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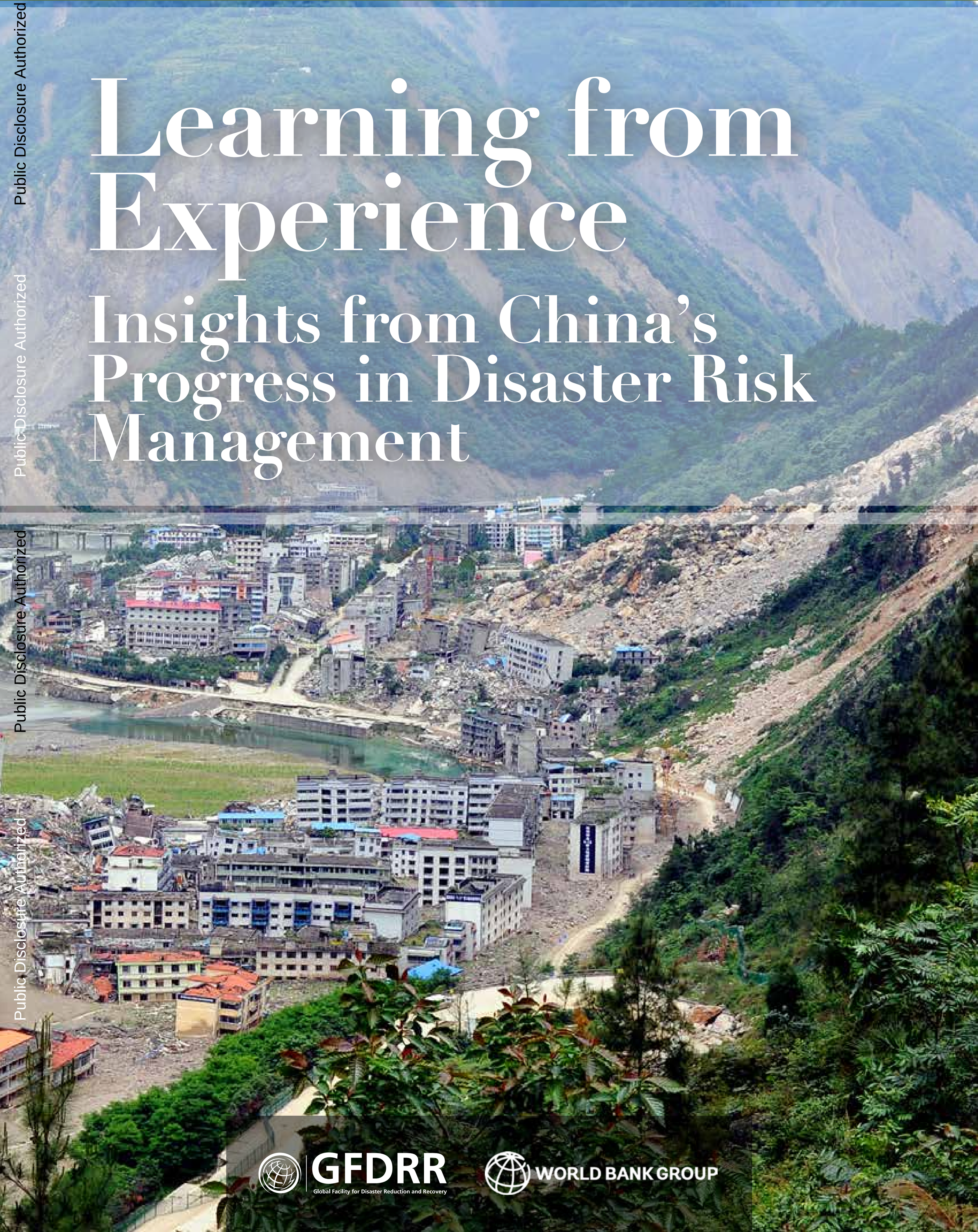
Learning from Experience

Insights from China's Progress in Disaster Risk Management



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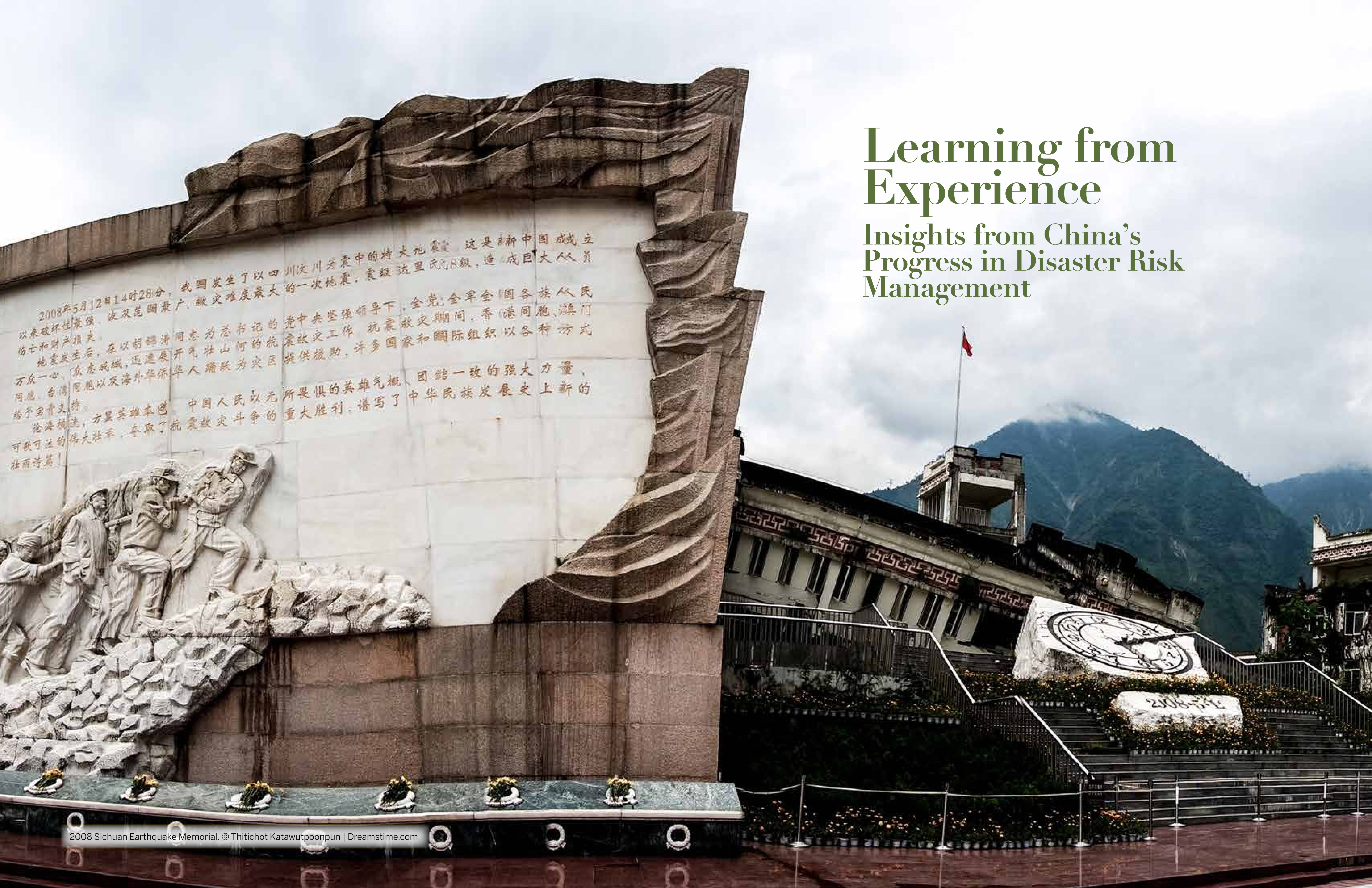

2008 Sichuan Earthquake Memorial. © Thitichot Katawutpoonpun | Dreamstime.com

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Foreword

China has long known more than its fair share of disasters, including earthquakes, typhoons, floods, and droughts. The good news is that in recent decades, the country has made tremendous headway in building its resilience to disasters. Learning from these efforts will be critical to strengthening resilience building efforts in China and beyond.

In that spirit, this Knowledge Note distills some lessons from China's[1] progress in many areas of disaster risk management. The note does not comprehensively cover the country's achievements, but focuses instead on topics that might be of particular interest to DRM practitioners globally. Drawing on expert insights from China's disaster risk management community, key themes highlighted by this note include:

- **The evolution of national disaster risk reduction (DRR) planning.** Over the years, a shift from reactive to proactive disaster reduction, as well as a focus on reducing disaster mortality and direct economic loss, have figured prominently in the evolution of China's DRR plans.
- **The rise of demonstration communities**. Underscoring China's commitment to community-based disaster risk management, the country has been implementing a nationwide initiative to designate select communities as demonstration communities for raising awareness about the importance of DRR.
- **Standardization of the disaster loss statistical system.** Efforts to strengthen and standardize the disaster loss statistical system have led to a marked improvement in the ability of disaster risk managers to use and analyze the country's disaster loss data for risk-informed reconstruction and planning.
- **Development of an agricultural insurance system**. China's agricultural insurance system has continued to develop rapidly, as evidenced by its growing market size, expanding list of insured perils, and increasing liability and coverage.

[1] Unless specified, the data and information in this report covers only mainland China.

Chengdong District, Xining, Northwest China. Photo by 泽新 李 on Unsplash.

- **Establishment of a catastrophe risk insurance system.** China has also made significant progress in establishing a catastrophe risk insurance system that allows for local innovations and pilots based on local characteristics.

- **Development of a comprehensive space-based system of disaster and emergency monitoring.** The development of this capability has strengthened the country's disaster risk management practices, in part by enabling more timely, accurate, and comprehensive post-disaster assessments.

- **Rise of counterpart support for post-disaster recovery.** In response to the devastation of the Wenchuan Earthquake in 2008, the Chinese government established a counterpart support program for post-disaster recovery, which designated select provinces and municipalities to support some of the most severely affected counties and cities.

Amid a changing climate, China is facing the specter of even more significant disaster risks in the future, which may also bring global cascading impacts. Taking stock of the progress that has been achieved so far, there is good reason to believe that the country will continue to learn and innovate toward a resilient future.

Acknowledgments

We wish to acknowledge the contributions of authors from the Academy of Disaster Reduction and Emergency Management, Faculty of Geographical Science, Beijing Normal University: (in alphabetical order) Mr. Qingyang Mu, Ms. Yu Qiao, Professor Jidong Wu, Ms. Jingyan Wu, Professor Wei Xu, Professor Saini Yang, and Professor Tao Ye.

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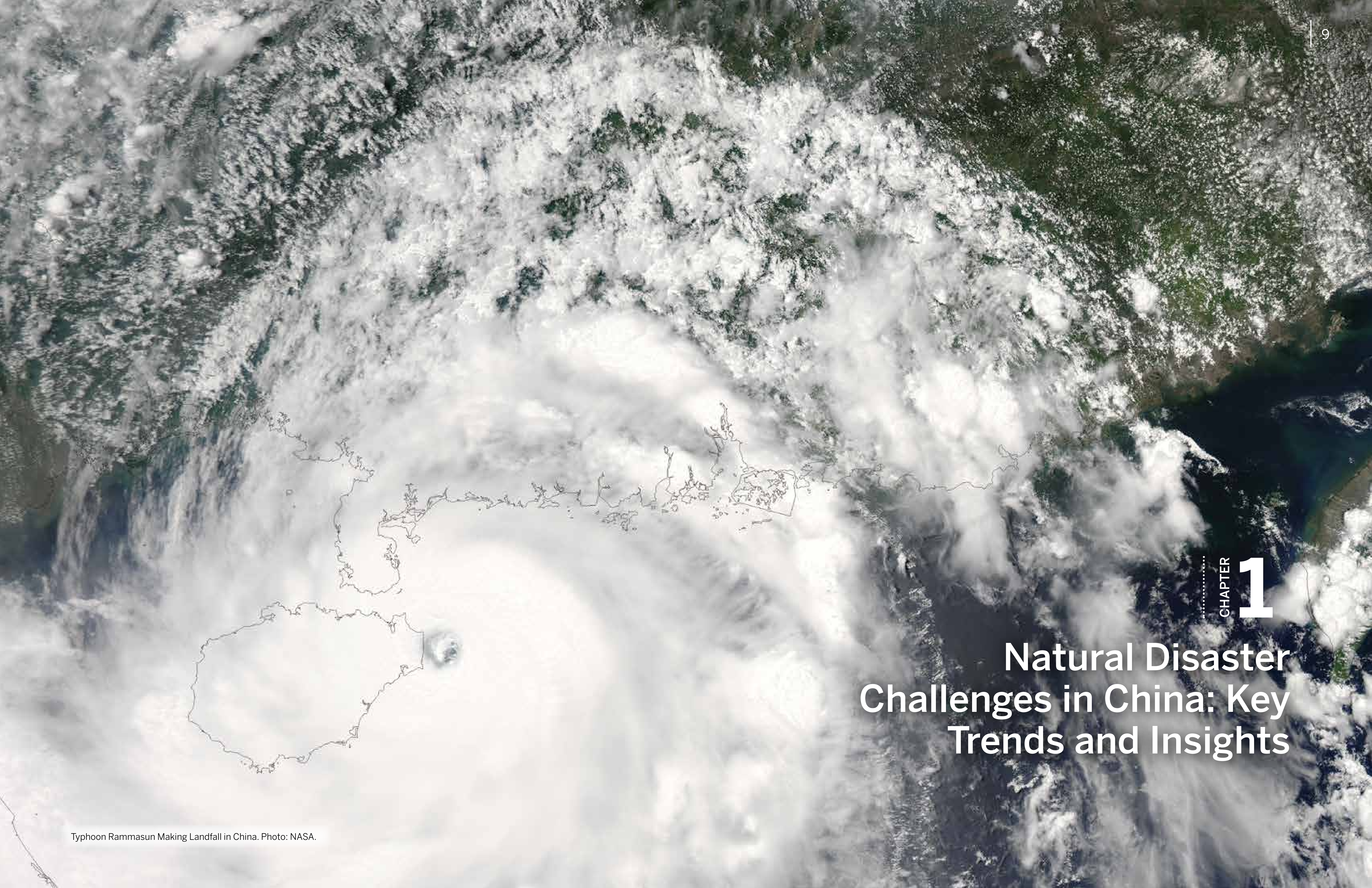
This report has been made possible by the generous support of the Global Facility for Disaster Risk Reduction and Recovery (GFDRR).

Abbreviations

CBDRR	community-based disaster risk reduction
CBIRC	China Banking and Insurance Regulatory Commission
CCCPC	Central Committee of the Communist Party of China
CIRC	China Insurance Regulatory Commission
DOF	department of finance (provincial)
DRR	disaster risk reduction
ESA	European Space Agency
GDP	gross domestic product
IDNDR	International Decade for Natural Disaster Reduction
NDCDRR	National Demonstration Communities on Disaster Risk Reduction
NDRCC	National Disaster Reduction Center of China
PDAs	personal digital assistants
UAV	unmanned aerial vehicle
UN-SPIDER	United Nations Platform for Space-Based Information for Disaster Management and Emergency Response
USGS	United States Geological Survey
WERP	Wenchuan Earthquake Recovery Project

Flooded Lian Road in Jiujiang District. Photo: humphery / Shutterstock.com.



CHAPTER 1

Natural Disaster Challenges in China: Key Trends and Insights

Typhoon Rammasun Making Landfall in China. Photo: NASA.

Together with climate change, rapid economic growth and urbanization, China's intensifying disaster risk is putting a strain on the country's resources, environment, and ecology. Against this backdrop, understanding and tackling disaster risk in China has never been more critical. Here are a few key trends and insights about China's natural disaster challenges.

