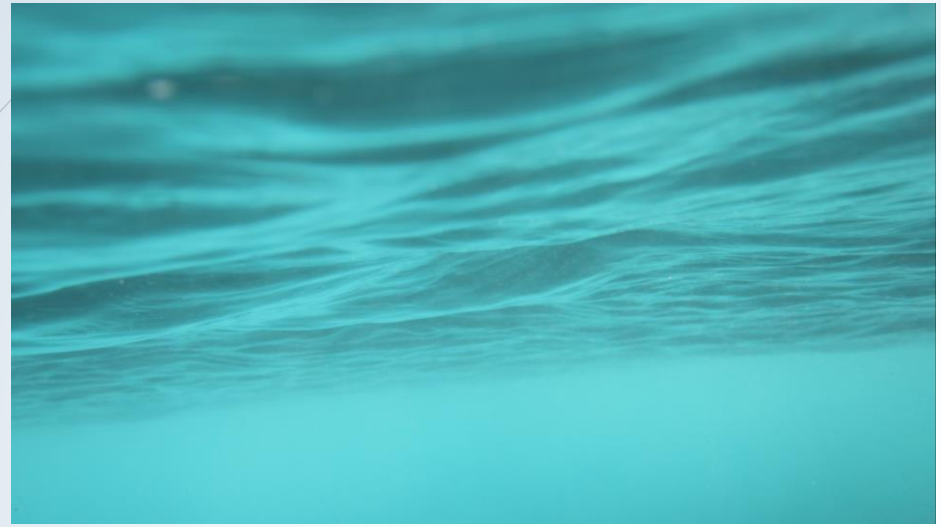

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An Integrated Framework for Examining Groundwater Vulnerability in the Mekong River Delta

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Contributors:
Authors, Sponsors, and Cooperators

- USGS Authors: K.A. Powlen, S. Haider, K.W. Davis, S. Shah, N. Burkardt, S.S. Romañach, M.E. Andersen
- Sponsor: US Department of State
- Cooperators: Arizona State University, Can Tho University, Institute de Technologie du Cambodge, US Army Corps of Engineers, Mekong River Commission

Groundwater in the Mekong River Delta

- Externally impacted
  - Climate changes
  - Development
- Locally Over-utilized
- Multiple physical impacts
  - Reduced availability
  - Land subsidence
  - Saltwater intrusion

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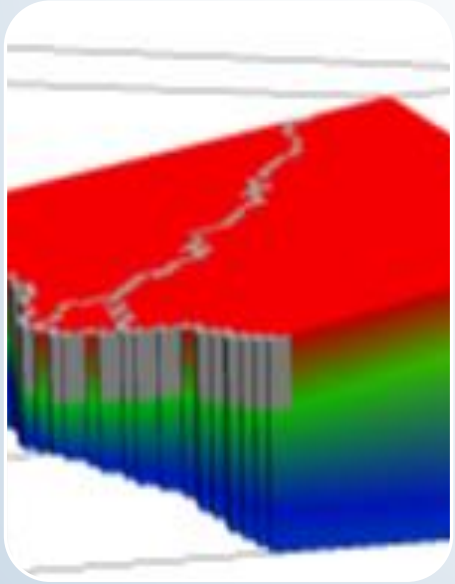
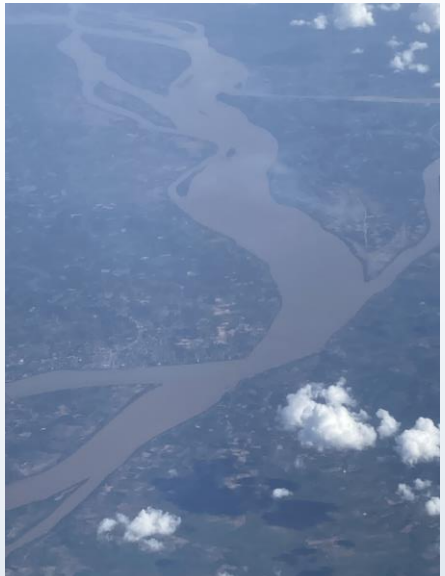
Groundwater Management and Socioeconomic Vulnerability Inputs

- MODFLOW 6
  Groundwater model
- Water Demands Data
- Socio-economic Data





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Stress Response: Socioeconomic Vulnerability to Groundwater Change

