1 **Supplementary Material**

2 <center>**Table S1.** Counties in the Jingjinji region.</center>

No	City	County	No	City	County
1	Beijing	Dongcheng District	26	Tianjin	Beichen District
2	Beijing	Xicheng District	27	Tianjin	Wuqing District
3	Beijing	Chaoyang District	28	Tianjin	Baodi District
4	Beijing	Fengtai District	29	Tianjin	Binhai New District
5	Beijing	Shijingshan District	30	Tianjin	Ninghe District
6	Beijing	Haidian District	31	Tianjin	Jinghai District
7	Beijing	Mentougou District	32	Tianjin	Jizhou District
8	Beijing	Fangshan District	33	Shijiazhuang	Chang'an District
9	Beijing	Tongzhou District	34	Shijiazhuang	Qiaoxi District
10	Beijing	Shunyi District	35	Shijiazhuang	Xinhua District
11	Beijing	Changping District	36	Shijiazhuang	Jingxing Mining Area
12	Beijing	Daxing District	37	Shijiazhuang	Yuhua District
13	Beijing	Huairou District	38	Shijiazhuang	Gaocheng District
14	Beijing	Pinggu District	39	Shijiazhuang	Luquan District
15	Beijing	Miyun District	40	Shijiazhuang	Luancheng District
16	Beijing	Yanqing District	41	Shijiazhuang	Jingxing County
17	Tianjin	Heping District	42	Shijiazhuang	Zhengding County
18	Tianjin	Hedong District	43	Shijiazhuang	Xingtang County
19	Tianjin	Hexi District	44	Shijiazhuang	Lingshou County
20	Tianjin	Nankai District	45	Shijiazhuang	Gaoyi County
21	Tianjin	Hebei District	46	Shijiazhuang	Shenze County
22	Tianjin	Hongqiao District	47	Shijiazhuang	Zanhuang County
23	Tianjin	Dongli District	48	Shijiazhuang	Wuji County
24	Tianjin	Xiqing District	49	Shijiazhuang	Pingshan County
25	Tianjin	Jinnan District	50	Shijiazhuang	Yuanshi County

3 Continued

No	City	County	No	City	County
51	Shijiazhuang	Zhao County	76	Handan	Hanshan District
52	Shijiazhuang	Xinji City	77	Handan	Congtai District
53	Shijiazhuang	Jinzhou City	78	Handan	Fuxing District
54	Shijiazhuang	Xinle City	79	Handan	Fengfeng Mining Area
55	Tangshan	Lu'nan District	80	Handan	Feixiang District
56	Tangshan	Lubei District	81	Handan	Yongnian District
57	Tangshan	Guye District	82	Handan	Linzhang County
58	Tangshan	Kaiping District	83	Handan	Cheng'an County
59	Tangshan	Fengnan District	84	Handan	Daming County
60	Tangshan	Fengrun District	85	Handan	She County
61	Tangshan	Caofeidian District	86	Handan	Ci County
62	Tangshan	Luan County	87	Handan	Qiu County
63	Tangshan	Luannan County	88	Handan	Jize County
64	Tangshan	Leting County	89	Handan	Guangping County
65	Tangshan	Qianxi County	90	Handan	Guantao County
66	Tangshan	Yutian County	91	Handan	Wei County
67	Tangshan	Zunhua City	92	Handan	Quzhou County
68	Tangshan	Qian'an City	93	Handan	Wu'an City
69	Qinhuangdao	Haigang District	94	Xingtai	Qiaodong District
70	Qinhuangdao	Shanhaiguan District	95	Xingtai	Qiaoxi District
71	Qinhuangdao	Beidaihe District	96	Xingtai	Xingtai County
72	Qinhuangdao	Funing District	97	Xingtai	Lincheng County

No	City	County	No	City	County
73	Qinhuangdao	Qinglong County	98	Xingtai	Neiqiu County
74	Qinhuangdao	Changli County	99	Xingtai	Baixiang County
75	Qinhuangdao	Lulong County	100	Xingtai	Longyao County

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No	City	County	No	City	County
101	Xingtai	Ren County	126	Baoding	Anxin County
102	Xingtai	Nanhe County	127	Baoding	Yi County
103	Xingtai	Ningjin County	128	Baoding	Quyang County
104	Xingtai	Julu County	129	Baoding	Li County
105	Xingtai	Xinhe County	130	Baoding	Shunping County
106	Xingtai	Guangzong County	131	Baoding	Boye County
107	Xingtai	Pingxiang County	132	Baoding	Xiong County
108	Xingtai	Wei County	133	Baoding	Zhuozhou City
109	Xingtai	Qinghe County	134	Baoding	Dingzhou City
110	Xingtai	Linxi County	135	Baoding	Anguo City
111	Xingtai	Nangong City	136	Baoding	Gaobeidian City
112	Xingtai	Shahe City	137	Zhangjiakou	Qiaodong District
113	Baoding	Jingxiu District	138	Zhangjiakou	Qiaoxi District
114	Baoding	Lianchi District	139	Zhangjiakou	Xuanhua District
115	Baoding	Mancheng District	140	Zhangjiakou	Xiahuayuan District
116	Baoding	Qingyuan District	141	Zhangjiakou	Wanquan District
117	Baoding	Xushui District	142	Zhangjiakou	Chongli District
118	Baoding	Laishui County	143	Zhangjiakou	Zhangbei County
119	Baoding	Fuping County	144	Zhangjiakou	Kangbao County
120	Baoding	Dingxing County	145	Zhangjiakou	Guyuan County
121	Baoding	Tang County	146	Zhangjiakou	Shangyi County
122	Baoding	Gaoyang County	147	Zhangjiakou	Yu County
123	Baoding	Rongcheng County	148	Zhangjiakou	Yangyuan County
124	Baoding	Laiyuan County	149	Zhangjiakou	Huaian County
125	Baoding	Wangdu County	150	Zhangjiakou	Huailai County

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No	City	County	No	City	County
151	Zhangjiakou	Zhuolu County	176	Cangzhou	Botou City
152	Zhangjiakou	Chicheng County	177	Cangzhou	Renqiu City
153	Chengde	Shuangqiao District	178	Cangzhou	Huanghua City
154	Chengde	Shuangluan District	179	Cangzhou	Hejian City
155	Chengde	Yingshouyingzi Mining Area	180	Langfang	Anci District
156	Chengde	Chengde County	181	Langfang	Guangyang District
157	Chengde	Xinglong County	182	Langfang	Gu'an County
158	Chengde	Luanping County	183	Langfang	Yongqing County
159	Chengde	Longhua County	184	Langfang	Xianghe County
160	Chengde	Fengning County	185	Langfang	Dacheng County
161	Chengde	Kuancheng County	186	Langfang	Wen'an County
162	Chengde	Weichang County	187	Langfang	Dachang County
163	Chengde	Pingquan City	188	Langfang	Bazhou City
164	Cangzhou	Xinhua District	189	Langfang	Sanhe City
165	Cangzhou	Yunhe District	190	Hengshui	Taocheng District
166	Cangzhou	Cang County	191	Hengshui	Jizhou District
167	Cangzhou	Qing County	192	Hengshui	Zaoqiang County
168	Cangzhou	Dongguang County	193	Hengshui	Wuyi County
169	Cangzhou	Haixing County	194	Hengshui	Wuqiang County

No	City	County	No	City	County
170	Cangzhou	Yanshan County	195	Hengshui	Raoyang County
171	Cangzhou	Suning County	196	Hengshui	Anping County
172	Cangzhou	Nanpi County	197	Hengshui	Gucheng County
173	Cangzhou	Wuqiao County	198	Hengshui	Jing County
174	Cangzhou	Xian County	199	Hengshui	Fucheng County
175	Cangzhou	Mengcun County	200	Hengshui	Shenzhou City
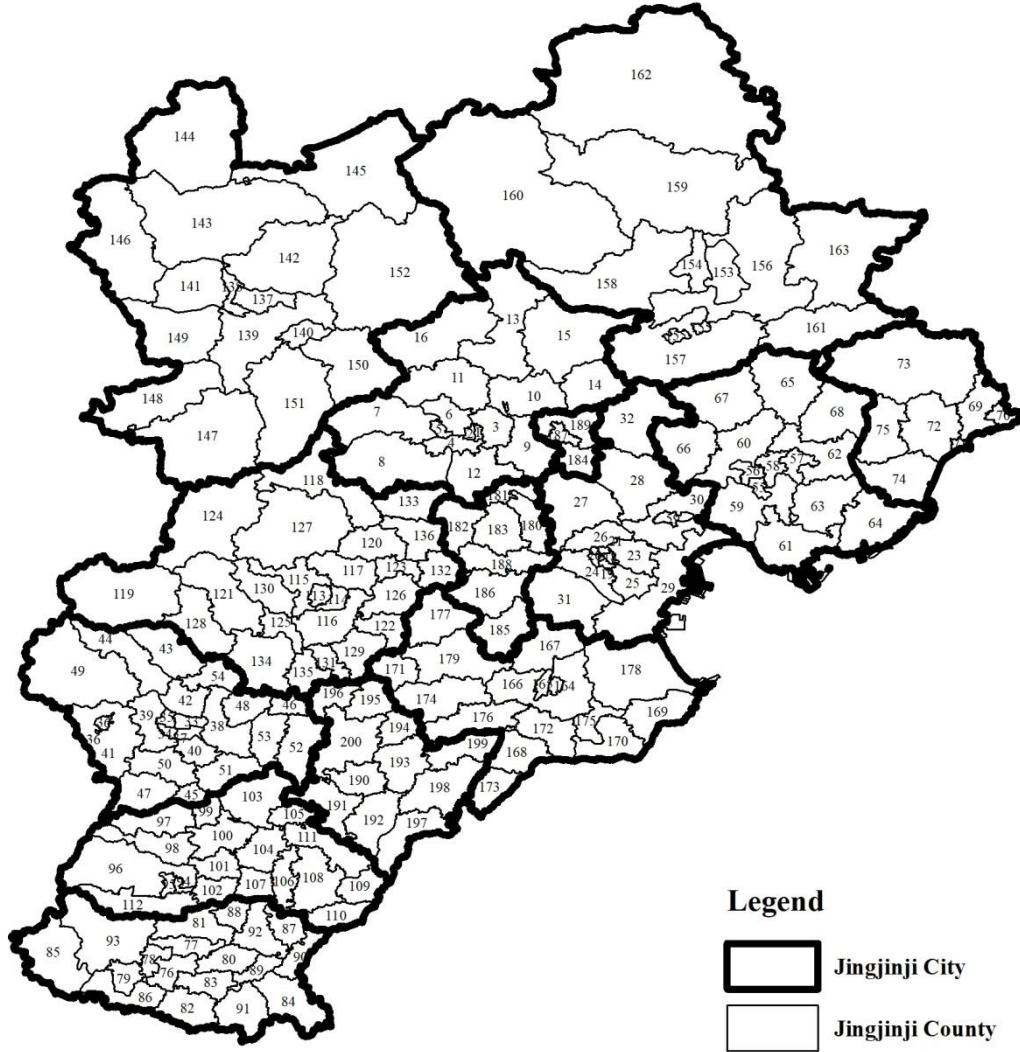
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7 **Figure S1.** Number of counties in the Jingjinji region.

