

June 2020

## China's Combating Desertification: National Solutions and Global Paradigm

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### Recommended Citation

Qi, LU; Jiaqiang, LEI; Xiaosong, LI; Youlin, YANG; and Feng, WANG (2020) "China's Combating Desertification: National Solutions and Global Paradigm," *Bulletin of Chinese Academy of Sciences (Chinese Version)*: Vol. 35 : Iss. 6 , Article 1.

DOI: <https://doi.org/10.16418/j.issn.1000-3045.20200427002>

Available at: <https://bulletinofcas.researchcommons.org/journal/vol35/iss6/1>

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# China's Combating Desertification: National Solutions and Global Paradigm

## Abstract

Desertification, since initial recognition in 1927 and common definition in 1992, through its vicissitudes, is still one of the serious global environmental issues face the world and exists as the bottleneck of the development. Desertification threatens the terrestrial ecological security and limits the sustainability of socio-economic development. In consideration of the impacts of desertification, an "Earth Cancer" and a persistent disease, the authors contribute four prescriptions of "good medicines" for the global initiatives to combat desertification, on the basic framework of Chinese strategies and experiences of "four horizontal beams and eight pillars", in line with the 15.3 goal of Sustainable Development Goals (SDGs); namely, development of Protocol of United Nations Convention to Combat Desertification (UNCCD) and unification of Weights and Measures" (benchmarks and indicators) of the implementation and compliance of the UNCCD; setting up of global observation network to monitor the area change of dryland change; compilation of global natural desert (heritage) directory to leave behind landscape of aboriginal sand sea for future generations; initiation of "global governance action to combat desertification" to strive for achieving the target of Land Degradation Neutrality (LDN) at 2030.

## Keywords

prevention and control of sands; combating desertification; China's programme; global governance; future strategy

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**Citation:** LU Qi, LEI Jiaqiang, LI Xiaosong, YANG Youlin, WANG Feng. China's Combating Desertification: National Solutions and Global Paradigm [J]. Bulletin of Chinese Academy of Sciences, 2020 (6): 656–664.

## China's Combating Desertification: National Solutions and Global Paradigm

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**Abstract:** Desertification, since initial recognition in 1927 and common definition in 1992, through its vicissitudes, is still one of the serious global environmental issues facing the world and exists as the bottleneck of development. Desertification threatens terrestrial ecological security and limits the sustainability of socio-economic development. In consideration of the impacts of desertification, an “Earth Cancer” and a persistent disease, the authors contribute four prescriptions of “good medicines” for the global initiatives to combat desertification, on the basic framework of Chinese strategies and experiences of “four horizontal beams and eight pillars,” in line with the 15.3 goal of Sustainable Development Goals (SDGs); namely, development of Protocol of United Nations Convention to Combat Desertification (UNCCD) and unification of Weights and Measures (benchmarks and indicators) of the implementation and compliance of the UNCCD; setting up of global observation network to monitor the area change of dry-land change; compilation of global natural desert (heritage) directory to leave behind landscape of aboriginal sand sea for future generations; initiation of “global governance action to combat desertification” to strive for achieving the target of Land Degradation Neutrality (LDN) at 2030. DOI: 10.16418/j.issn.1000-3045.20200427002-en

**Keywords:** prevention and control of sands; combating desertification; China's programme; global governance; future strategy

Affected by south and north trade-wind zone and the sub-tropical high, two natural desert belts have been formed near 15°S–35°S and 15°N–35°N. Deserts can even extend to 51°N and 55°S in some areas due to the impact of topography, altitude, and land and sea locations<sup>[1]</sup>. The aboriginal desert areas are dry and rainless with sparse vegetation and fragile system, but play an irreplaceable role in aspects including climate regulation, material circulation, and energy circulation, contributing to the balance and stability of the earth's biosphere.

