Global Water Partnership

How water resources management can support climate-resilient development in China

ABOUT THIS BRIEF

Water is a 'climate connector' – impacts of climate change on water will flow through all sectors of the economy and across national borders. This brief explains why integrated approaches to water management are essential for climate-resilient development, how China has laid a solid foundation in that sense, and what needs to change if China is to meet its commitments under the Paris Agreement and achieve the Sustainable Development Goals (SDGs).

SDG target 6.5, on integrated water resources management (IWRM), can make that climate connection. This brief looks at all four dimensions of IWRM, namely the enabling environment, institutions and participation, management instruments, and financing.

RECOMMENDATIONS

Key stakeholder(s)	Recommendation
Ministry of Water Resources (MWR) Ministry of Ecology and Environment (MEE) Ministry of Natural Resources (MNR)	The challenges posed by climate change are not explicitly considered in the National Water Law or its revisions and updates. 1 Update the 2016 National Water Law to reflect new policies on water resources management, in particular the 'Three Red Lines' and 'River and Lake Chief' initiatives, particularly in relation to emerging concerns and required adaptations around climate risk.
MWR in consultation with China's seven River Basin Commissions (RBCs)	China has a multi-layered and dynamic institutional landscape, where clarifying roles and responsibilities across biophysical and political boundaries can be difficult. 2 Clarify the roles and responsibilities between basins and political jurisdictions (for example, the relationship between the new River and Lake Chief system, established RBCs, and local governance bodies could be clearer). This could support the integrated management of water resources.

RECOMMENDATIONS CONTINUED...

Key stakeholder(s)	Recommendation
RBCs under MWR Business leaders, public–private partnerships (PPPs), and civil society	The 13th Five Year Plan (FYP) recommended increased public participation. Platforms to support this participation, such as the River and Lake Chief system, are growing. Private sector participation in water management is also on the rise (the recent growth in public–private partnerships (PPPs), including to support the delivery of municipal water supply and wastewater services, has made China one of the largest markets for PPPs globally). **3** Broaden business and civil society participation in water management decision-making while being sensitive to cultural norms and values. Water resource planning and management offers an ideal opportunity to support the ongoing development and use of participatory mechanisms in China and can enhance climate change adaptation.
MWR MEE and MNR RBCs under MWR	Data fragmentation, interpretation, access, and effective use are ongoing challenges in China. **4** Consolidate datasets on water resource conditions, trends, patterns of use and pressures. In addition, consider the World Bank's 2018 recommendation for establishing a national water information sharing platform. Consolidated datasets, along with improved means of accessing and using the data, would enhance China's capacity for adaptive management. The South-to-North Water Diversion Project (SNWDP) is a major water resource development project that will require adaptive management under changing conditions. **5** Systemically evaluate the SNWDP on an ongoing basis, including the impact of the transfer scheme on the receiving and contributing catchments and on surface and groundwater. In addition, monitor the transfers in relation to climate change impacts, so that the SNWDP remains viable (economically, environmentally, and socio-politically) under a changing climate.

THE CHALLENGE

Sustaining China's rapid economic growth will require coherent management of a range of interconnected climate- and water-related risks.[15, 42]

China's average **temperature** has increased by 1.2°C since 1960, especially in the north, where much of China's grain is produced. **Climate projections** indicate this warming trend will continue, with stronger warming in the summer months.[30]

Over half of China's population is affected by **water scarcity**, as shown in a 2020 study published in *Nature Communications*, which argues that there is an urgent need for China to improve its management of freshwater quantity and quality, above and beyond the currently implemented measures.[25]

Agriculture and **industry** are the #1 and #2 largest users of water, respectively, in China. Charting a development trajectory that enables consistent gross domestic product (GDP) growth using less water and creating less pollution, while increasing food and energy security, remains a central challenge.[46]

China's **water resource distribution is uneven**. Roughly 65% of the country's farmland lies to the north of the Yangtze River, an area with only 20% of the country's water resources that produces around half of China's grain, including nearly all the country's wheat and maize.[20, 37]

China is subject to **frequent climate hazards, including droughts, heatwaves, floods, and typhoons**. Between 2013 and 2018, climate hazards collectively cost the economy roughly US$126 billion.[27, 31]

China has experienced **the world's largest and most rapid industrialisation and urbanisation** with a current urban population of 810 million, up from 170 million in 1978. China's cities are increasingly having to rely on water drawn from more distant sources, which often have competing prior uses (typically agricultural and/or environmental).[9]

The extent of these developmental challenges, combined with China's particular geography and economic growth, has required large-scale responses, including:

- The **South-to-North Water Diversion Project (SNWDP)**, which is a massive water resource development response involving multiple inter-basin transfers. The South-to-North Water Diversion Middle Route Project has already transferred over 45 billion m^3 of water to the water-scarce north of China and has begun replacing exploited groundwater as part of a broader groundwater exploitation reduction programme to tackle the problem of falling groundwater levels in the north of China, including Beijing, Hebei, and Henan Provinces.
- The **Sponge Cities Initiative**, which was launched in 2014 in response to multiple urban water management problems (including flooding, pollution, and meeting the demands of ongoing urbanisation) in many of China's largest cities. 'Sponge Cities' aim to increase the capacity of a city for storing, permeating, and purifying rainwater, with simultaneous objectives of reducing pollution and restoring downstream ecologies.[20, 40]

Managing and, where appropriate, growing these large-scale responses in the face of diverse climate changes will require continual investment.

