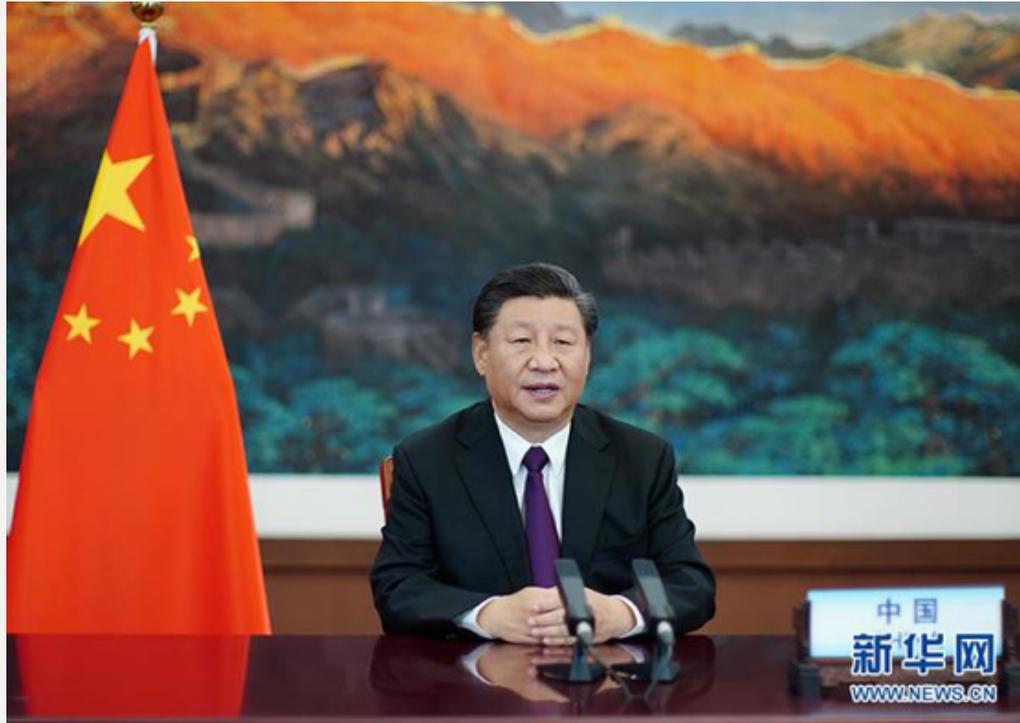




# Biodiversity and Revolution of Energy and Electric Power

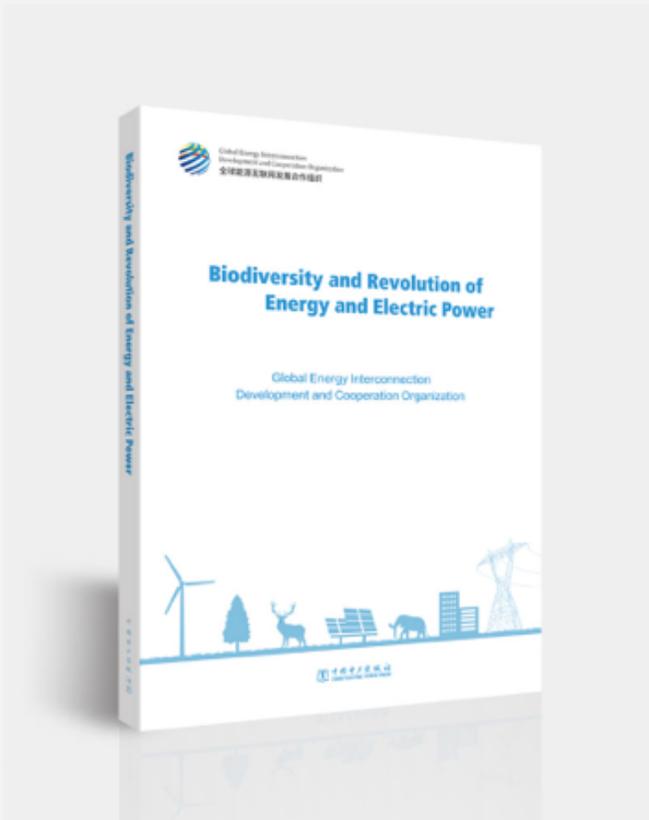
**Global Energy Interconnection Development and  
Cooperation Organization (GEIDCO)  
September 26, 2021**



**On September 30, 2020, Chinese President Xi Jinping, speaking at the United Nations Summit on Biodiversity, noted that biodiversity provides an important foundation for the survival and development of the human race. At the 15th meeting of the Conference of the Parties to the Convention on Biological Diversity (COP15 CBD) to be held in Kunming, China, this year, all efforts will be synergized to discuss new strategies for global biodiversity governance.**



## The intention for writing the book on *Biodiversity and Revolution of Energy and Electric Power*



- Recognizing the importance and urgency of biodiversity
- Analyzing the reasons and factors for biodiversity loss
- Proposing systematic plans for biodiversity conservation



## **1. Importance and Urgency of Biodiversity Protection**

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## 2. The Biodiversity Crisis and Unsustainable Energy Development

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## 3. GEI as a Systematic Solution for Biodiversity Protection

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## 4. Building a Shared Future for All Life on Earth Through Energy and Electric Power Revolution

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# The Connotation of Biodiversity



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According to the Convention on Biological Diversity (CBD), **biodiversity is defined as the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems, as well as the ecological complexes of which they are part; this includes species diversity, ecosystem diversity and genetic diversity.**

# 1.1 The Significance of Biodiversity



**Biodiversity is fundamental to economic and social development, civilization progress, and building a shared future for all life on earth**

## Biodiversity as an Essential Basis for Economic and Social Development

- **Food source:** More than **6,000** varieties of food crops provide a diversified dietary supply for human beings
- **Medicine source:** **4 billion** people worldwide primarily depend on natural drugs
- **Raw materials source:** **75,000** kinds of biological resources are used as industrial raw materials worldwide, and the output of related industries accounts for about **40%** of GDP



**Biopharmaceuticals**

## Biodiversity as a Major Pillar for Sustainable World Development

- **Curbing temperature rise:** Forest can absorb about one ton of CO<sub>2</sub> per hectare per day. Terrestrial and marine ecosystems can sequester about **5.6 billion** tons of carbon every year
- **Reducing environmental pollution:** **75%** of chemical pollutants can be disposed via bi...



