

Chapter Three China's Undertakings in Natural Disaster Reduction

The Chinese Government has long regarded disaster reduction as one of the basic state policies for promoting social stability and sustainable economic development, and has attached importance to disaster reduction undertakings, thus scoring great achievements over the past dozens of years.

Section 1 China's Construction Works in Disaster Reduction Engineering

While following the basic policy of "Giving priority to prevention and integrating it with disaster combating and relief operations", China's disaster reduction engineering also embodies the economic principle of "promoting what is beneficial and simultaneously eliminating what is harmful", so as to contribute to the nation's sustainable and steady socio-economic development.

China's construction works in disaster reduction engineering mainly include: engineering works beneficial to large areas, such as flood prevention/control and drought combating engineering works, seismic prevention and quake-resistance engineering works, landslide and mud-rock flow control projects, shelter-forest ecological engineering projects, desertification control engineering projects, forest disease prevention and insect pest control projects, agricultural ecological-disaster control engineering projects, forest and grassland fire control engineering projects, as well as engineering projects to address hazards of lesser impacts.

These engineering projects are mainly located in the middle and lower reaches of major rivers, where the ecological environment is relatively fragile and the areas are prone to relatively serious natural hazards' (see Fig.2).

1. Flood (tide) prevention and drought combating engineering works

— Up to 1992, China had built a series of engineering projects in this connection, including 24.2 thousand kilometres of flood preventive/control dikes, and 84000 reservoirs of medium and large sizes with a total water holding capacity of 466.8 billion cubic meters; 12000 kms

of tidal barrage; 490 thousand irrigation and drainage stations and 2.95 million motor-pumped wells with a total irrigation and drainage power of 65.97 million kilowatts; 5531 irrigated regions, with each covering an area of (or over) 667 *ha*; thereby bringing the total area of effectively irrigated land to 49.46 million *ha*. In addition, soil erosion in a total area of 58.64 million *ha* was initially brought under control.

— Physical infrastructure to strengthen agriculture's drought-combating capability has been intensified, and the relevant engineering projects include: those aimed at raising water-utilization efficiency through networks of plastic pipes, underground pipelines and cement canals; those involving construction/improvement of terraced land, dike-protected land, sandy land and underground reservoirs; those aimed at drought-combating by means of eco-farming, through great efforts at building shelter forest-belts and extensive grass planting; and those involving adoption of drought-combating cropping practices, including adjusting cropping patterns, selecting and using drought-resistant strains, and expanding areas of plastic-film covered farming plots.

Over the past 40 years, the flood prevention control engineering undertakings have played a significant role in China's disaster reduction, having saved the nation an estimated 300 billion *yuan* of losses which would have otherwise occurred, and having also brought about remarkable social benefits. The large-scale flood prevention engineering projects that have already been in use include: the flood prevention system in the lower reaches of the Yellow River, the river-harnessing engineering projects of the Yangtze River, Huaihe River, Haihe River and Liaohe River, etc. The engineering works currently under construction include: the harnessing projects of the Huaihe River and Taihu Lake; the Xiaolangdi Water Dam Engineering Project on the Yellow River, in addition to the gigantic Three-Gorge engineering project on the mighty Yangtze River and the great engineering project to channel water resources from the south to northern China--both known as "National engineering projects spanning the 2 centuries".

2. Seismic Prevention and Quake-resistance Engineering

On the basis of reinforcing seismic designing for new buildings and new projects, and seismic strengthening of existing buildings and structures lacking in earthquake resistant capability, regional comprehensive quake-resistance undertakings have been implemented, including works aiming at quake-prevention, earthquake isolation and alleviation. Thus,

reinforcement works against earthquake covering 230 million square metres of buildings of various types and covering the sites of a number of key facilities have been completed. These include:

— Reinforcement engineering works of major public-utility facilities in quake-prone areas have been completed, covering the communication, signal, water and hydropower supply facilities and the locomotive engineering and management facilities of China's 14 trunk railway-lines, such as the railways of Beijing-Baotou, Beijing-Guangzhou, Tianjin-Pukou, and Longhai and thousands of railway bridges.