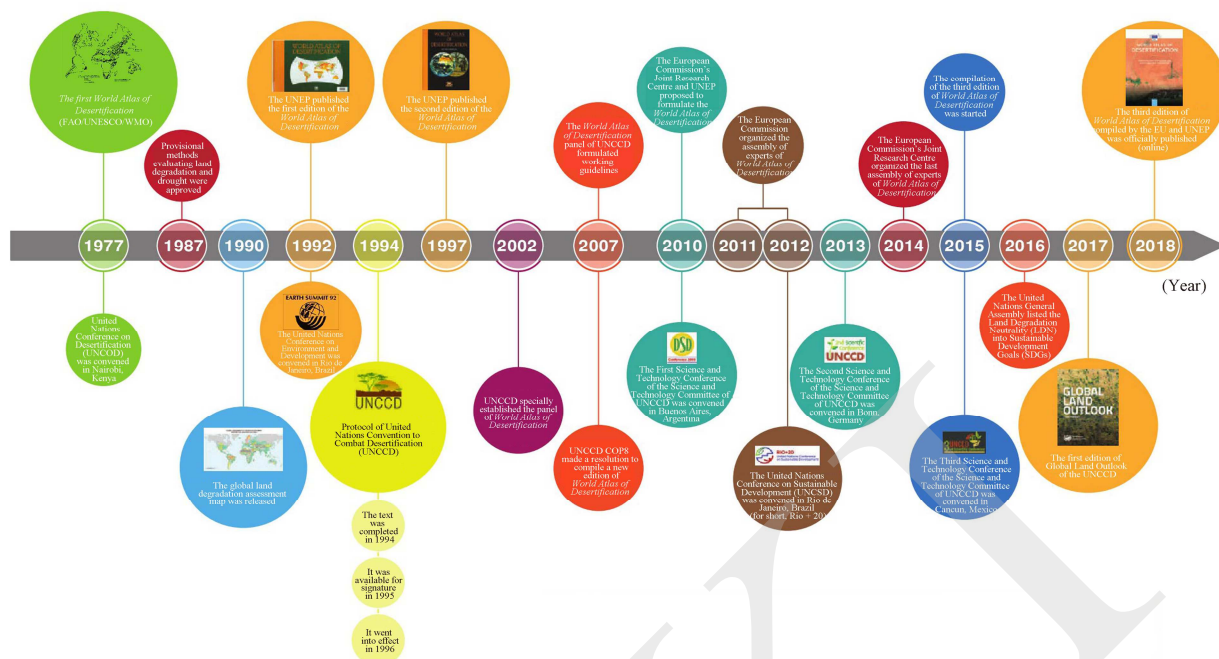
The global land reclamation movement brought by the Industrial Revolution has caused tremendous changes to land surfaces, breaking the original balance of the natural ecosystem. Land surface sandification and land desertification emerged then. Back in the 20th century, disasters related to desertification have soared since a French, Lavauden, first created the term “désertification” in 1927<sup>[2]</sup>. The dust bowl in the western United States in 1930s, the white storm in Central Asia in 1950s, and extreme droughts in the Sahel region of Africa from 1968 to 1973 occurred one after another. These disasters aroused great attention from the international

community. Global anti-desertification actions have started since the United Nations Conference on Desertification (UNCOD) was held in 1977<sup>[3]</sup>. In the Rio Earth Summit in 1992, three environmental conventions were published, and then the Protocol of United Nations Convention to Combat Desertification (UNCCD) was signed in 1994 in Paris, signifying that the global efforts to combat desertification have entered a rule-based and law-abiding new era (Figure 1)<sup>[4]</sup>.

Desertification has serious restrictions on China's ecological security and the sustainable socio-economic development. Huge ecological and economic losses are caused every year due to desertification in China. Direct economic losses caused by desertification exceed 64 billion CNY each year. Nearly 400 million people are directly or indirectly affected by desertification. One of the main manifestations of desertification in China is land sandification. Therefore, prevention and control of sands and afforestation are major measures to curb land degradation in north China, which are national actions to deal with desertification. Over the past 70 years, China is making steady progress in the prevention and control of sands in the course of continuous exploration, and

**Received:** 2020-5-26

**Supported by:** Strategic Priority Research Programme of the Chinese Academy of Sciences (Class A) (XDA20030000); Project of Field Station Alliance of the Chinese Academy of Sciences (KFJ-SW-YW037-02); Fundamental Research Funds for the Central Public Welfare Research Institutes (CAFYBB2019ZD002); Forestry Science and Technology Research Project of National Forestry and Grassland Administration of China (2019132701)



