GROSS ECOSYSTEM PRODUCT
生态系统生产总值

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Sustainable development

- Sustainable Development Theories (from SEEA 2003):

➢ **The three pillars approach** to sustainable development - According to this view there must be no single focus (or object) of sustainability, but instead all of the economic, social and environmental systems must be simultaneously sustainable in and of themselves.

➢ **The ecological approach** to sustainable development - Central to the ecological view of sustainable development is the notion that economic and social systems are sub-systems of the global environment. It follows that sustainability in the economic and social spheres is subordinate to sustainability of the environment.

➢ **The capital approach** to sustainable development -Sustainable development is development that ensures non-declining per capita national wealth by replacing or conserving the sources of that wealth; that is, stocks of produced, human, social and natural capital.

Ecosystem and human well-being

- Ecosystem as the basis of existence and development of human being
  - ✓ Create and Maintain life support system for the Earth, accumulate necessary conditions for existence and development of humanity: stabilize atmospheric chemical composition such as Oxygen, Water cycle, carbon cycle and nutrient cycle.
  - ✓ Provide food, raw material for human race: food, fresh water, medicines, fiber, energy and so on.
  - ✓ Depending on nature is eternal for human race.

Ecosystem and SDGs

Post-2015 SDGs : the four pillars of sustainable development(Jeffrey Sachs, 2012):

- economic development including ending extreme poverty (SEEA-CF, Green GDP)
- social inclusion (GNH and/or HDI)
- environmental sustainability (SEEA-EEA, GEP and GEA)
- good governance (Cross Cutting)

Healthy Ecosystems

◆Support development & enhance human well-being

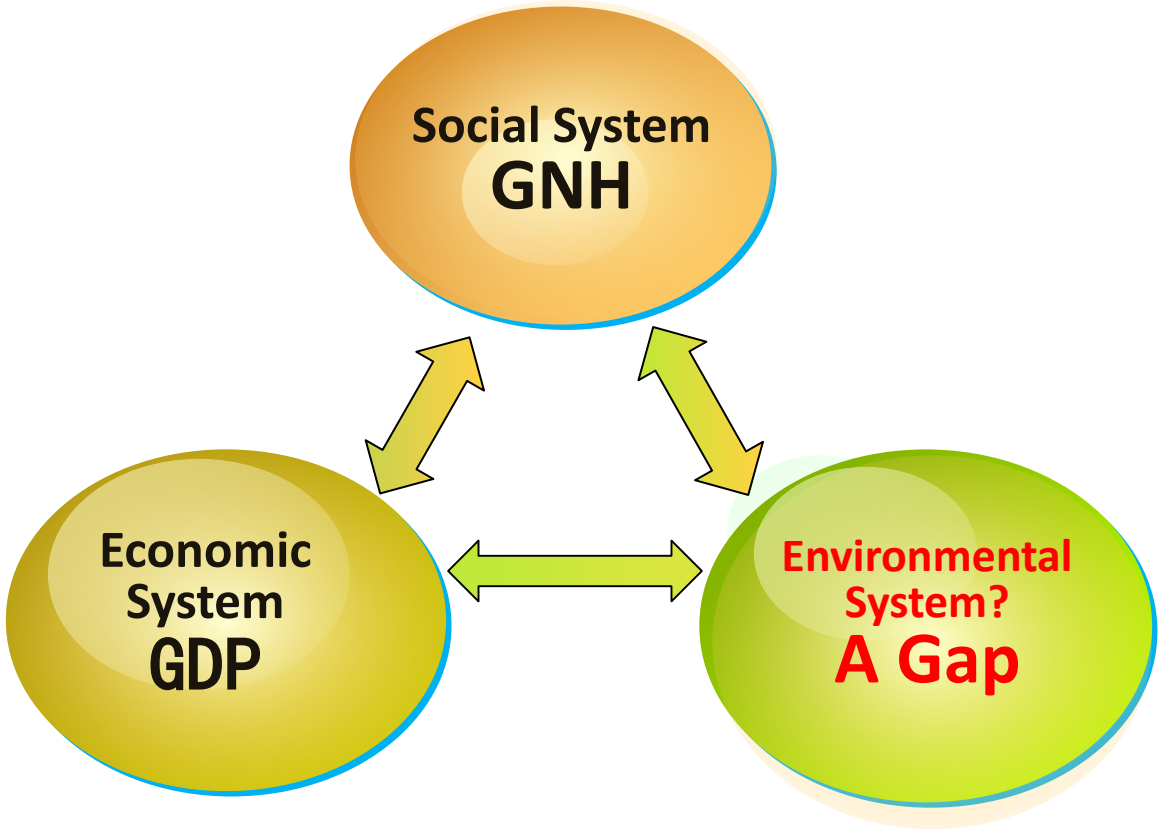
◆Require effective & adaptive governance so as to conserve ecosystem services to achieve SDGs