— Reinforcement works of 90 key power plants in the major grid of northern, northeastern, eastern, northwestern China and central parts of China.

— Reinforcement works of long-distance communication centres and part of class A communication lines and communication facilities.

— Reinforcement works of the engine-houses and pump-stations of the 6 major petroleum transmission pipelines, including the Shandong-Ningxia pipeline, Shenyang-Dalian pipeline and Qinhuangdao-Beijing pipeline.

— Reinforcement works of 60 major reservoirs, including the Miyun, Guangting, Yuecheng, Doushan Reservoirs.

— Reinforcement works for large-size (or key) enterprises located in areas which had been stricken by earthquakes above magnitude 7 on the Richter's Scale, including 20 large oil refineries, a large-size ethylene processing project with a productive capacity of nearly 1 million tons, more than 20 key iron and steel plants and other key enterprises which have great bearing on the national economy and people's livelihood.

3. Geological Disaster Prevention and Control Engineering Undertakings

— Geological survey has been carried out at the site of projects in mountainous areas prone to mud-rock flows in southwestern and northwestern China and Beijing, in areas prone to subsidence in the Wuhan Municipality of Hubei Province, and areas prone to landslide in Chongqing Municipality, as well as in areas prone to land-fissure in Xi'an Municipality.

— Large-scale works for prevention and control of landslide, cave-breakdown or mud-rock flow have been carried out in over 10 key areas and communication lines prone to such risks. Currently, such works are being carried out in 5 areas prone to land-slide, including the area of Liantzeya Precipice in the Three-Gorges Region of the Yangtze River.

— Comprehensive measures to harness sea-water erosion in the Laizhou gulf of Shandong Province have also been carried out.

4. Engineering Projects for Shelter-belt Systems, Afforestation and Combating Desertification

In the last 10 years, the nation has exerted great efforts in afforestation, and the results include that through the nation-wide drive of voluntary tree-planting, the accumulated number of trees so planted has reached 13 billion; that the urban greening areas have reached 473000 *ha*; that the nation annually increases her forest acreage by 5.33 million *ha*; that the total acreage of the nation's standing man-made forests has been increased to 33.79 million *ha*; and that the nation's forest coverage-rate has been raised from 8.6% in the early 1960s to the current 13.92%. In addition, the standing man-made grass-lands have been increased to 12 million *ha*.

— The "3 Northern" Shelter-belts Systems, covering vast areas of 13 Provinces and Autonomous Regions in northwestern, northern and northeastern China, have in a period of 14 years brought into being 13.4 million *ha* of man-made forests. As a result, in the vast areas of these Provinces and Autonomous Regions the forest coverage has been raised from 5.6% to 9.1%, 11 million *ha* of farm-land has been protected by the shelter-belts, and the sand-storm over a total area of 6.67 million *ha* has been brought under control.

— The shelter-belt system along the upper and middle reaches of the Yangtze River. Since its implementation in 1989, 3 million *ha* of man-made shelter-forests have been brought into being.

— The coastal shelter-belt system. Implemented since 1989, with an original tree-planting target of 3.56 million *ha*, the coastal shelter-belt system completed so far includes: 13000 *kms* of coastal shelter-belt, 2.47 million *ha* of farm-land protection shelter-belt network along the coast. Thus, the coastal man-made forest area now totals 6.67 million *ha*.

— The greening engineering projects on the plains. These involve 918 counties in the plains areas of the nation. Of these, 632 counties have reached the greening standards set by the State for the plains, with shelter-belt networks completed in 28.67 million *ha* of farmland in the plains, accounting for 82% of the areas suitable for afforestation.

— Taihang Mountains Greening Engineering Projects. Covering vast areas of the Taihang Mountains Range in 4 Provinces (and Municipalities), these projects have begun implementation, and are programmed to bring about 3.299 million *ha* of afforested areas by the year 2000.

— Sand Fixation and Desertification Control Engineering Projects. These are being implemented, and are designed to bring 7.119 million *ha* of desertification-prone land and decertified land under control by 2000.