**Figure 1** Course and milestones of global desertification control from 1977 to 2018

the ecological conditions of the desert areas have been significantly improved<sup>[5]</sup>. On July 12, 2018, Nature published a long review paper, which clearly stated that China had initiated 16 ecological restoration projects with large investments and profound influence including the construction project of protection forest system in the northwest, north, and northeast China, control of the sandstorm sources in Beijing and Tianjin, protection of natural forests, and returning farmlands to forests and grasses over the last 40 years. As of 2015, these 16 projects have mobilized 500 million labor forces and invested a total of more than 370 billion US dollars on approximately 6.2 million square kilometers of land. These efforts were unprecedented in the globe and have achieved great achievements<sup>[6]</sup>. From 2000 to 2017, China carried out green space restoration through a series of ecological restoration projects, and the land turned from yellow to green, contributing 25% of the global green space increase. Taking the United Nations Sustainable Development Goals 2030 (SDGs) as the benchmark, 17 indicators have shown an upbeat momentum, especially in SDG 15.3 (restoration of land degradation), which was most significantly improved. From 2000 to 2015, the net restoration land area in China accounted for 18.24% of the world's total restoration area (ranking top in the world), making an important contribution to the Land Degradation Neutrality (LDN). China's plans and models for combating desertification have once again become the focus of the international community<sup>[7,8]</sup>.

## 1 Favorable momentum through ups and downs

The war between humans and sandstorms has never ceased, but its intensity varies at different stages of human development. However, the real research and practices in prevention and control of sands in China have not achieved a significant improvement until 1949. Sand control in China is basically synchronized with the construction of the country. The last 70 years of sand control in China can be roughly divided into three stages<sup>[9,10]</sup>.

(1) The initial stage of national mobilization and marching into the desert. As early as 1949, the central government has attached importance to the desertification control through the establishment of the Ministry of Afforestation and Reclamation and the Desert Afforestation Bureau in Western Hebei Province and the mobilization of the masses. Through these efforts, China has taken the first step in the long journey of desertification control. In the 1950s, China's work in prevention and control of sands embraced a boom. The State Council established a desertification control leading group and the Shelter Forestry Center in Yulin of Shaanxi, and conducted the first aerial seeding experiment in sandy areas such as Yulin of Shaanxi and Minqin of Gansu. The technology of desertification control has enjoyed continuous improvements. In 1956, the Shapotou section of the Baotou-Lanzhou Railway crossed the Tengger Desert for more than 50 kilometers. Under the guidance of a Soviet expert, Petrov, a sand fixation technology with the straw checkerboard as sand barrier<sup>①</sup> was

① The key point is to plant psammophytes under the protection of straw checkerboard as sand barrier, which was adopted during the construction of railway and canal in Karakum Desert by the Soviet Union.

applied and achieved great success. In 1959, the Chinese Academy of Sciences organized some scientific and technological staff in various fields to conduct a comprehensive survey on most of the deserts, sandy lands, and Gobi in China, and established six comprehensive test stations and dozens of key stations, which initially formed the network platform of northern desert observation, scientific research, and experiment.

(2) The developing stage led by state will and projects. In 1978, the State Council formally approved the construction project of protection forest system in the northwest, north, and northeast China, which initiated the construction of the ecological environment with major projects in China and became a milestone event in the history of ecological construction. In the 1980s, China successively unveiled a series of laws and regulations to provide a legal basis for the protection and management of natural resources in desertification areas. In 1991, the State Council convened the first National Conference on Prevention and Control of Sands, and then issued the 1991–2000 National Sand Prevention and Control Guidelines and launched the National Projects of Prevention and Control of Sands. From the beginning of 2000, major national ecological projects such as the project of returning farmlands to forests and grasslands and the pilot project of the Beijing-Tianjin sandstorm source control were successively launched, thus reaching a new level in desertification control driven by major national ecological projects.

(3) The advancing stage with improvements of speed and efficiency through international cooperation. The UNCCD signed in October 1994 marked that China's combating desertification was officially in line with international standards. A multi-tiered, interdisciplinary, and joint management system was gradually formed from the central to the local authorities. From the submission of the first national implementation action plan in 1995 to the successful holding of the UNCCD COP13 in 2017, China's combating desertification has ushered into a new course with an internationally leading position through promotion through international cooperation. On June 17, 2016, on the first World Day to Combat Desertification after the establishment of the SDGs, China issued the Belt and Road Initiative for Combating Desertification and launched the Belt and Road Initiative for Sand Prevention and Control Project.