◆Need decisions that incorporate the conservation of ecosystem services in national planning

GDP, GNH and GEP

Human society and its living environment is

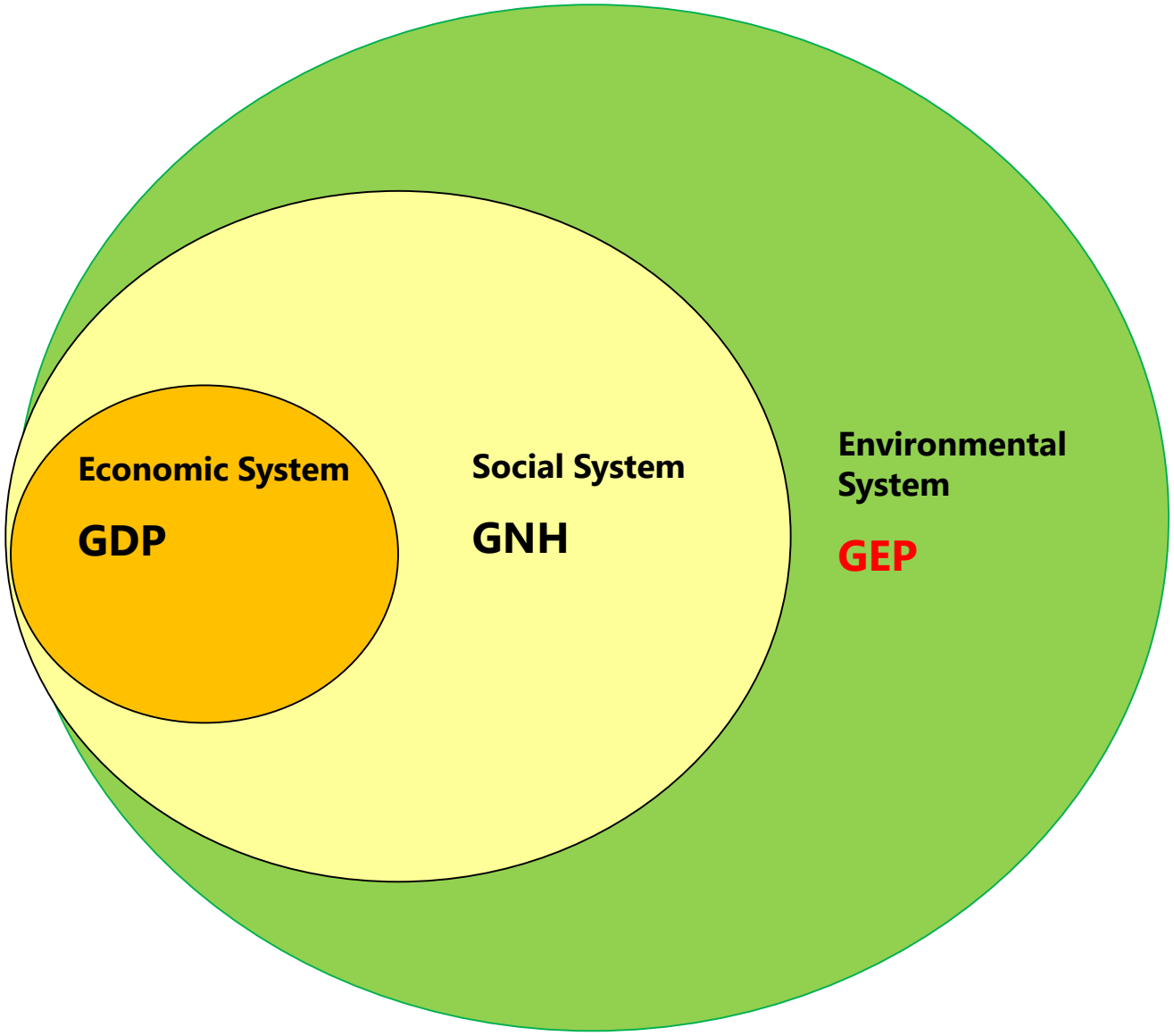
a coupled nature-economic-social system



GDP, GNH and GEP

Integrating Gross Ecosystem Product (GEP) into Accounting System of Sustainable Development /Ecological Civilization:

- ✓GDP Measure Economy
- ✓GNH Measure Society
- ✓GEP Measure Ecosystem



Gross Ecosystem Product (GEP)

GEP is the total value of final ecosystem goods and services supplied to human well-being in given region annually, like a county, a province, or a country.

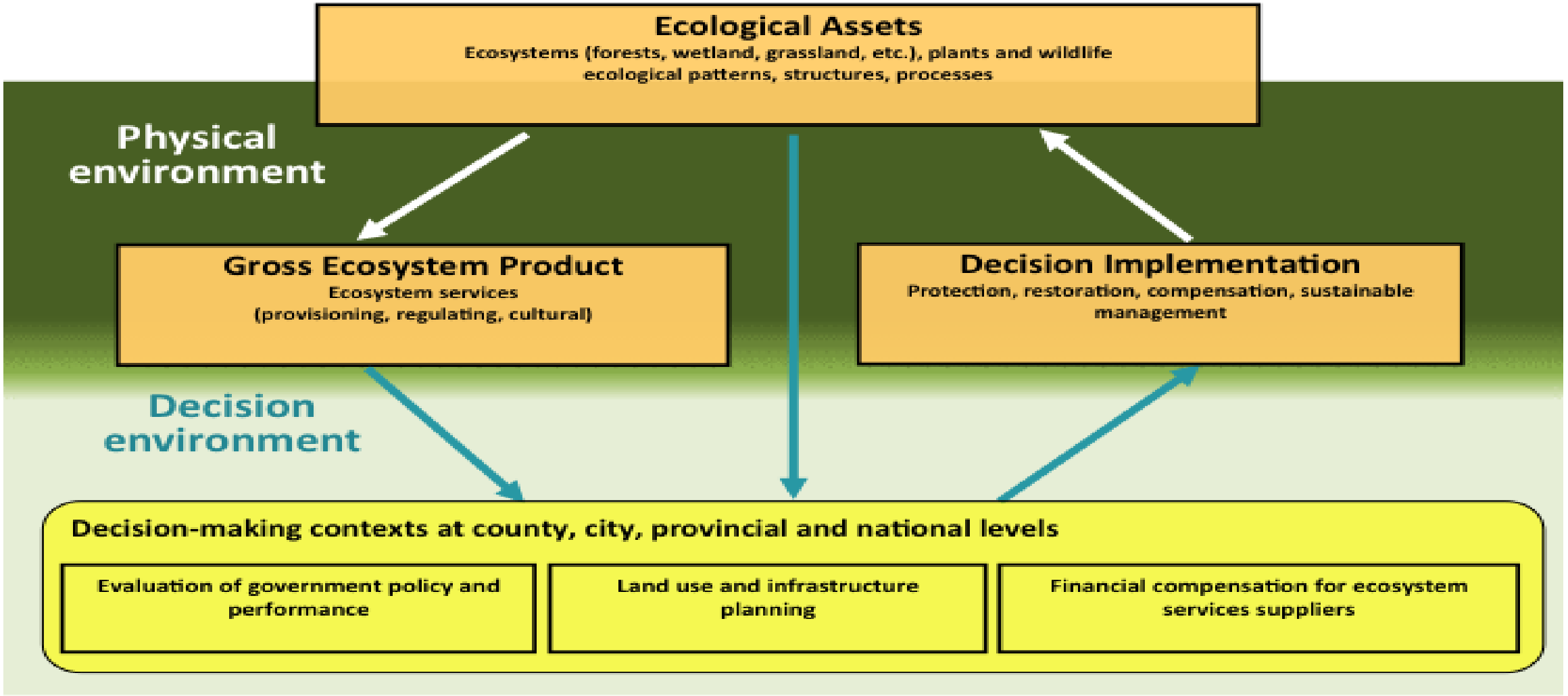
Ecosystem Asset (EA)

Ecosystem Assets are the natural resources that produce and provide ecological goods and services.