3

a) Original 0.25*0.25 degree annual mean runoff

b) Filled 0.25*0.25 degree annual mean runoff

c) Subsampled 0.01*0.01 degree annual mean runoff

d) Filtered subsampled 0.01*0.01 degree annual mean runoff

Legend

☐ Jingjinji County

Runoff (mm)

High : 310

Low : 0

e)

f)
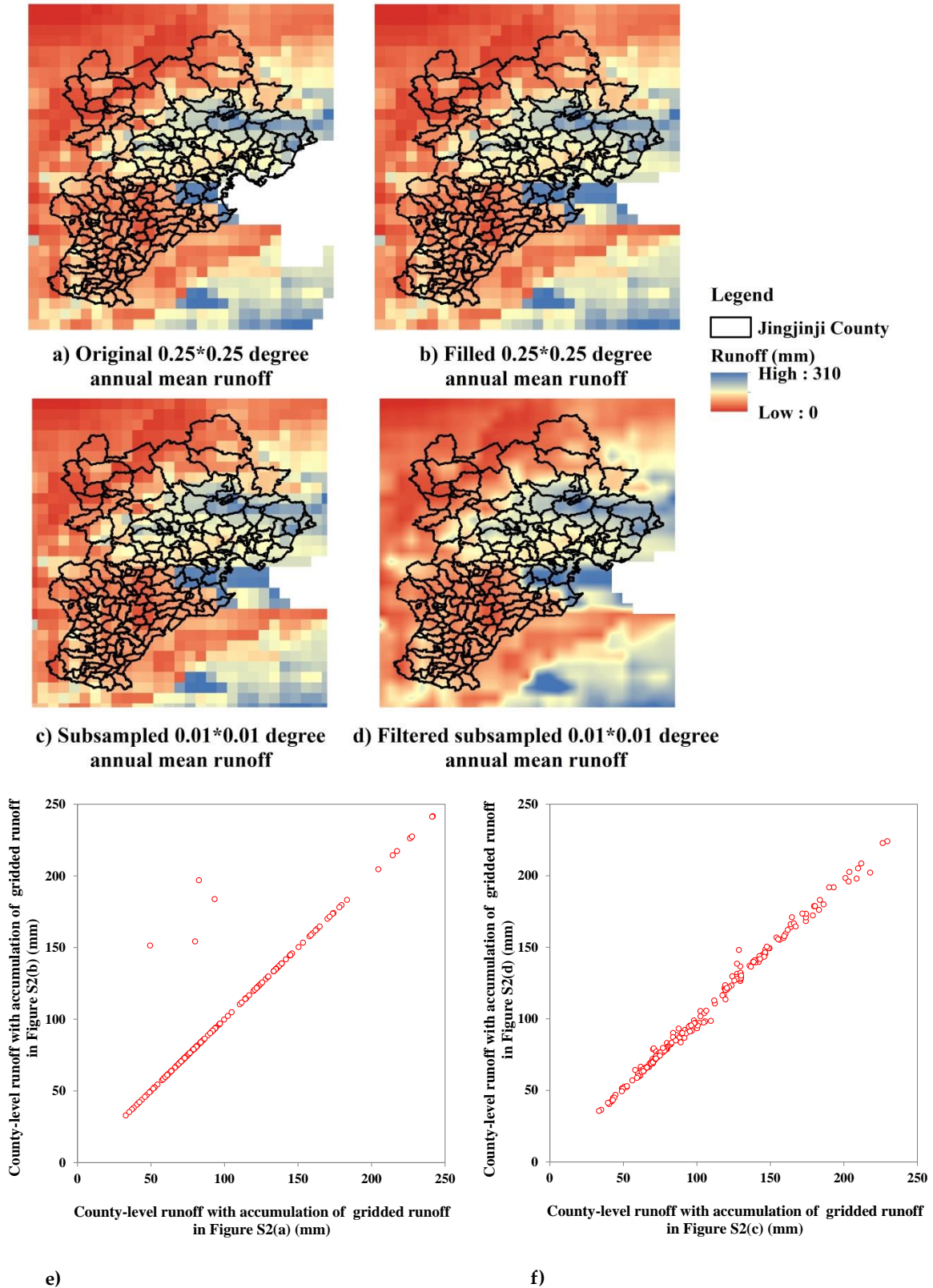
Figure S2. Step-by-step results of processing of annual mean runoff in the Jingjinji region. (**e**) Comparison between county-level runoff with accumulation of gridded runoff in (a) and that with accumulation of gridded runoff in (b) (runoff of only 148 counties can be obtained). (**f**) Comparison between county-level runoff with accumulation of gridded runoff in (c) and that with accumulation of gridded runoff in (d) (runoff of total 200 counties can be obtained).

4

To demonstrate the reliability of the downscaling procedure, the step-by-step results are shown in Figure S2, where Figures S2a–d correspond to the results of steps 1–4, respectively. It can be seen that

1) Because of step 1, the original 0.25° × 0.25° gridded daily runoff is converted into annual one, as shown in Figure S2a, and the data range cannot cover some counties in the east of study area;

2) Because of step 2, the data range can cover all counties of the study area, as shown in Figure S2b, and the total runoff for some east counties, where the partial runoff can be obtained from Figure S2a, can be obtained (see Figure S2e for comparison between county-level runoff with accumulation of gridded runoff in Figure S2a and that with accumulation of gridded runoff in Figure S2b);

3) Because of step 3, a 0.25° × 0.25° cell in Figure S2b divided into 25 × 25 0.01° × 0.01° cells in Figure S2c, Figure S2c looks similar to Figure S2b;

4) Because of step 4, Figure S2d looks smoother than Figure S2c (see Figure S2f for comparison between county-level runoff with accumulation of gridded runoff in Figure S2c and that with accumulation of gridded runoff in Figure S2d);