The Hindu Kush Himalayan (HKH) region extends over 3,500 km and bridges eight countries. China is heavily reliant on **4 of the 10** river basins in the HKH region (the Yangtze, Yellow, Brahmaputra, and Mekong/Lancang rivers), which collectively account for over **40% of China's total surface water resources**.

The **Yangtze River** is particularly important for China because of the size of the population and amount of economic activity reliant on its water. It is also prone to climate hazards (a major flood in 1998, for example, **inundated 21 million hectares of land** and **destroyed 5 million homes** in the Yangtze River Basin).[27, 31]

Other climate change implications for the Yangtze River include:

- increased **reservoir evaporation** from the 350+ large dams on the Yangtze
- further **saltwater intrusion** in Shanghai due to alterations in flow
- **alterations in flow**, affecting the flow regime and the reliability of the **hydropower** energy generation capacity of the facilities on the river.[20, 37]

An illustration of the interconnected nature of the water-related climate challenges facing China

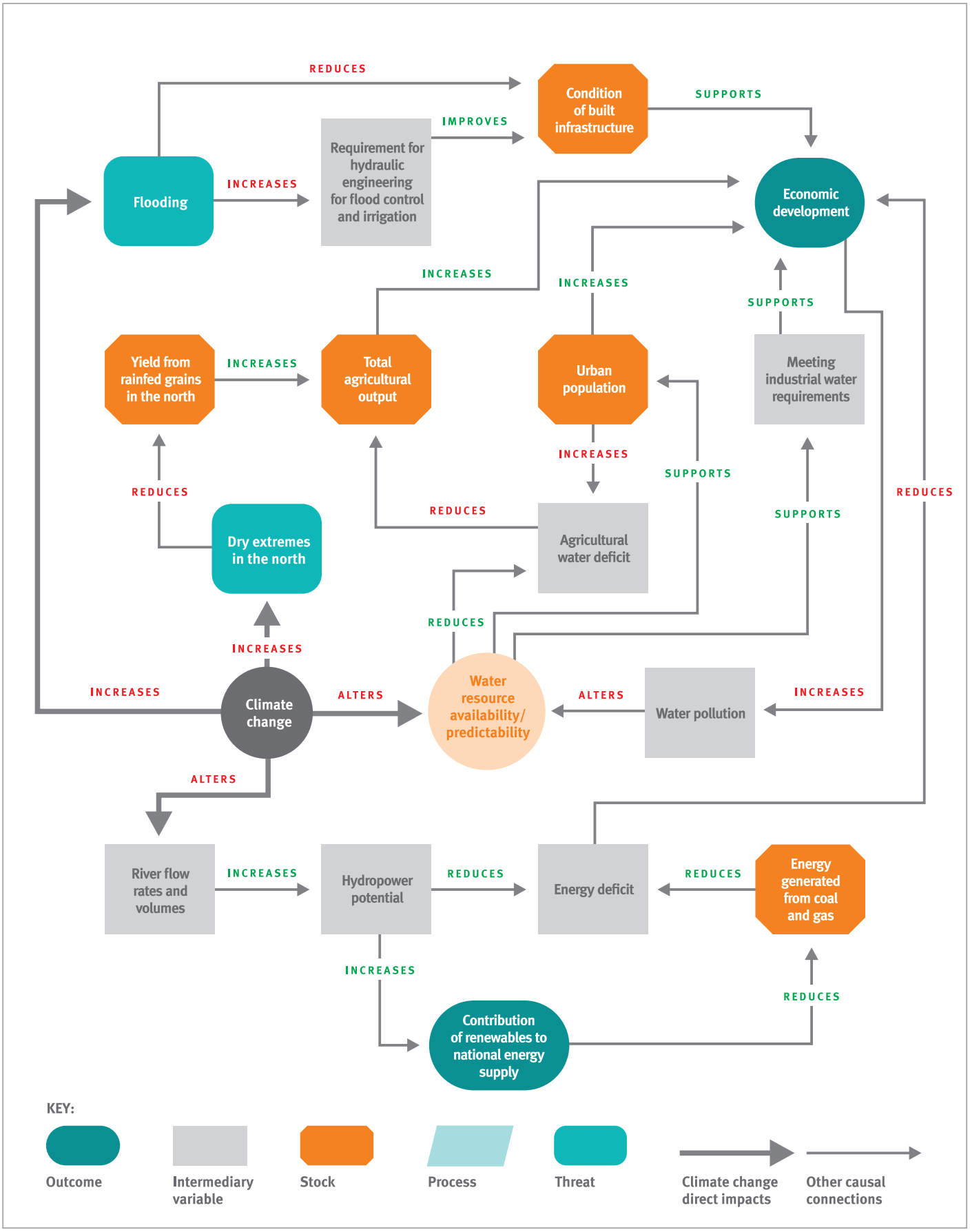
As with the water–energy–food nexus, climate resilience and sustainable development are interconnected. The diagram below maps the relationships between some of the key climate challenges facing China, showing why coordinated, integrated, and cross-sectoral responses are required to adapt to the impacts of climate change.

