4.2 Car and Rail Travel Times to Commercial Airports

The second accessibility indicator is also of the endowment type. The concept is similar to the previous one. The indicator shows access times to commercial airports.

Both, car and rail travel times are calculated for this analysis. All airports that offer scheduled flights are included in the list of destinations (see Figure 3). Again, the base calculation is done on a 2x2 km raster grid; results are aggregated in a second step to NUTS-3 regions. The indicator results are illustrated in Figures 8 to 11 for both road and rail modes for the two spatial levels.

In general, there are great disparities within all countries in the access times to commercial airports for both modes. Even in Germany with a relative high number of airports and good overall transport infrastructure there are regions with travel times of more than two hours to the next commercial airport, while there are other parts of the country with very good access with access times less than 15 minutes. Comparing the results for road and rail it is obvious that in most areasy the access times for rail are longer than for road: the 15 and 30 and 45 minute isochrones for the rail mode are significant smaller in all countries compared to their counterparts for road. These effects are most pronounced in the Baltic countries, in Poland and Belarus, as well as in many parts of Russia and also in Finland. The rather even distribution of commercial airports in the Nordic countries illustrates the importance of airports for travel in those areas. There is no south-north gradient in the access time to airports, however, at the raster level (Figures 8 and 10) there are greater disparities within a region than between them.

This is also reflected in the aggregated maps at NUTS-3 level (Figures 9 and 11). While the NUTS-3 regions hosting an airport and also smaller NUTS-3 regions close to airport regions experience very good access levels, NUTS-3 regions without any airport and NUTS-3 regions with a great territory do have intermediate levels of access to airports. NUTS-3 regions with poor and extremely poor levels of access can only be found in Eastern Europe (eastern parts of Poland, as well as Estonia, Belarus, and Russia). Due to the relative dense system of regional airports in the northernmost regions of Norway, Sweden and Finland, these regions have generally higher access levels as many parts of the Baltic countries and as many regions in Eastern Europe.

These findings are also reflected at national level (Table 2). In general, the average travel times, standard deviations and maximum travel times are higher for rail compared to road in all countries except for Denmark, Norway and Sweden, and to some extent also Finland and Poland where rail access is in a similar range as road access. Moreover, the summary results for both modes for the Nordic countries are generally better than for many other countries (such as Estonia, Latvia, Poland, Belarus, Russia) due to the huge differences in airport endowment. The average access level to airports by car is best in Germany. However, the BSR area in Germany is ranked lower than Sweden, Poland, Finland, Norway and Denmark considering access by rail. This also reflects that the rail network in northeast Germany is relatively weak, and that the airports are not directly linked to the rail network.

Table 2. Car and rail travel rimes to commercial airports.[*]

Country	Road			Rail		
	Average travel time (min)	Standard deviation travel time (min	Maximum travel time (min)	Average travel time (min)	Standard deviation travel time (min	Maximum travel time (min)
Belarus **	199	90	503	402	178	1006
Denmark	83	43	218	86	39	209
Estonia	131	62	321	168	71	330
Finland	101	51	397	122	72	453
Germany **	72	30	221	145	59	443
Latvi a	164	66	342	207	74	515
Lithuania	90	35	213	155	78	396
Norway	110	60	327	117	64	382
Poland	132	54	339	139	60	396
Russia **	335	164	801	669	328	1602
Sweden	111	63	334	112	61	338
BSR area	*167*	*132*	*801*	*334*	*263*	*1602*

[*] *statistics calculated based on raster cells:*
*** only those parts of the countries considered which are eligible under BSR Programme*

