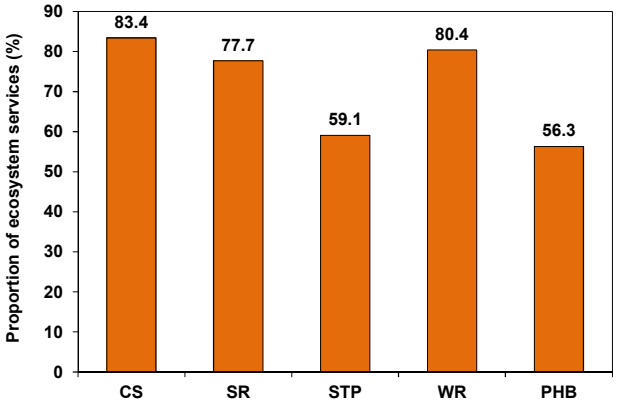


Protected Areas not well match with biodiversity and ecosystem service pattern

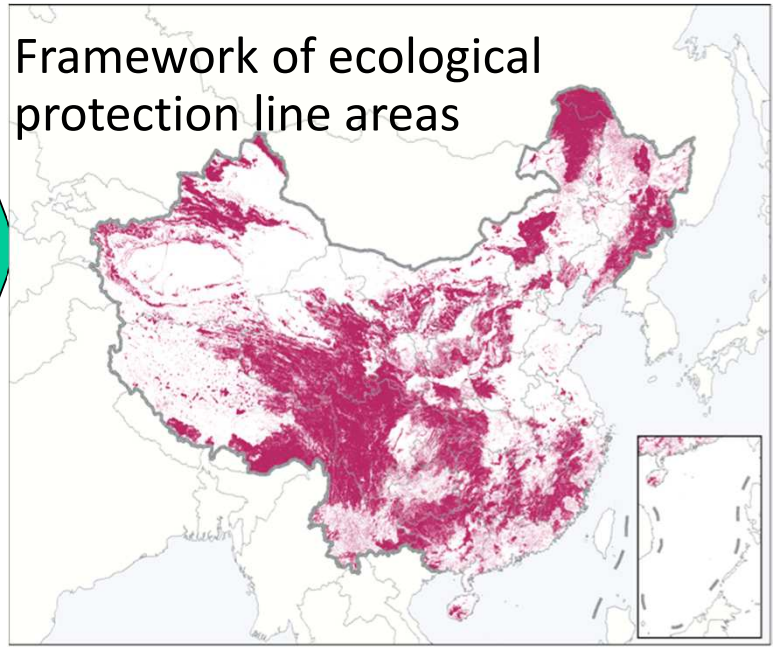
Linking ecosystem services to policy making

Ecological Protection Redline



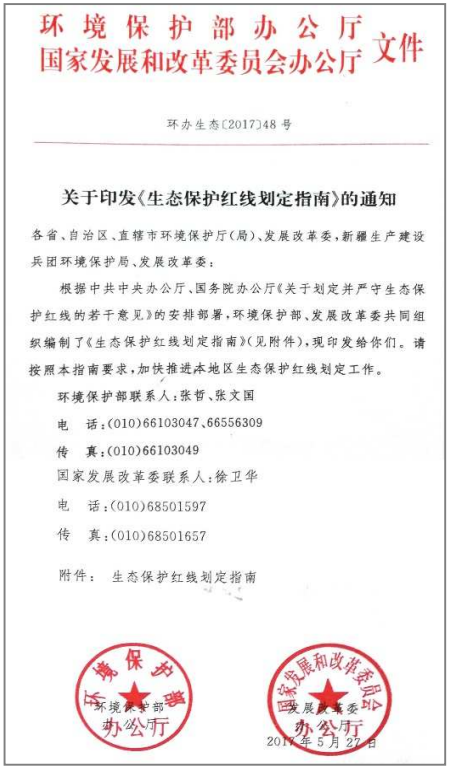


Provision of ecosystem services in EPR Areas (35 %)



✦The very high important areas are planned as Ecological Protection Redline (EPR) to protected strictly for providing ecosystem services and wildlife habitat

