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Mainstreaming ecosystem service accounting into conservation policy in China

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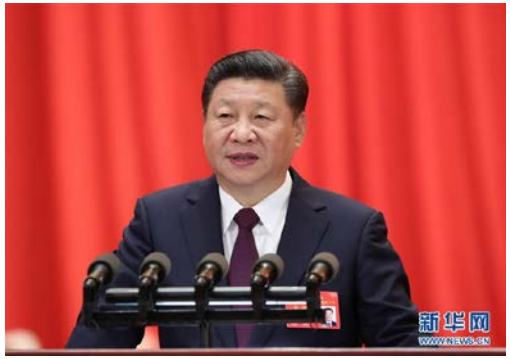
- Background
- China ecosystem survey and assessment
- Mapping ecosystem services of China
- Gross ecosystem product (GEP) accounting
- Linking ecosystem services to policy-making

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  - Fresh water withdrawn: 326.3 billion M^3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
  - Wildlife habitat lost
  - Soil erosions and rocky desertification,
  - Frequency of sandstorm and flooding
- ✧ Vicious-circle of ecosystem degradation and poverty

Background



China's Dream

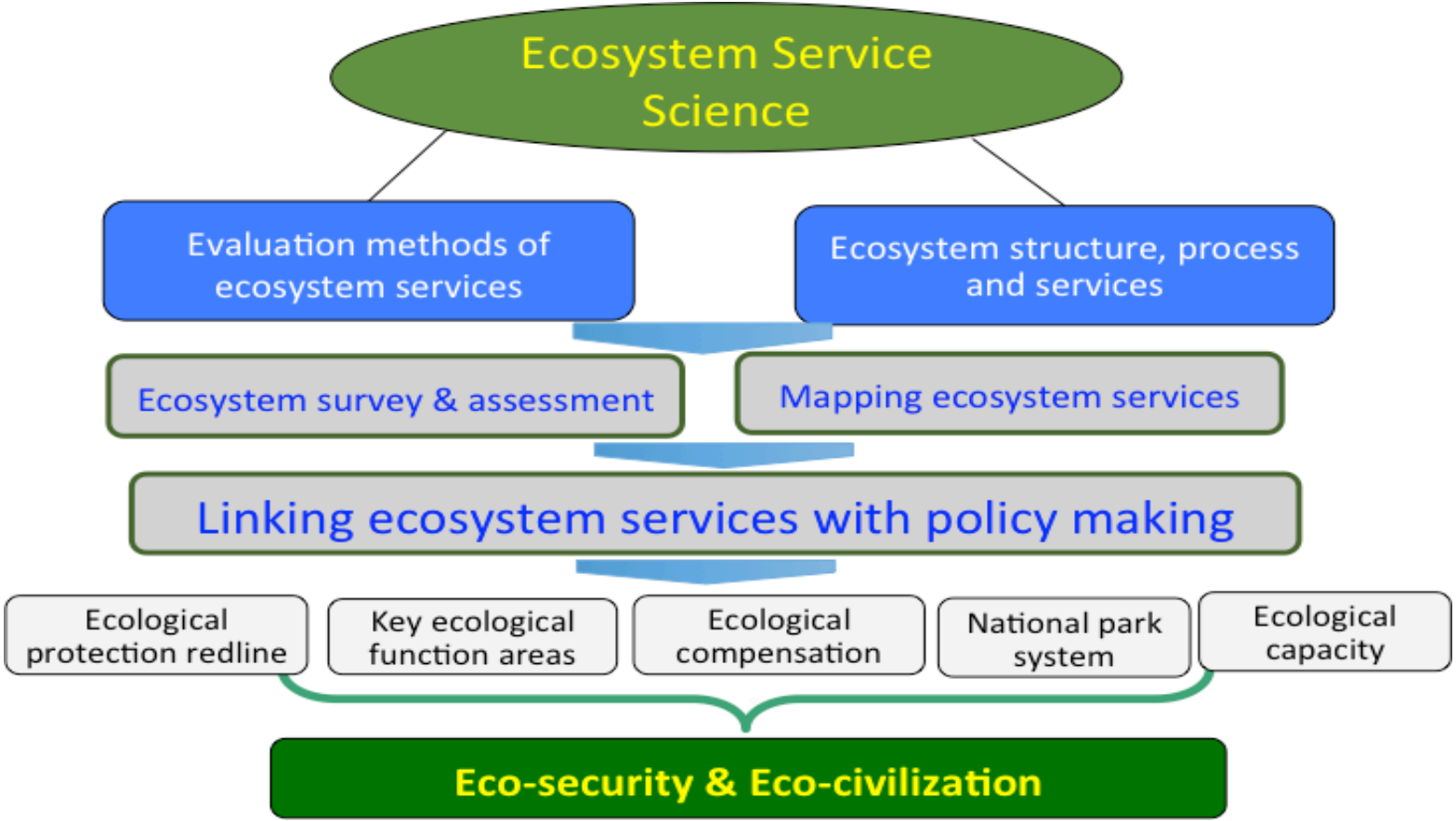
✧Harmonizing people and nature

✧ 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?