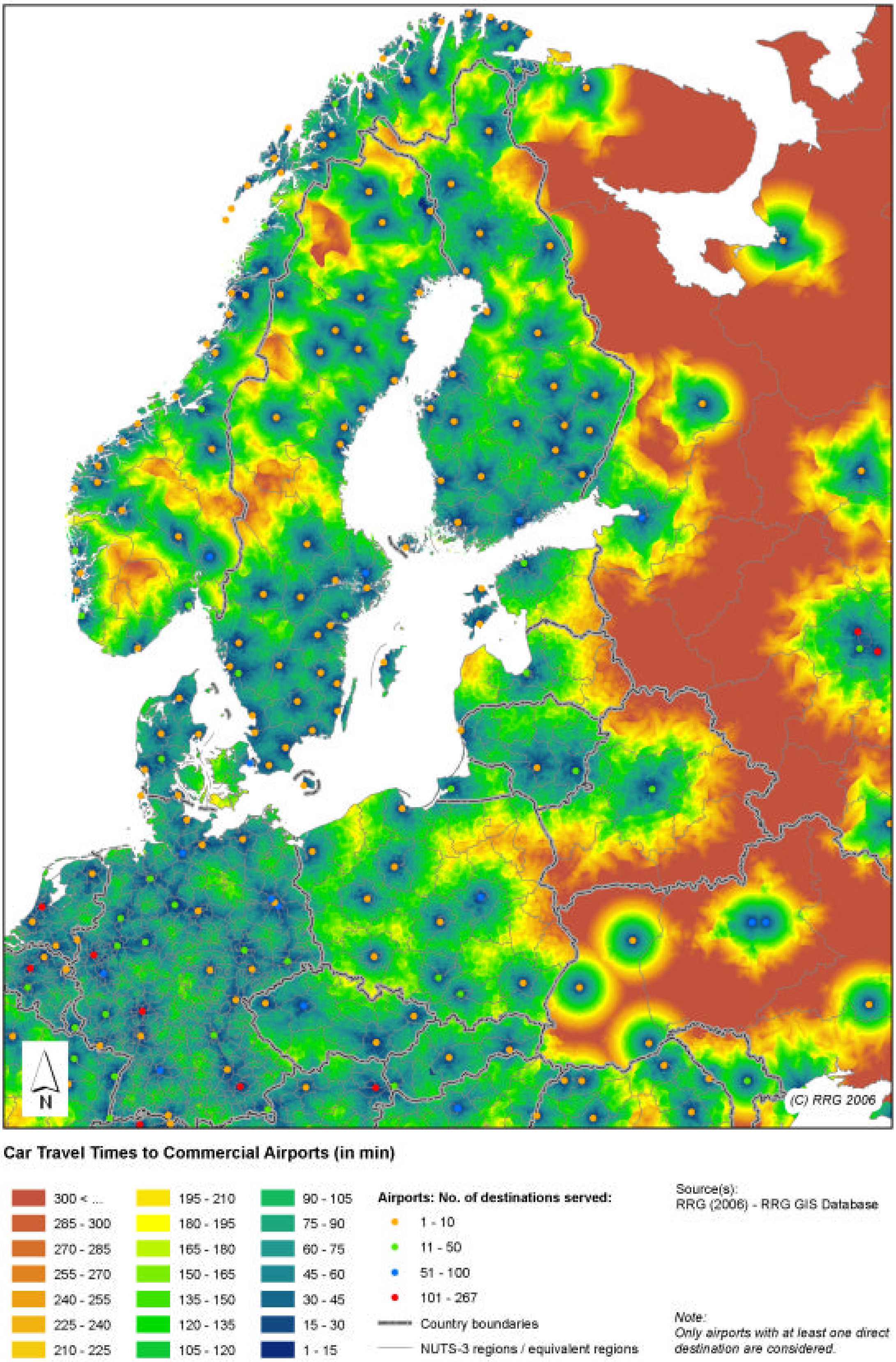

Figure 8. Car travel times to commercial airports (raster level).

