

Supplemental Material

Mapping the Energy-Water Nexus around the Pacific Rim

Vincent Tidwell and Barbie Moreland
Sandia National Laboratories

Below are additional maps and tables supporting the paper “Mapping the Energy-Water Nexus around the Pacific Rim”. Maps include:

1. Water consumption for energy production:
 - a. Thermoelectric power,
 - b. Coal extraction,
 - c. Oil extraction,
 - d. Natural gas extraction,
 - e. Uranium extraction,
 - f. Unconventional oil and natural gas extraction,
 - g. Oil refining,
 - h. Biofuel refining, and
 - i. Hydropower capacity.
2. Total water consumption for energy production.
3. Water Risk (WRI 2015)
4. Total water consumption mapped on water risk.
5. Total water consumption mapped on water risk centered on particular geographic regions:
 - a. Australia and New Zealand,
 - b. Brunei, Indonesia, Malaysia and Singapore,
 - c. Canada,
 - d. Chile and Peru,
 - e. China and Hong Kong, China
 - f. Japan and Korea,
 - g. Mexico,
 - h. Papua New Guinea,

- i. Philippines and Chinese Taipei,
 - j. Russia,
 - k. Thailand and Viet Nam,
 - l. United States.
- 6. Table of water consumption for energy production by APEC member economy
- 7. Energy consumption for water services:
 - a. Drinking water,
 - b. Wastewater, and
 - c. Desalination.
- 8. Table of energy used to provide water services by water sector and APEC member economy

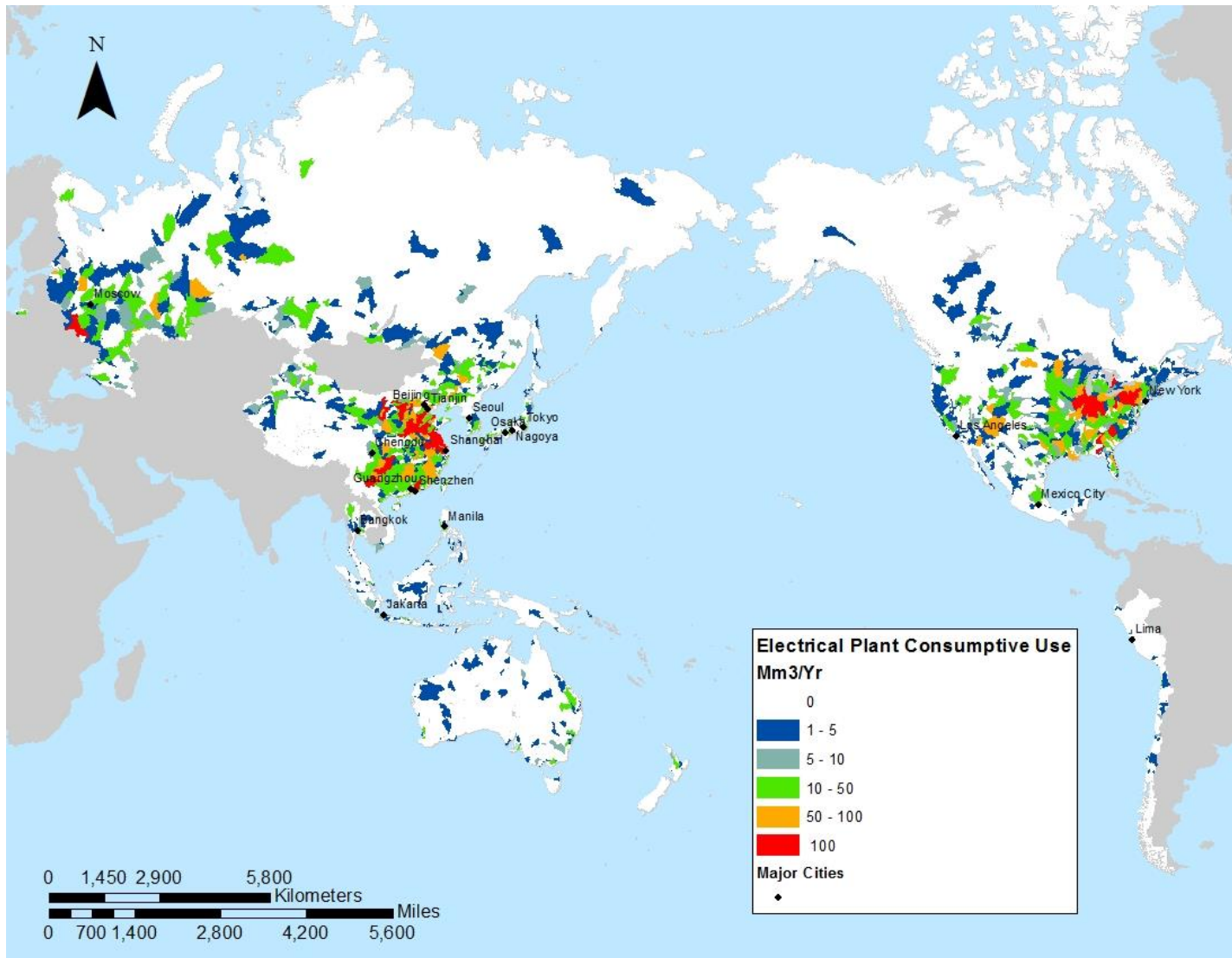


Figure A.1: Water consumed by thermoelectric power generation in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

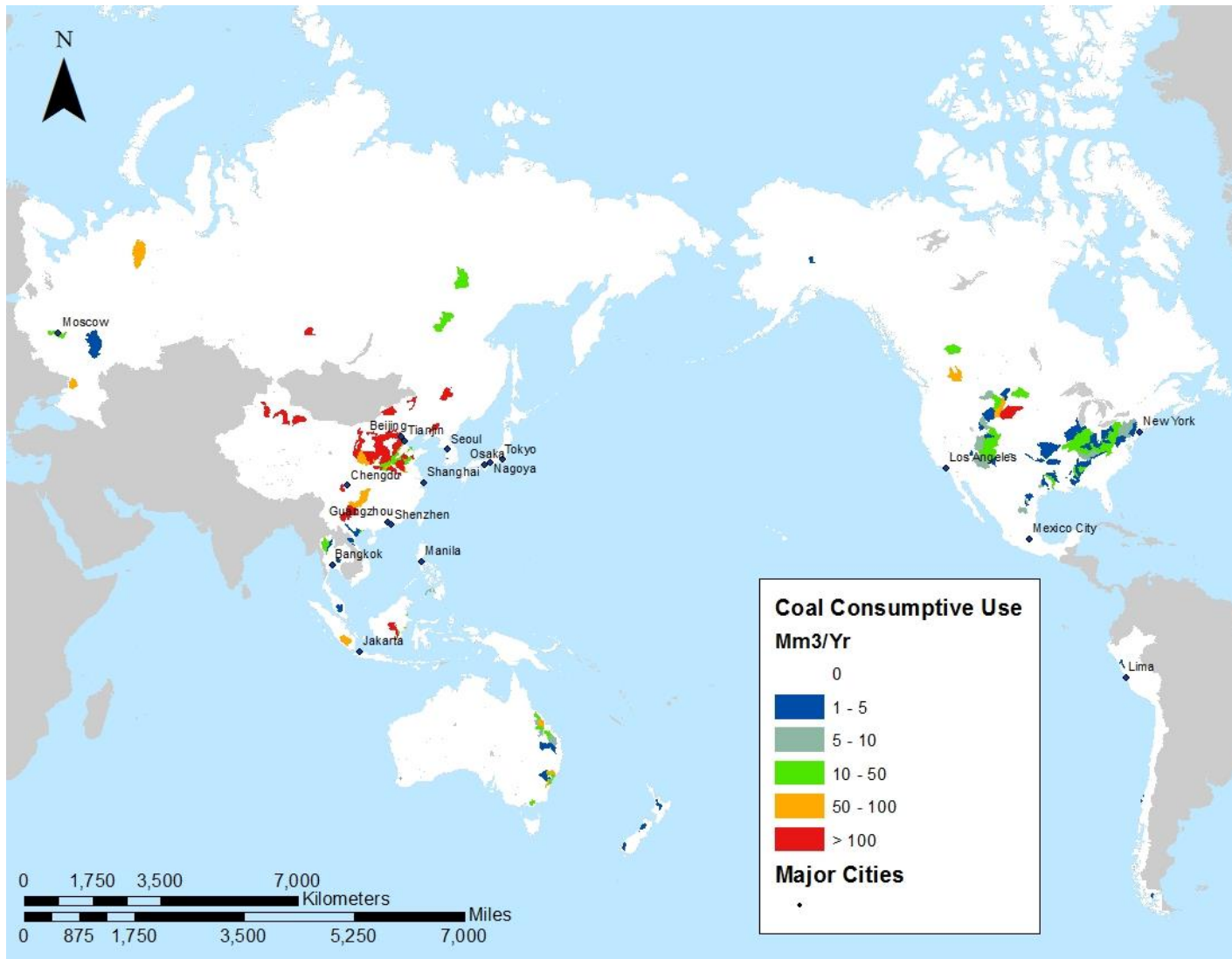


Figure A2: Water consumed for coal extraction in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

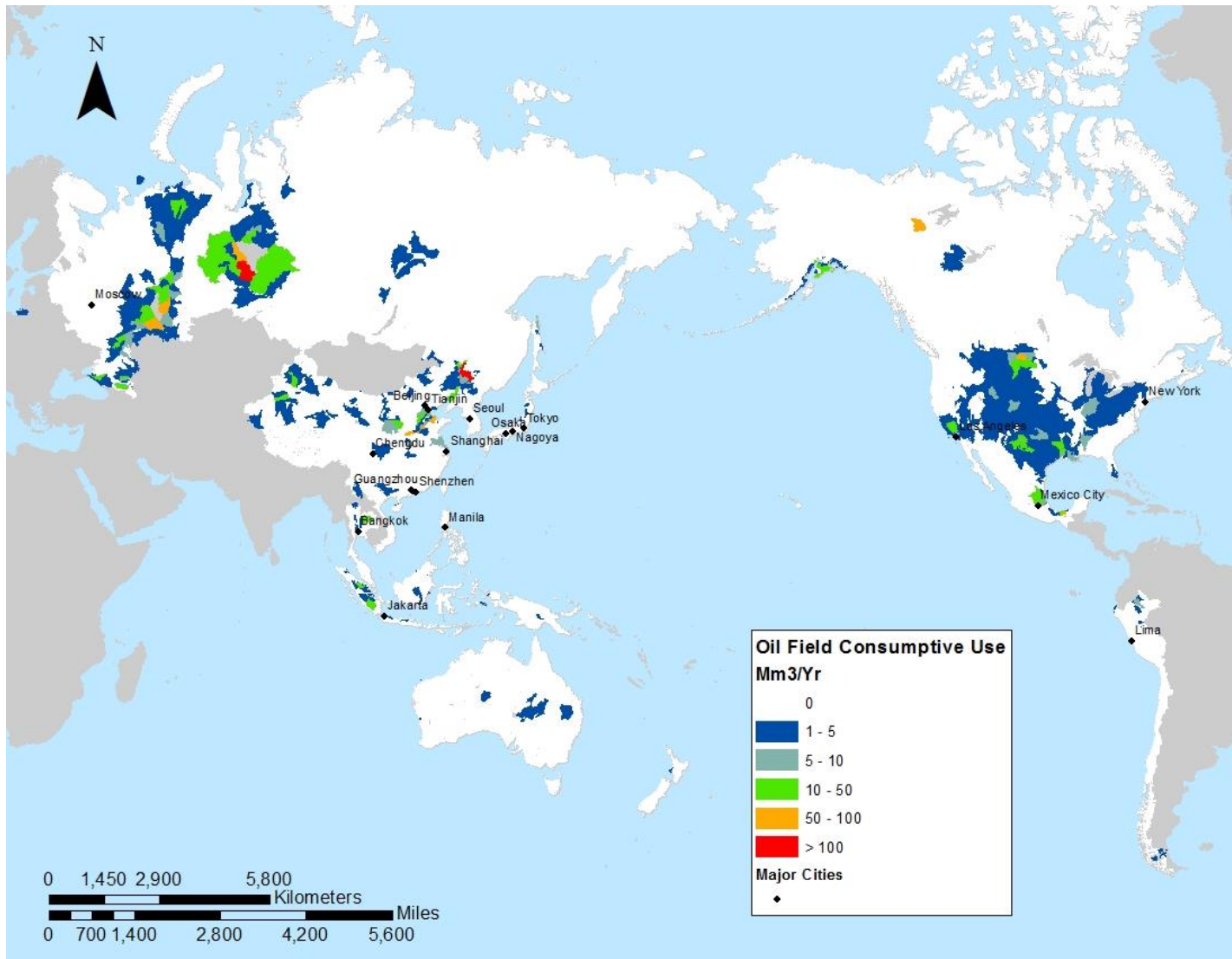


Figure A.3: Water consumed oil extraction in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