**Aquatic Plants Help Sewage Treatment**

## Biodiversity as a Key Factor Affecting the Rise and Fall of Human Civilization

- **A livable ecology is conducive to the creation of splendid civilization.** Human civilization originates in areas with dense forests, abundant water and fertile land
- **Biological degradation threatens the continuity of civilization.** For example, the ancient Loulan Kingdom was ruined due to excessive deforestation
- **Ecological civilization represents a new stage of human civilization.** There are three stages in the history of human civilization: primitive civilization, agricultural civilization and industrial civilization. Humanity is now in a stage of gradual transition toward ecological civilization, of which the biodiversity protection plays an essential role

# 1.2 Severe Loss of Biodiversity



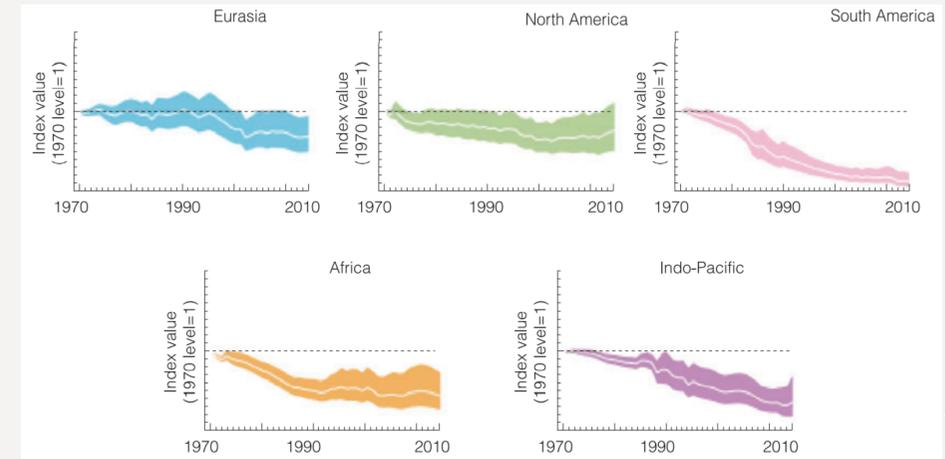
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## The severe loss of biodiversity poses a serious threat to all life on earth

In terms of species diversity, the rate of species extinction has been accelerating. One plant species becomes extinct every minute and one animal species every day. The current rate of species extinction is dozens to hundreds of times higher than the average rate over the past 10 million years, spelling the approaching sixth mass extinction

In terms of ecosystem diversity, forests, wetlands, coral reefs and other ecosystems have severely deteriorated. Since 1990, the global forest has decreased by 1.78 million km<sup>2</sup>, which is equivalent to five times the area of Germany; live coral coverage has nearly halved over the past 150 years

In terms of genetic diversity, that of wildlife has accelerated its degradation. The number of wild rice varieties cultivated in China has dropped from 46,000 in the 1950s to about 1,000, a decrease of more than 90%.



IUCN Red List of Threatened Species

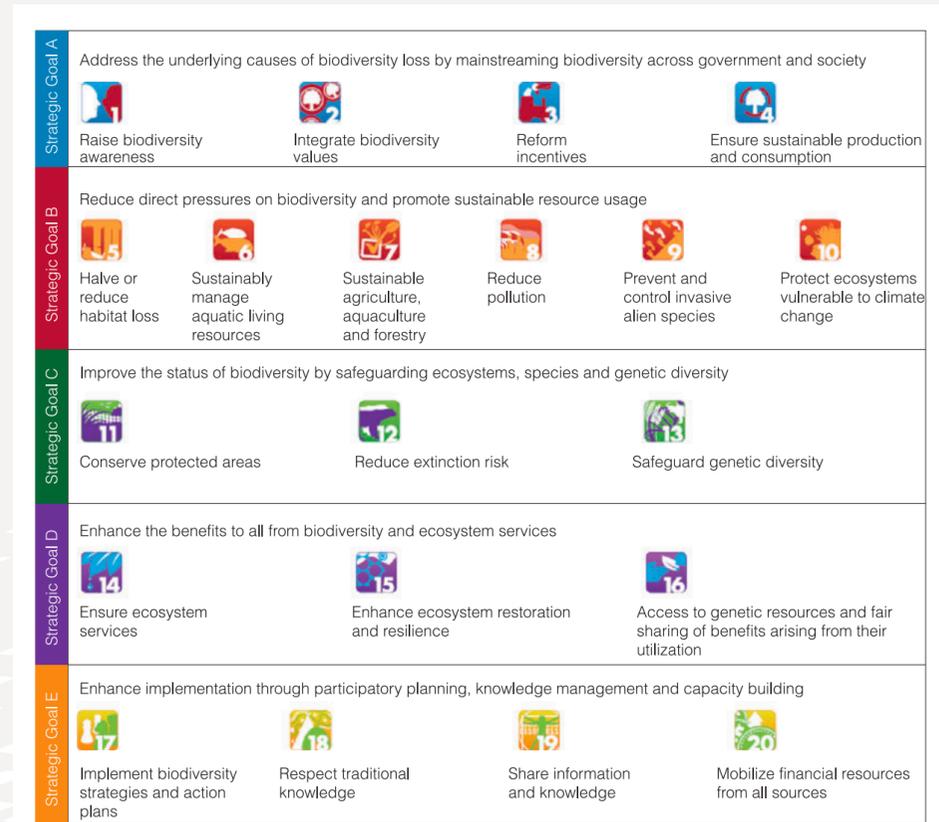


The Past, Present and Future Predictions of the Great Barrier Reef

# 1.3 Biodiversity Conservation faces huge challenges



- **People are short of knowledge of biodiversity.** Many people lack knowledge of the importance of biodiversity. Many countries still place one-sided emphasis upon economic growth, while overlook biodiversity protection.
- **The efforts in biodiversity conservation are sluggish.** Despite the UN's adoption of CBD, only **one third** of countries and regions have made active efforts. The annual biodiversity conservation **financing gap** reaches **hundreds of billions** of dollars, and **none** of the 20 Aichi Biodiversity Targets have been fully achieved
- **There is a lack of holistic solutions.** Most of the biodiversity governance solutions focus on a single technology and a specific industry, lack of targeted, systematic and holistic solutions.



20 Aichi Biodiversity Conservation Targets Proposed by COP10

**There is an urgent need to identify  
the root causes of the biodiversity loss,  
find effective solutions, and take strong  
measures**