MODFLOW Groundwater model

- 20-year baseline
- 20 years of climate change

Water Demand

- Domestic and livelihood water needs

Socio-economic Data

- Adaptive capacity

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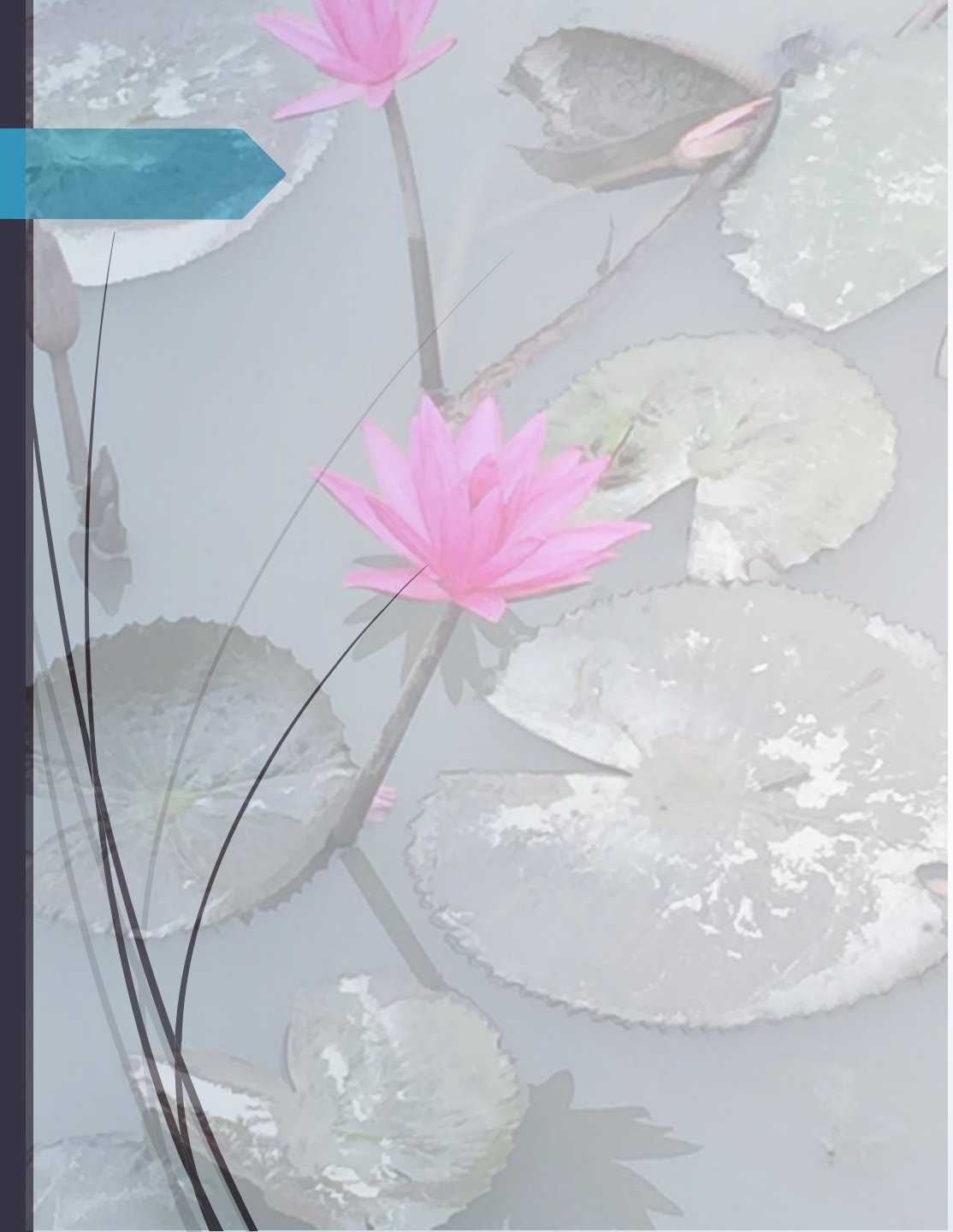

Vulnerability Summary

- Climate stress can affect groundwater availability
- Risk of groundwater stress is not uniform
- Exposure and sensitivity may vary independently
- Adaptation capacity is variable