- Natural Ecosystem Assets
- Natural-Based Artificial Ecosystem Assets
- Wild fauna and flora resources

Concept of GEP

GEP accounting and policy implementation

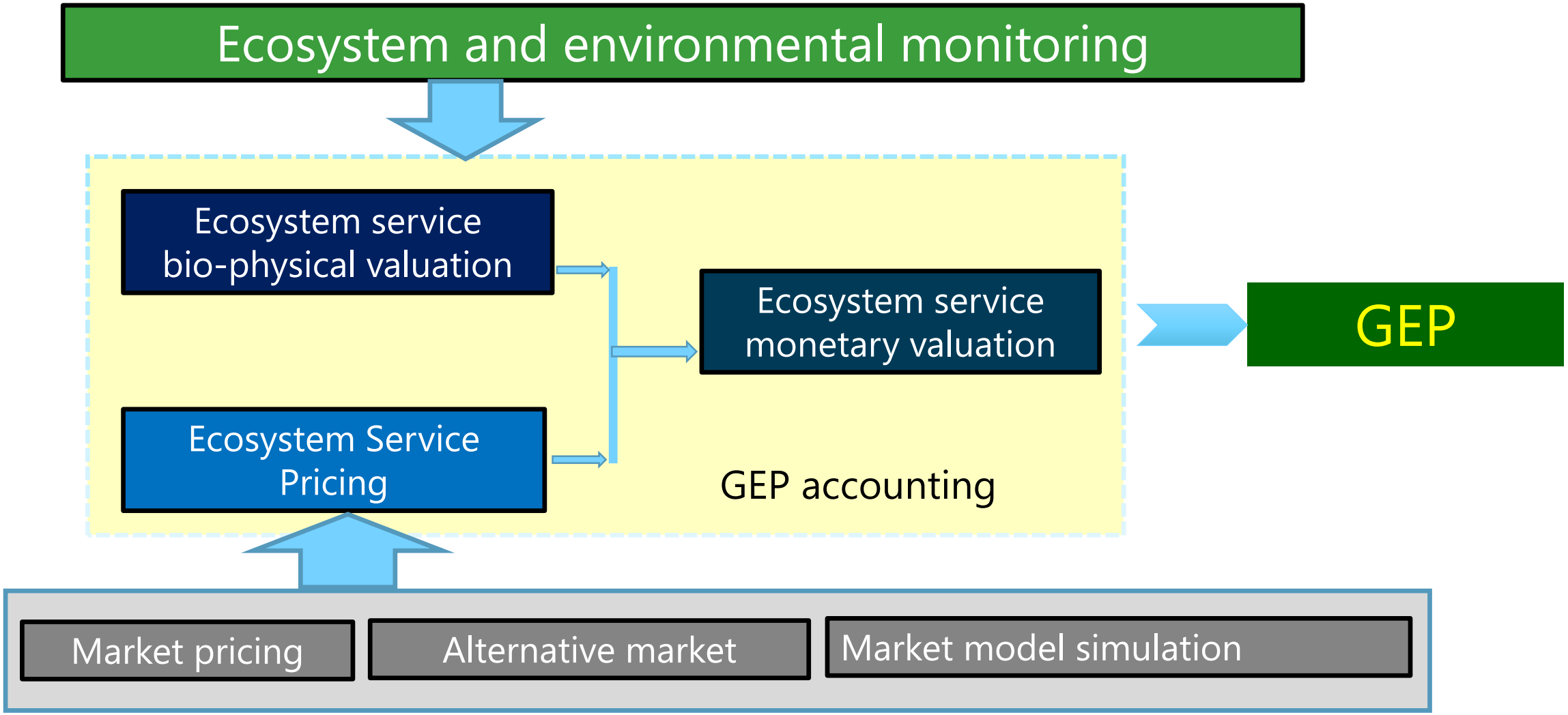


GEP accounting methods

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 bio-physical values of ecosystem goods and services**
  - ✓ Ecosystem Goods: grain, fruit, meat, eggs, vegetables, water, medicinal materials, biological materials, fiber, biomass etc;
  - ✓ Regulation and culture services: water conservation, soil conservation, contaminants purification, carbon sequestration, oxygen production, aesthetics, recreation, culture identity, knowledge, education, inspiration for art etc..
- **Pricing of ecosystem goods or services**
  - ✓timber price, water price, soil conservation price, pollutant purification price,...
  - ✓alternative market, market model simulation methods