## 2 Comprehensive governance and outstanding schemes

China's desertification control schemes have experienced several adjustments together with the changes in social conditions. Limited by economic conditions in the early stage, China adopted the form of national mobilization for desertification control. Desertification intensified in the middle stage. In view of this, China introduced a national layout and key protection and adopted a sand control model taking

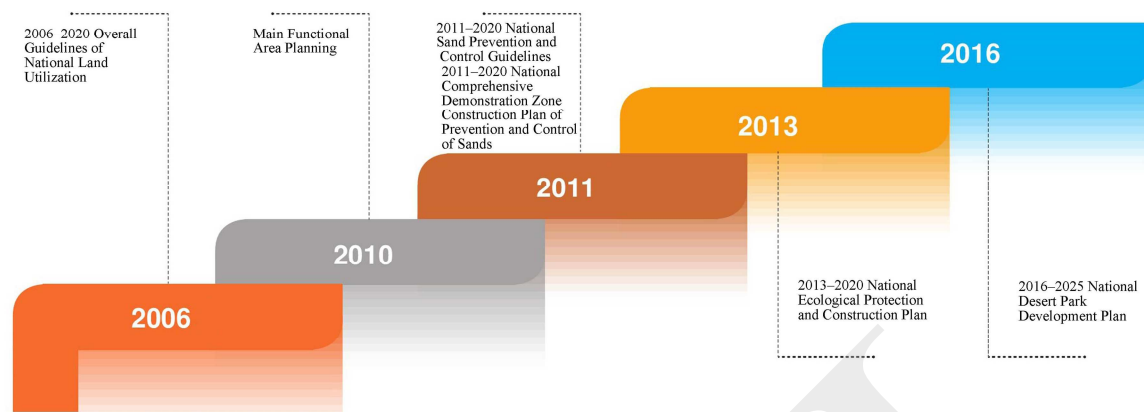
large-scale ecological projects as representative. In the new era, China has adopted all-round governance combined with the concept of sustainable development and encouraged people to shift from traditional sand control to rational use of sand for attaining the centenary goal of successful desertification control with reduction of man-made interferences. In the long course of combating desertification, we have accumulated rich experience and concluded the three-Chinese-character classics of desertification control which include prevention, control, and usage and the “four horizontal beams and eight pillars” of comprehensive governance<sup>[11]</sup>.

### 2.1 Beam I: Government leadership

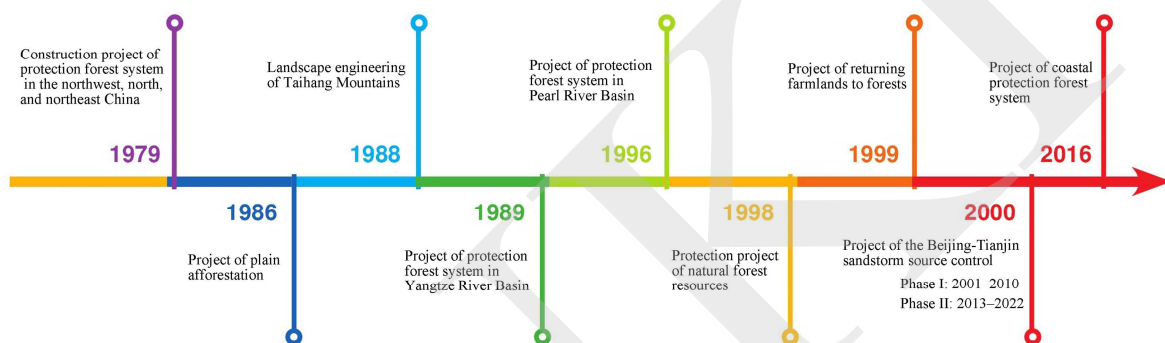
The Chinese government has played a leading role in the combating desertification in a long term. Through planning, engineering, job assignment, and clarification of rights and responsibilities, multiple projects are handled simultaneously with the integration of multiple regulations and the overall plan is made to promote the orderly development of China's combating desertification.

