

# Sustainable Development in China

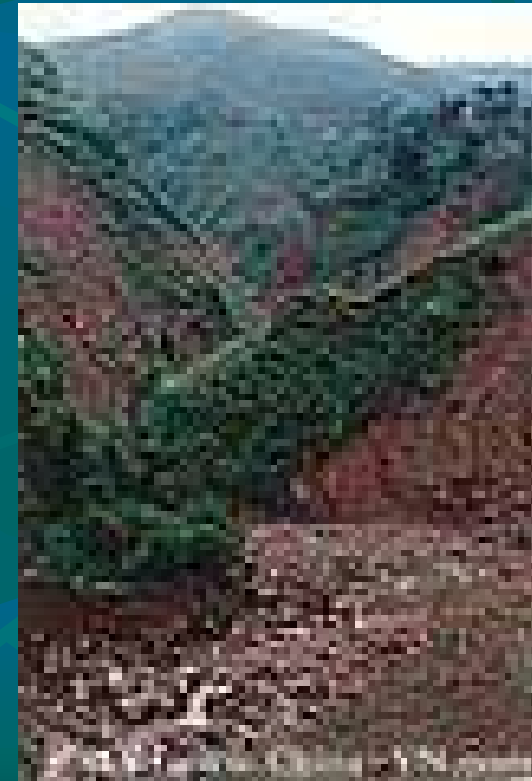
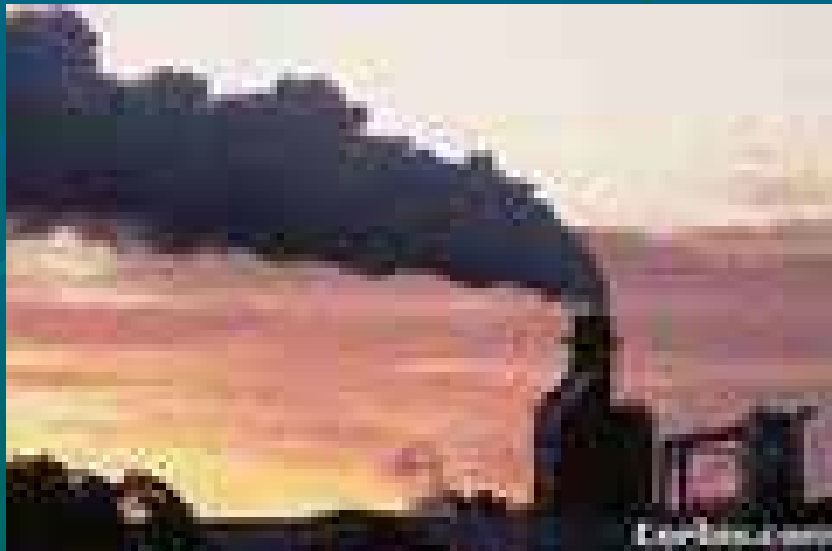


# New Words:

- GDP 国内生产总值      GPI 真实发展指标
- borrowing resources from the future 对未来资源的预支
- Shift functions from the community and household realm to that of the monetized economy  
对家庭和社区领域的功能转为由有偿劳动来承担
- Lifespan of consumer durables 耐用消费品的服务
- public infrastructure 公共基础设施
- resources-saving society 节约型社会
- Cycled economy 循环经济
- Cleaner Production Promotion Law <<清洁生产促进法>>
- Ecopolis 生态社会

# 1. Environmental issues in China

- Pollution
- Deterioration of Ecosystem



# 1.1 Pollution

- Just the cost of damages resulted from air and water pollution each year is conservatively estimated as high as **54 billion US Dollar** or roughly **8 percent of China's GDP**.



# Water pollution

- --- Cleaning up water pollution is called top priority.

China issues dire environment report (June 6, 2003 )

--- More than half the watersheds of China's seven main rivers are contaminated by industrial, farm and household waste.

annual report on the state of environment ( 2002 )

- Among the seven biggest water system, the one below “the V standard “ are nearly **27.9%** , and lost their direct function for using .
- From 2001 to 2004 , there are **3988** water pollution accidents happening in China ,nearly 1000 annually.
- In more than 1000 sources of the surface water, the unqualified one are almost **25%**.

- Nowadays ,there are 300,000,000 people in the rural area drinking unsafe water
  - Nearly 190,000,000 people drink water with nocuousness material
  - 63,000,000 people drink water with high fluorin
  - 2,000,000 people drink water with high As
  - 38,000,000 people drink bitter salt water



- The World Bank recently reported that about **50%** of the monitored urban river sections in northern China do not meet the lowest ambient standards, making the water unsuitable even for irrigation.
- Only about **8 percent** of the monitored urban river sections in northern China meet the standards for direct human contact.