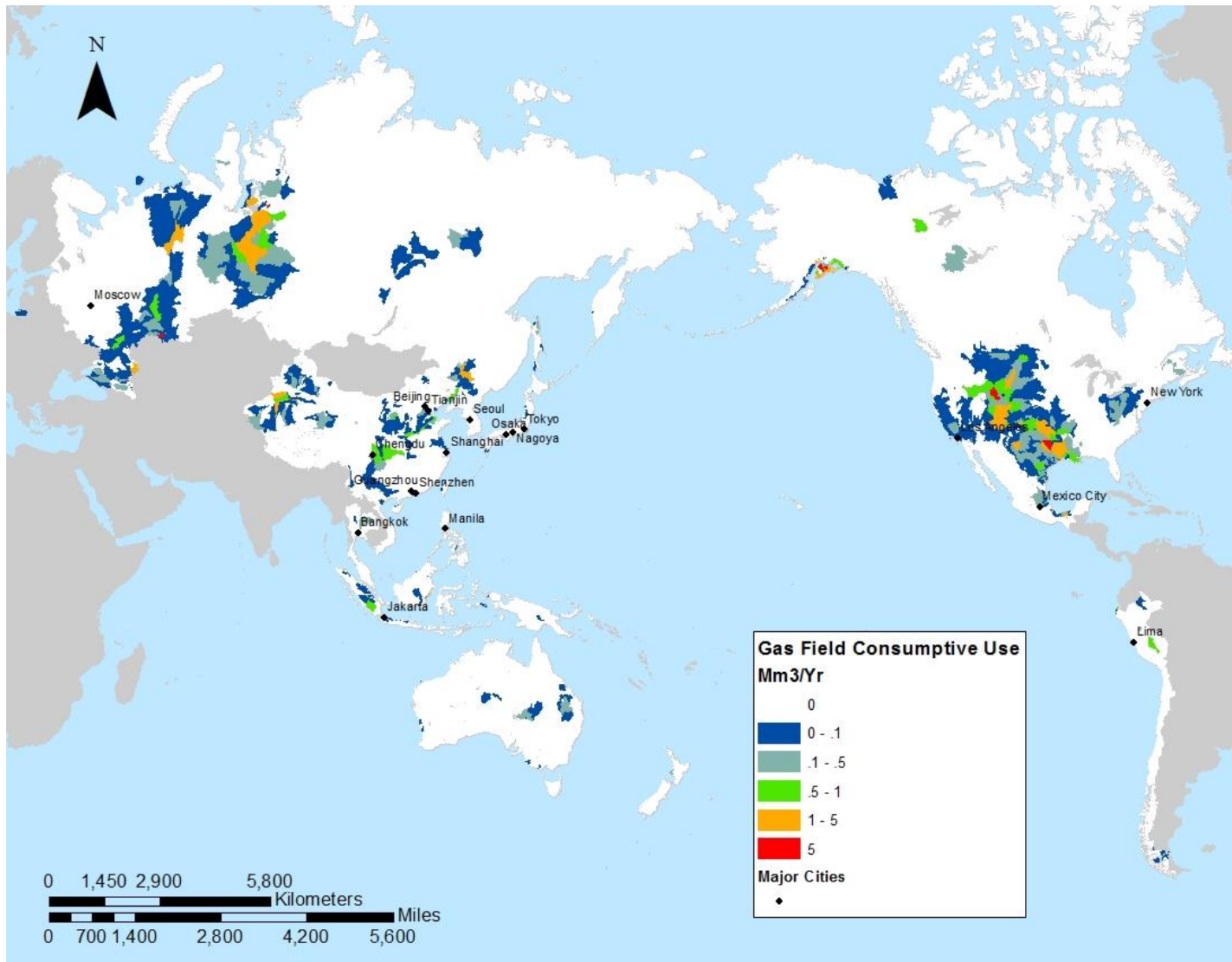


Figure A4: Water consumed for natural gas extraction in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

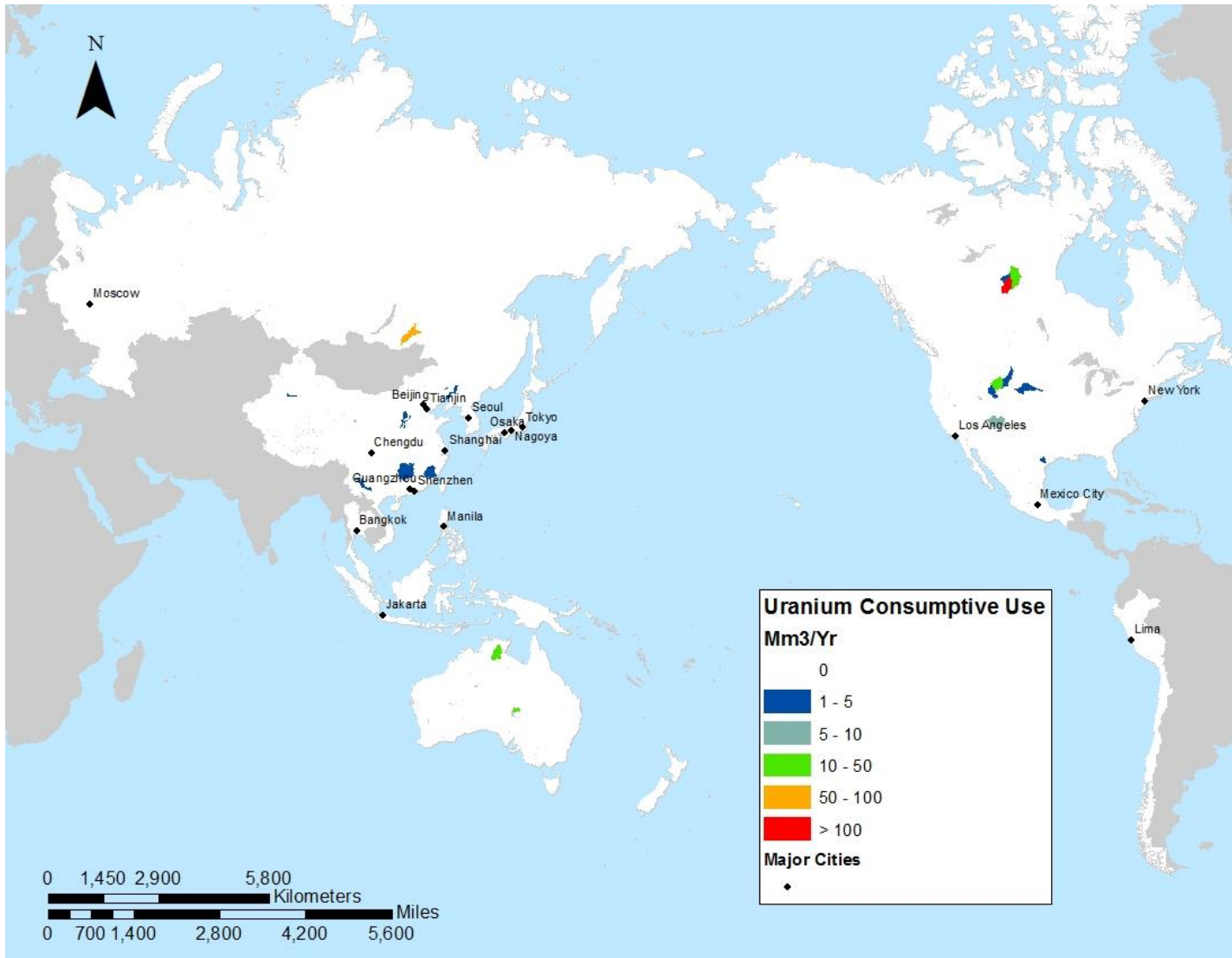


Figure A5: Water consumed for uranium extraction in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

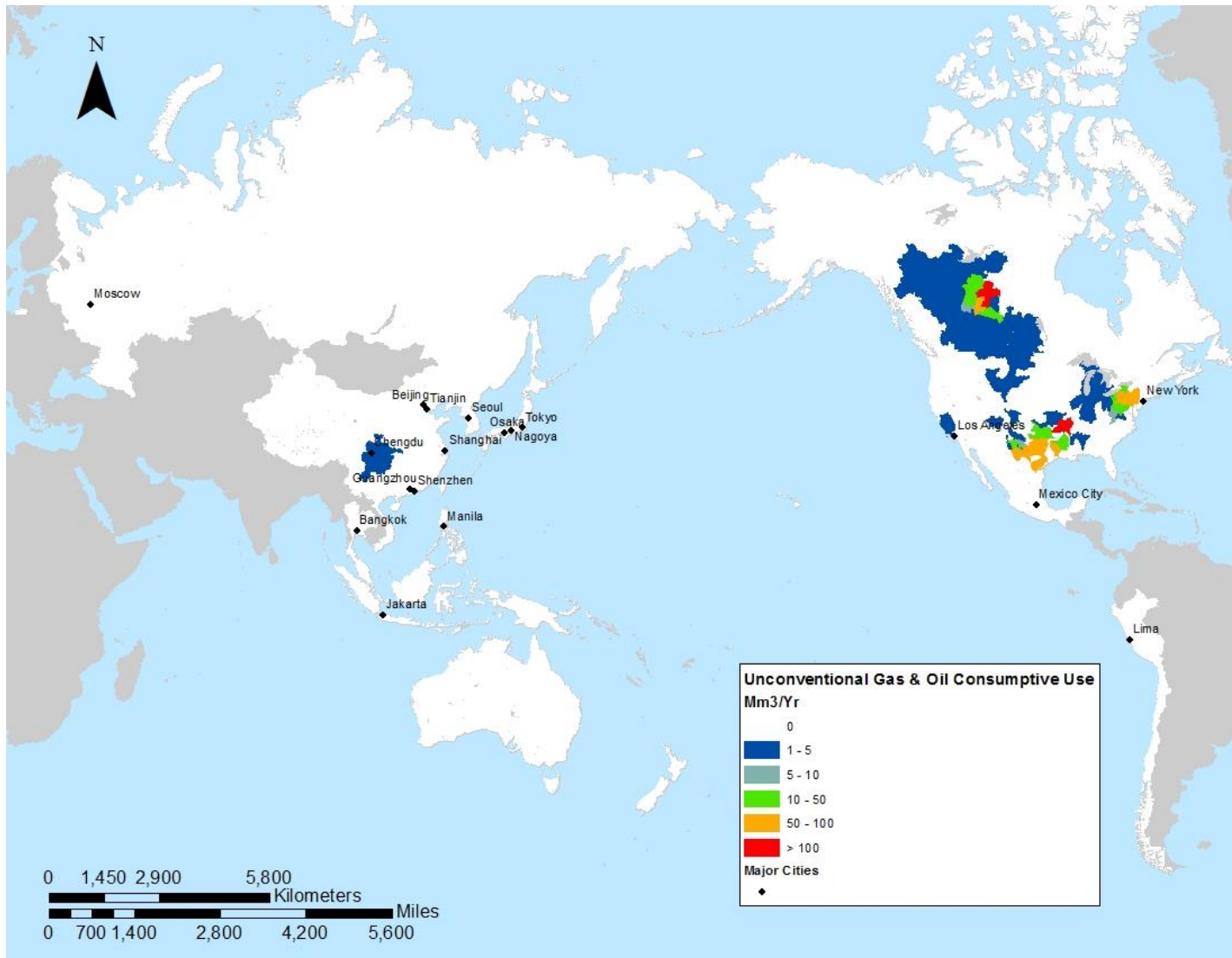


Figure A6: Water consumed for unconventional oil and gas extraction in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

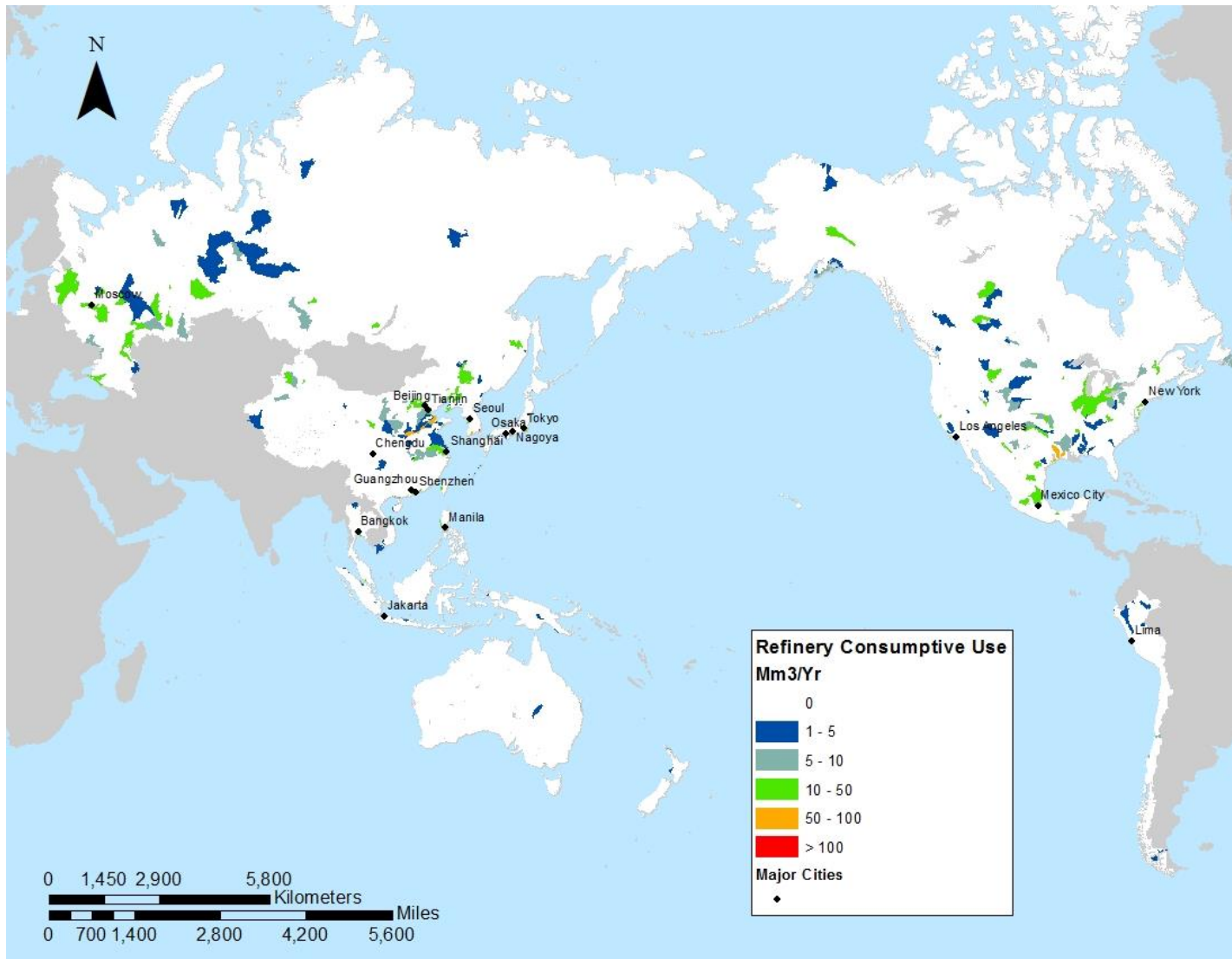


Figure A7: Water consumed for oil refining in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