Pillar I: Planning and engineering. In December 2010, the State Council issued the Main Functional Area Planning. In the areas affected by desertification in northwest China, areas that do not have the conditions for large-scale and high-intensity industrialization and urbanization were designated as key ecological functional areas with restricted development. The major purpose is to protect national ecological security and provide ecological products. Then, multiple guidelines and plans were formulated and unveiled such as 2011–2020 National Sand Prevention and Control Guidelines and 2016–2025 National Desert Park Development Plan (Figure 2). At the beginning of the 21st century, China integrated the national key ecological projects and successively implemented the construction projects of the protection forest systems, such as returning farmlands to forests and grasslands, the construction of protection forest system in the northwest, north, and northeast China, and later launched the governance projects of the Beijing-Tianjin sandstorm source control, the comprehensive governance project of rocky desertification in karst areas, the project of returning farmlands to grasslands, the construction project of water and soil conservation, etc. (Figure 3).

Pillar II: Institute establishment and clarification of rights and responsibilities. To act in line with UNCCD, China has established the China Coordination Group in Combating Desertification (19 departments as member units) for cooperative research to address major issues in combating desertification. Meanwhile, some related institutes such as China Monitoring Center of Desertification Control and China Training Center of Desertification Control have been established to further advance the scientific research, technology, and convention enforcement ability of China's combating desertification. Since 2009, in order to ensure the implementation of various national policies



**Figure 2** China's strategies and plans on land functions from 2006 to 2016



**Figure 3** China's key national ecological projects from 1979 to 2016

on national desertification control, the central government and relevant provincial governments have signed the liability letter for desertification control targets, combining the assessment of responsibility for desertification control targets and the implementation of the national desertification control plan. At the same time, the competent department of the State Council has taken the leading position in regularly inspecting the provinces with severe desertification and supervising the completion of their tasks.

## 2.2 Beam II: Participation by all citizens in the country

Pillar III: Voluntary tree-planting campaign participated by all citizens in the country. In 1981, the Fourth Session of the Fifth National People's Congress approved the Resolution on Carrying out the National Voluntary Tree-planting Campaign. Since the launch of the comprehensive voluntary tree-planting campaign, citizens across the country have been mobilized in voluntary tree planting. Regional authorities have established demonstration bases and carried out various forms of voluntary tree-planting activities based on the actual conditions of local ecological construction. In 2019, the number of people participating in those activities exceeded 500 million and the afforestation area surpassed 39,000 hectares<sup>[12]</sup>.

Pillar IV: Assistance from enterprises and non-governmental organizations. Enterprises have also played an indispensable role in China's desertification control and the development of the sand industry. Many enterprises have participated in the prevention and control of sands such as Elion Resources Group Co., Ltd., Inner Mongolia Mongolian Grass Ecological Environment (Group) Limited by Share Ltd., Hansen Wine Group Co., Ltd. At the same time, some individuals also became models in sand control including Wang Youde in Ningxia, Shi Guangyin and Niu Yuqin in Shaanxi. They set an example in transforming from personal sand control into sand control by enterprises cooperating with farmers. They stayed committed to the development idea of desert control and usage, taking advantage of enterprises, farmers, and bases, and closely integrated sand control and benefits. Through all these efforts, they have blazed a new trail in increasing income for farmers and herdsmen in the desert areas, improving the ecological environment, and achieving sustainable socio-economic development. At the same time, non-governmental organizations and social groups represented by China Green Foundation, China National Sand Control and Desert Industry Society, Inner Mongolia Association for Desertification Prevention and Control, Society of Entrepreneurs & Ecology raised funds for China's combating desertification.