✦EPR: 35 % of China



环境保护部办公厅
国家发展和改革委员会办公厅 文件

环办生态〔2017〕48号

关于印发《生态保护红线划定指南》的通知

各省、自治区、直辖市环境保护厅(局)、发展改革委，新疆生产建设兵团环境保护局、发展改革委：

根据中共中央办公厅、国务院办公厅《关于划定并严守生态保护红线的若干意见》的安排部署，环境保护部、发展改革委共同组织编制了《生态保护红线划定指南》(见附件)，现印发给你们。请按照本指南要求，加快推进本地区生态保护红线划定工作。

环境保护部联系人：张哲、张文国
电　话：(010)66103047、66556309
传　真：(010)66103049
国家发展改革委联系人：徐卫华
电　话：(010)68501597
传　真：(010)68501657

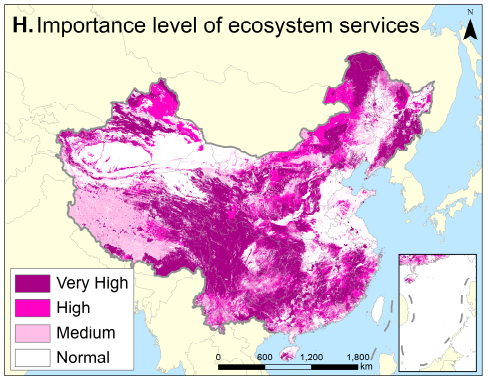
附件：　生态保护红线划定指南

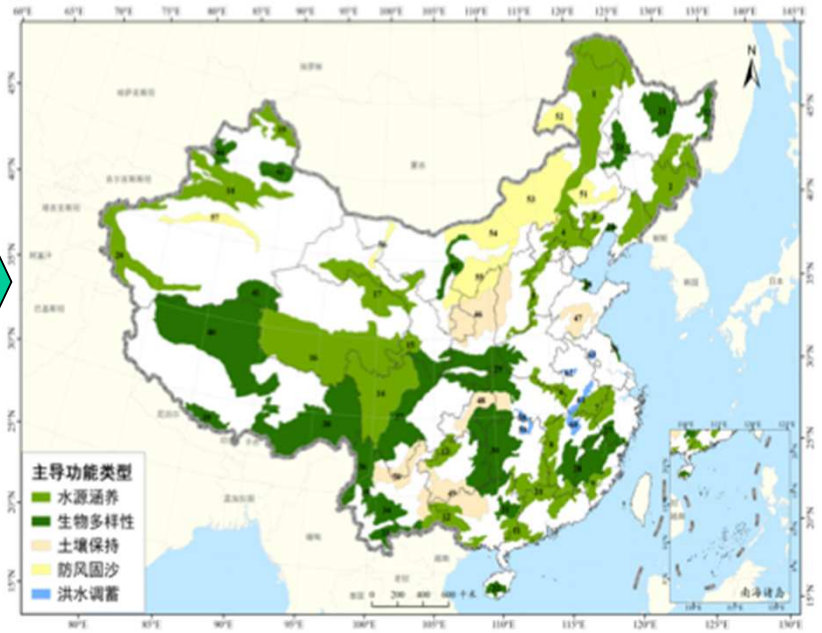
环境保护部办公厅
发展改革委办公厅
2017年5月27日

Guideline for ecological redlining by MEP and NDRC

Linking ecosystem services to policy making

Ecosystem function conservation areas





中华人民共和国环境保护部
中 国 科 学 院

公 告

2015 年 第 61 号

为落实《环境保护法》《中共中央关于全面深化改革若干重大问题的决定》《中共中央 国务院关于加快推进生态文明建设的意见》等关于加强重要区域自然生态保护、优化国土空间开发格局、增加生态用地、保护和扩大生态空间的要求，环境保护部和中国科学院在 2008 年印发的《全国生态功能区划》基础上，联合开展了修编工作，形成《全国生态功能区划（修编版）》。现予以发布。