Diversified types

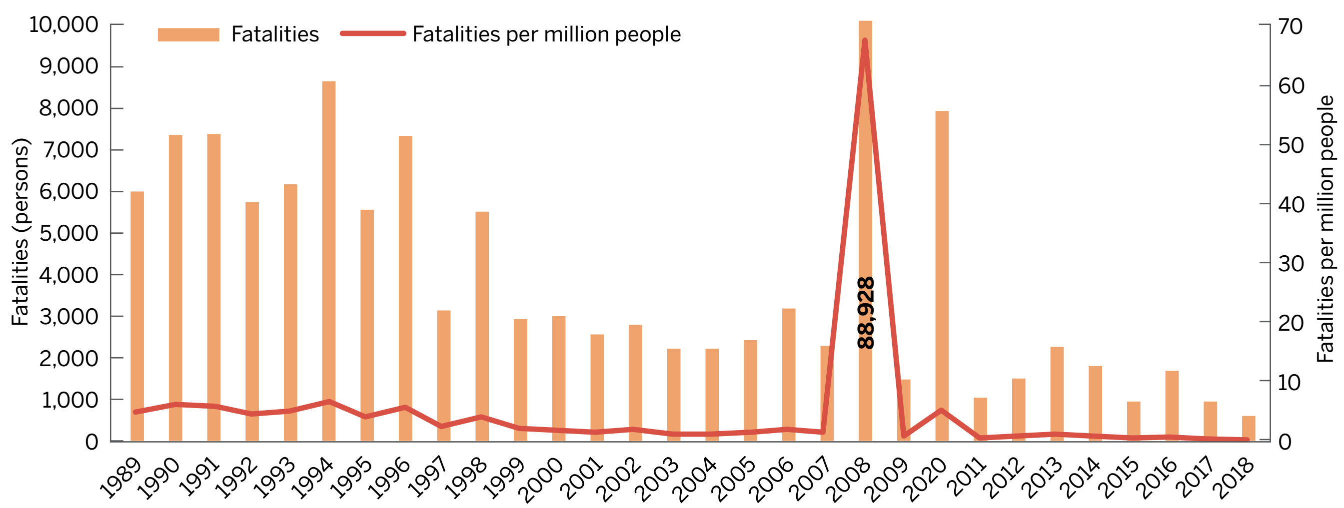
Major natural disasters in China include meteorological disasters, earthquake and geological disasters, ocean disasters, biological disasters, and forest and grassland fire. Altogether, there are over 100 types of various natural hazards. In the last few decades, almost all types of major hazards except volcanic eruptions have hit China; these include earthquakes, typhoons, floods, droughts and sandstorms, storm surges, landslides and debris flows, hailstorms, cold waves, heat waves, pests and rodent disease, forest and grassland fires, and red tides.

Wide geographic distribution

All provinces (autonomous regions, municipalities) in China are, to varying extents, facing negative impacts from natural disasters. Two-thirds of Chinese territory suffers from the threat of flooding. The eastern and southern coastal regions and some inland provinces often encounter tropical cyclones. Droughts often occur in the northeast, northwest, and north China, and particularly serious ones are common in southwest and south China. Each province (autonomous regions, municipalities) has experienced destructive earthquakes that measure 5.0 or higher on the Richter scale. Of China's territory, 69 percent is made up of mountains and plateaus, which suffers from frequent geological disasters such as landslides, debris flows, and rock collapses due to the complicated geological structure. The coastal region is prone to storm surges and red tides while the country's forests and grasslands are prone to fires. Half the country's population and more than 70 percent of Chinese cities are located in areas prone to meteorological, earthquake, geological, and oceanic disasters.

Photo: eugenesergeev

Figure 1.1. Losses from Natural Disasters in China: Direct Damages and Fatalities



High frequency

China is severely affected by monsoon weather and frequent meteorological disasters. Regional and partial droughts occur almost every year. Around 7 tropical cyclones hit the eastern coastal areas annually. Because China lies right in the region where the Eurasian, Pacific, and Indian Ocean plates meet, it suffers from frequent earthquakes due to still active tectonic movements. Most of the earthquakes that hit China are continental; they account for one-third of destructive continental earthquakes globally. China is a mountainous country, so the mountainous regions and hilly areas are frequently hit by collapse, landslide and debris flow. Fires often break out in forests and on grasslands.

Significant loss

Between 1989 and 2018, natural hazards caused the death of 195,820 people, and direct physical losses valued at 11,237 billion Chinese yuan (CNY, in 2018 values), or approximately US$1,698 billion (in 2018 values) (Figure 1.1). The direct damage has increased from US$47 billion in the 1990s to US$65 billion in the 2010s. Since 2000, 38.86 million hectares of crop have experienced a yield loss of at least 10 percent from natural disasters every year, out of which 4.95 million hectares were severely destroyed, representing a yield loss larger than 80 percent. Over the past three decades, the average annual fatalities per million people has been 5 persons, while direct economic loss as a percentage of gross domestic product (GDP) has been 2.25 percent.

Threats from very-large-scale disasters

China has suffered significant damage from several major large-scale disasters. Affecting 223 million people, the 1998 China floods claimed the lives of 4,150 people and damaged 21.2 million hectares of crops and 6.85 million houses. Overall, the disaster caused direct economic losses of 246 billion yuan (in 2018 values, or US$35 billion). The 2008 magnitude 8.0 Wenchuan Earthquake killed 69,227 people (plus 17,923 missing) and caused 1,053 billion yuan (in 2018 values, or US$ 159 billion) in direct economic losses.

Increasing disaster risks in a changing climate

At both a global and a regional level, climate change has increased and will continue to exacerbate the frequency and intensity of disasters in China. The likelihood of super typhoons and intense rainfall is rising, making riverine and flash floods also more likely. Droughts and heat waves are also projected to become more frequent and severe with climate change. Geological disasters triggered by climate extremes, such as landslides and debris, are also projected to become more frequent. Together with population growth, economic development and rapid urbanization, and interregional trade integration, China is facing even higher disaster risks in the future; this may also bring cascading global impacts of increasing severity.

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Survivors of the May 12 Sichuan Earthquake work to rebuild a house at the Yingxiu Township. (Photo by China Photos/Getty Images).

CHAPTER 2

The Evolution of National Disaster Risk Reduction Plans in China

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Rapid economic growth and urbanization in China are increasing the severity of the country's disaster challenge, a situation increasingly exacerbated by climate change.

Responding to the United Nations' International Decade for Natural Disaster Reduction (IDNDR) initiative, in 1989, the Chinese government set up an IDNDR committee, now called the National Disaster Reduction Committee. An inter-ministerial coordination mechanism under the State Council of China, the committee is responsible for drafting key disaster reduction policies and plans. Located in the Ministry of Civil Affairs before March 2018, the committee is now housed in the Ministry of Emergency Management.

In the three decades since its inception, the National Disaster Reduction Committee has taken the lead in drafting the development of comprehensive, national disaster reduction plans: the Disaster Reduction Plan of the People's Republic of China (1998–2010), the National Comprehensive Disaster Reduction 11th Five-Year Plan (2007–2010), and the National Comprehensive Disaster Prevention and Mitigation Plan 12th Five-Year Plan (2011–2015). Each of these plans was released by the State Council of China. On October 25, 2019, the Committee began preparations for the National Comprehensive Disaster Reduction 14th Five-Year Plan.

China's national DRR plans have been critical to ensuring that the country's disaster reduction practices are guided by appropriate planning. In line with the Hyogo Framework for Action (2005–2015) and the Sendai Framework for Disaster Risk Reduction (2015–2030), each of these plans also underscores China's commitment to integrating DRR into its sustainable development agenda.

Key Messages

1. China's national disaster risk reduction (DRR) plans have been critical to ensuring that the country's disaster reduction practices are guided by appropriate planning.
2. In line with the Sendai Framework for Disaster Risk Reduction (2015–2030), these plans have underscored China's commitment to integrating DRR into its sustainable development agenda.
3. Over the years, a shift from reactive to proactive disaster reduction, as well as a focus on reducing disaster mortality and direct economic loss, have both figured prominently in the evolution of China's DRR plans.

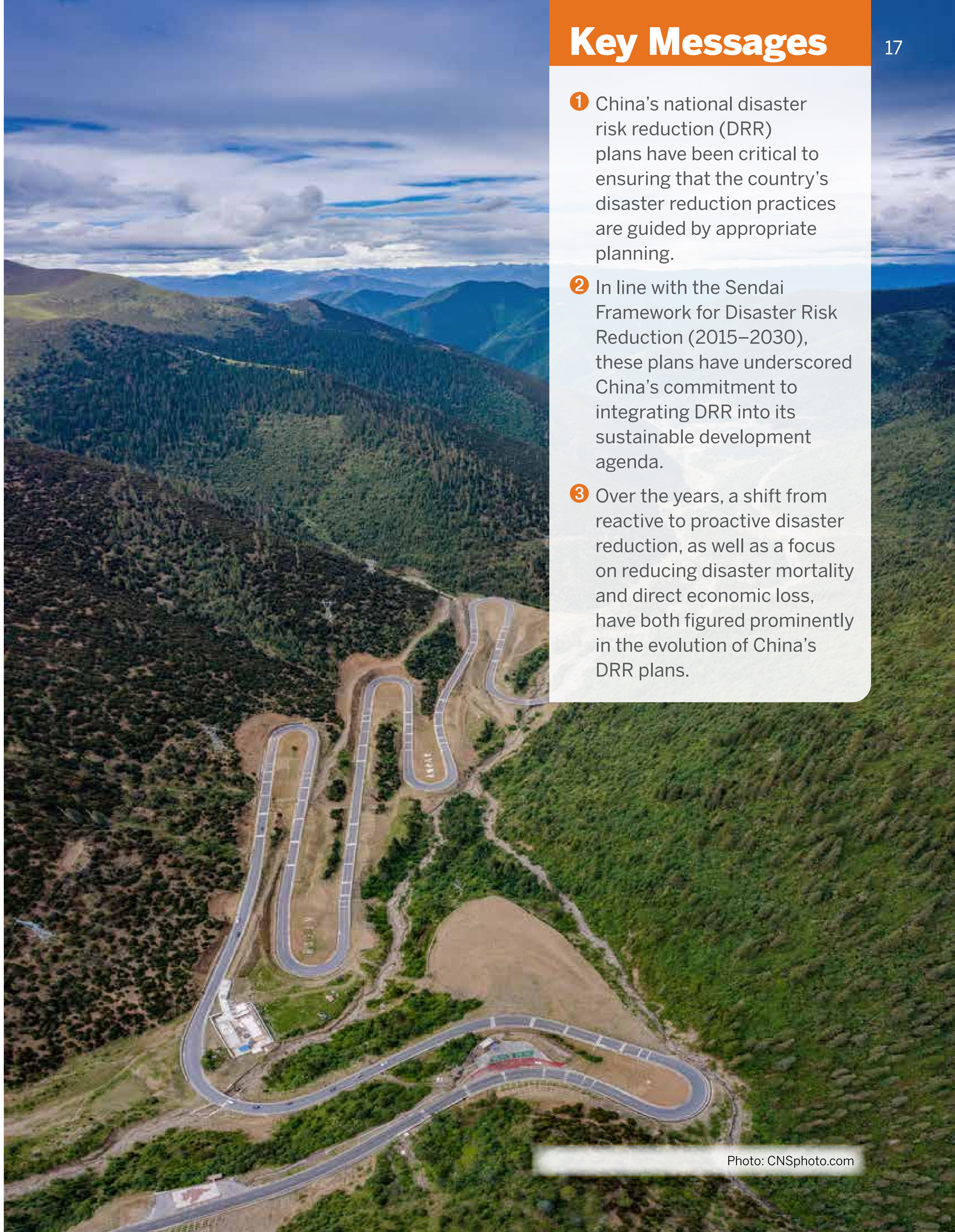


Photo: CNSphoto.com

Box 2.1. Shifting from Relief to Prevention

"Persist in the principle of prioritizing prevention and combining prevention with relief. Persist in integrating constant disaster reduction efforts and inconstant disaster relief efforts. Strive to realize a shift from focusing on post-disaster relief to prior-disaster prevention, from responding to individual disasters to responding to multiple disasters, from reducing disaster losses to reducing disaster risks."

Source: National Comprehensive Disaster Prevention and Mitigation Plan (2016–2020)

Since 1998, the Chinese government's disaster reduction work has been guided by the principle of prioritizing prevention and combining prevention and relief (Box 2.1). A closer look at China's recent national disaster reduction plans reveals several key trends in the evolution of the country's national disaster reduction planning (see the annex for more data and information).

From Reactive to Proactive Disaster Reduction

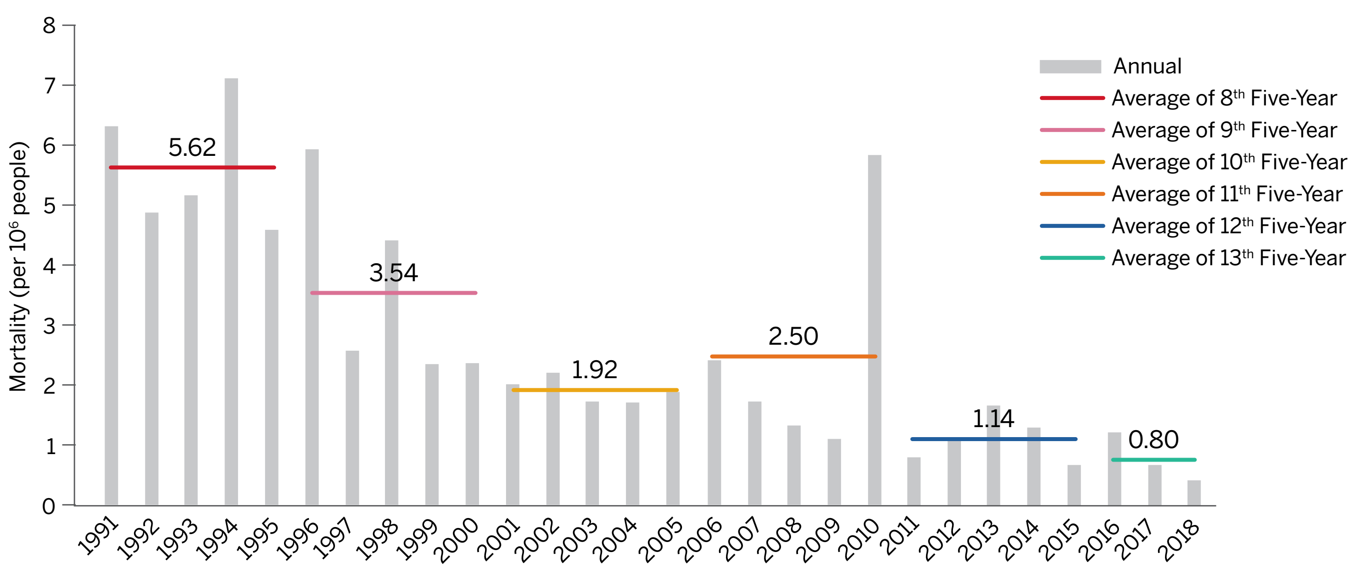
From the 11th Five-Year Plan (2006–2010) to the 13th (2016–2020), the plans reflect the transformation of China's comprehensive disaster reduction work from reactive to proactive, from disaster loss reduction to DRR, and from single hazard to multiple hazard disaster reduction. In line with this transformation, China's national comprehensive capacity for disaster prevention and mitigation has been strengthened on multiple fronts, including a significant improvement in disaster prevention and mitigation mechanism systems, disaster monitoring and information processing capabilities, and disaster emergency response and comprehensive risk prevention capabilities.

Focus on reducing disaster mortality and direct economic loss

China's disaster prevention and mitigation plans have always focused on reducing disaster mortality and direct economic loss. Since 1991, the country's disaster mortality rate and direct economic loss as a percentage of national GDP have shown a clear downward trend (Figure 2A.1 and Figure 2A.2), in line with the expected goals of the plans.

