

# GEP Accounting in Guizhou

## 贵州省GEP核算

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# GEP Accounting ( GEP核算 )

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# GEP概念 ( Concept )

- GEP的概念:生态系统生产总值 ( Gross Ecosystem Product ) 是指生态系统的生产和服务的价值总和, 是生态系统为人类福祉提供的产品和服务的经济价值总量, 一般以一年为核算时间单元。
- 其中, 生态系统包括
  - 自然生态系统: 如森林、草原、湿地、荒漠、淡水和海洋生态系统等
  - 以自然生态过程为主的人工生态系统: 如农田、草场、水产养殖场和城市绿地



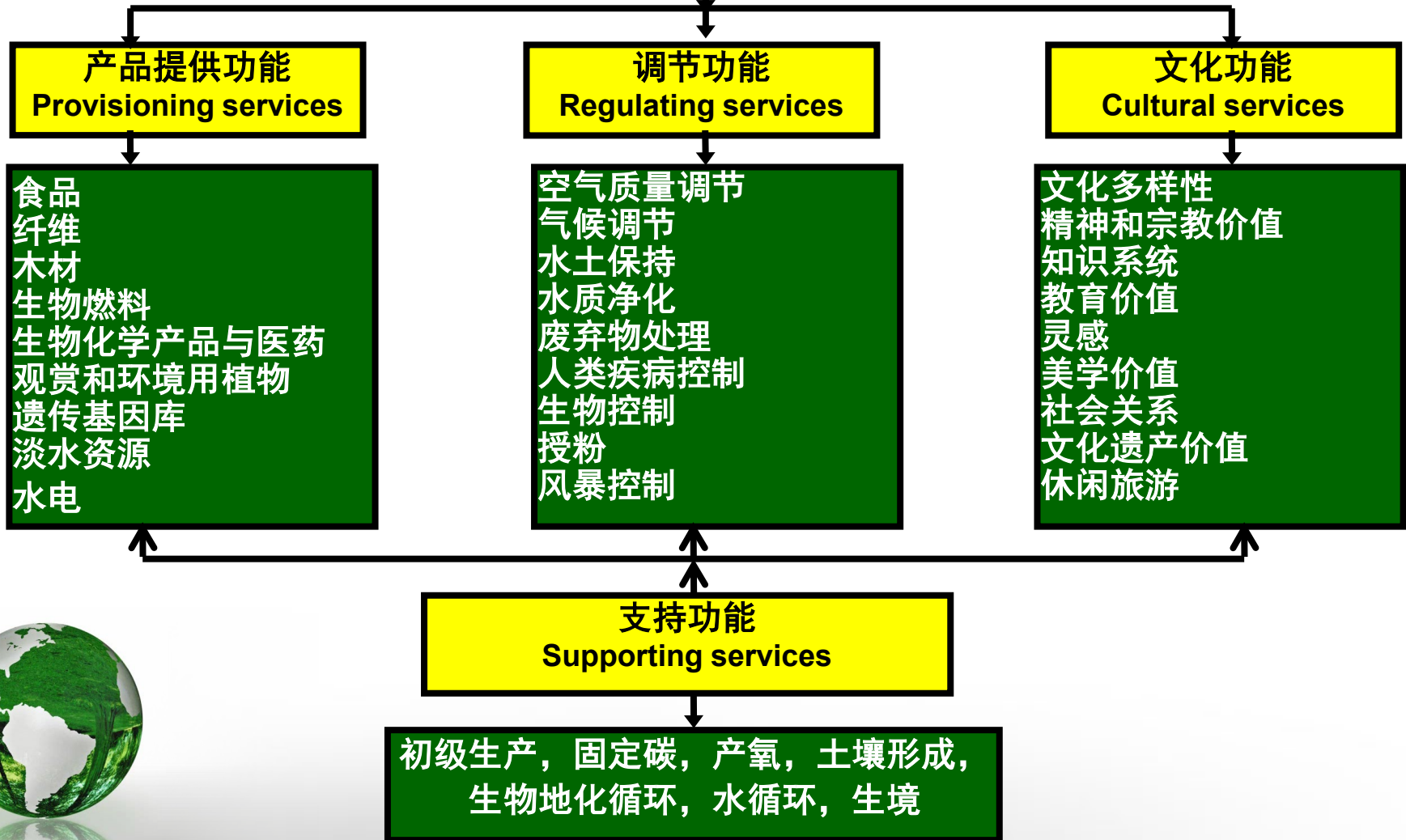
# GEP概念 ( Concept )