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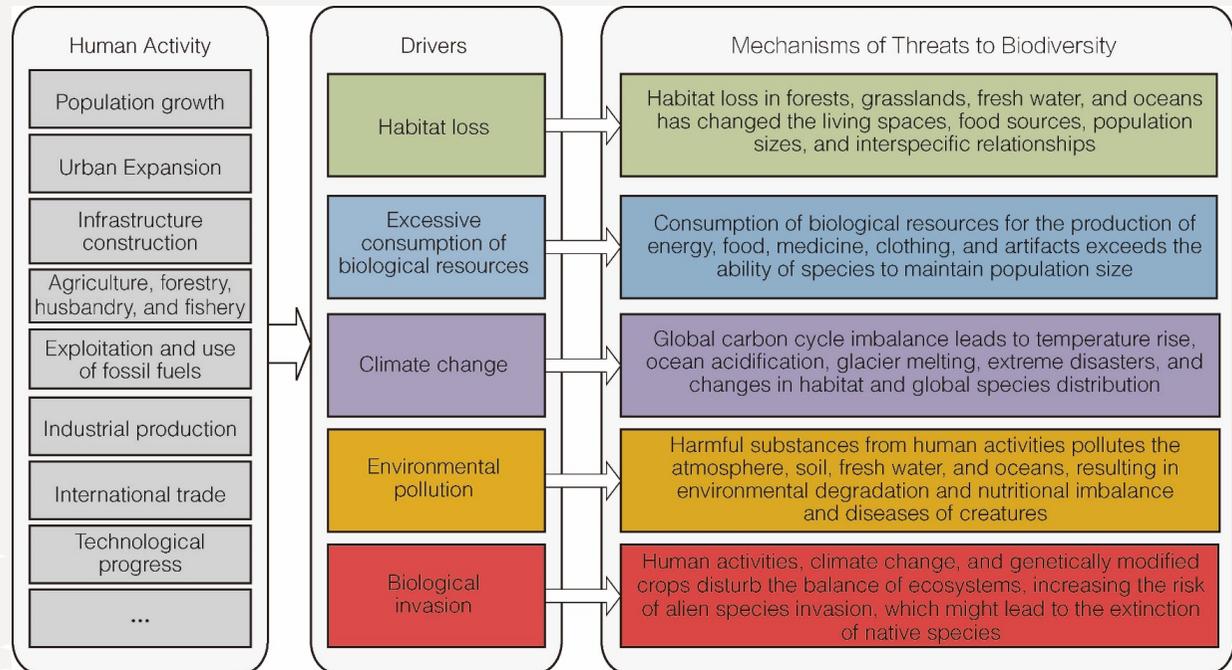
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# Five Drivers of the Biodiversity Crisis



The Global Assessment Report on Biodiversity issued by the Secretariat of the Convention on Biological Diversity last year pointed out that biodiversity loss can be attributed to five main causes — **habitat loss, overexploitation, climate change, environmental pollution, and invasive alien species**

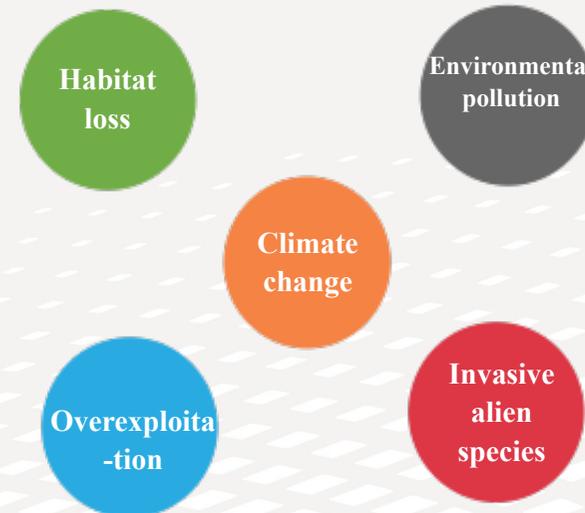
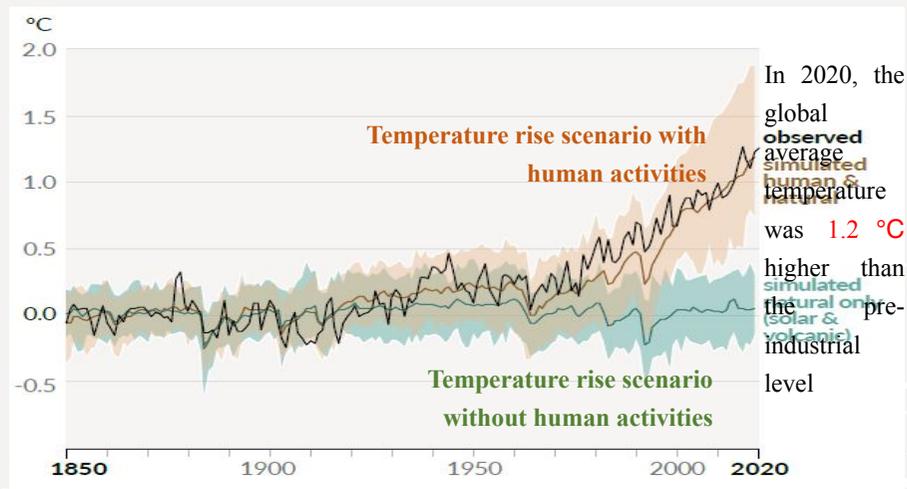


# The impact of climate change on biodiversity



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Climate change is the overall driver of the biodiversity crisis, affecting all life on earth. ① As climate change intensifies, temperature rise, glaciers melting, and ocean acidification accelerate, and extreme disasters like hurricanes and wildfires take place frequently. Increasing species go extinct due to their difficulty in adapting to the rapidly changing natural conditions; ② Climate change will also aggravate habitat loss, environmental pollution, invasive alien species, and overexploitation, further increasing the risk of biological extinction



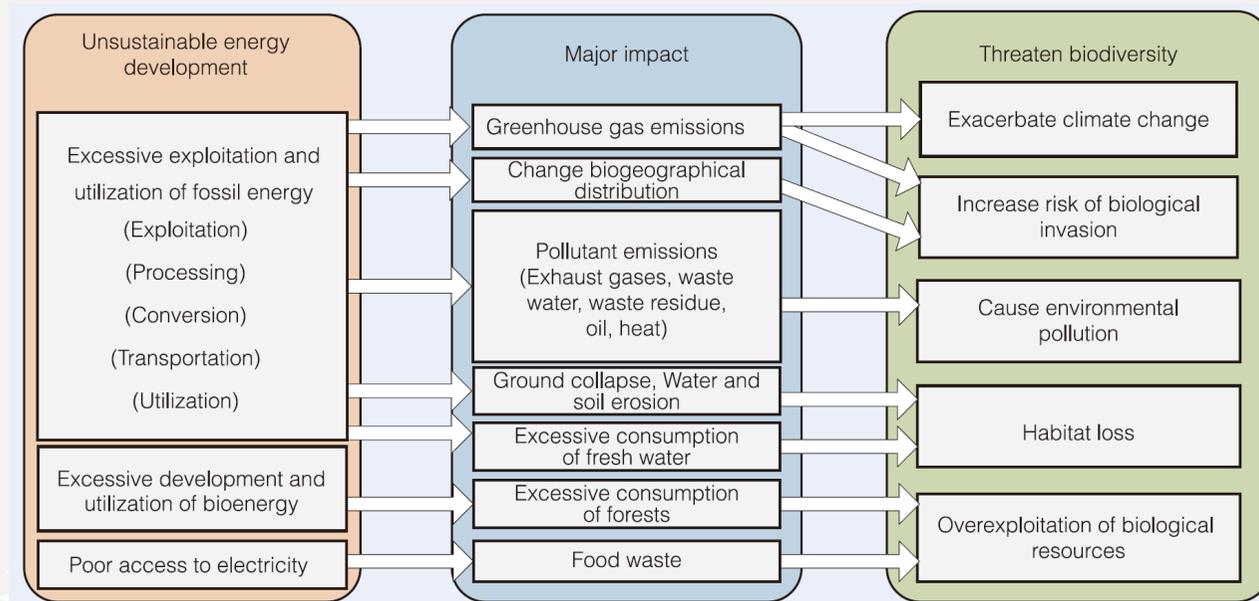
In the worst case, the global average temperature rise will reach **5.7°C** by the end of the 21st century