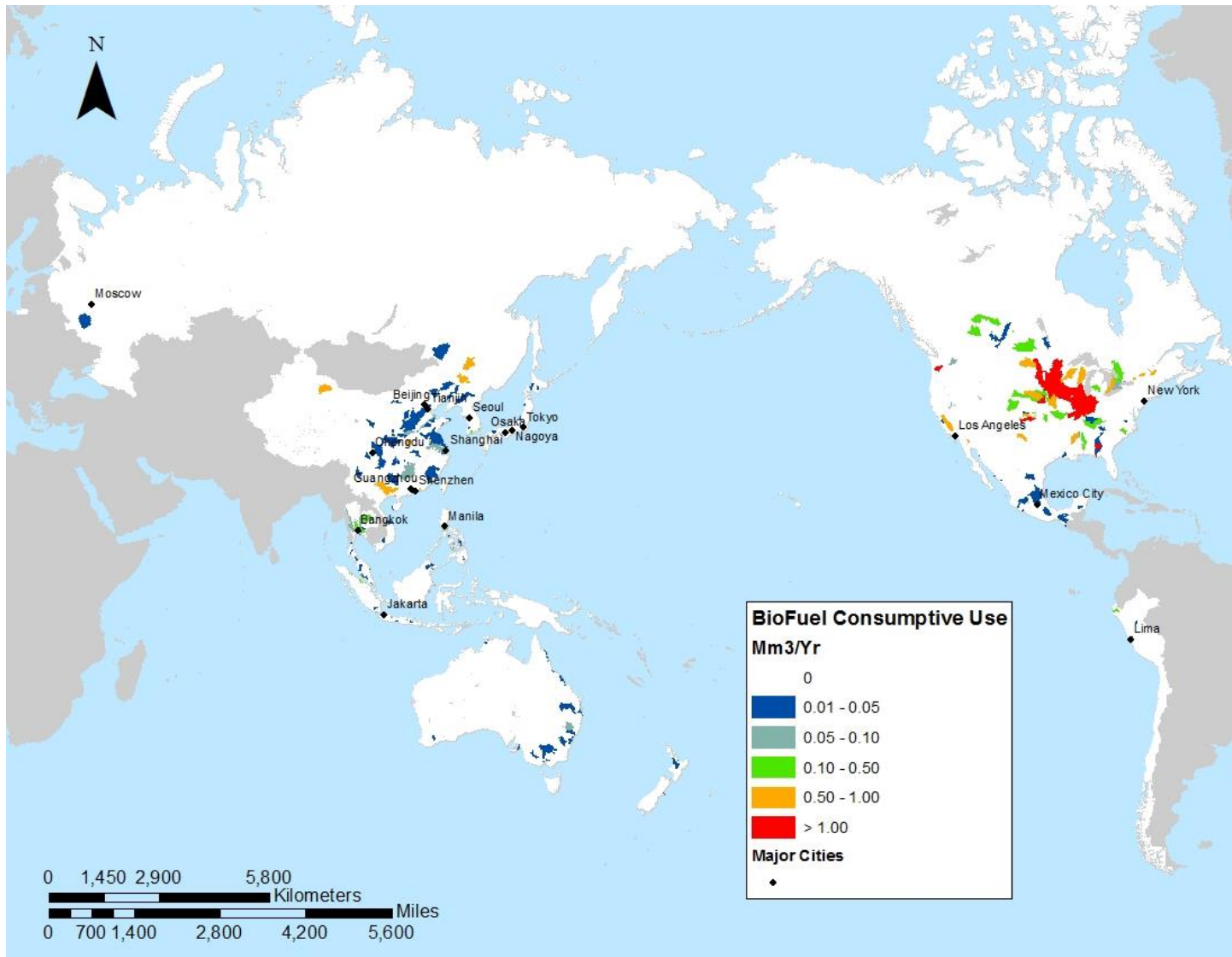


Figure A8: Water consumed for biofuel refining in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

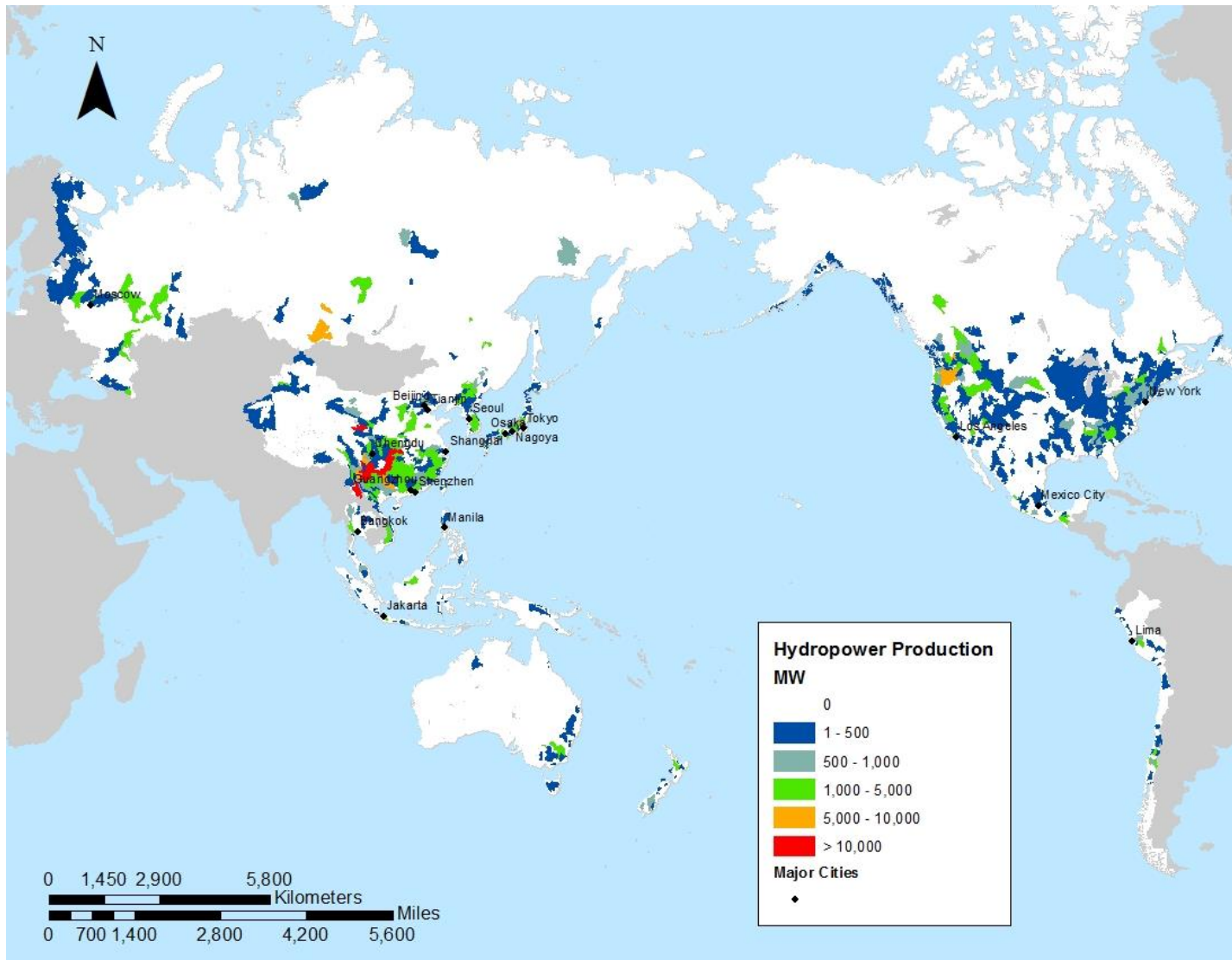


Figure A9: Hydropower capacity in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

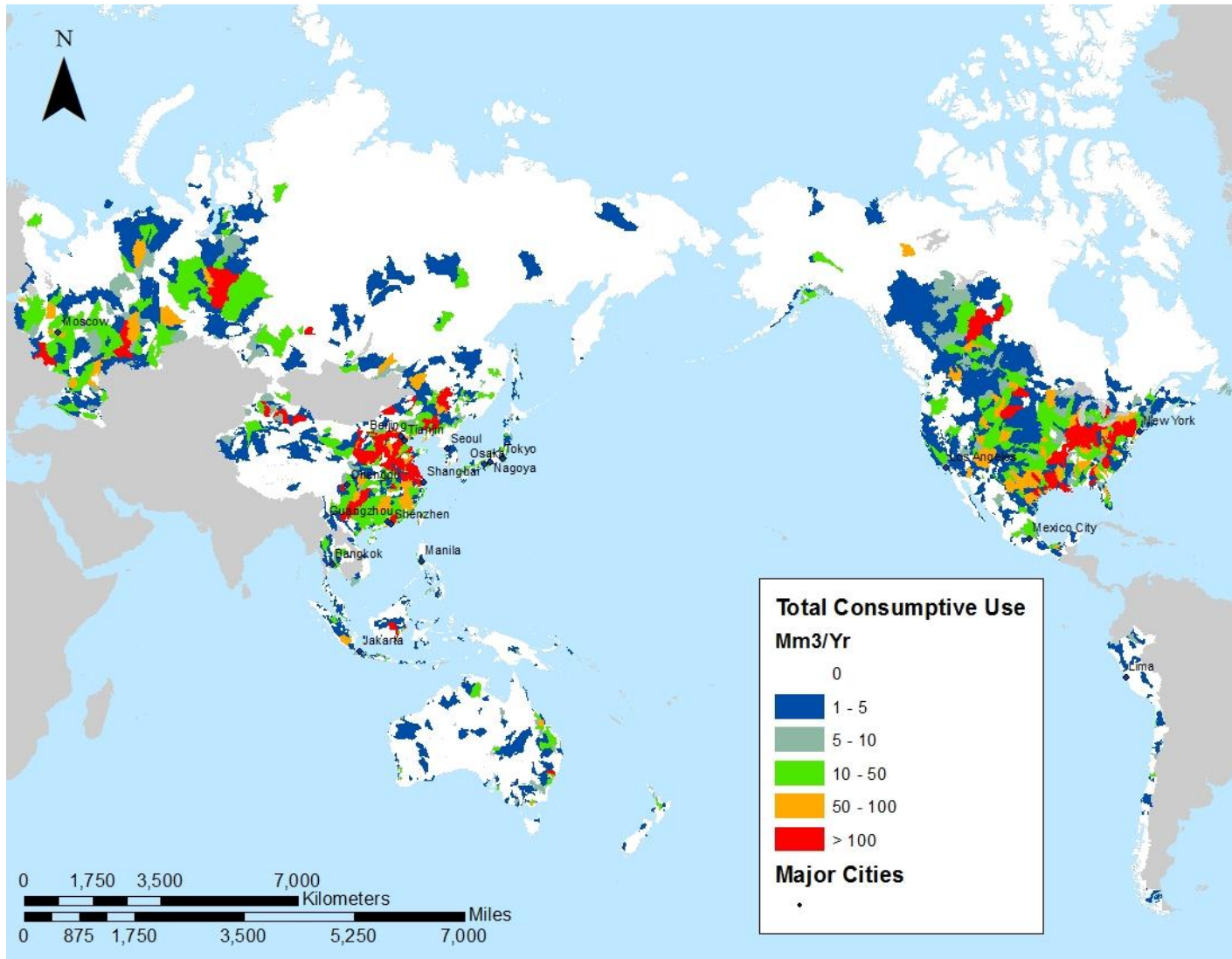


Figure A10: Total water consumed for energy production in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