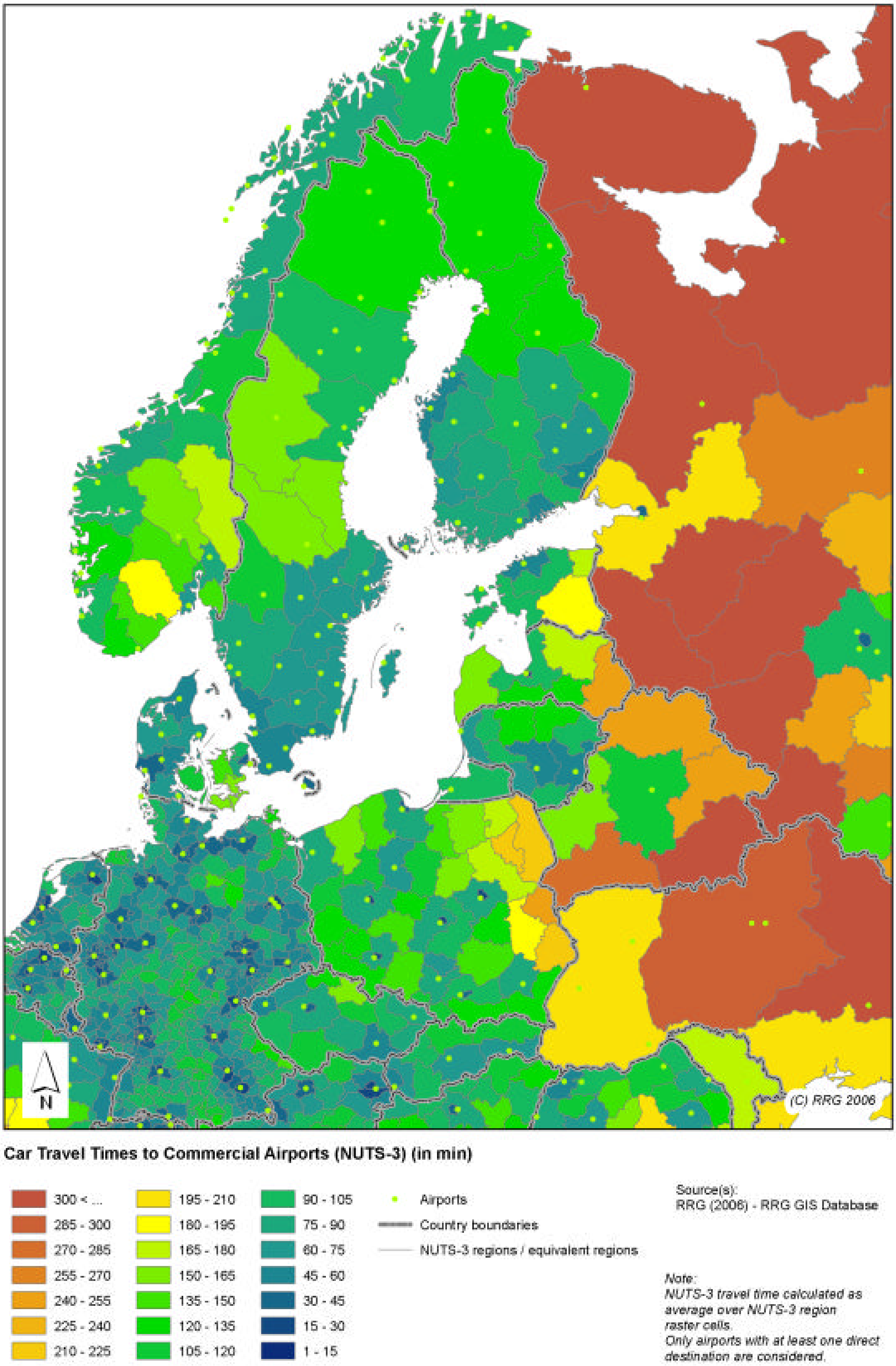

Figure 9. Car travel times to commercial airports (NUTS-3 level).