附件：全国生态功能区划（修编版）

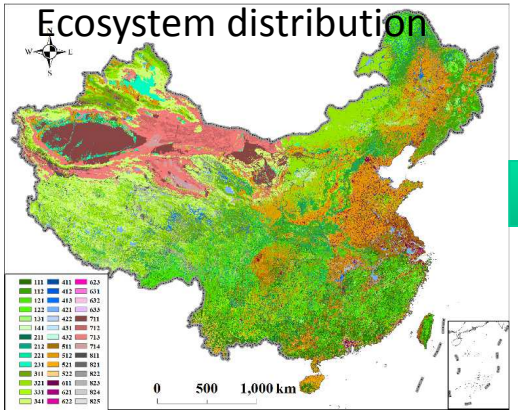
2015 年 11 月 13 日

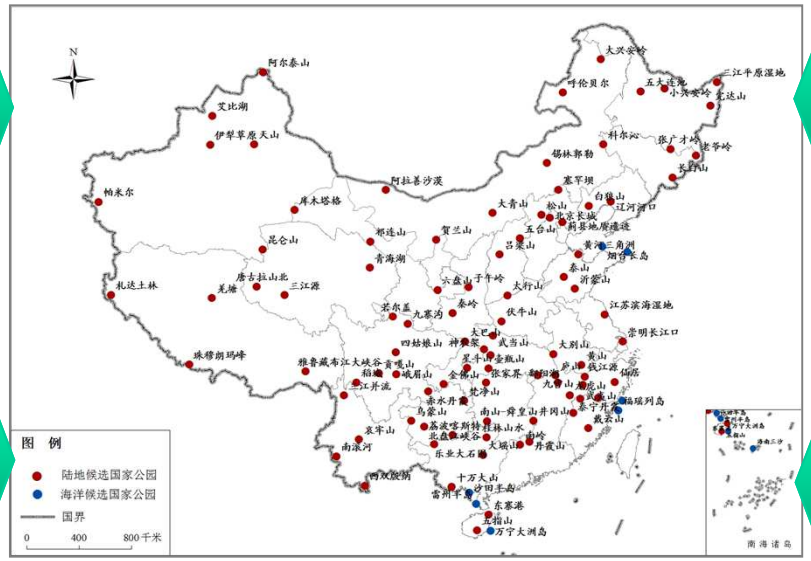
- 63 areas with critical ecosystem services were identified as Ecosystem function conservation areas (EFCAs) released in 2015 by MEP and CAS.
- Total 63 EFCAs, 49% of China.

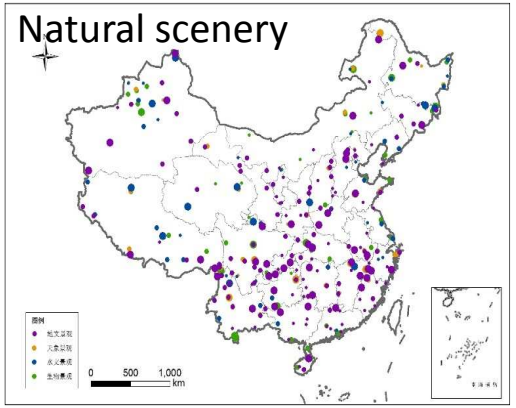
- Water retention
- Biodiversity conservation
- Soil retention
- Sand fixation
- Flood mitigation

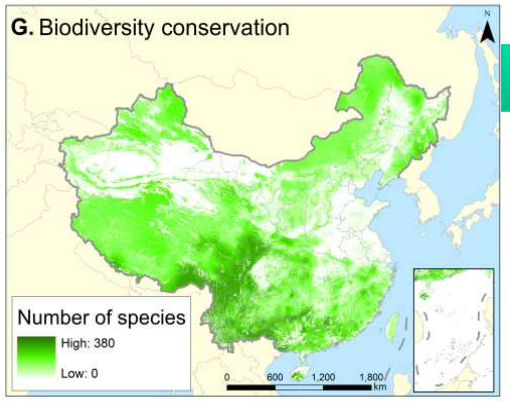
Linking ecosystem services to policy making

