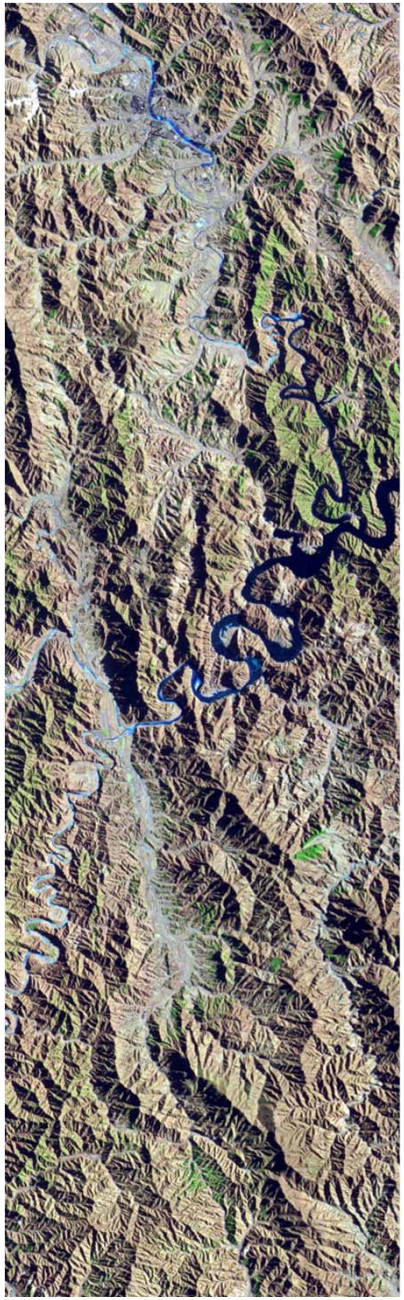
University of Glasgow

Sustainable Development Goals interlinkages analysis: adapting a tool for sub-national assessment in China



Fabrice Renaud, Brian Barrett, Jiren Xu, Xin Zhou, Qiuhua Liang, Trevor Hoey, Suiliang Huang, Lee Bosher, Xilin Xia, Jiaheng Zhao, Mustafa Moinuddin

Seminar Aalto University|20.02.2020 | Helsinki, Finland

Nankai University 南開大學 | Loughborough University | IGES | SDGs Aspiration to Action | NERC Science of the Environment | NSFC | 国家自然科学基金委员会 National Natural Science Foundation of China | JST Japan Science and Technology Agency

INTRODUCTION TO THE PROJECT

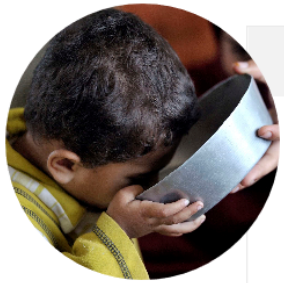
Synergies and Trade-offs between SDGs

Environmental Hazards – linked to many Goals

Source: https://www.un.org/sustainabledevelopment/

SDG Targets

Home | About | Campaigns | Goals | Take Action | Partnerships | News And Media | Learn More



Facts and figures | Goal 6 targets | Links

6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all

6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

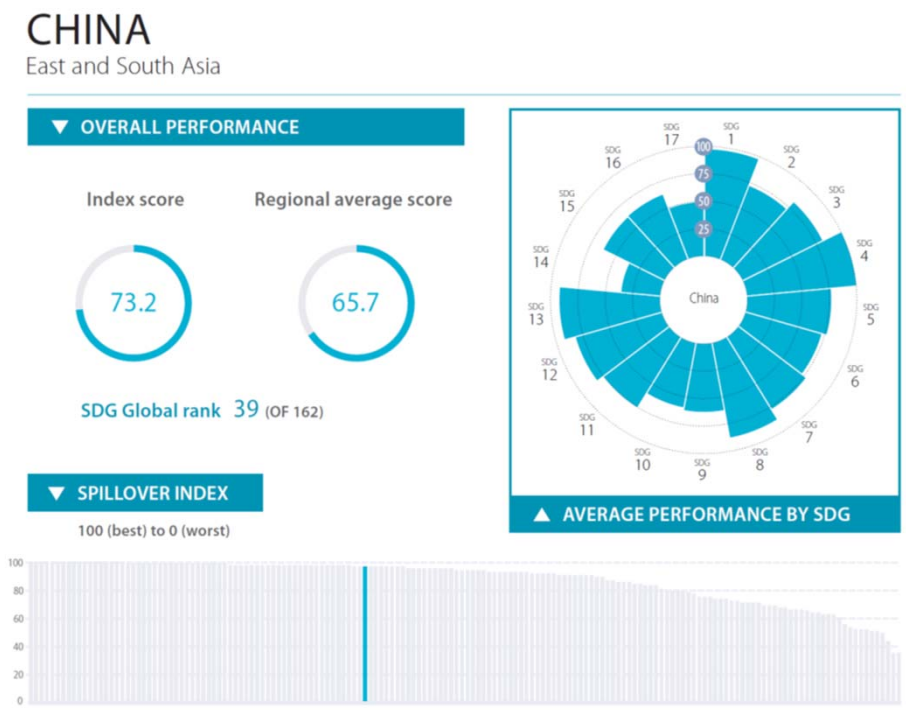
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.A By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

6.B Support and strengthen the participation of local communities in improving water and sanitation management

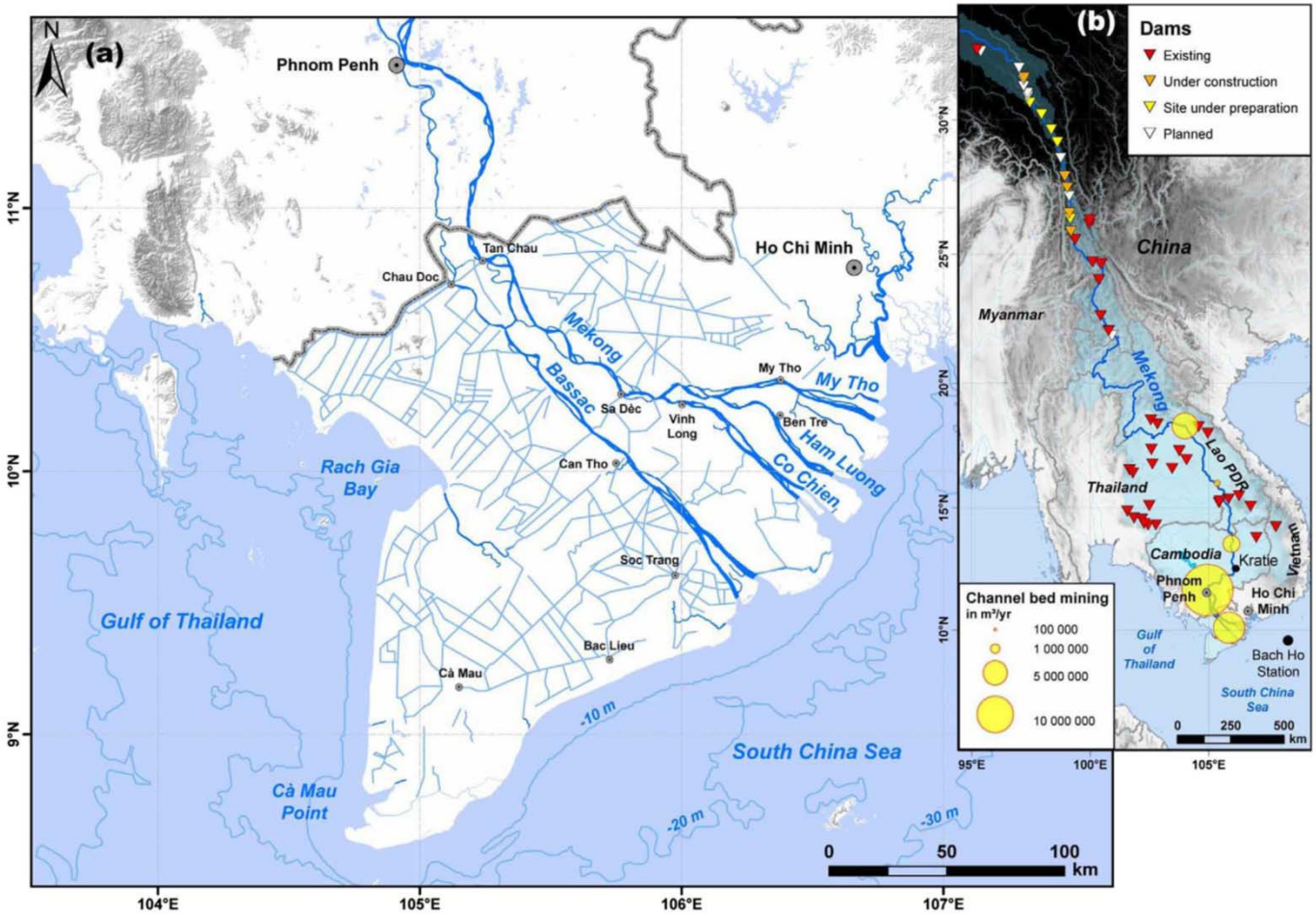
Source: https://www.un.org/sustainabledevelopment/water-and-sanitation/

SDGs in China



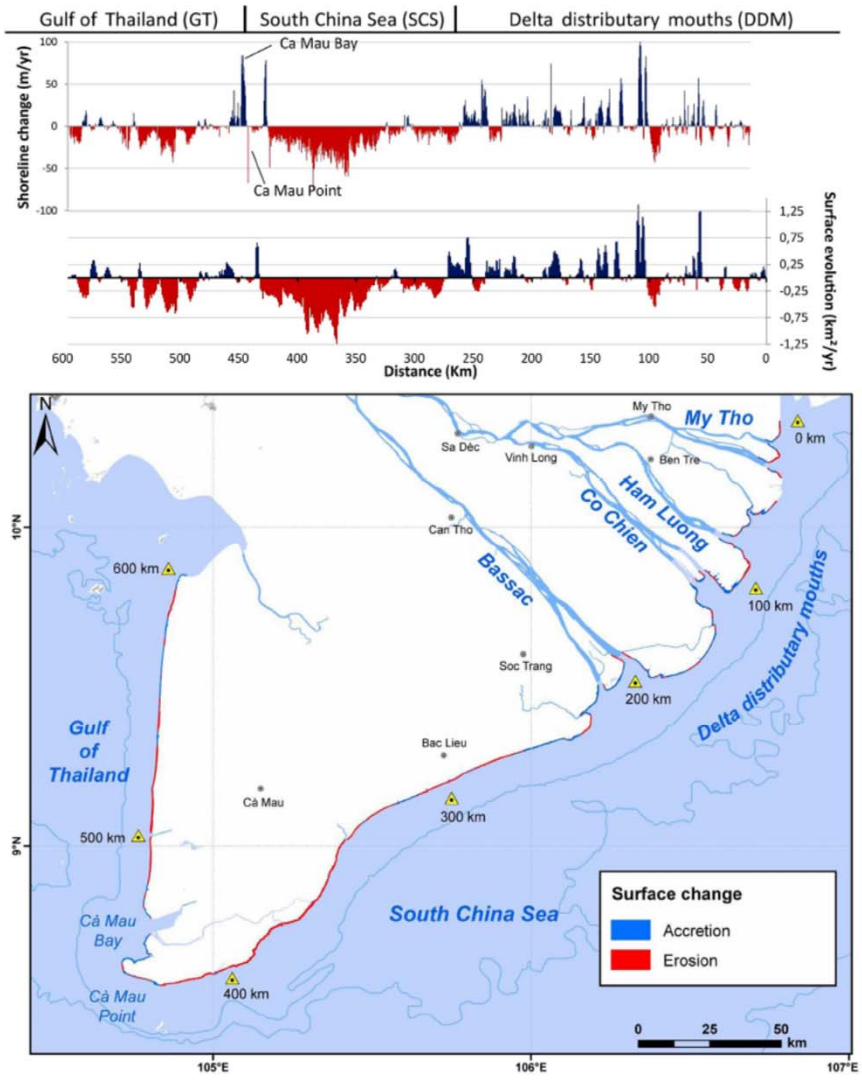
Source: Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G. (2019): Sustainable Development Report 2019. New York: Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN).

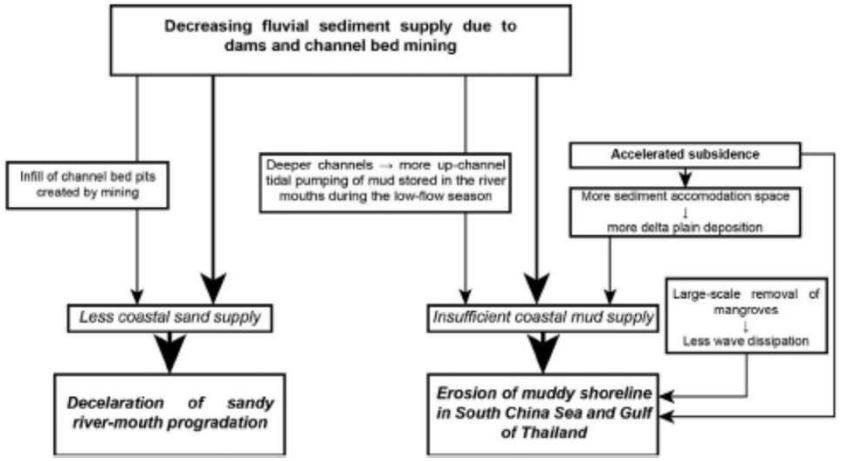
Human-Environment Systems – sub-national scale



Source: Anthony et al (2015) and references therein: Linking rapid erosion of the Mekong River delta to human activities. *Scientific Reports DOI: 10.1038/srep14745*

Human-Environment Systems – sub-national scale





Source: Anthony et al (2015): Linking rapid erosion of the Mekong River delta to human activities. *Scientific Reports DOI: 10.1038/srep14745*

Project Context and Hypothesis

Link between national and sub-national agenda can be contested as targets acted upon at the local level[1]

Hypothesis: Trade-offs between goals and targets at the sub-national scale create inequalities between segments of society in terms of achieving the SDGs at the national level

Scale: The basin scale, to represent the sub-national scale in this research

[1]Source: Nilsson et al (2016): A draft framework for understanding SDG interactions. ICSU.