GEP accounting methods

- **Accounting of economic values of ecosystem goods and services**

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

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

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

GEP accounting methods

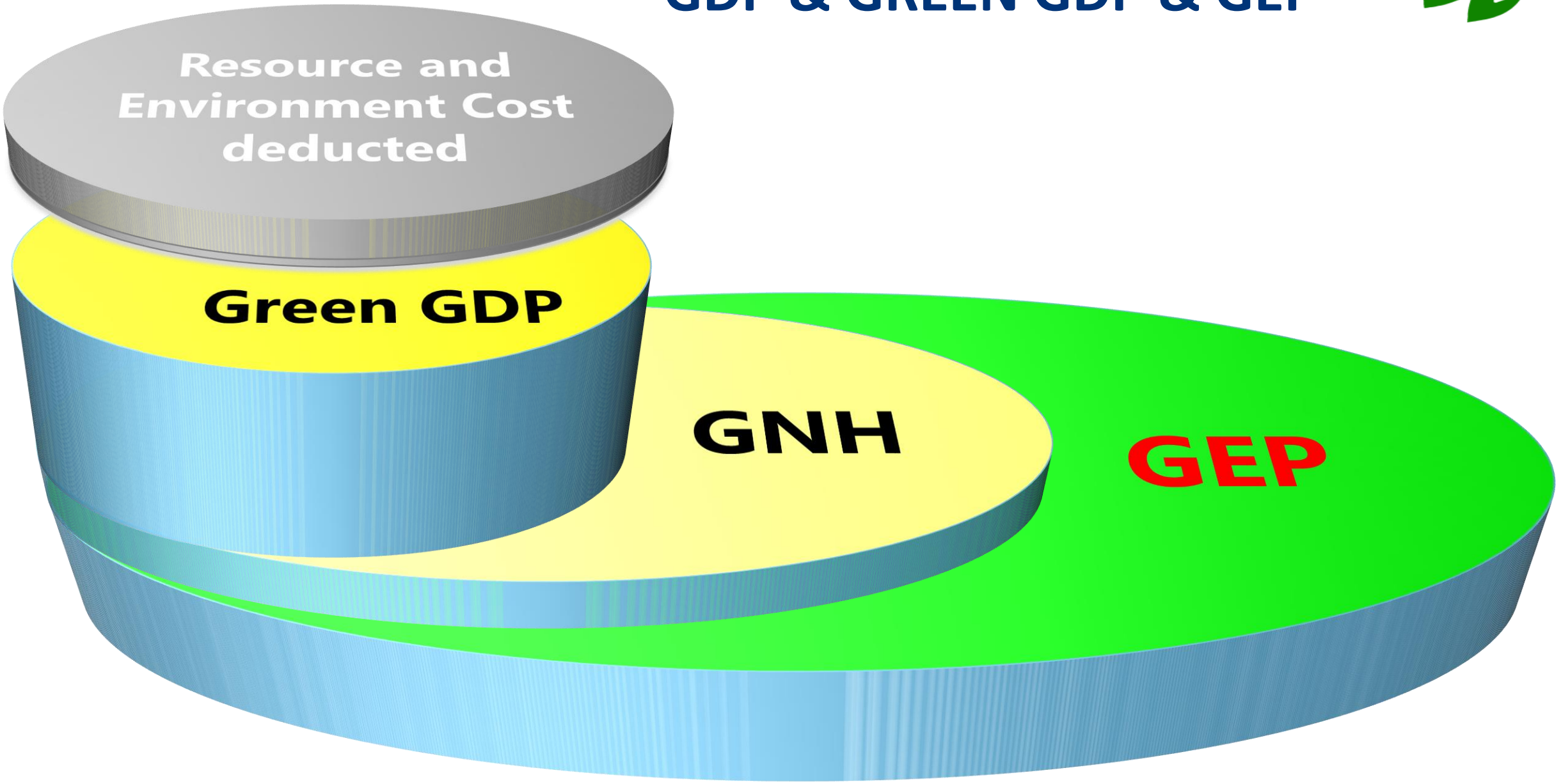
Ecosystem goods and services

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 methods

Services	Indicators	Quantity indicators	Quantitative valuation methods	Value indicators	Value valuation methods
Provisioning services	Agricultural products	Production of agricultural products	Statistical data	Value of agricultural products	Market price method
	Forestry products	Production of forestry products		Value of forestry products	
	Animal products	Production of animal products		Value of animal products	
	Fishery products	Production of fishery products		Value of fishery products	
	Water resources	Water consumption		Value of water resources	
	Ecological energy	Amount of ecological energy		Value of ecological energy	
	Others	e.g., production of ornamental resources		Value of ornamental resources	
Regulating services	Water retention	Amount of water retention	Water Balance Equation	Value of water retention	Surrogate market method
	Soil retention	Amount of soil retention	RUSLE	Value of sediment reduction	
				Value of diffused pollution reduction	
	Flood mitigation	Lake: adjustable storage capacity	Hydrologic data	Value of flood mitigation	
		Reservoir: flood control storage	Monitoring data		
		Swamp: stagnant water			
