CLIMATE RISK COUNTRY PROFILE

CHINA

WORLD BANK GROUP

ADB ASIAN DEVELOPMENT BANK

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ACKNOWLEDGEMENTS

This profile is part of a series of Climate Risk Country Profiles that are jointly developed by the World Bank Group (WBG) and the Asian Development Bank (ADB). These profiles synthesize the most relevant data and information on climate change, disaster risk reduction, and adaptation actions and policies at the country level. The profile is designed as a quick reference source for development practitioners to better integrate climate resilience in development planning and policy making. This effort is co-led by Veronique Morin (Senior Climate Change Specialist, WBG), Ana E. Bucher (Senior Climate Change Specialist, WBG) and Arghya Sinha Roy (Senior Climate Change Specialist, ADB).

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Climate and climate-related information is largely drawn from the Climate Change Knowledge Portal (CCKP), a WBG online platform with available global climate data and analysis based on the latest Intergovernmental Panel on Climate Change (IPCC) reports and datasets. The team is grateful for all comments and suggestions received from the sector, regional, and country development specialists, as well as climate research scientists and institutions for their advice and guidance on use of climate related datasets.

CONTENTS

FOREWORD

Climate change is a major risk to good development outcomes, and the World Bank Group is committed to playing an important role in helping countries integrate climate action into their core development agendas. The World Bank Group (WBG) and the Asian Development Bank (ADB) are committed to supporting client countries to invest in and build a low-carbon, climate-resilient future, helping them to be better prepared to adapt to current and future climate impacts.

Both institutions are investing in incorporating and systematically managing climate risks in development operations through their individual corporate commitments.

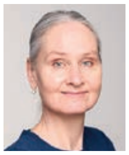
For the World Bank Group: a key aspect of the World Bank Group's Action Plan on Adaptation and Resilience (2019) is to help countries shift from addressing adaptation as an incremental cost and isolated investment to systematically incorporating climate risks and opportunities at every phase of policy planning, investment design, implementation and evaluation of development outcomes. For all International Development Association and International Bank for Reconstruction and Development operations, climate and disaster risk screening is one of the mandatory corporate climate commitments. This is supported by the World Bank Group's Climate and Disaster Risk Screening Tool which enables all Bank staff to assess short- and long-term climate and disaster risks in operations and national or sectoral planning processes. This screening tool draws up-to-date and relevant information from the World Bank's Climate Change Knowledge Portal, a comprehensive online 'one-stop shop' for global, regional, and country data related to climate change and development.

For the Asian Development Bank: its Strategy 2030 identified "tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability" as one of its seven operational priorities. Its Climate Change Operational Framework 2017-2030 identified mainstreaming climate considerations into corporate strategies and policies, sector and thematic operational plans, country programming, and project design, implementation, monitoring, and evaluation of climate change considerations as the foremost institutional measure to deliver its commitments under Strategy 2030. ADB's climate risk management framework requires all projects to undergo climate risk screening at the concept stage and full climate risk and adaptation assessments for projects with medium to high risk.

Recognizing the value of consistent, easy-to-use technical resources for our common client countries as well as to support respective internal climate risk assessment and adaptation planning processes, the World Bank Group's Climate Change Group and ADB's Sustainable Development and Climate Change Department have worked together to develop this content. Standardizing and pooling expertise facilitates each institution in conducting initial assessments of climate risks and opportunities across sectors within a country, within institutional portfolios across regions, and acts as a global resource for development practitioners.

For common client countries, these profiles are intended to serve as public goods to facilitate upstream country diagnostics, policy dialogue, and strategic planning by providing comprehensive overviews of trends and projected changes in key climate parameters, sector-specific implications, relevant policies and programs, adaptation priorities and opportunities for further actions.

We hope that this combined effort from our institutions will spur deepening of long-term risk management in our client countries and support further cooperation at the operational level.



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KEY MESSAGES

- The projected temperature increase in China due to climate change is expected to be above the global average. The highest emission pathway (RCP8.5) projects an increase of average temperatures in China to rise by 2.5°C by the 2050s and 5.2°C by the 2090s; more significant temperature increases are expected in northern and western regions.
- Increases in annual maximum and minimum temperatures are projected to be larger than the increase in average temperature, increasing the potential health, livelihood, and ecosystem risks of global warming.
- The impacts of hazards and sustained changes will not be equally distributed, they will likely be experienced most strongly by marginalized and asset-poor communities.
- Increased heat stress, compounded by the urban heat island effect, represents a major threat to human health, productivity levels, and energy demand in many of China's megacities.
- Hazards such as droughts, floods, and heatwaves are all expected to increase in probability, and increased loss and damage will be difficult to avoid without significant adaptation efforts.
- There is a very significant threat to biodiversity and natural resources, without careful planning, adaptation efforts may only exacerbate this threat and the challenges faced by communities most dependent on natural resources.
- Support for adaptation will be needed by many groups, particularly smallholder farmers who face potential yield losses and species range shifts.
- China's large population of vulnerable and undernourished people will experience increased pressure from climate drivers, particularly in coastal urban conurbations, in regions facing dryland expansion, and where livelihoods depend on outdoor manual labor.

COUNTRY OVERVIEW

The People's Republic of China is the world's second largest economy and the largest country by population, with over 1.4 billion people. The country is highly diverse, both in geography and ethnography. The country's geography can be generally divided into four regions. The Southern region, consisting of hilly terrain and the Yunnan-Guizhou Plateau. The Northern region, consisting of low productivity plains and deserts, including Inner Mongolia Autonomous Region. The Western Region, consisting of high-altitude plains and mountains in Tibet Autonomous Region, and the Eastern region, which can be sub-divided into the Central Plain, North Plain, and the Northeast Plain, consisting of alluvial plains of the Yangtze and Yellow Rivers, and a densely populated coastline. As of 2018 China contained six cities with populations over 10 million.[1]

[1] United Nations (2018). The World's Cities in 2018: Data booklet. URL: https://www.un.org/en/events/citiesday/assets/pdf/the_worlds_cities_in_2018_data_booklet.pdf

As of 2019, the economy of China was led by the service sector (53.9%) and industry (39.0%), with agriculture contributing 7.1% of national Gross Domestic Product (GDP). However, the relative contribution of sectors to GDP is somewhat mismatched against the labour force, with agriculture employing approximately 27.7% of the working population (over 200 million smallholder farmers), industry 28.8% and services 43.5%. China has made great progress in its efforts of comprehensive poverty alleviation by 2020. As of 2019, 0.6% of the population were reported to be below the national poverty line, representing a dramatic reduction in poverty rates over the past three decades[2] (see key indicators in **Table 1**). Rapid economic growth is believed to have coincided with growth in income and wealth inequality; in 2016 the World Bank Group estimated China's GINI Index (a representation of wealth distribution and inequality) at 38.5.[3]

Even in proportion to its large size and economy, China's vulnerability to climatic hazards is high. Annual losses due to natural hazards average $76 billion and around one third of China's agricultural land is affected by natural hazards such as storms, droughts, floods, land subsidence, and landslides.[4] China's Nationally Determined Contribution (2016) sets out a strong commitment to a transition to a sustainable and resilient low carbon economy. In 2020, China acknowledged its aim to peak CO2 emissions before 2030 and achieve carbon neutrality by 2060.[5] While vulnerability, as indicated by poverty rates, has reduced in China, levels of risk have remained high due to equally sharp rises in exposure as rapid development has taken place in urban areas without sufficient protection to natural hazards.[6] The urban population in China was 60.3% (2019) as people migrate from rural areas due to economic reasons and impacts from climate change (**Table 1**).

2 KPMG Global Climate Practice (2016). The 13-th Five-Year Plan for Economic and Social Development - Opportunities for Chinese and foreign businesses. URL: https://assets.kpmg/content/dam/kpmg/cn/pdf/en/2016/10/13fyp-opportunities-analysis-for-chinese-and-foreign-businesses.pdf

3 World Bank (2019). GINI Index (World Bank estimate) – China. Databank. URL: https://data.worldbank.org/indicator/SI.POV.GINI?locations=CN. [accessed 11/1/2019].

4 ADB (2015). Addressing climate change risks, disasters, and adaptation in the People's Republic of China. Asian Development Bank. URL: https://www.adb.org/sites/default/files/publication/177728/climate-change-risks-prc.pdf

5 Ministry of Foreign Affairs of the People's Republic of China. (2020). Statement by H.E. Xi Jinping President of the People's Republic of China At the General Debate of the 75th Session of The United Nations General Assembly. [22 September, 2020]. URL: https://www.fmprc.gov.cn/mfa_eng/zxxx_662805/t1817098.shtml#:~:text=China%20is%20the%20largest%20developing,hot%20war%20with%20any%20country.

6 People's Republic of China (2016). Enhance Actions on Climate Change: China's Nationally Determined Contributions to the UNFCCC. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/China%20First/China%27s%20First%20NDC%20Submission.pdf

TABLE 1. Key indicators

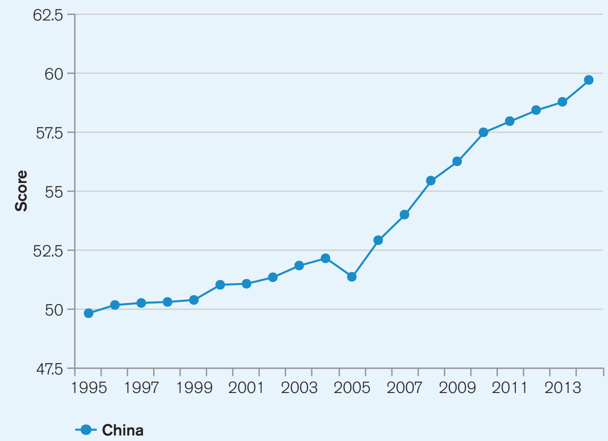
Indicator	Value	Source
Population Undernourished[7]	<2.5% (2017–2019)	FAO, 2020
National Poverty Rate[8]	0.6% (2019)	World Bank, 2020a
Share of Wealth Held By Bottom 20%[9]	6.5% (2016)	World Bank, 2020b
Net Annual Migration Rate[10]	–0.02% (2015–2020)	UNDESA, 2019
Infant Mortality Rate (Between Age 0 and 1)[10]	0.99% (2015–2020)	UNDESA, 2019
Average Annual Change in Urban Population[11]	2.4% (2015–2020)	UNDESA, 2018
Dependents per 100 Independent Adults[10]	42.2 (2020)	UNDESA, 2019
Urban Population as % of Total Population[12]	61.4% (2020)	CIA, 2020
External Debt Ratio to GNI[13]	14.5% (2018)	ADB, 2020
Government Expenditure Ratio to GDP[13]	24.1% (2019)	ADB, 2020

