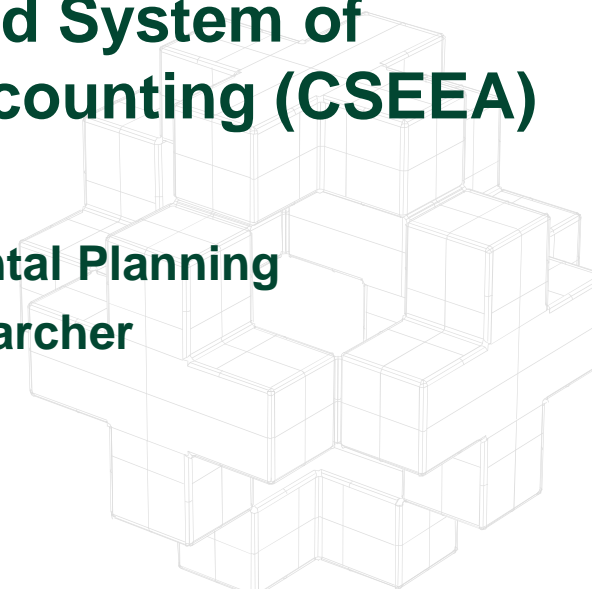




Progress of China Integrated System of Environmental and Economic Accounting (CSEEA)

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15th, May, 2011





Outline



1

Background and Framework of CSEEA

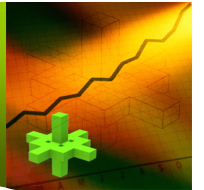
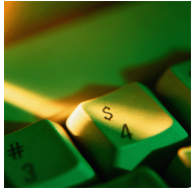
2

Methodologies for Ecologic degradation valuation

3

Challenges in the future CSEEA





1. Background and Framework of CSEEA



Background Scenario

- In 2004 central forum on population, resources and environment, President Hu proposed to study green national economic accounting methods, explore resource consumption, environmental degradation of economic development, and maintain the relative balance between human and nature relationship.
- At the 17th National Congress of the CPC, president Hu indicated once more that the price paid for economic growth in terms of resource consumption and environmental pressure is too great.
- How much real cost has China paid for her economic growth?