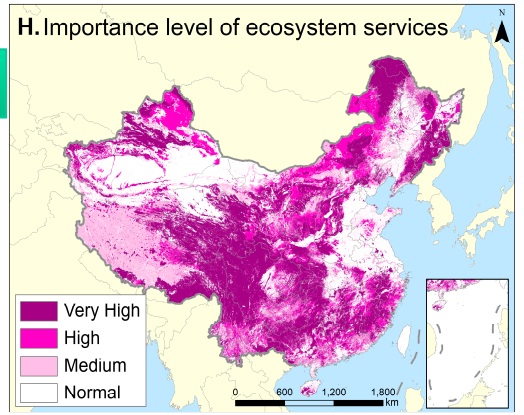
National park system planning







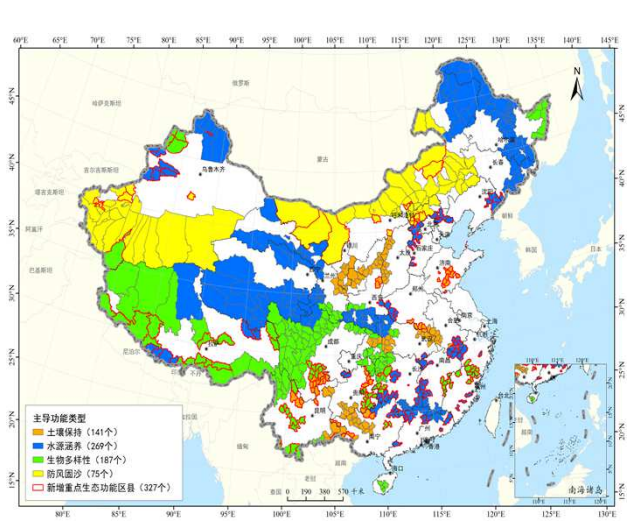




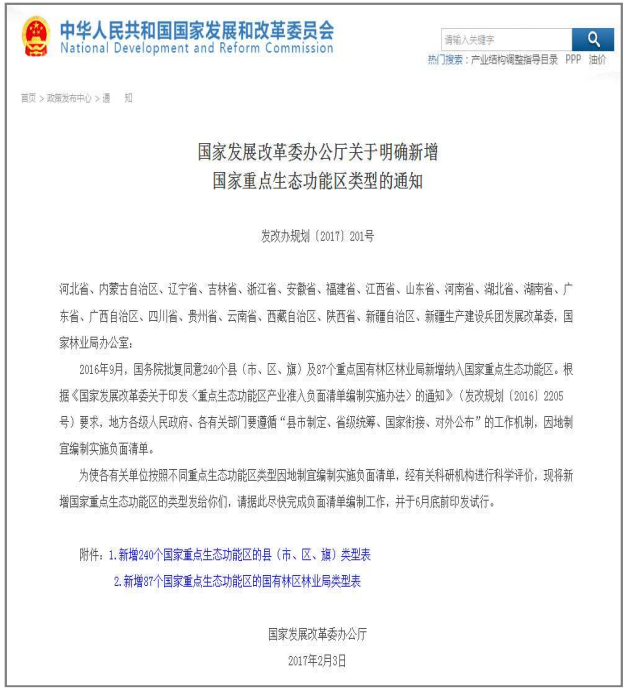
- The national parks were located based on distribution of represented ecosystems, natural landscape, wildlife and ecosystem services.

Linking ecosystem services to policy making

Identify the counties and their leading ecosystem services in key Ecological Function Areas



Enlarge national Key Ecological Function Area by State Council



- The 299 more counties were added in the lists in key ecological function areas, and released by State Council in 2016.
- Identification of leading ecosystem services of each county in national Key Ecological Function Area by NDRC

Identification of leading ecosystem services for the counties in national Key Ecological Function Area, by NDRC

Linking ecosystem services to policy making

437 counties in 2010

512 counties in 2014

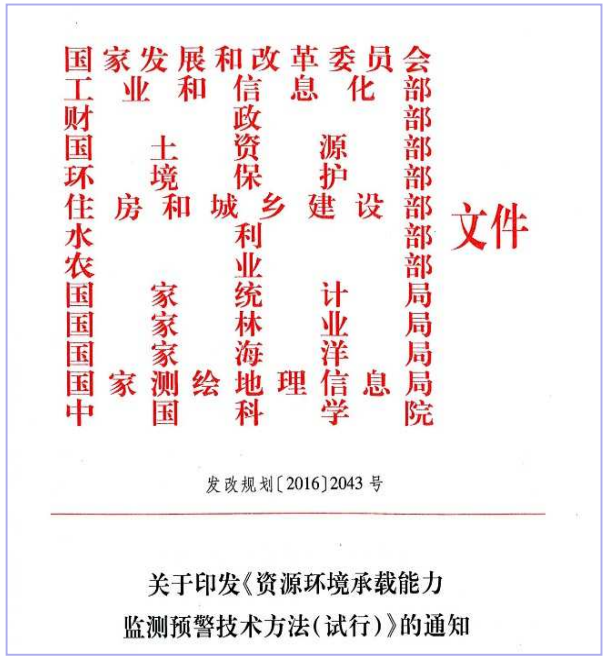
700 counties in 2016

Year	Budgets (billions RMB)	Benefited Counties
2008	6.0	221
2010	24.9	437
2014	48.3	512
2016	58.7	700

- In order to push conservation in key ecological function areas, Center government launched ecological financial transfer program based on ecosystem service pattern.
- The budget was increased to 58.7 billion yuan from 6.0 billion yuan in 2008.