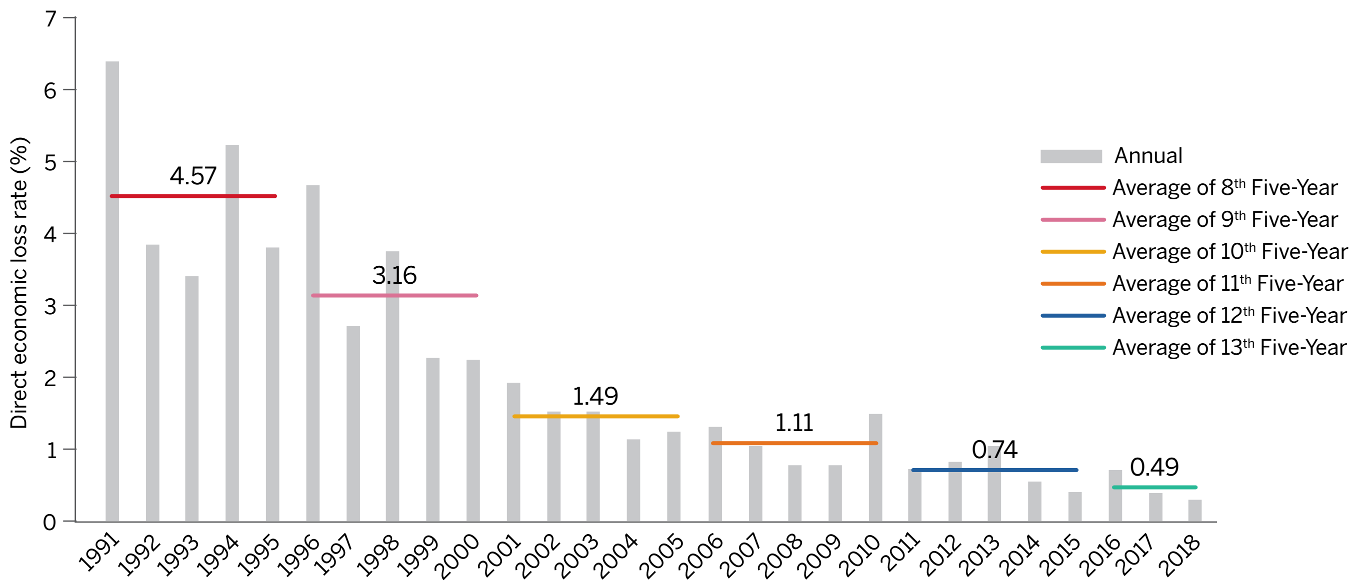
Sichuan Earthquake in May 2008. Photo Credit: Remko Tanis. Licensed under CC BY-NC-SA 2.0.

Figure 2A.1. Annual Disaster Mortality Rate per 10^6 People in China, 1991–2018



Data source: The annual disaster death toll from 1991 to 2017 is from the *China Civil Affairs Statistical Yearbook 2018*; the death toll of 2018 is from the Ministry of Emergency Management of China; and the population is from the *China Statistical Yearbook 2018.*
Note: The graph excludes the mortality from the Wenchuan Earthquake in 2008.

Figure 2A.2. Annual Direct Disaster Economic Loss Rate to National GDP in China, 1991–2018



Data source: The annual direct disaster economic loss for 1991 to 2017 is from the *China Civil Affairs Statistical Yearbook 2018*; the direct disaster economic loss of 2018 is from the Ministry of Emergency Management of China; and the annual national GDP is from the *China Statistical Yearbook 2019.*
Note: The graph excludes the losses from the Wenchuan Earthquake in 2008.

From the 11th to the 13th Five-Year Plan, the reduction of disaster mortality and economic loss have been the two most important objectives. Strikingly, the planning targets have become more quantitative rather than qualitative over time (Table 2A.1). The 13th Five-Year Plan committed to a "mortality rate less than 1.3 per million people" and annual economic loss ranging from "less than 1.5% of GDP" to "less than 1.3% of GDP."

A Commitment to the Sendai Framework for Disaster Risk Reduction

China's emphasis on reducing disaster mortality and economic losses from disasters—and its commitment to measure progress on a quantitative basis—are consistent with the Sendai Framework for Disaster Risk Reduction 2015–2030. Furthermore, the objectives of the Sendai Framework are in line with the national planning objectives spelled out in the five-year plans, including strengthening infrastructure fortification capabilities and escalating the disaster monitoring and forecasting and information platform.

Compared with the 11th Five-Year Plan, more attention has also been paid to disaster prevention, recovery capacity enhancement, risk management, and comprehensive prevention in the main tasks and initiatives of the 12th and 13th Five-Year Plans. This is also in line with the Sendai Framework, which emphasizes "strengthening disaster preparedness to respond effectively" and "building back better" in recovery and reconstruction.

China's commitment to planning for DRR reflects the country's view of disaster reduction as a top priority. Supported by the comprehensive framework of a national DRR plan, disaster prevention and mitigation are now firmly integrated into the country's sustainable development agenda, laying the foundation for China's active participation in international cooperation on DRR.

> **"China's emphasis on reducing disaster mortality and economic losses from disasters—and its commitment to measure progress on a quantitative basis—are consistent with the Sendai Framework for Disaster Risk Reduction 2015–2030."**

ANNEX 2A

The evolution of the country's national disaster reduction planning can be seen in the following tables.

Table 2A.1. Comparison of Goals in National Planning on Disaster Risk Reduction

Goal	11th Five-Year Plan (2007–2010)	12th Five-Year Plan (2011–2015)	13th Five-Year Plan (2016–2020)	Sendai Framework for Disaster Risk Reduction (2015–2030)
Annual average disaster mortality	Decrease in mortality compared with the 10th Five-Year Plan	Decrease in mortality compared with the 11th Five-Year Plan	Mortality rate < $1.3/10^6$	Substantially reduce global disaster mortality by 2030
Annual average direct disaster economic loss	Less than 1.5% of national GDP	Less than 1.5% of national GDP	Less than 1.3% of national GDP	Reduce direct disaster economic loss in relation to global GDP by 2030
Fortification standards	The restoration and reconstruction of disaster-damaged houses generally reach the required level of fortification	Post-disaster reconstruction infrastructure and housing generally meet the required fortification standards	Improving the level of prevention for critical infrastructure and basic public services	Substantially reduce disaster damage to critical infrastructure and disruption of basic services
Information platform	n.a.	Build a national comprehensive disaster reduction and risk management information platform	Establish and improve a multihazard comprehensive monitoring, forecasting, and early warning information release platform (the accuracy, timeliness, and public coverage of information are significantly improved)	Substantially increase the availability of and access to multihazard early warning systems and disaster risk information and assessments to people by 2030
Other	Basic life assistance within 24 hours; set up 1,000 integrated disaster reduction demonstration community, etc.	Basic life assistance within 12 hours; set up 5,000 integrated disaster reduction demonstration community, etc.	Basic life assistance within 12 hours; set up 5,000 integrated disaster reduction demonstration community, etc.	Significant reduction in the number of people affected globally by 2030, etc.

Note: n.a. = not applicable.

Table 2A.2. Comparison of the National 11th, 12th, and 13th Five-Year Disaster Reduction Plans

Goal	11th Five-Year Plan (2006–2010)	12th Five-Year Plan (2011–2015)	13th Five-Year Plan (2016–2020)
Annual average disaster mortality	Decrease in mortality compared with the 10th Five-Year Plan	Decrease in mortality compared with the 11th Five-Year Plan	Mortality rate < $1.3/10^6$
Annual average direct disaster economic loss	Less than 1.5% of national GDP	Less than 1.5% of national GDP	Less than 1.3% of national GDP
Integrated coordination mechanism	Establish comprehensive disaster reduction coordination mechanisms in provinces, disaster-prone cities, and counties	Further improve the disaster reduction mechanism, establish a comprehensive coordination mechanism for DRR in provinces, disaster-prone cities, and counties	Further improve the disaster prevention, mitigation, and relief mechanism and the legal system
Life assistance	Within 24 hours after the disaster	Within 12 hours after the disaster	Within 12 hours after the disaster
Fortification standards	The restoration and reconstruction of disaster-damaged houses generally reach the required level of fortification	Post-disaster reconstruction infrastructure and housing generally meet the required fortification standards	Improve the level of prevention for critical infrastructure and basic public services
National Demonstration Communities for Disaster Risk Reduction	Set up 1,000 demonstration communities	Set up 5,000 demonstration communities	Set up 5,000 demonstration communities; implement a pilot project to establish the national integrated disaster reduction demonstration counties
Information platform	Establish a national comprehensive disaster reduction and risk management information sharing platform; establish a national disaster monitoring, warning, assessment, and emergency response command system	Build a national comprehensive disaster reduction and risk management information platform; further improve disaster monitoring and warning, statistical verification, and information service capabilities	Establish and improve a multihazard comprehensive monitoring, forecasting, and warning information release platform (the accuracy, timeliness and public coverage of information are significantly improved)
Disaster reduction and social economic development planning	n.a.	Include disaster prevention and reduction work in national economic and social development planning	Include disaster prevention, mitigation, and relief in overall planning of national economic and social development
Disaster reduction education and public penetration rate	Significantly increase public awareness of disaster reduction	Significantly enhance awareness of disaster prevention and mitigation, and significantly increase awareness of disaster prevention and mitigation among primary, middle school and the public	Significantly improve public awareness of disaster prevention and mitigation knowledge and spread this awareness among school students.
Other	Establish disaster shelters for disaster-stricken urban and rural communities	Basically understand the natural disaster risk situation in key areas; further expand the disaster reduction team	Expand cooperation and assistance for disaster prevention, mitigation, and relief; significantly improve technology and education for disaster prevention and mitigation

Note: DRR = disaster risk reduction; n.a. = not applicable.

Table 2A.3. Comparison of Main Tasks of National Disaster Reduction Plans

Main tasks	11th Five-Year Plan (2006–2010)	12th Five-Year Plan (2011–2015)	13th Five-Year Plan (2016–2020)
Institutional mechanism	n.a.	n.a.	Improve the legal system for disaster prevention and reduction; improve the mechanism of DRR
Information management	Strengthen the investigation of potential hazards of natural disasters and information management capacity	Strengthen the information management and service for disaster prevention and mitigation	n.a.
Monitoring and forecasting	Strengthen monitoring and forecasting	Strengthen the development of monitoring and warning capabilities	Strengthen monitoring, forecasting, warning, and risk prevention capacity
Integrated management	Strengthen the comprehensive prevention and defense of natural disasters; strengthen the comprehensive response to catastrophe	Strengthen risk management capacity	n.a.
Emergency treatment	Strengthen emergency rescue capacity	Strengthen the capacity of emergency response and recovery	Strengthen the capacity of emergency response and recovery and reconstruction
Engineering defense	n.a.	Strengthen engineering defense capabilities	Strengthen the capacity of disaster prevention
Grassroots capacity	Strengthen urban and rural community disaster reduction	Strengthen regional, urban, and rural grassroots disaster prevention and mitigation capabilities	Strengthen regional, urban, and rural grassroots disaster prevention, mitigation, and relief capabilities
Technology	Strengthen the ability of disaster reduction science and technology support	Strengthen scientific and technological support for disaster prevention and mitigation	Strengthen scientific and technological support capabilities for disaster prevention, mitigation, and relief
Information dissemination and education	Strengthen the ability of publicity and education on disaster reduction	Strengthen the development of disaster prevention and mitigation culture	Strengthen publicity and education on disaster prevention and reduction
Team building and international cooperation	n.a.	Strengthen the development of disaster prevention and mitigation talents and professional teams	Promote international exchange and cooperation on disaster prevention, mitigation, and relief
Social mobilization	n.a.	Strengthen the capacity of disaster prevention and mitigation social mobilization	Support market and social forces

Note: n.a. = not applicable.

Table 2A.4. Comparison of Major Projects of National Disaster Reduction Plans

Major Projects	11th Five-Year Plan (2006–2010)	12th Five-Year Plan (2011–2015)	13th Five-Year Plan (2016–2020)
Risk investigation	Implement a national disaster risk and disaster reduction capability survey project in key regions	National natural disaster comprehensive risk investigation project	Natural disaster comprehensive assessment business platform development project
Rescue command system	National four-level disaster emergency rescue command system development project	National natural disaster emergency rescue command system development project	n.a.
Disaster relief material reserve system	Central level disaster relief material reserve system development project	National disaster relief material reserve project	National natural disaster relief material reserve system development project
Satellite disaster reduction	Satellite disaster reduction development project	Environmental disaster reduction satellite development project	Civil space infrastructure disaster reduction application system project
Catastrophe research	Asian regional catastrophe research center development project	National catastrophe prevention simulation project	n.a.
Capacity building	Community disaster reduction development demonstration project	Comprehensive disaster reduction demonstration community and evacuation site development project	Emergency shelter development project
Popular science	Disaster reduction science popularization and education project	Disaster reduction and prevention science popularization and education project	Disaster reduction and prevention science popularization project
Technology transformation	Disaster reduction science and technology innovation and achievement transformation project	National comprehensive disaster reduction and risk management information engineering	n.a.

Note: n.a. = not applicable.

Table 2A.5. Comparison of Safeguard Measures of National Disaster Reduction Plans

Safeguard measures	11th Five-Year Plan (2006–2010)	12th Five-Year Plan (2011–2015)	13th Five-Year Plan (2016–2020)
Institutional mechanisms	Strengthen national comprehensive disaster reduction management system and mechanism	Improve working mechanism	Strengthen organizational leadership and form a joint effort
Planning	Integrate comprehensive disaster reduction into national economic and social development planning	Improve planning implementation and evaluation	Strengthen follow-up assessment and strengthen supervision and management
Legal system	Strengthen the development of a disaster reduction legal system and establish a sound disaster reduction standard system	Improve laws and regulations and plan system	n.a.
Disaster reduction fund	Increase investment in disaster reduction	Increase capital investment	Strengthen financial security and smoothen access
Global cooperation	Promote international communication and cooperation in the field of disaster reduction	Develop extensive international cooperation and communication	n.a.
Education and training	Strengthen the cultivation and development of professional teams for disaster reduction	n.a.	Strengthen professional training and improve team quality

Note: n.a. = not applicable.

"Disaster prevention and mitigation are now firmly integrated into China's sustainable development agenda, laying the foundation for active participation in international cooperation on disaster risk reduction."

CHAPTER 3

Disaster Loss Statistics in China: Advancing Risk-Informed Decision Making

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Photo by Qingbao Meng on Unsplash

Systematic disaster data are critical to effective disaster risk management. This was illustrated in the aftermath of the magnitude 8.0 Wenchuan Earthquake, which struck southwestern China in 2008, when gaps in the country's disaster data hampered efforts toward risk-informed decision-making in the recovery process.

Critically, the classification of disaster types was not uniform among different disaster management departments, affecting the accuracy of disaster statistics. For instance, different disaster management departments applied varying definitions of the same loss indicator. Furthermore, in the absence of a disaster loss reporting system, loss information was manually collected, without a consistent time scale; this affected the efficiency of the emergency management system. These challenges were exacerbated by the limited number of disaster loss statisticians at the grassroots level.

The Standardization of Natural Disaster Loss Statistics

Recognizing the importance of addressing gaps in China's disaster data, the National Disaster Reduction Center of China (NDRCC), which is affiliated with the Ministry of Emergency Management of China, has devoted considerable effort over the past decade to revising and improving the disaster loss statistical system. Since 2009, the Technical Committee on Disaster Reduction and Relief of Standardization Administration of China has issued several national and industry standards to improve China's disaster loss statistical system. Between 2009 and 2012, national standards on natural disaster statistics encompassing 28 basic indicators and 116 extended indicators related to population, buildings, infrastructure, agriculture, and other sectors were published. In 2012, the national standard on classification and codes for natural disasters was issued, defining five main disaster categories

Key Messages

1. China has made significant headway in strengthening the standardization of its disaster loss statistical system over the past decade.
2. As a result, there has been a marked improvement in the ability of disaster risk managers to use and analyze the country's disaster loss data for risk-informed reconstruction and planning.
3. Looking ahead, several critical challenges must be addressed to further strengthen China's disaster loss statistical system, including the need to fully account for economic losses.

Emergency information signpost at River Viewing Pavilion Park, Chengdu. Photo: syrnx.

and 39 disaster types within those categories. In conjunction with these efforts, national and industry standards on sampling and verification of disaster losses were developed to ensure the quality of loss data.

In 2014, the statistical system for especially severe natural disaster losses was officially issued and executed, with the aim of more comprehensively understanding the scope and losses of disasters. Entailing 738 statistical indicators, this system is initiated when a particularly serious natural disaster occurs, the National Natural Disaster Relief Level I emergency response is initiated, or the State Council decides to conduct a comprehensive assessment of disaster losses.

The national natural disaster loss reporting platform, activated and available online as of 2009, was integrated with this statistical system. As a result of this integration, by 2018, more than 734,000 disaster information officers using computers or mobile phones from local villages and towns could quickly report event-level disaster loss information. These disaster information officers need to be trained to have professional qualification certificates.

Statistical Disaster Information for Risk-Informed Reconstruction and Planning

The efforts to standardize disaster loss statistics have made a significant contribution toward strengthening emergency relief and reconstruction as well as national disaster risk reduction (DRR) planning.