— Engineering Projects of Grass-planting and Grassland Protection.

5. Forest-Fire Prevention and Control Engineering Projects

The national forest-fire prevention and control efforts have been markedly intensified since 1988. Annual forest fire occurrences have dropped from 16000 (in 1950-1978) to 9000 (1988-1992), the fire-damage rate has dropped from 8.5 per thousand to 0.4 per thousand.

— With assistance from World Bank, the Daxinganling Mountains Forest Post-Fire Rehabilitation Project has been completed. In the 4 years of its implementation, 3900 *kms* of passway and log-transportation roads have been built or widened, and a comprehensive system to prevent and control forest-fires has been established to cover 22 million *ha* of forests.

6. Prevention and Control Engineering Projects against Biological Disasters in Agriculture and Forestry

— According to statistics in 1991, more than 28000 plant-protection companies, "plant hospitals" and professional task forces at township and county levels have been set up across China, employing more than 20000 professionals. And preventive or control measures against plant-diseases, insect-pests, rodents, etc. have been carried out by professionals in over 10%

of the nation's afflicted areas.

— According to statistics in 1979-1988, annually on an average, preventive or control measures had been taken against the above-mentioned biological disasters in 150 million *ha* of China's farmland, accounting for 80% of the farmland prone to such disasters.

— Initial surveys have identified more than 1000 kinds of biological control-agents resources against agricultural pests. In 1991, biological control was applied to 20 million *ha* of farmland nationwide.

— By the end of the 1980s, integrated pest management (IPM) technology in rice production was disseminated and applied to 13 million *ha* of paddy fields annually, accounting for 10 percent of the areas under the past-control programme. In recent years, emphasis has been laid on the control of cotton boll-worm in cotton fields, on the monitoring and control of brown plant-hoppers in paddy fields, as well as on locusts control.

— The national fishery environment monitoring network has been set up.

— An national programme on forest-fire control has begun implementation, involving the setting up of networks for forest-fire forecasting and early-warning networks for fire behaviour monitoring and for fire behaviour communication, networks of fire isolation passway, as well as the setting up of professional fire brigades with improved fire-fighting equipment.

— According to the survey conducted in 1992, more than 2400 county-level stations for forest diseases and insect pests prevention, control and quarantine had been set up, staffed with 11 thousand professionals. From 1979 to 1991, an accumulated area of 46 million *ha* of forests was protected, thus having controlled the rising tendency of forest diseases and pests.

— 4.2 million *ha* of grassland are annually under prevention and control, accounting for 21% of the area affected by pests and rodents.

Section 2 The Non-engineering Undertakings

China's non-engineering undertakings related to disaster reduction include: the establishment of systems for disaster monitoring, assessing, forecasting and early-warning (see Chapter Four); land use programming; disaster and risk zoning and disaster reduction programming; disaster insurance; disaster rescue and relief; disaster reduction through application of relevant science and technology; publicity and education; and legislation.

1. China's Land Use Structure and Programming

According to China's land use programming, by the year 2000, the nation's land use structure will be as follows: arable land under cultivation, accounting for 12.9%; garden land, 0.9%; forest land, 23.3%; grassland, 27.6%; water area, 3.9%; land for human settlement and industries, 2.4%; land for communication purposes, 0.9%; and unused land (usually with difficult terrain features), 28.1%. Thus, it can be seen that the proportion of land that can be specifically used for disaster reduction engineering projects is extremely limited. Therefore, even greater efforts should be made to control a rapid growth of population, so as to reduce the pressure on the land resources and to mitigate the losses from natural disasters.

2. Zoning of Natural Hazards and Risk, and Disaster Reduction Programming

The zoning of natural hazards and risk, and disaster reduction programming are conducive to avoiding heavy losses from disasters and giving guidance to the relevant prevention, monitoring, forecasting, combating and relief activities. On the basis of enhancing the zoning, risk assessment and programming relating to individual categories of natural disasters, China has actively initiated and stressed the regional integrated programming related to the zoning and risk assessment, and integrated programming on natural disasters reduction.