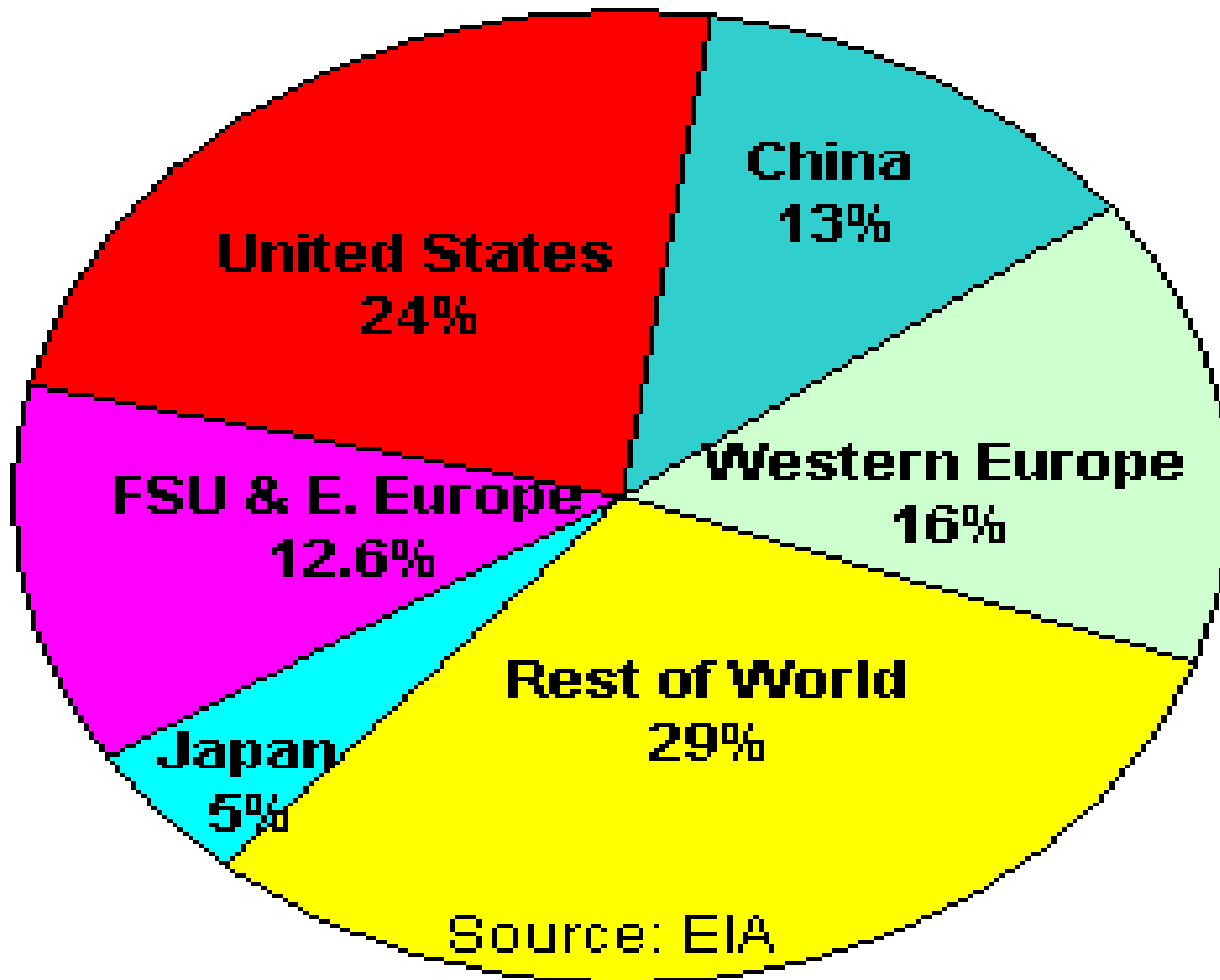


# Air pollution

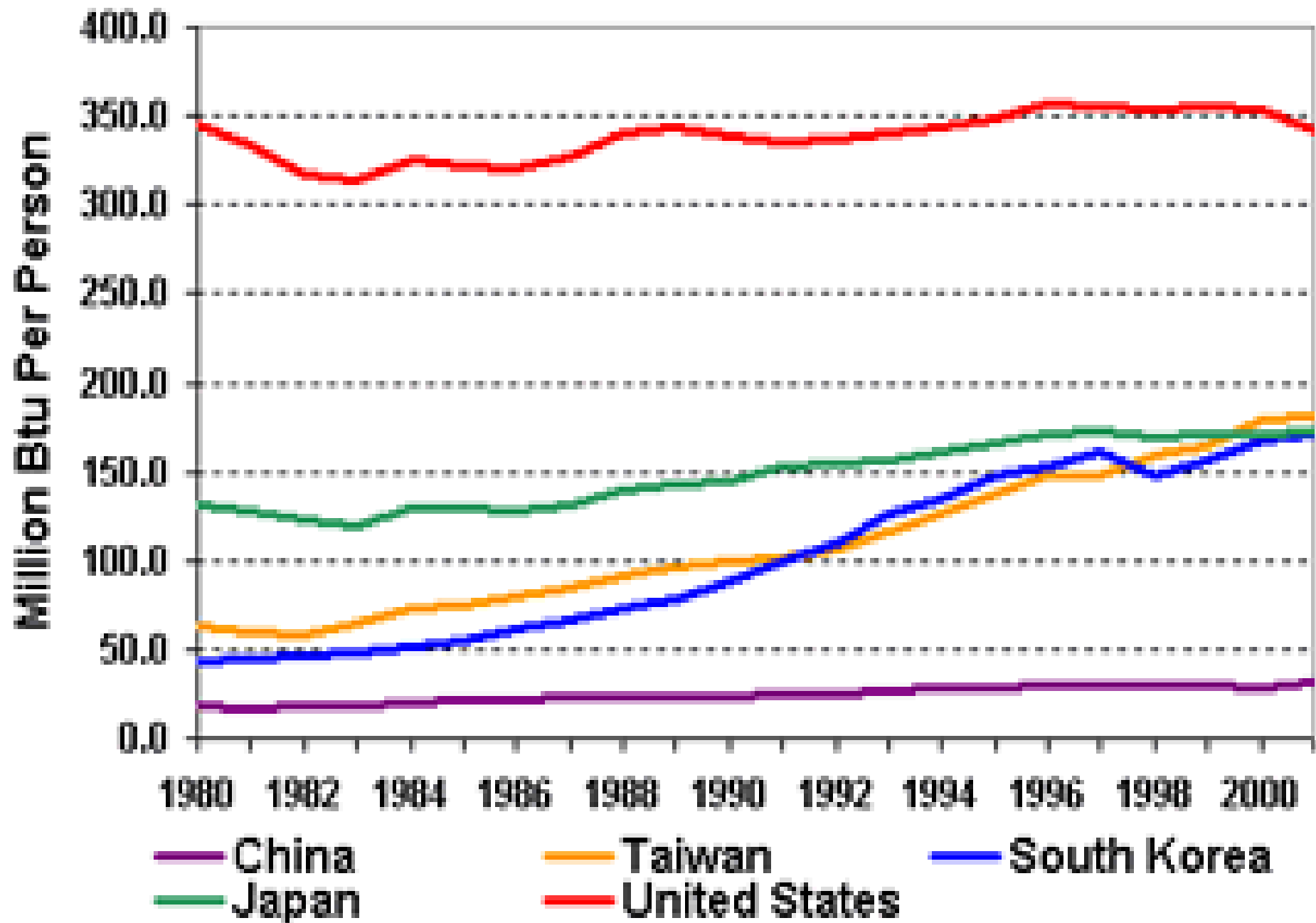
- The ten most polluted cities in China ( 2004 ) :  
Linfen , Yangquan , Datong , Jinchang , Yibin ,  
Zhuzhou , Chongqing , Jiaozuo , Changzhi , Panzhihua  
(临汾、阳泉、大同、金昌、宜宾、株洲、重庆、焦作、  
长治、攀枝花)
- Sulfur dioxide and soot caused by coal combustion are two major air pollutants, resulting in the formation of acid rain, which now falls on about 30% of China's total land area.
- Industrial boilers and furnaces consume almost half of China's coal and are the largest single point sources of urban air pollution.