China's Third National Communication to the UNFCCC (NC3) (2018) identifies the impacts of climate change in areas such as agriculture, water resources, ecosystems, coastal areas, and human health as priority concerns.[14] This document aims to succinctly summarize the climate risks faced by China. This includes rapid onset and long-term changes in key climate parameters, as well as impacts of these changes on communities, livelihoods and economies, many of which are already underway. This is a high-level synthesis of existing research and analyses, focusing on the geographic domain of China, therefore potentially excluding some international influences and localized impacts. The core data presented is sourced from the database sitting behind the World Bank Group's Climate Change Knowledge Portal (CCKP), incorporating climate projections from the Coupled Model Inter-comparison Project Phase 5 (CMIP5). This document is primarily meant for WBG and ADB staff to inform their climate actions and to direct them to many useful sources of secondary data and research.[15]

[7] FAO, IFAD, UNICEF, WFP, WHO (2020). The state of food security and nutrition in the world. Transforming food systems for affordable healthy diets. FAO. Rome. URL: http://www.fao.org/documents/card/en/c/ca9692en/
[8] World Bank (2020a). Poverty headcount ratio at national poverty lines. URL: https://data.worldbank.org/indicator/SI.POV.NAHC [accessed 17/12/20]
[9] World Bank (2020b). Income share held by lowest 20%. URL: https://data.worldbank.org/indicator/SI.DST.FRST.20 [accessed 17/12/20]
[10] UNDESA (2019). World Population Prospects 2019: MIGR/1. URL: https://population.un.org/wpp/Download/Standard/Population/ [accessed 17/12/20]
[11] UNDESA (2019). World Urbanization Prospects 2018: File 6. URL: https://population.un.org/wup/Download/ [accessed 17/12/20].
[12] CIA (2020). *The World Factbook*. Central Intelligence Agency. Washington DC. URL: https://www.cia.gov/the-world-factbook/
[13] ADB (2020b). Key Indicators for Asia and the Pacific 2020. Asian Development Bank. URL: https://www.adb.org/publications/key-indicators-asia-and-pacific-2020
[14] People's Republic of China (2018). The People's Republic of China Third National Communication on Climate Change. URL: https://unfccc.int/sites/default/files/resource/China%203NC_English_0.pdf
[15] Nadin, R. (Ed.), Opitz-Stapleton, S. (Ed.), Yinlong, X. (Ed.). (2016). Climate Risk and Resilience in China. London: Routledge. URL: https://www.taylorfrancis.com/books/e/9781315744988

Due to a combination of political, geographic, and social factors, China is recognized as vulnerable to climate change impacts, ranked 61st out of 181 countries in the 2020 ND-GAIN Index.[16] The ND-GAIN Index ranks 181 countries using a score which calculates a country's vulnerability to climate change and other global challenges as well as their readiness to improve resilience. The more vulnerable a country is the lower their score, while the more ready a country is to improve its resilience the higher it will be. Norway has the highest score and is ranked 1st. **Figure 1** is a time-series plot of the ND-GAIN Index showing China's progress.

FIGURE 1. The ND-GAIN Index summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience. It aims to help businesses and the public sector better prioritize investments for a more efficient response to the immediate global challenges ahead.



Green, Inclusive and Resilient Recovery

The coronavirus disease (COVID-19) pandemic has led to unprecedented adverse social and economic impacts. Further, the pandemic has demonstrated the compounding impacts of adding yet another shock on top of the multiple challenges that vulnerable populations already face in day-to-day life, with the potential to create devastating health, social, economic and environmental crises that can leave a deep, long-lasting mark. However, as governments take urgent action and lay the foundations for their financial, economic, and social recovery, they have a unique opportunity to create economies that are more sustainable, inclusive and resilient. Short and long-term recovery efforts should prioritize investments that boost jobs and economic activity; have positive impacts on human, social and natural capital; protect biodiversity and ecosystems services; boost resilience; and advance the decarbonization of economies.

[16] University of Notre Dame (2020). Notre Dame Global Adaptation Initiative. URL: https://gain.nd.edu/our-work/country-index/

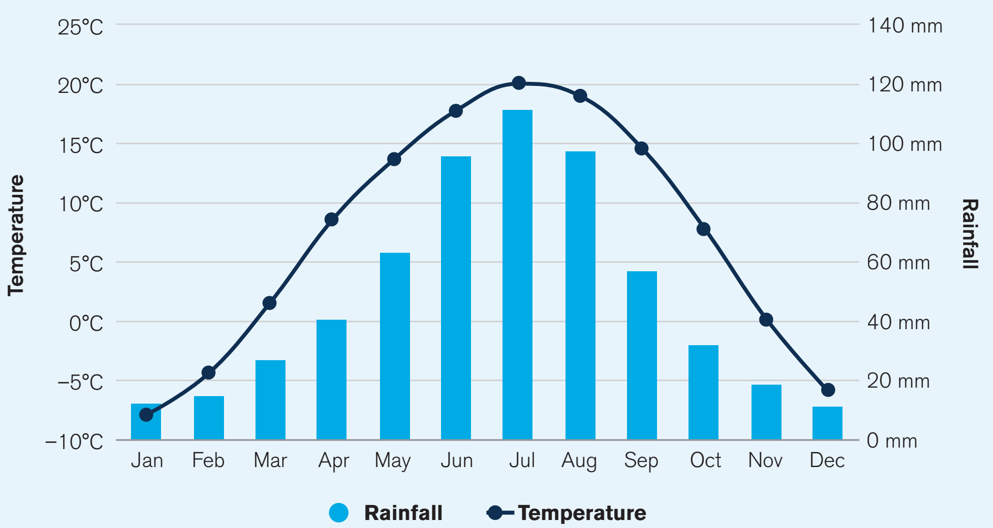
Climate Baseline

Overview

China's climate varies dramatically according to a number of variables, including altitude, latitude, and distance from the coast. China's annual cycle for the most recent climatology, 1991–2020, is shown in **Figure 2**, but this conceals considerable regional variation. Southern China experiences a tropical climate, with high temperatures and heavy rainfall particularly during the summer (May-September), while the mountainous regions of Southwestern China experience more moderate temperatures. Inner Mongolia Autonomous Region and Tibet Autonomous Region experience much harsher climates, with very cold winters and particularly strong winds in high-altitude regions. Central and eastern China experience fewer climate extremes but summers are known to be notably humid. The variability of climate (i.e. higher variability results in less predictability) has been shown to be greater in the north of China, compared to the South.[17] **Figure 3** shows the observed spatial differences of temperature and rainfall in China.

Annual cycle

FIGURE 2. Average monthly temperature and rainfall in China over 1991–2020[18]

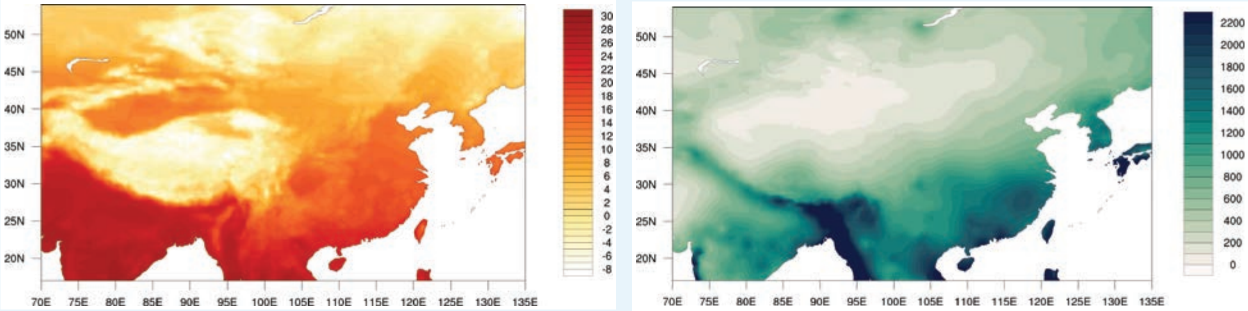


[17] Xu, Z., Tang, Y., Connor, T., Li, D., Li, Y., Liu, J. (2017). Climate variability and trends at a national scale. Scientific Reports: 3258. URL: https://www.nature.com/articles/s41598-017-03297-5.pdf

[18] WBG Climate Change Knowledge Portal (CCKP, 2021). Climate Data: Historical. URL: https://climateknowledgeportal.worldbank.org/country/china/climate-data-historical

Spatial Variation

FIGURE 3. Annual mean temperature (°C) (left) and annual mean precip (mm) (right) in China over the period 1991–2020[18]. Maps present the coordinates of China: latitude 77°01′33″E–134°39′41″E and 53°17′20″N–21°20′20″N.



Key Trends

Temperature

China's NC3 reports that between 1901–2010 the average surface air temperature of China increased by 0.98°C with a particular acceleration in warming since 1980. As of 2010, China experienced warming at around 0.25°C per decade. Increases in the frequency of heat waves have also been documented, along with reductions in the frequency of extreme cold events, with particularly high temperatures recorded in the period 1990–2010.[19] Trends in historic warming show considerable regional variation.[20] Average temperature rises are strongest in the northern regions and weakest in the south.

Precipitation

China's NC3 reports that no statistically significant changes in annual average rainfall patterns were detected in China between 1960 and 2010. Intra-annual changes however, were significant as Spring and Autumn precipitation rates declined 3.2 millimeters (mm)/year and 3.6 mm/year respectively, this was offset by increases in summer precipitation.[21] Work by Ma et al. (2015) also points to an increase in both the frequency of dry days and drought, and the intensity of precipitation events over the period 1960 and 2013. Regionalised changes in precipitation have also been documented: annual average precipitation declined in Northeastern China between 1960 and 2010 while simultaneously increasing in Western, Central, and Southern areas.[22]

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[19] People's Republic of China (2018). The People's Republic of China Third National Communication on Climate Change. URL: https://unfccc.int/sites/default/files/resource/China%203NC_English_0.pdf

[20] Carbon Brief (2018). Mapped: How every part of the world has warmed – and could continue to. Infographics, Berkeley Dataset. 26 September 2018]. URL: https://www.carbonbrief.org/mapped-how-every-part-of-the-world-has-warmed-and-could-continue-to-warm

[21] People's Republic of China (2018). The People's Republic of China Third National Communication on Climate Change. URL: https://unfccc.int/sites/default/files/resource/China%203NC_English_0.pdf

[22] Ma, S., Zhou, T., Dai, A., Han, Z. (2015) Observed changes in the distributions of daily precipitation frequency and amount over China from 1960 to 2013. Journal of Climate: 28: 6960-6978. URL: https://opensky.ucar.edu/islandora/object/articles%3A16889

A Precautionary Approach

Studies published since the last iteration of the IPCC's report (AR5), such as Gasser et al. (2018), have presented evidence which suggests a greater probability that earth will experience medium and high-end warming scenarios than previously estimated.[23] Climate change projections associated with the highest emissions pathway (RCP8.5) are presented here to facilitate decision making which is robust to these risks.