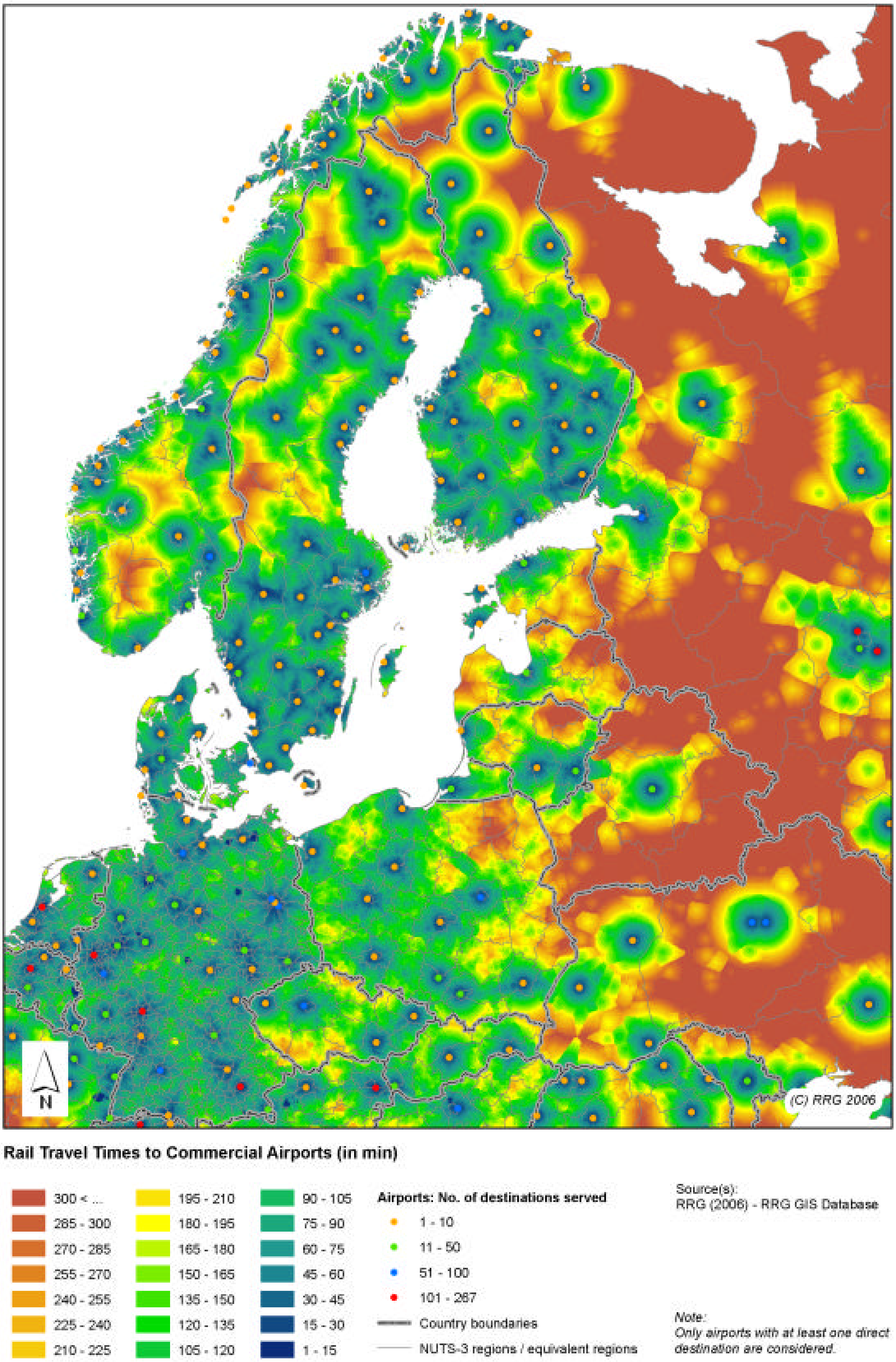

Figure 10. Rail travel times to commercial airports (raster level).