*--- A report released in 1998 by the WHO*

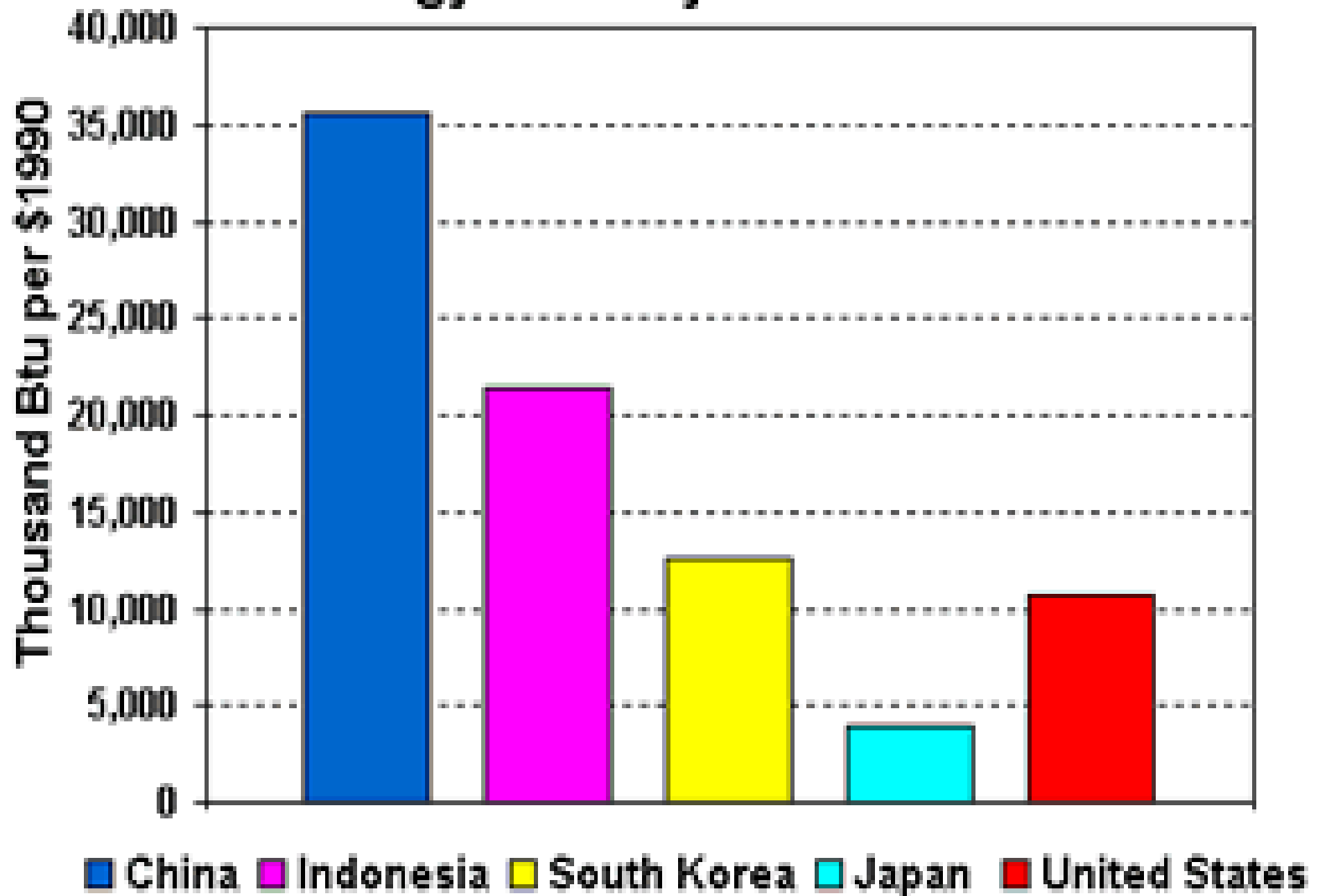
# 2001 Energy-Related Carbon Emissions



## Per Capita Energy Consumption of Selected Countries



## 2001 Energy Intensity of Selected Countries



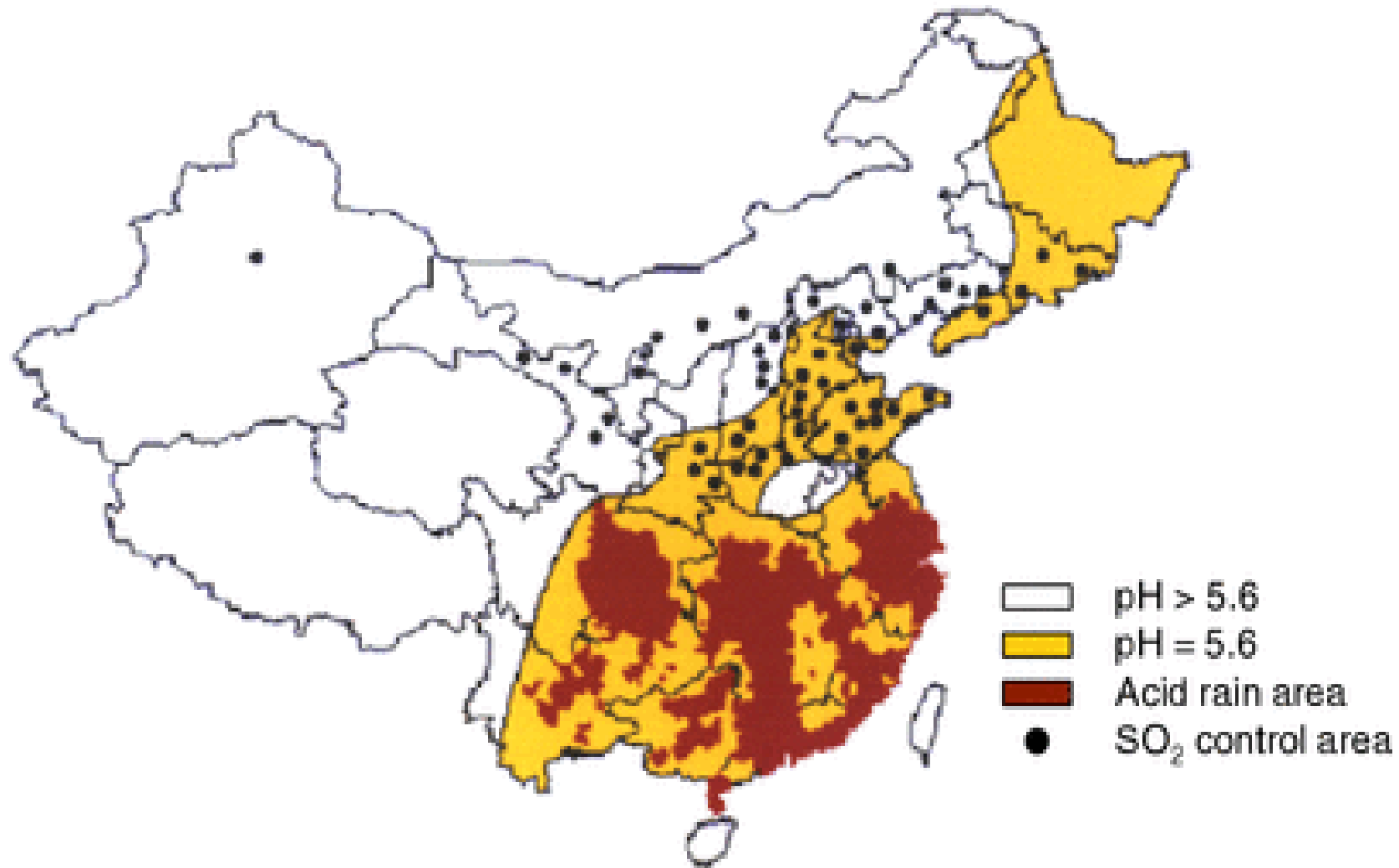


FIGURE 9 Damage from SO<sub>2</sub> and NO<sub>x</sub> emissions.

- Air pollution is an important factor contributing to the high mortality rate of chronic obstructive pulmonary disease in China .
- The World Bank report stated that nearly equal rates of the disease among men and women in China (despite the fact that few women smoke) suggest that high concentrations of indoor and outdoor air pollutants are the main cause of chronic obstructive pulmonary disease in China.

# Other pollutions

- In 2002, the noise of traffic in 325 cities was monitored, and more than **60 percent** had mild noise pollution.
- Total domestic garbage reached **136.38 million tons**, an increase of 1.2 percent over the previous year.





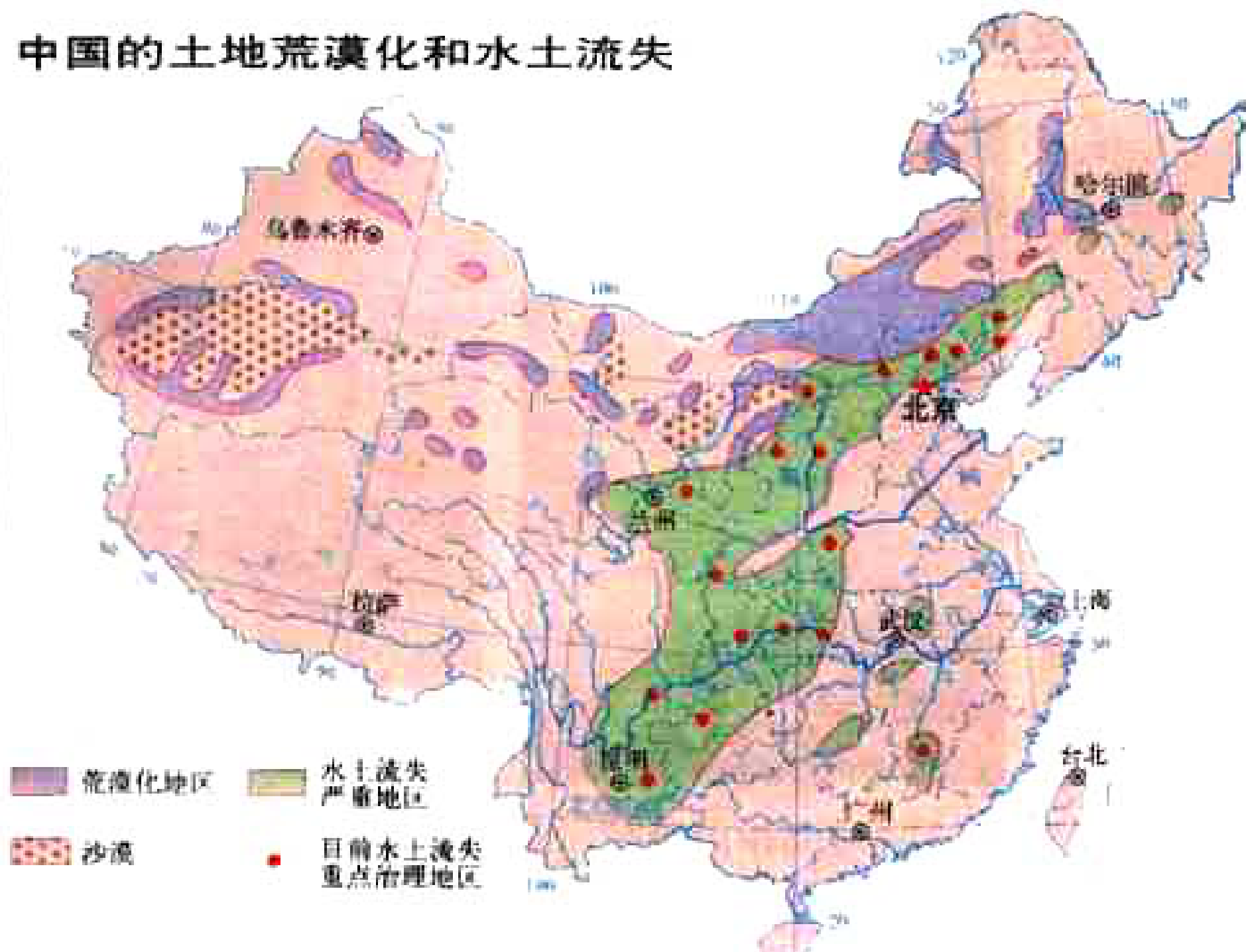
- According to the 1997 Report on the State of Environment by NEPA
  - the rate of industrial solid wastes re-utilization increased 2.2%
  - the total rate of industrial solid wastes re-utilization is only 45.2%.
  - 45.8% of the total solid wastes are not been re-utilized.
  