Most critically, disaster loss information can be released much sooner than before. Almost all of the first loss report can now be acquired by the central government within 24 hours. This loss report provides several key indicators, including on population deaths, the number of building collapses, and the number of evacuated people, all of which are essential to launch an appropriate corresponding emergency plan. The report also informs a range of publicly disseminated risk communication resources such as disaster reports on mobile phones, Yesterday's Disasters, and the Annual Atlas of Natural Hazard-induced Disasters.

The disaster loss information collected provides a foundation for comprehensive loss estimation for major natural disasters, including for resilient recovery. In the aftermath of the 2008 Wenchuan Earthquake, the estimation found that the reconstruction need was 1.17 times the direct physical damage for the 2008 Wenchuan Earthquake, considering the costs of increased fortification and inflation.

The expedited release of disaster loss information means that the time for a comprehensive loss estimation for major natural disasters has been shortened. Case in point: this exercise took 27 days after the 2013 Lushan Earthquake, compared with 112 days following the 2008 Wenchuan Earthquake.

Analysis of disaster loss based on the collected information also informs disaster risk planning goals. For example, the planning goal for the direct damage as a percentage of GDP was set to 1.5 percent annually in the National Comprehensive Disaster Prevention and Mitigation Plan (2011–2015). This is based on the analysis of actual loss during the period of 2006–2010, which was about 1.8 percent of annual GDP on average.

Looking Ahead: Keeping Up with Evolving Disaster Challenges

The progress toward strengthening China's disaster loss statistics system has been remarkable. But this system requires constant review and reassessment to ensure that it keeps up with the country's evolving disaster risk. Here are a few of the most critical lessons learned and challenges.

Lessons Learned

- **Developing disaster loss statistical norms is key.** Developing disaster loss statistical norms is key to building a standardized disaster loss statistical system. Between 2009 and 2013, at least five national standards on disaster loss statistics were issued in China.

- **A web-based disaster loss report platform is an efficient tool for disaster information gathering and servicing.** More than 75,000 annual disaster loss records on average between 2010 and 2013 were gathered through China's national natural disaster management platform from province-level, prefectural-level, and county-level disaster information officers. Annual disaster reports can now be prepared in one day, while they previously took one month.

- **A hierarchical system for disaster loss statistical indicators should be considered to meet disaster risk decision-making needs in different levels.** The 28 basic loss indicators are mainly used to support emergency response decision-making, combined with the other 116 extended loss indicators. Together, they can allow reconstruction needs for different sectors to be estimated. Meanwhile, there are 738 loss statistical indicators related to major disasters that can support a more comprehensive disaster impact assessment and refined reconstruction need estimation.

Challenges

- **The locally reported number of disaster losses may exaggerate the loss of destruction,** which may be explained by the fact that reported losses are linked to the resources and support that can be obtained for reconstruction. Verification of the loss figures is time consuming and laborious.

- **Although there are 738 loss statistical indicators related to major disasters, whether these are enough—or even redundant—remains to be seen.** For example, the restoration and reconstruction of natural ecosystems and natural heritage was the main mission in the recovery strategy after the 2017 Jiuzhaigou Earthquake, yet there are no such loss indicators for this reconstruction need assessment in the present disaster loss statistical system.

- **Strengthening open sharing mechanisms for disaster loss statistics will continue to be critical moving forward.** The event-level disaster loss statistics are used mainly for disaster management at present, while these data are also valuable for researchers in understanding disaster impact mechanisms.

- **Losses in terms of economic flows have not been included in the present disaster statistical system.** The output of the economy's productive sectors is sensitive to disasters. Estimating this indirect economic loss due to business interruption resulting from disasters is useful to understanding how accelerated recovery and reconstruction could contribute to reducing output loss risk, and could also help ensure a more comprehensive understanding of disaster impacts.

- **Economic impacts, at macro and micro levels, and human development impacts are not fully accounted for in the current disaster loss statistical system.** The impacts of the disaster on the quality of human life in the medium and long term, as well as on economic performance and personal/household income and employment in all sectors, are yet not fully evaluated.

CHAPTER 4

National Demonstration Communities for Disaster Risk Reduction: Progress and Challenges

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Community members in Mianzhu, Sichuan cleaning after 2010 landslide. Photo: Tarzan9280..

Building resilient communities can mitigate natural disaster risks (Michel-Kerjan 2015). Since the concept of a *disaster-resistant community* was first proposed in the United States in 1994 (Geis 2000), community-based disaster risk reduction (CBDRR) has been seen worldwide as a crucial approach to effectively improve disaster response capabilities, mitigating disaster losses and risks.

The most basic administrative unit in China, communities (or "villages" as they are called in rural areas), have played an increasingly important role in the country's comprehensive DRR efforts in the 21st century.

Underscoring China's commitment to community-based disaster risk management, in 2007, the National Commission for Disaster Reduction of China began to implement a nationwide project to designate selected communities as demonstration communities for DRR. The goal is to promote and encourage capacity building on DRR in the surrounding vicinity, in large part by strengthening awareness about DRR.

Under the project, which is called the National Demonstration Communities on Disaster Risk Reduction, or NDCDRR, communities can apply to their respective provincial departments of civil affairs to become a Comprehensive Disaster Reduction Demonstration Community. The evaluation of the application covers three main components: infrastructure, community residents' capacity, and disaster management. If the application is successful, the community is subjected to a standardized evaluation of its DRR capacity building efforts. All communities across China are encouraged to mobilize all possible resources from all types of stakeholders (e.g., various level of governments, industries, nongovernmental organizations, academia, volunteers) to facilitate DRR capacity building.

Key Messages

1. China has selected over 12,000 communities nationwide as demonstration communities for disaster risk reduction (DRR), with the goal of promoting capacity building on DRR in surrounding areas.
2. Demonstration communities have risen nearly fortyfold since 2008, and now cover every province in China.
3. Spatial agglomeration analysis reveals that DRR demonstration communities are, in fact, encouraging DRR capacity building in surrounding areas, albeit with significant regional variation.

Mother and daughter in Liping, Guozhou Province. Photo: jameslee999.

Below are several key trends on the progress and challenges in the development of China's DRR demonstration communities.

Demonstration Communities Have Risen Nearly Fortyfold since 2008

The number of DRR demonstration communities in every province in China has risen dramatically over the past dozen years, especially since 2011. By the end of 2018, the total number of these communities had exceeded 12,535, nearly 40 times higher than the figure of 284 in 2008. Between 1,000 and 1,500 new demonstration communities have been added each year since 2011. The provinces with the most DRR demonstration communities are shown in Box 4.1.

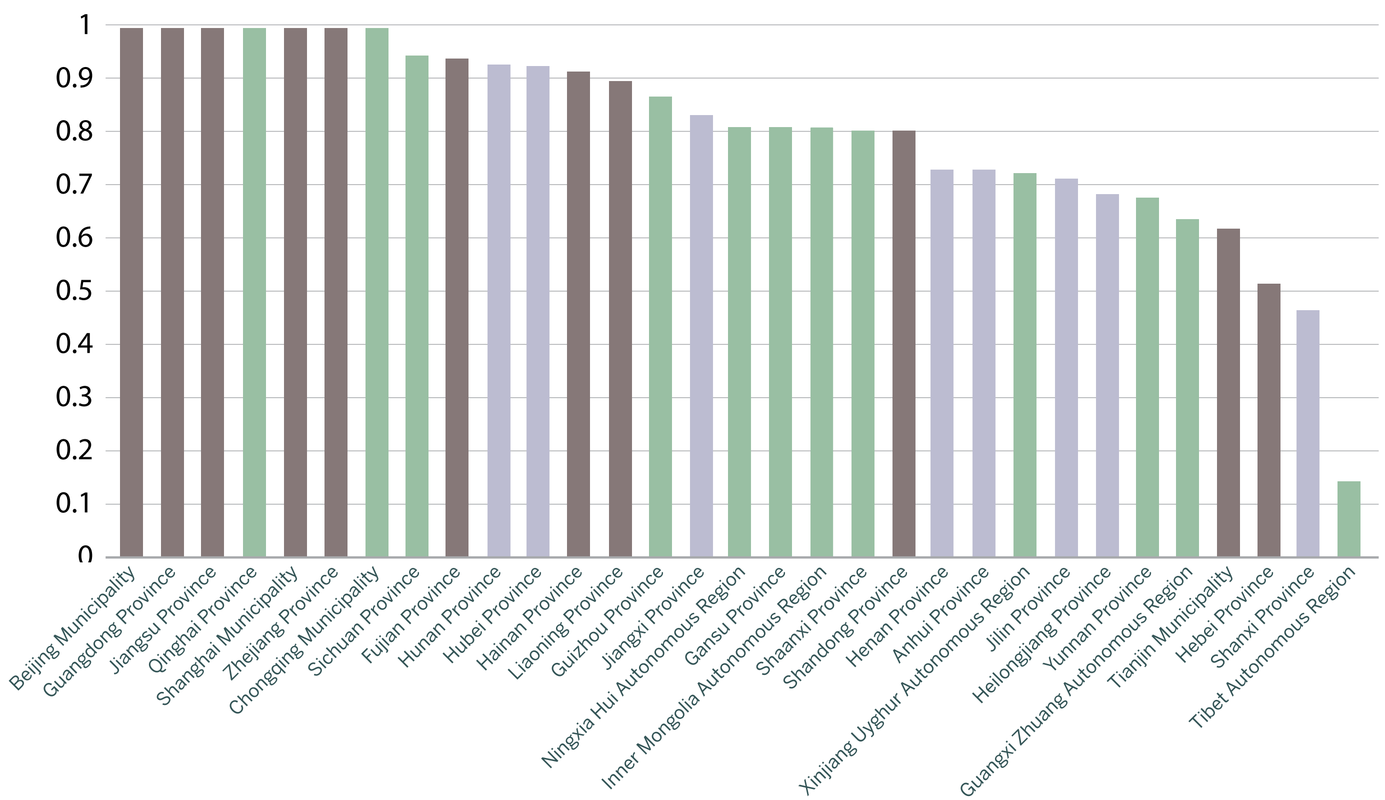
Box 4.1. Provinces with the Most DRR Demonstration Communities

- Guangdong Province
- Zhejiang Province
- Shandong Province
- Jiangsu Province
- Hubei Province
- Sichuan Province
- Hunan Province

Source: Ministry of Emergency Management.

By the end of 2017, DRR demonstration communities had achieved 100 percent coverage at the provincial level and 87 percent coverage at the county and city level.

Figure 4.1. Provincial Coverage of National Demonstration Communities on Disaster Risk Reduction (NDCDRR) in 2017



At the country level, the coverage rate varies considerably (Figure 4.1). Ninety-five DRR demonstration communities are located in Dongguan City, Guangdong Province—more than any other county. Counties and cities in the capital circle (Beijing, Tianjin, and Hebei), the Yangtze River Delta (Shanghai, Jiangsu, and Zhejiang) and the Pearl River Delta (Guangdong) account for over a third (35 percent) of the total number of DRR demonstration communities in China.

National Plans, Regulations, and Standards Have Helped Drive the Growth of DRR Demonstration Communities

Much of the growth in the number of demonstration communities has been driven by goal setting in national plans and policies. In November 2011, the General Office of the State Council issued the National Comprehensive Disaster Prevention and Mitigation Plan (2011–2015), which set the goal of creating 5,000 national comprehensive disaster reduction demonstration communities, in line with the broader aim of strengthening grassroots disaster prevention and mitigation capacity building in both rural and urban areas. The National Comprehensive Disaster Prevention and Mitigation Plan of the 13th Five-Year (2016–2020), issued by the General Office of the State Council, set the goal of adding 5,000 more demonstration communities during this five-year period.

At the same time, the Chinese government has consistently made the development of regulations and standards that can guide the continued development of DRR demonstration communities a top priority. In December 2011, the Ministry of Civil Affairs promulgated national standards for the establishment of comprehensive DRR communities. This was followed in 2016 when the General Office of the State Council promulgated the National Comprehensive Disaster Prevention and Mitigation Plan (2016–2020), which required the "strengthening the overall planning of disaster reduction resources and forces at the community

Village in Zhejiang Province. Photo: 邱国标


3-D urban model of Lankao County, Henan Province. Photo: © Wuwei1970 | Dreamstime.com

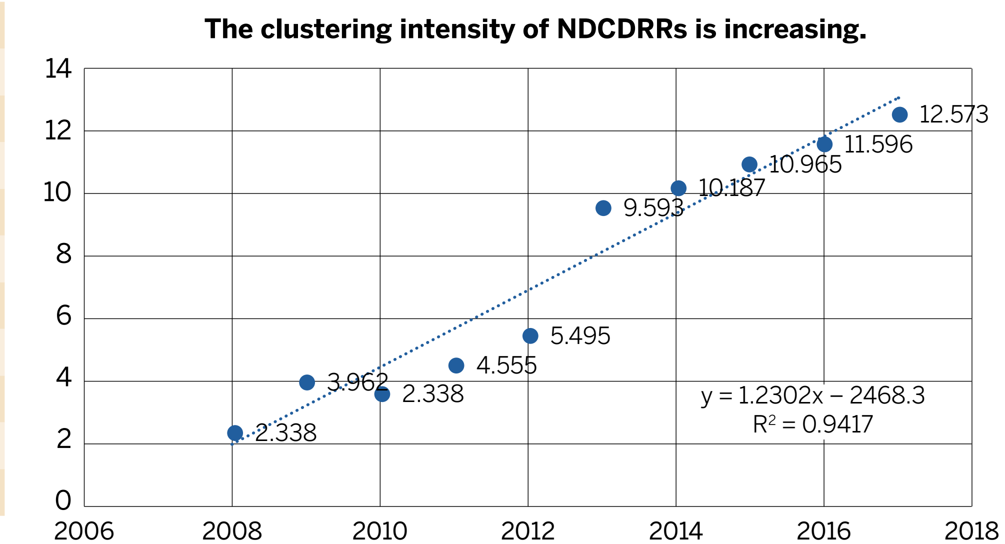
level, and deepening the establishment of comprehensive disaster reduction demonstration communities." This commitment was reaffirmed in 2018 when the Ministry of Civil Affairs, the China Seismological Bureau, and the China Meteorological Bureau jointly issued the Interim Measures for the Establishment and Management of National Demonstration Communities on Comprehensive Disaster Reduction. The establishment of the Ministry of Emergency Management of China in 2018 is expected to give further impetus to the growth of CBDRR.

DRR Demonstration Communities Are Encouraging DRR Capacity Building in Surrounding Areas, Albeit with Significant Regional Variation

Based on an analysis of spatial agglomeration using the Global Moran's Index, China's sustained development of DRR demonstration communities in 31 Chinese provinces seems to have led to the emergence of demonstration communities in surrounding areas. In fact, the significance of this relationship has been increasing. The global Moran index of the spatial distribution of demonstration community in 2008–2017 is positive, and the Z value of the significance test index increases with time (Figure 4.2).

Figure 4.2. **Spatial Agglomeration of National Demonstration Communities on DRR**

Year	Moran's I
2008	0.556
2009	0.474
2010	0.243
2011	0.192
2012	0.176
2013	0.251
2014	0.240
2015	0.238
2016	0.239
2017	0.243



Data Source: Ministry of Emergency Management.

The analysis reveals, however, that there are significant differences in the demonstration effect of communities. This must be a key consideration for policy makers and planners in the next phase of growth for DRR demonstration communities. The demonstration effect seems to be stronger in Jilin, Heilongjiang, Beijing, Eastern Shandong, Jiangsu, Zhejiang, Shanghai, Hunan, Hubei, Chongqing and Guangdong. The effect, however, seems to be weaker in Hebei, Shanxi, Guangxi, Yunnan, western Sichuan, Tibet, and southern Xinjiang.

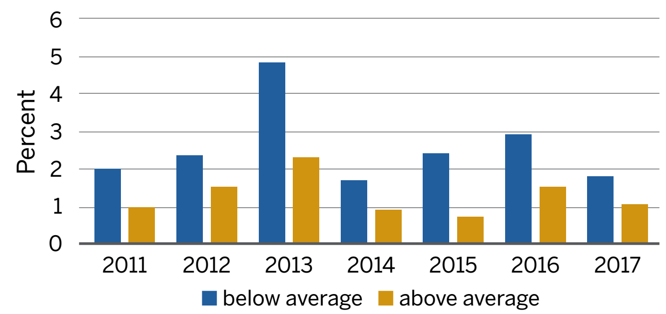
Disaster Risk Reduction Benefits Are Evident in Demonstration Communities

An analysis of disaster loss data also reveals that DRR demonstration communities are not only encouraging DRR efforts in neighboring areas, but they are also generating demonstrable DRR benefits within their respective localities. We categorize the districts and counties into two groups: a district or county with fewer than average demonstration communities (the low-value group) and one with more than average demonstration communities (the high-value group). We calculate and compare the population loss per 10,000 people and direct economic loss caused by disasters in these two groups respectively in order to evaluate the disaster reduction benefit of the demonstration communities (Figure 4.3).[2] The average loss rate of disaster-related population the low-value group is about 2.02 times that in the high-value group. The average direct economic loss rate due to disasters in the low-value group is about 1.32 times that in the high-value group. This difference shows that the disaster reduction benefits of demonstration communities is more pronounced when they reach a certain scale.