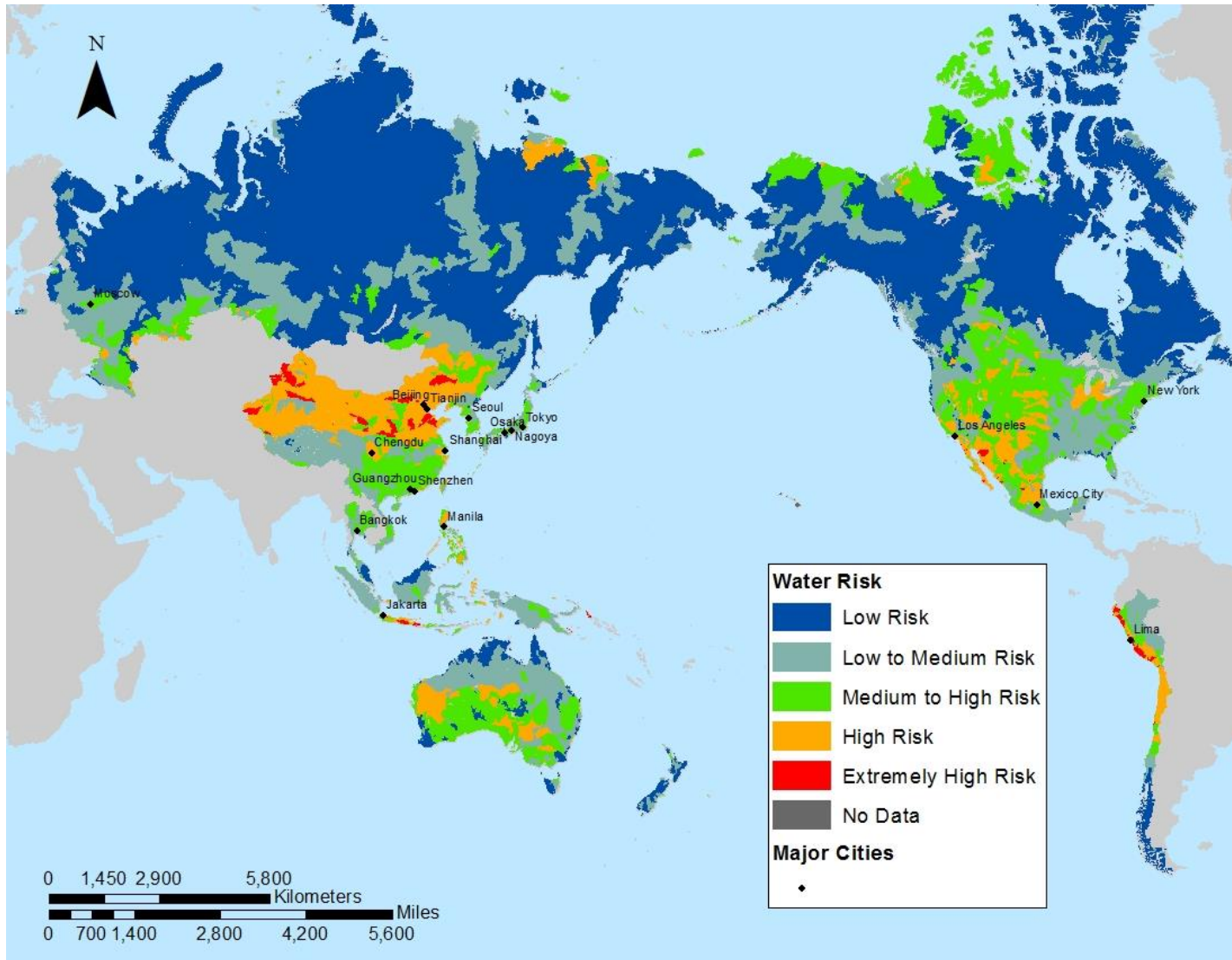


Figure A11: Water risk in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region. Data are reproduced from WRI (2015).

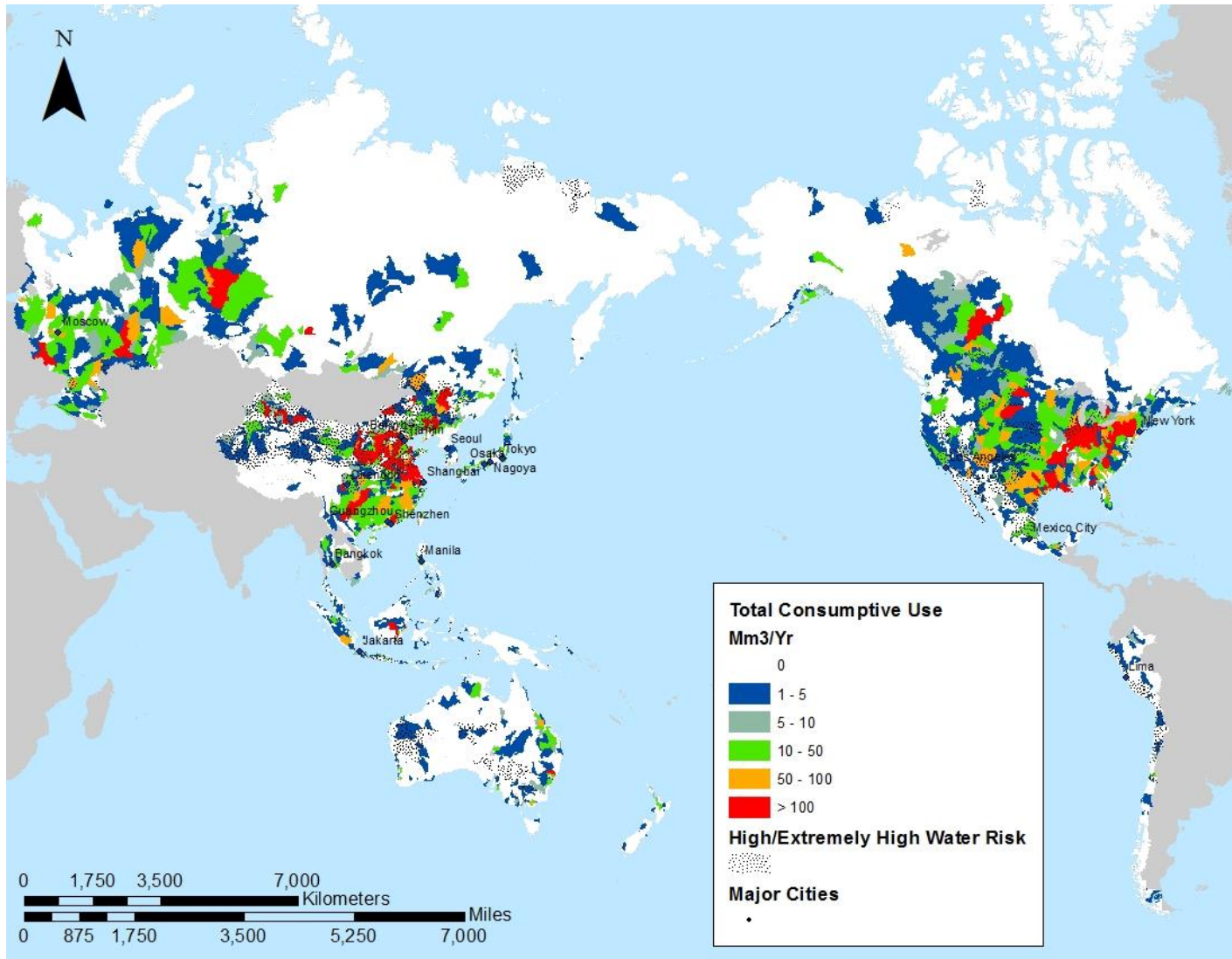


Figure A12: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]). Data are mapped for the 21-member economies of APEC for almost 12,000 watersheds across this region.

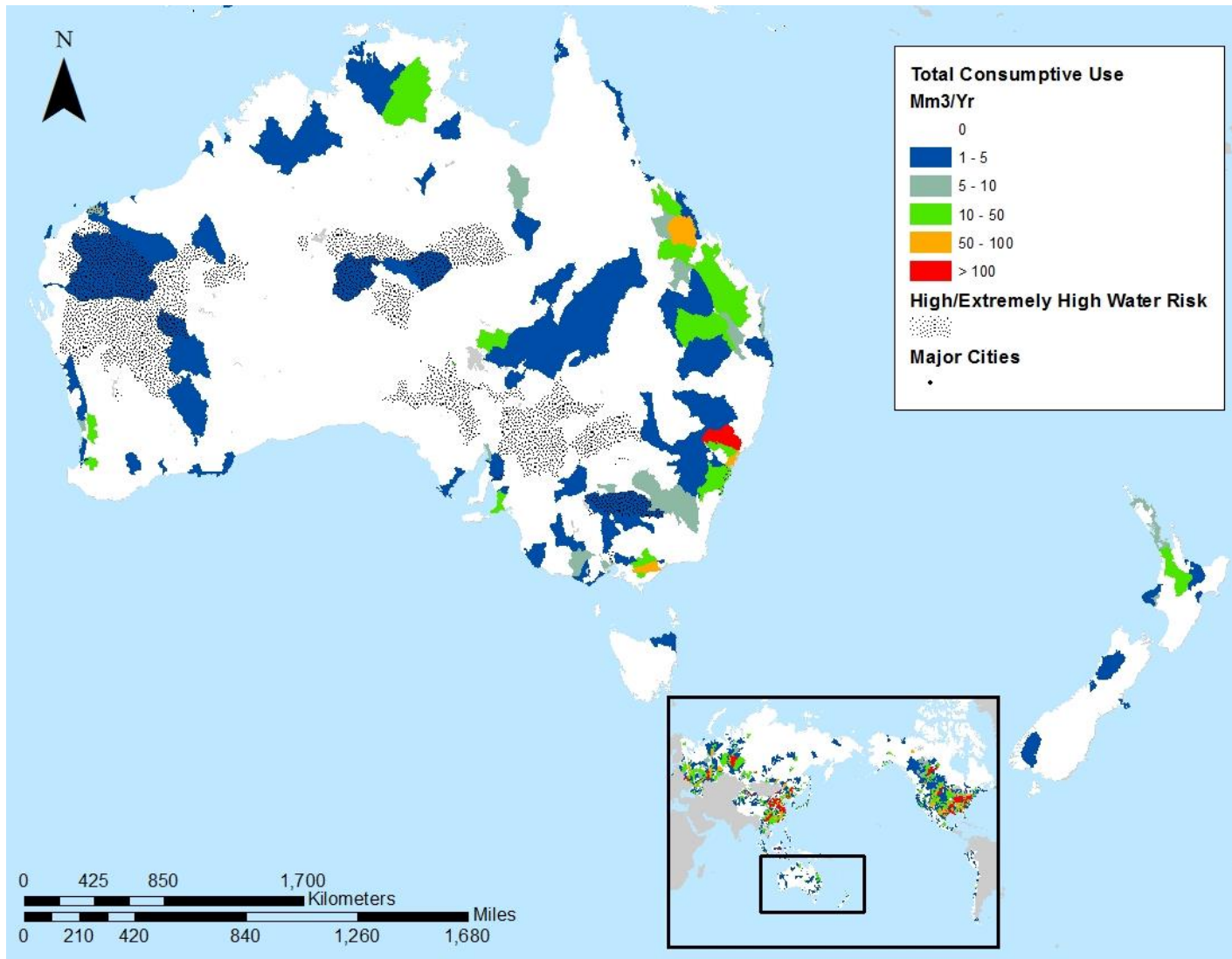


Figure A13: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]) for Australia and New Zealand.

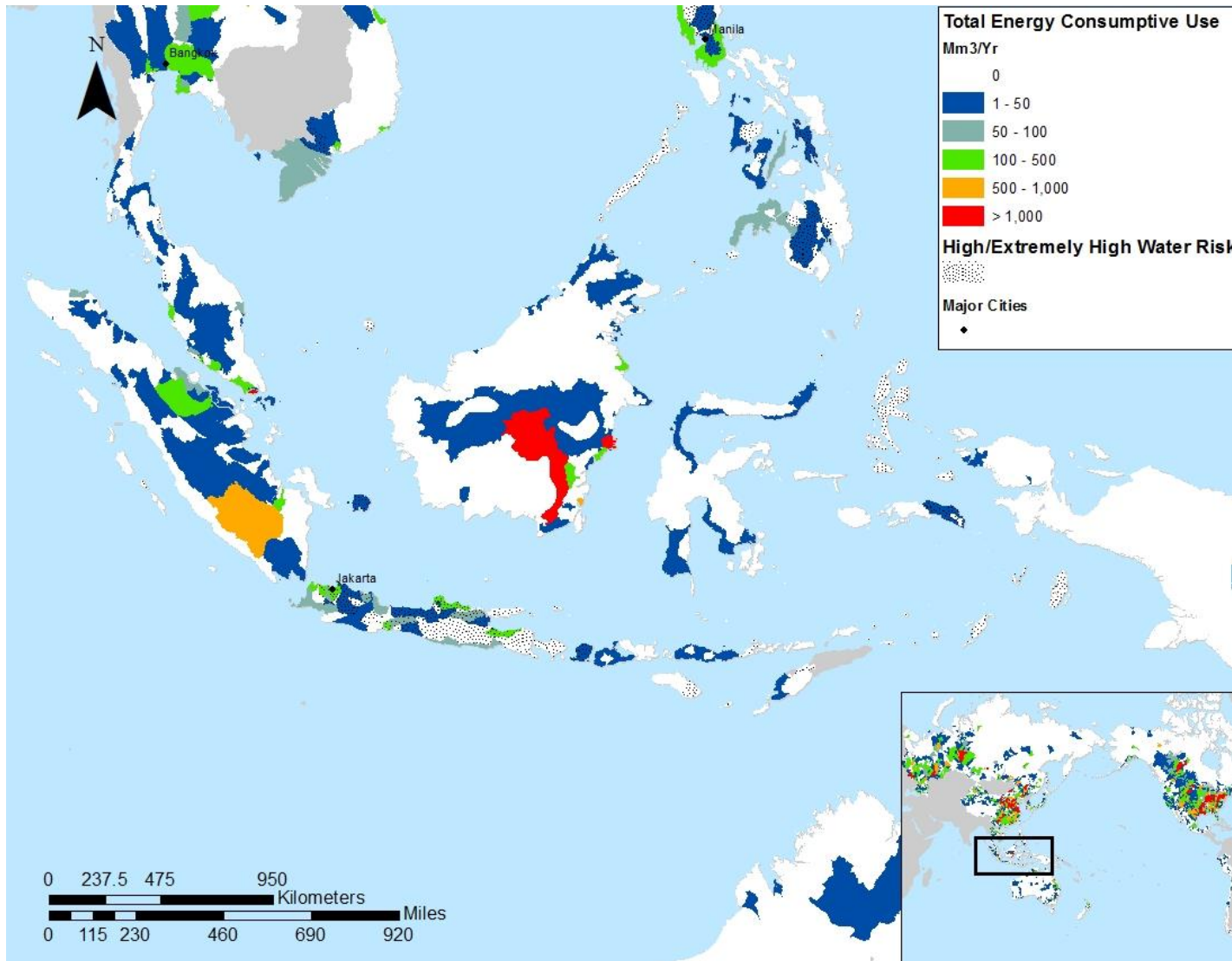


Figure A14: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]) for Brunei, Indonesia, Malaysia and Singapore.