- Most of the household wastes are disposed by simple landfill ---- occupy large land space & causes water and air pollution.

# 1.2 Deterioration of Ecosystem

- Erosion, desertification, droughts, storms, and sandstorms...



# 中国的土地荒漠化和水土流失



## 2. Causes of environmental degradation

- Pressures of population growth and economic development
- Backward environmental technology and weak management
- Conflict between environmental protection and economic development

- Environmentally adverse industry locations
- Weaknesses of government functions in environmental management
- Weak law enforcement
- Lack of effective efficient environmental policy instruments.

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# **3. Implementation of Rio Declaration**

- **Part One** ---- An overview of the implementation of Rio Declaration in China
  - Relevant policies, plans, laws
  - Institutions
  - Problems and Possible Solutions
- **Part Two** ---- Implementation of the Rio Principles



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## 3.1 An Overview

## *A. Policy, Plan and Law*

- China participated in the UN Conference on ED held in Rio De Janeiro in 1992 .
- China have signed all the major legal documents concluded:
  - Rio Declaration on Environment and Development
  - Agenda 21
  - Framework Convention on Climate Change
  - Convention on Biological diversity
  - Forest Principles.

# Developments and Progress

- The adoption of the Ten Important Measures on ED by the Chinese Government in August, 1992 .
  - The first time officially adopted the concepts of sustainable development and the strategy of sustainable development
- The establishment of Leading Group and the Center for the Management of China's Agenda 21.
- The adoption of China's Agenda 21

- National Five-Year Plan for Social and Economic Development and the Outline of Long-term Social and Economic Development Objectives for the Year 2010

--- March 17, 1996

- Major national, regional and local action plans
- Framework of Environmental Legislation
- Implementation and Enforcement of Law



# China's Agenda 21

- The adoption of the Chinas Agenda 21 by the State Council on Feb 25, 1994.
  - *sector 1:*  
Sustainable Development Major Strategies
  - *sector 2:*  
Society Sustainable Development
  - *sector 3:*  
Economic Sustainable Development
  - *sector 4:*  
Conservation and Sustainable Use of Natural Resources and environment



# Sustainable Economy

- China's Agenda 21 states that China must keep a proper high rate of economic growth in order to eliminate poverty and meet the basic material needs and the increasing cultural needs of people.
- The Agenda sets forth an average rate of 8-9% annual GNP growth for the remaining years of this century.
- The Agenda calls for reforming economy and switching to the track of sustainable development.

# Sustainable Society

- maintaining public order and social stability
- population growth control and population quality improvement
- justice distribution of social wealth
- carrying forward the moral and cultural tradition
- strengthening education and training
- housing and medical condition improvement
- enhancement of the sense and capability of sustainable development of the population especially the governmental leaders at various levels of the government.



# Sustainability of Natural Resources & Ecological Environment

- Protecting the life supporting capacity of the nature
- Solving the major ecological problems
- Prevention and control of pollution
- Improvement of urban and rural environment conditions
- Sets forth the general goal of environmental protection for the year 2000

# International Participation & Cooperation

- Greenhouse gas control
- Save alternative substances of CFC and relevant technology
- Toxic chemicals and hazardous wastes control
- Marine environmental protection
- Biodiversity conservation.



# Major Plans

- Trans-Century Green Project
- A Total Quantity Control Plan for Industrial Pollutants
- Helping Eighty Million People in Seven Years Plan
- Forestry Action Plan
- Chinas Water Conservation Agenda 21
- National Plan for Medium-and-Long-Term Water Supply and Demand
- Program and Ninth Five-Year Plan of Water Pollution Control in the Huai River Basin
- Chinas Ocean Agenda 21 and Action Plan



# Framework of Environmental Legislation

- The Constitution of PRC (1982) and its amendments (1979, 1989)
- Pollution control laws and the related implementing regulations
- Natural resource laws and the related implementing regulations

- Laws and regulations related to environmental protection
- International environmental treaties
- Various environmental standards



# The Environmental Protection Law

- “Comprehensive basic law” or “The Charter” of EP in China
- Establishe the governmental organization on environmental regulation
- All units and individuals have duty to protect environment and file a lawsuit against the violators of environmental law



- Marine Environment Protection Law (1982)
- Law on Prevention and Control of Water Pollution (1984, 1996)
- Law on Prevention and Control of Air Pollution (1987, 1995)
- Law on Prevention and Control of Pollution Caused by Solid Wastes (1995)
- Law on Prevention and Control of Noise Pollution (1996)....





- Forest Law (1984, 1997)
- Grassland Law (1985), Fishery Law (1986)
- Mineral Resources Law (1986, 1996)
- Law on Coal Mining (1996)
- Land Management Law (1986, 1988, 1998)
- Water Resources Law (1988)
- Water and Soil Conservation Law (1991)
- Wild Animal Protection Law (1988)
- Cultural Relics Protection Law (1982, 1991)



- General Principles of Civil Law (1986)
- Criminal Law (1979, 1997)
- Administrative Litigation Law (1989)
- Law on Civil Procedure (1991)
- Law on Criminal Procedure (1979, 1996)
- Law on Administrative Penalty (1996)
- State Compensation Law (1994) ...



- The new Criminal Law (1997) , specifies environmental crime as a new category of crime.
  - radioactive wastes
  - toxic substances
  - hazardous wastes
  - aquatic resources
  - endangered wild animals
  - land management
  - mineral resources and forests management



- Basel Convention on Control of Trans-boundary Movement and Disposal of Hazardous Wastes (1989)
- Vienna Convention on Ozone Layer Protection (1985)
- Montreal Protocol on Substances that Deplete Ozone Layer (1987, 1990, 1992)
- Framework Convention on Climate Change (1992)
- Convention on Biological Diversity (1992)
- Convention on Combating Desertification (1994)
- Convention on Nuclear Safety (1994).....
- In addition, China has contracted bilateral environmental agreements with 15 countries by 1996.



