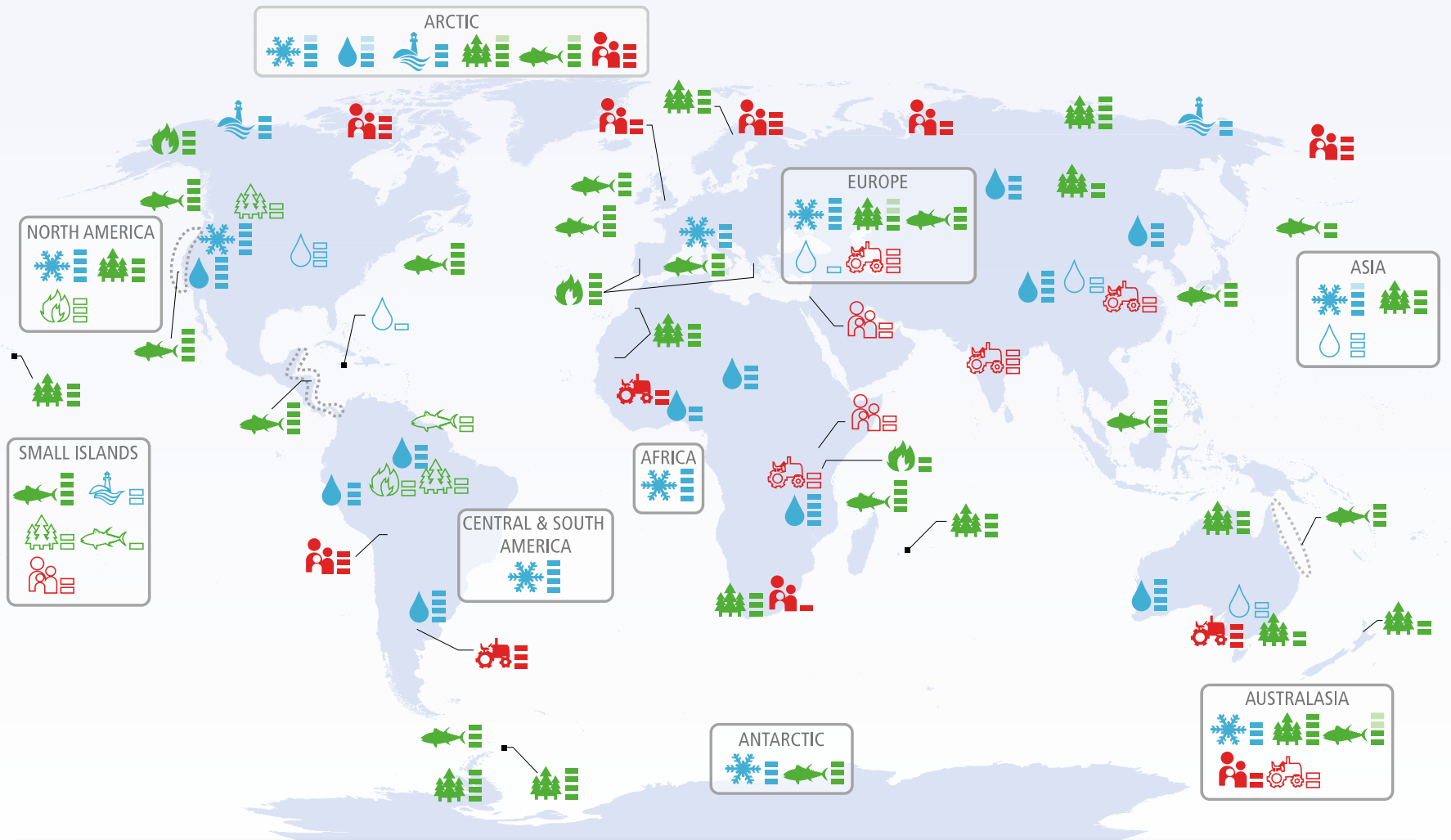
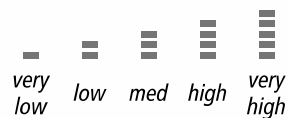


CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY





Confidence in attribution to climate change



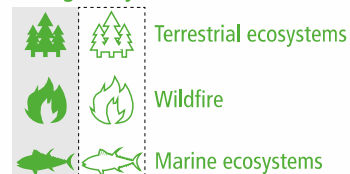
indicates confidence range

Observed impacts attributed to climate change for

Physical systems



Biological systems



Human and managed systems



Regional-scale impacts

Outlined symbols = Minor contribution of climate change
Filled symbols = Major contribution of climate change

An underwater photograph of a coral reef. The water is a deep, murky green. In the foreground, there is a dense, textured coral reef with various types of coral, including some that appear bleached or dead. A single, prominent, fan-shaped coral structure is visible in the center. The background shows more coral and the surface of the water with some light filtering through.

WIDESPREAD OBSERVED IMPACTS

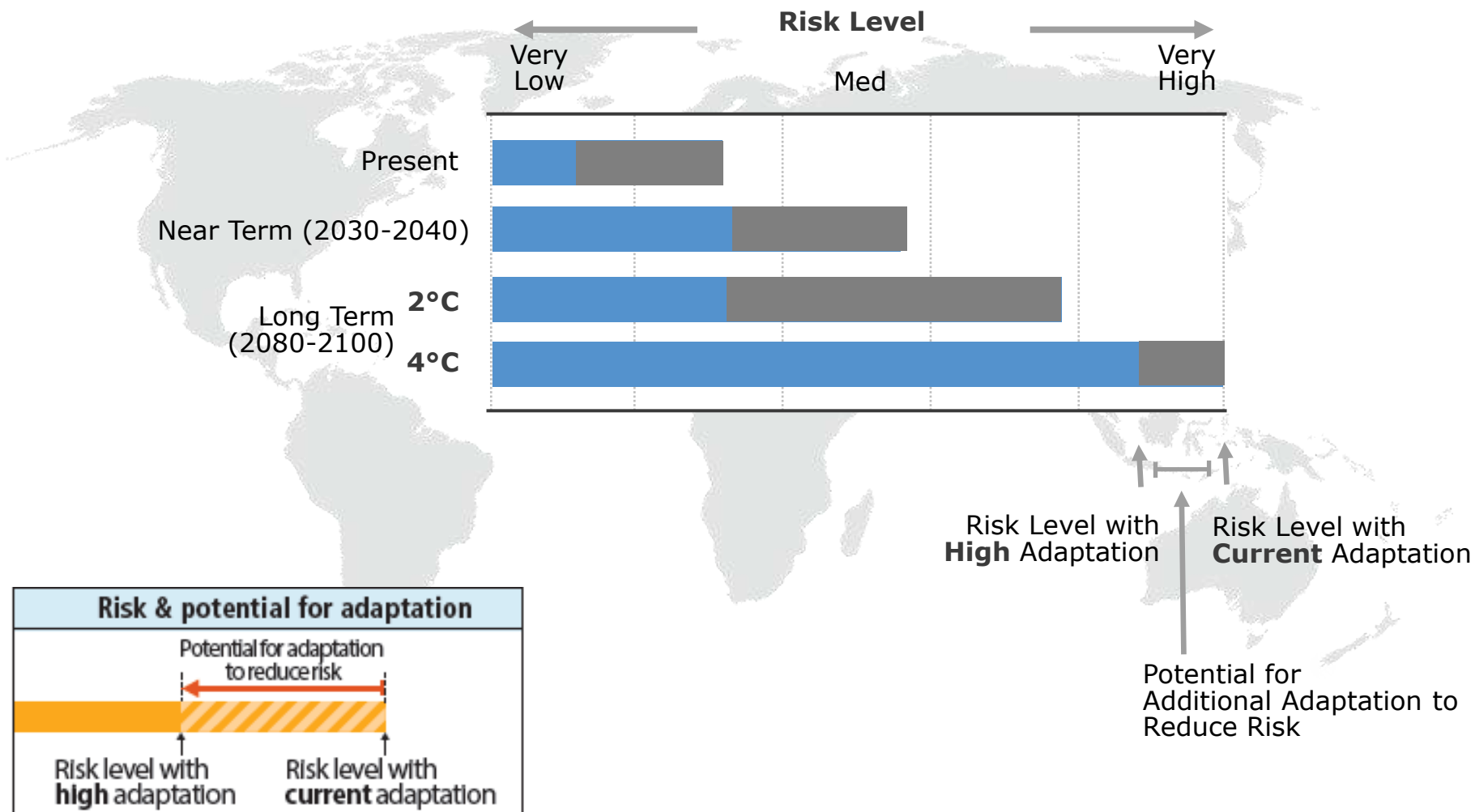
A CHANGING WORLD



CLIMATE CHANGE

REDUCING AND MANAGING RISKS

Assessing risk



Asia

Coordinating Lead Authors:

Yasuaki Hijioka (Japan), Erda Lin (China), Joy Jacqueline Pereira (Malaysia)

Lead Authors:

Richard T. Corlett (China), Xuefeng Cui (China), Gregory Insarov (Russian Federation), Rodel Lasco (Philippines), Elisabet Lindgren (Sweden), Akhilesh Surjan (India)

Contributing Authors:

Elena M. Aizen (USA), Vladimir B. Aizen (USA), Rawshan Ara Begum (Bangladesh), Kenshi Baba (Japan), Monalisa Chatterjee (USA/India), J. Graham Cogley (Canada), Noah Diffenbaugh (USA), Li Ding (Singapore), Qingxian Gao (China), Matthias Garschagen (Germany), Masahiro Hashizume (Japan), Manmohan Kapshe (India), Andrey G. Kostianoy (Russia), Kathleen McInnes (Australia), Sreeja Nair (India), S.V.R.K. Prabhakar (India), Yoshiki Saito (Japan), Andreas Schaffer (Singapore), Rajib Shaw (Japan), Dáithí Stone (Canada/South Africa /USA), Reiner Wassman (Philippines), Thomas J. Wilbanks (USA), Shaohong Wu (China)

Review Editors:

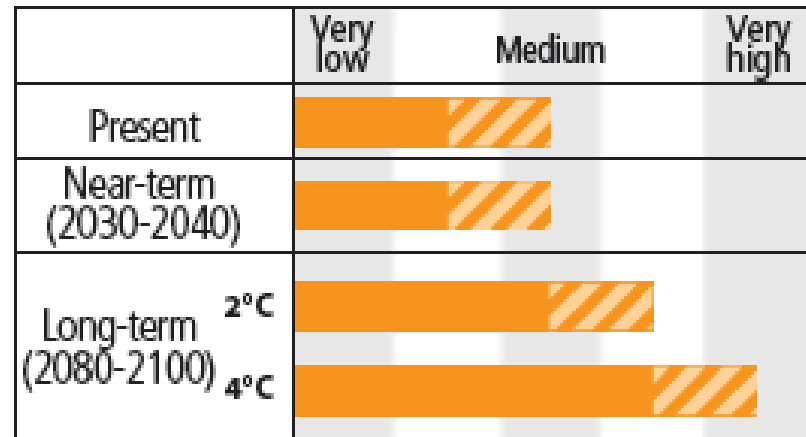
Rosa Perez (Philippines), Kazuhiko Takeuchi (Japan)

Volunteer Chapter Scientists:

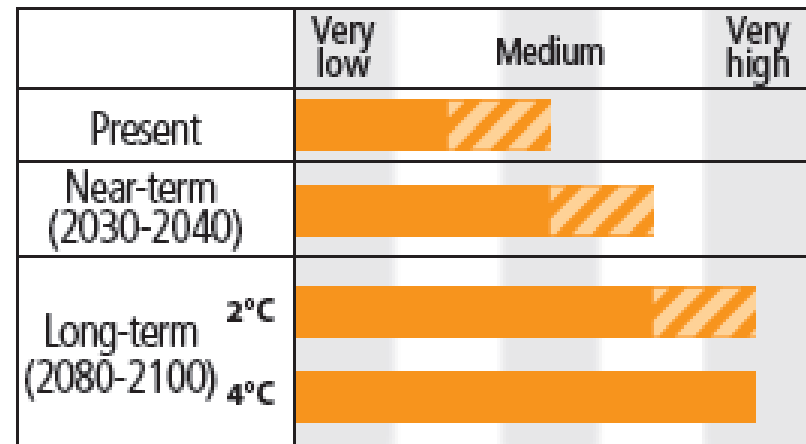
Yuko Onishi (Japan), Wen Wang (China)

Key Risks in Asia

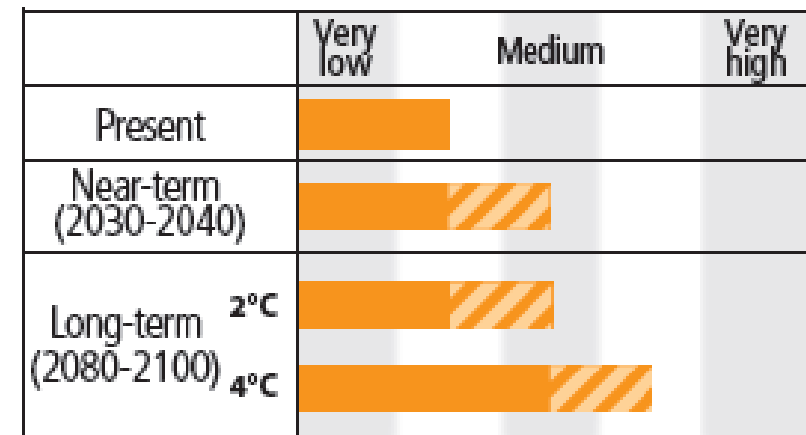
Increased coastal, riverine and urban flooding leading to widespread damage to infrastructure and settlements in Asia (medium confidence)



Increased risk of heat-related mortality (high confidence)



Increased risk of drought-related water and food shortage causing malnutrition (high confidence)