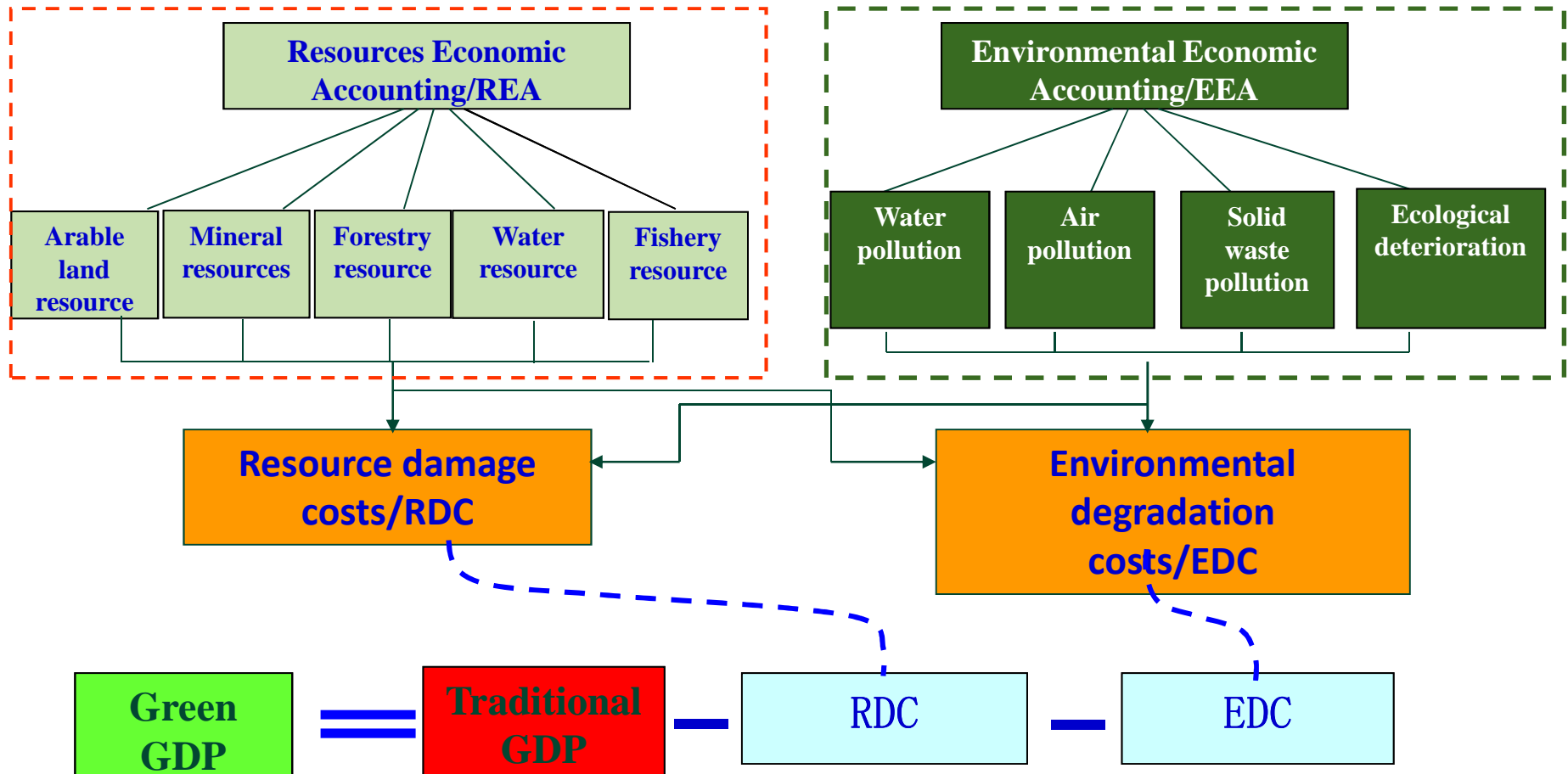


Chinese Progress on Green GDP accounting

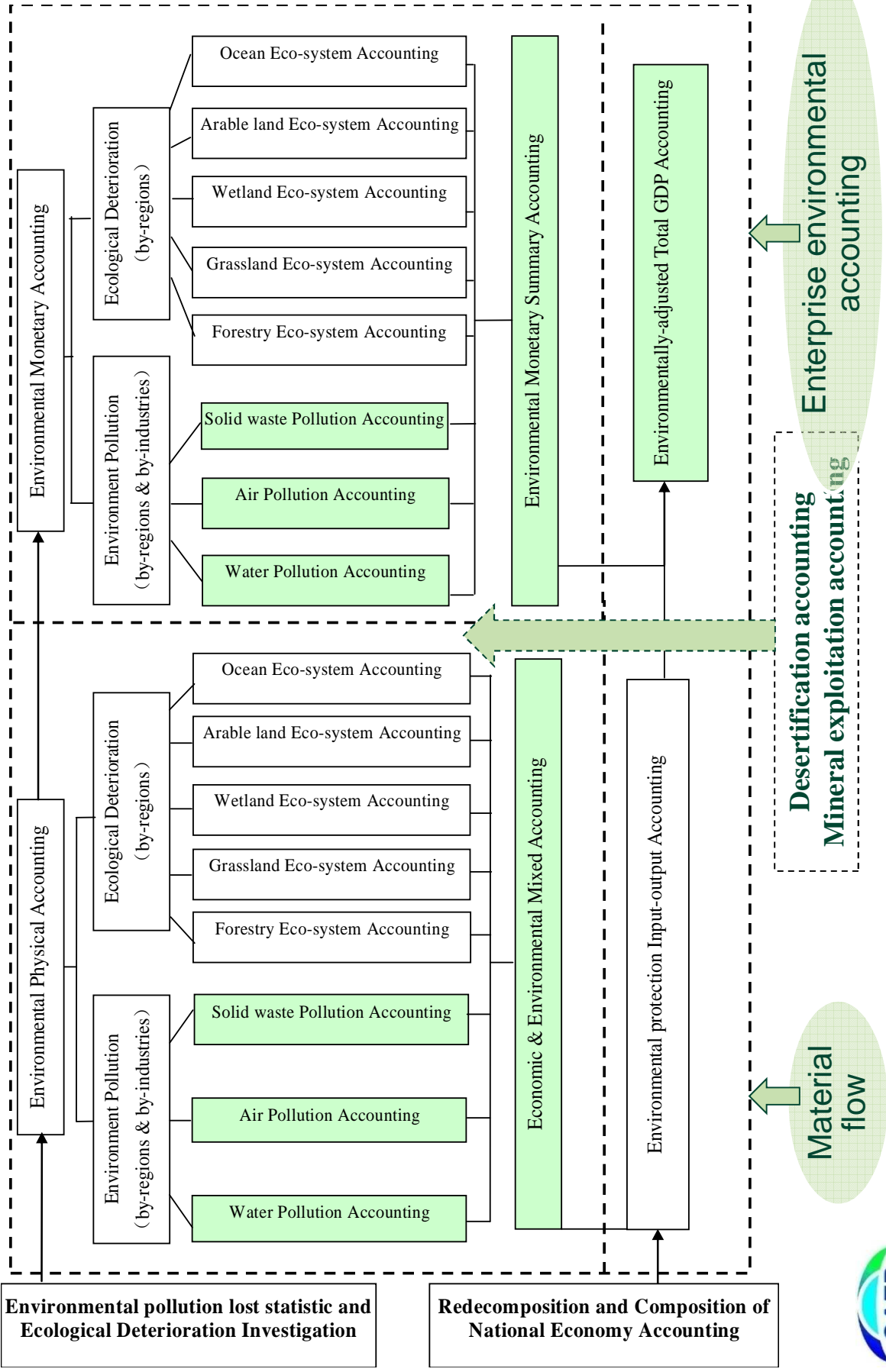
- **The State Environmental Protection Administration (SEPA) and the National Bureau of Statistics (NBS) jointly launched the project of *Integrated Environmental and Economic Accounting (Green GDP Accounting) of China* between 2004 and 2006.**
- ***China Environmental and Economic Accounting Study Report 2004* was issued by SEPA and NBS in 2006.**
- **CAEP as the representative of the technical group has completed five years report of China environmental and economic accounting during the period of 2004 to 2008 and the 2009 report is undergoing.**
- **NBS has committed to establishment of China resources and environmental economic accounting system, although it hold different views on green GDP.**