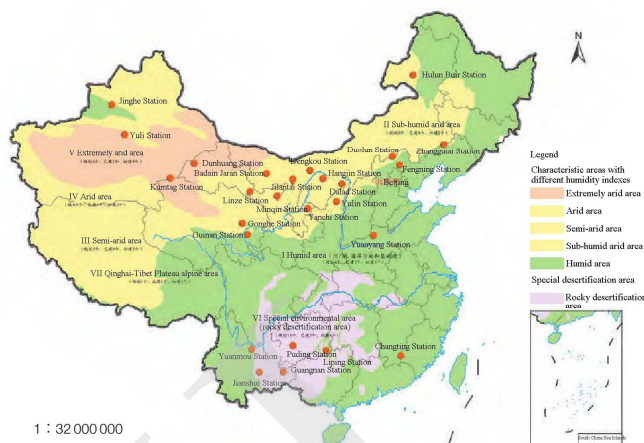


## 2.3 Beam III: Technological support

Pillar V: Scientific research and technology promotion. The Chinese government has included combating desertification in science and technology development plan and has strengthened the research on basic theories and applied technologies for combating desertification. Through systematic arrangements by the National Natural Science Foundation of China, the National Basic Research Program of China (973 Program), and the National High-tech R&D Program of China (863 Program), the investment has been continuously increased with total funding of over 500 million CNY. Great support has been given to the basic information investigation of the desert and Gobi and basic and practical researches on desertification occurrence mechanism as well as restoration and recovery mechanism of degraded vegetation, which strengthened research on urgently needed key technologies for combating desertification. With regard to the application and promotion of technologies in combating desertification, the central government, provinces (autonomous regions, municipalities), and many counties (cities) have established technology promotion networks, and a large number of technologies and information for combating desertification can be shared in time. The authorities, universities, and research institutes also regularly organize vocational training, edit and issue technology promotion handbooks, and popularize and promote knowledge and technologies for combating desertification.

Pillar VI: Desertification monitoring, early warning, observation, research network. The national desertification monitoring has started in 1994. Nowadays, a monitoring system that combines desertification macro-monitoring, positioning monitoring, and project monitoring of vulnerable areas has been formed, covering over 500 county-level administrative regions in more than 30 provinces across the country. The national macro-monitoring system releases monitoring results once every five years. Five times of national desertification monitoring and two times of rocky desertification monitoring have been completed so far, providing basic data for planning and policy formulation to combat desertification. Meanwhile, China has established a comprehensive monitoring system for sandstorms, attaining the goal of tracking and monitoring the entire process of the occurrence, development, and impact of sandstorms and providing sand-dust weather forecasting and early warning services for the government and the public. China Desert Ecosystem Observation and Research Network basically covers China's eight major deserts and four major sandy lands, as well as some atypical sandy lands, karst rocky desertification, dry-hot valleys with droughts, and other special environmental areas in central and southern China and southwest China. At present, 26 desert observation and research stations have been approved, forming a trinity of observation, research, and demonstration. What's more, a long-term observation and research network system that meets the diverse needs of

combating desertification and constructing regional economy has been established (Figure 4).



**Figure 4** Diagram of the station distribution of China Desert-Grassland Ecosystem Observation and Research Field Station Alliance

## 2.4 Beam IV: Legal protection

Pillar VII: Establishment of laws and regulations. China is the first country in the world to incorporate prevention and control of sands into the law. It is also a great practice in the history of prevention and control of sands in the world. In 2001, the *Law of the People's Republic of China on Desert Prevention and Transformation* is the legal basis for guiding China's combating desertification and won the 2017 Future Policy Award. At the same time, related laws including the *Forest Law of the People's Republic of China*, *Grassland Law of the People's Republic of China*, *Law of Water and Soil Conservation of the People's Republic of China* are closely connected with combating desertification. China has established several national standards including the *Technical Regulations for Sandification Prevention and Control*, *Technical Code of Practice on the Sandified Land Monitoring*, and *Technical Regulations of Sand and Dust Storm Monitoring*, and a series of industrial standards including the *Observation Technical Regulations for Desert Ecosystem* and *Build Technology Rules of Oasis Shelter-forest System*. All these efforts have provided technical norms in obtaining the data of desertification status and the information of the occurrence and development of natural disasters such as sandstorms.

Pillar VIII: Preferential policies. In 2005, the State Council made a decision to further accelerate China's combating desertification, improved relevant policies and regulations, and established the basic policy that the one who invests has the ownership and the one who contributes to the governance will enjoy the benefits to closely connect China's combating desertification with the economic development. In recent years, China has continuously unveiled various policies to vigorously support desertification combating. Other preferential and incentive policies include forestry subsidy policies,

grassland ecological protection subsidies and rewards, desertified land closure and protection subsidies, tax preferential policies, forest ecological benefit compensation mechanisms.