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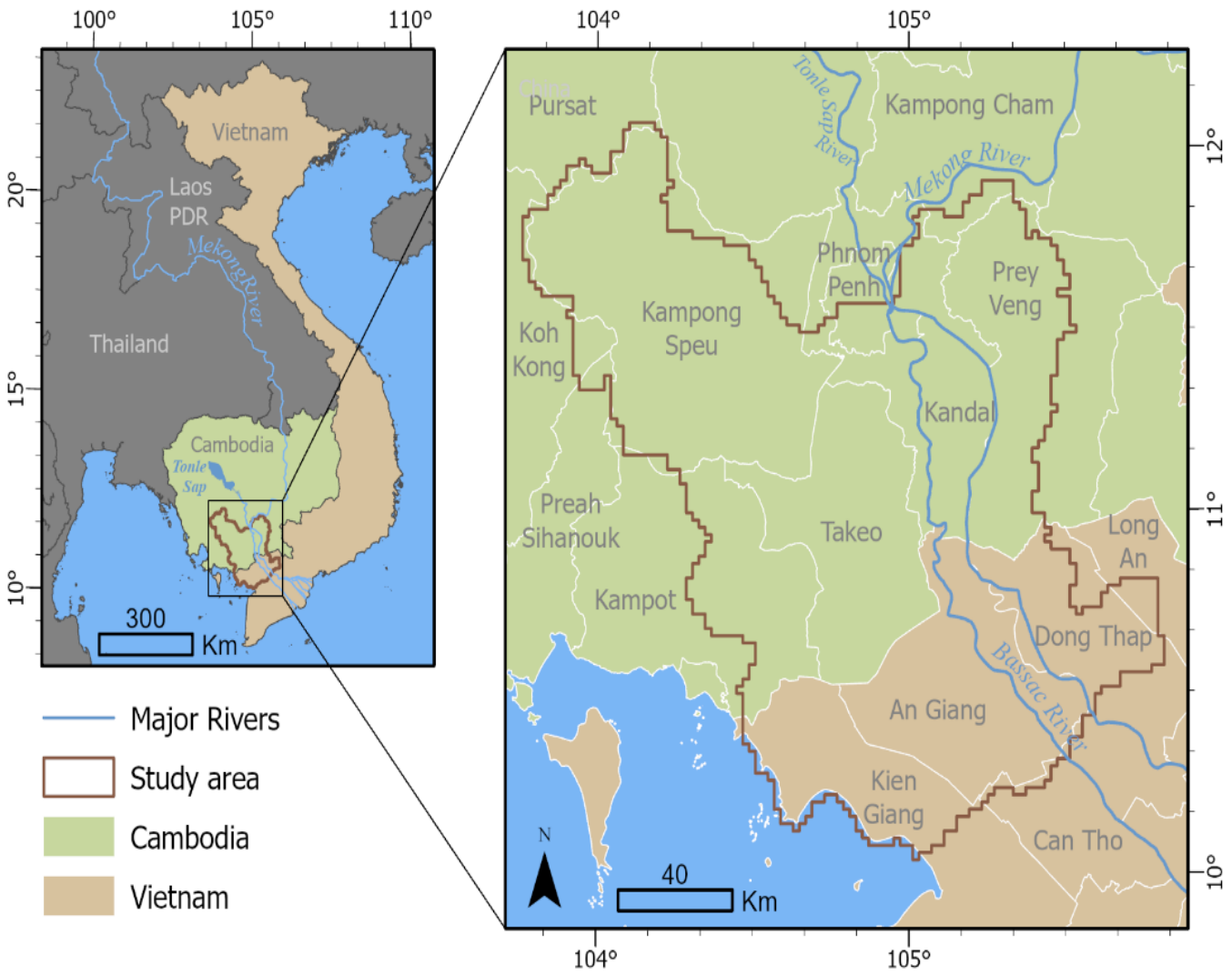
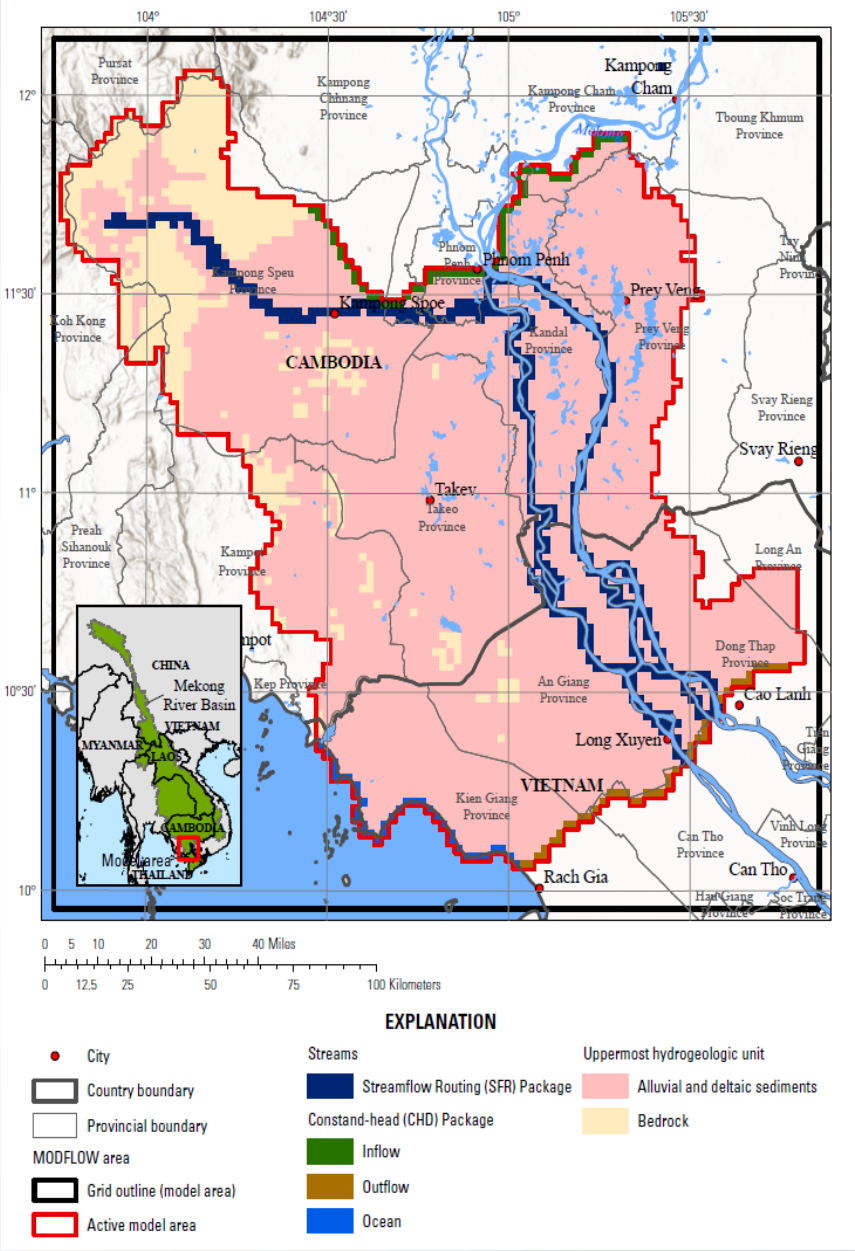
Study Area


100°
105°
110°
20°
15°
10°
Vietnam
Laos PDR
Mekong River
Thailand
Cambodia
Tonle Sap
300
Km
Major Rivers
Study area
Cambodia
Vietnam
104°
105°
12°
11°
10°
Pursat
Tonle Sap River
Kampong Cham
Mekong River
Phnom Penh
Prey Veng
Koh Kong
Kampong Speu
Kandal
Preah Sihanouk
Takeo
Long An
Kampot
Dong Thap
Bassac River
An Giang
Kien Giang
Can Tho
N
40
Km

Proof-of-concept MODFLOW 6 model

- 20-year baseline
- Based on limited groundwater data
  - Mapped surface geology
  - Limited well logs support qualitative assessment
  - Smaller domain models



