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Annexes 1–5: Urban sprawl in Europe

Joint EEA-FOEN report

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

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References can be found in the main report: http://www.eea.europa.eu/publications/urban-sprawl-in-europe

Annex 1 Values of urban sprawl metrics

A1.1 Countries

Table A1.1 Urban sprawl values for 2006 (orange) and 2009 (green) at the country level

Code	Country/ countries	*TA* (km²)	*BA* (km²)	*WUP* (UPU/ m²)	*UP* (UPU/ m²)	*UD* (inhab. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/ m²)	*PBA* (%)	Population	Number of workplaces
AL	Albania	28 619.6272	350.299378	0.03	0.54	11 469.19	87.19	43.75	1.22	2 981 755	1 035 894
AT	Austria	83 927.71	3 228.961794	1.61	1.73	3 645.48	274.31	44.94	3.85	8 282 984	3 488 132
BA	Bosnia and Herzegovina	51 181.5356	1 208.638137	1.01	1.07	3 812.27	262.31	45.28	2.36	3 842 562	765 097
BE	Belgium	30 666.86	3 992.366068	6.48	6.12	3 587.83	278.72	47.02	13.02	10 584 534	3 739 412
BG	Bulgaria	110 978.76	3 696.789490	0.93	1.35	2 906.48	344.06	40.41	3.33	7 679 290	3 065 367
CH	Switzerland	40 767.69	2 471.149845	2.47	2.76	4 408.29	226.85	45.45	6.06	7 508 739	3 384 814
CY	Cyprus	9 246.31	494.889466	2.49	2.42	2 272.80	439.99	45.26	5.35	778 684	346 103
CZ	Czech Republic	78 870.06	4 413.333570	2.05	2.42	3 405.36	293.65	43.33	5.60	10 287 189	4 741 816
DE	Germany	357 441.6	32 083.770553	3.74	4.02	3 567.04	280.34	44.82	8.98	82 314 906	32 129 316
DK	Denmark	43 019.13	2 857.101991	2.98	2.99	2 756.37	362.80	45.07	6.64	5 447 084	2 428 134
EE	Estonia	43 490.76	738.458825	0.71	0.75	2 652.20	377.05	44.32	1.70	1 342 409	616 131
ES	Spain	505 982.94	11 511.636733	0.64	0.98	5 489.78	182.16	43.27	2.28	44 474 631	18 721 704
FI	Finland	337 837.54	3 962.044408	0.59	0.54	1 902.56	525.61	46.11	1.17	5 276 955	2 261 073
FR	France	548 672.75	28 033.466803	2.26	2.31	3 075.00	325.20	45.12	5.11	63 645 065	22 557 955
GR	Greece	132 028.72	3 131.350283	0.66	1.00	4 949.37	202.05	42.19	2.37	11 171 740	4 326 487
HR	Croatia	56 434.27	2 380.603621	1.81	1.87	2 500.45	399.93	44.44	4.22	4 441 238	1 484 564
HU	Hungary	93 012 61	5 034.640747	2.02	2.34	2 762.95	361.93	43.17	5.41	10 066 158	3 844 288
IE	Ireland	69 946.01	2 461.288622	1.78	1.63	2 514.34	397.72	46.40	3.52	4 312 526	1875980
IS	Iceland	102 687.7	290.047866	0.11	0.12	1 591.27	628.43	42.81	0.28	307 672	153 872
IT	Italy	300 670.2016	16 268.606276	2.04	2.46	4 949.46	202.04	45.37	5.41	59 131 287	21 389 507
KS	Kosovo	10 907.17	344.419802	0.65	1.41	7 155.47	139.75	44.65	3.16	2 126 708	337 779
LI	Liechtenstein	160.38	18.663827	5.47	5.36	3 385.79	295.35	46.06	11.64	35 168	28 024
LT	Lithuania	64 899.39	2 457.624770	1.64	1.68	1 919.75	520.90	44.32	3.79	3 384 879	1 333 154
LU	Luxembourg	2 595.79	234.039312	3.86	4.04	3 159.75	316.48	44.80	9.02	476 187	263 318
LV	Latvia	64 586.04	1 328.009529	0.90	0.92	2 500.11	399.98	44.63	2.06	2 281 305	1 038 866
MC	Monaco	2.01	1.624374	0.00	36.17	4 9821.03	20.07	44.75	80.81	35 292	45 636
ME	Montenegro	13 783.9892	221.257043	0.70	0.73	3 605.25	277.37	45.29	1.61	624 896	172 792
MKD	The former Yugoslav Republic of Macedonia	25 464.8652	406.332173	0.37	0.69	6 383.68	156.65	43.42	1.60	2 041 941	551 953
MT	Malta	315.47	69.807077	4.14	10.34	7 890.77	126.73	46.72	22.13	407 810	143 022
NL	Netherlands	35 519.43	5 130.749976	6.40	6.71	4 407.45	226.89	46.48	14.44	16 357 992	6 255 511
NO	Norway	323 383.25	1 593.500715	0.16	0.21	4 201.84	237.99	43.12	0.49	4681134	2 014 508
PL	Poland	311 927.79	13 013.754057	1.58	1.84	3 982.04	251.13	44.17	4.17	38 125 479	13 695 759
PT	Portugal	91 953.21	4 379.952874	2.20	2.19	3 518.94	284.18	45.99	4.76	10 599 095	4 813 697
RO	Romania	238 391.89	6 299.948031	0.73	1.11	4 821.77	207.39	41.99	2.64	21 565 119	8 811 800
RS	Serbia	77 516.00	2 998.923366	1.54	1.71	3 290.49	303.91	44.08	3.87	7 397 651	2 470 266
SE	Sweden	449 719.79	3 816.996158	0.34	0.38	3 395.39	294.52	44.34	0.85	9 113 257	3 846 941
SI	Slovenia	20 276.82	735.624266	1.53	1.64	3 821.94	261.65	45.16	3.63	2 010 377	801 138

Table A1.1 Urban sprawl values for 2006 (orange) and 2009 (green) at the country level (cont.)

Code	Country/ countries	*TA* (km²)	*BA* (km²)	*WUP* (UPU/ m²)	*UP* (UPU/ m²)	*UD* (inhab. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/ m²)	*PBA* (%)	Population	Number of workplaces
SK	Slovakia	49 025.35	1 987.733639	1.24	1.70	3 778.42	264.66	41.86	4.05	5 393 637	2 116 849
SM	San Marino	61.01	11.871851	8.18	8.88	4 244.12	235.62	45.61	19.46	30 368	20 018
UK	United Kingdom	244 551.4972	17 773.707355	3.07	3.38	4 836.43	206.76	46.56	7.27	60 781 346	25 179 968
EU-32	Europe-32	4 842 987.7188	186 669.031227	1.56	1.72	3 833.16	260.88	44.75	3.85	512 265 876	201 134 226
AL	Albania	28 619.6272	373.047607	0.05	0.57	10 629.30	94.08	43.83	1.30	2 918 674	1 046 562
AT	Austria	83 927.71	3 376.479302	1.70	1.81	3 535.10	282.88	44.96	4.02	8 375 290	3 560 891
BA	Bosnia and Herzegovina	51 181.5356	1 277.328018	1.09	1.13	3 647.33	274.17	45.36	2.50	3 843 126	815 708
BE	Belgium	30 666.86	4 056.996523	6.59	6.22	3 619.10	276.31	47.05	13.23	10 839 905	3 842 789
BG	Bulgaria	110 978.76	3 842.885115	0.98	1.40	2 800.18	357.12	40.44	3.46	7 563 710	3 197 049
CH	Switzerland	40 767.69	2 565.912898	2.57	2.86	4 411.91	226.66	45.47	6.29	7 785 806	3 534 770
CY	Cyprus	9 246.31	543.798454	2.74	2.66	2 184.34	457.80	45.25	5.88	819 140	368 701
CZ	Czech Republic	78 870.06	4 507.280935	2.11	2.48	3 398.63	294.24	43.43	5.71	10 506 813	4811781
DE	Germany	357 441.6	32 655.347922	3.83	4.10	3 516.30	284.39	44.84	9.14	81 802 257	33 023 734
DK	Denmark	43 019.13	2 906.922427	3.04	3.05	2 734.45	365.70	45.12	6.76	5 534 738	2 414 100
EE	Estonia	43 490.76	776.165982	0.76	0.79	2 429.39	411.63	44.35	1.78	1 340 127	545 484
ES	Spain	505 982.94	12 367.330221	0.75	1.06	5 164.99	193.61	43.49	2.44	45 989 016	17 888 168
FI	Finland	337 837.54	4 073.430115	0.61	0.56	1 874.20	533.56	46.08	1.21	5 351 427	2 282 990
FR	France	548 672.75	28 715.557826	2.33	2.36	3 047.93	328.09	45.16	5.23	64 658 856	22 864 079
GR	Greece	132 028.72	3 284.454112	0.72	1.05	4 774.31	209.45	42.32	2.49	11 305 118	4 375 878
HR	Croatia	56 434.27	2 515.968023	1.92	1.98	2 360.06	423.72	44.50	4.46	4 425 747	1 512 082
HU	Hungary	93 012.61	5 197.693617	2.12	2.42	2 629.07	380.36	43.25	5.59	10 014 324	3 650 782
IE	Ireland	69 946.01	2 573.706118	1.89	1.71	2 383.03	419.63	46.50	3.68	4 467 854	1 665 354
IS	Iceland	102 687.7	292.871327	0.11	0.12	1 586.94	630.15	42.77	0.29	317 630	147 138
IT	Italy	300 670.2016	17 011.541042	2.18	2.57	4 799.65	208.35	45.39	5.66	60 340 328	21 309 191
KS	Kosovo	10 907.17	355.889703	0.68	1.46	7 165.11	139.57	44.66	3.26	2 208 107	371 820
LI	Liechtenstein	160.38	20.067880	6.06	5.80	3 255.27	307.19	46.34	12.51	35 894	29 432
LT	Lithuania	64 899.39	2 525.007174	1.69	1.73	1 817.05	550.34	44.34	3.89	3 329 039	1 259 038
LU	Luxembourg	2 595.79	243.872312	4.01	4.21	3 306.34	302.45	44.86	9.39	502 066	304 258
LV	Latvia	64 586.04	1 366.309112	0.93	0.95	2 276.79	439.21	44.69	2.12	2 248 374	862 431
MC	Monaco	2.01	1.629227	0.00	36.23	51 545.93	19.40	44.70	81.06	35 646	48 334
ME	Montenegro	13 783.9892	223.343646	0.70	0.74	3 687.44	271.19	45.37	1.62	616 411	207 155
MKD	The former Yugoslav Republic of Macedonia	25 464.8652	437.270625	0.43	0.75	6 095.32	164.06	43.45	1.72	2 052 722	612 584
MT	Malta	315.47	76.563563	5.58	11.36	7 368.64	135.71	46.80	24.27	414 372	149 797
NL	Netherlands	35 519.43	5 265.422620	6.61	6.90	4 392.92	227.64	46.54	14.82	16 574 989	6 555 590
NO	Norway	323 383.25	1 789.511366	0.19	0.24	3 909.76	255.77	43.25	0.55	4 858 199	2 138 352
PL	Poland	311 927.79	13 469.415797	1.66	1.91	3 955.58	252.81	44.26	4.32	38 167 329	15 111 998
PT	Portugal	91 953.21	4 583.073557	2.33	2.29	3 349.41	298.56	45.98	4.98	10 637 713	4 712 900
RO	Romania	238 391.89	6 491.103041	0.78	1.15	4 655.53	214.80	42.08	2.72	21 462 186	8 757 343
RS	Serbia	77 516.00	3 150.976649	1.65	1.79	3 027.38	330.32	44.13	4.06	73 06 677	2 232 518
SE	Sweden	449 719.79	4 538.051801	0.42	0.45	2 907.12	343.98	44.43	1.01	9 340 682	3 851 974
SI	Slovenia	20 276.82	805.873723	1.73	1.80	3 498.36	285.85	45.24	3.97	2 046 976	772 259
SK	Slovakia	49 025.35	2 101.887906	1.36	1.80	3 627.75	275.65	42.08	4.29	5 424 925	2 200 192
SM	San Marino	61.010	12.869102	9.08	9.64	4 106.44	243.52	45.72	21.09	31 632	21 214
TR	Turkey	771 359.2204	11 991.910076	0.20	0.65	7 722.73	129.49	42.03	1.55	72 561 312	20 048 993
UK	United Kingdom	244 551.4972	18 217.085013	3.18	3.47	4 774.10	209.46	46.60	7.45	62 026 962	24 943 140
EU-32	Europe-32	4 842 987.7188	193 558.490533	1.64	1.79	3 739.64	267.41	44.80	4.00	51 850 7792	202 941 746

Note: *DIS*, dispersion; *LUP*, land uptake per person; *PBA*, percentage of built-up area; *BA*, built-up area; *TA*, total area; *UD*, utilisation density; *UP*, urban permeation; *WUP*, weighted urban proliferation. The unit for each metric is indicated in parentheses. The values for Turkey (TR) are available for 2009 only.

A1.2 Nomenclature of Territorial Units for Statistics-2 regions

Table A1.2 Urban sprawl values for 2006 (orange) and 2009 (green) at the NUTS-2 level

Code	NUTS-2	*TA* (km²)	*BA* (km²)	*WUP* (UPU/m²)	*UP* (UPU/m²)	*UD* (inh. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/m²)	*PBA* (%)	Population	Number of workplaces
AT11	Burgenland (AT)	3 964.82	171.487775	1.37	1.79	2 152.10	464.66	41.28	4.33	280 062	88 997
AT12	Niederösterreich	19 196.81	953.411212	1.97	2.16	2 263.99	441.70	43.57	4.97	1 588 567	569 945
AT13	Wien	414.88	232.282053	3.11	27.46	1 0637.55	94.01	49.04	55.99	1 661 246	809 665
AT21	Kärnten	9 542.27	256.290171	1.16	1.20	3 028.92	330.15	44.86	2.69	559 393	216 889
AT22	Steiermark	16 409.80	535.126740	1.53	1.50	3 180.91	314.38	45.85	3.26	1 202 483	499 707
AT31	Oberösterreich	11 988.26	529.435803	2.00	2.03	3 795.31	263.48	45.97	4.42	1 403 663	605 708
AT32	Salzburg	7 161.10	173.195238	0.90	1.08	4 438.87	225.28	44.51	2.42	526 048	242 744
AT33	Tirol	12 647.65	241.638902	0.70	0.84	4 155.95	240.62	44.01	1.91	697 253	306 986
AT34	Vorarlberg	2 602.12	101.462970	1.55	1.80	5 037.06	198.53	46.15	3.90	364 269	146 806
BE10	Région de Bruxelles-Capitale/Brussels Hoofdstedelijk Gewest	162.52	107.397213	0.24	32.54	15 263.07	65.52	49.24	66.08	1 031 215	607 997
BE21	Prov. Antwerpen	2 875.51	636.390386	11.19	10.48	3 691.00	270.93	47.35	22.13	1 700 570	648 350
BE22	Prov. Limburg (BE)	2428.12	415.686349	8.94	8.03	2 615.95	382.27	46.88	17.12	820 272	267 143
BE23	Prov. Oost-Vlaanderen	3 008.06	543.031558	9.39	8.57	3 416.59	292.69	47.46	18.05	1 398 253	457 061
BE24	Prov. Vlaams-Brabant	2 118.83	361.570389	8.60	8.10	3 845.54	260.04	47.49	17.06	1 052 467	337 966
BE25	Prov. West-Vlaanderen	3 169.09	532.482040	8.83	7.93	2 955.01	338.41	47.21	16.80	1 145 878	427 609
BE31	Prov. Brabant Wallon	1 097.14	108.406350	4.33	4.59	4 441.94	225.13	46.41	9.88	370 460	111 074
BE32	Prov. Hainaut	3 813.66	500.257948	6.75	6.19	3 315.58	301.61	47.21	13.12	1 294 844	363 803
BE33	Prov. Liège	3 857.92	374.233519	4.82	4.56	3 635.56	275.06	47.04	9.70	1 047 414	313 136
BE34	Prov. Luxembourg (BE)	4 460.10	177.410124	1.64	1.74	1 884.51	530.64	43.84	3.98	261 178	73 153
BE35	Prov. Namur	3 675.91	195.696560	2.28	2.38	3 061.10	326.68	44.76	5.32	461 983	137 064
BG31	Severozapaden	19 070.40	629.829009	0.95	1.33	2 015.97	496.04	40.27	3.30	943 664	326 055
BG32	Severen tsentralen	14 803.11	561.765665	1.01	1.50	2 289.05	436.86	39.59	3.79	941 240	344 671
BG33	Severoiztochen	14 647.37	561.529836	1.00	1.51	2 481.33	403.01	39.46	3.83	993 549	399 794
BG34	Yugoiztochen	19 800.92	555.316510	0.67	1.09	2 829.28	353.45	38.70	2.80	1 129 846	441 299
BG41	Yugozapaden	20 297.06	719.774080	1.22	1.54	4 268.36	234.28	43.47	3.55	2 116 791	955 464
BG42	Yuzhen tsentralen	22 359.90	668.230322	0.80	1.20	3 220.88	310.47	40.13	2.99	1 554 200	598088
CH01	Région lémanique	8 375.27	406.189037	1.91	2.22	4 892.53	204.39	45.81	4.85	1 389 988	597 302
CH02	Espace Mittelland	10 060.06	586.017410	2.30	2.61	4 212.28	237.40	44.86	5.83	1 703 966	764 501
CH03	Nordwestschweiz	1 958.57	340.212592	7.41	7.98	4 374.24	228.61	45.96	17.37	1 026 801	461 371
CH04	Zürich	1 728.08	337.355056	7.33	9.13	5 608.57	178.30	46.77	19.52	1284052	608 027
CH05	Ostschweiz	1 1351.06	419.281899	1.52	1.65	3 703.42	270.02	44.76	3.69	1 065 253	487 525
CH06	Zentralschweiz	4 483.05	228.731468	1.91	2.28	4 582.11	218.24	44.73	5.10	713 828	334 245
CH07	Ticino	2 811.60	138.329063	2.24	2.24	3 301.11	302.93	45.60	4.92	324 851	131 788
CY00	Cyprus	9 246.31	494.889466	2.49	2.42	2 272.80	439.99	45.26	5.35	778 684	346 103
CZ01	Praha	496.22	234.880440	8.56	22.92	8 239.47	121.37	48.42	47.33	1 188 126	747 164
CZ02	Střední Cechy	11 017.63	698.506516	2.47	2.75	2 391.22	418.20	43.42	6.34	1 175 254	495 028
CZ03	Jihozápad	17 616.55	648.927082	1.20	1.54	2 671.89	374.27	41.76	3.68	1184543	549320
CZ04	Severozápad	8 650.15	468.992327	2.07	2.37	3 441.35	290.58	43.78	5.42	1 127 867	486 100
CZ05	Severovýchod	12 442.94	619.065731	1.80	2.15	3 484.95	286.95	43.28	4.98	1 488 168	669 245
CZ06	Jihovýchod	13 989.68	671.029054	1.46	2.00	3 538.97	282.57	41.60	4.80	1 644 208	730 545
CZ07	Střední Morava	9 229.83	523.293700	1.99	2.43	3 394.03	294.63	42.92	5.67	1 229 733	546 344
CZ08	Moravskoslezsko	5 427.06	521.242026	4.07	4.31	3 388.44	295.12	44.85	9.60	1 249 290	516 908
DE11	Stuttgart	10 557.03	1 219.547285	4.03	5.12	4 824.93	207.26	44.31	11.55	4 005 380	1 878 847
DE12	Karlsruhe	6 918.44	818.221904	4.26	5.26	4 704.63	212.56	44.49	11.83	2 734 260	1 115 168
DE13	Freiburg	9 355.87	772.647640	3.01	3.61	3 908.57	255.85	43.68	8.26	2 193 178	826 770
DE14	Tübingen	8 917.96	727.082038	2.97	3.53	3 433.97	291.21	43.30	8.15	1 805 935	690 840
DE21	Oberbayern	17 529.35	1 634.386261	4.02	4.23	3 811.13	262.39	45.42	9.32	4 279 112	1 949 754
DE22	Niederbayern	10 327.08	645.383851	2.65	2.77	2 616.16	382.24	44.38	6.25	1 193 820	494 605
DE23	Oberpfalz	9 691.39	531.478192	2.18	2.41	2 900.51	344.77	43.87	5.48	1 087 939	453 620
DE24	Oberfranken	7 231.87	482.096651	2.71	2.95	3 179.64	314.50	44.27	6.67	1 094 525	438 368
DE25	Mittelfranken	7 244.87	644.107052	3.54	3.96	3 806.68	262.70	44.53	8.89	1 712 622	739 287
DE26	Unterfranken	8 529.46	596.703945	2.41	2.98	3 104.76	322.09	42.54	7.00	1 337 876	514 744
DE27	Schwaben	9 991.30	781.497696	3.03	3.42	3 198.87	312.61	43.79	7.82	1 786 764	7131 43

Table A1.2 Urban sprawl values for 2006 (orange) and 2009 (green) at the NUTS-2 level (cont.)

Code	NUTS-2	*TA* (km²)	*BA* (km²)	*WUP* (UPU/m²)	*UP* (UPU/m²)	*UD* (inh. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/m²)	*PBA* (%)	Population	Number of workplaces
DE30	Berlin	892.05	522.415854	7.11	28.68	9 160.51	109.16	48.98	58.56	3 404 037	1 381 560
DE40	Brandenburg	29 655.03	1 703.761299	2.36	2.52	2 009.24	497.70	43.84	5.75	2 547 772	875 493
DE50	Bremen	401.01	185.448842	20.29	22.26	5 268.04	189.82	48.13	46.25	663 979	312 973
DE60	Hamburg	753.33	365.305270	12.99	23.64	7 296.84	137.05	48.75	48.49	1 754 182	911 392
DE71	Darmstadt	7 443.29	1 065.364715	5.19	6.45	5 022.16	199.12	45.07	14.31	3 772 906	1 577 528
DE72	Gießen	5 379.89	438.151317	2.82	3.48	3 350.25	298.48	42.76	8.14	1 057 553	410 366
DE73	Kassel	8 291.28	548.688775	2.40	2.85	3 159.03	316.55	43.09	6.62	1 244 900	488 427
DE80	Mecklenburg-Vorpommern	23 059.31	1 024.817012	1.60	1.89	2 267.14	441.08	42.60	4.44	1 693 754	629 647
DE91	Braunschweig	8 122.39	714.595422	3.40	3.84	3 113.90	321.14	43.70	8.80	1 641 776	583 402
DE92	Hannover	9 065.61	884.623014	4.13	4.38	3 462.86	288.78	44.89	9.76	2 160 253	903 076
DE93	Lüneburg	15 578.94	839.760595	2.10	2.34	2 572.56	388.72	43.48	5.39	1 702 938	457 401
DE94	Weser-Ems	15 004.24	1 298.053610	4.01	3.93	2 598.49	384.84	45.39	8.65	2 477 718	895 259
DEA1	Düsseldorf	5 293.87	1 456.181225	12.01	13.08	5 067.75	197.33	47.54	27.51	5 217 129	2 162 436
DEA2	Köln	7 362.92	1 269.954060	7.39	8.04	4 741.68	210.90	46.59	17.25	4 384 669	1 637 048
DEA3	Münster	6 917.19	977.741631	6.64	6.53	3 564.12	280.57	46.22	14.13	2 619 372	865412
DEA4	Detmold	6 525.44	863.009184	6.21	6.08	3 263.89	306.38	45.96	13.23	2 065 413	751355
DEA5	Arnsberg	8 012.96	1 184.906273	6.69	6.88	4 233.91	236.19	46.51	14.79	3 742 162	1274626
DEB1	Koblenz	8 076.56	651.785379	3.28	3.57	3 221.85	310.38	44.28	8.07	1 513 939	586015
DEB2	Trier	4 928.29	249.964445	1.82	2.17	2 852.06	350.62	42.80	5.07	515 819	197095
DEB3	Rheinhessen-Pfalz	6 851.55	684.857714	3.92	4.45	3 951.09	253.09	44.49	10.00	2 023 102	682831
DEC0	Saarland	2 571.00	349.373156	6.02	6.27	4 142.31	241.41	46.11	13.59	1043 167	404044
DED2	Dresden	7 946.67	915.873098	5.60	5.29	2 497.97	400.33	45.88	11.53	1 657 114	630705
DED4	Chemnitz	6 524.60	705.212631	5.01	4.93	3 052.24	327.63	45.65	10.81	1 592 065	560410
DED5	Leipzig	3 978.73	435.995896	4.89	4.97	3 238.76	308.76	45.33	10.96	1 000 595	411493
DEE0	Sachsen-Anhalt	20 550.64	1 324.121843	2.36	2.76	2 498.52	400.24	42.87	6.44	2441 787	866552
DEF0	Schleswig-Holstein	15 760.24	1 253.124455	3.40	3.56	3 061.33	326.66	44.74	7.95	2 834 254	1001976
DEG0	Thüringen	16 199.95	1 085.356286	2.38	2.86	2 913.11	343.28	42.75	6.70	2 311 140	850621
DK01	Hovedstaden	2 566.32	528.105644	9.50	9.74	4 591.61	217.79	47.35	20.58	1 636 749	788106
DK02	Sjælland	7 288.45	567.178528	3.52	3.49	2 025.54	493.70	44.85	7.78	816 118	332724
DK03	Syddanmark	12 142.66	700.446581	2.48	2.57	2 452.11	407.81	44.47	5.77	1 189 817	527755
DK04	Midtjylland	13 106.80	697.075102	2.27	2.36	2 564.26	389.98	44.46	5.32	1 227 428	560053
DK05	Nordjylland	7 914.90	350.713097	1.88	1.96	2 362.10	423.35	44.31	4.43	576 972	251446
EE00	Estonia	43 490.76	738.458825	0.71	0.75	2 652.20	377.05	44.32	1.70	1 342 409	616131
ES11	Galicia	29 570.57	963.007264	1.45	1.50	3 947.57	253.32	45.91	3.26	2 723 915	1077621
ES12	Principado de Asturias	10 602.46	208.656725	0.44	0.88	6 969.51	143.48	44.79	1.97	1 058 059	396177
ES13	Cantabria	5 320.43	116.969782	0.51	0.98	6 771.84	147.67	44.46	2.20	563 611	228489
ES21	País Vasco	7 234.44	293.973733	0.18	1.80	10 392.16	96.23	44.32	4.06	2 124 235	930787
ES22	Comunidad Foral de Navarra	10 390.86	179.593102	0.46	0.72	4 802.72	208.22	41.61	1.73	596 236	266299
ES23	La Rioja	5 044.75	94.646232	0.55	0.79	4 626.10	216.16	42.22	1.88	306 254	131589
ES24	Aragón	47 721.58	461.354415	0.25	0.39	3 956.41	252.75	40.23	0.97	1 275 904	549402
ES30	Comunidad de Madrid	8 030.53	780.515205	0.27	4.50	11 507.29	86.90	46.30	9.72	6 052 583	2929033
ES41	Castilla y León	94 225.10	1 112.589277	0.27	0.45	3 118.63	320.65	38.43	1.18	2 486 166	983591
ES42	Castilla-la Mancha	79 458.19	917.378503	0.29	0.45	2 915.63	342.98	39.39	1.15	1 929 947	744789
ES43	Extremadura	41 634.25	458.190395	0.27	0.43	3 142.69	318.20	39.15	1.10	1 074 419	365529
ES51	Cataluña	32 109.97	1 495.975420	1.08	2.10	6 942.17	144.05	45.07	4.66	7 085 308	3300003
ES52	Comunidad Valenciana	23 255.09	1 173.498679	1.57	2.27	5 761.74	173.56	44.89	5.05	4 759 263	2002126
ES53	Illes Balears	4 991.08	213.320946	0.78	1.82	6 960.32	143.67	42.64	4.27	1 014 405	470376
ES61	Andalucía	87 600.03	2 174.436281	0.81	1.09	4 983.74	200.65	43.87	2.48	7 917 397	2919432
ES62	Región de Murcia	11 313.34	362.387317	0.98	1.40	5 356.39	186.69	43.80	3.20	1 370 802	570284
ES63	Ciudad Autónoma de Ceuta (ES)	19.75	7.087080	0.31	16.04	1 3298.11	75.20	44.70	35.88	71 561	22684
ES64	Ciudad Autónoma de Melilla (ES)	13.86	8.848437	4.34	29.96	10 027.53	99.73	46.92	63.84	67 556	21172
ES70	Canarias (ES)	7 446.66	457.602007	1.80	2.78	6 139.58	162.88	45.16	6.15	1 997 010	812475
FI19	Länsi-Suomi	64 597.36	1 484.906782	1.16	1.06	1 271.23	786.64	45.96	2.30	1 338 973	548682
FI1B	Helsinki-Uusimaa	9 485.06	826.664032	4.79	4.15	2 656.15	376.48	47.64	8.72	1 467 453	728290
FI1C	Etelä-Suomi	35 539.75	938.980097	1.39	1.23	1 725.17	579.65	46.53	2.64	1 146 472	473429

Table A1.2 Urban sprawl values for 2006 (orange) and 2009 (green) at the NUTS-2 level (cont.)

Code	NUTS-2	*TA* (km²)	*BA* (km²)	*WUP* (UPU/m²)	*UP* (UPU/m²)	*UD* (inh. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/m²)	*PBA* (%)	Population	Number of workplaces
FI1D	Pohjois- ja Itä-Suomi	226 740.15	652.992822	0.12	0.13	2 746.02	364.16	43.94	0.29	1 297 134	495998
FI20	Åland	1 475.22	39.501972	1.20	1.19	1 050.08	952.31	44.50	2.68	26 923	14557
FR10	Île de France	12 068.96	2 064.114849	3.19	8.12	8 029.15	124.55	47.49	17.10	11 598 866	4 974 216
FR21	Champagne-Ardenne	25 719.10	887.151933	1.13	1.44	2 078.86	481.03	41.65	3.45	1 339 487	504 775
FR22	Picardie	19 505.72	878.406909	1.60	1.92	2 840.80	352.01	42.74	4.50	1 900 354	595 021
FR23	Haute-Normandie	12 354.29	731.268336	2.69	2.70	3 349.61	298.54	45.63	5.92	1 816 716	632 751
FR24	Centre (FR)	39 529.85	1 351.797524	1.42	1.51	2 577.31	388.00	44.18	3.42	2 526 919	957 083
FR25	Basse-Normandie	17 758.75	744.353434	1.85	1.88	2 642.03	378.50	44.82	4.19	1 461 429	505 174
FR26	Bourgogne	31 752.89	1 083.924667	1.39	1.49	2 032.50	492.01	43.71	3.41	1 633 891	569 185
FR30	Nord-Pas-de-Calais	12 445.13	1 451.563319	5.50	5.41	3 676.12	272.03	46.37	11.66	4 021 676	1 314 448
FR41	Lorraine	23 669.39	1 198.183959	2.03	2.22	2 580.34	387.55	43.82	5.06	2 339 881	751 837
FR42	Alsace	8 330.34	834.557058	4.32	4.49	3 004.42	332.84	44.78	10.02	1 827 248	680 115
FR43	Franche-Comté	16 307.49	824.547477	2.04	2.21	1 906.77	524.45	43.62	5.06	1 158 671	413 548
FR51	Pays de la Loire	32 375.37	2 110.273884	3.01	2.94	2 262.09	442.07	45.18	6.52	3 482 594	1 291 032
FR52	Bretagne	27 472.28	2 093.665740	3.72	3.48	2 018.13	495.51	45.73	7.62	3 120 288	1 105 004
FR53	Poitou-Charentes	25 967.33	1 148.155007	1.92	1.96	2 046.65	488.60	44.43	4.42	1 739 780	610 088
FR61	Aquitaine	41 804.27	1 769.321292	2.02	1.93	2 435.39	410.61	45.66	4.23	3 150 890	1 158 103
FR62	Midi-Pyrénées	45 602.31	1 393.882915	1.41	1.39	2 774.69	360.40	45.40	3.06	2 810 247	1 057 340
FR63	Limousin	17 055.76	416.423382	1.11	1.10	2 432.03	411.18	45.12	2.44	737 001	275 753
FR71	Rhône-Alpes	44 728.87	3 068.423715	3.36	3.16	2 714.63	368.37	46.09	6.86	6 065 959	2 263 681
FR72	Auvergne	26 171.99	777.486689	1.27	1.32	2 351.07	425.34	44.34	2.97	1 339 247	488 679
FR81	Languedoc-Roussillon	27 644.33	1 250.331798	1.78	1.97	2 666.69	375.00	43.65	4.52	2 560 870	773 376
FR82	Provence-Alpes-Côte d'Azur	31 681.79	1 702.187151	2.49	2.49	3 776.36	264.81	46.25	5.37	4 864 015	1 564 059
FR83	Corse	8 726.54	169.284767	0.74	0.84	2 214.24	451.62	43.16	1.94	299 209	75 628
GR11	Anatoliki Makedonia, Thraki	14 190.38	283.461445	0.53	0.80	2 933.28	340.91	39.92	2.00	607 205	224 268
GR12	Kentriki Makedonia	18 842.71	712.428444	1.13	1.57	3 736.75	267.61	41.57	3.78	1 927 823	734 347
GR13	Dytiki Makedonia	9 460.84	94.317275	0.18	0.36	4 168.11	239.92	36.02	1.00	293 864	99 261
GR14	Thessalia	14 050.58	335.159922	0.67	0.97	3 048.21	328.06	40.51	2.39	737 034	284 603
GR21	Ipeiros	9 153.03	152.154625	0.57	0.71	3 128.20	319.67	42.47	1.66	348 520	127 451
GR22	Ionia Nisia	2 297.91	81.091052	1.29	1.54	3 820.70	261.73	43.62	3.53	225 879	83 945
GR23	Dytiki Ellada	11 313.26	194.969887	0.44	0.72	5 151.20	194.13	41.78	1.72	736 899	267 430
GR24	Sterea Ellada	15 558.94	186.810264	0.29	0.48	4 124.75	242.44	39.75	1.20	556 441	214 105
GR25	Peloponnisos	15 509.90	182.634335	0.26	0.47	4 592.89	217.73	39.56	1.18	595 092	243 727
GR30	Attiki	3 812.47	574.900976	1.19	7.16	9 828.97	101.74	47.50	15.08	4 032 456	1 618 231
GR41	Voreio Aigaio	3 847.02	58.831666	0.35	0.61	4 594.13	217.67	39.75	1.53	201 083	69 197
GR42	Notio Aigaio	5 309.45	99.236465	0.56	0.79	4 205.30	237.80	42.00	1.87	304 975	112 344
GR43	Kriti	8 346.24	158.659134	0.53	0.81	5 370.13	186.22	42.87	1.90	604 469	247 551
HR03	Jadranska Hrvatska	24 688.36	999.850010	1.75	1.80	1 923.55	519.87	44.34	4.05	1 462 444	460 817
HR04	Kontinentalna Hrvatska	31 745.91	1 380.726553	1.84	1.94	2 888.21	346.23	44.52	4.35	2 978 794	1 009 038
HU10	Közép-Magyarország	6 916.02	1 015.182822	6.80	6.85	4 108.87	243.38	46.66	14.68	2 872 678	1 298 571
HU21	Közép-Dunántúl	11 115.03	727.877103	2.41	2.80	2 114.09	473.02	42.75	6.55	1 107 453	431 346
HU22	Nyugat-Dunántúl	11 328.53	611.397961	1.82	2.27	2 329.24	429.32	41.99	5.40	999 361	424 731
HU23	Dél-Dunántúl	14 167.63	537.626796	1.19	1.57	2 425.98	412.20	41.31	3.79	967 677	336 594
HU31	Észak-Magyarország	13 426.07	584.470049	1.35	1.80	2 799.00	357.27	41.36	4.35	1 251 441	384 490
HU32	Észak-Alföld	17 723.73	778.253062	1.59	1.88	2 596.71	385.10	42.79	4.39	1 525 317	495 580
HU33	Dél-Alföld	18 335.60	763.749600	1.54	1.79	2 377.42	420.62	42.88	4.17	1 342 231	473524
IE01	Border, Midland and Western	33 273.97	972.864653	1.48	1.35	1 678.58	595.74	46.10	2.92	1 153 796	479 230
IE02	Southern and Eastern	36 672.04	1 487.939766	2.03	1.89	3 061.60	326.63	46.60	4.06	3 158 730	1 396 749
IS00	Island	102 687.70	290.047866	0.11	0.12	1 591.27	628.43	42.81	0.28	307 672	153 872
ITC1	Piemonte	25 402.32	1 162.019878	1.56	2.05	5 220.28	191.56	44.76	4.57	4 352 828	1 713 236
ITC2	Valle d'Aosta/Vallée d'Aoste	3 261.48	39.156917	0.38	0.52	4 631.41	215.92	43.12	1.20	124 812	56 540
ITC3	Liguria	5 414.04	313.605949	1.38	2.65	7 017.33	142.50	45.74	5.79	1 607 878	592 799
ITC4	Lombardia	23 876.69	2 613.219971	4.27	5.06	5 177.32	193.15	46.22	10.94	9 545 441	3 984 028
ITF1	Abruzzo	10 795.92	518.312269	2.21	2.20	3 436.03	291.03	45.83	4.80	1 309 797	471 137
ITF2	Molise	4 440.71	90.601786	0.54	0.84	4 652.24	214.95	41.28	2.04	320 074	101 427
ITF3	Campania	13 599.77	1 204.411691	2.95	4.14	6 126.27	163.23	46.72	8.86	5 790 187	1 588 365

Table A1.2 Urban sprawl values for 2006 (orange) and 2009 (green) at the NUTS-2 level (cont.)

Code	NUTS-2	*TA* (km²)	*BA* (km²)	*WUP* (UPU/m²)	*UP* (UPU/m²)	*UD* (inh. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/m²)	*PBA* (%)	Population	Number of workplaces
ITF4	Puglia	19 358.29	1 069.761361	1.97	2.47	4 894.17	204.32	44.66	5.53	4 069 869	1 165 721
ITF5	Basilicata	9 992.03	156.849575	0.39	0.64	4 938.11	202.51	41.01	1.57	591 338	183 203
ITF6	Calabria	15 085.09	439.091862	0.67	1.22	5 846.09	171.05	42.03	2.91	1 998 052	568 920
ITG1	Sicilia	25 718.44	1 575.904000	2.60	2.79	4 060.78	246.26	45.51	6.13	5 016 861	1 382 533
ITG2	Sardegna	24 112.89	615.221826	0.81	1.07	3 614.35	276.67	42.09	2.55	1 659 443	564 184
ITH1	Provincia Autonoma di Bolzano/Bozen	7 398.86	99.267130	0.21	0.56	7 032.11	142.20	41.54	1.34	487 673	210 385
ITH2	Provincia Autonoma di Trento	6 206.23	157.258738	0.84	1.10	4 498.86	222.28	43.39	2.53	507 030	200 454
ITH3	Veneto	17 760.81	1 450.902909	3.30	3.73	4 627.72	216.09	45.69	8.17	4 773 554	1 940 820
ITH4	Friuli-Venezia Giulia	7 725.48	379.283493	1.86	2.19	4 461.90	224.12	44.68	4.91	1 212 602	479 724
ITH5	Emilia-Romagna	22 478.8496	1 234.766836	2.02	2.47	4 898.78	204.13	45.03	5.49	4 223 264	1 825 584
ITI1	Toscana	22 987.85	1 015.071677	1.77	2.04	5 004.29	199.83	46.23	4.42	3 638 211	1 441 504
ITI2	Umbria	8 453.65	289.584411	1.31	1.52	4 115.49	242.98	44.41	3.43	872 967	318 814
ITI3	Marche	9 398.892	462.685227	1.91	2.22	4 619.91	216.45	45.18	4.92	1 536 098	601 465
ITI4	Lazio	17 201.91	1 338.702261	2.96	3.65	5 595.03	178.73	46.92	7.78	5 493 308	1 996 770
LI00	Liechtenstein	160.38	18.663827	5.47	5.36	3 385.79	295.35	46.06	11.64	35 168	28 024
LT00	Lietuva	64 899.39	2 457.624770	1.64	1.68	1 919.75	520.90	44.32	3.79	3 384 879	1 333 154
LU00	Luxembourg	2 595.79	234.039312	3.86	4.04	3 159.75	316.48	44.80	9.02	476 187	263 318
LV00	Latvija	64 586.04	1 328.009529	0.90	0.92	2 500.11	399.98	44.63	2.06	2 281 305	1 038 866
ME00	Montenegro	13 783.9892	221.257043	0.70	0.73	3 605.25	277.37	45.29	1.61	624 896	172 792
MK00	The former Yugoslav Republic of Macedonia	25 464.8652	406.332173	0.37	0.69	6 383.68	156.65	43.42	1.60	2 041 941	551 953
MT00	Malta	315.47	69.807077	4.14	10.34	7 890.77	126.73	46.72	22.13	407 810	143 022
NL11	Groningen	2 406.75	252.019247	4.81	4.78	3 143.65	318.10	45.61	10.47	573 614	218 646
NL12	Friesland (NL)	3 536.08	284.305548	3.50	3.61	3 050.85	327.78	44.93	8.04	642 209	225 163
NL13	Drenthe	2 679.76	248.291058	4.29	4.21	2 647.98	377.65	45.39	9.27	486 197	171 272
NL21	Overijssel	3 420.91	401.810439	5.50	5.45	3 809.97	262.47	46.42	11.75	1 116 374	414 511
NL22	Gelderland	5 137.73	629.819820	5.39	5.66	4 236.98	236.02	46.14	12.26	1 979 059	689 473
NL23	Flevoland	1 562.45	122.776722	3.57	3.64	4 037.26	247.69	46.32	7.86	374 424	121 257
NL31	Utrecht	1 449.17	258.588180	5.43	8.32	6 456.29	154.89	46.65	17.84	1 190 604	478 917
NL32	Noord-Holland	2 877.96	608.873771	7.22	9.96	6 140.16	162.86	47.09	21.16	2 613 070	1 125 514
NL33	Zuid-Holland	3 019.80	778.474604	9.16	12.26	6 108.26	163.71	47.56	25.78	3 455 097	1 300 028
NL34	Zeeland	1 927.33	181.584232	3.84	4.15	2 842.87	351.76	44.09	9.42	380 497	135 723
NL41	Noord-Brabant	5 081.66	862..627199	8.03	7.92	3 910.53	255.72	46.68	16.98	2 419 042	954 284
NL42	Limburg (NL)	2 209.56	440.229535	9.88	9.34	3 515.24	284.48	46.88	19.92	1 127 805	419 708
NO01	Oslo og Akershus	5 371.10	209.844409	0.82	1.82	7 565.72	132.18	46.52	3.91	1 057 794	529 830
NO02	Hedmark og Oppland	52 590.05	157.643835	0.09	0.12	3 270.42	305.77	41.27	0.30	371 729	143 832
NO03	Sør-Østlandet	36 598.23	337.353172	0.36	0.41	3 711.24	269.45	44.24	0.92	900 152	351 846
NO04	Agder og Rogaland	25 776.38	247.370764	0.35	0.42	3 863.48	258.83	43.61	0.96	673 027	282 686
NO05	Vestlandet	49 079.31	270.254578	0.16	0.23	4 271.44	234.11	41.63	0.55	808 290	346 086
NO06	Trøndelag	41 182.01	147.927333	0.12	0.15	3 889.98	257.07	42.72	0.36	407 905	167 530
NO07	Nord-Norge	112 786.17	221.239899	0.06	0.08	2 966.70	337.07	41.00	0.20	462 237	194 115
PL11	Lódzkie	18 218.87	818.244180	1.82	2.04	4 416.54	226.42	45.39	4.49	2 566 198	1 047 606
PL12	Mazowieckie	35 558.56	1 916.797772	2.33	2.45	3 781.09	264.47	45.42	5.39	5 171 702	2 075 884
PL21	Malopolskie	15 183.31	917.263667	2.43	2.78	4 873.41	205.20	46.01	6.04	3 271 206	1 198 993
PL22	Slaskie	12 333.13	1 407.539834	5.11	5.33	4 459.42	224.24	46.70	11.41	4 669 137	1 607 676
PL31	Lubelskie	25 123.30	836.503664	1.22	1.45	3 578.52	279.45	43.45	3.33	2 172 766	820 680
PL32	Podkarpackie	17 845.98	699.235966	1.49	1.73	4 028.65	248.22	44.28	3.92	2 097 564	719 415
PL33	Swietokrzyskie	11 710.37	509.295536	1.79	1.94	3 527.35	283.50	44.65	4.35	1 279 838	516 624
PL34	Podlaskie	20 187.31	539.817384	0.88	1.12	2 948.09	339.20	41.98	2.67	1 196 101	395 330
PL41	Wielkopolskie	29 826.53	1 221.123717	1.48	1.78	3 778.61	264.65	43.53	4.09	3 378 502	1 235 644
PL42	Zachodniopomorskie	22 443.01	619.800819	0.80	1.14	3 557.99	281.06	41.21	2.76	1 692 838	512 410
PL43	Lubuskie	13 988.20	406.399998	0.89	1.21	3 440.96	290.62	41.61	2.91	1 008 520	389 885
PL51	Dolnoslaskie	19 946.44	845.770760	1.45	1.86	4 636.61	215.67	43.85	4.24	2 882 317	1 039 195
PL52	Opolskie	9 411.76	394.407463	1.33	1.76	3 449.94	289.86	41.99	4.19	1 041 941	318 743
PL61	Kujawsko-Pomorskie	17 971.35	619.715717	1.17	1.50	4 430.42	225.71	43.52	3.45	2 066 371	679 228
PL62	Warminsko-Mazurskie	24 010.26	543.633232	0.66	0.93	3 515.53	284.45	41.25	2.26	1 426 883	484 278
PL63	Pomorskie	18 169.41	696.356874	1.34	1.67	4 106.04	243.54	43.48	3.83	2 203 595	655 677

Table A1.2 Urban sprawl values for 2006 (orange) and 2009 (green) at the NUTS-2 level (cont.)

Code	NUTS-2	*TA* (km²)	*BA* (km²)	*WUP* (UPU/m²)	*UP* (UPU/m²)	*UD* (inh. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/m²)	*PBA* (%)	Population	Number of workplaces
PT11	Norte	21 277.98	1 260.434242	2.75	2.78	4 293.44	232.91	46.94	5.92	3 744 341	1 667 253
PT15	Algarve	4 994.90	264.804643	2.66	2.45	2 337.38	427.83	46.19	5.30	421 528	197 421
PT16	Centro (PT)	28 197.60	1 324.563002	2.19	2.14	2 672.90	374.13	45.49	4.70	2 385 891	1 154 532
PT17	Lisboa	2 852.70	738.236376	10.91	12.45	5 472.19	182.74	48.09	25.88	2 794 226	1 245 545
PT18	Alentejo	31 520.04	591.484016	0.68	0.80	1 850.88	540.28	42.55	1.88	764 285	330 482
PT20	Região Autónoma dos Açores (PT)	2 323.30	82.248081	1.18	1.53	4 235.68	236.09	43.12	3.54	243 018	105 358
PT30	Região Autónoma da Madeira (PT)	786.69	80.573908	4.51	4.76	4 459.19	224.26	46.49	10.24	245 806	113 488
RO11	Nord-Vest	34 159.99	682.744114	0.45	0.82	5 588.22	178.95	41.20	2.00	2 729 256	1 086 065
RO12	Centru	34 103.67	685.104856	0.46	0.82	5 117.41	195.41	40.68	2.01	2 524 176	981 783
RO21	Nord-Est	36 849.45	1 016.387993	0.77	1.17	5 150.20	194.17	42.53	2.76	3 727 910	1 506 693
RO22	Sud-Est	35 758.99	963.967999	0.76	1.11	4 071.35	245.62	41.25	2.70	2 834 335	1 090 317
RO31	Sud–Muntenia	34 480.22	1 165.834163	1.07	1.43	3 927.18	254.64	42.26	3.38	3 304 840	1 273 599
RO32	Bucureşti–Ilfov	1 800.76	374.507586	2.73	9.84	8 786.76	113.81	47.33	20.80	2 232 162	1 058 545
RO41	Sud-Vest Oltenia	29 233.24	784.812950	0.81	1.13	4 215.19	237.24	42.13	2.68	2 285 733	1 022 403
RO42	Vest	32 005.57	611.382998	0.48	0.77	4 453.50	224.54	40.52	1.91	1 926 707	796 085
SE11	Stockholm	7 093.28	322.627121	0.55	2.11	8 811.44	113.49	46.42	4.55	1 918 104	924 705
SE12	Östra Mellansverige	43 304.34	660.711740	0.66	0.69	3 201.62	312.34	44.93	1.53	1 524 509	590 840
SE21	Småland med öarna	35 987.60	369.880912	0.38	0.44	3 099.24	322.66	43.18	1.03	802 247	344 104
SE22	Sydsverige	14 398.00	436.274375	1.23	1.37	4 260.08	234.74	45.18	3.03	1 335 936	522 628
SE23	Västsverige	34 598.06	686.753217	0.84	0.90	3 795.80	263.45	45.12	1.98	1 827 143	779 636
SE31	Norra Mellansverige	72 011.91	633.331692	0.37	0.39	1 813.34	551.47	44.05	0.88	824 853	323 596
SE32	Mellersta Norrland	77 173.40	292.697117	0.14	0.16	1 790.85	558.39	42.72	0.38	370 998	153 179
SE33	Övre Norrland	165 153.20	408.165865	0.09	0.10	1 760.12	568.14	42.14	0.25	509 467	208 955
SI01	Vzhodna Slovenija	12 214.46	381.397977	1.29	1.40	3 828.72	261.18	44.98	3.12	1 080 901	379 365
SI02	Zahodna Slovenija	8 062.36	354.056990	1.88	1.99	3 815.82	262.07	45.35	4.39	929 476	421 542
SK01	Bratislavský kraj	2 051.55	180.570373	2.97	3.96	5 438.22	183.88	45.04	8.80	606 753	375 229
SK02	Západné Slovensko	14 989.47	749.499555	1.52	2.08	3 480.52	287.31	41.59	5.00	1 862 227	746 418
SK03	Stredné Slovensko	16 261.50	513.826002	0.99	1.32	3 570.19	280.10	41.89	3.16	1 351 088	483 367
SK04	Východné Slovensko	15 722.83	542.114264	0.98	1.42	3 845.89	260.02	41.15	3.45	1 573 569	511 344
UKC1	Tees Valley and Durham	3 030.28	441.116071	7.24	6.84	3 564.36	280.56	46.98	14.56	1 155 938	416 357
UKC2	Northumberland and Tyne and Wear	5 576.60	454.098785	3.90	3.86	4 324.19	231.26	47.43	8.14	1 400 640	562 970
UKD1	Cumbria	6 832.20	188.156223	1.09	1.22	3 731.60	267.98	44.42	2.75	496 754	205 370
UKD3	Greater Manchester	1 276.80	549.688387	13.98	20.89	6 663.21	150.08	48.52	43.05	2 559 796	1 102 894
UKD4	Lancashire	3 082.89	388.756650	5.21	5.92	5 153.72	194.03	46.93	12.61	1 447 343	556 200
UKD6	Cheshire	2 282.222	328.736718	7.03	6.80	3 987.33	250.79	47.20	14.40	885 010	425 772
UKD7	Merseyside	696.5652	361.156949	21.14	25.02	5 691.89	175.69	48.25	51.85	1 489 519	566 147
UKE1	East Yorkshire and Northern Lincolnshire	3 523.67	325.318526	4.05	4.22	3 869.03	258.46	45.68	9.23	908 488	350 178
UKE2	North Yorkshire	8 321.64	305.051271	1.49	1.63	3 604.64	277.42	44.57	3.67	778 922	320 679
UKE3	South Yorkshire	1 553.19	325.772779	8.42	9.94	5 489.70	182.16	47.39	20.97	1 296 829	491567
UKE4	West Yorkshire	2 030.91	543.886794	10.56	12.79	5 704.96	175.29	47.76	26.78	2 179 858	922 995
UKF1	Derbyshire and Nottinghamshire	4 793.90	564.970567	4.86	5.50	5 047.99	198.10	46.69	11.79	2 052 460	799 506
UKF2	Leicestershire, Rutland and Northamptonshire	4 921.25	524.603927	4.59	4.92	4 445.52	224.95	46.18	10.66	1 638 830	693 308
UKF3	Lincolnshire	5 928.06	272.605916	1.84	2.04	3 505.46	285.27	44.31	4.60	688 531	267 079
UKG1	Herefordshire, Worcestershire and Warwickshire	5 902.22	451.208938	3.58	3.56	3 873.07	258.19	46.51	7.64	1 257 082	490 480
UKG2	Shropshire and Staffordshire	6 208.99	526.219521	3.94	3.94	3 960.90	252.47	46.50	8.48	1 510 856	573 445
UKG3	West Midlands	902.41	558.476604	20.70	30.29	6 642.33	150.55	48.94	61.89	2 602 343	1 107 246
UKH1	East Anglia	12 593.09	691.891521	1.97	2.44	4 713.60	212.15	44.47	5.49	2 292 620	968 678
UKH2	Bedfordshire and Hertfordshire	2 879.66	399.155528	5.03	6.48	5 753.74	173.80	46.72	13.86	1 653 870	642 766
UKH3	Essex	3 686.87	435.402639	4.59	5.47	5 221.02	191.53	46.29	11.81	1 674 480	598 765
UKI1	Inner London	319.91	273.451656	0.03	42.22	1 8835.42	53.09	49.39	85.48	2 989 558	2 161 019

Table A1.2 Urban sprawl values for 2006 (orange) and 2009 (green) at the NUTS-2 level (cont.)

Code	NUTS-2	*TA* (km²)	*BA* (km²)	*WUP* (UPU/m²)	*UP* (UPU/m²)	*UD* (inh. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/m²)	*PBA* (%)	Population	Number of workplaces
UKI2	Outer London	1 255.93	771.366962	13.61	30.08	7 830.53	127.71	48.98	61.42	4 584 846	1 455 368
UKJ1	Berkshire, Buckinghamshire and Oxfordshire	5 747.47	558.901330	3.43	4.50	5 718.47	174.87	46.26	9.72	2 167 656	1 028 406
UKJ2	Surrey, East and West Sussex	5 463.06	658.919167	4.62	5.65	5 523.18	181.06	46.82	12.06	2 622 408	1 016 922
UKJ3	Hampshire and Isle of Wight	4 158.19	475.184323	4.39	5.34	5 484.65	182.33	46.76	11.43	1 833 776	772 446
UKJ4	Kent	3 740.31	432.104080	4.60	5.37	5 170.33	193.41	46.49	11.55	1 636 050	598 073
UKK1	Gloucestershire, Wiltshire and Bristol/ Bath area	7 480.38	731.792282	4.29	4.55	4 488.53	222.79	46.48	9.78	2 273 243	101 1428
UKK2	Dorset and Somerset	6 122.77	447.288916	3.18	3.32	3 769.47	265.29	45.48	7.31	1 225 550	460 491
UKK3	Cornwall and Isles of Scilly	3 580.12	205.344856	2.34	2.56	3 550.88	281.62	44.55	5.74	526 235	202 920
UKK4	Devon	6 723.73	383.732047	2.42	2.60	4 140.40	241.52	45.59	5.71	1 126 126	462 678
UKL1	West Wales and The Valleys	13 162.56	774.134272	2.65	2.68	3 283.44	304.56	45.49	5.88	1 884 553	657 269
UKL2	East Wales	7 657.72	407.258392	2.44	2.46	3 819.04	261.85	46.19	5.32	1 084 483	470 853
UKM2	Eastern Scotland	18 144.77	601.165661	1.28	1.49	4 623.09	216.31	45.12	3.31	1 956 616	822 627
UKM3	South Western Scotland	13 203.82	753.002312	2.62	2.66	4 203.84	237.88	46.69	5.70	2 285 828	879 674
UKM5	North Eastern Scotland	6 514.37	180.751973	1.05	1.22	3 675.43	272.08	43.88	2.77	445 785	218 557
UKM6	Highlands and Islands	41 097.59	282.844196	0.24	0.29	2 393.70	417.76	42.18	0.69	442 347	234 697
UKN0	Northern Ireland (UK)	14 155.38	741.622676	2.54	2.43	3 271.09	305.71	46.37	5.24	1 750 597	675 317
AT11	Burgenland (AT)	3 964.82	189.118507	1.56	1.98	1 970.26	507.55	41.57	4.77	283 965	88 648
AT12	Niederösterreich	19 196.81	986.956123	2.06	2.24	2 207.30	453.04	43.63	5.14	1 607 976	570 536
AT13	Wien	414.88	233.946708	2.70	27.66	1 0901.35	91.73	49.05	56.39	1 698 822	851 512
AT21	Kärnten	9 542.27	271.873127	1.25	1.28	2 873.41	348.02	44.94	2.85	559 315	221 887
AT22	Steiermark	16 409.80	558.762281	1.60	1.56	3 052.19	327.63	45.82	3.41	1 208 372	497 077
AT31	Oberösterreich	11 988.26	556.942928	2.13	2.14	3 642.22	274.56	45.99	4.65	1 411 238	617 273
AT32	Salzburg	7 161.10	180.181750	0.94	1.12	4 315.44	231.73	44.38	2.52	529 861	247 703
AT33	Tirol	12 647.65	254.025152	0.75	0.89	4 012.71	249.21	44.06	2.01	706 873	312 456
AT34	Vorarlberg	2 602.12	109.457591	1.74	1.94	4 761.87	210.00	46.19	4.21	368 868	152 355
BE10	Région de Bruxelles-Capitale/Brussels Hoofdstedelijk Gewest	162.52	108.468118	0.17	32.87	15 855.12	63.07	49.25	66.74	1 089 538	630 237
BE21	Prov. Antwerpen	2 875.51	633.528547	11.07	10.44	3 791.64	263.74	47.37	22.03	1 744 862	657 251
BE22	Prov. Limburg (BE)	2 428.12	416.664431	8.95	8.05	2 680.86	373.01	46.91	17.16	838 505	278 515
BE23	Prov. Oost-Vlaanderen	3 008.06	554.834355	9.58	8.76	3 462.66	288.80	47.49	18.44	1 432 326	488 878
BE24	Prov. Vlaams-Brabant	2 118.83	364.978271	8.63	8.19	3 940.75	253.76	47.52	17.23	1 076 924	361 363
BE25	Prov. West-Vlaanderen	3 169.09	549.093886	9.21	8.20	2 872.48	348.13	47.30	17.33	1 159 366	417 897
BE31	Prov. Brabant Wallon	1 097.14	110.609120	4.38	4.68	4 541.55	220.19	46.44	10.08	379 515	122 822
BE32	Prov. Hainaut	3 813.66	501.232975	6.78	6.21	3 332.15	300.11	47.26	13.14	1 309 880	360 306
BE33	Prov. Liège	3 857.92	388.456725	5.01	4.73	3 569.91	280.12	46.99	10.07	1067 685	319 070
BE34	Prov. Luxembourg (BE)	4 460.10	182.464105	1.70	1.80	1 887.99	529.67	43.89	4.09	269 023	75 467
BE35	Prov. Namur	3 675.91	206.668856	2.46	2.52	2 946.17	339.42	44.91	5.62	472 281	136 600
BG31	Severozapaden	19 070.40	656.347834	1.00	1.39	1 884.01	530.78	40.33	3.44	902 537	334 027
BG32	Severen tsentralen	14 803.11	599.058599	1.09	1.61	2 114.27	472.98	39.67	4.05	914 939	351 634
BG33	Severoiztochen	14 647.37	572.508936	1.02	1.54	2 428.19	411.83	39.45	3.91	988 935	401 225
BG34	Yugoiztochen	19 800.92	573.979305	0.70	1.12	2 741.26	364.80	38.69	2.90	1 116 560	456 868
BG41	Yugozapaden	20 297.06	743.131898	1.27	1.59	4 236.83	236.03	43.55	3.66	2 112 519	1 036 001
BG42	Yuzhen tsentralen	22 359.90	697.476218	0.84	1.25	3 076.17	325.08	40.15	3.12	1 528 220	617 338
CH01	Région lémanique	8 375.27	428.295479	2.02	2.34	4 865.87	205.51	45.82	5.11	1 462 210	621 821
CH02	Espace Mittelland	10 060.06	613.439266	2.44	2.74	4 127.15	242.30	44.92	6.10	1 741 923	789 832
CH03	Nordwestschweiz	1 958.57	347.231984	7.52	8.16	4 454.63	224.49	46.00	17.73	1 060 753	486 038
CH04	Zürich	1 728.08	344.938089	7.25	9.33	5 765.77	173.44	46.76	19.96	1 351 297	637 537
CH05	Ostschweiz	11 351.06	443.544711	1.62	1.75	3 630.61	275.44	44.79	3.91	1 094 202	516 137
CH06	Zentralschweiz	4 483.05	228.866597	1.85	2.28	4 750.78	210.49	44.64	5.11	739 701	347 595
CH07	Ticino	2 811.60	144.104233	2.36	2.34	3 272.21	305.60	45.74	5.13	335 720	135 819
CY00	Cyprus	9 246.31	543.798454	2.74	2.66	2 184.34	457.80	45.25	5.88	819 140	368 701

Table A1.2 Urban sprawl values for 2006 (orange) and 2009 (green) at the NUTS-2 level (cont.)

Code	NUTS-2	*TA* (km²)	*BA* (km²)	*WUP* (UPU/m²)	*UP* (UPU/m²)	*UD* (inh. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/m²)	*PBA* (%)	Population	Number of workplaces
CZ01	Praha	496.22	239.719247	8.16	23.41	8 400.40	119.04	48.46	48.31	1 249 026	764 711
CZ02	Střední Cechy	11 017.63	711.592137	2.53	2.81	2 485.87	402.27	43.53	6.46	1 247 533	521 392
CZ03	Jihozápad	17 616.55	673.137680	1.27	1.60	2 618.71	381.87	41.92	3.82	1 209 506	553 248
CZ04	Severozápad	8 650.15	481.228495	2.15	2.44	3 392.79	294.74	43.88	5.56	1 143 834	488 872
CZ05	Severovýchod	12 442.94	629.310389	1.85	2.19	3 443.97	290.36	43.35	5.06	1 509 758	657 565
CZ06	Jihovýchod	13 989.68	682.194123	1.50	2.03	3 527.00	283.53	41.70	4.88	1 666 700	739 401
CZ07	Střední Morava	9 229.83	532.011675	2.05	2.48	3 349.71	298.53	43.02	5.76	1 233 083	548 999
CZ08	Moravskoslezsko	5 427.06	529.508843	4.18	4.39	3 365.47	297.14	44.96	9.76	1 247 373	534 671
DE11	Stuttgart	10 557.03	1 229.554175	4.06	5.16	4 816.98	207.60	44.31	11.65	4 000 848	1 921 885
DE12	Karlsruhe	6 918.44	824.052578	4.31	5.30	4 686.11	213.40	44.50	11.91	2 740 503	1 121 098
DE13	Freiburg	9 355.87	788.098122	3.08	3.68	3 892.43	256.91	43.72	8.42	2 196 018	871 597
DE14	Tübingen	8 917.96	746.637756	3.07	3.63	3 378.19	296.02	43.33	8.37	1 807 552	714 731
DE21	Oberbayern	17 529.35	1 655.576198	4.07	4.29	3 847.23	259.93	45.46	9.44	4 346 465	2 022 923
DE22	Niederbayern	10 327.08	661.877435	2.75	2.85	2 539.86	393.72	44.47	6.41	1 189 194	491 881
DE23	Oberpfalz	9 691.39	543.638993	2.26	2.47	2 825.05	353.98	43.96	5.61	1 081 417	454 388
DE24	Oberfranken	7 231.87	483.347662	2.76	2.97	3 134.24	319.06	44.38	6.68	1 076 400	438 529
DE25	Mittelfranken	7 244.87	646.152651	3.54	3.97	3 862.41	258.91	44.54	8.92	1 710 145	785 561
DE26	Unterfranken	8 529.46	610.238541	2.49	3.05	3 022.34	330.87	42.60	7.15	1 321 957	522 390
DE27	Schwaben	9 991.30	818.214070	3.22	3.59	3 078.06	324.88	43.86	8.19	1 784 753	733 757
DE30	Berlin	892.05	513.574604	5.56	28.20	9 611.49	104.04	48.98	57.57	3 442 675	1493 543
DE40	Brandenburg	29 655.03	1 732.620212	2.40	2.56	1 956.67	511.07	43.80	5.84	2 511 525	878 641
DE50	Bremen	401.01	187.707573	20.70	22.53	5 221.69	191.51	48.13	46.81	661 716	318 435
DE60	Hamburg	753.33	367.822209	12.12	23.81	7 505.96	133.23	48.76	48.83	1 774 224	986 635
DE71	Darmstadt	7 443.29	1 066.476129	5.14	6.46	5 095.15	196.27	45.08	14.33	3 792 941	1 640 913
DE72	Gießen	5 379.89	439.984556	2.85	3.50	3 292.70	303.70	42.77	8.18	1 044 269	404 470
DE73	Kassel	8 291.28	565.381786	2.50	2.94	3 044.74	328.44	43.12	6.82	1 224 741	496 699
DE80	Mecklenburg-Vorpommern	23 059.31	1 056.538421	1.66	1.95	2 179.94	458.73	42.61	4.58	1 651 216	651 975
DE91	Braunschweig	8 122.39	729.126029	3.48	3.92	3 047.12	328.18	43.69	8.98	1 616 720	605 013
DE92	Hannover	9 065.61	899.915530	4.22	4.46	3 378.24	296.01	44.89	9.93	2 142 440	897 694
DE93	Lüneburg	15 578.94	854.141395	2.14	2.39	2 564.72	389.91	43.53	5.48	1 693 654	496 979
DE94	Weser-Ems	15 004.24	1 327.437369	4.13	4.02	2 570.42	389.04	45.43	8.85	2 476 001	936 070
DEA1	Düsseldorf	5 293.87	1 457.374564	12.05	13.09	5 057.59	197.72	47.55	27.53	5 172 839	2 197 966
DEA2	Köln	7 362.92	1 291.273225	7.58	8.17	4 683.46	213.52	46.61	17.54	4 383 044	1 664 581
DEA3	Münster	6 917.19	1 005.846378	6.91	6.73	3 479.88	287.37	46.28	14.54	2 597 636	902 592
DEA4	Detmold	6 525.44	877.443450	6.35	6.18	3 204.65	312.05	45.98	13.45	2 043 212	768 684
DEA5	Arnsberg	8 012.96	1 234.786346	7.16	7.17	4 000.90	249.94	46.55	15.41	3 676 032	1 264 230
DEB1	Koblenz	8 076.56	672.913984	3.43	3.69	3 025.53	330.52	44.29	8.33	1 490 711	545 211
DEB2	Trier	4 928.29	261.690465	1.92	2.27	2 745.58	364.22	42.84	5.31	513 794	204 699
DEB3	Rheinhessen-Pfalz	6 851.55	685.062569	3.90	4.45	4 001.50	249.91	44.49	10.00	2 008 170	733 107
DEC0	Saarland	2 571.00	350.998560	6.07	6.29	4 088.26	244.60	46.09	13.65	1 022 585	412 389
DED2	Dresden	7 946.67	933.840929	5.73	5.39	2 444.04	409.16	45.90	11.75	1 631 486	650 859
DED4	Chemnitz	6 524.60	695.079430	4.93	4.86	3 053.10	327.54	45.63	10.65	1 540 029	582 119
DED5	Leipzig	3 978.73	450.629432	5.11	5.14	3 128.00	319.69	45.37	11.33	997 217	412 353
DEE0	Sachsen-Anhalt	20 550.64	1 377.302322	2.50	2.88	2 356.11	424.43	42.98	6.70	2 356 219	888 859
DEF0	Schleswig-Holstein	15 760.24	1 281.370430	3.50	3.64	3 004.86	332.79	44.78	8.13	2 832 027	1 018 316
DEG0	Thüringen	16 199.95	1 100.811497	2.44	2.91	2 848.27	351.09	42.82	6.80	2 249 882	885 521
DK01	Hovedstaden	2 566.32	534.673335	9.55	9.88	4 663.14	214.45	47.40	20.83	1 680 271	812 988
DK02	Sjælland	7 288.45	575.216163	3.59	3.54	1 951.40	512.45	44.90	7.89	820564	301 914
DK03	Syddanmark	12 142.66	714.952339	2.55	2.62	2 385.81	419.14	44.53	5.89	1 200 277	505 464
DK04	Midtjylland	13 106.80	708.316044	2.32	2.41	2 544.37	393.02	44.52	5.40	1 253 998	548 223
DK05	Nordjylland	7 914.90	359.900238	1.94	2.02	2 291.32	436.43	44.34	4.55	579 628	245 017
EE00	Estonia	43 490.76	776.165982	0.76	0.79	2 429.39	411.63	44.35	1.78	1 340 127	545 484
ES11	Galicia	29 570.57	1 051.177903	1.62	1.63	3 627.11	275.70	45.89	3.55	2 738 602	1 074 136
ES12	Principado de Asturias	10 602.46	217.130015	0.49	0.92	6 716.08	148.90	44.68	2.05	1 058 114	400 149
ES13	Cantabria	5 320.43	120.272106	0.52	1.00	6 742.22	148.32	44.38	2.26	577 997	232 904
ES21	País Vasco	7 234.44	298.877709	0.21	1.83	10 143.66	98.58	44.38	4.13	2 138 588	893 126

Table A1.2 Urban sprawl values for 2006 (orange) and 2009 (green) at the NUTS-2 level (cont.)