The Third Generation Seismic Intensity Zoning Map(1990) which was approved in 1992 by the State Council (i.e. the Central Government), provides the basic data for the nation's economic construction and land use, and also offers a basis for designing earthquake-combating works for industrial sites and civil-engineering construction in general. Besides, the nation's formulation of the zoning of agricultural, meteorological and ecological disasters, the zoning of flood and storm risks, of agricultural insurance and of forest-fire insurance have

provided data useful to the construction, development, input and disaster reduction undertakings, in the corresponding fields.

From the viewpoint of a comprehensive study, the following are areas of comprehensive high risks of natural disasters: the coastal areas of southeastern China, the lower Yangtze and Huaihe River valley, northern China plains, northeastern plains, the Sichuan Basin, the areas where farmland and pastures meet in a zig-zag pattern in north China, and the areas along the middle and lower reaches of great rivers, lakes in the eastern part of China. On the basis of the above-mentioned data, China is now formulating integrated national disaster reduction plans.

3. Natural Disaster Insurance

China's insurance undertakings have played an important role in regional disaster reduction, especially in damage prevention, disaster losses mitigation and in post-disaster production-recovery.

— Since resuming its business in 1980, the People's Insurance Company of China has borne substantial risk responsibilities, with its insurance amount having increased from 140.8 billion *yuan* in 1980 to 6167.5 billion *yuan* by the end of 1992. Agricultural insurance, which was initialled by PICC in 1982, has now covered nearly 100 types of risks, thus playing a useful role in dispersing and mitigating risks.

— Ministry of Civil Affairs has also sponsored disaster relief cooperative insurance in the rural areas, which is under trial implementation in more than 100 counties.

4. Natural Disaster Relief

Disaster relief is not only a major post-disaster task of the Government to minimize losses but also an undertaking that has direct bearing on disaster reduction involving thousands upon thousands of households.

— For an average year, the Central Government allocates 1.4 billion *yuan* of relief funds, 1.5 million tons of relief grain and a large quantity of cement, steel, timber, and other materials for disaster relief. In the case of the 1991 extraordinary flooding disaster in eastern

China, more than 60 million people across the country participated in the relief operations, 8 million disaster victims were safely migrated, 7.5 million tons of grain and 30 billion *yuan* were mobilized and duly distributed for disaster relief purposes.

— Over the past 40 years, the People's Liberation Army (PLA) of China has actively participated in the nation's disaster relief, having been engaged in 4.1 hundred thousand disaster-relief operations, with the accumulated participation of 17.99 million persons of the armed forces, 110000 cruises of airplanes and naval vessels, and 13.34 million numbers of runs of vehicles. And in these relief operations the PLA has rescued and helped migrate or transfer 4.15 million disaster-stricken people and 34.58 million tons of goods and materials in the disaster-stricken areas.

5. Natural Disasters Reduction by Relying on Science and Technology

The Chinese Government has all along attached great importance to reducing natural disasters by relying on relevant science and technology. In this connection the Government has set up over 100 disaster-reduction research institutions across China, and has incorporated subjects and projects on natural disaster reduction into the various science key-programmes and long-term programmes of scientific research. These include:

— The study of integrated prevention and control technology and know-how on crop diseases and insect pests;

— The study of integrated prevention and control of forest-fires;

— The study of digital forecast of marine disastrous environments and key technologies on the study in off-shore waters;

— The study of monitoring and forecasting technologies on typhoons, torrential rains and other disastrous weather.

— The study of key technologies on seismic and geological disasters and disaster reduction in urban areas;

— The study of global climate change prediction, the related impact assessment, and the

response policies and measures;

— The study of water resources of the Yellow River;

— The disaster remote-sensing study;

— The study of the formative causes, and patterns of major types of natural disasters, and their monitoring and risk assessment;

— The R and D and application of flood-prevention remote sensing and related early warning system, and the technological study of prevention and control of landslide and mud-rock flows;

— Urban programming against earthquakes and other disasters, and the study of urban integrated disaster reduction engineering works;

— Relevant Government Ministries and local governments have also formulated a series of scientific and technological projects on disaster reduction.