- 借鉴千年生态系统评估 ( MA ) 提出的分类方案，GEP包括提供生态产品、生态调节服务、生态文化服务与生态支持功能四方面的价值。



# GEP概念 ( Concept )

## 生态系统服务功能 Ecosystem Services





# Study area-Guizhou ( 研究区 )



Area: 176,000km<sup>2</sup>

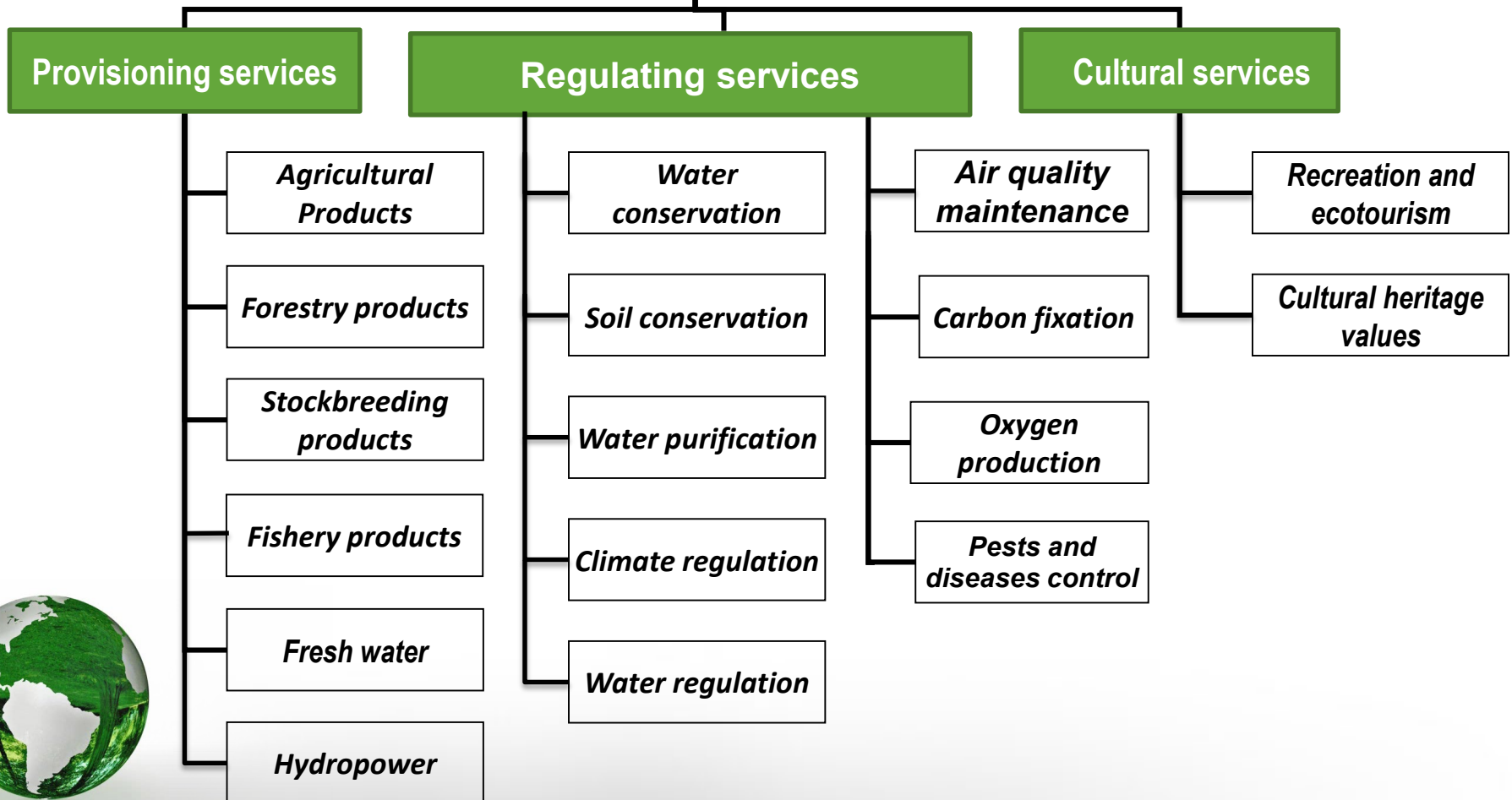
Population: 35million

Guizhou province lie in the Southwest China, It's natural environment is beautiful, but it's economic condition is poor.