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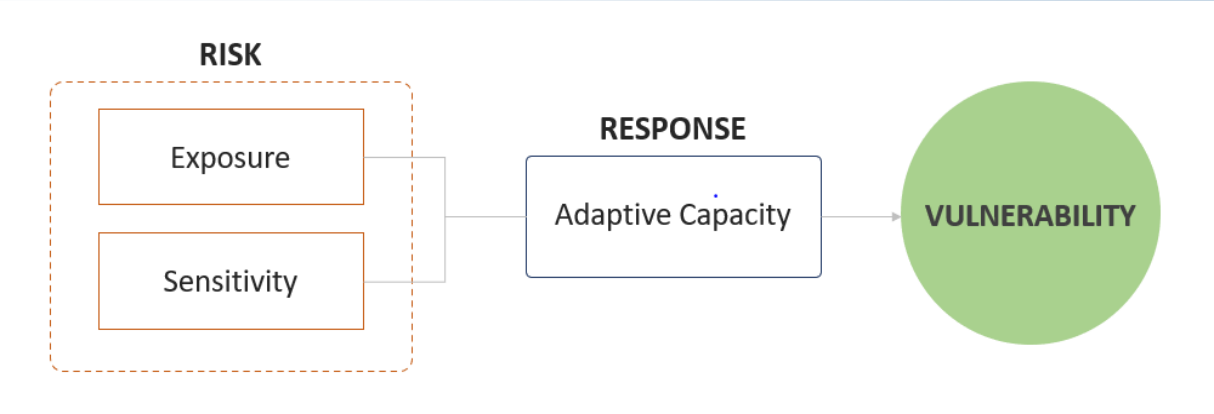
Vulnerability (IPCC, 2007)

- Risk
  - Exposure: the degree to which a system or population will experience change
  - Sensitivity: The degree to which the population is affected by that change
- Response
  - Adaptive Capacity: Ability to absorb or adapt to change



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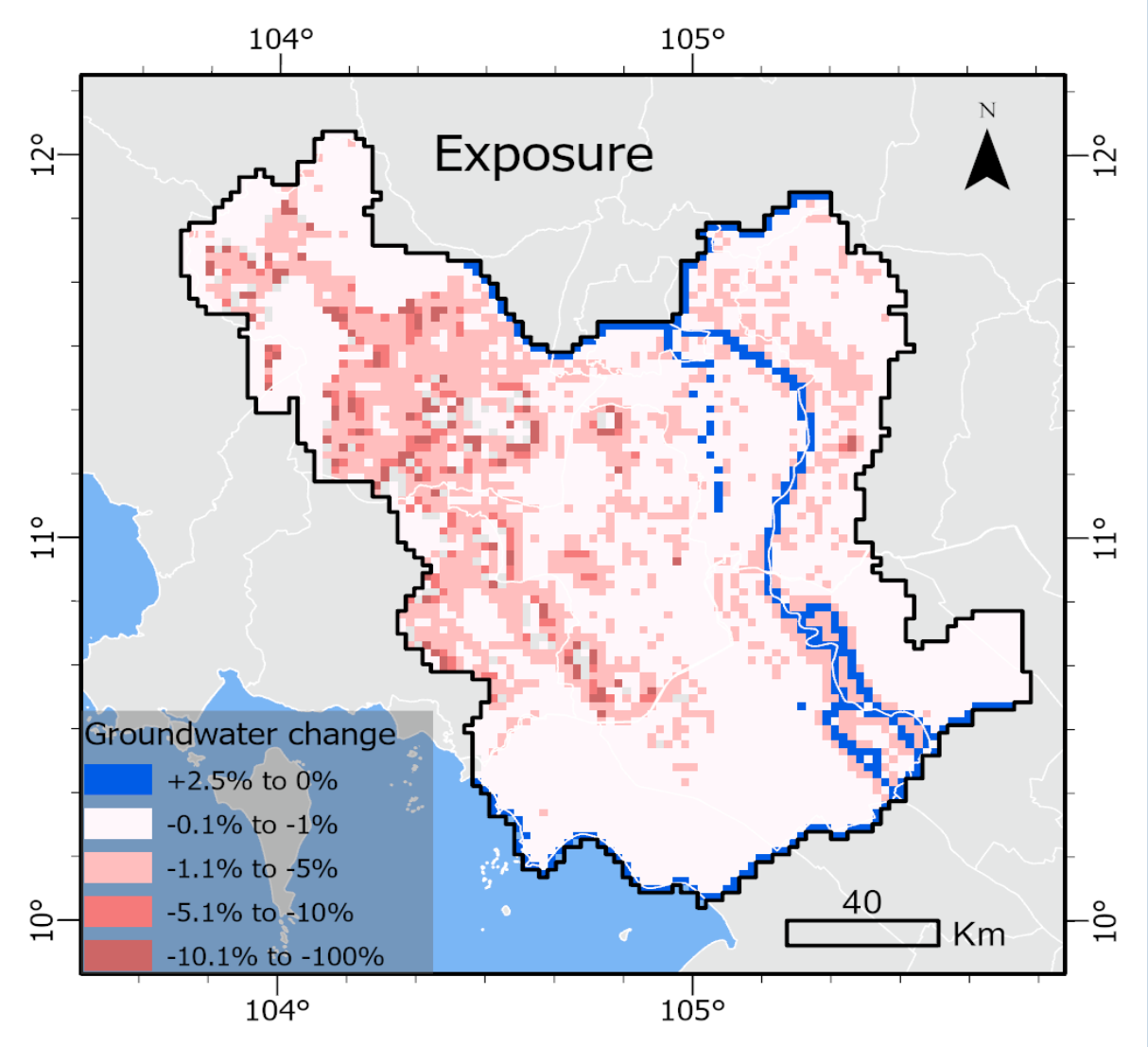
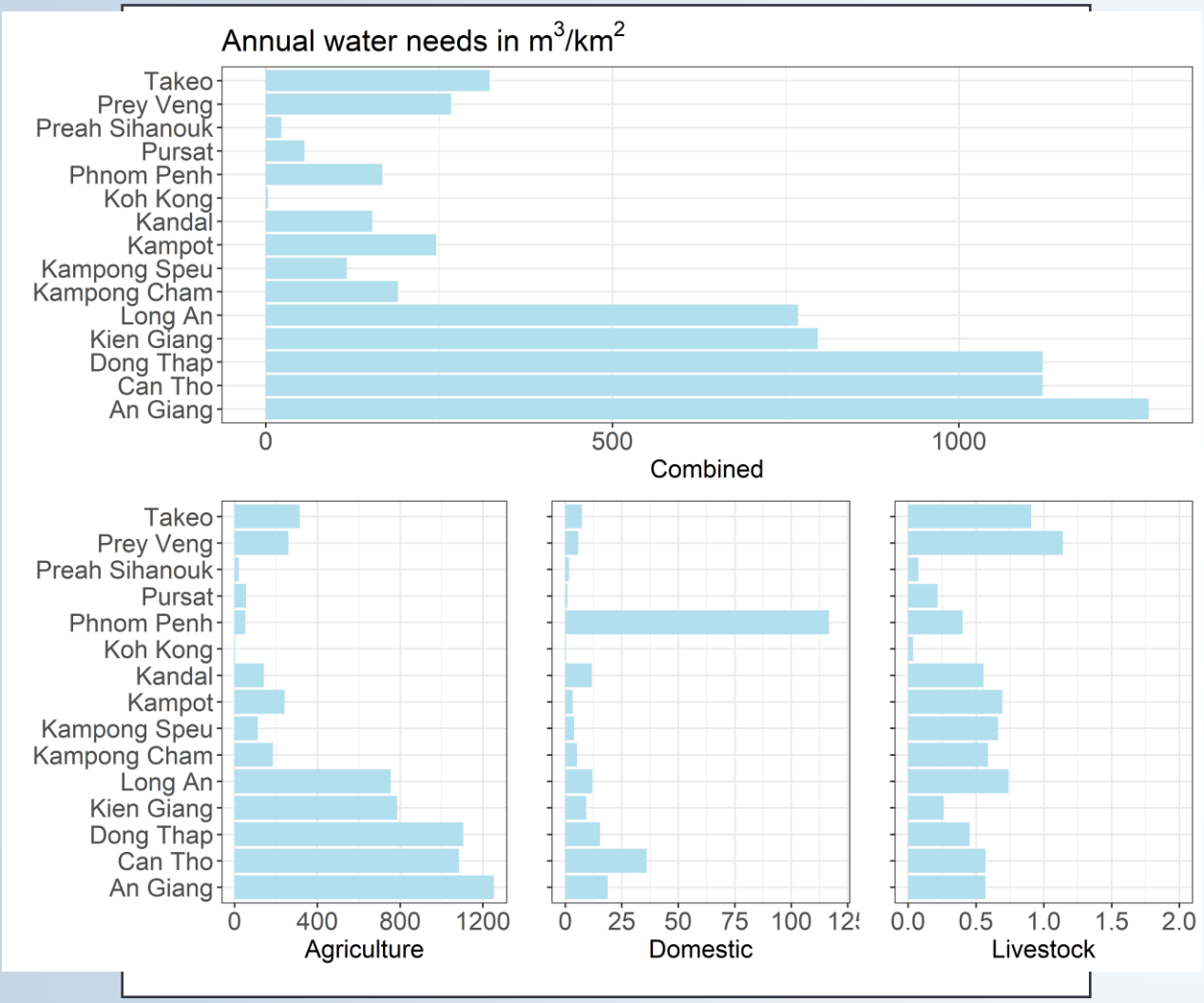
Exposure to Groundwater Stress