	Sandstorm prevention	Amount of sand-fixation	REWQ	Value of desertification reduction	
	Carbon sequestration -oxygen release	Amount of carbon sequestration	Mass balance method	Value of carbon dioxide sequestration	
		Amount of oxygen release		Value of oxygen release	
	Air quality maintenance	Amount of SO_2 absorption	Model of plants purification	Value of SO_2 treatment	
		Amount of NO_X absorption		Value of NO_X treatment	
		Amount of dust reduction		Value of dust treatment	
	Water purification	Amount of COD reduction	Model of water purification	Value of COD treatment	
		Amount of total nitrogen reduction		Value of total nitrogen treatment	
		Amount of total phosphorus reduction		Value of total phosphorus treatment	
	Climate regulation	Energy consumption of plant transpiration	Model of transpiration and evaporation	Value of plant transpiration	
		Energy consumption of water surface evaporation		Value of water surface evaporation	
	Biological control	Area of pest and disease occurrence	Analogy method	Value of biological control	
Cultural services	Natural landscape	Number of tourists	Travel cost method	Value of landscape recreation	Travel cost method

GDP & GREEN GDP & GEP



GEP PILOTS

GEP is researched and developed by IUCN and RCEES-CAS.

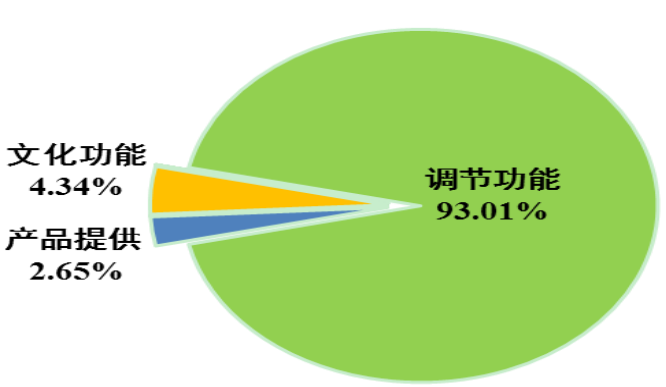
IUCN China and RCEES are working with Chinese Central & local government at 30 GEP pilot studies: e.g.

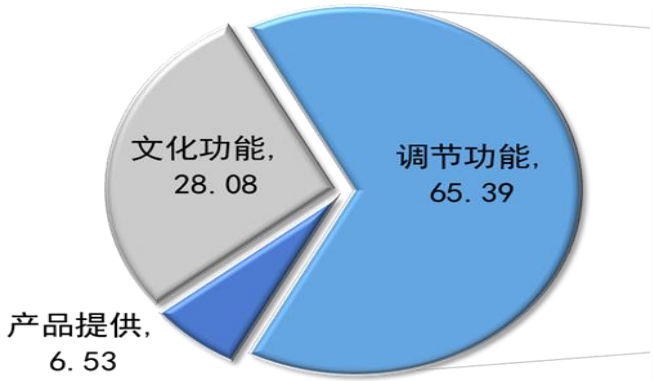
- ►Guizhou & Qinghai Province
- ►Shenzhen & Tonghua City Qiandongnan Prefecture
- ►Xing'an League, Ganzi Prefecture, Ordos City
- ►Arxan City, Xishui County
- ►10 counties of Guizhou province