Code	NUTS-2	*TA* (km²)	*BA* (km²)	*WUP* (UPU/m²)	*UP* (UPU/m²)	*UD* (inh. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/m²)	*PBA* (%)	Population	Number of workplaces
ES22	Comunidad Foral de Navarra	10 390.86	186.183793	0.49	0.75	4 750.63	210.50	41.73	1.79	619 011	265 480
ES23	La Rioja	5 044.75	99.313818	0.60	0.84	4 471.00	223.66	42.44	1.97	314 005	130 027
ES24	Aragón	47 721.58	485.708245	0.27	0.41	3 836.27	260.67	40.52	1.02	1 313 017	55 0291
ES30	Comunidad de Madrid	8 030.53	815.345465	0.33	4.71	1 1297.88	88.51	46.39	10.15	6 335 807	2 875 872
ES41	Castilla y León	94 225.10	1 165.566110	0.29	0.48	2 951.48	338.81	38.71	1.24	2 499 155	940 993
ES42	Castilla-la Mancha	79 458.19	975.794388	0.32	0.49	2 820.22	354.58	39.72	1.23	2 035 516	716 442
ES43	Extremadura	41 634.25	497.628994	0.31	0.47	2 902.65	344.51	39.58	1.20	1 082 792	361 649
ES51	Cataluña	32 109.97	1 596.209372	1.31	2.25	6 529.41	153.15	45.17	4.97	7 301 132	3 121 179
ES52	Comunidad Valenciana	23 255.09	1 222.031171	1.71	2.36	5 589.22	178.92	44.99	5.25	4 994 322	1 835 885
ES53	Illes Balears	4 991.08	219.367842	0.80	1.88	7004.64	142.76	42.79	4.40	1 079 094	457 500
ES61	Andalucía	87 600.03	2 466.075115	1.02	1.24	4 428.74	225.80	44.22	2.82	8 206 057	2 715 550
ES62	Región de Murcia	11 313.34	406.110998	1.22	1.59	4 916.90	203.38	44.19	3.59	1 460 664	536 144
ES63	Ciudad Autónoma de Ceuta (ES)	19.75	7.240376	0.20	16.41	14 024.62	71.30	44.77	36.66	74 403	27 140
ES64	Ciudad Autónoma de Melilla (ES)	13.86	8.905905	3.16	30.13	10 610.01	94.25	46.90	64.26	72 515	21 977
ES70	Canarias (ES)	7 446.66	493.145872	2.18	3.01	5 718.21	174.88	45.40	6.62	2 088 225	731 686
FI19	Länsi-Suomi	64 597.36	1 515.330828	1.19	1.08	1 263.40	791.51	46.01	2.35	1 355 168	559 308
FI1B	Helsinki-Uusimaa	9 485.06	798.455795	4.57	4.01	2 848.35	351.08	47.59	8.42	1 517 542	756 737
FI1C	Etelä-Suomi	35 539.75	982.529713	1.45	1.29	1 649.85	606.12	46.55	2.76	1154648	466 380
FI1D	Pohjois- ja Itä-Suomi	226 740.15	730.007813	0.13	0.14	2 442.99	409.34	43.99	0.32	1296335	487 064
FI20	Åland	1 475.22	28.940996	0.83	0.86	1 423.67	702.41	43.97	1.96	27 734	13 468
FR10	Île de France	12 068.96	2 085.707908	3.15	8.22	8 093.19	123.56	47.54	17.28	11 786 234	5 093 804
FR21	Champagne-Ardenne	25 719.10	909.916387	1.18	1.48	2 006.57	498.36	41.77	3.54	1 335 923	489 886
FR22	Picardie	19 505.72	900.634692	1.67	1.98	2 758.15	362.56	42.86	4.62	1 914 844	569 240
FR23	Haute-Normandie	12 354.29	746.568072	2.75	2.76	3 321.08	301.11	45.64	6.04	1 836 954	642 460
FR24	Centre (FR)	39 529.85	1 383.633254	1.48	1.55	2 530.67	395.15	44.30	3.50	2 548 065	953 457
FR25	Basse-Normandie	17 758.75	763.856879	1.90	1.93	2 662.84	375.54	44.86	4.30	1 473 494	560 531
FR26	Bourgogne	31 752.89	1 110.062291	1.43	1.53	2 020.23	494.99	43.77	3.50	1 642 115	600 472
FR30	Nord-Pas-de-Calais	12 445.13	1 485.187571	5.69	5.54	3 577.39	279.53	46.41	11.93	4 038 157	1 274 945
FR41	Lorraine	23 669.39	1 226.306945	2.09	2.27	2 523.51	396.27	43.85	5.18	2 350 920	743 678
FR42	Alsace	8 330.34	842.978509	4.38	4.54	2 984.52	335.06	44.82	10.12	1 845 687	670 200
FR43	Franche-Comté	16 307.49	845.134199	2.10	2.26	1 858.41	538.09	43.66	5.18	1 171 763	398 846
FR51	Pays de la Loire	32 375.37	2 164.054468	3.10	3.02	2 257.88	442.89	45.23	6.68	3 571 495	1 314 670
FR52	Bretagne	27 472.28	2 160.875805	3.85	3.60	2 016.03	496.02	45.76	7.87	3 199 066	1 157 323
FR53	Poitou-Charentes	25 967.33	1 188.252230	2.00	2.04	2 030.41	492.51	44.48	4.58	1 770 363	642 273
FR61	Aquitaine	41 804.27	1 811.009161	2.07	1.98	2 436.49	410.43	45.67	4.33	3 232 352	1 180 145
FR62	Midi-Pyrénées	45 602.31	1 445.378569	1.47	1.44	2 752.87	363.26	45.45	3.17	2 881 756	1 097 187
FR63	Limousin	17 055.76	423.604895	1.14	1.12	2 426.20	412.17	45.14	2.48	742 771	284 978
FR71	Rhône-Alpes	44 728.87	3 111.906040	3.40	3.21	2 720.89	367.53	46.08	6.96	6 230 691	2 236 467
FR72	Auvergne	26 171.99	805.002150	1.32	1.37	2 253.15	443.82	44.40	3.08	1 347 387	466 402
FR81	Languedoc-Roussillon	27 644.33	1 301.611843	1.87	2.06	2 627.62	380.57	43.74	4.71	2 636 350	783 790
FR82	Provence-Alpes-Côte d'Azur	31 681.79	1 742.333247	2.55	2.54	3 751.25	266.58	46.26	5.50	4 899 155	1 636 768
FR83	Corse	8 726.54	175.420601	0.77	0.87	2 235.73	447.28	43.20	2.01	309 693	82 500
GR11	Anatoliki Makedonia, Thraki	14 190.38	292.069254	0.56	0.83	2 852.28	350.60	40.14	2.06	606 721	226 342
GR12	Kentriki Makedonia	18 842.71	746.236529	1.23	1.66	3 584.55	278.98	41.86	3.96	1 954 582	720 338
GR13	Dytiki Makedonia	9 460.84	102.020928	0.20	0.39	3 892.77	256.89	36.27	1.08	293 061	104 083
GR14	Thessalia	14 050.58	352.016114	0.72	1.02	2 897.47	345.13	40.62	2.51	736 083	283 873
GR21	Ipeiros	9 153.03	161.064172	0.61	0.75	3 044.58	328.45	42.55	1.76	359 096	131 277
GR22	Ionia Nisia	2 297.91	90.487021	1.49	1.73	3 615.32	276.60	43.83	3.94	234 440	92 700
GR23	Dytiki Ellada	11 313.26	212.022207	0.52	0.79	4 811.58	207.83	42.00	1.87	745 397	274 764
GR24	Sterea Ellada	15 558.94	197.531406	0.32	0.51	3 843.42	260.18	39.92	1.27	554 359	204 837
GR25	Peloponnisos	15 509.90	192.403276	0.29	0.49	4 345.64	230.12	39.74	1.24	591 230	244 885
GR30	Attiki	3 812.47	581.189150	1.14	7.24	9 922.14	100.78	47.52	15.24	4 109 748	1 656 894
GR41	Voreio Aigaio	3 847.02	61.702230	0.38	0.64	4 395.86	227.49	39.82	1.60	199 968	71 266
GR42	Notio Aigaio	5 309.45	112.368568	0.67	0.89	3 802.82	262.96	42.20	2.12	308 647	118 670

Table A1.2 Urban sprawl values for 2006 (orange) and 2009 (green) at the NUTS-2 level (cont.)

Code	NUTS-2	*TA* (km²)	*BA* (km²)	*WUP* (UPU/m²)	*UP* (UPU/m²)	*UD* (inh. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/m²)	*PBA* (%)	Population	Number of workplaces
GR43	Kriti	8 346.24	166.230664	0.58	0.86	5 159.71	193.81	42.95	1.99	611 786	245 917
HR03	Jadranska Hrvatska	24 688.36	1 054.906845	1.86	1.90	1 835.64	544.77	44.38	4.27	1 469 262	467 166
HR04	Kontinentalna Hrvatska	31 873.37	1 461.031884	1.97	2.04	2 738.86	365.12	44.59	4.58	2 956 485	1 045 074
HU10	Közép-Magyarország	6 916.02	1 051.212594	7.12	7.10	4 020.39	248.73	46.69	15.20	2 951 436	1 274 850
HU21	Közép-Dunántúl	11 115.03	751.374532	2.52	2.90	2 012.96	496.78	42.85	6.76	1 098 654	413 835
HU22	Nyugat-Dunántúl	11 328.53	637.841696	1.95	2.37	2 173.87	460.01	42.17	5.63	996 390	390 195
HU23	Dél-Dunántúl	14 167.63	548.138924	1.23	1.60	2 304.98	433.84	41.39	3.87	947 986	315 463
HU31	Észak-Magyarország	13 426.07	598.207396	1.40	1.84	2 615.73	382.30	41.40	4.46	1 209 142	355 608
HU32	Észak-Alföld	17 723.73	803.618748	1.66	1.94	2 416.63	413.80	42.83	4.53	1 492 502	449 549
HU33	Dél-Alföld	18 335.60	789.900830	1.61	1.85	2 240.23	446.38	42.94	4.31	1 318 214	451 347
IE01	Border, Midland and Western	33 273.97	1 017.282502	1.57	1.41	1 572.09	636.10	46.20	3.06	1 204 423	394 836
IE02	Southern and Eastern	36 672.04	1 555.893412	2.15	1.98	2 914.16	343.15	46.69	4.24	3 263 431	1 270 693
IS00	Island	102 687.70	292.871327	0.11	0.12	1 586.94	630.15	42.77	0.29	317 630	147 138
ITC1	Piemonte	25 402.32	1 337.426106	1.99	2.36	4 618.52	216.52	44.90	5.26	4 446 230	1 730 693
ITC2	Valle d'Aosta/Vallée d'Aoste	3 261.48	38.646403	0.37	0.51	4 740.65	210.94	43.08	1.18	127 866	55 343
ITC3	Liguria	5 414.04	327.355308	1.55	2.76	6 767.47	147.77	45.67	6.05	1 615 986	599 381
ITC4	Lombardia	23 876.69	2 652.049656	4.30	5.13	5 201.02	192.27	46.19	11.11	9 826 141	3 967 235
ITF1	Abruzzo	10 795.92	528.465530	2.25	2.24	3 407.09	293.51	45.82	4.90	1 338 898	461 632
ITF2	Molise	4 440.71	96.970479	0.61	0.91	4 372.09	228.72	41.46	2.18	320 229	103 734
ITF3	Campania	13 599.77	1 246.716832	3.26	4.29	5 860.01	170.65	46.77	9.17	5 824 662	1 481 117
ITF4	Puglia	19 358.29	1 110.545395	2.12	2.57	4 702.99	212.63	44.76	5.74	4 084 035	1 138 848
ITF5	Basilicata	9 992.03	169.070651	0.45	0.70	4 526.85	220.90	41.14	1.69	588 879	176 478
ITF6	Calabria	15 085.09	460.181670	0.76	1.29	5 547.79	180.25	42.15	3.05	2 009 330	543 663
ITG1	Sicilia	25 718.44	1643.678198	2.76	2.91	3 882.70	257.55	45.53	6.39	5 042 992	1 338 913
ITG2	Sardegna	24 112.89	679.473439	0.94	1.19	3 253.08	307.40	42.37	2.82	1 672 404	537 981
ITH1	Provincia Autonoma di Bolzano/Bozen	7 398.86	100.534335	0.20	0.56	7 171.37	139.44	41.45	1.36	503 434	217 535
ITH2	Provincia Autonoma di Trento	6 206.23	159.897596	0.85	1.12	4 574.27	218.61	43.37	2.58	524 826	206 588
ITH3	Veneto	17 760.81	1 546.580995	3.64	3.99	4 428.46	225.81	45.77	8.71	4 912 438	1 936 539
ITH4	Friuli-Venezia Giulia	7 725.48	383.195623	1.86	2.21	4 456.15	224.41	44.57	4.96	1 234 079	473 497
ITH5	Emilia-Romagna	22 543.5864	1 291.949023	2.13	2.58	4 838.75	206.66	45.04	5.73	4 395 569	1 855 850
ITI1	Toscana	22 987.85	1 052.724738	1.86	2.12	4 923.54	203.11	46.22	4.58	3 730 130	1 452 997
ITI2	Umbria	8 453.65	296.349228	1.34	1.56	4 133.73	241.91	44.41	3.51	900 790	324 236
ITI3	Marche	9 408.3028	476.111980	1.97	2.28	4 544.79	220.03	45.12	5.06	1 559 542	604287
ITI4	Lazio	17 201.91	1 369.355289	2.97	3.73	5 683.81	175.94	46.90	7.96	5 681 868	2 101 294
LI00	Liechtenstein	160.38	20.067880	6.06	5.80	3 255.27	307.19	46.34	12.51	35 894	29 432
LT00	Lietuva	64 899.39	2 525.007174	1.69	1.73	1 817.05	550.34	44.34	3.89	3 329 039	1 259 038
LU00	Luxembourg	2 595.79	243.872312	4.01	4.21	3 306.34	302.45	44.86	9.39	502 066	304 258
LV00	Latvija	64 586.04	1 366.309112	0.93	0.95	2 276.79	439.21	44.69	2.12	2 248 374	862 431
ME00	Montenegro	13 783.9892	223.343646	0.70	0.74	3 687.44	271.19	45.37	1.62	616 411	207155
MK00	The former Yugoslav Republic of Macedonia	25 464.8652	437.270625	0.43	0.75	6 095.30	164.06	43.45	1.72	2 052 722	612 572
MT00	Malta	315.47	76.563563	5.58	11.36	7 368.64	135.71	46.80	24.27	414 372	149 797
NL11	Groningen	2 406.75	254.778881	4.88	4.83	3 153.09	317.15	45.66	10.59	576 668	226 674
NL12	Friesland (NL)	3 536.08	291.240957	3.59	3.70	3 043.78	328.54	44.94	8.24	646 305	240 170
NL13	Drenthe	2 679.76	255.560518	4.46	4.34	2 609.15	383.27	45.48	9.54	490 981	175 814
NL21	Overijssel	3 420.91	412.337827	5.66	5.60	3 807.62	262.63	46.46	12.05	1 130 345	439 681
NL22	Gelderland	5 137.73	64.6205550	5.52	5.81	4 296.67	232.74	46.21	12.58	1 998 936	777 598
NL23	Flevoland	1 562.45	127.040218	3.68	3.77	4 115.21	243.00	46.35	8.13	387 881	134 917
NL31	Utrecht	1 449.17	264.671661	5.40	8.53	6 576.85	152.05	46.72	18.26	1 220 910	519 796
NL32	Noord-Holland	2 877.96	620.293531	7.35	10.16	6 150.65	162.58	47.13	21.55	2 669 084	1 146 124
NL33	Zuid-Holland	3 019.80	803.900126	9.62	12.68	6 055.54	165.14	47.63	26.62	3 505 611	1 362 441
NL34	Zeeland	1 927.33	186.163425	4.00	4.27	2 783.02	359.32	44.22	9.66	381 409	136 688
NL41	Noord-Brabant	5 081.66	882.933130	8.29	8.12	3 874.18	258.12	46.75	17.37	2 444 158	976 486
NL42	Limburg (NL)	2 209.56	457.168808	10.41	9.71	3 368.81	296.84	46.94	20.69	1 122 701	417 414
NO01	Oslo og Akershus	5 371.10	263.773799	1.48	2.29	6 448.00	155.09	46.54	4.91	1 123 359	577 455
NO02	Hedmark og Oppland	52 590.05	197.701324	0.12	0.16	2 632.61	379.85	41.75	0.38	375 925	144 545

Table A1.2 Urban sprawl values for 2006 (orange) and 2009 (green) at the NUTS-2 level (cont.)

Code	NUTS-2	*TA* (km²)	*BA* (km²)	*WUP* (UPU/m²)	*UP* (UPU/m²)	*UD* (inh. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/m²)	*PBA* (%)	Population	Number of workplaces
NO03	Sør-Østlandet	36 598.23	361.039031	0.39	0.44	3 602.69	277.57	44.17	0.99	928 852	371 861
NO04	Agder og Rogaland	25 776.38	257.405554	0.36	0.44	3 926.80	254.66	43.64	1.00	706 823	303 957
NO05	Vestlandet	49 079.31	318.370125	0.20	0.27	3 778.29	264.67	42.03	0.65	835 517	367 378
NO06	Trøndelag	41 182.01	155.314851	0.12	0.16	3 867.19	258.59	42.67	0.38	422 102	178 530
NO07	Nord-Norge	112 786.17	233.109045	0.06	0.08	2 840.28	352.08	40.95	0.21	465 621	196 475
PL11	Lódzkie	18 218.87	854.373795	1.93	2.13	4 388.25	227.88	45.51	4.69	2 541 832	1 207 376
PL12	Mazowieckie	35 558.56	1 999.661278	2.44	2.56	3 838.88	260.49	45.50	5.62	5 222 167	2 454 299
PL21	Malopolskie	15 183.31	948.856998	2.57	2.88	4 752.58	210.41	46.08	6.25	3 298 270	1 211 252
PL22	Slaskie	12 333.13	1 440.719077	5.26	5.46	4 460.04	224.21	46.77	11.68	4 640 725	1 784 933
PL31	Lubelskie	25 123.30	877.234374	1.31	1.52	3 485.97	286.86	43.60	3.49	2 157 202	900 807
PL32	Podkarpackie	17 845.98	725.524998	1.56	1.80	4 018.44	248.85	44.34	4.07	2 101 732	813 744
PL33	Swietokrzyskie	11 710.37	518.223492	1.83	1.98	3 502.04	285.55	44.70	4.43	1 270 120	544 717
PL34	Podlaskie	20 187.31	553.818275	0.91	1.15	3 001.30	333.19	42.10	2.74	1 189 731	472 446
PL41	Wielkopolskie	29 826.53	1 255.139078	1.55	1.84	3 707.06	269.76	43.62	4.21	3 408 281	1 244 596
PL42	Zachodniopomorskie	22 443.01	631.385792	0.83	1.16	3 577.94	279.49	41.33	2.81	1 693 198	565 865
PL43	Lubuskie	13 988.20	423.427094	0.94	1.26	3 294.58	303.53	41.63	3.03	1 010 047	384 967
PL51	Dolnoslaskie	19 946.44	893.008706	1.58	1.97	4 455.79	224.43	43.95	4.48	2 876 627	1 102 431
PL52	Opolskie	9 411.76	403.526139	1.38	1.81	3 412.22	293.06	42.10	4.29	1 031 097	345 823
PL61	Kujawsko-Pomorskie	17 971.35	640.677919	1.22	1.55	4 460.10	224.21	43.61	3.56	2 069 083	788 407
PL62	Warminsko-Mazurskie	24 010.26	558.961129	0.69	0.96	3 517.77	284.27	41.33	2.33	1 427 118	539 179
PL63	Pomorskie	18 169.41	721.800078	1.40	1.73	4 131.01	242.07	43.54	3.97	2 230 099	751 662
PT11	Norte	21 277.98	1 330.140247	2.99	2.94	4 026.07	248.38	46.99	6.25	3 745 575	1 609 665
PT15	Algarve	4 994.90	284.014717	2.89	2.63	2 216.84	451.09	46.30	5.69	434 023	195 592
PT16	Centro (PT)	28 197.60	1 382.301676	2.29	2.23	2 537.77	394.05	45.43	4.90	2 381 068	1 126 891
PT17	Lisboa	2 852.70	742.452600	10.95	12.51	5 476.54	182.60	48.07	26.03	2 830 867	1 235 204
PT18	Alentejo	31 520.04	618.491827	0.71	0.83	1 738.20	575.31	42.55	1.96	753 407	321 654
PT20	Região Autónoma dos Açores (PT)	2 323.30	96.591279	1.51	1.81	3 678.25	271.87	43.43	4.16	245 374	109 913
PT30	Região Autónoma da Madeira (PT)	786.69	90.741599	5.37	5.37	3 986.53	250.84	46.55	11.53	247 399	114 345
RO11	Nord-Vest	34 159.99	709.961713	0.50	0.86	5 303.73	188.55	41.41	2.08	2 719 719	1 045 723
RO12	Centru	34 103.67	701.603736	0.50	0.84	4 975.26	200.99	40.86	2.06	2 524 418	966 240
RO21	Nord-Est	36 849.45	1 052.571876	0.83	1.22	4 948.31	202.09	42.62	2.86	3 712 396	1 496 056
RO22	Sud-Est	35 758.99	996.715824	0.80	1.15	3 893.90	256.81	41.29	2.79	2 811 218	1 069 893
RO31	Sud–Muntenia	34 480.22	1 179.138648	1.09	1.45	3 835.44	260.73	42.30	3.42	3 267 270	1 255 250
RO32	Bucureşti–Ilfov	1 800.76	385.070768	2.86	10.13	8 758.31	114.18	47.38	21.38	2 261 698	1 110 873
RO41	Sud-Vest Oltenia	29 233.24	807.724063	0.86	1.17	4 037.75	247.66	42.19	2.76	2 246 033	1 015 357
RO42	Vest	32 005.57	642.306580	0.52	0.82	4 240.62	235.81	40.66	2.01	1 919 434	804 347
SE11	Stockholm	7 093.28	377.422060	0.97	2.48	7 940.17	125.94	46.65	5.32	2 019 182	977 613
SE12	Östra Mellansverige	43 304.34	739.941065	0.75	0.77	2 910.84	343.54	44.89	1.71	1 558 292	595 560
SE21	Småland med öarna	35 987.60	459.658640	0.49	0.55	2 482.09	402.89	43.35	1.28	810 066	330 846
SE22	Sydsverige	14 398.00	532.764060	1.64	1.68	3 595.91	278.09	45.51	3.70	1 383 653	532 120
SE23	Västsverige	34 598.06	807.542083	1.01	1.05	3 248.66	307.82	45.00	2.33	1 866 283	757 149
SE31	Norra Mellansverige	72 011.91	772.479153	0.46	0.47	1 477.84	676.66	44.19	1.07	825 931	315 671
SE32	Mellersta Norrland	77 173.40	356.346588	0.18	0.20	1 440.66	694.13	42.87	0.46	369 708	143 667
SE33	Övre Norrland	165 153.20	482.748885	0.10	0.12	1 466.93	681.70	42.33	0.29	507 567	200 590
SI01	Vzhodna Slovenija	12 214.46	422.772010	1.50	1.56	3 418.13	292.56	45.13	3.46	1 084 935	380 140
SI02	Zahodna Slovenija	8 062.36	382.926683	2.08	2.15	3 588.70	278.65	45.36	4.75	962 041	434 502
SK01	Bratislavský kraj	2 051.55	196.178172	3.42	4.32	5 172.23	193.34	45.18	9.56	622 706	391 973
SK02	Západné Slovensko	14 989.47	797.523066	1.68	2.23	3 300.82	302.95	41.82	5.32	1 866 400	766 081
SK03	Stredné Slovensko	16 261.50	538.335628	1.07	1.39	3 428.19	291.70	42.08	3.31	1 350 688	494 830
SK04	Východné Slovensko	15 722.83	567.738586	1.05	1.49	3 756.11	266.23	41.36	3.61	1 585 131	547 359
TR10	Istanbul	5 315.6092	1 037.822571	0.04	9.36	15 984.00	62.56	47.95	19.52	12 915 158	3 673 402
TR21	Tekirdag, Edirne, Kirklareli	18 845.6704	418.689957	0.41	0.84	4 842.51	206.50	37.75	2.22	1 511 952	515 560
TR22	Balikesir, Çanakkale	23 759.636	357.376989	0.21	0.55	6 020.26	166.11	36.78	1.50	1 617 820	533 682
TR31	Izmir	11 768.252	554.728078	0.46	2.12	9 031.95	110.72	45.06	4.71	3 868 308	1 141 971
TR32	Aydin, Denizli, Mugla	32 001.438	567.134879	0.35	0.74	6 330.38	157.97	41.56	1.77	2 707 898	882 282
TR33	Manisa, Afyonkarahisar, Kütahya, Usak	45 363.2548	569.354389	0.16	0.48	6 640.54	150.59	38.03	1.26	2 940 947	839 874

Table A1.2 Urban sprawl values for 2006 (orange) and 2009 (green) at the NUTS-2 level (cont.)

Code	NUTS-2	*TA* (km²)	*BA* (km²)	*WUP* (UPU/m²)	*UP* (UPU/m²)	*UD* (inh. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/m²)	*PBA* (%)	Population	Number of workplaces
TR41	Bursa, Eskisehir, Bilecik	29 108.0736	609.111547	0.32	0.89	7 497.96	133.37	42.70	2.09	3 508 133	1 058 962
TR42	Kocaeli, Sakarya, Düzce, Bolu, Yalova	20 216.246	637.728175	0.89	1.44	6 478.45	154.36	45.79	3.15	3 193 210	938 278
TR51	Ankara	24 873.6104	703.119254	0.35	1.27	8 470.80	118.05	44.75	2.83	4 650 802	1 305 177
TR52	Konya, Karaman	48 165.9532	697.699485	0.35	0.58	4 145.69	241.21	39.88	1.45	2 224 547	667 900
TR61	Antalya, Isparta, Burdur	35 938.9828	633.034980	0.53	0.77	5 390.20	185.52	43.68	1.76	2 592 075	820 108
TR62	Adana, Mersin	29 241.9628	468.034604	0.09	0.71	10 043.11	99.57	44.41	1.60	3 703 114	997 408
TR63	Hatay, Kahramanmaras, Osmaniye	23 278.9556	370.270462	0.09	0.69	9 759.22	102.47	43.17	1.59	2 957 713	655 840
TR71	Kirikkale, Aksaray, Nigde, Nevsehir, Kirsehir	31 333.6544	472.450891	0.33	0.58	3 954.60	252.87	38.66	1.51	1 504 789	363 566
TR72	Kayseri, Sivas, Yozgat	59 792.236	555.853918	0.17	0.36	5 190.56	192.66	38.49	0.93	2 326 584	558 611
TR81	Zonguldak, Karabük, Bartin	9 543.7712	380.641715	1.85	1.84	3 640.56	274.68	46.16	3.99	1 026 825	358 925
TR82	Kastamonu, Çankiri, Sinop	26 492.5452	180.043887	0.13	0.27	5 403.45	185.07	39.47	0.68	745 976	226 883
TR83	Samsun, Tokat, Çorum, Amasya	38 014.7496	470.820459	0.14	0.50	7 639.10	130.91	40.45	1.24	2 739 487	857 157
TR90	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüshane	35 073.5544	348.366761	0.04	0.42	10 229.35	97.76	42.43	0.99	2 526 619	1 036 946
TRA1	Erzurum, Erzincan, Bayburt	40 793.0836	214.137566	0.07	0.20	6 467.06	154.63	38.05	0.52	1 062 205	322 635
TRA2	Agri, Kars, Igdir, Ardahan	29 924.2232	296.413354	0.20	0.38	4 666.14	214.31	38.69	0.99	1 135 856	247 251
TRB1	Malatya, Elazig, Bingöl, Tunceli	36 626.7676	180.230689	0.01	0.19	11 295.10	88.53	39.28	0.49	1 626 357	409 367
TRB2	Van, Mus, Bitlis, Hakkari	40 891.9996	261.151214	0.03	0.24	9 008.15	111.01	38.28	0.64	2 012 044	340 445
TRC1	Gaziantep, Adiyaman, Kilis	15 191.8988	259.471884	0.04	0.72	11 100.52	90.09	42.37	1.71	2 364 249	516 024
TRC2	Sanliurfa, Diyarbakir	33 962.5492	479.969071	0.16	0.57	7 560.14	132.27	40.06	1.41	3 128 748	499 888
TRC3	Mardin, Batman, Sirnak, Siirt	25 840.5428	218.222543	0.02	0.33	10 315.61	96.94	39.64	0.84	1 969 896	281 202
UKC1	Tees Valley and Durham	3 030.28	440.994680	7.25	6.84	3 556.09	281.21	46.99	14.55	1 170 984	397 234
UKC2	Northumberland and Tyne and Wear	5 576.60	459.749165	3.94	3.91	4 321.46	231.40	47.41	8.24	1 424 460	562 330
UKD1	Cumbria	6 832.20	197.396339	1.17	1.29	3 612.34	276.83	44.51	2.89	494 697	218 365
UKD3	Greater Manchester	1 276.80	552.979443	14.36	21.02	6 593.79	151.66	48.53	43.31	2 615 144	1 031 088
UKD4	Lancashire	3 082.89	394.314925	5.35	6.01	5 100.08	196.08	46.98	12.79	1 447 496	563 540
UKD6	Cheshire	2 267.6944	332.217375	7.25	6.92	3 865.11	258.72	47.24	14.65	886 997	397 060
UKD7	Merseyside	707.9288	367.972963	22.34	25.09	5 427.85	184.23	48.27	51.98	1 469 347	527 956
UKE1	East Yorkshire and Northern Lincolnshire	3 523.67	341.440468	4.33	4.44	3 736.78	267.61	45.77	9.69	919 438	356 449
UKE2	North Yorkshire	8 321.64	308.121189	1.50	1.65	3 674.43	272.15	44.60	3.70	799 304	332 867
UKE3	South Yorkshire	1 553.19	329.976931	8.63	10.07	5 427.64	184.24	47.40	21.25	1 322 813	468 182
UKE4	West Yorkshire	2 030.91	547.748069	10.59	12.89	5 730.48	174.51	47.78	26.97	2 238 127	900 733
UKF1	Derbyshire and Nottinghamshire	4 793.90	585.076896	5.12	5.70	4 951.16	201.97	46.72	12.20	2 089 452	807 356
UKF2	Leicestershire, Rutland and Northamptonshire	4 921.25	540.150829	4.77	5.07	4 374.74	228.59	46.18	10.98	1 676 416	686 602
UKF3	Lincolnshire	5 928.06	281.833107	1.91	2.11	3 435.78	291.05	44.33	4.75	700 466	267 850
UKG1	Herefordshire, Worcestershire and Warwickshire	5 902.22	464.894705	3.72	3.66	3 802.11	263.01	46.52	7.88	1 271 724	495 855
UKG2	Shropshire and Staffordshire	6 208.99	533.788111	4.00	4.00	3 959.86	252.53	46.51	8.60	1 524 515	589 209
UKG3	West Midlands	902.41	561.414583	21.45	30.44	6 536.95	152.98	48.94	62.21	2 646 889	1 023 048
UKH1	East Anglia	12 593.09	706.452825	2.02	2.50	4 733.90	211.24	44.51	5.61	2 358 545	985 729
UKH2	Bedfordshire and Hertfordshire	2 879.66	406.958684	5.14	6.61	5 761.33	173.57	46.76	14.13	1 711 506	633 118
UKH3	Essex	3 686.87	443.932483	4.69	5.57	5 202.80	192.20	46.28	12.04	1 729 185	580 505
UKI1	Inner London	319.91	273.201261	0.02	42.19	1 9645.45	50.90	49.40	85.40	3 072 182	2 294 980
UKI2	Outer London	1 255.93	780.100519	13.63	30.44	7 859.43	127.24	49.01	62.11	4 717 185	1 413 963

Table A1.2 Urban sprawl values for 2006 (orange) and 2009 (green) at the NUTS-2 level (cont.)

Code	NUTS-2	*TA* (km²)	*BA* (km²)	*WUP* (UPU/m²)	*UP* (UPU/m²)	*UD* (inh. and jobs per km²)	*LUP* (m² per inh. or job)	*DIS* (UPU/m²)	*PBA* (%)	Population	Number of workplaces
UKJ1	Berkshire, Buckinghamshire and Oxfordshire	5 747.47	576.360326	3.68	4.66	5 627.93	177.69	46.50	10.03	2 239 547	1 004 167
UKJ2	Surrey, East and West Sussex	5 463.06	715.529162	5.38	6.15	5 184.25	192.89	46.92	13.10	2 687 897	1 021 588
UKJ3	Hampshire and Isle of Wight	4 158.19	528.069763	5.33	5.95	5 001.86	199.93	46.82	12.70	1 876 967	764 366
UKJ4	Kent	3 740.31	452.934266	4.92	5.63	5 057.65	197.72	46.51	12.11	1 674 986	615 797
UKK1	Gloucestershire, Wiltshire and Bristol/ Bath area	7 480.38	743.604202	4.36	4.62	4 476.96	223.37	46.47	9.94	2 339 669	989 415
UKK2	Dorset and Somerset	6 122.77	440.546538	3.12	3.28	3 885.84	257.34	45.56	7.20	1 236 950	474 942
UKK3	Cornwall and Isles of Scilly	3 580.12	208.402418	2.36	2.59	3 581.05	279.25	44.51	5.82	535 365	210 935
UKK4	Devon	6 723.73	380.930558	2.39	2.58	4 162.78	240.22	45.55	5.67	1 140 502	445 230
UKL1	West Wales and The Valleys	13 162.56	785.128798	2.72	2.72	3 236.55	308.97	45.57	5.96	1 895 856	645 254
UKL2	East Wales	7 657.72	415.618677	2.52	2.51	3 762.00	265.82	46.25	5.43	1 107 019	456 537
UKM2	Eastern Scotland	18 144.77	631.904534	1.39	1.58	4 479.52	223.24	45.33	3.48	2 002 483	828 147
UKM3	South Western Scotland	13 203.82	774.396371	2.70	2.73	4 134.91	241.84	46.63	5.86	2 297 793	904 265
UKM5	North Eastern Scotland	6 514.37	189.992264	1.12	1.28	3 617.67	276.42	43.97	2.92	460 117	227 212
UKM6	Highlands and Islands	41 097.59	293.688	0.25	0.30	2 181.69	458.36	42.23	0.71	447 728	193 008
UKN0	Northern Ireland (UK)	14 155.38	761.016947	2.63	2.50	3 221.14	310.45	46.42	5.38	1 794 362	656 978

Note: *DIS*; dispersion; *LUP*; land uptake per person; *PBA*; percentage of built-up area; *BA*; built-up area; *TA*, total area; *UD*; utilisation density; *UP*; urban permeation; *WUP*; weighted urban proliferation. The unit for each metric is indicated in parentheses. The values for Turkey (TR) are available for 2009 only, because Eurostat did not provide data for these NUTS-2 regions in 2006 and the values in other sources were so different from the 2009 values that they did not appear to be reliable.

Annex 2 Cross-boundary connection procedure, horizon of perception and the relationship between weighted urban proliferation and population density

A2.1 Cross-boundary connection procedure

There are two options for how to treat the boundaries of reporting units (Moser et al., 2007):

1. **Cutting-out procedure:** only the distances between urban points located within the reporting unit are taken into account (i.e. everything outside the boundary is neglected).

2. **Cross-boundary connections (CBC) procedure:** all distances between urban points within the reporting unit and any other urban points that are smaller than the horizon of perception (*HP*) are taken into account, regardless of the reporting unit in which the surrounding urban points are located (i.e. the second points include urban areas within a buffer zone around the reporting unit width of the *HP*) (Figure A2.1).

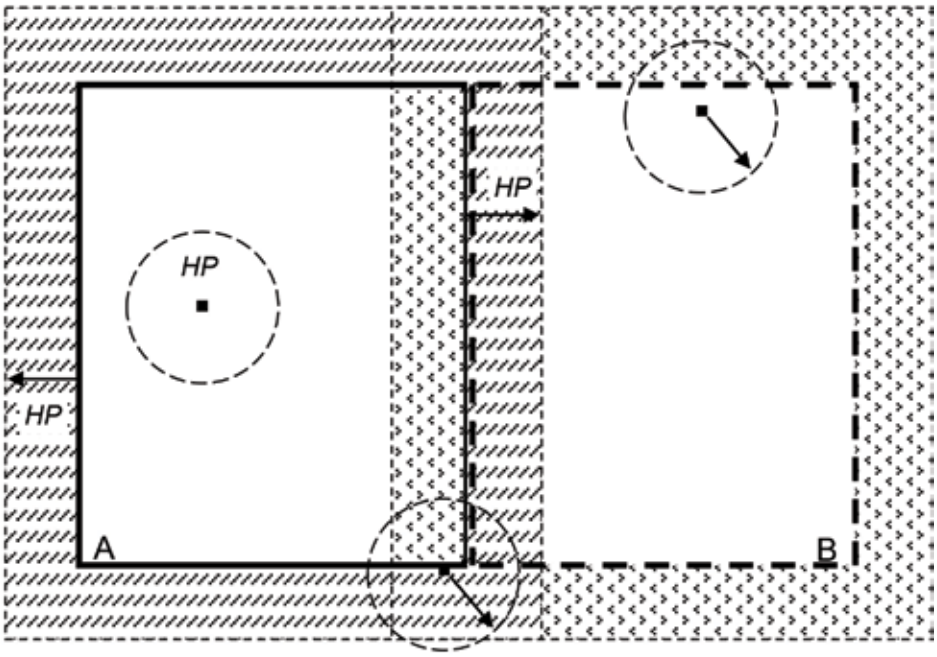
The cutting-out procedure has the advantage that no data are needed from areas outside the reporting unit and that, as a consequence, the results are not influenced by urban development outside the reporting unit. This corresponds to cutting out the reporting unit from its context. However, it has the disadvantage that the true context of the urban areas located close to the boundary is only partly considered, even though these parts of the reporting unit will actually be influenced by all development processes surrounding them, including those on the other side of the boundary (Figure A2.1). For example, a human seeking recreation will perceive a location as affected by urban sprawl if there are many developed areas visible, regardless of whether the buildings are located inside or outside the reporting unit. In addition, the calculations for adjacent reporting units using the cutting-out procedure are not well related to the results for the combination of several adjacent reporting units because all the distances between the urban points located in reporting unit A and those in reporting unit B are neglected when calculated separately (but included when their combination is analysed). The smaller the reporting units, the larger this bias.

The CBC procedure has the important advantage that all points within urban areas are treated equally regardless of how close they are to the boundary of a given reporting unit. No distances between any two points of urban area that are smaller than *HP* are neglected. If they cross the boundary between two reporting units, they are taken into account in the sprawl calculations of both reporting units (Figure A2.1). This procedure solves the so-called 'boundary problem' (Moser et al., 2007). It has been applied to other landscape metrics before, for example to the effective mesh size metric and the effective mesh density metric for quantifying the degree of landscape fragmentation (Moser et al., 2007; Girvetz et al., 2008; EEA & FOEN, 2011a). The only possible disadvantage of this treatment is that data for the built-up areas outside the reporting unit within a buffer width of *HP* need to be available, which may not always be the case.

As a consequence, the calculation of the sprawl measures according to the CBC procedure can be performed in a two-step procedure when an approximation based on raster cells is used. First, the values for every cell of urban area can be calculated, taking into account the distances to all other urban cells closer than *HP*. Second, the cells that are actually part of the reporting unit of interest are selected and their contributions are added up. Their sums are divided by the size of the reporting unit, resulting in the value of urban permeation (*UP*), etc.

The CBC procedure also has the advantage that the metrics *UP* and dispersion of the built-up areas (*DIS*) are rigorously area-proportionately additive (criterion 13 in Box 2.1, Section 2.2). Because of its advantages, the CBC procedure is the most appropriate method and was used in this report. However, the cutting-out procedure may also be useful in other cases (e.g. when data for the areas outside the reporting units are not available).

Figure A2.1 Illustration of the application of the CBC procedure to calculate urban permeation and weighted urban proliferation



Note: One very small urban patch in reporting unit A and one very small urban patch in reporting unit B are shown. All distances between points within urban areas and other urban points located within the *HP* of the first point are taken into account, even when the other urban points are located in other reporting units. The buffers are of width *HP* to indicate the area around a reporting unit, within which urban points may be included in the calculation of the values of dispersion, *UP* and *WUP*.

Source: Modified after Jaeger et al., 2010a.

A2.2 Horizon of perception

Urban sprawl can be measured at different scales. Accordingly, the weighted urban proliferation (*WUP*) method includes a parameter called *HP*, which specifies the scale of analysis of urban sprawl. When the distances between two locations are larger than the *HP*, urban development at the two locations is considered independently. There are several rules that can be used to define the *HP* in a non-subjective way. For practical reasons, only one *HP* is used in this report, rather than a series of *HP*s. Values other than 2 km can be used if there is a reason why different scales of analysis are of interest. In general, all *HP*s are correct to some degree (as far as they are practical and not misleading), because all these scales at which urban sprawl can be analysed exist, but some scales are more useful than others in the study of urban sprawl. Although the choice of *HP* may be arbitrary to some degree, there are good reasons why a certain value is preferred. Based on the evidence from Switzerland (Jaeger et al., 2008; Schwick et al., 2012), a good choice for the *HP* is between 1 km and 5 km. Switzerland has a large range of urban sprawl values (from the dense lowlands to the Alps). This range encompasses more or less all densities and almost all settlement structures found in Europe. Below are some important criteria that are useful when choosing a particular *HP*:

1. Argument of distances that are perceptible by humans: the definition of sprawl used in this report is based on the visual perception of sprawl. (Some authors in the literature argue that, although they find it difficult or impossible to define 'sprawl', they would recognise it when they *see* it.) Therefore, the choice of the *HP* can be based on the following estimation: owing to the curvature of the earth, people with an eye height of 180 cm can see the surrounding area within a radius of 4.8 km (assuming that there are no obstacles obstructing their view; calculated using the Pythagorean formula $x^2 + (6\ 370\ \text{km})^2 = (6\ 370\ \text{km} + 1.80\ \text{m})^2$, where 6 370 km is the average radius of the earth); therefore, distances between 1 km and 5 km are suitable choices for *HP* (Jaeger et al., 2010a). Owing to obstacles, the real view will often be less than 4.8 km, and greater than 4.8 km in elevated locations. As an alternative to a fixed value for *HP*, a

viewshed could be calculated for each point in the landscape, but this would require a much greater effort, and would also require that the scale of analysis change as a function of the location (and the size of the viewshed of each location).

2. Values below 1 km are too small because at such a small scale, the focus is on a rather small part of a city, and does not relate the inner areas of a city to the development that is occurring farther away. In addition, the analysis should discover a situation in which two settlements start growing towards each other, and *HP*s smaller than 1 km would detect this situation only when the settlements are closer to each other than 1 km. Therefore, 1 km appears to be a minimum value for *HP*.

3. However, if an *HP* of 10 km is used, newly built-up areas between two villages that are at a distance of 8 km will appear to represent some form of densification (in-fill), whereas, in fact, this would be interpreted as sprawl at this scale (leapfrog development). For example, villages in the Alps are often closer to each other than 5 km. If the *HP* is larger than 5 km, the buildings from neighbouring villages are already taken into account, which should not be the case. Therefore, *HP* values greater than 5 km appear to be too large.

4. An *HP* of 2 km seems most suitable for practical reasons. Typical distances between two settlements in many European countries are between 3 km and 5 km. Distances between villages founded hundreds of years ago would often be in this order of magnitude. Historically, it would not have made much sense to create villages closer to each other because the land between them was needed for agriculture to feed the people in the villages. Today, these villages are growing towards each other, a process which is detectable when using an *HP* of 2 km. This value captures the contribution of every built-up parcel of land (and it also keeps calculation times manageable). However, in some countries (e.g. Sweden and Canada), these distances may be larger, which will raise the question of whether there is an interest in capturing the macrostructure (using larger *HP*s).

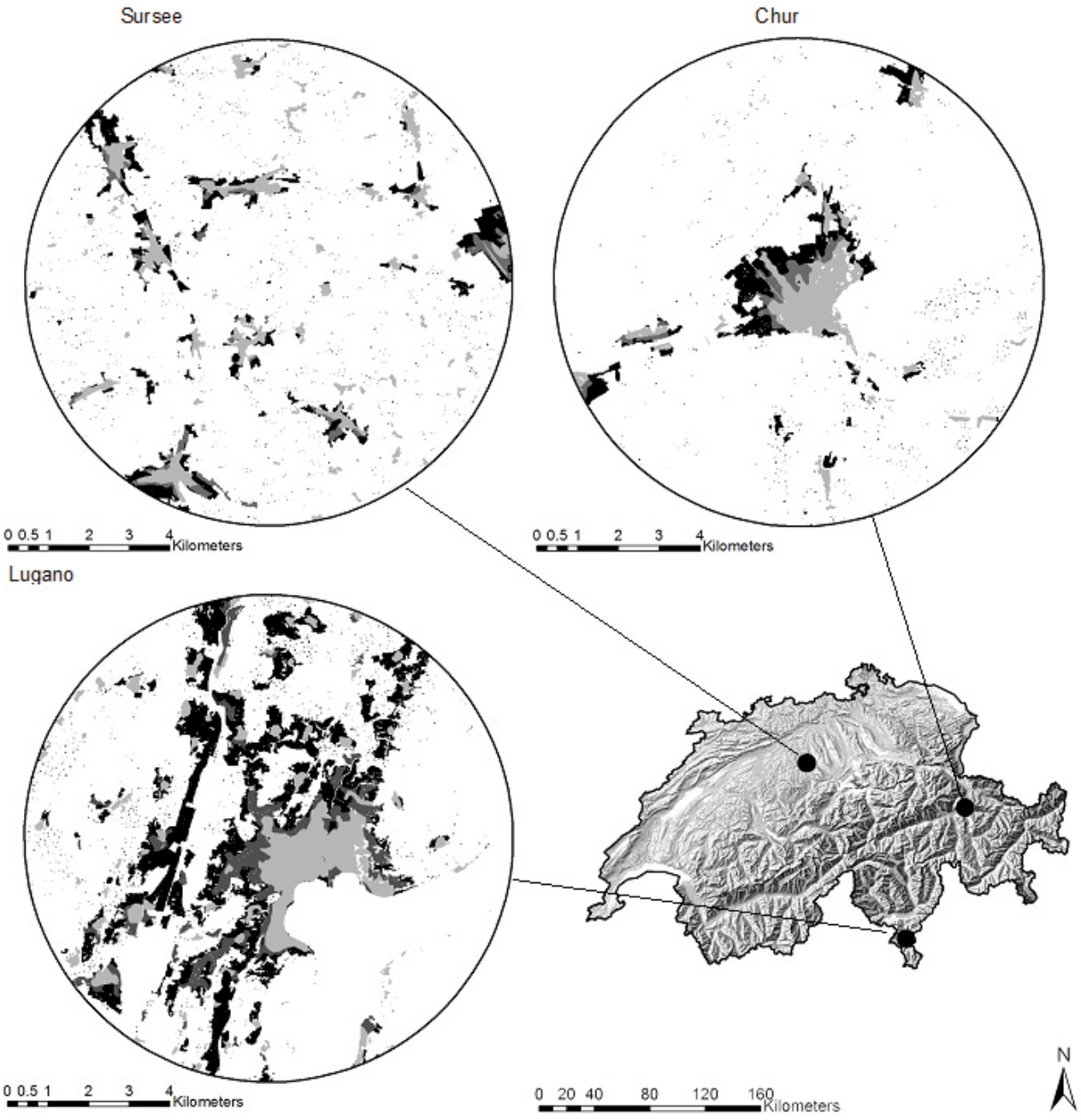
This report used an *HP* of 2 km. The value of dispersion increases when the *HP* increases; for example, the *DIS* values for an *HP* of 5 km are about 55–80 % higher than for an *HP* of 2 km, and about 100–160 % higher for an *HP* of 10 km (Jaeger et al., 2008; Schwick et al., 2012).

Jaeger et al. (2008) explored the use of *HP* = 10 km but then abandoned it for the reasons listed above. Wissen Hayek et al. (2011) used an *HP* of 5 km. According to the tests on the influence of *HP* by Jaeger et al. (2008) and the sensitivity analysis by (Orlitová et al., 2012), differences in the choice of *HP* usually have a rather small effect (as long as *HP* is between 1 km and 5 km), and different values of *HP* do not usually change the overall message.

The ranking order of reporting units according to their *DIS* value usually does not change when a different *HP* is used, but it can happen in some cases. Three regions from Switzerland may be used as examples: Jaeger et al. (2010a) applied the metrics to three examples from Switzerland (Sursee, Chur and Lugano; Map A2.1) to enhance the intuitive understanding of the metrics. Each example region is a circle of 113.95 km^2 in size (i.e. it has a diameter of 12 045 m). The examples are based on the VECTOR25 (V25) data from the Federal Office of Topography (Swisstopo), Berne, for 2002. Historic maps were digitised for 1960 and 1935. The results for two *HP*s were compared (2 km and 5 km). The settlement pattern outside the circles within the *HP* also influenced the values of the metrics through the CBC procedure. Therefore, each characterisation of the three regions includes a brief description of the regions' surroundings.

The Sursee region is located in the Swiss lowlands and is dominated by agriculture. The area includes many small villages and hamlets and contains no large towns. The settlements are embedded in the valleys of the soft chains of hills running from the south-east to the north-west. The settlements are evenly distributed across the landscape and this pattern is continued for 5 km around the circle. The second example is Chur, which is located on an alluvial cone in an Alpine valley with steep slopes. From there it grows into the valley bottom of the River Rhine which flows from the south-west to the north-east. A chain of small villages follows the river, and this chain is continued outside the circle, but there the number of villages is rather small. The third example, Lugano, is located on a lake (to the south-east of the city). It is bordered by mountain ranges to the west and the east. The development of settlements proceeded along the valley bottoms from the south to the north. To the north of the circle shown, the number of settlements is much smaller, and only a thin chain of villages continues. To the south, the settlement area is bordered by another lake, so there are almost no settlements outside the circle in this direction.

Map A2.1 Urban development in three regions in Switzerland (Sursee, Chur and Lugano)



Note: The diameter of each landscape is 12 km. The maps show the development of urban areas at three time-points, 1935 (light grey), 1960 (dark grey) and 2002 (black), using national data from Switzerland.

Table A2.1 Values of urban dispersion (*DIS*) and urban permeation (*UP*) for two *HP*s (2 km and 5 km) in the three example regions shown in Map A2.1 from Switzerland for three time-points (1935, 1960, 2002)

Region	Year	Built-up area (ha)	Number of inhabitants and jobs	Land uptake per inhabitant or job (m^2)	Values of sprawl metrics			
					HP = 2 km		*HP* = 5 km	
					DIS_2 (UPU/m^2)	UP_2 (UPU/m^2)	DIS_5 (UPU/m^2)	UP_5 (UPU/m^2)
Sursee	1935	532.5	22 637	235.2	41.64	1.95	76.50	3.57
	1960	671.1	26 400	254.2	41.38	2.44	75.06	4.42
	2002	1 126.1	38 792	290.3	43.52	4.30	73.89	7.30
Chur	1935	443.4	27 219	162.9	42.28	1.65	61.68	2.40
	1960	550.8	41 315	133.3	42.75	2.07	60.98	2.95
	2002	946.6	65 310	144.9	45.06	3.74	64.61	5.37
Lugano	1935	858.8	58 138	147.7	46.13	3.48	69.53	5.24
	1960	1 358.1	74 671	181.9	47.08	5.61	70.94	8.45
	2002	2 862.5	157 081	182.2	47.82	12.01	74.79	18.79

Sources: Jaeger et al., 2010a; Schwick et al., 2012.

With an increasing *HP*, the values of the urban sprawl metrics also increase. Therefore, the values for the 5-km *HP* are always higher than those for the 2-km *HP*.

Both the amount of urban area and the increase in this between 1935 and 2002 are very similar in Sursee and Chur (+111–113 %), whereas Lugano has a larger urban area and a relative increase that is more than twice as high (+230 %) (Table A2.1).

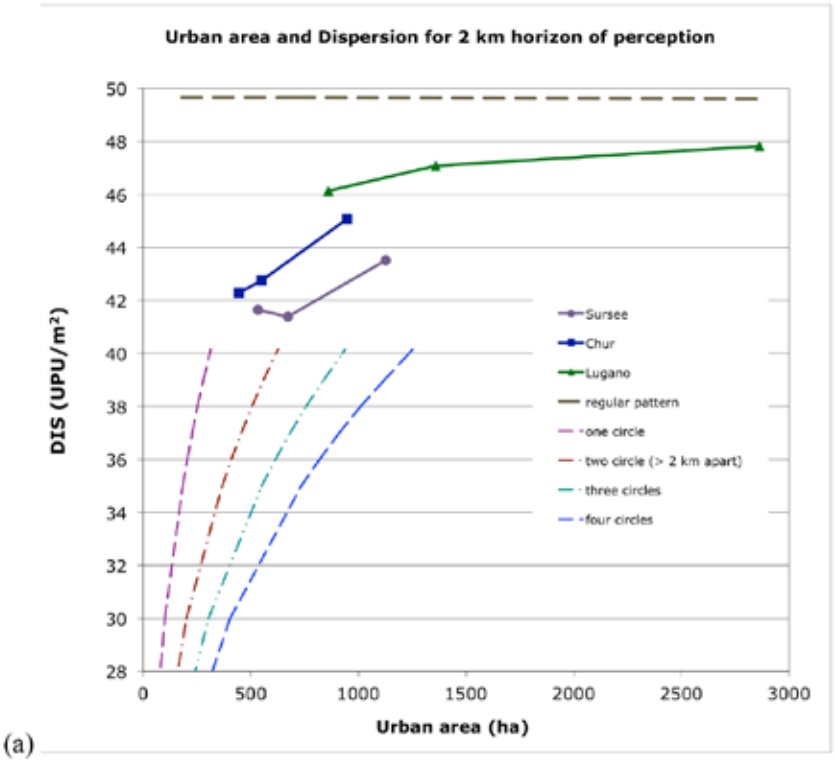
At all three time-points (1935, 1960 and 2002), *UP* was highest in the Lugano region and lowest in the Chur region (Table A2.1). Between 1960 and 2002, *UP* increased by more than three times the increase observed between 1935 and 1960 in all three regions. In general, *UP* increases more than urban area if *DIS* increases; if *UP* increases less than urban area, then *DIS* decreases.

At the 2-km *HP*, *DIS* is highest in Lugano. The *DIS* has increased rather uniformly with increasing urban area in Lugano for both *HP*s (Figure A2.2). There were already many small villages around the town of Lugano in 1935 which were closer than 2 km to each other and therefore relevant for both *HP*s (Map A2.1), and dispersion was already high. By 1960, new urban areas had been added in the form of strands at the fringe of the main town as well as rather dispersed additions to the older villages. By 2002, new development had extended the strands and had connected many of the surrounding villages, forming elongated stripes. Therefore, dispersion had increased even further.

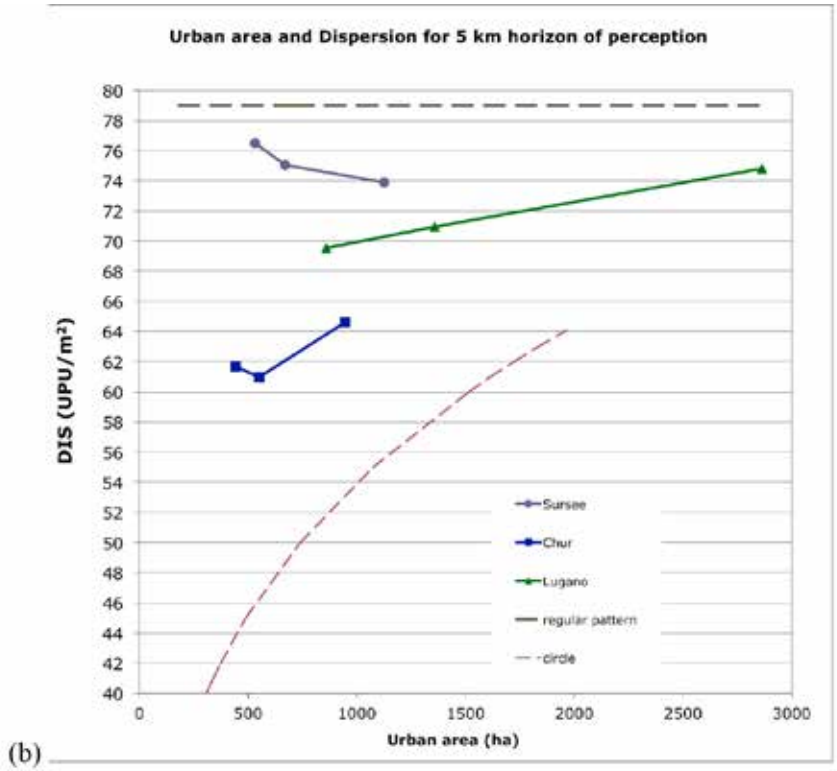
DIS increased more steeply in Sursee and Chur between 1935 and 2002 than in Lugano for the 2-km *HP*. However, the value of *DIS* first decreased in Sursee between 1935 and 1960 (Figure A2.2a). In 1935, the many villages in Sursee were mostly separated by distances greater than 2 km and therefore contributed independently to the sprawl metrics for the 2-km *HP*. The urban areas that had developed by 1960 were located close to the existing villages and, therefore, were still not perceived from neighbouring villages (thus, the *DIS* decreased). Each village maintained some distance from all others, and large distances between urban points (but < 2 km) were rare. Only after 1960 did the urban areas extend farther away from the villages and reduce the average distances between the boundaries of the villages to < 2 km, which means that significant parts of neighbouring villages were now often within the *HP* of each village. Therefore, the *DIS* increased steeply between 1960 and 2002.

In Chur, the urban area was not broken up into as many independent small villages in 1935 at the 2-km scale as in Sursee; only about four small villages surround the main town and are sufficiently far away to be independent of it (i.e. > 2 km) (Map A2.1). Therefore, *DIS* is higher in Chur than in Sursee for the 2-km *HP*, whereas it is higher in Sursee than in Chur for the 5-km *HP*. This is clearly visible in the map of Sursee (Map A2.1), as each village includes in its 5-km *HP* three to five of its surrounding villages. This implies a much more scattered distribution of the urban areas at this scale than the distribution in the concentrated arrangement of the town of Chur, which is surrounded

Figure A2.2 Development of urban dispersion and urban area in the three example regions shown in Map A2.1 between 1935 and 2002 for two *HP*s: (a) 2 km and (b) 5 km



(a)



(b)

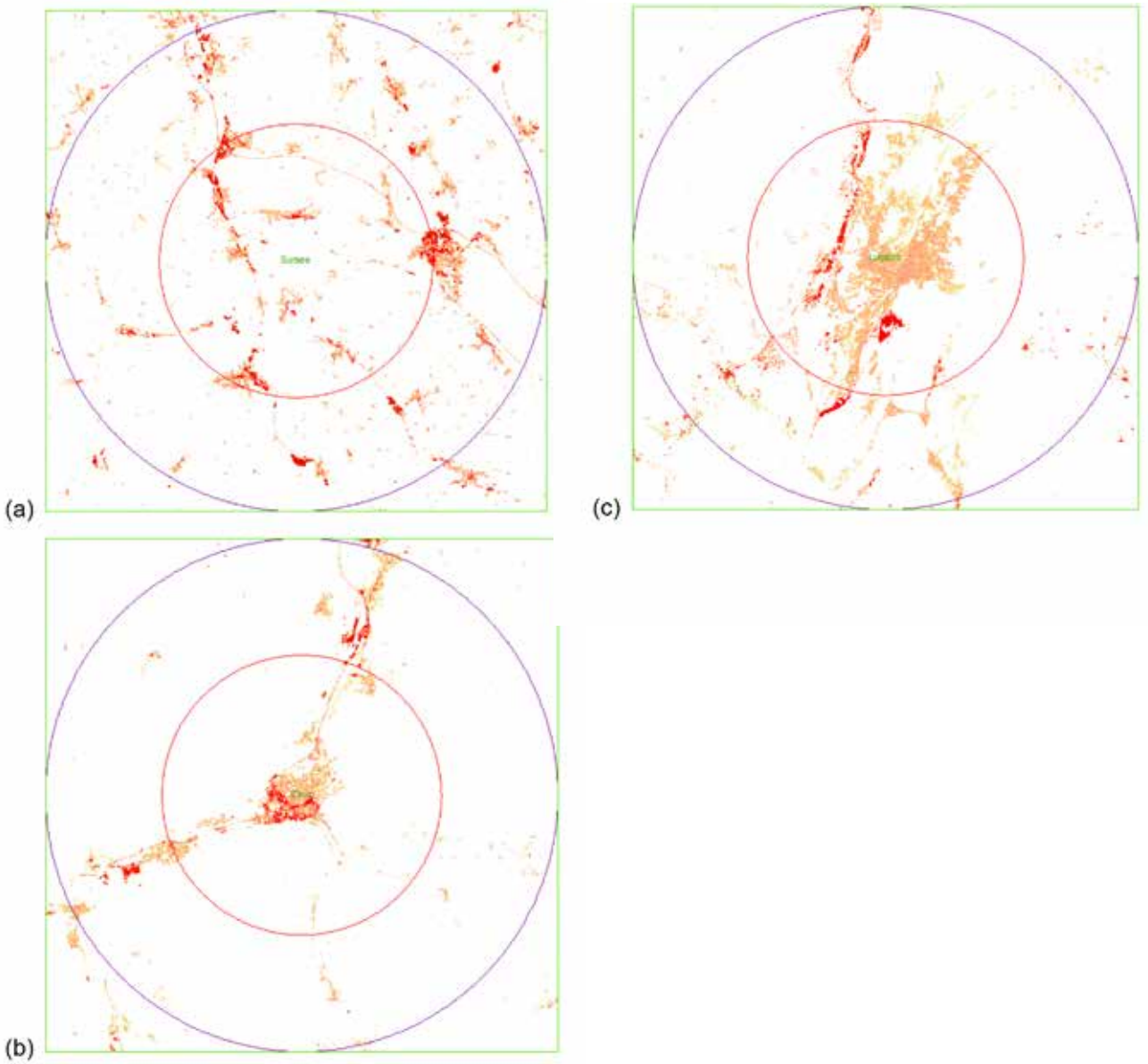
Note: The three time-points correspond to the years 1935, 1960 and 2002. For comparison, the values of *DIS* for a regular distribution of 15 m × 15 m built-up cells (dashed lines at the top: 49.66 UPU/m² for *HP* = 2 km and 79.01 UPU/m² for *HP* = 5 km) and for a solid circle (up to four circles for *HP* = 2 km) of urban area are indicated by broken lines (Jaeger et al., 2010a). The area of a circle is 313.2 ha for a circle with a 2-km diameter and 1 963.5 ha for a circle with a 5-km diameter. Therefore, these lines end here (with *DIS* = 40.15 UPU/m² and 64.1 UPU/m²).

by only one or two small villages (the third village at the north-east border of the region is almost independent for the 5-km *HP*). This difference also explains why the *DIS* continued to decrease in Sursee between 1960 and 2002 for the 5-km *HP*. At this scale, new urban areas filled in the space between the villages in a rather dense form (i.e. denser than the distribution of villages in 1935).