Linking ecosystem services to policy making

Providing methods and data for ecological carrying capacity evaluation



国家发展和改革委员会
工业和信息化部
财政部
国土资源部
环境保护部
住房和城乡建设部
水利部
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国家林业局
国家海洋局
国家测绘地理信息局
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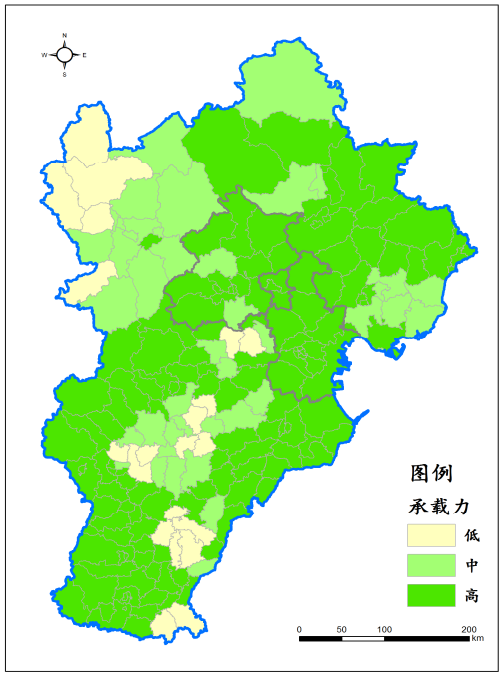
文件

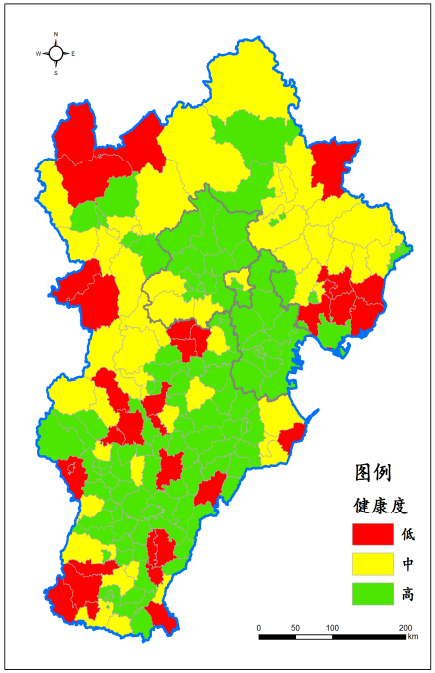
发改规划〔2016〕2043号

关于印发《资源环境承载能力监测预警技术方法（试行）》的通知

Methods and data for ecological carrying capacity evaluation, released by 13 ministries



Ecological carrying capacity in Jing-Jin-Ji regiona



Ecosystem Health index in Jing-Jin-Ji regiona

Linking ecosystem services to policy making

- The information and findings in ecosystem service studies have been used in supporting national, regional,provincial conservation policy making and environmental management.
  - National and provincial ecological redline planning
  - National key ecological functional region planning
  - National park planning
  - National ecological transfer payment
  - National and provincial natural reserve monitoring
  - Ecological carrying capacity assessment and early warning
- Database: http://www.ecosystem.csdb.cn/: 3T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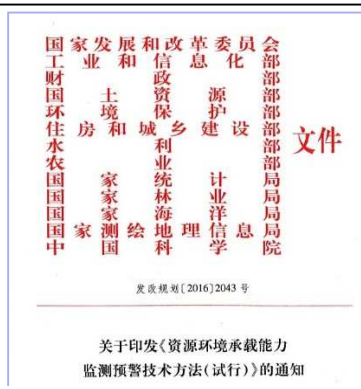
国务院 总理 新闻 政策 互动 服务 数据 国情
国务院关于同意新增部分县（市、区、旗）纳入国家重点生态功能区的批复
国函〔2016〕161号
各省、自治区、直辖市人民政府，国务院各部委、各直属机构：
国家发展改革委《关于调整国家重点生态功能区范围的请示》（发改规划〔2016〕1381号）收悉。现批复如下：


国家发展和改革委员会
工业和信息化部
财政部
国土资源部
环境保护部
住房和城乡建设部
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国家海洋局
国家测绘地理信息局
中国科学院
文件
发改规划〔2016〕2043号
关于印发《资源环境承载能力监测预警技术方法（试行）》的通知