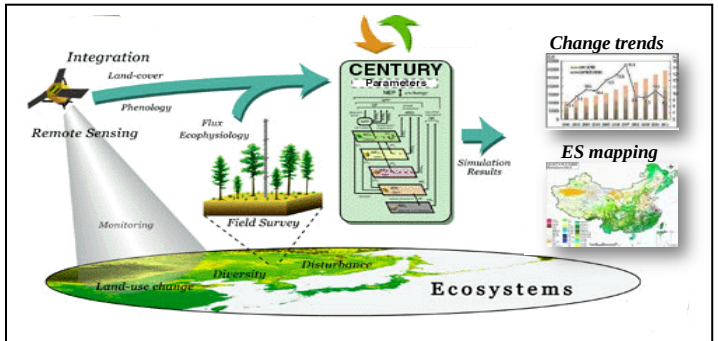
Background

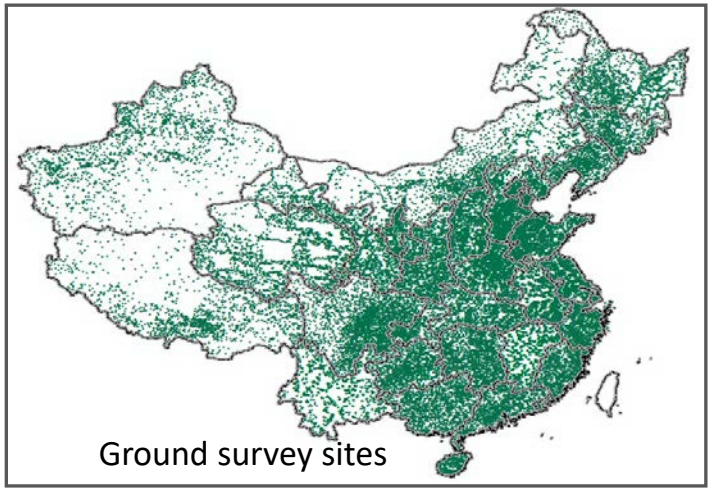

Ecosystem Service Science
Evaluation methods of ecosystem services
Ecosystem structure, process and services
Ecosystem survey & assessment
Mapping ecosystem services
Linking ecosystem services with policy making
Ecological protection redline
Key ecological function areas
Ecological compensation
National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

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

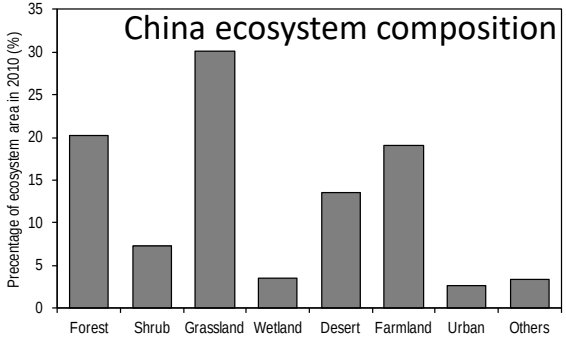




China ecosystem patterns and changes

China ecosystem composition and patterns

China Ecosystem pattern in 2010

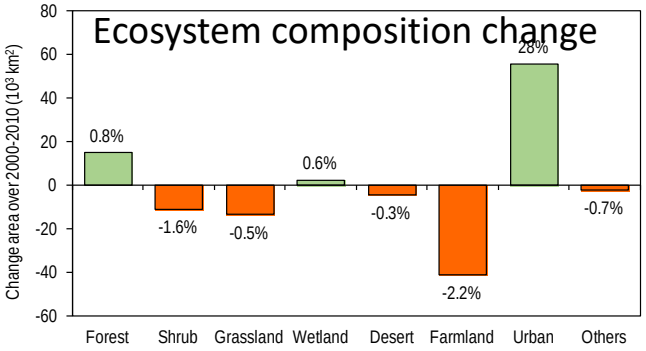


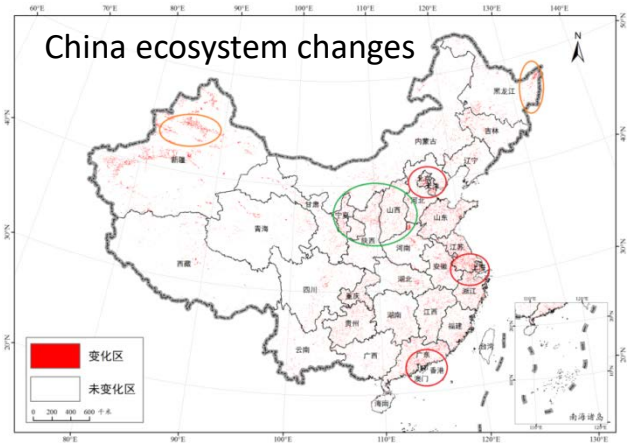
Ecosystem types	Areas (km^2)	Percentages (%)
Forests	190.83	20.17
Shrubs	69.23	7.32
Grassland	283.68	29.98
Wetland	35.61	3.76
Desert	127.73	13.50
Cropland	181.59	19.19
Urban	25.41	2.69
Others	32.02	3.38

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

China ecosystem patterns and changes

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.

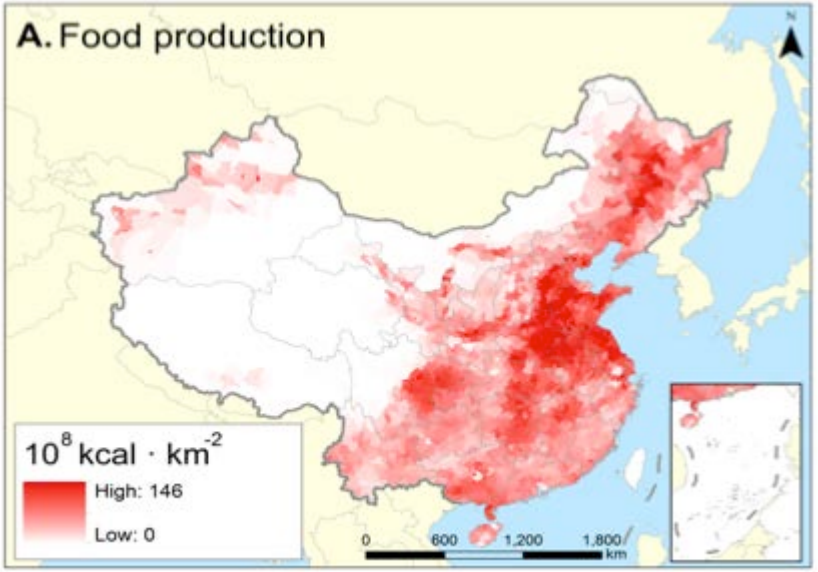
Forest restored regions: Loess Plateau, the surroundings of Sichuan Plain, Zhejiang, Guizhou, Chongqing