### 3 Strategy upgrading for the future

#### 3.1 Formulation of National Actions 2035 for LDN

On April 27, 2020, General Secretary Xi Jinping hosted the 13th Session of the Central Committee of Comprehensively Deepening Reform. The session approved the Overall Plan for Major Projects of National Key Ecological System Protection and Restoration (2021-2035). During the session, it was clearly stated that China would continuously promote ecological protection and restoration through staying committed to the new development ideas, making an overall plan in the integrated protection and restoration of mountains, rivers, forests, farmlands, lakes, and grasslands, and making a scientific layout of major projects of national key ecological system protection and restoration. Taking the evolution rules and internal mechanism of natural ecosystems into consideration, China will make an overall plan and comprehensive implementation to enhance the self-repair ability of the ecosystem, strengthen the stability of the ecosystem, promote the overall improvement of the quality of the natural ecosystems, and improve the overall supply capacity of ecological products. On May 26, 2017, General Secretary Xi Jinping emphasized in the 41st collective study session of the Political Bureau of the Central Committee of the Communist Party of China that we should put protection at first priority and focus on natural restoration while carrying out a large-scale action on afforestation and accelerating the comprehensive governance of water and soil erosion, desertification, and rocky desertification.

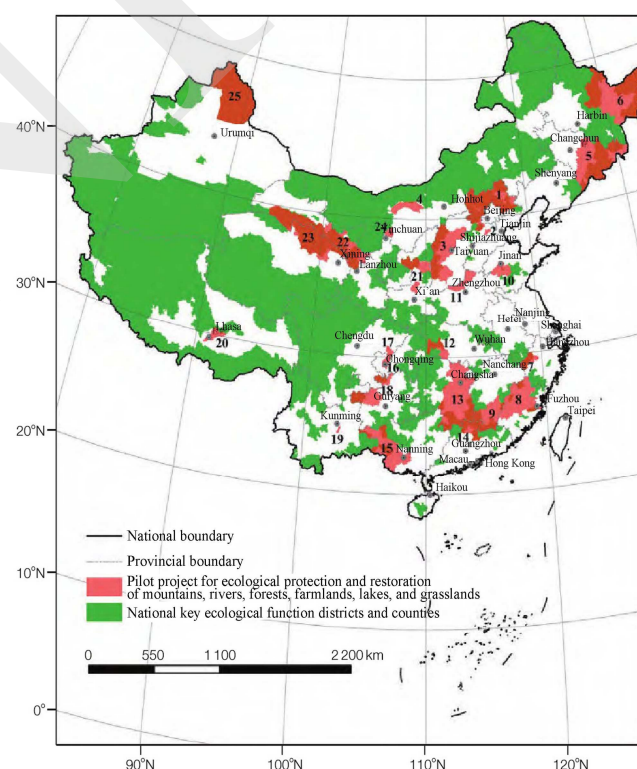
In his speech, General Secretary Xi Jinping mentioned the six-in-one concept of mountains, rivers, forests, farmlands, lakes, and grasslands, and the new concept of all-round governance covering all dimensions, regions, and procedures. On one hand, the new concept is reflected in the breadth of governance, from local areas to regional areas, then to the whole country, and finally to the globe. On the other hand, it is reflected in the depth of governance, which is to adjust the structure of the desert ecosystem, upgrade its functions, and realize the transition from sand control to sand usage as soon as possible. This has raised new policy requirements for the development of China's desert industry and also pointed out new heights, new directions, and new ideas for China's prevention and control of sands in the new era.

The strategy for combating desertification in the new era should take objectives for 2035 into consideration, meet the SDGs, and serve the needs of the country. It can be summarized as the "24-Chinese-character policy," which is expressed as follows in English: putting protection at the first

priority, green development, adjusted measures to local conditions, classified policies, systematic governance, and overall enhancement. The specific measures are reflected in three levels.

(1) Learning from nature and planning projects. Key national special ecological projects in the new era should be planned and implemented, including the construction project of protection forest system in the northwest, north, and northeast China (Phase VI), protection project of natural forests (Phase III), project of returning farmlands to forests and grasslands (Phase III), and the project of the Beijing-Tianjin sandstorm source control (Phase III). The principle of adjusting measures to local conditions and implementing policies according to classification should be followed strictly to restore afforestation for areas that are suitable for greening and keep those areas that are suitable as wasteland.

(2) Comprehensive governance and ability improvement. Taking the national ecological security strategy of "two ecological protective screens and three shelter belts" as the framework, China has initiated 25 pilot projects for ecological protection and restoration of mountains, rivers, forests, farmlands, lakes, and grasslands (Figure 5) guided by the "three lines" (the baseline of ecological functional support, the bottom line of environmental quality and safety, and the upper limit of natural resource utilization) and the "four systems" (a scientific, moderate, and orderly national land



**Figure 5** Diagram of the layout of 25 pilot projects for ecological protection and restoration of mountains, rivers, forests, farmlands, lakes, and grasslands and national key ecological function districts and counties<sup>[13]</sup>



space layout system, an industrial system of green, cyclic, and low-carbon development, an ecological civilization system combining restrictions and incentives, and a green action system with the governance by the government, enterprises, and the public).