5) The runoff of only 148 counties can be obtained with the spatial resolution of 0.25° × 0.25°, while the runoff of total 200 counties can be obtained with the spatial resolution of 0.01° × 0.01°.
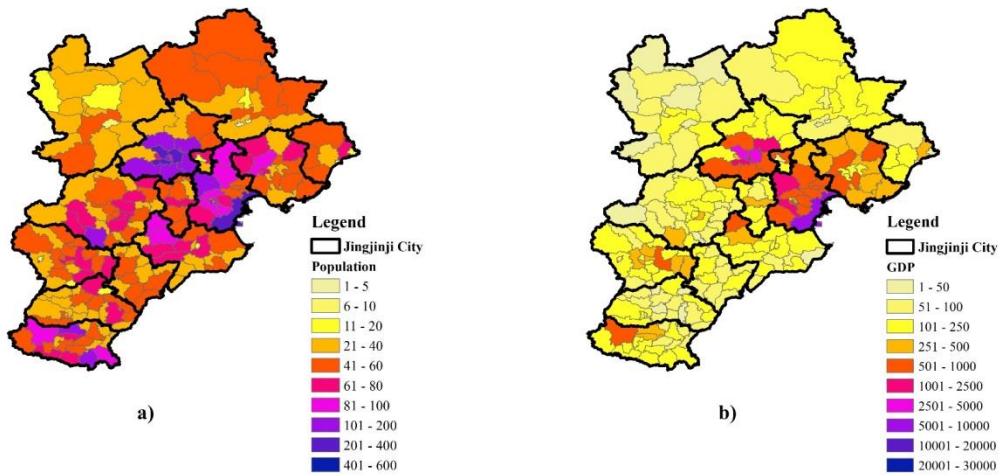
Figure S3. Population and gross domestic product (GDP) at county level for the current scenario. (**a**) Population (Unit: 10^4); (**b**) GDP (Unit: 100 million CNY).
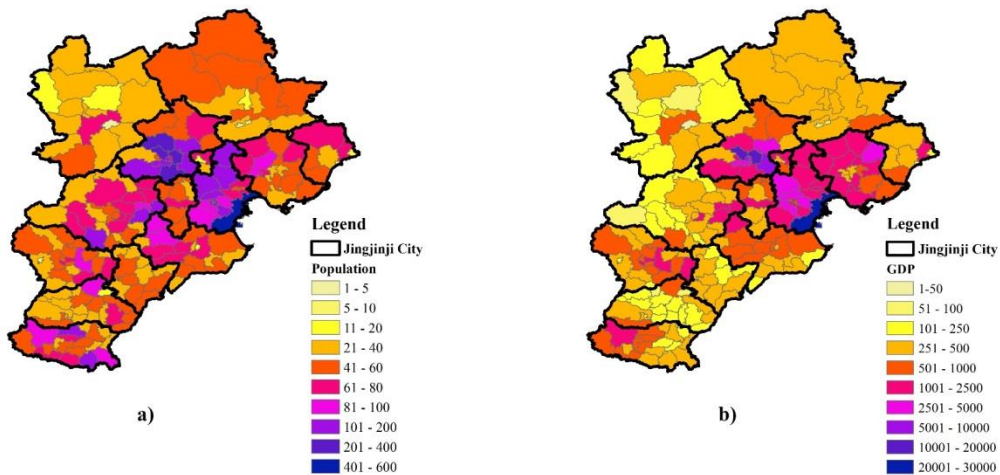