At the centre of the diagram is water resource availability/predictability, which is impacted both by climate change and by recurring droughts (as shown by the words written on the arrows between the variables). The complex relationship between climate change and water availability/predictability is not shown here for reasons of space. The word 'alters' is used to describe the fact that climate change can affect water resources via multiple vectors, including via changes in temperature and precipitation, and impact on availability in multiple ways, including via seasonality, changing frequency and intensity of rainfall events, and fluctuating water quality.

To illustrate the accurate reading of this diagram, two causal chains are described:

- **Causal chain 1**: The relationship between water resource availability/predictability and agricultural water deficit is inverse: an increase in water availability/predictability will generally reduce the agricultural water deficit (defined as the gap between the demand for agricultural water, expressed in the diagram as agricultural water requirements, and the water available for agriculture). The impacts of climate change in China are expected to mostly alter water resource availability/predictability in negative ways, which will then increase the agricultural water deficit. An increasing deficit will reduce the total agricultural output, with associated decrease in economic development.
- **Causal chain 2**: Climate change is also increasing flooding in China, one of the impacts of which is a decline in the condition of built infrastructure. Flooding increases the requirement for hydraulic engineering for flood control and management, which can mitigate the impact of flooding and therefore improve the condition of built infrastructure, which, in turn, supports economic development. The remainder of the diagram can be read in the same way.

THE INTERCONNECTED NATURE OF WATER-RELATED CLIMATE CHALLENGES IN CHINA



ENABLING ENVIRONMENT

What do key policy statements say about integration of water, climate, and other SDG agendas?

The Chinese government is implementing some of the world's most ambitious water resources management strategies in an effort to manage pollution, mediate between competing water uses, and deal with multiple pressures – including climate change. The National Water Law set the country on a new management path, emphasising integrated approaches and demand management. Since then, many new principles, laws, and policies have been announced that are continuing to reshape the water landscape. The National Water Law should be revised to reflect these, and to ensure that new pressures on water – including from climate change – are comprehensively addressed on an ongoing basis.

POLICY STATEMENTS

SECTOR	KEY POLICY STATEMENTS (INCLUDING LAWS, STRATEGIES, AND PLANS)
Cross-sectoral	■ 14th Five Year Plan (2021–2025) ■ National Plan on Implementation of the 2030 Agenda for Sustainable Development (2016)
Climate change	■ National Climate Change Adaptation Strategy (2013–2020) ■ Nationally Determined Contribution (NDC) (2016)
Water (national)	■ National Water Law (1998) ■ The Most Stringent System for Water Resources Management (2011) ■ 1997 Flood Control Law (amended in 2016)
Water (trans-boundary)	■ Hindu Kush Himalayan (HKH) region's 'Call to Action' (2020)

Development plans: The **14th Five Year Plan (FYP)** details China's development strategy and pathway for 2021–2025, with environmental and efficiency targets that cover carbon emissions, energy consumption, water quality, and forest cover. The 14th FYP marks a further shift towards a more sustainable, service-orientated growth path.[47]

Water-related priorities highlighted in the 14th FYP include:

- water conservation, especially in agriculture
- water diversion
- flood control and disaster mitigation
- water supply and irrigation
- protecting water resources and aquatic ecosystems, especially upstream
- pollution control, including non-point source pollution.

However, no specific links are made between climate change and water resources strategy or targets. Similarly, while the 14th FYP talks about a 'green' transformation, implications for water resources development and management under a changing climate are not elaborated upon, and there is just one reference to climate change adaptation, referring to infrastructure needing to adapt to climate change.

Water – national: The first **National Water Law** was issued in 1988 and was revised in 2002 and then updated twice, first in 2009 and then in 2016. The 2002 revision, in particular, elaborates a comprehensive water resource planning system and institutional framework, with a shift away from supply-side development to integrated management and water conservation, underpinned by a modern system of water rights. However, the challenges posed by climate change are not explicitly considered in either the 1988 law or its two recent updates (see **Recommendation 1**).

Since publication of the National Water Law, several high-level policies and directives have been issued by the central government under the banner of **Developing a Water Saving Society**, with pilot projects in water-stressed northern provinces testing new technologies and approaches for water conservation and water demand management (see text box, below). Irrigation water use has been one example of success: multiple efficiency measures and programmes have resulted in a reduction in average irrigation water use (measured in cubic metres per hectare [m^3/ha]). In 2000, the average irrigation water use was 7,185 m^3/ha; by 2016 it had fallen to 5,700 m^3/ha (a reduction of over 20%).[11]
The most significant policy development, however, occurred in 2011 when the Chinese Communist Party (CCP) and State Council announced **The Most Stringent System for Water Resources Management**, otherwise known as the **Three Red Lines** policy, designed to establish clear and binding limits on water withdrawals,

Illustrative initiatives forming part of a Water Saving Society:

- new irrigation technologies (such as drip irrigation)
- quota definition and management (via measurement of evapotranspiration, using prepaid water tickets or electricity quotas)
- direct payments to farmers for not growing – and irrigating – winter wheat.