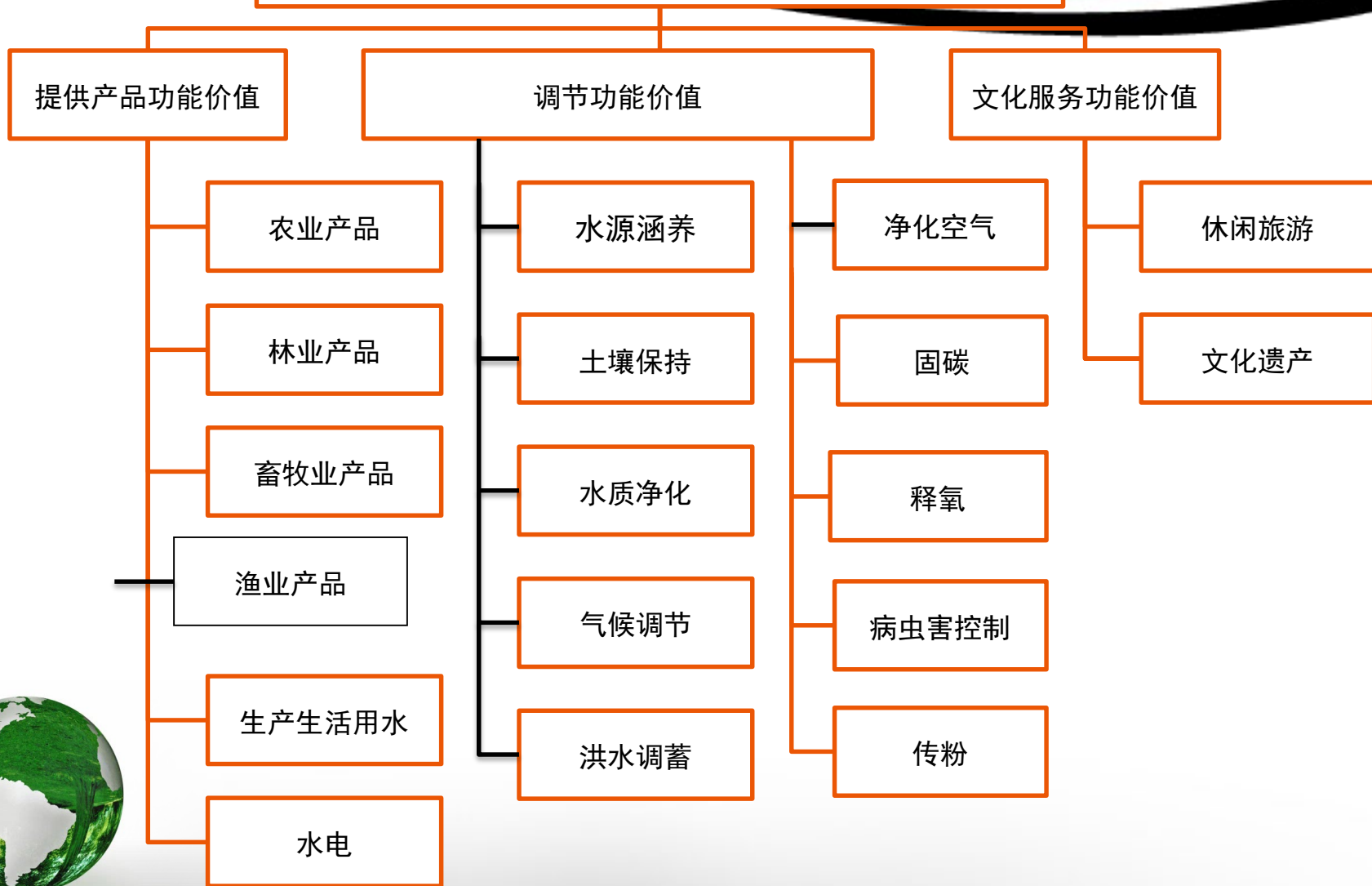
# GEP accounting index system

## GEP accounting index system in Guizhou



# 生态系统GEP评估\_指标体系

## 贵州省生态系统生产总值核算指标体系





# GEP accounting method (核算方法)

- The values of provisioning services accounting method (产品提供服务核算方法)
- The values of regulating services accounting method (调节服务核算方法)
- The values of cultural services accounting method (文化服务核算方法)



# The values of provisioning services accounting method

Items	Products	Accounting method
<b>Agricultural products</b> (农产品)	Rice,Wheat,Corn,Soybeans,Potato,Rapeseed,Peanuts,Sugarcane,Tobacco,Vegetable,Apples,Pears,Oranges,Bananas,Tea, .etc.	Market pricing method:  <i>Values = Production * Price</i>
<b>Forestry products</b> (林产品)	Lacquer, Tung oil seeds, Tea oil seeds, Tallow seeds, Nutgall, Palm flake, Rosin, Walnuts, Chestnut, Chinese herb medicine, Flowers,.	
<b>Stockbreeding products</b> (畜牧产品)	Beef, Mutton, Pork, Poultry, Milk, Eggs, Honey, etc.	
<b>Fishery products</b> (渔业产品)	Fish, Shrimp, etc.	
<b>Fresh water</b> (淡水产品)	Irrigation water, Urban public water, Industrial water, Residents water, Water resources to other provinces	
<b>Hydropower</b> (水能源)	Hydropower generation	<i>Values = Hydropower * Power price</i>
<b>Bio-energy</b> (生物能源)	Firewood	<i>Values = Firewood consumption * Firewood price</i>

# The values of regulating services accounting method

Services Items	Indicators	Accounting method