## ■ **state standards**

- ambient environmental quality standards
- pollutant discharge standards
- monitoring methodology standards
- environmental specimen standards
- basic scientific standards

## ■ **voluntary environmental standards**

- ISO 14000



# Implementation and Enforcement of Law

## *Strong actions :*

- closing down 15 kinds of small sized, heavy polluting factories
  - small scaled paper pulp mill
  - dying mill
  - electroplating mill
  
- China has closed down over **60,000** such polluting sources.  
---- National Report of the State of the Environment (1996)

## *Strong actions continue...*

- The first phase of water pollution control in Huai River Basin
- Return illegal trans-boundary movements of hazardous wastes and other wastes to the exporting countries

## *B. Institutions*

- China has established an nation-wide environmental regulatory institution in 1979.
  - The central level---- State Environmental Protection Administration (SEPA)
  - The local levels ---- Environmental Protection Bureaus (EPB)



# Environmental NGO

- Friend of Nature
- Earth Village
- China Division of the Wetland International
- student environmental groups and organizations
- Chinese Peoples Political Consultative Conference (CPPCC)

## *C. Problems and Solutions*

- Backward industrial technology and poor management of production
  - **Out-of-dated technology**
  - **Pollutions caused by TVIE**
  
- Environmentally unsustainable economic growth and the deterioration of environment
  
- Solutions

# Use of out-of-dated technology

- In terms of GDP produced by per Kg energy resource
  - Japan is 15 times higher than China
  - Germany and France are 9 times higher than China
  - United States is 5 times higher than China .

# Pollutions caused TVIE

- **TVIE** ----township and village industrial enterprises
- Industrial waste water discharged by TVIE in 1995 had occupied 21% of the national waste water discharge and increased by **120.5%** based on the level of 1989.
- COD discharge occupied 44.3% of the national total and increased **245.6%** based on the level of 1989.
- Total suspending substances discharge occupied 47.9% of the national total and increased **524%** based on the level of 1995.

## 2) Unsustainable Economic Growth and Environmental Deterioration

- Water resources shortage and Water pollution
- Air pollution
- Solid wastes
- Coastal water pollution

# 3) Solutions

- Continuing the economic reform and changing the mode of growth to sustainable development mode.
- Keeping properly high economic growth
  - eliminate poverty and to enhance the economic capability for environmental protection.
- Increasing investments for science and technology and continuing reform the systems of scientific research
  - lay down a strong scientific knowledge basis for economic and social development.

- Increasing investments for education  
---- enhance the quality of Chinese population and prepare a high quality human resource.
- Continuing control the growth rate of population  
----- avoid the disaster of over growth of population.
- Increasing investments for environmental protection  
---- stop the current trend of environmental deterioration and improve the nations environmental supporting capability.

- Improving the legal and policy making system
  - make the political process meet the requirements of sustainable economy, sustainable society and sustainable resources and environment supporting capability.
- Strengthening land management, including natural resources regulation, land use planing, urban planing and harnessing of major river and lake basins.
- Strengthening the administrative capacity in environment protection.



The background of the slide features a dark blue gradient with faint, stylized green and blue leaf patterns scattered across it. The text is centered and rendered in a white, serif font with a subtle drop shadow.

## **3.2 Implementation of the Rio Principles**

## Principle 2: States Sovereign Right to its Natural Resources and States Environmental Responsibility

- Principle 2 is the basis of whole international environmental law.
- It reflects the reality of the contemporary international society.
- It is the most important legal principle guiding the practice of China in global environmental protection.

## Principle 3: Right to Development, Inter and Intra Generation Equity and Integration Environment Protection with Development Process

- Give priority to developing national economy  
----alleviate poverty and improve the living standards of the people
- Change the pattern of economic growth
- Pursue the strategic change since the economic reform in 1978
- Technology innovation and upgrading ----integrating environment protection with the industrial development

## Principle 10: Public Participation

- Kept issuing a National Report on the State of the Environment annually for many years, for example, report on air quality.
- Peoples Congresses and CPPCC committees at various levels
- New legislation in the last decade
  - improved the legal channels for accessing to judicial and administrative proceedings

# Principle 13: Law on Liability

- specialized laws
  - civil liabilities
  - administrative liabilities
  - criminal liabilities
    - fine, detention and imprisonment
- general laws and regulations
  - General Principles of Civil Law (1986)
  - Administrative Punishment Law (1996)
  - Criminal Law (1979, 1997)
  - Regulations on Public Security Management and Punishment (1986, 1994).

# Principle 15: Precautionary Principle

- As a developing country, China assumes no obligation on green house gases reduction under FCCC and its protocol at present.
- But China has taken measures to control its air pollution, including green house gases emission control.
- Chinas practice on implementing precautionary principle including the activities implementing the Framework Convention on Climate Change, Vienna Convention on Ozone Layer Protection, and Montreal Protocol on Substances that Deplete Ozone Layer.

- Since December, 1993, no new project producing ozone-depleting chemicals has been allowed.
- Since 1995, a license is required for existing plants to produce chlorofluorocarbons in order to limit the quantity of CFCs.
- In the industry of electrical home-appliances, the manufacture of substitute refrigeration substances and products has progressed from lab research to experimental production-line manufacturing in several instances.
- In the aerosol industry, the shift to chlorofluorocarbon substitution is nearing completion.



# Principle 16: Polluter-Pay Principle

- **Prevention and Control of Water Pollution Law**
  - pay a discharging fee to the local urban infrastructure construction and maintenance department
  - pay an excessive pollutants discharging fee if the discharge violated the national or local pollutant discharge standards.
- **Mineral Resources Law**
  - pay a natural resources tax and a natural resources compensation fee





- Fishery Law

- pay a fee for propagation and protection of fishery resources

- Forest Law

- levying a fee for afforestation , forest restoration fee

## However ...

- The pollutant discharge fee is lower than the costs of controlling pollution by the polluters.
- The scope of the fee needs to be expanded to cover all pollutants discharging activities

## Principle 17: Environmental Impact Assessment

- EIA has been adopted by Chinese environmental law since the first Environmental Protection Law in 1979.
- Both the Environmental Protection Law (1979, 1989) and the specialized environmental statutes concerning pollution control and natural resources conservation have provisions on EIA.

- Minor environmental impacts or technology upgrading projects with total investment under certain sizes
  - filling an EIA Form.
- Large and medium sized construction projects having significant environmental impacts or technology upgrading projects with total investment under certain sizes but having significant environmental impacts
  - prepare an EIA Report.

# Principle 18: Notification of Environmental Emergencies

- China ratified the Convention on Early Notification of a Nuclear Accident
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1987 )
- Convention on Physical Protection of Nuclear Material ( 1989 )
- Convention on Nuclear Safety ( 1996 )

## **Principle 19: Prior Notification and Consultation**

- China ratified Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal in 1992
- assumed the obligation on prior notification and consultation on transboundary movements of hazardous wastes and their disposal.

# Principle 20: Womens Role

- The fourth World Womens Conference (1995) in Beijing ----encouraged further development of women in China
- One important contribution of women ---- the family planning policy
  - low population growth rate (about 0.1 to 0.2%) in the past ten years

# Programs to Help Chinese Women

- Illiteracy-elimination programs
- Science and technology training courses
- Employment training courses
- The Chinese Womens Federation
  - helping women and protecting women and childrens legal rights