Figure 4.3. Disaster-Related Loss Rates Relative to Average Number of Demonstration Communities

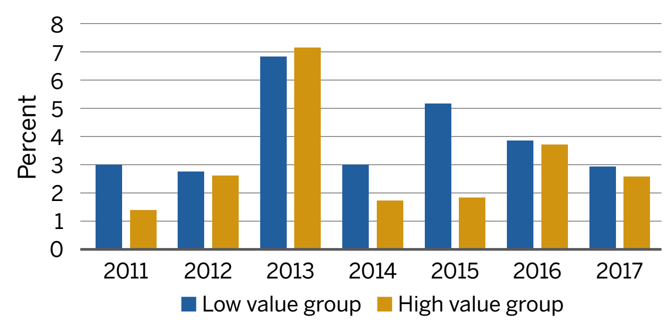
A. Death Rate

The average loss rate of disaster-related population in the low-value group is about 2.02 times that in the high-value group.



B. Direct Economic Loss Rate

The average direct economic loss rate of disaster in the low-value group is about 1.32 times that in high-value group.



Data Source: Ministry of Emergency Management.

It should be noted that there are significant spatial differences between the DRR benefits from demonstration communities seen in urban versus rural areas. Rural areas in China still account for about 50 percent of the total population, but only 30 percent of DRR demonstration communities are located in rural areas.[3] Over 70 percent of the communities can be found in cities and towns. This is expected to be a pressing issue in the National Comprehensive Disaster Reduction 14th Five-Year Plan, which is now being prepared.

[2] Because of limited county-level disaster loss data availability, when analyzing the DRR benefits of demonstration communities, the demonstration communities are matched to each county.

[3] The Sixth National Population Census of China (2010).

The result of the joint efforts by the government, communities, enterprises, and other key bodies is that China's progress on the development of its DRR demonstration communities has occurred in tandem with the country's reforms of disaster prevention and mitigation measures, such as the improvement of infrastructure resilience, monitoring and early warning, emergency response, and so on.

Looking ahead, a key challenge will be how to sustain the progress that has been achieved. Regulations released in 2018 clearly put forward the "withdrawal mechanism," which states that demonstration communities that fail to meet these requirements must take remedial measures, and the communities that continue to fail to meet these standards after efforts to rectify will be delisted. The effectiveness of this new mechanism remains to be evaluated in the future.

Notes on Data and Methods

In order to analyze the spatial and temporal distribution characteristics of the comprehensive disaster reduction demonstration community and its disaster reduction demonstration effect in the past 10 years, the relevant data from the Ministry of Civil Affairs, the Ministry of Emergency Management, the National Statistical Bureau, and the National Disaster Reduction Center of the People's Republic of China were collected. These data included the list of the national demonstration community on DRR and the county disaster information (including the number of deaths and the amount of direct economic losses); county social and demographic-economic data; and the 2017 edition of the national provincial, municipal, and county administrative divisions. The spatial correlation and clustering characteristics of demonstration communities by province are depicted by the global Moran index and the local Moran index respectively.

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Geis, D. E. 2000. "By Design: The Disaster Resistant and Quality-of-Life Community." *Natural Hazards Review* 1 (3): 151–60.

"The result of the joint efforts by the government, communities, enterprises, and other key bodies is that China's progress on the development of its disaster risk reduction demonstration communities has occurred in tandem with the country's reforms of disaster prevention and mitigation measures."

Photo by Tuan Anh Tran on Unsplash.

CHAPTER 5

Fostering Rural Resilience: A Closer Look at China's Agricultural Insurance Pilot

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China has one of the largest agricultural sectors in the world. Like many other countries, it has struggled to establish an effective agricultural insurance system that can attract the voluntary participation of agricultural producers and provide them with effective risk protection.

Since the mid-2000s, China has renewed efforts to accelerate the development of the country's agricultural insurance system (Figure 5.1). In line with the Central Committee of the Communist Party of China's Document No. 1 of 2004, this has come in tandem with legal and policy reforms designed to strengthen the framework for agricultural insurance in China.

Drawing upon the country's long exploration of agricultural insurance dating back to the 1930s and building upon smaller-scale trials in the years prior, in 2007, China launched a new round of pilot agricultural insurance programs with US$134.3 million (1 billion yuan) in premium subsidies to farmers in six provinces and autonomous regions.[4] Four basic principles have underpinned this new round of pilot programs: government guidance, market operation, voluntary participation, and coordinated promotion. The goal is that farmers, enterprises, and the government all benefit from the agricultural sector's ability to protect itself from loss or damage due to natural disasters and other risks (Wang et al. 2011).

This chapter presents several key observations about the development of China's agricultural insurance pilot; Box 5.1 shows the operational model of the system.

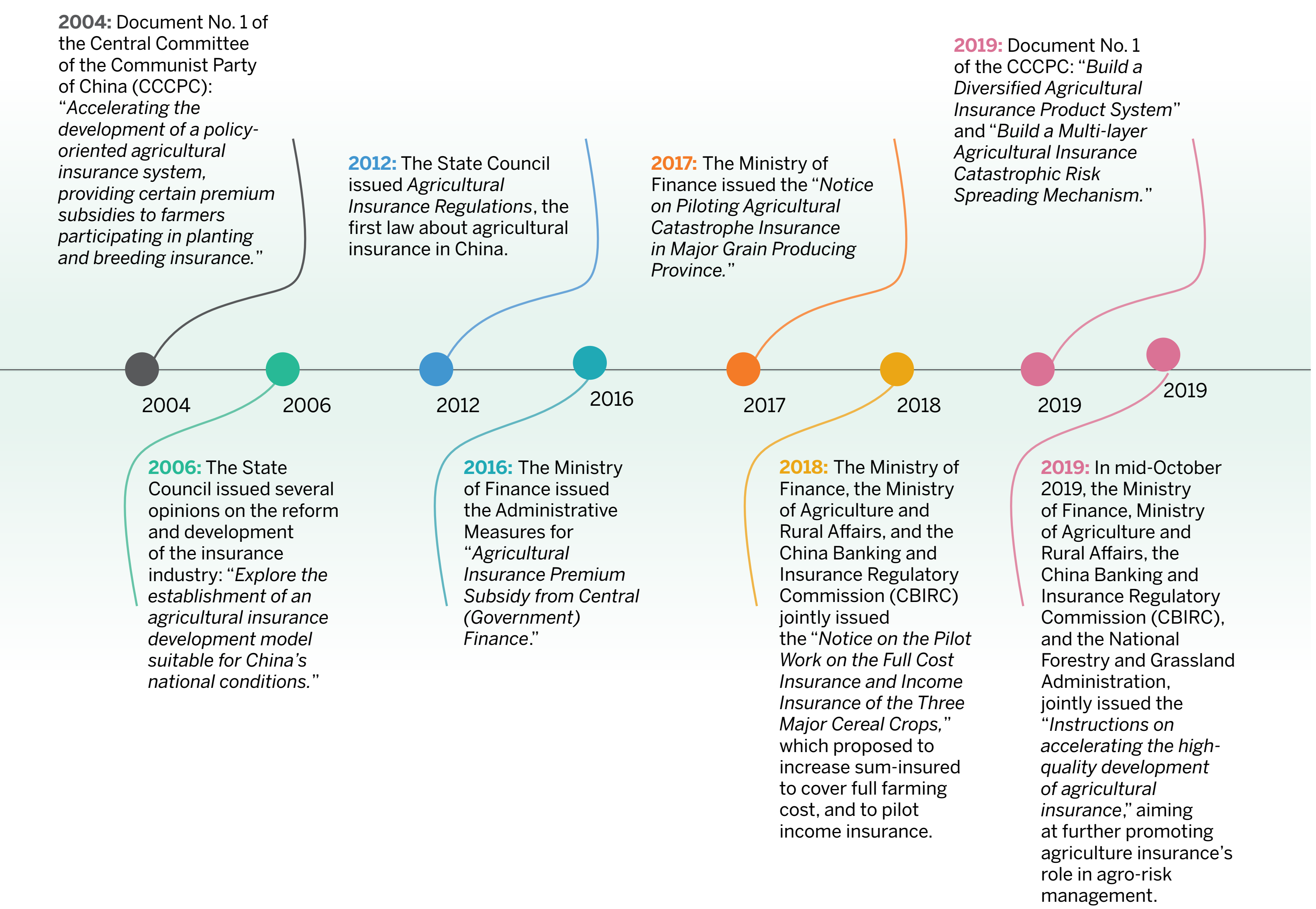
[4] 1 yuan = US$0.1443 as of March 7, 2020.

Key Messages

1. Since the mid-2000s, China has embarked on a renewed effort to accelerate the development of the country's agricultural insurance system.
2. In 2007, China launched its latest round of pilot agricultural insurance programs, characterized by a government-backed market approach with heavy premium subsidies.
3. China's agricultural insurance system has continued to develop rapidly, as evidenced by its growing market size, expanding list of insured perils, and increasing liability and coverage. It has also played an increasingly successful role in protecting agricultural producers against disaster losses.
4. China's agricultural insurance system is still facing critical challenges, including the lack of critical data and underdeveloped technique, that are common in many developing countries. Renewed efforts are being made to tackle these challenges.

Photo: PICC P&C.

Figure 5.1. The Evolution of the Chinese Agricultural Insurance Program



Reliance on Premium Subsidies

Premium subsidies are the core element of China's agricultural insurance pilot, creating strong incentives for farmers to voluntarily participate in the program (Ye et al. 2017). Premium subsidies from four levels of government gradually increased from 76 percent in 2007 to 79.5 percent in 2018 (Figure 5.2). Potential beneficiaries of these premium subsidies, which initially covered farmers of basic grains and selected oil crops and livestock, now cover a wider range of producers including those that harvest rapeseed, peanuts, potatoes, highland barley, rubber, bananas, and sugar beets.

Booming Market Size

China's agricultural insurance market keeps growing. From 2007 to 2018, agricultural insurance provided a total of US$2.4 trillion in risk protection; in total, it paid US$32.12 billion to 330 million affected households, playing an active role in disaster relief and post-disaster recovery. Currently, China's agricultural insurance premium revenue is the second largest in the world and the largest in Asia. Livestock insurance and forest insurance rank first in the world (Table 5.1).

Box 5.1. How China's Agricultural Insurance System Works: The Operational Model

In developing China's agricultural insurance pilot, the lack of a ready-to-use operational model meant that an operational scheme had to be established following several years of experimentation. There are two critical parts to understanding the operation of agricultural insurance in China: the underwriting part and the loss-adjustment part.

The entire underwriting procedure involves the policyholder (agricultural producers) and local insurance companies who directly underwrite the policy, along with government and insurance company headquarters at various levels. The basic procedure can be summarized as follows, taking Hunan Province in central China as an example (Wang et al. 2011):

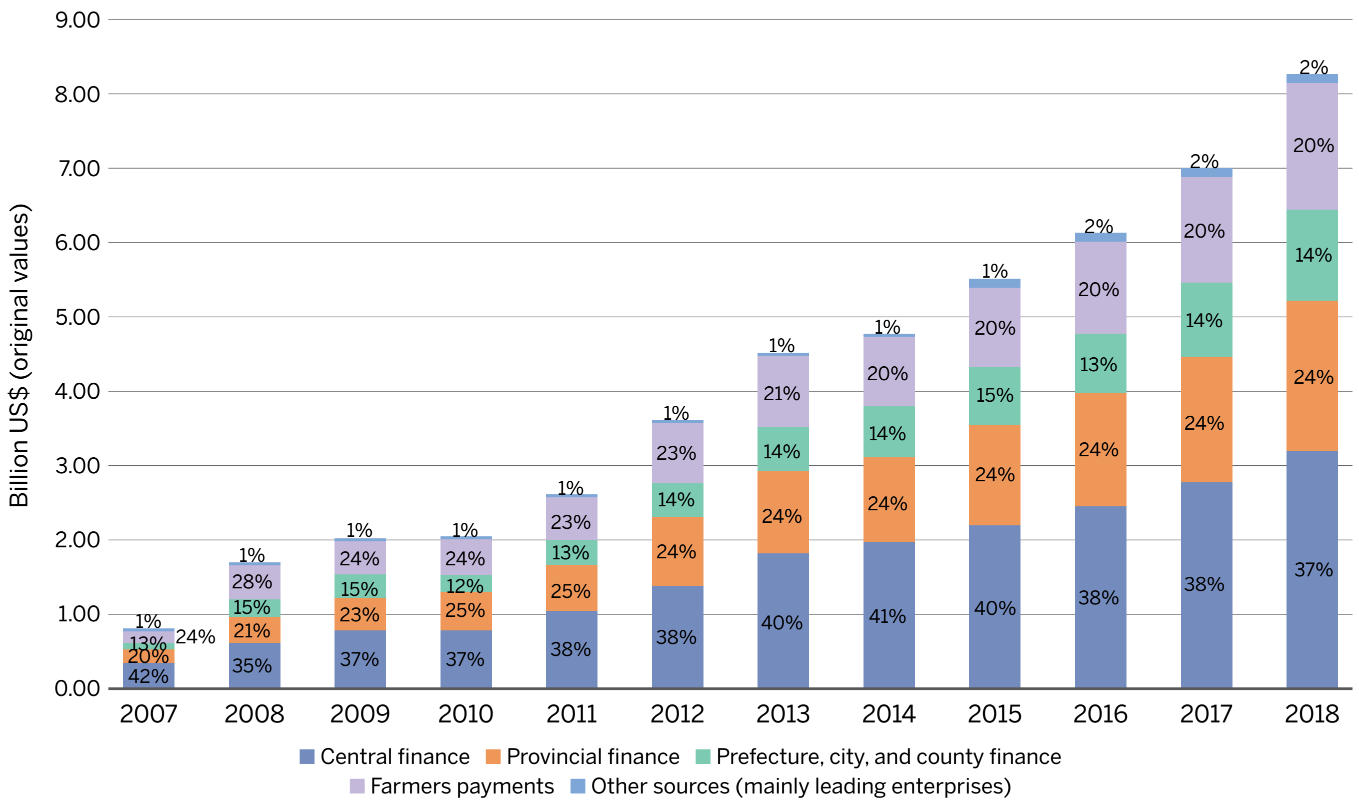
1. At the beginning of a fiscal/insurance year, the provincial department of finance (DOF) selects the underwriting insurance companies. In general, at least two companies should be selected; each would be allocated to specific regions and insurance lines. Each insurer is likely to oversee one single business line (crop or livestock) with central government subsidy.
2. Insurers are eligible for business start propagation and underwriting procedures. Participation is on a voluntary basis. In most cases, producers participate as small groups (villages), signing a single policy with the local insurer with a detailed list of participants attached. This approach is believed to achieve a balance between individual participation and administrative costs. Producers should pay premiums (the amount after premium subsidy) on their own. because of the large number of households in each county, county-level insurance branches have expanded their service networks by hiring local assistant agents on a part-time basis to form a bridge between farmers and formal agents. Most of the assistant agents are village heads.
3. Insurers submit the policies signed and proof of premium collected to the provincial DOF. The DOF then validates the materials and authorizes the provincial-level premium subsidy. The provincial DOF then submits the application to the Ministry of Finance for the premium subsidy from the central government. When premium subsidies are ready, the DOF pays the subsidy to insurers, but simultaneously reserves a certain portion of the premium to raise the catastrophe risk fund according to the "*Agricultural Insurance Catastrophic Risk Reserve Management Method*" issued by Ministry of Finance (2013).