The broken lines indicate the *DIS* value for an even distribution of urban cells with a width of 15 m (i.e. maximum value of *DIS*) and for a circular configuration. The area of a circle with a diameter of 2 km is 313.2 ha, and 1 963.5 ha for a 5-km diameter; therefore, the lower curves end at these values. For *HP* = 2 km, up to four circles of a 2-km diameter can fit into the 113.95-km^2 landscape with distances > 2 km, and the corresponding four lines are included in Figure A2.2a.

The three examples illustrate clearly that it is important to keep in mind what the *HP* is when interpreting the values of the metrics.

Map A2.2 Urban areas of (a) Sursee, (b) Chur and (c) Lugano according to the 2006 *Pan*-European High Resolution Layers of Imperviousness Degree data set



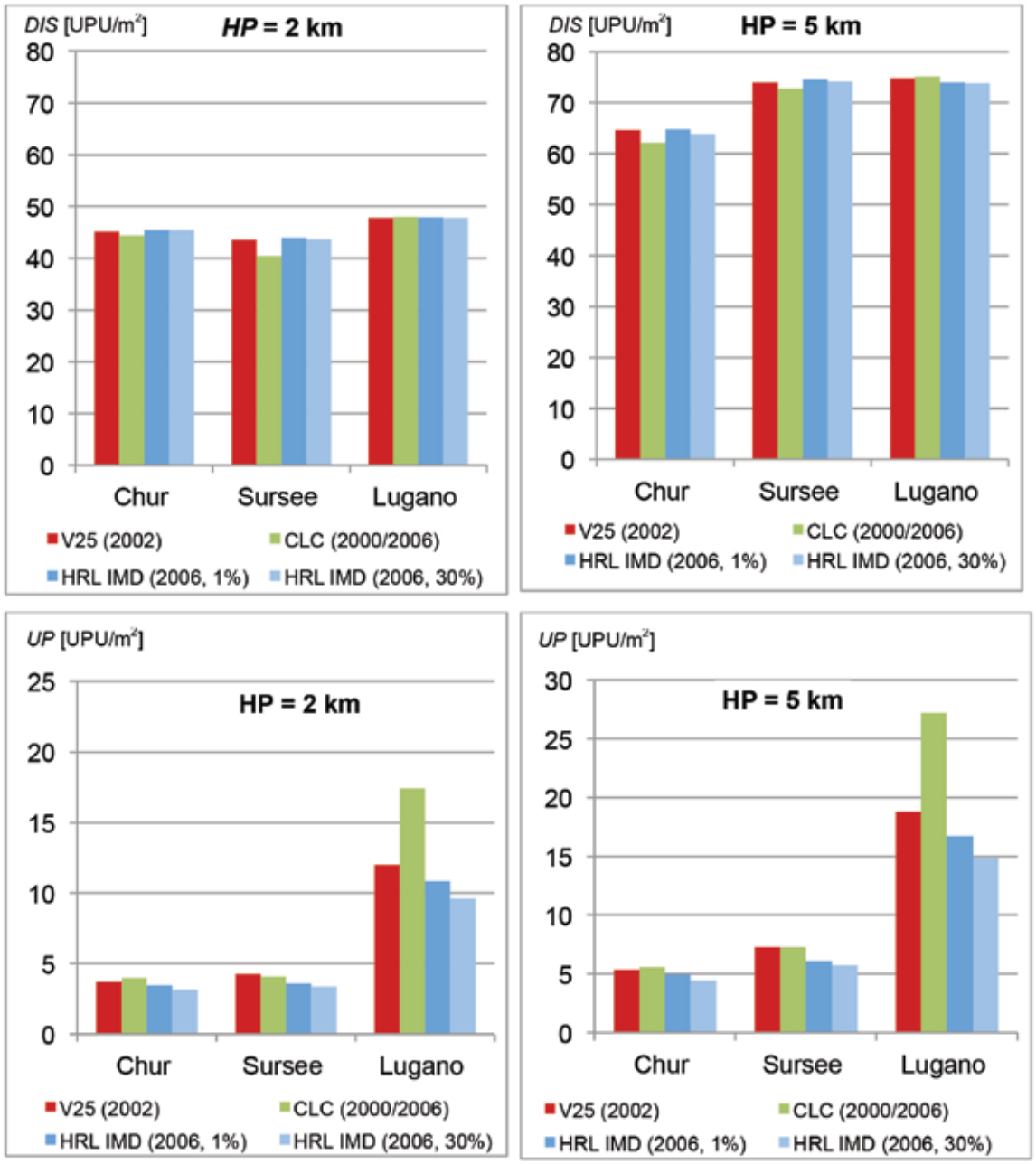
Note: The red circle has a diameter of 12 km and delineates the regions used in the Swiss study (Map A2.1). The purple circle represents the 5-km buffer which corresponds to an *HP* of 5 km around the study area. The orange to red colour indicates the degree of imperviousness (1–100 %).

Source: Orlitová et al., 2012.

Comparison of different data sources: The following figure shows the urban areas using the 2006 Pan-European High Resolution Layers of Imperviousness Degree data set for all three example regions.

Three data sets (V25, Pan-European High Resolution Layers of Imperviousness Degree (HRL IMD) 1 % and HRL IMD 30 %) correspond well with the values published in the Swiss study for both *DIS* and *UP* and *HP*s of both 2 km and 5 km in terms of their trends and their absolute values. As expected, the CLC data set with the largest urban area in Lugano results in the highest values for *UP*. The CLC data overestimate built-up areas when they include open areas that are smaller than the minimum mapping unit used in the CLC data, whereas the other three data sets are more sensitive.

Figure A2.3 The values of *DIS* (in UPU/m²) and *UP* (in UPU/m²) for two *HP*s (2 km and 5 km) for Chur, Sursee and Lugano based on the V25 data set from Switzerland, the Corine Land Cover data set and the Pan-European High Resolution Layers data set (1 % threshold and 30 % threshold)



Note: The order of the *DIS* values changes between Sursee and Chur, but it does not change for the *UP* values.

Source: Orlitová et al., 2012.

A2.3 Relationship between weighted urban proliferation and population density

Our hypothesis about the relationship between urban sprawl and population density states that dispersion and *UP* would first increase with increasing population density as the buildings spread in the region, but at some point densification efforts will increase the utilisation density (*UD*) of the built-up areas (Section 2.4.1), resulting in a decrease in urban sprawl. This corresponds to the transition from a suburban area to an area with an urban character.

According to the statistical analysis of the European NUTS-2 regions, only a few NUTS-2 regions exhibit a reduction in *WUP* values at high population densities (Figure 3.5 in Section 3.3.2). At the level of the NUTS-2 regions, we rarely see the effect of densification as a result of increasing population density, because the NUTS-2 regions are so large that densification does not occur across the entire NUTS-2 region, but only in some parts of it. However, the effect of increasing densification as a result of increasing population density is visible at a smaller scale than that of the NUTS-2 regions. Therefore, we use data from Switzerland at the municipality level to demonstrate this relationship (Figure A2.4).

The highest *WUP* values are observed in the range of population density between 1 600 and 4 500 inhabitants and jobs/km^2. In this range, the full range of *WUP* values is possible. Therefore, good spatial planning can make a big difference here. At higher values of population density, there is a strong decline in *WUP* because land uptake per person (*LUP*) declines considerably.

This illustrates the influence that population density has on urban sprawl. On average, increasing population density is associated with higher levels of urban sprawl when population density is < 3 000 inhabitants and jobs per km^2, and with decreasing levels of urban sprawl when population density is > 5 000 inhabitants and jobs per km^2 (where *LUP* is below 150 m^2 per inhabitant or job, and accordingly, $w_2(LUP) < 0.5$).

A2.4 Formulae for the weighting functions $w_1(DIS)$ and $w_2(LUP)$

The weighting functions are explained in detail in Jaeger and Schwick (2014) and Schwick et al. (2012). Their formulae are:

Weighting of Dispersion (*DIS*):

$$w_1(DIS) = 0.5 + e^{(0.294432\ m^2/\ UPU \times DIS - 12.955)} / (1 + e^{(0.294432\ m^2/UPU \times DIS - 12.955)})$$

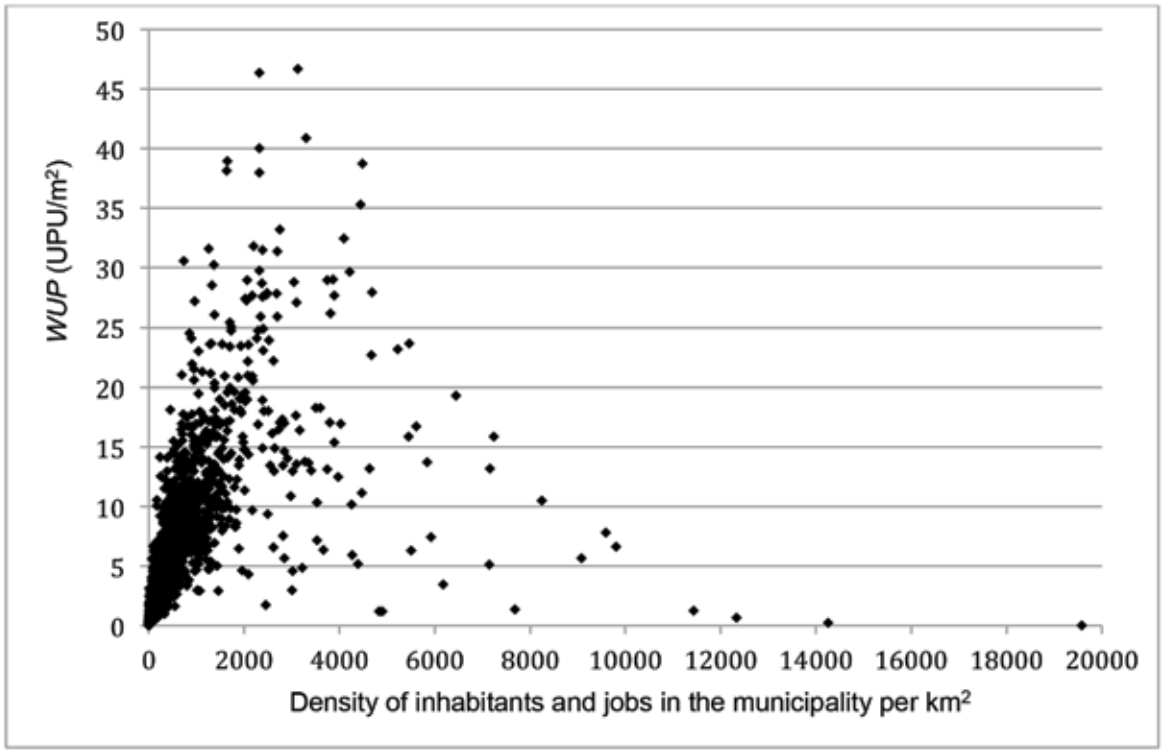
Weighting of Land Uptake per Person (*LUP*):

$$w_2(LUP) = e^{(4.159 - 613.125\ (inh. + jobs)/m^2/\ LUP)} / (1 + e^{(4.159 - 613.125\ (inh. + jobs)/m^2/\ LUP)})$$

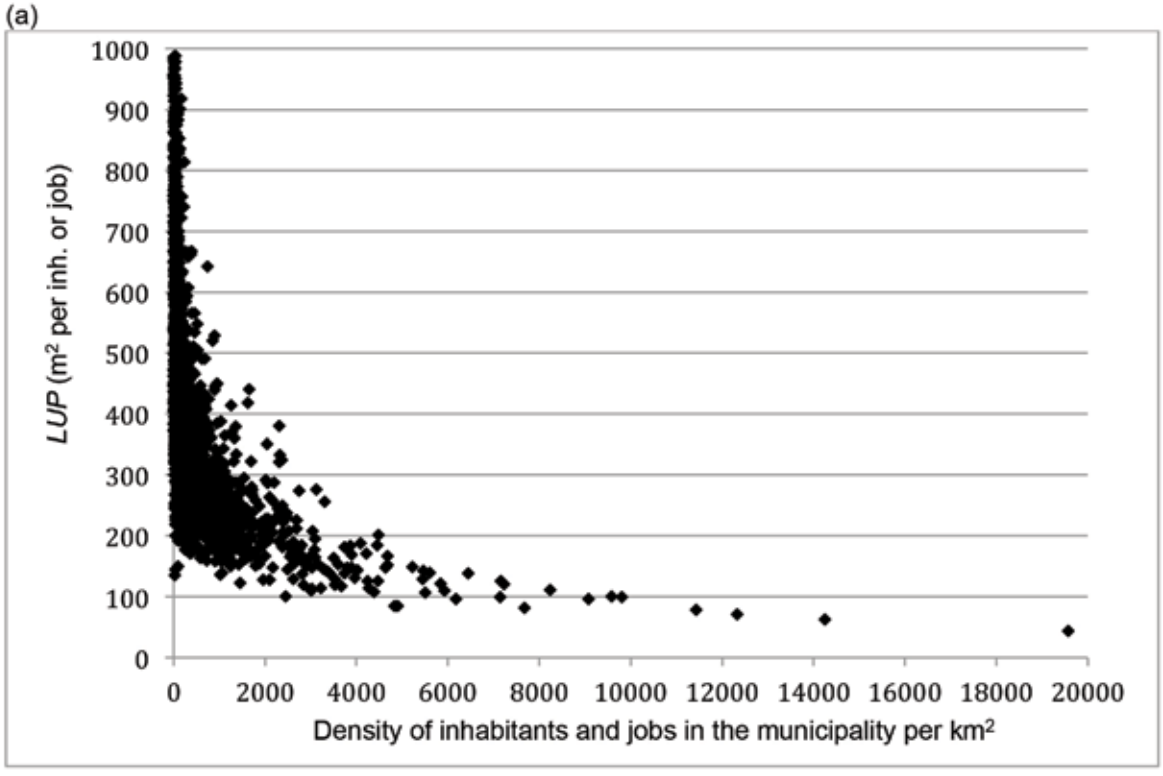
Including these weighting functions, the formula for the calculation of *WUP* is:

$$WUP = UP \times w_1(DIS) \times w_2(LUP).$$

Figure A2.4 **(a) Values for *WUP* in relation to the number of inhabitants and jobs per km² in the 2 495 municipalities in Switzerland (2010 values); (b) values for *LUP* (m² per inhabitant or job) in relation to the number of inhabitants and jobs per km²**



(a)



(b)

Source: Authors' calculations, prepared for this report.

Annex 3 Data limitations and additional information

There were several limitations to the data sets used in this report for the built-up areas (sections A3.1 to A3.4), the number of inhabitants and jobs (Section A3.5) and the delineation of NUTS-2 regions (Section A3.6). The best available data that are comparable across the 32 European countries covered in this report (EU-28 + 4) were used. This annex explains how the authors of this report addressed these data limitations. It also provides a comparison of the original *WUP* values with adjusted *WUP* values when irreclaimable areas are excluded from the reporting units (Section A3.7).

A3.1 Cloud coverage in the Pan-European High Resolution Layers of Imperviousness Degree 2006 and 2009

The main reasons to use the High Resolution Layer of Imperviousness Degree (HRL IMD) were the thematic content, level of detail and the spatial coverage of the 33 EEA member countries and six cooperating countries (EEA-39). HRL IMD is one of the five high-resolution layers on land cover characteristics produced in the frame of Global Monitoring for Environment and Security (GMES) precursor activities and the Geoland2 project, and for the 2012 and 2015 reference years is continued under Copernicus Land Monitoring Services. This pan-European product was available for the reference years 2006 and 2009. Data for the reference year 2012 are available from Q2 2016 (too late to be included in the analysis for this report). Each tile (raster file) represents the built-up and non-built-up areas through their continuous degree of imperviousness, ranging from 0 % to 100 % at 20 m × 20 m resolution (minimum mapping unit (MMU)) in the European projection ETRS89-LAEA. The total area of this data set covers ca. 5 500 000 km^2 and includes the following countries and partners: Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, the former Yugoslav Republic of Macedonia, France (without overseas departments and territories), Germany, Greece, Hungary, Iceland, Ireland, Italy, Kosovo ([1]), Latvia, the Principality of Liechtenstein, Lithuania, Luxembourg, Malta, Montenegro, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom. More information is available at http://land.copernicus.eu/pan-european/high-resolution-layers/imperviousness/view.

A3.1.1 Treatment of the areas covered by clouds

The urban sprawl metrics for 2006 and 2009 were calculated using Copernicus Land HRL IMD 2006 and 2009 data, which are based on satellite images. The HRL IMD data set is an 8-bit raster file that includes the following codes: 0 = non-built-up areas; 1–100 = imperviousness level of built-up areas; 254 = clouds; and 255 = area outside working region. A threshold of 30 % was chosen as an approximation for the separation of non-urban and urban pixels (20 m × 20 m). (Given that all sealed surfaces are captured in the data, a 30 % threshold, or any other threshold, cannot remove roads and other large sealed surface areas outside settlements; see below.) A binary map was prepared in the form of a raster file using the following codes: 1 = imperviousness level between 30 % and 100 %; 0 = all other classes. This map was used for the calculation of all sprawl metrics. Accordingly, areas under the clouds were not included in the calculation of the metrics for 2006. For example, there are locations in Paris with clouds in 2006 (shown in blue in Map A3.1).

To avoid over- and under-estimation of urban cells under cloud cover for 2006 and 2009 in the estimation of temporal changes between 2006 and 2009, four cases have to be considered:

1. No clouds in 2006 and no clouds in 2009: the built-up area for 2006 and 2009 and the real changes can be measured correctly. This is most often the case (> 98 % of the time).

([1]) Under UNSC Resolution 1244/99.

2. Clouds in 2006 and in 2009: no information about the built-up areas or changes in them is available. This scenario is rare (< 0.05 % of the time).

3. No clouds in 2006, but clouds in 2009: in these areas, the information from 2006 was also used for 2009 because it is very likely that these built-up areas still existed in 2009 (i.e. were not demolished) (Figure A3.2). However, no information about the changes can be given. Therefore, this approach assumes no change between 2006 and 2009. Given that only a small part of the total area of Europe was covered by clouds in 2006, the underestimation in the decrease in built-up area in these cells is small (< 1 %).

4. Clouds in 2006, but no clouds in 2009: information on the built-up area in 2009 is available, but no changes can be determined because the information for 2006 is missing. The built-up areas detected in 2009 may have been in existence in 2006, or they may have been constructed after 2006. Therefore, those areas that were covered by clouds in 2006 were omitted from the HRL layer of 2009. As a consequence, the total size of the built-up areas in both years is underestimated, but the measurement of the real change between 2006 and 2009 is more accurate.

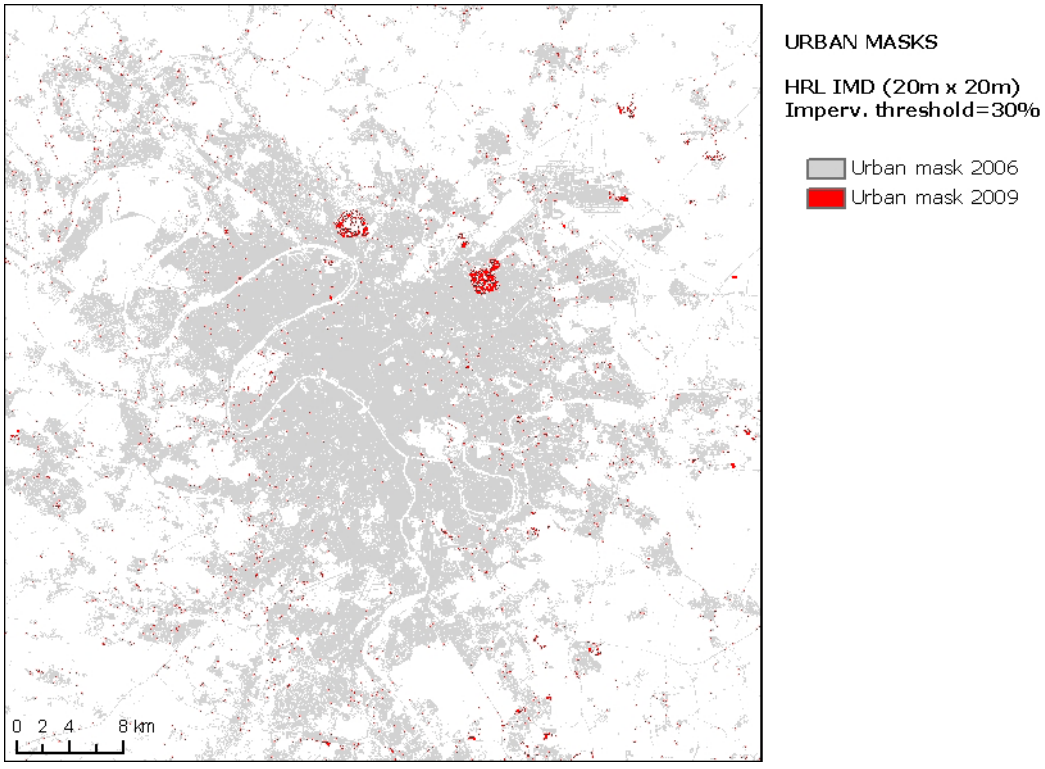
This approach implies that:

1. the real amount of built-up area is underestimated by a small percentage;

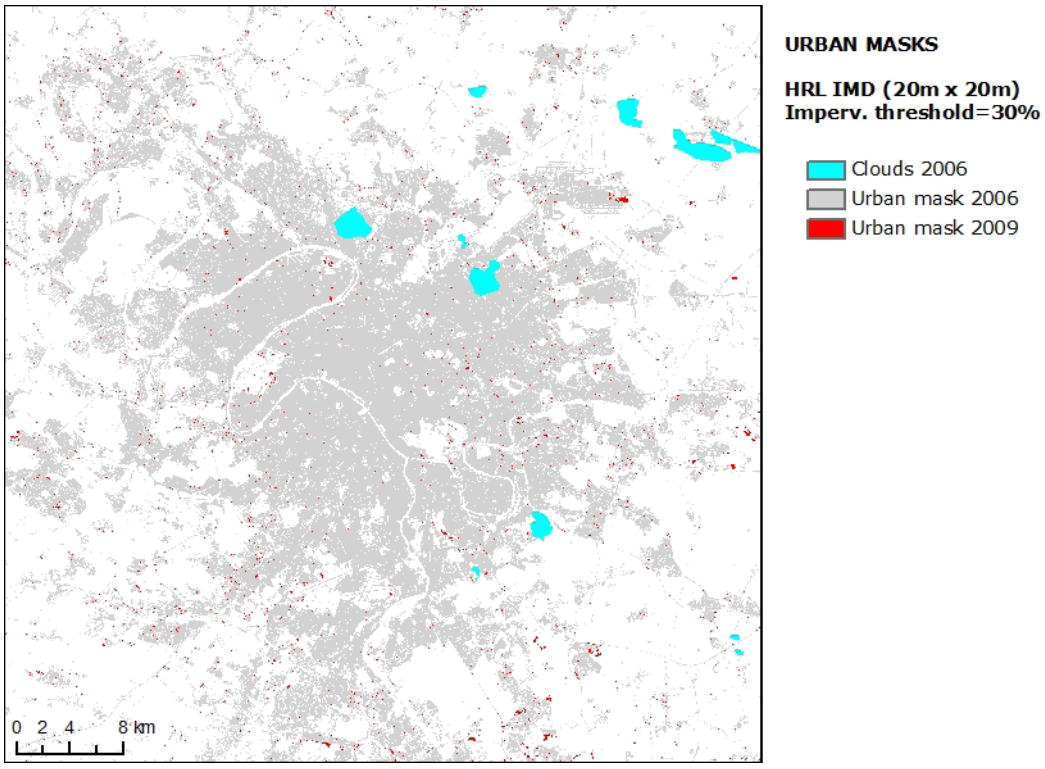
2. the change in built-up area between 2006 and 2009 is underestimated by a small percentage.

We used the 20-m raster data for all analyses to ensure the most accurate spatial information. The 100-m raster could also be used for future analysis. However, the 100-m 2006–2009 IMD change product from Geoland2 overestimates the sealing increase in already sealed areas (T. Langanke, EEA, personal communication Sept. 2, 2015). Preliminary checks of the data indicate that additional filtering to remove noise in the data has not been applied consistently. This means that the 2009–2012 change data will show a lower magnitude of change. A full reprocessing of the timeline will be done, but before these results are available, it is not possible to directly compare the change rates in already sealed areas for the periods 2006–2009 and 2009–2012 (T. Langanke, EEA, personal communication Sept. 2, 2015; see Section A3.1.3). Fortunately, the filtering through the 30 % threshold at the 20-m raster is likely to have removed most of these effects.

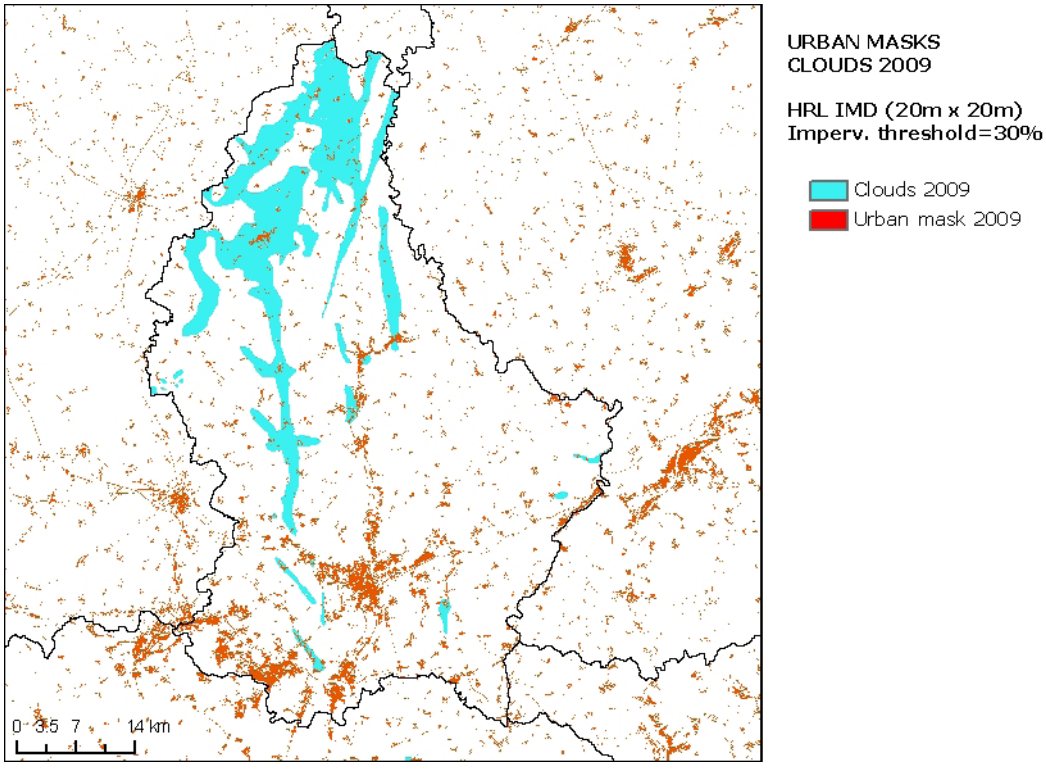
Map A3.1a **Urban map (20 m × 20 m) for 2006 (grey) for Paris on top of the urban map of 2009 (red) without the clouds of 2006**



Map A3.1b Urban map (20 m × 20 m) for 2006 (grey) for locations in Paris with clouds in 2006 shown in blue



Map A3.2 Illustration of the map of built-up areas for 2009. Urban pixels (red) that were located under clouds of 2009 (blue) were added from the 2006 data set into the 2009 data set if they were urban in 2006 (and not covered by clouds in 2006). Example from Luxembourg (pixel size 20 m × 20 m)



A3.1.2 Example of Finland

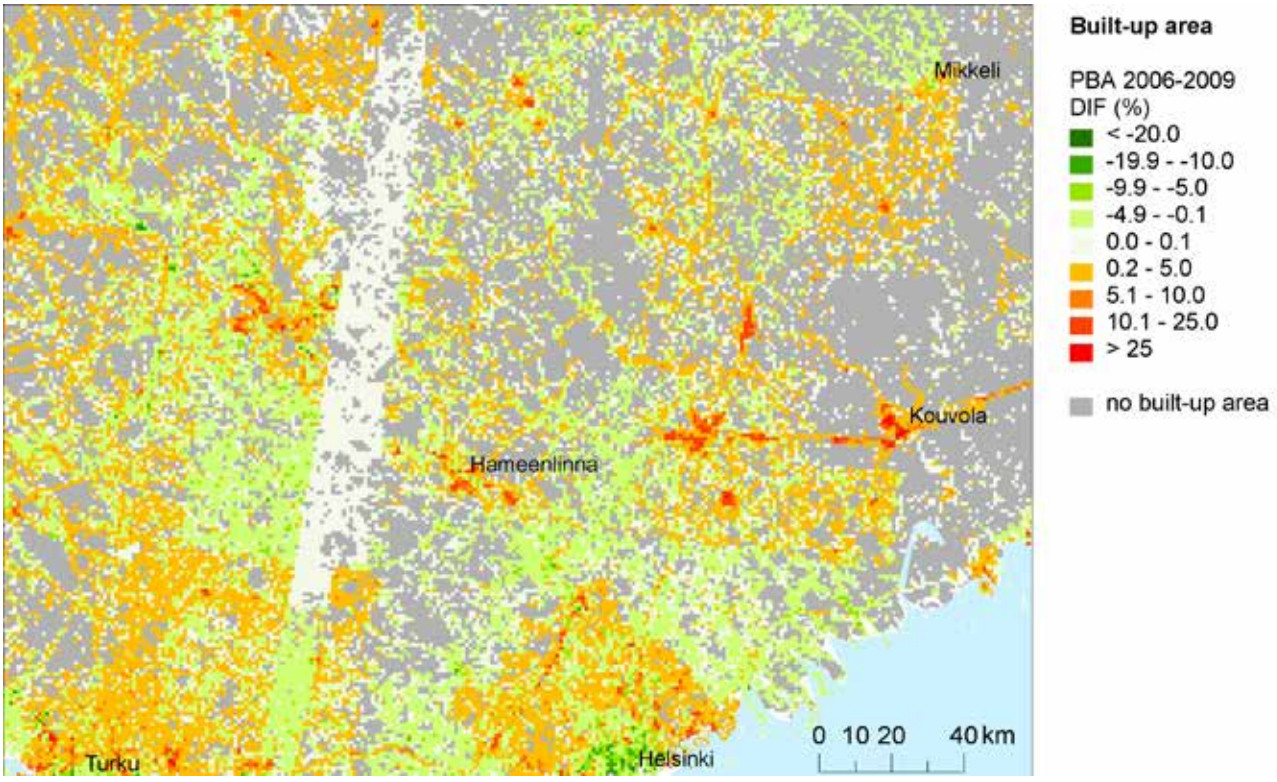
The HRL data sets are based on satellite images. There are more clouds in the more northern parts of the satellite images. According to the product specification of the HRL IMD data set, the layers can contain up to 5 % cloud coverage per country. However, across Europe, the cloud cover in the HRL IMD data for 2009 is much smaller, at < 0.2 %. This has an insignificant influence on the results at the country and NUTS-2 scales. It affects the change detection of the 1-km^2-grid in only a limited number of cells.

For example, the map of changes in the percentage of built-up area (*PBA*) between 2006 and 2009 in Finland at the 1-km^2-grid level exhibits an almost vertical stripe of cells with 'no change' (Map A3.3; shown in white). Cells with 'no change' would usually be spread in a rather irregular pattern in a country. It is unusual to see such a pattern of a vertical stripe. This issue seems to be attributable to the fact that there were clouds present in these parts of Finland in 2009 when the HRL IMD data were collected.

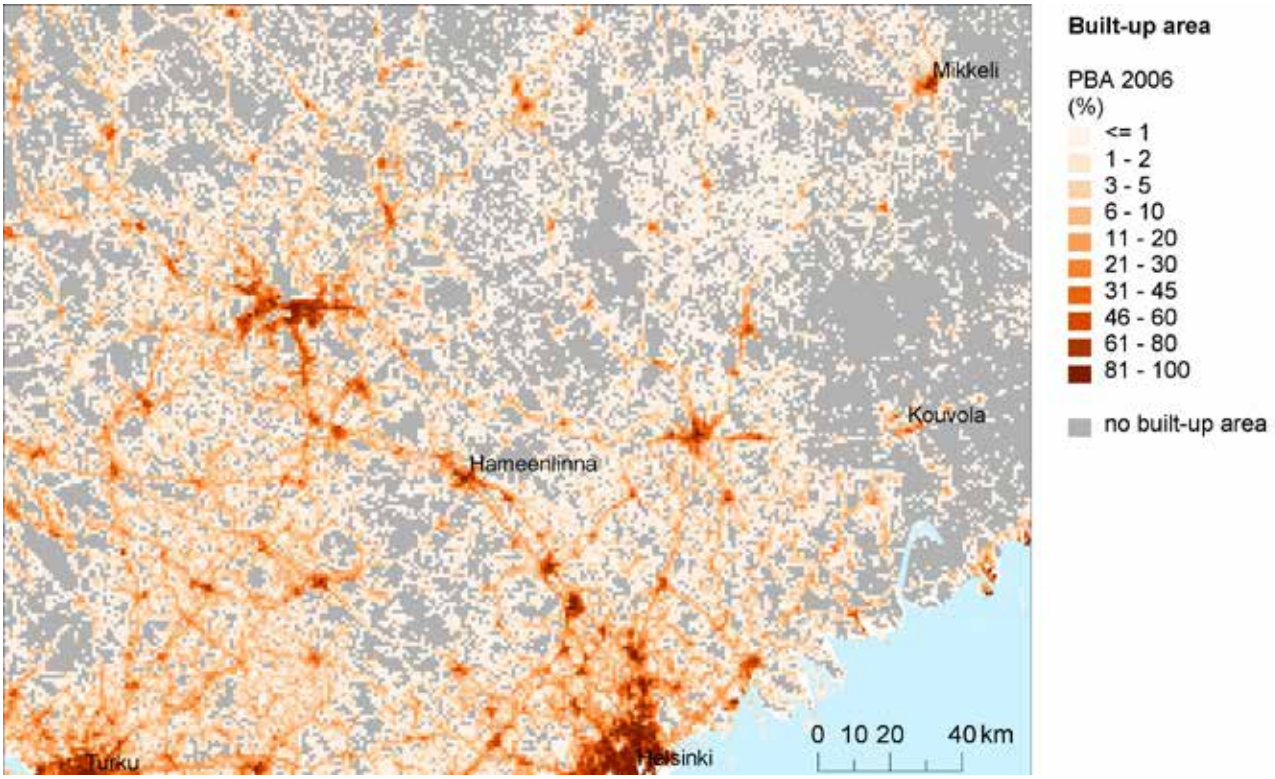
In the case that there were clouds in the HRL IMD data for 2009, but no clouds in the 2006 data, the 2009 data were filled in from the 2006 data set as the best possible approximation. This approach resulted in the 'strangely shaped' areas of 'no change'.

Therefore, the 2006 and 2009 cloud maps (Map A3.7) delineate the areas of 'no change' over Europe. Accordingly, such areas are expected mainly in Denmark, Finland, Ireland, Norway, Sweden and the United Kingdom.

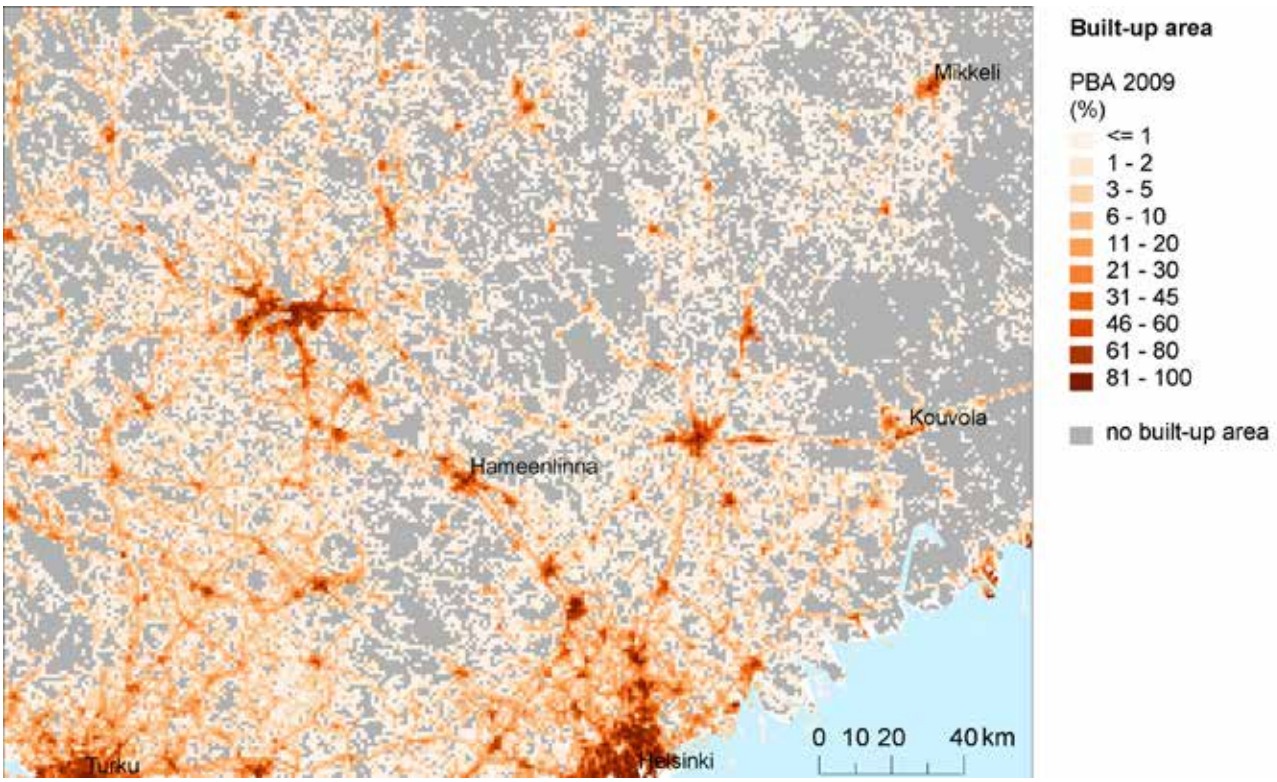
Map A3.3 **Part of the map of changes in *PBA* 2006–2009 for Finland at the 1-km^2-grid level. A vertical stripe of cells with 'no change' is visible (in white)**



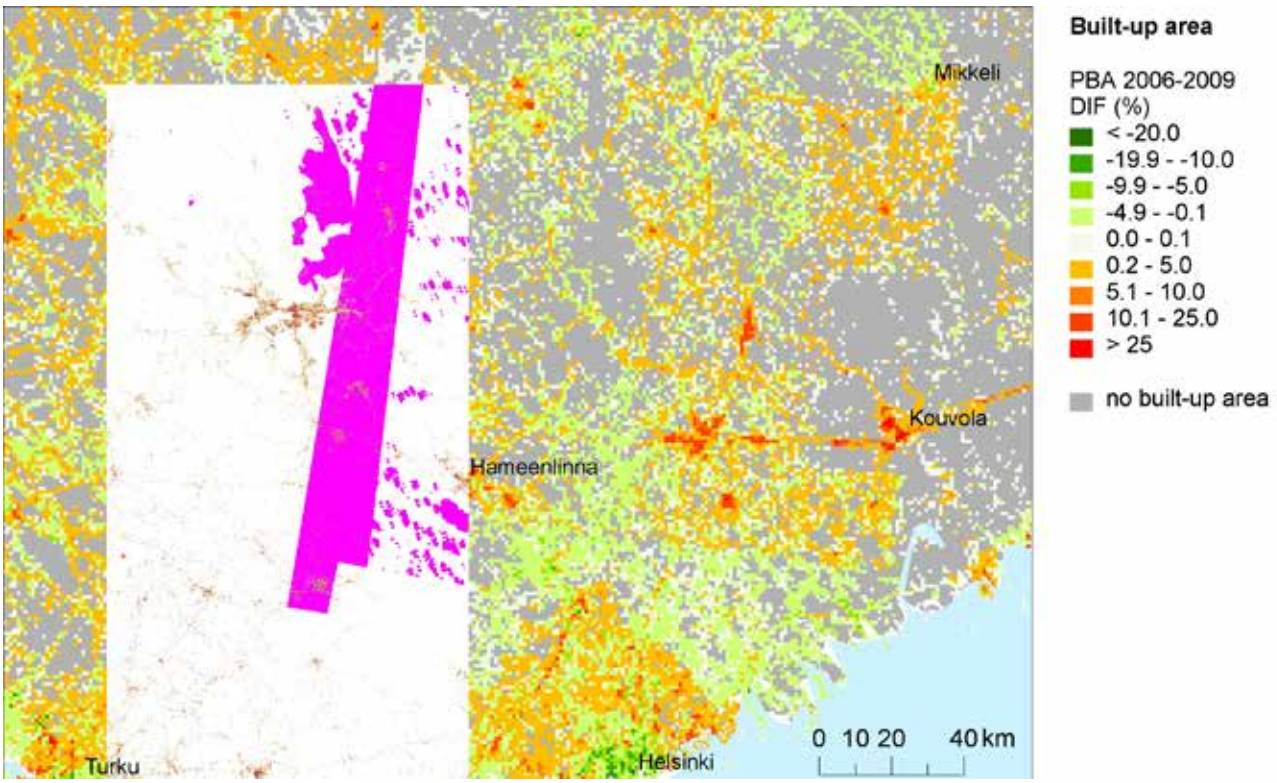
Map A3.4 **Map of *PBA* in 2006 from Finland at the 1-km²-grid level. There were no clouds present in 2006 when these HRL IMD data were collected**



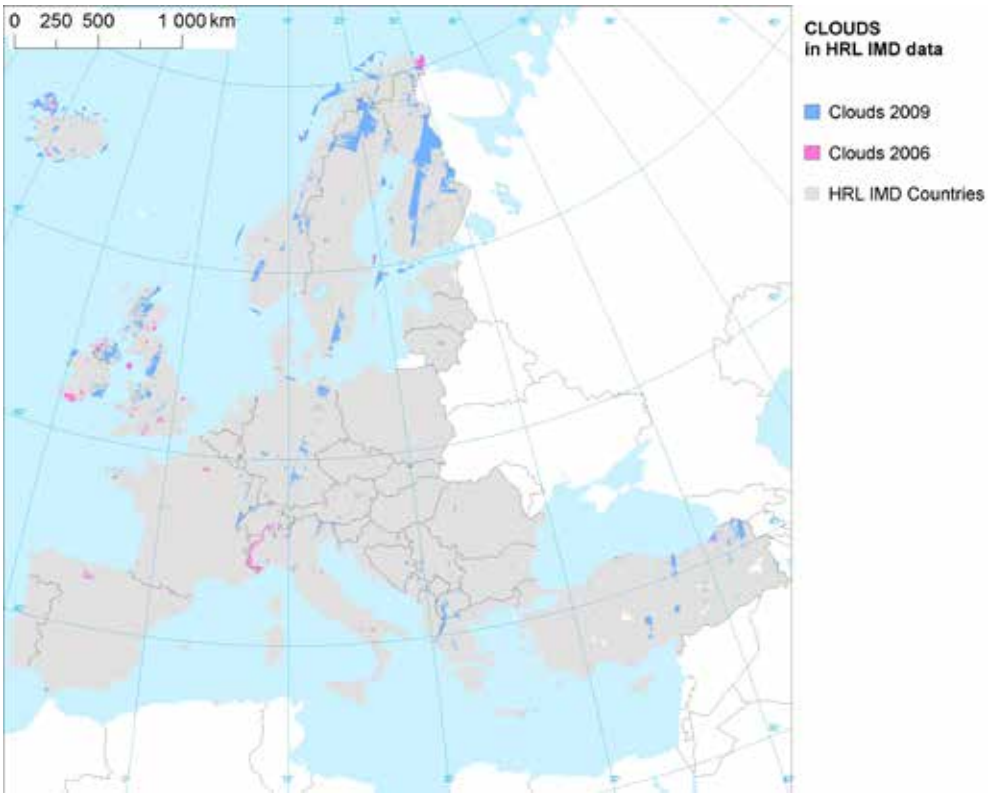
Map A3.5 **Map of *PBA* in 2009 from Finland at the 1-km²-grid level. The areas covered by clouds in 2009 are not visible on this map because they were replaced by the 2006 values**



Map A3.6 **Source data (pixels of the HRL IMD are visible on the left) with the path of clouds (in magenta) in 2009, and the map of changes in *PBA* on the right as shown above (Map A3.3)**



Map A3.7 **Map of clouds in 2006 (pink) and 2009 (blue) in Europe in the HRL IMD data set**



A3.1.3 Change detection: example of London

The map of London exhibits some cells in the 1-km^2-grid where there is a decrease in *PBA* between 2006 and 2009. It may be unexpected in a large city such as London that the *PBA* would decrease in those locations. Map A3.8 shows a zoom of the 1-km^2-grid with an example of a decrease in *PBA* in London (shown in green).

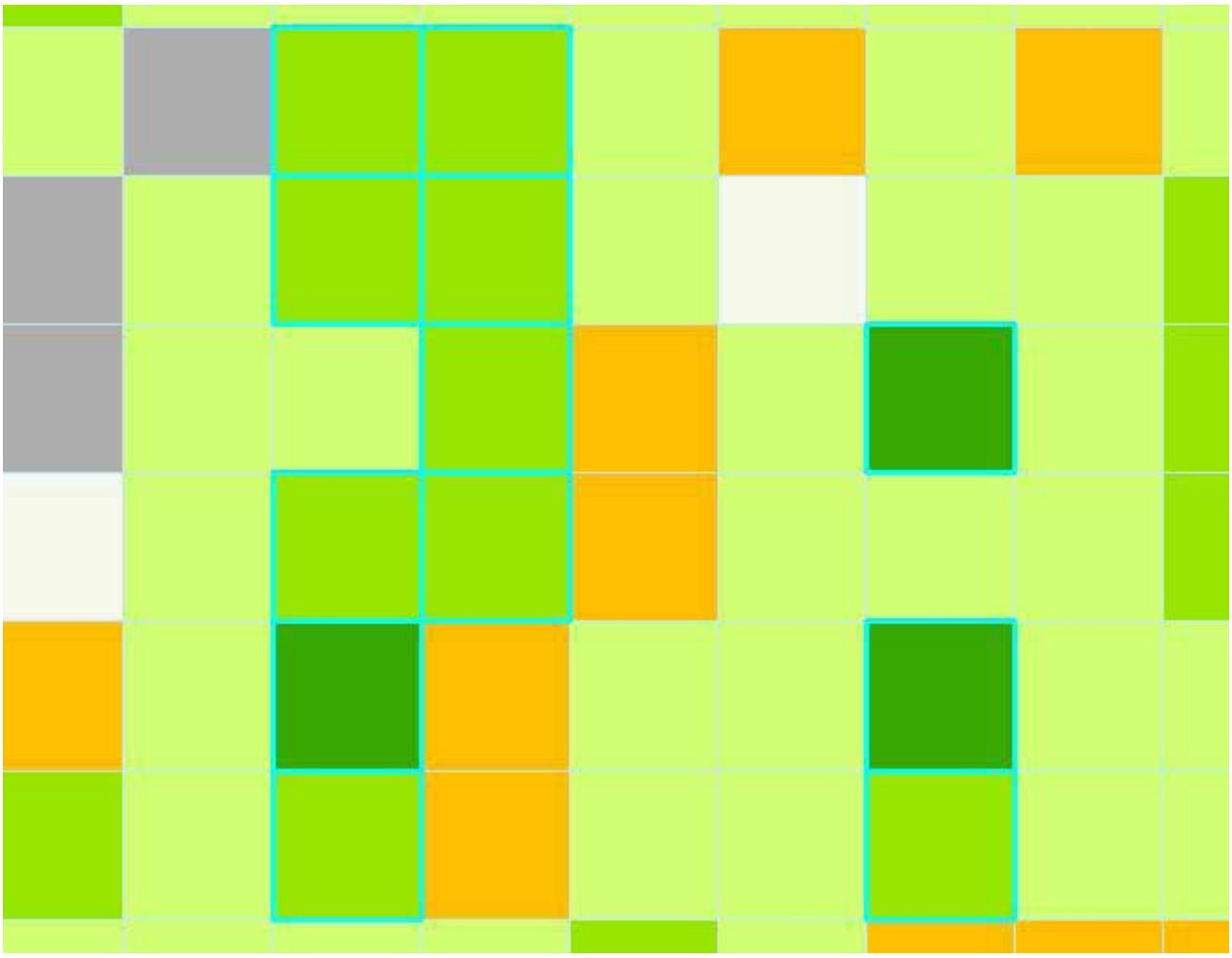
The degree of imperviousness for each 20 m × 20 m pixel of the HRL IMD data set was derived from the Normalised Difference Vegetation Index (NDVI), which is calculated automatically from satellite scenes.

The source data show the imperviousness degrees for 2006 (Map A3.9) and 2009 (Map A3.10). The same legend was used in both data sets.

A change in imperviousness degree between 2006 and 2009 from values > 30 % to values < 30 % is visible in several cells (from orange or brown to green). This results in a reduction in the values of *PBA* for the respective 1-km^2 cells. Considering the 30 % threshold for built-up pixels, these changes result in a local decrease of 'built-up area' for some grid cells. This can be a result of measures taken on the ground to reduce the areas covered by impervious surfaces, but it does not necessarily suggest that the *PBA* has decreased. It may be attributable to a shift in the detection of the degree of imperviousness based on the NDVI or could be caused by a calibration error between NDVI values calculated for the 2006 and 2009 images.

Very low imperviousness values are the least reliable overall (in particular, low-level changes on pixels that are already sealed). One could apply a threshold of

Map A3.8 Zoom of the 1-km^2 grid with an example of a decrease in *PBA* in London (green cells)



Map A3.9 Imperviousness degree of the example area shown in Map A3.8 in 2006

Note: Green indicates an imperviousness degree of 1–29 %; orange-brown-red indicates an imperviousness degree of 30–100 %; pink indicates clouds. The pixels indicate a size of 20 m × 20 m (50 × 50 pixels in each grid cell of 1 km^2).

30 % to have a more reliable sealing mask by removing some pixels with very low imperviousness values. A threshold means a reduction in the overall area created for the binary imperviousness mask. Using a threshold of 30 % (and not a lower value) was suggested in a validation report by the Institute of Geodesy, Cartography and Remote Sensing (FÖMI) in 2010 (Maucha et al., 2010). Therefore, the 30 % threshold is to some extent supported by testing performed by the European Topic Centre (ETC). In the creation of the Imperviousness Degree (IMD) product and the change product (IMC), a threshold of 30 % is used twice: first, the countries perform verification and enhancement based on a 30 % density-filtered mask (i.e. to map and label omission and commission errors) and second, the service providers remove changes of < 30 % in already sealed pixels for the creation of the change product.

These changes represent 'technical change', so they are likely to be noise rather than real change signals.

When the ETC checked the 100 largest positive and negative change areas for the 2006–2009 data (for both Hungary and EEA-39), they found that almost all negative changes were not real (e.g. greenhouses) (T. Langanke, EEA, personal communication, Sept. 2, 2015). Both the 2006–2009 and the 2012 imperviousness products should have a filter for 'technical changes' applied for already sealed pixels. This is done by the service providers producing the IMD and IMC products to address the issue of variation within sealed areas for every reference year that shows different sealing levels for the same pixel, even if sealing actually stays the same. If this noise (or technical change) is counted as real change, large amounts of low-level positive and

Map A3.10 Imperviousness degree of the example area shown in Map A3.8 in 2009

Note: Green indicates an imperviousness degree of 1–29 %; orange-brown-red indicates an imperviousness degree of 30–100 %; pink indicates clouds. The pixels indicate a size of 20 m × 20 m (50 × 50 pixels in each grid cell of 1 km²).

negative change in sealed areas would be detected. Therefore, there is a step (sealing change analysis with thresholds) in the creation of the change product, where changes of < 30 % for already sealed pixels (new sealing < 30 % is still captured) are filtered out, and consequently removed from the 100-m change product and the final 100-m status layer. This filtering is currently not applied on the 20-m status layer, which should therefore not be used for change monitoring. This will probably be changed in the future to fully harmonise the 20-m and 100-m products. In this sense, the low-level changes in the original 20-m status layers are filtered with 30 %, such that only changes > 30 % make it into the change product and the 100-m status layer. There may still be < 30 % changes (positive or negative) in the final 100-m change product because they might be caused by strong change signals (> 30 %) in the underlying 20-m data. If a cut-off or filter is used to derive a built-up mask on the final 100-m status layer, some pixels will indeed be lost and others gained. In general, most negative change signals in the IMD data are false, given that de-sealing rarely happens in reality. Therefore, any decreases should be interpreted with caution.

An additional issue is still under investigation. Much more change was discovered in the 2006–2009 change data set than in the new 2009–2012 change product. This is likely to be due to a combination of higher omission and commission errors in 2006 and 2009 (which are now corrected), and perhaps to an inconsistent or erroneous application of the 30 % filtering on the side of the Geoland2 project when creating the 2006–2009 change product. This will

be checked in more detail in the future (i.e. a direct comparison of the change rates for the two periods, that is 2006–2009 and 2009–2012). However, the existing 2006 and 2009 data remain the best sealing information available at this point in time.

The HRL layer includes wide roads in the open countryside, whereas narrow roads are not included because they are not detected. It was not possible to remove the wide roads because any algorithm for removing them would have caused a larger error than leaving them in the data set.

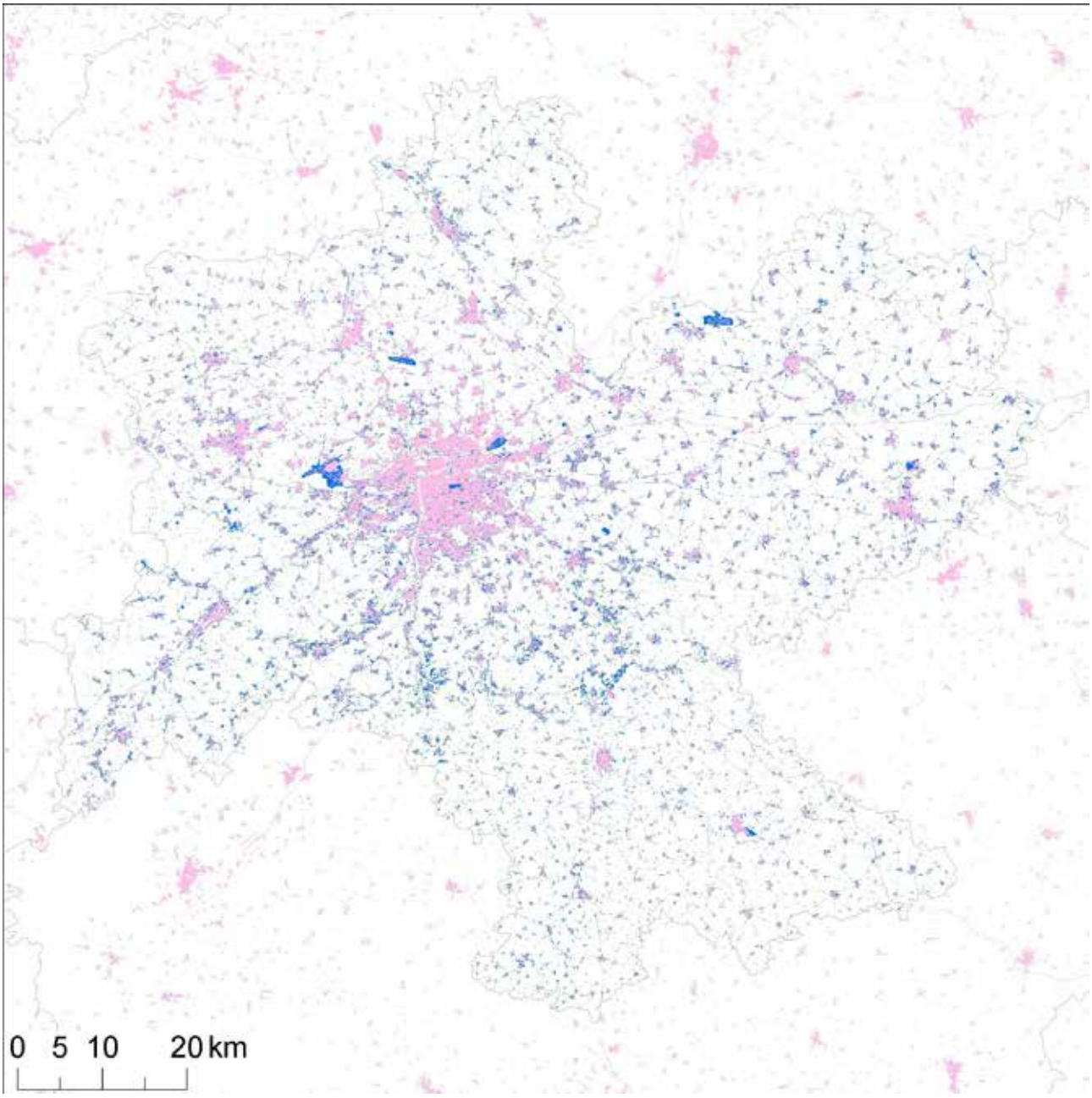
A3.2 Comparison with Urban Atlas data

We compared the built-up areas based on two data sets from Copernicus Land service relevant for urban monitoring: the HRL IMD layer in 2006 and the Urban Atlas data for the same year. Here, we provide examples from three countries: Czech Republic (Prague), Germany (Ruhr region) and Spain (Galicia). We used Urban Atlas data because they are developed using more precise satellite imagery with the support of *in situ* data (national data). They are not only based on satellite images, but also use national data to verify the categorisation of the Urban Atlas land-cover classification. However, Urban Atlas data are not available for complete EU coverage. They are available only for Functional Urban Areas (FUAs), which are defined as 'densely populated municipalities (urban cores) and adjacent municipalities with high levels of commuting towards the densely populated urban cores (hinterland)' (OECD, 2013: 30). FUAs can extend across administrative boundaries, reflecting the economic geography of where people actually live and work.

In the following figures, the pink colour represents the HRL IMD layer, and the blue colour indicates the Urban Atlas layer. The HRL IMD layer is on top of the Urban Atlas layer. This makes areas that are not covered by the HRL IMD layer visible. In turn, almost all the areas that are part of the HRL IMD layer are also covered in the Urban Atlas (they are not shown here because they are so small). The imperviousness threshold for the differentiation of urban and non-urban cells was set to 30 %. Accordingly, the classes used from the Urban Atlas include all artificial surfaces (type 1) except the following classes: 11240 — Discontinuous Very Low Density Urban Fabric (Sealing level < 10 %); 11230 — Discontinuous Low Density Urban Fabric (Sealing level 10–30 %); 13100 — Mineral extraction and dump sites; 13300 — Construction sites; 13400 — Land without current use; 14100 — Green urban areas; and 14200 — Sports and leisure facilities (see http://www.eea.europa.eu/data-and-maps/data/urban-atlas#tab-methodology).

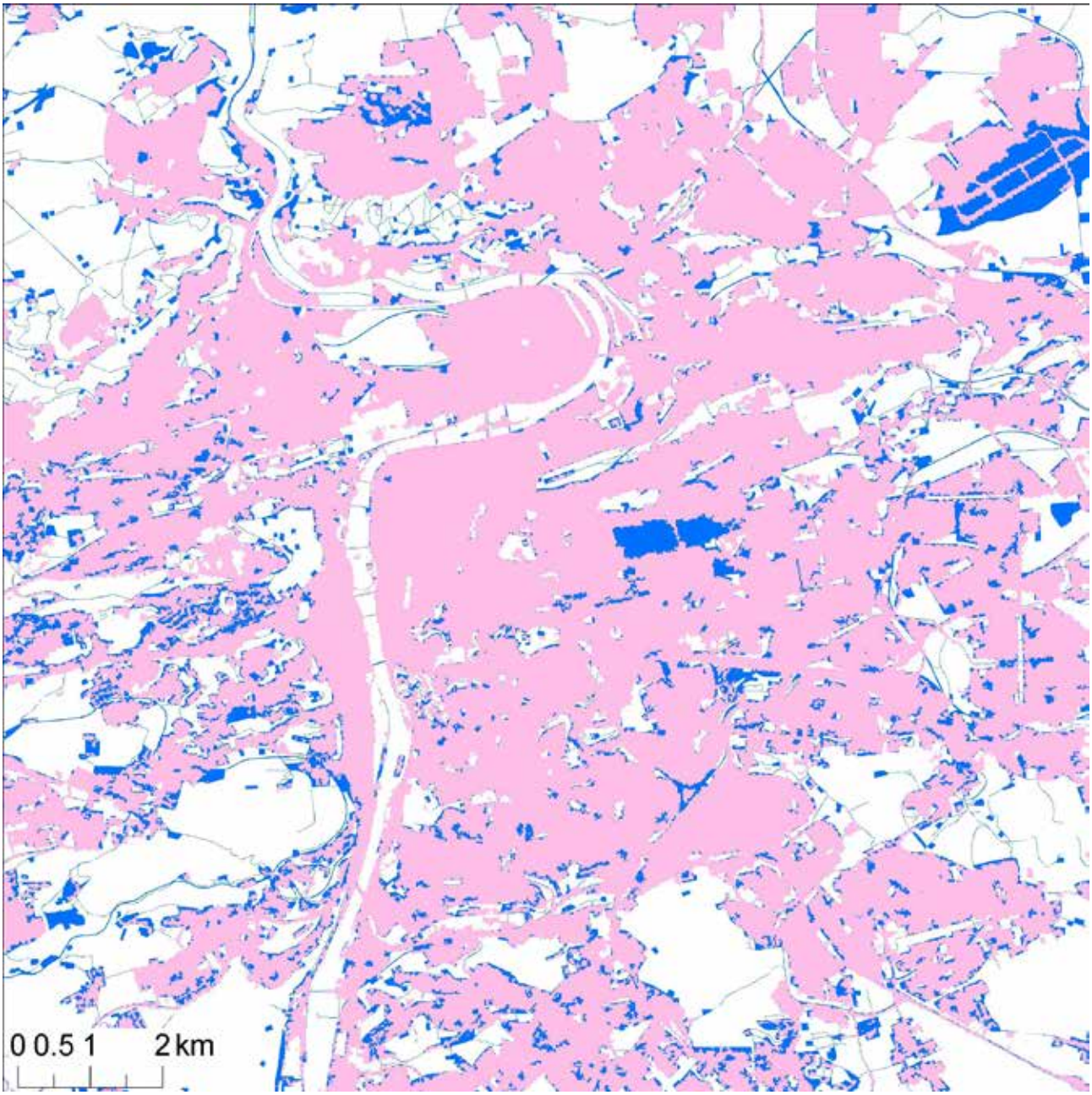
A3.2.1 Prague (Czech Republic)

Map A3.11 Prague (Czech Republic). Overlay of the built-up areas according to HRL IMD (30 %) (pink) on top of Urban Atlas data layer (blue) (reference year 2006)

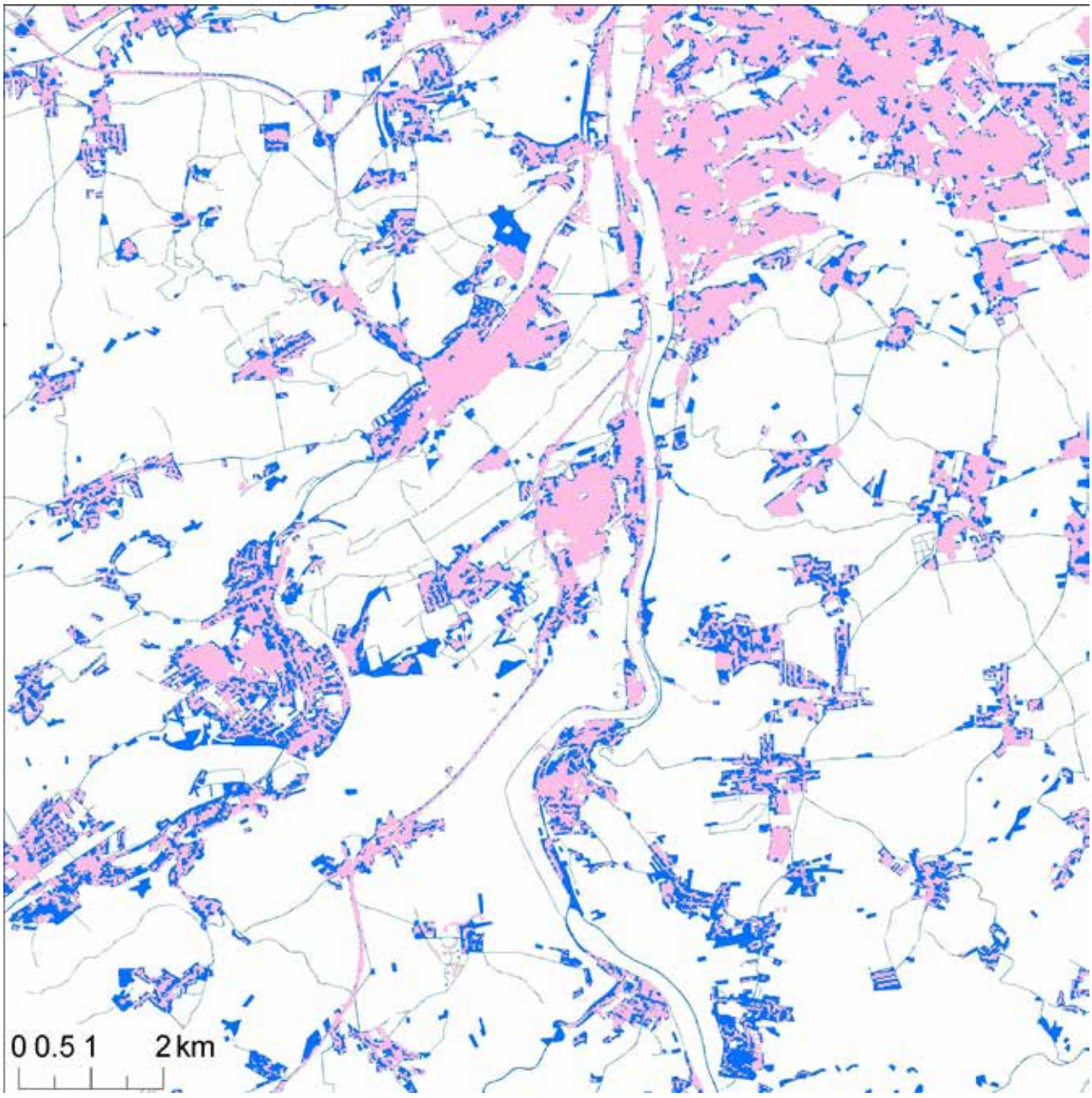


Note: HRL is a raster data set in 20 m × 20 m cells; Urban Atlas is a vector data set.