The Framework of Green GDP Accounting



The Framework of CSEEA Accounting





Environmental pollution accounting and Ecological deterioration accounting

Environmental pollution

- ❖ **Physical accounting:** pollution emission
 - Industries:** 3 major industries, 39 industrial sectors;
 - Regions:** 31 provinces
 - Indicators:** generation, discharge and treatment of wastewater and pollutants as SO₂, NO_x, COD, NH₃-H, household waste and industrial solid waste, etc.
- ❖ **Monetary accounting:** Imputed abatement cost
Environmental degradation cost

Ecological degradation

- **Physical accounting:** Stocks and flows (Changes in stock)
 - Regions:** 31 provinces
 - Indicators:** different ecosystems focused on different indicators
- **Monetary accounting:** Ecological deterioration cost





Concepts and definition in CSEEA



Imputed abatement cost refers to the cost paid for treatment of all the pollutants discharged into the environment in accordance with the current pollution control technology.

Imputed abatement cost = discharge × unit cost of the imputed abatement

Environmental degradation cost refers to damages on environmental functions, human health, crops production and etc. caused by pollutants discharge in the process of production and consumption with the current pollution control level.

Ecological damage cost refers to damages on ecosystem caused by human activities leading to deterioration of ecological quality, affecting the normal function of ecosystem services, bringing the loss of ecosystem services.

Pollution cost accounting matrix: causal agents and sectors

	Human health	Planting	Forestry	Livestock	Fishery	Land	Ground water	Material	Industry	Life	Tourism
Air pollution											
SO ₂	×	√	√					√			
TSP(PM ₁₀)	√	×								√	×
F	×			×							
Acid rain		√	×		×	×		√			
Ozone	×	×	×								
Heavy metal	×	×				×					
Indoor pollution	×										
Water pollution											
Drinking water pollution	√			×	×						
Water pollution		√			×	×	×	×	√	√	×
Water shortage		√	√	√	√				√	√	√
Solid waste pollution						∅	×				
Noise, heat and radiation <i>et al</i>	×									×	
Pollution accidents							√				

Notes: √ indicates accounting item, × is not accounted now, ∅ means land loss is accounted, not including soil pollution



Monetary accounting by regions-imputed abatement cost

Regions	Water pollution		Air pollution		Solid waste		Total	
	Actual abatement cost	Imputed abatement Cost	Actual abatement cost	Imputed abatement Cost	Actual abatement cost	Imputed abatement Cost	Actual abatement cost	Imputed abatement Cost
	①	②	③	④	⑤	⑥	⑦=①+③+⑤	⑧=②+④+⑥
<u>Eastern region</u>								
Beijing								
...								
Hainan								
Subtotal								
Proportion to total %								
<u>Central region</u>								
Shanxi								
...								
Hunan								
Subtotal								
Proportion to total %								
<u>Western region</u>								
Inner Mongolia								
...								
Xinjiang								
Subtotal								
Proportion to total %								
Total								



Monetary accounting by regions-environmental pollution cost

Regions	Air pollution cost					Water pollution cost					Cost of land occupied by solid waste	Cost of pollution accidents	Total	GDP	Percentage of pollution cost to GDP (%)	
	Health	Agriculture	Material	Daily life	Total	Water shortage caused by pollution	Health	Life	Industrial water pretreatment	Agriculture						Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)						(11)
Eastern regions	Beijing												—			
												—			
	Hainan												—			
	Total												—			
	Rate %												—			
Central regions	Shanxi												—			
												—			
	Hunan												—			
	Total												—			
	Rate %												—			
Western regions	Inner mongolia												—			
												—			
	Xinjiang												—			
	Total												—			
	Tate %												—			
Total																