Climate Future

Overview

The main data source for the World Bank Group's Climate Change Knowledge Portal (CCKP) is the Coupled Model Inter-comparison Project Phase 5 (CMIP5) models, which are utilized within the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC), providing estimates of future temperature and precipitation. Four Representative Concentration Pathways (i.e. RCP2.6, RCP4.5, RCP6.0, and RCP8.5) were selected and defined by their total radiative forcing (cumulative measure of GHG emissions from all sources) pathway and level by 2100. In this analysis of RCP2.6 and RCP8.5, the extremes of low and high emissions pathways, are the primary focus RCP2.6 represents a very strong mitigation scenario, whereas RCP8.5 assumes business-as-usual scenario. For more information, please refer to the RCP Database.

For China, these models show a trend of consistent warming that varies by emissions scenario. However, the projections in rainfall are less certain and vary by both RCP scenario as well as models. Projected precipitation trends do show a likely reduction in rainfall across central regions, but an increase in intensity for extreme rainfall events. **Tables 2** and **3** below, provide information on temperature projections and anomalies for the four RCPs over two distinct time horizons, presented against the reference period of 1986–2005.

TABLE 2. Projected anomaly (changes °C) for maximum, minimum, and average daily temperatures in China for 2040-2059 and 2080-2099, from the reference period of 1986–2005 for all RCPs. The table is showing the median of 16 GCM model ensemble and the 10–90th percentiles in brackets.[24]

	Average Daily Maximum Temperature		Average Daily Temperature		Average Daily Minimum Temperature	
Scenario	2040–2059	2080–2099	2040–2059	2080–2099	2040–2059	2080–2099
RCP2.6	1.6 (–0.6, 3.8)	1.5 (–0.7, 3.8)	1.6 (–0.5, 3.5)	1.5 (–0.6, 3.5)	1.5 (–0.7, 3.7)	1.5 (–0.8, 3.6)
RCP4.5	1.9 (–0.2, 4.1)	2.6 (0.4, 5.0)	1.9 (–0.1, 3.8)	2.6 (0.5, 4.7)	1.9 (–0.3, 4.0)	2.7 (0.4, 4.9)
RCP6.0	1.6 (–0.4, 3.8)	3.3 (1.1, 5.8)	1.6 (0.4, 3.6)	3.3 (1.1, 5.6)	1.7 (–0.5, 3.8)	3.3 (0.9, 5.7)
RCP8.5	2.5 (0.4, 4.7)	5.2 (2.9, 7.9)	2.5 (0.6, 4.5)	5.2 (3.0, 7.7)	2.6 (0.4, 4.7)	5.4 (3.0, 7.8)

[23] Gasser, T., Kechiar, M., Ciais, P., Burke, E. J., Kleinen, T., Zhu, D., . . . Obersteiner, M. (2018). Path-dependent reductions in CO2 emission budgets caused by permafrost carbon release. Nature Geoscience, 11, 830-835. URL: https://www.nature.com/articles/s41561-018-0227-0?WT.feed_name=subjects_carbon-cycle

[24] WBG Climate Change Knowledge Portal (CCKP, 2021). Climate Data: Historical. URL: https://climateknowledgeportal.worldbank.org/country/china/climate-data-historical.

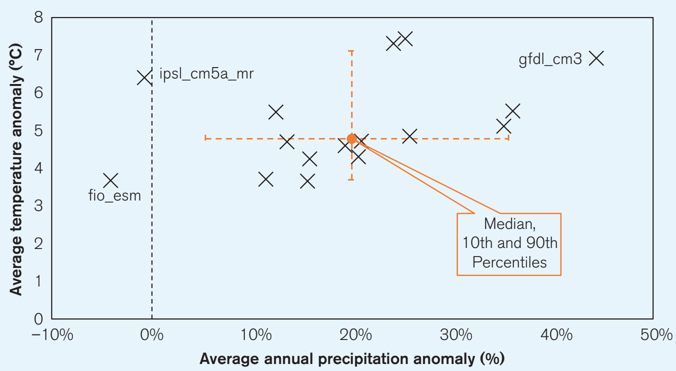
TABLE 3. Projections of average temperature anomaly (°C) in China for different seasons (3-monthly time slices) over different time horizons and emissions pathways, showing the median estimates of the full CCKP model ensemble and the 10th and 90th percentiles in brackets[24]

Scenario	2040–2059 Jun–Aug	2040–2059 Dec–Feb	2080–2099 Jun–Aug	2080–2099 Dec–Feb
RCP2.6	1.5 (–0.9, 3.7)	1.8 (–0.4, 3.8)	1.5 (–1.1, 3.7)	1.6 (–0.4, 3.7)
RCP4.5	1.9 (–0.4, 3.9)	2.0 (–0.2, 4.1)	2.6 (0.2, 4.8)	2.9 (0.6, 4.9)
RCP6.0	1.6 (–0.6, 3.7)	1.8 (–0.5, 3.8)	3.3 (0.7, 5.8)	3.5 (1.2, 5.7)
RCP8.5	2.4 (0.2, 4.5)	2.7 (0.5, 4.7)	5.0 (2.6, 7.6)	5.6 (3.4, 8.1)

Model Ensemble

Climate projections presented in this document are derived from datasets available through the CCKP, unless otherwise stated. These datasets are processed outputs of simulations performed by multiple General Circulation Models (GCM) (for further information see Flato et al., 2013).[25] Collectively, these different GCM simulations are referred to as the 'model ensemble'. Due to the differences in the way GCMs represent the key physical processes and interactions within the climate system, projections of future climate conditions can vary widely between different GCMs; this is particularly the case for rainfall related variables and at national and local scales. The range of projections from 16 GCMs; for annual average temperature change and annual precipitation change in China under RCP8.5 is shown in **Figure 4**. Spatial representation of future projections of annual temperature and precipitation for mid and late century under RCP8.5 are presented in **Figure 5**.

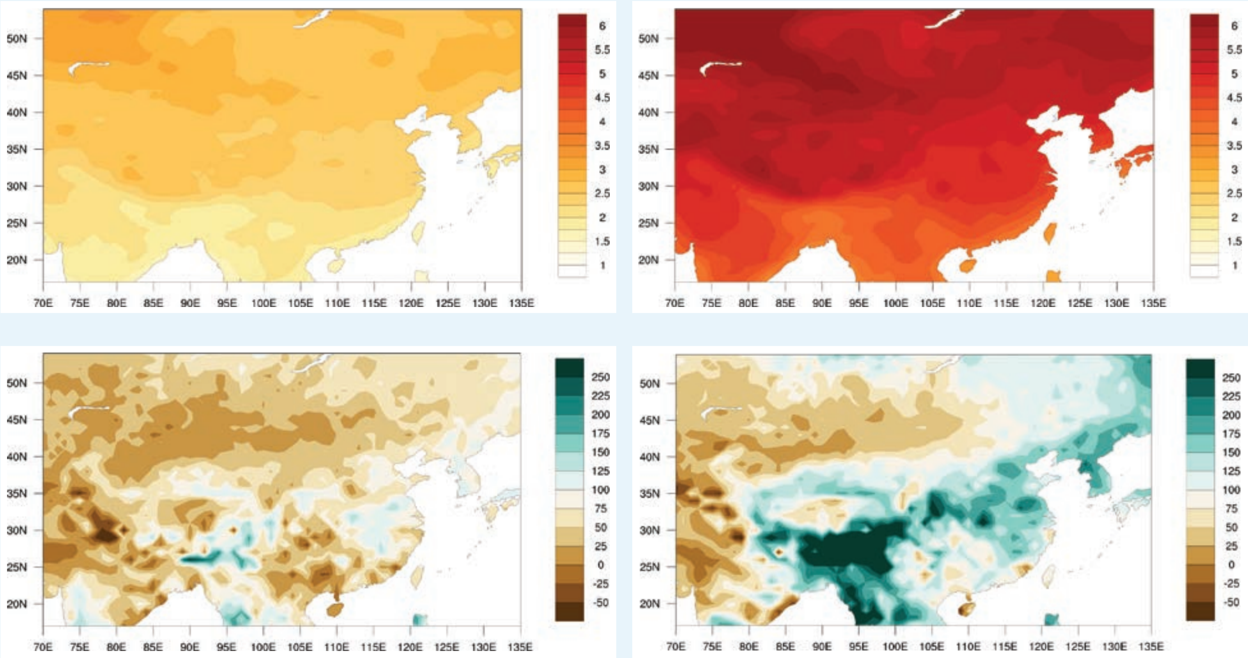
FIGURE 4. 'Projected average temperature anomaly' and 'projected annual rainfall anomaly' in China. Outputs of 16 models within the ensemble simulating RCP8.5 over the period 2080–2099. Models shown represent the subset of models within the ensemble which provide projections across all RCPs and therefore are most robust for comparison.[24] A selection of outlier models are labelled.



[25] Flato, G., Marotzke, J., Abiodun, B., Braconnot, P., Chou, S. C., Collins, W., . . . Rummukainen, M. (2013). Evaluation of Climate Models. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, 741–866. URL: http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf

Spatial Variation

FIGURE 5. CMIP5 ensemble projected change (32 GCMs) in annual temperature (top) and precipitation (bottom) by 2040–2059 (left) and by 2080–2090 (right) relative to 1986–2005 baseline under RCP8.5[26]. Maps present the coordinates of China: latitude 77°01′33″E–134°39′41″E and 53°17′20″N–21°20′20″N.



Temperature

While all of China will experience warming trends, temperature increase in China is expected to be most severe in its central and norther regions. Projections of future temperature change are presented in three primary formats. Shown in **Table 2** are the changes (anomalies) in daily maximum and daily minimum temperatures over the given time period, as well as changes in the average temperature. **Figures 6** and **7** display the annual and monthly average temperature projections. While similar, these three indicators can provide slightly different information. Monthly and annual average temperatures are most commonly used for general estimation of climate change, but the daily maximum and minimum can provide insight into how daily life might be impacted, such as the viability of ecosystems, health impacts, productivity of labor, and the yield of crops, which are often disproportionately influenced by temperature extremes.