# Fossil energy is the big-picture factor affecting biodiversity



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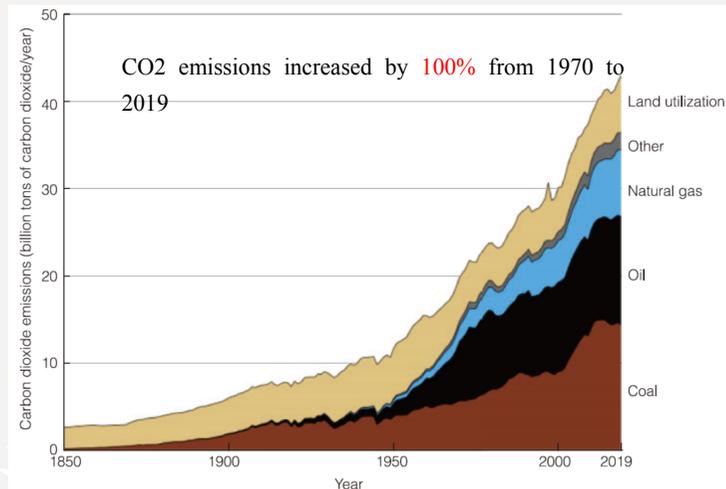
**Biodiversity loss is essentially caused by human activities. In particular, the unreasonable energy development and utilization methods dominated by fossil energy have wide-range and systematic impacts on biodiversity, which is an important root cause of biodiversity crisis**



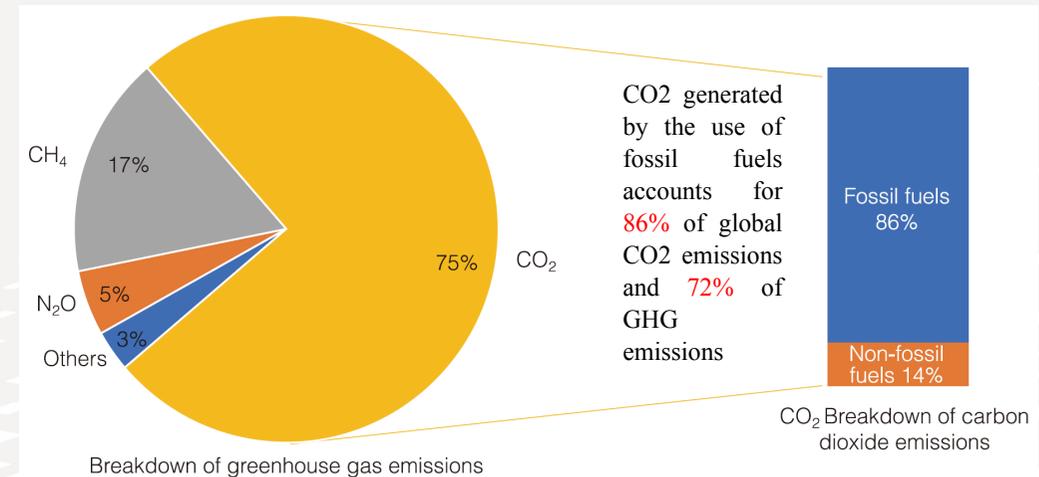
## 2.1 Exacerbating Climate Change



**In terms of climate change, the massive exploitation of fossil fuels is the root cause of climate change and poses a huge threat to biodiversity.** In 2019, the CO<sub>2</sub> generated by the use of fossil fuels such as coal, oil and gas accounted for **86%** of global CO<sub>2</sub> emissions and **72%** of GHG emissions. In the exploitation and consumption of natural gas, about 8% of methane leaks into the atmosphere. The exploitation and combustion of coal and oil also causes methane leakage



Global CO<sub>2</sub> Emissions, Total & Breakdown, 1850-2019



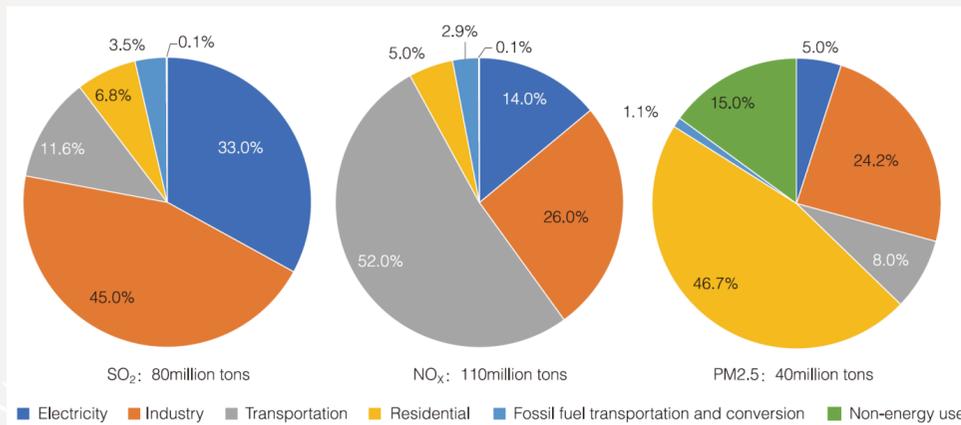
Breakdown of GHG and CO<sub>2</sub> Emissions, 2019

## 2.2 Causes Environmental Pollution



**In terms of environmental pollution, energy production and consumption have caused a large number of pollutants to be discharged into the atmosphere, freshwater, soil, and ocean, severely degrading the living environment of all life.** The combustion of fossil fuels and the utilization of primary biomass energy produce more than **90%** of the world's SO<sub>2</sub>, NO<sub>x</sub>, and **85%** of PM<sub>2.5</sub>. The production of fossil fuels such as coal, shale gas, and oil causes serious water and soil pollution, and about **10 million tons** of oil pollutants are discharged into the ocean every year.