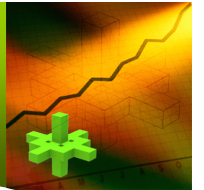
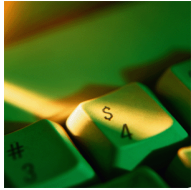


Framework for ecological deterioration cost

Ecological function	Production of organic substances	Air conditioning	Water conservation	Water storage balance	Soil Conservation	Nutrient cycling	Pollution Mitigation	Wildlife habitat	Disturbance regulation
Forestry	√	√	√		√	√	√	√	
Wetland	√	√	√	√	√	√	√	√	√
Grassland	√	√	√		√	√			
Arable land	×	×	×		×	×			
Marine	×	×		×		×	×	×	×

Notes: √ indicates accounted item, × indicates not accounted item.





2. Methodologies for ecologic degradation valuation

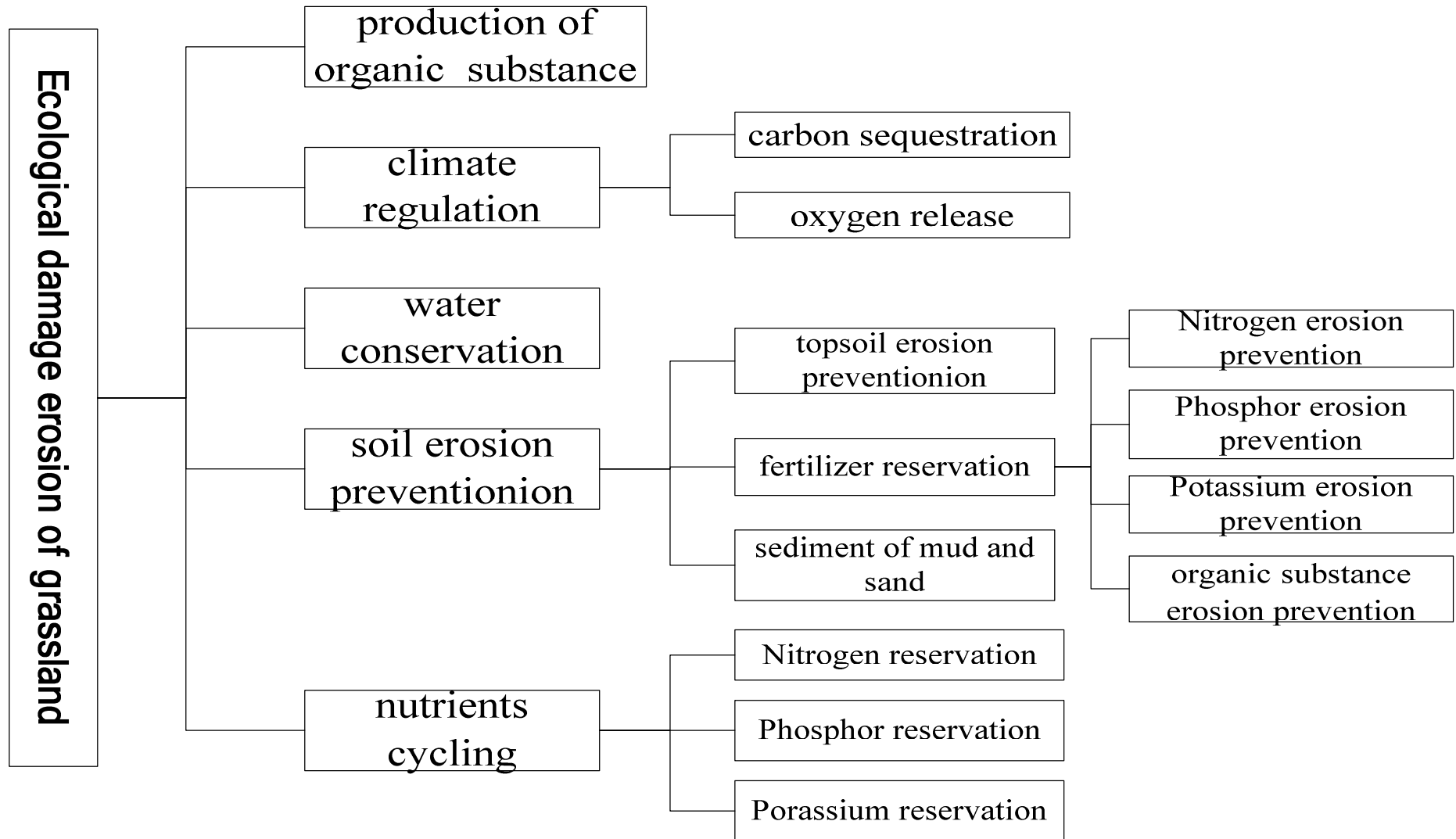


Accounting methods and contents of ecological deterioration of grassland

Number	Contents	Methods	
		Physical accounting	Monetary accounting
1	Loss of production of organic substances	Ecological remote sensing	Replacement value method
2	Loss of air conditioning	Photosynthesis equation	Carbon trading price and industrial oxygen price
3	Loss of water resource conservation	Water storage function	Shadow engineering method
4	Loss of soil erosion	Soil erosion function	Opportunity cost method, Replacement value method, Shadow engineering method
5	Loss of nutrient cycling	Nutrient cycling function	Market value method



Indicators for economic loss valuation of Grassland deterioration





Scopes and data sources

- ❖ **Scopes:** 31 provinces, inclusive of alpine meadow, alpine grassland, meadow, highland lawn, grass slope, desert grassland.

- ❖ **Data used for calculation:** observation data of meteorological data, remote sensing data, soil data, DEM data, administrative map and other economic statistical data, and their sources are:
 - **Meteorological data:** State Meteorological Bureau of China;
 - **Remote sensing data:** Chinese Academy of Agricultural Sciences
 - **Soil data:** China soil type map of 1:100 million based on the second soil survey, and soil properties(1km × 1km) data coming from China Soil Annals
 - **DEM data:** <http://www.nasa.gov/centers/hq/home/index.html>, 1km × 1km
 - **Boundary data:** 1:400 million provincial boundary map of China
 - **Economic statistical data:** relevant literatures, Price Monitoring Center of China, Collection of Agricultural Product Price in China in 2006, and other survey data.