[26] WBG Climate Change Knowledge Portal (CCKP 2021). China. Climate Data. Projections. URL: https://climateknowledgeportal.worldbank.org/country/china/climate-data-projections

Temperature changes in China are projected to be considerably higher than the global average, at an estimated 5°C increase for average change, and slightly higher, 5.2°C and 5.4°C in terms of change in maximum and minimum temperatures, respectively, by end of century. There is scope to reduce these changes dramatically by achieving lower global emissions pathways. Temperature changes are estimated to be slightly higher in winter months (October to February) compared to summer (May to August), (**Figure 7** and **Table 3**); however, uncertainty in the model ensemble is high. The global model ensemble also suggests increases will be weaker in the vicinity of the coast and stronger inland, particularly at higher altitudes. Regional projections of change by the 2090s under RCP8.5 range from 4.3°C in Kunming in the Southwest, to 5.5°C in Urumqi in the Northwest.[27]

FIGURE 6. Historic and projected average annual temperature in China under RCP2.6 (blue) and RCP8.5 (red) estimated by the model ensemble. Shading represents the standard deviation of the model ensemble.[28]

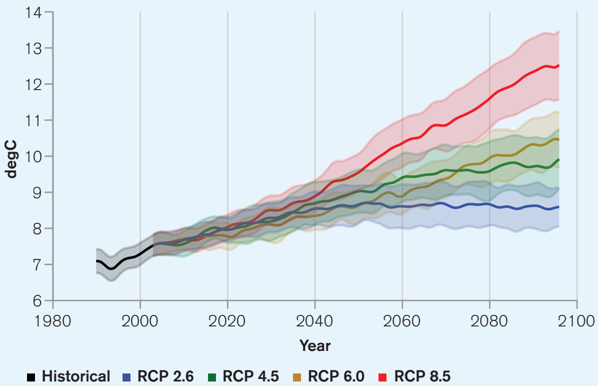
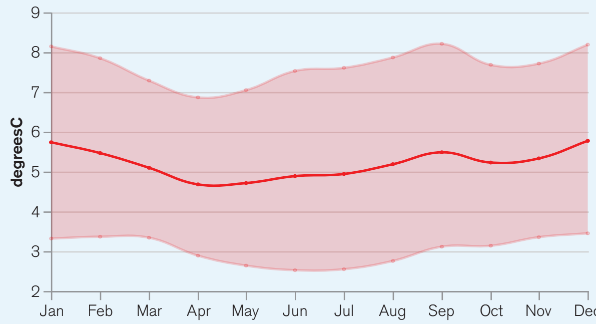


FIGURE 7. Projected change (anomaly) in monthly temperature, by month, for China for the period 2080–2099 under RCP8.5. The value represents the median of the model ensemble and shaded areas show the 10th–90th percentiles.[29]



[27] KNMI Climate Explorer (2019). CMIP5 Projections. URL: https://climexp.knmi.nl/start.cgi

[28] WBG Climate Change Knowledge Portal (CCKP, 2021). China. Agriculture Interactive Climate Indicator Dashboard. URL: https://climatedata.worldbank.org/CRMePortal/web/agriculture/crops-and-land-management?country=CHN&period=2080-2099

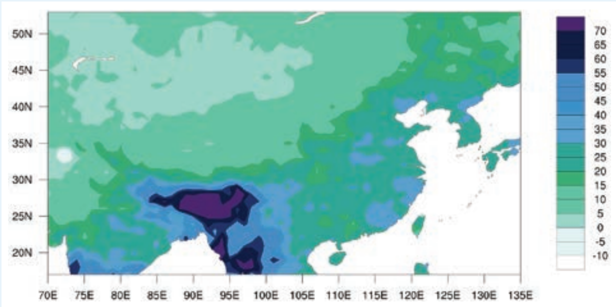
[29] WBG Climate Change Knowledge Portal (CCKP, 2021). China. Agriculture Interactive Climate Indicator Dashboard. URL: https://climatedata.worldbank.org/CRMePortal/web/agriculture/crops-and-land-management?country=CHN&period=2080-2099

Precipitation

At a national scale, changes in average monthly precipitation over China hold considerable uncertainty. While a small increase is projected in the summer months from May to August, the model range includes a minority of models also projecting a small decrease. Research conducted subsequently to the IPCC's AR5 report has begun to build more certainty around future precipitation changes using downscaling and bias correction techniques. Thus far, these studies, such as Yang et al. (2018), confirm that increases in precipitation are most likely, on most emissions pathways and in most regions of China.[30] This work also gives an indication that there may be potential reductions in average precipitation in the central regions of China to the northeast of the Yunnan-Guizhou Plateau. At present, downscaling work makes consideration of only a subset of the available global climate models, and as such further work is required.

There is greater confidence around changes to the future intensity of heavy rainfall events. Under all emissions pathways, an increase in the precipitation associated with a maximum 5-day rainfall event is expected in the Central, Southern, and Eastern regions of China (**Figure 8**). Under all emissions pathway's, precipitation reductions are projected in the Western regions, and under lower emissions pathways reductions are also expected in the arid northern regions. These changes match global trends, which suggest the intensity of sub-daily extreme rainfall will increase as temperatures increase—a finding supported by evidence from different regions of Asia.[31]

FIGURE 8. Projected change in the maximum 5-day rainfall (mm) over China for the period 2080–2099 for emissions pathways RCP8.5 compared to the 1986–2005 baseline[24]
This map presents the coordinates of China: latitude 77°01′33″E–134°39′41″E and 53°17′20″N–21°20′20″N.



[30] Yang, X., Wood, E., Sheffield, J., Ren, L., Zhang, M., Wang, Y. (2018). Bias correction of historical and future simulations of precipitation and temperature for China from CMIP5 models. Journal of Hydrometeorology: 19: 609–623. URL: https://journals.ametsoc.org/doi/pdf/10.1175/JHM-D-17-0180.1

[31] Westra, S., Fowler, H. J., Evans, J. P., Alexander, L. V., Berg, P., Johnson, F., Kendon, E. J., Lenderink, G., Roberts, N. (2014). Future changes to the intensity and frequency of short-duration extreme rainfall. Reviews of Geophysics, 52, 522–555. URL: https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2014RG000464

China faces significant disaster risk levels and is ranked 71st out of 191 countries by the 2019 Inform Risk Index[32] (**Table 4**). This ranking is driven strongly by the exposure component of risk. China has very high exposure to flooding (ranked jointly 13th), including, riverine, flash, and coastal, and very high exposure to tropical cyclones and their associated hazards (ranked 6th). Drought exposure is proportionately lower, but still significant (ranked jointly 55th). Disaster risk in China is also elevated by its moderate levels of social vulnerability and the country's net risk score is significantly offset by its strong coping capacity. The section that follows analyses climate change influences on the exposure component of risk in China. As seen in **Figure 1**, the ND-GAIN Index presents an overall picture of a country's vulnerability and capacity to improve its resilience. In contrast, the Inform Risk Index identifies specific risks across a country to support decisions on prevention, preparedness, response and a country's overall risk management.

TABLE 4. Selected indicators from the INFORM 2019 Index for Risk Management for China. For the sub-categories of risk (e.g. "Flood") higher scores represent greater risks. Conversely the most at-risk country is ranked 1st. Global average scores are shown in brackets.

Flood (0–10)	Tropical Cyclone (0–10)	Drought (0–10)	Vulnerability (0–10)	Lack of Coping Capacity (0–10)	Overall Inform Risk Level (0–10)	Rank (1–191)
8.4 [4.5]	8.1 [1.7]	4.6 [3.2]	3.1 [3.6]	3.6 [4.5]	4.3 [3.8]	71

Heatwaves

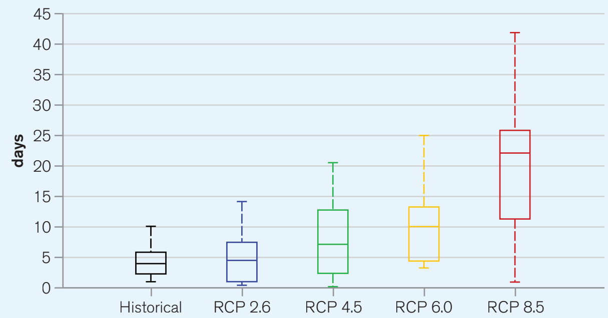
The current median probability of a heat wave (defined as a period of 3 or more days where the daily temperature is above the long-term 95th percentile of daily mean temperature) is around 2% in China.[33] An increase in the frequency and intensity of heatwaves has already been documented in recent decades. This trend is expected to continue, with median annual heatwave probability reaching 5%–22% by the 2090s, depending on emissions pathway. A particularly serious future heat wave threat has been projected in the area of the North China Plain, where climate change is expected to interact with local irrigation practices to result in heatwaves which will present severe risk for laborers working outdoors.[34]

While heatwaves refer to the occurrence of exceptionally high heat (based on a static baseline), the incidence of permanent (chronic) heat stress is likely to increase significantly in China under all emissions pathways.[35] Cities identified by Matthews et al. (2017), where exposure to chronic heat stress is projected to be very significant, include Guangzhou, Shanghai, and Beijing. At the national level the extent of this risk can be captured

[32] European Commission (2019). INFORM Index for Risk Management. China Country Profile. URL: https://drmkc.jrc.ec.europa.eu/inform-index/Countries/Country-Profile-Map
[33] WBG Climate Change Knowledge Portal (CCKP 2021). China. Climate Data. Projections. URL: https://climateknowledgeportal.worldbank.org/country/china/climate-data-projections
[34] Kang, S., Eltahir, E. (2018). North China Plain threatened by deadly heatwaves due to climate change and irrigation. Nature Communications: 9: 2894. URL: https://www.nature.com/articles/s41467-018-05252-y.pdf
[35] Matthews, T., Wilby, R.L. and Murphy, C. (2017). Communicating the deadly consequences of global warming for human heat stress. Proceedings of the National Academy of Sciences, 114, 3861-3866. URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5393218/pdf/pnas.201617526.pdf

in the prevalence of days with Heat Index >35°C, this represents the combination of temperature and humidity to produce conditions dangerous for human health. As shown in **Figure 9**, the average annual frequency of dangerous days is expected to increase under all emissions pathways by the 2090s, with a particularly large potential increase under the highest emissions pathway, RCP8.5.

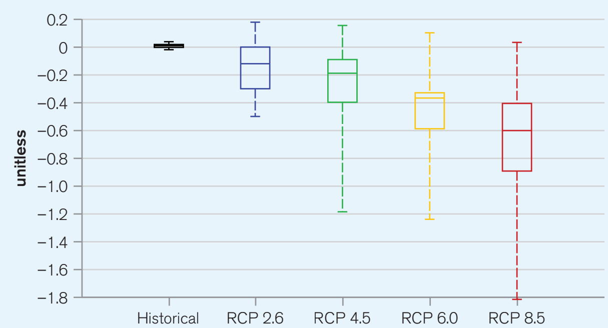
FIGURE 9. Box plots showing historical (1986–2005) and projected (2080–2099) average annual frequency of days with Heat index >35°C[28]



Drought

Two primary types of drought may affect China, meteorological (usually associated with a precipitation deficit) and hydrological (usually associated with a deficit in surface and subsurface water flow, potentially originating in the region's wider river basins). At present, China faces an annual median probability of severe meteorological drought of around 4%, as defined by a Standardized Precipitation Evaporation Index (SPEI) of less than –2.[18]

FIGURE 10. Boxplots showing the projected change in SPEI index of drought in 2080–2099 under four emissions pathways[38]



Changes in the probability of extreme drought are most significant in the northern and western regions of China, regions which are also projected to experience greater general warming. Work by Leng et al. (2015) suggests particularly large increases to the duration of agricultural droughts across much of the western and central regions of China, with risk particularly high in the Yunnan-Guizhou Plateau region.[36] Zhang et al. (2015) suggest that agricultural losses to drought have been increasing in recent decades, with rates of loss to drought highest in north and northeastern China, reaching 14%–18% of yield in some provinces.[37] This trend may continue as the probability of drought is projected to increase to around 20%–36% depending on emissions pathway (**Figure 10**).