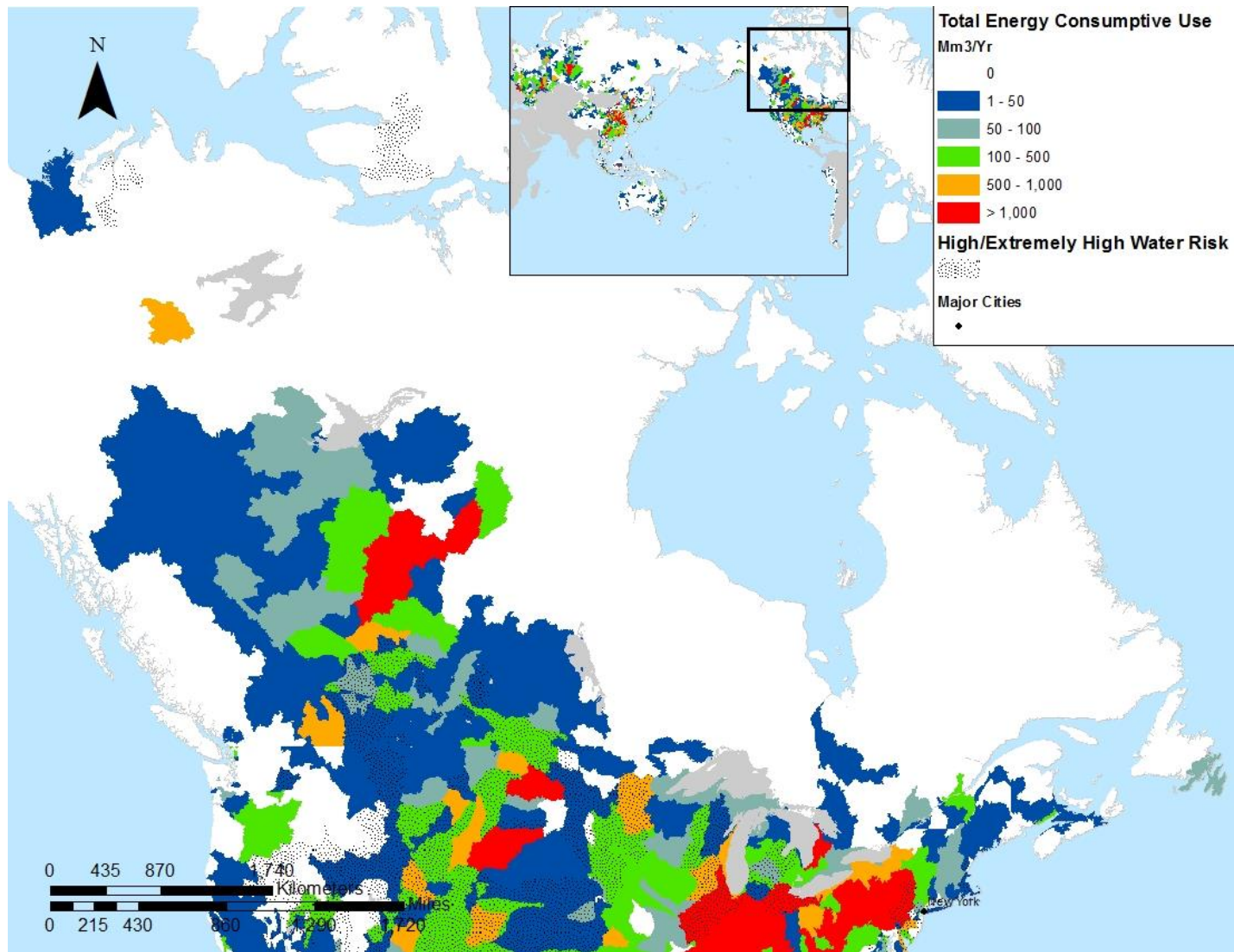


Figure A15: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]) for Canada.

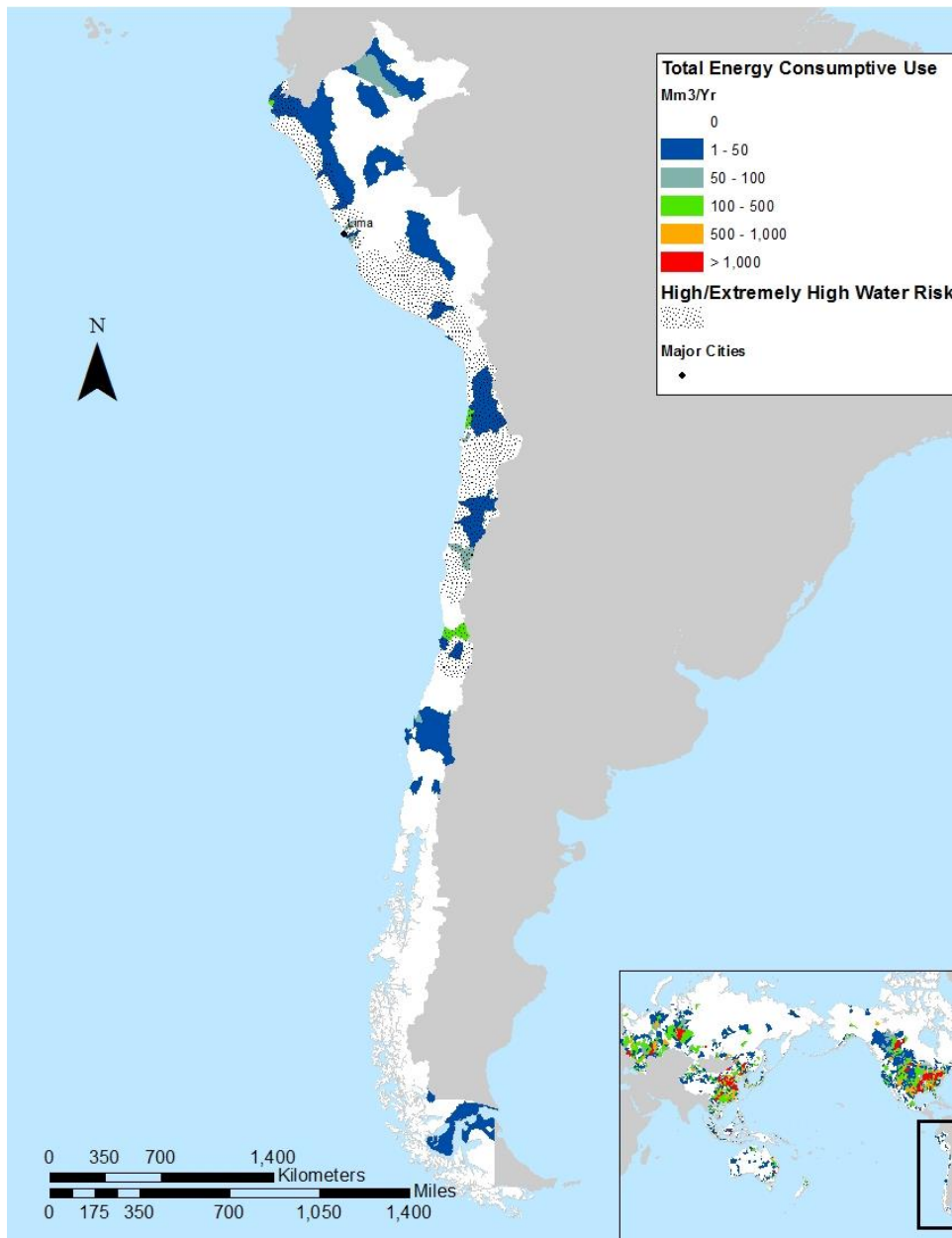


Figure A16: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]) for Chile and Peru.

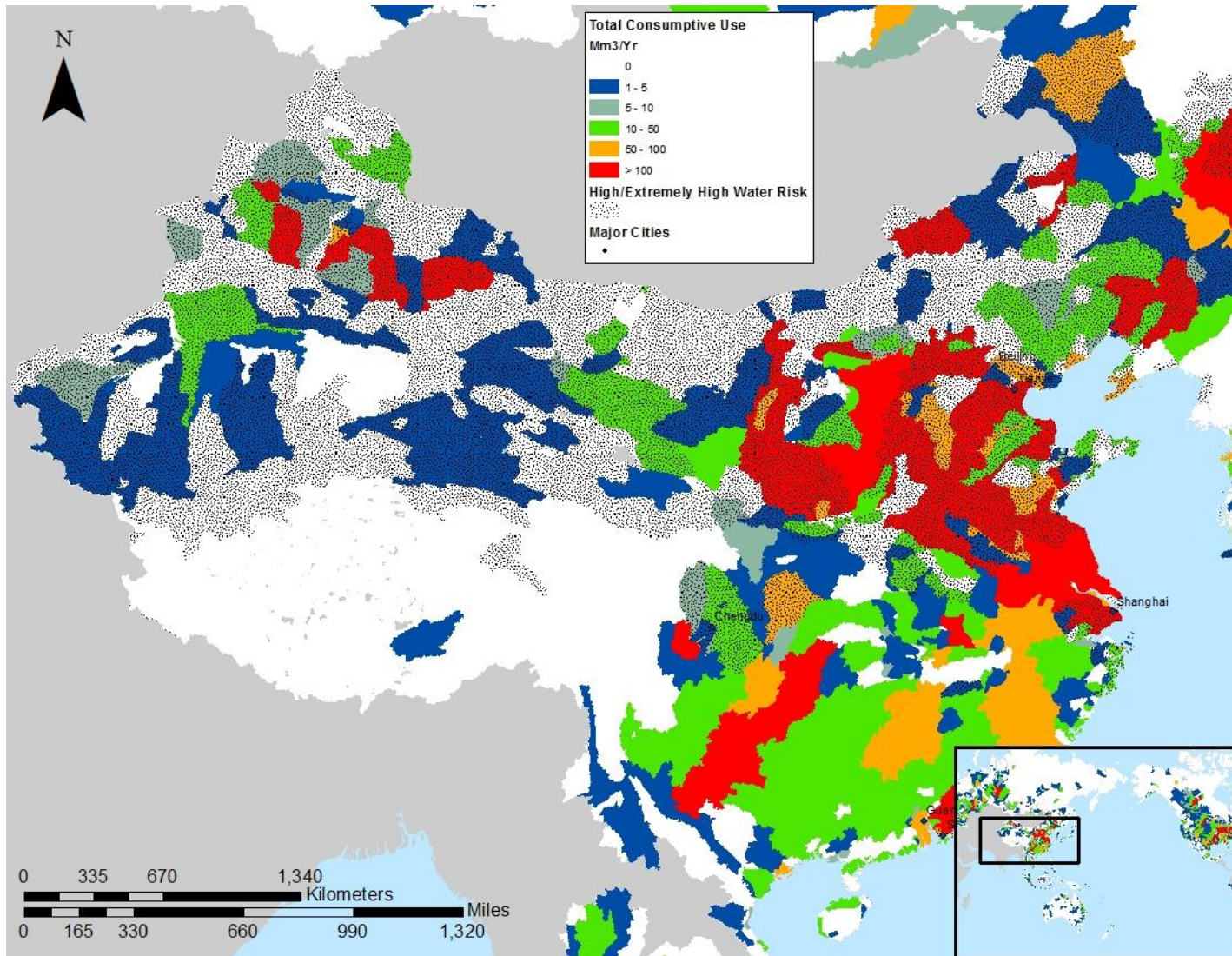


Figure A17: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]) for China and Hong Kong, China.