Aims

Overarching Aim: provide scientifically-grounded, policy-relevant information on the synergies and trade-offs between selected sustainable development goals and targets within a large river basin

Additional Aim: provide policy recommendations to remove or mitigate the trade-offs and help achieve equitable development across the river basin

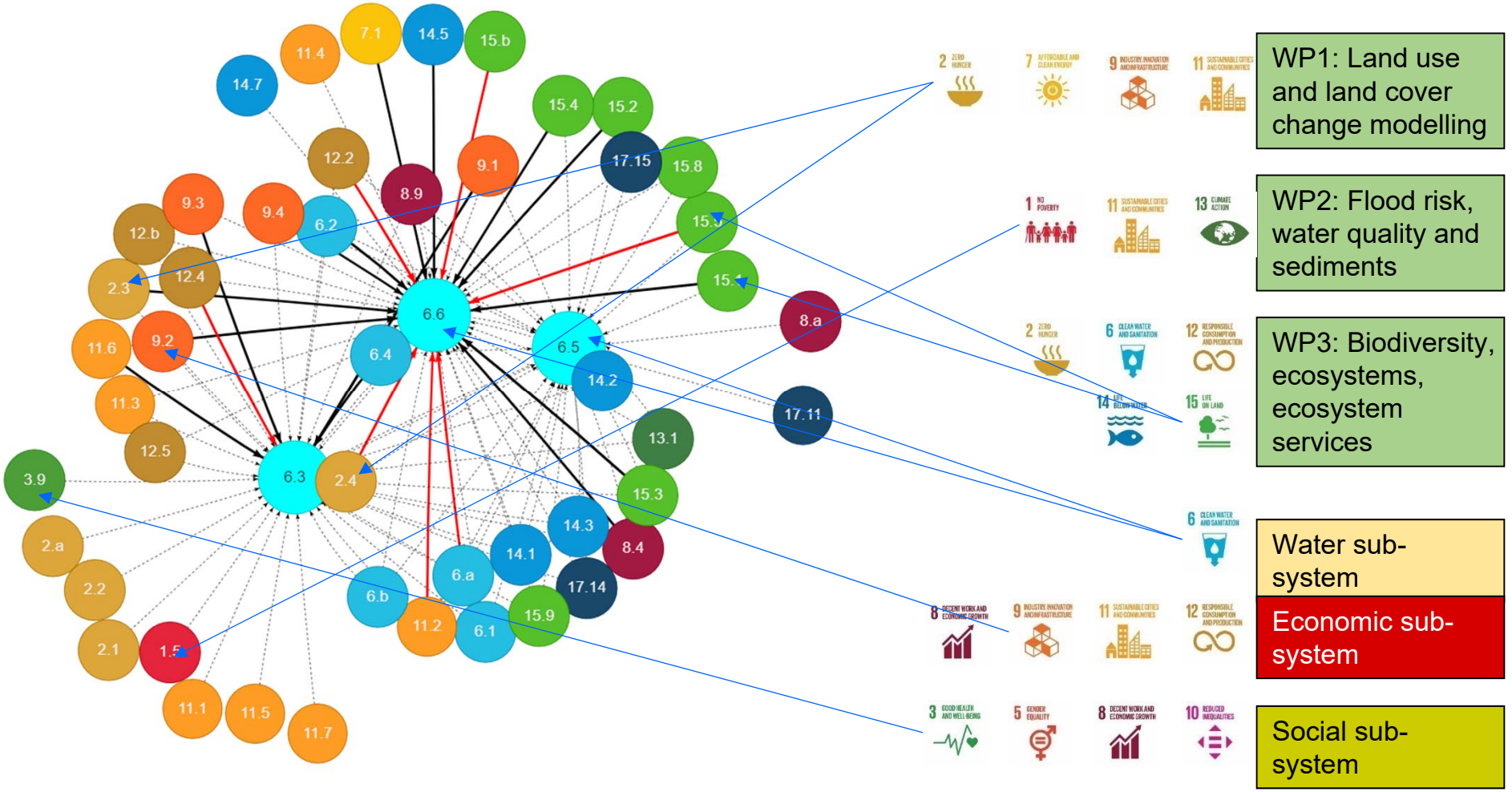
SDG Synergies and Trade-offs

2030 Agenda is an integrated agenda, an “indivisible whole”

- -3 → Cancelling effect
- 0 → Neutral relationship
- +3 → Indivisible (completely linked objectives)
- Interactions are context specific

Source: Nilsson et al (2016): A draft framework for understanding SDG interactions. ICSU.

SDG interlinkages analysis at the river basin level: An image of the interlinkages (without spatial and temporal dimensions)

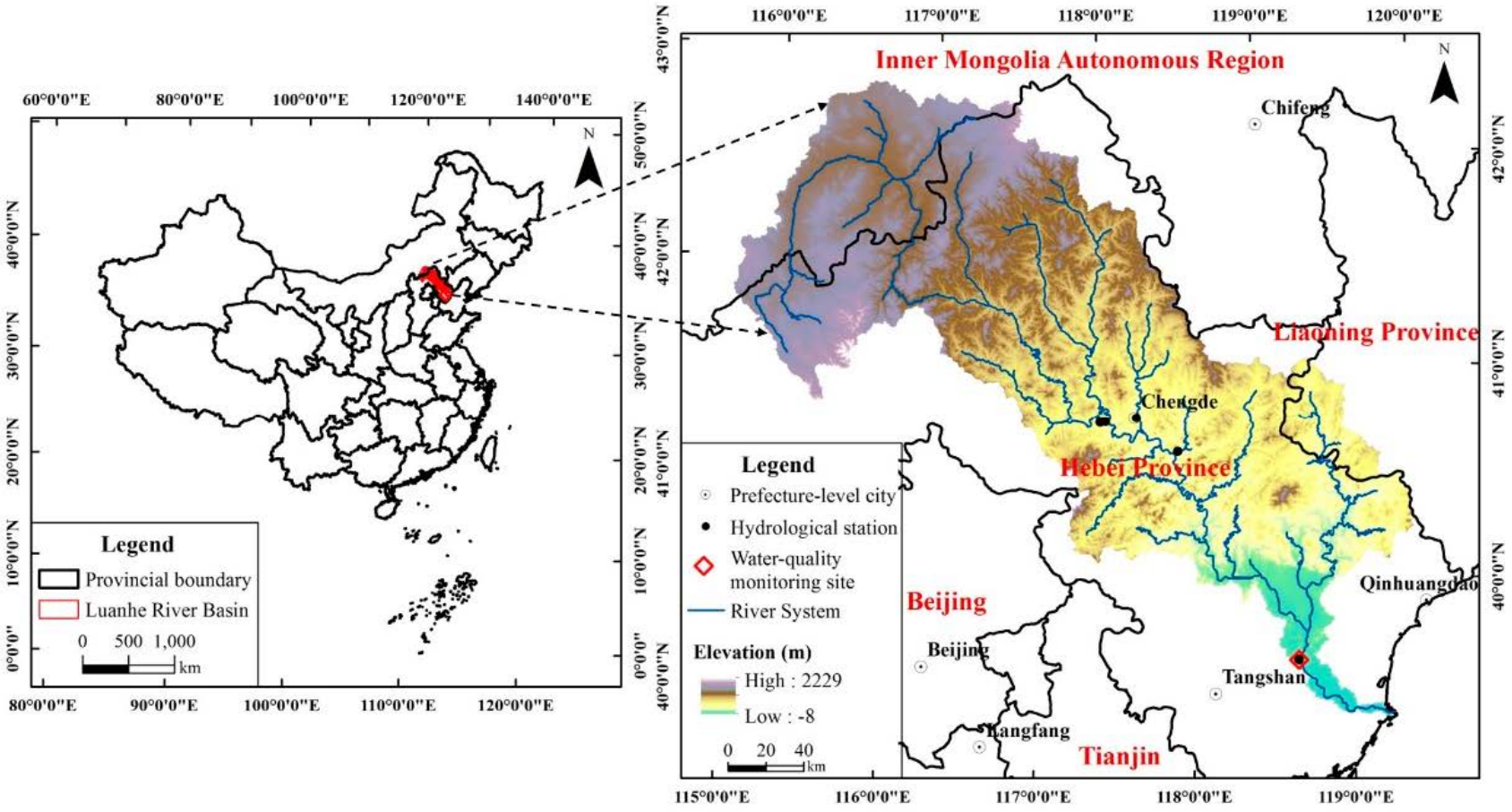


Source: A sreenshot taken from IGES SDG Interlinkages Analysis and Visualisation Web Tool (V3.0) by selection of China and Targets 6.3 (water pollution), Target 6.5 (integrated water resources management) and Target 6.6 (water-related ecosystems).

Note: i) Each node represents one SDG Target with the fluorescent blue ones indicating the selected targets. ii) A line in black represents a positive link and a line in red represents a negative link. A dotted line indicates that indicator-level data is not available.

THE LUANHE RIVER BASIN

Luanhe River Basin



Source: Bi et al. (2019): Evolution of Drought-Flood Abrupt Alternation and Its Impacts on Surface Water Quality from 2020 to 2050 in the Luanhe River Basin. *International journal of environmental research and public health 16(5):691*

Luanhe River Basin

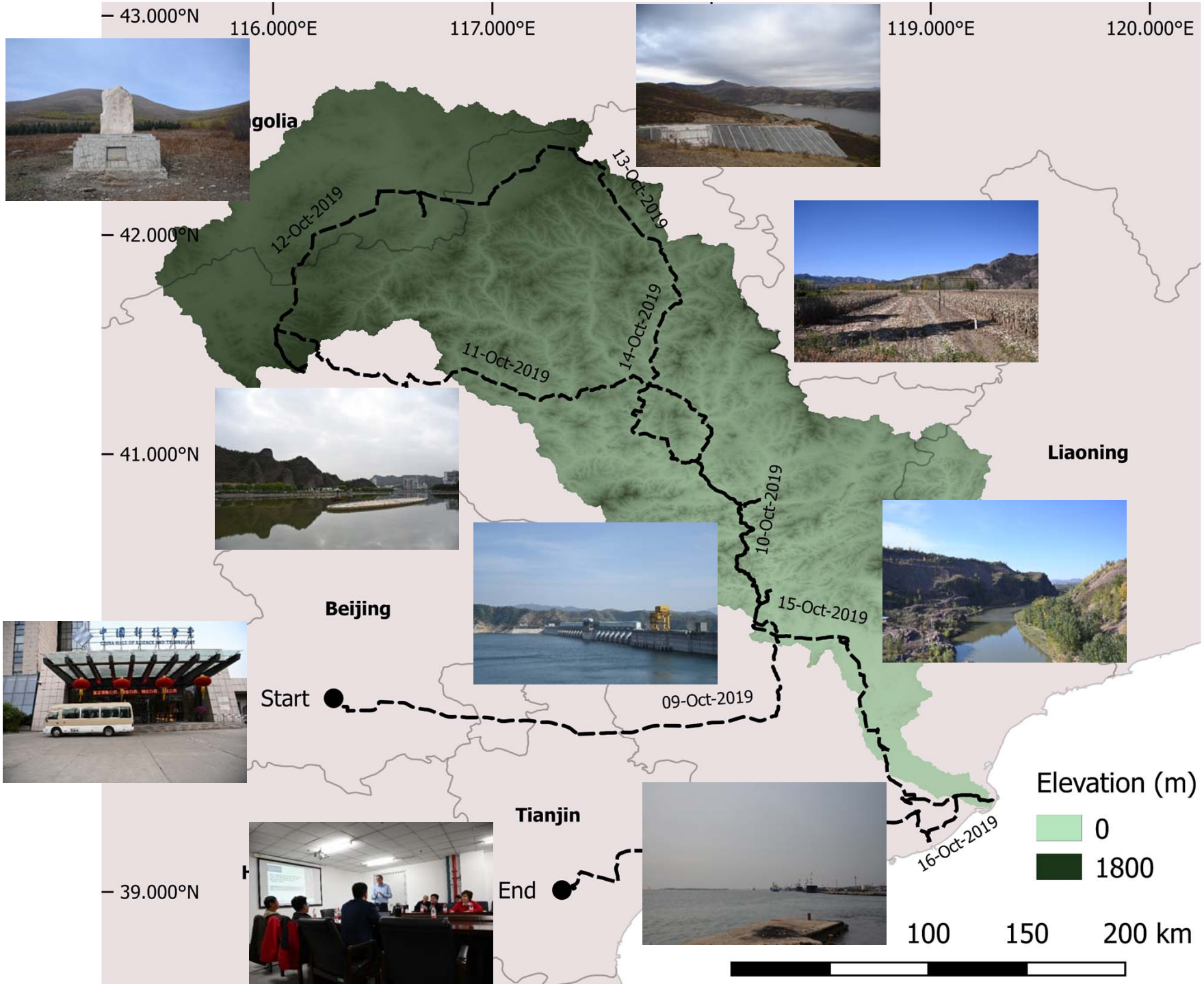
- Located in the northern portion of the Haihe River Basin (one of the seven largest in China)
- The Luanhe river is the most important water source in northern China
- Covers 27 counties of Hebei Province, Inner Mongolia and Liaoning Province
- Length: 885km; Area: 44,750 km^2; Mountainous cover 98%#
- Average annual temperature of 6.1 ℃ and precipitation of 444 mm (1986-2015)*
- 225 inhabitants/km^2
- Rapid economic development (GDP per capita 1.46 time higher than national average)‡