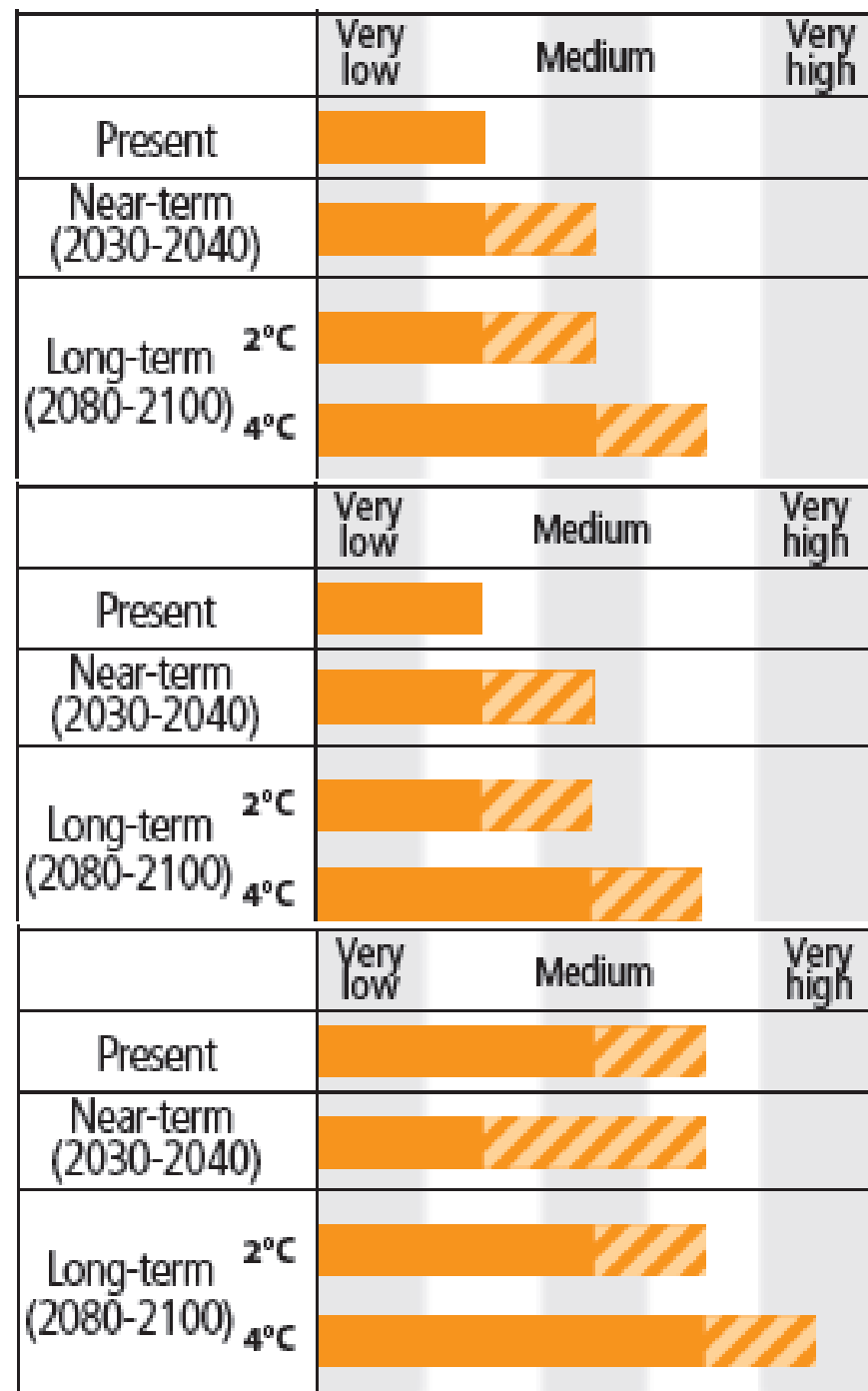


Key Risks in Asia

Increased risk of flood-related deaths, injuries, infectious diseases and mental disorders (medium confidence)

Increased risk of water and vector-borne diseases (medium confidence)

Exacerbated poverty, inequalities and new vulnerabilities (high confidence)



Key Risks in Asia

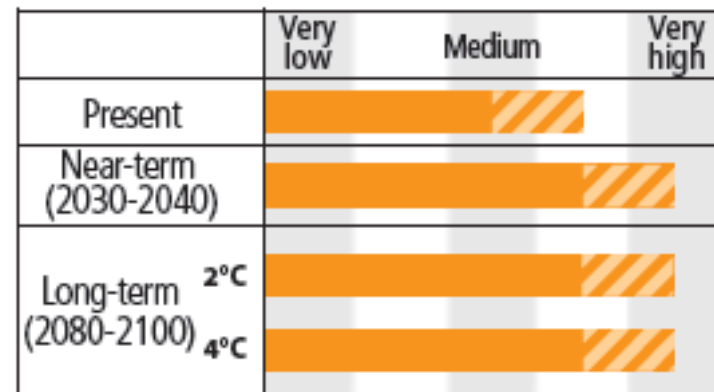
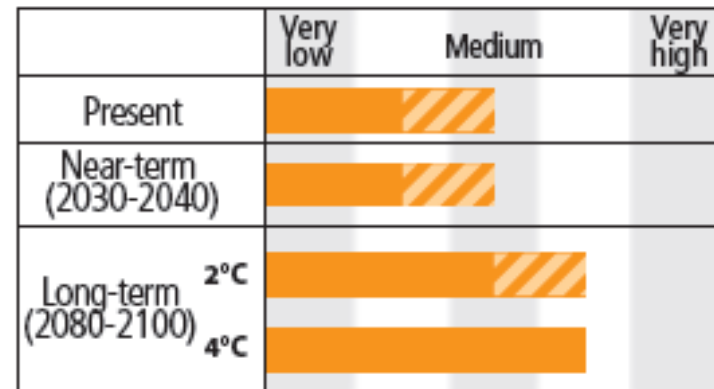
Increased risk of crop failure and lower crop production could lead to food insecurity in Asia (medium confidence)