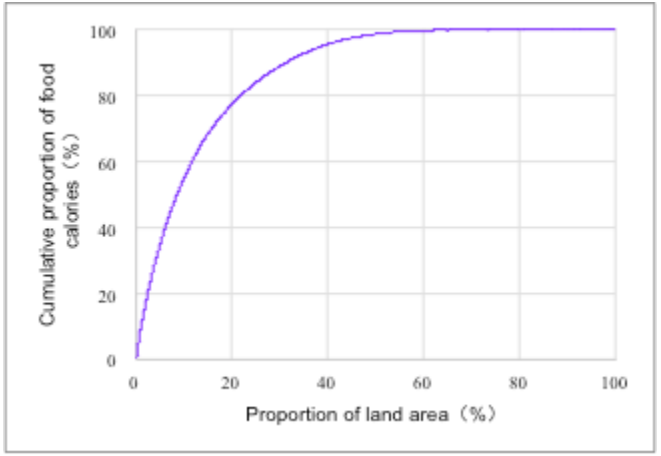
Mapping ecosystem services of China

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

Mapping ecosystem services of China

Food production



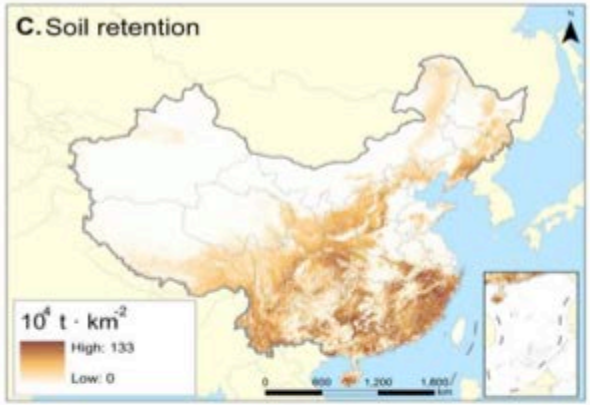


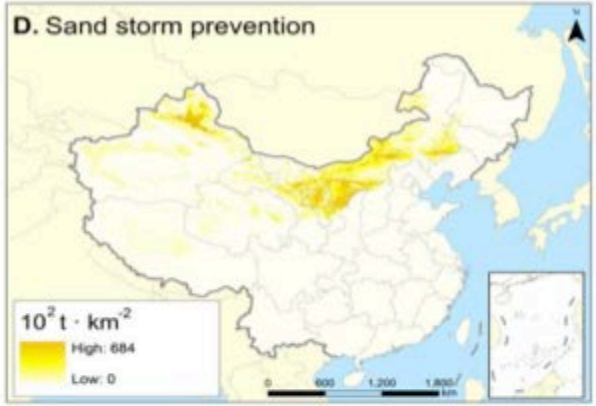
The curve showed that 18.5% land provided 75% food of China

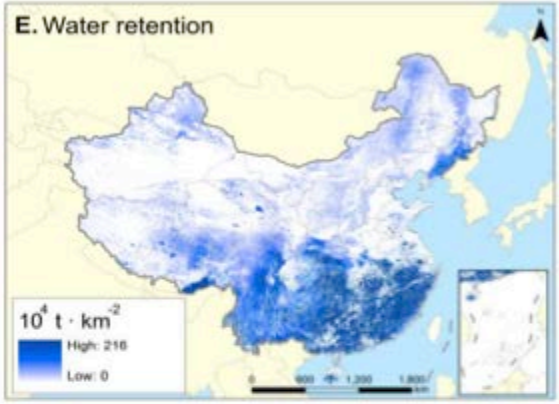
Importance of food production	Area (10^4km^2)	Area proportion (%)
Very high	80.86	8.54
High	94.71	10.01
Medium	121.74	12.86
Normal	649.25	68.59