<b>Soil conservation</b> (土壤保持)	Fertilizer conservation 土壤肥力保持, Silt decreasing (降低 泥沙淤积)	$E_f = \sum_i A_c \cdot C_i \cdot P_i (i = N、P、K)$ , $E_f$ : Values of Fertilizer conservation, $A_c$ : Fertilizer conservation, $C_i$ : Fertilizer, $P_i$ : Price $E_n = 24\% \cdot A_c \cdot C / \rho$ , $E_n$ : Values of Silt decreasing, $A_c$ : Silt conservation, $C$ : Reservoir building price (yuan/m <sup>3</sup> ), $\rho$ : Soil density
<b>Water conservation</b> (水源涵养)	Water conservation	$E_w = W_f \cdot P$ , $W_f = R + I_w - E_r - O_w$ , $E_w$ : Values of water conservation, $P$ : Reservoir building price (yuan/m <sup>3</sup> ), $W_f$ : Water conservation, $R$ : The total annual precipitation, $I_w$ : Input water, $E_r$ : Evaporation annual, $O_w$ : Output water.
<b>Water purification</b> (水质净化)	Industrial wastewater, Domestic wastewater	$W_p = I_w \cdot P_i + D_w \cdot P_d$ , $W_p$ : Values of water purification, $I_w$ : Industrial wastewater (t), $P_i$ : Industrial wastewater purification price (yuan/t), $D_w$ : Domestic wastewater (t), $P_d$ : Domestic wastewater purification price (yuan/t).
<b>Climate regulation</b> (气候调节)	Plant transpiration heat absorption, Water surface evaporation heat absorption	$E_c = (F_a + G_a) \cdot H_a \cdot \rho \cdot P_e + W_a \cdot E_p \cdot \beta \cdot P_e$ , $E_c$ : Values of Climate regulation services, $F_a$ : Forest area, $G_a$ : Grassland area, $H_a$ : heat absorption(kj/km <sup>2</sup> ), $P_e$ : Power price, $W_a$ : Water area, $E_p$ : Evaporation annual (m), $\rho$ : 1kwh · 3600kj <sup>-1</sup> , $\beta$ : evaporation heat absorption(kJ · m <sup>-3</sup> ).