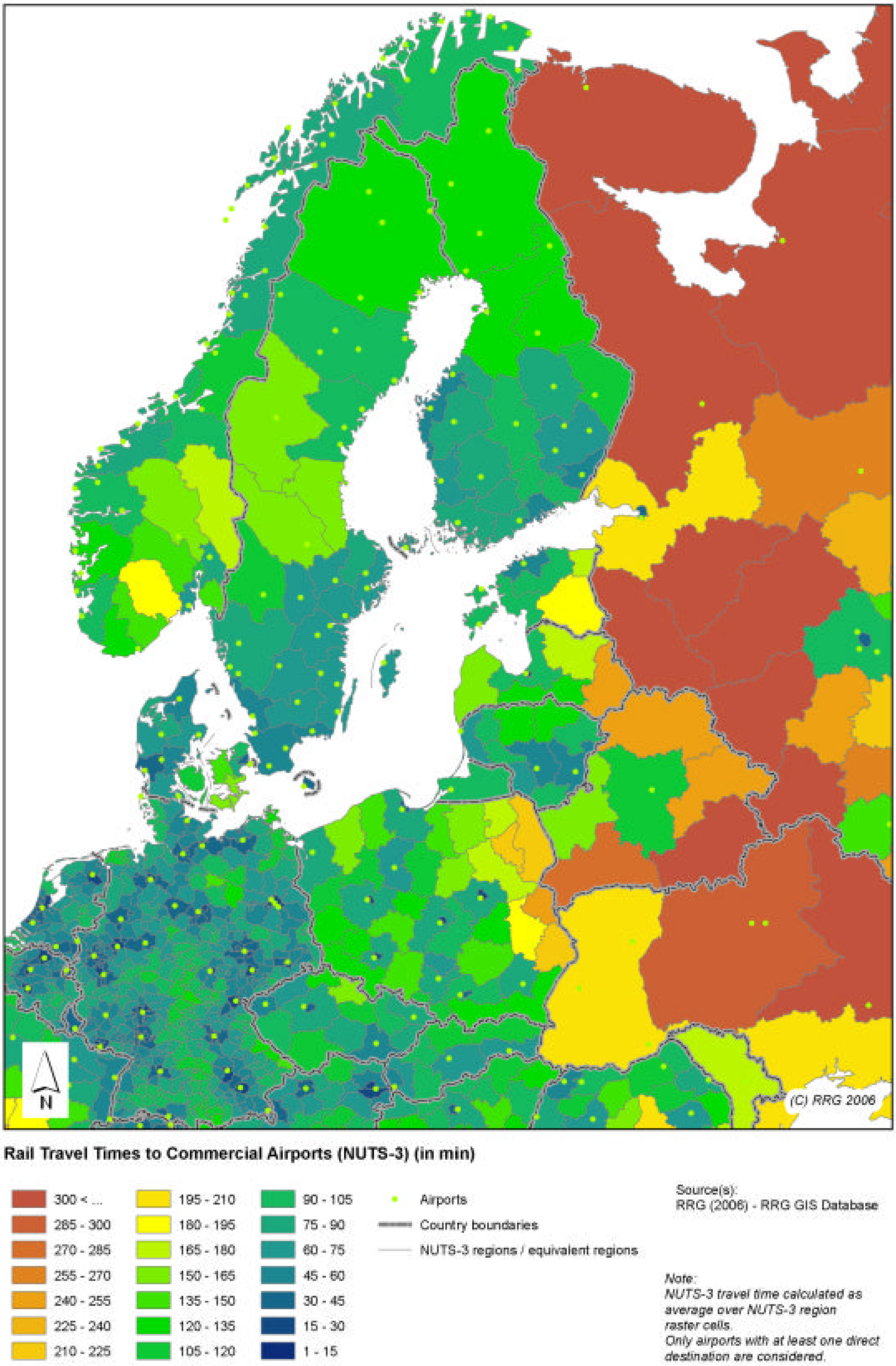

Figure 11. Rail travel times to commercial airports (NUTS-3 level).