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[36] Leng, G., Tang, Q., Rayburg, S. (2015). Climate change impacts on meteorological, agricultural and hydrological droughts in China. Global and Planetary Change: 126: 23–34. URL: https://www.sciencedirect.com/science/article/pii/S0921818115000193?via%3Dihub

[37] Zhang, Q., Gu, X., Singh, V. P., Kong, D., & Chen, X. (2015). Spatiotemporal behavior of floods and droughts and their impacts on agriculture in China. Global and Planetary Change, 131(May 2018), 63–72. URL: https://www.sciencedirect.com/science/article/pii/S0921818115000922?via%3Dihub

[38] WBG Climate Change Knowledge Portal (CCKP 2021). China. Water Sector Interactive Dashboard. URL: https://climatedata.worldbank.org/CRMePortal/web/water/land-use-/-watershed-management?country=CHN&period=2080-2099

Flood

The World Resources Institute's AQUEDUCT Global Flood Analyzer can be used to establish a baseline level of flood exposure.[39] As of 2010, assuming protection for up to a 1 in 25-year event, the population annually affected by flooding in China is estimated at 6.2 million people and expected annual impact on GDP is estimated at $42 billion. Development and climate change are both likely to increase these figures. The climate change component can be isolated and by 2030 is expected to increase the annually affected population by 1.3 million people, and the damages by $43 billion under the RCP8.5 emissions pathway (AQUEDUCT Scenario B).

The majority of China's provinces are at high flood risk. Flooding is the largest driver of average annual losses to disaster, UNISDR estimate flood impacts at around $19 billion per year (somewhat lower than the AQUEDUCT estimate), storm surge impacts also represent a major risk costing an estimated $5 billion per year.[40] The nature of this risk varies by region. Work by Huang et al. (2012) suggests that China's south-central provinces such as Hunan and Guangxi experience highest risk in terms of vulnerable populations, but northwestern provinces experience the highest risk of death.[41] Provinces in the east and southeast, such as Zhejiang and Fujian, experience highest economic risk, and east and central provinces, such as Henan and Hubei experience highest agricultural vulnerability

Work by Paltan et al. (2018) shows that even under lower emission pathways in line with the Paris Climate Agreement, nearly all Asian countries face an increase in the frequency of extreme river flows.[42] What would historically have been a 1 in 100-year flow, is likely to become a 1 in 50-year or 1 in 25-year event in most of South, Southeast, and East Asia. There is good agreement among models on this trend. Particularly significant increases in the magnitude of extreme floods are seen in the region of the Yangtze basin. Increases in the intensity of extreme precipitation events are also increasing the risk of surface (pluvial) flooding, associated impacts include infrastructural damage in urban environments, and landslide risk in rural areas. Coastal flooding issues are also expected to worsen, these are addressed in the following section.

Estimates from Willner et al. (2018) suggest China faces a very significant increase in the population exposed to fluvial flooding, with an additional 27–35 million people affected every year by the 2030s-2040s as a result of climate change (assuming a constant population) (**Table 5**).[43] This represents more than a doubling of the 1971–2004 median estimate of the exposed population, which stood at 24 million. Changes to China's population, both in terms of size and spatial distribution, are likely to exacerbate the total risk as exposure is high in a number of the nation's major urban conurbations and China continues to experience rapid migration to urban areas, notably in its floodplain and river delta regions. Cai et al. (2018) suggest that around 50% of migrants to urban conurbations are moving to areas which are drought or flood prone.[44]

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39 WRI (2018). AQUEDUCT Global Flood Analyzer. URL: https://floods.wri.org/# [Accessed: 23/11/2018].

40 UNISDR (2014). Basic Country Statistics and Indicators: China. URL: https://www.preventionweb.net/countries/chn/data/ [accessed: 12/11/2019].

41 Huang, D., Zhang, R., Huo, Z., Mao, F., E, Y., & Zheng, W. (2012). An assessment of multidimensional flood vulnerability at the provincial scale in China based on the DEA method. Natural Hazards, 64(2), 1575–1586. URL: https://link.springer.com/article/10.1007%2Fs11069-012-0323-1

42 Paltan, H., Allen, M., Haustein, K., Fuldauer, L., & Dadson, S. (2018). Global implications of 1.5°C and 2°C warmer worlds on extreme river flows Global implications of 1.5°C and 2°C warmer worlds on extreme river flows. Environmental Research Letters, 13. URL: https://iopscience.iop.org/article/10.1088/1748-9326/aad985/pdf

43 Willner, S., Levermann, A., Zhao, F., Frieler, K. (2018). Adaptation required to preserve future high-end river flood risk at present levels. Science Advances: 4:1. URL: https://advances.sciencemag.org/content/4/1/eaao1914/tab-pdf

44 Cai, J., Kummu, M., Niva, V., Guillaume, J. H. A., & Varis, O. (2018). Exposure and resilience of China's cities to floods and droughts: a double-edged sword. International Journal of Water Resources Development, 34(4), 547–565. URL: https://www.tandfonline.com/doi/abs/10.1080/07900627.2017.1353411

TABLE 5. Estimated number of people in China affected by an extreme river flood (extreme river flood is defined as being in the 90th percentile in terms of numbers of people affected) in the historic period 1971–2004 and the future period 2035–2044. Figures represent an average of all four RCPs and assume present day population distributions.[43]

Estimate	Population Exposed to Extreme Flood (1971–2004)	Population Exposed to Extreme Flood (2035–2044)	Increase in Affected Population
16.7 Percentile	18,223,214	45,632,993	27,409,779
Median	23,857,707	55,244,696	31,386,989
83.3 Percentile	34,316,364	69,442,970	35,126,606

Tropical Cyclones

Climate change is expected to interact with cyclone hazards in complex ways which are currently poorly understood. Known risks include the action of sea-level rise to enhance the damage caused by cyclone-induced storm surges, and the possibility of increased windspeed and precipitation intensity. Modelling of climate change impacts on cyclone intensity and frequency conducted across the globe points to a general trend of reduced cyclone frequency and increased intensity and frequency of the most extreme events.[45] However, further research is required to better understand potential changes in cyclone seasonality and routes, and the potential for cyclone hazards to be experienced in unprecedented locations.

China's southern coastline experiences high cyclone risks, with moderate risk in coastal areas of eastern China. Study of recent trends in cyclone activity (1975–2014) suggests increases have taken place in the intensity and frequency of cyclones making landfall in eastern China; changes have not been detected in the south.[46] Other studies suggest this is part of a general trend involving an eastward shift of cyclone activity in the Western North Pacific. Studies suggest this shift may be enhanced by climate change under higher emissions pathways.[47] The suggested consequence is a small reduction in the number of cyclones threatening southern China, and a small increase in the number threatening Eastern and Northern China.[48]

[45] Walsh, K., McBride, J., Klotzbach, P., Balachandran, S., Camargo, S., Holland, G., Knutson, T., Kossin, J., Lee, T., Sobel, A., Sugi, M. (2015). Tropical cyclones and climate change. WIREs Climate Change: 7: 65–89. URL: https://onlinelibrary.wiley.com/doi/full/10.1002/wcc.371

[46] Li, R., Zhou, W., Shun, C., Lee, T. (2017). Change in destructiveness of landfalling tropical cyclones over China in recent decades. Journal of Climate: 30: 3367–3379. URL: https://pdfs.semanticscholar.org/3344/dd971ae3a4e1b434b0cb473fc76995a8ea51.pdf

[47] Kossin, J., Emmanuel, K., Camargo, S. (2016). Past and projected changes in Western North Pacific tropical cyclone exposure. Journal of Climate: 29: 5725–5739. URL: https://dspace.mit.edu/bitstream/handle/1721.1/108396/Past%20and%20projected.pdf?sequence=1&isAllowed=y

[48] Colbert, A., Soden, B., Kirtman, B. (2015). The impact of natural and anthropogenic climate change on Western North Pacific tropical cyclone tracks. Journal of Climate: 28: 1806–1823. URL: https://journals.ametsoc.org/doi/10.1175/JCLI-D-14-00100.1

Natural Resources

Water

China's water sector faces major challenges over coming decades. Issues identified by the World Bank Global Water Security and Sanitation Partnership (GWSP)/Development Research Center (DRC) (2018) include the comparatively low per capita supply, inefficient irrigation, loss of natural aquatic ecosystem services, and poor water quality.[49] The loss of ecosystem services have been exacerbated by a traditional infrastructure and control-oriented approach to flood management. China faces these challenges having made significant recent water governance reforms; however, many challenges remain, including the need to strengthen resilience to the combined impact of climate change and rapid development, particularly urbanization (see World Bank/GWSP/DRC, 2018).[49]

Declines in water runoff have been measured across north and central China, these relate primarily to human development impacts, but in many cases also to climate. China's NC3 suggests around 30%–40% of the reduction in runoff in the Yellow River can be attributed to climate change. Climate change is also estimated to be responsible for a 4% increase in runoff in southern China and a 12% reduction in northern China. Future climate change is expected to further reduce river water levels across much of China with the exception of the southeastern region.[50] Contributing factors to the changes ongoing in China's water resource profile are the retreat of its glaciers and reductions in its snow cover. Around 82% of China's glaciers are estimated to be in retreat and climate model ensemble projections suggest the mountain ranges feeding China's major rivers will lose anything from 20%–90% of their mass. This process has been documented in the Qilian mountain range by Sun et al. (2018). It is likely that these changes will further increase the variability and unpredictability of China's water supply, ultimately impacting on the reliability of water resources for human domestic consumption and agricultural production. At a minimum, changes to the seasonality of water supply and increases in the intensity of extreme precipitation events will place pressure on water infrastructure, and may ultimately drive crop planting dates and growing range shifts.[51]

Coastal Zone

Sea-level rise threatens significant physical changes to coastal zones around the world. Global mean sea-level rise was estimated in the range of 0.44 meter (m)–0.74 m by the end of the 21st century by the IPCC's Fifth Assessment Report.[52] Yet, some studies published more recently have highlighted the potential for more significant rises (**Table 6**).