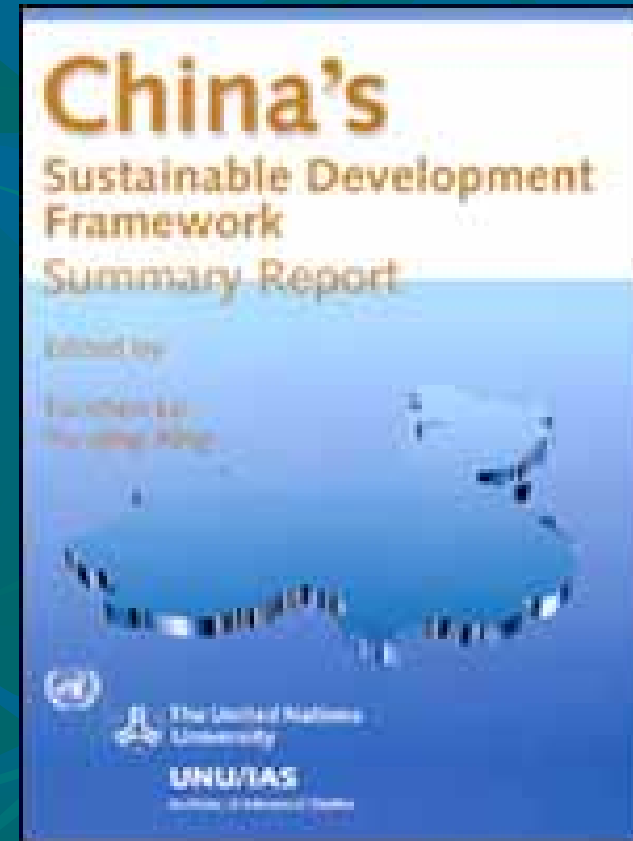


# Principle 21: Youths Role

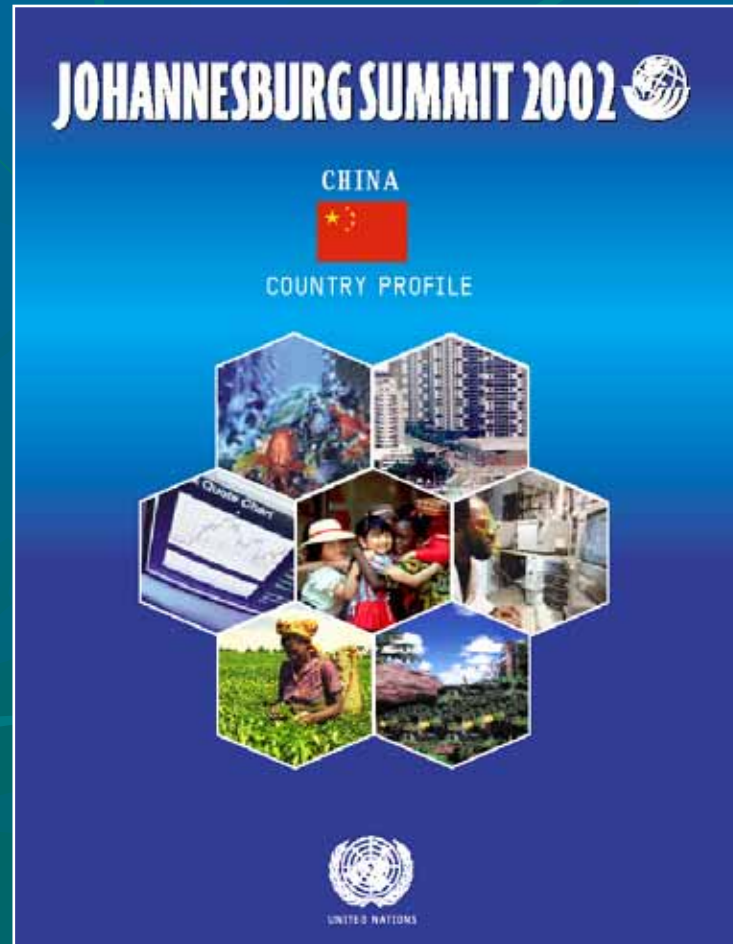
- Active in the cause of sustainable development  
----launched and implemented "Hope Project"
- From 1989 to 1995, the Project helped 1.25 million teenage dropouts back to school.
- By the end of June 1996, 2500 "Hope" primary schools had opened.

## 3.3 China's Sustainable Development Framework: Summary Report (Tokyo, UNU/IAS, 1999)

- Eco-restructuring for sustainable development:
  - ✓ the reconciliation of three broad objectives of economic growth (or development)
  - ✓ equity in development, both within and between countries
  - ✓ environmental sustainability



## 3.4 China Country Profile



The 2002 Country Profiles Series provides information on the implementation of Agenda 21 on a country-by-country and chapter-by-chapter basis .

# The purpose of Country Profiles :

- Help countries monitor their own progress
- Share experiences and information with others
- Serve as institutional memory to track and record national actions undertaken to implement Agenda 21.

**(1) CHAPTER 17:**

Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources.

**(2) CHAPTER 18:**

Protection of the quality and supply of freshwater resources: application of integrated approaches to the development, management and use of water resources

## 3.4.1 Protection of the oceans

### *Decision-Making:*

#### China's Ocean Agenda 21

- Exploration and protection of maritime resources, improvement of the polluted marine environment, and the implementation of sustainable development.



--- Made by The State Oceanic Administration, May of 1996



## *Programmes and Projects:*

- In 1993, the Xiamen coastal area was chosen as one of the three demonstration areas for the "Maritime Pollution Prevention and Control Project in South Asian Maritime Space" by UNDP, the Global Environment Facility and the International Maritime Affairs Organisation.



## *Information:*

- Information-sharing mechanism with nearly 100 institutions in more than 60 countries.
- China is actively promoting the implementation of the global ocean monitoring system programme and participating in the Northeast Asia Ocean Monitoring System Programme.
- China also formulated a national Oceanic Eco-Environment Monitoring Network Plan.



## *Status:*

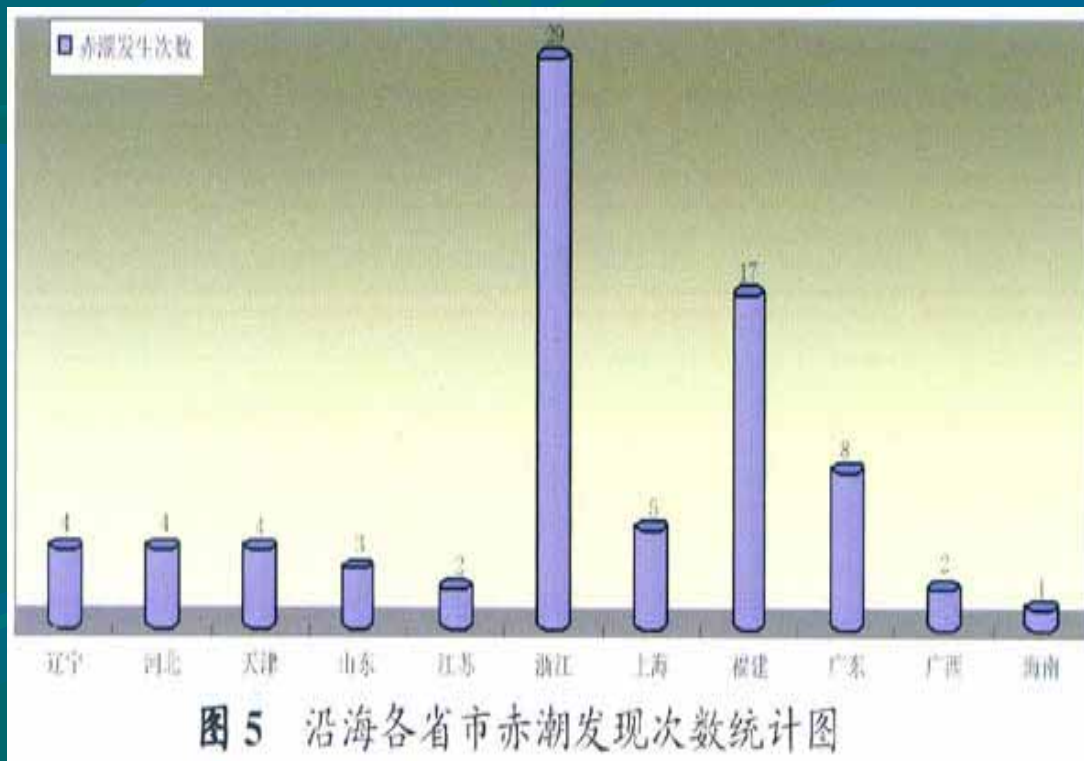
- In recent years, the Chinese fishery department has clearly stipulated that fishery fallowing must be carried out in the East China Sea and Yellow Sea in July and August 1999.
- Since the early 1990s, 25 nature preserves have been set up, covering a total area of 660,000 hectares.