Water shortage in arid areas of Asia (medium confidence)

KEY CONCLUSIONS: IPCC-WG2

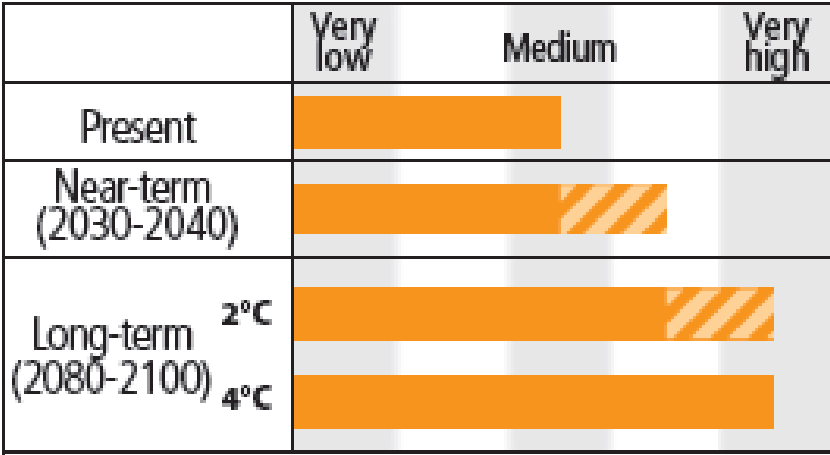
Chapter 24, Asia

- ❑ Water scarcity is expected to be a major challenge for most of the region due to increased water demand and lack of good management (*medium confidence*)
- ❑ There is *low confidence* in future precipitation projections at a sub-regional scale and thus in future freshwater availability in most parts of Asia.
- ❑ Integrated water management strategies could help adapt to climate change, including developing water saving technologies, increasing water productivity, and water reuse.

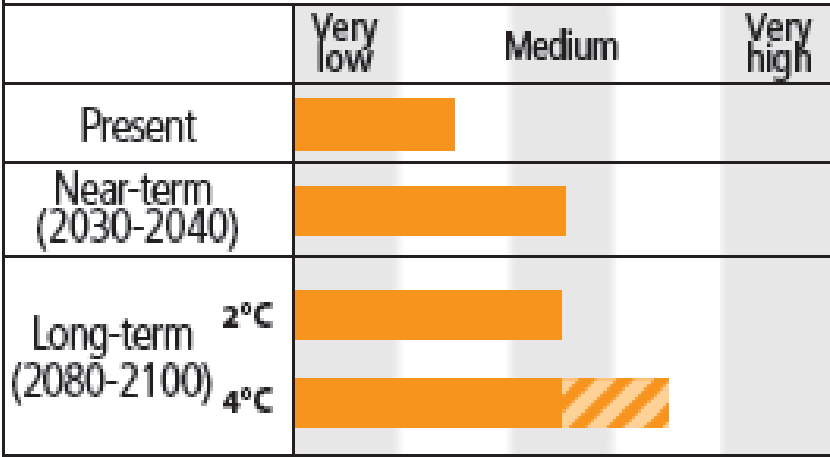


Key Risks in Asia

Coral reef decline in Asia (high confidence)



Mountain-top extinctions in Asia (high confidence)



Adaptation is already occurring

- 
- Combining Traditional and Scientific Knowledge
 - Adapting Communications Infrastructure
 - Coastal & Water Management
 - Environmental Protection & Land Planning
 - Disaster Risk Management
 - Development Planning
 - Early Warning Systems
 - Mangrove Reforestation
 - Water Resources Management
 - Disaster Risk Management
 - Basic Public Health
 - Livelihood Diversification
 - Ecosystem-Based Adaptation
 - Water Resources Management
 - Resilient Crop Varieties
 - Planning for Sea-Level Rise
 - Planning for Reduced Water Availability
 - International Cooperation
 - Marine Spatial Planning
 - Municipal-Level Actions
 - Adapting Energy & Public Infrastructure