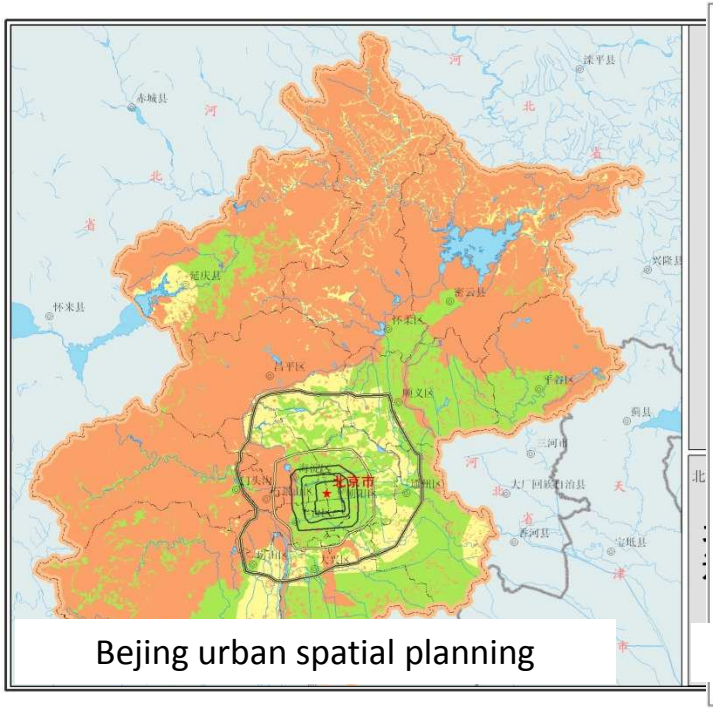

中华人民共和国环境保护部
中国科学院
公告
2015年 第61号


环境保护部办公厅
国家发展和改革委员会办公厅 文件
关于印发《生态保护红线划定指南》的通知

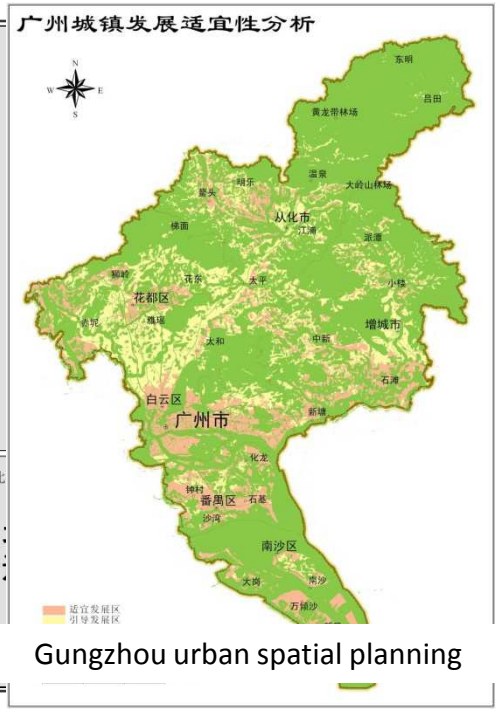

中华人民共和国环境保护部
关于生态保护红线制度创新研究成果应用证明

Applications in local governments

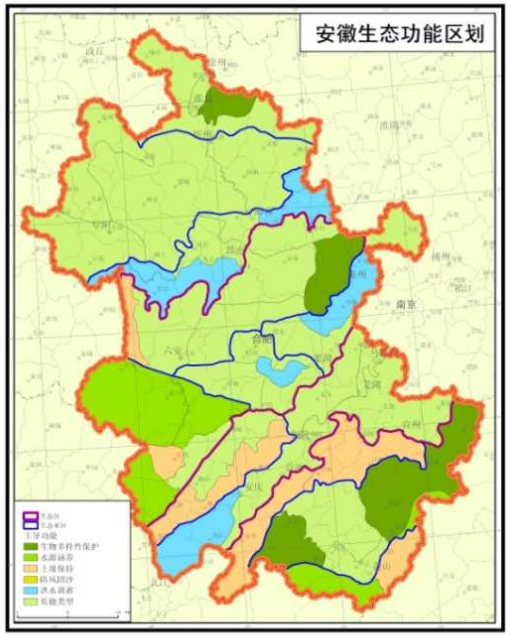
- ✧ All provinces in China have mapped ecosystem services, and identified local ecosystem function conservation areas.
- ✧ Ecosystem service spatial patterns were the basis for urban master planning and regional land use planning in many cities, as Beijing, Guangzhou