Percent change under Council Study C3 climate scenario over 20 years





Publicly available data

Sensitivity: Sector Water Use

Publicly available data

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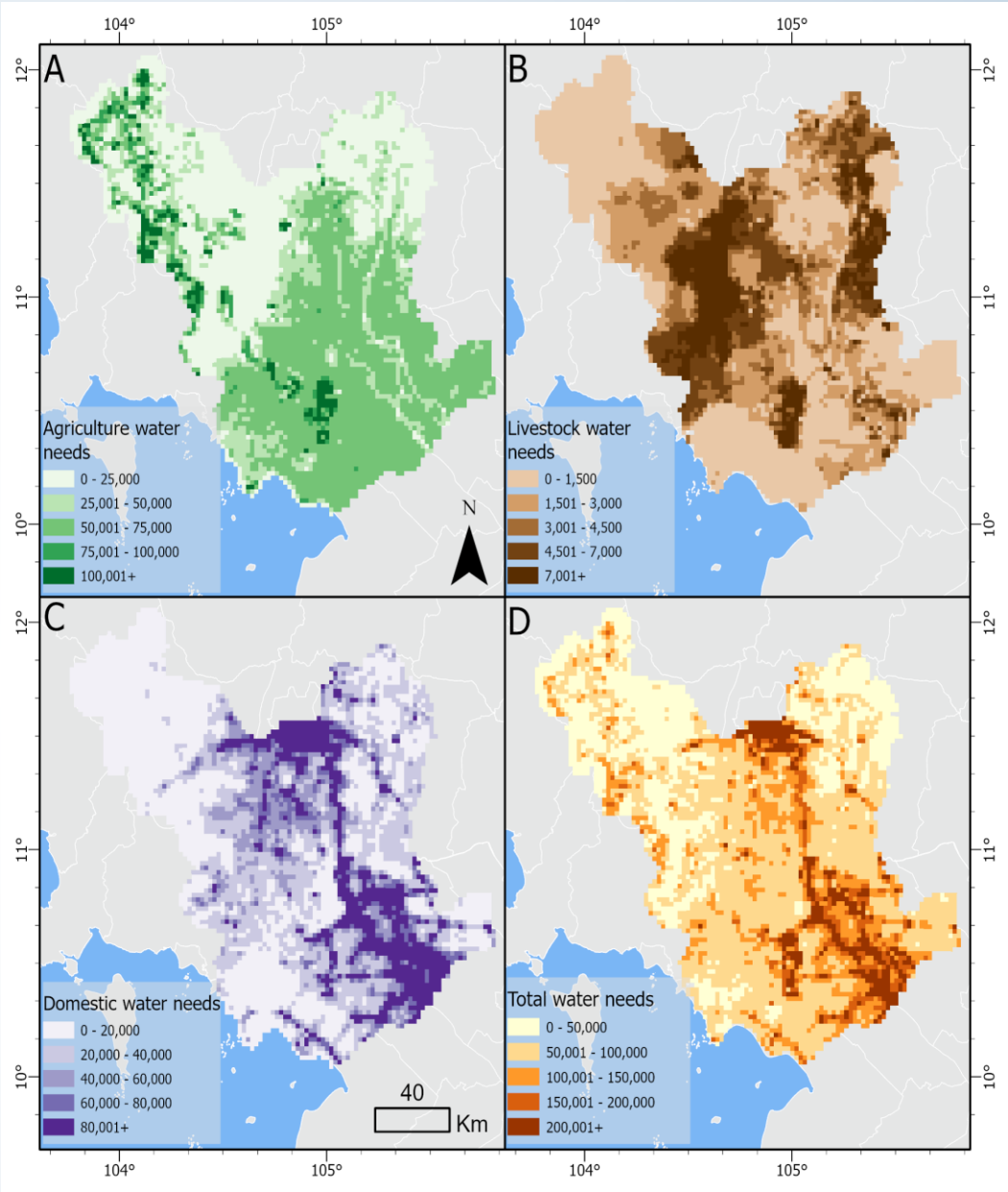
Sensitivity: Water Demand for Agriculture, Livestock, Domestic