### ➤ Air pollution



Emissions and Sources of the World's Three Major Air Pollutants, 2015

### ➤ Freshwater and soil ➤ Marine pollution



Every ton of coal mined pollutes 1 to 10 tons of water

Every 1 million m<sup>3</sup> of shale gas produced generates 30 to 130 m<sup>3</sup> of wastewater



Oil pollution poses a serious threat to marine life



A coastal thermal power plant with installed capacity of above 1 GW discharges approx. 30 to 50 m<sup>3</sup> of cooling water per second

## 2.3 Destruction of Biological Habitats



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**In terms of habitat loss, the exploitation and transportation of fossil fuels have a direct impact on habitats.** The mining of fossil fuels such as coal and oil causes surface collapse and water and soil erosion. Every 10,000 tons of coal mined causes about **3,000 m<sup>2</sup>** of surface collapse. Transportation of fossil fuels requires the large-scale construction of roads and pipelines, creating barriers that lead to habitat loss and fragmentation



**Coal mining causes serious water and soil erosion**



**Large oil companies exploring for oil and building pipelines and roads in Nigeria lead to the fragmentation of habitats in the Niger Delta**

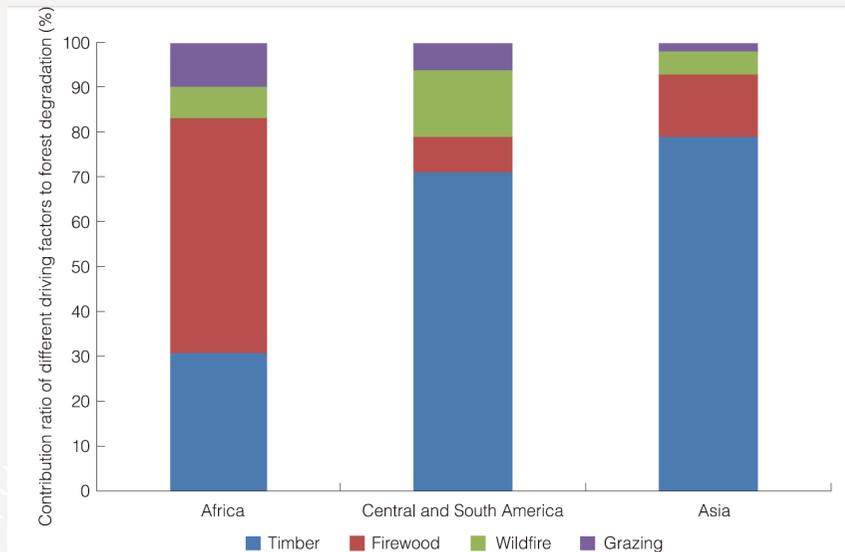


**A single horizontal well for the extraction of shale gas consumes **7,500-27,000 m<sup>3</sup>** of water during the entire production process**

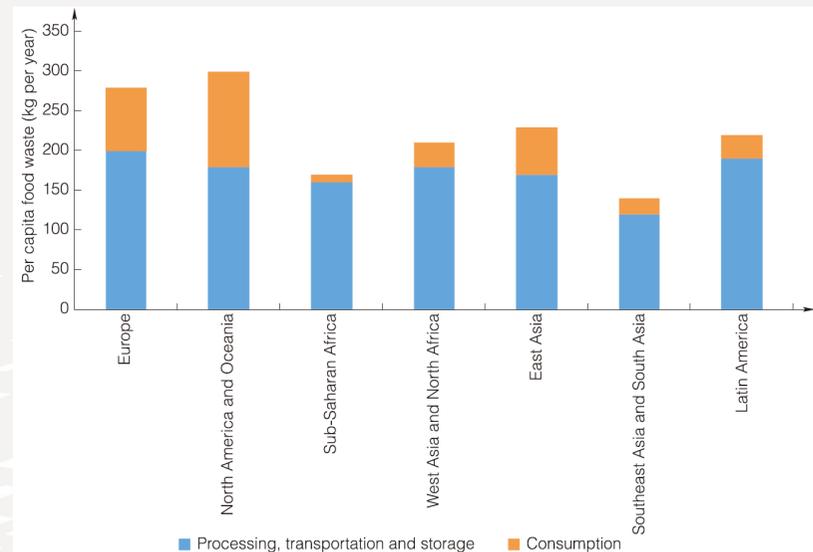
## 2.4 Overexploitation of Biological Resources



**In terms of overexploitation of biological resources, power shortages and excessive reliance on primary biomass energy such as firewood lead to excessive consumption of trees and waste of food.** About 3 billion people in Africa, Asia, Central and South America still use traditional biomass fuels such as firewood and charcoal for heating and cooking. In Africa, more than 10,000 km<sup>2</sup> of forests are cut down for firewood each year. In addition, the lack of access to electricity prevents food from being stored efficiently, with more than 30% of the world's food wasted each year



**Factors of Forest Degradation by Region**



**In areas with severe power shortages such as Africa, Latin America, and Southeast Asia, a large amount of food is wasted due to inefficient storage**

## 2.5 Increasing the Risk of Biological Invasion



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**In terms of invasive alien species, the large-scale and long-distance transportation of fossil fuels significantly increases the risk of alien species invasion.** In 2019, more than **a quarter** of the world's sea transportation was used to transport oil and liquefied natural gas. The annual seaborne volume of oil exceeded **2.1 billion** tons, and the ballast water of oil tankers "smuggled" more than **10,000 kinds** of marine organisms. In addition, the combustion of fossil fuels leads to climate change, intensifies hurricanes and biological migration, and increases the risk of alien species invasion.



A 300,000-ton tanker needs **100,000** tons of ballast water



Hurricanes significantly increase the likelihood of microbes such as the soybean rust fungus spreading over long distances with the wind



Global temperature rise forces species to accelerate their migration to high latitudes and high altitudes, increasing the risk of alien species invasion

**Unsustainable energy development structure  
dominated by fossil fuels  
is a major cause of the biodiversity crisis  
which should be addressed through an energy and  
electric power revolution**



## 1. Importance and Urgency of Biodiversity Protection

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## 2. The Biodiversity Crisis and Unsustainable Energy Development

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## **3. GEI as a Systematic Solution for Biodiversity Protection**

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## 4. Building a Shared Future for All Life on Earth Through Energy and Electric Power Revolution

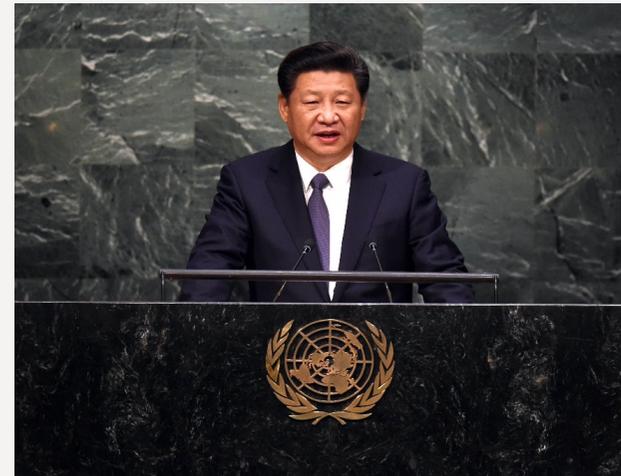
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## The Proposal of GEI



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- On September 26, 2015, General Secretary Xi Jinping proposed discussions on **“establishing Global Energy Interconnection (or GEI), to meet global power demand with clean and green alternatives”** at the UN Sustainable Development Summit. At the Belt and Road Forum for International Cooperation on May 14, 2017, General Secretary Xi Jinping called for collective action **“to seize opportunities presented by the new round of changes in the energy mix and the revolution in energy technologies to develop global energy interconnection and achieve green low-carbon development”**.
- UN Secretary General Mr. António Guterres commented that **GEI is key to the realization of inclusive and sustainable growth worldwide, and praised GEIDCO's work as crucial for the implementation of the UN 2030 Agenda and the Paris Agreement.**





In essence, GEI is **“Smart Grids + UHV Grids + Clean Energy”**. It would represent a crucial platform for large-scale development, delivery and consumption of clean energy resources worldwide. It will accelerate **“Two Replacements, One Increase, One Restore and One Conversion”**, so as to shift the focus of energy production to clean energy, expand energy allocation to global interconnection and transform energy consumption to an electric-centric approach.