Bejing urban spatial planning



Gungzhou urban spatial planning



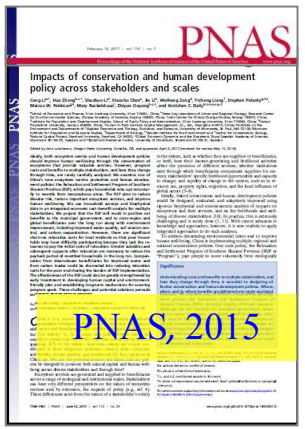
Anhui province eco-service zoning

Linking ecosystem services to policy making

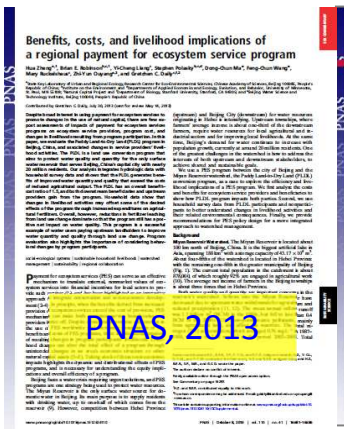
- The papers published on international and Chinese journals,*including papers in Science, PNAS, Nature-ecology & evolution, Ecology Letters,Frontier in Ecology and Environt Sciences*

Science, 2016

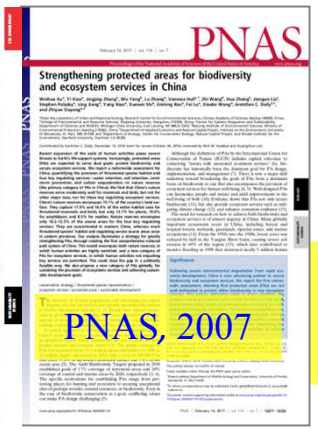
PNAS, 2017



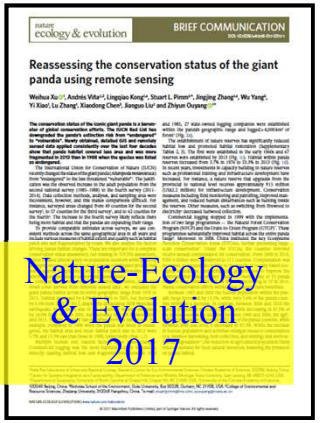
PNAS, 2015



PNAS, 2013

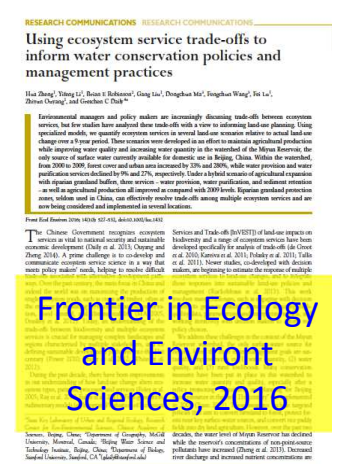


PNAS, 2007



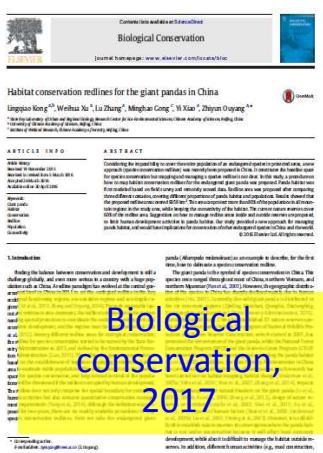
Nature-Ecology & Evolution 2017

Ecology Letters, 2015



Frontier in Ecology and Environt Sciences, 2016

Wetlands, 2015



Biological conservation, 2017

Water Resource Research 2017

Linking ecosystem services to policy making

REVIEW

Biodiversity losses and conservation responses in the Anthropocene

Christopher N. Johnson,[1]* Andrew Balmford,[2] Barry W. Brook,[1] Jessie C. Buettel,[1] Mauro Galetti,[3] Lei Guangchun,[4] Janet M. Wilmshurst[5,6]