6. Publicity, Education and Legislation in Disaster Reduction

— China's publicity on disaster reduction is carried out mainly at the following two levels: One is mass-oriented, aiming at enhancing their knowledge of and capability for disaster prevention and disaster reduction, by making full use of existing mass media to hold popular knowledge-contests, to exhibit and show relevant popular-science telefilms and to publish easy-reading articles to improve the people's disaster reduction awareness. The other level is of a more professional nature, and involves the publishing of special disaster reduction magazines and collections of relevant essays, which are also being exchanged among domestic and foreign professionals engaged in disaster reduction.

— In recent years, China has attached importance to education in natural-disaster reduction. She has introduced basic and special curricula on disaster reduction into such faculties in institutions of higher learning as geoscience, construction engineering and water conservancy engineering, where postgraduates doing master or doctoral degrees on disaster reduction are educated. The nation has, moreover, set up specialized Disaster Reduction Colleges, which

include disaster risk-management specialties. In addition, general knowledge of disaster reduction has been incorporated into the courses of geography and of basic natural science in the middle schools and primary schools. And public education in disaster reduction has been conducted and supplemented, in some places, by rehearsals on disaster reduction. All this has contributed to raising the disaster reduction awareness of the general public.

— Various relevant departments have increasingly attached importance to disaster-reduction legislation. Laws and regulations on some categories of disasters have been promulgated, or are being drafted or amended.

7. Shortcomings in the Nation's Disaster Reduction Undertakings

Though China has achieved great progress in disaster reduction there are a number of deficiencies which remain to be addressed, and which are attributable to the nation's relatively weak economic foundation, magnitude of disasters and relatively late start of non-engineering undertakings:

— The financial input for disaster reduction has not kept pace with the nation's socio-economic development.

— Lack of national integrated risk assessment on natural hazards and national or regional comprehensive programmes for disaster reduction. And this is not conducive to the optimal and comprehensive utilization of the nation's natural resources nor to giving full play to comprehensive benefits.

— The implementation of non-engineering disaster reduction measures is still lacking in momentum.

— Further efforts are needed to improve the disaster reduction engineering works against individual categories of disasters, and to improve the early warning systems. Moreover, comprehensive regional disaster-reduction engineering systems in high-risk areas are still lacking.

Chapter Four China's Natural Hazards Monitoring and Early Warning Systems

The nation's monitoring and early warning systems for natural hazards include those for monitoring, analysis and forecasting of various hazards. The disaster information and early warning are issued to the general public as necessary, so as to draw their attention in time to adopt relevant measures for purposes of disaster reduction.

Section 1 The National Hazards Monitoring and Early Warning Systems

Over the past 40 years, departments of the Chinese Government pertinent to natural hazard management, having increasingly strengthened their efforts in building their disaster monitoring and forecast systems, have established their relevant networks, which are playing important roles in disaster reduction. Each of these networks consists generally of the following four component parts: the network for observation of natural hazards, relevant elements and phenomena; the telecommunication system for the real-time collection, transmission and exchange of the observation data; the system for data processing, analysis and diagnosing, modelling and formulation of forecasts or warnings; and the system for services, including the transmission and dissemination of such forecasts or warnings. Each relevant department has its own emphasis in the establishment of networks. Generally speaking, the monitoring and early warning systems relating to sudden or abrupt hazards are relatively more comprehensive, and these relate to meteorology, oceanology, hydrology and seismology.

In addition to the above, a great number of non-governmental or auxiliary observation, monitoring or forecasting stations and their staff workers have started functioning, thereby making up for the deficiencies of the State-run professional stations and networks to some extent. In recent years, China has made remarkable achievements in monitoring floods and waterlogging, droughts, forest and grassland fires, sea ice, desertification, crop diseases and insect pests, landslides, mud-rock flows etc. through the application of aviation/satellite remote-sensing and land-based remote sensing technologies.

Currently, the major real-time data transmission networks of different systems are mostly hooked up through medium-speed transmission links (satellite, wire or microwave), and some are collecting data from observatory stations by means of satellite receiving and transmission. Computers have in the main been applied to automatic real-time dissemination and exchange of real-time data.