Figure S4. Population and GDP at county level for the future scenario. (**a**) Population (Unit: 10^4); (**b**) GDP
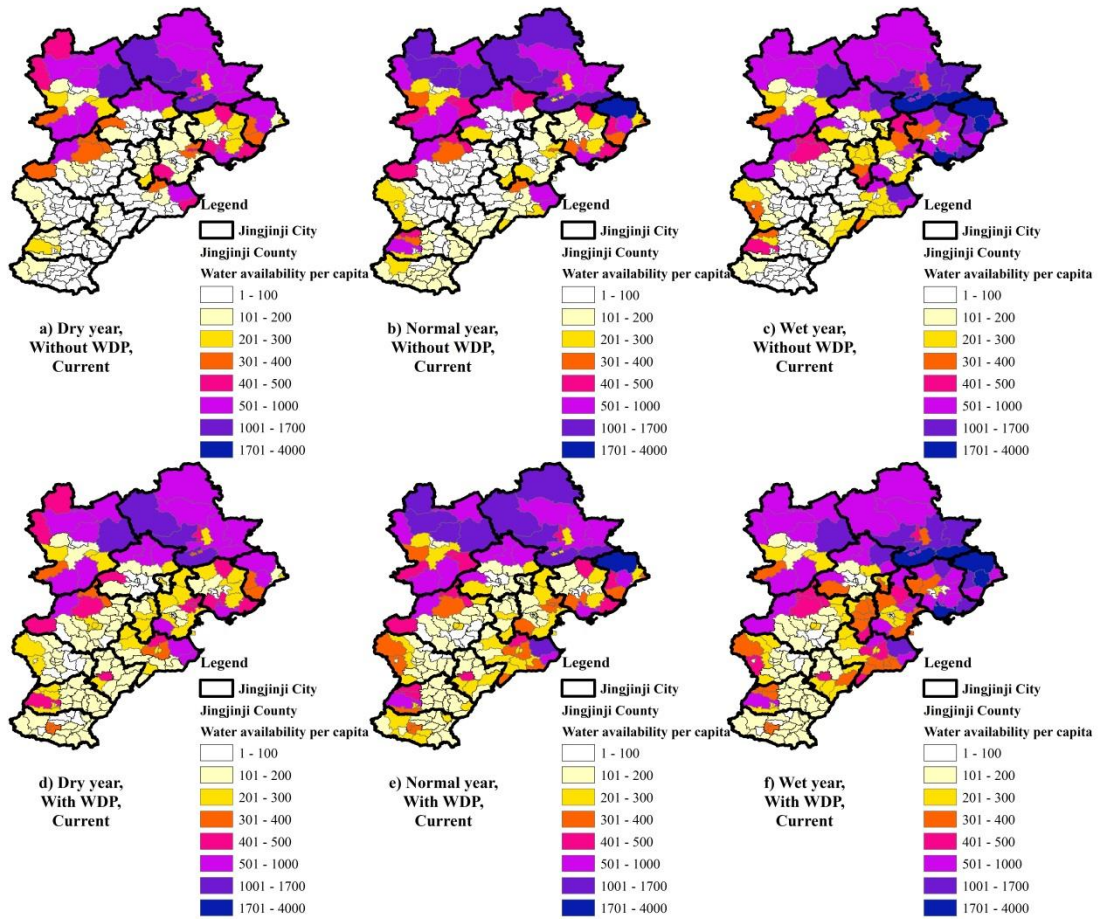
(Unit: 100 million CNY).
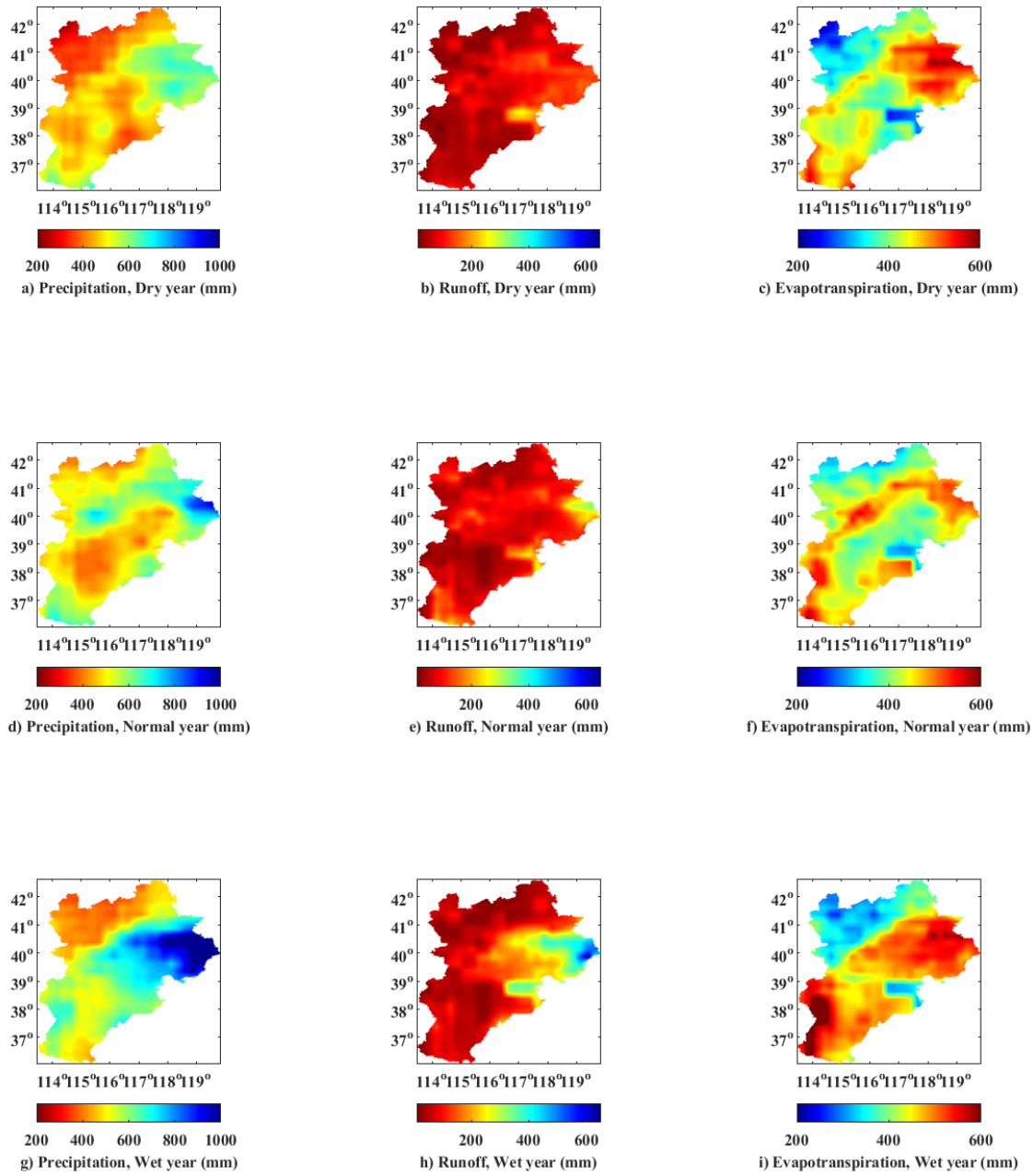
Figure S5. Spatial distribution of precipitation, runoff, and evapotranspiration in typical years in the Jingjinji region.
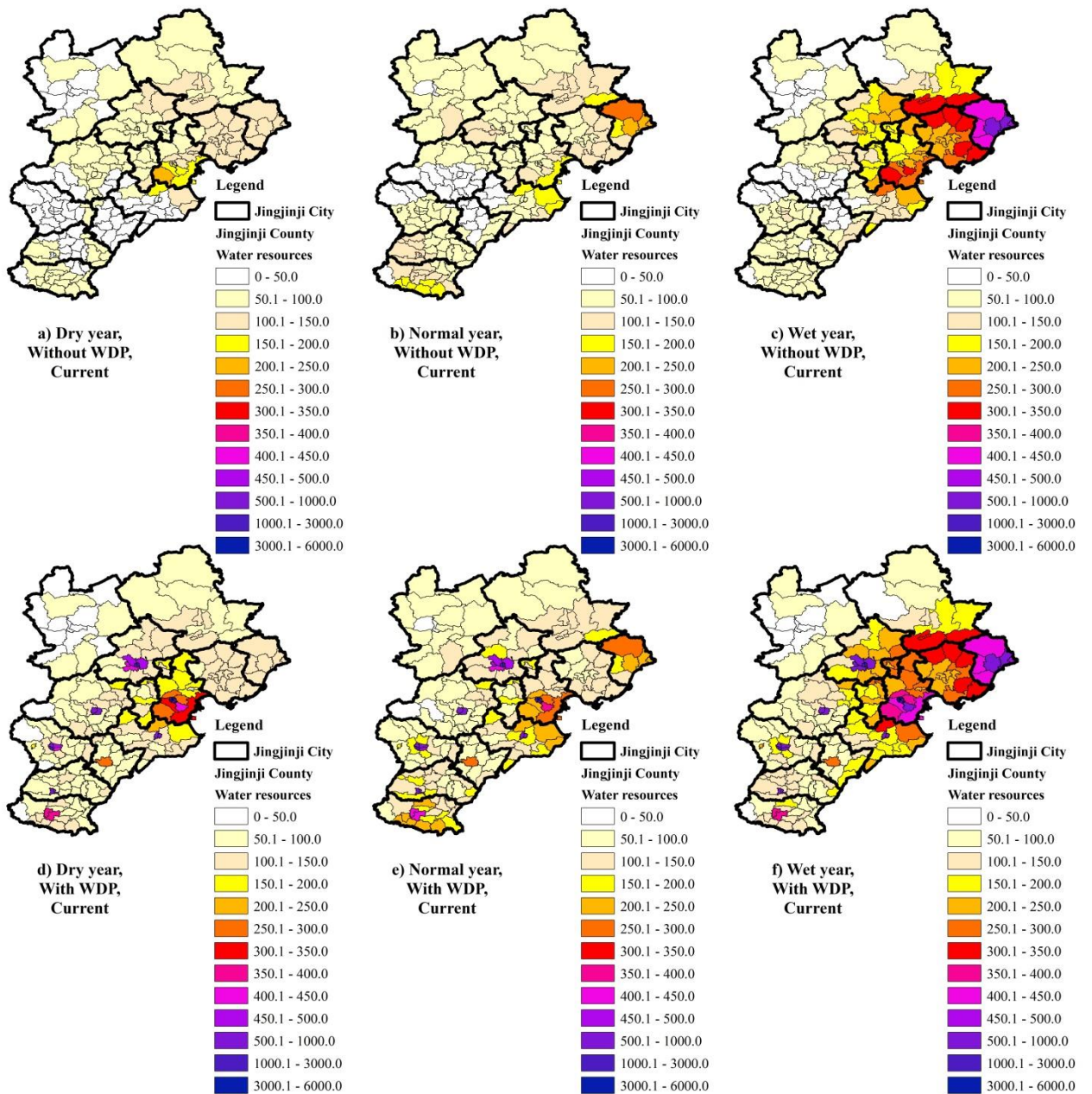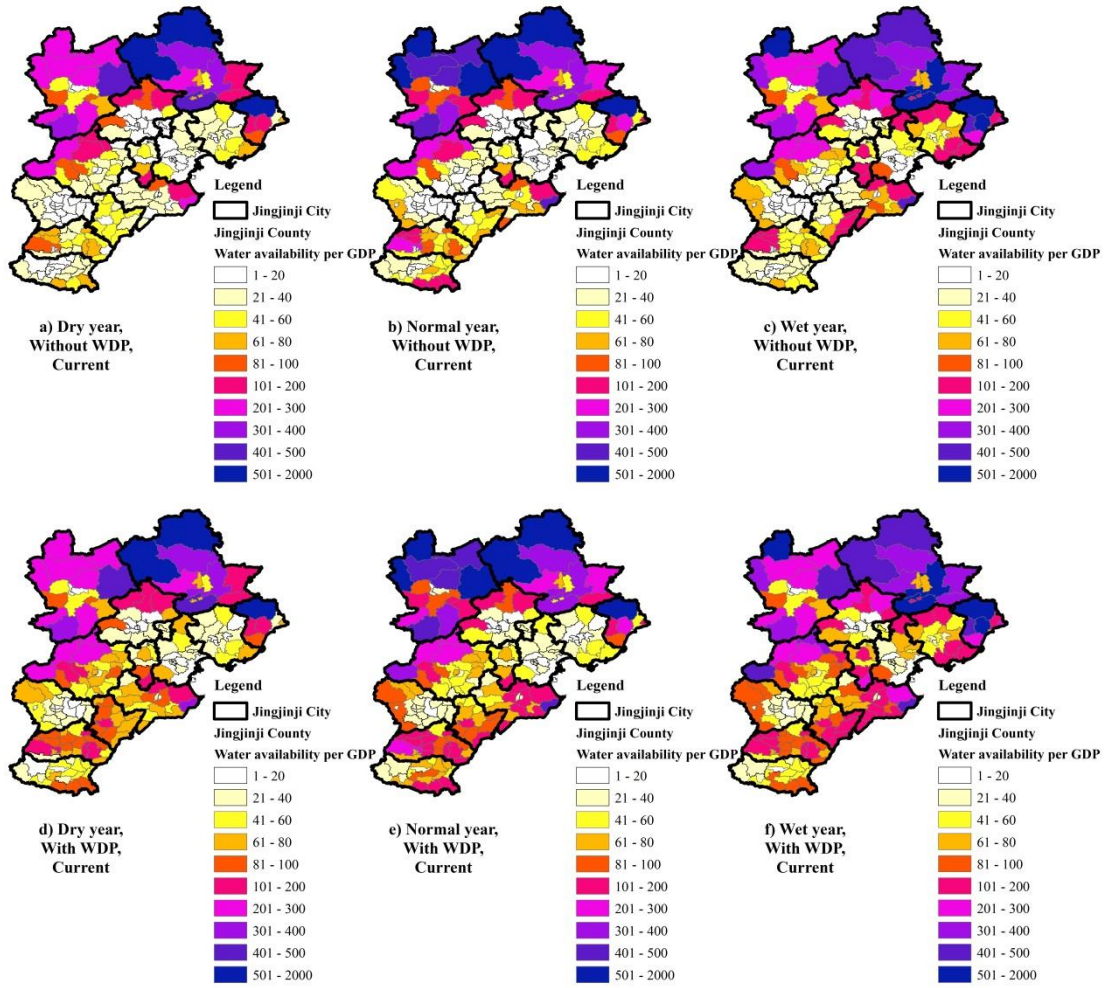
41