(3) All-round governance and physical fitness. The overall control and systematic governance are implemented according to different biological-geographical units such as local areas, regions, and river basins for an all-round quality and efficiency improvement. For great rivers, especially the Yellow River, Tarim River, Heihe River, Shiyang River, Danghe River, and Shule River basins in the north, a whole-basin governance and restoration project is implemented. In the project area, the foundation and achievements should be consolidated.

### 3.2 China's solutions going to the world <sup>[14,15]</sup>

Desertification is facing grave difficulties today. It is a new challenge for the people who specialize in sand control in China to effectively promote China's experience in prevention and control of sands to the whole world and pool the strengths of all countries to deal with global desertification problem. On September 6, 2017, the UNCCD COP13 was held in China. General Secretary Xi Jinping emphasized in his congratulatory letter to the conference that combating desertification is a common challenge for mankind and requires the international community to work together to tackle it.

The Chinese government has promoted valuable experience in the prevention and control of sands to the world by building platforms, promoting technology, and constructing systems. ① Building platforms. It relies on the convenient conditions of international platforms such as the Belt and Road and Forum on China-Africa Cooperation to establish a cooperation mechanism for combating desertification with participating countries and have a regular exchange of experience in prevention and control of sands. ② Promoting technology. It means delivering new methods, technologies, ideas, and thoughts of China in combating desertification to participating countries and providing skill training for their relevant staff. ③ Constructing systems. It means introducing China's current desertification control system to the world for other countries to learn.

The globalization of China's sand control plan is high praise of the achievements made by Chinese people through generations engaged in the prevention and control of sands, and China will shoulder the responsibility as a major power. Four proposals have been made for global efforts to combat desertification.

(1) To formulate the protocol of UNCCD and unify the benchmarks and indicators for the whole world to follow. Different from the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity UNCCD has not formed any binding protocol or implementation agreement till now. Although the LDN has been raised and three indicators including land coverage, vegetation

productivity, and carbon storage have been used for evaluating LDN, there is still no unified evaluation method, data, and standard. It is advised that the UNCCD COP should discuss and formulate a binding protocol and set up rigid indicators that are measurable, comparable, and verifiable, develop methods and technologies for the evaluation of LDN to provide a unified and scientific evaluation method and standard for global evaluation of LDN and scientifically evaluate the effect of combating desertification in different countries, so as to promote joint implementation of the protocol.

(2) To set up a global observation network and establish a desertification monitoring and evaluation system based on big data. There is regular implementation of global desertification monitoring and evaluation (once every five years) to observe the changes in drylands. It is advised to compile a list of technologies for combating desertification and a list of technical requirements in various countries, build a directory and an information exchange platform of sustainable land management in desertified areas and ecological restoration technologies, and construct information sharing platforms about characteristic plants and germplasm resources that have sand fixation effect, drought resistance, and saline-alkali tolerance so as to promote the information exchange. What's more, the global desert ecosystem service assessment and value accounting will be carried out.

(3) To compile the global natural desert (heritage) directory to leave the landscape of aboriginal deserts for future generations. With reference to the World Heritage List, the global natural desert (heritage) directory is compiled with the joint efforts by UNCCD, International Union for Conservation of Nature, United Nations Educational, Scientific and Cultural Organization (UNESCO), and Desert Green Foundation. National parks, dryland nature reserves, and restricted protection areas are established to effectively protect aboriginal deserts as the heritage of nature and our culture.

(4) To initiate actions in the global governance of combating desertification and build a community of shared future for mankind in arid regions. China would like to lead the whole world by firstly attaining the goal of LDN by 2030. It is advised to play the coordinating role of UNCCD, United Nations Environment Programme (UNEP), FAO, UNESCO, other international organizations, strengthen the bilateral cooperation such as the China-Arab States Cooperation Forum and Forum on China-Africa Cooperation, enhance the multi-lateral cooperation in the Belt and Road regions, central Asian regions, and the northeast Asian sub-regions, implement the Belt and Road Initiative for Combating Desertification and support and promote the global cooperation in combating desertification.

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