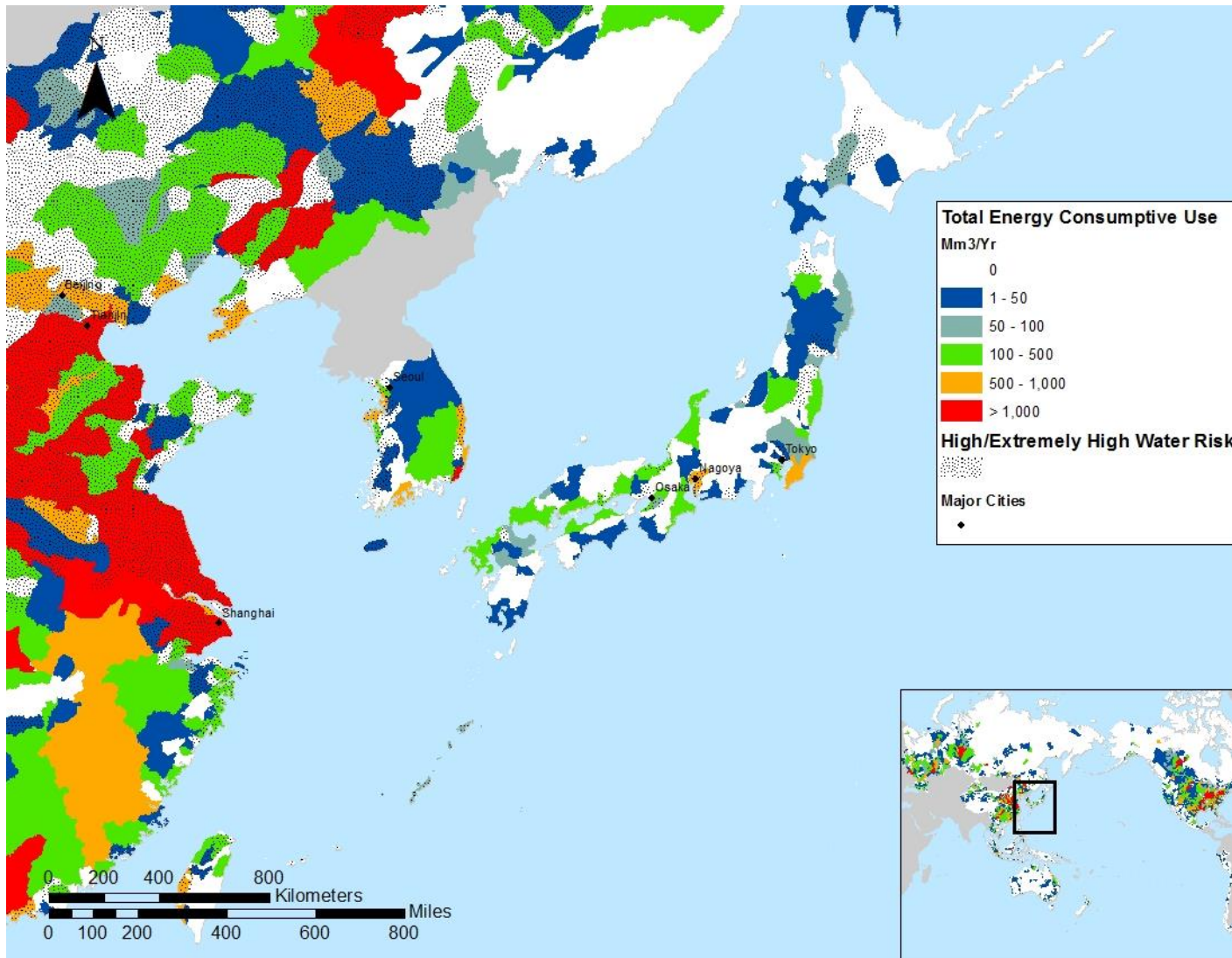


Figure A18: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]) for Japan and Korea.

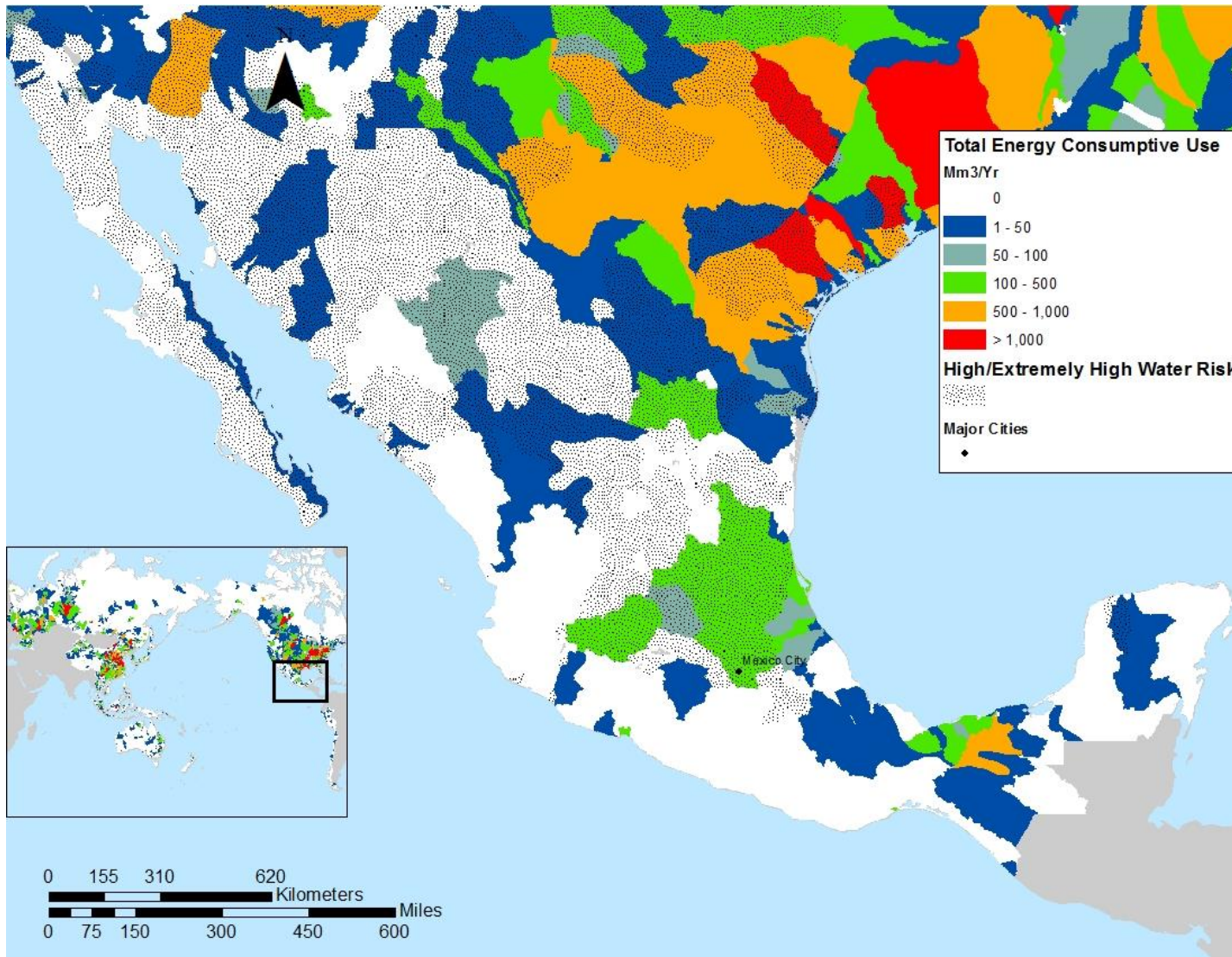


Figure A19: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]) for Mexico.

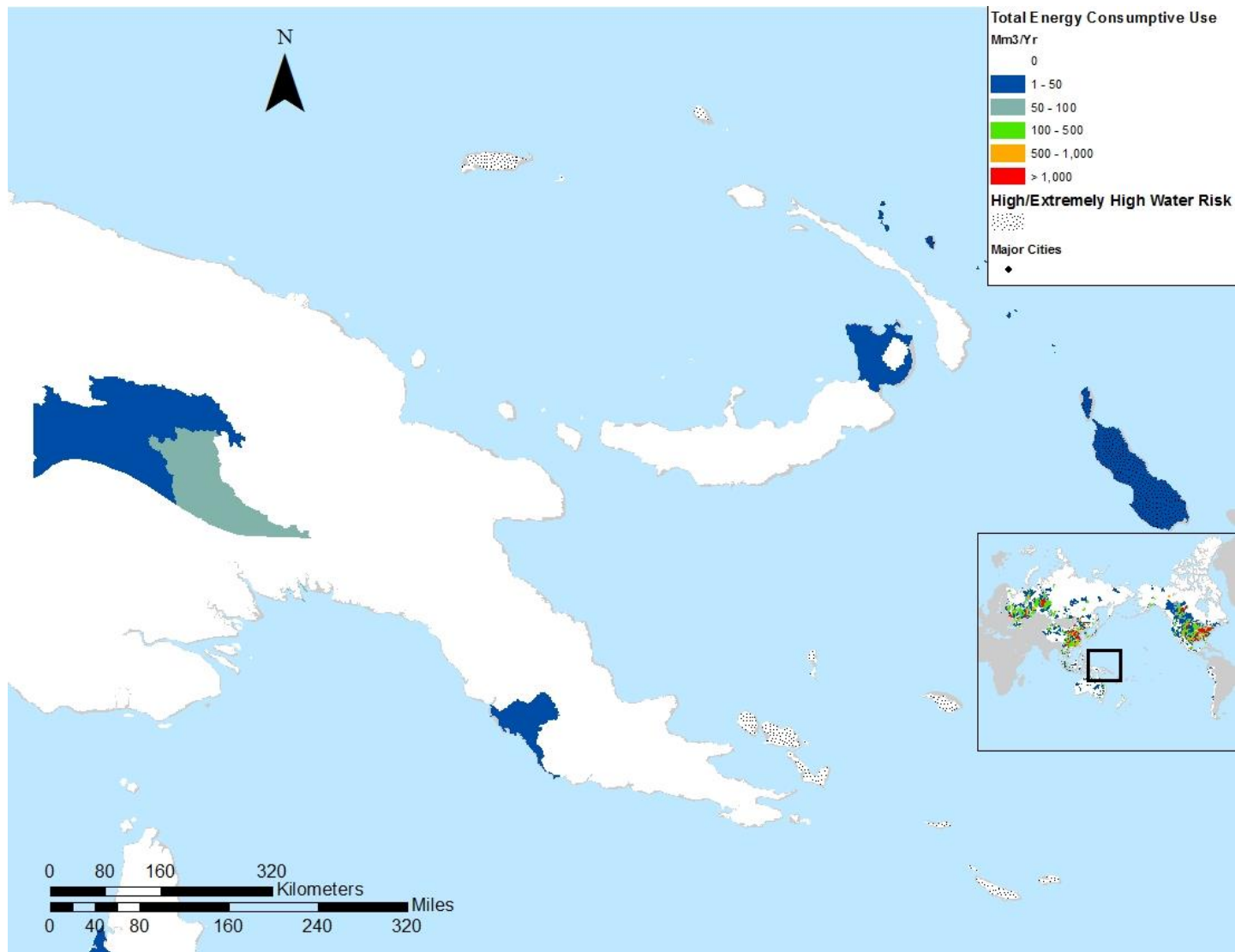


Figure A20: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]) for Papua New Guinea.

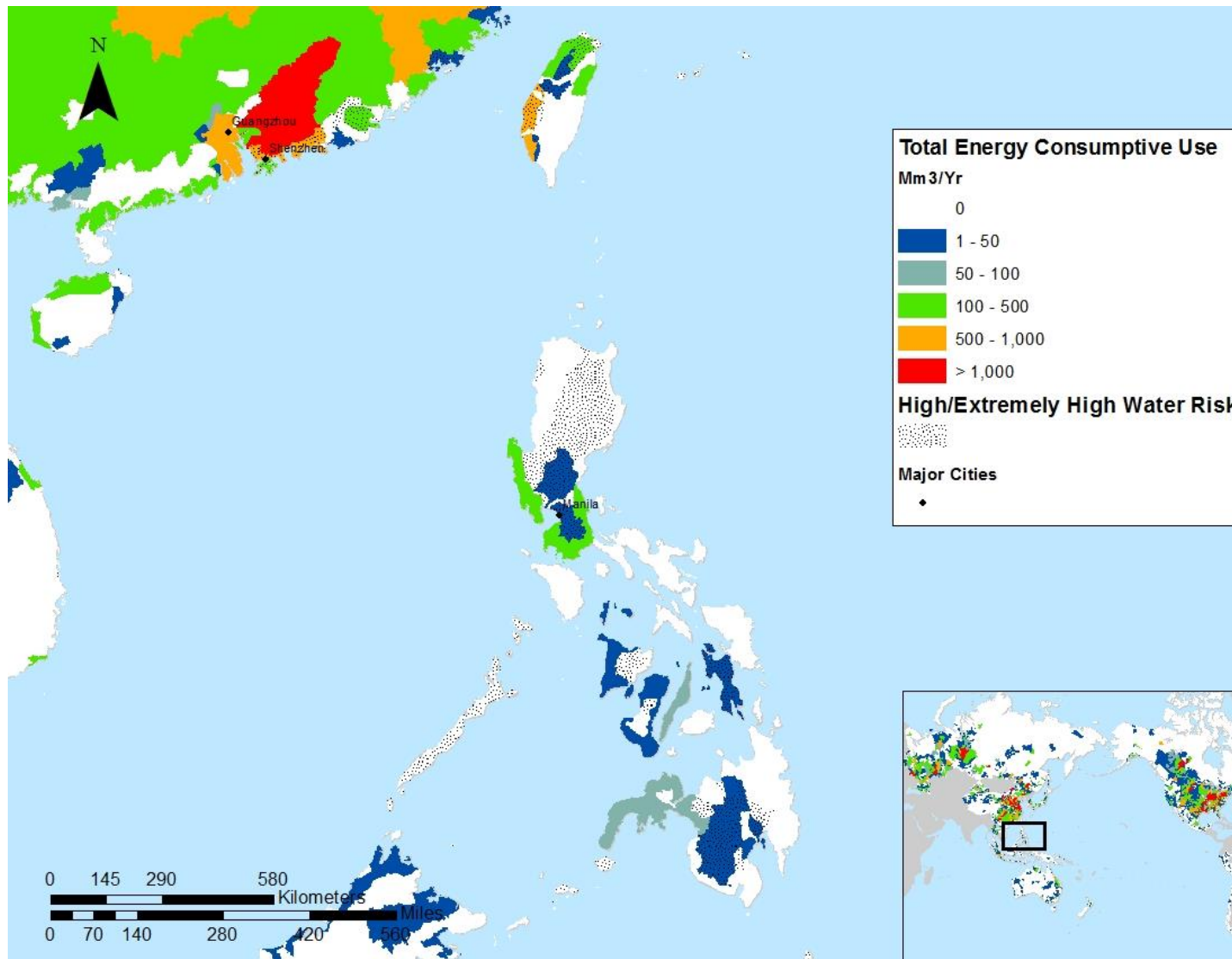


Figure A21: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]) for the Philippines and Chinese Taipei.