Sources:

Wang et al. (2015): Effects of large-scale climate patterns and human activities on hydrological drought: A case study in the Luanhe River basin, China. *Natural Hazards, 76: 1687–1710*

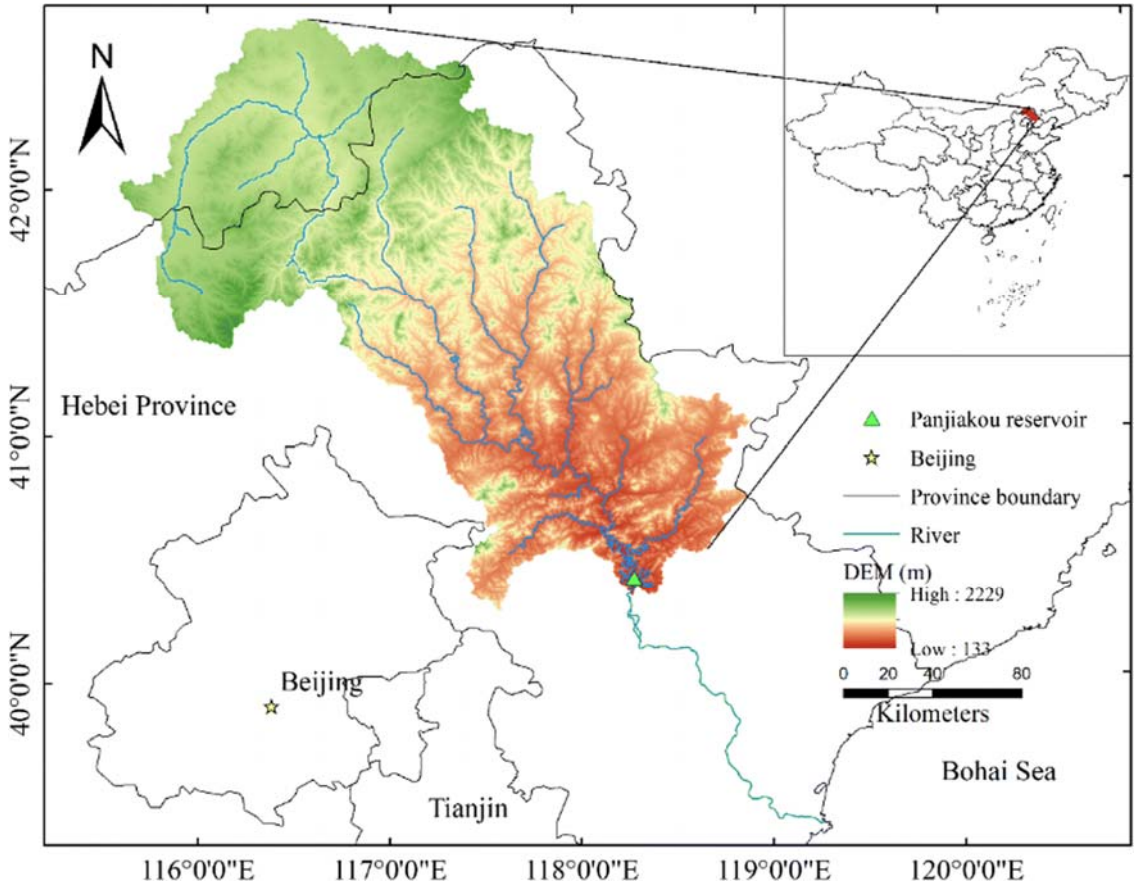
**RESDC. Meteorological Data. Available online: http://www.resdc.cn/*

‡ *Liu, Y.F. (2012): An analysis of the hydrology, geology and economic situation of the Luanhe River Basin. J. Hebei Normal Univ. Nat. 32, 24–26. (In Chinese).*


43.000°N
42.000°N
41.000°N
39.000°N
116.000°E
117.000°E
119.000°E
120.000°E
12-Oct-2019
13-Oct-2019
14-Oct-2019
11-Oct-2019
10-Oct-2019
15-Oct-2019
09-Oct-2019
16-Oct-2019
Start
End
Beijing
Tianjin
Liaoning
Elevation (m)
0
1800
100
150
200 km

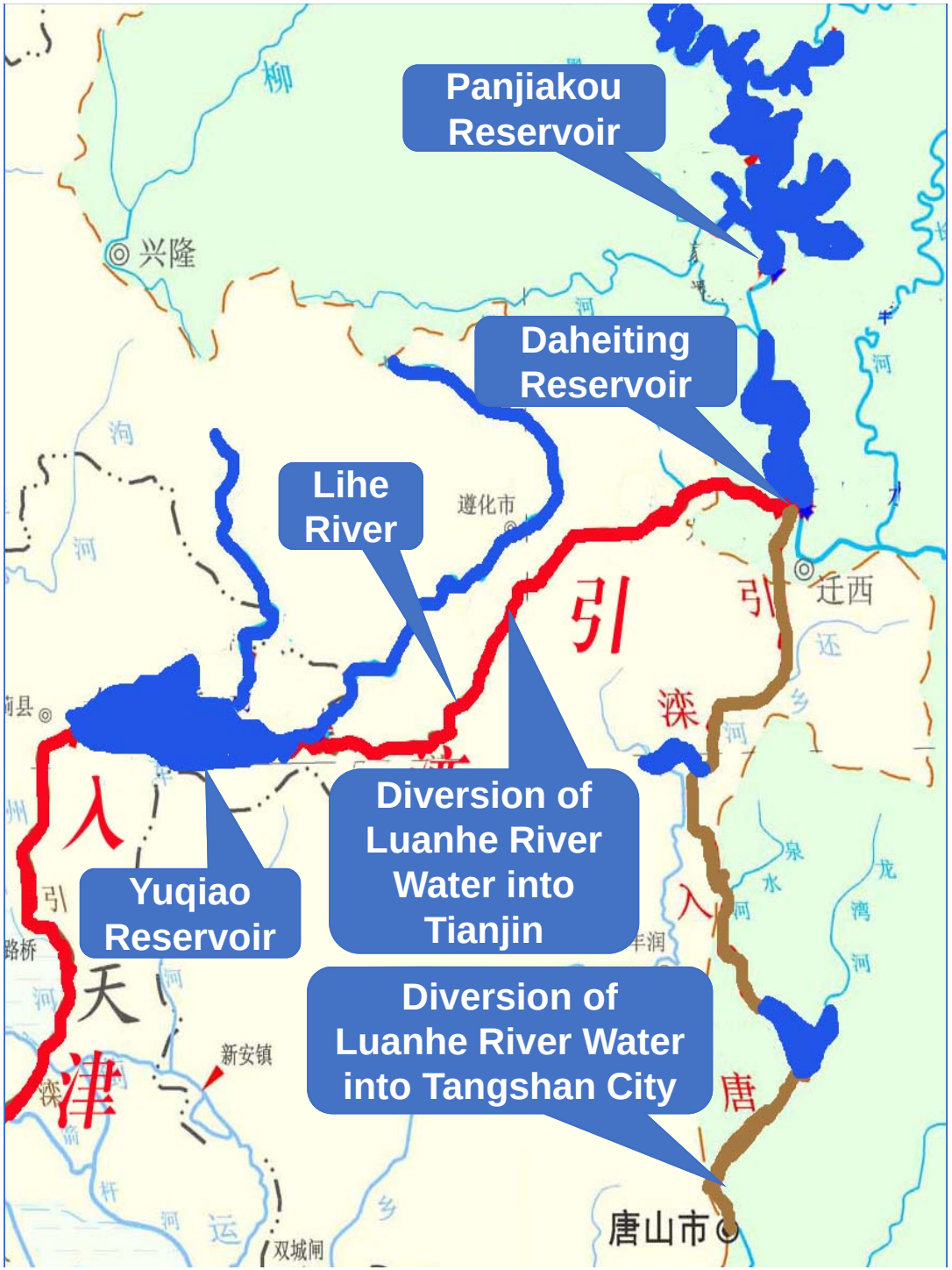
Panjiankou Reservoir

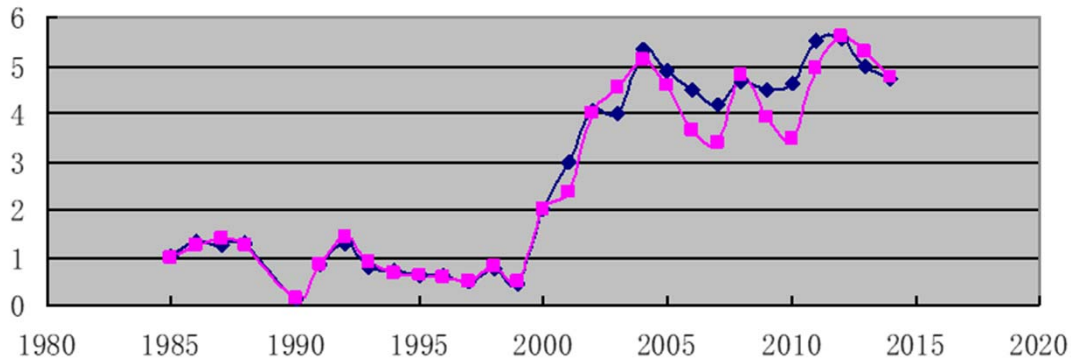
- 75% of the LRB area
- Impounded in 1979 with capacity of 2.93 billion m^3
- Supply water to Tianjin (1.95 billion m^3/year) and Tangshan (0.95 billion m^3/year)



Source: Li, Jianzhu, et al (2019): Water supply risk analysis of Panjiakou reservoir in Luanhe River basin of China and drought impacts under environmental change. Theoretical and Applied Climatology. 137 (3-4): 1-16.

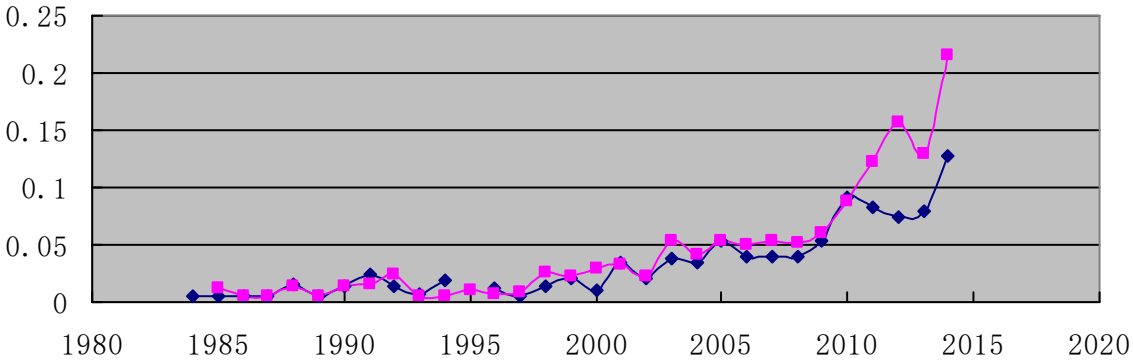
In August 1981, Started the **Luanhe-Tianjin water division project**. The water through Panjiakou-Daheiting Reservoir in the upper reaches of the Luanhe River in Hebei Province are linked to Tianjin in 1983.





Annual variations of TN concnetrations in Panjiakou (Red) and Daheiting (Black) Reservoirs

Panjiakou, Daheiting Reservoirs in Qianxi County, Hebei Province became the **second largest freshwater fish farm area**.



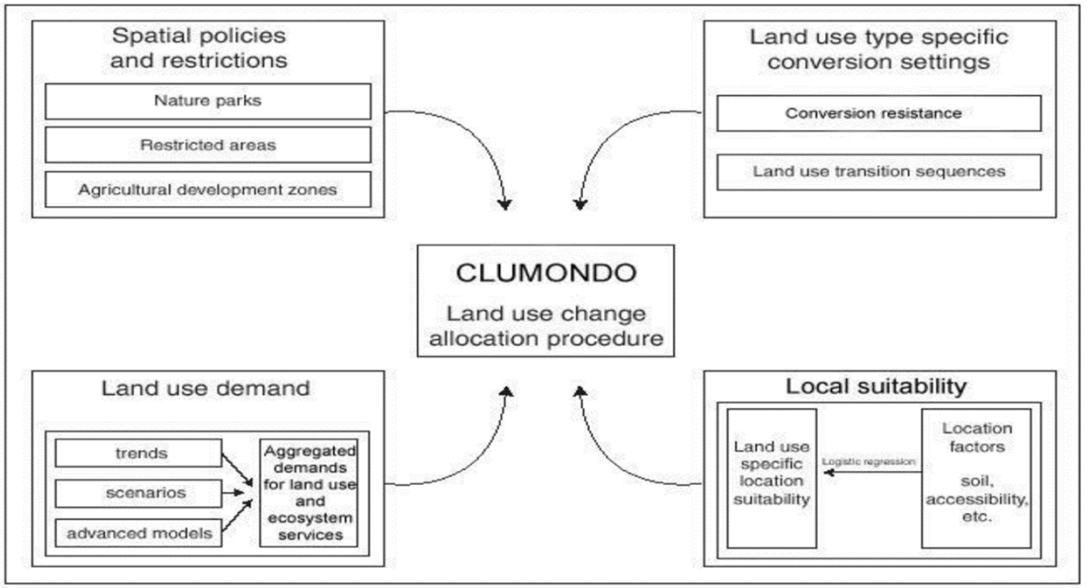
Annual variation of TP concentrations in Pnjiakou (Red) and Daheiting (Black) Reservoirs

In 2017, under the leadership of the central and local government, **all 75000 fish cages were removed after compensating fish farmers.**

LAND USE AND LAND USE CHANGE SCENARIOS

WP1 progress: Future land system change modelling

- CLUMondo is a forward-looking model that simulates land system changes as a function of derived demands for services.
- It accounts for the local suitability, spatial constraints, and competition between land systems.