Publicly available data



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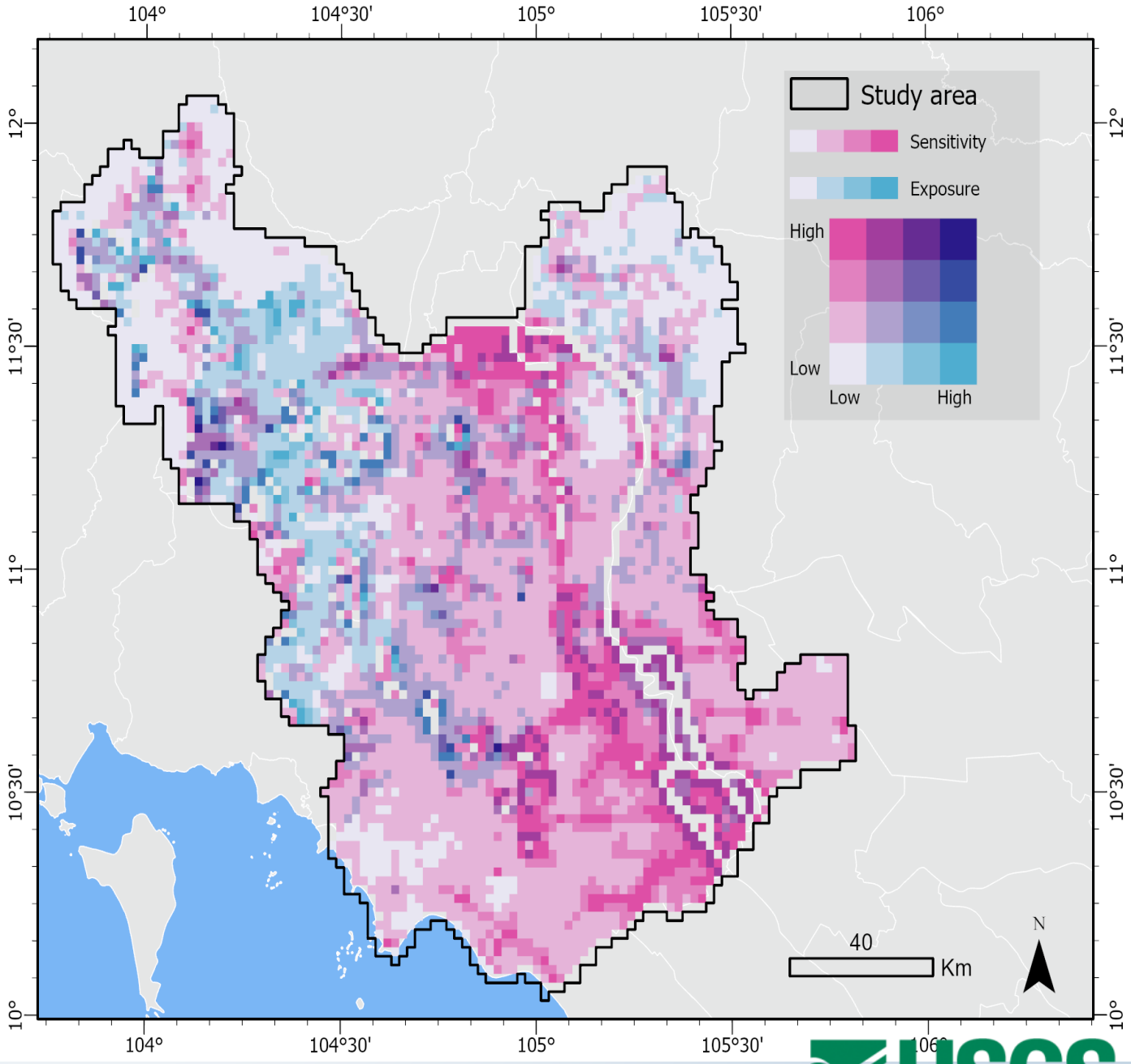
Vulnerability (Risk)