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[49] World Bank/GWSP/DRC (2018). Watershed: A new era of water governance in China. Policy brief. URL: http://documents.worldbank.org/curated/en/999601541495579766/Watershed-A-New-Era-of-Water-Governance-in-China.pdf

[50] People's Republic of China (2018). The People's Republic of China Third National Communication on Climate Change. URL: https://unfccc.int/sites/default/files/resource/China%203NC_English_0.pdf

[51] Sun, M., Liu, S., Yao, X., Guo, W., & Xu, J. (2018). Glacier changes in the Qilian Mountains in the past half-century: Based on the revised First and Second Chinese Glacier Inventory. Journal of Geographical Sciences, 28(2), 206–220. URL: https://link.springer.com/article/10.1007/s11442-018-1468-y

[52] Church, J. a., Clark, P. U., Cazenave, A., Gregory, J. M., Jevrejeva, S., Levermann, A., . . . Unnikrishnan, A. S. (2013). Sea level change. In Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 1137–1216). Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. URL: https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter13_FINAL.pdf

TABLE 6. Estimates of global mean sea-level rise by rate and total rise compared to 1986–2005 including likely range shown in brackets, data from Chapter 13 of the IPCC's Fifth Assessment Report with upper-end estimates based on higher levels of Antarctic ice-sheet loss from Le Bars et al. 2017[53]

Scenario	Rate of Global Mean Sea-Level Rise in 2100	Global Mean Sea-Level Rise in 2100 Compared to 1986–2005
RCP2.6	4.4 mm/yr (2.0–6.8)	0.44 m (0.28–0.61)
RCP4.5	6.1 mm/yr (3.5–8.8)	0.53 m (0.36–0.71)
RCP6.0	7.4 mm/yr (4.7–10.3)	0.55 m (0.38–0.73)
RCP8.5	11.2 mm/yr (7.5–15.7)	0.74 m (0.52–0.98)
Estimate inclusive of high-end Antarctic ice-sheet loss		1.84 m (0.98-2.47)

An estimated 11.4% of China's population live in low-elevation coastal areas. Key areas of vulnerability include the Pearl and Yangtze river deltas. China's NC3 reports rates of sea-level rise which are higher than the international average, recorded at 2.6 mm/year between 1980 and 2010. In many areas the relative rate of sea-level rise is further increased by the contribution of human development-linked subsidence. A direct impact of this has been an acceleration of coastal erosion rates and saltwater intrusion, and an increased risk from storm surges. These phenomena are all expected to worsen under all climate change scenarios, increasing the risk faced by coastal populations and putting strain on coastal defense infrastructure. The UK Met Office (2014) estimated that without further action an additional 9–23 million people will experience persistent coastal flooding (**Table 7**).[54]

TABLE 7. The average number of people experiencing flooding per year in the coastal zone in the period 2070–2100 under different emissions pathways (assumed medium ice-melt scenario) and adaptation scenarios for China[53]

Scenario	Without Adaptation	With Adaptation
RCP2.6	9,640,000	2,350
RCP8.5	23,195,90	6,060

Soil Degradation, Dryland Expansion and Desertification

China's development involved particularly fast economic growth, industrialization, and agricultural intensification since the early 1990s has exerted major pressure on China's soils. Issues over the application of pesticides, as well as the over utilization and low efficiency of fertilizer application, release of heavy metals, and poor land management practices have been widespread, but with notable regional differentiation according to local industry and environmental features.[55]

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53 Le Bars, D., Drijhout, S., de Vries, H. (2017). A high-end sea level rise probabilistic projection including rapid Antarctic ice sheet mass loss. Environmental Research Letters: 12:4. URL: https://iopscience.iop.org/article/10.1088/1748-9326/aa6512/pdf

54 UK Met Office (2014). Human dynamics of climate change: Technical Report. Met Office, UK Government. URL: https://www.metoffice.gov.uk/weather/learn-about/climate-and-climate-change/climate-change/impacts/human-dynamics/index

55 Lu, Y., Song, S., Wang, R., Liu, Z., Meng, J., Sweetman, A. J., . . . Wang, T. (2015). Impacts of soil and water pollution on food safety and health risks in China. Environment International, 77, 5–15. URL: https://www.sciencedirect.com/science/article/pii/S0160412015000021?via%3Dihub

Concerted efforts have been made by the Chinese state to mitigate these impacts, and reduce the rates of land degradation. These include 'greening' and eco-restoration,[56] and afforestation.[57] Latter efforts have particularly been focused in the northern regions where aridity is high and wind erosion of soils has been a key issue. Human, land and water management practices, particularly irrigation, are key drivers of soil health issues in the historical record,[58] and will remain of critical importance for successful adaptation under climate change.[59] Northeastern China has been identified as a hotspot for potential dryland expansion and desertification, with large areas expected to increase in aridity even under lower emission scenarios. Impacts of this trend will include the loss of agricultural land and productivity, as well as biodiversity loss, dust storms, and sedimentation of reservoirs.[60] Soil management has also been effective in the mitigation of climate change, and studies are increasingly highlighting the importance of management practices sensitive to soil-carbon stocks and fluxes.[61] Huang et al. (2015) also warn of the potential for increased warming local to areas affected by degradation which may result from the reduced carbon sequestration potential of the landscape.[60]

Economic Sectors

Agriculture

Climate change will influence food production via direct and indirect effects on crop growth processes. Direct effects include alterations to carbon dioxide availability, precipitation, and temperatures. Indirect effects include impacts on water resource availability and seasonality, soil organic matter transformation, soil erosion, changes in pest and disease profiles, the arrival of invasive species, and decline in arable areas due to the submergence of coastal lands and desertification. On an international level, these impacts are expected to damage key staple crop yields, even on lower emission pathways. Tebaldi and Lobell (2018) estimate 5% and 6% declines in global wheat and maize yields respectively even if the Paris Climate Agreement is met and warming is limited to 1.5°C.[62] Across China, seasonal droughts driven by climate change could lead to substantial crop yield losses of nearly 8% by 2030 for its three primary crops (rice, wheat and corn). Corn yields are likely to suffer the greatest yield losses with projected drop of nearly 20% of total production, followed by wheat with a 4% decline, and rice decreasing 1.5%.[63] Shifts in the optimal and viable spatial ranges of certain crops are also inevitable, though the extent and speed of those shifts remains dependent on the emissions pathway.

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56 Zhao, X., Wu, P., Gao, X., & Persaud, N. (2015). Soil Quality Indicators in Relation to Land Use and Topography in a Small Catchment on the Loess Plateau of China. Land Degradation & Development, 26(1), 54–61. URL: https://onlinelibrary.wiley.com/doi/pdf/10.1002/ldr.2199

57 Guo, Z., Huang, N., Dong, Z., Van Pelt, R. S., & Zobeck, T. M. (2014). Wind Erosion Induced Soil Degradation in Northern China: Status, Measures and Perspective. Sustainability, 6(12), 8951–8966. URL: https://www.mdpi.com/2071-1050/6/12/8951

58 Leng, G., Tang, Q., Huang, M., & Leung, L. R. (2015). A comparative analysis of the impacts of climate change and irrigation on land surface and subsurface hydrology in the North China Plain. Regional Environmental Change, 15(2), 251–263. URL: https://link.springer.com/article/10.1007/s10113-014-0640-x

59 Zhang, X., Xu, M., Sun, N., Xiong, W., Huang, S., & Wu, L. (2016). Modelling and predicting crop yield, soil carbon and nitrogen stocks under climate change scenarios with fertilizer management in the North China Plain. Geoderma, 265, 176–186. URL: https://www.sciencedirect.com/science/article/pii/S0016706115301427?via%3Dihub

60 Huang, J., Yu, H., Guan, X., Wang, G., Guo, R. (2015). Accelerated dryland expansion under climate change. Nature Climate Change: 6: 166-171. URL: https://www.nature.com/articles/nclimate2837.pdf

61 Jiang, G., Xu, M., He, X., Zhang, W., Huang, S., Yang, X., . . . Murphy, D. V. (2014). Soil organic carbon sequestration in upland soils of northern China under variable fertilizer management and climate change scenarios. Global Biogeochemical Cycles, 28(3), 319–333. URL: https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1002/2013GB004746

62 Tebaldi, C., & Lobell, D. (2018). Differences, or lack thereof, in wheat and maize yields under three low-warming scenarios. Environmental Research Letters: 13: 065001. URL: https://iopscience.iop.org/article/10.1088/1748-9326/aaba48

63 Zhou, S. et al., (2018). Adapting to climate change. Scenario analysis of grain production in China. *China Agricultural Economic Review*. 9(4). URL: https://www.emerald.com/insight/content/doi/10.1108/CAER-10-2016-0173/full/html

A further, and perhaps lesser appreciated influence of climate change on agricultural production is through its impact on the health and productivity of the labor force. Work by Dunne et al. (2013) suggests that global labor productivity during peak months has already dropped by 10% as a result of warming, and that a decline of up to 20% might be expected by mid-century under the highest emission pathway (RCP8.5).[64] In combination, it is highly likely that the above processes will have a considerable impact on national food consumption patterns both through direct impacts on internal agricultural operations, and through impacts on the global supply chain.

China's NC3 reports climate change impacts already being experienced by the agricultural sector. Wheat and corn yields have declined 5% between 1980 and 2010 with the highest decreases (10%) experienced in the Loess Plateau region of North-central China. These reductions are attributed primarily to water resource limitations, and extreme climate events.[65] A key parameter for agricultural systems is the reference evapotranspiration rate, which has increased significantly in the Loess Plateau region, and is projected to increase further.[66] Both positive and negative crop responses linked to temperature rises have been seen, depending on local conditions.

Future yield declines are expected to be partially mitigated by rises in atmospheric carbon dioxide concentration, but the net change is still expected to be negative for some crops, such as maize, which are important to national food security.[67] The most vulnerable regions of China are believed to be those termed 'agricultural-pastoral transition zones' in central and northern China, these regions experience low annual precipitation rates (currently around 400 mm/year). Many such regions have experienced land degradation and desertification, though the extent to which these processes link to climate and human development practices is complex. Climatic factors contributing to agricultural productivity declines include the increased variability of water resource availability and intensification of extremes that result in flood and drought.

China's NC3 reports analysis of historical agricultural costs to flood, estimating that between 1950–2000, an average of 3% of production was lost every year. Zhang et al. (2015) suggest that agricultural losses to flood have been increasing in recent decades, with annual losses in the range of 4%–10% of yield.[37] This increasing trend in losses is strongest in Western China. The projected increases in the frequency of extreme (rapid onset) climate events such as heat waves and floods, are all expected to increase agricultural losses from disaster.