Land system classification

- Based on three main classification factors: (1) land use/cover, (2) livestock, and (3) agricultural intensity
- Land use/cover represents the composition of the landscape
- Livestock and agricultural intensity data represent important characteristics of land management and farming systems.

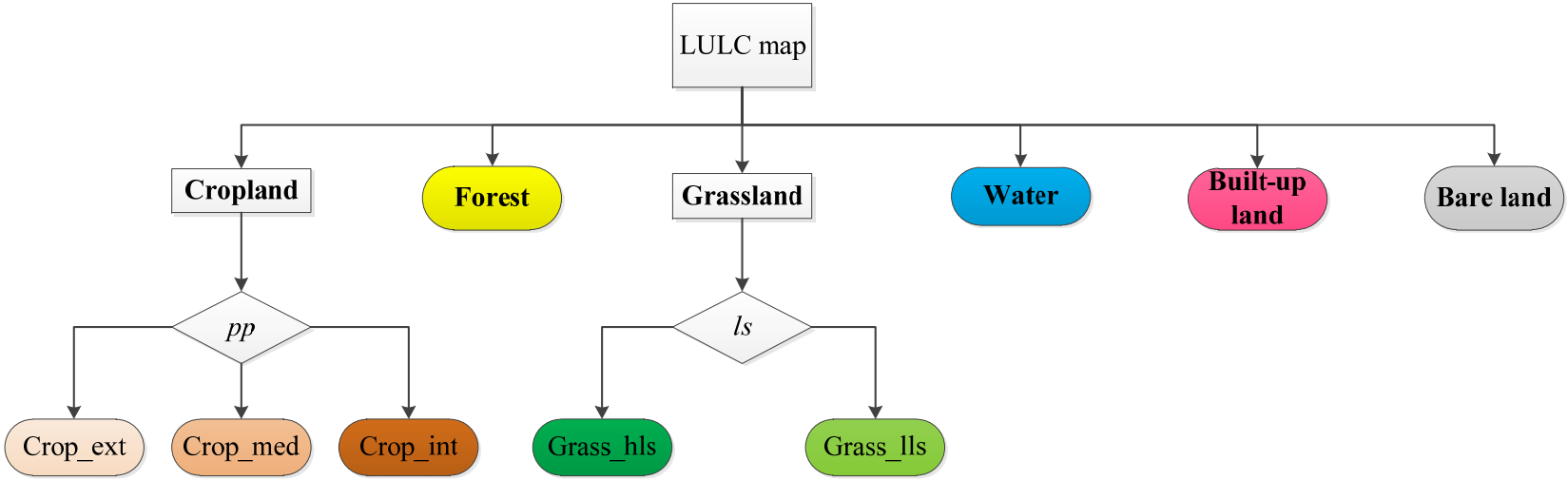


Fig. 1. The method of the Luanhe river basin (LRB) land system classification. The italics in Fig.1 represent the classification variables (*pp* is the potential cropland production, *bgs* is the bovines, goats and sheep density); the boldface represents the main land system categories; and colors represent the final land system classification outcome.

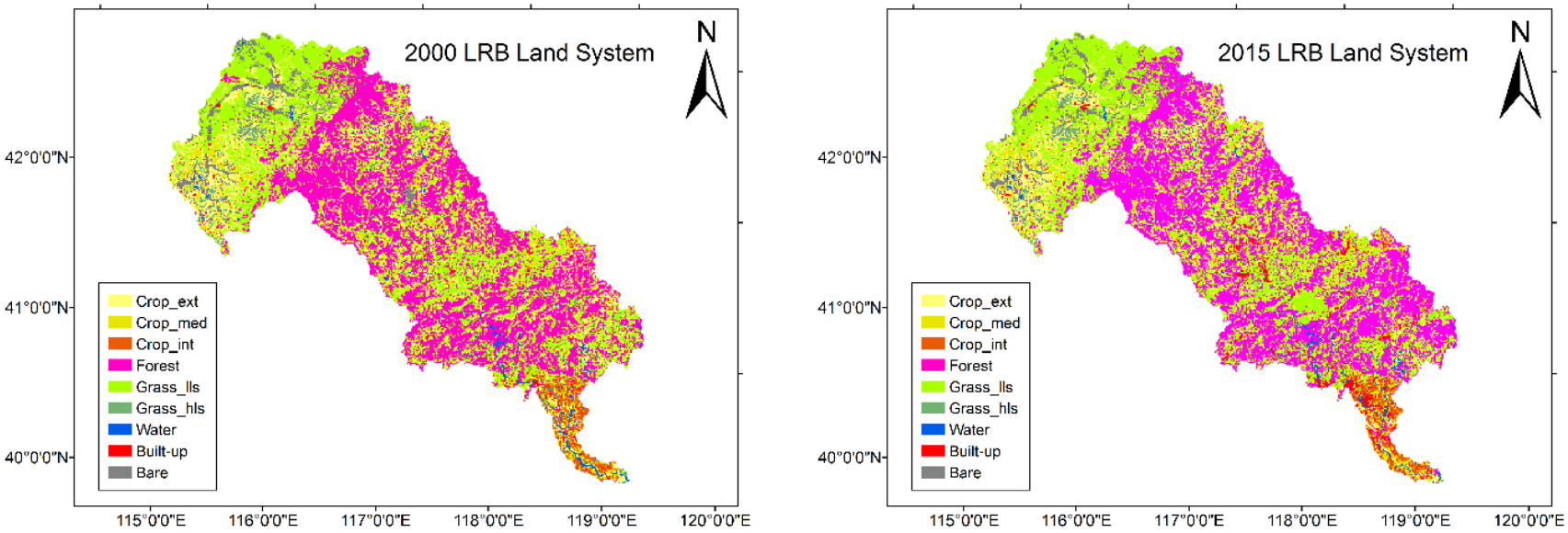


Fig. 2. Land system of Luanhe River Basin in 2000 and 2015.

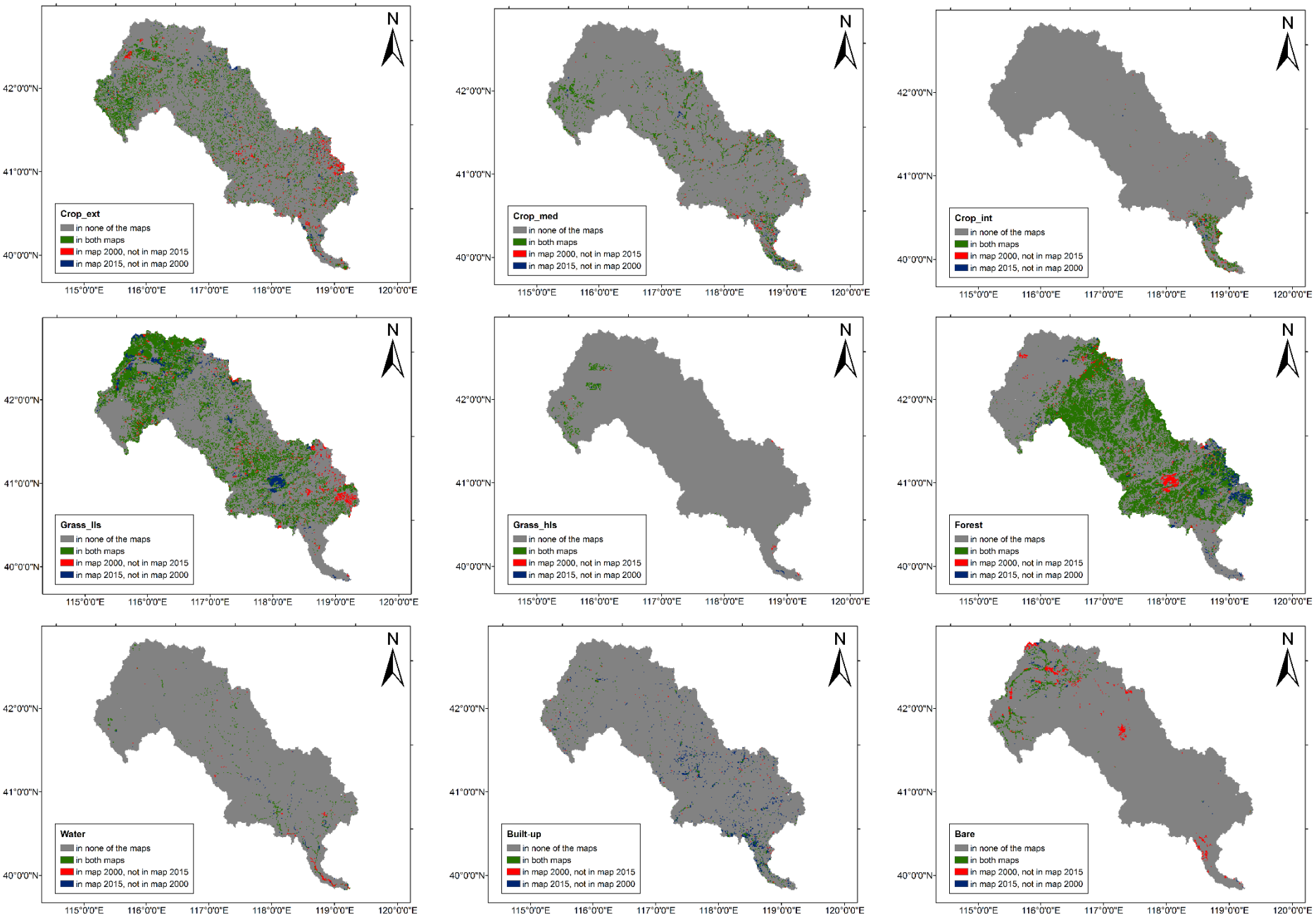


Fig. 3. Comparison of Land System of LRB in 2000 and 2015.

Spatial determinants of LS

Table. 1. Land system of Luanhe River Basin in 2000 and 2015

Main category	Factors	Unit	Source
Climatic	Mean annual Temperature	℃	RESDC (http://www.resdc.cn/)
	Mean annual Precipitation	mm	
	≥10℃ accumulated temperature	℃	
	Moisture index	%	
Topographic features	Altitude	m	NASA SRTM V3.0
	Slope	degree	derived from Altitude
	Landforms	-	RESDC (http://www.resdc.cn/)
Soil characteristics	Sand content	%	HWSD v1.2
	Silt content	%	
	Clay content	%	
	Organic content	%	
	pH	$-\log(H^+)$	
	Drainage	class	
	Soil type	-	
Socio-economic	Market influence	USD/person	Verburg et al. 2011. doi.org/10.1088/1748-9326/6/3/034019
	Market accessibility	index (0-1)	
	Population density	people/km^2	RESDC (http://www.resdc.cn/)
	GDP	USD/km^2	

Scenario formulation

“Trend”

Follows the Middle of the Road shared socioeconomic pathway (SSP2)

Trend does not shift markedly from historical patterns, with relatively low commitment to achieve development goals

Driven by the demand for crop production, livestock, and built-up area

Statistical yearbook and previous LS change

“Sustainability”

Follows the Sustainable shared socioeconomic pathway (SSP1)

A pathway that is characterized by increased commitment to achieve socio-economic development goals

“National planning on medium- and long-term food security” (2008–2020) and “General Land Use Planning in Hebei Province (2006–2020)”

“Conservation”

Sustainability scenario was used as a baseline, extended by the implementation of the ecological restoration and protection policy targets

A series of policies promoting afforestation have been implemented for biodiversity conservation and sand fixation.