Pink: Sensitivity, total water needs

Blue: Exposure, MODFLOW 6 outputs

Purple: Highest risk of water stress



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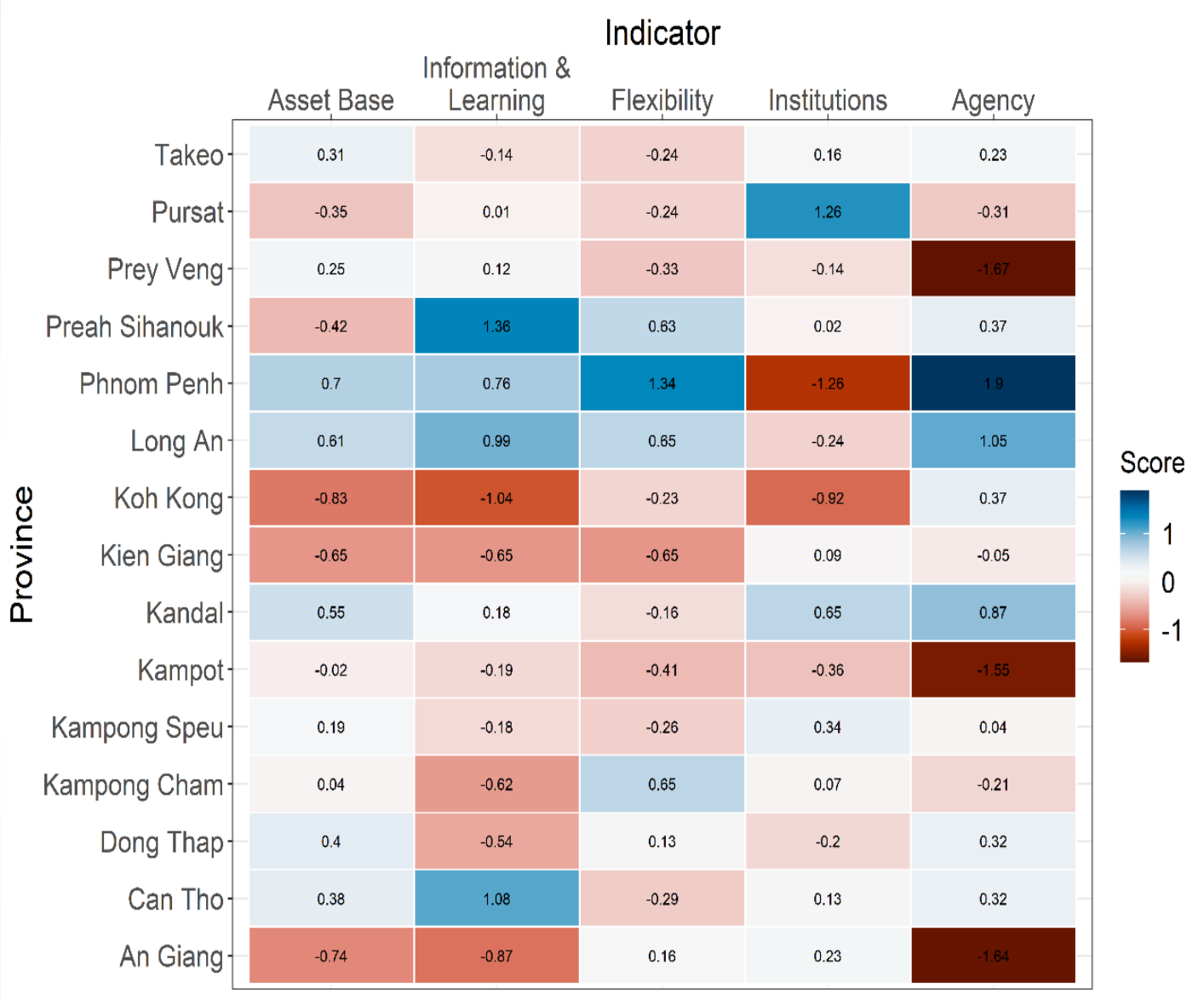
Adaptive Capacity (Response)

Publicly available data



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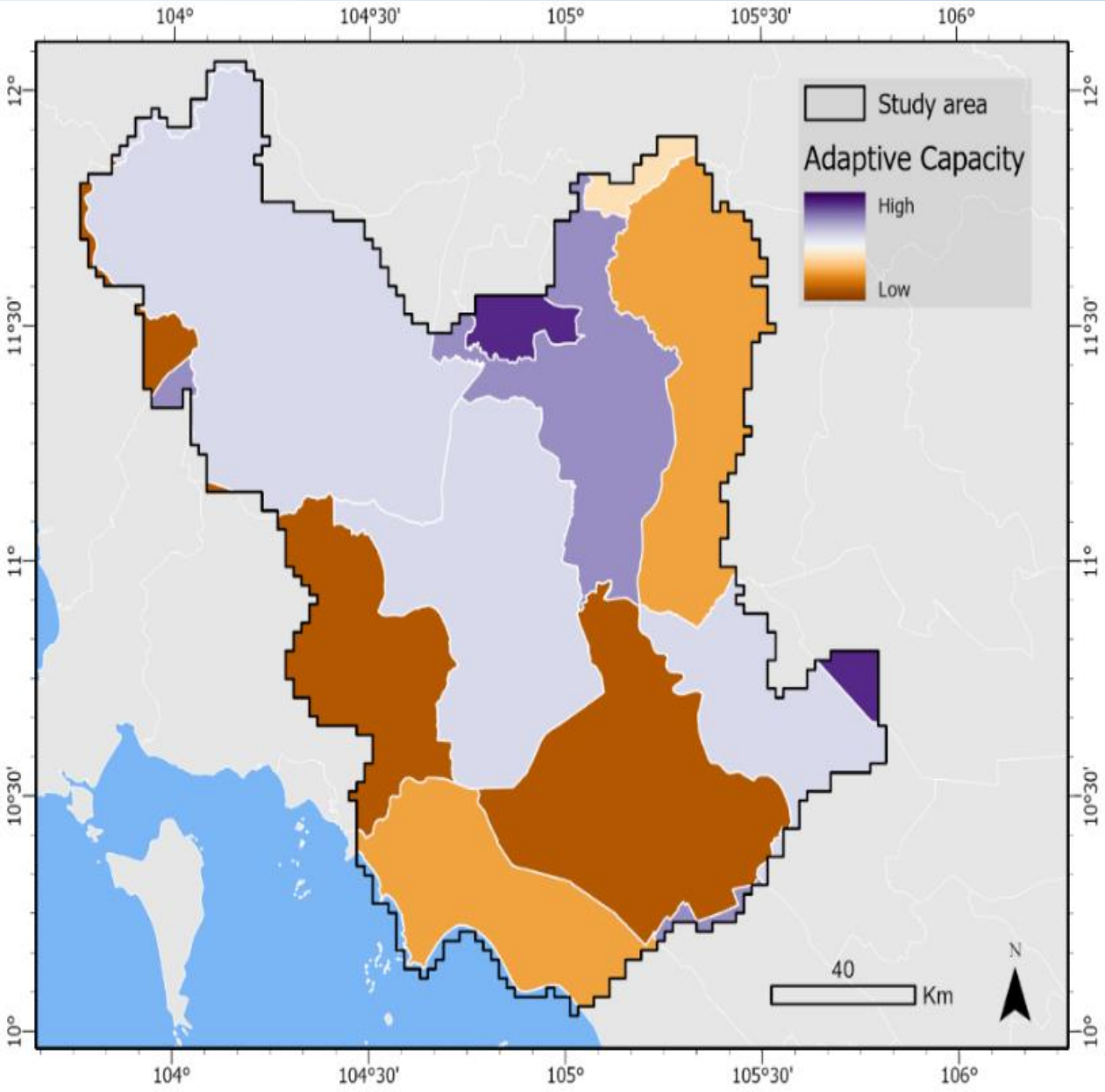
Adaptive Capacity Summary Map