The basic loss-adjustment procedure is summarized as below, taking Hunan Province in central China as an example:

1. Policyholders report perils, diseases, and losses to the local insurance branch.
2. Agricultural technicians (there are several in each county affiliated with the department or Ministry of Agriculture and Rural Development) are invited to conduct on-site loss-adjustment, confirming that the loss is insured and evaluating the degree of loss (the percentage of damage). Agricultural insurance agents (representatives of insurer), representatives of local governments (i.e., village heads and representatives of the finance department), and the policyholder co-witness the entire procedure. An agreement on the loss-adjustment result must be reached and signed by all parties, and a record of the case is kept.
3. The local insurer computes the indemnity according to loss-adjustment records. Payment is made generally no later than 10 days after reporting via bank transfer to the policyholder directly. At the end of the season, a list of loss-adjustment records and corresponding payments would be posted at the village center for the public's inspection.

In 2016, the Insurance Association of China released the "*General Principles of Agricultural Insurance Service*" which sets up an industrial technical standard of insurance underwriting and loss-adjustment procedure.

Figure 5.2. The Composition and Amount of Financial Agricultural Insurance Premium Subsidies at All Levels in China



Data source: The China Banking and Insurance Regulatory Commission (CBIRC) and the then-China Insurance Regulatory Commission (CIRC).

A Comprehensive Product System

China's agricultural insurance has developed a comprehensive product system. Main products include insurance for subsistence grain and oil crops, basic female livestock, and public and commercial forest; this is supplemented by insurance for special local agricultural products. Indemnity-based products have dominated China's agricultural insurance program (Ye et al. 2020); in addition, weather-index and price-index insurances are some of the most innovative types. Other agriculture-related insurances are an extension of the market. Insured varieties cover major cereal crops, livestock and poultry, cash crops, forests, and crops with local characteristics. By 2019, there were 16 agricultural products endorsed in the list of central finance subsidies, and 270 different types of insurance products covering crops, livestock, forest, and aquaculture.

Expanding List of Insured Risks

China's agricultural insurance has gradually covered drought, plant diseases, and insect pests, and it now approaches nearly all risk protection including damage from natural disasters (rainstorms, floods, waterlogging, droughts, typhoons, hail, frost, and so on), various kinds of disease and illness, accidents, and government-ordered slaughter—for instance, livestock slaughter for epidemic prevention. Protection for the market and price risk is also on the way: a 2019 instruction issued by the Ministry of Finance, together with other three authorities, is encouraging the development of price-index insurance and revenue insurance.

Table 5.1. China's Agricultural Insurance, 2007–2018

Year	Sum-Insured (US$, billions)	Number of participants (100 million households)	Premium revenue (US$, billions)	Crops insured (million hectares)	Forest insured (million hectares)	Livestock insured (billion head)	Indemnity expenditure (US$, billions)	Benefited farmers (10,000 households)
2007	25.80	0.50	0.78	13.60	1.88	--	0.43	--
2008	35.96	0.90	1.66	30.49	5.16	3.27	0.96	1,072
2009	57.18	1.33	2.01	44.35	19.16	3.61	1.43	1,798
2010	59.15	1.40	2.04	45.49	32.16	3.71	1.44	1,966
2011	97.85	1.69	2.61	53.87	96.08	3.98	1.23	2,129
2012	136.91	1.83	3.61	64.99	75.17	4.65	0.97	2,654
2013	208.04	2.14	4.60	74.10	127.23	6.84	3.13	3,131
2014	244.80	2.47	4.89	78.79	187.47	8.72	3.22	3,189
2015	294.62	2.29	5.62	96.82	194.23	9.74	3.90	3,368
2016	324.00	2.04	6.27	115.31	151.29	12.84	4.49	3,804
2017	418.50	2.13	7.19	140.43	169.64	17.31	5.02	4,690
2018	519.00	1.95	8.59	166.23	173.80	21.48	5.90	5,226

Source: The China Banking and Insurance Regulatory Commission (CBIRC) and the then-China Insurance Regulatory Commission (CIRC).

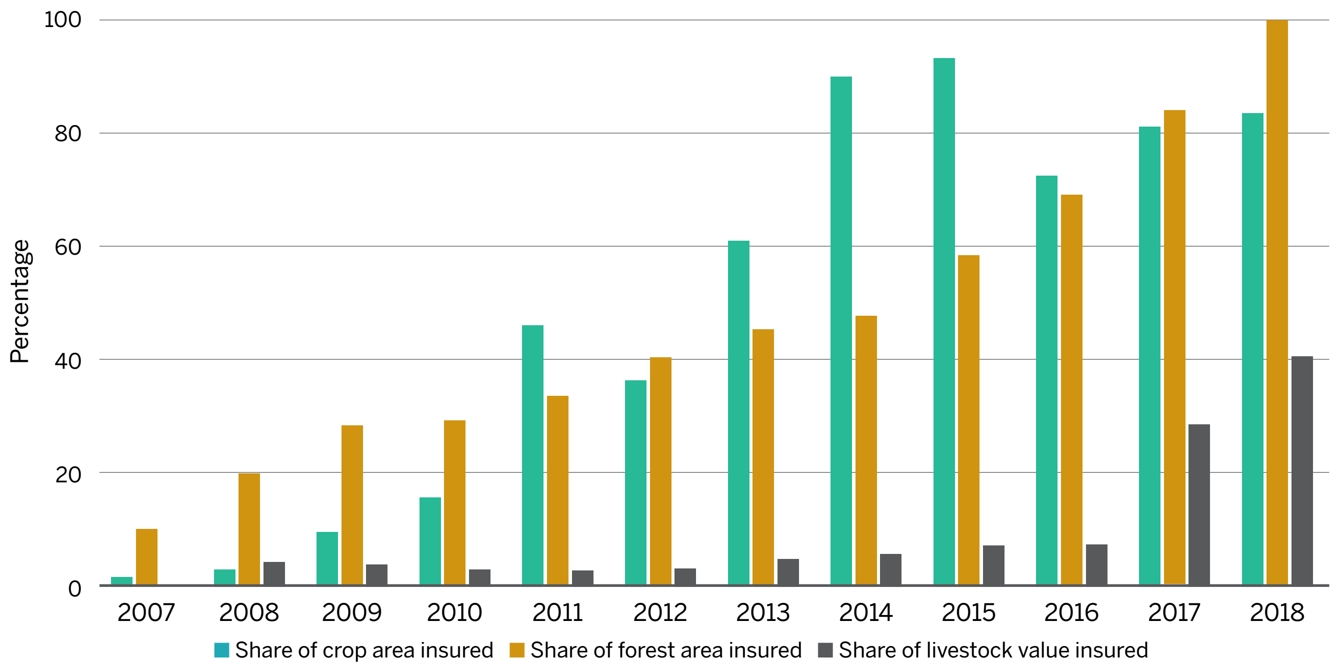
Increasing Liability and Coverage

China's agricultural insurance started with a strategy of "low liability but wide participation" (Ye et al. 2017) by providing limited sum insured and wide coverage of protection to farmers. China's insurance program has continued to provide heavy subsidies for subsistence agricultural products, but also offered high-liability and low-subsidy plans for cash crops, adapting to diversified needs from producers. In the past years, it has gradually raised the sum insured from purely replacement cost to including labor costs (Figure 5.3). Liability is expected to rise further according to the 2019 instruction from the Ministry of Finance, which has directly called for promoting the growth of the sum insured.

Extended List of Insurers

At the beginning of the pilot program (2007), only some insurance companies were eligible to underwrite agricultural insurance policies and receive premium subsidies: People's Property and Casualty Insurance Company of China; China United Property and Casualty Insurance Company; China Pacific Insurance Company; Anhua Agriculture Insurance Company; Guoyuan Agricultural Insurance Co., Ltd.; Gruopama-AVIC Property Insurance Co., Ltd.; and Sunlight Agricultural Mutual Insurance Company. In the past years, the Chinese government has gradually established a system to evaluate the market entry and exit of agricultural insurers. The system is designed to accommodate more insurers in the market, encourage market competition, and increase service quality. In 2013, 25 companies were in the agricultural insurance market, and

Figure 5.3. The Overall Level of China's Agricultural Insurance Liability and Coverage, 2007–2018



Data sources: Insured areas and sum insured from the China Banking and Insurance Regulatory Commission (CBIRC) and the then-China Insurance Regulatory Commission (CIRC). Nationwide crop sown area, forest area, and animal husbandry value-added from Statistical Yearbook of China.

Note: Share of crop area insured = crop area insured / crop sown area; Share of forest area insured = forest area insured / total forest area; Share of livestock production insured = livestock insurance sum insured / animal husbandry value-added.

at least 2 companies were providing service in a single province (Feng and Tuo 2014). In 2019, the total number was 32, and at least 3 companies were in each province (except for Tibet). Box 5.2 provides an example of agricultural insurance that helped during a major drought.

While the development of agricultural insurance in China has undoubtedly made major progress since the mid-2000s, the sector still faces considerable challenges that must be addressed if it is to reach its full potential.

- **Lack of critical data.** There remain gaps in fundamental data with respect to the insured (e.g., georeferenced farmland, livestock, and forest). Without precise data on the insured, it is difficult to link the farm indemnity written in a contract to georeferenced farm plots, leading to confusion and even chaos in loss adjustment. The lack of historical yield or loss data has hampered quantitative risk assessment and corresponding risk-based premium rating, and the premium rates are still province-based, ignoring the huge spatial difference in production risks. These data are either simply absent (e.g., farm-level yield data), or they lack viable protocols or mechanisms to share between government agencies and the industry.
- **Underdeveloped technique.** Most operations still rely heavily on manual computations, which can lead to great uncertainty. For instance, loss-adjustment results have been mostly based on the expertise of agricultural technicians, and the final results are subjected to the negotiation between the policyholder and the insurer. Nationwide quantitative risk assessment and risk-based premium maps are still absent (Zhang et al. 2015). Agricultural insurers still concentrate on premium revenue while associated risk is largely ignored. There has been a rise in the use of information technology in agricultural insurance. The use of personal digital assistants (PDAs) for georeferenced positioning of the insured during underwriting, and drone-based remote sensing and rapid loss-assessment are a few examples. The 2019

Repairing collapsed hill in Fengdu, Chongqing. Photo: ClaudineVM.

Box 5.2. In Focus: Agricultural insurance indemnity against the 2014 major drought in Liaoning

A farmer helped by agricultural insurance during the Liaoning drought.

Photo: PPIC Property and Casualty Company Limited.

From July 1 to August 9, 2014, average precipitation in Liaoning Province was only 90 millimeters, 60 percent lower than the multi-annual average, making the drought the worst since 1951. In total, 1,951,000 hectares of crops were affected, and total drop in yield was estimated to be more than 5 billion kilograms. This drought could have led to devastating damage to producers' livelihoods. Fortunately, 1,284,000 hectares of crops were insured. After the disaster, insurance companies partnered with local government authorities to mobilize human resources to conduct loss-adjustment at crop fields. By November 10, 2014, all loss-adjustment work was finished, and in total 380 million yuan in indemnities were paid via bank transfer to individual producers.

On November 6, 2014, Mr. Luo Quan'an, a local producer living in Houshan Viliage, Nanda Township, Xingcheng Municipality, received his indemnity of 6,000 yuan from the insurance company. His 2 hectares of maize were totally damaged by the drought. "It is amazing that I paid only 75 yuan/hectare for premium, and in return the 6,000 yuan indemnity largely reduced my loss," he said excitedly. "Our farming people would have much more confidence about our income than before [against natural disasters due to the help of agricultural insurance]." The photo above shows another farmer helped by insurance.

instruction by the Ministry of Finance also calls for compiling the first-generation national agricultural production risk maps and risk-based premium rating results.

- **Farmers' awareness.** As is typical in a developing agricultural sector, Chinese producers have limited experience in using insurance. The development of the agricultural insurance market has entailed an extensive learning-by-doing process in which producers get to know insurance and learn to use insurance via deep involvement in the operational cycle, including paying the premium, witnessing the loss-adjustment procedure, and receiving indemnity in person (Ye et al. 2016). However, this process poses some problems. In some regions, local insurers work only with the representatives of the group policy, most likely village heads, when collecting premium and paying indemnity, because it is very costly to face tens of thousands of farming households in one county directly. In some counties, local governments are providing enough subsidy to allow producers to join the program for free, which saves a lot of administrative costs. For instance, the premium for paddy in Hunan Province was only 4 yuan per mu (1/15 hectare), and the cost incurred in collecting the premium could be several fold more than that in far-flung villages.

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"While the development of agricultural insurance in China has undoubtedly made major progress since the mid-2000s, the sector still faces considerable challenges that must be addressed if it is to reach its full potential."

CHAPTER 6

The Development of Catastrophe Insurance in China: An Exploration

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Photo: PICC Property and Casualty Company Limited.

China's system of compensation for catastrophic loss has relied heavily on government relief and public donations; insurance has played a rather weak role. According to Chinese government figures, insurance claims in China have historically accounted for less than 1 percent of direct economic losses in major large-scale disasters.

According to preliminary statistics, direct economic losses from the 2008 snowstorm and ice storm disaster, the 2008 Wenchuan Earthquake, and the 2010 Yushu Earthquake were 151.7 billion yuan, 845.1 billion yuan, and 64 billion yuan respectively; by contrast, insurance indemnity for the three disasters were only 5 billion yuan, 1.66 billion yuan, and 0.08 billion yuan, respectively.

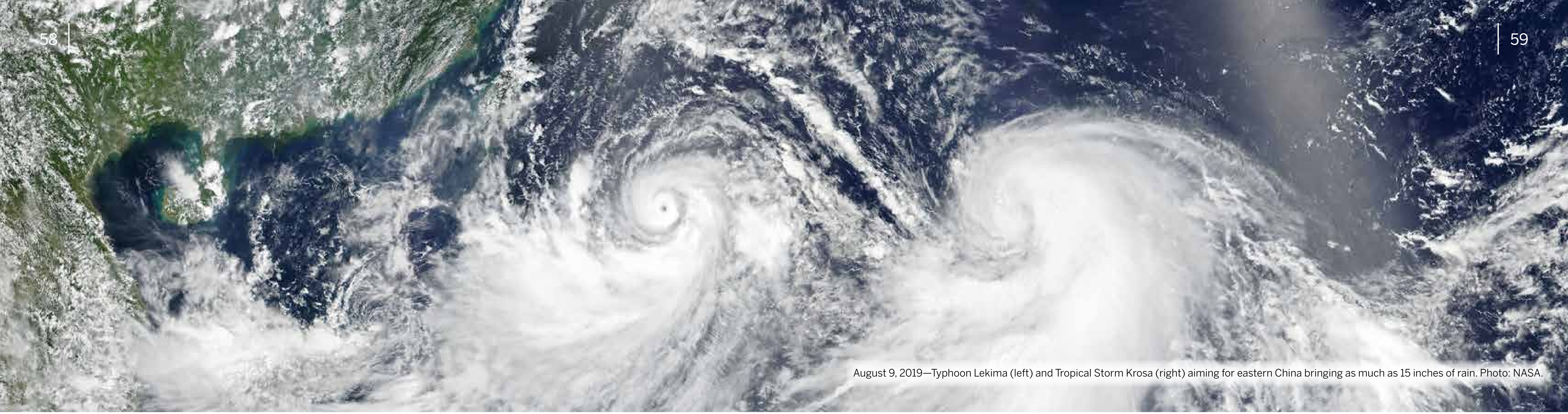
Since the 2008 Wenchuan Earthquake, the Chinese government has recognized the importance of catastrophe insurance in ensuring rapid rehabilitation and recovery in the aftermath of a disaster. China is a large country with a vast territory, and its disaster risk profile is characterized by significant regional variation. In establishing a catastrophe insurance protection mechanism, the Chinese government has accordingly put forward a national guideline that allows for local innovations and pilots based on local characteristics, with the goal of developing a system that fully addresses risk protection needs across the country (Figure 6.1).

Under this guideline, the country has laid the foundations for a diversified catastrophe insurance product system, which consists of both national standards and localized policies, single-peril (earthquake) versus multiple-peril, and indemnity-based and index-based types (Table 6.1). Besides, as the public in China still has a relatively low awareness and acceptance of natural disaster insurance (Wang et al. 2012), in some local pilots—including in Ningbo, Shenzhen, and

Key Messages

1. In the aftermath of the 2008 Wenchuan Earthquake, the Chinese government recognized the importance of catastrophe insurance in promoting rapid rehabilitation and recovery following a disaster.
2. China has since made significant progress in establishing a catastrophe insurance indemnity mechanism that allows for local innovations and pilots based on local characteristics.
3. Looking ahead, major challenges for catastrophe insurance in China include its very limited coverage and the underdevelopment of supporting techniques such as catastrophe risk models.