Two Replacements

Clean replacement in energy production and electricity replacement in energy consumption



One Increase

Raising the electrification level of the whole society



One Restore

Restoring fossil fuels to their basic attributes



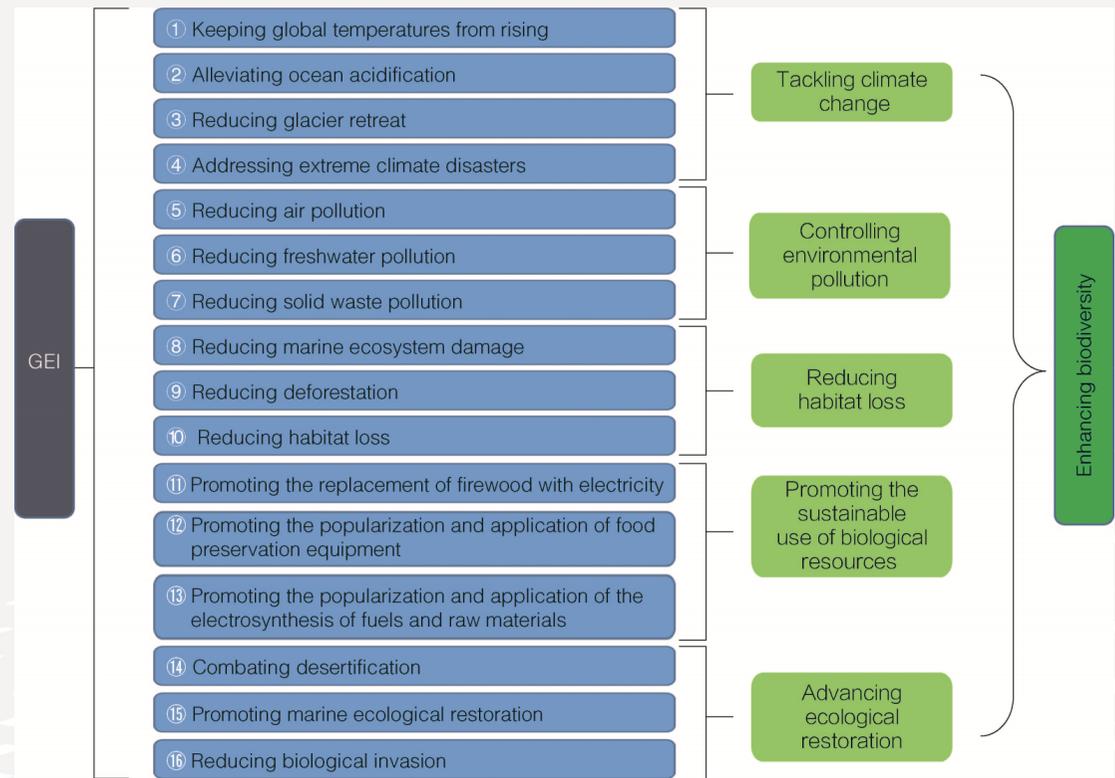
One Conversion

Conversion of water, CO<sub>2</sub> and other substances into such fuels and raw materials as hydrogen, methane, and methanol through clean energy power generation

# Key Mechanisms for GEI to Conserve Biodiversity



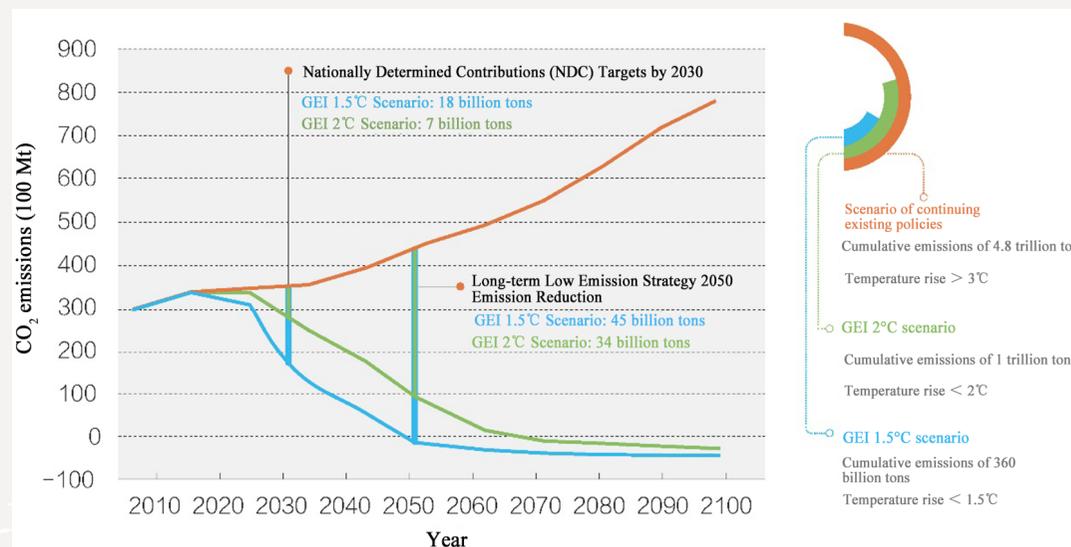
GEI development will facilitate biodiversity conservation in **six** aspects and **16** dimensions, including **tackling climate change, controlling environmental pollution, reducing habitat loss, promoting the sustainable use of biological resources, reducing biological invasions, and advancing ecological restoration.** It can effectively reverse the damage inflicted by fossil fuel use on biodiversity and provide sufficient green energy for ecological restoration, making it an excellent tool for mitigating and eliminating the biodiversity crisis.



## 3.1 Tackling Climate Change



**Building GEI will accelerate the decarbonization of the energy system and radically address climate change, thus reducing the impact of rising temperatures, ocean acidification, glacier retreat and extreme climate disasters on biodiversity.** Through clean replacement and electricity replacement, carbon neutrality will be basically achieved by 2050 and the target of controlling global temperature rise to 1.5°C will be achieved by the end of this century. Compared with the BAU scenario, they can help avoid the extinction of more than **40%** of bird species and more than **60%** of amphibian species.