“National Forest Management Planning (2016–2050)”, “Land greening planning of Hebei Province (2018-2035)” and “Implementation plan of afforestation in Zhangjiakou city and Chengde Bashang area of Hebei Province”

Table. 2. Average annual percentage change in demand from 2015 to 2050 for the different scenarios

Demand	Trend	Sustainability	Conservation
Crop production (ton)	2.1%	1%	1%
Livestock numbers (head)	2.7%	0.9%	0.9%
Built-up land (km^2)	9.6%	0.69%	0.69%
Forest (km^2)			0.35%

ECOSYSTEM SERVICES AND DISSERVICES


NANKAI UNIVERSITY
南開
16 PEACE, JUSTICE AND STRONG INSTITUTIONS

University of Glasgow

Class I Land cover types[1]	Class II Land cover types[2]		Provisioning Services											
			Crops	Livestock	Fodder	Capture fisheries	Aquaculture	Wild foods	Timber	Wood fuel	Energy (biomass)	Biochemicals and medicine	Freshwater	Provisioning Services (PS) Σ
		Confidence Score	2.1	2.1	2.2	2.3	2.3	1.9	2.0	2.0	1.9	1.8	2.5	
Cropland	Irrigated croplands	2.1	4.9	2.9	3.5	1.7	1.9	1.5	0.5	1.1	2.9	1.7	1.9	24.5
	Rainfed croplands	2.1	4.9	3.0	3.9	0.5	0.9	1.7	1.0	2.2	3.1	2.1	0.9	24.3
Woodland	Forest	2.1	2.7	2.9	2.8	0.6	0.6	3.3	4.3	4.5	4.2	3.1	1.4	30.3
	Nursery and orchard	1.9	2.7	2.9	2.7	0.5	0.5	2.9	3.5	4.1	3.7	3.0	1.3	27.8
Grassland	Grassland	2.0	2.4	4.1	3.9	1.1	0.8	3.1	1.7	1.8	2.1	2.6	1.4	25.0
Water body	Stream and river	2.7	2.1	2.5	1.9	2.8	2.8	2.8	0.9	1.1	1.0	1.7	4.3	24.0
	Lakes	2.6	2.5	2.7	2.1	4.2	4.2	3.3	0.9	1.0	1.2	3.0	4.6	28.0
	Reservoirs and ponds	2.7	2.9	2.9	2.3	4.1	4.1	2.9	0.9	0.9	1.3	3.0	4.3	28.6
	Beach and shore	2.3	2.5	3.0	2.1	2.3	2.6	2.4	1.0	1.1	0.7	1.8	3.5	23.0
Built-up land	Urban and rural land	2.1	0.6	1.1	0.5	0.5	0.4	0.5	0.7	0.8	0.8	0.7	0.5	7.0
	Industrial area and traffic utilization	2.1	0.5	0.6	0.5	0.4	0.4	0.5	0.6	0.8	1.0	1.1	0.5	6.9
Unused land	Sandy land	1.7	1.1	0.6	0.7	0.4	0.4	1.6	1.2	1.3	1.8	1.9	0.5	11.5
	Swamp	2.4	2.0	2.1	1.8	2.2	1.9	2.1	1.9	2.0	0.8	2.3	3.1	21.3
	Bare land, rock or gravel	1.7	0.8	0.6	0.5	0.4	0.4	0.7	0.5	0.5	0.5	0.4	0.5	5.9

Class I Land cover types[1]	Class II Land cover types[2]		Regulating and Maintenance									
			Local climate regulation	Global climate regulation	Flood protection	Fire protection	Groundwater recharge	Air quality regulation	Erosion regulation	Nutrient regulation	Water purification	Pollination	Regulating Services (RS) Σ
		Confidence Score	2.5	2.3	2.3	2.1	2.3	2.3	2.3	1.9	2.2	1.9	
Cropland	Irrigated croplands	2.1	2.9	2.9	3.0	3.1	2.9	3.3	2.7	3.2	1.6	1.9	27.7
	Rainfed croplands	2.1	2.7	2.6	2.7	1.3	1.6	2.2	2.5	3.1	1.0	2.3	22.0
Woodland	Forest	2.1	4.5	4.2	3.7	1.1	3.2	4.5	3.9	3.3	3.4	3.7	35.4
	Nursery and orchard	1.9	4.2	3.7	3.5	1.1	2.7	4.2	3.1	2.9	3.0	3.3	31.7
Grassland	Grassland	2.0	3.7	3.4	3.1	1.6	3.1	3.7	3.4	3.0	3.1	3.8	31.9
Water body	Stream and river	2.7	4.1	3.6	3.3	4.0	3.5	3.9	2.8	3.1	3.8	0.9	33.1
	Lakes	2.6	4.1	3.7	3.7	4.2	4.3	4.1	3.1	3.3	3.8	0.9	35.2
	Reservoirs and ponds	2.7	3.9	3.3	4.3	4.1	4.2	4.0	3.9	3.4	3.7	0.9	34.7
	Beach and shore	2.3	3.7	3.3	3.7	3.7	3.6	3.5	2.9	3.0	3.7	1.4	32.5
Built-up land	Urban and rural land	2.1	0.7	1.0	0.5	1.1	0.5	0.7	1.6	0.5	0.6	0.5	7.8
	Industrial area and traffic utilization	2.1	0.7	0.9	0.5	1.1	0.3	0.7	1.6	0.5	0.4	0.4	7.0
Unused land	Sandy land	1.7	0.7	0.9	1.8	2.4	0.6	1.3	1.1	0.7	1.6	1.3	12.3
	Swamp	2.4	2.5	2.1	3.0	2.5	3.4	3.1	2.7	2.5	2.9	2.0	27.1
	Bare land, rock or gravel	1.7	0.9	0.9	0.8	0.9	0.7	0.7	0.6	0.6	0.6	0.5	7.2

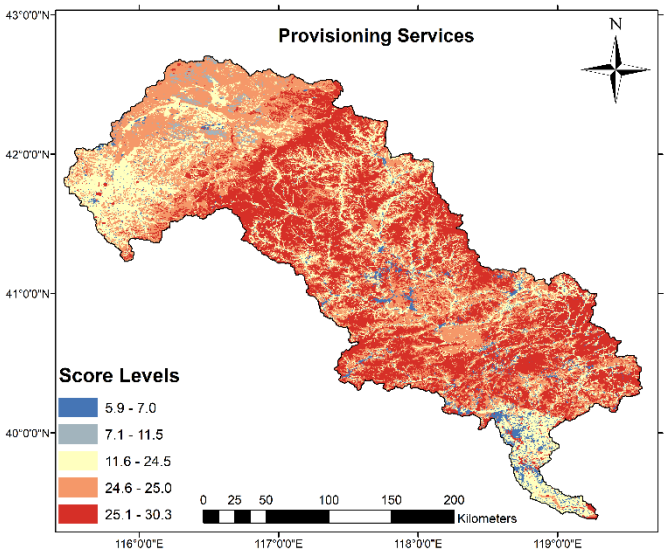
Class I Land cover types[1]	Class II Land cover types[2]		Cultural Services					
			Aesthetic	Existence and bequest	Knowledge and education	Emblematic and symbolic	Physical and experiential interactions	Cultural Services (CS) Σ
		Confidence Score	2.0	2.1	2.0	2.1	2.4	
Cropland	Irrigated croplands	2.1	2.1	1.9	2.0	2.3	1.7	9.9
	Rainfed croplands	2.1	1.9	1.7	1.9	2.2	1.7	9.5
Woodland	Forest	2.1	4.2	3.0	3.2	2.9	3.4	16.8
	Nursery and orchard	1.9	3.7	2.4	2.3	2.2	2.8	13.5
Grassland	Grassland	2.0	4.5	2.1	2.5	2.3	3.6	14.9
Water body	Stream and river	2.7	4.0	2.5	2.7	2.7	3.9	15.8
	Lakes	2.6	4.6	3.7	3.7	3.9	4.3	20.3
	Reservoirs and ponds	2.7	3.3	3.1	3.2	3.1	3.7	16.3
	Beach and shore	2.3	3.2	1.7	2.1	1.9	2.3	11.2
Built-up land	Urban and rural land	2.1	2.5	3.4	3.4	3.9	3.5	16.7
	Industrial area and traffic utilization	2.1	0.7	1.6	2.5	2.1	1.6	8.5
Unused land	Sandy land	1.7	2.3	1.9	1.8	1.9	2.3	10.3
	Swamp	2.4	3.5	2.3	2.1	2.5	1.9	9.2
	Bare land, rock or gravel	1.7	0.5	0.7	0.7	0.7	0.5	3.3

Class I Land cover types[1]	Class II Land cover types[2]		Ecological Integrity								
			Abiotic heterogeneity	Biodiversity	Energy capture	Reduction of nutrient loss	Storage capacity	Metabolic efficiency	Biotic water flows	Ecological Integrity (EI) Σ
		Confidence Score	2.6	2.3	1.9	2.0	2.1	1.9	1.9	
Cropland	Irrigated croplands	2.1	3.5	3.3	3.2	2.9	2.9	2.8	3.0	21.6
	Rainfed croplands	2.1	3.3	3.3	3.3	2.7	2.9	2.7	1.7	19.9
Woodland	Forest	2.1	4.5	4.4	4.0	4.0	3.9	3.3	3.5	27.6
	Nursery and orchard	1.9	4.5	3.4	3.5	3.6	3.5	3.0	3.2	24.7
Grassland	Grassland	2.0	3.9	3.9	3.5	3.8	3.5	3.1	3.0	24.7
Water body	Stream and river	2.7	3.5	3.7	3.3	2.7	3.1	3.0	4.1	23.4
	Lakes	2.6	4.7	4.6	3.7	3.7	3.9	3.1	4.3	27.9
	Reservoirs and ponds	2.7	3.6	3.9	3.5	3.1	3.5	2.8	4.0	24.4
	Beach and shore	2.3	2.5	4.2	3.0	2.9	2.9	2.7	2.9	22.9
Built-up land	Urban and rural land	2.1	1.9	1.0	1.3	0.8	0.8	0.9	0.5	7.2
	Industrial area and traffic utilization	2.1	1.1	0.5	0.6	0.7	0.7	0.7	0.4	4.6
Unused land	Sandy land	1.7	2.4	1.9	1.6	1.5	1.3	1.1	0.5	10.3
	Swamp	2.4	3.5	3.7	2.1	2.5	2.6	2.1	2.5	19.1
	Bare land, rock or gravel	1.7	0.9	1.0	0.7	0.8	1.0	0.7	0.8	5.9

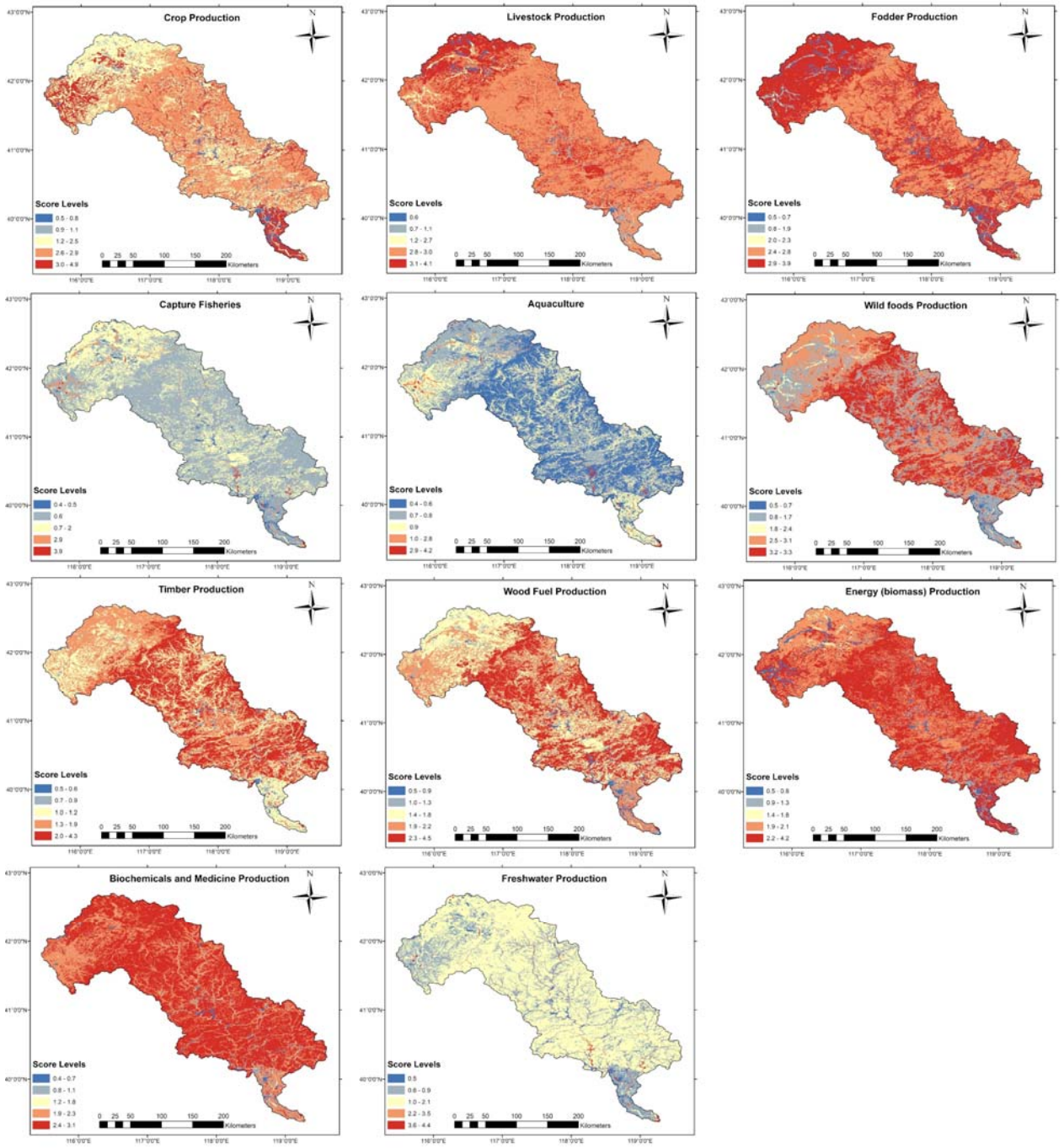
Class I Land cover types[1]	Class II Land cover types[2]		Ecosystem Disservices										
			Invasive species	Pests and diseases	Droughts	Fires	Floods	Erosion and siltation	Leaching of nutrients	Human diseases from pathogens	Allergens	Dangerous or poisonous plants and animals	Heat island effect	Ecosystem Disservice (EDS) Σ
		Confidence Score	1.9	1.8	2.1	1.7	2.4	2.3	1.9	1.5	1.4	1.9	2.0	
Cropland	Irrigated croplands	2.1	2.7	4.1	1.9	1.1	1.9	2.2	2.9	1.9	1.5	1.5	0.5	22.2
	Rainfed croplands	2.1	2.7	3.9	3.3	2.9	1.3	2.0	2.7	1.7	1.5	1.6	1.9	25.6
Woodland	Forest	2.1	2.6	2.5	1.4	4.3	0.9	0.7	1.5	1.2	2.2	2.8	0.8	20.9
	Nursery and orchard	1.9	2.3	2.4	1.4	4.1	0.9	0.7	1.3	2.1	2.1	2.5	0.8	19.3
Grassland	Grassland	2.0	2.5	2.5	1.3	2.7	1.1	0.7	1.4	1.4	1.4	2.1	0.8	17.7
Water body	Stream and river	2.7	2.2	1.6	0.9	0.5	2.3	1.6	1.3	1.3	1.0	1.9	0.6	15.3
	Lakes	2.6	2.7	1.9	1.0	0.4	1.5	1.9	1.5	1.5	1.1	2.1	0.6	17.1
	Reservoirs and ponds	2.7	2.3	3.1	0.9	0.3	2.1	2.9	1.9	2.2	1.7	2.4	0.7	21.3
	Beach and shore	2.3	2.5	1.5	0.8	0.3	2.2	2.4	2.1	2.2	2.0	2.9	0.5	19.3
Built-up land	Urban and rural land	2.1	2.0	0.8	2.7	3.1	3.3	2.4	1.5	3.1	2.8	2.0	4.4	29.1
	Industrial area and traffic utilization	2.1	1.4	0.6	2.4	3.7	3.0	2.9	1.3	2.4	2.2	1.9	4.2	26.9
Unused land	Sandy land	1.7	1.8	0.5	3.1	2.3	0.7	2.2	1.3	2.8	1.8	1.1	2.2	17.1
	Swamp	2.4	2.3	1.3	1.6	0.9	1.8	1.9	1.9	2.1	2.1	2.1	0.4	18.5
	Bare land, rock or gravel	1.7	0.5	0.5	0.6	0.8	0.6	0.6	0.5	0.8	0.8	0.7	0.3	7.2