Over the longer-term future, sustained temperature increases, and particularly daily, monthly and annual maximum temperatures are likely to drive a northward range shift in the optimal growing ranges of current crops. Some studies have suggested this process may be beneficial to net production in China, having already resulted in a net gain in agriculturally productive land, and further gains may be seen under distinct climate change scenarios.[68] However, the increase in other stressors may offset these gains. Specifically the risk that an increase in the frequency of

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[64] Dunne, J. P., Stouffer, R. J., & John, J. G. (2013). Reductions in labor capacity from heat stress under climate warming. Nature Climate Change, 3(6), 563–566. URL: http://www.precaution.org/lib/noaa_reductions_in_labour_capacity_2013.pdf

[65] People's Republic of China (2018). The People's Republic of China Third National Communication on Climate Change. URL: https://unfccc.int/sites/default/files/resource/China%203NC_English_0.pdf

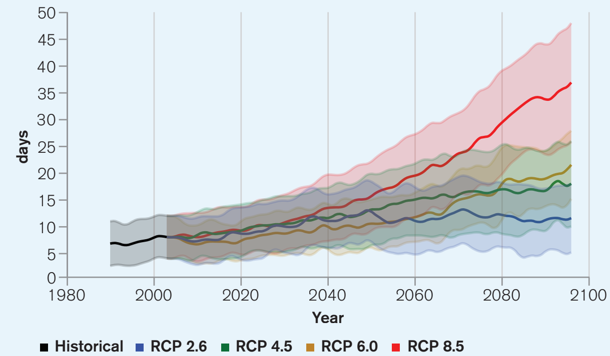
[66] Li, Z., Zheng, F.-L., & Liu, W.-Z. (2012). Spatiotemporal characteristics of reference evapotranspiration during 1961–2009 and its projected changes during 2011–2099 on the Loess Plateau of China. Agricultural and Forest Meteorology, 154–155, 147–155. URL: https://www.sciencedirect.com/science/article/pii/S0168192311003212

[67] Chen, Y., Zhang, Z., & Tao, F. (2018). Impacts of climate change and climate extremes on major crops productivity in China at a global warming of 1.5 and 2.0 ?C. Earth System Dynamics Discussions, 9, 543–562. URL: https://www.earth-syst-dynam.net/9/543/2018/

[68] Yang, x., Chen, f., Lin, X., Liu, Z., Zhang, H., Zhao, J., Li, K., Ye, Q., Li, Y., Lv, S., Yang, P., Wu, W., Li, Z., Lal, R., Tang, H. (2015). Potential benefits of climate change for crop productivity in China. Agricultural and Forest Meteorology: 208: 76–84. URL: https://www.sciencedirect.com/science/article/pii/S0168192315001288?via%3Dihub

very hot days (>35°C) (**Figure 11**) and potential water resource limitations may damage yields, as has been suggested at the global level.[69] There is, however, significant differences between emissions pathways, with higher emissions scenarios resulting in notably larger increases in daily maximum temperatures (**Figure 12**).

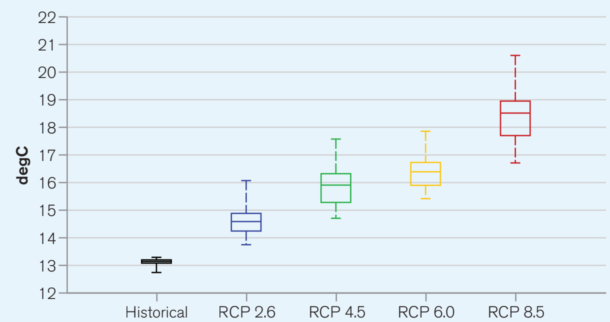
FIGURE 11. Increase in the annual average number of hot days (>35°C) in China under two emissions pathways. RCP2.6 (Blue) and RCP8.5 (Red)[28]



Urban

Research has established a reasonably well constrained relationship between heat stress and labor productivity, household consumption patterns, and (by proxy) household living standards.[70] In general terms, the impact of an increase in temperature on these indicators depends on whether the temperature rise moves the ambient temperature closer to, or further away from, the optimum temperature range. The optimum range can vary depending on local conditions and adaptations.

FIGURE 12. Average daily maximum temperature in China under four emissions pathways over he period 2080–2099[28]



The effects of temperature rise and heat stress in urban areas are increasingly compounded by the phenomenon of the Urban Heat Island effect (UHI). Dark surfaces, residential and industrial sources of heat, an absence of vegetation, and air pollution[71] can push temperatures higher than those of the rural surroundings, commonly anywhere in the range of 0.1°C–3°C in global mega-cities.[72] As well as impacting on human health (see: Communities) the temperature peaks that will result from combined UHI and climate change, as well as future urban expansion, are likely to damage the productivity of the service sector economy, both through direct impacts on labor productivity, but also through the additional costs of adaptation.

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[69] Elliott, J., Deryng, D., Müller, C., Frieler, K., Konzmann, M., Gerten, D., [. . .] Wisser, D. (2014). Constraints and potentials of future irrigation water availability on agricultural production under climate change. Proceedings of the National Academy of Sciences: 111: 3239–3244. URL: https://www.pnas.org/content/111/9/3239

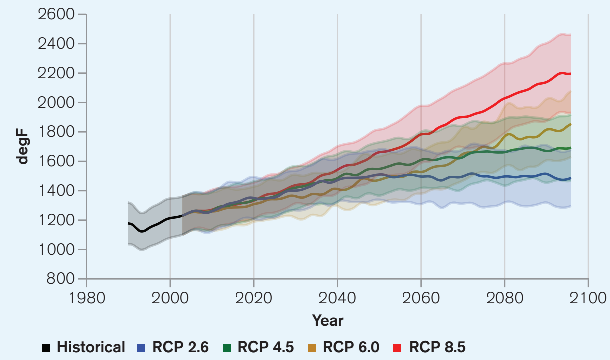
[70] Mani, M., Bandyopadhyay, S., Chonabayashi, S., Markandya, A., Mosier, T. (2018). South Asia's Hotspots: The Impact of Temperature and Precipitation changes on living standards. South Asian Development Matters. World Bank, Washington DC. URL: https://openknowledge.worldbank.org/bitstream/handle/10986/28723/9781464811555.pdf?sequence=5&isAllowed=y

[71] Cao, C., Lee, X., Liu, S., Schultz, N., Xiao, W., Zhang, M., & Zhao, L. (2016). Urban heat islands in China enhanced by haze pollution. Nature Communications, 7, 1–7. URL: https://www.ncbi.nlm.nih.gov/pubmed/27551987

[72] Zhou, D., Zhao, S., Liu, S., Zhang, L., & Zhu, C. (2014). Surface urban heat island in China's 32 major cities: Spatial patterns and drivers. Remote Sensing of Environment, 152, 51–61. URL: https://www.sciencedirect.com/science/article/pii/S0034425714002053

Research suggests that on average, a one-degree Celsius increase in ambient temperature can result in a 0.5%–8.5% increase in electricity demand.[73] Notably this serves business and residential air-cooling systems. This increase in demand places strain on energy generation systems which is compounded by the heat stress on the energy generation system itself, commonly due to its own cooling requirements, which can reduce its efficiency. **Figure 13** highlights the large projected increase in cooling demand in China, doubling under the highest emission pathway (RCP8.5).

FIGURE 13. Historic and projected annual cooling degree days in China (cumulative degrees above 65°F) under RCP2.6 (Blue) and RCP8.5 (Red). The values shown represent the median of 32 GCM model ensemble with the shaded areas showing the 10–90th percentiles.[28]



With many of China's large and expanding urban conurbations also located in both coastal and floodplain regions, urban infrastructure and livelihoods are not only vulnerable to heat stress but also to the effects of extreme climate events, particularly flood and storm surge. Key highly exposed and vulnerable urban conurbations include those in the Pearl River Delta, such as Hong Kong, Shenzhen and Guangzhou, where waterlogging is a common problem, and poorer groups and smaller businesses have been shown to hold high vulnerability to projected climate changes.[74] The large number of lives and livelihoods in exposed areas, and the very high value of the exposed infrastructure and assets mandates further research, vulnerability assessment, and implementation of disaster risk reduction and adaptation measures. Technical standards should be strengthened for critical infrastructure, particularly in areas expected to be most severely affected by rising temperature, changing precipitation patterns, or flooding.

Communities

Poverty and Inequality

China has made significant progress in reducing poverty rates, however recent decades have been marked by a sharp rise in wealth and income inequality. Piketty et al. (2017) estimate that between 1978 and 2015 the share of national income accruing to the top 10% of earners rose from 27% to 41% and the share held by the bottom 50% of earners fell from 27% to 15%.[75] From 2014 to 2017, progress on reducing the rate of undernourishment

[73] Santamouris, M., Cartalis, C., Synnefa, A., & Kolokotsa, D. (2015). On the impact of urban heat island and global warming on the power demand and electricity consumption of buildings—A review. Energy and Buildings, 98, 119–124. URL: https://pdfs.semanticscholar.org/17f8/6e9c161542a7a5acd0ad500f5da9f45a2871.pdf

[74] Yang, L., Scheffran, J., Qin, H., & You, Q. (2015). Climate-related flood risks and urban responses in the Pearl River Delta, China. Regional Environmental Change, 15(2), 379–391. URL: https://link.springer.com/article/10.1007%2Fs10113-014-0651-7

[75] Piketty, T., Yang, L., Zucman, G. (2017). Capital Accumulation, Private Property and Rising Inequality in China, 1978–2015, 1978–2015. National Bureau of Economic Research Working Paper Series No. 23368. URL: https://voxeu.org/article/capital-accumulation-private-property-and-inequality-china-1978-2015

also began to slow, and an estimated 124.5 million people remain undernourished. An estimated 9%–10% of the population remains undernourished.[76] The country's poverty and inequality dynamics increase not only China's vulnerability to climate change, but also climate change will further exacerbate these trends. Levels of risk in China are driven up significantly by the size of the population exposed to natural hazards and climate change impacts. For instance, ADB (2015) reports that an estimated 11.4% of the population lives in low-elevation coastal zones.[5]

Many of the projected changes are likely to disproportionately affect the poorest groups in society. Heavy manual labor jobs are commonly among the lowest paid whilst also being most at risk of productivity losses due to heat stress.[77] Poorer businesses are least able to afford cooling systems, an increasing need given the projected increase in cooling days, and poorer farmers and communities are least able to afford local water storage, irrigation infrastructure and adaptation technologies. Despite contributing only 8.3% of GDP, agriculture employs 27.7% of the labor force, and as of 2018 there were estimated to be more than 200 million smallholder farmers.[78] These farmers face issues such as dryland expansion and desertification, increased flood frequency, range shifts in viable crop varieties, and an increased frequency of days with unsafe temperatures, yet their capacity to adapt will be limited by both deprivation and income inequality. High rates of migration to cities may well be supplemented by those for whom farming becomes an unviable livelihood. Planning is needed for the vulnerability of new arrivals many of whom may end up in hazard-prone areas at the urban periphery.

Gender

An increasing body of research has shown that climate-related disasters have impacted human populations in many areas including agricultural production, food security, water management and public health. The level of impacts and coping strategies of populations depends heavily on their socio-economic status, socio-cultural norms, access to resources, poverty as well as gender. Research has also provided more evidence that the effects are not gender neutral, as women and children are among the highest risk groups. Key factors that account for the differences between women's and men's vulnerability to climate change risks include: gender-based differences in time use; access to assets and credit, treatment by formal institutions, which can constrain women's opportunities, limited access to policy discussions and decision making, and a lack of sex-disaggregated data for policy change.[79]

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[76] FAO, IFAD, UNICEF, WFP, WHO (2017*)*. The state of food security and nutrition in the world. Building Resilience for peace and food security. FAO. Rome. URL: http://www.fao.org/3/a-i7695e.pdf

[77] Kjellstrom, T., Briggs, D., Freyberg, C., Lemke, B., Otto, M., Hyatt, O. (2016). Heat, human performance, and occupational health: A key issue for the assessment of global climate change impacts. Annual Review of Public Health: 37: 97–112. URL: https://www.annualreviews.org/doi/pdf/10.1146/annurev-publhealth-032315-021740

[78] Cui, Z., Zhang, H., Chen, X., Zhang, C., Ma, W., Huang, C., . . . Dou, Z. (2018). Pursuing sustainable productivity with millions of smallholder farmers. Nature, 555(7696), 363–366. URL: https://www.nature.com/articles/nature25785

[79] World Bank Group (2016). Gender Equality, Poverty Reduction, and Inclusive Growth. URL: http://documents1.worldbank.org/curated/en/820851467992505410/pdf/102114-REVISED-PUBLIC-WBG-Gender-Strategy.pdf

Human Health

Nutrition

The World Food Program estimates that without adaptation, the risk of hunger and child malnutrition on a global scale could increase by 20% respectively by 2050.[80] As of 2016, the prevalence of undernourishment, as a percent of the population, is 8.7% in China, or approximately 120 million people. Work by Springmann et al. (2016) has assessed the potential for excess, climate-related deaths associated with malnutrition.[81] The authors identify two key risk factors that are expected to be the primary drivers: a lack of fruit and vegetables in diets, and health complications caused by increasing prevalence of people underweight. The authors' projections suggest there could be approximately 230 climate-related deaths per million linked to lack of food availability in China by mid-century under RCP8.5. This estimate does not include the impact of potential climate-related changes to the nutritional content of food. China will be particularly affected in absolute terms, with 47% of all climate change/nutrition-related deaths projected to occur within the country.