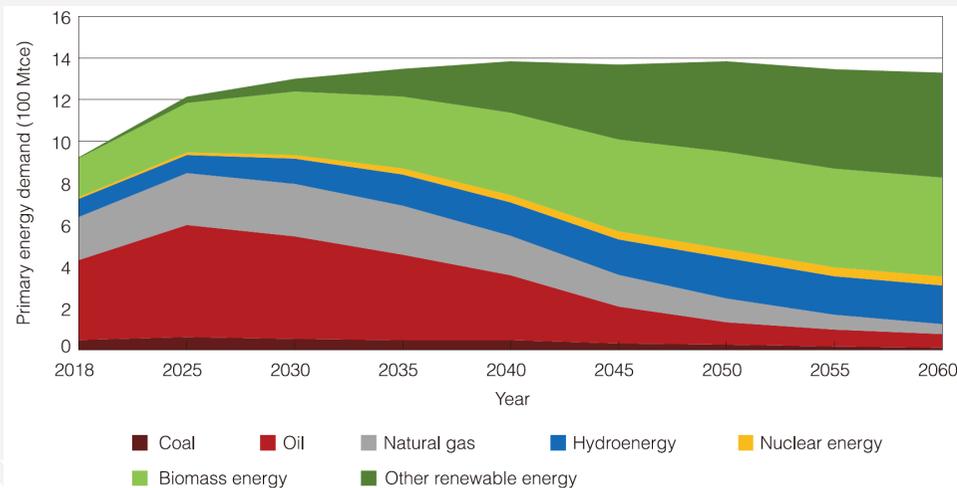


GEI Mitigation Roadmap

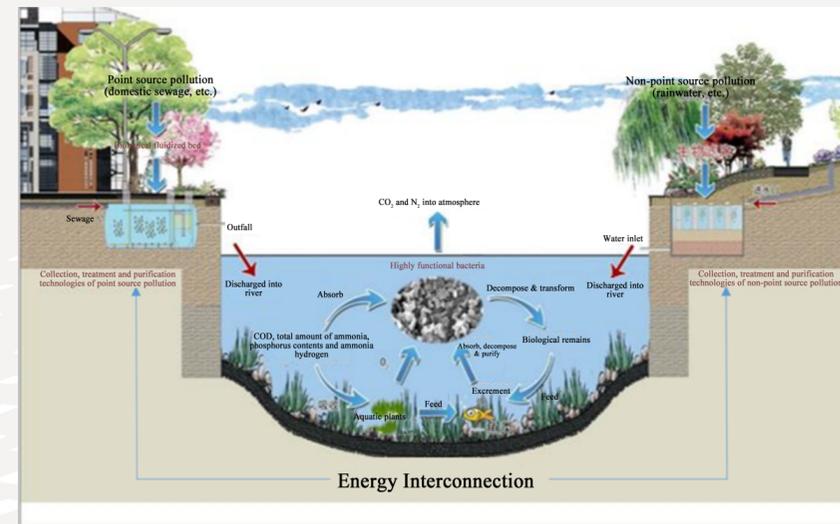
## 3.2 Controlling Environmental Pollution



**Building GEI will significantly reduce the air, water and solid waste pollution caused by fossil energy development, transportation and use.** By 2050, the annual global clean energy generating capacity will reach **79 PWh**, reducing emissions of SO<sub>2</sub> by **64 Mt**, NO<sub>x</sub> by **100 Mt**, and fine particulate matter by **14.6 Mt** per year. The industrial wastewater, chemical oxygen demand, and ammonia nitrogen emissions will drop by more than **60%**. The installed capacity of waste-to-energy plants will exceed **200 GW**, and **2,600 Mt** of waste will be processed each year.



GEI Reduces Coal and Oil Demand



GEI Promotes Freshwater Ecological Restoration

### 3.3 Reducing Habitat Loss



Building GEI accelerates phaseout of fossil fuels and significantly reduces the loss of biological habitats like oceans and forests through fossil energy development and utilization. By 2050, global consumption of fossil fuels such as coal, oil and natural gas will be reduced by more than 80% compared to the current level, significantly reducing the damage to biological habitats caused by the development and transportation of fossil fuels as well as the discharge of cooling water from coastal thermal power plants. Besides, UHV single-circuit transmission line is equivalent to 5 UHV lines, which can save more than 60% of the corridor area and significantly reduce the impact on biological habitats.



Large Transmission Capacity and Small Footprint for UHV Transmission



Green protective slope around substation



Erection of ropeway in high mountains



Transmission towers of different base height

GEI Alleviates Habitat Loss

### 3.4 Promoting the Sustainable Use of Biological Resources



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GEI development can reduce the cost of energy, allowing everyone to get affordable modern energy. It will also facilitate the popularization and application of food preservation equipment, advance the development of technologies related to electrosynthesis of fuels, raw materials and other aspects, and effectively restrain overexploitation of biological resources. By 2050, the global power accessibility will reach 100% while the levelized cost of energy will be decreased by 40%. Refrigerators, refrigeration houses and other food preservation facilities will be widely used, and technologies like the electrosynthesis of hydrogen, methane and protein will significantly reduce people's dependence on biological resources.



Reduced Use of Firewood Helps Protect Forest Resources



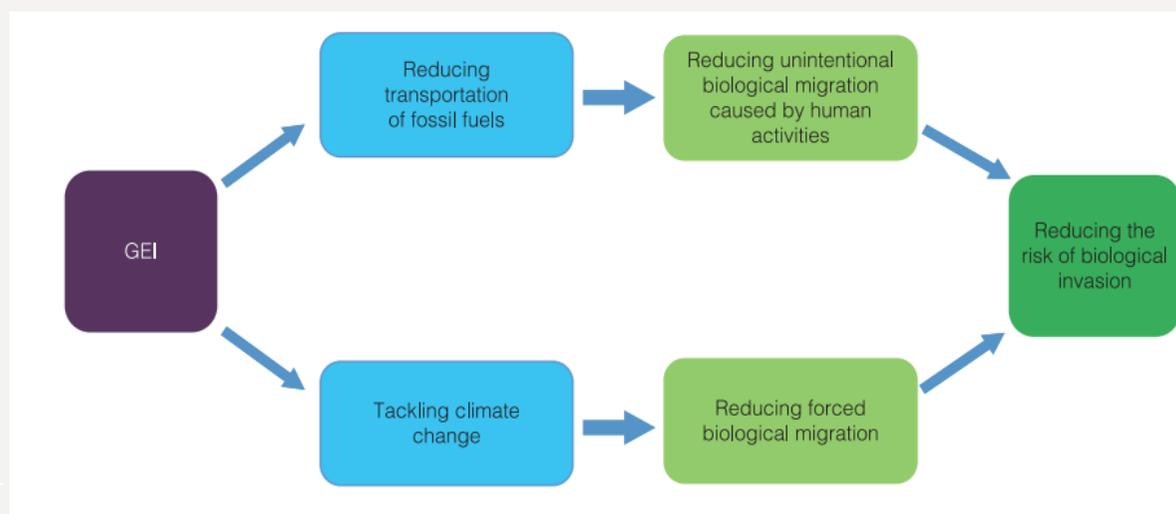
Food Preservation Helps Reduce Waste



## 3.5 Reducing Biological Invasions



**Building GEI effectively reduces the risk of invasive alien species resulting from fossil energy transportation and climate change.** By promoting electricity as the main form of energy use, biological invasions caused by long-distance transportation of fossil energy such as coal, oil and gas will be significantly reduced; in addition, by promoting comprehensive decarbonization of energy systems, global temperature rise will be effectively curbed and the risk of invasive alien species caused by forced biological migration will be reduced.