# The values of regulating services accounting method

Services Items	Indicators	Accounting method
<b>Water regulation</b> (洪水调蓄)	Lakes regulation, Reservoir regulation	$E_a = (L_p + R_p) \cdot P_v$ , $E_a$ : Values of Water regulation, $L_p$ : Water volume of lakes regulation, $R_p$ : Water volume of reservoirs regulation, $P_v$ : Reservoir building price (yuan/m <sup>3</sup> ).
<b>Air quality maintenance</b> (空气净化)	Sulfur dioxide purification, Industrial fumes, Dusts	$E_f = \sum_i C_i \cdot P_i$ ( $i = SO_2$ 、Industrial fumes、Dusts), $C_i$ : Air pollutant, $P_i$ : Price of air purification.
<b>Carbon fixation</b> (固碳)	Plants carbon fixation	$6CO_2 + H_2O = C_6H_{12}O_6 + 6O_2 + 6H_2O$
<b>Oxygen production</b> (氧生产)	Oxygen production	$6CO_2 + H_2O = C_6H_{12}O_6 + 6O_2 + 6H_2O$
<b>Pests and diseases control</b> (病虫害控制)	Area of natural forest	$E_b = NF_a \cdot (MF_r - NF_r) \cdot P_b$ , $NF_a$ : Area of natural forest, $MF_r$ : The incidence rate of artificial forest, $NF_r$ : The incidence rate of natural forest, $P_b$ : Control costs (yuan/km <sup>2</sup> ).



# The values of cultural services accounting method

- 自然景观价值 = 使用价值 + 非使用价值

The natural landscape value = use value + nonuse value

- 使用价值 = 消费者支出 + 消费者剩余

Use value - TCM (Travel cost method)

Use value = consumer's expenditures + consumers' surplus

- 非使用价值 = 支付总体 \* 支付率 \* 支付额度

- Nonuse value - CVM (Contingent Valuation Method)

- Nonuse value = All payment \* payout ratio \* payments



# Result-The values of provisioning services

Items	Products	Production	Values (billion yuan)
<b><i>Agricultural products</i></b>	Rice,Wheat,Corn,Soybeans,Potato,Rapeseed,Peanuts,Sugarcane,Tobacco,Vegetable,Apples,Pears,Oranges,Bananas,Tea.....	2445.46*10 <sup>4</sup> t	56.523
<b><i>Forestry products</i></b>	Lacquer, Tung oil seeds, Tea oil seeds, Tallow seeds, Nutgall, Palm flake, Rosin, Walnuts, Chestnut, Chinese herb medicine, Flowers.....		6.549
<b><i>Stockbreeding products</i></b>	Beef, Mutton, Pork, Poultry, Milk, Eggs, Honey.....	194.99*10 <sup>4</sup> t	33.286
<b><i>Fishery products</i></b>	Fish, Shrimp.....	8.79*10 <sup>4</sup> t	1.382
<b><i>Fresh water</i></b>	Irrigation water, Urban public water, Industrial water, Residents water, Water resources to other provinces	1009.90*10 <sup>8</sup> m <sup>3</sup>	103.629
<b><i>Hydropower</i></b>	Hydropower generation	416.58*10 <sup>8</sup> kWh	0.303
<b><i>Bio-energy</i></b>	Firewood	1207.67*10 <sup>4</sup> t	6.763
	Total		208.345