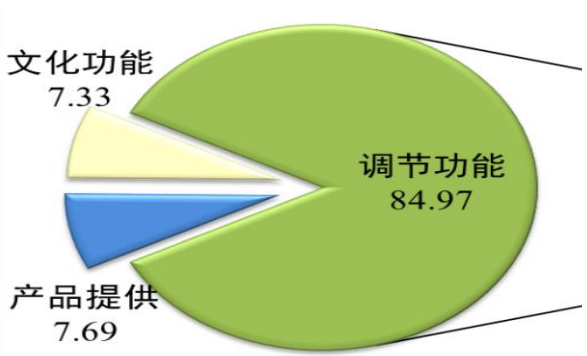
GEP and GEP accounting in Qinghai, Qiandongnan and Eshan, Pingbian

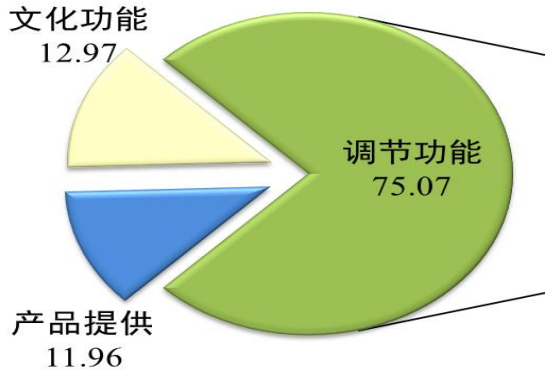
GEP and EA accounting of pilot areas

Areas	GEP (billion yuan)	Provisioning services (billion yuan)	Regulating services (billion yuan)	Cultural services (billion yuan)	GEP/GDP	GEP density (million yuan/km^2)	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 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 all study areas increased.
- Regulating services value increased : Qinghai, Qiandongnan and Pingbian;
- Regulating services value decreased : Eshan.

Main findings

- Indicators system of GEP accounting can reflect types of ecosystem products and services in different area.
- GEP accounting indicated the effects of ecological protection efforts on ecosystem products and services of the four areas.
- Existing ecological and environmental monitoring and statistics can basically support GEP accounting in provincial, municipal and county scales.

Main findings

Recommendations

- Ecological benefit assessment method based on GEP accounting can used to performance evaluation of eco-compensation.
- To improve GEP index system and methods, to standardize valuation methods of ecological goods and services, to program GEP and ecological asset accounting technical guideline.
- Strengthen the sharing from environmental, hydrological, forest, meteorological and statistical data, improving the eco-environmental monitoring system, providing a data base for establish performance evaluation mechanism for eco-compensation with GEP assessment.

ADVANTAGES AND OPPORTUNITIES

GEP can be applied to measure the status of ecosystem services, which is an important indicator of sustainable development. It is also an critical indicator for measuring the progress of Eco-civilization.

GEP is an universal measure of ecological status. It can be applied to various countries and regions, and all types of ecosystems.

GEP is possible an indicator of SEEA-EEA

ADVANTAGES AND OPPORTUNITIES

GEP can be applied as a quantitative indicator for officials' performance appraisal and off-office auditing.

GEP can be applied as a scientific basis for PES/Eco-Compensation and public financial transfers.

GEP的使用方法和适用范围
GEP Application

做为量化“绿水青山就是金山银山”的抓手
to measure “Lucid waters and lush mountains are invaluable assets”

注：引自国务院印发的《全国主体功能区规划》

- 展现“绿水青山”的经济价值 unfold the value of Ecosystem
- 让决策层和公众了解保护自然和修复自然的意义和作用 Support decision-makers and publics to understand the meaning of nature conservation

GEP的使用方法和适用范围
GEP Application

做为政绩考核的指标 can be applied as a quantitative indicator for officials' performance appraisal and off-office auditing

- 建立完善的绩效考核和领导干部离任审计制度 improve the system of officials' performance appraisal and off-office auditing
- 有利于引导当地政府和公众对生态保护与修复的重视和关注 guide local government and publics to pay attention to eco-protection