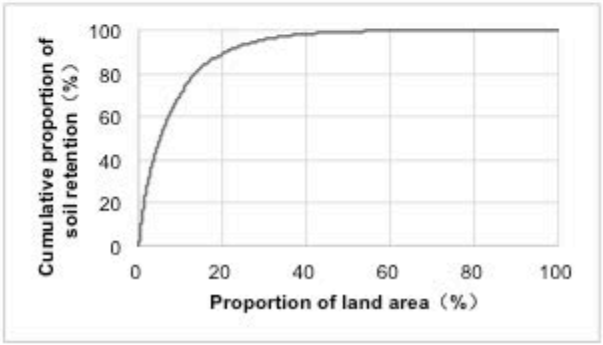
Mapping ecosystem services of China

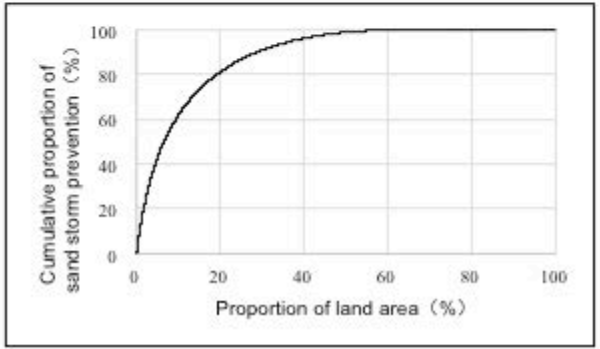
Ecosystem service pattern in China

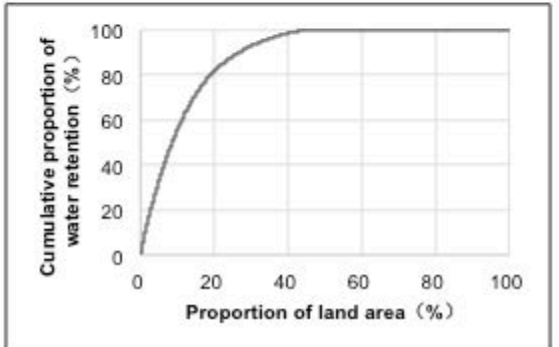






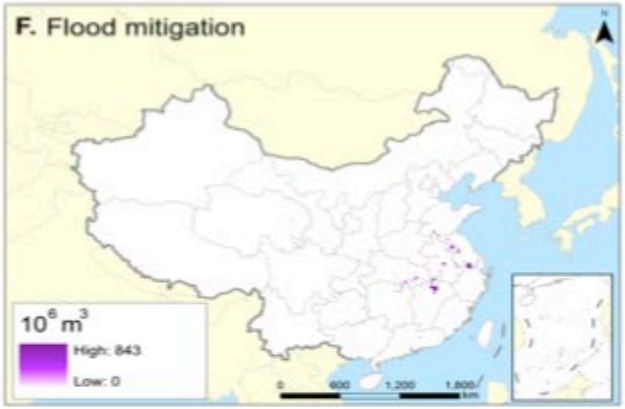


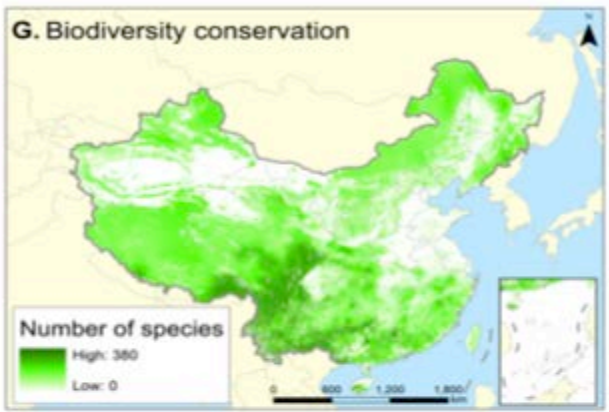


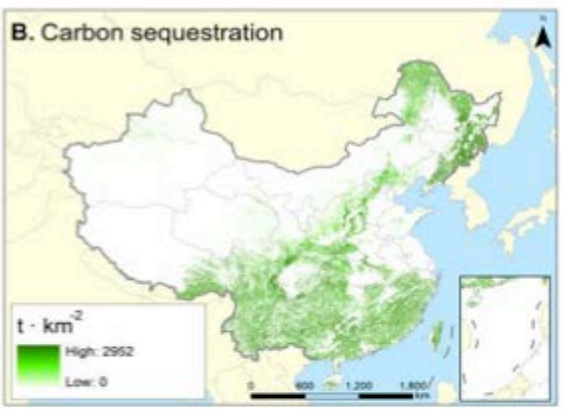


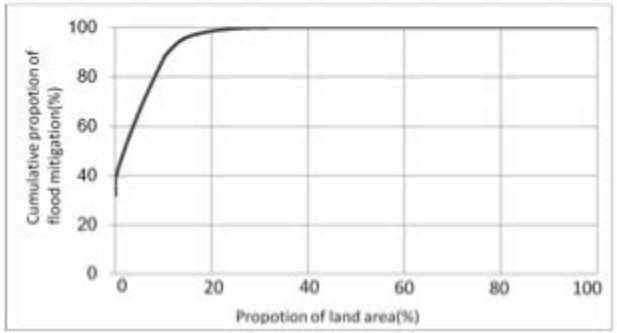
Mapping ecosystem services of China

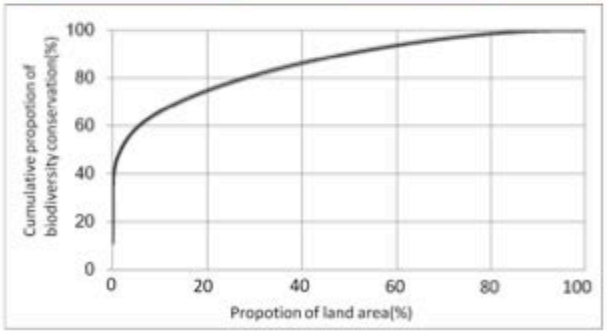
Ecosystem service pattern in China

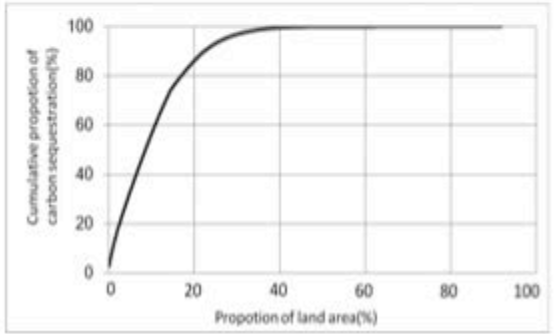






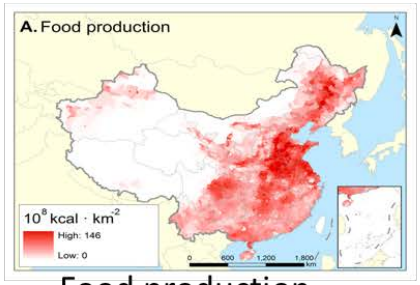




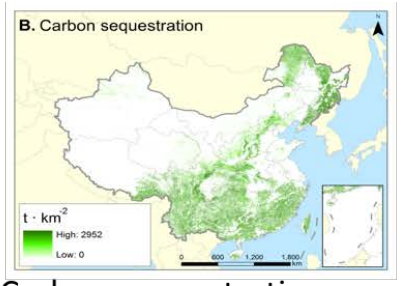


Mapping ecosystem services of China

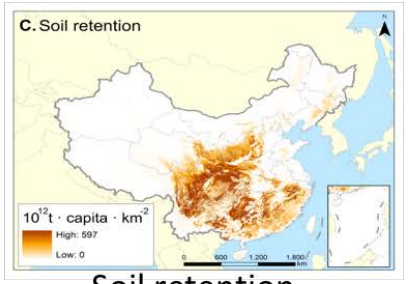
Spatial pattern of ecosystem services



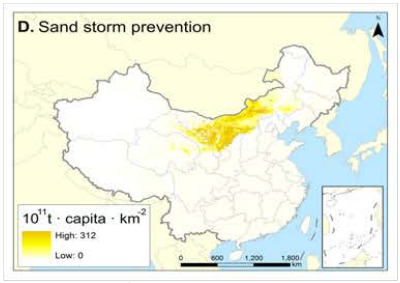
Food production



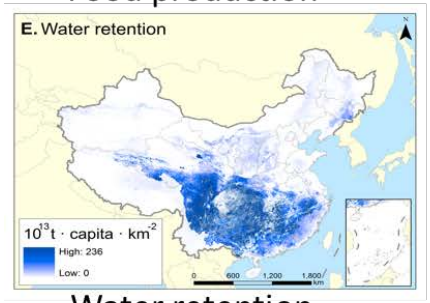
Carbon sequestration



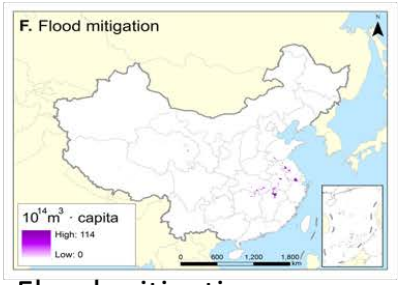
Soil retention



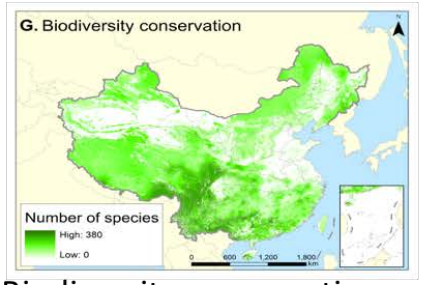
Sand storm prevention