The department in charge of management of different categories of natural disasters have established their forecast mechanisms at national, regional (including major river-valleys and sea regions), provincial and prefectural or even county levels, to take charge of the processing, analysis, diagnosing, modelling, forecasting and warning operations. Apart from publicly issuing disaster forecasts and warnings covering the whole country or the relevant big regions, the National and Regional Centres also offer analysis and diagnosing data and various pre-disaster guidance output to relevant operational units, and in the meantime carry out global or trans-national forecasts. The forecast and warning mechanisms below the provincial level are generally in charge of the forecast and warning only within their respective administrative areas.

Section 2 Current Status of Natural Hazards Monitoring and Early Warning Systems

1. Meteorological Observation, Forecast and Warning

— In addition to regular surface and upper-air observation, the meteorological observation and monitoring system also encompasses different multi-functional automatic weather-stations, meteorological radar-sets, weather satellites, meteorological rocket and airplane detection, and these have an effective range from several meters underground to dozens of kilometres or to even higher altitudes. Currently, the meteorological observation and monitoring network in China consists of 2490 surface meteorological weather stations, 957 precipitation observation stations as well as 143 radio-meteorological stations and radar wind-observation stations. Thus the nation's meteorological network density has met the requirements set by World Meteorological Organization(WMO). In addition, the nation has various kinds of weather radar-sets and satellite-information receiving installations currently in use. All in all, about 20000 professionals are now engaged in the nation's meteorological observation and

monitoring networks.

— In respect of weather forecast, on the basis of digital prediction, comprehensive analysis and multiple prediction methods have been used to make long-, medium- and short-term forecasts and imminent forecasts. And the accuracy of these forecasts has been markedly improved.

— The dissemination of forecasts and warnings is mainly conducted through radio-broadcasting and television programmes; automatic telephone services in cities; special telephone responses to weather inquiries; weather forecast and warning broadcasting; warning receivers installed by more than 70000 users; as well as through newspapers and other written materials, etc..

2. Hydrologic Observation and Forecast/Prediction

— While carrying out large-scale water conservancy undertakings, China has also rapidly developed her hydrologic observation and forecast/prediction. Up to the end of 1992, China already had 3172 hydrologic stations, 1149 hydro-metric stations, 15368 precipitation stations, 64 hydrologic experimental stations and 13684 metering wells of underground water in charge respectively of the reporting of hydrologic information on rivers, lakes and reservoirs, with 8843 stations having been equipped with a total of 12000 wireless talkies.

— Currently, all the flood control departments from the central down to the local levels are engaged in the hydrologic forecast/prediction.

3. Marine Observation, Forecast and Warning

— The nation's marine and coastal disaster analysis, forecast and warning system consists of 3 tiers of forecast organizations: the National Marine Forecast Center, the 3 sea regional centers and Hainan Center. They issue forecasts and warnings relating to typhoon storm-surge, temperate-zone storm-surge, sea wave, sea ice, tsunami, and warnings on marine accidents and oil spilling, etc.

— With renovation and upgrading in recent years, marine environment and disaster monitoring networks have carried out automation in their monitoring, observation as well as

in data collection relating to tides, waves and sea temperature. At present, the nation has 60 coastal and island oceanic stations, 10 central oceanic stations, with 30 of these stations having been equipped with automatic wave metering system, 40 with automatic tidal gauge systems. These stations, together with the stations under the Ministry of Water Conservancy and other relevant departments, have formed the national tide-observation network with 104 stations, which are effectively monitoring the coastal storm-surge and the sea-level changes.

4. Seismic Disaster Observation, Prediction/Forecast and Warning

— The seismic precursor observation system is composed of 1300 professional and local stations of 3 different levels, namely the national, regional and provincial levels.

— The main methods to observe and monitor seismic precursors involve application of technologies in the fields of seismic metering, geomagnetism, topographic deformation, the physical and chemical dynamics of underground water, terrestrial electricity, crustal stress gravity, meteorology, ground temperature, and anomalies of living beings.