42   **Figure S6.** Water resources in typical years under current scenarios. (Unit: mm)
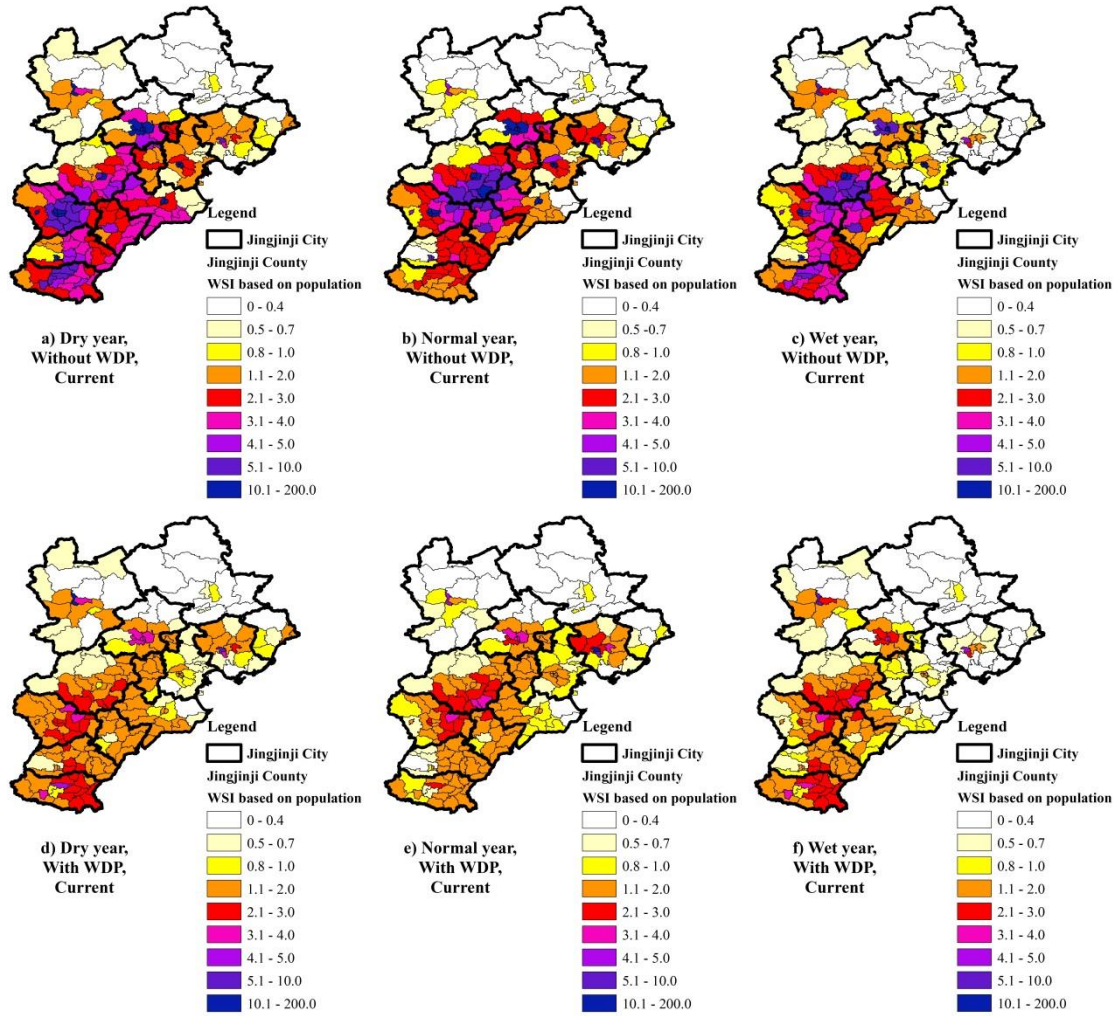
43