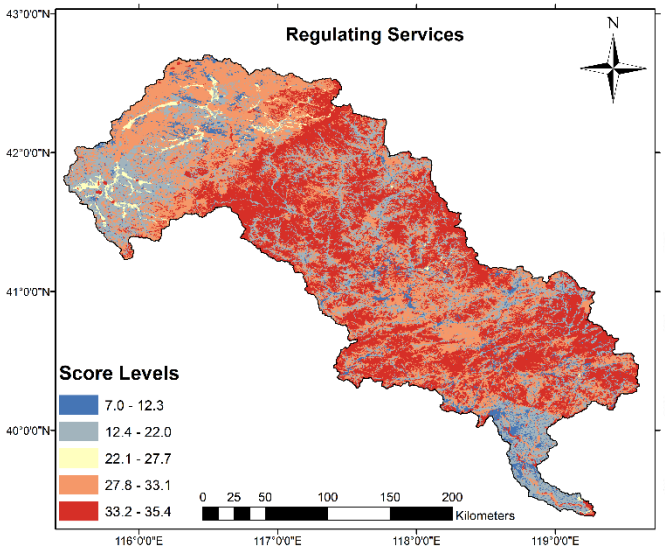
ES/EDS capacity scores	Colour
0~1	
1~2	
2~3	
3~4	
4~5	

Confidence Level	CS_{land} *$CS_{ES/EDS}$
High Confidence	≥6
Moderately	3~6
Low Confidence	≤3

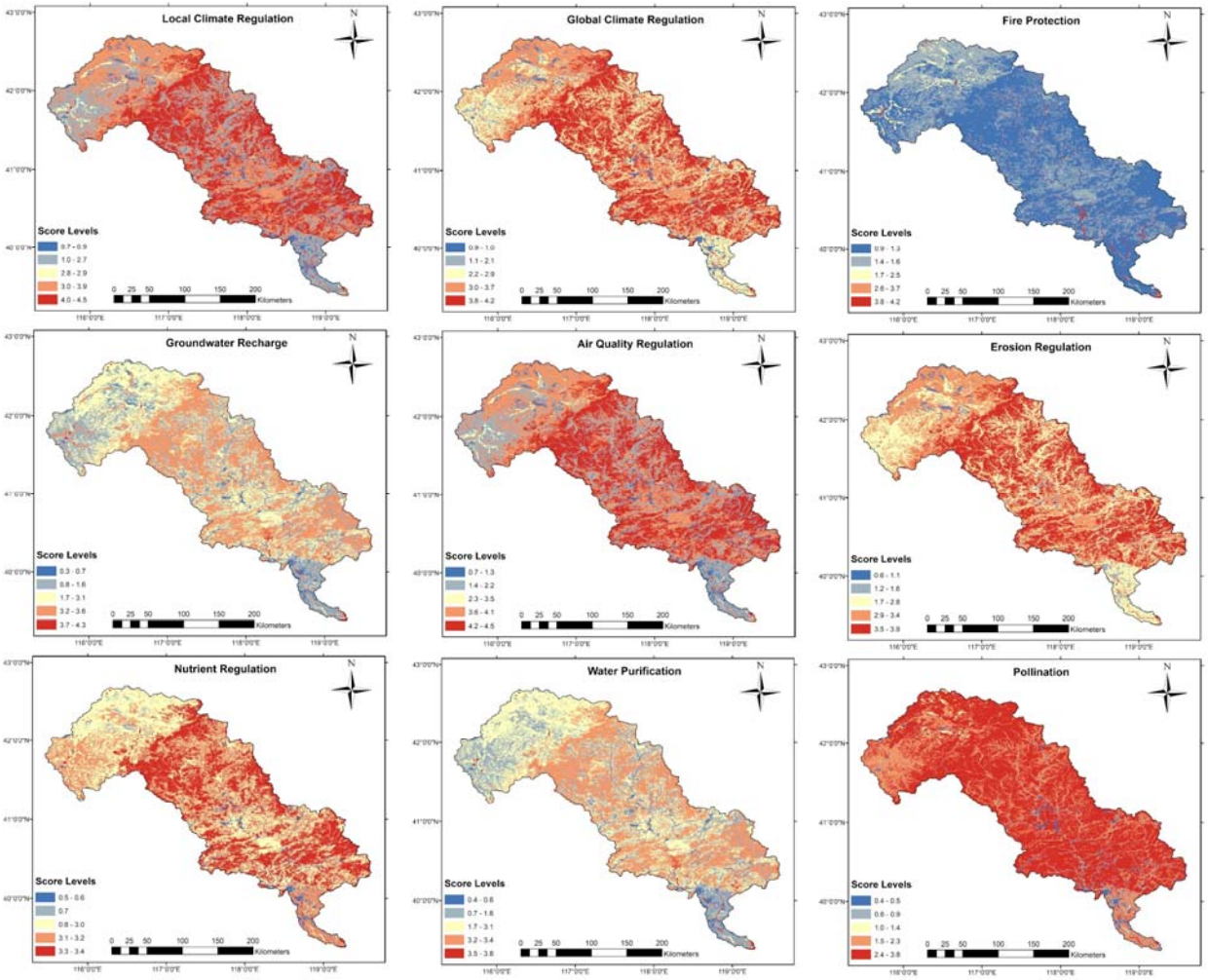


For PSs, hotspots are widespread in the Upper-Middle Reaches including woodlands, grasslands, and also the waterbodies including rivers, lakes and reservoirs, while coldspots distributed in the built-up land areas which are mainly concentrated in the downstream.

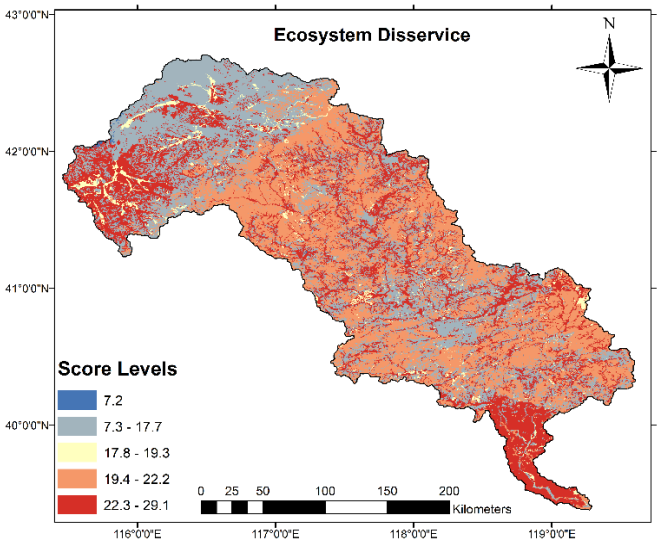


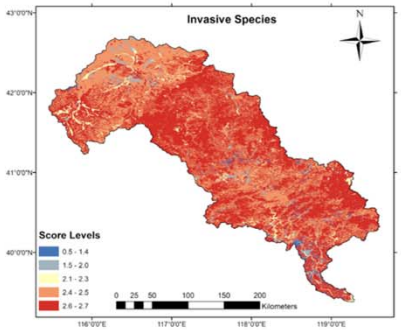


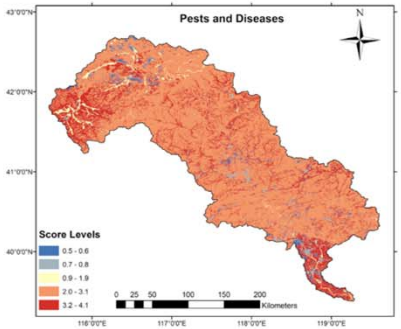
For RSs, hotspots are also widespread in the Upper-Middle Reaches including woodlands, and waterbodies, while coldspots distributed in the built-up land areas and all the unused land excepted to swamps.

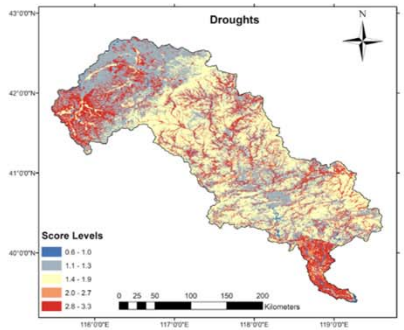


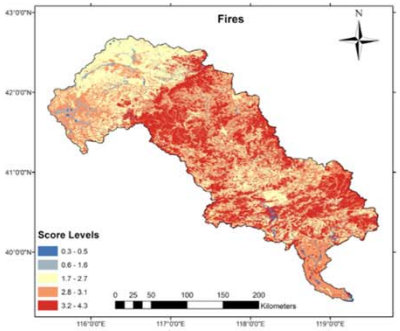
University of Glasgow

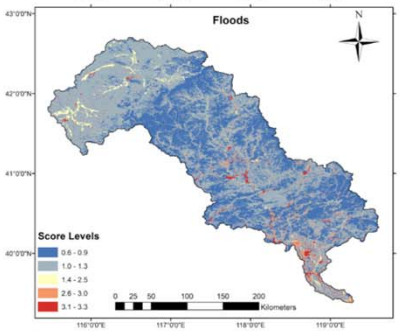


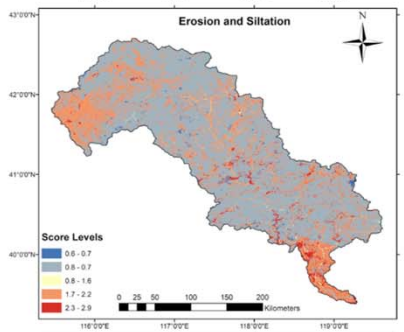


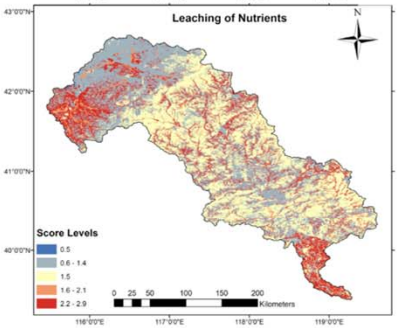


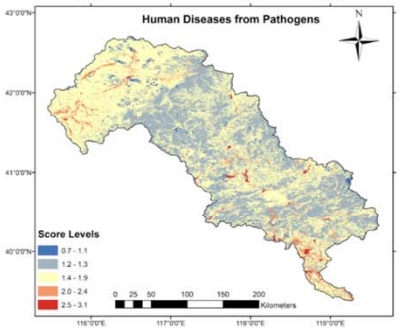


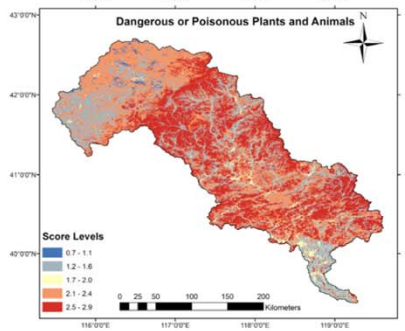


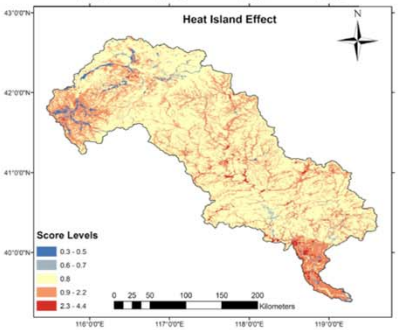












For EDSs, hotspots are concentrated in the built-up land areas and the cropland.