Map A3.12a **Two examples from the Prague region (Czech Republic). Overlay of the built-up areas according to HRL IMD (30 %) (pink) on top of Urban Atlas data layer (blue)**



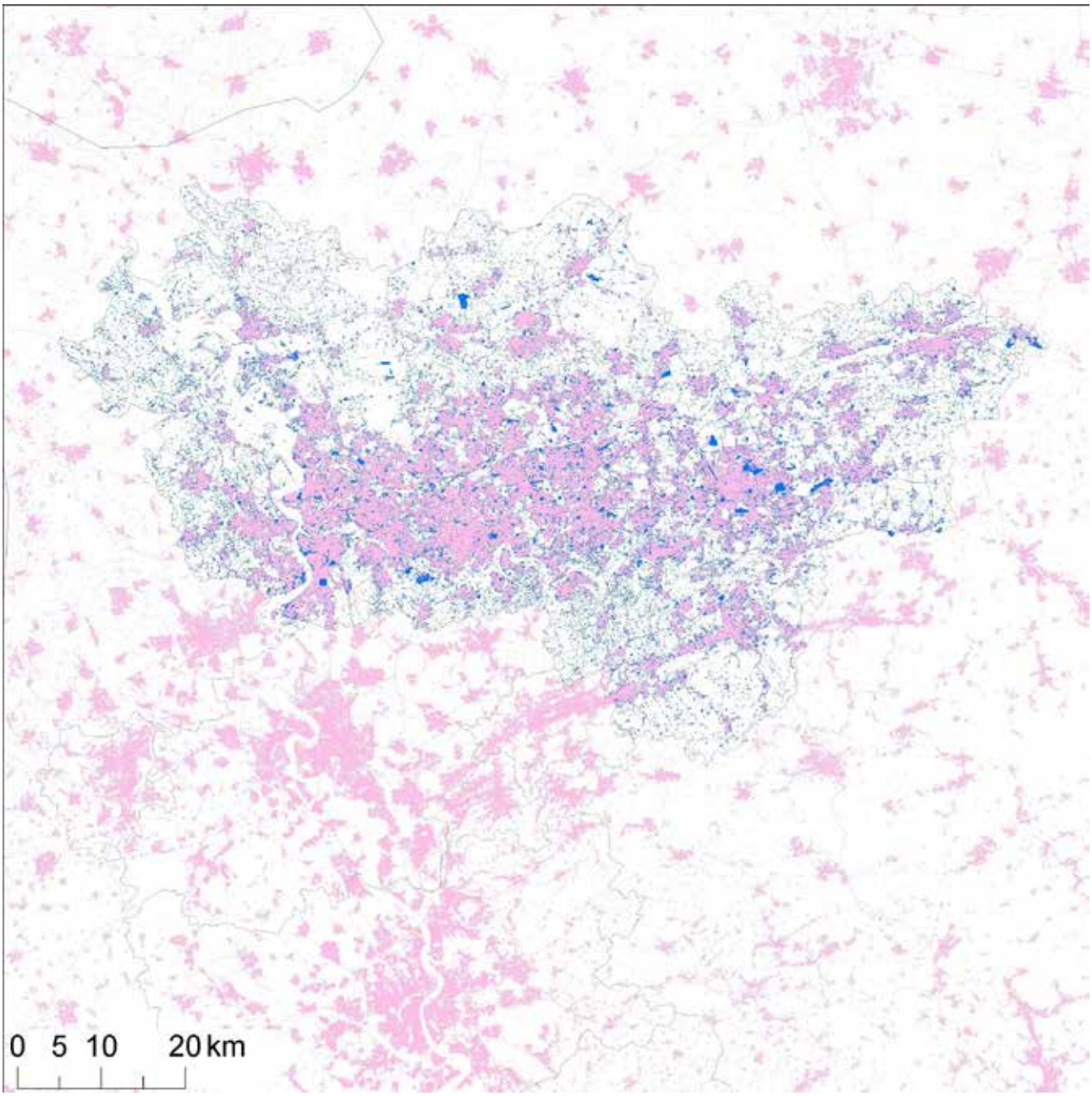
Map A3.12a **Two examples from the Prague region (Czech Republic). Overlay of the built-up areas according to HRL IMD (30 %) (pink) on top of Urban Atlas data layer (blue)**



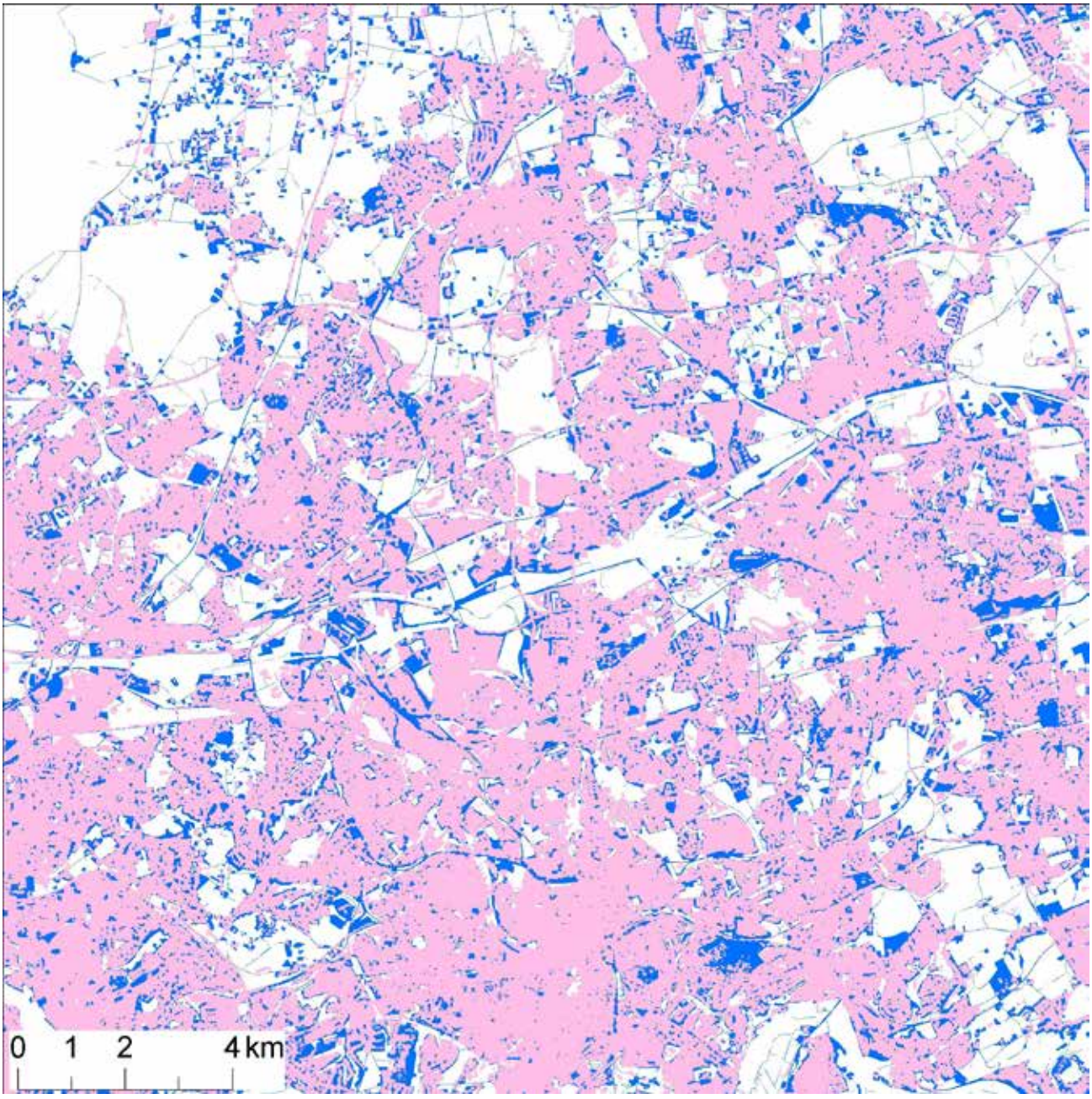
A3.2.2 Ruhr metropolitan region (Germany)

The Ruhr metropolitan region includes several major cities such as Dortmund, Bochum, Essen, Duisburg, Oberhausen, Bottrop, Mülheim an der Ruhr, Gelsenkirchen, Herne, Recklinghausen, Hagen and Hamm.

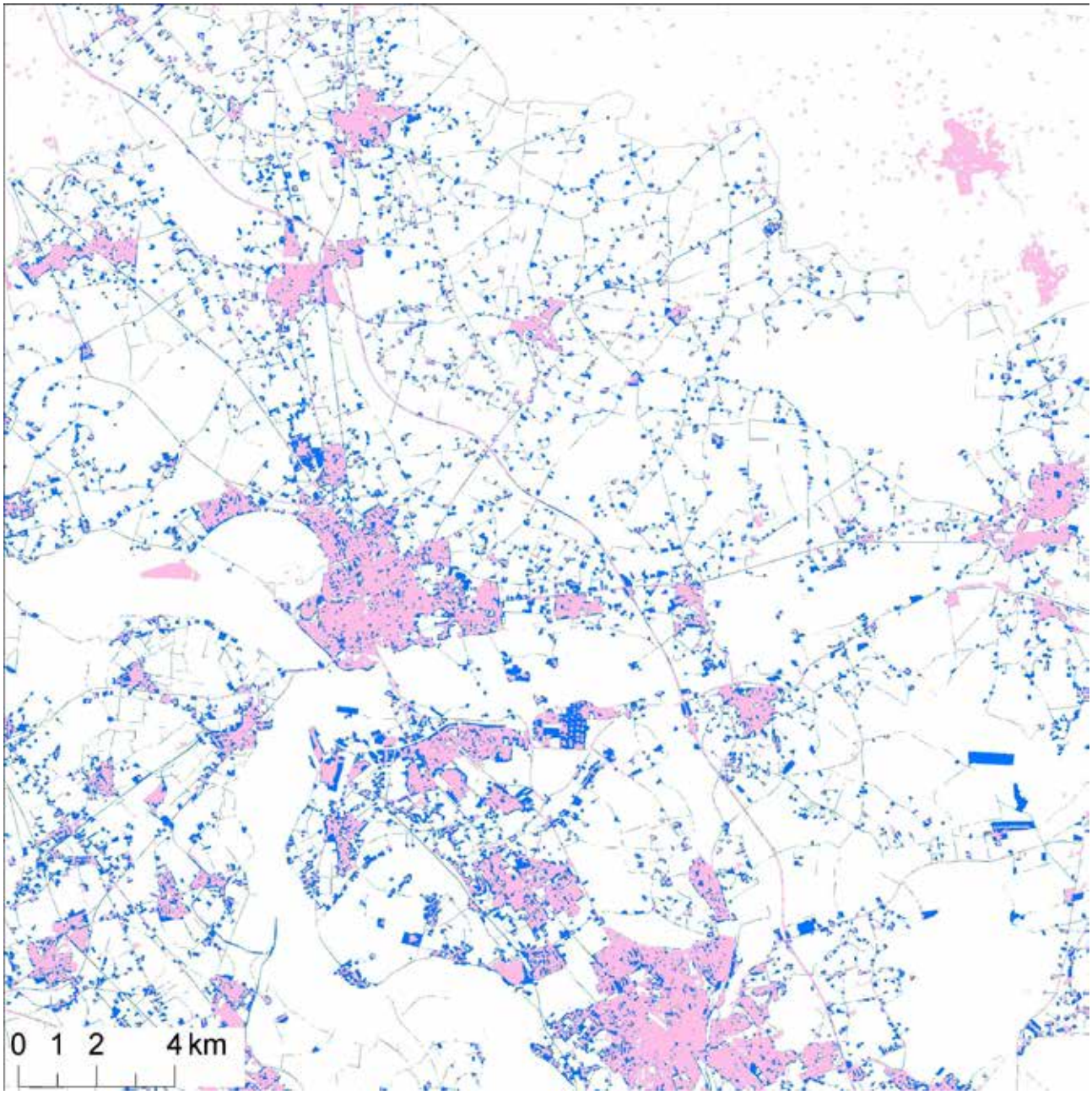
Map A3.13 Ruhr metropolitan region (Germany) (named 'Lange Urban Zone of Essen'). Overlay of the built-up areas according to HRL IMD (30 %) (pink) on top of Urban Atlas data layer (blue) (reference year 2006)



Map A3.14a **Two examples from the Ruhr metropolitan region (Germany). Overlay of the built-up areas according to HRL IMD (30 %) (pink) on top of Urban Atlas data layer (blue)**

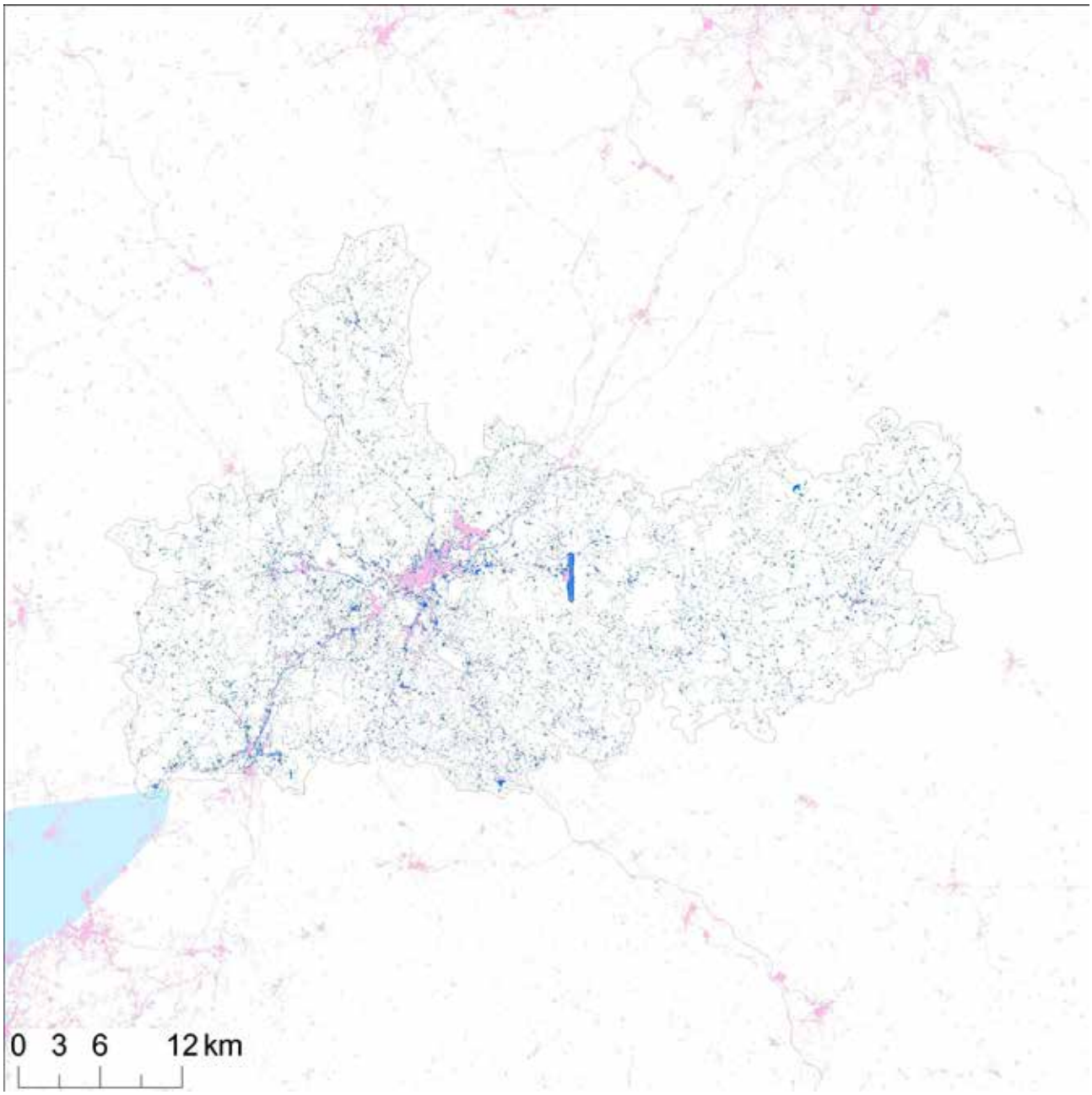


Map A3.14b **Two examples from the Ruhr metropolitan region (Germany). Overlay of the built-up areas according to HRL IMD (30 %) (pink) on top of Urban Atlas data layer (blue)**

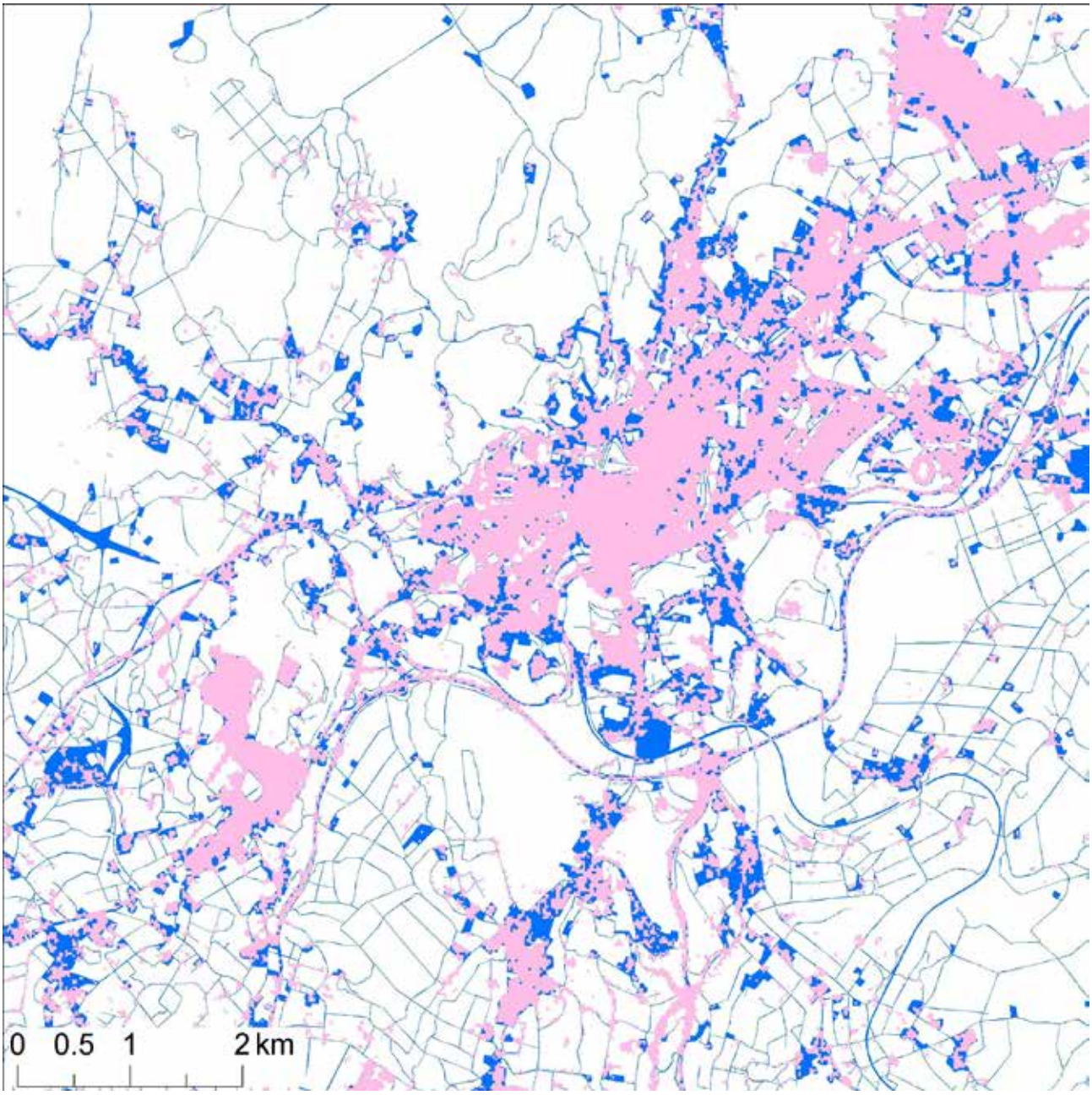


A3.2.3 Santiago de Compostela (Galicia, Spain)

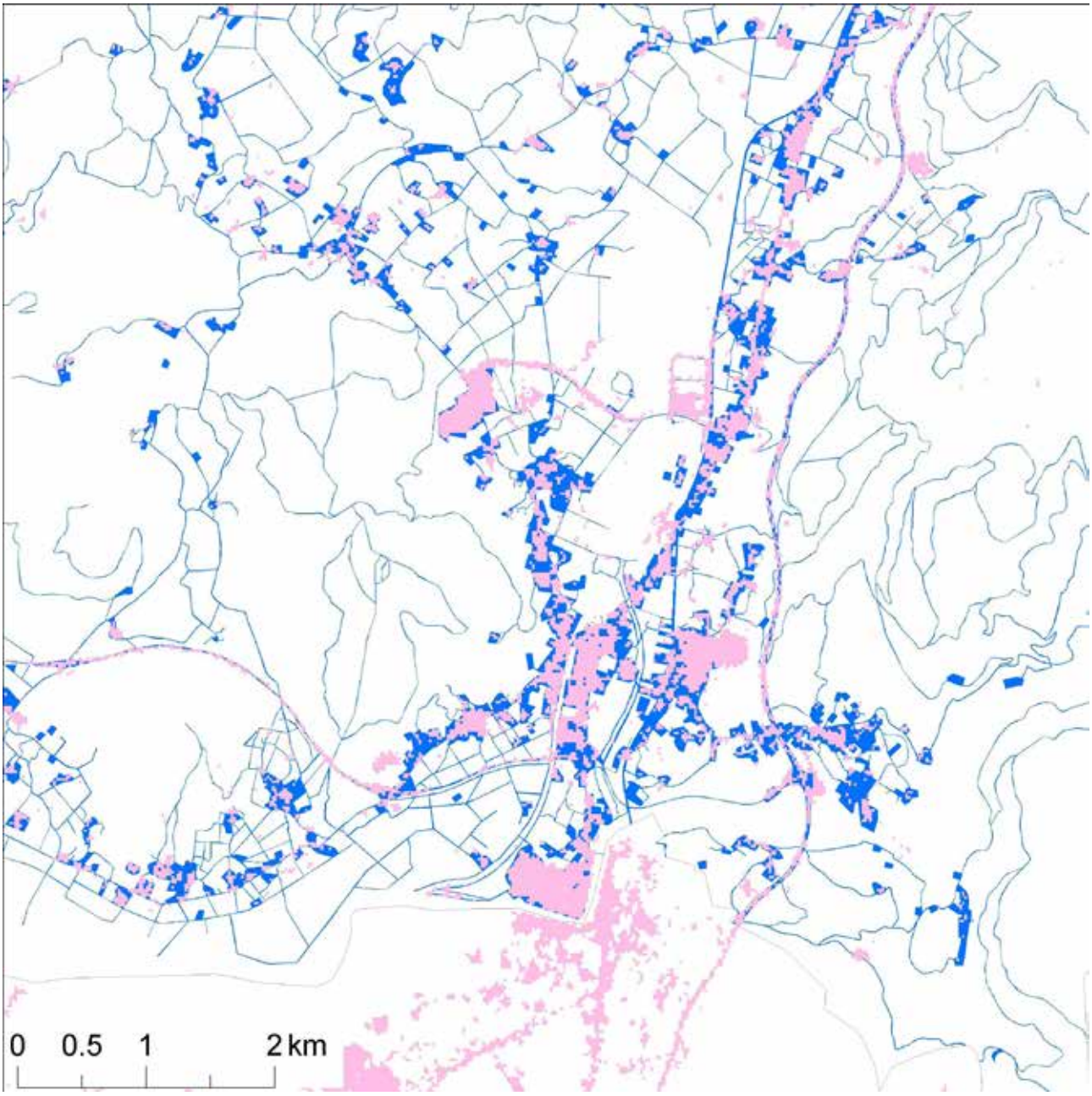
Map A3.15 **Santiago de Compostela, Galicia (Spain). Overlay of the built-up areas according to HRL IMD (30 %) (pink) on top of Urban Atlas data layer (blue) (reference year 2006)**



Map A3.16a **Two examples from the Santiago de Compostela region (Galicia, Spain). Overlay of the built-up areas according to HRL IMD (30 %) (pink) on top of Urban Atlas data layer (blue)**



Map A3.16b Two examples from the Santiago de Compostela region (Galicia, Spain). Overlay of the built-up areas according to HRL IMD (30 %) (pink) on top of Urban Atlas data layer (blue)



A detailed comparison with the national data from Switzerland was also performed. This resulted in the application of a linear correction factor (*LCF*) for the calculation of the amount of built-up areas in the HRL IMD data set (see Annex A3.4). A visual comparison of the data sets in three example regions is given in Annex A2.2.

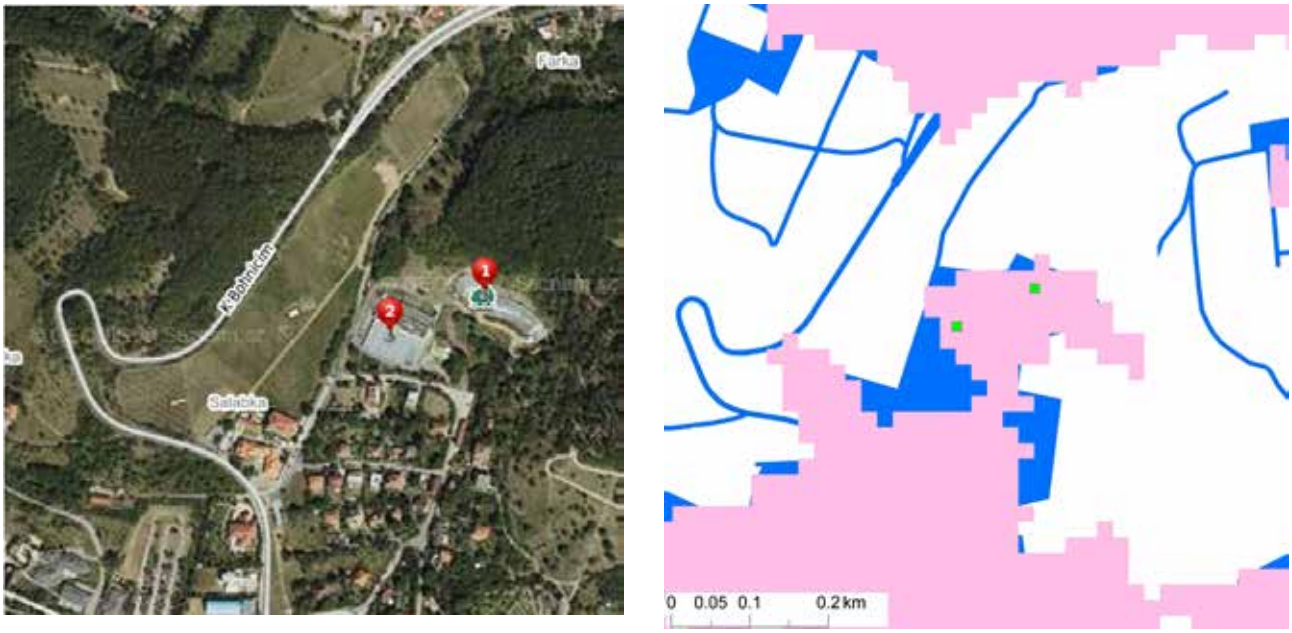
A3.3 Greenhouses

Greenhouses are included in the definition of built-up areas used in this report. An important argument is that urban sprawl is perceived visually and that all buildings contribute. Greenhouses are buildings and are visually perceived and, therefore, they are covered by both the HRL IMD and Urban Atlas data (Map A3.17).

According to the product specifications of the GMES/ Copernicus Initial Operations for the Land Monitoring Service land imperviousness HRL, 'greenhouses should be classified as impervious surfaces' (EEA, 2015a). In some regions, greenhouses cover rather large areas (e.g. almost 200 km^2 in Almeria (Spain), where greenhouse farming is the most important economic activity, and more than 100 km^2 in the Netherlands).

There are some areas, for example in southern Spain, for which there is an error in the IMD 2006 and 2009 data. In one year they are correctly classified as sealed, but in the other reference year they are classified as non-sealed, which results in a false change signal (T. Langanke, EEA, personal communication 2 September, 2015).

Map A3.17 **Examples of two greenhouses from the Botanic Garden of Prague. (a) Satellite image (Google Maps). (b) Overlay of the built-up areas according to HRL IMD (30 %) (pink) on top of Urban Atlas data layer (blue). Both layers cover the greenhouses**



Notes: Cells represent 20 m × 20 m; Urban Atlas data is a vector data set.

A3.4 Linear correction factor for built-up areas

The built-up area is rather difficult to measure precisely and often differs largely between different source data. It was necessary to implement a correction factor for the calculation of the built-up areas in Europe. This correction factor is based on the comparison of the results from the HRL IMD data set with the results from the V25 data set for the NUTS-2 regions in Switzerland.

The base data for the settlement areas were Swisstopo's digital landscape model swissTLM3D at a scale of 1:25 000 (for 2010) and V25 (for 2002, same scale). The swissTLM3D is a topographical landscape model that includes both natural and artificial landscape features in vector form. V25 includes a layer of settled areas, which were manually captured along their borders. However, for 2010, only 85 % of the settlement areas could be obtained from the swissTLM3D. For the missing 15 %, cantonal data sets were used, mostly for the cantons of Zurich, Lucerne, Obwalden and Nidwalden.

Data on inhabitants and jobs were drawn from two different sources. Population data were drawn from the 2010 and 2000 censuses. Data on jobs for 2010 and 2002 were drawn from the 2008 and 2001 federal business censuses.

Switzerland has seven NUTS-2 regions. Two are identified by means of a single canton; the other five are regions comprising several cantons:

- CH01: Region Lemanique (Geneva, Vaud, Valais);
- CH02: Espace Mittelland (Berne, Solothurn, Fribourg, Neuenburg, Jura);
- CH03: Nordwestschweiz (Basel-Stadt, Basel-Landschaft, Aargau);
- CH04: Zurich (Zurich);
- CH05: Ostschweiz (St Gallen, Thurgau, Appenzell-Innerrhoden, Appenzell-Ausserrhoden, Glarus, Schaffhausen, Graubünden);
- CH06: Zentralschweiz (Uri, Schwyz, Obwalden, Nidwalden, Luzern, Zug);
- CH07: Ticino (Ticino).

On average, the built-up areas are 29 % smaller in the Pan-European High Resolution Layers of Imperviousness (HRL-Imp) data set than in the V25 data set (using V25 as 100 %). These differences vary between 23.8 % and 33.7 % in the NUTS-2 regions. Accordingly, the built-up areas in the V25 data set are, on average, 40.9 % (more precisely: 40.8686 %, see below) larger than in the HRL-Imp data set (using HRL-Imp as 100 %). Therefore, it is necessary to implement a correction factor for the calculation of the built-up areas in Europe (see arguments below).

After the application of the *LCF*, the differences in *WUP* in the NUTS-2 regions of Switzerland varied between 0 % and 12 %. Even more importantly, the ranking of the NUTS-2 regions is the same as when calculating *WUP* with V25. We therefore conclude that the HRL-Imp is very suitable for sprawl analysis on a European scale and that there is a very good agreement between HRL-Imp and V25 data (after application of the *LCF*).

The determination of the correction factor is based on the following rationale:

1. For Europe, a consistent data set is needed that covers all of Europe. The HRL IMD data set is the best available data source (Orlitová et al., 2012).

2. According to the definition of urban sprawl, the measurement of sprawl is based on the land taken up by settlements (for residential, commercial and industrial purposes) in the landscape.

3. The V25 data set delineates land uptake for settlements according to the definition of urban sprawl. The category of 'built-up areas' in V25 is one of the primary land cover categories. In addition to the footprints of the buildings, this also includes the parcels on which the buildings are constructed (e.g. the garden around a house, where no additional main building can be constructed). As the parcel is taken up by the settlement area, no additional main building can be constructed on it.

4. The HRL IMD data set, however, captures impermeable areas. We chose the 30 % threshold according to previous tests (Orlitová et al., 2012). This is a good approximation of the built-up area, but there are some systematic differences: for example, in the centres of cities, the impervious area will usually be larger than in residential areas, although in both cases the land is taken up for settlement purposes. Therefore, it is desirable and possible to compare the amount of impervious area with the amount of land uptake for all regions for which such data sets exist. The V25 has high accuracy and high consistency across Switzerland. Another advantage of this data set is that it covers many different types of settlements because Switzerland includes a large range from mountainous to rural to highly densified urban

areas. The built-up areas in V25 are larger than in HRL IMD (for Switzerland, they are 2 470 km² in V25 and 1 755 km² in HRL IMD for 2006).

5. On average, the built-up areas are 29 % smaller in the HRL IMD data set than in the V25 data set. These differences vary between 23.8 % and 33.7 % in the NUTS-2 regions (and between 16.1 % and 21.4 % in the test regions used by Orlitová et al. (2012)). The differences are small in compact cities and larger in more dispersed settlement areas. Accordingly, the built-up areas in the V25 data set are, on average, 40.9 % (more precisely: 40.8686 %, see below) larger than in the HRL-Imp data set (using HRL IMD as 100 %). The differences in *WUP* vary between 35 % and 54.4 %. These differences in *WUP* are bigger than those in the built-up area because of the weighting function of *LUP*.

6. The simplest correction factor would be to use 1.408686 to multiply the HRL IMD impervious areas to calculate the corresponding amounts of built-up areas. However, for regions with very high amounts of impervious area (> 67 % according to HRL), this correction factor would result in values of > 100 % built-up areas, which is impossible. This implies that a reporting unit with 100 % of impervious areas should have a correction factor of 1 (100 % of built-up area), whereas regions with an impervious area between 67 % and 100 % should have correction factors lower than 1.408686.

7. Therefore, we chose a linear correction factor (*LCF*) that was calibrated through the following two values: (1) it is 1 for 100 % impervious area, and (2) for the percentage of impervious area in Switzerland (4.25 % according to HRL), it is 1.408686 (resulting in the correct 5.987 % built-up area). This approach results in the following formula for the *LCF*:

   $LCF(X) = 1.426826 - 0.426826 \times X$

   where X = portion of impervious area according to HRL IMD.

8. In the NUTS-2 regions in Switzerland, the proportion of built-up areas ranges between 3.6 % and 18.9 %. About 90 % of all NUTS-2 regions are within this range. We also looked at the maps of four regions with higher proportions of impervious area (VA: Vatican City; MC: Monaco; UKI1: Inner London; and DE30: Berlin) and found that the *LCF* gives reasonable results (based on the map).

9. Without a correction factor (based on HRL IMD alone), five out of seven NUTS-2 regions in Switzerland are in the wrong ranking order. With a constant correction factor (1.408686), only the two highest regions are left in the wrong rank order. With the use of *LCF*, the ranking of all seven NUTS-2 regions is correct. This is important for the statistical analysis. Without correction, the *WUP* values for these NUTS-2 regions differ by 35 % to 54 % (smaller than the correct value for Switzerland based on V25). Using the constant correction factor, the *WUP* values are smaller by 0.2 % to 23.4 %; and the *LCF* improves the values of *WUP* even further (between 0.2 % and 15.9 %).

10. The more urban a region, the better the HRL data set represents the built-up areas. In rural regions, the imperviousness data capture a different phenomenon, and these values underestimate the built-up areas more substantially. Therefore, an *LCF* that is smaller for more urban regions and larger for rural regions accords with this fact.

The correction factor cannot be determined from the Urban Atlas, because it includes only urban regions and rural regions are also needed, as the correction factor also needs to be valid there.

A visual comparison of the two source data sets for the three regions (Sursee, Lugano and Chur) is presented in Annex A2.2.

Greenhouses were not considered in the national study of Switzerland (Schwick et al., 2012) because they were not available in the map used (V25).

We did not apply any corrections to the *DIS* (i.e. the *DIS* was calculated for the HRL IMD data set), for two reasons. First, the relative differences are small (between 0.6 % and 1.4 %). Second, it is impossible to correct the values for *DIS* because this would require information about the spatial distribution of the missing built-up areas, and the spatial distribution of the impervious areas is the best available information at the European level.

A3.5 Numbers of inhabitants and jobs

A3.5.1 At country and NUTS-2 region level

Population data at the European level were provided by Eurostat. The regional demographic statistics provide annual data on population and key demographic indicators at NUTS-2 and NUTS-3 levels for 35 countries. Basic information can be found at: http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/demoreg_esms.htm. Population data published on the Eurostat data portal are: population on 1 January by age and sex — NUTS-2

regions (demo_r_d2jan): http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database (steps to go through the information: database by themes — General and regional statistics — Regional statistics by NUTS classification — Regional demographic statistics — Population and area). Population statistics for Turkey for 1 January 2007 are available only at the NUTS-0 level. Population statistics for Albania, Bosnia and Herzegovina, Kosovo and Serbia are not available within this data set. For countries where the Eurostat population data at the NUTS-2 level are still not available, National Statistical Offices were contacted or other sources were found and the values were completed. This concerned the following regions: DED4, DED5, DK01-DK05, ITH5, ITI3, UKD6 and UKD7. Data for populations at the NUTS-2 level were still not available for Turkey for 2006/2007.

The job statistics (in the meaning of workplaces) are very important for the calculation of *UD* and *LUP*, in particular in industrial areas that often have a low number of inhabitants but a high number of jobs. The employment data at the European level are provided by Eurostat. The source for the regional labour market statistics down to the NUTS-2 level is the EU Labour Force Survey (EU LFS). It categorises residents in private households according to their labour status: employed, unemployed, inactive. A description of the EU LFS can be found at http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/EU_labour_force_survey.

The data sets are called 'Employment by sex, age and NUTS 2 regions (1 000) (lfst_r_lfe2emp)' and 'Employment and commuting by NUTS 2 regions (1 000) (lfst_r_lfe2ecomm)' (http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/regional_statistics/data/database) (regional statistics by NUTS classification: Regional labour market statistics — Regional employment — LFS annual series). The first shows the number of employed persons regardless of the region of place of work. The second data set contains a breakdown according to the region/country of work: FOR, Foreign country; INR, In the same region; OUTR, In another region; NRP, No response.

The EU LFS covers 33 countries, providing Eurostat with data from national labour-force surveys: the 28 Member States of the European Union (EU), the three European Free Trade Association (EFTA) countries (Iceland, Norway and Switzerland) and two EU candidate countries (the former Yugoslav Republic of Macedonia and Turkey). LFS data for Liechtenstein, Albania, Bosnia and Herzegovina, Montenegro, Serbia and Kosovo are not available within the EU LSF.

Data for COUNTRYW (country of place of work) and REGIONW (region of place of work) are collected within the survey microdata. These jobs data are not published on the data portal, but can be requested from Eurostat. A cross-check between the requested jobs data and employment statistics downloaded from the Eurostat data portal (lfst_r_lfe2emp, lfst_r_lfe2ecomm) demonstrated good agreement between both data sets. Data provided on request from Eurostat were processed and used for the calculation of the metrics *UD* and *LUP*.

Correction of employment data using commuter data: The employment data obtained from Eurostat account for the number of people in each NUTS-2 region who have a job, but not for the locations of their jobs. For the *UD* and *LUP* metrics, the number of jobs (in the meaning of workplaces) is needed (i.e. the number of people who work in particular regions). This value is calculated from the number of employed people who work and live in the same region + the number of people who commute into a particular region from another region in which they live. Therefore, we corrected the employment data using the data set on commuters, which contains information about commuters among the NUTS-2 regions.

We compared the number of jobs with the Eurostat data set and found a good level of agreement. The difference between the requested commuter data set and the Eurostat employment data over all NUTS-2 regions (excluding Denmark, Liechtenstein, Slovenia, Turkey and three German (DE41, DE42 and DEE0), three Finnish (FI13, FI18, FI1A), nine Italian (ITD1–5, ITE1–4) and two English (UKD2, UKD5) NUTS-2 regions) was 0.31 %.

Conversion factor for part-time and full-time equivalents: Eurostat provided information on full-time and part-time jobs for almost all NUTS-2 regions. Part-time employment had to be corrected to full-time equivalents. We were able to find information about full-time and part-time jobs for most NUTS-2 regions from Eurostat.

The full-time equivalents were calculated using the following steps:

1. Full-time jobs counted as one full-time equivalent (regardless of how many hours a full-time job represents in different countries).

2. The numbers from Eurostat include only the sum of full-time and part-time jobs. There are two options for approximating the full-time equivalents:

   - using a correction factor that is applied to the sum of full-time and part-time jobs;

   - using a correction factor that is applied to the number of part-time jobs, while counting full-time jobs directly.

When the information about full-time and part-time jobs is available only as a sum, then only option (a) is possible. However, if the information about full-time and part-time jobs is available separately, option (b) is more accurate (because the correct number of full-time jobs does not need any correction factor and should be used directly). In our case, we were able to find information about full-time and part-time jobs separately for all NUTS-2 regions, so we applied option (b). This data set also includes a column of employees, who have not provided information about the status of their job ('no response').

3. To determine the conversion factor between part-time jobs and full-time equivalents, we used the data from Switzerland. The conversion factor for option (a) is 0.849 for Switzerland (based on the Swiss Volkszählung 2000 and Betriebszählung 2001). The total number of jobs was 3 965 000, of which the number of full-time jobs was 2 748 000 and part-time jobs was 1 217 000. This conversion factor for option (a) corresponds with the conversion factor CF_{pt} between part-time jobs and full-time equivalents according to the equation:

   $0.849 \times 3\,965\,000 = 2\,748\,000 + CF_{pt} \times 1\,217\,000,$

   which is based on the comparison of the Swiss Volkszählung 2000 and the Betriebszählung 2001. The full-time equivalents should be the same in both cases: 0.849 applied to the total number of jobs, and the sum of full-time jobs plus the part-time jobs multiplied by the corresponding part-time conversion factor. This results in:

   $\boldsymbol{CF}_{pt} = (0.849 \times 3\,965\,000 - 2\,748\,000) / 1\,217\,000 = 0.50804.$

   We applied this conversion factor to all part-time jobs in all NUTS-2 regions, where data were available. The sum of the full-time and adjusted part-time jobs results in the number of full-time equivalents. We also added the information about employees who have not given information ('no response') in the same ratio of full-time and part-time jobs in each NUTS-2 region. For countries without information about part-time and full-time workers, the number of employees was multiplied with the conversion factor for Switzerland 0.849, which was obtained from the calculation based on Swiss data. The sum of this number and the population size was divided by the built-up area (in m^2) to calculate utilisation density.

4. The determination of the CF_{pt} can be adjusted for different countries in the future based on national data sets where available.

5. An alternative approach would be to count part-time jobs and full-time jobs in the same way. However, when these data about the numbers of part-time versus full-time jobs are available (as they are for all of Europe), they should be used because the measurement of sprawl will be more accurate. In addition, we expect that such data will be more readily available in the future. Other refinements are possible (e.g. tourists counted in inhabitant equivalents, use of schools), but the two most important parts of *LUP* are clearly the inhabitants and the number of full-time equivalents.

A3.5.2 At the 1-km²-grid level

We used the data about inhabitants from GEOSTAT 2006 and GEOSTAT 2011 data sets (http://ec.europa.eu/eurostat/web/gisco/geostat-project). The GEOSTAT project provides census data for the European population grid. The European population grid data set integrates data from national grid initiatives and the European disaggregated data set produced by the Austrian Institute for Technology into an integrated single population grid data set. The European population grid data set does not cover Albania, Bosnia and Herzegovina, Croatia, the former Yugoslav Republic of Macedonia, Kosovo, Montenegro, Serbia and Turkey.

A European data set relating to the number of jobs at the 1-km^2-grid level in the meaning of workplaces is not available. The European Observation Network for Territorial Development and Cohesion (ESPON) data set of employment data disaggregated into the 1-km^2 European Grid does not contain the appropriate information because this data set is based on employment statistics and not on statistics of jobs (workplaces).

For the cells indicating 'no data' for 2006, it was safe to assume that the number of inhabitants was 0, as there were no values of '0' in the original 2006 data set, and the comparison of the sum of inhabitants of 1-km^2 cells that belonged to particular NUTS-2 regions (using the centroid of the cells to identify the respective NUTS-2 region) matched well with the total number of inhabitants of NUTS-2 regions.

We estimated the values for 2009 for each cell from its values for 2006 and 2011, using the value of 2006 and adding three-fifths (multiplication by 3/5) of the difference between 2006 and 2011 (as 2009 is 3 years away from 2006, and 2 years from 2011).

Given that there were no job data available at this scale, there was no correction needed for full-time equivalents or for the commuters between different 1-km^2 cells.

A3.6 Changes in the delineation of the Nomenclature of Territorial Units for Statistics-2 regions

The NUTS classification has changed since its introduction at the end of the 1990s. Some regions were split, merged or renamed, which complicates the comparison between different time-points (Table A3.1). Before the regulation in 2003, the European Commission (EC) agreed on the structure of NUTS-2 regions (EC, 2011c). In 2003, the NUTS 2003 classification was introduced (Commission Regulation (EC) No 1059/2003 from 26 May 2003), and it was extended in 2004 and 2007 owing to new Member States joining the EU (Commission Regulation (EC) No 1888/2005 and No 176/2008). At the beginning of 2008, a previous correction by the EC resulted in the NUTS 2006 classification (Commission Regulation (EC) No 105/2007), which again was improved in 2012 with the introduction of the NUTS 2010 classification (Commission Regulation (EU) No 31/2011). A new amendment is planned for 2015 to introduce the NUTS 2013 classification. In this report, the NUTS-2 regions in the delineation of 2010 were used, and data from earlier years were adjusted to this delineation.

Table A3.1 Changes in the coding of NUTS-2 regions from the first classification, NUTS 2003, to the recent update, NUTS 2010, as a result of changes in the sizes of NUTS-2 regions ('shift'), merging of regions ('merge'), split of regions ('split'), or without any given reason (only 'new name')

NUTS	Type	NUTS	Type	NUTS	NUTS	Type	NUTS	Type	NUTS
2003		2006		2010	2003		2006		2010
BG11	New name, shift	BG31		BG31	ITD1		ITD1	New name	ITH1
BG12	New name, shift	BG32		BG32	ITD1		ITD2	New name	ITH2
BG13	New name, shift	BG33		BG33	ITD3		ITD3	New name	ITH3
	New region, shift	BG34		BG34	ITD4		ITD4	New name	ITH4
BG21	Merge, shift	BG41		BG41	ITD5		ITD5	New name, shift	ITH5
BG23					ITE1		ITE1	New name	ITI1
BG22	New name, shift	BG42		BG42	ITE2		ITE2	New name	ITI2
DK	Split	DK01		DK01	ITE3		ITE3	New name, shift	ITI3
		DK02		DK02	ITE4		ITE4	New name	ITI4
		DK03		DK03	RO06	New name	RO11		RO11
		DK04		DK04	RO07	New name	RO12		RO12
		DK05		DK05	RO01	New name	RO21		RO21
DED1		DED1	New name, shift	DED4	RO02	New name	RO22		RO22
DED3		DED3	New name, shift	DED5	RO03	New name	RO31		RO31
DEE1	Merge	DEE0		DEE0	RO08	New name	RO32		RO32
DEE2					RO04	New name	RO41		RO41
DEE3					RO05	New name	RO42		RO42
DE41		DE41	Merge	DE40	SI00	Split	SI01		SI01
DE42		DE42					SI02		SI02
FI13		FI13	Merge	FI1D	SE01	New name	SE11		SE11
FI1A		FI1A			SE02	New name	SE12		SE12
FI18		FI18	Split	FI1B	SE09	New name	SE21		SE21
				FI1C	SE04	New name	SE22		SE22
GR11		GR11	New name	EL11	SE0A	New name	SE23		SE23
GR12		GR12	New name	EL12	SE06	New name	SE31		SE31
GR13		GR13	New name	EL13	SE07	New name	SE32		SE32
GR14		GR14	New name	EL14	SE08	New name	SE33		SE33
GR21		GR21	New name	EL21	UKD2		UKD2	New name, shift	UKD6
GR22		GR22	New name	EL22	UKD5		UKD5	New name, shift	UKD7
GR23		GR23	New name	EL23	UKM1	New name	UKM5		UKM5
GR24		GR24	New name	EL24	UKM4	New name	UKM6		UKM6
GR25		GR25	New name	EL25					
GR30		GR30	New name	EL30					
GR41		GR41	New name	EL41					
GR42		GR42	New name	EL42					
GR43		GR43	New name	EL43					

Source: EC, 2011c.

In addition, Croatia joined the EU on 1 July 2013. Previously, the country was classified into three NUTS-2 regions: Northwest Croatia (Sjeverozapadna Hrvatska, HR01), Sredisnja i Istocna (Panonska) Hrvatska (HR02), and Adriatic Croatia (Jadranska Hrvatska, HR03). This classification was valid from 2007 to 2012. In 2012, the two NUTS-2 regions HR01 and HR02 were merged into Continental Croatia (Kontinentalna Hrvatska, HR04).

A3.7 Calculation of adjusted weighted urban proliferation values when irreclaimable areas are excluded from the reporting units

Interpretation of the *WUP* values between different regions should take into account that areas may be included where it is impossible to construct buildings (called 'irreclaimable areas'). When a study area contains a large amount of such areas (e.g. bodies of water, glaciers, cliffs and steep slopes), the *WUP* values are correspondingly low. For a comparison with regions that have few or no such areas, it is useful to re-calculate the *WUP* values only for the areas in which construction is possible before comparing them.

The *WUP* values can easily be determined with reference to only those parts of the study area in which construction is possible. For example, a given region may have a value of *WUP* = 3.2 UPU/km^2. The proportion of land that can be settled on may be 39 % (i.e. irreclaimable area = 61 %), hence the *WUP* value for that region alone is:

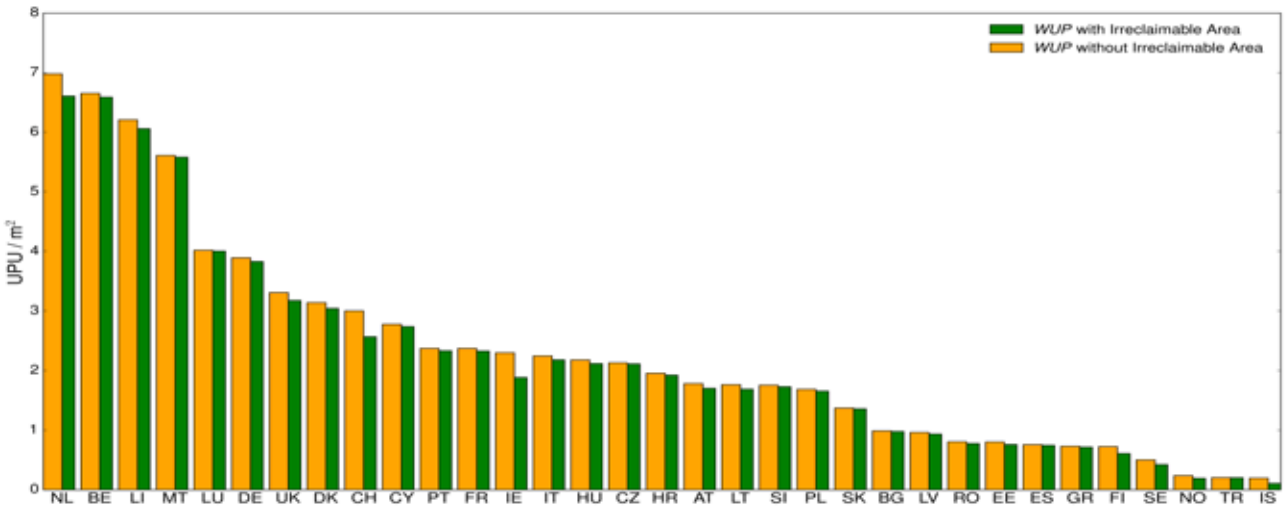
3.2 UPU/km^2 / 0.39 = 8.2 UPU/km^2

The values of *DIS* and UD do not change, as they refer directly to the built-up areas (and there are none in the irreclaimable areas).

Although this report took the entire area of our reporting units into account, this Annex provides information about the resulting changes in the *WUP* values when the irreclaimable areas from the reporting units are excluded (Hennig et al., 2015). The types of areas in which the construction of buildings in Europe is not feasible were taken from CLC data and included:

- glaciers and perpetual snow
- watercourses
- water bodies
- coastal lagoons
- estuaries
- seas and oceans
- inland marshes
- peat bogs
- salt marshes
- salines
- intertidal flats.

Figure A3.1 The *WUP* values for the EU-28 + 4 countries, including (green) and excluding (orange) the irreclaimable areas in the reporting units (countries) for 2009



Excluding the areas that are not suitable for construction from the reporting units used in the calculation of urban sprawl results in larger *WUP* values for all countries (Figure A3.1). The largest differences between *WUP* values with and without accounting for irreclaimable areas is expected in countries with a greater spatial extent of the excluded land-cover types. For example, the Netherlands is well known for having a long struggle with the sea to regain land. Many Dutch areas are characterised by the influence of the sea with salt marshes, previously intertidal flats transformed to constructional ground and protected by dikes, peat bogs and watercourses. In contrast, Ireland's coastlines are characterised to a certain extent by cliff lines and small, but rocky, hills at the edges of the island; and roughly 15 % of the area of Switzerland is covered by the Alps. Additional areas can be considered unsuitable for buildings (e.g. steep slopes and rocky areas, at least in some regions and protected areas, such as forests in Switzerland). For any particular country, determining the extent of such irreclaimable areas is possible in a more reliable and detailed way (for the example of Switzerland, see appendix B in Hennig et al. (2015)). However, there are no consistent data sets available across Europe for including such areas.

When considering the relative changes (Figure A3.2), the *WUP* values excluding irreclaimable areas increase considerably in the Scandinavian countries and Iceland (84.2 %). The northern parts of these countries are covered to a large extent by mountains and glaciers, which, in addition to the climate, makes these areas less favourable for the construction of built-up areas.

Similarly, the *WUP* values increased in all NUTS-2 regions when irreclaimable areas were excluded (Figure A3.3). The largest relative changes were observed for the Irish NUTS-2 Border, Midland and Western region (IE01, 34.57 %), the Aosta Valley (ITC2, 33.19 %) in Italy and the Lake Geneva region (CH01, 33.85 %) in Switzerland. Twenty-five other NUTS-2 regions showed an increase of between 10 % and 28 %. The differences are very similar for 2006 and 2009 (values for 2006 are presented in Hennig et al. (2015).

Figure A3.2 Relative changes in *WUP* values (%) as a result of the exclusion of irreclaimable areas from the reporting units (2009)

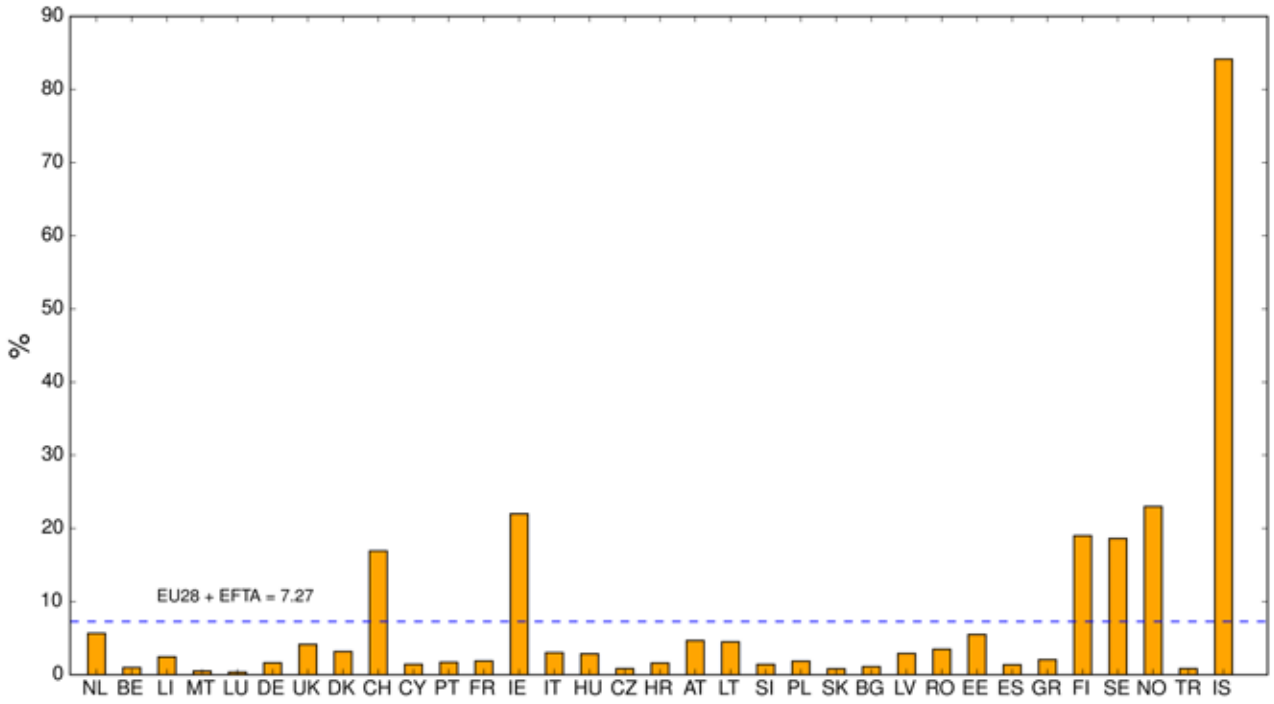
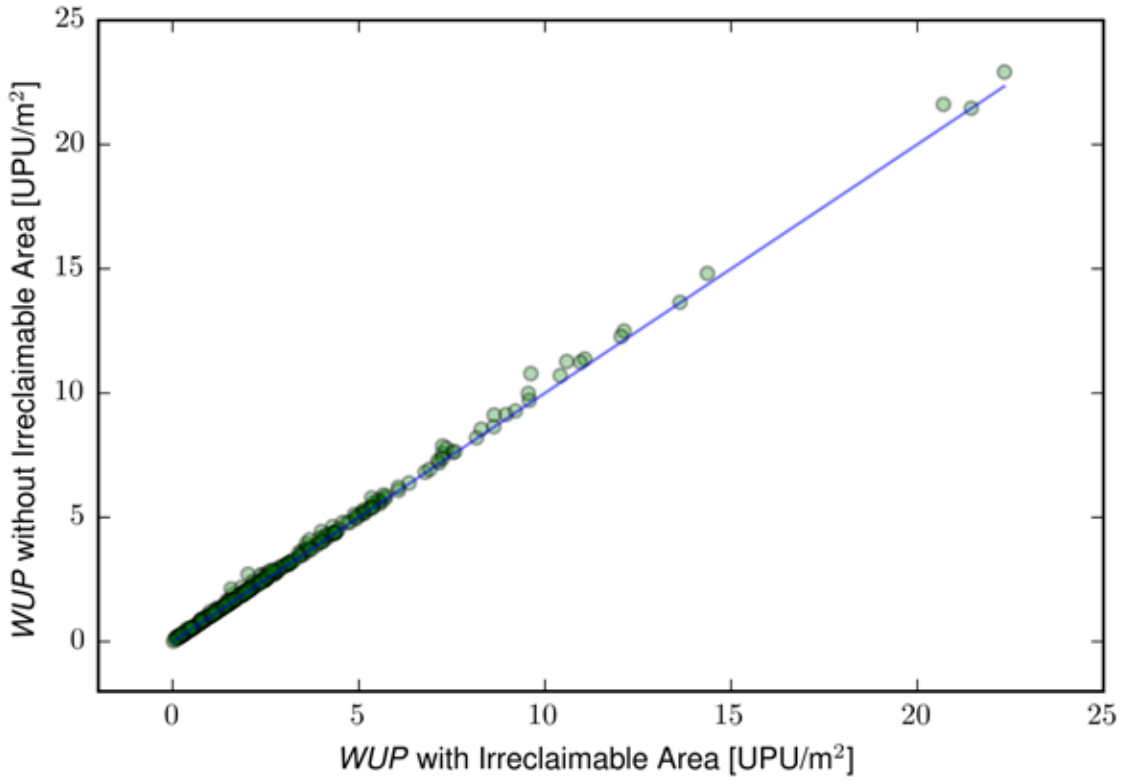


Figure A3.3 The *WUP* with and without consideration of irreclaimable areas at the NUTS-2 level (2009)



Note: The 1:1 diagonal line indicates the location of regions without change. All data points are above the diagonal.

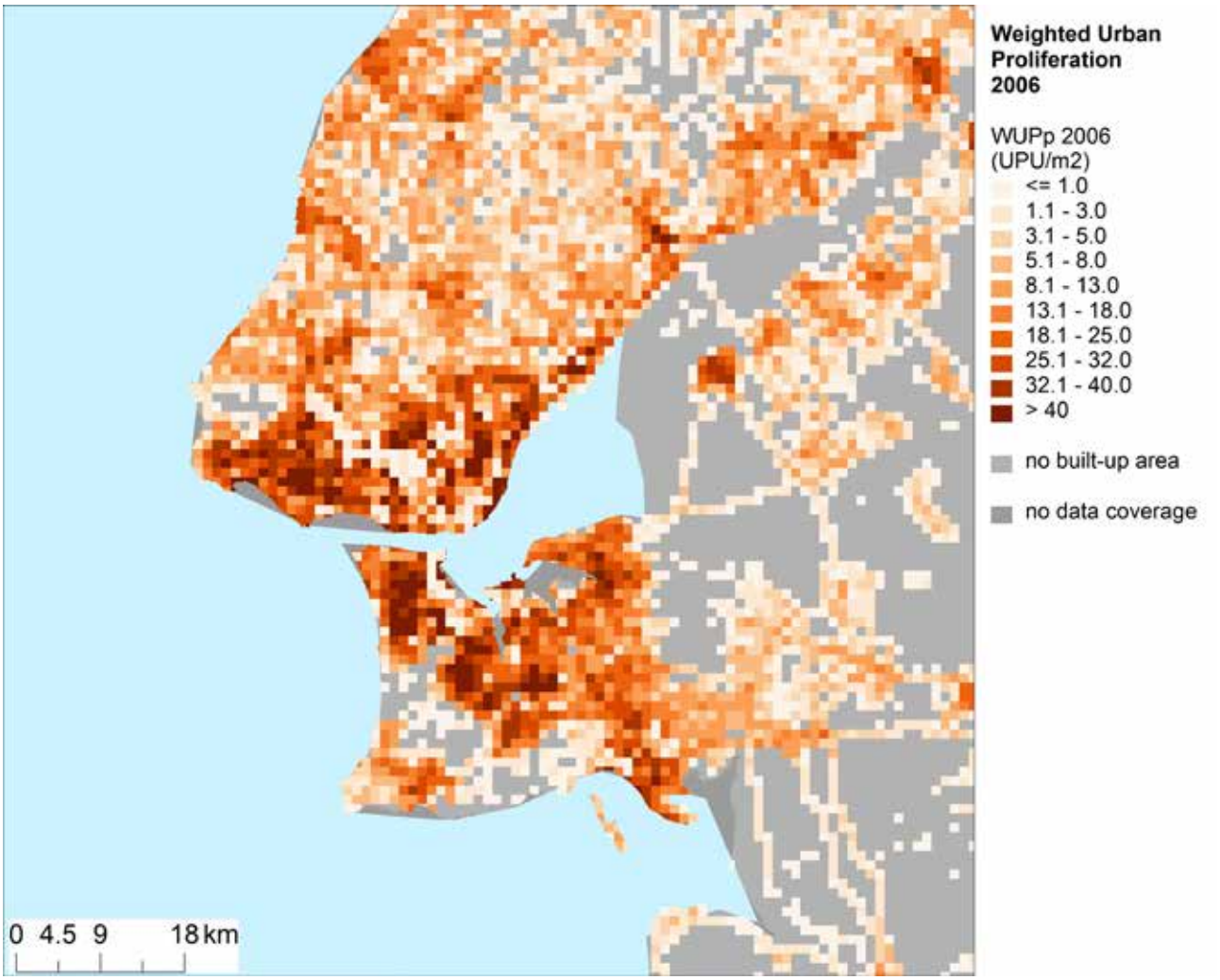
Annex 4 Further examples of maps at the 1-km²-grid scale

This annex presents additional examples of maps at the scale of 1 km² (Sections A4.1 to A4.6) and compares the findings of this report with those of other studies (Section A4.7).