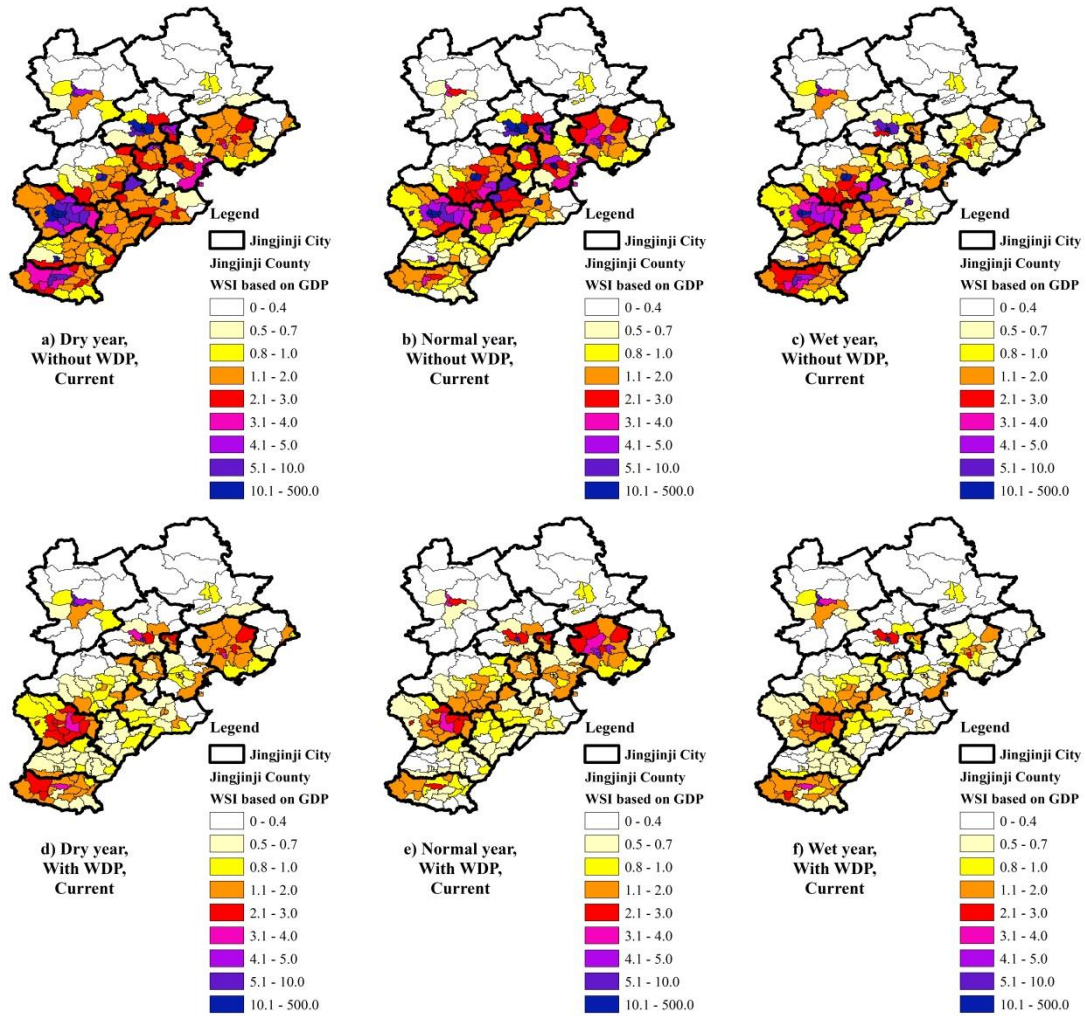44   **Figure S7.** Water availability per capita in typical years under current scenarios. (Unit: m³)
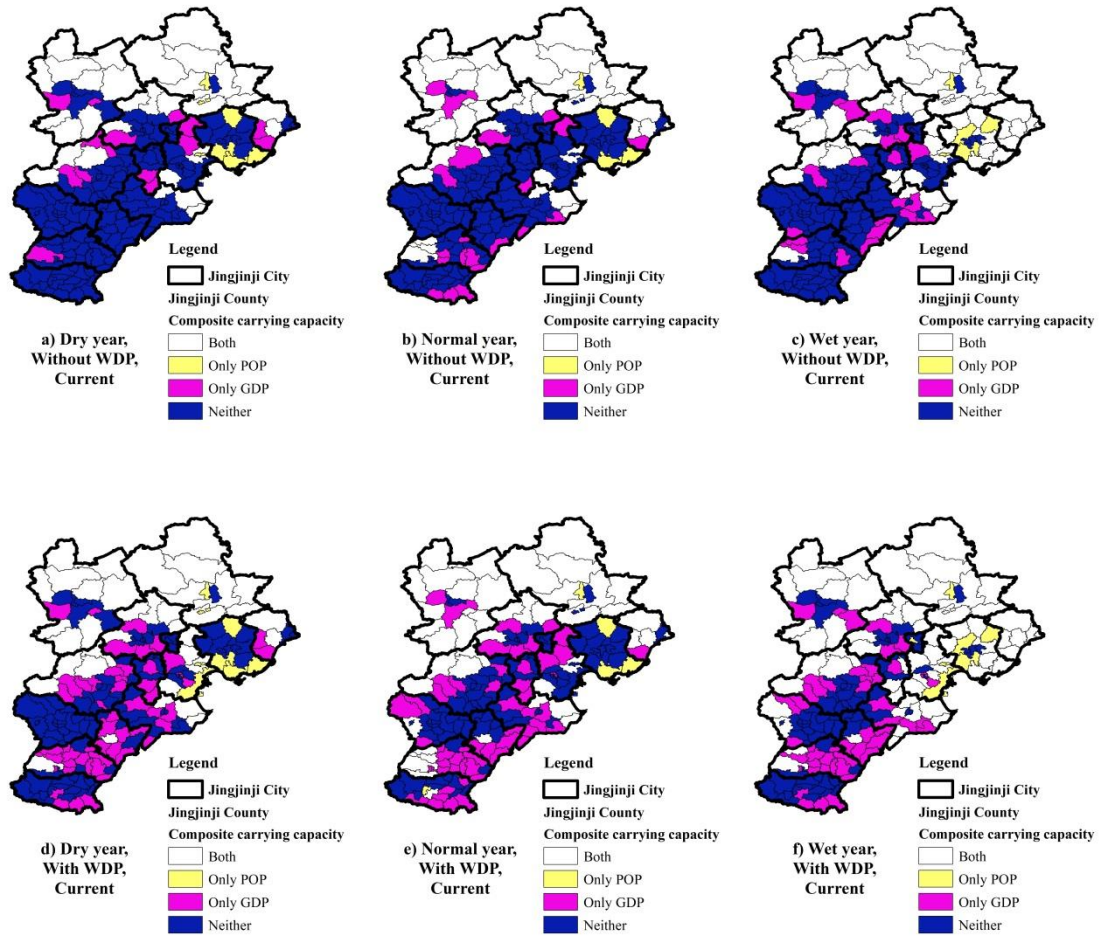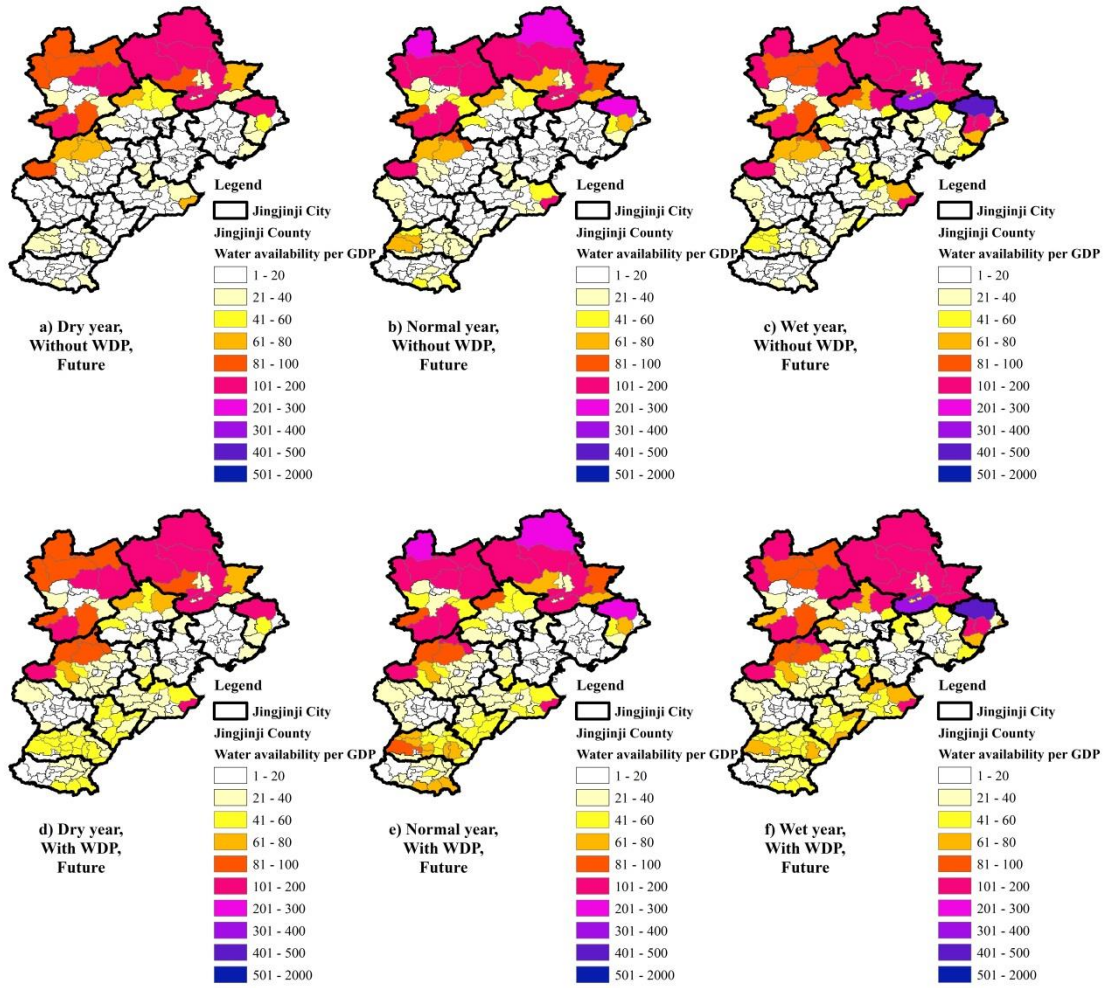
Figure S8. Water availability per unit GDP in typical years under current scenarios. (Unit: m³)