FLOOD RISK

High-Performance Integrated Modelling System (HiPIMS): Overview

- **Whole System**
  - Simulate **multiple processes**, including flooding, landslide, debris flow and sediment transport, in a single codebase
- **Fully Dynamic**
  - Solves fully 2D depth-integrated **dynamic equations** using Godunov-type **finite volume method**
- **High-Resolution** and **Large-Scale**
  - Run on modern **Graphic Processing Units** (GPUs) or other **high-performance** facilities to support many cells simulations

- **Key scientific innovations**:
  - A **unified mathematical framework** for simulation of both water and mass flows

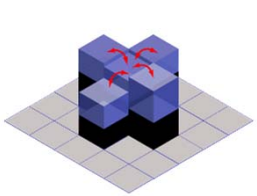
Engineering Geology, 234:174-191

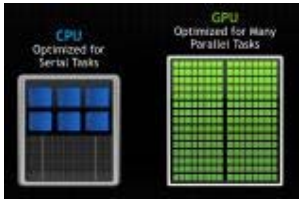
  - **New discretisation schemes** for complex topography and stiff friction terms

Water Resources Research, 53:3730-3759

  - **High-Performance Computing Algorithm** on GPUs

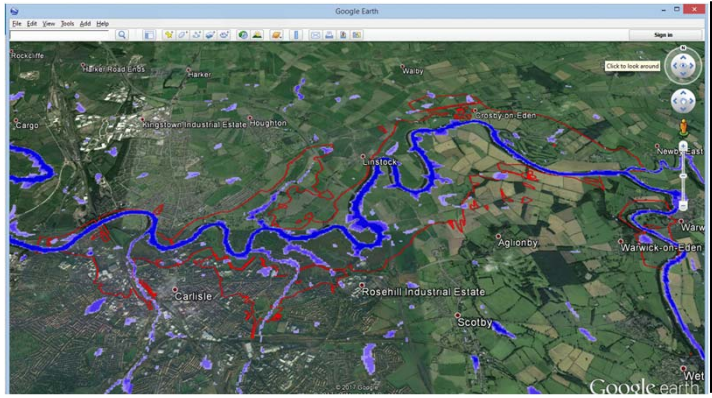
Environmental Modelling and Software, 75:28-42



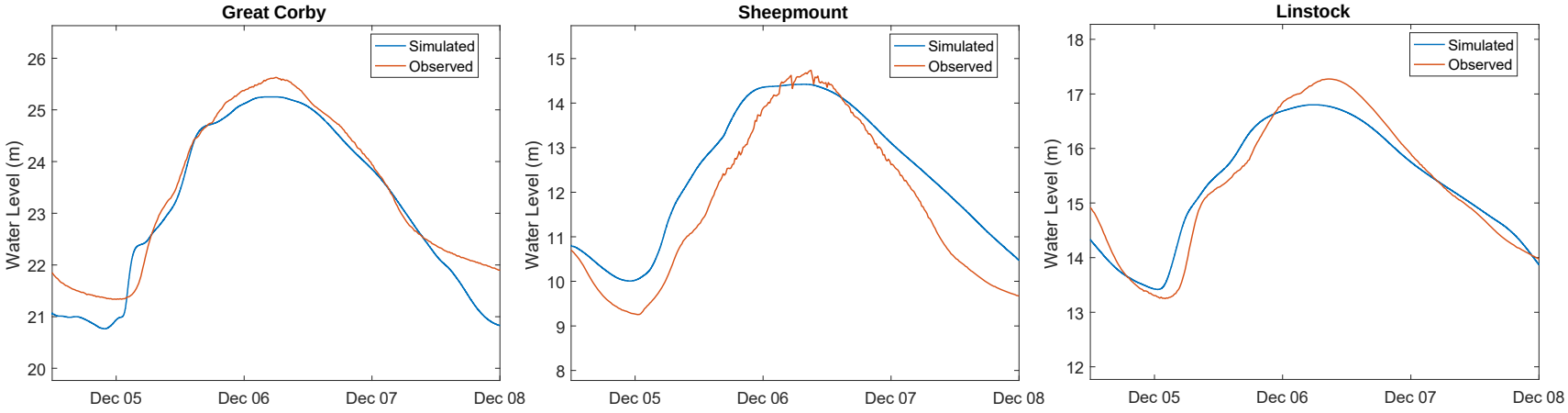


Storm Desmond in Eden Catchment

December 5th – 7th , 2015. Heavy rainfall (1/3 of annual average) caused floods in Eden catchment.



Resolution	5 m
Number of Cells	94 million
Device	8 NVIDIA K80
Computing time	37 h 30 mins
Event duration	96 h 00 mins



Flood risk maps: workflow

Workflow:

1. Set up the flood event of 2012 and use the remote sensing data to calibrate the parameters (friction, infiltration) of the numerical model
2. Divide the Luanhe catchment into different blocks based on the administrative division
3. Set up the design rainfall based on the existing county level intensity-duration formula for Luanhe catchment (Derivation Of The Chicago Storm is adopted here)
4. Simulate the design rainfall for different rainfall return period and storm duration
5. Analysis the flood risk based on the inundation area and influence

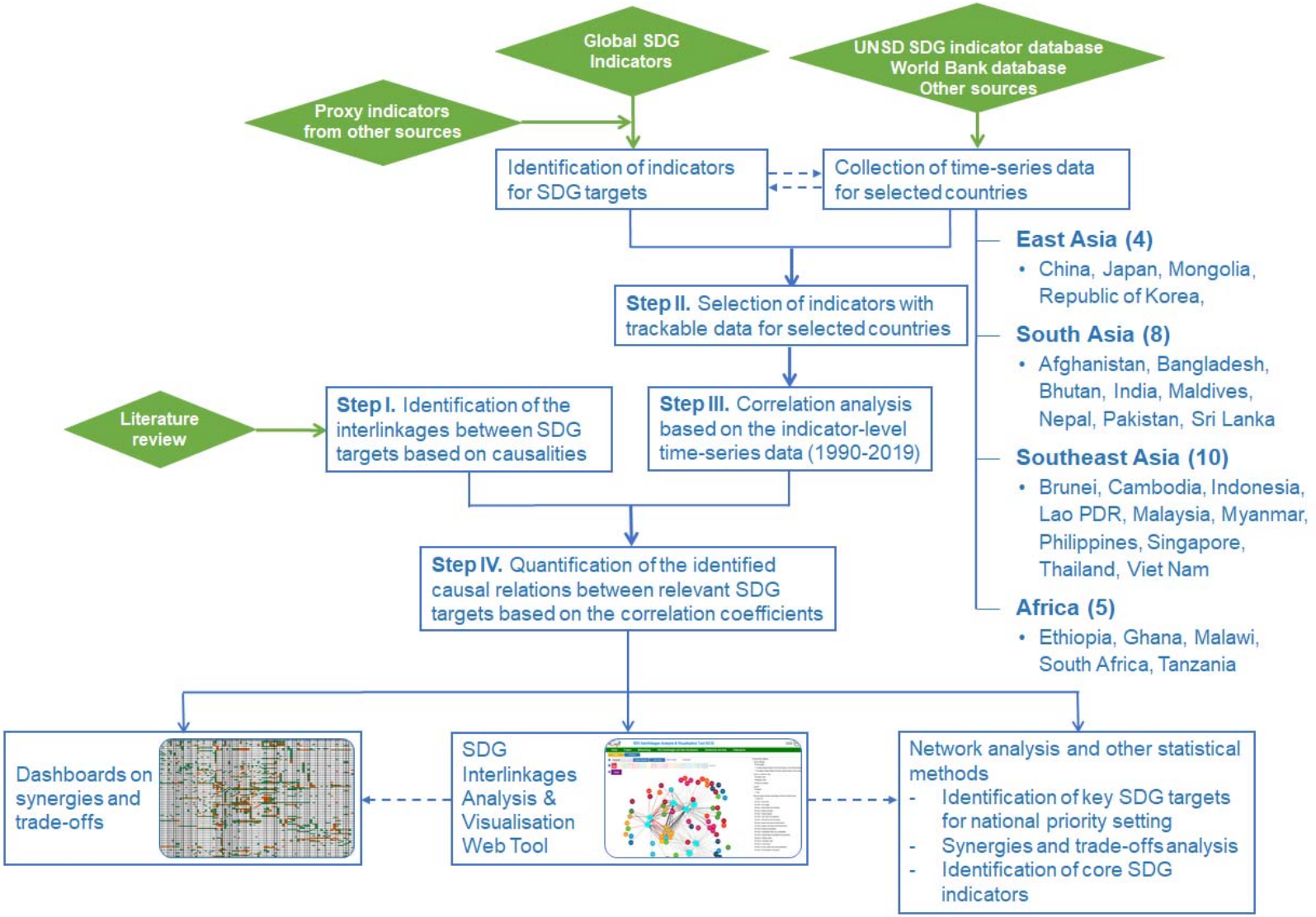
Calibration: 2012 flood event

By the influence of Typhoon Saola and Damrey.

Caused 32 death and 12.3 billion RMB economic losses for Hebei province

TOOL FOR SDG SYNERGIES AND TRADEOFF ANALYSIS

IGES approach on SDG interlinkages analysis



Source: https://sdginterlinkages.iges.jp/visualisationtool.html

Network Analysis

- Based on Social Network Analysis

- Degree centrality
  - Number of edges connected to a node
  - High degree of centrality → wide interactions with other nodes (targets)

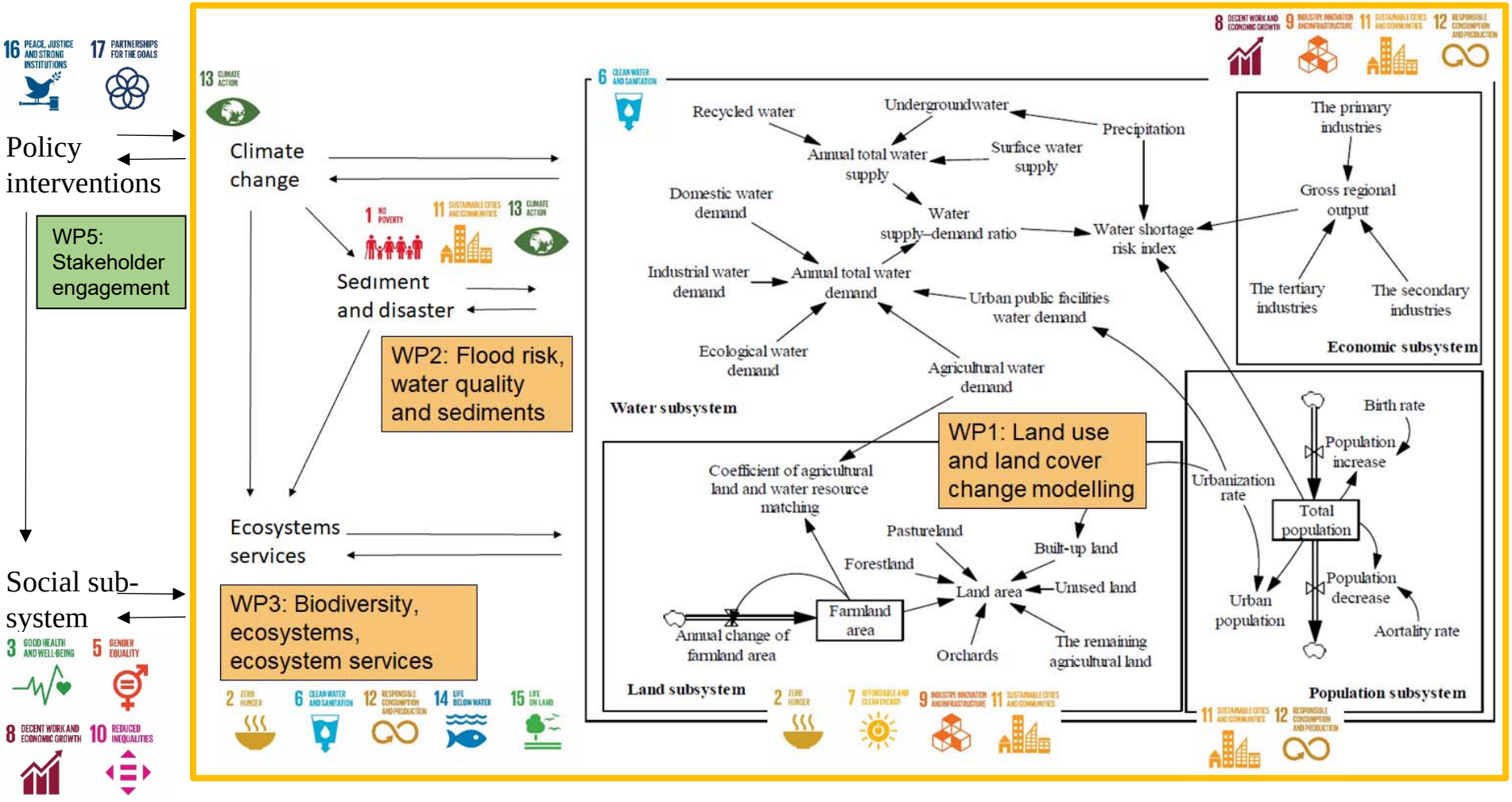
- Eigenvector centrality
  - Wide interactions with other targets
  - Closeness to central points in the network (“influential targets”)