# Result-The values of regulating services

<b>Services Items</b>	<b>Indicators</b>	<b>Services</b>	<b>Price</b>	<b>Value</b> Billion yuan
<b><i>Soil conservation</i></b>	<i>Fertilizer conservation</i>	65.27*10 <sup>4</sup> t	2600yuan/t	1.697
	<i>Silt decreasing</i>	0.97*10 <sup>8</sup> m <sup>3</sup>	6.11yuan/m <sup>3</sup>	0.593
<b><i>Water conservation</i></b>	<i>Water conservation</i>	863.99*10 <sup>8</sup> m <sup>3</sup>	6.11yuan/m <sup>3</sup>	527.898
<b><i>Water purification</i></b>	<i>Industrial wastewater,</i>	0.32*10 <sup>8</sup> t	2.09 yuan/ t	0.067
	<i>Domestic wastewater</i>	1.59*10 <sup>8</sup> t	2.09 yuan/ t	0.332
<b><i>Climate regulation</i></b>	<i>Plant transpiration heat absorption,</i>	10.25*10 <sup>11</sup> kJ	0.46 yuan/ kWh	0.131
	<i>Water surface evaporation heat absorption</i>	4.18*10 <sup>15</sup> kJ	0.46 yuan/ kWh	533.6

# Result-The values of regulating services

<b>Services Items</b>	<b>Indicators</b>	<b>Services</b>	<b>Price</b>	<b>Value</b> (billion yuan)
<b><i>Water regulation</i></b>	<i>Lakes regulation</i>	0.83*10 <sup>8</sup> m <sup>3</sup>	6.11yuan/m <sup>3</sup>	0.507
	<i>Reservoir regulation</i>	117.59*10 <sup>8</sup> m	6.11yuan/m <sup>3</sup>	71.847
<b><i>Air quality maintenance</i></b>	<i>Sulfur dioxide purification,</i>	114.89*10 <sup>4</sup> t	1200yuan/t	1.379
	<i>Industrial fumes,</i>	25.1*10 <sup>4</sup> t	150yuan/t	0.038
	<i>Dusts</i>	8.83*10 <sup>4</sup> t	150yuan/t	0.013
<b><i>Carbon fixation</i></b>	<i>Plants carbon fixation</i>	2.76*10 <sup>8</sup> t	120 yuan/ t	33.12
<b><i>Oxygen production</i></b>	<i>Oxygen production</i>	2.08*10 <sup>8</sup> t	1000yuan/t	208.00
<b><i>Pests and diseases control</i></b>	<i>Area of natural forest</i>	52151.86km <sup>2</sup>	100 yuan/mu	0.091
<b>Total</b>				<b>1379.313</b>



# Result-The values of cultural services

Level	Value (billion yuan)	Number	Sum of value (billion yuan)	Percentage (%)
National	11.875	8	95.00	22.96
Provincial	4.896	15	73.44	17.75
Prefecture and county	1.916	128	245.248	59.28
Total	—	151	413.688	100.00



# Result

<b>Services values</b>	<b>Values</b> (billion yuan)	<b>Percentage</b>
Provisioning services	208.345	10.41%
Regulating services	1379.313	68.92%
Cultural services	413.688	20.67%
Total	2001.346	100%



In 2010, GEP is GDP 4.3 times, Guizhou.