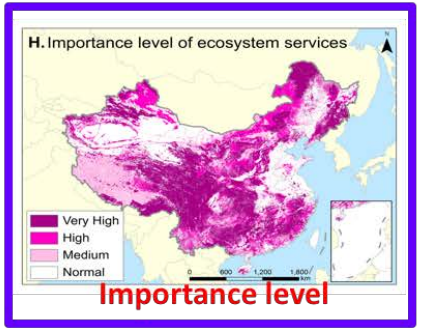
Water retention



Flood mitigation



Biodiversity conservation

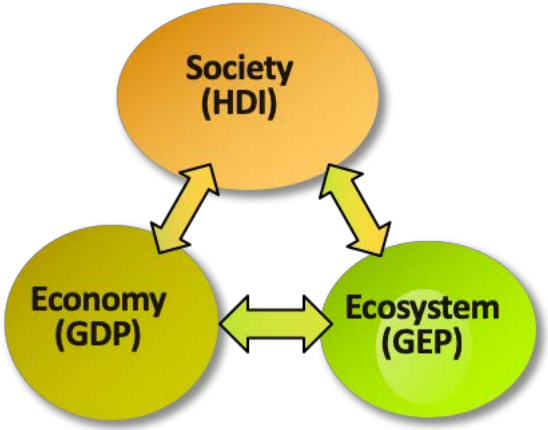


We translated biophysical supply of ecosystem services into importance of service provision by weighting supply by the number of people affected.

Gross ecosystem product (GEP) accounting

Gross Ecosystem Product Accounting

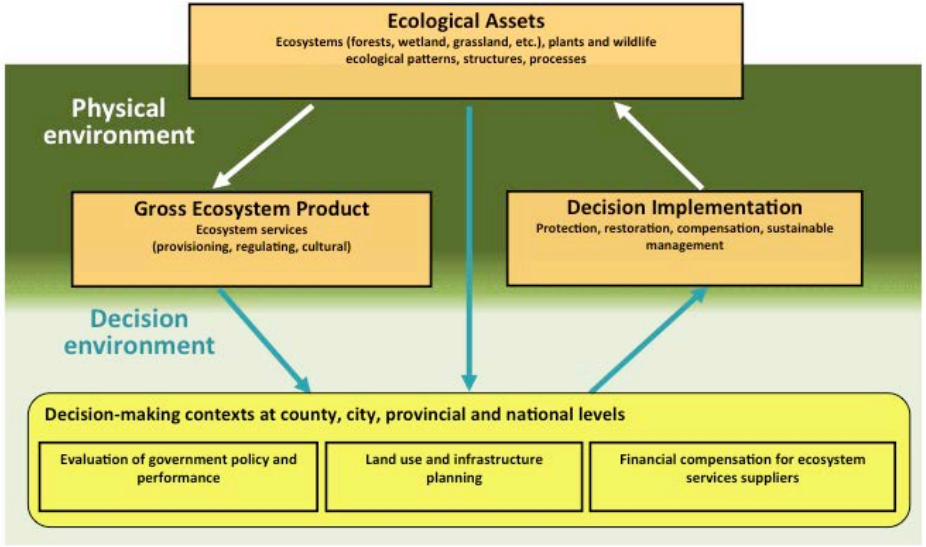
- A region or city is a coupled human and natural system, consisting of social, economic and natural sub-systems.
- China, as well as many other countries, needs a index or system to evaluate:
  - ✓ contribution of ecosystems to human welfare.
  - ✓ effects of natural conservation efforts.
  - ✓ performance of local government or communities in natural conservation, particularly in China.



- **G**ross **E**cosystem **P**roduct (**GEP**)
  - ✓ the total value of ecosystem **final goods and services** supplied to human well-being in a region annually, like a country, province/state, county or city.