A4.1 Lisbon

A4.1.1. Lisbon 2006

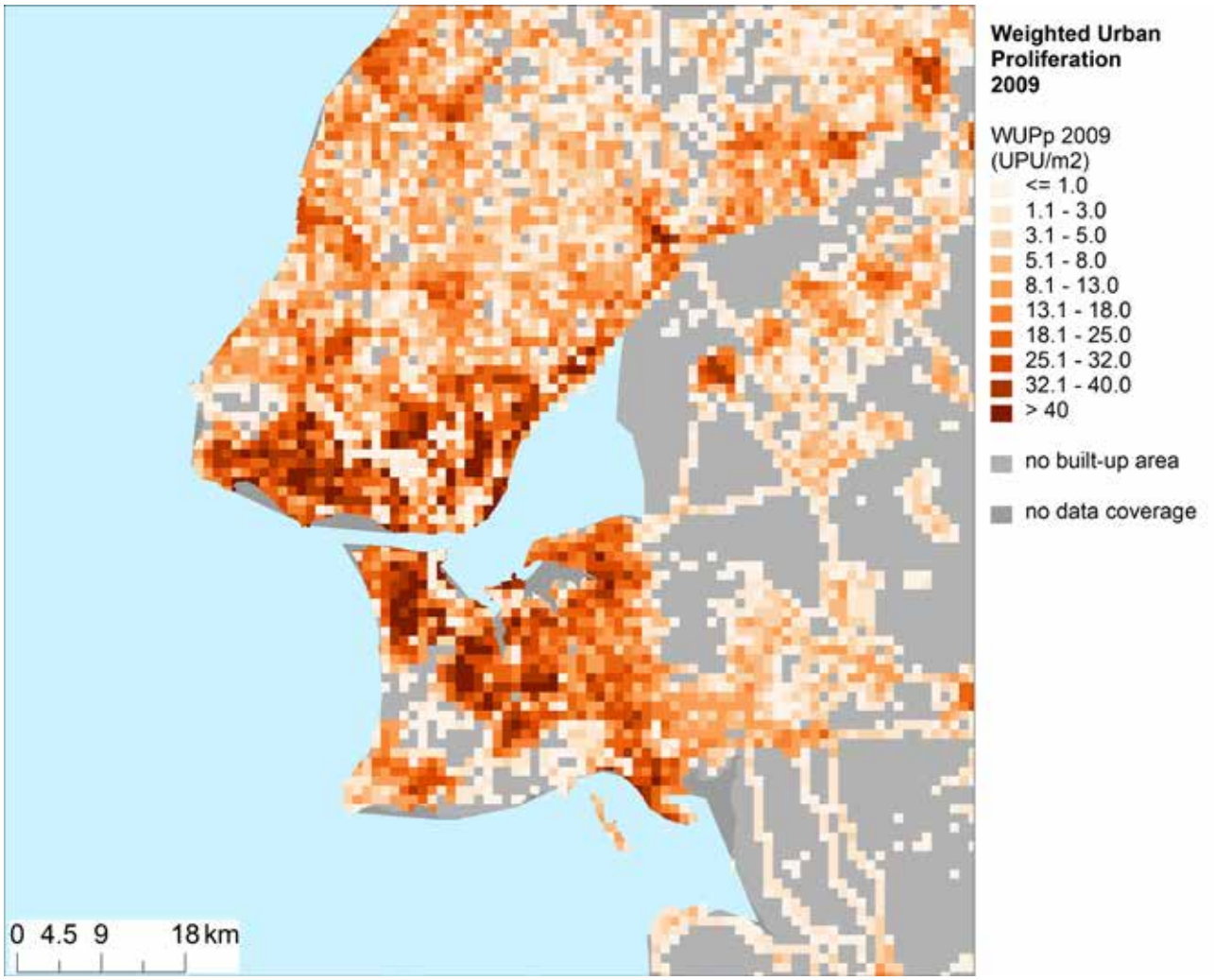
Map A4.1 **Top panel: *WUP*p. Bottom panel upper left (UL): *LUP*p; upper right (UR): built-up area; lower left (LL): *DIS*; lower right (LR): *UP***



Map A4.1 **Top panel: *WUP*p. Bottom panel upper left (UL): *LUP*p; upper right (UR): built-up area; lower left (LL): *DIS*; lower right (LR): *UP* (cont.)**

A4.1.2 Lisbon 2009

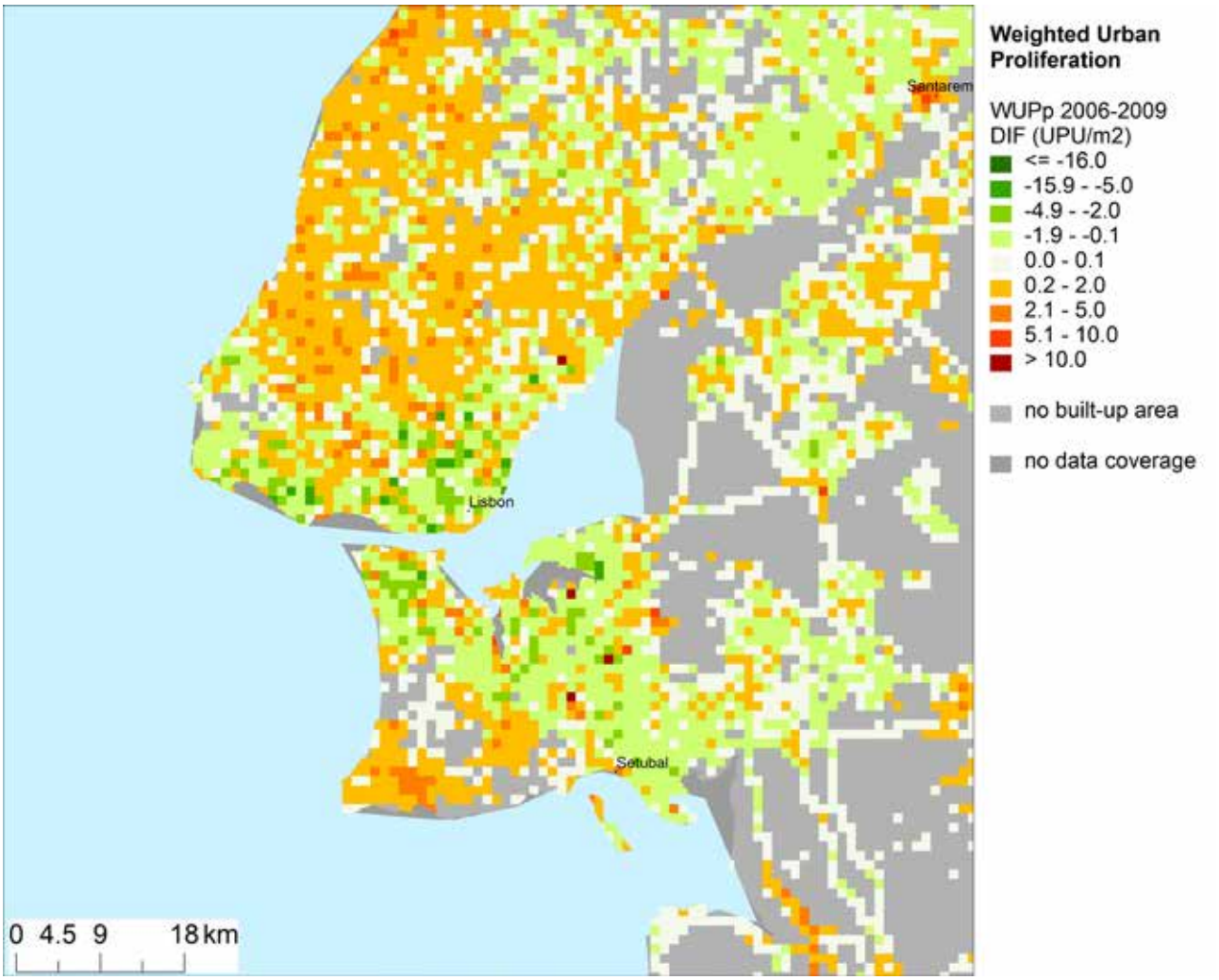
Map A4.2 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP*



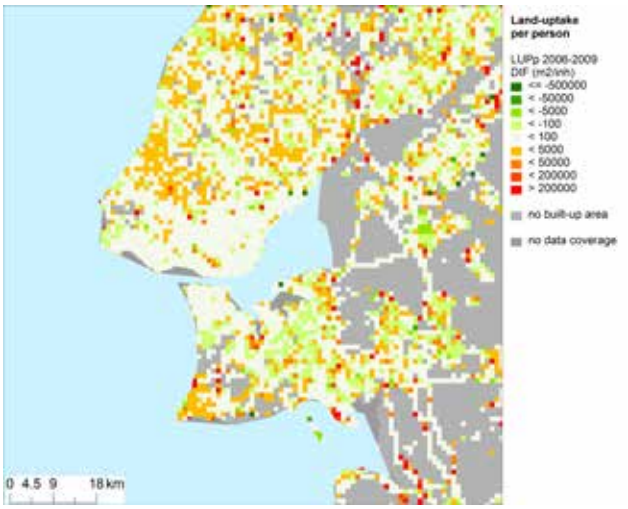
Map A4.2 **Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont.)**

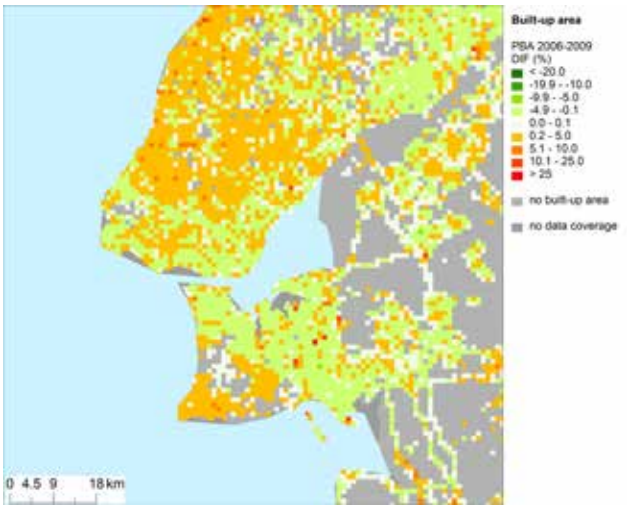
A4.1.3 Lisbon: changes 2006–2009

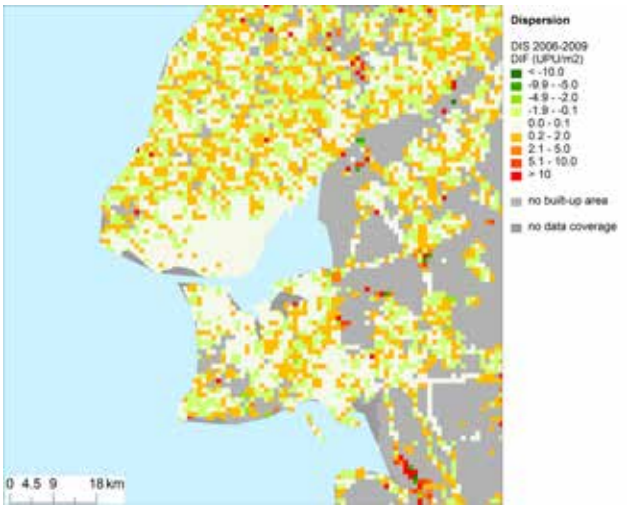
Map A4.3 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP*

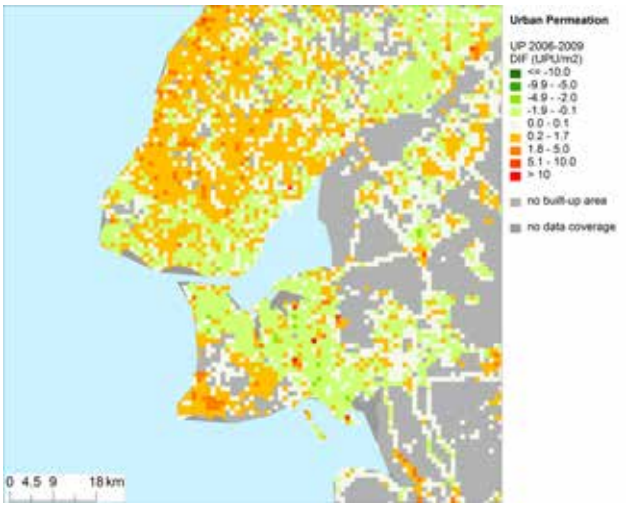


Map A4.3 **Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont.)**





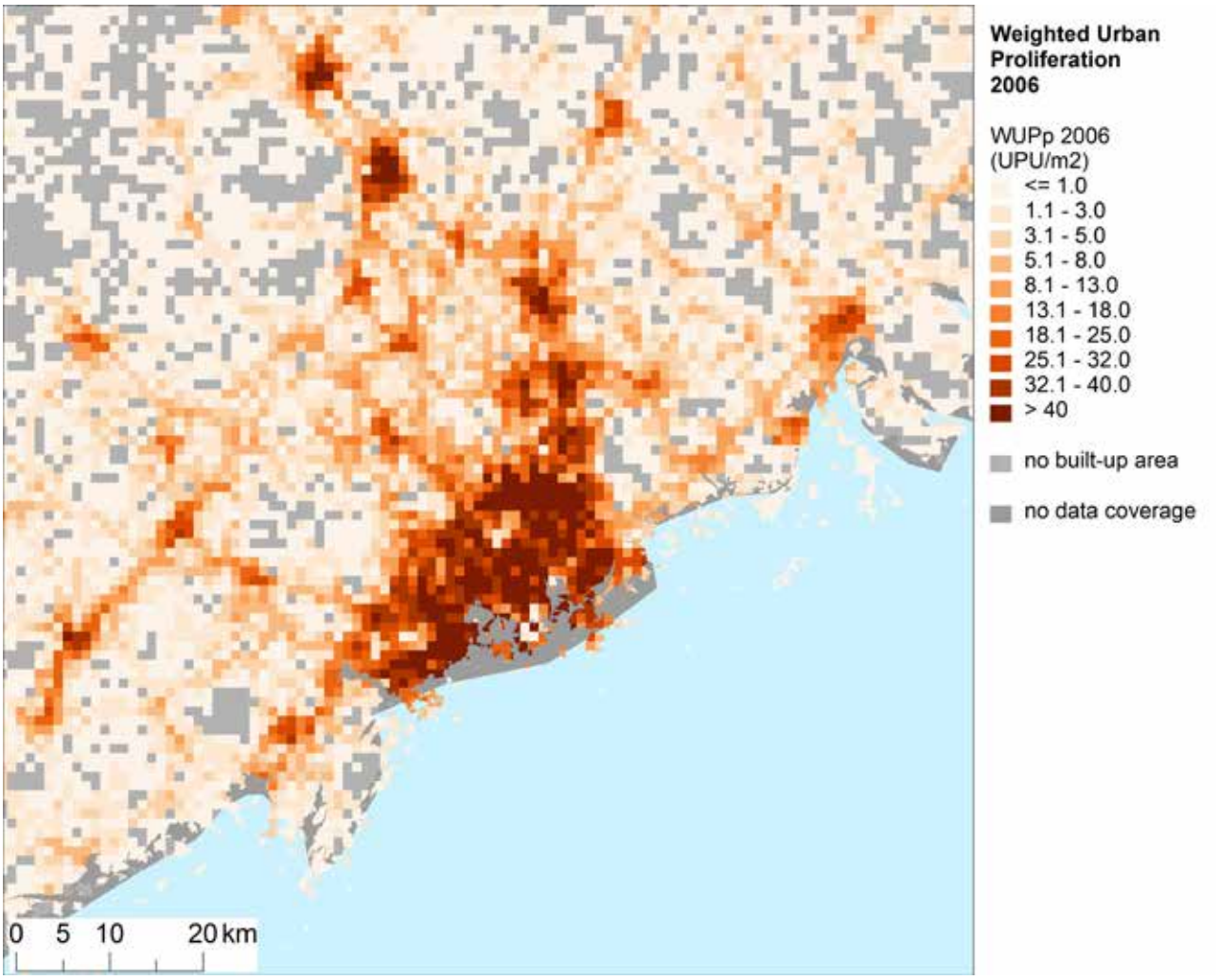




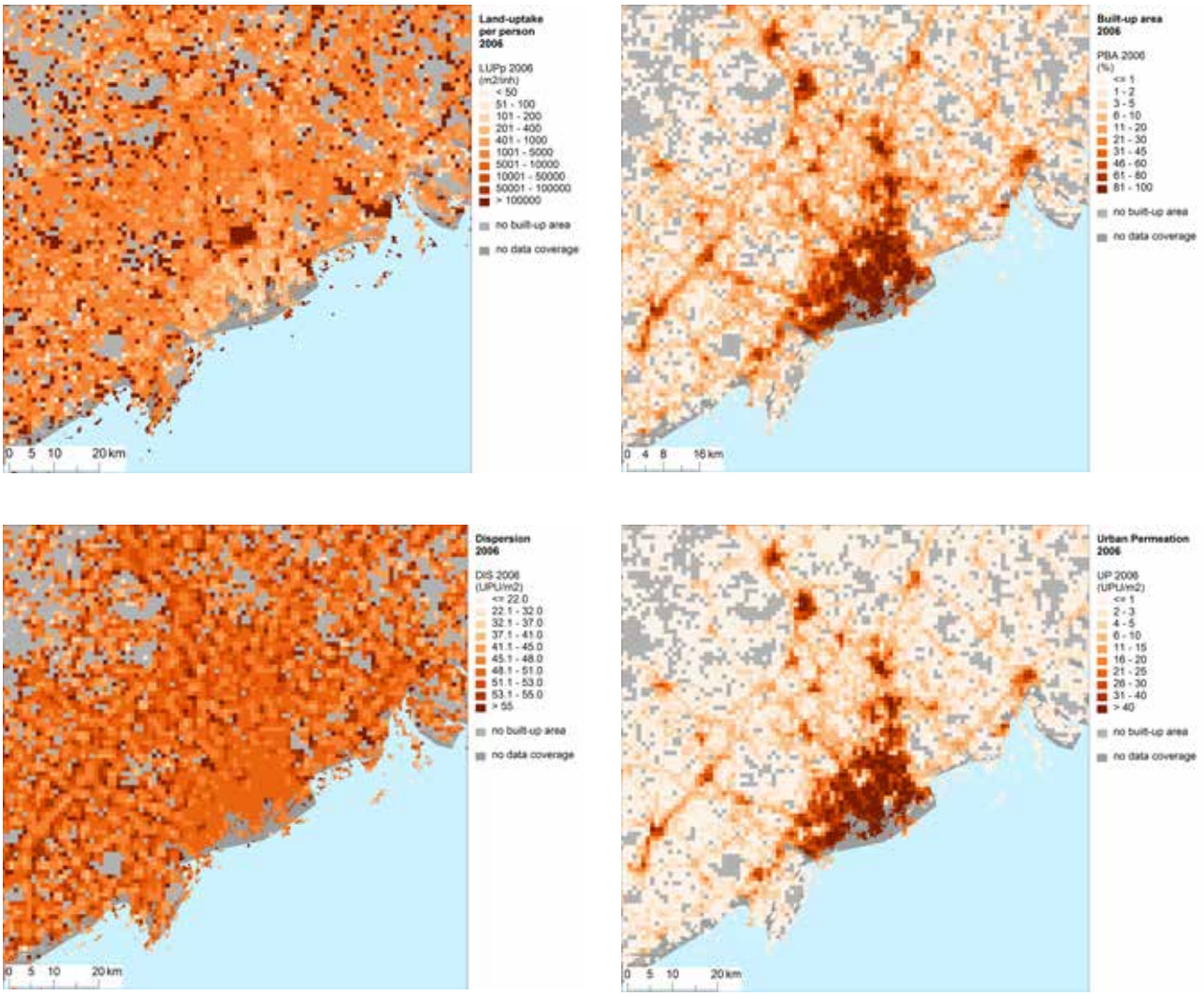
A4.2 Helsinki

A4.2.1 Helsinki 2006

Map A4.4 **Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP***

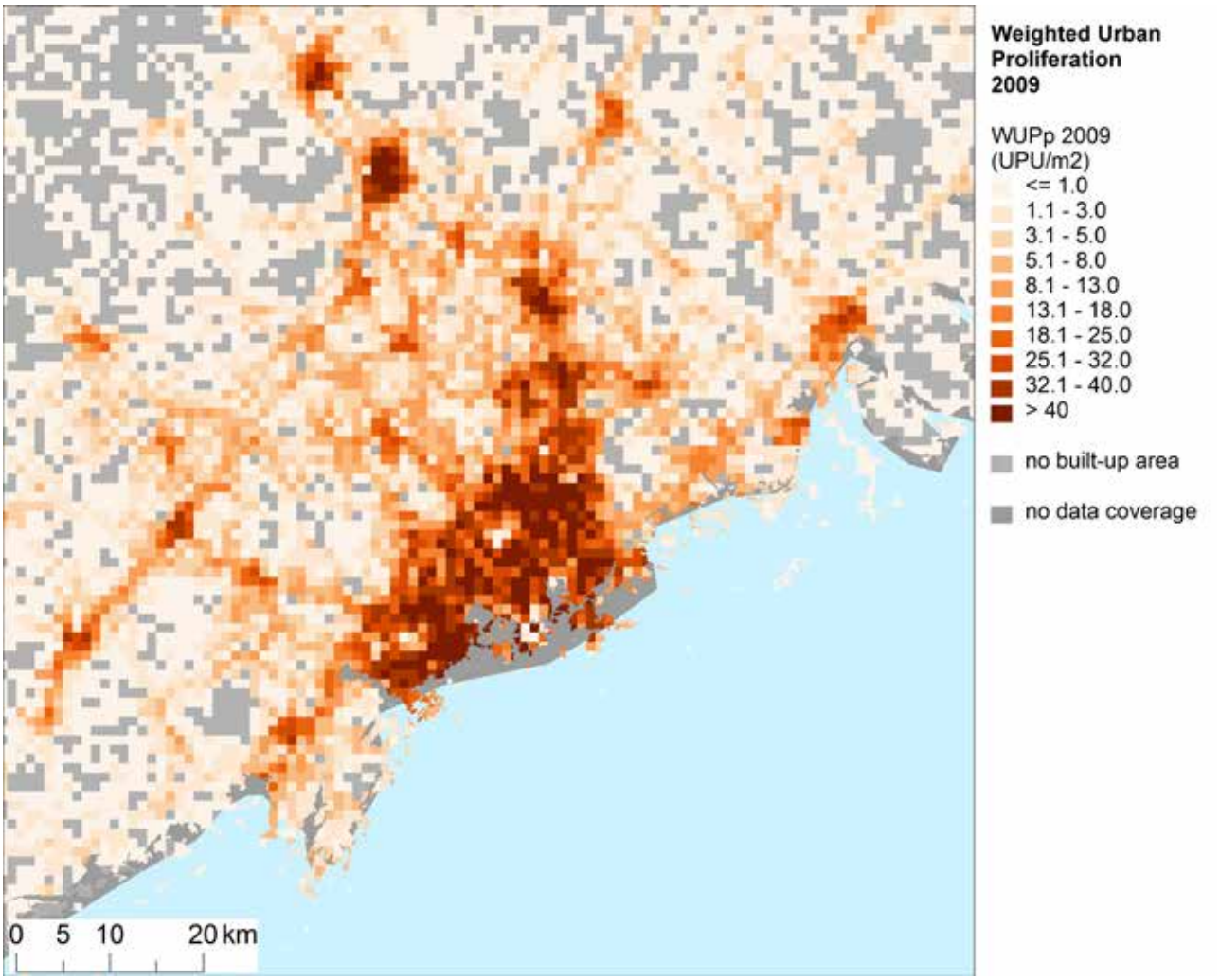


Map A4.4 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont.)

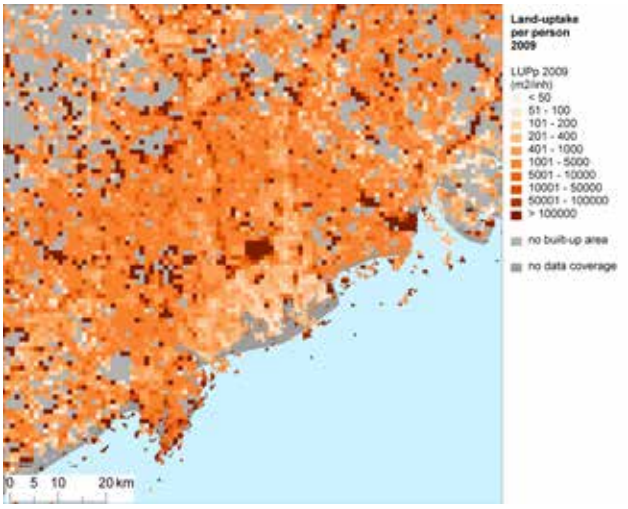


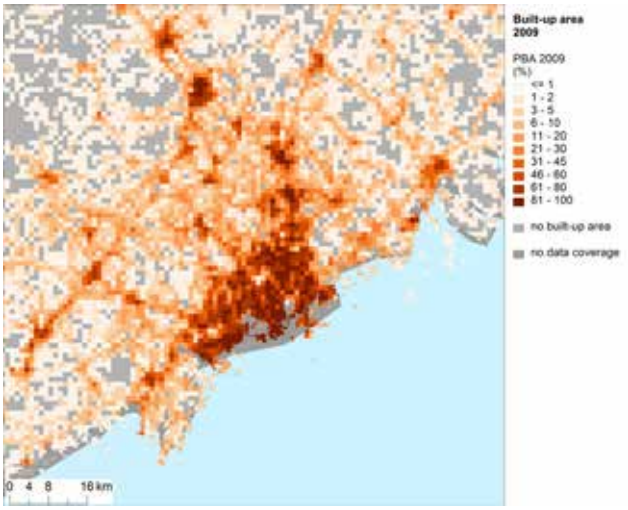
A4.2.2 Helsinki 2009

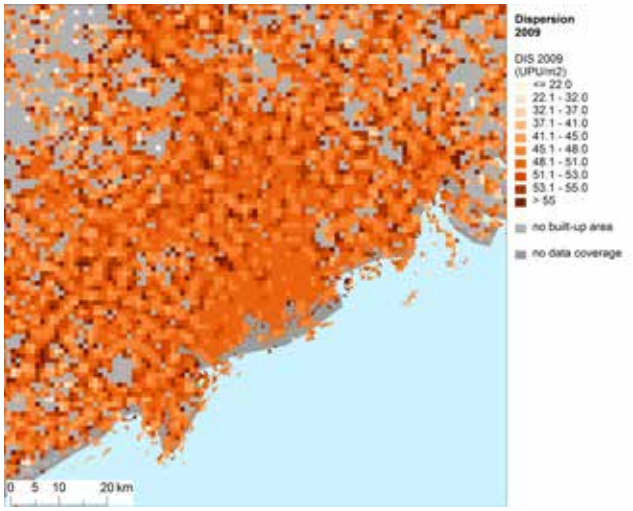
Map A4.5 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; down LR: *UP*

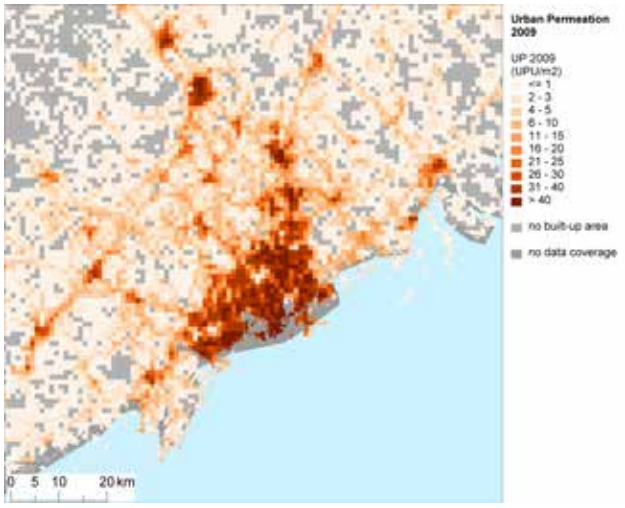


Map A4.5 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; down LR: *UP* (cont.)



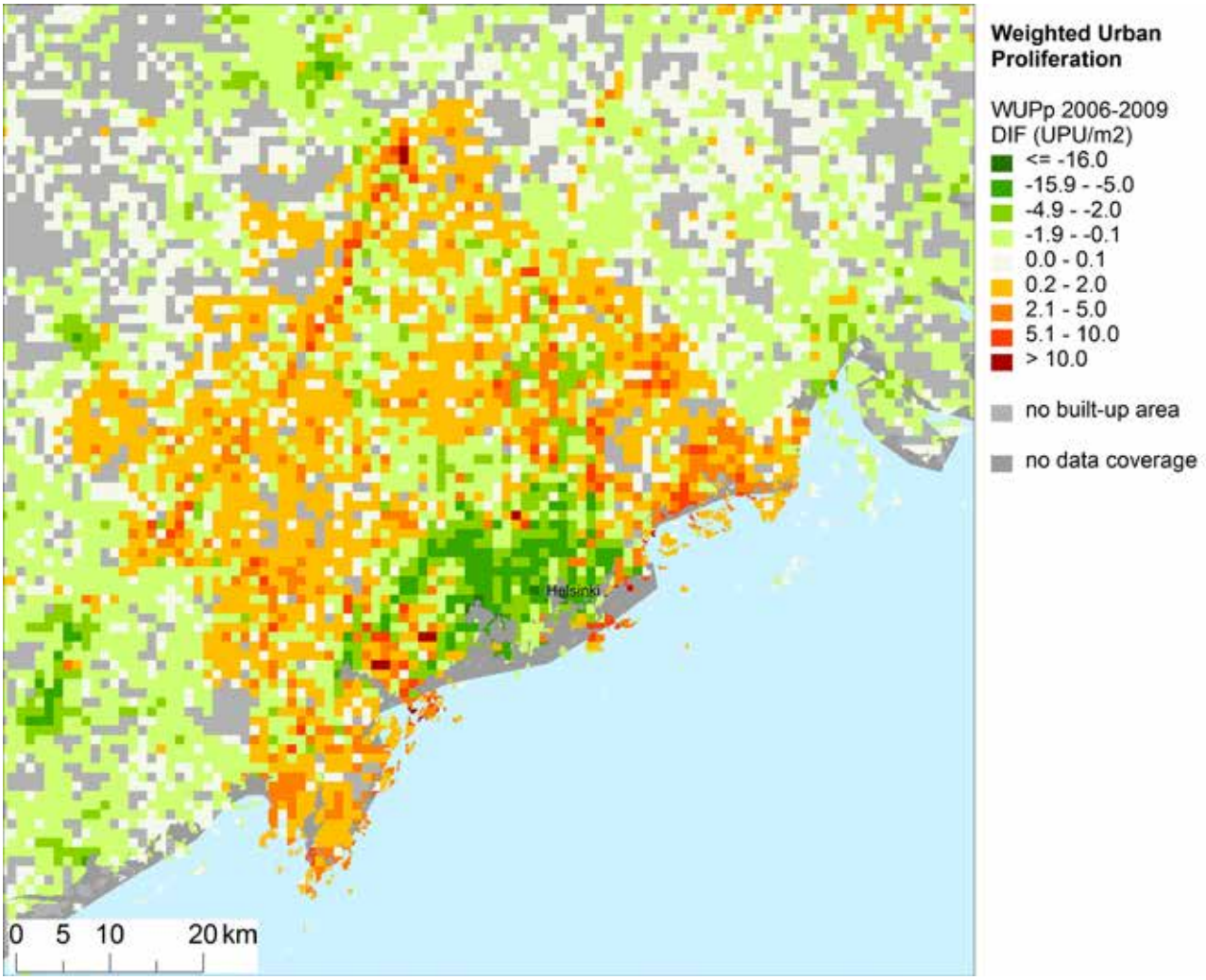




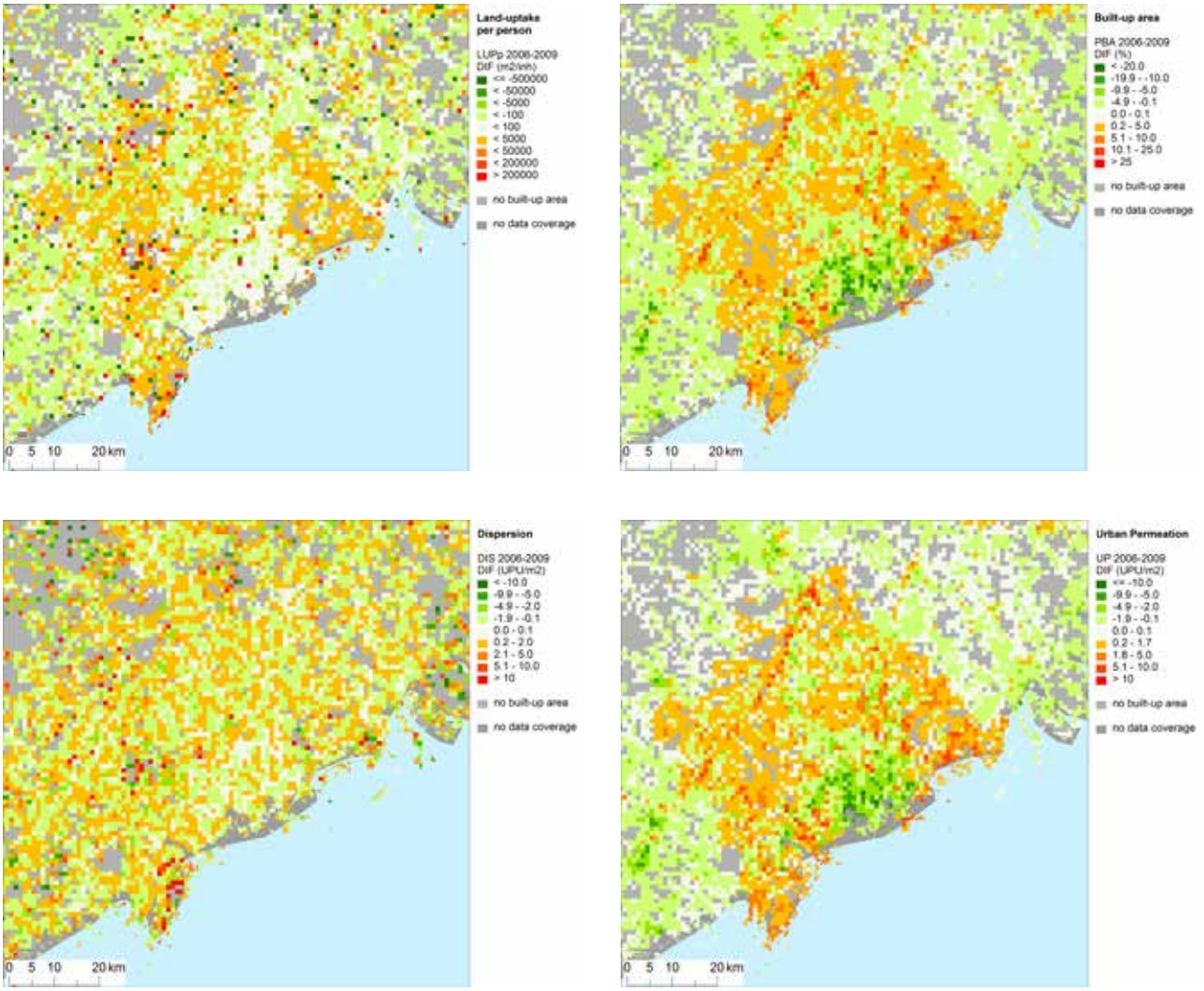


A4.2.3 Helsinki: changes 2006–2009

Map A4.6 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP*



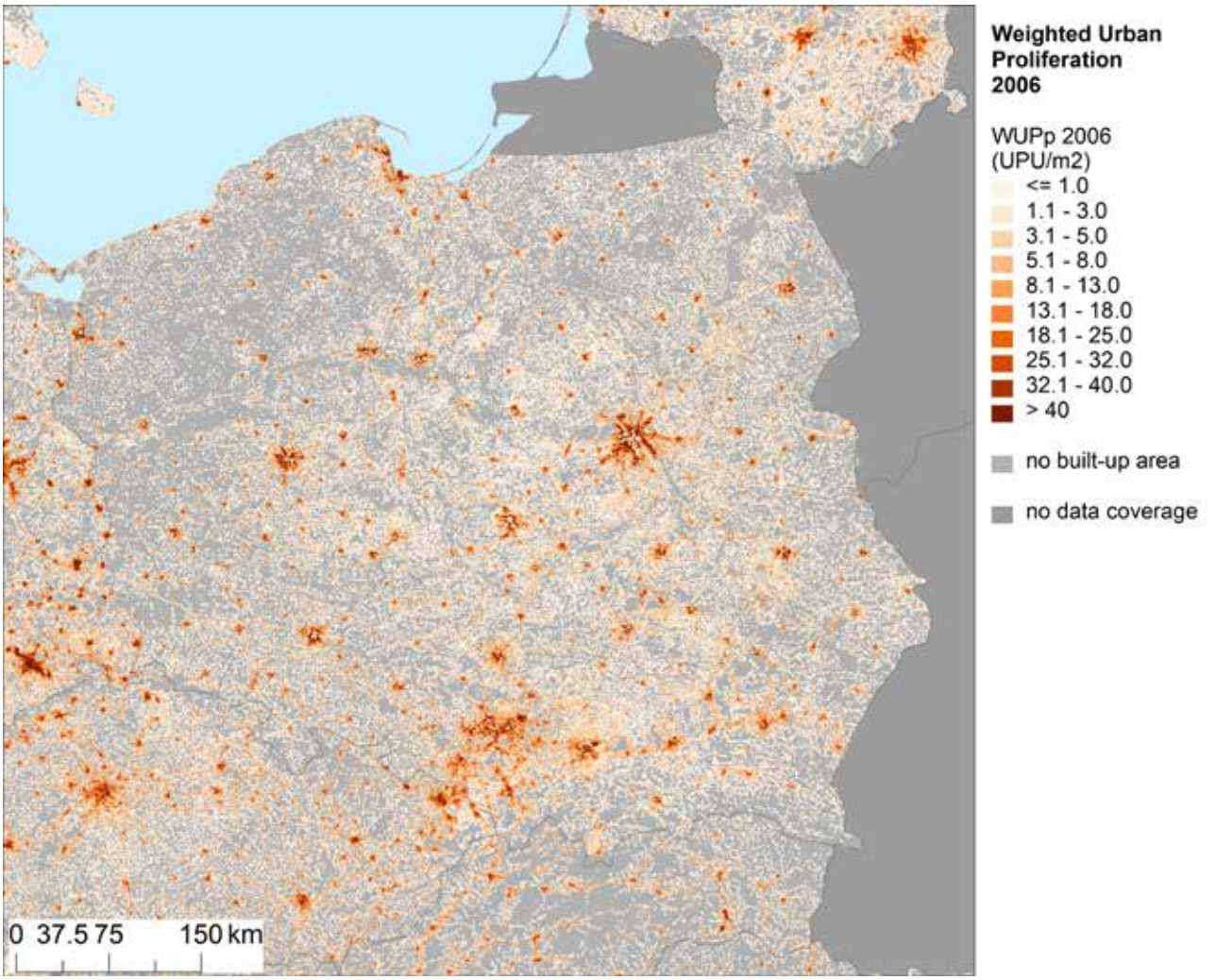
Map A4.6 **Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont.)**



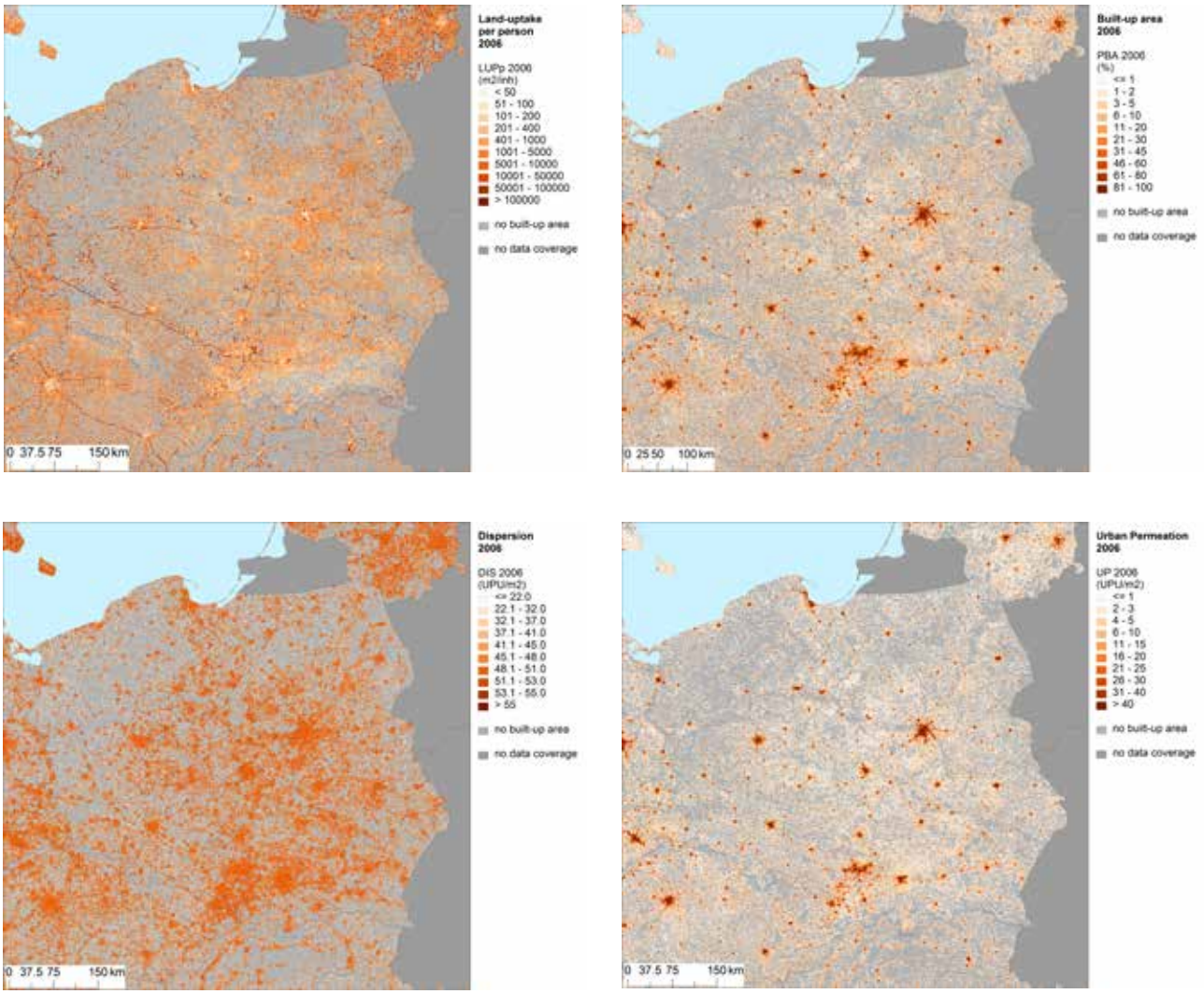
A4.3 Poland

A4.3.1 Poland 2006

Map A4.7 **Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP***

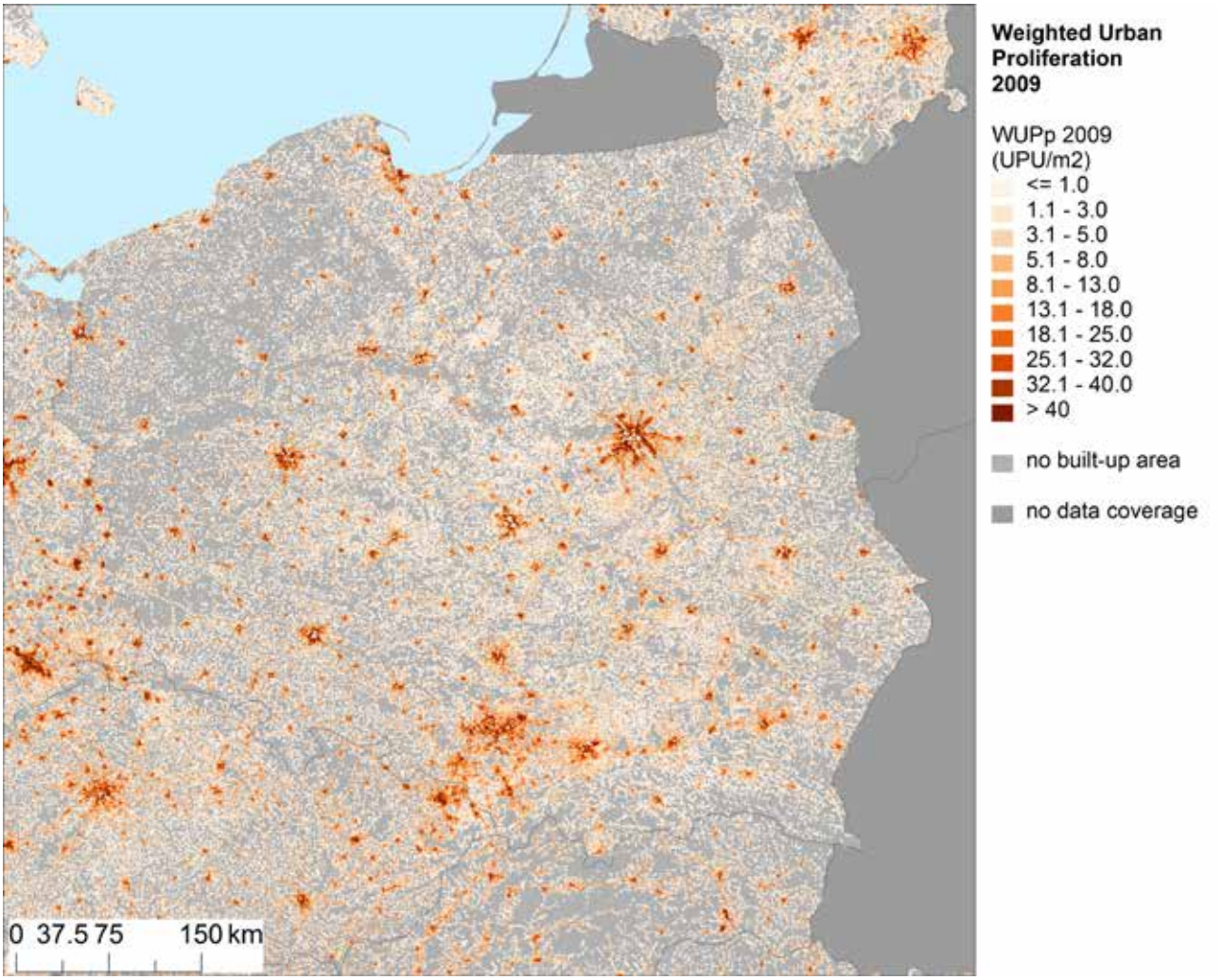


Map A4.7 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont.)

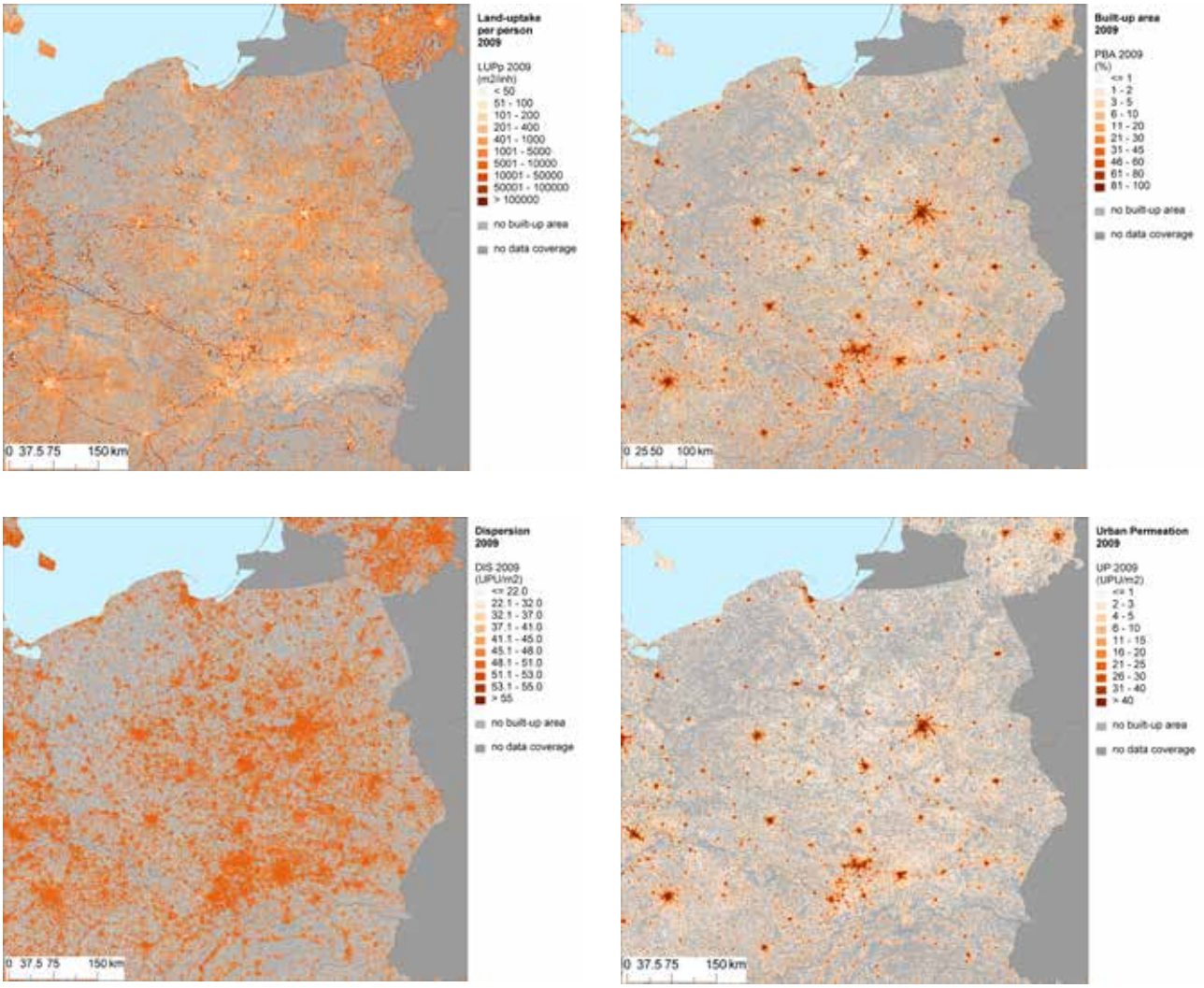


A4.3.2 Poland 2009

Map A4.8 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP*

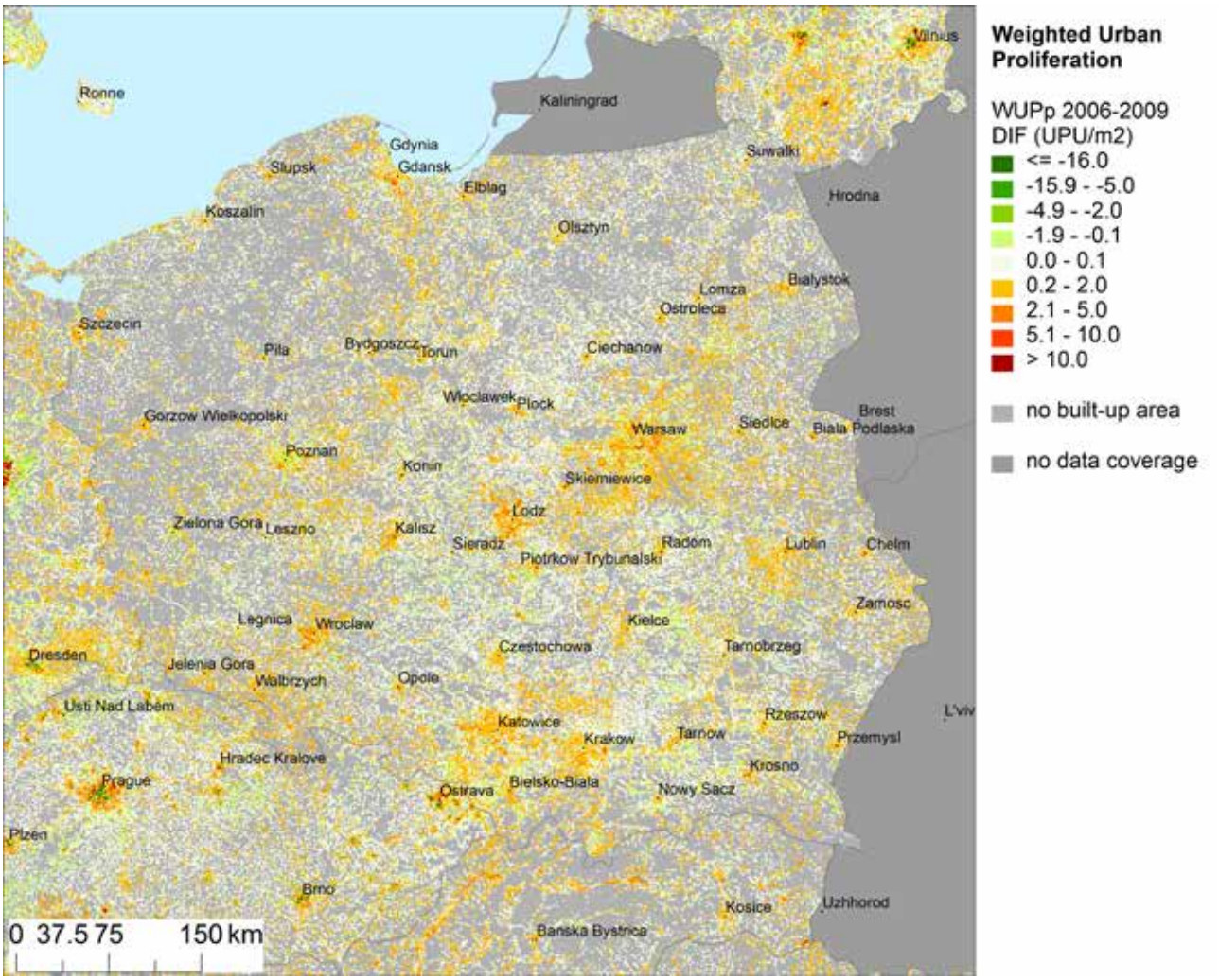


Map A4.8 **Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont)**

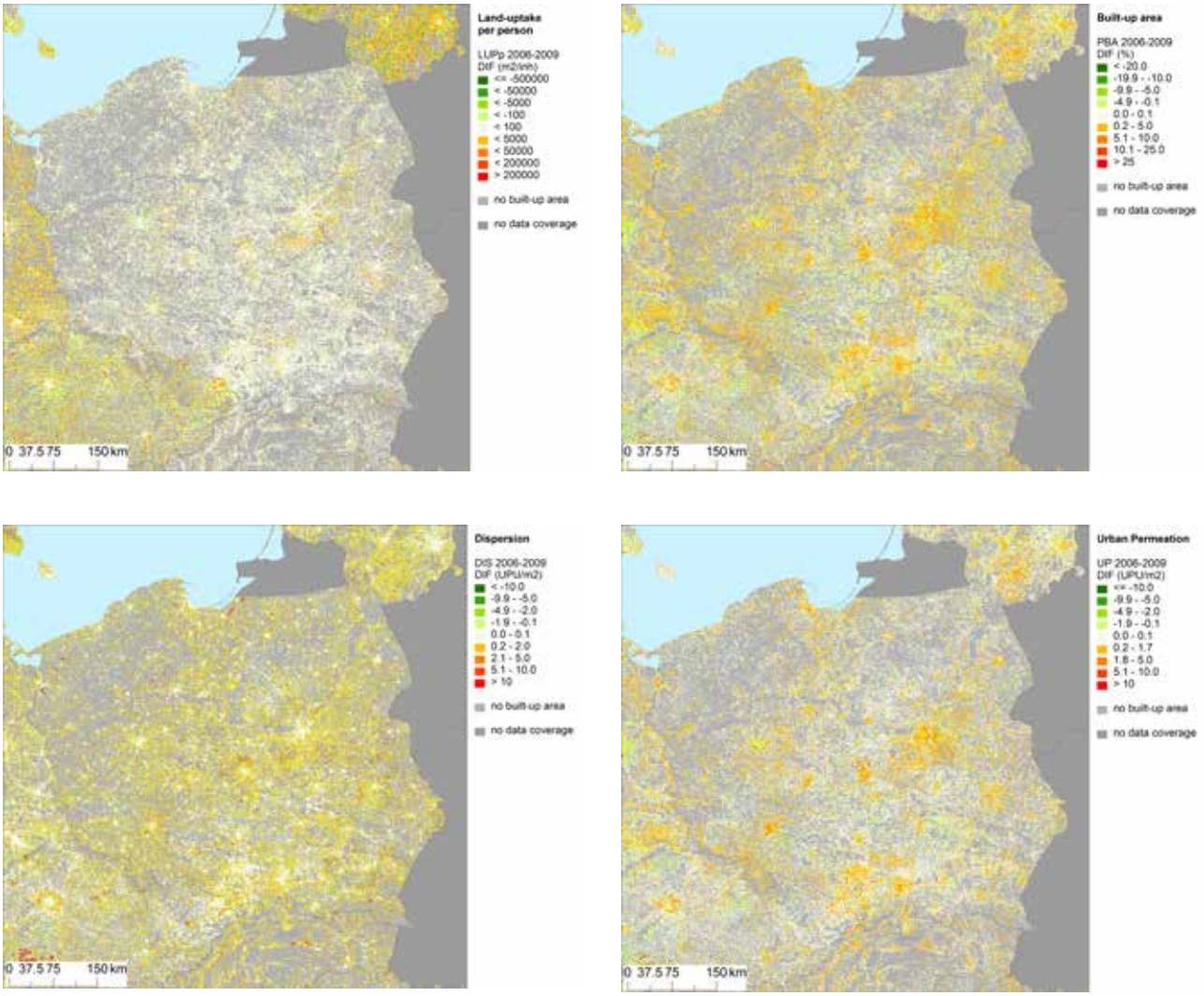


A4.3.3 Poland: changes 2006–2009

Map A4.9 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP*



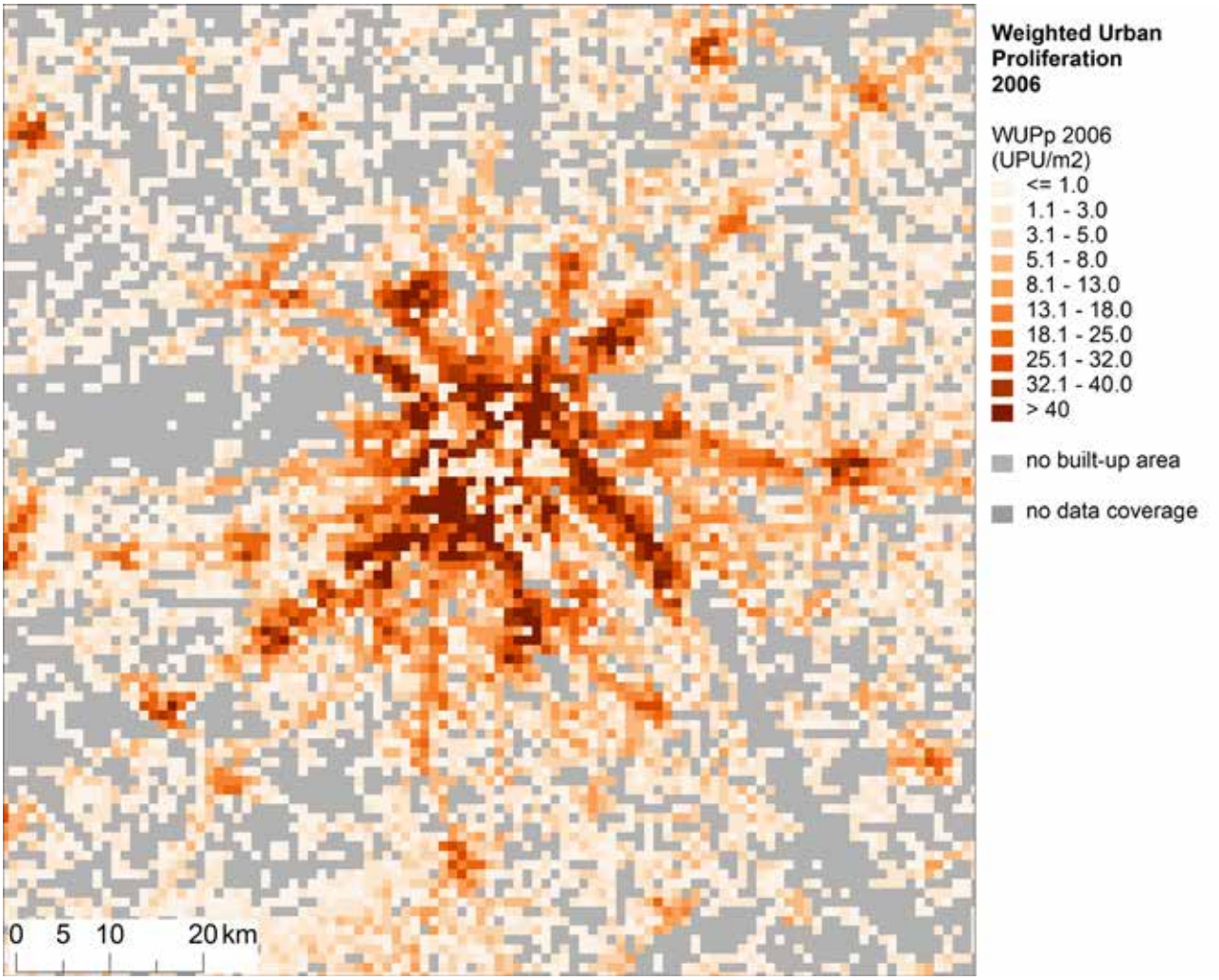
Map A4.9 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont)



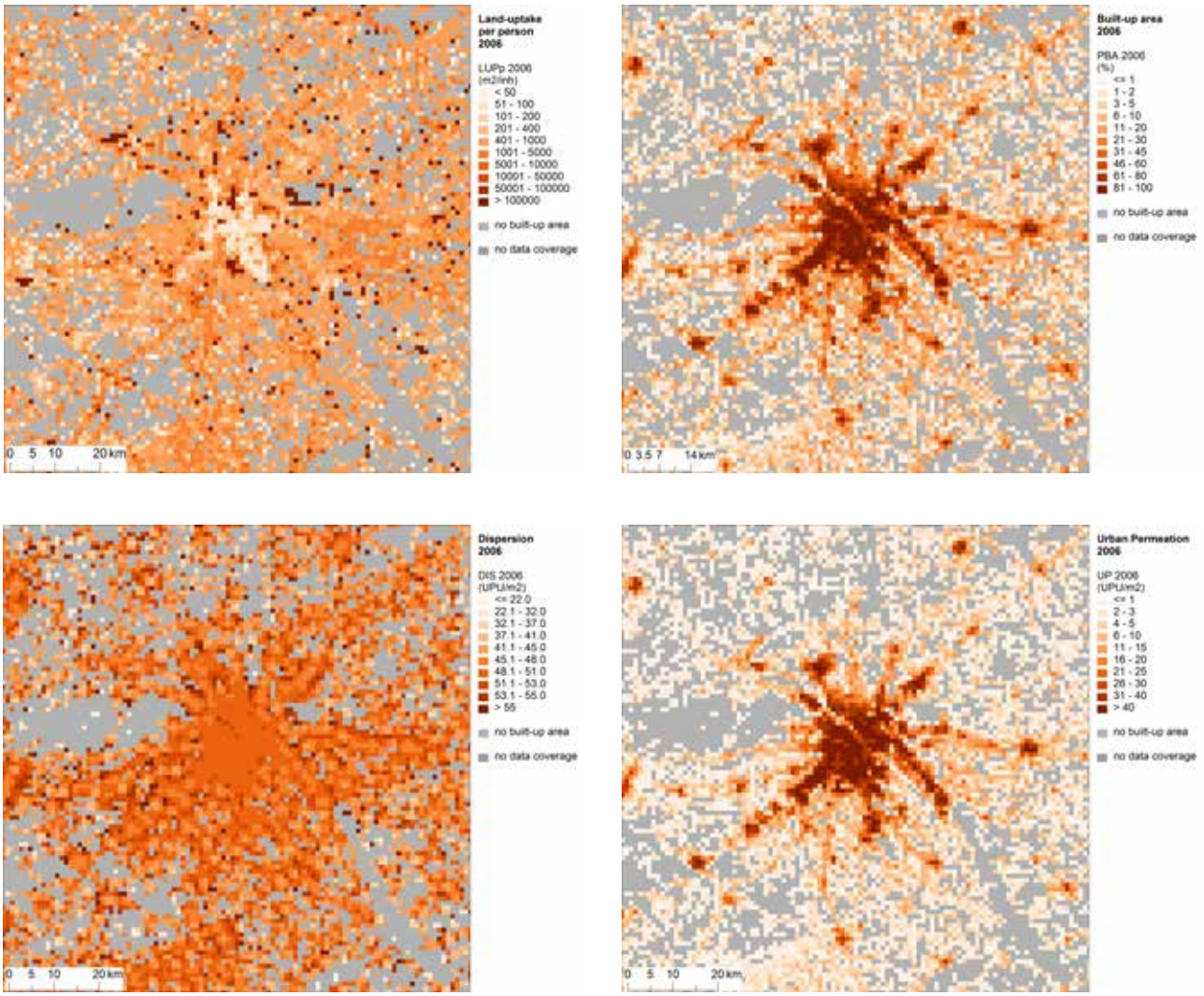
A4.4 Warsaw

A4.4.1 Warsaw 2006

Map A4.10 **Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP***

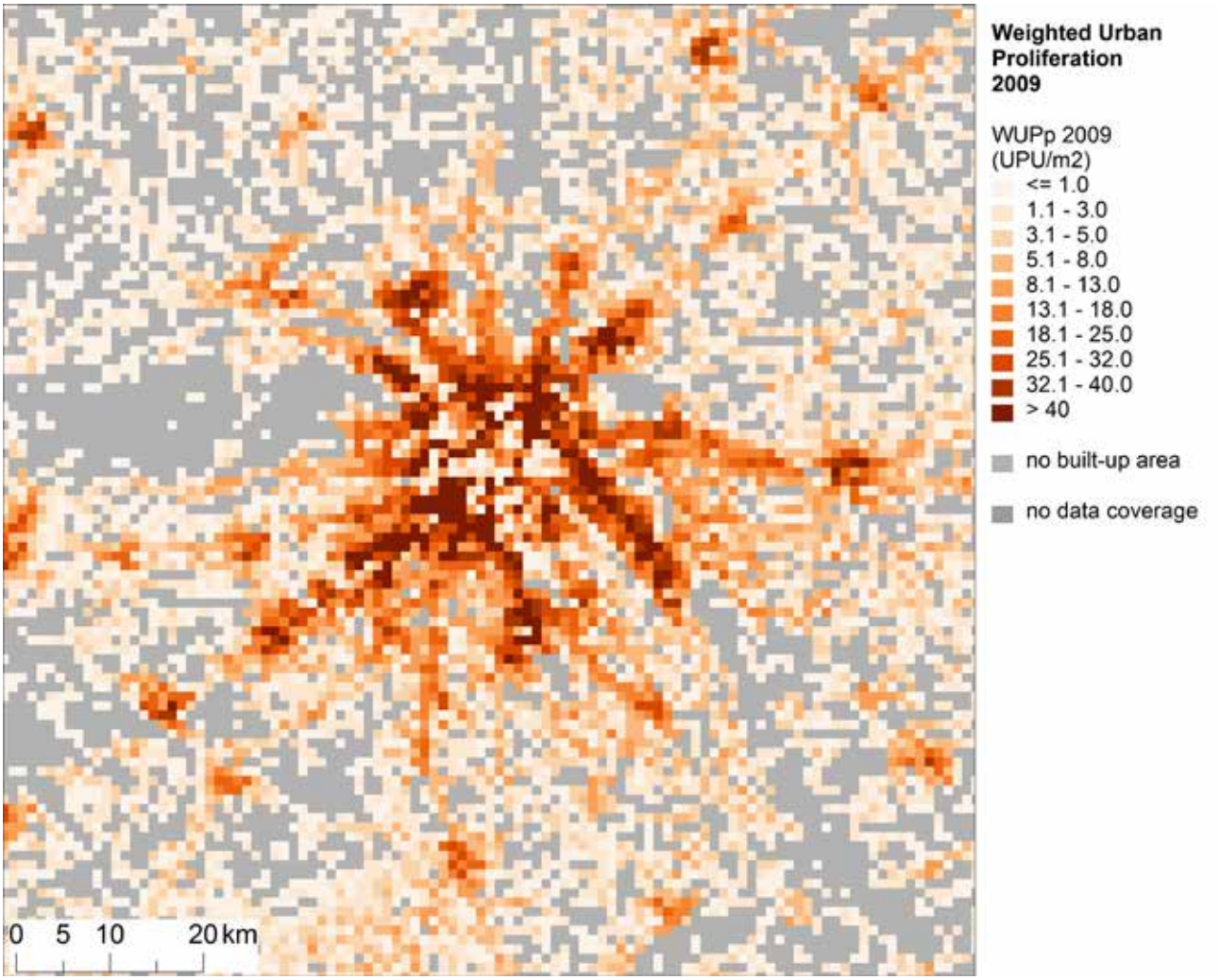


Map A4.10 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont.)