Damaged bridge construction after super typhoon Mangkhut in 2018. Photo: lzf.



August 9, 2019—Typhoon Lekima (left) and Tropical Storm Krosa (right) aiming for eastern China bringing as much as 15 inches of rain. Photo: NASA.

Figure 6.1. The Development of China's Catastrophe Insurance System

2008: After the 2008 Wenchuan Earthquake, the then-CIRC, now part of the China Banking and Insurance Regulatory Commission (CBIRC), and other relevant government departments and research institutions, such as Beijing Normal University, conducted catastrophe insurance studies, which were reported to the State Council and the National Commission for Disaster Reduction.

2010: The then-CIRC research project titled "*Catastrophe Insurance System*" suggested the overall frameworks of China's catastrophe insurance system, including plans for natural catastrophes and agricultural disasters.

2013: The then-CIRC published the China earthquake insurance system report as well as two pilot program plans for earthquake insurance in Sichuan and Yunnan, respectively

2014: In a policy document titled "*Opinions on Accelerating the Development of Modern Insurance Service Industry*," the State Council of China requested the incorporation of insurance into the country's disaster prevention and relief system and the gradual formation of a multi-layer catastrophe risk spreading mechanism with financial support. The State Council also encouraged local explorations of effective disaster risk protection.

2014: Pilot programs were launched in Shenzhen, Ningbo, Yunnan, and Sichuan.

2016: The then-CIRC and the Ministry of Finance issued "*The Implementation Plan for Establishing an Earthquake Catastrophe Insurance System for Urban and Rural Residential Buildings*". That same year, the product received its first underwritings in Beijing, Shanghai, and Shenzhen.

2016: In the second half of that year, Guangdong started pilot catastrophe index insurance in 10 prefectures, covering typhoons, rainstorms, and earthquakes.

Guangdong—local governments are purchasing insurance on behalf of all the citizens. Insurance indemnity covers many areas that were previously handled by government relief.

China's catastrophe insurance system is still in its pilot stage and there are many challenges ahead. It is worth noting that, despite the progress that has been made in expanding the reach of catastrophe insurance over the past decade, overall coverage is still very limited. Moreover, the pilot areas are mostly in economically developed areas. Most provinces in the central and western regions, as well as most rural areas, still have no coverage. Certain types of insurance—flood insurance and typhoon insurance for example—as well as supporting techniques such as catastrophe risk models, are still underdeveloped.

Indemnity Stories

- **Sichuan.** On September 12, 2018, an earthquake of magnitude 5.3 occurred in Hanzhong City, Shannxi Province, a province neighboring the north of Sichuan. People's Property and Casualty Insurance Company of China (PICC P&C), Guanyuan Branch, paid a total of 25,000 yuan for earthquake house damage.[5] This was the first indemnity case of the pilot program. On June 17, 2019, a magnitude 6 earthquake hit Changning County, Sichuan Province, claiming the lives of 12 people and causing the relocation of over 4,000 people. In total, more than 10,000 houses were damaged. Two days after the quake, the insurance industry received 65 claims with an estimated total indemnity of 596,100 yuan.[6]
- **Yunnan.** On March 27, 2017, three consecutive earthquakes with magnitudes of 4.7, 5.1, and 4.3 struck Yangbi County, Dali Prefecture. The index-based earthquake insurance was triggered. Indemnity was computed and paid within 32 hours after the quake, for a total amount of 28 million yuan.[7]
- **Ningbo.** Since 2015, Ningbo's program has had six mass indemnities triggered by catastrophes. In August 2019, Super Typhoon Lekima hit

[5] Sina News. http://news.sina.com.cn/o/2018-11-15/doc-ihnvukff4923490.shtml (in Chinese).
[6] Sina News. http://news.sina.com.cn/o/2019-06-19/doc-ihytcerk7959547.shtml (in Chinese).
[7] YNY DC. http://www.ynydc.com/webNews/content.do?id=5682 (in Chinese).

nine provinces on China's eastern coast. For the city of Ningbo, total direct economic loss was estimated to be 1.97 billion yuan. By August 12, insurance companies had received reports of more than 53,000 cases with total claims up to 460 million yuan. By August 15, total claims had reached 634 million yuan, and the estimated final indemnity could be over 700 million yuan.[8]

- **Shenzhen.** On April 11, 2019, a rainstorm struck Shenzhen, causing a flash food and claiming nine lives. Shenzhen catastrophe insurance paid a final indemnity of 250,000 yuan for each dead or missing person, and an extra 20,000 yuan for the relocation of family members.[9]

- **Guangdong.** On August 23, 2017, Typhoon Hato landed in Zhuhai. According to the formal report from Guangdong Province's climate center, the wind speed of Hato exceeded the threshold of predefined index for Yangjiang City and Yunfu City; insurance indemnity was triggered. Within half a day, 1.2 million and 10 million yuan were paid to bank accounts specified by Yangjiang and Yunfu city governments respectively.[10] In 2018, Super Typhoon Mangkhut triggered insurance indemnity for Yangjiang and Maoming. Within 24 hours, insurance companies paid 5.5 million and 20 million yuan to the departments of finance of Yangjiang and Maoming cities, according to index calculation, respectively.[11]

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[11] Sina News. http://gd.sina.com.cn/finance/observer/2018-09-19/cj-ihkhfqnt0535235.shtml (in Chinese).

3D Render of Guangzhou City. Relief texture SRTM data courtesy of NASA. Phoro: FrankRamspott.

Table 6.1. China's Catastrophe Insurance: National and Local Systems Compared

	National Earthquake Catastrophe Insurance	Sichuan Earthquake Catastrophe Insurance	Government-Supported Earthquake Insurance for Rural Residential House in Yunnan Province	Ningbo (Zhejiang) Catastrophe Insurance	Shenzhen (Guangdong) Catastrophe Insurance	Guangdong Catastrophe Insurance
Perils and triggers	Destructive earthquake vibrations and secondary disasters including tsunami, fire, explosion, subsidence, mudflow, and landslide.	Destructive earthquakes of magnitude 4.7 (and above) and its secondary disasters.	Earthquakes of magnitude 5 (and above) and secondary disasters.	Typhoon, strong tropical storm, tornado, rainstorm, flood, and blizzard and their secondary disasters. Losses of family property (> 2,000 households) or casualties (> 3 people).	15 types of disasters (storm, rainstorm, cliff collapse, lightning, flood, tornado, squall line, typhoon, tsunami, mudflow, landslide, sinkhole, hail, waterlogging, earthquakes of magnitude 4.5 (and above) and their secondary disasters.	Typhoon and flood (heavy rainfall). Typhoon: Typhoon track enters the predefined spatial extent and reaches the threshold (the 2-minute average speed of the maximum wind near the eye reads 32.6 m/s, force 12). Heavy rainfall: Heavy rainfall events occur in the insured area, and the maximum rainfall of any effective observation station reaches the disaster threshold.
Sum insured	Urban residential houses: 50,000 ~ 1,000,000 yuan per household. Rural residential houses: 20,000 ~ 1,000,000 yuan per household. Given that this segment of insurance industry is still nascent, the initial insurance amount will not exceed 1 million yuan, and will be gradually improved according to the operation situation. The part that is greater than 1 million yuan can be supplemented by commercial insurance.	From 50,000 yuan for urban housing and 20,000 yuan for rural housing, with upper limits of 1 million yuan per household. The upper limit of an annual aggregate payment is either 8 times the premium revenue, or 800 million yuan. If the annual total insurance loss exceeds the sum of the limit and insurance reserve fund, the policy callback is proportional.	Rural house loss: 420 million yuan/a in total. Resident death: 100,000 yuan/person, 80 million yuan/a.	Casualty benefits: 200,000 yuan/person, 300 million yuan/accident. Family property: 3,000 yuan/household, 300 million yuan/accident. Public event relocation: 13,500 yuan/person.	Casualty benefits: 100,000 yuan/person, 2 billion yuan/accident. Nuclear emergency relief: 2,500 yuan/person, 500 million yuan/accident. House loss: 20,000 yuan/household, 200 million yuan/accident. Indemnity limits apply only to events. No annual upper limits.	Indemnity limits are determined by the local financial budget. For the procurement bidding of 2017–2020, typhoon insurance has an upper limit of 1.07 billion yuan and heavy rain insurance has an upper limit of 1.09 billion yuan in 10 prefectures.
Loss-adjustment	Indemnity-based. Damages classified into 5 levels according to the national standards formulated by the China Earthquake Administration and the Ministry of Civil Affairs. Level I and II (slight damage), no indemnity. Level III (medium damage), 50% of the sum insured. Level IV (severe damage) and level V (total collapse): 100% of the sum insured.	Indemnity-based. Classified into 5 levels of damage according to the *National Standard Classification of Earthquake Damage Level of Buildings (Architecture)*. Similar to the national standard policy.	Index-based and indemnity-based. Indemnity for housing is decided by the earthquake magnitude, as long as the epicenter is within specific location (in Dali Prefecture or in the surrounding area). Mortality is indemnified according to the actual number of deaths.	Indemnity-based. Casualty: Follows *Life-Insurance Disability Evaluation Standard*. Family property damage relief: Depends on the depth of water logging or actual damage.	Indemnity-based. Casualty benefits: Refer to *Life-Insurance Disability Evaluation Standard*.	Index-based. After the occurrence of the disaster event, the index calculation institution shall compute the disaster index and issue a report according to the typhoon or rainfall data. After confirmation by the government and insurance companies, the insurance company shall indemnify according to a pre-defined structure.

Table 6.1. Cont.

	National Earthquake Catastrophe Insurance	Sichuan Earthquake Catastrophe Insurance	Government-Supported Earthquake Insurance for Rural Residential House in Yunnan Province	Ningbo (Zhejiang) Catastrophe Insurance	Shenzhen (Guangdong) Catastrophe Insurance	Guangdong Catastrophe Insurance
Underwriting	Voluntary participation.	Voluntary participation.	Whole participation of Dali Prefecture.	Whole participation for the first year. Encourage voluntary participation.	Whole participation handled by the Bureau of Civil Affairs of Shenzhen.	The provincial government buys service for prefecture governments through open bidding.
Premiums and rates	Using risk-based premium rates according to the regional risk level, building structure, urban and rural differences.	Set 4 levels of premium rates according to earthquake risk and building structure and rural and urban difference.	Premium rate of 2016 is 6.43%	Casualty: 4.17%. Family property damage relief: 8.33%.	Unknown.	Total premium for year 2017 is 123.8 million yuan.
Premium payment	Policyholders pay the premium, but premium subsidy is encouraged.	Policyholders pay 40% of the premium, and government provides 60% premium subsidy. 100% premium subsidy is applicable for households needing special assistance.	Fully paid by the Dali Prefecture government.	Fully paid by the government. Municipal and county (district) finance cover 60% and 40% of the cost, respectively.	Fully paid by the Shenzhen government.	Fully paid by the government.
Reserve fund	A portion of the premium revenue will be used to set up a special reserve fund, which rolls over in an independent account year by year. The extraction, accumulation, and use of of the fund is subject to specific management measures defined by the financial department.	Premium surplus (total revenue subtracting the cost of reinsurance, indemnities, operating expenses, and predefined profits) will be fully put into the a reserve fund. The contractor shall set up separate account for the reserve fund. The fund is subject to independent accounting.	If no claims, 70% of annual revenue will be reserved or 60% of premium surplus will be reserved. The predefined profit rate is 6% after tax. The fund shall be put in an independent account, subject to independent accounting, and roll over year by year.	Premium surplus will be fully reserved. Besides, Ningbo municipal government arranges another 10.2 million yuan each year to support the reserve fund. The fund shall be supervised and managed by the relevant departments designated by the Ningbo municipal government. Insurers can apply for funding when simple loss ratio exceeds 125%, and the funding is up to the total fund available in the reserve.	Unknown.	Unknown.
Catastrophe risk sharing	In the initial stage of operation, the general idea is total control and quota management. On one hand, define the upper limit of a single earthquake so that the loss can be shared by layers of insurer, reinsurer, and reserve fund. On the other hand, define insurance sales quota in high-risk areas of earthquakes.	Multi-layer risk-sharing mechanism of insurance-reinsurance-reserve fund-government contigent fund.	Multi-player pooling by involving approximately 2–3 insurance and reinsurance companies.	Multi-layer risk-sharing: (1) Total indemnity ≤ 300 million, paid by insurance company. (2) Total indemnity exceeding 300 million yuan, paid by the reserve fund, up to the maximum fund raised. (3) Residents are encouraged to purchase commercial catastrophe coverage on their own.	Multi-layer risk-sharing: (1) Insurance. (2) Reserve fund. To cover the cost of casualty assistance and nuclear emergency relocation that is beyond the limit of insurance. 3) Personal catastrophe insurance, which residents should purchase independently.	Not specified.

Table 6.1. Cont.

	National Earthquake Catastrophe Insurance	Sichuan Earthquake Catastrophe Insurance	Government-Supported Earthquake Insurance for Rural Residential House in Yunnan Province	Ningbo (Zhejiang) Catastrophe Insurance	Shenzhen (Guangdong) Catastrophe Insurance	Guangdong Catastrophe Insurance
Impact	In 2018, premium revenue reached 124 million yuan, providing risk protection of 159.9 billion yuan. In total, risk protection of 266.5 billion yuan was provided, and 5.33 million yuan has been indemnified to 10.08 million households since implementation.	By the first quarter of 2018, 18 cities (states) in Sichuan Province have joined in the earthquake catastrophe insurance program. It has benefited 1.65 million urban and rural residents and provided total risk protection of 43.1 billion yuan.	During 2015–2019, the program collected in total 140 million yuan in insurance premiums, and the corresponding protection reached 1.186 billion yuan. In 2015–2018, there were four earthquakes of magnitude 5 or above, and in total 69.69 million yuan was indemnified, taking 11.4% of the total residential loss. The payment was as quick as 32 hours after the quake.	From 2015 to 2018, the program paid 193.3 million yuan to more than 333,000 households affected by disasters.		In 2016, the program provided 2.347 billion yuan of risk protection. In 2016–2017, the program paid indemnity of 89 million yuan to 10 cities. In 2017–2018, 14 cities paid 185 million yuan in premiums and received 493 million yuan of indemnity.

Note: Data about the national standard program, the Sichuan program, the Ningbo program, and the Shenzhen program are provided by People's Property and Casualty Insurance Company of China. Data about the Yunnan program was provided by the Yunnan earthquake risk management innovation laboratory and Champion Property & Casualty Insurance Co., Ltd. Data about the Guangdong program was provided by the Guangdong Meteorological Administration.

CHAPTER 7

Leveraging Space-Based Satellite Technologies for Emergencies and Disasters in China

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Satellite antennas in Beijing. Photo: bingdian.

Satellite-based reporting is undoubtedly a step up from ground-based reporting when it comes to the timeliness, accuracy, and comprehensiveness of data collection for rapid disaster assessment. This was illustrated in the aftermath of the 2008 Wenchuan Earthquake, when ground-based reporting methods became a bottleneck in efforts to collect disaster data. By the time satellite-based remote sensing could be used to gather these data, it was already more than three days since the disaster.

This meant that emergency responders could not put critical geospatial data on the location of damaged areas (e.g., the damage level of buildings, roads, and the physical environment) to use until after the critical 72-hour "golden" window, hampering efforts to rescue people who would have otherwise have had a larger chance of survival.

As shown in the timeline, in the 12 years since the Wenchuan Earthquake, China has quickly established a relatively comprehensive space-based system of disaster and emergency monitoring, which consists of integrated observations from satellite, unmanned aerial vehicle (UAV), station, and field investigations. The development of this system has strengthened China's disaster and emergency monitoring capabilities in three ways.

First, the acquisition of satellite data to prepare for and respond to disasters and emergencies is now virtually guaranteed. Domestically, China can rely on more than 20 civil satellites, including the Small Satellite Constellation for Environment and Disaster Monitoring and Forecasting. Internationally, in the emergency phase of severe disasters, China can obtain remote sensing satellite data from 18 space agencies worldwide free of charge through its affiliation with the International Charter on

Key Messages

1. In the 12 years since the Wenchuan Earthquake, China has quickly established a relatively comprehensive space-based system of disaster and emergency monitoring.
2. The development of this capability has strengthened the country's disaster risk management practices, in part by enabling more comprehensive post-disaster assessments.
3. A key challenge moving forward will be determining how to ensure that China's comprehensive space-based system of disaster and emergency monitoring is better aligned with the needs of key decision-makers and planners.