- Betweenness centrality
  - Nodes play an important role in connecting unconnected targets

- Closeness centrality
  - Mean distance from one node to other nodes
  - Degree of direct influence on other nodes

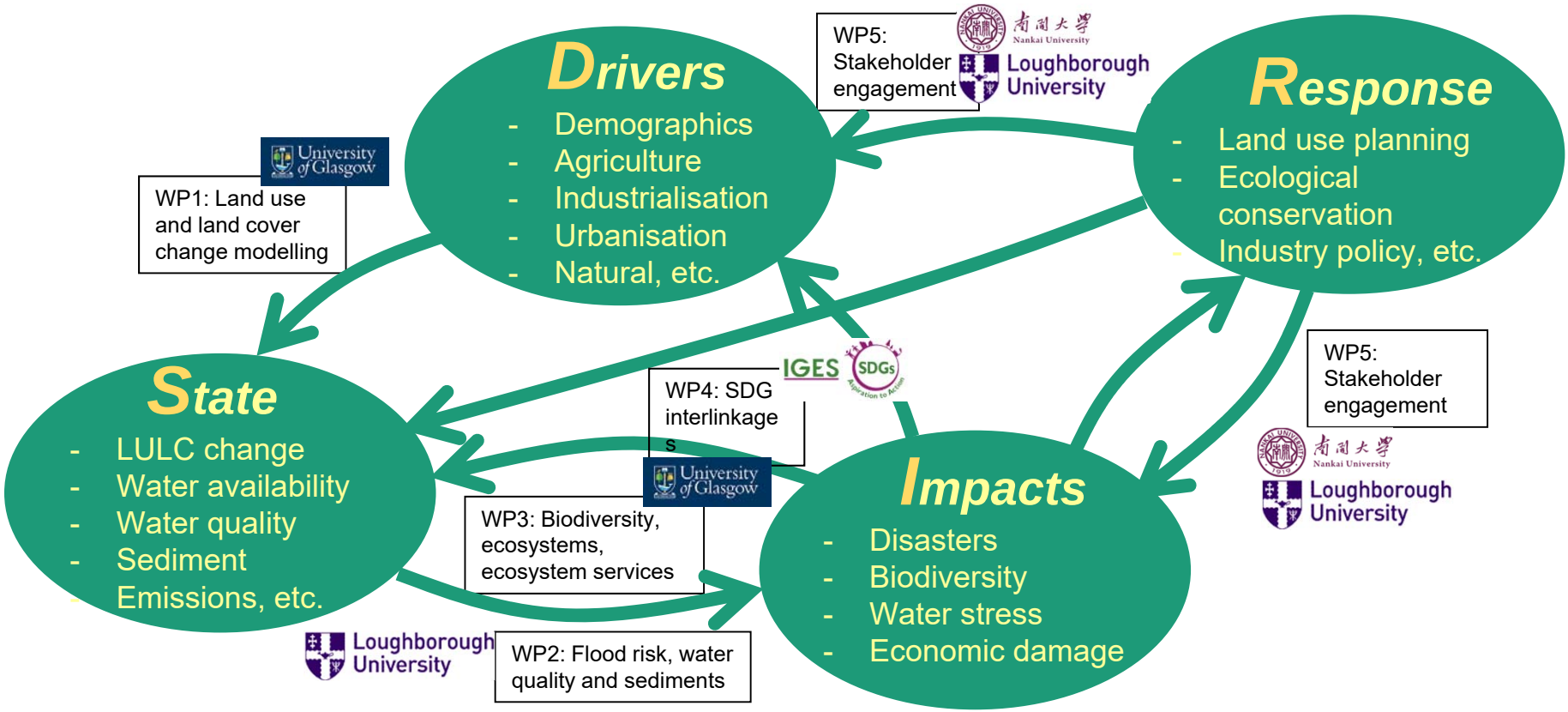
Source: Zhou & Moinuddin (eds) (2017): Sustainable Development Goals Interlinkages and Network Analysis. A practicaltool for SDG integration and policy coherence. IGES: https://www.iges.or.jp/en/pub/sustainable-development-goals-interlinkages/en

SDG interlinkages analysis at the river basin level: A framework of the human-aquatic environment interactions



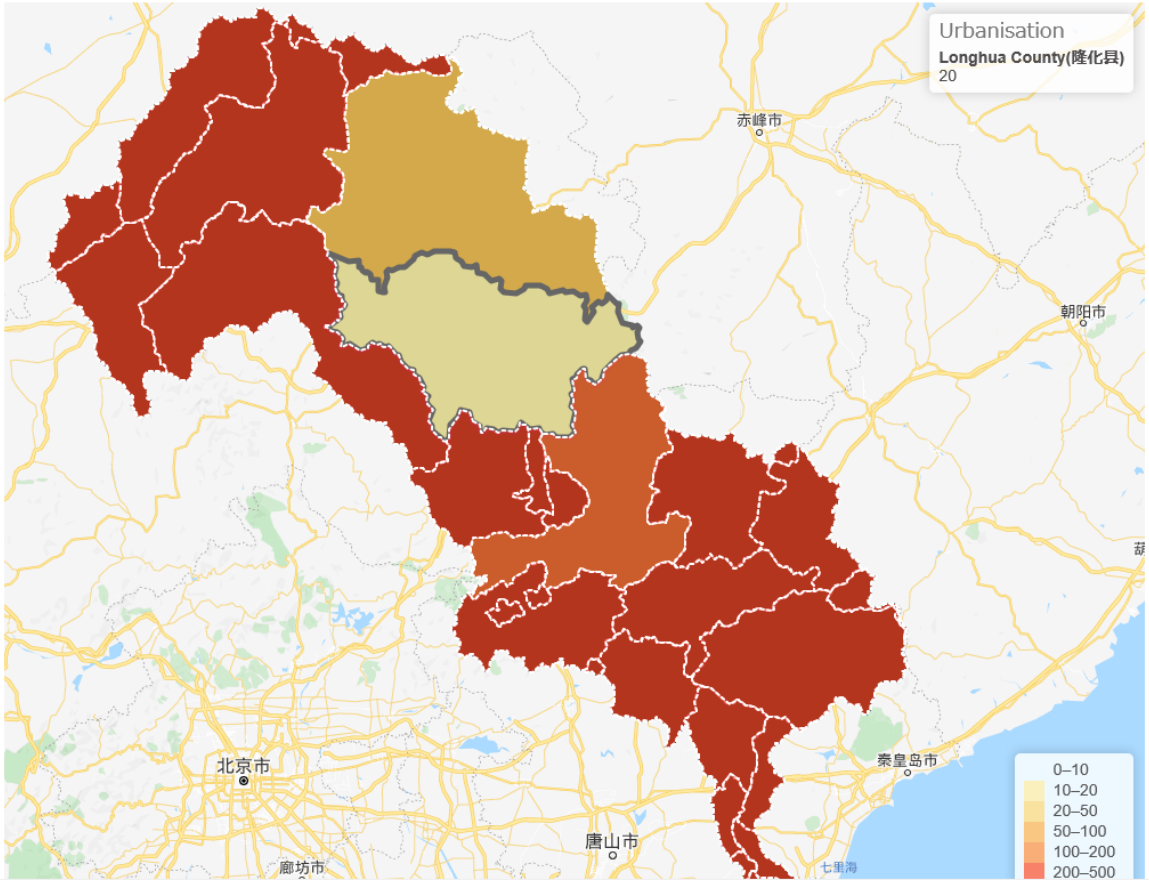
Source: Zhou, et al., 2019. The SD chart is from Jiang, Q.X., 2018. Water 2018, 10, 868

A simplified DPSIR framework for the analysis of the human-nature interlinkages at the river-basin level

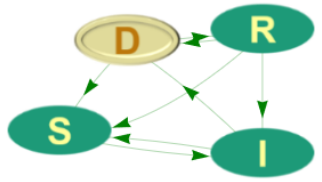


SDG Interlinkages Analysis for Luanhe River Basin

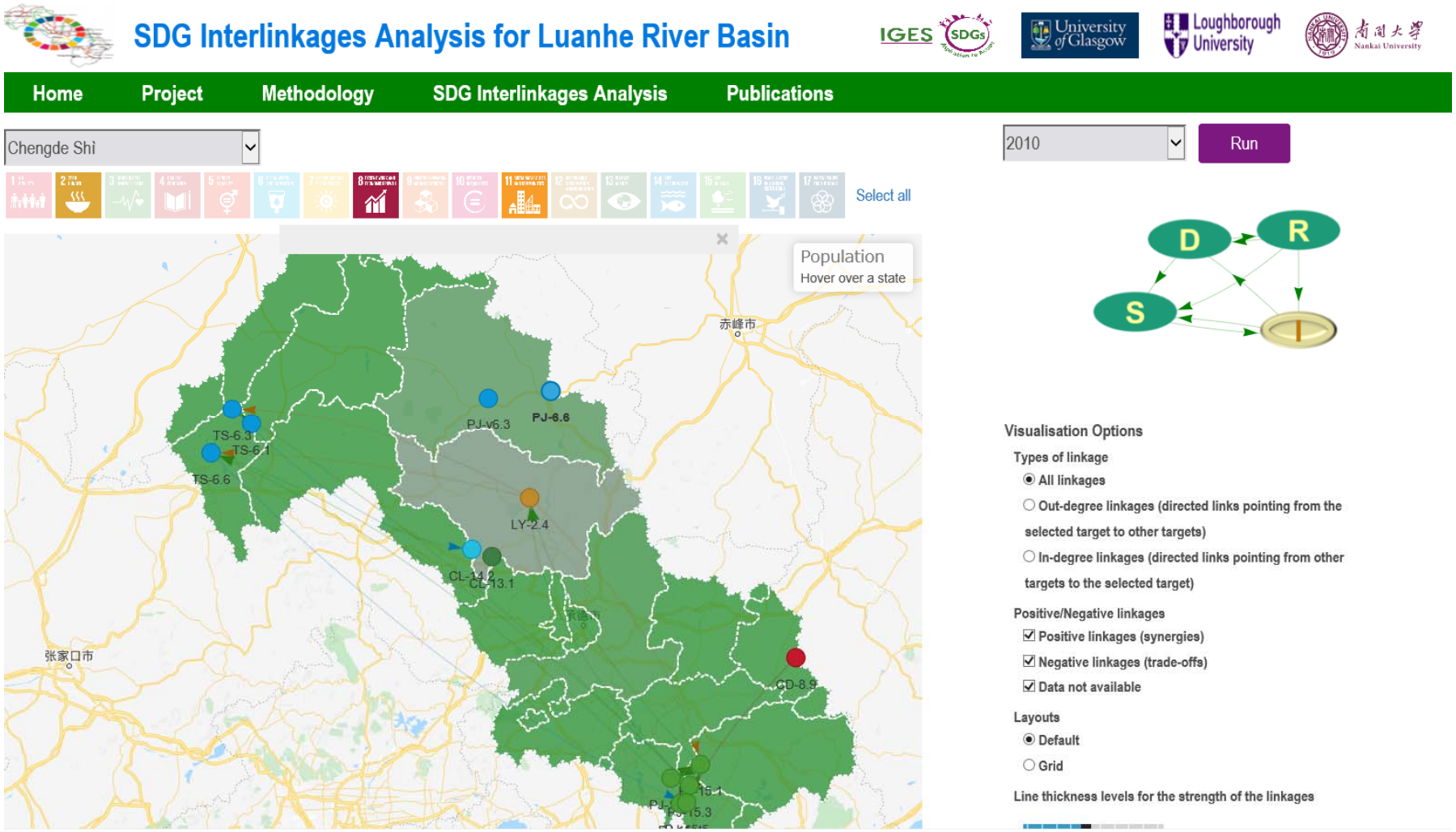
Home | Project | Methodology | SDG Interlinkages Analysis | Publications



2030 Run



State	Scenarios	Chengde Shi
Population	H M L	
Living standard	H M	
Economic growth	H M L	
Urbanisation	H M	
Climate change	RCP4.5 RCP8.5	


SDG Interlinkages Analysis for Luanhe River Basin
Home
Project
Methodology
SDG Interlinkages Analysis
Publications
Chengde Shi
2010
Run
Select all
Population
Hover over a state
D
R
S
I
Visualisation Options
Types of linkage
All linkages
Out-degree linkages (directed links pointing from the selected target to other targets)
In-degree linkages (directed links pointing from other targets to the selected target)
Positive/Negative linkages
Positive linkages (synergies)
Negative linkages (trade-offs)
Data not available
Layouts
Default
Grid
Line thickness levels for the strength of the linkages
赤峰市
张家口市
PJ-v6.3
PJ-6.6
TS-6.3
TS-6.1
TS-6.6
LY-2.4
CL-14.2
CL-13.1
CD-8.9

Limitations

- Identification of SDG interlinkages not straightforward in some cases → depends on extent of the literature
- Needs to be contextualised: some targets are relevant in one country/region, but not in another
- Indicator definition / Data availability → particularly problematic the higher the spatial resolution you aim at
- Based on correlation analysis but correlation does not always equate to causality

Source: Building on Zhou & Moinuddin (eds) (2017): Sustainable Development Goals Interlinkages and Network Analysis. A practicaltool for SDG integration and policy coherence. IGES: https://www.iges.or.jp/en/pub/sustainable-development-goals-interlinkages/en

University of Glasgow

Thank You!

https://luanhelivinglab.home.blog/

@riverSDGs1