# Discussion

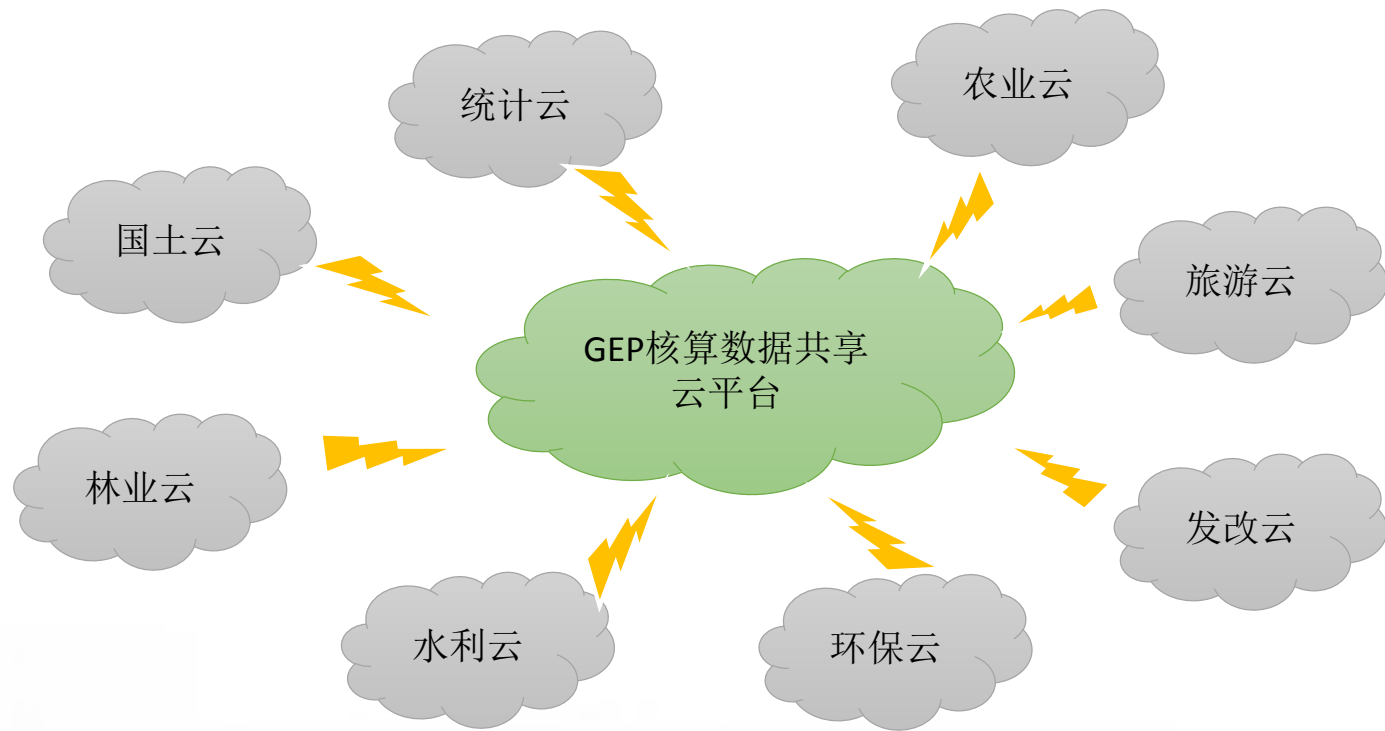
- How to unify the method of services assessment ?
- How to judge and monitor the result of assessment ?