Gross Ecosystem Product Accounting

- GEP accounting can be a potential tools to link ecosystem service accounting to conservation policy.



- China is studying GEP accounting methods and technical guideline at national, provincial, and county levels.
- Pilot studies were widely distributed in China.

Gross Ecosystem Product Accounting

The principles 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,
- ✧ 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 accounting based on bio-physical value accounting.

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

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

✓GEP: the sum economic value of ecosystem provision services (EPV), regulating services (ERV) and cultural services (ECV) in the given area annually.

Gross Ecosystem Product Accounting

Ecosystem services

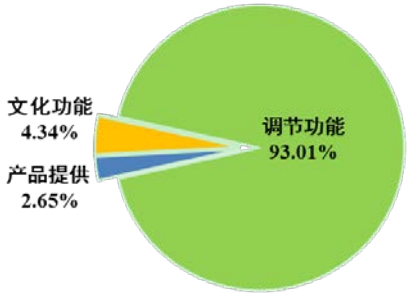
Categories	Goods and services (examples)
Provisioning services	Food: grain, vegetable, fruits, meat, milk, egg, fish,
	Materials: wood, fiber, water, genes,
	Energy: bio-energy(fuelwood), hydro-power
	Others: herb medicine, seedling, ornament
Regulating services	Regulation services: water conservation,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

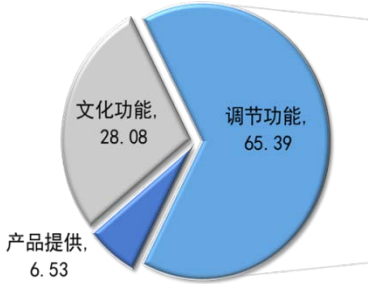
GEP accounting in

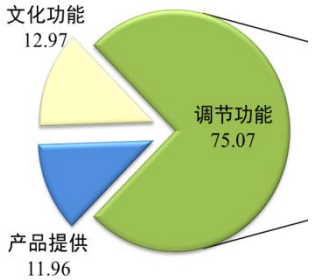
Qinghai province, Qiandongnan city and Eshan county

GEP accounting of pilot areas

Areas	GEP (billion yuan)	Provisioning services (billion yuan)	Regulating services (billion yuan)	Cultural services (billion yuan)
Qinghai Province	1714.83	45.38	1595.04	74.41
Qiandongnan city	413.63	27.00	270.48	116.16
Eshan County	15.78	1.89	11.84	2.05







GEP accounting of pilot areas

The value of regulating services of Qinghai Province in 2015

Services	Indicators	Quantification		Value (billion yuan)	Total (billion yuan)
		Quantification	Unit		
Water retention	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 of Qiandongnan city

Services	Indicators	Quantification		Value (billion yuan)	Total (billion yuan)
		Quantification	Unit		
Water retention	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	
	Energy consumption of plant transpiration	1689.63	10^8 kwh	80.291	

GEP accounting of pilot areas

The value of regulating services of Eshan County

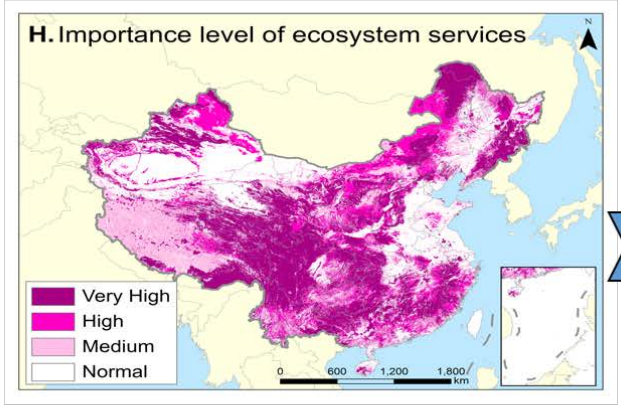
Services	Indicators	Quantification		Value (billion yuan)	Total (billion yuan)
		Quantification	Unit		
Water retention	Amount of water conservation	4.34	10^8 m^3	3.518	3.518
Soil retention	Amount of soil retention	0.21	10^8 m^3	0.384	1.469
	Reduction of nitrogen non-point source pollution	0.004	10^8 t	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

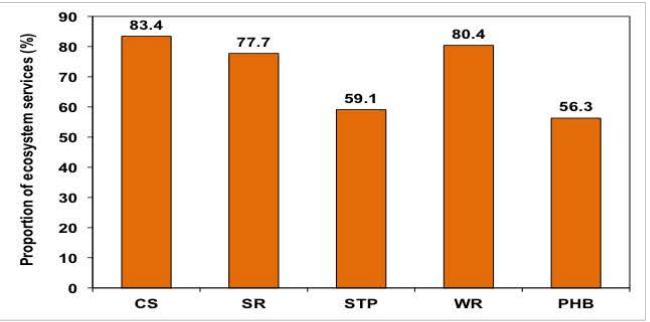
Linking ecosystem services to policy making

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

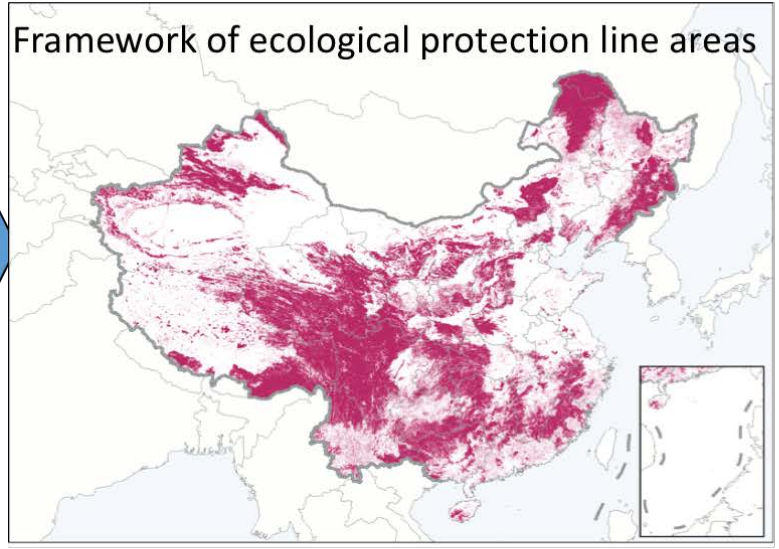
Linking ecosystem services to policy making