Beijing. *Source:* Leonardo Sandon/ U.S. Geological Survey.

Space and Major Disasters. For example, after the 2008 Wenchuan Earthquake, the National Disaster Reduction Center of China (NDRCC) acquired more than 1,000 scenes of pre-image remote sensing data from 23 satellites, including five from China, to quickly estimate the extent of damage to housing, transportation lines, and farmland.

Second, critical emergency response and disaster management products, based on high-resolution imagery data, have become widely available, including damage distribution maps of buildings, roads and crops, flood distribution map, and 3D scene of disaster area (Figure 7.1). For example, remote-sensing technology was used in earthquake-induced building damage detection after the 2017 Jiuzhaigou Earthquake, in monitoring reconstruction progress after the 2008 Wenchuan Earthquake and the 2010 Yushu Earthquake, and in monitoring the landslide and the river blocking dam of the Yarlung Zangbo River in Milin County of Tibet on October 17 and 29, 2018.

Third, the timeliness, accuracy, and pertinence of the comprehensive assessment of severe natural disasters has been improved. Using remote sensing data made available by medium- and high-resolution satellites, property losses can now be verified, thus ensuring the accuracy of damage numbers, when paired with loss statistics and field investigation. At the same time, comprehensive loss assessments can now be finished much more quickly. It took two weeks to complete this process in areas in Tibet affected by the 2015 Nepal earthquake, compared with two months in areas affected by the 2008 Wenchuan Earthquake (Table 7.1).

As one of the members of the International Charter on Space and Major Disasters and UN-SPIDER (United Nations Platform for Space-Based Information for Disaster Management and Emergency Response), China has also been providing strong support for international cooperation mechanisms on disaster response. It has already mobilized its satellite data system to aid emergency response to international disasters more than 40 times since 2007, including following the 2010 Haiti Earthquake, the 2010 Gulf of Mexico oil spill, the 2010 Pakistan floods (Zhang and Liu 2010), and the 2019 India flood inundation in parts of Morigaon district, Assam State.[12]

Figure 7.1. 3D Scene of disaster-affected area after the 2017 Jiuzhaigou Earthquake

Source: NDRCC, http://www.ndrcc.org.cn.

From the sky to the ground, China continues to make progress in constructing an integrated disaster monitoring and evaluation system for emergency response and disaster management. A key challenge moving forward will be determining how to ensure that the country's comprehensive space-based system of disaster and emergency monitoring is better aligned with the needs of key decision-makers and planners at every level of government. Critical steps to address this include:

- Establishing a multi-level coordination and information sharing mechanism for space satellite-based resources.
- Developing relevant standards and work procedures to ensure the proper sharing and service of data and products.
- Strengthening data analysis techniques for disaster management, including cloud computing and multi-source data mining, to improve the utilization efficiency of observation data.

Table 7.1. Time statistics of major natural disaster loss assessment

Disaster event	Disaster occurrence date	Number of days needed since the disaster occurrence date			Days required to complete loss assessment
		Launch the assessment	Local loss report	Complete loss assessment	
Wenchuan Earthquake	May 12, 2008	26	77	112	86
Yushu Earthquake	April 14, 2010	5	11	28	23
Zhouqu Mudslides	August 8, 2010	5	10	36	31
Lushan Earthquake	April 20, 2013	5	16	27	22
Ludian Earthquake	August 3, 2014	11	18	28	17
Nepal Earthquake (Tibet disaster area)	April 25, 2015	10	20	27	17

Source: Fan et al. 2016.

[12] Guancha, https://www.guancha.cn/industry-science/2019_07_24_510821.shtml (in Chinese).

Aerial view over northwest China. Photo: Zhao Liu.

Timeline

2007

China becomes the newest member of the International Charter on Space and Major Disasters, a joint initiative established in 2000 for providing emergency response satellite data free of charge to those affected by disasters anywhere in the world.[13] As one of the Charter members, China can acquire different satellite data of affected areas within a matter of hours or days from different space agencies for disaster monitoring purposes through the activation of the International Charter mechanism.

2008–2009

The Small Satellite Constellation for Environment and Disaster Monitoring and Forecasting, which included three satellites, was successfully launched into space from China. This has enabled the dynamic monitoring of natural disasters, including rapid damage assessments, which are critical to rescue and reconstruction work.

2009

The Satellite Disaster Reduction Application Center was established. The center is affiliated with the National Disaster Reduction Center of China (NDRCC,) which has been under the jurisdiction of the Ministry of Emergency Management since 2018. The main responsibilities of this center are to use remote sensing technology to conduct major natural disaster monitoring, early warning and evaluation, and international exchange and cooperation in the application of space technology in disaster reduction. It is also responsible for managing disaster reduction satellite operation and assisting in the decision-making functions of the National Disaster Reduction Committee and the Ministry of Emergency Management.

2010

The United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) set up its first office in China in a bid to promote international cooperation in disaster management by using space-based information.

2010

The National Emergency Monitoring Cooperation Mechanism for Major Natural Disasters using Unmanned Aerial Vehicle (UAV) was established in China. The cooperation mechanism aims to improve the speed and capability of emergency response by establishing a UAV monitoring team to respond more quickly to major disasters. UAV allows a 0.2m resolution image of the disaster area to be acquired.

2015

China issued the Medium- and Long-term Development Plan for National Civil Space Infrastructure (2015–2025) to strengthen global observation capability through remote sensing, communication broadcasting, navigation, and positioning.

2017

The National Bureau of Defense Science and Technology of China released a working mechanism and process to acquire high-resolution remote sensing satellite for emergency management.

[13] The International Charter is composed of space agencies and space system operators from around the world who work together to provide satellite imagery for disaster monitoring purposes. There are 17 Charter members, including the European Space Agency (ESA) and the United States Geological Survey (USGS). The Charter mechanism had been activated 631 times and served 126 countries for disaster response as of November 21, 2019, and has played a major role in emergency management worldwide.

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CHAPTER 8

The Counterpart Support Program for the Wenchuan Earthquake Recovery: Lessons and Reflections

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Source:

Reconstructed Wenchuan County of Sichuan Province, supported by Guangdong Province. Author's own photo.

On May 12, 2008, a magnitude 8.0 earthquake occurred in Wenchuan, Sichuan Province. The casualties caused by the disaster reached 87,150 and more than 20 million people were affected.

Critical infrastructure, such as houses, transportation infrastructure, schools, and hospitals were seriously damaged. The direct economic losses caused by this disaster was more than US$121 billion.[14]

In response to the devastation, the Chinese government established a counterpart support program for post-disaster recovery and reconstruction efforts, with the consent of the Party Central Committee and the State Council of China (see also Box 8.1).

Under the theme of "one province for one severely affected county, with the strength of the whole country, to accelerate the recovery and reconstruction," the program designated 19 provinces and municipalities of provincial status to support the severely affected counties and cities in Sichuan, Gansu, and Shaanxi Provinces, in a unified fashion, with no less than 1 percent of their fiscal income for three consecutive years. The key objectives and components of the program include but are not limited to:

1. Provide planning, architectural design, expert consultation, engineering construction, and supervision services.
2. Build and repair houses for urban and rural residents.

[14] This figure is based on exchange rate: 1 USD = 6.98 RMB.

Key Messages

1. In response to the devastation of the Wenchuan earthquake in 2008, the Chinese government established a counterpart support program for post-disaster recovery and reconstruction.
2. The program designated 19 provinces and municipalities of provincial status to support some of the most severely affected counties and cities.
3. This program enables the most severely affected countries and cities to start significant reconstruction in a timely manner and in line with the principles of "build back better."

5.12 Sichuan earthquake memorial. *Source:* Tarzan9280.

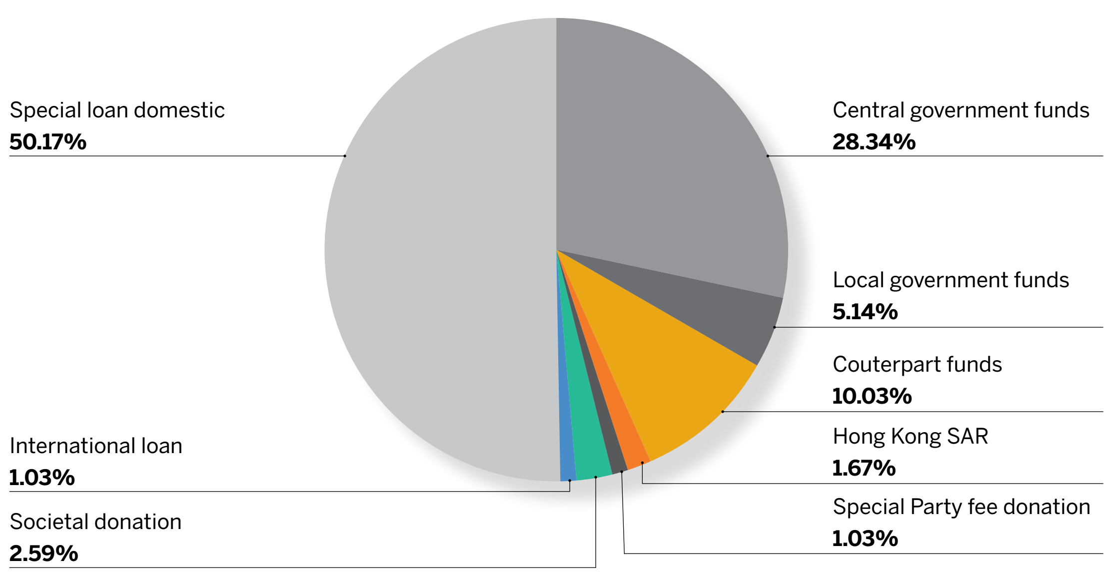
3. Build and repair public service facilities such as schools, hospitals, public communication, culture and sports, and social welfare facilities.
4. Build and repair urban and rural roads, water supply (drainage), gas supply, sewage and garbage treatment, and other infrastructure.
5. Construct and repair agricultural, rural, and other infrastructure.
6. Provide mechanical equipment, equipment and tools, building materials, and other support.
7. Encourage enterprises' investment in the construction of factories, commercial circulation, and participation in the construction of operational infrastructure.

The State Council took the lead in developing policy making around the counterpart support program, in line with the top-down approach that was adopted by the Chinese government in the reconstruction following the Wenchuan Earthquake. In keeping with the guidance document issued by the State Council, the affected provinces and counties made reconstruction plans step by step. These have laid the foundation for the counterpart support provided.

The counterpart support program ultimately enabled the affected localities to glean lessons and insights from the experiences of other localities in China. In particular, the affected provinces and counties were better able to develop a "people-centered" reconstruction plan and ensure that the reconstruction of housing, schools, and hospitals of both urban and rural residents were adequately prioritized.

Moreover, countersupport program funds helped cover the staggering costs of the reconstruction, ultimately covering a tenth of these costs, which totaled nearly US$143 billion. By comparison, international agencies (e.g., the World Bank) provided just over 1 percent of the funds. Just over half of the funding came from reconstruction lending provided by domestic financial agencies (Figure 8.1).

Figure 8.1. Source of Financial Resources for the Reconstruction after the Wenchuan Earthquake, as of November 2011



Data source: ChinaNews.Com, http://www.chinanews.com/gn/2011/05-09/3025977.shtml.

Box 8.1. Results and Highlights from the Wenchuan Earthquake Recovery

Photo Credit: World Bank

Wenchuan Earthquake Recovery Project. The Wenchuan Earthquake Recovery Project (WERP), supported by the World Bank and implemented by the Chinese government, played a key role in restoring and enhancing basic infrastructure, as well as health and education services, in 27 severely affected counties in Sichuan and Gansu, the two provinces hardest hit by the earthquake. Adopting the principles of building back better, WERP built or renovated 300 roads, constructed and equipped 67 health facilities, and rehabilitated and constructed nine wastewater treatment plants. The project also pioneered an innovative model in post-disaster reconstruction, integrating restoration and reconstruction with revitalization and development, while considering the local context.

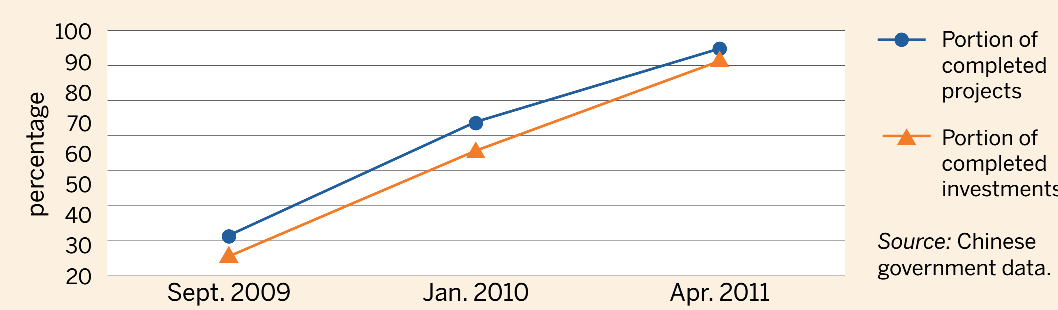
Recovery and reconstruction policies. After the disaster, the State Council and Sichuan Province successively issued 105 policies to support the recovery and reconstruction of the disaster area, covering finance, taxes, land, industry, assistance, and other aspects; these policies played a crucial role in the post-disaster reconstruction. Meanwhile, enterprises, social organizations, and individuals from all regions were encouraged to invest in the disaster areas and build operational infrastructure. Financial institutions were also encouraged to provide support to counterpart enterprises.

Relocation and rehabilitation. In the first three months after the earthquake, the State Council provided 500 grams of food and US$1.5 (10 yuan) of subsidies to each affected person in the disaster area on a daily basis, in addition to a US$710 (5,000 yuan) consolation fee to each victim's family. In total, 15.1 million people were transferred and resettled. In response to the call of the state, all parts of the country formed a pair with the local disaster area, drawing extensively on the active participation of the public.

Reconstruction. The reconstruction of the Wenchuan disaster area in China was undertaken with a high degree of efficiency. Within three months of the disaster, the State Council had formulated a master plan for Wenchuan Earthquake reconstruction. Over a year after the earthquake, 34 percent of the planned reconstruction projects had been completed. By September 2011, just three years after the earthquake, over 98 percent of the more than 4,200 restoration and reconstruction projects included in the national plan had been completed, and nearly 99 percent of the estimated investment (about US$12.5 billion) had been completed (Figure B8.2).

Building back better. With the goal of building back better, the technical level and disaster prevention level of houses, hospitals, schools, and major roads have been greatly improved. More than 2,100 kilometers of level II and higher-level roads were built, which is around 50 percent more than that before the earthquake. Almost all the towns and villages in Sichuan, Gansu, and Shaanxi are covered by the newly built road network. In Qingchuan, Pingwu, Beichuan, Maoxian, Wenchuan, Songpan, Jiuzhaigou, and other mountainous areas, at least three alternative routes were built to ensure network redundancy. Driving conditions have been significantly improved. According to the statistics of the Department of Transportation of Sichuan Province, highway travel time has been shortened by 30 percent and its capacity increased by 50 percent.

Figure B8.2. Progress of Wenchuan Earthquake Reconstruction Plan



Source: Chinese government data.

Notwithstanding these benefits from the counterpart support, several key challenges also emerged over the course of the implementation of the program.

The supporting province/municipality and the recipient county paired up are not equal at the administrative level. The administrative level of the provider, in this case, is higher than that of the recipient. As a result, the priorities of the provider, a province, and the recipient, a county, did not always align well. Under the supervision and assessment of the provincial vertical leadership, the supporting province/municipality will naturally pay special attention to the assessment and strive to complete the reconstruction work within the shortest time and limited scope, while the long-term development of the disaster area and the specific interests of the local victims could not be fully addressed. For example, the rapid reconstruction caused fragmentation of original neighborhoods in some areas, which hindered long-term community recovery.

While the infrastructure is much improved from a technical perspective than it was before the disaster, this misalignment in priorities helps explain the lack of focus on how to make the infrastructure system more sustainable after the reconstruction. The reconstructed infrastructure is of better quality and thus requires higher operational and maintenance costs afterwards; this is a challenge for some countries with a lower level of economic development.

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