## 3.6 Promoting Ecological Restoration



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**Building GEI facilitates ecological restoration of deserts, oceans and other environments.** By 2050, through the promotion of PV desertification control and "electricity-water-land-forest" ecological restoration and other related models, the area of PV power stations in desertification areas worldwide can reach **650,000 km<sup>2</sup>**, and nearly **1,000,000 km<sup>2</sup>** of desertification areas can be controlled. In addition, sufficient clean energy to provide an important guarantee for the global ecological monitoring system, wildlife drinking water, shelters, etc.



Initial stage of construction



After putting into operation

**PV Desertification Control in Inner Mongolia Facilitates Ecological Restoration of Deserts**

**GEI marks a profound transformation in the field of energy  
and electric power**

**As a systematic solution to biodiversity conservation, it can  
effectively mitigate and eliminate the five drivers for  
biodiversity loss**



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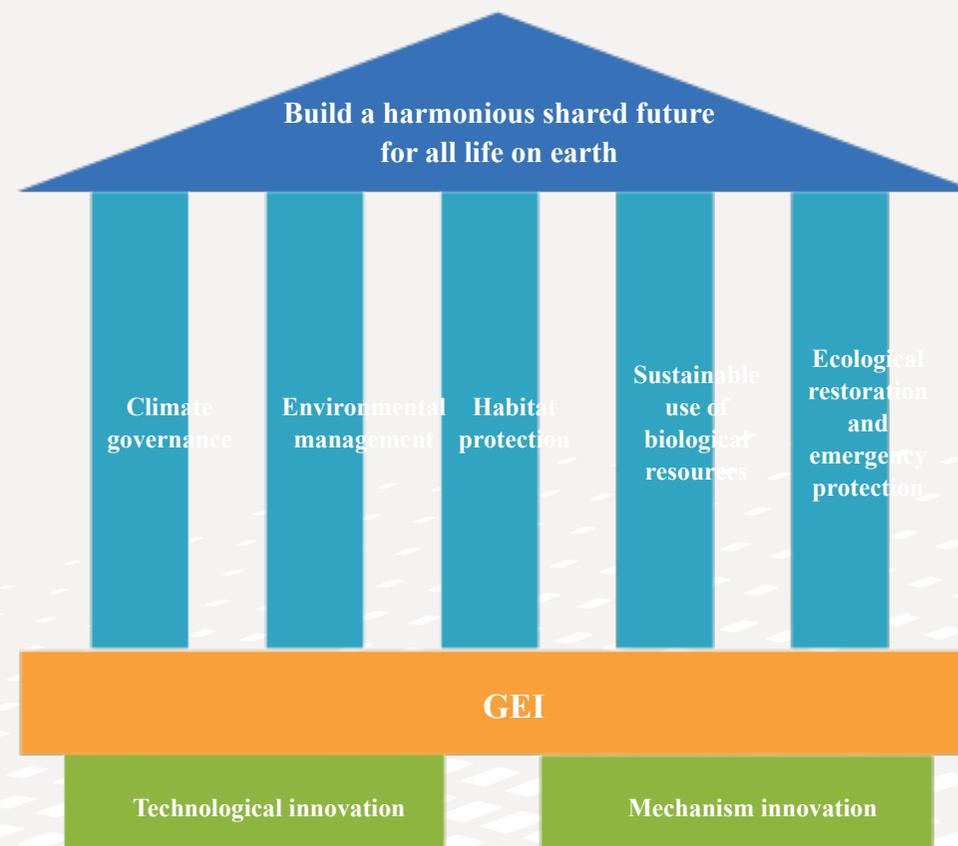
## **4. Building a Shared Future for All Life on Earth Through Energy and Electric Power Revolution**

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## 4.1 General Idea



Based on the research on GEI, the five action plans of climate governance, environmental management, habitat protection, sustainable use of biological resources and ecological restoration are put forward with technological innovation and mechanism innovation as the guarantee and with GEI development as the platform. They provide systematic plans and action roadmaps that can be replicated and promoted to facilitate biodiversity conservation and build a shared future for all life on earth.



## 4.2 Action Plans



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Energy, transportation, and information networks integration (ETI Integration) shifts ETI networks from a mode of separate development to one of integrated, shared and coordinated development. It will permit the co-construction and sharing of ETI network channels, facilities and terminals, improve resource utilization efficiency, reduce occupation of land and space, and create an eco-friendly green infrastructure system.



**Key project of ETI Integration: Xiong'an New Area's utility tunnel concentrates traffic, electricity and communication facilities underground, which greatly enhances the utilization efficiency of urban land resources.**

## 4.2 Action Plans



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### "Electricity-water-land-forest" ecological restoration:

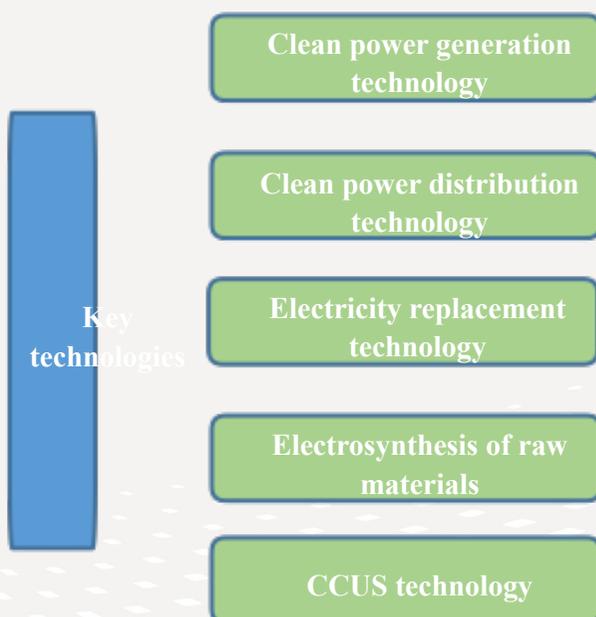
Accelerates the construction of clean energy-powered seawater desalination projects, eliminates fresh water shortages, and promotes the ecological protection and restoration of fragile areas such as deserts, savannas and Gobi.



**"Miracle Garden" in Dubai: Relies on solar power generation to achieve large-scale desalination of seawater and provide sufficient water for urban vegetation.**



### 6 Promote Technological and Institutional Innovation



**GEI is an innovative platform for coordinated governance of energy, climate and biodiversity, a systematic solution to resolve the biodiversity crisis. It will play a key role in promoting ecological civilization, and the building of a Shared Future for All Life on Earth.**