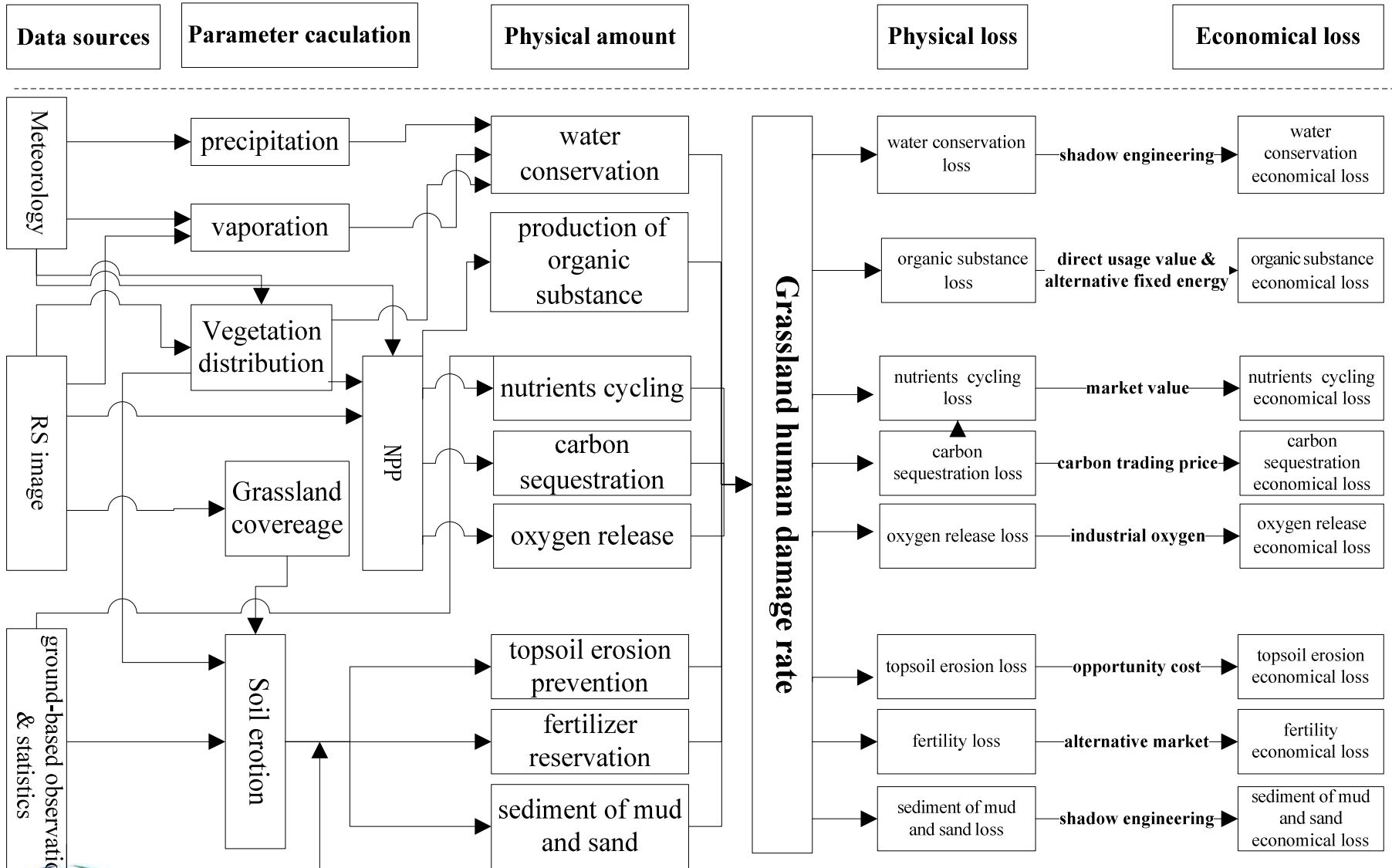


Physical accounting of grassland ecological deterioration

Regions		Loss of production organic substances / t	Loss of Climate regulation		Loss of water conservation / m ³	Loss of water and soil conservation/ t						Loss of nutrient cycling / t		
			Carbon sequestration / t	Oxygen release / t		topsoil	soil N	soil P	Soil K	Soil organic substances	Sediment of mud & sand	N	P	K
Eastern region	Beijing													
	Tianjin													
													
	Total													
	Rate %													
Central region	Shanxi													
	Jilin													
													
	Total													
	Rate %													
Western region	Inner Mongolia													
	Guangxi													
													
	Total													
	Rate %													
Total														



Technical Line





Methods for physical damage accounting



- **Area of grassland:** Interpretation from time-series remote sensing data of MODIS / NDVI with 1km resolution.
- **Production of organic substances:** improved CASA model
- **carbon sequestration and oxygen release:** conversion of organic matter according to photosynthesis equation.
- **Water conversation:** If underlying surface is soil (woodland, scrub, grassland, etc.), it is estimated by water storage capacity of different vegetation.; If it is water (river, rice fields, marshes, etc.), it is estimated by rainfall conversion rate.
- **Soil conservation:** water erosion quantity is based on USLE model, and wind erosion quantity is estimated with national standards (SL190-96).



Methods for physical damage accounting

$$L = \sum V_c \times r$$

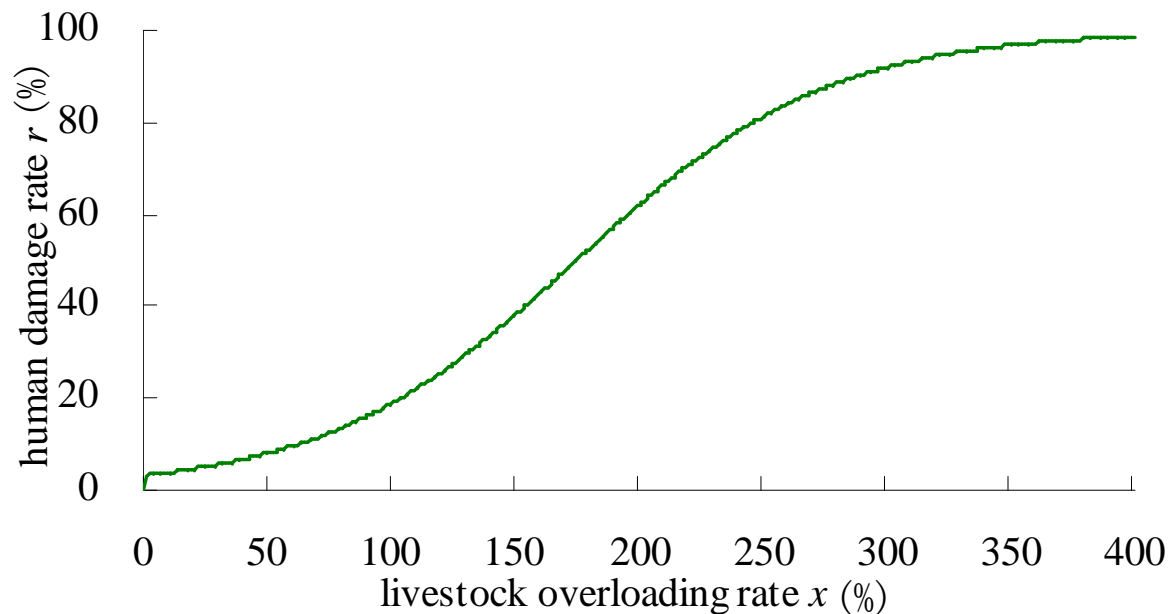
- ❖ L is the cost of grassland ecological deterioration.
- ❖ V_c ($c=1,2,\dots,n$) indicates the various ecosystem service value of grassland, such as climate regulation, water and soil conservation, etc.
- ❖ r is the destruction rate of human activities.