water efficiency, and water quality. Under China's hierarchical water management system, national targets are broken down by province and local jurisdiction according to a detailed, formulaic process, monitored and enforced through the cadre evaluation system. In 2016, two additional indicators were added: **(i) reduction in water use per unit of GDP**, and **(ii) reduction in total pollutant loads in key zones**. The target-setting process could, in theory, be adjusted to account for changing resource conditions as climate change accelerates.[45]

A new system of **River and Lake Chiefs** was announced in 2016, making local party officials directly responsible for achieving environmental targets for each stretch of every major lake and waterway. The system is focused primarily on water quality and pollution control. China's 1997 **Flood Control Law** (amended in 2016), meanwhile, mandates flood planning at basin and watershed level, with land use controlled according to flood risk. To date, flood control measures have focused both on early warning, land zoning, and the hard infrastructure of dams and dykes, and 'green' approaches to flood management. Such laws, policies, pilot projects, and programmes demonstrate a real commitment to broad water resource management goals, largely in response to scarcity, floods, pollution, and ecosystem degradation. Measures provide the means to deal with a range of potential climate and water futures, even if climate change is not explicitly considered in the documents reviewed.[8]

As an upper riparian country that shares **40 major transboundary river basins with 16 countries**, China has long been part of multilateral processes and is a signatory to multiple types of regional cooperation mechanisms. The largest multilateral network encompasses the **Hindu Kush Himalayan (HKH) region**. Ministers from across all eight of the HKH countries recently signed a significant declaration agreeing to strengthen cooperation in the region to promote a united voice for the HKH at regional, global, and UN platforms. The declaration was signed in October 2020 and contained an agreement to enhance the uptake of scientific evidence for improving policies in the region focusing on mountain environments and livelihoods and to assess the feasibility of establishing a regional institutional mechanism.[23]

China's **National Climate Change Adaptation Strategy** (NAS, 2013–2020), published by the **National Development and Reform Commission (NDRC)**, highlights water resources management as a key component of adaptation (for water-related priority actions, see text box, below). The NAS followed the publication of the NDRC's **China National Climate Change Programme** (CNCCP) for 2007–2010, which highlighted as priorities under 'water resources':

1. Enhanced water resources management
2. Strengthened infrastructure planning
3. Water conservation and reallocation.[26]

Pilot projects for **water resource conservation and protection** in Jiangxi and Xinjiang are highlighted, with the expectation that lessons learned will be upscaled. The Strategy also includes weather-based financial instruments such as bonds and weather-index based insurance. Specific, quantified targets are limited, but include a 'protection rate' for natural wetlands of 60%.

NAS water-related priority actions:

- stronger aquatic ecosystem management and protection
- the development of more 'rational' water allocation systems
- a drive to increase water use efficiency to safeguard high-priority drinking water supplies
- enhanced flood and drought management.

China's **Nationally Determined Contribution (NDC)**, submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in 2015, makes frequent reference to China's prioritisation of resource conservation and environmental protection. Under the **NDC Policy Area H** (Enhancing Overall Climate Resilience), the first three priorities relate to freshwater resources, covering:

1. Water management and recycling/reuse
2. Agricultural water conservation
3. Robust water infrastructure.

At the 75th Session of the UN General Assembly in September 2020, President Xi Jinping committed to **scaling up China's NDCs** by adopting more vigorous policies and measures, aiming to have CO_2 emissions peak before 2030 and achieve carbon neutrality before 2060.[7]

In terms of the **Sustainable Development Goals (SDGs)**, China's **National Plan on Implementation of the 2030 Agenda for Sustainable Development** was released by the Ministry of Foreign Affairs (MFA) in 2016. This plan translates each SDG target into action plans, with subsequent reports made publicly available on the MFA's website.[34]

INSTITUTIONS AND PARTICIPATION

Are China's institutions ready to manage the impacts of climate change on water resources and on other water-related sectors in an integrated way?

China has a long-established water bureaucracy that combines depth (from the national level down to county and township levels) with breadth (nationwide coverage and replication of structures, responsibilities, and reporting lines). Historically, however, roles and responsibilities have been split between multiple ministries and departments. Reforms announced in 2018 are a work in progress, but will need to address issues around coordination and authority, particularly in relation to the ability of RBCs to plan, monitor, and enforce water allocations in a flexible manner as climate and socio-economic conditions change. Broader participation in decision-making – from across government bodies but also including business interests and civil society – is also recommended.

The Ministry of Water Resources (MWR), under the State Council, has the primary responsibility for **water resources management** (see diagram on 'China's institutions' below). River Basin Commissions (RBCs – seven in total) under MWR are authorised to manage water resources within their basins. **Water Resource Departments** and **Water Affairs Bureaus** are then tasked with water resource administration within the applicable political boundaries (province/region, municipality, county, and township) in accordance with basin plans.