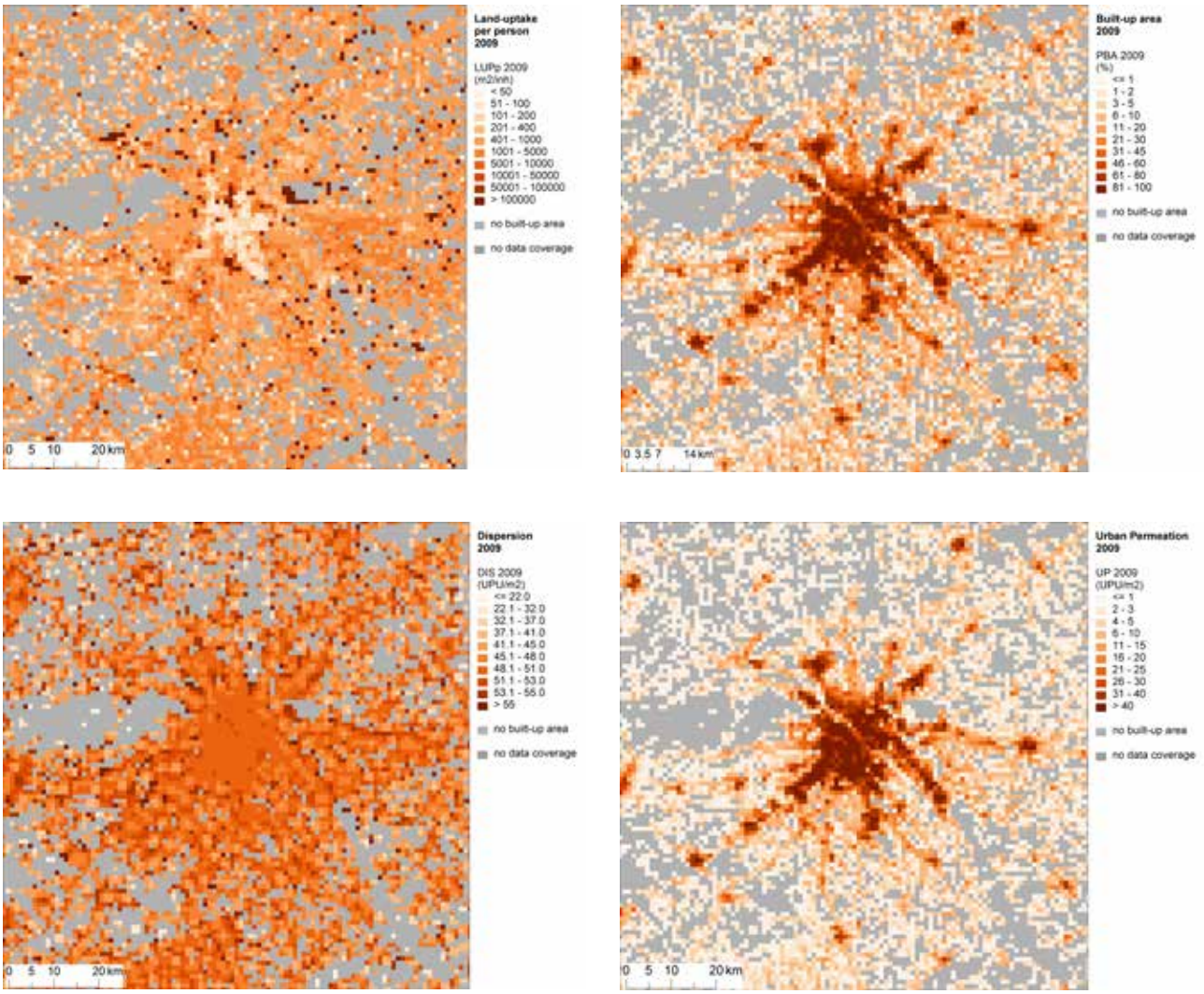


A4.4.2 Warsaw 2009

Map A4.11 Top panel: *WUP*p. Bottom panel UL: *LUP*p; down UR: built-up area; LL: *DIS*; LR: *UP*

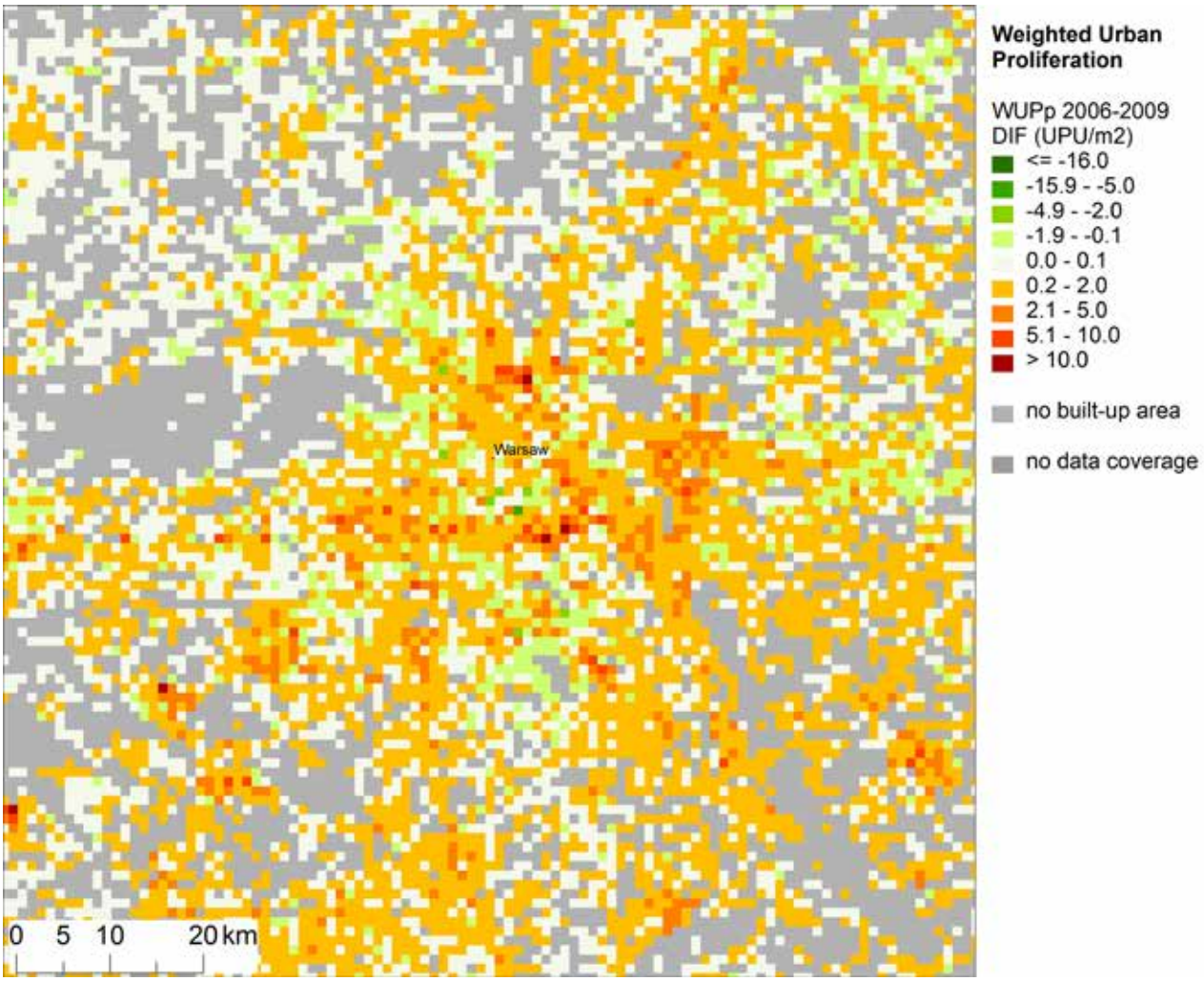


Map A4.11 Top panel: *WUP*p. Bottom panel UL: *LUP*p; down UR: built-up area; LL: *DIS*; LR: *UP* (cont.)

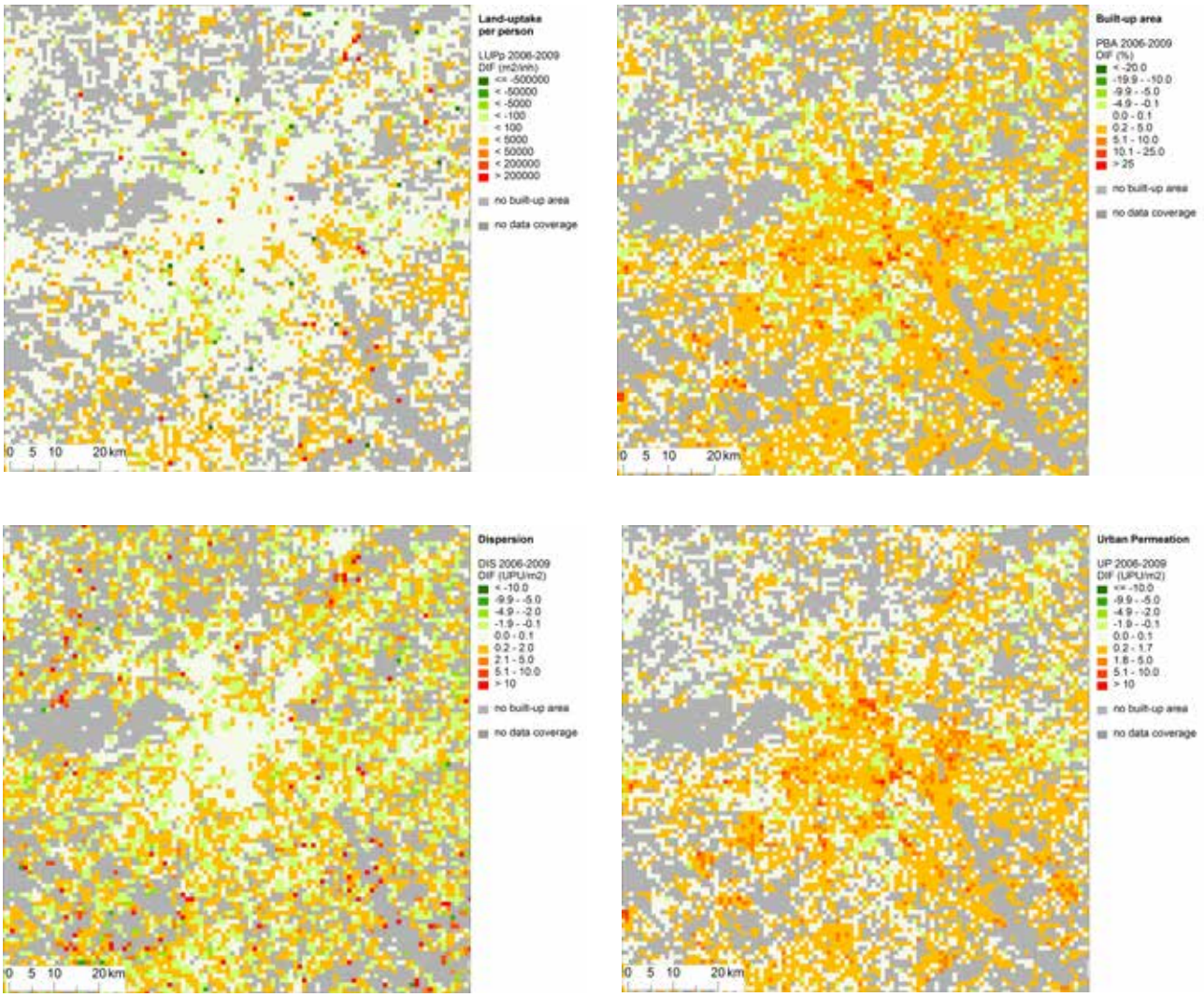


A4.4.3 Warsaw: changes 2006–2009

Map A4.12 Top panel: *WUP*p; UL: *LUP*p; UR: built-up area, LL: *DIS*; LR: *UP*



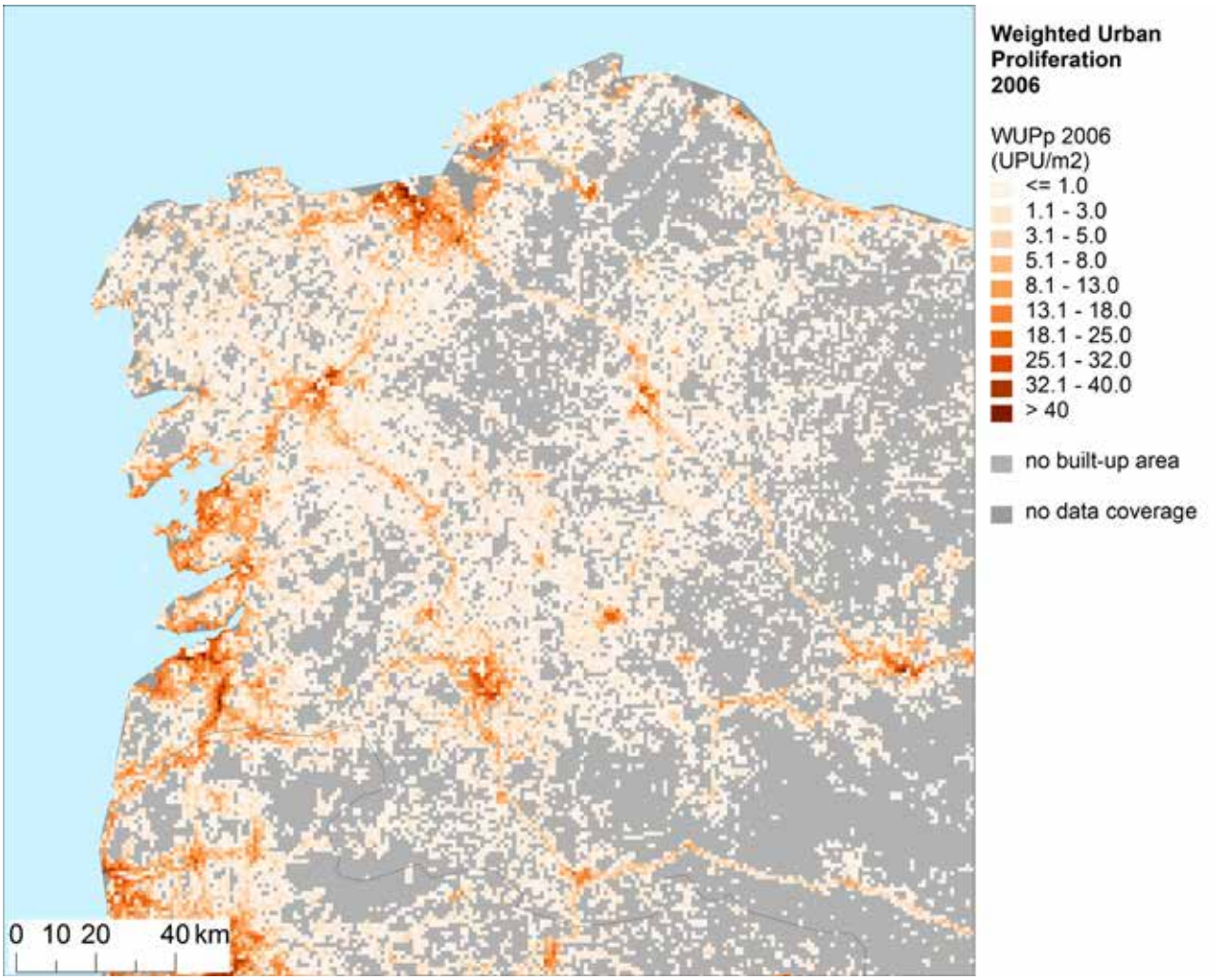
Map A4.12 Top panel: *WUP*p; UL: *LUP*p; UR: built-up area, LL: *DIS*; LR: *UP* (cont.)



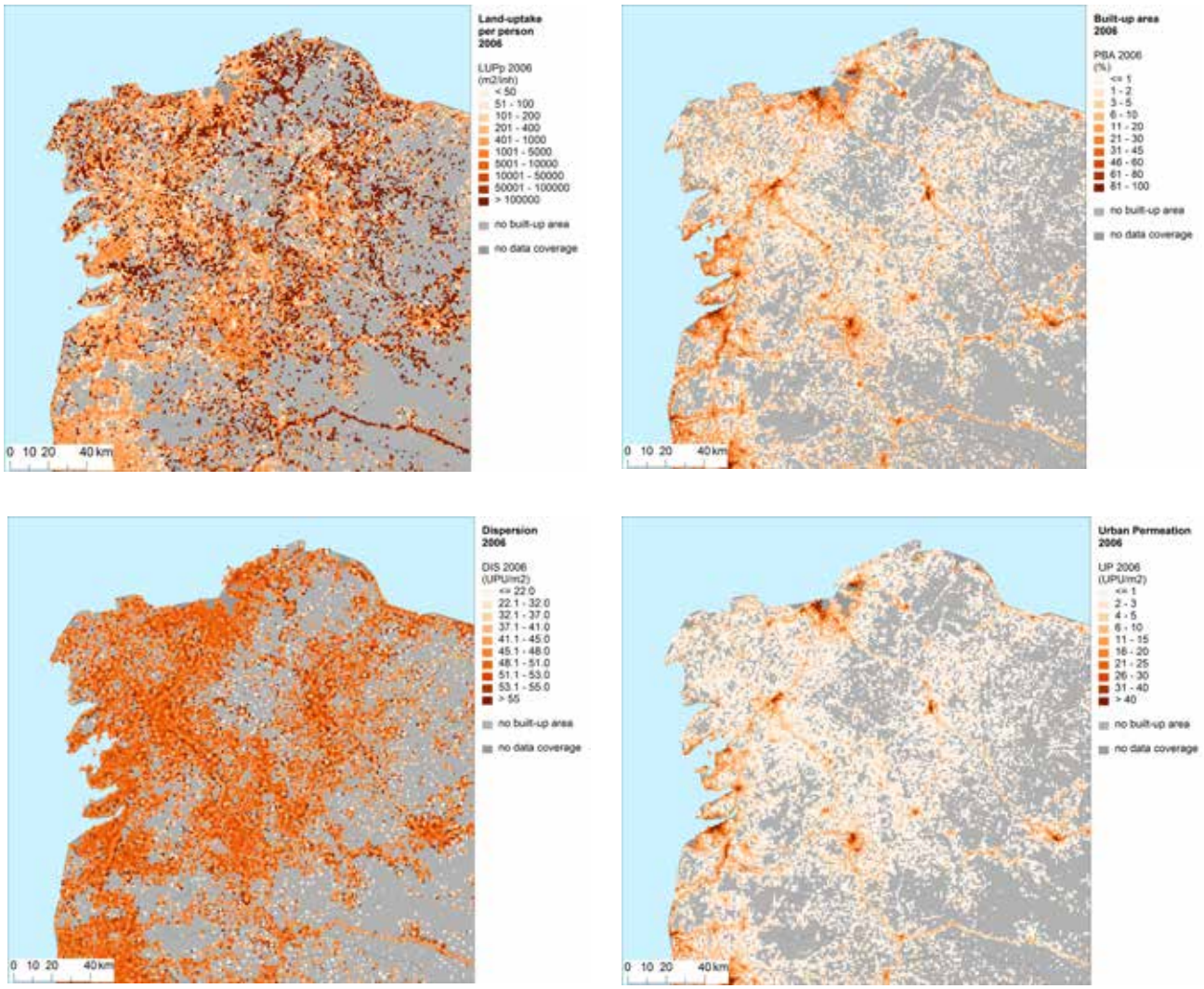
A4.5 Galicia

A4.5.1 Galicia 2006

Map A4.13 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area, LL: *DIS*; LR: *UP*

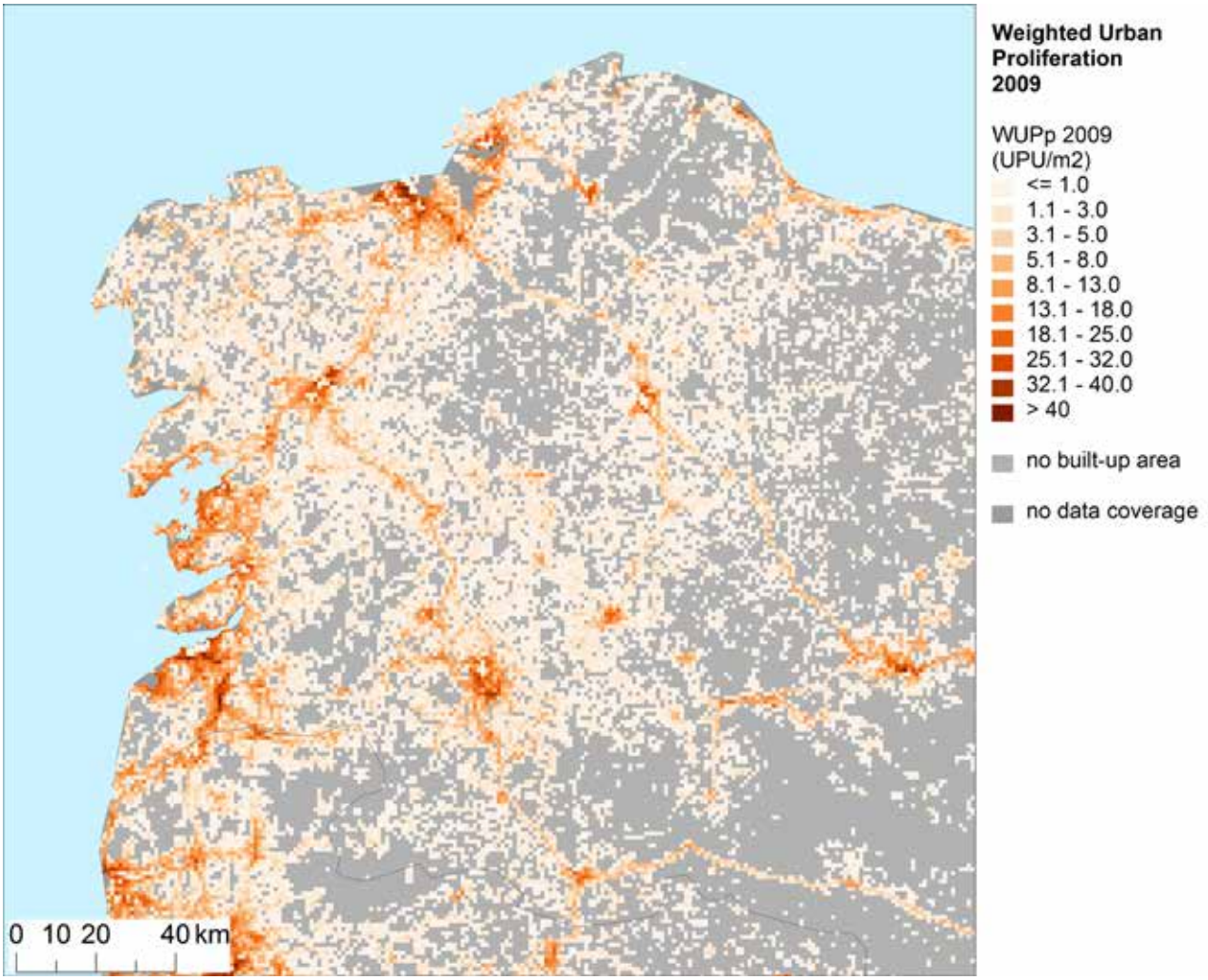


Map A4.13 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area, LL: *DIS*; LR: *UP* (cont.)

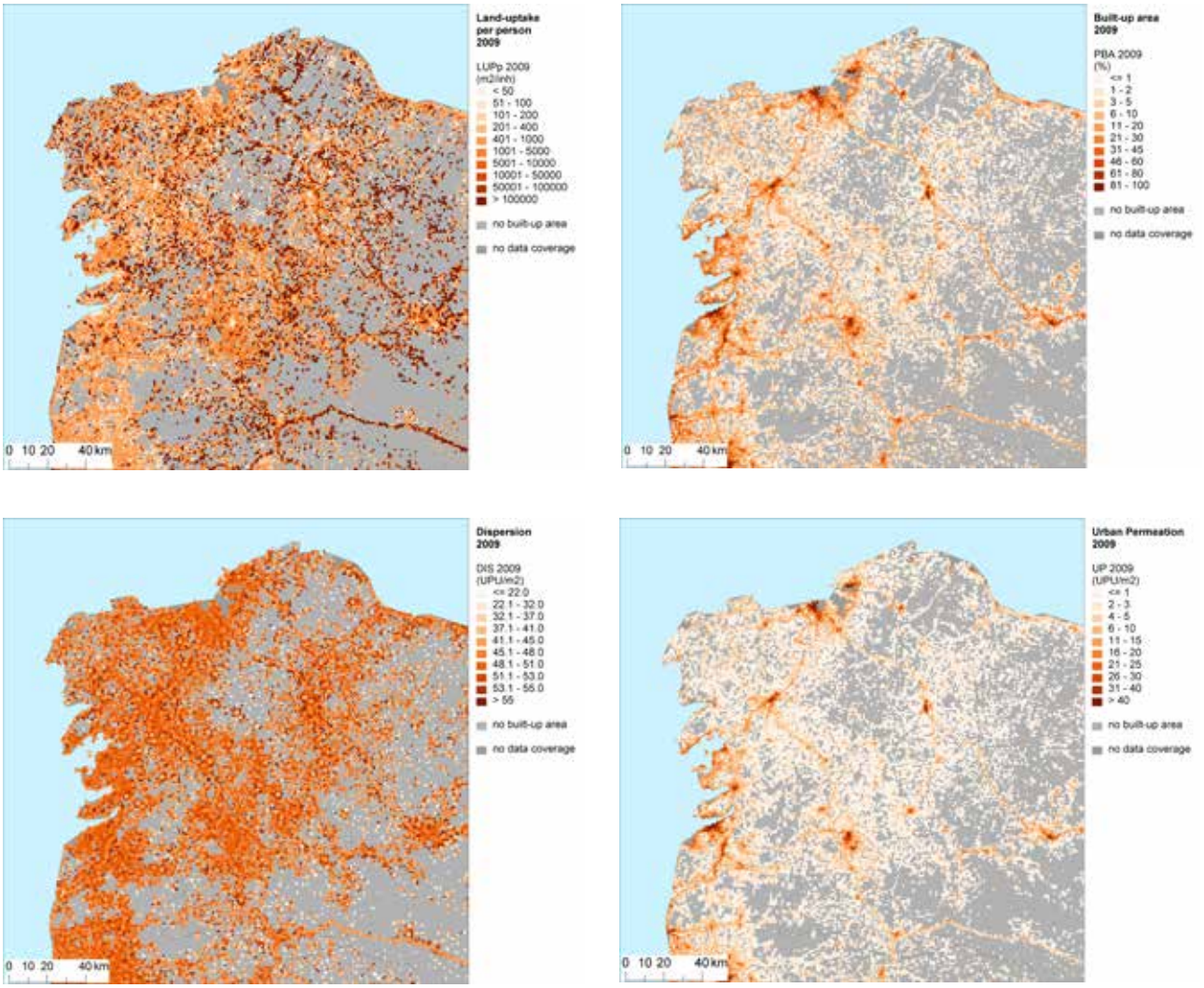


A4.5.2 Galicia 2009

Map A4.14 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP*

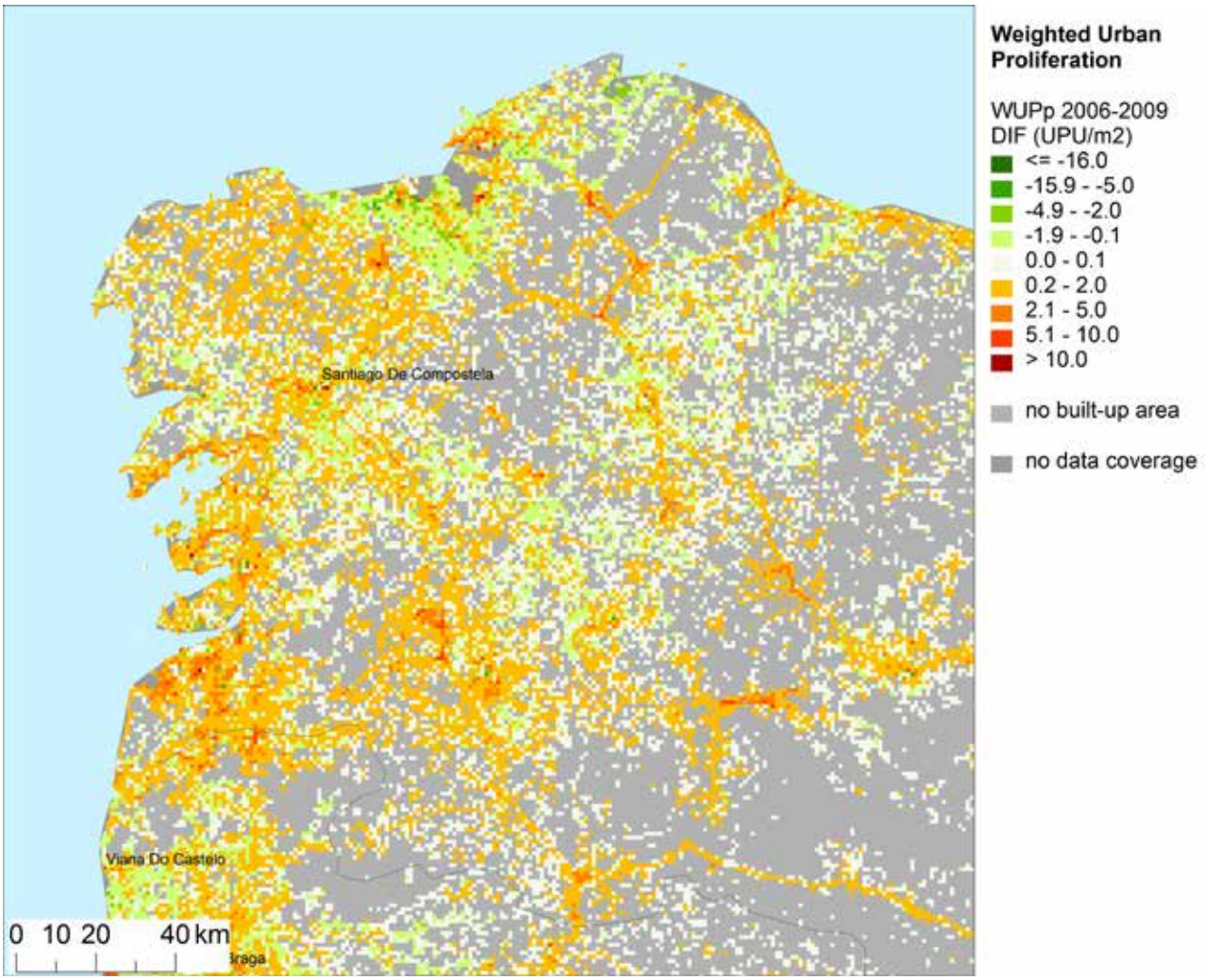


Map A4.14 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont.)

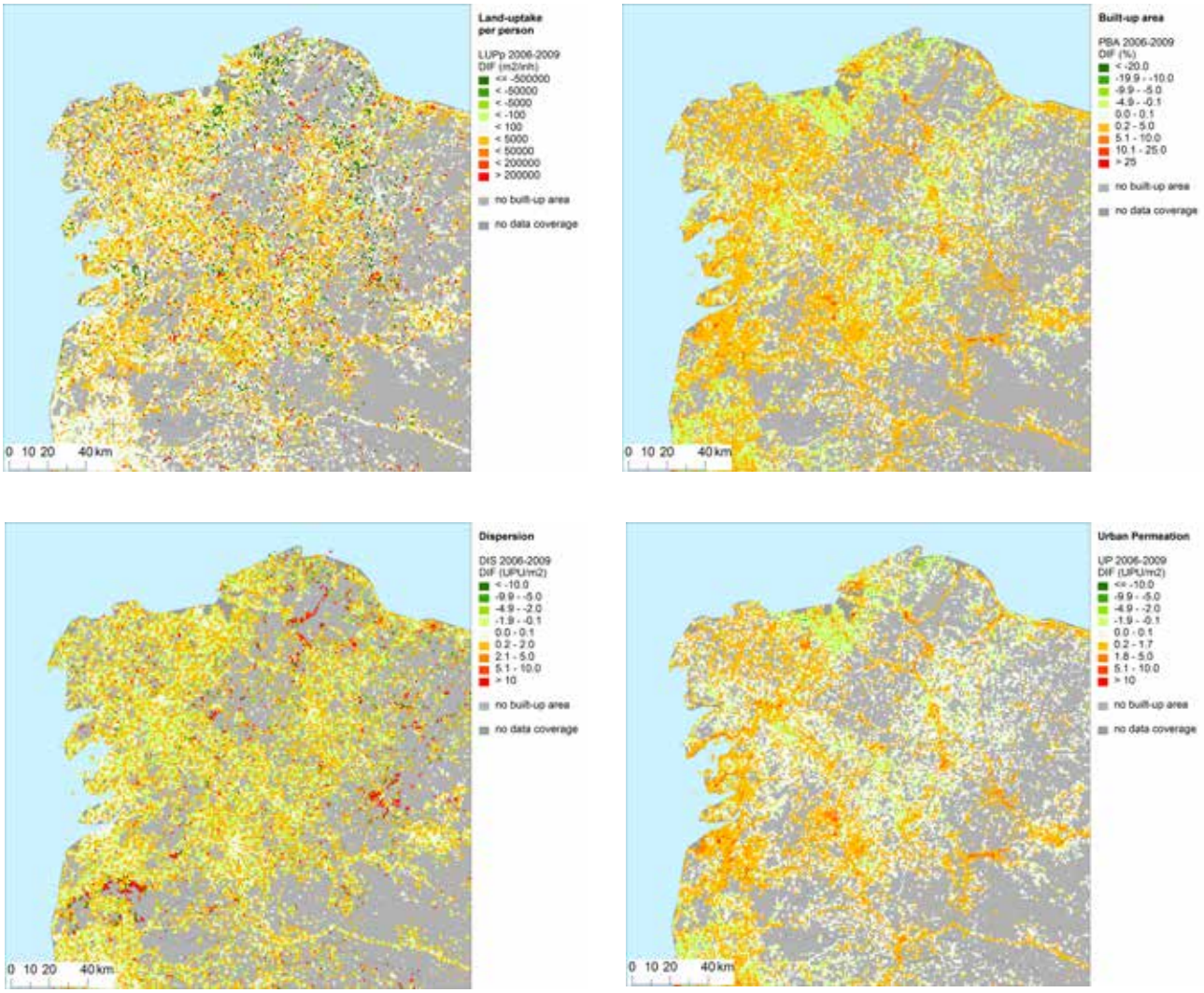


A4.5.3 Galicia: changes 2006–2009

Map A4.15 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP*



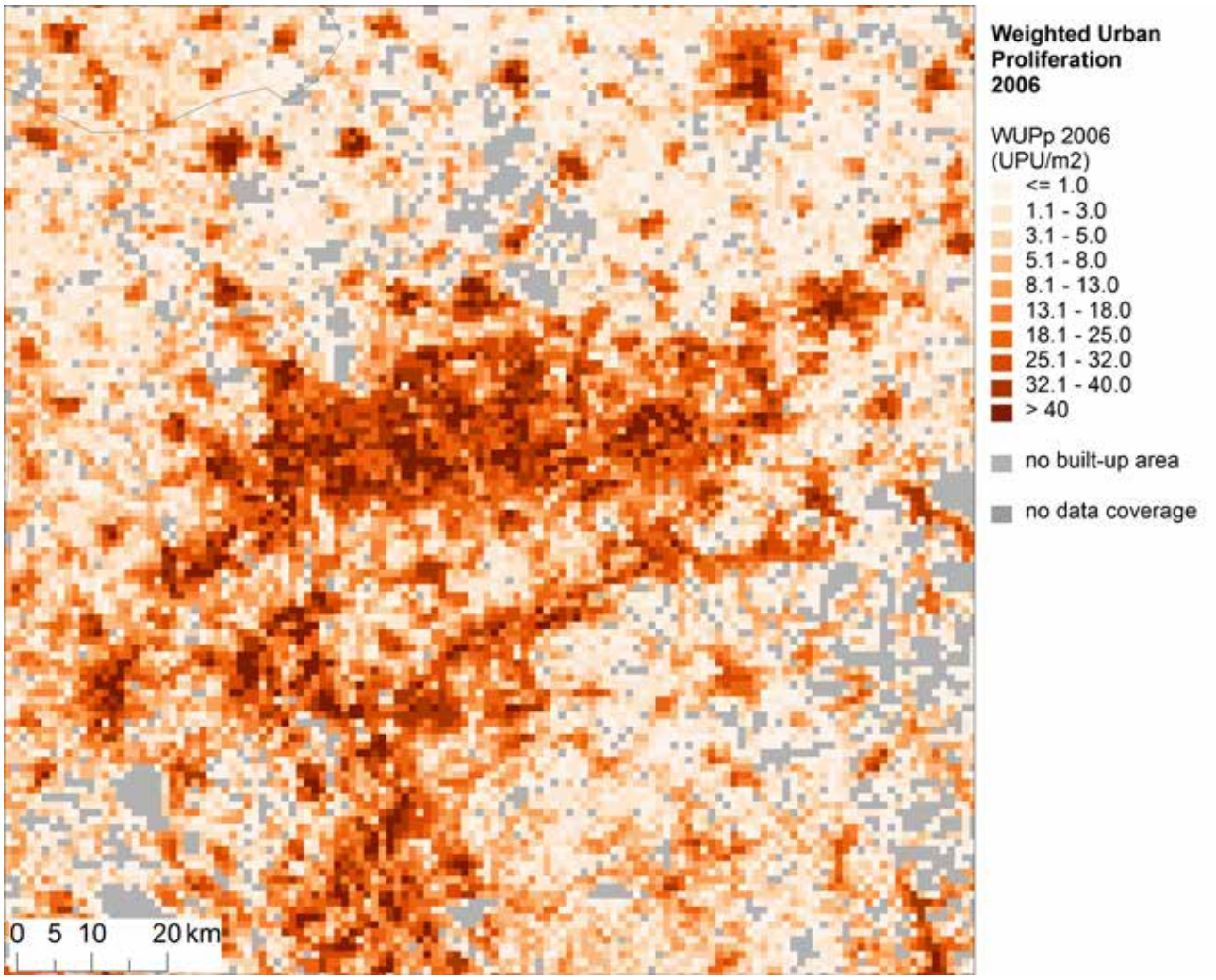
Map A4.15 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont.)



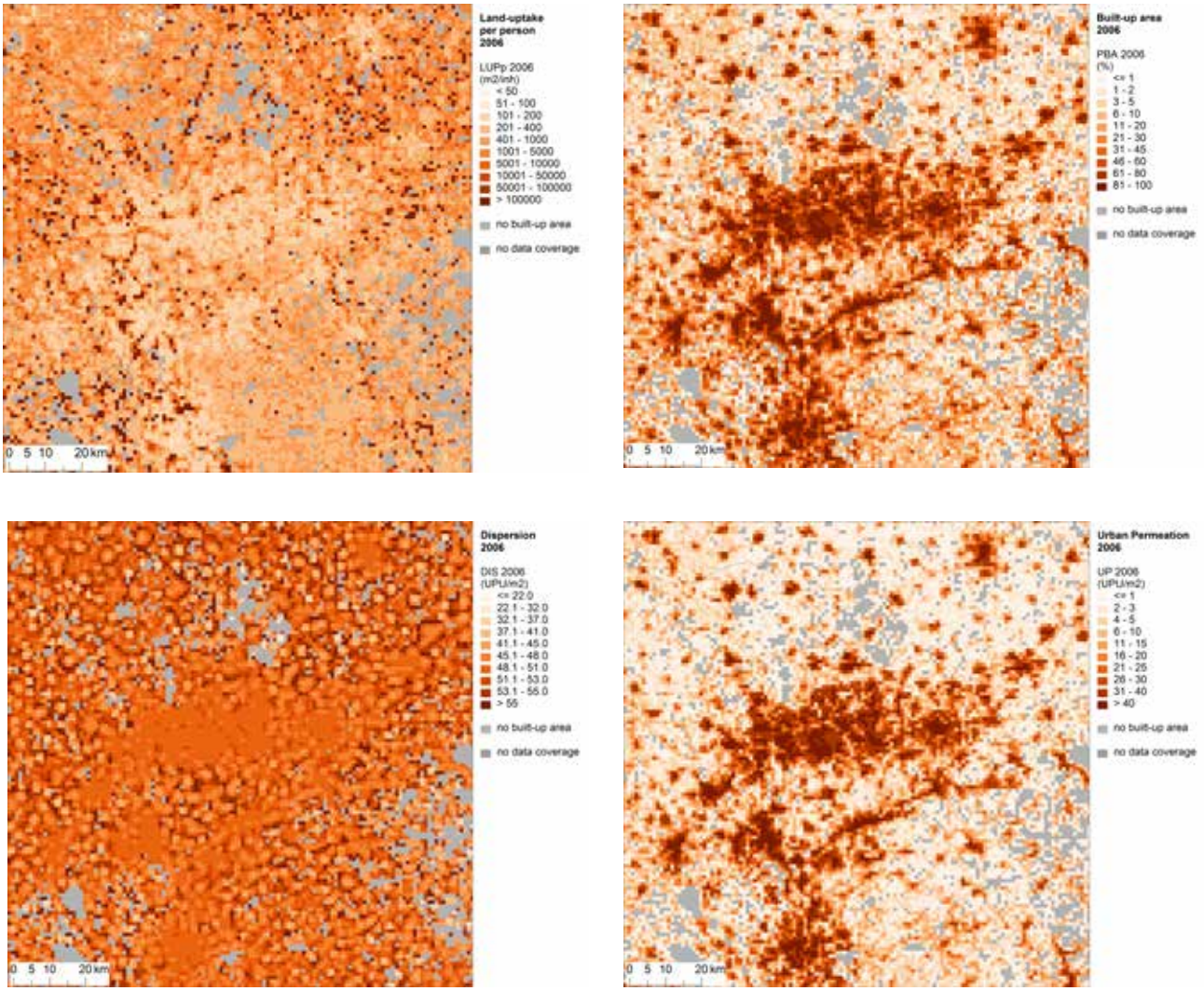
A4.6 Ruhr metropolitan region

A4.6.1 Ruhr metropolitan region 2006

Map A4.16 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP*

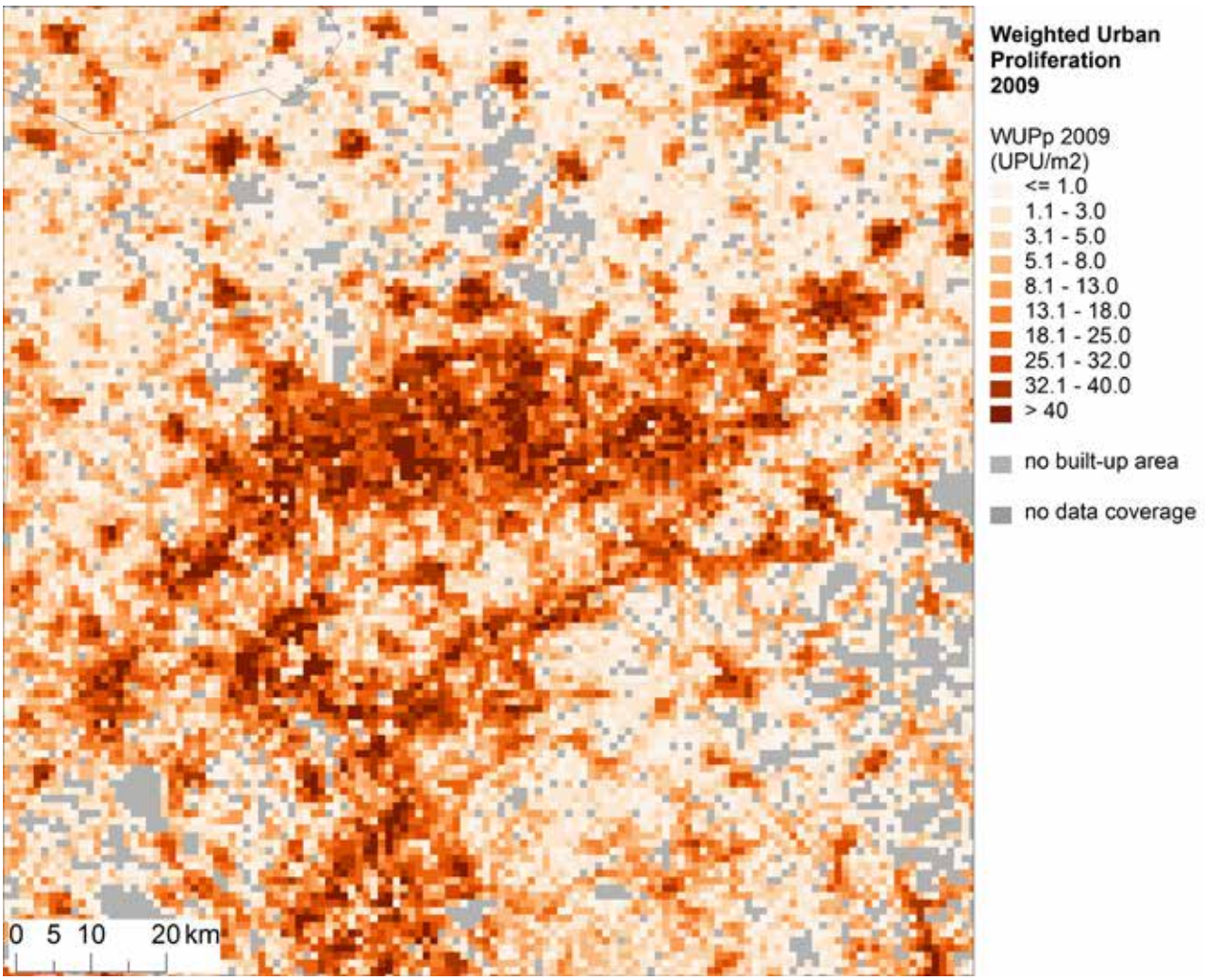


Map A4.16 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont,)

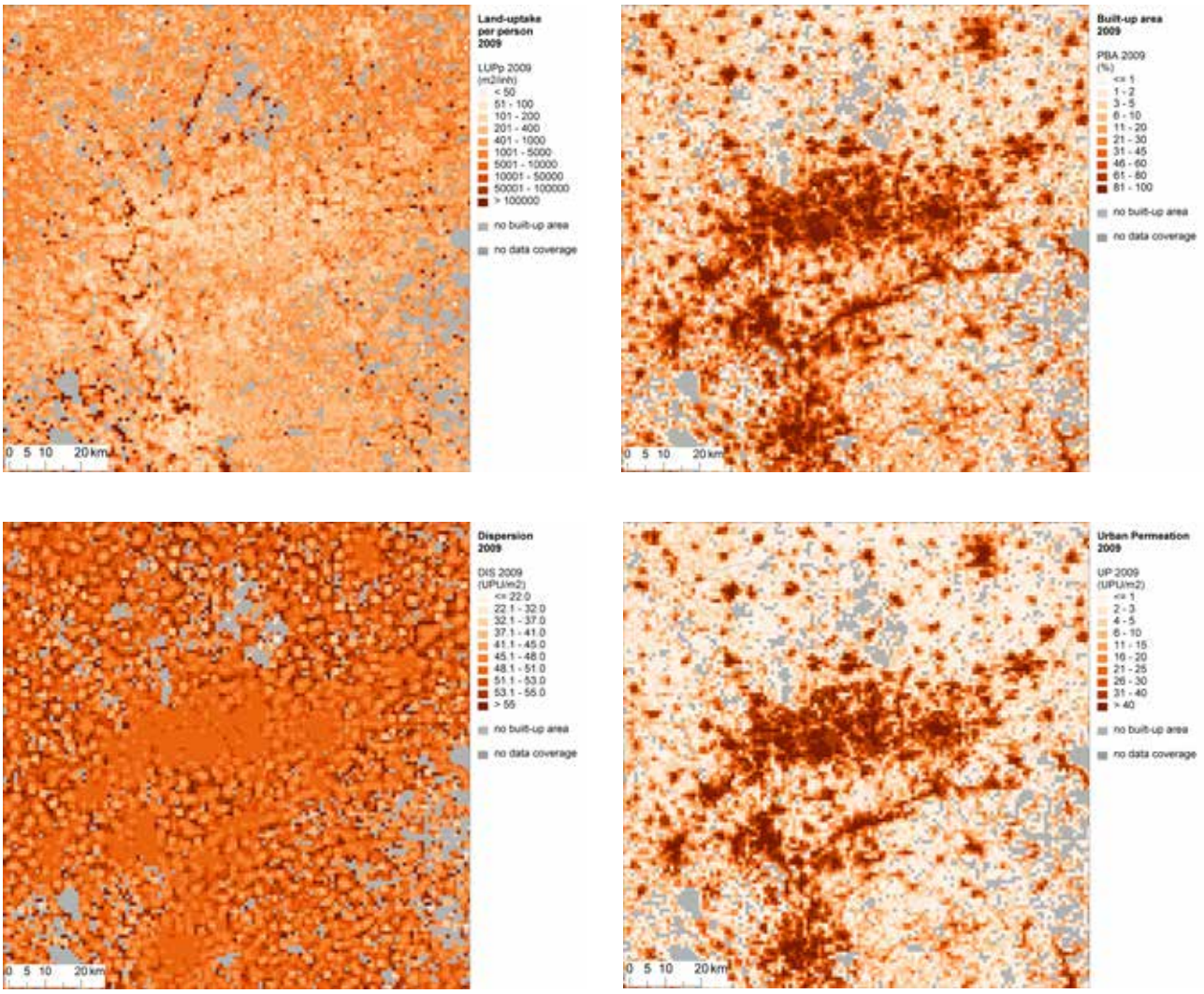


A4.6.2 Ruhr metropolitan region 2009

Map A4.17 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP*

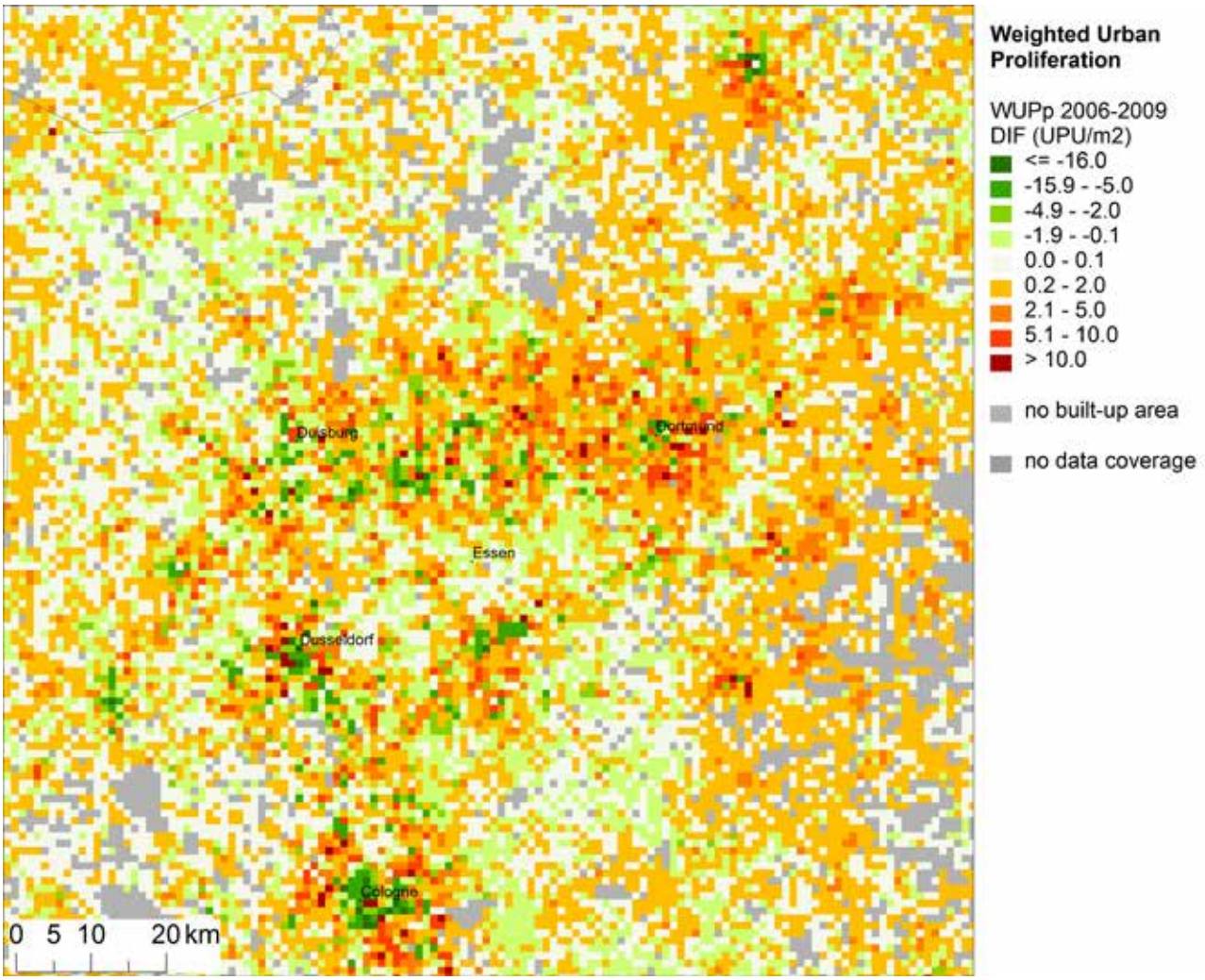


Map A4.17 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont,)

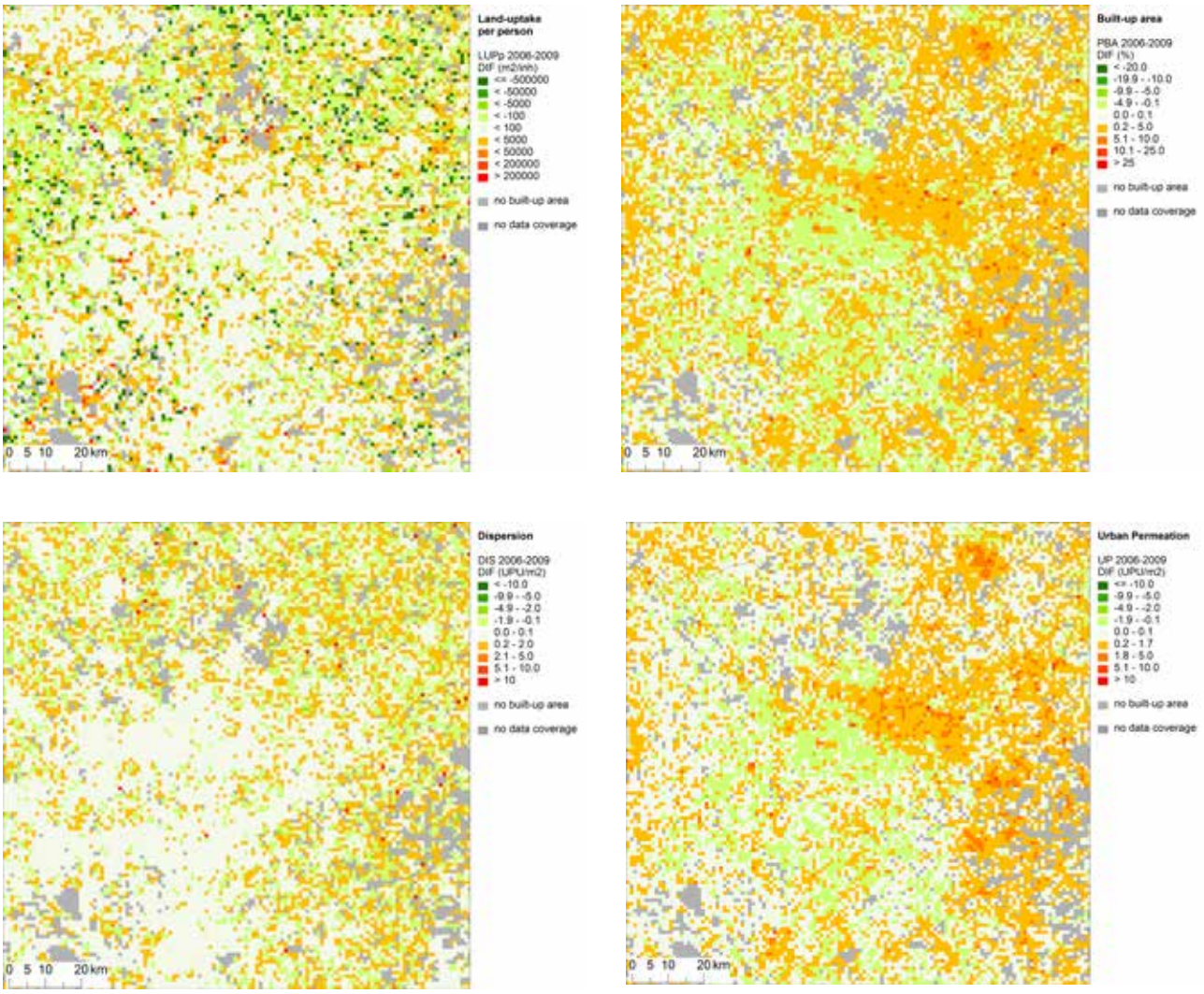


A4.6.3 Ruhr metropolitan region: changes 2006–2009

Map A4.18 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP*



Map A4.18 Top panel: *WUP*p. Bottom panel UL: *LUP*p; UR: built-up area; LL: *DIS*; LR: *UP* (cont,)



A4.7 Brief comparison with results from other studies

The results of this report are in general agreement with studies published by the EEA (2006b) and Siedentop and Fina (2012) and with the results from regional studies, namely that there are low levels of sprawl in the Scandinavian countries and in the hinterlands of Spain and high sprawl in the Benelux countries, Western Germany, the central and southern regions of England and along the coast of the western Mediterranean sea. Most studies about urban sprawl in Europe consider temporal changes in built-up areas for cities or urban regions (Kasanko et al., 2006; Turok and Mykhnenko, 2007; Catalán et al., 2008; Arribas-Bel et al., 2011; Oueslati et al., 2015) or select regions (EEA, 2006b; Couch et al., 2007), but not for all EU-28 and EFTA-4 countries. In these studies, the strongest increases in urban sprawl were reported for the outskirts of cities and for rural areas. Even many cities with declining populations, most of which are found in Central and Eastern Europe (Turok and Mykhnenko, 2007), have exhibited increases in urban sprawl (Reckien and Karecha, 2007; Siedentop and Fina, 2010; Salvati et al., 2013; Haase et al., 2014). The depopulation of city cores and the expansion of single-house residential areas have increased sprawl in several regions (Catalán et al., 2008) Siedentop and Fina, 2010).

However, there are also some substantial differences in the results for some countries, owing to the differences in the data layers used for built-up areas. Siedentop and Fina (2012) used CLC data for 1990, 2000 and 2006 with a resolution of 25 ha at each time-point (and 5 ha for changes), whereas the HRL IMD has a resolution of 0.04 ha. In addition, different regions in each CLC layer are based on data from different years (up to 5 years difference), whereas the HRL IMD includes data from only 1 year. These differences are most pronounced in regions that have a dispersed settlement structure. For example, in sparsely settled regions, small patches of built-up area are not captured by the CLC data (e.g. in Finland), whereas in densely settled regions, built-up areas often have many small open spaces which are too small to be captured by the CLC data (e.g. in Belgium). By contrast, in regions with a more compact settlement structure, the differences between the two data sets are smaller (e.g. in the Netherlands).

Siedentop and Fina (2012) studied 26 countries in Europe for 1990, 2000 and 2006 at two scales (countries and cells of size 20 km × 20 km = 400 km^2). They observed the strongest increases in sprawl in Ireland, Portugal and Spain. Their results are similar in terms of the ranking of the highest values of the *PBA* for 2006 (and in Figure 3.3 in Chapter 3) in Belgium, Denmark, Germany, Luxembourg, the Netherlands and the United Kingdom (Liechtenstein and Malta were not studied) and the lowest values in Estonia, Finland, Latvia and Sweden, (Iceland and Norway were not studied). However, Siedentop and Fina (2012) found considerably higher values for the *PBA* for Bulgaria and Romania (higher than in Austria and Italy). Regarding land uptake per inhabitant, their results also agree with our findings (on land uptake per inhabitant or job) in many cases (e.g. very high values in Finland, Lithuania and Latvia, low values in Spain, Romania and Italy), but there also are some differences. Siedentop and Fina (2012) did not use the built-up area from the CLC data for this variable, but used the sealed surface from the EU FTS-Soil-Sealing data set, in combination with population data for 2001.

Siedentop and Fina (2012) used the pattern metric of 'effective open space' to characterise the spatial arrangement of built-up areas. According to this metric, the highest urban sprawl is found in Belgium, Croatia, Denmark, Luxembourg and the Netherlands, whereas the lowest levels are in Finland, Latvia, Spain and Sweden. These results agree partially with the values of dispersion (Figure 3.3b in Chapter 3). The differences can be explained by the fact that 'effective open space' measures something other than dispersion, and by the different base data. Siedentop and Fina (2012) explain that 'effective open space' indicates the degree of fragmentation of open spaces and potential habitats.

Siedentop and Fina (2012) found the greatest increases in urban sprawl in Ireland, Portugal and Spain (for 1990–2006). This report found the strongest relative increases in *WUP* (2006–2009) in Malta (35 %), Sweden (23 %), Norway (17 %), Spain (16 %) and Slovenia (13 %) (Malta and Norway were not studied by Siedentop and Fina). Therefore, the results agree only for Spain. However, Siedentop and Fina (2012) used a different method for the calculation of sprawl and covered a different time period. The banking crisis of 2006–2011 may also have contributed to the differences in the findings.

Annex 5 Source data and some comments about the statistical analysis of driving forces

This annex presents the geographical extent of the study area (Section A5.1) and the sources of the data for the countries and the NUTS-2 regions (Section A5.2), followed by some comments on the analysis of driving forces (Section A5.3). If not specified otherwise, websites were last time accessed between September and October 2015.

A5.1 Geographical extent of the study area

Europe ranges geographically from the Atlantic coast in the west to the Ural mountains in the east, and from the Barents Sea in the north to the Mediterranean Sea in the south, and includes 49 countries, of which 5 belong only partially to Europe (Azerbaijan, Georgia, Kazakhstan, Russia and Turkey) ([2]). Three additional countries do not belong to the continent of Europe, but are occasionally listed among European countries for historical reasons or owing to cultural proximity (Armenia, Cyprus and Israel). Our study of urban sprawl considers Europe as it is defined politically (i.e. only the 28 EU and the 4 EFTA countries (Norway, Iceland, Switzerland and Liechtenstein)). For the analysis at the country level, we included a few countries that do not belong to the EU or EFTA when data were available, in order to provide a more complete picture of urban sprawl in Europe. These countries are the Balkan countries and partners (Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Kosovo, Montenegro and Serbia) and the city states of Monaco and San Marino. Other countries were not considered owing to a lack of data in the HRL soil sealing layer (e.g. Andorra) or unreliable or incomplete information for the calculation of urban sprawl (e.g. Vatican City).

A5.2 Source data

The information on population size, the number of people commuting to work and the number of people in full- and part-time employment was obtained from Eurostat for almost all countries ([3]). For Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Kosovo, Monaco, Montenegro, San Marino and Serbia, we referred to third-party sources (see below).

A5.2.1 Explanatory variables

Our statistical model consisted of 14 numerical explanatory variables about demography (population size and ageing index), the socio-economic situation (employment rate, *GDP* per capita (in Purchasing Power Standards (PPS)), household size, fuel price (in USD), number of passenger cars per person, road density, rail density), variables related to political or governmental activity (natural resource protection indicator (*NRPI*), governmental effectiveness) and several geophysical variables (relief energy, net primary productivity, irreclaimable area, proportion of coast length).

As far as possible, we used base data to calculate several variables. Ageing index describes the proportion of the population over 64 years of age in relation to the proportion of the population under 15 years of age:

> Ageing index = (population > 64 years / population < 15 years) × 100.

Employment rate is defined as the ratio of the number of working age (15–64 years) people in employment to the total number of the population of the same age:

> Employment rate = No of employed people of working age / No of people of working age.

Household size is the average number of people living in one household:

> Household size = population size / No of households.

([2]) https://en.wikipedia.org/wiki/Europe (last accessed 3 August 2015).
([3]) http://ec.europa.eu/eurostat/web/main/home (last accessed 3 August 2015).

Similarly, the number of passenger cars was divided by population size in order to obtain an intensive variable that accounts for the fact that more cars are present in a region in which the population is larger:

Passenger cars per inhabitant = No of passenger cars / population size.

Road and rail density were calculated as:

Road density = length of road infrastructure / area;

Rail density = length of rail infrastructure /area.

Finally, the proportion of coast length was calculated from the border length of each reporting unit and its length of coast:

Proportion of coast length = coast length / border length.

Although information was available for geophysical variables for all reporting units, the situation was different for household size, the number of passenger cars, ageing index and employment rate, and there was no information on these variables in the Eurostat database for 2006 and 2009 for Albania, Bosnia and Herzegovina, Kosovo, Monaco, San Marino, Serbia and Turkey. Although Eurostat contained values about employment rate for some of these countries, there was no pre-calculated value for ageing index. Consequently, we searched elsewhere for this information or for data that would allow us to calculate these variables.