How to get r ?- destruction rate of human activities

- ❖ Relationship between grassland livestock overloading rate and grassland vegetation degradation views a Logistic growth curve

$$r = \frac{1.0}{1.0 + 29.875 \times 0.143^x} \quad x > 0$$
$$r = 0 \quad x = 0$$



Accounting contents and methods of Wetland ecological deterioration

No.	Type of ecological damage	Methods	
		Physical accounting	Monetary accounting
1	Production of organic substance	Ecological remote sensing method and unit NPP calculation	Replacement value method
2	Air conditioning	Photosynthesis equation	Market value method
3	Water conservation	Water storage converting function	Shadow engineering method
4	Soil conservation	Soil erosion function	Opportunity cost, Replacement value method
5	Nutrient cycling	Nutrient cycling function	Replacement value method
6	Wildlife habitat	Destroyed wetland area by human activities	Unit resource value method
7	Pollution mitigation	Destroyed wetland area by human activities	Unit resource value method
8	Flood mitigation	Destroyed wetland area by human activities	Unit resource value method
9	Disturbance regulation	Destroyed wetland area by human activities	Unit resource value method

Data source: Census for China National Wetlands Inventory 2003



Physical accounting of wetland ecological deterioration

Region	Destroyed area by human activities / hm ²	Loss of production of organic substances / t	Loss of air conditioning		Loss of water conservation /m ³	Loss of soil conversation/ t					Loss of nutrient cycling/ t			
			Carbon Sequestration/ t	Oxygen release / t		Topsoil	Soil N	Soil P	Soil K	Soil organic substances	N	P	K	
Eastern region	Beijing													
	Tianjin													
													
	Total													
	Rate %													
Central region	Shanxi													
	Jilin													
													
	Total													
	Rate %													
Western region	Inner Mongolia													
	Guangxi													
													
	Total													
	Rate %													
Total														



Monetary accounting of wetland ecological deterioration

Region	Cost of production of organic substances	cost of Climate regulation		Cost of water conservation	Cost of soil conservation		Cost of water storage balance	Cost of nutrient cycling			Cost of pollution mitigation	Wildlife habitat cost	Cost for disturbance regulation
		Sequestration	Oxygen release		Topsoil	Soil fertility		N	P	K			
Eastern region	Beijing												
	Tianjin												
												
	Total												
	Rate %												
Central region	Shanxi												
	Jilin												
												
	Total												
	Rate %												
Western region	Inner Mongolia												
	Guangxi												
												
	Total												
	Rate %												
	Total												



Accounting content and methods for forestry ecological deterioration

No.	Ecological damage	Methods	
		Physical accounting	Monetary accounting
1	Loss of production of organic substances	Ecological remote sensing	Replacement value method
2	Reduced ability for climate regulation	Photosynthesis equation	Replacement value market
3	Loss of water conservation	Water conservation function	Shadow engineering method
4	Loss of soil conservation	Soil erosion function	Opportunity cost method, Replacement value method, Shadow engineering method
5	Loss of soil nutrients (N, P, K)	Nutrient function	Replacement value market
6	Reduced wildlife habitat	Field survey	Unit resource value method
7	Reduced pollution mitigation	Pollution mitigation function	Replacement value market

Data source: 6th and 7th Census for China National Forestry Inventory



Desertification Hazard Classification and accounting methods

Damage of desertification	Hazards	Loss Category	Methods
Resources damage	land degradation	Loss of soil fertility	Replacement value method
Environmental damage	Environmental pollution	Increase in medical care costs	human capital approach
Production damage	Agricultural loss	Loss of crop production Loss of livestock production	Market value method Replacement value method
Infrastructure damage	Living facilities destruction Hydropower Facilities destruction	Housing Construction Sedimentation losses of irrigation canal Loss of reservoir sedimentation Increased investment in flood control	Restoration cost method Restoration cost method Restoration cost method Defensive expenditures method
Traffic damage	Transport damage	Loss of road traffic Loss of rail traffic Loss of air traffic	Restoration cost method Defensive expenditures method Replacement value method

Data source: 3rd Survey for China National Desertification 2005



Physical accounting of desertification ecological deterioration

regions	Land	Agricultural production	Livestock production	Transportation			Hydraulic facility			Living facility	Health effect
	Desertification area/ 10^4km^2	Affected agricultural area/ 10^4km^2	Affected livestock area/ 10^4km^2	Highway mileage / 10^4km	Railway mileage / 10^4km	Flight delays /hours	Irrigation channels Buried by sand/ 10^4k m	Reservoir sedimentation / 10^4m^3	River sedimentation / 10^4m^3	Housing area / 10^4m^2	Outpatient times
Shanxi											
Hebei											
Ningxia											
Shaanxi											
Qinghai											
Gansu											
Tibet											
Inner Monglia											
Xinjiang											
Others											
Total											