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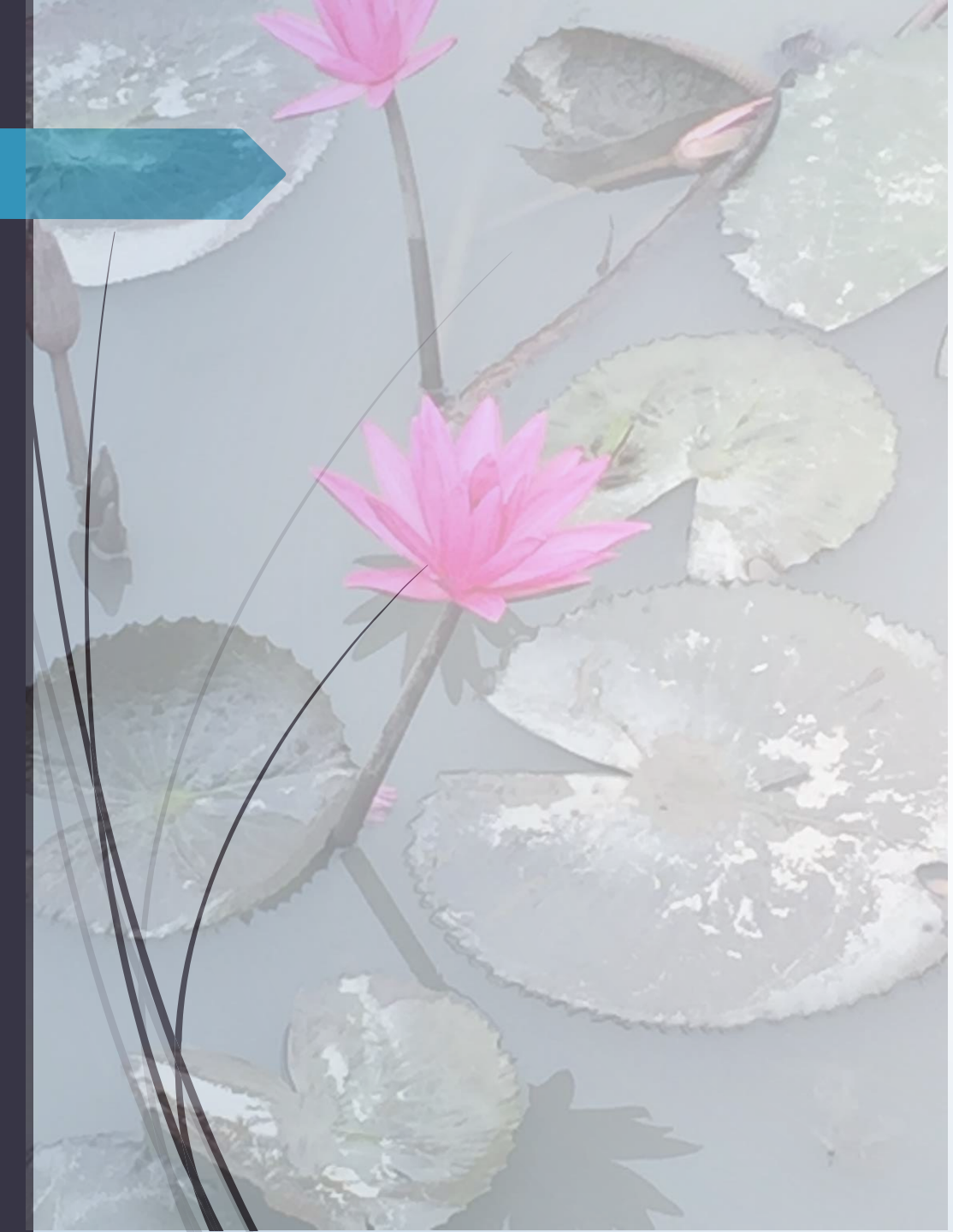

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