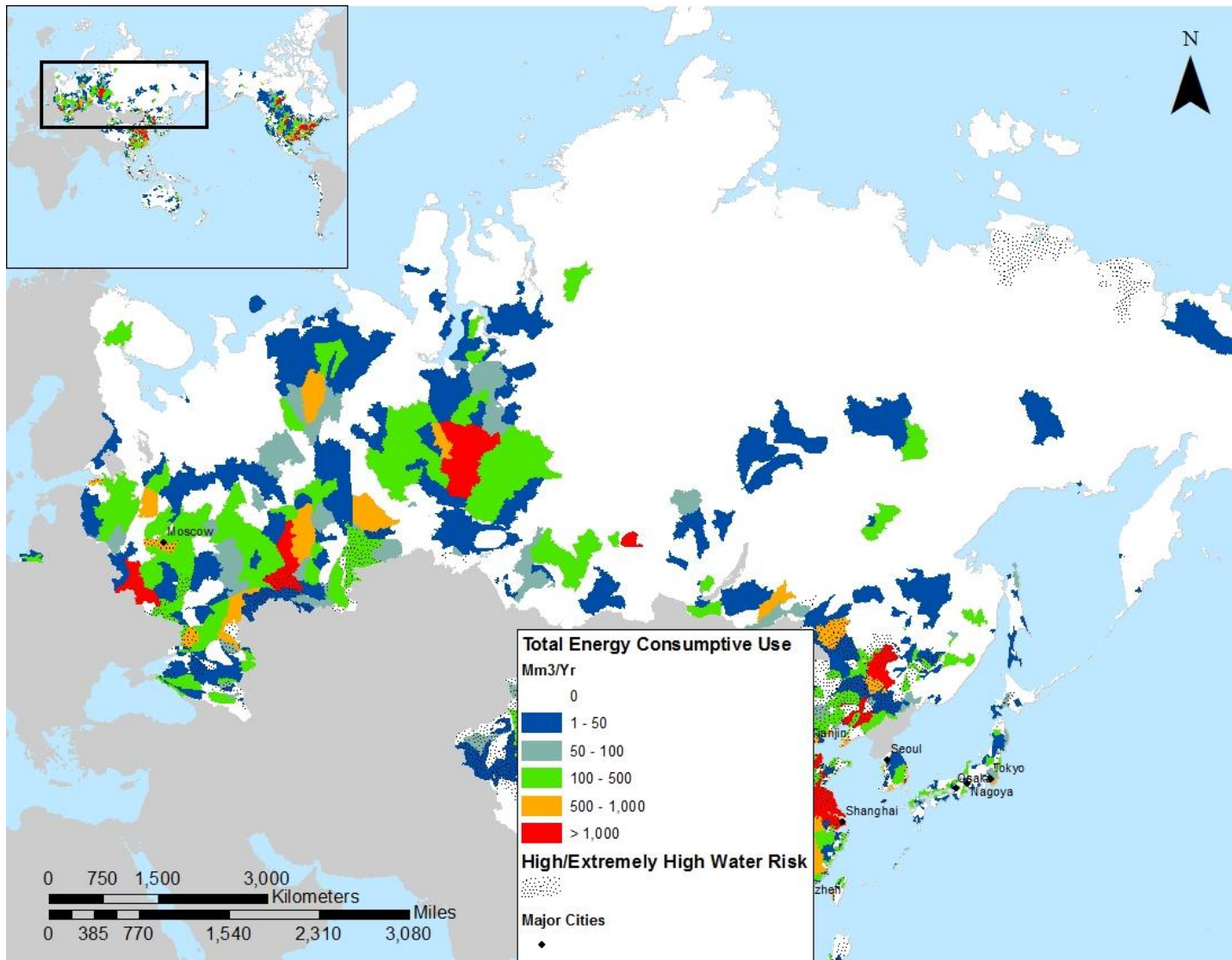


Figure A22: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]) for Russia.

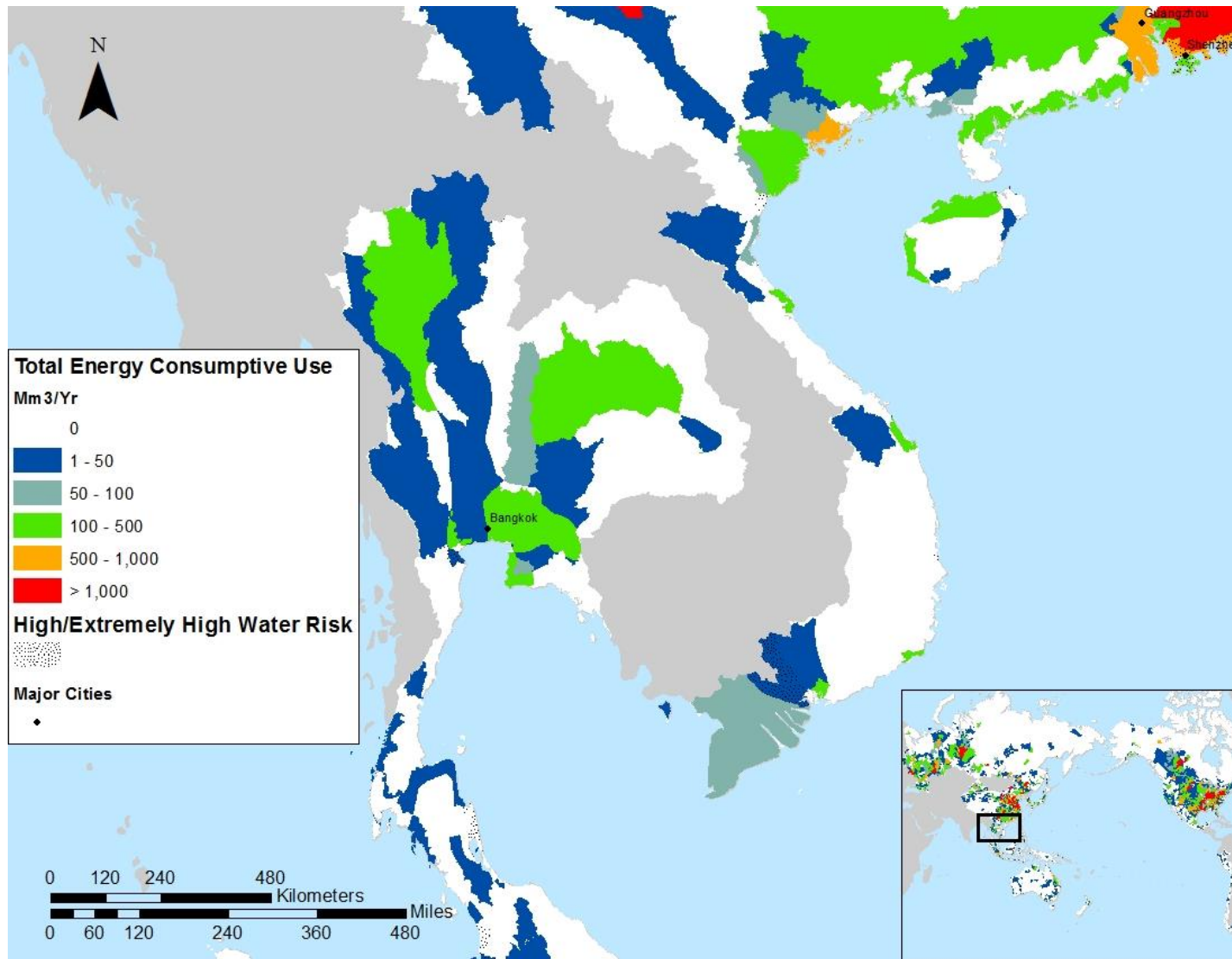


Figure A23: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]) for Thailand and Viet Nam.

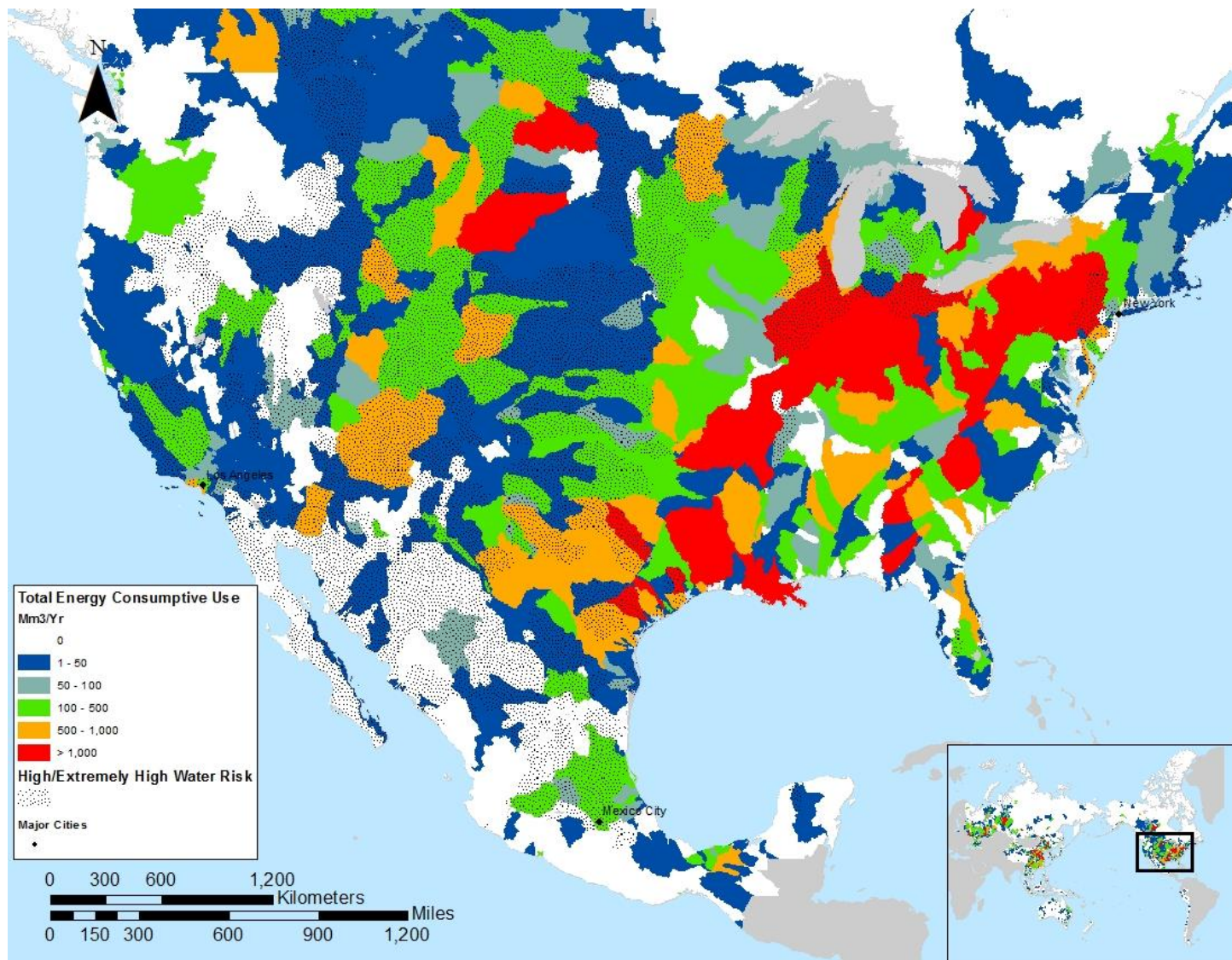


Figure A24: Total water consumption for energy production (Figure A10) mapped over regional water risk (Figure A11 [WRI 2015]) for the United States.

Table A1: Water consumption for energy production aggregated by APEC member economy. Water consumption values are in Mm³/yr.