Monetary accounting of desertification ecological deterioration

Regions	Cost of land	Cost of agricultural production	Cost of Livestock production	Cost of transportation			Cost of hydraulic Facility			Cost of living facility	Cost of health effect
	Desertification land	Affected agriculture	Affected livestock	Highway	Railway	Flight	Burial irrigation channels	Reservoir sedimentation	River sedimentation	Housing damage	Outpatient
Shanxi											
Hebei											
Ningxia											
Shaanxi											
Qinghai											
Gansu											
Tibet											
Inner Monglia											
Xinjiang											
Others											
Total											



Ecological deterioration of mining activities

Land
destruction
and
occupation

Groundwater
damage

Waste
emission

Geological
hazard

How we get the affected areas of mines?

Total estimation: regression
analysis

survey for the 25 key mining
areas field survey

3 typical survey of mining
areas: remote sensing &
field survey



Physical accounting of Ecological deterioration of mining activities

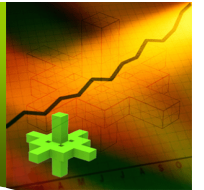
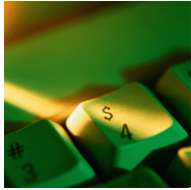
Regions		Environmental pollution			Ecological deterioration				
		Air pollutant emission /10 ⁸ m ³	Wastewater discharge /10 ⁴ t	Solid waste deposit /10 ⁴ t	Occupied arable land area /10 ⁴ ha	Occupied forest ry area /10 ⁴ ha	Occupied grassland area /10 ⁴ ha	Loss of groundwater /10 ⁴ m ³	Geological hazard area / ha
Eastern region	Beijing								
	Tianjin								
								
	Total								
	Rate %								
Central region	Shanxi								
	Jilin								
								
	Total								
	Rate %								
Western region	Inner Mongolia								
	Guangxi								
								
	Total								
	Rate %								
Total									



Monetary accounting of Ecological deterioration of mining activities

Regions		Cost of environmental pollution				Cost of ecological degradation					Total	
		Air pollutant emission	Wastewater discharge	Solid waste deposit	Sub-total	Arable land destruction	Forestry land destruction	Grassland land destruction	Groundwater destruction	Geological hazard		Sub-total
Eastern region	Beijing											
	Tianjin											
											
	Total											
	Rate %											
Central region	Shanxi											
	Jilin											
											
	Total											
	Rate %											
Western region	Inner Mongolia											
	Guangxi											
											
	Total											
	Rate %											
Total												





3. Challenges in the future CSEEA





Challenges in the future CSEEA

- **How to put the accounting results into practical use to improve the effectiveness of environmental governance?**
 - **Make environmental performance review based on environmental and economic accounting**
 - enterprises
 - provinces
 - water basins
 - pollution emission reduction
 - **Cost-effect/benefit Analysis**
 - Environmental plan
 - Environmental policies
 - Environmental projects
 - Etc.





Potential application areas

- **Set basis for the design of environmental economic policies**
 - Basic studies: waste generation and discharge coefficient, unit waste treatment cost, pollution and ecologic cost
 - Application areas:
 - **Impute abatement cost:** environmental investment gap and requirement
 - **Environmental input-output accounting:** economic contribution or reduction of environmental protection activities
 - Provide basis for environmental taxation, ecological compensation, industries restructuring, evaluation for sustainability





Challenges in CSEEA

❖ How to get the available data for CSEEA?

- Environmental data
 - Air pollutants: O₃, VOCs, Heavy metal
 - water quality data of rural area, water shortage data
 - Soil pollution:
- Ecological data
 - It is almost impossible to get the surveying data of relevant ministries.

❖ Methodological issues

- Physical pollution
- Value of natural resource
- Value of environment as such
- Value of ecological service





Ongoing activities

- **Set up the environmental accounting system and methodologies**
 - Design a set of indicators for evaluation of resource productivity efficiency and their social and environmental cost and guide the plants improve their environmental management level.
 - Set basis for the environmental risks recognition and management, environmental information disclosure, public environmental rights and interests.
- **Set up the material flow accounting system and methodologies**
 - Design a set of accountable, measurable and applicable indicators for evaluation of circular economy.
 - Set basis for evaluation of sustainability.
- **Develop environmental plans based on CSEEA and MFA**
- **Having studies on wild life habit and develop the Chinese quantitative or semi-quantitative evaluation methods for biodiversity.**





Thanks for your attention

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