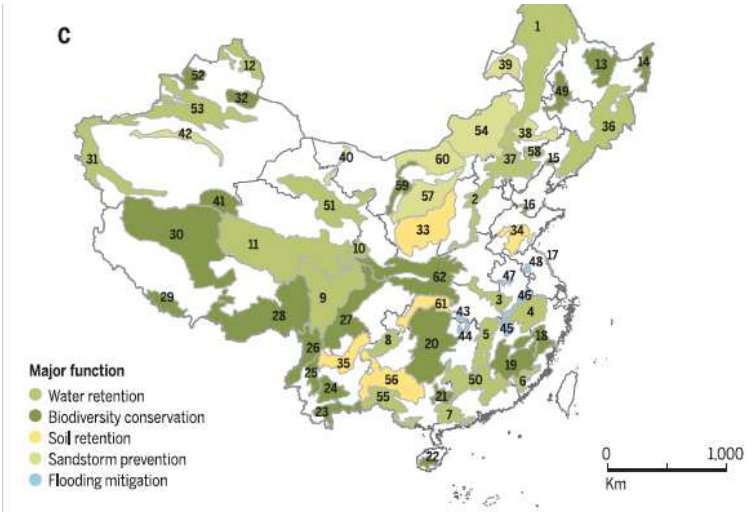


Fig. 3. Responses to biodiversity decline. (**A**) The cumulative number of islands on which one or more species of invasive vertebrates have been eradicated, since 1950. Data are from the Database of Island Invasive Species Eradications (http://diise.islandconservation.org). Island eradications of invasive predators have been essential in preventing the extinction of species such as the kakapo *Strigops habroptilus* (**B**) Recovery of the golden lion tamarin in Brazil. Reintroduction of captive-bred animals and restoration of corridors linking forest fragments have resulted in a dramatic increase in the wild population; shown are population estimates and intervention timeline from Associação Mico-Leão-Dourado. (**C**) China's National Ecosystem Function Zoning scheme, developed by the Ministry of Environment Protection and Chinese Academy of Sciences, to identify areas with key ecosystem functions and where development is restricted to protect those functions (source, www.mep.gov.cn/gkml/hbb/bgg/201511/t20151126_317777.htm).

- Christopher Johnson, Science, 2017, Vol 356(6335),270-275, introduced the EFCAs in China

REVIEW

doi:10.1038/nature11157

Securing natural capital and expanding equity to rescale civilization

Paul R. Ehrlich[1], Peter M. Kareiva[2] & Gretchen C. Daily[3]

wide range of ecosystems, services and scales. Perhaps most ar
China is establishing a new network of 'ecosystem function co
areas' (EFCAs; Fig. 3). EFCAs are being zoned so as to focus co
and restoration in places with high return on investment for pub
at the same time, high-impact human activities are being zoned
or enhance natural capital values.

These initiatives have dual goals: to harmonize people and
securing critical natural capital, and to alleviate poverty. Speci
government aims to protect ecosystems and their biodiversity
control, hydropower production efficiency, irrigation supply, more pro-
ductive agriculture and tourism. In addition, it aims to open non-farm
sectors, increase household income and make land-use practices more
sustainable in rural areas[70]. Although these initiatives represent a
massive scientific and policy undertaking, there is still little understand-
ing of the local costs of implementation, or their effects on poor and
vulnerable populations in or near the target areas. The EFCA model
represents a new paradigm for integrating conservation and human
development, but for this policy innovation to have wide applicability,
it will be important to assess and improve local livelihoods[71].

- Paul Ehrlich et al, Nature, 2013 "the EFCA model represents a new paradigm for integrating conservation and human development"

Concluding remarks

- China has made big efforts to apply ecosystem service evaluation and mapping in conservation policies.
- Ecosystem service evaluation can be powerful and useful tools to support conservation policy making and innovation.
- **Opportunity**
  - ✓ Urban ecological restoration: ecosystem service orientation
  - ✓ Coastal management.
  - ✓ GEP accounting: for evaluation of ecological compensation, conservation efforts.
  - ✓ Marketing mechanism for ecosystem services.
- **Scientific infrastructure**
  - ✓ Evaluation,monitoring, modeling of ecosystem services.
  - ✓ We need powerful ecosystem service assessment tools and platform.


Chinese Academy of Sciences (CAS)
Ministry of Environmental Protection of China
National Development and Reform Commission of China
Ministry of Science and Technology of China
National Natural Science Foundation of China
Natural Capital Project
… …


Thanks !