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Figure S9. Water scarcity index (WSI) based on population in typical years under current scenarios.

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Figure S10. Water scarcity index (WSI) based on GDP in typical years under current scenarios.

Figure S11. Composite carrying capacity in typical years under current scenarios.
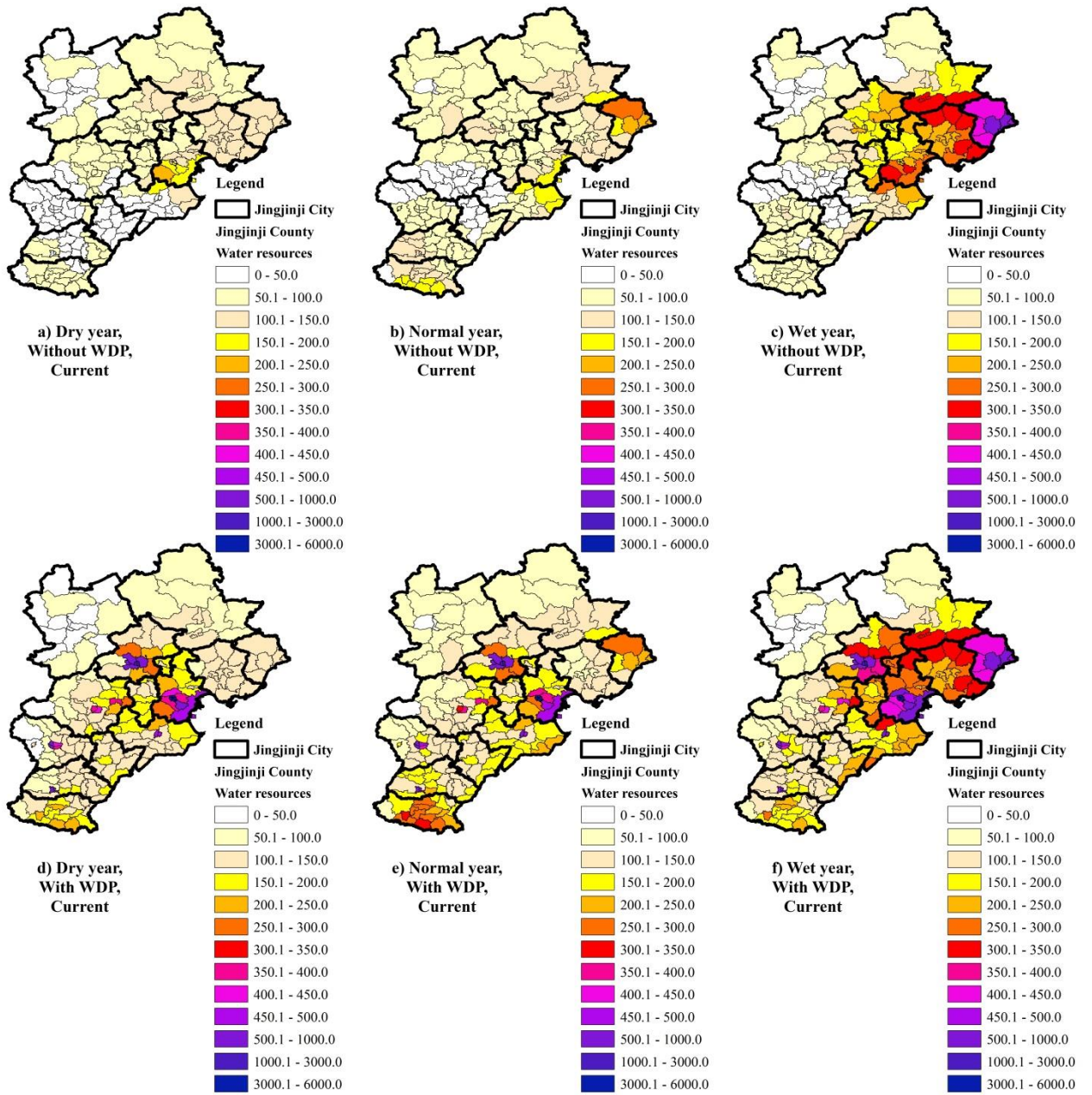
Figure S12. Water resources in typical years under future scenarios. (Unit: mm)
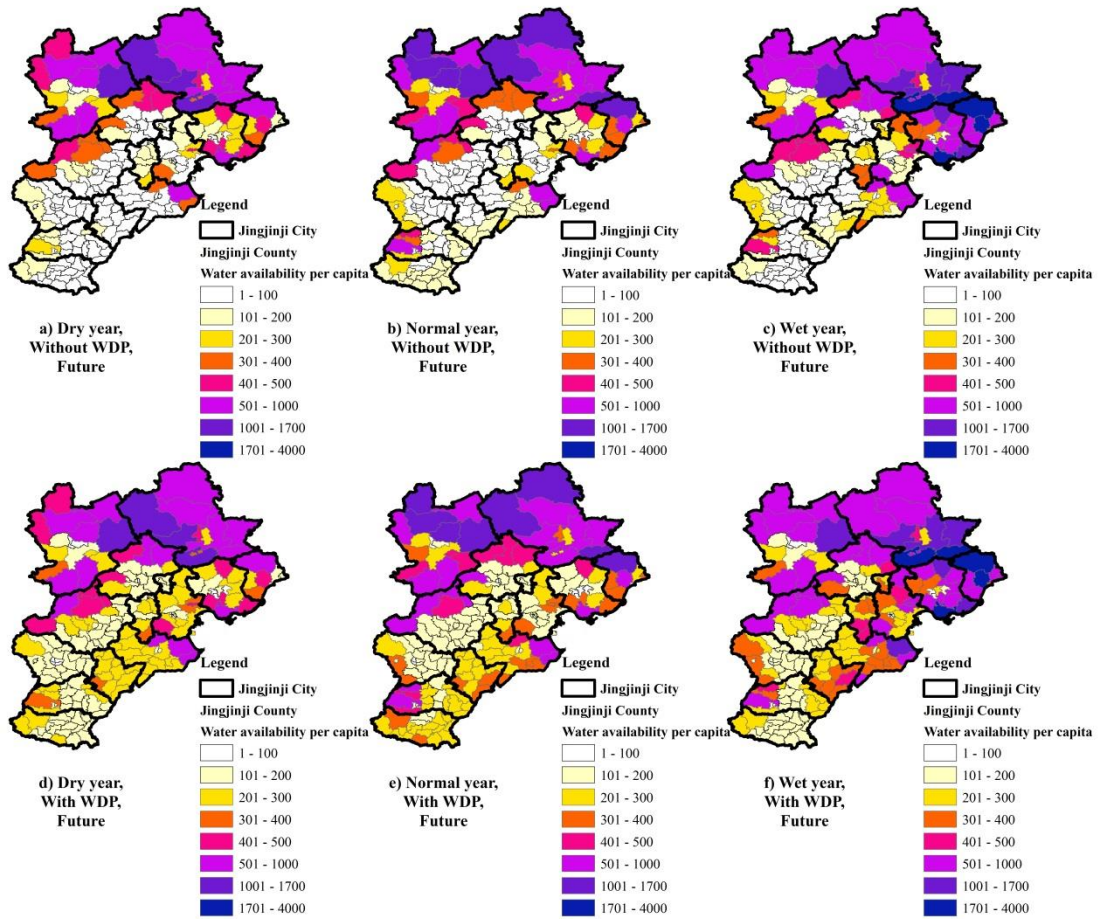
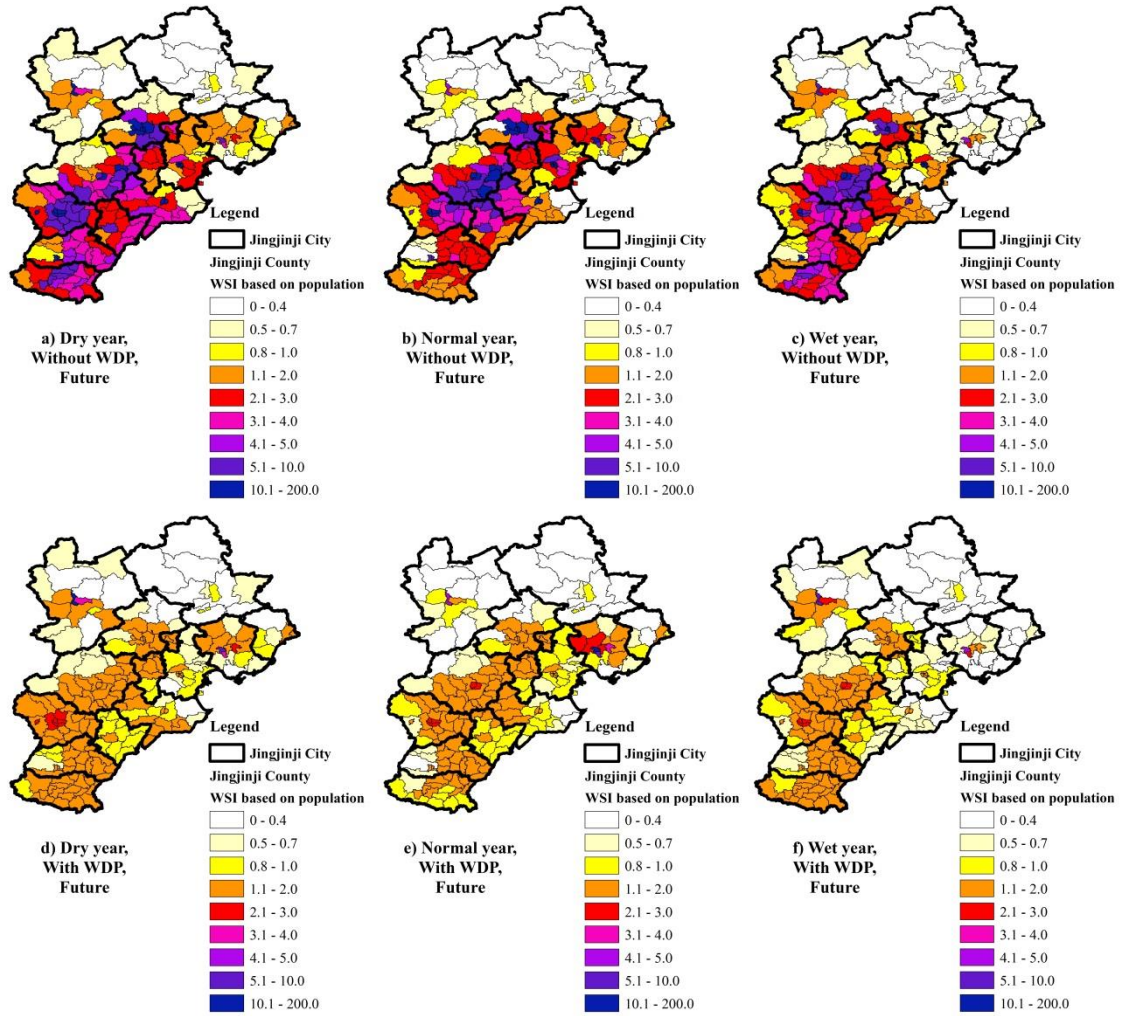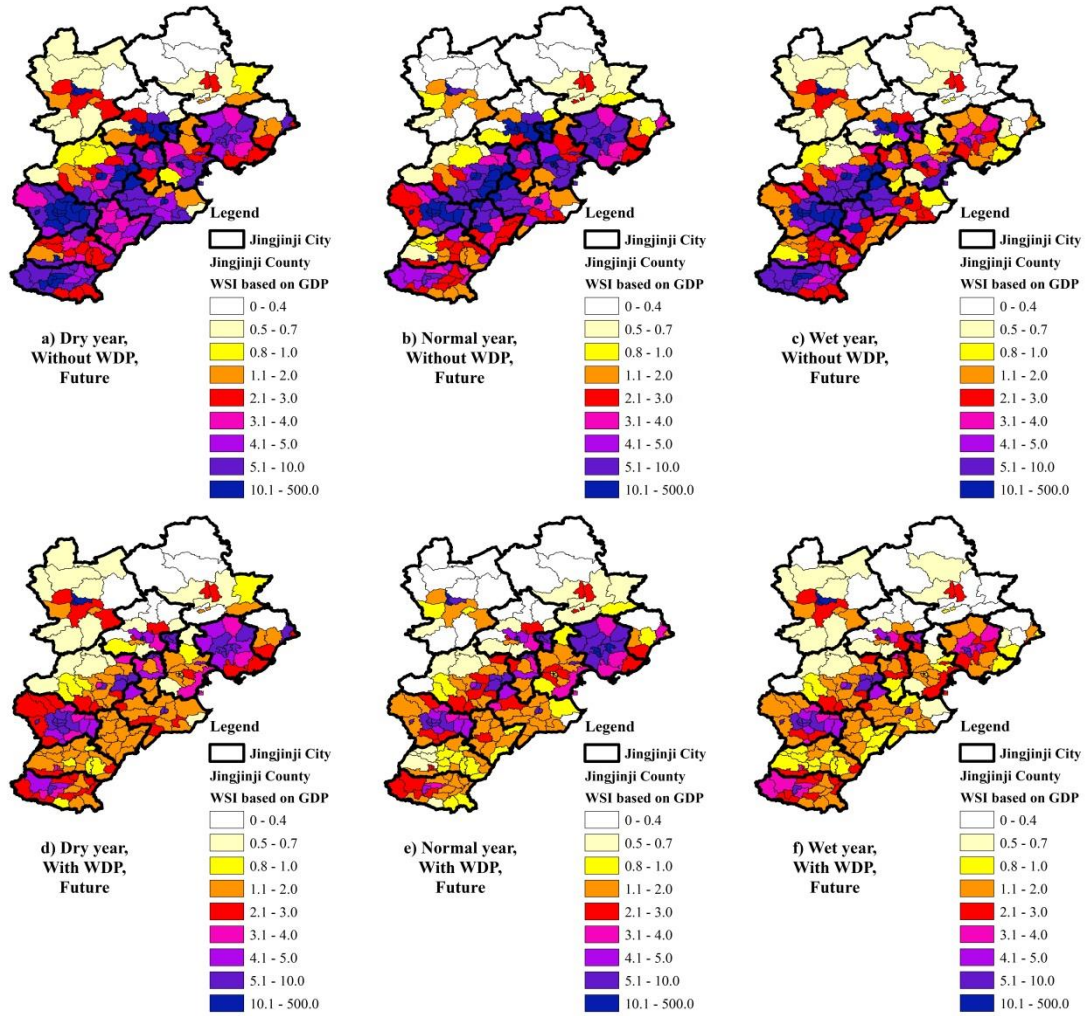**Figure S13.** Water availability per capita in typical years under future scenarios. (Unit: m³)