Effective risk management and adaptation are tailored to local and regional needs and circumstances

- Changes in climate extremes vary across regions
- Each region has unique vulnerabilities and exposure to hazards
- Effective risk management and adaptation address the factors contributing to exposure and vulnerability



Source: IPCC, 2012

ipcc
INTERGOVERNMENTAL PANEL ON climate change

Observations of Past Events

Climate Phenomenon	Asia	Southeast Asia
Heat Waves	It is likely that the frequency of heat waves has increased in large parts of Asia.	No Specific Observations (published in peer reviewed literature)
Drought	There is medium confidence that more megadroughts occurred in monsoon Asia and wetter conditions prevailed in arid Central Asia monsoon region during the Little Ice Age (1450–1850) compared to the Medieval Climate Anomaly (950–1250).	No Specific Observations (published in peer reviewed literature)
Floods	With high confidence, past floods larger than recorded since the 20th century occurred during the past five centuries in eastern Asia. There is medium confidence that in the Near East and India modern large floods are comparable or surpass historical floods in magnitude and/or frequency.	No Specific Observations (published in peer reviewed literature)

Future Projections

Source: IPCC, 2013

Climate Phenomenon	Asia	Southeast Asia
Precipitation	Future increase in precipitation extremes related to the monsoon is very likely in East Asia, South Asia and Southeast Asia.	Future increase in precipitation extremes related to the monsoon is very likely in Southeast Asia.
	Indian monsoon rainfall is projected to increase. For the East Asian summer monsoon, both monsoon circulation and rainfall are projected to increase.	There is low confidence in projections of future changes in the Madden-Julian Oscillation due to the poor skill in model simulations of this intraseasonal phenomenon and the sensitivity to ocean warming patterns. Future projections of regional climate extremes in Southeast Asia are therefore of low confidence.
		Reduced precipitation in Indonesia in Jul-Oct due to pattern of Indian Ocean warming (RCP 4.5 or higher end scenarios)
El Niño-Southern Oscillation	Natural modulations of the variance and spatial pattern of El Niño-Southern Oscillation are so large that confidence in any projected change for the 21 st century remains low. Confidence is low in changes in climate impacts for most of Asia.	Low Confidence in any projected change for the 21 st century.