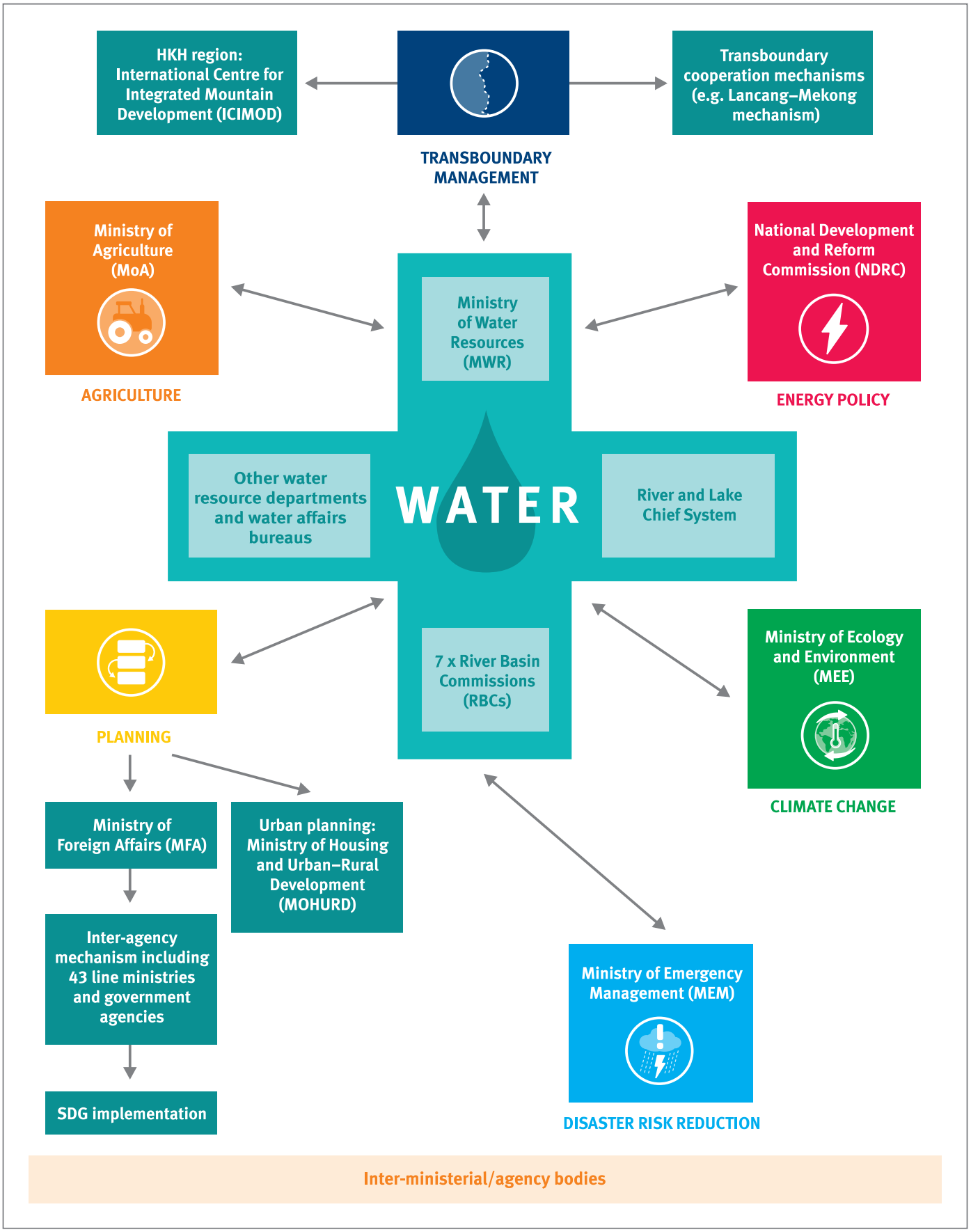
Roles and responsibilities for water governance have historically spanned different government ministries and their agencies at the provincial and local levels. Institutional reforms introduced in 2018 are designed to address some of these fragmentation and coordination problems, and will see a consolidation of responsibilities within MWR, supported by the establishment of the **Ministry of Ecology and Environment (MEE)** and the **Ministry of Natural Resources (MNR)**. Reforms will also see MEE assuming responsibility for China's international climate diplomacy, and for coordinating domestic climate policy among ministries, though **energy policy** remains with the **National Development and Reform Commission (NDRC)**. The 2018 reforms are a work in progress, but they signal a renewed commitment to environmental protection and sustainable natural resource management (see **Recommendation 1**). Under the new arrangements, RBCs are expected to maintain their responsibilities for basin-wide water planning, allocating water between upstream and downstream provinces and regions. RBC plans allocate long-term rights to water via **Water Resource Allocation Plans** and, via **Annual Regulation Plans**, also define annual volumes available for trans-provincial/regional allocation depending on water availability. **Provincial/regional plans** then allocate agreed allocations among prefectures, and prefecture-level plans allocate water between counties.[42]

The system as a whole, comprising planning and regulatory mechanisms for defining and allocating shares of available water, can therefore accommodate changing resource conditions, including long-term shifts linked to climate change. Nonetheless, operationalising such a system of water rights is politically, administratively, and scientifically challenging.[42]

Political, administrative, and scientific challenges of operationalising China's system of water rights:

- The relationship between RBCs and provincial/regional governments remains ambiguous.
- RBCs lack the political authority to strictly enforce withdrawals, and do not include representatives from provincial or local government.
- The relationship between the new River and Lake Chief system and long-established RBC–local government water planning is also unclear.
- Defining, allocating, and monitoring rights and withdrawals is a mammoth undertaking in a country of China's size – particularly for groundwater economies in the north where millions of farmers own, or share, groundwater infrastructure.
- Understanding of resource conditions, trends, and patterns of use remains patchy.