## 2002年主要海洋灾害损失统计

灾种	发生次数	灾害次数	死亡、失踪 (人)	经济损失 (亿元)
风暴潮	8	2	30	63.1
赤潮	79	8	无	0.2
巨浪	33	6	94	2.5
溢油	6	2	无	0.05
合计	--	--	124	65.9

2002年我国海域共发现赤潮79次，其中渤海13次，黄海4次，东海51次，南海11次，累计面积超过10,000平方公里，直接经济损失2,300万元。



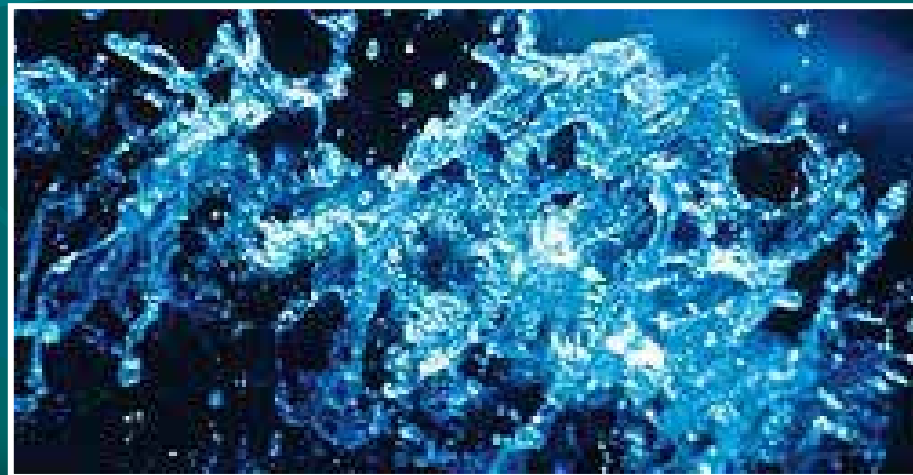
## *Cooperation:*

- China is involved in cooperation on international marine legislation, marine living resources in high seas, seabed mineral resources, marine scientific research, marine environmental protection, polar exploration and peaceful use, and marine affairs cooperation and exchange in the Asia-Pacific Region.
- The UN Convention on the Law of the Sea was ratified in 1996.

## 3.4.2 Protection of the quality and supply of freshwater resources

### *Decision-Making:*

- China's Water Conservation Agenda 21
- National Plan for Medium- and Long-Term Water Supply and Demand

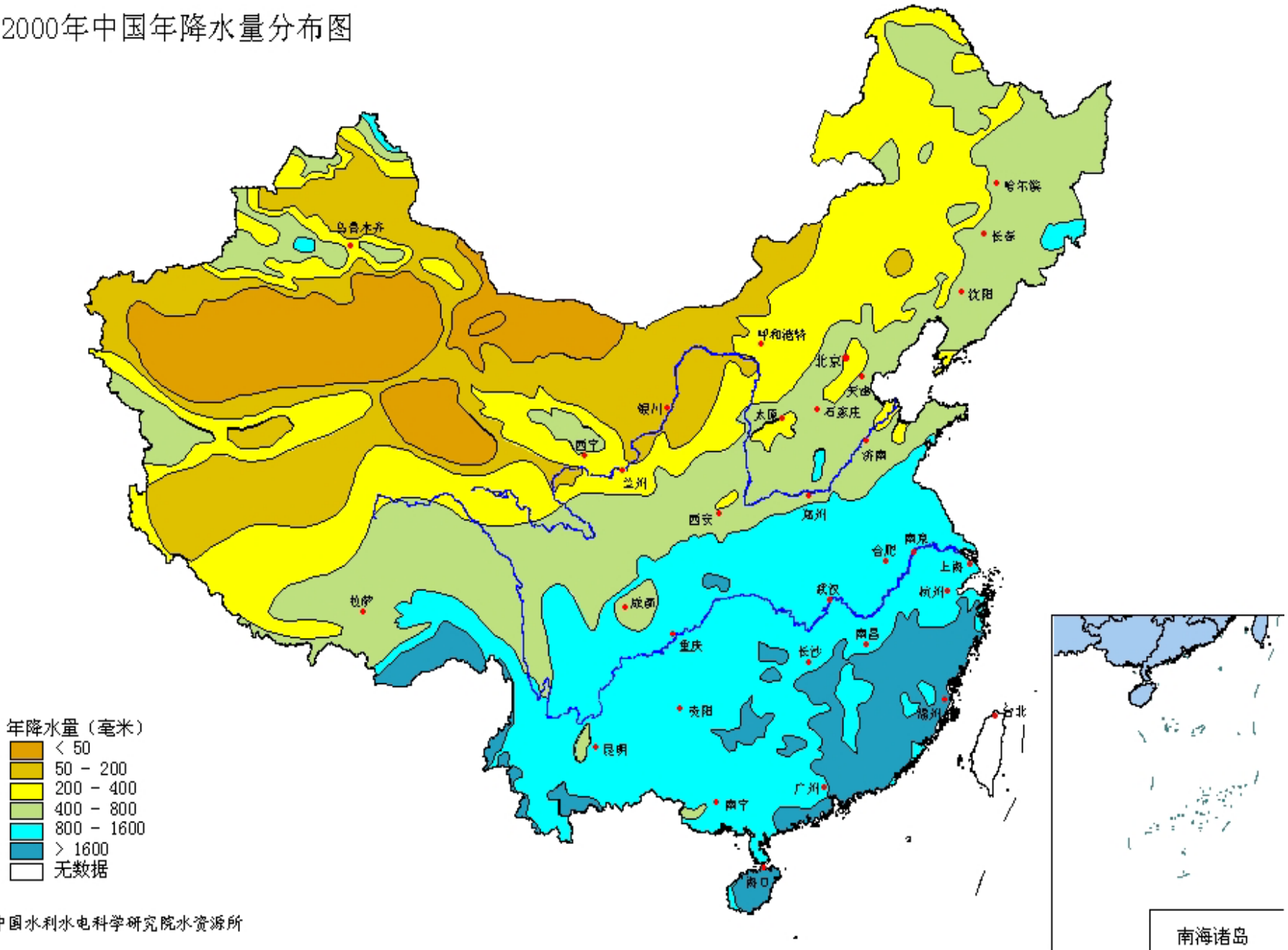




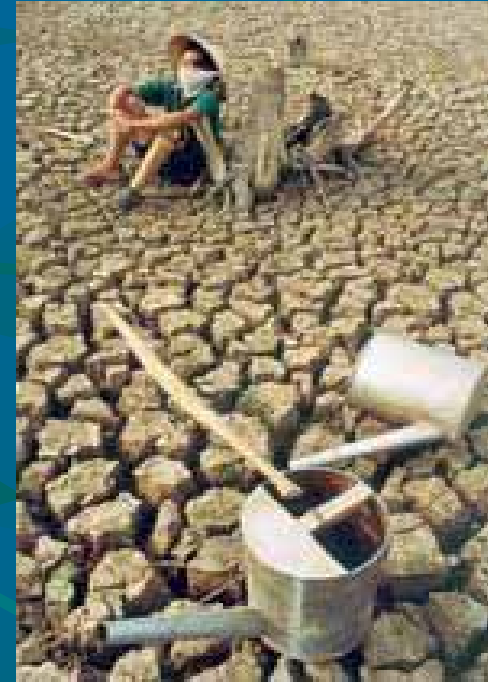
## *Status:*

- China's water resources amount to the fifth-largest in the world.
- But with the country's population swelling to 1.3 billion, many of China's rivers are drying up, and the water table is falling.
- 400 of China's 668 cities are dealing with water shortages in the year 2004.
- Three-fourths of China's rivers are polluted, and more than 700 million people drink contaminated water.  
--- The World Bank 2004
- China loses more than 30 billion cubic meters of water every year.

2000年中国年降水量分布图



# Water crisis in China





## *Objectives :*

- Implement the policy of rational exploration, utilization, and comprehensive conservation of water.
- Strengthen the management of river basins and lakes.
- Improve the management and control of water pollution .
- Vigorously maintain and improve the natural utility of water resources and the ecological environment of basins.

*In the Ninth Five-Year Plan (1996-2000), the water issue is placed at its importance above all other threatening factors.*

## *Programmes and Projects:*

- Water transferring projects
  - transferring water from the south to the north in the central, eastern, and western parts of China
- Three Rivers and Three Lakes water pollution control project (*Huaihe River, Haihe River, Liaohe River, Taihu Lake, Dianchi Lake, and Chaohu Lake* ) in 1994.
- China Water -Conserving Development Programme for Irrigation Agriculture.