Another issue in the search for adequate data was the reference year. The population size recorded in Eurostat referred to 1 January of each year; however, some national statistical offices had undertaken their censuses in the middle or at the end of the year. In cases in which the values were reported for 1 January each year, we used those from the next calendar year (i.e. the values for 2006 are those from 1 January 2007). In the other cases, we took the values from the given year (i.e. mid-2006 or the end of 2006 for 2006). Although this information was often given for the population data, it was lacking for employment and other socio-economic data. In such cases we decided to use the data from the year being studied (i.e. data from 2006 for the analysis for 2006).

A5.2.2 Sources at the country level

Albania

Source: Republika e Shqiperise, Instituti i Statistikave (INSTAT)

Path:

1. Themes > Population > Population 1 January 2001–2015: http://www.instat.gov.al/media/132226/tab-1.xlsx (last accessed 14 September 2015).

2. Themes > Labour Market > Employment Rate 2007–2014: http://www.instat.gov.al/media/231093/tab2.xlsx (last accessed 14 September 2015).

3. Themes > Labour Market > Labour force participation rate 2007–2014: http://www.instat.gov.al/media/231090/t4.xlsx (last accessed 14 September 2015).

Population

The following population data were available from the Statistical Institute of the Albanian Republic (URL's listed see above): 2006: 203 700 (1 January 2007); 2009: 178 704 (1 January 2010); 2012: 174 179 (1 January 2013).

Commuting (28 September 2014)

There was no information about commuting in the database of the Statistical Institute or in Eurostat for Albania. We used the values for employment as substitutes for the values for commuting. Although the Statistical Institute of Albania provides information on employment, the values are low. We therefore used values reported in the United Nations Economic Commission for Europe (UNECE) Statistical Database (http://www.unece.org/stats/).

Full- and part-time employment

See information on commuting and Table A5.1.

Table A5.1 AL_EmploymentUNECE: The total number of people in employment and the number of people in full- and part-time employment in Albania (1 000), 2007–2012

Employment status	2007	2008	2009	2010	2011	2012
Employed	1 197.7	1 123	1 160.5	1 167.4	1 160.5	1 117.1
Full-time	868.8	872.6	928.9	902.7	859.9	856.8
Part-time	328.9	250.4	231.6	264.7	299.6	259.4

Employment
There was no information on the number of people of different working ages and no information on employment rates for 2006.

Solution: we used the data on employment rates for 2007 (> 15 years = 50.3; 15–64 years = 56.6) and 2009 (> 15 years = 47.5; 15–64 years = 53.5) to calculate the number of people of working age > 15 years and between 15–64 years using the following formulae:

2006, > 15 years:

0.503 × (population size 2007 – population size < 15 years 2007) = 0.503 × 2 981 755 – 744 919 = 1 125 128.508 = 1 125 129

Table A5.2 Total number of households in Albania, 2001–2011

Year	Estimate of the total number of households
2001	726 895
2002	726 432
2003	725 968
2004	725 505
2005	725 042
2006	724 579
2007	724 115
2008	723 652
2009	723 189
2010	722 725
2011	722 262

Source: 2001 and 2011 censuses; see Table 2.21: Households by number of Members, type of household at http://www.instat.gov.al/media/153054/tab_2.21.xls (accessed 25 October 2015) for 2001 and Table 1.4.3: Private households by type of household, number of household members and urban and rural area at http://www.instat.gov.al/media/178253/tab_1_4_3.xls (accessed 25 October 2015) for 2011.

2006, 15–64 years:

0.566 × (population size 2007 – population size < 5 years 2007 – population size > 64 years 2007) = 0.566 – 2 981 755 – 744 919 – 283 365 = 982 595.913 = 982 596

2009, > 15 years:

0.475 × (population size 2010 – population size < 15 years 2010) = 0.475 × (2 918 674 – 656 952) = 1 074 317.950 = 1 074 318

2009, 15–64 years:

53.5 × (population size 2010 – population size < 15 years 2010 – population size > 64 years 2010) = 0.535 × (2 918 674 – 656 952 – 313 659) = 925329.925 = 925 330

Number of households in Albania
Total number of households in 2001: 726 895.

Total number of households in 2011: 722 262.

Slope = (722 262 – 726 895) / (2011–2001) = – 463.3.

Bosnia and Herzegovina

Population
There is information on Bosnia and Herzegovina's population size, but not demographic structure, for 2006 and 2007 in Eurostat. We used the Eurostat information on population size in our data (for 1st January of the following year; i.e. for 2006 the information from 1st January, 2007 was used, and so on): 2006: 3 842 562; 2009: 3 843 126.

Full- and part-time employment
There was no information found in the Eurostat database or the National Statistical Office of Bosnia and Herzegovina as regards full- and part-time employment. We therefore used the information about employment from the UNECE statistical database (http://www.unece.org/stats/) for this country.

Commuting
See paragraph on Commuting in Bosnia and Herzegovina above.

Ageing index
Eurostat contains no information about the demographic structure of Bosnia and Herzegovina. However, we found information in the National Statistical database of Bosnia and Herzegovina from 2008.

Source: Bosnia and Herzegovina, Federation of Bosnia and Herzegovina, Institute for Statistics of the Federation of Bosnia and Herzegovina.

Path: for 2008: under 'DATA OF FB&H' choose 'STATISTICAL YEARBOOK — ANNUALLY DATA' > ESTIMATION AND NATURAL CHANGE > The estimate of the present population by age and sex, 30 June 2008 (http://www.fzs.ba/Dem/ProcPrist/stalno.pdf, p. 52). For 2009: under 'DATA OF FB&H' choose 'STATISTICAL YEARBOOK — ANNUALLY DATA' > ESTIMATION AND NATURAL CHANGE > The estimate of the present population by age and sex, 30 June 2009 (http://www.fzs.ba/saopcenja/2009/14.2.1.pdf, p. 1).

However, the population information in the sources of the National Statistical Office differs. For example, the Annual Statistical Report 2007 (http://www.fzs.ba/SG2007.pdf) contains mid-year population estimates for 2006 (p. 65, permanent population (in thousands): 2 845; present population (in thousands): 2 325 (p. 37 of the same yearbook: 2 325 018)). These estimates are different from those reported in the Labour Force Survey 2007 (http://www.bhas.ba/ankete/ARS-07-bh.pdf, Reference week 16–22 April 2007, 3 372 000) or in Eurostat (1 January 2007: 3 842 562) — Table A5.4 lists the numbers provided by the Labour Force Surveys.

Table A5.3 BA_Commuting: The total number of people in employment and the number of people in full- and part-time employment in Bosnia and Herzegovina, from the UNECE database (1 000)

Bosnia and Herzegovina	2006	2009	2012
Employed	810.8	859	NA
Full-time	717.9	771	NA
Part-time	92.9	88	NA

Table A5.4 BA_Employment: Information on population and employment in Bosnia and Herzegovina according to the Labour Force Survey 2008 and 2011

Variable	2006	2007	2009	2010
Population (1 000)	3 372	3 315	3 129	3 130
Population < 15 years (1 000)	639	590	534	533
Population 15–64 years (1 000)	2 242	2 235	2 008	2 101
Population < 15 years (%)	19.0	17.8	17.1	17.0
Population 15–64 years (%)	66.5	67.4	66.7	67.1
Population at working age (1 000)	2 733	2 725	2 594	2 597
No of employed people (1 000)	811	850	859	843
Employment rate	29.7	31.2	33.1	32.5
Activity rate	43.1	43.9	43.6	44.6
Reference week	3–9 April	16–22 April	11–17 May	12–18 April

Owing to the similarity of the values reported in the Labour Force Surveys, we used the values in these surveys to calculate the percentages of the population < 15 years and > 64 years of age.

For 2006: using the data from the Labour Force Survey for 2007 (reference week: 16–22 April 2007) (http://www.bhas.ba/ankete/ARS-07-bh.pdf, p. 24) (accessed October 2015):

- total population 2007: 3 315 000;
- number of people < 15 years of age in 2007: 590 000;
- number of people > 64 years of age in 2007: no information, but can be calculated from: total population – persons < 15 years – persons 15–64 years = 3 315 000 – 590 000 – 2 235 000 = 490 000;
- population on 1 January 2007 according to Eurostat: 3 842 562.

< 15 years:

590 000 / 3 315 000
× 3 842 562 = 683 894.8959 = 683 895;

> 64 years:

490 000 / 3 315 000
× 3 842 562 = 567 980.5067873 = 567 981.

For 2009: using the data from the Labour Force Survey 2011 reported for 2009 (reference week: 11–17 May 2009) (http://www.fzs.ba/Anketa/LFS_2011_001_01_bh.pdf, p. 25) (accessed October 2015):

- total population 2009: 3 130 000;
- number of people < 15 years of age in 2007: 533 000;
- number of people > 64 years of age in 2007: no information, but can be calculated from: total population – persons < 15 years – persons 15–64 years = 3 130 000 – 533 000 – 2 101 000 = 496 000;
- population on 1 January 2007 according to Eurostat: 3 843 126.

< 15 years:

533000 / 3 130 000
× 3 843 126 = 654 436.472 = 654 436;

> 64 years:

496 000 / 3 130 000
× 3 843 126 = 609 006.5482 = 609 007.

Employment

1. Labour Force Survey 2007: http://www.bhas.ba/ankete/ARS-07-bh.pdf (last accessed 15 September 2015).
2. Labour Force Survey 2011: http://www.fzs.ba/Anketa/LFS_2011_001_01_bh.pdf (last accessed 15 September 2015).

Problem: the employment rate in the Labour Force Survey for 2007 was 31.2 %, which is the ratio of employed people (850 000) to the number of people of working age (2 725 000) (Table A5.4):

No of people in employment / working age population (aged > 15 years) = 850 000 / 2 725 000 = 0.3119.

The information on employment rate in the Labour Force Survey thus includes those people aged over 64 years who may also work. This situation applies for the data for 2009. Although there is no information in the Bosnian and Herzegovinian Labour Force Survey about the number of people aged 15–64 years who are working, we used the information provided in Eurostat about the employment rate in the 15–64 years age group to approximate the values (file: cpc_siemp — Candidate countries and potential candidates: SI-Employment in Non EU Countries (noneu) -> Candidate countries and potential candidates (cpc_si) -> Key indicators on EU policy: Structural indicators (cpc_si)).

To calculate the number of employed person aged > 15 years and between 15–64 years for 2006, we used all the following variables:

- the population size in Eurostat (1 January 2007): 3 842 562;
- the population size reported in the Labour Force Survey for 2007: 3 315 000;
- the working age population in the Labour Force Survey 2007: 2 725 000 (which is the same as the working age population > 15 years);
- the working age population aged 15–64 years in the Labour Force Survey 2007: 2 235 000;
- the employment rate for people aged 15–64 years from Eurostat for the year 2007 (40.1 %; note there is no value for 2006).

1. Percentage of working age population (15–64 years) in the population in 2006:

   2 235 000/ 3 315 000 = 67.42 %.

2. The number of people is supposed to be when using the population information from Eurostat:

   0.6742081 × 3 842 562 = 2 590 686.597= 2 590 687.

Using the population data from Eurostat, the working age population aged 15–64 years was expected to be 2 590 687 in 2006.

1. The number of employed people aged 15–64 years in 2006 given the information above about the working age population adjusted for the population data:

   2 590 686.5972851 × 0.401 =
   1 038 865.3255 = 1 038 865.

For the calculation of the 2009 values, we used the information from the Labour Force Survey 2011, which also contains the information for 2010. The values from this report and the information from Eurostat were:

- Eurostat population size for Bosnia and Herzegovina on 1 January 2010: 3 843 126;
- Eurostat employment rate of the population aged 15–64 years (there is no information for the population aged > 15 years in Eurostat) in 2010: 33.3 %;
- population size according to the National Statistical Office of Bosnia and Herzegovina for 2010: 3 310 000;
- working age population between 15–64 years according to the National Statistical Office of Bosnia and Herzegovina for 2010: 2 597 000.

1. Percentage of working age population (aged 15–64 years) using the data from the Labour Force Survey in Bosnia and Herzegovina:

   2 597 000 / 3 310 000 = 0.784592= 78.46 %.

2. How many this is supposed to be when using the information on population size in Eurostat was calculated as:

0.7845921450151 × 3 843 126 =
3 015 286.4719 = 3 015 286.

The working age population aged 15–64 years using the population data from Eurostat was expected to be 3 015 286 in 2009.

1. The number of employed people aged 15–64 years in 2009 given the information above about the working age population in the Labour Force Survey and adjusted for the population size from Eurostat was calculated as:

   3 015 286.4719033232628 × 0.333 =
   1 004 090.3951 = 1 004 090.

Number of households in Bosnia and Herzegovina
Data were available from the 1991 and 2013 censuses only (preliminary results, 10 September 2015). These results were used to approximate the household numbers in 2006 and 2009 for Bosnia and Herzegovina. The Yugoslav wars took place between the census years, the outcome of which was the formation of the country Bosnia and Herzegovina. There is no information on whether the value for 2001 refers to Bosnia and Herzegovina in its recent form or if a larger area was covered by the 1991 census.

Census 2013: 721 199 (http://www.fzs.ba/Novo%20saopstenje%2020133.pdf) (last access 15 September 2015); census 1991: 1 207 098 (http://www.fzs.ba/Dem/Popis/PopisiPopulE.htm) (last access 15 September 2015).

slope = (1 207 098 – 721 199) / (2013 – 1991) =
22086.3181818 = 22 086.

In 2006, there were 875 803 households, and in 2009, there were 809 544 households.

Kosovo

Population and employment
For population, we used the values from Eurostat reported on 1 January 2007 and 1 January 2010. We show, however, the difference between the values reported in Eurostat and by the Statistical Office of Kosovo.

Source: Statistical Office of Kosovo; https://ask.rks-gov.net/ENG/(last access 25 September 2015).

Path:

1. For population data: under 'Statistics by theme' > Population > Publications;
2. For employment rate: under 'Statistics by theme' > Labour market > Publications.

Table A5.5 Information about demography and employment in Kosovo in 2006 and 2009

Demographic variables	2006	2009
I. Population	2 105 000	2 207 000
Men	1 066 000	1 115 000
Women	1 039 000	1 092 000
II. Population at working age (% of I)	1 315 220.00 (62.48)	1 412 250.00 (63.99)
Men	650 260.00 (61)	702 450.00 (63)
Women	664 960.00 (64)	709 800.00 (65)
III. Labour Force Survey (% of II)	684 475.600 (52.04)	678 576.150 (48.05)
Men	460 384.080 (70.8)	474 153.750 (67.5)
Women	224 091.520 (33.7)	204 422.400 (28.8)
IV. Employed person (% of II)	381 501.140 (29.01)	371 819.700 (26.33)
Men	302 370.900 (46.5)	282 384.900 (40.2)
Women	79 130.240 (33.7)	89 434.800 (12.6)
V. Part-time (% of IV)	88 873.00610 (23.30)	60 855.8832 (16.37)
Men	67 428.710700 (22.3)	47 440.6632 (16.8)
Women	21 444.29540 (27.1)	13 415.220 (15)
VI. Temporary (% of IV)	231 297.1212 (60.83)	241 636.386 (64.99)
Men	182 632.0236 (60.4)	179 032.0266 (63.4)
Women	48 665.0976 (61.5)	62 604.360 (70)
VII. Self-employed (% of IV)	93 916.3199 (24.62)	88 528.8285 (23.81)
Men	86 478.0774 (28.6)	80 479.69650 (28.5)
Women	7 438.24256 (9.4)	8 049.1320 (9)

Eurostat reported the following population sizes for 1 January 2006, 2007, 2009 and 2010:

2006: 2 100 000

2007: 2 126 708

2009: 2 180 686

2010: 2 208 107.

Although the difference in the population values between Eurostat and the Statistical Office of Kosovo is small for 2006 (0.24 %), it is larger for 2009 (1.21 %). Eurostat also reports the employment rates for Kosovo in the age group 15–64 years as follows: 28.7 % (2006); 26.2 % (2007); 26.1 % (2009); and no value (2010). The values from the Statistical Office of Kosovo are similar to those reported in Eurostat, although for 2006 there is a difference of 0.3 %. We used the values reported in Eurostat for 1 January of the following year, because we assumed that they were somehow harmonised with the values reported for other countries.

Commuting

There is no information available for commuting in Kosovo in the Eurostat database or from the Statistical Office of Kosovo. We therefore replaced the number of employed persons corrected for commuting with the total number of employed persons not corrected for commuting. The values for employment in 2006 and 2009 are reported in the table above.

Full- and part-time employment

The Statistical Office of Kosovo reports values on the number of people in part-time employment, but there is no information about full-time employment. We used the difference between the total number of employed and part-time employed persons to approximate the number of full-time employed persons in both years:

2006:
381 501.140 – 88 873.00610 = 292 628.13 = 292 628;

2009:
371 819.700 – 60 855.8832 = 304 963.817 = 304 964.

Serbia

Source: Statistical Office of the Republic of Serbia; http://www.stat.gov.rs/ (accessed September and October 2015).

Path:

1. For recent data including 2009: Data > Statistical office databases > Themes > Employment and Earnings > Labour Force Survey > Basic sets of the population aged 15 years and over by working activity;

For older data including 2006: Data > Areas data > Employment and Earnings Publications > archive (under 'Statistical Releases' or 'Bulletins'): Title: Labour Force Survey, October 2006, Preliminary results, No 059, Year 2007, Type: Statistical release, Marl 3M14, Area: Employment and Earnings. http://pod2.stat.gov.rs/ObjavljenePublikacije/G2007/pdfE/G20071059.pdf (accessed September and October 2015).

Population
Information on the population size in Serbia for 2006 and 2009 was available in the Eurostat database (we used the values from the following year, as the census data were recorded on 1 January): 2006: 7 397 651; 2009: 7 306 677.

Commuting
There was no information on commuting for 2006 and 2009 in the Eurostat database or in any other national or international database. We therefore used the population size and the employment rate for the age range 15–64 years from Eurostat to calculate the number of employed people in Serbia. Eurostat does not provide information on the census date of employment rates, although the date for population size is referred to as being 1 January each year; therefore, we used the value from 2007 for both population size and employment rate. We proceeded in the same way for 2009 (i.e. we used the information from 1 January 2010).

Full- and part-time employment
Information on full- and part-time employment was found for October 2006 in Communication No 58, Issue LVII, 15 March 2007, RS10 (SERB 59, RS10, 150307), Labour Force Survey (p. 10): total employment = 2 630 691; full-time employment = 2 442 901; part-time employment = 187 790. We adjusted these values for the number of employed persons in the Eurostat database for 2007 (which we used for 2006 as we assumed that the census date is 1 January 2007):

Example for 2006:

Full-time corrected:
(2 442 901 / 2 630 691) × 2 560 179.1 =
2 377 431.57896 = 2 377 432;

Part-time corrected:
(187 790 / 2 630 691) × 2 560 179.1 =
182 757.2530 = 182 757.

Similarly, we found full- and part-time information for 2009 in the Bulletin of the Serbian Statistical database on the Labour Force Survey 2009 (p. 15): total employment = 2 616 437; full-time employment = 2 375 939; part-time employment = 240 498. We adjusted for the number of employed people in the Eurostat database for 2010 (which we used for 2009, as we assumed that the census date is the 1 January 2010):

Examples for 2009:

Full-time corrected:
(2 375 939 / 2 616 437) × 2 338 253.5 =
2 123 325.6075 = 2 123 326;

Part-time corrected:
(240 498 / 2 616 437) × 2 338 253.5 =
214 927.892 = 214 928.

Ageing index
The raw data used to calculate the ageing index were the populations < 15 years of age and > 64 years of age. The Statistical Office of Serbia provides the population size for the different age classes; however, the total population size for the country differs from the value reported in Eurostat. We used a simple proportional approach to adjust the values so that their sum equals the value reported in Eurostat. Again, the problem of the census date remained. The values reported by Eurostat are between the values reported for 2006 and 2007 in the Serbian Statistical database. We decided to use the data from the next calendar year (i.e. from 2007 for 2006).

This results in the following numbers:

Table A5.6 RS_AgeingInde: Population size in the different age classes from the Serbian Statistical Office and after correction for the total population size in Eurostat

Age range (years)	2006	2007	2009	2010	ES06	ES09
Total	7 411 569	7 381 579	7 320 807	7 291 436	7 397 651	7 306 677
0	71 088	69 100	69 274	68 892	69 250	69 036
1–4	308 702	302 869	283 293	277 673	303 528	278 253
5–9	364 588	365 362	378 026	382 658	366 158	383 458
10–14	413 917	405 427	384 412	373 037	406 310	373 817
15–19	456 643	446 332	427 700	423 036	447 304	423 920
20–24	506 330	500 542	480 717	467 866	501 632	468 844
25–29	516 101	513 378	511 603	509 802	514 496	510 868
30–34	501 731	508 798	516 217	516 600	509 906	517 680
35–39	476 137	477 059	485 083	492 183	478 098	493 212
40–44	491 068	483 448	475 799	474 252	484 501	475 243
45–49	532 242	522 462	504 906	494 201	523 600	495 234
50–54	606 834	594 432	549 201	530 453	595 726	531 562
55–59	532 607	552 830	578 927	581 153	554 034	582 368
60–64	358 714	368 236	424 831	466 218	369 038	467 193
65–69	406 429	389 709	353 702	332 641	390 558	333 336
70–74	385 892	379 415	360 758	351 719	380 241	352 454
75–79	280 438	285 337	291 779	290 423	285 958	291 030
80–84	145 423	151 810	163 491	170 040	152 141	170 395
85 and over	56 685	65 033	81 088	88 589	65 175	88 774

Table A5.7 RS_AgeClass: Population size in the three different age classes in Serbia for 2006 and 2009

Age (years)	2006	2009
< 15	1 145 246	1 104 564
> 64	1 274 072	1 235 990
15–64	4 978 333	4 966 123

Employment by age classes

There appears to be some confusion in the Serbian database as regards employment in general, because different values for the numbers of employed people can be found in the database on working activity (which gives a value of 2 616 437 'employed' people (2009) for all of Serbia) and the database for employment (which give a value of 1 889 085 for the category of 'formal employment' for all of Serbia in 2009). There is no clarification of the terms 'employed' when used in relation to working activity and employment in general. We assumed that working activity accounted for every person working in Serbia, whereas those who are employed are only those people who have a working contract, such as in factories or offices (i.e. not people employed by the government). The first value is also mentioned in the Labour Force Survey 2009, which is available only in Cyrillic (e.g. p. 50). The number of employed people in each age class can also be found here (p. 50, Tab- RS_Employment).

The number of people > 15 years of age according to the information from the Labour Force Survey 2009 is 6 350 328, whereas the Statistical Yearbook of Serbia 2009 (Eurostat - page 20) shows 4 899 384 inhabitants aged 15–64 years. The total population in Serbia is 7 528 262, which differs significantly from the value reported in the population worksheet (7 320 807). The difference of 200 000 people may be due to the fact that population censuses in Serbia were undertaken in 2002 and 2011, with the years in between representing estimates. Deviations may be the consequence of different approaches or rounding errors. Using the values from the Labour Force Survey from 2009, the proportion of employed people aged 15–64 years is 50.388 % (2 468 689 / 4 899 384 × 100) and aged < 15 years is 41.20 % (2 616 437 / 6 350 328 × 100). We applied the percentages on the corrected population values above to approximate the number of employed persons aged < 15 years and between 15–64 years in 2009:

15–64 years:

4 966 123 × 0.503877426 = 2 502 317.2744 = 2 502 317;

< 15 years:

Table A5.8 RS_Employment: The number of employed people in each age class according to the Labour Force Survey, 2009 (p. 50)

Age class (years)	2009	% (total)	% (15–64 years)
Total	2 616 437	100	NA
15–19	20 077	0.77	0.81
20–24	124 321	4.75	5.04
25–29	240 222	9.18	9.73
30–34	295 695	11.30	11.98
35–39	324 032	12.38	13.13
40–44	327 668	12.52	13.27
45–49	360 710	13.79	14.61
50–54	364 622	13.94	14.77
55–59	289 786	11.08	11.74
60–64	121 556	4.65	4.92
65–69	61 479	2.35	NA
70–74	44 344	1.69	NA
> 75	41 925	1.60	NA
15–64	2 468 689	94.35	100

Note: There is an error in the Serbian Labour Force Survey data, which states that there are 2 468 688 employed people aged 15–64 years.

(4 966 123 + 1 235 990) × 0.412016041 =
2 555 370.044 = 2 555 370.

For each year, we took the information from the Statistical Yearbook 2007, p. 103 and the information from Communication No 58, Issue LVII, 15.03.2007,

Table A5.9 R2_Employment: The number of employed people in each age class according to the Labour Force Survey, 2007 (p. 5, results from October 2006)

Age class	2006	% (total)	% (15–64 years)	Population
Total	2 630 691	100	NA	6 512 298
15–19	37 072	1.41	1.47	458 500
20–24	147 772	5.62	5.87	488 287
25–29	234 329	8.91	9.31	447 073
30–34	314 938	11.97	12.51	476 843
35–39	322 171	12.25	12.80	452 315
40–44	380 162	14.45	15.11	524 158
45–49	374 303	14.23	14.87	542 214
50–54	380 431	14.46	15.12	660 909
55–59	245 248	9.32	9.74	588 389
60–64	80 368	3.06	3.19	409 784
65–69	51 781	1.97	NA	470 051
70–74	32 922	1.25	NA	426 566
> 75	29 194	1.11	NA	567 209
15–64	2 516 794	95.67	100	5 048 472

RS10 (SERB 59, RS10, 150307), Labour Force Survey, p. 5 (Table A5.9).

The number of people aged 15–64 years is 5 048 472 (the report incorrectly mentions 5 048 473), whereas the number of inhabitants older than 15 years is 6 512 298 (the report incorrectly mentions 6 512 300). This gives 49.85 % (2 516 794 / 5 048 472 × 100) employed person aged between 15 and 64 years and 40.3957 % (2 630 691 / 6 512 298 × 100) aged > 15 years.

Now, using the corrected population size from above, we can approximate the number of employed people in the different age classes:

15–64 years:

4 978 333 × 0.4985 = 2 481 827.8925587777 = 2 481 828.

> 15 years:

6 252 405 × 0.403957 = 2 525 705.2982 = 2 525 705.

Number of households in Serbia
Censuses of household number are available only for 2002 and 2011, which are accessible in the statistical pocketbook of Serbia 2014 (p. 29, http://www.webrz.stat.gov.rs/WebSite/repository/documents/00/01/35/49/STATISTICKI_KALENDAR_2014.zip) (accessed September and October 2015). We used a proportional approach to calculate the values for 2006 and 2009:

2002: 2 521 190;

2011: 2 487 886;

slope = (2 487 886 – 2 521 190) / (2011–2002) = –3 700.44

Monaco

Population
The value for 2006 was calculated using the census information from 2000 (35 113) and 2008 (35 352) given in Monaco en Chiffres 2010 (http://www.gouv.mc/content/download/12696/159335/file/Monaco%20en%20chiffres%202010.pdf, p. 19) (accessed September and October 2015):

(35 352 – 35 113) / (2008 - 2000) = 29.875

2006:

35 113 + (6 × 29.875) = 35 292.250 = 35 292

The value for 2009 was presented in the same report on the same page (2009: 35 646).

Commuting
Owing to the lack of information on commuting, we used the information on employment for 31 December in 2006 and 2009, which was given in Monaco en Chiffres 2010 (http://www.gouv.mc/content/download/12696/159335/file/Monaco%20en%20chiffres%202010.pdf, p. 180) (accessed September and October 2015): 2006: 45 636, 2009: 48 334.

Full- and part-time employment

No information was available.

Table A5.10 Estimated number of households in Serbia using the censuses from 2002 and 2011

Year	Number of households
2002	2 521 190
2003	2 517 490
2004	2 513 789
2005	2 510 089
2006	2 506 388
2007	2 502 688
2008	2 498 987
2009	2 495 287
2010	2 491 586
2011	2 487 886

San Marino

Population
Information about the population size in San Marino was found in the Statistical Yearbook of San Marino for both 2006 (Bollettino di Statistica, IV trimestre 2006, p. 7: 30 368) and 2009 (Bollettino di Statistica, IV trimestre 2009, p. 7: 31 632).

Commuting
There is no information in the Eurostat database or in the Sammarinese database on commuting and the number of workplaces. Therefore, we used the employment values from the same sources as the population data.

Full- and part-time employment
The part-time values were also taken from the Sammarinese database owing to lack of information in Eurostat: 2006: 1 499 (Bollettino di Statistica, IV trimestre 2006, pp. 59–60); 2009: 1 762 (Bollettino di Statistica, IV trimestre 2009, pp. 59–60). We subtracted the part-time values from the number of employed people to give the number of people in full-time employment:

2006: 20 755 – 1 499 = 19 256;

2009 = 22 081 – 1 762 = 20 319.

Employment
The Statistical Yearbook of San Marino reports the number of employed people in each age class. However, all people older than 50 years of age were grouped into a single class, which is why only the data for employed people > 15 years can be considered.

Table A5.11 SM_Employment: Employment values for 2006 and 2009 from Bollettino di Statistica, IV trimestre 2006 (p. 48) and IV trimestre 2009 (also p. 48). These values are the annual means

San Marino	2006	2009
Dependent	18 654	20 083
Independent	2 101	1 998
Unemployed	517	728
Total	21 272	22 809

Table A5.12 SM_EmploymentAge: Employed person per age class according to the Statistical Yearbook (Bullettino di Statistica) of San Marino for 2006 (p. 48) and 2009 (p. 48)

Age class (years)	2006	2009
16–18	55	46
19–25	1 469	1 212
26–30	2 417	2 115
31–40	7 303	7 217
41–50	6 025	7 076
> 50	3 426	4 043
Total	20 695	21 709

A5.2.3 Sources at the NUTS-2 level

Population size
Values for population size (from 1 January of the following year) for the following NUTS-2 regions were missing:

- Germany: DED4, DED5 (1 January 2007 and 1 January 2010);
- Italy: ITH5, ITI3 (1 January 2007 and 1 January 2010);
- United Kingdom: UKD6, UKD7 (1 January 2007 and 1 January 2010).

(a) Germany:
Source: GENESIS; http://www.regionalstatistik.de/ (accessed September and October 2015).

Path: Table 173-01-4, 'Bevölkerungsstand: Bevölkerung nach Geschlecht — Stichtag 31.12 — regionale Tiefe: Kreise und kreisfreie Städte.'

In Eurostat the NUTS 2006 NUTS-2 layer was changed to a NUTS 2010 NUTS-2 layer in 2008, which was accompanied by wider shifts in boundaries among certain regions and changes to their codes. In Germany, the change was related to the district reform on 1 August 2008 and affected the NUTS-2 regions Chemnitz and Leipzig. The previous code DED1 was changed to DED4 for Chemnitz, whereas the code for Leipzig changed from DED3 to DED5. The following table shows the composition of each of the two NUTS-2 regions with respect to NUTS-3 regions and their population values on 31 December in 2006, 2009 and 2012. Information about the composition of the NUTS-2 regions for the NUTS 2010 layer was taken from Eurostat, whereas the information for the population values was taken from the German GENESIS regional database. Some of the values for some NUTS-3 regions for 2006 are the same, whereas no values were reported for the following regions in the other coding. Vogtlandkreis gained considerably in the new classification, because the area of the district was extended. Finally, the Local Administrative Unit information was not suitable to rearrange the districts appropriately. Sources are provided in the explanation of the creation of the new districts below.

The district changes in the composition of new districts as a result of the reform on 1st August 2008 were:

- Erzgebirgskreis (DED42): merging of the former districts Annaberg (DED14), Aue-Schwarzenberg (DED1B), Stollberg (DED1A) and Mittlerer Erzgebirgskreis (DED18) (source: http://en.wikipedia.org/wiki/Erzgebirgskreis, last time accessed 25 July 2014);
- Mittelsachsen (DED43): merging of the former districts Döbeln (DED33, now part of Leipzig (DED3)), Freiberg (DED16) and Mittweida (DED19) (source: http://en.wikipedia.org/wiki/Mittelsachsen, last accessed 25 July 2014);
- Nordsachsen (DED53): merging of the former districts Delitzsch (DED32) and Torgau-Oschatz (DED36) (source: http://en.wikipedia.org/wiki/Nordsachsen, last time accessed 25 July 2014);
- Leipzig, Landkreis (DED52): merging of the former districts Muldentalkreis (DED35) and Leipziger Land (DED34) (source: http://en.wikipedia.org/wiki/Leipzig_(district), last time accessed 25 July 2014);
- Zwickau: merging of the former districts Zwickauer Land (DED1C), Chemnitzer Land (DED15) and the urban district of Zwickau (DED13) to the new district Zwickau (source: http://en.wikipedia.org/wiki/Chemnitzer_Land, last accessed 25 July 2014);
- Plauen, kreisfreie Stadt (DED12): Plauen was included as part of Vogtlandkreis as a result of the reform on 1 August 2008 (source: http://en.wikipedia.org/wiki/Vogtlandkreis, last time accessed 25 July 2014).

According to the reform, Döbeln (DED33) was the only district that changed the NUTS-2 region and caused the boundary shift. Given this information, population size in each region can be calculated. For the NUTS 2006 classification, this was possible only for 2006. However, ESPON provided data for 2006 and 2009.

Table A5.13 NUTS subclassification for Chemnitz (DED1 and DED4) and Leipzig (DED3 and DED5)

NUTS-2 region	2006	2009	2012
DED1 (NUTS 2006)			
Chemnitz, kreisfreie Stadt (DED11)	245 700	NA	NA
Plauen, kreisfreie Stadt (DED12)	68 430	NA	NA
Zwickau, kreisfreie Stadt (DED13)	96 786	NA	NA
Annaberg (DED14)	82 383	NA	NA
Chemnitzer Land (DED15)	133 014	NA	NA
Freiberg (DED16)	143 343	NA	NA
Vogtlandkreis (DED17)	188 568	NA	NA
Mittl. Erzgebirgskreis (DED18)	88 030	NA	NA
Mittweida (DED19)	129 586	NA	NA
Stollberg (DED1A)	88 259	NA	NA
Aue-Schwarzenberg (DED1B)	129 246	NA	NA
Zwickauer Land (DED1C)	127 192	NA	NA
DED4 (NUTS 2010)			
Chemnitz, Stadt (DED41)	245 700	243 089	241 210
Erzgebirgskreis (DED42)	387 918	372 390	355 275
Mittelsachsen, Landkreis (DED43)	344 457	332 236	317 204
Vogtlandkreis (DED44)	256 998	247 196	236 227
Zwickau, Landkreis (DED45)	356 992	345 118	330 294
Total	**1 592 065**	**1 540 029**	**1 480 210**
DED3 (NUTS 2006)			
Leipzig, kreisfreie Stadt (DED31)	506 578	NA	NA
Delitzsch (DED32)	122 004	NA	NA
Döbeln (DED33)	71 528	NA	NA
Leipziger Land (DED34)	146 819	NA	NA
Muldentalkreis (DED35)	130 297	NA	NA
Togau-Oschatz (DED36)	94 900	NA	NA
DED5 (NUTS 2010)			
Leipzig, Stadt (DED51)	506 578	520 838	518 862
Leipzig, Landkreis (DED52)	277 113	269 694	259 207
Nordsachsen, Landkreis (DED53)	216 904	208 661	198 629
Total	**1 000 595**	**999 193**	**976 698**

Note: Population data were taken from the GENESIS regional statistical database for the next calendar year, because they were evaluated on 1 January each year (i.e. the data below are from 1 January 2007, 2010 and 2013).

(b) Italy

Source: Istituto nazionale di statistica (Istat); http://www.istat.it/en/ (accessed September and October 2015).

Path: (a) for Emilia-Romagna: http://www.istat.it/en/emilia-romagna/; (b) for Marche: http://www.istat.it/en/marche/.

In Italy, the NUTS-2 regions Emilia-Romagna (ITD5 and ITH5) and Marche (ITE3 and ITI3) were affected by boundary shifts. There was no information for the NUTS-3 regions available from the Italian Statistical Office in order to verify the population size for the two NUTS-2 regions. We used the information from the Italian Statistical Office for both NUTS-2 regions, because their sum agrees with the difference from the Eurostat database (see Table A5.14).

Table A5.14 Validation of the population data for the Italian NUTS-2 regions Emilia-Romagna and Marche in the years 2006 and 2009

	2006	2009
Emilia-Romagna (Statistical Office)	4 223 264	4 395 569
Marche (Statistical Office)	1 536 098	1 559 542
Sum	**5 759 362**	**5 955 111**
Total Italy (Eurostat) without Emilia-Romagna and Marche	53 371 925	54 385 217
Total for Italy (Eurostat)	59 131 287	60 340 328
Difference between totals in Eurostat	**5 759 362**	**5 955 111**

(c) United Kingdom
Source: Office for National Statistics — Neighbourhood Statistics; http://www.neighbourhood.statistics.gov.uk/dissemination/ (accessed September and October 2015).

In the course of the change of the reference layer from NUTS 2006 to NUTS 2010, two NUTS-2 regions in the UK were also affected. Cheshire was shifted and the code changed from UKD2 to UKD6. The boundaries for Merseyside were also shifted and the code changed from UKD5 to UKD7. Both NUTS-2 regions lack remarkable data in the records of Eurostat and, therefore, we needed to assemble the data from other sources or from information about smaller NUTS units. Cheshire consists of the three smaller units Warrington (UKD61), Cheshire East (UKD62) and Cheshire West and Chester (UKD63). Merseyside includes the following smaller units: East Merseyside (Knowsley, St Helens and Halton) (UKD71), Liverpool (UKD72), Sefton (UKD73) and Wirral (UKD74) ([4]). The boundary shift between Cheshire and Merseyside was triggered by the district Halton. Table A5.15 below shows the population statistics for Cheshire and Merseyside, with all smaller units according to the table in the UK Government Statistics Database for mid-2006. In other words, moving the population information in the table from Merseyside to Cheshire would result in the values for the previous NUTS-2 classification from the NUTS 2006 layer (i.e. Cheshire as UKD2 and Merseyside as UKD5). Note that Halton, Knowsley and St Helens form the NUTS-3 region UKD71.

For 2009, the NUTS-3 regions of Cheshire were reassembled and changed to new unitary authorities, which came into affect on 1 April 2009; this is in line with the NUTS-3 regions reported in Eurostat's population data for 2009 which can be found at http://www.neighbourhood.statistics.gov.uk/dissemination/ (last accessed 23 September 2015). Note that many values are estimates.

Table A5.15 UK1: Population values for Cheshire and Merseyside for 2006 before the boundary shift resulting from the change to a unitary authority

UKD6 (Cheshire)		UKD7 (Merseyside)	
Warrington (UA)	194 000	Halton (UA)	119 500
Chester	119 700	Knowley	151 300
Congleton	92 500	St Helens	177 600
Crewe and Nantwich	115 800	Liverpool (UKD72)	436 100
Ellesmere Port and Neston	81 900	Sefton (UKD73)	277 500
Macclesfield	150 700	Wirral (UKD74)	311 200
Vale Royal	126 000		
Total	706 000	Total	1 473 200

Note: The values were evaluated mid-year

([4]) Source: http://en.wikipedia.org/wiki/NUTS_of_the_United_Kingdom (last accessed 28 July 2014).

Table A5.16 UK2: Population values for Cheshire and Merseyside for 2006, 2009 and 2012 after the boundary shift

Name	2006	2009	2012
UKD6 (Cheshire)			
Warrington (UKD61)	194 603	200 057	203 700
Cheshire East (UKD62)	362 049	368 023	372 100
Cheshire West and Chester (UKD63)	328 358	329 116	330 200
Total	**885 010**	**897 196**	**906 000**
UKD7 (Merseyside)			
Knowsley (UKD71)	148 788	147 070	145 900
St Helens (UKD71)	175 199	175 272	176 100
Halton (UKD71)	121 275	123 636	125 700
Liverpool (UKD72)	453 055	457 523	469 700
Sefton (UKD73)	275 852	274 153	273 700
Wirral (UKD74)	315 350	317 771	320 200
Total	**1 489 519**	**1 495 425**	**1 511 300**

Ageing index
The ageing index is constructed from the population groups age of > 64 years of age and < 15 years of age:

Ageing index = population size aged > 64 years / population size aged < 15 years × 100

The ageing index was calculated using data from Eurostat on the population structure on 1 January of the following year (File name: demo_r_2jan). However, there was no information about the German NUTS-2 regions Chemnitz (DED4) and Leipzig (DED5). In order to obtain population structure for these two regions, we used data from the online German database GENESIS (https://www-genesis.destatis.de/genesis/online/ (accessed September and October 2015):, File: 12411–0005, Bevölkerungsstand: Bevölkerung nach Geschlecht und Altersjahren — Stichtag 31.12. — regionale Tiefe: Kreise und kreisfreie Städte, Table A5.17).

Employment rate
The number of people employed in a given region is described using the variable employment rate. We used the raw data to calculate the employment rate. Two options were available: (1) people in employment aged > 15 years, and (2) people in employment aged between 15 and 64 years of age. The first approach takes into account that in some countries the society consists of a higher percentage of older people and, consequently, there is a higher likelihood that more elderly people are still working:

1. employment rate 15–64 years = employed people 15–64 years / population 15–64 years;
2. employment rate > 15 years = employed people > 15 years / population > 15 years.

Liechtenstein (LI00) and Montenegro (ME00) were the two NUTS-2 regions (and countries) that lacked information on employment in the Eurostat database. The missing values for Liechtenstein were replaced with data obtained from the employment and workplaces' statistics (Beschäftigungs- und Arbeitsplätzestatistik) of the Principality of Liechtenstein for 2006 and the employment statistics (Beschäftigungsstatistik) for 2009:

Source: Landesverwaltung Fürstentum Liechtenstein, Amt für Statistik (AS); http://www.llv.li/#/11480/amt-fur-statistik (accessed September and October 2015).

Path: '3 Arbeit und Erwerb' > 'Beschäftigungsstatistik' > 'frühere Publikationen':

(a) 2006: http://www.llv.li/files/as/pdf-llv-avw-statistik-beschaeftigungs-_und_arbeitsplaetzestatistik_2006 (accessed September and October 2015) (reporting date: 31 December 2006);

(b) 2009: http://www.llv.li/files/as/pdf-llv-as-beschaeftigungsstatistik_2009 (accessed September and October 2015) (reporting date: 31 December 2009).

We restricted the employment in Liechtenstein to those people working and living in Liechtenstein, otherwise there are more employed people in Liechtenstein than people living in this country, which would result in a rate > 100 % in our calculations.

Table A5.17 AgeingIndex1: Population size for the different age classes for Chemnitz (DED4) and Leipzig (DED5)

Age (years)	DED41	DED42	DED43	DED44	DED45	DED51	DED52	DED53	DED4	DED5
Young										
< 1	1 821	2 899	2 466	1 783	2 457	4 399	1 930	1 509	11 426	7 838
1	1 800	2 966	2 407	1 773	2 525	4 266	2 129	1 549	11 471	7 944
2	1 764	3 002	2 481	1 793	2 665	4 228	2 020	1 688	11 705	7 936
3	1 741	2 843	2 515	1 755	2 604	3 869	2 070	1 640	11 458	7 579
4	1 731	2 788	2 535	1 789	2 469	3 746	2 085	1 657	11 312	7 488
5	1 693	2 912	2 580	1 803	2 537	3 671	2 092	1 660	11 525	7 423
6	1 726	2 899	2 545	1 958	2 683	3 602	2 222	1 746	11 811	7 570
7	1 630	2 855	2 491	1 807	2 544	3 389	2 111	1 570	11 327	7 070
8	1 495	2 789	2 397	1 719	2 369	3 219	2 011	1 479	10 769	6 709
9	1 441	2 626	2 431	1 738	2 332	3 031	1 932	1 562	10 568	6 525
10	1 302	2 645	2 195	1 578	2 213	2 741	1 864	1 485	9 933	6 090
11	1 210	2 350	2 053	1 484	2 031	2 429	1 665	1 252	9 128	5 346
12	1 173	2 192	1 961	1 377	2 010	2 535	1 584	1 269	8 713	5 388
13	1 174	2 366	2 025	1 458	2 156	2 538	1 588	1 282	9 179	5 408
14	1 272	2 375	2 155	1 542	2 273	2 784	1 848	1 421	9 617	6 053
Total	22 973	40 507	35 237	25 357	35 868	50 447	29 151	22 769	159 942	102 367
Old										
65	4 418	5 591	5 418	4 360	5 832	8 127	4 507	3 239	25 619	15 873
66	4 512	5 955	5 555	4 509	5 994	8 033	4 536	3 496	26 525	16 065
67	4 532	5 901	5 395	4 359	5 890	7 976	4 417	3 448	26 077	15 841
68	4 025	5 491	5 104	3 987	5 261	7 244	4 019	3 110	23 868	14 373
69	3 582	4 974	4 725	3 725	5 010	6 567	3 494	2 640	22 016	12 701
70	3 494	5 108	4 468	3 500	4 838	6 458	3 476	2 720	21 408	12 654
71	3 385	5 209	4 636	3 601	4 902	6 263	3 352	2 618	21 733	12 233
72	3 012	4 773	4 281	3 311	4 479	5 729	3 165	2 423	19 856	11 317
73	2 345	3 798	3 384	2 472	3 606	4 283	2 546	1 982	15 605	8 811
74	2 214	3 624	3 415	2 437	3 319	4 441	2 443	1 958	15 009	8 842
75–80	11 848	18 836	16 751	12 061	17 053	20 104	11 550	9 183	76 549	40 837
80–85	8 023	12 734	11 139	8 688	11 980	13 428	7 807	5 892	52 564	27 127
> 85	6 448	8 883	8 163	6 806	9 115	11 687	5 532	4 096	39 415	21 315
Total	61 838	90 877	82 434	63 816	87 279	110 340	60 844	46 805	386 244	217 989

Similarly, information about the number of employed people was obtained from the Statistical Office of Montenegro. However, the data were not distributed among the different age classes and there is no information about the reporting date. We assumed that the data represent the number of employed people in the age class 15–64 years for each year.

Source: MONSTAT — Department of Statistics of labour market, life conditions, social services and household consumption; http://www.monstat.org/eng/(accessed September and October 2015).

Path: 'Labour Market' > 'Employment from administrative sources'

(a) http://www.monstat.org/userfiles/file/zarade/zaposlenost%202010%20za%20sajt-en.xls (accessed September and October 2015) (reporting date: NA).

Gross domestic product per capita in purchasing power standards

Information about gross domestic product (*GDP*) per capita in PPS is missing for:

Switzerland: all NUTS-2 regions in 2006 and 2009;

Iceland: for 2006 and 2009;

Liechtenstein: for 2006 and 2009;

Montenegro: for 2006 and 2009;

Norway: all NUTS-2 regions, but only for 2006.

(a) Switzerland

The Swiss Federal Statistical Office reports *GDP* per capita values in Swiss francs for 2008, whereas Eurostat has only the total.

Source 1: Bundesamt für Statistik Schweiz (BfS) — Federal Statistical Office, Switzerland; http://www.bfs.admin.ch/ (last accessed 6 August 2014).

URL1 (Country values of *GDP* per capita in Swiss francs for each year between 1990–2012):

http://www.bfs.admin.ch/bfs/portal/en/index/themen/04/02/01/key/bip_einw.Document.111473.xls (last accessed 6 August 2014);

URL2 (Regional values of *GDP* per capita in Swiss francs for 2008):

http://www.bfs.admin.ch/bfs/portal/en/index/themen/04/02/05/key/01.Document.165813.xls (last accessed 6 August 2014);

Source 2: Eurostat; http://ec.europa.eu/eurostat/data/.

File: Purchasing Power Parities (PPP), price level indices and real expenditures for ESA95 aggregates (prc_ppp_ind), Eurostat (last accessed 11 August 2014). (In the recent database (1 October 2015) the table was renamed to 'Purchasing Power Parities (PPPs), price level indices and real expenditures for ESA2010 aggregates (prc_ppp_ind)'.)

We used the *GDP* per capita total from 2008 for the country as well as the regional values in 2008 to approximate the regional values in Swiss francs in 2006 using the total from 2006 for Switzerland.

2006: CH06-NX = CH-08-NX/CH-08-TOTAL × CH-06-TOTAL

Regional values for 2009 were already present in the table 'Gross domestic product (GDP) per region and canton, year 2009' (T 4.6.1, File).

The resulting values were transformed into PPS using the PPP value for the corresponding year from File (2006: 2.04018; 2009: 2.02076).

(b) Iceland

Source: Statistics Iceland; http://www.statice.is/Statistics/National-accounts-and-public-fin/National-accounts-overview (last accessed 6 August 2014).

The Statistical Office of Iceland provided information on *GDP* per capita in PPS from 1990–2013, with 2006: 30 759; 2009: 29 877; and 2012: 31 244.

(c) Liechtenstein

Source: Landesverwaltung Fürstentum Liechtenstein, AS (Regional Government Authority of the Principality of Liechtenstein Statistical Office); http://www.as.llv.li/ (accessed September and October 2015).

File: Volkswirtschaftliche Gesamtrechnung 2009, AS, Fürstentum Liechtenstein.

Path: 4. Volkswirtschaft > Volkswirtschaftliche Gesamtrechnung > frühere Publikationen > Volkswirtschaftliche Gesamtrechnung 2009 (http://www.llv.li/files/as/pdf-llv-as-volkswirtschaftliche_gesamtrechnung_2009_vers2) (accessed September and October 2015).

The Statistical Office of the Principality of Liechtenstein reports the country's *GDP* (called 'Bruttoinlandsprodukt') for 2006 (CHF 5 015.5 million., p. 48) and 2009 (CHF 4 906.4 million, p. 48). We divided the *GDP* by the number of inhabitants (2006: 35 168; 2009: 35 742). The result is then again divided by the

Table A5.18 CH_GDP: Calculation of *GDP* per capita in PPS using the PPP from Eurostat and information from the Swiss Federal Statistical Office

NUTS-2	2008 CHF	2006 CHF	2009 CHF	2006 PPS	2009 PPS
CH01	75 771.97	69 166.91	73 347.11	33 902.36	36 296.80
CH02	62 952.39	57 464.82	60 565.79	28 166.54	29 971.79
CH03	82 306.92	75 132.21	79 408.99	36 826.27	39 296.60
CH04	94 513.80	86 275.02	90 887.71	42 287.95	44 976.99
CH05	60 268.36	55 014.76	58 135.84	26 965.64	28 769.29
CH06	67 234.11	61 373.31	65 067.39	30 082.30	32 199.46
CH07	65 909.19	60 163.87	63 878.55	29 489.49	31 611.15
CH	73 641.33	67 222	71 061.64		
PPP		2.04018	2.02076		

Swiss PPSs for the corresponding years (there are no special PPSs for Liechtenstein, because it uses the same currency as Switzerland) to approximate the *GDP* per capita in PPS for Liechtenstein.

2006:

CHF 5 051 500 000 / 35 168 = 142 615.44586/2.04018 = 69 903.4 PPS *GDP* per capita;

2009:

CHF 4 906 400 000 /35 894 = 136 691.369031/2.02076 = 67 643.5 PPS *GDP* per capita.

(d) Montenegro

Source: Eurostat; http://ec.europa.eu/eurostat/data/.

File: Candidate countries and potential candidates: *GDP* and main aggregates (cpc_ecnagdp), data table with 'GDP per capita at current prices (PPS)' (last accessed 9 July 2014).

Values for *GDP* per capita in PPS are provided as of 2005.

(e) Norway

Source: Eurostat; http://ec.europa.eu/eurostat/data/.

File: GDP at current market prices by NUTS 2 regions (nama_r_e2gdp) (last accessed 9 July 2014).

A proportional approach was used given the regional data and Norwegian total for 2009 and 2006.

NO06-NX = (NO06-TOTAL / NO09-TOTAL) × NO09-NX

Household size
The variable household size has (together with passenger cars) the greatest number of missing values for the NUTS-2 regions: all Swiss, Danish, Croatian, Norwegian and Swedish NUTS-2 regions plus Iceland, Liechtenstein and Montenegro, and Merseyside (UKD7) and Cheshire (UKD6) from the UK.

(a) Liechtenstein (20 November 2014)

For Liechtenstein, there is information about the household number from the 2000 census (all households: 13 325) and 2010 (all households: 15 474), which can be found in the corresponding 'Volkszählung' (population census) of that year. Using the difference between the household numbers and calculating the changes per year allows an approximation of the household sizes for 2006 and 2009:

15 474 – 13 667) / (2010 – 2000) = 180.7

2006:

13 667 + (6 × 180.7) = 13 667 + 1 084.2 = 14 751.2 = 14 751;

2009:

15 474 – 180.7 = 15 293.3 = 15 293;

2012:

15 747 + (2 × 180.7) = 15 474 + 301.4 = 15 835.4 = 15 835.

Table A5.19 NO_GDPpCPPS: Values and results for the calculation of the *GDP* per capita in PPS for Norway in 2006

NUTS-2	2009	2006
NO01	44 500	47 079.710144927536
NO02	42 000	25 391.304347826088
NO03	26 300	27 824.63768115942
NO04	34 700	36 711.59420289855
NO05	33 200	35 124.637681159424
NO06	28 000	29 623.188405797104
NO07	26 900	28 459.420289855072
NO	41 400	43 800

(b) Iceland

There is information on the number of households in Iceland in the National Statistical Database of Iceland (Statistics Iceland, http://www.statice.is/pages/2496). No information about the reporting date was given, which is why we used the data for the given year (i.e. 2006 for 2006 and 2009 for 2009).

(c) Denmark

The Statistical Office of Denmark (Statistics Denmark) provided data on the number of households from 1986 for Denmark, NUTS-2 regions and smaller administrative units. The reporting date is 1 January each year. We used the data from 1 January 2007 for 2006 and 1 January 2010 for 2009.

(d) Norway

Information on household numbers for 2006 and 2009 was obtained from the Norwegian Statistical Office (http://www.ssb.no/en/familie, table 06076: Private households, persons per private households and persons in private households (C), last accessed 4 August 2014). The information was given at the municipality level and data were assembled at the NUTS-2 level (http://en.wikipedia.org/wiki/NUTS/of?Norway, last accessed 4 August 2014).

Table A5.20 Iceland_Household: Mean of household number in each year from National Statistical Database of Iceland

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
111 200	112 900	114 300	117 900	121 900	126 100	124 600	122 900	123 900	124 000

Table A5.21

Danish NUTS-2 Region	2006	2009
DK01 (Region Hovedstaden)	794 599	806 768
DK02 (Region Sjaelland)	368 596	373 381
DK03 (Region Syddanmark)	546 930	553 779
DK04 (Region Midtjylland)	554 512	568 951
DK05 (Region Nordjylland)	267 421	270 538

Table A5.22 Norway_Households: Private households and persons in private households, by region, time and contents

Counties	Households						
	2006	2007	2008	2009	2010	NUTS-3 2010	NUTS-2 2010
Østfold	115 663	116 835	118 787	120 571	122 045	NO031	NO03
Akershus	207 216	211 613	216 997	221 994	225 853	NO012	NO01
Oslo	282 926	289 730	297 514	306 017	309 074	NO011	NO01
Hedmark	83 877	84 170	85 048	85 681	86 118	NO021	NO02
Oppland	80 142	80 373	81 061	81 673	82 646	NO022	NO02
Buskerud	107 546	109 021	111 399	113 047	114 815	NO032	NO03
Vestfold	98 490	99 560	101 522	103 349	104 319	NO033	NO03
Telemark	73 500	73 821	74 553	75 306	75 850	NO034	NO03
Aust-Agder	43 779	44 305	45 134	45 869	46 590	NO041	NO04
Vest-Agder	68 316	69 190	70 471	71 762	72 948	NO042	NO04
Rogaland	162 549	166 296	171 379	175 776	179 172	NO043	NO04
Hordaland	193 321	196 496	200 586	205 337	208 922	NO051	NO05
Bergen (–1971)	0	0	0	0	0		
Sogn og Fjordane	42 680	42 525	42 747	43 079	43 576	NO052	NO05
Møre og Romsdal	101 034	101 558	102 966	104 337	105 944	NO053	NO05
Sør-Trøndelag	121 988	124 475	127 404	129 706	131 518	NO061	NO06
Nord-Trøndelag	53 584	54 059	54 865	55 364	55 910	NO062	NO06
Nordland	102 192	102 310	102 661	103 279	104 068	NO071	NO07
Troms Romsa	66 688	67 189	68 042	68 868	69 508	NO072	NO07
Finnmark Finnmárku	31 409	31 329	31 395	31 624	32 017	NO073	NO07

Merging over the NUTS-2 regions, we obtained the following results for 2006, 2009 and 2012 (Table A5.23).

(e) Sweden

The lack of data for Swedish household numbers at the NUTS-2 level in the Eurostat and national databases for 2006 required a different approach. We used the total number of households across Sweden in 2006 from the National Statistical database and distributed the total among the NUTS-2 regions proportionately according to the information from 2009. The total number of households for Sweden in 2006 was 4 465 000. The calculation for the NUTS-2 region was done in the following way:

SE-N2-Y6-X_i = (SE-N2-Y9-X_i/SE-N0-Y9) × SE-N0-Y6

where 'SE' = Sweden, 'N2' = NUTS-2, 'N0' = Country value, 'Y6' = Year 2006, 'Y9' = Year 2009, and 'X_i' the corresponding Swedish NUTS-2 regions.

(f) Croatia

Eurostat lacks information about household numbers in Croatia for 2005 and 2006, although from 2007 the values are available (Eurostat, File lfst_r_lfsd2hdd). The country's total number of households for 2005 and 2006 are reported in the Eurostat database (2005: 1 569.6; 2006: 1 569.9). We therefore used the percentage of the NUTS-2 values from 2007 to approximate the NUTS-2 values for 2006:

HR-N2-Y6-X_i = (HR-N2-Y7-X_i / HR-N0-Y7) × HR-N0-Y6

where 'HR' = Croatia, 'N2' = NUTS-2, 'N0' = Country value, 'Y6' = Year 2006, 'Y9' = Year 2009 and 'X_i' = the corresponding NUTS-2 region. The calculation resulted in 530 470 households in HR03 and 1 039 430 households in HR04 for 2006.

Table A5.23 Norway_Households

NUTS-2	2006	2009	2012
NO01	490 142	528 011	550 044
NO02	164 019	167 354	172 020
NO03	395 199	412 273	426 325
NO04	276 644	293 407	308 513
NO05	337 035	352 753	368 237
NO06	175 572	185 070	191 644
NO07	200 289	203 771	209 263

Table A5.24 Sweden_Households

NUTS-2 Region	2006	2009
Sweden (Country)	4 465 (from Nat. Stat.)	4 248.7
SE11	1 035.67	985.5
SE12	733.75	698.2
SE21	376.33	358.1
SE22	647.68	616.3
SE23	875.72	833.3
SE31	380.32	361.9
SE32	174.03	165.6
SE33	241.60	229.9

(g) Switzerland

The household numbers for the Swiss NUTS-2 regions were derived from the 2000 and 2012 censuses. The differences in household numbers between the two census years and the changes per year were calculated. The changes per year were then used to approximate the household numbers in 2006 and 2009.

(h) Montenegro

The Statistical Office of Montenegro provides estimates of the household numbers for each year (http://www.monstat.org/eng/index.php, Household Budget Survey > Household Consumption) (accessed September and October 2015). The date of the recording, however, is unknown, so we used the information for the same year.

(i) United Kingdom: Merseyside and Cheshire

The two UK NUTS-2 regions lacked information on household size for 2006. We used the total of the NUTS-1 region and the associated NUTS-2 region values of 2009, as well as the total for the NUTS-1 region in 2006 to approximate the values for these two NUTS-2 regions.

Cheshire (UKD6) – 2006: (Cheshire (UKD6) 2009 / UKD 2009 Total) × UKD 2006 Total = 387.3/2 966.6 × 2 978.5 = 388.85.

Merseyside (UKD7) – 2006: (Merseyside (UKD7) 2009 / UKD 2009 Total) × UKD 2006 Total = 648.9/2 966.6 × 2 978.5 = 651.50.

Passenger cars
Information about the number of passenger cars was missing for several regions:

- Denmark: all NUTS-2 regions (DK01:05);
- Finland: FI1B (Helsinki-Uusimaa), FI1C (Etelä-Suomi);
- France: Ile de France (Paris, FR10) — 2009 only;
- Germany: DE40 (Brandenburg), DED4 (Chemnitz), DED5 (Leipzig);
- Iceland: Iceland (IS00);
- Italy: ITH5 (Emilia-Romagna), ITI3 (Marche);
- Montenegro: Montenegro (ME00);

Table A5.25 Switzerland_Households

NUTS-2	2006	2009
CH (Country)	3 302 068.5	3 395 403.3
CH01	605 506.5	624 389.25
CH02	747 677.5	764 467.25
CH03	457 749.5	470 723.25
CH04	598 542	614 026.5
CH05	452 636.5	465 585.25
CH06	295 991	307 721.5
CH07	143 965.5	148 490.25

Table A5.26 Montenegro_Households: The number of households according to the Statistical Office of Montenegro, 2005–2013

Year	Number of households in Montenegro
2005	181 254
2006	180 338
2007	183 376
2008	183 853
2009	183 510
2010	183 162
2011	183 330
2012	188 363
2013	192 197

- the former Yugoslav Republic of Macedonia: the former Yugoslav Republic of Macedonia (MK00);
- Portugal: all Portuguese NUTS-2 regions (PT11, PT15:18, PT20, PT30);
- Sweden: all Swedish NUTS-2 regions (SE11, SE21:23, SE31:33);
- UK: UKD6 (Merseyside), UKD7 (Cheshire), UKM5 (North Eastern Scotland), UKM6 (Highlands and Islands).

(a) Denmark (26 August 2014)

Source: Statistics Denmark; http://www.dst.dk/en/Statistik/statistikbanken.aspx.

File: BIL707: Stock of vehicles per 1 January by region and type of vehicle.

Only the country value for the number of passenger cars in 2006 was available in the Eurostat database (2006: 2 020), and there was no value for 2009 (Stock of vehicles by category and NUTS-2 regions, File: tran_r_vehst, extraction date: 9 July 2014). We found information about the regions in the Danish Statistical Database.

We used the information about passenger cars for private use and the total from the Eurostat database to calculate the corrected private passenger car numbers for the Danish NUTS-2 regions for 2006:

DK01: 532 337/1 963 288 × 2 020 000 = 547 714;

DK02: 313 155/1 963 288 × 2 020 000 = 322 201;

DK03: 450 763/1 963 288 × 2 020 000 = 463 784;

DK04: 452 053/1 963 288 × 2 020 000 = 465 111

DK05: 214 980/1 963 288 × 2 020 000 = 221 190.

(b) Finland

Values were missing for two NUTS-2 regions that had resulted from a region being split. On request, Sami Lahtinen provided information on 15 August 2014 about the number of passenger cars for all Finnish NUTS-2 regions in the period 2006–2012, up to 31 December in each year. There was also some information about 'unknown' cars that do not belong to any regions. We distributed these 'unknown' cars proportionately among the Finnish NUTS-2 regions.

Table A5.27 Denmark_Vehicles: Stock of vehicles per 1 January by time, region and type of vehicle for 2007 in Denmark

NUTS-2	Passenger cars for habitation/rental	Passenger cars for rescue	Passenger cars for other uses	Passenger cars for private use	Passenger cars total
DK01 (Region Hovedstaden)	32	142	2 763	532 337	535 274
DK02 (Region Sjaelland)	15	51	1 790	313 155	315 011
DK03 (Region Syddanmark)	22	70	2 572	450 763	453 427
DK04 (Region Midtjylland)	102	47	2 513	452 053	454 715
DK05 (Region Nordjylland)	8	23	1 294	214 980	216 305
Total	179	333	10 932	1 963 288	1 974 732

Table A5.28 FI_Cars: Passenger cars for the Finnish NUTS-2 regions

NUTS-2	2006	2007	2008	2009	2010	2011	2012
FI19	666 763.84	684 540.73	720 671.66	744 197.73	789 775.65	798' 008.51	821 354.90
FI1B	637 956.99	652 602.62	685 628.55	698 443.45	723 935.80	749 366.67	769 050.37
FI1C	570 894.68	586 465.57	614 150.98	630 681.48	650 437.48	670 084.62	687 258.15
FI1D	613 670.43	629 911.17	662 342.27	684 929.92	711 398.74	735 675.90	758 892.74
FI20	162'57.04	16 828.51	17 690.84	18 403.68	19 243.39	20 165.08	20 912.59

(c) France (accessed 26 August 2014)

Surprisingly, in 2009 there was no value given for the number of passenger cars in Ile de France (Paris, FR10). As Ile de France was the only French region without information on passenger cars, but the country's total was reported, we subtracted the sum of the remaining regions from the country's total: 31 934 000 (country total for 2009 in Eurostat database) – 26 499 000 (country value without FR10 in Eurostat database) = 4 895 000.

(d) Germany (accessed 26 August 2014)

Source: DESTATIS — GENESIS Online Database; https://www-genesis.destatis.de/genesis/online/

Path: Themes > 46 Transport und Verkehr > 462 Strassenverkehr ohne Personenbeförderung > 46251 Statisik des Kraftfahrzeug- und Anhängerbestandes > 46251–0001 Kraftfahrzeugbestand: Deutschland, Stichtag, Kraftfahrzeugarten.

The German online database GENESIS provides the number of passenger cars for the NUTS-2 regions Chemnitz (DED4) and Leipzig (DED5), as well as for the Brandenburg region (not NUTS-2) for 2006 (using values reported for 1 January of the following year, i.e. for 2006 we used values for 1 January 2007). We used these values, their total, the total reported in the Eurostat database for Germany and the sum of all the remaining German NUTS-2 regions to estimate the missing values for Brandenburg (DE40), Leipzig (DED5) and Chemnitz (DED4). We used the values in Eurostat for the corresponding year (i.e. values from 2006 for 2006, because there was no information about the reporting date).

- Chemnitz 2006/2009/2012: 934 356/820 009/819 710;
- Leipzig 2006/2009/2012: 497 425/447 833/461 555;
- Brandenburg 2006/2009/2012: 1 465 416/1 308 910/1 337 091;
- sum of the values of the missing regions in Eurostat: 2 896 927/2 576 752/2 618 356;
- Eurostat total for Germany: 46 090 000;
- Eurostat total for Germany from all remaining NUTS-2 regions: 43 214 000;
- difference between Eurostat German total and total without considering DE40, DED4, and DED5: 46 090 000 – 43 214 000 = 2 876 000;
- DE40 2006: (1 465 416/2 896 927) × 2 876 000 = 1 454 830.0375;
- DED4 2006: (934 356/2 896 927) × 2 876 000 = 927 606.3415;
- DED5 2006: (497 425/2 896 927) × 2 876 000 = 493 831.6706.