Heat-Related Mortality

Research has placed a threshold of 35°C (wet bulb ambient air temperature) on the human body's ability to regulate temperature, beyond which even a very short period of exposure can present risk of serious ill-health and death.[82] Temperatures significantly lower than the 35°C threshold of 'survivability' can still represent a major threat to human health. Climate change will push global temperatures closer to this temperature 'danger zone' both through slow-onset warming and intensified heat waves. While China is projected to experiences increases in average, maximum as well as minimum temperature, certain areas are still at high-risk to extreme cold events. Increased intensity and frequency of these cold events is likely to require additional heating and may also overload energy supply infrastructure during winter months.

Work by Honda et al. (2014), which utilized the A1B emissions scenario from CMIP3 (most comparable to RCP6.0), estimates that without adaptation, annual heat-related deaths in the Eastern Asian region, will increase 245% by 2030 and 421% by 2050.[83] China's many large urban areas are expected to be hotspots of increased heat-related mortality risk, with one study estimating that in the period 2041–2060 there will be 37,800 excess deaths per year under RCP8.5 and 25,800 under RCP2.6 attributable to climate change.[84]

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[80] WFP (2015). Two minutes on climate change and hunger: A zero hunger world needs climate resilience. The World Food Program. URL: https://docs.wfp.org/api/documents/WFP-0000009143/download/

[81] Springmann, M., Mason-D'Croz, D., Robinson, S., Garnett, T., Godfray, H. C. J., Gollin, D., . . . Scarborough, P. (2016). Global and regional health effects of future food production under climate change: a modelling study. The Lancet: 387: 1937–1946. URL: https://www.ncbi.nlm.nih.gov/pubmed/26947322

[82] Im, E. S., Pal, J. S., & Eltahir, E. A. B. (2017). Deadly heat waves projected in the densely populated agricultural regions of South Asia. Science Advances, 3(8), 1–8. URL: https://advances.sciencemag.org/content/3/8/e1603322

[83] Honda, Y., Kondo, M., McGregor, G., Kim, H., Guo, Y-L, Hijioka, Y., Yoshikawa, M., Oka, K., Takano, S., Hales, S., Sari Kovats, R. (2014). Heat-related mortality risk model for climate change impact projection. Environmental Health and Preventive Medicine 19: 56–63. URL: https://www.ncbi.nlm.nih.gov/pubmed/23928946

[84] Li, Y., Ren, T., Kinney, P. L., Joyner, A., & Zhang, W. (2018). Projecting future climate change impacts on heat-related mortality in large urban areas in China. Environmental Research: 163: 171–185. URL: https://www.ncbi.nlm.nih.gov/pubmed/29448153

Disease

Studies suggest climate changes are likely to delay the eradication of infectious diseases, an area in which China has made considerable recent progress.[85] One particular concern in this regard is that the percentage of the geographic region of China that will be hospitable to the transmission of dengue fever is projected to rise under a high emissions (RCP8.5) scenario–up to 39% by the period the 2040s to 2070s, from a baseline of 34% based on the period 1961–1990. However, if the most ambitious emission reduction targets are able to be met (RCP2.6) this could fall to 33% over that same period.

Climate change pressures, such as increased incidence of extreme rainfall and flood, as well as higher temperatures, represent environmental drivers of vector and water-borne diseases. Diarrheal disease is a significant health risk to children in China. UNICEF estimates that around 5,000 children under five years of age died as a result of diarrheal disease in 2016.[86] This represents around 3% of all under five deaths. While overall deaths are projected to decline significantly, modelling by WHO estimates the change in the number of diarrheal deaths of individuals under fifteen years of age is projected to increase the number of deaths in the 2030s by around 5%–15% and by around 10%–20% in mid-century, under the A1B scenario in the East Asia region.[87]

POLICIES AND PROGRAMS

National Adaptation Policies and Strategies

TABLE 8. Key national adaptation policies, strategies, and plans

Policy/Strategy/Plan	Status	Document Access
Nationally Determined Contribution (NDC) to Paris Climate Agreement	Submitted	September, 2016
The National Strategy for Climate Change Adaptation	Active	November, 2013
National Communications to the UNFCCC	Three Submitted	Latest: December, 2018
National Strategy for Climate Change Adaptation	Enacted	October, 2013
National New Urbanization Plan (2014–2020)	Active	March, 2014
China's Policies and Actions for Addressing Climate Change	Active	November, 2019
The 13-th Five-Year Plan for Economic and Social Development	Enacted	2016
Post-2020 Poverty Reduction Policy Options for the People's Republic of China	Active	June, 2020
The 14th Five-Year Plan: Sector Impact Outlook	Released	March, 2021

[85] Hodges, M., Belle, J., Carlton, E., Liang, S., Li, H., Luo, W., Freeman, M., Liu, W., Gao, Y., Hess, J., Remais, J. (2014). Delays in reducing waterborne and water-related infectious diseases in China under climate change. Nature Climate Change: 4: 1109–1115. URL: https://www.ncbi.nlm.nih.gov/pubmed/25530812

[86] UNICEF (2019). Data: Diarrhoeal Disease. URL: https://data.unicef.org/topic/child-health/diarrhoeal-disease/ [accessed 29/01/2019]

[87] WHO (2014). Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. World Health Organization. URL: https://apps.who.int/iris/bitstream/handle/10665/134014/9789241507691_eng.pdf?sequence=1&isAllowed=y

Climate Change Priorities of ADB and the WBG

ADB Country Partnership Strategy

The overarching goal of China's current Country Partnership Strategy (2021–2025) with ADB is to support government efforts to achieve high-quality, green development through investments and knowledge solutions. Among the the strategic priorities are: (i)environmentally sustainable development, and (ii) climate change adaptation and mitigation.

TABLE 9. Priority areas of ADB's Country Partnership Strategy with China[88]

Priority Areas	Intervention
Environmentally sustainable development	• Integrated approach to natural resource management to conserve, protect, and restore natural capital assets and balance the economy, ecology, and people's needs and well-being • Support a long-term integrated approach to managing pollution from all source across urban and rural areas and at national, provincial, and local levels • Support the development of multimodal low-carbon transport and SMEs engagement in green production and processes • Explore inclusive livelihoods and business opportunities in ecotourism; protect and restore coastal and marine ecosystems and rivers through integrated water resource, flood control, and drought management; and reduce land-based sources of marine pollution, including plastic under the Healthy Oceans and Sustainable Blue Economies Initiative • Mainstream environmental infrastructure through private sector solutions by expanding nonsovereign operations with advanced technology and innovative business models that promote greater resilience and help improve access to finance, resource efficiency, and quality standards
Climate change mitigation and adaptation	• Support the development of climate-resilient infrastructure in vulnerable areas and introduce climate-smart agriculture and forestry, by enhancing agricultural resilience and productivity, optimizing carbon sink functions to absorb carbon, and adopting green technology • Develop a stronger sustainable risk management framework for water, floods, drought, and extreme weather • Support the country's efforts to achieve its NDC by promoting low-carbon urban and rural development, green and smart infrastructure, energy efficiency, waste-to-energy, and advanced clean energy interventions • Explore new approaches, such as carbon capture use and storage, and hydrogen technology • Target the development of a circular economy, near zero-carbon livable cities and rural development, sustainable low-carbon transport systems, green finance, and private sector investments • Support institutions at various government levels to mainstream urban and urban–rural climate change adaptation action plans • Strengthen disaster risk management processes with a focus on containing flood risk • Support efforts to finance disaster risk reduction through greater private sector involvement, green finance, risk insurance, and catastrophe bonds • Finance climate-related nonsovereign projects, including support for innovative renewable energy technologies and investments that generate regional public goods • Explore potential investments in high development impact technologies, including climate-smart agriculture, new generation renewable energy, mini-grid networks, energy storage, and energy efficient solutions

[88] ADB (2021). People's Republic of China, 2021–2025—Toward High-Quality, Green Development. Manila. https://www.adb.org/sites/default/files/institutional-document/684081/prc-cps-2021-2025.pdf

WBG Country Partnership Framework

China's Country Partnership Framework (CPF) (2020–2025) with the WBG focuses on the environment and climate change. Through the CPF, the WBG is committed to supporting greener growth by helping China to shift to a more sustainable energy path; enhance urban environmental services; promote low-carbon urban transport; promote sustainable agriculture practices; pilot sustainable natural resource management approached; improve pollution management; and strengthen mechanisms for managing climate change.

In this engagement, the WBG offered analytical and advisory services and strategic investment, as shown in **Table 10**.

TABLE 10. Actions to support greener growth identified through the 2020–2025 Country Partnership Framework between China and the WBG[89]

Analytical and Advisory Services	Target Areas
Supporting greener growth	• Facilitating the transition to a lower-carbon energy path • Reducing air, soil, water, and marine plastic pollution • Demonstrating sustainable agriculture practices and improving food system quality and safety • Strengthening sustainable natural resource management • Promoting low-carbon transport and cities
Strategic investment outcomes	• Shifting to a sustainable energy path through increased investment in renewable energy, specifically solar • Enhancing environmental services • Promoting low-carbon urban transport • Promoting sustainable agricultural practices • Demonstrating sustainable natural resource management approaches and enhanced green financing for both urban and rural areas • Demonstrating pollution management measures, such as coal mine closures by 2022 • Strengthening institutional and financial mechanisms for climate change

[89] WBG (2019). Country Partnership Framework for the People's Republic of China for the Period FY2020-FY2025. URL: http://documents1.worldbank.org/curated/en/902781575573489712/pdf/China-Country-Partnership-Framework-for-the-Period-FY2020-2025.pdf

CLIMATE RISK COUNTRY PROFILE

CHINA

WORLD BANK GROUP

ADB ASIAN DEVELOPMENT BANK