## *Research and Technologies:*

- Some practical water-conserving technologies have been developed and these are being used in the technical preparations for the establishment of 300 demonstration counties for water conserving irrigation projects during the Ninth Five-Year Plan.

## *Cooperation:*

- UNDP and several national governments are providing support to a development and conservation project for the Yellow River delta and to the Integrated Development and Management Project of the Mountain-River-Lake Region of Jiangxi Province.

# 4. Methods for SD

- 4.1 Economic Method
- 4.2 Community-based Conservation  
Management in Sustainable Development

## 4.1 Economic Method

According to Ophuls (1997), there are five key economic imperatives:

- Use multiple measures to provide a more robust picture of human well-being, rather than sole reliance on one measure (GDP)–GPI-Genuine Progress Indicators
- Get the prices right
- Eliminate ecologically damaging and economically perverse incentives
- Develop improved performance indicators
- Move from pioneer to climax economics; energy is devoted primarily to the maintenance of the current capital stock rather than new growth.

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## 4.1.1 WHAT'S WRONG WITH THE GDP?

## **1. GDP treats crime, divorce and natural disasters as economic gain**

- Crime adds billions of dollars to the GDP due to the need for locks and other security measures, increased police protection, property damage, and medical costs. Divorce adds billions of dollars more through lawyer's fees, the need to establish second households and so forth.

## **2. GDP ignores the non-market economy of household and community**

- The crucial functions of childcare, elder care, other home-based tasks, and volunteer work in the community go completely unreckoned in the GDP because no money changes hands.



### **3. GDP treats the depletion of natural capital as income**

- The GDP violates basic accounting principles and common sense by treating the depletion of natural capital as income, rather than as the depreciation of an asset. As a result, the more the nation depletes its natural resources, the more the GDP goes up.

### **4. GDP increases with polluting activities and then again with clean-ups**

- Since the GDP first added the economic activity that generated that waste, it creates the illusion that pollution is a double benefit for the economy.

## **5. GDP takes no account of income distribution**

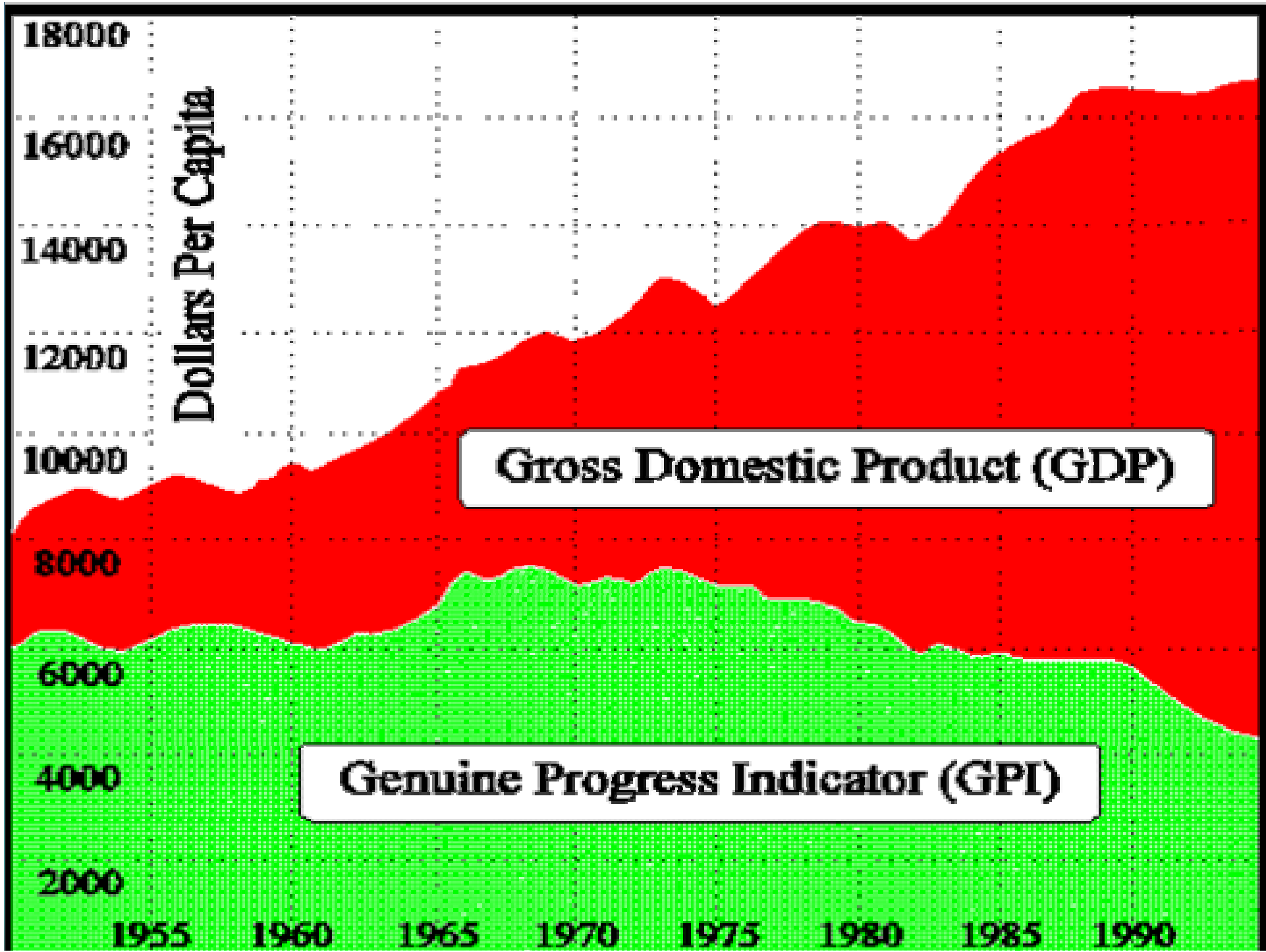
- By ignoring the distribution of income, the GDP hides the fact that a rising tide does not lift all boats. From 1973 to 1993, while GDP rose by over 50 percent, wages suffered a decline of almost 14 percent.

## **6. GDP ignores the drawbacks of living on foreign assets**

- In recent years, consumers and government alike have increased their spending by borrowing from abroad. This raises the GDP temporarily, but the need to repay this debt becomes a growing burden on our national economy.

## WHAT IS THE GENUINE PROGRESS INDICATOR—GPI?

---The GPI takes into account more than twenty aspects of our economic lives that the GDP ignores.



- Specifically, the GPI reveals that much of what economists now consider economic growth, as measured by GDP, is really one of three things:

- 1) fixing blunders and social decay from the past;

- 2) borrowing resources from the future;

- 3) shifting functions from the community and household realm to that of the monetized economy.

## **1. Crime & family breakdown**

- GPI subtracts the costs arising from crime and divorce.

## **2. Household & volunteer work**

- GPI includes the value of household work figured at the approximate cost of hiring someone to do it.

## **3. Income distribution**

- A rising tide does not necessarily lift all boats—not if the gap between the very rich and everyone else increases. GPI rises when the poor receive a larger percentage of national income, and falls when their share decreases.

## **4. Resource depletion**

- Compared with GDP, GPI counts the depletion or degradation of wetlands, farmland, and non-renewable minerals (including, oil) as a current cost.

## **5. Pollution**

- The GPI subtracts the costs of air and water pollution as measured by actual damage to human health and the environment.

## **6. Long-term environmental damage**

- The GPI treats as costs the consumption of energy and of ozone-depleting chemicals.

## **7. Changes in leisure time**

- When leisure time increases, the GPI goes up

## **8 .Defensive expenditures**

## **9 .Lifespan of consumer durables & public infrastructure**

- The GPI treats the money spent on capital items as a cost, and the value of the service they provide year after year as a benefit.

## **10. Dependence on foreign assets**