Supplementary material for

Characteristics of Urban Flood Resilience Evolution and Analysis of Influencing Factors: A Case Study of Yingtan City, China

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This supplement has 14 pages containing detailed information includes:

Supplementary table: Table S1–S6.

Table S1. Questionnaire of expert

Primary indicator	Secondary indicator	Scoring area				
		Extremely Important	Impor tant	General Importance	Not Important	Least Important
Socio-econo mic resilience	Per capital GDP	☐	☐	☐	☐	☐
	Local fiscal expenditure	☐	☐	☐	☐	☐
	Proportion of tertiary industry to GDP	☐	☐	☐	☐	☐
	Number of healthcare workers per 10 000 population	☐	☐	☐	☐	☐
	Percentage of population aged over 60 and under 18	☐	☐	☐	☐	☐
	Number of students in ordinary institutions of higher education	☐	☐	☐	☐	☐
	Unemployment rate	☐	☐	☐	☐	☐
	Density of population	☐	☐	☐	☐	☐
Ecological	Per capita public	☐	☐	☐	☐	☐

resilience	green areas					
	Proportion of unused land area	☐	☐	☐	☐	☐
	Comprehensive utilization rate of general industrial solid waste	☐	☐	☐	☐	☐
	Green coverage rate of built-up area	☐	☐	☐	☐	☐
	Centralized treatment rate of sewage treatment plant	☐	☐	☐	☐	☐
	Surface area of lakes and rivers	☐	☐	☐	☐	☐
	Land development intensity	☐	☐	☐	☐	☐
Infrastructure resilience	Number of hospital beds per 10 000 population	☐	☐	☐	☐	☐
	Proportion of rural residential areas and industrial and	☐	☐	☐	☐	☐

mining land					
Per capita refuge area	☐	☐	☐	☐	☐
Density of road network in built district	☐	☐	☐	☐	☐
Number of internet broadband users	☐	☐	☐	☐	☐
Communication coverage	☐	☐	☐	☐	☐
Number of buses per 10,000 people	☐	☐	☐	☐	☐
Density of sewers in built district	☐	☐	☐	☐	☐
Central city pumping capacity	☐	☐	☐	☐	☐

Table S2. Expert background

Expert	Work Field	Years in Field	Highest Degree	Department
Expert A	Urban Planning	25	Bachelor's	Government Department

Expert B	Urban Emergency Management	31	Bachelor's	Government Department
Expert C	Sponge City	18	Master's	Research Institute
Expert D	Urban Flood Control and Drainage	15	Doctorate	Research Institute
Expert E	Urban Flood Control and Drainage	20	Doctorate	Research Institute

Table S3. Calculation of the final combined weight of the 5 experts' questionnaires.

Primary indicator	Primary indicator weight	Secondary indicator	Socio-economic resilience weight	Ecological resilience weight	Infrastructure resilience weight	Flood resilience weight
Socio-economic resilience	0.4244	Per capita GDP (A1)	0.3940	0	0	0.1672
		Local fiscal expenditure (A2)	0.1787	0	0	0.0759
		Number of healthcare workers per 10 000 population (A3)	0.0852	0	0	0.0362
		Percentage of population aged over 60 and under	0.1384	0	0	0.0587

		18 (A4)				
		Unemployment rate (A5)	0.0426	0	0	0.0181
		Density of population (A6)	0.1611	0	0	0.0684
		Per capita public green areas (B1)	0	0.2117	0	0.0393
		Green coverage rate of built-up area (B2)	0	0.1916	0	0.0355
Ecological resilience	0.1856	Centralized treatment rate of sewage treatment plant (B3)	0	0.0515	0	0.0096
		Surface area of lakes and rivers (B4)	0	0.2524	0	0.0468
		Land development intensity (B5)	0	0.2929	0	0.0543
Infrastructure resilience	0.3900	Number of hospital beds per 10 000 population (C1)	0	0	0.1176	0.0459

Per capita refuge area (C2)	0	0	0.1648	0.0643
Density of road network in built district (C3)	0	0	0.1736	0.0677
Communi cation coverage (C4)	0	0	0.0732	0.0286
Density of sewers in built district (C5)	0	0	0.2841	0.1108
Central city pumping capacity (C6)	0	0	0.1867	0.0728

Table S4. Statistical data of various indicators in Yingtan City from 2010 to 2022.