— China's current state of art in earthquake prediction can be summarized as follows: some, though not all, types of earthquakes can be predicted with a reasonable degree of certainty; long- and medium-range earthquake prediction has attained a degree of reliability, though the successful rate for imminent earthquake predicting is still relatively low.

5. The Observation and Monitoring of Geological Disasters

— The geological disaster monitoring involves the observation and monitoring of landslides, cave breakdown, mud-rock flows, underground water level, subsidence, underground-water contamination and pollution, ground fissure or crack, etc..

— China has set up 3 tiers of geological disaster monitoring stations, namely, the National Monitoring Headquarters; the 30 monitoring stations at the provincial levels, and the 160 sub-stations at prefectural (municipal) levels, with a total staff of 2000 people. In addition, the nation has 19000 subterranean-water monitoring posts or stations.

6. Monitoring and Early Warning of Biological Disasters in Agriculture

— The nation has set up more than 1900 monitoring and forecasting stations which are responsible for the forecasting and warning of crop disease, pests and rodent, with nearly 10 thousand full-time staff members. With the National Plant Protection General Station under the Ministry of Agriculture as the core, the monitoring and forecasting network is responsible for the monitoring, forecasting and warning of major biological disasters caused by plant diseases and pests and by rodents in the country.

— To prevent the importation of dangerous diseases, pests, and noxious weeds and their spread in China, the nation has set up more than 240 animal and plant quarantine posts or stations at the ports of entry in relevant harbours and airports, etc., and has in addition set up more than 1800 plant quarantine stations nationwide, with a total staff of more than 8000 professionals.

7. Monitoring and Early Warning of Biological Disasters in Forestry

— China has established 1898 forestry quarantine stations for forest disease and pests control, with a total staff of more than 8000 full-time workers. The National Center for Forest Disease and Insect Pests Survey takes charge of guiding and coordinating the nation's monitoring and survey work, and issuing disaster information and forecasts.

— The National Center and some provincial stations have established relevant prediction modelling based mainly on statistic methods to conduct the medium and short-term prediction of disease and insect pests, and have achieved tangible results.

8. Monitoring, Forecasting and Warning of Forest Fires and Grassland Fires

— Up to 1993, China has set up ,in her major forest areas, 334 forest-fire prevention stations, 6132 observatory stations and 112 forest-fire risk weather forecast stations, staffed with 540000 full-time and part-time forest guards as well as 10000 forest policemen in the major forest areas and relevant local units. In the State-owned forests in northeastern China and Inner Mongolia and southwestern China, 13 aerial forest protection stations equipped with a total of 60 forest-protection airplanes. In addition, some major fire prevention areas have been equipped with satellite data receiving and processing installations.

— The nation has set up the Grassland-fire Prevention Commanding Headquarters, and the sub-command mechanism in 13 province/autonomous regions, staffed with 10000 full-time and part-time professional fire-fighters as well as 200000 volunteers. A nation-wide fire-fighting information management network is being established. And computer transmission of colour pictures and other satellite-monitoring data has been initiated in the country.

9. Problems and Shortcomings

Thanks to more than 40 year's efforts, particularly to the hard work of the last 10 years, China has established national hazard monitoring and forecast systems with multi-functions of scientific research, data collection, monitoring, analysis and processing of basic data, and has established tens of thousands of observation/monitoring stations staffed with hundreds of thousands of professional people. Great achievements have been made, however some shortcomings remain to be improved or resolved.

— The above-mentioned monitoring, forecast and warning systems have respectively their own system aimed at addressing one single category of disasters or an individual disaster respectively. Therefore, there has been duplication of efforts for instance, each having its own telecommunication system for each category of disasters, and its own installations for collecting meteorological information relating to various kinds of disasters. And this has not only caused waste in financial resources but also inconvenience in the timely exchange and sharing of information on various kinds of natural disasters and inconvenience in the integrated study of the trends of these disasters.

— The overall technological level of monitoring, forecast and warning systems of various disasters is still lagging considerably behind the advanced levels of developed countries. And there are still some weak links, for instance, problems in the prompt transmission and dissemination of various disaster warnings.