57

58 **Figure S14.** Water availability per unit GDP in typical years under future scenarios. (Unit: m³)
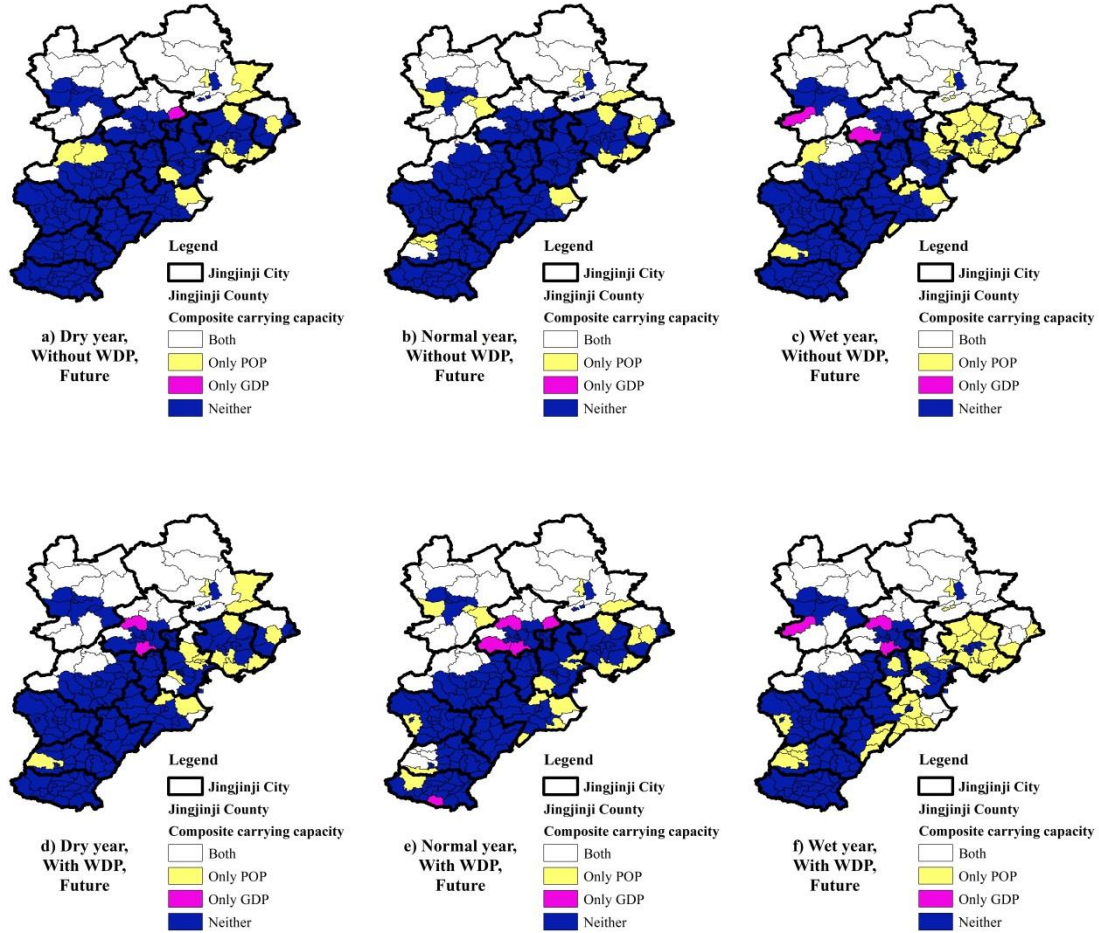
59

60 **Figure S15.** Water scarcity index (WSI) based on population in typical years under future scenarios.

Figure S16. Water scarcity index (WSI) based on GDP in typical years under future scenarios.

a) Dry year, Without WDP, Future

b) Normal year, Without WDP, Future

c) Wet year, Without WDP, Future

d) Dry year, With WDP, Future

e) Normal year, With WDP, Future

f) Wet year, With WDP, Future

63

64 **Figure S17.** Composite carrying capacity in typical years under future scenarios.
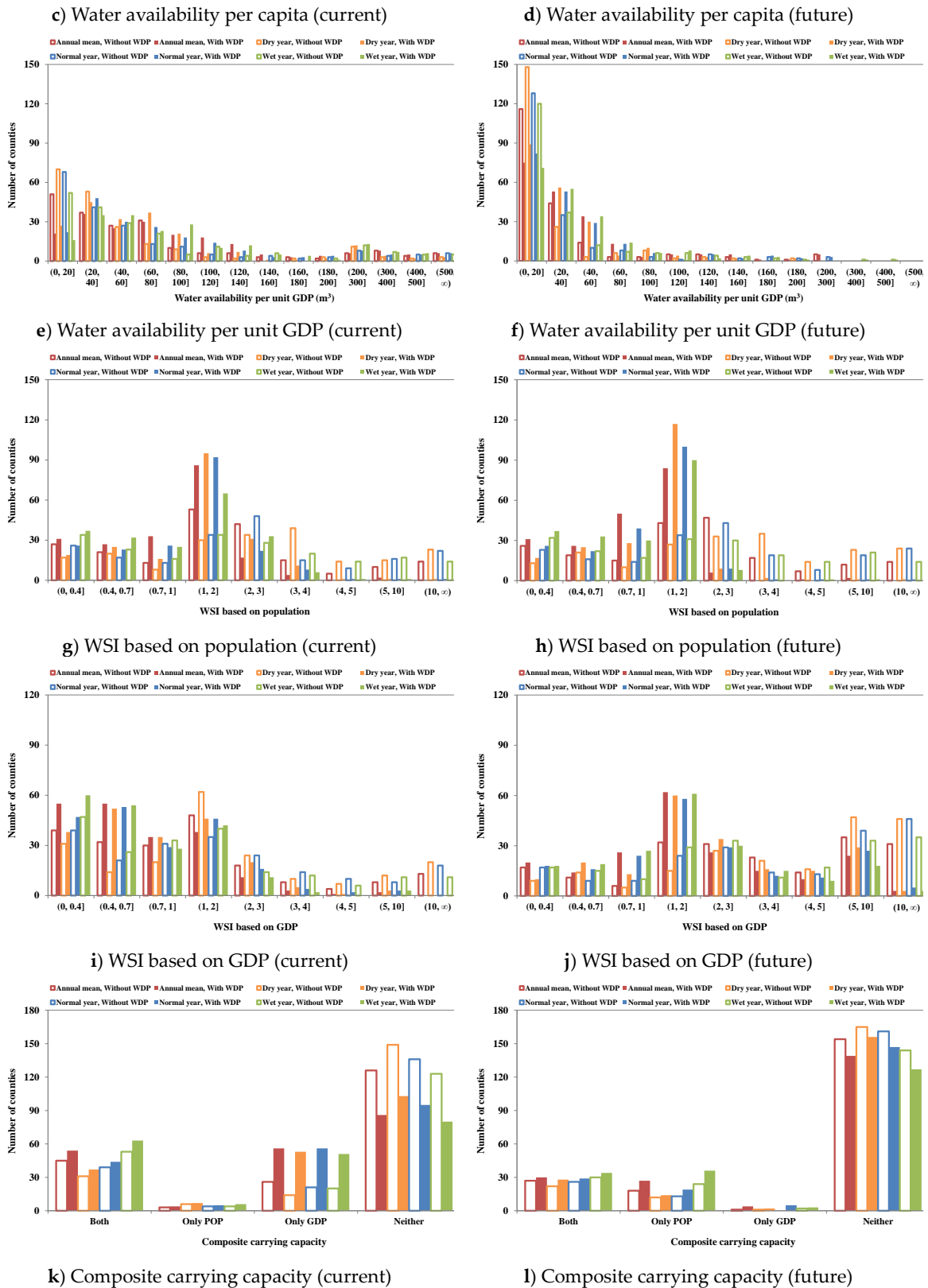
a) Water resources (current)

b) Water resources (future)

18
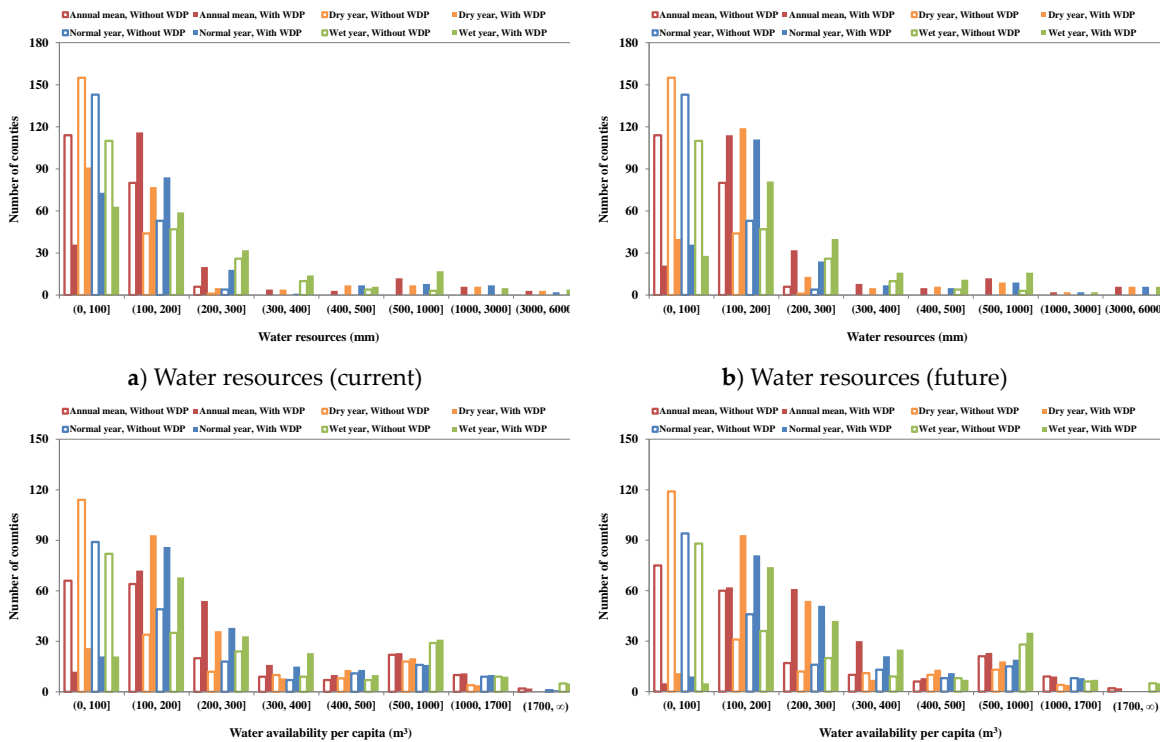
Figure S18. Number of counties for various statistics.