Primary indicator	Secondary index	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Socio-economic resilience	Per capita GDP (A1)	Yuan/person	30999	38172	43744	49969	54302	56896	61709	64712	69923	79833	84139	99069	107111
	Local fiscal expenditure (A2)	100 million Yuan	40.81	68.12	88.05	100.37	114.97	127.74	128.03	128.35	140.18	155.06	188.97	188.65	208.42
	Number of healthcare workers per 10 000 population (A3)	person	54.69	55.72	57.37	60.83	62.48	62.78	64.78	68.89	68.53	70.33	70.19	75.60	80.46
	Percentage of population aged over 60 and under 18 (A4)	%	29.10	29.56	29.99	30.44	30.88	31.33	31.77	32.24	32.70	33.16	34.02	34.05	34.50
	Unemployment rate (A5)	%	3.50	3.50	3.50	3.50	3.20	2.98	3.00	2.98	2.98	2.91	3.28	3.20	3.27

Ecological resilience	Density of population (A6)	person/km^2	2761	2659	3460	3449	3702	3503	3093	3107	3023	3378	3348	3371	2904
	Per capita public green areas (B1)	m^2	12.69	13.13	12.39	14.27	13.29	15.86	15.29	23.79	17.34	13.96	15.11	17.34	20.66
	Green coverage rate of built-up area (B2)	%	47.34	37.84	38.91	40.45	41.34	45.15	41.30	46.74	40.94	46.19	44.03	46.19	47.57
	Centralized treatment rate of sewage treatment plant (B3)	%	77.90	93.49	94.73	93.78	94.22	97.54	97.66	97.05	95.76	95.67	95.25	96.11	97.70
	Surface area of lakes and rivers (B4)	km^2	12.15	12.40	12.38	12.47	12.40	12.17	11.88	11.71	11.47	11.35	11.24	11.22	10.71
	Land development intensity (B5)	%	0.67	0.86	0.90	0.93	0.94	0.95	1.10	1.11	1.39	1.39	1.57	1.62	1.62

Infrastructure resilience	Number of hospital beds per 10 000 population (C1)	sheet	25.71	28.78	33.68	40.49	43.31	43.49	45.10	62.05	61.28	62.87	70.19	68.22	69.76
	Per capita refuge area (C2)	m^2	3.36	3.39	3.41	4.00	4.45	4.66	5.13	5.69	5.97	6.36	6.96	7.85	8.48
	Density of road network in built district (C3)	km/km^2	5.36	4.16	3.97	3.85	3.96	3.93	3.75	4.60	6.28	6.48	7.46	8.28	8.30
	Communication coverage (C4)	%	54.88	61.78	71.87	72.84	72.65	71.45	77.17	68.14	77.94	93.62	94.75	97.49	100.0
	Density of sewers in built district (C5)	km/km^2	2.58	2.57	2.45	5.24	5.17	5.15	4.46	6.68	9.34	6.48	7.64	15.12	15.94
	Central city	m^3/s	25.76	27.33	32.75	34.56	35.23	39.05	41.71	47.13	50.35	52.96	58.20	64.00	67.61

pumping capacity (C6)

Table S5. Classification of flood resilience index of Yingtan City in 2016.