Ecological Protection Redline (EPR)

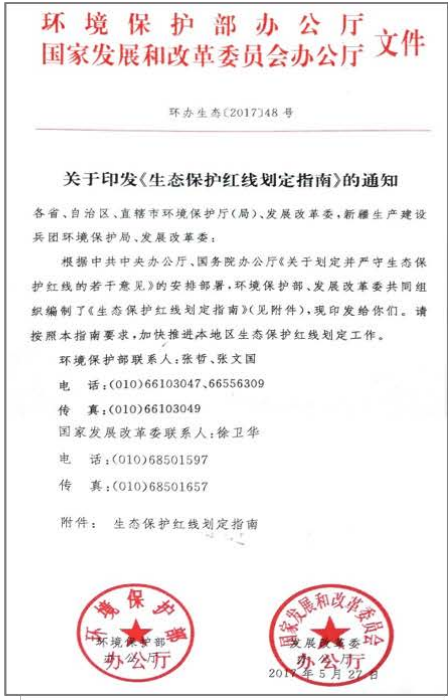




Provision of ecosystem services in EPR Areas (35 %)



- 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

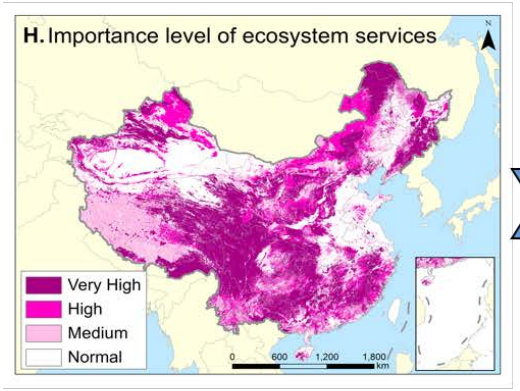
附件：　生态保护红线划定指南

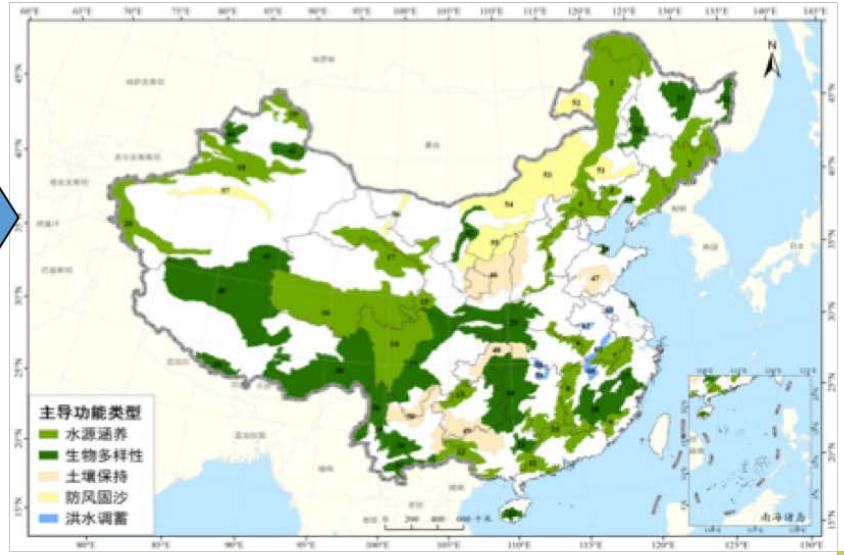
环境保护部办公厅
发展改革委办公厅
2017年5月27日

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）

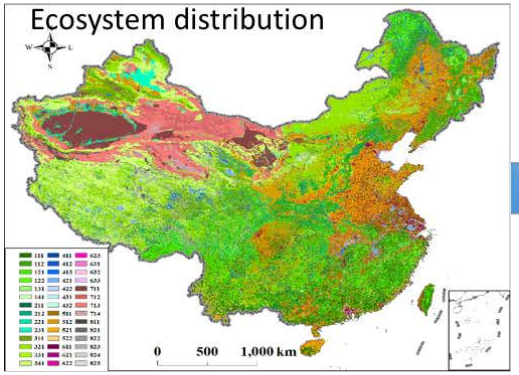
2015 年 11 月 13 日

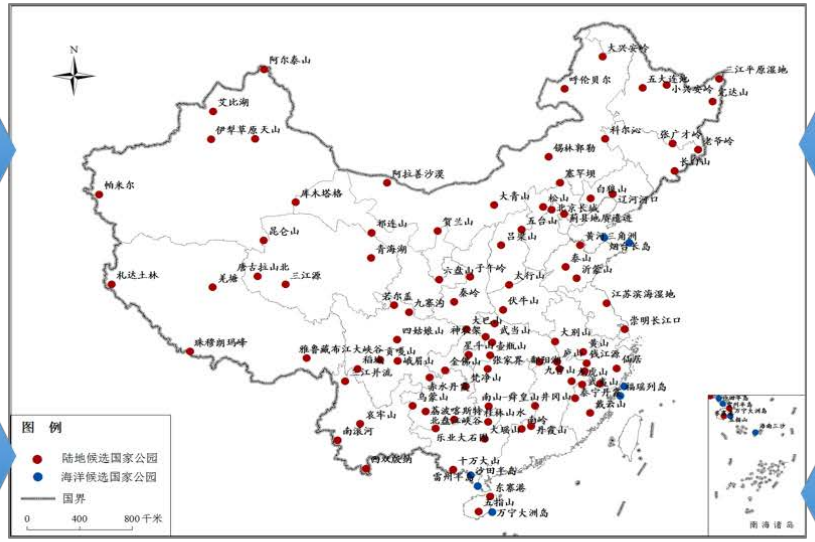
- 63 areas with critical ecosystem services were identified as Ecosystem function conservation areas (EFCAs) released in 2015 by MEP and CAS.
- Total 63 EFCAs, 49% of China.