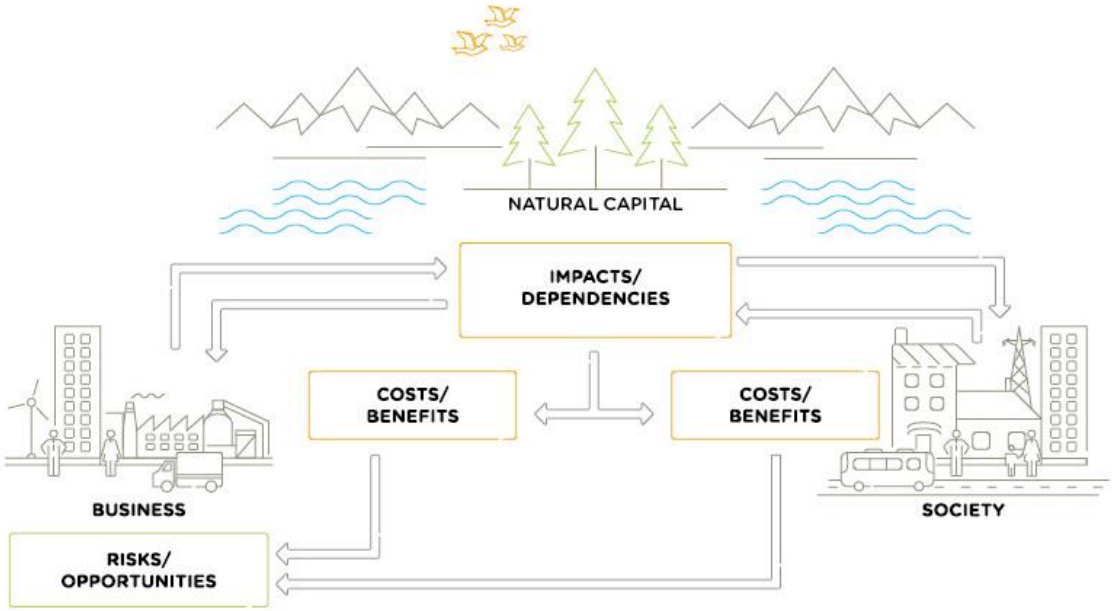
GEP的使用方法和适用范围
GEP Application

做为自然保护地和生态保护修复成效的量化依据
Can be a quantitative basis for the conservation effect of natural conservation and ecological restoration

- 自然保护地成效 Effectiveness of protected areas
- 生态保护修复 Ecological restoration
- 生态指挥棒 Ecological baton
- 大众宣传工具 Tool of public awareness raising

GEP的使用方法和适用范围
GEP Application

做为区域之间生态联系、海外投资的依据 Ecological linkages of different regions and can be the basis of foreign investment



- 评估区域间生态联系 Measure the ecological connection of different regions in the world
- 了解一带一路国家生态状况 Measure the ecological state of the Belt and Road Initiative countries
- 评估企业对生态系统的依赖程度和对生态资产的影响 Assess the degree to which an enterprise depends on the ecosystem and its impact on the ecological assets

GEP Accounting and Application

行政单位

Administrative Unit

- 自然保护地 PAs
- 县 County
- 市 City
- 省 Province
- 国家 Country
- 各州 Continent
- 特定行政区域 Specific administrative area
- 全球 Global

自然地理单元

Geographical unit

- 流域 River basin
- 山系 Mountain
- 海域 Ocean
- 生态区和生物圈 Ecoregions

企业

Private Sector

- 产业和企业类型 Industry and the type of the private sectors

生态系统类群

Ecosystem Types

- 森林 Forest
- 湿地 Wetland
- 草地 Grassland
- 荒漠 Dryland
- 农田 Farmland
- 湖泊河流 Lake and river
- 海洋 Ocean
- 城市绿地等 City green land

2nd World Forum on Ecosystem Governance

1. Integrate natural capital values into political，economic, financial and technical decision making – so that nations, especially at the national level, prioritize the importance of natural capital, including its services–not only their monetary values but also ecological, biological, ethical, cultural and aesthetic values;
2. Promote SEEA-EEA and integrate this with other initiatives to develop a framework for ecosystem accounting (natural capital accounting), recognizing the need for its continued improvement;
8. Make the case for how natural capital and ecosystem accounting can be mainstreamed in economic, social and governance indicators in decision making, and politically to ensure that natural capital and ecosystem accounting becomes a core component of sustainable development, fiscal planning and economic decision making.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Workshop on Eco-Civilization and Its Indicator Frame
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森林
生态系统生产总值
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生态系统生产总值核算

Thanks

Chinese Academy of Sciences

National development and Reform Commission

Ministry of Environmental Protection

State Forestry Administration

Standardization Administration of China

International Union for Conservation of Nature

Asian Development Bank

Natural Capital Project (Stanford University, Minnesota University)

Thank you!

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