CHINA'S INSTITUTIONS



Public participation in water management in China

The revised National Water Law (2016) has little to say on broad stakeholder participation in water governance beyond the role of government agencies in defining, allocating, and monitoring rights. The wider planning policy landscape describes China's official position on public participation more explicitly. The **13th Five Year Plan**, for example, has a section on public participation, stating that "residents' rights to be informed, to participate, to make decisions, and to conduct oversight, and improve institutional channels for public participation in government" must be safeguarded.[14]

As a second example, the new **River and Lake Chief** system foresees an expanded role for public supervision and participation, where the system acts as a platform for citizens to make recommendations, report issues, and get information about the water management plans of their local chiefs. River Chief status is not restricted solely to party officials, either. In December 2017, the CEO of AB InBev – the world's largest brewer – became the first foreign River Chief in China (see **Recommendation 2**).[18]

The extent to which businesses are engaged in dialogue and planning around the impacts of climate change on water is difficult to ascertain from formal policies. However, in the 2017 SDG Indicator 6.5.1 reporting, China self-assessed its performance on broad stakeholder engagement in water resources management as relatively weak, suggesting that water resource management remains dominated by state actors with only minor outreach to the private sector and wider civil society. The GWP-convened workshop report on SDG Indicator 6.5.1 also highlighted a need for greater business/private sector engagement in planning (see **Recommendation 3**).[19]

Broader legal analyses, published in 2018 in the *Chinese Journal of Environmental Law*, show that it is insufficiently clear what type of public participation is often called for and which 'public' should be invited to participate.[33]

The **Ministry of Housing and Urban–Rural Development (MOHURD)** is in charge of **urban planning**, which includes the recent Sponge City programme along with the Ministry of Water Resources and the Ministry of Finance. At the city level, **public–private partnerships (PPPs)** for the delivery of municipal water supply and wastewater services are now commonplace. (China has become one of the most important and active markets for PPPs globally, with more than **500 PPPs initiated between 1990 and 2017**.) Although the regulatory framework for PPPs has been strengthened considerably over recent years, it is not known whether this covers technical design standards that are appropriate to a range of potential climate and water futures (see **Recommendation 3**). This matters because piped systems may have **multiple points of vulnerability** in both wetter and drier climates, from source through to treatment, distribution, and sewage systems. In addition, the World Bank, citing MWR survey data, notes that many Chinese small and medium-sized cities have **inadequate flood protection** and/or **rely on a single source of water**, potentially making these cities vulnerable to the impacts of climate change.[5, 45]

In terms of **Disaster Risk Management**, state flood control and drought management functions are headed by the Ministry of Emergency Management (MEM). At

THE SPONGE CITY INITIATIVE

- This initiative was launched in **2014** in response to multiple urban water management problems (including flooding, pollution, and meeting the demands of ongoing urbanisation).
- 'Sponge Cities' aim to increase the capacity of a city for **storing**, **permeating**, and **purifying rainwater**, with simultaneous objectives of **reducing pollution** and **restoring downstream ecologies**.
- The initiative has been **piloted in major cities**, including **Beijing**, **Shanghai**, and **Shenzen**.
- National targets were set in 2015 to collect and recycle **70%** of the cities' rainwater by **2020**.
- While a range of implementation challenges have been recognised (including technical, institutional/legal, and financial), the project has had many successes and offers examples to other countries for building sustainable, climate-resilient cities and urban water management systems.[20, 40]

the **transboundary level**, China is a member of the **International Centre for Integrated Mountain Development (ICIMOD)**, which is a regional knowledge development and learning centre that serves the eight regional member countries of the Hindu Kush Himalayan (HKH) region.[40]

To address inter-agency coordination for the **Sustainable Development Goals (SDGs)**, China created a mechanism coordinated by the **Ministry of Foreign Affairs** that formulates the implementation plan, reviews progress on implementation, and strengthens policy coordination and communication across the 43 line ministries and government agencies included in the mechanism. China has, more recently, also been playing a more active role at the global level to support the SDGs, illustrated by announcements made at the 75th Session of the UN General Assembly in September 2020, where President Xi Jinping announced Chinese support for a **'UN Global Geospatial Knowledge and Innovation Centre'** and an **'International Research Centre of Big Data for SDGs'** to facilitate the implementation of the 2030 Agenda for Sustainable Development.[7, 48]

MANAGEMENT INSTRUMENTS

Are management decisions in water and other SDGs being guided by evidence of climate change?

China's water institutions have deployed a broad range of management instruments to deal with climate extremes, water scarcity, and environmental protection, but more needs to be done to ensure data sharing and use across institutions. Moreover, as pressure on water resources increases – including from climate change – the premium placed on robust, timely, and comprehensive data, and its conversion into decision-relevant information, will increase. Looking beyond data and information, China has followed a 'learning by doing' approach to the implementation of regulatory, economic, and technical reforms in the water sector that has worked well. However, flood management has been identified as a critical area for further reform as China urbanises, and flood risk and (potentially) population exposure increases.