Secondary index	Unit	Level 1	Level 2	Level 3	Level 4	Level 5
Per capita GDP (A1)	Yuan/person	10987~31714	31715~46408	46409~66231	66232~95113	95114~207163
Local fiscal expenditure (A2)	100 million Yuan	19.41~28 7.53	287.53~54 3.18	543.18~9 25	925~172 7.72	1727.72~61 91.56
Number of healthcare workers per 10 000 population (A3)	person	0~25	25~30	30~35	35~40	＞40
Percentage of population aged over 60 and under 18 (A4)	%	＞25	20~25	15~20	10~15	0~10
Unemployment rate (A5)	%	7.68~16.55	4.34~7.67	2.54~4.33	1.28~2.53	0.08~1.27
Density of population (A6)	person/km2	6939~13369	4543~6938	2851~4542	1580~2850	121~1579
Per capita public green areas (B1)	m2	2.50~8.53	8.54~12.33	12.34~16.61	16.62~24.58	24.59~46.88
Green coverage rate of built-up area (B2)	%	12.03~23.26	23.27~31.78	31.79~39.30	39.31~43.49	43.50~51.37
Centralized treatment rate of sewage	%	42.07~68.68	68.69~83.54	83.55~90.42	90.43~95.55	95.56~100

treatment plant (B3)					
Surface area of lakes and rivers (B4)	km2	0~7	7~9	9~11	11~13	>13
Land development intensity (B5)	%	19.71~46.23	8.66~19.70	4.19~8.65	1.52~4.18	0.02~1.51
Number of hospital beds per 10 000 population (C1)	sheet	14.31~38.19	38.20~50.97	50.98~65.29	65.30~85.35	85.36~138.64
Per capita refuge area (C2)	m2	0~0.5	0.5~1.5	1.5~2.5	2.5~3.5	>3.5
Density of road network in built district (C3)	km/km2	2.74~5.79	5.80~8.35	8.36~12.22	12.23~18.70	18.71~35.64
Communication coverage (C4)	%	50~60	60~70	70~80	80~90	90~100
Density of sewers in built district (C5)	km/km2	0.98~6.86	6.87~10.78	10.79~16.48	16.49~30.51	30.52~61.90
Central city pumping capacity (C6)	m3/s	0~2	2~10	10~50	50~200	>200

Table S6. Classification of flood resilience index of Yingtan City in 2022.

Secondary index	Unit	Level 1	Level 2	Level 3	Level 4	Level 5
Per capita GDP (A1)	Yuan/person	19915~49885	49886~70999	71000~100824	100825~142721	142722~218118
Local fiscal expenditure (A2)	100 million Yuan	26.81~40.68	40.68~80.66	80.66~170.07	170.68~315.25	315.25~84.31
Number of healthcare workers per 10 000 population (A3)	person	0~25	25~30	30~35	35~40	>40
Percentage of population aged over 60 and under 18 (A4)	%	>25	20~25	15~20	10~15	0~10
Unemployment rate (A5)	%	15.85~63.55	6.99~15.84	3.99~6.98	2.15~3.98	0.21~2.14
Density of population (A6)	person/km^2	6800~12677	4565~6800	2938~4565	1670~2938	109~1670
Per capita public green areas (B1)	m^2	1.37~9.98	9.99~14.53	14.54~18.65	18.66~28.62	28.63~49.27
Green coverage rate of built-up area (B2)	%	9.39~25.27	25.28~37.09	37.10~42.39	42.40~46.71	46.72~64.36
Centralized treatment rate of	%	71.99~86.00	86.01~93.20	93.21~96.60	96.61~98.66	98.67~100.00

sewage treatment plant (B3)					
Surface area of lakes and rivers (B4)	km^2	0~7	7~9	9~11	11~13	>13
Land development intensity (B5)	%	29.56~48.55	13.56~29.55	5.68~13.55	1.87~5.67	0.01~1.86
Number of hospital beds per 10 000 population (C1)	sheet	23.75~43.40	43.41~54.55	54.56~67.62	67.63~88.73	88.74~500.00
Per capita refuge area (C2)	m^2	0~0.5	0.5~1.5	1.5~2.5	2.5~3.5	>3.5
Density of road network in built district (C3)	km/km^2	0.76~5.05	5.06~7.24	7.25~9.02	9.03~11.51	11.52~18.43
Communication coverage (C4)	%	50~60	60~70	70~80	80~90	90~100
Density of sewers in built district (C5)	km/km^2	0.35~6.78	6.79~10.51	10.52~14.91	14.92~21.61	21.62~36.06
Central city pumping capacity (C6)	m^3/s	0~2	2~10	10~50	50~200	>200