This calculation ensured that we keep the total from the Eurostat database, while estimating the number of passenger cars for the missing German NUTS-2 regions.

(e) Iceland

The numbers of passenger cars in 2006 and 2009 for Iceland were available from Statistics Iceland.

Source: Statistics Iceland; http://www.statice.is/Statistics/Tourism,-transport-and-informati/Aviation (accessed September and October 2015).

Path: 7. Tourism, Transport and Information Technology > Transport > Registered Motor Vehicles 1950–2013.

Table A5.29 Iceland_PassengerCars: The number of passenger cars in Iceland 2006–2010 according to Statistics Iceland

Year	Passenger cars
2006	197 305
2007	207 513
2008	209 740
2009	205 338
2010	204 736

(f) Italy

Source: National Statistical Office of Italy; http://noi-italia2012en.istat.it/.

Path: Infrastructures and Transport > Passenger cars > Stock of passenger cars, coaches/buses and motorcycles by region (http://noi-italia2012en.istat.it/fileadmin/user_upload/allegati/S13I04S12s0_01.xls).

The National Statistical Office of Italy provides information on the vehicle rates for the NUTS-2 regions in the years 2002–2011 (file downloaded on 5 April 2014). Given that there is no information about the reporting date, we used the values for the corresponding years. For 2006, there are 615.4879 cars per 1 000 inhabitants in Emilia-Romagna (ITH5) and 628.4931 cars per 1 000 inhabitants in Marche (ITI3). For these two regions, the National Statistical Office of Italy reported a population size in 2006 of 4 223 264 in Emilia-Romagna and 1 536 098 in Marche. Therefore, we have the following number of cars in these two regions in 2006 (using the population size from 1 January of the following year and dividing it by 1 000):

ITH5:

4 223.264 × 615. 4879 = 2 599 368;

ITI3:

1 536.098 × 628.4931 = 965 427.

For 2009:

ITH5:

4 395.569 × 608.278 = 2 673 730;

ITI3:

1 559.542 × 628.211 = 979 722

(g) Montenegro (26 August 2014)

No data for the number of passenger cars were available from the Statistical Office of Montenegro. We used the information about passenger cars per 1 000 inhabitants from the World Bank database ([5]) and the corresponding population size from Eurostat for 1 January 2007 to approximate the numbers of passenger cars in Montenegro in 2006 and 2009 (the population size has changed in the database for Montenegro from 2014 (624 896, file downloaded on 9 July 2014) to 2015 (614 624, extraction date: 28 September 2015)):

2006:

(243.322 × 624.896) / 1000 = 152.051;

2009:

(283.802 × 616.411) / 1000 = 174.939.

This way we corrected for the information about population size in the Eurostat database.

(h) The former Yugoslav Republic of Macedonia (26 August 2014)

Similarly to Montenegro, we used the information from the World Bank to calculate the number of passenger cars in the former Yugoslav Republic of Macedonia for 2006 and 2009 (note that population is in thousands):

2006:

(118.58845 × 2 041.941) / 1 000 = 242 151;

2009:

(137.2035 × 2 052.722) / 1 000 = 281 641.

([5]) http://data.worldbank.org/indicator/IS.VEH.PCAR.P3 (last accessed 10 July 2014).

(i) Portugal

Source: Associacio de automovel Portugal; http://www.acap.pt/pt/pagina/36/estat%C3%ADsticas/ (direct link: http://www.autoinforma.pt/estatisticas/estatisticas.html?MIT=36458) (accessed September and October 2015).

File: Quardro 58 — Automobiles in Portugal from 1974–2010.

No information was available in Eurostat and the National Statistical Database at the regional level, but only at the district level. After two unsuccessful requests for information, the number of passenger cars was roughly approximated using the population data at the regional level and the country's total number of passenger cars reported in the Portuguese automobile association for 2006 (4 290 000) and 2009 (4 457 000).

Table A5.30 Portugal_Cars: Estimation of the number of passenger cars using the total of each year for the entire country and the population sizes for each NUTS-2 region

NUTS-2	Population	Cars in Portugal	Passenger cars
2006			
PT11	3 744 341	4 290 000	1 515 527.77761
PT15	421 528	4 290 000	170 614.10620
PT16	2 385 891	4 290 000	965 693.05115
PT17	2 794 226	4 290 000	1 130 967.27032
PT18	764 285	4 290 000	309 345.52902
PT20	243 081	4 290 000	98 387.40855
PT30	245 806	4 290 000	99 490.35649
TOTAL	10 599 095		
2009			
PT11	3 745 575	4 457 000	1 569 324.88919
PT15	434 023	4 457 000	181 847.40564
PT16	2 381 068	4 457 000	997 622.33442
PT17	2 830 867	4 457 000	1 186 079.58487
PT18	753 407	4 457 000	315 663.24444
PT20	245 374	4 457 000	102 807.05242
PT30	247 399	4 457 000	103 655.48901
Total	10 637 713		

(j) Sweden

Source: Statistics Sweden; http://www.scb.se/en_/Finding-statistics/ (accessed September and October 2015).

Path: Transport and Communications > Road Traffic > Registered Vehicles.

File link (2006): http://www.scb.se/Statistik/TK/TK1001/SSM%200020701.pdf (accessed September and October 2015).

File name: vehicles in use by kind of vehicle and county at the turn of the year 2006/2007.

The Swedish Statistical database has values for the number of passenger cars for the Swedish counties, which can be assembled to the corresponding NUTS-2 regions. The Eurostat database has no information about the Swedish NUTS-2 regions for 2006, but the total for 2006 (4 203 000). In order to take into account the total for 2006 from the Eurostat database and thus be able to compare the values with the remaining values in the Eurostat database, we assembled the county values and corrected them for the total in the Eurostat database.

The assemblage and the correction for the total reported in Eurostat resulted in the following values:

Table A5.31 Sweden_Cars: Passenger cars in Sweden in 2006 at the county level

County	NUTS-3	Passenger_Cars	NUTS-2
Stockholm laen	SE110	768 957	SE11
Uppsala laen	SE121	133 191	SE12
Soedermanlands laen	SE122	125 364	SE12
Oestergoetlands laen	SE123	188 930	SE12
Joenkoepings laen	SE211	161 191	SE21
Kronobergs laen	SE212	89 293	SE21
Kalmar laen	SE213	117 593	SE21
Gotlands laen	SE214	31 627	SE21
Blekinge laen	SE221	76 406	SE22
Skane laen	SE224	548 832	SE22
Hallands alaen	SE231	146 275	SE23
Vastra Goetalands laen	SE232	694 809	SE23
Vaermlands laen	SE311	141 074	SE31
Oerebro laen	SE124	129 200	SE12
Vaestmanlands laen	SE125	124 128	SE12
Dalanas laen	SE312	146 591	SE31
Gaevleborgs laen	SE213	138 064	SE31
Vaesternorrlands laen	SE321	123 611	SE32
Jaemtlands laen	SE322	66 408	SE32
Vaesterbottens laen	SE331	120 494	SE33
Norrbottens laen	SE332	130 408	SE33
Okaent laen	NA	17	NA
Hela riket		4 202 463	

Table A5.32 Sweden_Cars in NUTS-2 regions

NUTS-2	Swedish Statistical Database	Corrected according to Eurostat
SE11	768 957	769 058.37005
SE12	700 813	700 905.38677
SE21	399 704	399 756.69217
SE22	625 238	625 320.42387
SE23	841 084	841 194.87841
SE31	425 729	425 785.12300
SE32	190 019	190 044.04982
SE33	250 902	250 935.07591
Total	4 202 446	4 203 000 (Eurostat)

(k) United Kingdom (30 July 2014)

Source: Department of Transport, United Kingdom; https://www.gov.uk/government/organisations/department-for-transport/about/statistics.

Table VEH 0105 — Licensed vehicles by body type, by local authority, Great Britain.

Four English NUTS-2 regions lack information about the number of passenger cars for at least one of the two years: Cheshire (UKD6, 2006 and 2009), Merseyside (UKD7, 2006 and 2009), North Eastern Scotland (UKM5, 2006) and Highlands and Islands (UKM6, 2006). Information about these regions can be found at the unitary authority level, which can be assembled for UKD5, UKD6 and UKM5 (Table A5.32). The situation for the Highlands and Islands (UKM6) is not as simple, because several smaller units were merged into other unitary authorities, which made it impossible to obtain information for passenger cars (Table UK_UKM6). The Highland unitary authority consists of several smaller regions: Inverness, Nairn, Badenoh and Strathspey, Skye, Ross, Lochaber, Caithness and Sutherland, Cromarty and the Kyle of Lochalsh ([5]). The problematic region for the assemblage of passenger cars for North Eastern Scotland (UKM6) is Arran and Cumbrae. This smaller regional unit forms, together with Lochaber, Skye, Lochalsh and Argyll and Bute, the NUTS-3 region UKM63, which in turn is part of the NUTS-2 region UKM6. In the table for the transport statistics of Great Britain, however, it is part of North Ayrshire, which belongs to UKM33 in the NUTS classification (Table A5.34). This NUTS-3 region in turn is part of South Western Scotland (UKM3) and thus does not belong to Highlands and Islands (see information on Isle of Arran ([6]) and Great Cumbrae ([7])). These two units have a small population and thus the number of cars they contribute to the NUTS-2 regions can be expected to be negligible.

Table A5.33 UK_Cars: The number of passenger cars according to the UK transport statistics database after assembling the regions to the NUTS-2 regions defined by the EU classification system

NUTS-2		2006	2009	2012
Cheshire (UKD6)				
Warrington UA	UKD61	98 461	98 910	100 801
Cheshire		419 651	NA	NA
Cheshire East	UKD62	NA	197 538	200 286
Cheshire West and Chester	UKD63	NA	267 480	172 080
TOTAL		518 112	563 928	473 167
Merseyside (UKD7)				
Knowsley		51 857	53 420	51 500
St Helens		75 737	77 505	77 550
Halton		55 019	56 032	56 867
Liverpool	UKD72	135 830	137 418	132 491
Sefton	UKD73	115 196	116 872	115 562
Wirral	UKD74	138 148	140 380	139 971
TOTAL		571 787	581 627	573 941
North Eastern Scotland (UKM5)				
Aberdeen		86 852	Not required	Not required
Aberdeenshire		125 576	Not required	Not required
TOTAL		212 428	Not required	Not required
Highlands and Islands (UKM6)				
Highland UA		101 871	Not required	Not required
Moray UA		41 393	Not required	Not required
Argyll and Bute UA		40 444	Not required	Not required
Eilean Siar UA		11 974	Not required	Not required
Orkney Islands UA		9 704	Not required	Not required
Shetland Islands IA		10 090	Not required	Not required
TOTAL		215 476	Not required	Not required

([5]) https://en.wikipedia.org/Wiki/Highland_(council_area) (last accessed 1 August 2014).
([6]) https://en.wikipedia.org/wiki/Isle_of_Arran (last accessed 1 August.2014).
(7) https://en.wikipedia.org/wiki/Great_Cumbrae (last accessed 1 August 2014).

Table A5.34 UK_Cars2: Adjusted number of passenger cars for UKD6, UKD7, UKM5 and UKM6

NUTS-2	2006	2006 corrected	2009	2009 corrected
Cheshire (UKD6)	518 112	520 910.10	563 928	567 592.99
Merseyside (UKD7)	571 787	574 874.98	581 627	585 407.01
North Western Scotland (UKM5)	212 428	213 575.23	NA	
Highlands and Islands (UKM6)	215 476	216 639.69	NA	
SUM	1 517 803	1 526 000	1 145 555	1 153 000
UK TOTAL (Eurostat)	27 992 000		28 753 000	
UK TOTAL w/o UKD6,7, UKM5,6	26 466 000		27 600 000	
Diff	1 526		1 153	

Finally, the total number of passenger cars of each NUTS-2 region was adjusted using the total for the UK in the Eurostat database for the corresponding year.

Road and railway length
Information on road and rail density in 2006 and 2009 was missing for:

- Bulgaria: all NUTS-2 regions;
- Germany: Brandeburg (DE40), Chemnitz (DED4), Leipzig (DED5);
- Finland: Helsinki-Uusimaa (FI1B), Etelä-Suomi FI1C, Aland (FI20);
- Croatia: Kontinental Hrvastka (HR04);
- Iceland: IS00;
- Italy: Emilia-Romagna (ITH5), Marche (ITI3);
- Montenegro: ME00;
- the former Yugoslav Republic of Macedonia: MK00;
- UK: Cheshire (UKD6), Merseyside (UKD7).

Erika Orlitova calculated the road and railway lengths using TeleAtlas for 2006. We did not have access to the information for 2009, hence we used the same values for road and rail length in both years. There are, however, some minor changes, as can be seen in the following descriptions of the missing values.

Table A5.35 UK_UKM6: Composition of Highlands and Islands (UKM6) according to the EU NUTS classification and the Transport Statistics

NUTS-3 Code	NUTS-3	Transport statistics
UKM61	Caithness and Sutherland	Part of Highland UA
	Ross and Cromarty	
UKM62	Inverness	Part of Highland UA
	Nairn	
	Badenoch and Strathspey	
	Moray	Moray UA
UKM63	Lochaber	Part of Highland UA
	Skye	
	Lochalsh	
	Arran	Part of North Ayrshire (UKM33)
	Cumbrae	
UKM64	Eilean Siar (Western Isles)	Eilean Siar UA
UKM65	Orkney Islands	Orkney Islands UA
UKM66	Shetland Islands	Shetland Islands UA

(a) Bulgaria (25 April 2014)

Source: National Statistical Institute of Bulgaria.

Road: http://www.nsi.bg/en/content/7203/national-road-network-road-category (file: http://www.nsi.bg/sites/default/files/files/data/timeseries/Transport_2.1.3.1_en.xls).

Rail: http://www.nsi.bg/en/content/7191/length-railway-network (file: http://www.nsi.bg/sites/default/files/files/data/timeseries/Transport_2.1.2.3_en.xls).

In the National Statistical Institute of Bulgaria, information about the national road network by road category is presented as of 31 December 2006 at the district level. We merged the information at the district level for the NUTS-2 level.

Table A5.36 BG_Roads: Road length in Bulgaria at the district level for Category I roads, Category II roads and Category III roads and road connections by crossroads and junctions

NUTS-2	NUTS-3	Planning regions and districts	Total	Motorway	Category I	Category II	Category III
2006							
		Total	19 373	394	2 969	4 021	11 989
BG31	BG311	Vidin	611	NA	74	91	446
BG31	BG313	Vratsa	634	NA	59	231	344
BG31	BG312	Montana	601	NA	52	162	387
BG32	BG321	Veliko Tarnovo	938	NA	153	142	643
BG32	BG322	Gabrovo	503	NA	86	30	387
BG31	BG315	Lovech	746	7	106	78	555
BG31	BG314	Pleven	791	NA	96	205	490
BG32	BG323	Ruse	512	NA	110	155	247
BG33	BG331	Varna	712	58	135	42	477
BG33	BG332	Dobrich	826	NA	83	242	501
BG32	BG324	Razgrad	501	NA	56	162	283
BG32	BG325	Silistra	504	NA	57	147	300
BG33	BG334	Targovishte	523	NA	77	106	340
BG33	BG333	Shumen	605	26	188	77	314
BG41	BG413	Blagoevgrad	666	NA	87	153	426
BG41	BG415	Kyustendil	577	NA	85	54	438
BG41	BG414	Pernik	540	NA	80	66	394
BG41	BG412/BG411	Sofia	1 483	118	363	346	656
BG42	BG425	Kardzhali	601	NA	77	74	450
BG42	BG423	Pazardzhik	739	51	59	202	427
BG42	BG421	Plovdiv	1 022	50	129	240	603
BG42	BG424	Smolyan	539	NA	NA	110	429
BG34	BG344	Stara Zagora	838	28	167	215	428
BG42	BG422	Haskovo	1 063	21	160	147	735
BG34	BG341	Burgas	1 161	35	249	253	624
BG34	BG342	Sliven	541	NA	85	202	254
BG34	BG343	Yambol	596	NA	96	89	411
2009							
		Total	19 435	418	2 975	4 028	12 014
BG31	BG311	Vidin	611	NA	74	91	446
BG31	BG313	Vratsa	634	NA	59	231	344
BG31	BG312	Montana	603	NA	52	162	389
BG32	BG321	Veliko Tarnovo	937	NA	153	141	643
BG32	BG322	Gabrovo	503	NA	86	30	387
BG31	BG315	Lovech	748	7	106	78	557
BG31	BG314	Pleven	791	NA	96	205	490
BG32	BG323	Ruse	512	NA	110	155	247
BG33	BG331	Varna	712	58	135	42	477

Table A5.36 BG_Roads: Road length in Bulgaria at the district level for Category I roads, Category II roads and Category III roads and road connections by crossroads and junctions (cont.)

NUTS-2	NUTS-3	Planning regions and districts	Total	Motorway	Category I	Category II	Category III
BG33	BG332	Dobrich	826	NA	83	242	501
BG32	BG324	Razgrad	501	NA	56	162	283
BG32	BG325	Silistra	506	NA	57	147	302
BG33	BG334	Targovishte	523	NA	77	106	340
BG33	BG333	Shumen	606	26	188	77	315
BG41	BG413	Blagoevgrad	666	NA	87	153	426
BG41	BG415	Kyustendil	577	NA	85	54	438
BG41	BG414	Pernik	546	NA	80	66	400
BG41	BG412/BG411	Sofia	1 483	118	363	346	656
BG42	BG425	Kardzhali	620	NA	83	74	463
BG42	BG423	Pazardzhik	739	51	59	202	427
BG42	BG421	Plovdiv	1 022	50	129	240	603
BG42	BG424	Smolyan	539	NA	NA	110	429
BG34	BG344	Stara Zagora	861	52	167	215	427
BG42	BG422	Haskovo	1 063	21	160	147	735
BG34	BG341	Burgas	1 169	35	249	261	624
BG34	BG342	Sliven	541	NA	85	202	254
BG34	BG343	Yambol	596	NA	96	89	411

Merging the information for the NUTS-2 regions results in:

Table A5.37 Bulgaria_Roads in NUTS-2 regions

NUTS-2	31 December 2006	31 December 2009
BG31	3 383 000	3 387 000
BG32	2 958 000	2 959 000
BG33	2 666 000	2 667 000
BG34	3 136 000	3 167 000
BG41	3 266 000	3 272 000
BG42	3 964 000	3 983 000

The Bulgarian rail network was also assembled using the information from the National Statistical Institute of Bulgaria.

Table A5.38 Bulgaria_Rail Network in the districts

NUTS-2 2010	Districts	31 December 2006	31 December 2009
BG31	Vidin	101	101
BG31	Vratsa	106	112
BG31	Montana	115	115
BG32	Veliko Tarnovo	226	226
BG32	Gabrovo	72	72
BG31	Lovech	111	111
BG31	Pleven	216	215
BG32	Ruse	160	160
BG33	Varna	195	193
BG33	Dobrich	60	60
BG32	Razgrad	92	92
BG32	Silistra	70	70
BG33	Targovishte	69	69
BG33	Shumen	166	166
BG41	Blagoevgrad	162	158
BG41	Kyustendil	121	130
BG41	Pernik	115	111
BG41	Sofia	298	297
BG41	Sofia cap.	203	203
BG42	Kardzhali	67	67
BG42	Pazardzhik	186	186
BG42	Plovdiv	330	330
BG42	Smolyan	NA	NA
BG34	Stara Zagora	290	292
BG42	Haskovo	200	201
BG34	Burgas	186	184
BG34	Sliven	133	133
BG34	Yambol	96	96

Railway lengths (in meters) in the Bulgarian NUTS-2 regions for 2006 and 2009 after merging the information at the district level are:

Table A5.39 Bulgaria_Rail Network in the NUTS-2 regions

NUTS-2	31 December 2006	31 December 2009
BG31	649 000	654 000
BG32	620 000	620 000
BG33	490 000	488 000
BG34	705 000	705 000
BG41	899 000	899 000
BG42	783 000	784 000

(b) Germany

Information about road and rail density for the three NUTS-2 regions Brandenburg (DE40), Chemnitz (DED4) and Leipzig (DED5) in 2006 were obtained from TeleAtlas by Erika Orlitova.

Table A5.40 DE_RoadsRail: Road and rail length (km) in 2006 for three German NUTS-2 regions

Name	NUTS-2	Motorways	Primary roads	Secondary roads	Local roads	Unknown	Roads total	Railways	Communication total
Brandenburg	DE40	965.48	3 014.21	8 868.16	3 262.04	9.57	16 119.46	3 014.21	19 133.67
Chemnitz	DED4	251.25	1 016.94	4 044.90	1 618.11	2.38	6 933.59	1 016.94	7 950.54
Leipzig	DED5	151.40	635.04	2 005.96	631.59	0.00	3 423.98	635.04	4 059.02

(c) Finland

Information about road and rail density for the three NUTS-2 regions Helsinki-Uusimaa (FI1B), Etelä-Suomi (FI1C) and Pohjois-ja Itä-Suomi (FI1D) in 2006 was obtained from TeleAtlas by Erika Orlitova.

Table A5.41 FI_RoadsRail: Road and rail length (km) in 2006 for three Finnish NUTS-2 regions

Name	NUTS-2	Motorways	Primary roads	Secondary roads	Local roads	Unknown	Roads total	Railways	Communication total
Helsinki-Uusimaa	FI1B	283.31	510.95	1 760.64	5 319.67	0.00	7 874.57	510.95	8 385.53
Etelä-Suomi	FI1C	273.68	1 653.32	5 101.34	15 569.81	0.00	22 598.15	1 653.32	24 251.47
Pohjois- ja Itä-Suomi	FI1D	119.23	6 877.09	14 416.77	45 997.88	0.00	67 410.97	6 877.09	74 288.06

(d) Croatia

The missing information for the NUTS-2 region Kontinentalna Hrvatska (HR04) was calculated from HR01 and HR02. In the NUTS-2 2010 layer, these two previous NUTS-2 regions were merged to HR04. The base data were provided by Erika Orlitova on 28 May 2014.

These values differ from those reported in the Croatian database by a factor of almost 2 (HR03: 20 573.24; HR04: 29 561.96; HR: 50 135.20). In 2006, the Croatian National Statistical Bureau published a value of 28 788 km of all roads. Erika Orlitova had sent a previous file without information about the roads and railways for Croatia. In this previous version, we used the values reported in the Statistical Yearbook 2007 (42. Transport and Communication, pp. 680–683) for 2006 (Table A5.43).

Table A5.42 HR_RoadsRail: Road and railway length (km) in the Croatian NUTS-2 regions

NUTS-2	Code	Motorways	Primary roads	Secondary roads	Local roads	Unknown	Roads total	Railways
Sjeverozapadna Hrvatska	HR01	539.21	258.33	3 541.86	7 514.87	0.00	11 854.27	614.50
Sredisnja i Istocna	HR02	730.89	695.50	5 569.80	10 711.50	0.00	17 707.69	1 363.57
Jadranska Hrvatska	HR03	768.89	1 537.08	6 496.35	11 770.92	0.00	20 573.24	753.10

Table A5.43 HR_RoadsRail2: Road and railway length (km) in the Croatian NUTS-2 regions added in the first version of the data table about road and railway length, where there was no information about the Croatian roads and the railways

NJUTS-2	NUTS-2 (2010)	Motorways	Primary roads	Secondary roads	Local roads	Unknown	Roads Total
HR01	HR04 (part)	0.00	1 223.00	2 667.00	2 557.00	0.00	6 447.00
HR02	HR04 (part)	0.00	2 638.00	4 071.00	3 696.00	0.00	10 405.00
HR03	HR03	0.00	4 008.00	3 806.00	3 806.00	0.00	11 936.00
	HR04	0.00	3 861.00	6 738.00	6 253.00	0.00	16 852.00

Note: This file was sent by Erika Orlitova on 23 April 2014.

(e) Iceland (12 May 2014)

The National Statistical Office of Iceland provides information on roads by category and region from 2003–2011.

Source: National Statistical Office of Iceland; http://www.statistics.is/ or http://www.hagstofa.is/.

Path: Tourism, Transport and IT > Transport > Public roads by type and region 2003–2011. For 2012, the Statistical Yearbook of 2012 reports the length of the roads in Iceland.

There is no information about the railway length in the statistical database; however, internet searches suggest that there is no railway system in Iceland. We therefore set the values to zero for 2006 and 2009.

Table A5.44 IS_Roads: Road length in Iceland (km)

	2006	2009	2012
Iceland (IS00)	13 038	12 888	12 890

(f) Italy

Information on road and rail density for the two NUTS-2 regions Emilia-Romagna (ITH5) and Marche (ITI3) in 2006 was obtained from TeleAtlas by Erika Orlitova.

Table A5.45 IT_RoadsRail: Road and rail length (km) in the year 2006 for two Italian NUTS-2 regions

Name	NUTS-2	Motorways	Primary roads	Secondary roads	Local roads	Unknown	Roads total	Rails	Communication Total
Emilia-Romagna	ITH5	633.60	1033.98	13 164.13	9350.71	0.00	24 182.42	1033.98	25 216.40
Marche	ITI3	250.91	418.50	4988.12	3678.80	0.00	9336.34	418.50	9754.84

(g) Montenegro

Source: Statistical Office of Montenegro (MONSTAT); http://www.monstat.org/eng/.

Path: Road 2006: http://www.monstat.org/userfiles/file/publikacije/godisnjak2009-sadrzaj/saobracaj.pdf (p. 162).

Road 2009/2012: Short Term Indicators > Transport > Road > Classification of Roads > Data (http://www.monstat.org/userfiles/file/saobracaj/kat_puteva/putna%20mreza%202012.xls);

Rail 2006: http://www.monstat.org/userfiles/file/publikacije/godisnjak2009-sadrzaj/saobracaj.pdf (p. 162);

Rail 2009: http://www.monstat.org/userfiles/file/publikacije/godisnjak%202013/18.saobracaj.pdf (p. 154).

Table A5.46 ME_RoadsRail: Road and rail length (km) in Montenegro

	2006	2009	2012
Road	7 368	7 624	7 905
Rail	250	250	250

(h) The former Yugoslav Republic of Macedonia

Information about road and rail density for the former Yugoslav Republic of Macedonia in 2006 was obtained from the State Statistical Office of the Republic of Macedonia.

Source: State Statistical Office of the Republic of Macedonia; http://www.stat.gov.mk/.

Path (Road): MAKStat Database > Statistics by Municipality > under 'Transport' choose 'Local road network, by municipalities, km'.

File (Rail): 2006/2009: http://www.stat.gov.mk/pdf/sg2010/14.%20Transport.pdf (p. 502); 2012: www.stat.gov.mk/Publikacii/.../14-TransTurVnatr-TransTourTrade.pdf (p. 580)

Table A5.47 MK_RoadsRail: Road and rail length (km) in the former Yugoslav Republic of Macedonia

	2006	2009	2012
Road	8 995	9 258	9 355
Rail	696	696	696

(f) United Kingdom

Information about road and rail density for the NUTS-2 regions Cheshire (UKD6) and Merseyside (UKD7) in 2006 was obtained from TeleAtlas by Erika Orlitova.

Full- and part-time jobs
Information about employment is required to calculate *UD* and *WUP*. Several of the NUTS-2 regions lacked the information about full- and part-time employment. In 2006, these were the following NUTS-2 regions:

- Denmark: all five NUTS-2 regions (i.e. DK01:05)
- Croatia: both Croatian NUTS-2 regions (i.e. HR03, HR04)
- Liechtenstein: LI00
- Montenegro: ME00
- the former Yugoslav Republic of Macedonia: MK00
- UK: the two English NUTS-2 regions Merseyside (UKD6) and Cheshire (UKD7).

In 2009, these were:

- Liechtenstein: LI00
- Montenegro: ME00
- the former Yugoslav Republic of Macedonia: MK00.

Table A5.48 UK_RoadsRail: Road and rail length (km) in 2006 for two English NUTS-2 regions

Name	NUTS-2	Motorways	Primary roads	Secondary roads	Local roads	Unknown	Roads total	Rails	Communication total
Cheshire	UKD6	117.36	826.87	290.78	2 137.64	0.00	3372.65	826.87	4 199.52
Merseyside	UKD7	62.38	475.87	209.71	610.45	0.00	1358.41	475.87	1 834.27

(a) Denmark (29 September 2014)

Source: Statistics Denmark; http://www.statbank.dk/

File1: INDV1: Full-time employees by region, unit, ancestry, age, sex and years in Denmark (DISCONTINUED).

Comment: This data set also contains information about employed person in different age classes.

File2: RASA1: Employed (workplace) by region, industry (DB07), socio-economic status, ancestry, age and sex (DISCONTINUED) (Note: Just mark the NUTS-2 regions in the region window and the years in the year window.)

The Danish Statistical Office provides information about full-time employment for each region. We calculated part-time employment by subtracting the number of full-time employees from the total in each year. We used a table of the information about the total workplaces (or total employed) in the given region (File2).

Table A5.49 DK_FPT: The number of people in full-time (FT) and part-time (PT) employment as well as the total number of people in employment (WP) in the Danish NUTS-2 regions in 2006 and 2009

NUTS-2	2006 FT	2006 WP	2006 PT	2009 FT	2009 WP	2009 PT
DK01	657 385	914 690	257 305	677 807	937 416	259 609
DK02	325 535	339 685	14 150	322 122	340 376	18 254
DK03	465 635	587 909	122 274	467 456	589 909	122 453
DK04	493 613	624 390	130 777	501 748	642 497	140 749
DK05	221 854	280 101	58 247	224 218	284 435	60 217
DK	2 164 022	2 754 646		2 193 351	2 801 519	

Note: The information for the workplaces for Denmark and the Danish NUTS-2 regions was taken from Statistics Denmark, table 'RASA1'. The difference between the sum of the individual NUTS-2 region workplaces and the countries total is not based on wrong calculation by the authors.

FT, full time; PT, part time; WP, total number of people in employment.

(b) Croatia (18–19 August 2014)

No information about full- and part-time employees for Croatia in 2006 was available. In order to obtain information for the missing year, we approximated the values as following:

1. We assembled the information about employees for the reference date 31 March 2007 for the counties at the NUTS-2 level from the Statistical Bureau of Croatia (HR03: 371 162; HR04: 824 493; HR00: 1 195 655).

2. Information obtained on request from Eurostat by Erika Orlitova about commuting data revealed the following movement patterns of employees in 2006.

People going from Croatia (HR00) to work in:

- SAME: 1 555.923645;
- FOREIGN: 22.092475;
- OTHER: 7.516885.

People coming to Croatia (HR00) from:

- SI01 (Slovenia): 0.3042825;
- SI02 (Slovenia): 0.26237 (all to HR02);
- UKK4 (UK): 0.51325.

We are interested only in the people working in the same region (HR00: 1 555.923645) and those coming to Croatia for work. Excluding the information about people coming from Slovenia to work in the NUTS-2 region HR02, which will be added at the end, there were 1 555.923645 + 0.3042825 + 0.51325 = 1 556.7411775 people working in Croatia in 2006. Note that the number reported by the Statistical Bureau of Croatia is different — 1 555 924 — and the results differ slightly if the employment data from the Statistical Bureau of Croatia are used. We used the most recent data (i.e. the latest data obtained from Eurostat on request by Erika Orlitova (see values above)).

The Statistical Bureau of Croatia provided data about the number of employed people on 31 March of each year at the county level. The information of 31 March 2007 was assembled accordingly (Table A5.50, HR03: 371 162, HR04: 824 493, HR: 1 195 655) and the total of employed people living also in Croatia (HR00: 1 556 741.1775) proportionately distributed among the NUTS-2 regions.

Assembling the counties for the two NUTS-2 regions HR03 and HR04 results in 371 162 employed persons in HR03 and 824 493 employed persons in HR04. Multiplying the ratio of the number of employed people with the total reported for Croatia in the commuting table and correcting for commuters from foreign countries (1 556 741.1775) yields the following values for the regions:

Table A5.50 HR_Employed2006: Employed people on 31 March 2007 in the Croatian counties

Counties	NUTS-3 2010	NUTS-2 2010	31 March 2007
Zagreb	HR042	HR04	60 908
Krapina-Zagorje	HR043	HR04	27 627
Sisak-Moslavina	HR04E	HR04	38 180
Karlovac	HR04D	HR04	31 631
Varazdin	HR044	HR04	51 185
Koprivnica-Krizevci	HR045	HR04	27 427
Bjelovar-Bilogora	HR047	HR04	25 911
Primorje-Gorski kotar	HR031	HR03	95 403
Lika-Senj	HR032	HR03	10 000
Virovitica-Podravina	HR048	HR04	16 594
Pozega-Slavonia	HR049	HR04	16 105
Slavonski-Brod Posavina	HR04A	HR04	28 802
Zadar	HR033	HR03	34 126
Osijek-Baranja	HR04B	HR04	77 922
Sibenik-Knin	HR034	HR03	23 246
Vukovar-Sirmium	HR04C	HR04	33 176
Split-Dalmatia	HR035	HR03	110 882
Istria	HR036	HR03	65 487
Dubrovnik-Neretva	HR037	HR03	32 018
Medimurje	HR046	HR04	30 568
City of Zagreb	HR041	HR04	358 457

Calculating the numbers for each Croatian NUTS-2 region, we got (371 162 / 1 195 655) × 1 556.7411775 = 0.310425666266607 × 1 556.7411775 = 483 252 people working in HR03, and (824 493 / 1 195 655) × 1 556.7411775 = 0.6895743337333929 × 1 556.7411775 = 1 073 489 people working in HR04. Then, we added the information for people going to work from Slovenia to HR02, which is part of HR04: 1 073.4887602699002 + 0.26237 = 1 073 751 people in HR04.

We then distributed the numbers among full-time and part-time employees using the information from Eurostat. For all of Croatia (HR or HR00), there were 1 436.8 people in full-time employment, 149.5 in part-time employment, and no people without responses in 2006, which totals 1 436.8 + 149.5 = 1 586.3 employed persons for 2006 in the entire country. Using the NUTS-2 values for employment from the Statistical Bureau of Croatia (above) and the proportions of the values from Eurostat, we got (1 436.6 / 1 586.3) × 483.2524172300998 = 0.9056294521843283 × 483.2524172300998 = 437 648 full-time and 483.2524172300998 – 437.6476218828478 = 45 605 part-time employed people in HR03.

For HR04, we have

(1 436.6 / 1 586.3) × 1 073.48876 = 0.9056294521843283 × 1 073.48876 = 972 183 full-time, and 1 073.4887602699002 – 938.3510027357346 = 135 138 part-time employed people.

(c) Liechtenstein (18–19 August 2014)

In the 'Beschäftigungs- und Arbeitsplätzestatistik' (Employment- and working place statistics) from 2006, the Statistical Office of Liechtenstein reports 24 874 full-time (Vollzeit) employees, 3 894 part-time employees working between 50 % and 89 % of full time, and 2 306 part-time employees working below 50 % of full time. We summed all part-time jobs together into a single group, resulting in 24 874 full-time and (3 894 + 2 306) = 6 200 part-time employees in Liechtenstein for 2006.

(d) Montenegro (28 September 2014)

Source: UNECE Statistical Database (compiled from national and international (Eurostat) official sources); www.unece.org/stats/ > UNECE Statistical Glossary > Concepts and Definitions by Statistical Domain > Social and Demographic Statistics > Work and the Economy > Part-time employment

File: Employment by Sex, Measurement, Full-Time and Part-Time Status, Country and Year (http://w3.unece.org/PXWeb2015/pxweb/en/STAT/STAT__30-GE__03-WorkAndeconomy/008_en_GEWE_FPTEmployment_r.px/?rxid=ac46e910-e8c0–466c-b993–3dfa16c0b469)

Table A5.51 ME_FPT: Full- and Part-time workers (in thousand) in Montenegro taken from the UNECE Statistical Database

ME00	2006	2007	2008	2009	2010	2011	2012
Total	178.4	212.7	221.9	213.6	209.4	196	201
Full-time	167	195.8	202.1	200.5	199	187	191.9
Part-time	11.4	16.9	19.7	13.1	10.4	9	9.1

(e) The former Yugoslav Republic of Macedonia (28th September 2014)

Source: UNECE Statistical Database (compiled from national and international (Eurostat) official sources); www.unece.org/stats/ > UNECE Statistical Glossary > Concepts and Definitions by Statistical Domain > Social and Demographic Statistics > Work and the Economy > Part-time employment.

File: Employment by Sex, Measurement, Full-Time and Part-Time Status, Country and Year (http://w3.unece.org/PXWeb2015/pxweb/en/STAT/STAT__30-GE__03-WorkAndeconomy/008_en_GEWE_FPTEmployment_r.px/?rxid=ac46e910-e8c0–466c-b993–3dfa16c0b469).

The State Statistical Office of the Republic of Macedonia (http://www.stat.gov.mk/Default_en.aspx) also reported data in the 'Labour Force Survey 2008' from the 'Statistical Review: Population and Social Statistics' with 570 404 employed persons in 2006 (p. 67). However, there is no information about the numbers of part-time and full-time employed people, nor could this information be found in the Labour Force Surveys for 2006 and 2007. In the 'Labour Force Survey 2009' from the 'Statistical Review: Population and Social Statistics', there are 629 901 employed persons, of whom 594 677 are full-time and 35 224 are part-time (p. 30).

Table A5.52 MK_FPT: Full- and Part-time workers (in thousand) in the former Yugoslav Republic of Macedonia taken from the UNECE Statistical Database

MK00	2006	2007	2008	2009	2010	2011	2012	2013
Total	570.5	590.2	609	629.9	637.8	645.1	650.5	678.8
Full-time	532.8	550.4	573.7	594.7	600.1	604.4	608.7	647.5
Part-time	37.7	39.8	35.3	35.2	37.7	40.7	41.8	31.3

(f) United Kingdom (18–19 August 2014)

Data about full- and part-time employment for Cheshire (UKD6) and Merseyside (UKD7) were searched in the neighbourhood statistics of the Office for National Statistics (http://www.neighbourhood.statistics.gov.uk/dissemination/LeadHome.do?a=5&i=1001&m=0&r=1&s=1408462277909&enc=1&extendedList=true&areaSearchText=&areaSearchType=140). The information was assembled according to the authorities forming the NUTS-2 regions.

The period 2001–2011 covers 10 years. We divided the time period by two to receive the value for Cheshire (UKD6) and Merseyside (UKD7) in 2006:

Cheshire 2006:

- full-time:
  (306 159 + 312 611) / 2 = 618 770 / 2 = 309 385;
- part-time:
  (103 713 + 129 519) / 2 = 233 232 / 2 = 116 616.

Merseyside 2006:

- full-time: (423 414 + 455 269) / 2 = 878 683 / 2 = 439 341.5 = 439 341;
- part-time:
  (151 905/201 057) / 2 = 352 962 / 2 = 176 481.

Commuting database

The *UD* and *WUP* variables require information about the number of workplaces when taking commuters into account. The Eurostat database — and other databases — that report values about employment consider the number of employed people who live in each given reporting unit (country, region, etc.). However, a person may be working in a different region. In extreme cases, industrial regions may have many more employed people than may live there. We tried to remove the bias introduced when using employment data alone for the calculation of *WUP* and its components. Several values are missing in our data for 2006 and 2009:

- Denmark: all NUTS-2 regions (2006)
- Croatia: all NUTS-2 regions (2006)
- Switzerland: all NUTS-2 regions (2006, 2009)
- Liechtenstein: 2006, 2009
- Montenegro: 2006, 2009
- the former Yugoslav Republic of Macedonia: 2006, 2009
- Slovenia: all NUTS-2 regions (2006, 2009)
- UK: Cheshire (UKD6) and Merseyside (UKD7) (2006).

Table A5.53 UK_FPT: Full- and part-time workers in the two English NUTS-2 regions Cheshire (UKD6) and Merseyside (UKD7)

	FT2001	PT2001	FT2011	PT2011
Cheshire (UKD6)				
Cheshire East	126 634	42 509	128 052	53 084
Cheshire West and Chester	110 865	38 578	111 828	48 310
Warrington	68 660	22 626	72 731	28 125
Total	306 159	103 713	312 611	129 519
Merseyside (UKD7)				
Halton	37 719	12 644	41 526	16 051
Knowsley	40 484	13 867	43 165	18 526
Liverpool	114 137	40 680	133 983	62 647
St Helens	54 680	18 396	56 395	22 185
Sefton	84 134	32 181	83 438	38 481
Wirral	92 260	34 137	96 762	43 167
Total	423 414	151 905	455 269	201 057

(a) Denmark

Commuting data were sent by Karen Larsen from Statistics Denmark on 6 March 2014. The file contained information about employed people working in the same region, in other NUTS-2 regions, and outside Denmark. In 2009, a new data source for the numbers and locations of employed people was used, which is why there is a break in the statistics and the employment level is lower.

Assembling the data into the number of employed people working in the same region (IN.SAME), in a different NUTS-2 region of the same country (IN.OTHER) and outside Denmark (FOREIGN) for Danish NUTS-2 region resulted in the following Table A5.55.

We used the totals in the second part of the table for the analysis in 2006.

Table A5.54 DK_COMMUTING: Employed people working in the same Danish NUTS-2 region, in a different Danish NUTS-2 region and outside Denmark

		Men	Women	TOTAL
Region Hovedstaden	Region Hovedstaden	410 103	396 591	806 694
	Region Sjælland	17 071	9 573	26 644
	Region Syddanmark	2 387	1 262	3 649
	Region Midtjylland	2 057	1 120	3 177
	Region Nordjylland	808	403	1 211
	Outside Denmark	1 438	273	1 711
Region Sjælland	Region Hovedstaden	56 098	36 209	92 307
	Region Sjælland	155 894	153 273	309 167
	Region Syddanmark	1 323	459	1 782
	Region Midtjylland	983	260	1 243
	Region Nordjylland	382	76	458
	Outside Denmark	782	95	877
Region Syddanmark	Region Hovedstaden	5 132	2 166	7 298
	Region Sjælland	1 526	694	2 220
	Region Syddanmark	298 635	263 612	562 247
	Region Midtjylland	10 062	4 567	14 629
	Region Nordjylland	988	249	1 237
	Outside Denmark	2 449	159	2 608
Region Midtjylland	Region Hovedstaden	4 128	1 780	5 908
	Region Sjælland	875	357	1 232
	Region Syddanmark	11 207	7 288	18 495
	Region Midtjylland	316 667	278 193	594 860
	Region Nordjylland	6 011	3 340	9 351
	Outside Denmark	1 253	124	1 377
Region Nordjylland	Region Hovedstaden	1 840	643	2 483
	Region Sjælland	340	82	422
	Region Syddanmark	1 408	328	1 736
	Region Midtjylland	6 864	3 617	10 481
	Region Nordjylland	143 694	124 150	267 844
	Outside Denmark	1 169	129	1 298

Table A5.55 Denmark_Commuting

2006	IN.SAME	IN.OTHER	FOREIGN	TOTAL
Region Hovedstaden	806 694	34 681	1 711	843 086
Region Sjælland	309 167	95 790	877	405 834
Region Syddanmark	562 247	25 384	2 608	590 239
Region Midtjylland	594 860	34 986	1 377	631 223
Region Nordjylland	267 844	15 122	1 298	284 264
2006	**IN.SAME**	**FROM.OTHER**	**FOREIGN (ONLY SWEDEN)**	**TOTAL**
Region Hovedstaden	806 694	107 996	NA	914 690
Region Sjælland	309 167	30 518	NA	339 685
Region Syddanmark	562 247	25 662	NA	587 909
Region Midtjylland	594 860	29 530	NA	624 390
Region Nordjylland	267 844	12 257	NA	280 101

Note: NA: Not available.

(b) Croatia

See calculation under the section for employment.

(c) Switzerland

There was no information about commuting available for the Swiss NUTS-2 regions. We solved the problem by replacing the missing values with the sum of full-time, part-time and no response. The data were obtained from Eurostat and taken from the corresponding year (i.e. values from 2006 in the Eurostat database represent the situation in 2006, etc.).

Source: Eurostat; http://ec.europa.eu/eurostat

File: Employment by full-time/part-time, sex and NUTS 2 regions (1 000) (lfst_r_lfe2eftpt) (extracted 18 August 2014).

Table A5.56 Switzerland_Employment

NUTS-2	Full-time	Part-time	No response	Total
2006				
CH01	480 700	224 700	2 900	708 300
CH02	596 900	324 200	3 500	924 600
CH03	361 900	190 400	3 300	555 600
CH04	479 500	248 400	2 800	730 700
CH05	394 300	183 500	NA	577 800
CH06	265 900	130 900	2 200	399 000
CH07	110 400	42 100	NA	152 500
2009				
CH01	493 100	245 300	4 900	743 300
CH02	611 900	345 700	2 800	960 400
CH03	380 700	203 100	2 600	586 400
CH04	491 600	281 600	3 500	776 700
CH05	406 300	210 300	3 600	620 200
CH06	272 100	148 600	NA	420 700
CH07	112 500	45 900	NA	158 400
2012				
CH01	506 200	257 400	NA	763 600
CH02	615 100	376 600	NA	991 700
CH03	384 400	218 100	NA	602 500
CH04	508 600	297 500	NA	806 100
CH05	415 500	223 400	NA	638 900
CH06	283 800	157 400	NA	441 200
CH07	113 000	51 100	NA	164 100

(d) Liechtenstein

Source: Landesverwaltung Fürstentum Liechtenstein, AS; http://www.llv.li/#/11480/amt-fur-statistik

Path: 3. Arbeit und Erwerb > Beschäftigungsstatistik > frühere Publikationen >

(a) Beschäftigungs- und Arbeitsplätzestatistik per 31. Dezember 2006;

(b) Beschäftigungsstatistik 2009.

(Neither link provides the PDF file owing to missing specifications in the PDF format, 6 October 2015.)

The 'Beschäftigungs- und Arbeitsplätzestatistik' (Employment and working place statistics) of 2006 reports the number of people living and working in Liechtenstein, the number of foreigners coming to Liechtenstein for work, and the number of people leaving Liechtenstein each day for work (p. 15 and p. 82 in the abovementioned report for 2006, p. 17 and p. 40 in the report for 2009).

(e) Montenegro

No information was available about commuters. We used the information on full-time and part-time employment as described above (p. 135).

(f) The former Yugoslav Republic of Macedonia

No information was available on commuters. We used the information of full-time and part-time as described above (p. 135).

(g) Slovenia

Source: Statistical Office of the Republic of Slovenia; http://pxweb.stat.si/pxweb/Dialog/statfile1.asp.

Path: Demography and Social Statistics > under 'Labour Market' > 'Labour Migrations, annually > person in employment (excluding farmers) by sex, municipalities of residence, year and municipality of workplace'.

Data about foreigners in 2006 for the two Slovenian NUTS-2 regions were received from the Statistical Office of Slovenia by Nuska Brot: SI01 = 16 543, SI02 = 24 643. Information at the municipality level about residences and workplaces were also provided by the Statistical Office of Slovenia for 2006 (see file at the end of path), which was assembled at the NUTS-2 level. The merging of the values for the municipalities resulted in 379 907 and 418 190 employed persons in 2006 in SI01 (Vzhodna Slovenija) and SI02 (Zahodna Slovenija), respectively.

For 2009, information on workplaces and residences was also found in the Statistical Office of Slovenia for the Slovenian NUTS-2 regions. In addition, the data also considered foreigners coming to Slovenia for work: Austria — 43, Hungary — 156, Croatia — 1 858, Italy — 269. There was, however, no information about the Slovenian NUTS-2 regions in which the foreigners are working. Vzhodna Slovenija (SI01) borders with Italy, and Zahodna Slovenija (SI02) borders with Hungary. The values about the people commuting from these countries to Slovenia for work were therefore assigned to each of the NUTS-2 regions. Austria shares almost half its border with each region, which is why half of the people commuting from Austria to Slovenia were assigned to SI01 and the other half to SI02. Croatia shares a major part of its border with SI01 with a total length of the frontier between 667.8 km and 670 km (depending on the source (Gru and Kuzma, 2011; Statistical Yearbook of the Republic of Croatia, 2011) ([8]) ([9])). For the smaller border of SI02, we estimated a length of approximately 80 km. The number of foreign commuters was proportionately distributed between the Slovenian NUTS-2 regions based on the length of the border:

Table A5.57 LI_COMMUTER People living and working in Liechtenstein (Group 1), leaving Liechtenstein each day for work (Group 2) and foreigners coming to Liechtenstein for work (Group 3)

	Population	Group 1	Group 2	Group 3	TOTAL
2006	35 168	15 936	1 287	15 138	31 074
2009	35 894	16 173	1 437	16 704	32 877

Note: We have used the permanent population for Liechtenstein

([8]) Gru, Barbara and Kuzma, Igor. 2011. Territory and Climate. Statistical Yearbook of the Republic of Slovenia. Ljubljana, Statistical Office of the Republic of Slovenia. 38 pages.

([9]) Geographical and Meteorological Data (http://www.dzs.hr/Hrv_Eng/ljetopis/2011/SLJH2011.pdf). Statistical Yearbook of the Republic of Croatia (Croatian Bureau of Statistics) 43: 41. December 2011. ISSN 1333-3305. (see also https://en.wikipedia.org/wiki/Geography_of_Croatia).

SI02:

(80 / 667.8) × 1 858 = 0.1197963462 × 1 858 = 222.58 = 223

SI01:

1 858 – 223 = 1 635

These values were used to calculate the number of employed persons in Slovenia:

SI01:

378 327 + 21.5 (half from Austria) + 156 (total from Hungary) + 0 (Italy) + 1 635 (Croatia) = 380 139.5 = 380 140

SI02:

433 988 + 21.5 (Austria) + 0 (Hungary) + 269 (Italy) + 223 (Croatia) = 434 501.5 = 434 502

Table A5.58 UK_COMM Number of commuters (counts and real values) at the NUTS-2 level

N2	In same	From other	Other countries	No response	Sum	Proportional unknown	Result
UK00	NA	128 190	56 793	NA	184 983	NA	NA
UKC1	440 466	32 843	0	690	473 999	2 941.22	476 940.22
UKC2	590 752	51 495	NA	474	642 721	3 988.16	646 709.16
UKD1	226 491	15 670	NA	NA	242 161	1 502.64	243 663.64
UKD2	377 467	147 836	NA	NA	525 303	3 259.57	528 562.57
UKD3	1 100 202	138 263	301	0	1 238 766	7 686.69	1 246 452.69
UKD4	576 948	57 103	0	NA	634 051	3 934.36	637 985.36
UKD5	476 045	62 294	0	NA	538 339	3 340.46	541 679.46
UKD6	0	0	NA	NA	489 000	3 034.30	492 034.30
UKD7	0	0	NA	NA	655 000	4 064.35	659 064.35
UKE1	383 271	26 457	183	0	409 911	2 543.55	412 454.55
UKE2	317 614	57 840	0	NA	375 454	2 329.74	377 783.74
UKE3	496 838	66 119	0	NA	562 957	3 493.21	566 450.21
UKE4	968 423	84 779	NA	NA	1 053 202	6 535.24	1 059 737.24
UKF1	845 352	74 739	0	NA	920 091	5 709.27	925 800.27
UKF2	716 400	76 649	NA	NA	793 049	4 920.96	797 969.96
UKF3	281 233	26 392	NA	NA	307 625	1 908.85	309 533.85
UKG1	479 908	87 533	NA	NA	567 441	3 521.04	570 962.04
UKG2	573 996	82 837	NA	NA	656 833	4 075.73	660 908.73
UKG3	1 030 138	226 867	958	NA	1 257 963	7 805.81	1 265 768.81
UKH1	1 038 592	81 458	380	1 090	1 121 520	6 959.16	1 128 479.16
UKH2	611 515	117 112	0	NA	728 627	4 521.22	733 148.22
UKH3	615 262	71 024	587	NA	686 873	4 262.13	691 135.13
UKI1	1 194 944	1 171 224	4 510	802	2 371 480	14 715.31	2 386 195.31
UKI2	1 209 559	411979	5 486	956	1 627 980	10 101.81	1 638 081.81
UKJ1	964 945	207 602	279	NA	1 172 826	7 277.52	1 180 103.52
UKJ2	1 032 703	152 088	195	NA	1 184 986	7 352.98	1 192 338.98
UKJ3	788 573	104 239	0	NA	892 812	5 540.00	898 352.00
UKJ4	630 285	59 195	762	NA	690 242	4 283.03	694 525.03
UKK1	1 069 179	96 459	0	NA	1 165 638	7 232.92	1 172 870.92
UKK2	496 100	39 155	0	NA	535 255	3 321.32	538 576.32
UKK3	215 062	25 916	NA	NA	240 978	1 495.30	242 473.30
UKK4	505 651	41 115	314	NA	547 080	3 394.70	550 474.70
UKL1	704 641	47 732	400	NA	752 773	4 671.05	757 444.05
UKL2	417 300	118 589	352	NA	536 241	3 327.44	539 568.44
UKM2	881 042	58 893	493	NA	940 428	5 835.47	946 263.47
UKM3	933 023	65 900	332		999 255	6 200.50	1 005 455.50
UKM5	232 844	18 170		1 288	252 302	1 565.56	253 867.56
UKM6	239 995	27 101		567	267 663	1 660.88	269 323.88
UKN0	749 584	0	559	2 391	752 534	4 669.56	757 203.56

Note: From the first data table sent by Erika Orlitova.

There is a discrepancy between the values calculated at the statistical regional level including the foreigners and those reported in the Slovenian statistical database for employment by region of employment. Further information can be taken from the Yearly Statistical Reports about the Slovenian regions ([10]).

(h) United Kingdom (28 August 2014)

Data from NOMIS Official Labour Market Statistics were used for the number of workplaces in Cheshire (UKD6, 489 000) and Merseyside (UKD7, 655 000). These values were extended by the numbers for the UK that could not be assigned to the NUTS-2 regions, which have been taken from the first table on commuting data.

A5.3 Further comments on the analysis of driving forces

A5.3.1 Outliers in the ridge regression for the countries

The ridge regression at the country level is based on 35 observations (Section 3.3.1). Countries with insufficient or unreliable data were excluded from the entire data set (including Andorra, Albania, Kosovo, Malta, Monaco, San Marino, Turkey and Vatican City) and only the 32 countries from the EU and the EFTA together with Bosnia and Herzegovina, Montenegro, the former Yugoslav Republic of Macedonia and Serbia were kept. Using 15 numerical explanatory variables, there are 35–15 = 20 degrees of freedom left for the residuals. As the ridge regression is used to tackle multicollinearity, this additional correction implies further loss in degrees of freedom. Although there are some debatable common rules about the required number of observations to perform reliable estimates, there is little doubt that 35 observations represent rather little information for the estimation of the relationship between the response and the explanatory variables.

Keeping *all* countries in the analysis is not a viable alternative, because some countries are evidently outliers or have a disproportionately strong influence on the regression line. Consequently, these countries would violate regression assumptions and distort the relationship, and they do not represent the situation for the majority of all European countries. Removing these countries is thus justified when identifying a representative relationship for the great majority of European countries and determining the best estimate values for the coefficients. This is even more justified by the fact that some information (population, working places) for some of these countries was based on less reliable information.

A few countries, however, are influential observations, although their information was taken from the same source as for the majority of European countries (Eurostat) and their data can be expected to be reliable. These influential observations were Belgium and the Netherlands. Both countries have the highest urban sprawl values in Europe and affect the relationship of *WUP* with the ageing index, and with *NRPI*. Keeping these values in the analysis, the estimates for these two explanatory variables are close to zero and can be well expected not to be statistically significant. When excluding Belgium and the Netherlands from the analysis, both variables show a clear positive, and very probably significant, relationship with urban sprawl.

A5.3.2 Spearman rank correlation

Robust versions of the ridge regression exist, which use M-estimators or trimmed squares. However, their implementations in the statistical software R-Cran are less user-friendly and additional information is required to run the command. This information was not available to the authors at the time of this report. However, Spearman rank correlation is a simpler and more familiar approach that can be used to understand the relationships between variables, and which is not affected by influential observations. This non-parametric approach transforms the observations into ranks according to the order of values and does not require a normal distribution. We applied this approach, and our results underline the applicability of Spearman rank correlation for studying the relationship of urban sprawl with all variables (Table A5.59). The correlation coefficients represent very well the relationships expected from observation of the pairwise plots (Figure 3.4). In addition, the robustness of the Spearman rank correlation against outliers and influential observations allowed us to use all other (previously excluded) countries with less reliable information without much distortion of the pattern (except ageing index) (Table A5.59).

We have, however, not pursued the correlation analysis in this report, because it does not provide the possibility to make predictions. Despite the fact that the number of observations in the analysis of countries was small and any predictions should be interpreted

([10]) Slovene Regions in Figures. Statistical Office of the Republic of Slovenia, http://www.stat.si/eng/pub_regije.asp (last accessed 28 September 2014).

Table A5.59 Spearman rank correlation between *WUP* and the explanatory variables (same as for the ridge regression model, but excluding power terms) at the country level for 2006 and 2009

Variables	All countries 2006	All countries 2009	Excluding TR, Balkan countries and city states 2006	Excluding TR, Balkan countries and city states 2009	Excluding TR, Balkan countries, and city states, BE and NL 2006	Excluding TR, Balkan countries, and city states, BE and NL 2009
Population density (log)	0.602	0.607	0.857	0.873	0.831	0.849
Ageing index (log)	– 0.071	– 0.034	– 0.035	0.026	– 0.006	0.083
Employment rate (%) (logit)	– 0.035	0.066	– 0.006	0.189	– 0.061	0.132
*GDP*c (PPS) (log)	0.262	0.290	0.330	0.358	0.276	0.300
Household size (log)	– 0.361	– 0.342	– 0.256	– 0.220	– 0.187	– 0.151
Road density	0.586	0.587	0.769	0.773	0.727	0.731
Rail density	0.393	0.396	0.712	0.716	0.658	0.663
Governmental effectiveness	0.332	0.372	0.233	0.294	0.197	0.252
NRPI	0.163	0.031	0.168	0.099	0.289	0.161
Cars per inhabitant	0.418	0.289	0.348	0.341	0.383	0.353
Gasoline price (USD/ litre)	0.130	0.304	0.227	0.363	0.121	0.272
Relief energy (log)	– 0.173	– 0.161	– 0.134	– 0.119	– 0.010	0.010
Irreclaimable area (logit)	– 0.158	– 0.162	– 0.388	– 0.394	– 0.421	– 0.438
NPP (Power,2)	0.293	0.296	0.382	0.381	0.420	0.423
Coast Length Ratio (asin)	– 0.157	– 0.150	– 0.146	– 0.139	– 0.115	– 0.109

Note: TR, Turkey, BE, Belgium, NL, The Netherlands. Balkan countries include Kosovo, Albania, Bosnia and Herzegovina and Serbia. We kept the Balkan countries Montenegro and the former Yugoslav Republic of Macedonia, because information about them can be also found in Eurostat for some variables. Andorra, Monaco, San Marino and Vatican City were considered city states, because they cover a small area in comparison to many European countries, and their area is in some cases almost entirely built up (Vatican City, Monaco).

with caution, they give at least an idea about potential drivers and future scenarios.

A5.3.3 Outliers in the ridge regression for the NUTS-2 regions

Among the NUTS-2 regions, some observations have a strong influence on the regression line or can be considered outliers with respect to the population of NUTS-2 regions. Several reasons can explain this situation. All are based on the fact that the NUTS-2 regions capture geographical, social and geophysical characteristics at a smaller scale than the countries and exhibit more extreme values. For example, Ceuta (ES63) and Mellila (ES64) have more than five cars per inhabitant according to the information from Eurostat. Similarly, the Aosta Valley (ITC2) has more than one car per inhabitant, which is higher than in all remaining NUTS-2 regions.

Brussels Capital Region (BE10) and Inner London (UKI1) differ from other regions in terms of road density and rail density, *GDP* per capita and population density. These two regions capture only the city cores, which are entirely built over. They are much smaller than most other NUTS-2 regions, which results in proportionately larger values. Their economic productivity is larger than in other NUTS-2 regions that include rural areas. Rural areas do not have a high *GDP* per capita, and, accordingly, the inclusion of rural areas into a NUTS-2 region results in a lower *GDP* per capita.

In some other regions, some values are missing: the Azores (PT20) and Madeira (PT30) have no information about rail density and net primary productivity; for the Balearic Islands (ES53) and the Greece NUTS-2 regions Ionia Nisia (GR22), Voreio Aigaio (GR41), Notio Aigaio (GR42) and Kirit (GR43) there is no information about rail density, because these regions are small islands and do not have railway systems.

In a few cases, some explanatory variables had surprisingly high or low values (employment rate (Montenegro ME00, Iceland IS00), net primary productivity (Merseyside UKD7), ageing index (Flevoland NL23), household size (Stockholm SE11,

Highlands and Islands UKM6), their status as a NUTS-2 region was less clear (the former Yugoslav Republic of Macedonia MK00), or they did not belong to the EU-28 or the EFTA (the former Yugoslav Republic of Macedonia MK00, Montenegro ME00). The exclusion of these NUTS-2 regions resulted in *n* = 267 observations for the analysis at the NUTS-2 level. The much larger number of observations is not a concern as is the case for the countries.

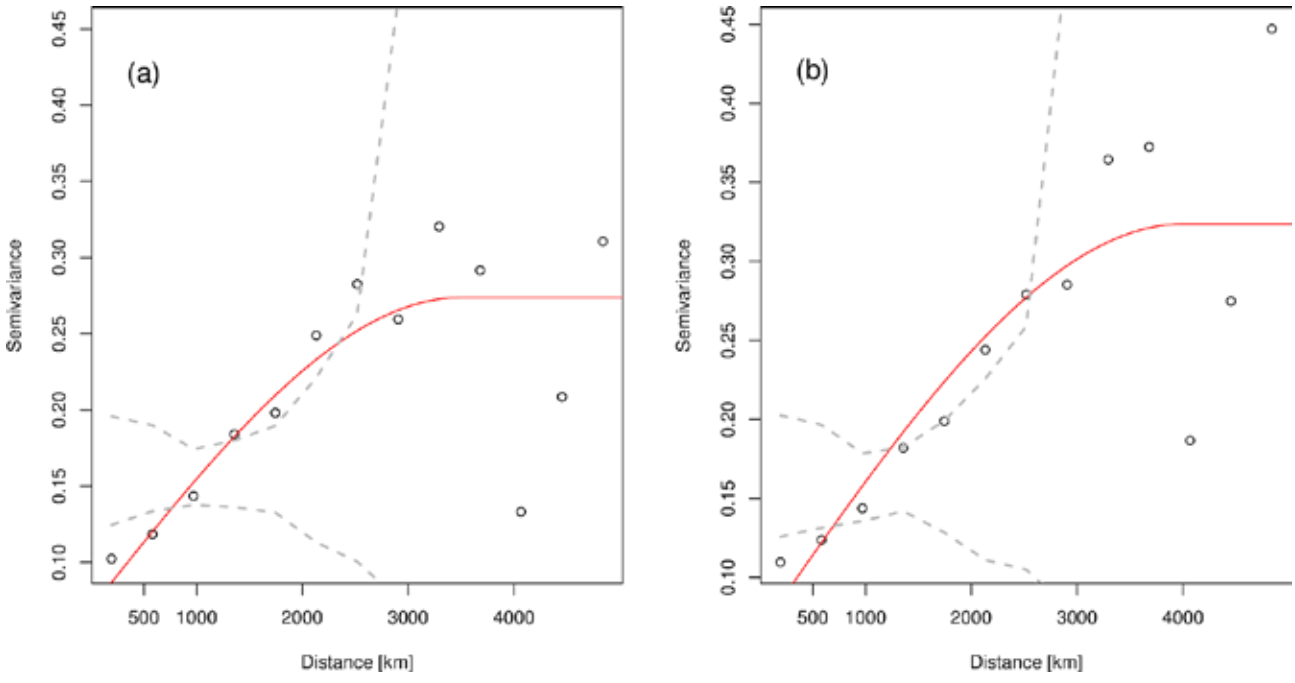
A5.3.4 Sample or population

In our study, we generally considered the EU and the EFTA countries, which represent our study area. Given that we are studying only the EU-28 and the EFTA countries and we have the information about all these countries, significance tests are unnecessary. In statistical terms, we are dealing with the population and not only with a sample. Significance tests were developed to make conclusions about a population based on a sample taken from the population. The *p*-value indicates the probability of obtaining a value of a test statistic as large as the observed one or larger given the null hypothesis (i.e. that there is no effect). The test statistic (e.g. *t*-value) is based on an estimate and a standard error, which are derived from the sample. This estimate represents the population value and the standard error indicates the range of the estimate based on our sample. While we have the information from all (or almost all) countries and NUTS-2 regions of our study area, we are already working with the population and therefore, statistical tests are not needed. Nonetheless, we have provided the *p*-values, because the majority of readers are familiar with *p*-values. We also provide a ranking of the variables based on the sizes of the coefficients, which is of greater importance. It is closer to the concept of statistical population.

The concepts of population and sample are also related to some assumptions of the analysis. Regression approaches require normality of errors, equal variance (also termed homoscedasticity) and independence of observations to provide reliable estimates of the coefficients. Violation of several assumptions affects the standard errors, but not the estimated coefficients. Spatial autocorrelation, for example, violates the assumption of independence, but it does not affect to a remarkable extent the estimation of coefficients. Consequently, in regression analysis with the analysis of population data where no *p*-value is required, some violations are of less concern.

When the regression analysis is based on samples and *p*-tests are required to draw conclusions about the population values, violation of the independence assumption affects variables with very low *p*-values

Figure A5.1 Variograms of the residuals from the ride regression models for the NUTS-2 regions in 2006 (a) and 2009 (b)



(below 0.001) to a much lesser extent. Although the variogram of the residuals in Figure A5.1 below shows that there is some spatial pattern, the fact above implies that the explanatory variables such as population density, relief energy, road and rail density will still remain significant even when corrections are applied (Figure A5.1). To our knowledge, an implementation of corrections for both multicollinearity and spatial autocorrelation combined has not been implemented in the available statistical software.

The red lines in Figure A5.1 represent a spherical spatial model. The dotted lines are envelopes drawn from a permutation of the values across the locations. As permutations remove spatial autocorrelation, the envelopes represent the situation without spatial autocorrelation. Some points at very small distances and at a distance of about 2 000 km are slightly beyond the confidence bounds and consequently there are some — albeit minor — patterns of spatial dependence in the data. This is also underlined by the spherical model, which describes the spatial pattern in our data moderately well. We do not show the situation for the countries, because there are too few observations and the envelopes are very large, thus rendering their application meaningless.

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