Climate services – broadly defined as the provision and translation of weather and climate information into forms and formats that support decision-making – are provided by several different organisations in China. The fragmentation of responsibilities, and data, reflects the historically disjointed nature of water-related decision-making, split between multiple ministries, departments, commissions, and bureaus (see **Recommendations 1 and 4**).[29]

The **China Meteorological Administration (CMA)** is the lead government organisation charged with providing weather and climate information services to a variety of end users at different levels. It does this via the National Meteorological Centre (NMC), the Public Meteorological Service Centre, various provincial and prefectural centres and offices, and a number of other departments, as summarised in the table below.

The NMC provides weather forecasts and climate prediction information to other government ministries, including MWR and the Ministry of Agriculture (MoA). NMC is also responsible for forecasting and early warning for hazards such as typhoons, heat/cold waves, and heavy rainfall events. Many of its products are free and publicly available.[29]

Early warning systems focus on floods, and the CMA has developed national flash flood and flood risk thresholds based on analyses of historical rainfall in consultation with MWR and other stakeholders. Real-time and potential flood warnings are transferred to provincial and sub-provincial governments and their related departments via the **National Emergency Public Events Early Warning Information Release System (NEPIRS)**. In addition, various

THE CHINA METEOROLOGICAL ADMINISTRATION (CMA)

CMA DEPARTMENTS	ROLE DESCRIPTION
The Department of Forecasting and Networking	Manages forecast production within CMA, and issues forecasts internally across departments
The Department of Emergency Responses, Disaster Mitigation, and Public Service	Manages the international issuance of hazard early warning and coordinates communication and connections outside CMA
The Public Meteorological Service Centre	Provides climate service products for the public and businesses, and also releases and publicises weather hazard and early warning information to state-level media
Meteorological Communication and Outreach Centre	Coordinates communication with the media and researches weather and climate information communication techniques and modes.
The National Climate Centre (NCC)	The parent organisation of the Beijing Climate Centre (BCC), which is a regional climate centre providing climate services to users within Asia.

departments and agencies within MWR have 'in-house' monitoring responsibilities and provide internal climate services for different applications. The **Bureau of Hydrology** under MWR, for example, operates roughly 20,000 gauging stations that record temperature and rainfall. **The Research Centre for Climate Change** under MWR develops climate projections for use in water balance models to estimate the potential impacts of climate change on water availability throughout the country.[26]

MWR cooperates closely with nationwide departments and agencies in **data monitoring and providing services**. MWR also shares data to research institutes and companies according to related management rules and guidelines. The centre also provides climate risk assessments and probabilities of future hydrological extremes under different climate scenarios, with information passed to RBCs and reportedly used for planning and management decisions (see **Recommendation 4**).

RBCs and provincial water authorities also produce their own **daily, monthly, and seasonal forecasts** to assist with water management (e.g. preparation of basin allocation and regulation plans – see 'Institutions and participation' section above) and flood risk planning. Long-term climate information can, in theory, be used to adjust the water rights issued to individual jurisdictions and water users (e.g. irrigation districts) (see **Recommendation 4**). In Hebei Province, a programme funded by the Chinese government and the Swiss Agency for Development and Cooperation (SDC) was linking groundwater modelling, climate information, and real-time monitoring of water withdrawals (via electricity use) to develop a flexible groundwater allocation and licensing plan. Here, the threat of climate change is being used, in part, to justify a concerted response to declining groundwater levels, even though the major driver of change is intensive irrigation (see **Recommendation 5**).[10]

Communication between information providers and users, and in particular the provision of decision-relevant information to end users, is a continuing weakness, though recent institutional reforms (see above) may help. Although national and basin-level water resource management organisations reportedly use climate projections and scenarios, many other sector agencies do not, and remain ill equipped to do so. Scientists, in turn, are uncertain how best to communicate information in a policy-relevant way. To address problems of **data fragmentation, interpretation, access, and use**, the World Bank has argued for the establishment of a national water information sharing platform (see **Recommendation 4**). Sharing of data and information has also been raised as an issue at the regional scale. Several initiatives have

improved data sharing with China's riparian neighbours on the Lancang-Mekong River, including the Lancang-Mekong Cooperation initiative[1] and the Lancang-Mekong Water Resources Cooperation Information Sharing Platform[2], while Action 6 of the **HKH 2020 Call to Action**, for example, includes promoting and using the ICIMOD Regional Database System and emphasises the importance of fostering cooperation and capacity building to support data and information sharing among the eight member countries of the HKH region.[22, 26, 29, 42, 49]

FINANCES

How ready is China to finance water-related climate action?

China has ramped up its national investment in water resources management and environmental protection as it seeks to build an 'ecological civilisation'. International climate finance remains small in comparison to domestic financing, but may have an important role to play in piloting international best practice in key areas (such as flood management, groundwater conservation/protection, and the definition of water rights). Climate finance within China is still skewed towards mitigation over adaptation.