# Research on GEP accounting mechanisms

## 核算机制研究

- (一) 建设数据共享体系

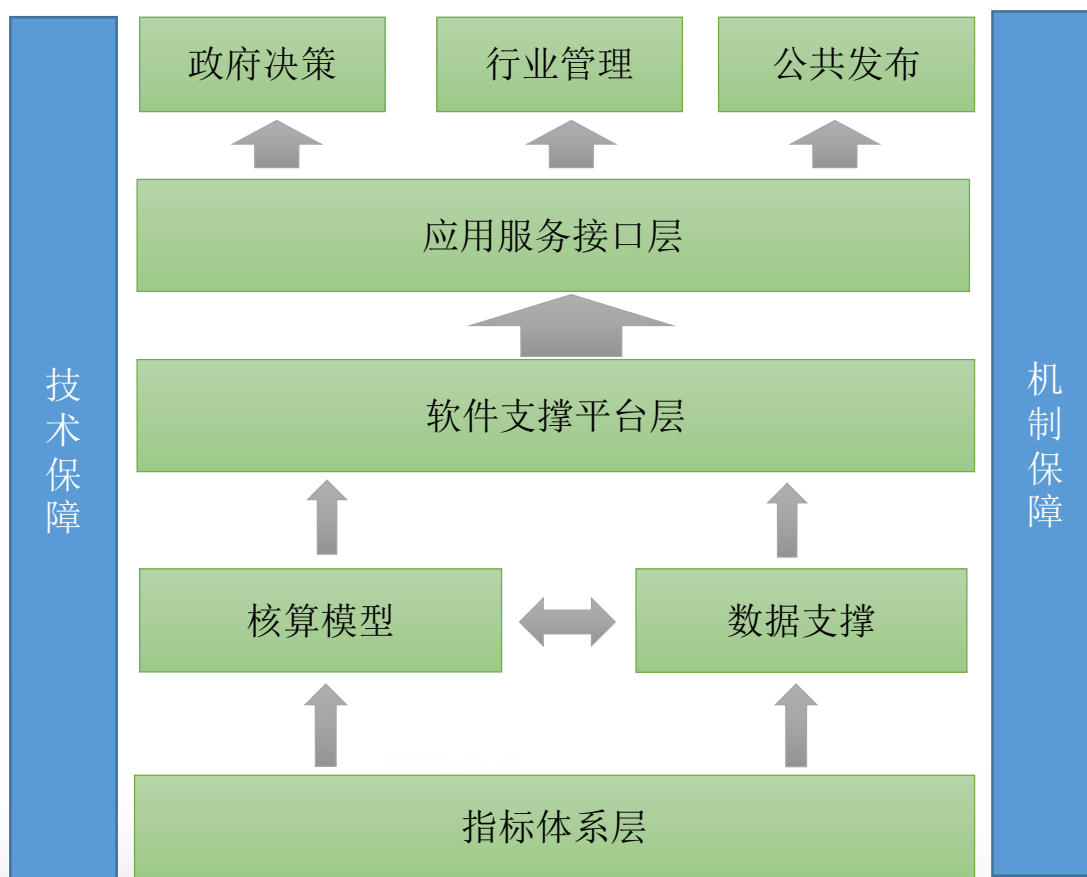




# Research on GEP accounting mechanisms

## 核算机制研究

- （二）建设软件支撑平台



# Research on GEP accounting mechanisms

## 核算机制研究

- （三）建设大数据综合技术支撑体系

- 近几年，随着大数据、机器学习和人工智能等技术的发展。在GEP价值核算过程中，如果引入大数据等相关技术，不仅可为核算提供更多的数据来源，也会使不同来源数据之间得到很好的验证和修订，提高数据的科学性和准确性。借助这些技术，可以使核算过程简化模型、优化算法，减少主观因素产生的影响，提高核算结果的客观性和可信度。因此，建立大数据综合技术支撑体系，是GEP核算技术发展的必然趋势。



# Research on GEP accounting mechanisms

## 核算机制研究

- （四）运营机制建设

- 实现生态系统价值核算持续、稳定、高效运行，需要建立一套完善的运营机制。方案之一，是把生态系统价值核算工作纳入“国民经济核算体系”框架范围内，在框架体系下增加GEP核算内容，这种运营方式可以与当前国民经济核算工作进行有机的集成，把GEP核算指标与国民经济核算指标进行统一处理和综合分析，在业务上具有很好的衔接性。方案之二，建立独立的生态系统价值核算的第三方运营机构，由专业化团队开展工作，可以是企业化运营方式，也可以是政府公益性业务机构，这种方式具有相对独立性，运行效率高，但需要处理好部门之间的业务关系。



# Research on GEP accounting mechanisms

## 核算机制研究

- (五) 构建监督机制
- GEP核算结果涉及到地方政府和部门之间的诸多利益，如何保证数据来源的客观性和准确性以及核算过程的科学性与合理性，是核算面临的重要问题。建立有效的数据来源与核算过程监督机制是非常必要的。一方面可以通过行政手段加强核算过程的管理，建立有效的法律法规制度；另一方面可以建立第三方监督机构，充分发挥专家团队的知识和技术优势，保证核算结果的客观性和公正性。





# Research on GEP accounting mechanisms

## 核算机制研究

- (六) 构建保障机制
- GEP核算是一项系统工程，必须切实加强领导，周密组织协调。加强对核算工作的组织领导和检查指导，对重大事项统一部署、综合决策，协调各部门、各地区之间的关系；按照建立公共财政的要求，把GEP核算资金纳入本级年度财政预算，加大人才队伍建设，提高技术支撑投入，确保核算工作常态高效运行。



- GEP核算处于研究起步阶段，核算指标体系、核算方法以及数据的科学性和现势性需要进一步深入研究。



**Thanks !**