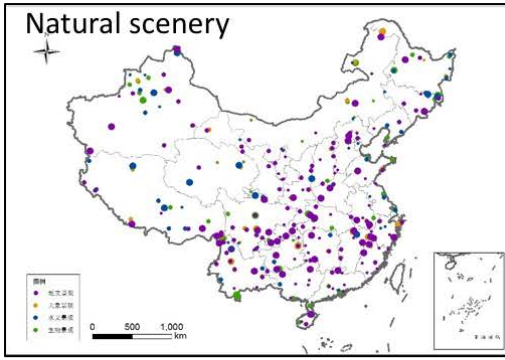
- Water retention
- Biodiversity conservation
- Soil retention
- Sand fixation
- Flood mitigation

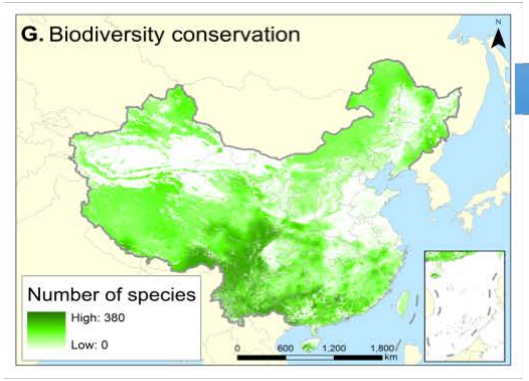
Linking ecosystem services to policy making

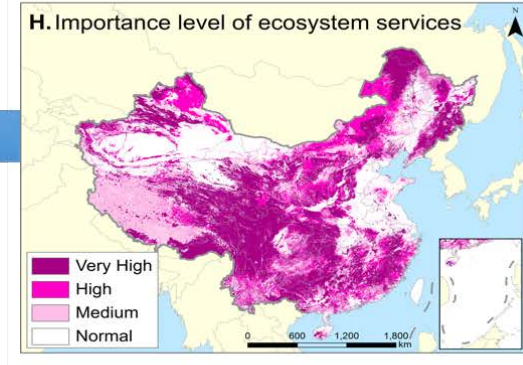
National park system planning





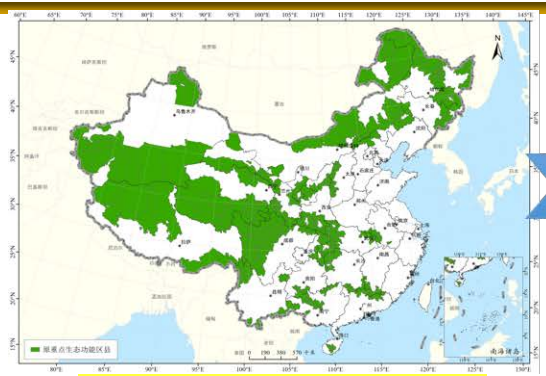






- The national parks were located based on distribution of represented ecosystems, natural landscape, wildlife and ecosystem services.

Linking ecosystem services to policy making



437 counties in 2010

512 counties in 2014

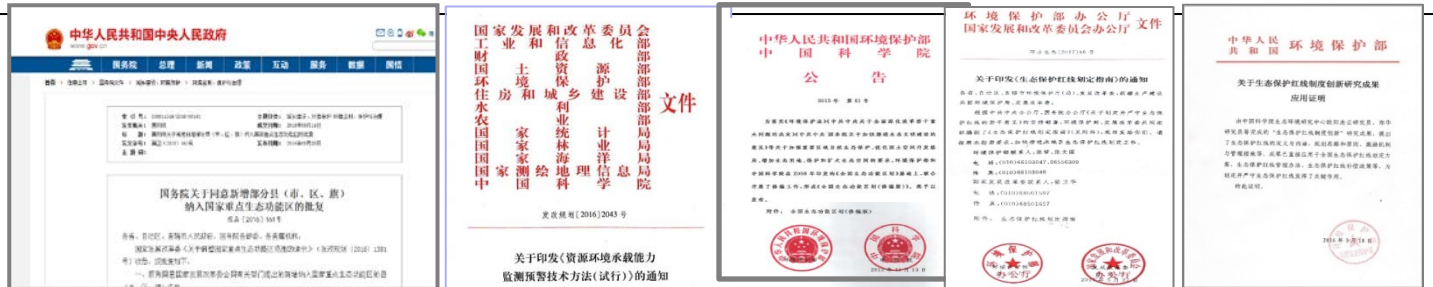
700 counties in 2016

Year	Budgets (billions RMB)	Benefited Counties
2008	6.0	221
2010	24.9	437
2014	48.3	512
2017	62.7	715

- 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 62.7 billion yuan in 2017 from 6.0 billion yuan in 2008.

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



Conclusion

- China has made big efforts to apply ecosystem service evaluation and accounting in conservation policies.
- Ecosystem service accounting can be powerful and useful tools to support policy making and innovation in biodiversity and natural conservation.
- **GEP accounting provide a new tools to evaluate**
  - ✓ Effectiveness of ecological compensation and restoration, and related policy
  - ✓ Conservation efforts and efficiency of local government
  - ✓ The contribution of nature to human
  - ✓ While, there are many questions need to study in GEP accounting
- **Scientific infrastructure**
  - ✓ Methods improvement of evaluation,monitoring 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
Asian Development Bank
IUCN-China
… …

Thanks !