APEC Economy	Thermoelectric	Oil Refining	Bio Fuel Refining	Coal	Uranium	Oil Production	Gas Production	Unconventional Oil and Gas	Hydropower (MW)	Total Water Consumption
Australia	459	38	1	440	93	10	2	0	7959	1043
Brunei	1	1	0	0	0	0	0	0	0	2
Canada	283	153	6	70	164	96	2	995	16893	1768
Chile	53	16	0	1	0	1	0	0	6298	71
China	8296	802	9	3810	13	650	14	28	223816	13621
Hong Kong, China	10	0	0	0	0	0	0	0	0	10
Indonesia	253	86	2	463	0	128	5	0	4979	937
Japan	593	120	0	0	0	2	1	0	45258	716
Korea	404	234	0	2	0	0	0	0	6225	641
Malaysia	101	44	0	3	0	0	0	0	5758	148
Mexico	143	119	0	16	0	190	5	71	12020	543
New Zealand	38	11	0	5	0	5	0	0	5461	59
Papua New Guinea	5	2	0	0	0	5	0	0	143	12
Peru	11	14	0	0	0	23	2	0	3385	51
Philippines	58	20	0	8	0	0	0	0	3297	87
Russia	1697	422	0	370	63	1823	101	0	49740	4476
Singapore	20	99	0	0	0	0	0	0	0	119
Chinese Taipei	254	91	0	0	0	0	0	0	4783	344
Thailand	126	75	2	19	0	27	0	0	3379	249
United States	6249	1521	64	934	29	717	89	4262	81369	13866
Viet Nam	103	10	0	44	0	0	0	0	14489	157
Total	19153	3879	85	6184	362	3677	222	5356	495249	38919

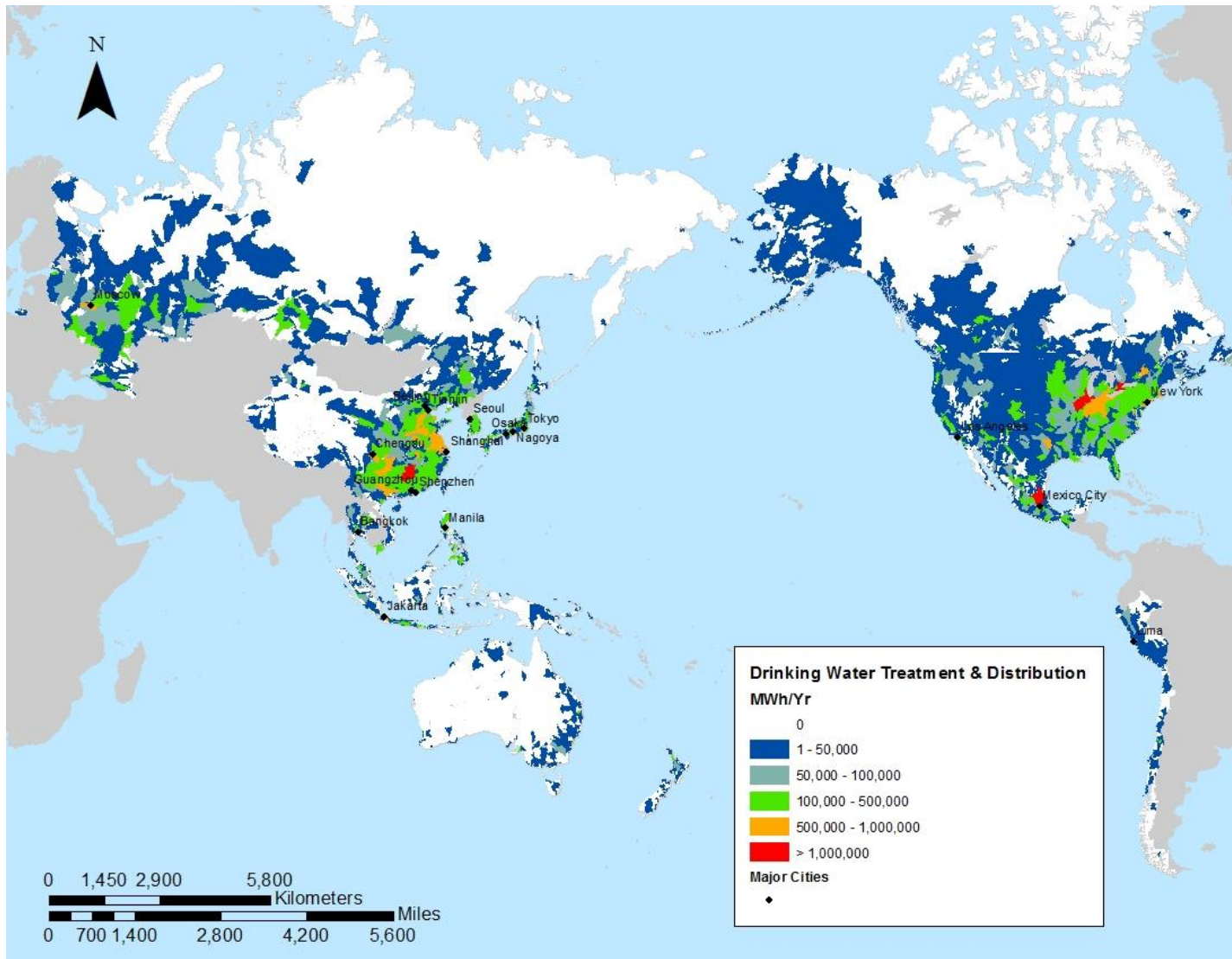


Figure A25: Energy used to provide drinking water services in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

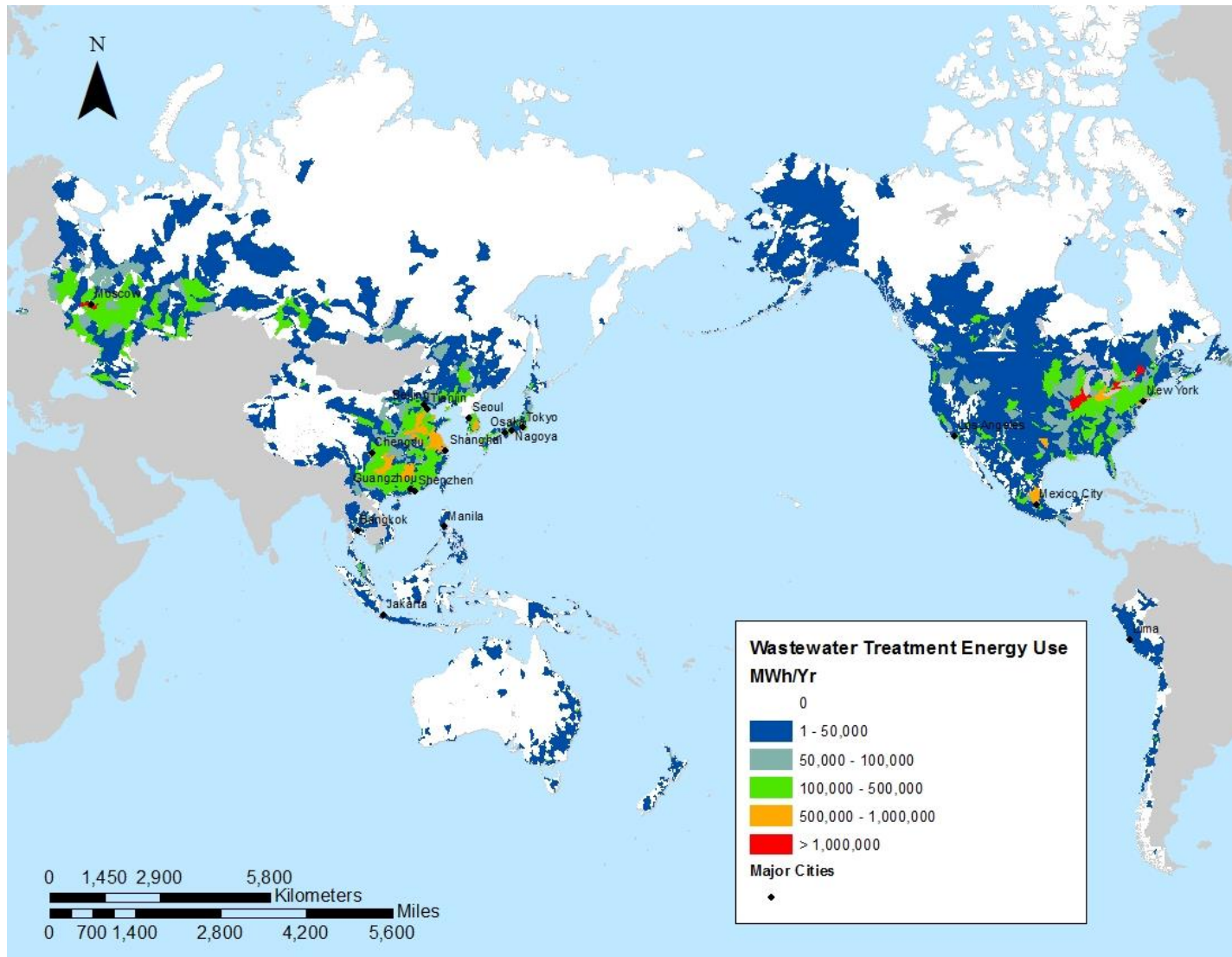


Figure A26: Energy used to provide wastewater services in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

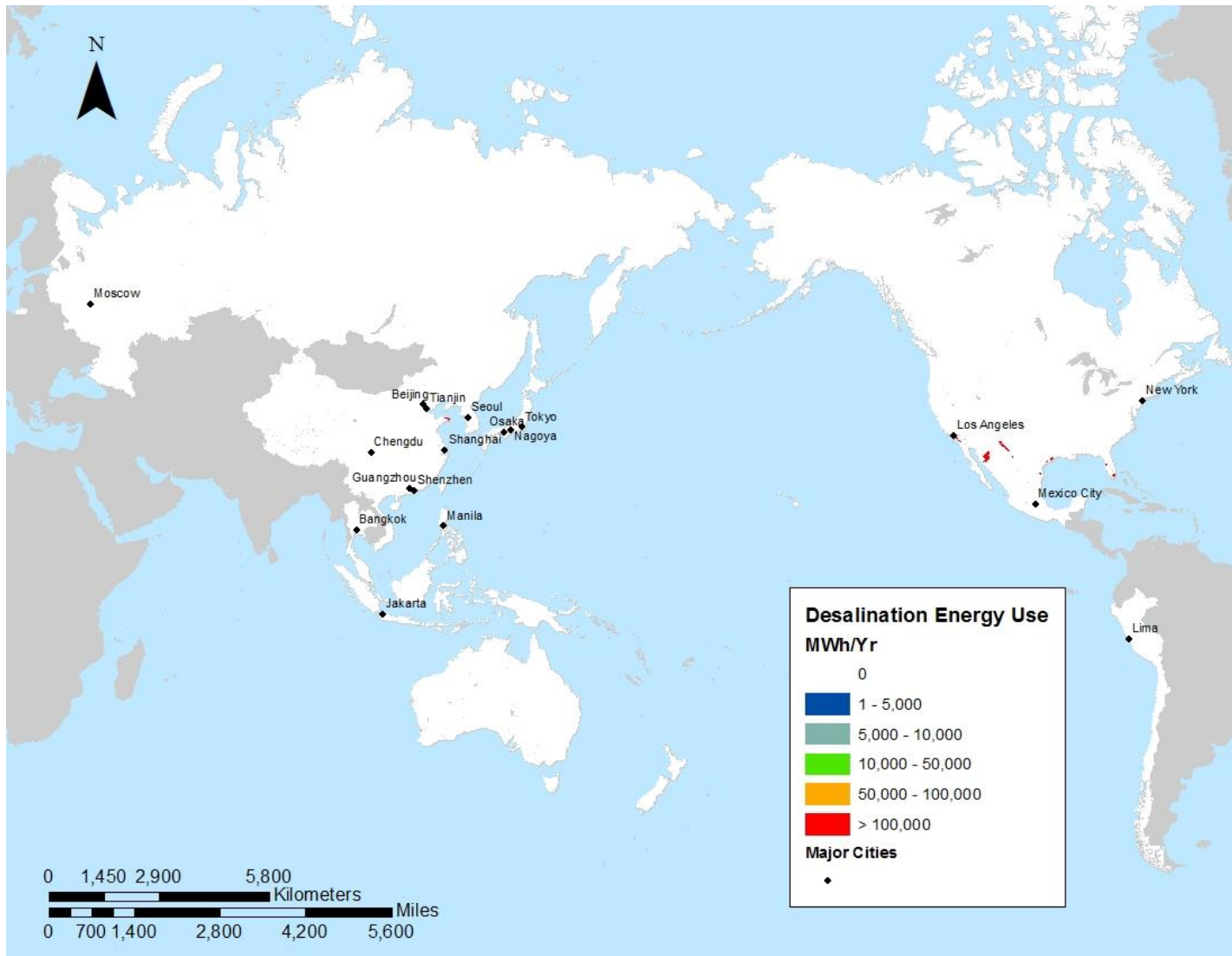


Figure A27: Energy used in desalination plants in the 21-member economies of APEC. Data are mapped for almost 12,000 watersheds across this region.

Table A2: Energy consumption used to provide water services aggregated by water sector and economy.

	Desalination Mwh/yr	Drinking Water Mwh/yr	Wastewater Mwh/yr	Percent of Energy Production
APEC Economy				
Australia	162,259	2,731,585	1,355,070	1.91
Brunei	-	93,770	298	2.77
Canada	-	5,764,893	6,978,745	2.43
Chile	-	783,291	659,919	2.29
China	186,493	37,886,473	34,053,600	1.61
Hong Kong, China	-	167,245	150,325	-
Indonesia	-	7,180,165	203,938	4.42
Japan	-	11,156,927	9,966,540	2.29
Korea	-	4,171,875	6,238,742	2.16
Malaysia	-	2,500,996	2,126,105	3.92
Mexico	168,889	6,880,196	2,700,265	4.17
New Zealand	-	656,290	192,420	2.12
Papua New Guinea	-	54,137	1,357	1.79
Peru	-	661,788	186,322	2.42
Philippines	-	2,839,872	92,145	4.81
Russia	-	8,250,269	14,171,809	2.52
Singapore	454,916	691,765	359,771	3.42
Chinese Taipei	-	627,699	564,196	0.53
Thailand	-	1,663,044	791,361	1.57
United States of America	3,217,286	41,408,090	30,191,648	1.95
Viet Nam	-	721,033	262,054	0.91
Total	4,189,843	136,891,403	111,246,630	2.50