Chapter 24, Asia: Coverage of Information

Sector	Topics/issues	North Asia		East Asia		Southeast Asia		South Asia		Central Asia		West Asia	
	O = Observed impacts, P = Projected Impacts	O	P	O	P	O	P	O	P	O	P	O	P
Freshwater resources	Major river runoff	/	x	/	/	/	/	/	x	x	x	x	x
	Water supply	x	x	x	x	x	x	x	x	x	x	x	x
Terrestrial and inland water systems	Phenology and growth rates	/	/	/	/	x	x	x	x	x	x	x	x
	Distributions of species and biomes	/	/	/	/	x	x	x	/	x	x	x	x
	Permafrost	/	/	/	/	/	x	/	/	/	/	/	x
	Inland waters	x	x	/	x	x	x	x	x	x	x	x	x
Coastal systems and low-lying areas	Coral reefs	NR	NR	/	/	/	/	/	/	NR	NR	/	/
	Other coastal ecosystems	x	x	/	/	x	x	x	x	NR	NR	x	x
	Arctic coast erosion	/	/	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Food production systems and food security	Rice yield	x	x	/	/	x	/	x	/	x	x	x	/
	Wheat yield	x	x	x	x	x	x	x	/	x	x	/	/
	Corn yield	x	x	x	/	x	x	x	x	x	x	x	x
	Other crops (e.g., barley, potato)	x	x	/	/	x	x	x	x	x	x	/	/
	Vegetables	x	x	/	x	x	x	x	x	x	x	x	x
	Fruits	x	x	/	x	x	x	x	x	x	x	x	x
	Livestock	x	x	/	x	x	x	x	x	x	x	x	x
	Fisheries and aquaculture production	x	/	x	/	x	/	x	x	x	x	x	x
	Farming area	x	/	x	/	x	x	x	/	x	/	x	x
	Water demand for irrigation	x	/	x	/	x	x	x	/	x	x	x	x
	Pest and disease occurrence	x	x	x	x	x	x	x	/	x	x	x	x
Human settlements, industry, and infrastructure	Floodplains	x	x	/	/	/	/	/	/	x	x	x	x
	Coastal areas	x	x	/	/	/	/	/	/	NR	NR	x	x
	Population and assets	x	x	/	/	/	/	/	/	x	x	x	x
	Industry and Infrastructure	x	x	/	/	/	/	/	/	x	x	x	x
Human health, security, livelihoods, and poverty	Health effects of floods	x	x	x	x	x	x	/	x	x	x	x	x
	Health effects of heat	x	x	/	x	x	x	x	x	x	x	x	x
	Health effects of drought	x	x	x	x	x	x	x	x	x	x	x	x
	Water-borne diseases	x	x	x	x	/	x	/	x	x	x	x	x
	Vector-borne diseases	x	x	x	x	/	x	/	x	x	x	x	x
	Livelihoods and poverty	x	x	/	x	x	x	/	x	x	x	x	x
	Economic valuation	x	x	x	x	/	/	/	/	x	x	x	x

Vulnerability in Cambodia, Lao PDR and Thailand

ENHANCING LOCAL LEVEL CLIMATE CHANGE ADAPTATION IN SOUTHEAST ASIA (PHASE 1)

(ENV/DIS/12/008/REG)



FINAL REPORT
29 JUNE 2016

Figure 5: National Vulnerability Index



Source: Open Development, 2013

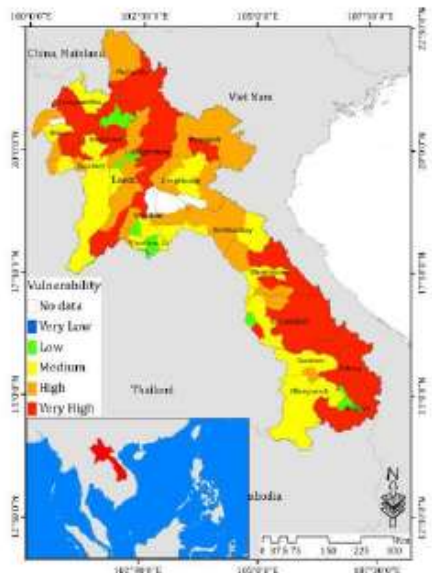


Figure 15. Vulnerability level of districts in Lao PDR by RIZALDI BOER, ADI RAKHMAN AND AHMAD FAQIH

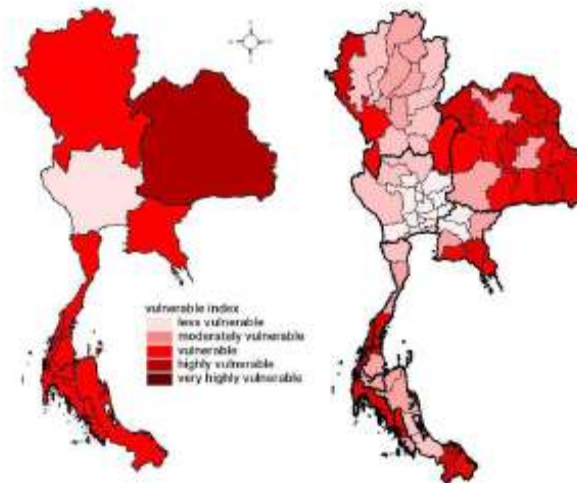


Fig. 9 Regional and provincial vulnerability to climate change in Thailand (Prasertsak, 2011)