China has not depended on international aid to fuel its economic growth and poverty alleviation efforts. The Chinese economy is now worth around **US$20 trillion**, and the government has proved adept at shifting spending priorities in line with its five-year plans, especially over the last ten years, to support environmentally sustainable development. In 2017 alone, China invested more than RMB 717.6 billion (roughly US$104 billion equivalent) to deal with a range of water scarcity, flooding, and water pollution issues.[45]

As the organisation China Water Risk (CWR) notes, **climate finance in China** is skewed towards mitigation rather than adaptation, and this leaves assets vulnerable to the inevitable impacts of climate change. The recent developments described in this brief illustrate that a multitude of adaptation activities are under way and many more are planned. **China's Green Bonds market** has grown in recent years to become the second largest Green Bonds market globally, which reflects the central government's mandate of a nationwide push for the greening of the financial system in China as part of the 13th FYP. Reporting from mid-2020 by the organisation Climate Policy Initiative shows that the focus of this internal funding remains on the energy transition, with hydropower being the one water-related domain well funded by the issuance of Green Bonds. There are many opportunities for innovative funding of adaptation measures.[16, 21]

China has a history of using modest amounts of **bilateral and multilateral funding** to pilot technical, economic, and regulatory innovations, in keeping with its 'learning by doing' approach to water sector reform. Examples include:

- the use of World Bank funding to pilot irrigation reforms in Xinjiang, which were aimed at reducing the consumptive use of water (via control of evapotranspiration)
- SDC support for combined groundwater management, modelling, and climate change activities on the North China Plain.[10, 41]

These projects show that **international climate financing** can support water-related climate adaptation, but in order to prioritise water, the MWR and other water-related

[1] See http://www.lmcchina.org/eng/index.html
[2] See http://www.lmcwater.org.cn/

ministries will need to work with the Ministry of Finance to formulate strong, fundable proposals. (The national contact points for two of the largest climate funds, namely the Green Climate Fund (GCF) and the Global Environment Facility (GEF), remain with the Ministry of Finance; by comparison, the Adaptation Fund's contact point in China is in the NDRC.)

Looking more broadly at **bilateral and multilateral finance** tagged as climate-related, the water sector spent roughly US$1.25 billion, some 13% of total climate-related commitments. Out of the US$1.25 billion investment in water-related components, the largest commitment (approximately 30%) was earmarked for flood prevention and control.[28]

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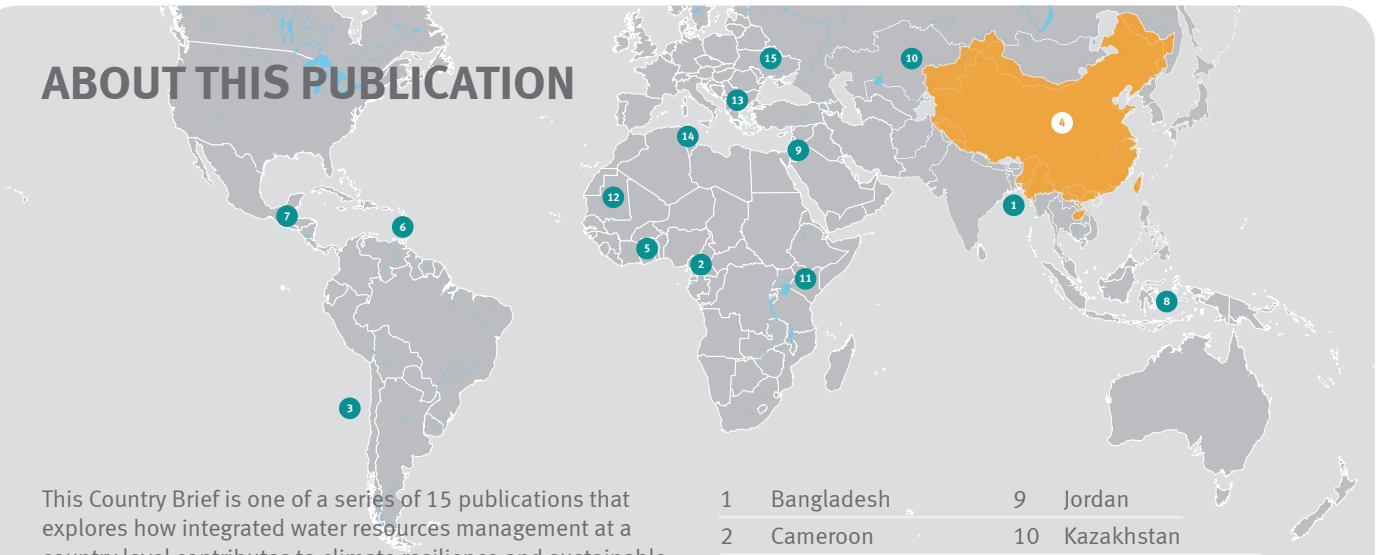

This Country Brief is one of a series of 15 publications that explores how integrated water resources management at a country level contributes to climate resilience and sustainable development, as well as meeting the commitments under the Paris Agreement and achieving the Sustainable Development Goals (SDGs).

The full synthesis report, The Untold Story of Water in Climate Adaptation. Part II. 15 Countries Speak, of the work undertaken in all 15 countries is available at www.gwp.org.

1	Bangladesh	9	Jordan
2	Cameroon	10	Kazakhstan
3	Chile	11	Kenya
4	**China**	12	Mauritania
5	Ghana	13	North Macedonia
6	Grenada	14	Tunisia
7	Guatemala	15	Ukraine
8	Indonesia		

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