4.3 Lorry Travel Times to Transport Terminals

The third accessibility indicator of the endowment type gives a measure for freight transport. The indicator shows freight transport times to transport terminals based on lorry travel times. Similar to the previous indicators, the first map presents the indicator results at the 2x2 km raster level (Figure 12), while the following map illustrates the aggregated results at NUTS-3 level (Figure 13).

The results at raster level show very distinct patterns of access times (Figure 12): Coastal regions having seaports experience very good and good access times to transport terminals, and also regions along important inland waterways have good access, while the other parts of the BSR face long access times to such terminals. As a consequence, a clear gradient in the access quality from harbour regions to the hinterland is visible, which holds particularly true for the three Nordic countries, but to some extend also for Germany and Denmark. As far as Norway, Sweden and Finland are concerned, this reflects the great importance of harbour facilities for (goods) transport even in the northernmost parts of the country, in particular for ferry services and short sea shipping services. Poland and the Baltic states mark a contrast to these countries. Although they have a number of important harbours as well, the density of harbours and so the density of such transport terminals is much lower than in the other countries so that only small portions of the coastal areas benefit in terms of access times.

The NUTS-3 level map (Figure 13) is replicating the raster results in a somewhat smoothed way. Again, the coastal NUTS-3 regions stand out with good access times to transport terminals compared to mainland regions. However, as the NUTS-3 regions in northern Finland and northern Sweden have rather large territories with substantial amount of areas far away from the sea, the aggregated results for these areas give only medium to even poor access times although those regions have substantial numbers of seaports. Apart from the northernmost regions of Norway, Sweden and Finland, the longest access times are in the eastern parts of Poland, Belarus and Russia with the exception of the Kaliningrad and St. Petersburg areas.

However, in case of the northern parts of the Baltic Sea it is important not only to analyse the landside access to the transport terminals but also to mention the seaside access to the harbours, as the duration and extent of the ice coverage is hampering the usage of the ports. The ice season in the most northern part of the Baltic Sea lasts for six months and in the central parts 2-3 weeks, thus making all Finnish harbours, so as many Swedish ports ice bound during normal winters. Finland is the only country in the world of which all ports are ice bound during winter. Figures 12 and 13 are illustrating these phenomena by showing the ice coverage in the Northern parts of the Baltic Sea, the Gulf of Bothnia and the Gulf of Finland as of 16 March 2005, derived from information provided by the Finnish Institute of Marine Research (2005). At that day the extent of the ice coverage in the northernmost parts of the Baltic Sea was about 177,000 km^2. Although the maximum extend of the ice coverage is varying from year to year and week to week, it is obvious that all Finnish ports, all ports of northern Sweden, as well as all seaports in Estonia and along the Russian coast are frozen. On average the Baltic Sea starts to freeze at October / beginning of November each year, while the ice remains until April or even May, depending on the actual climatic conditions and on the lat/long position. During this period any shipping service can only be ensured through icebreakers which keep open certain channels to dedicated ports. However, although icebreakers are widely operating, free movements of cargo vessels are very limited during winter times, as only small channels through the ice are kept open, so that the seaside access to harbours is restricted.

Table 3 summarises the indicator results by country. Germany and Denmark show the shortest average travel time, followed by Lithuania. Compared to the rather good impression on the raster map, the average results for Finland, Norway and Sweden are somewhat poorer reflecting the overall size of their territories with rather great disparities between the most and least accessible parts of the countries (see for example Finland with 146 minutes on average and 558 minutes at maximum with a standard deviation of 106 minutes).

*Table 3. Lorry travel rime to transport terminals.**

Country	Average travel time (min)	Standard deviation travel time (min	Maximum travel time (min)
Belarus **	302	104	623
Denmark	52	29	152
Estonia	112	72	310
Finland	146	106	558
Germany **	50	25	168
Latvia	152	82	354
Lithuania	97	44	284
Norway	114	79	400
Poland	116	55	314
Russia **	461	273	1641
Sweden	140	101	467
BSR area	*211*	*205*	*1641*

* *statistics calculated based on raster cell:*

*** only those parts of the countries considered which are eligible under BSR Programme*

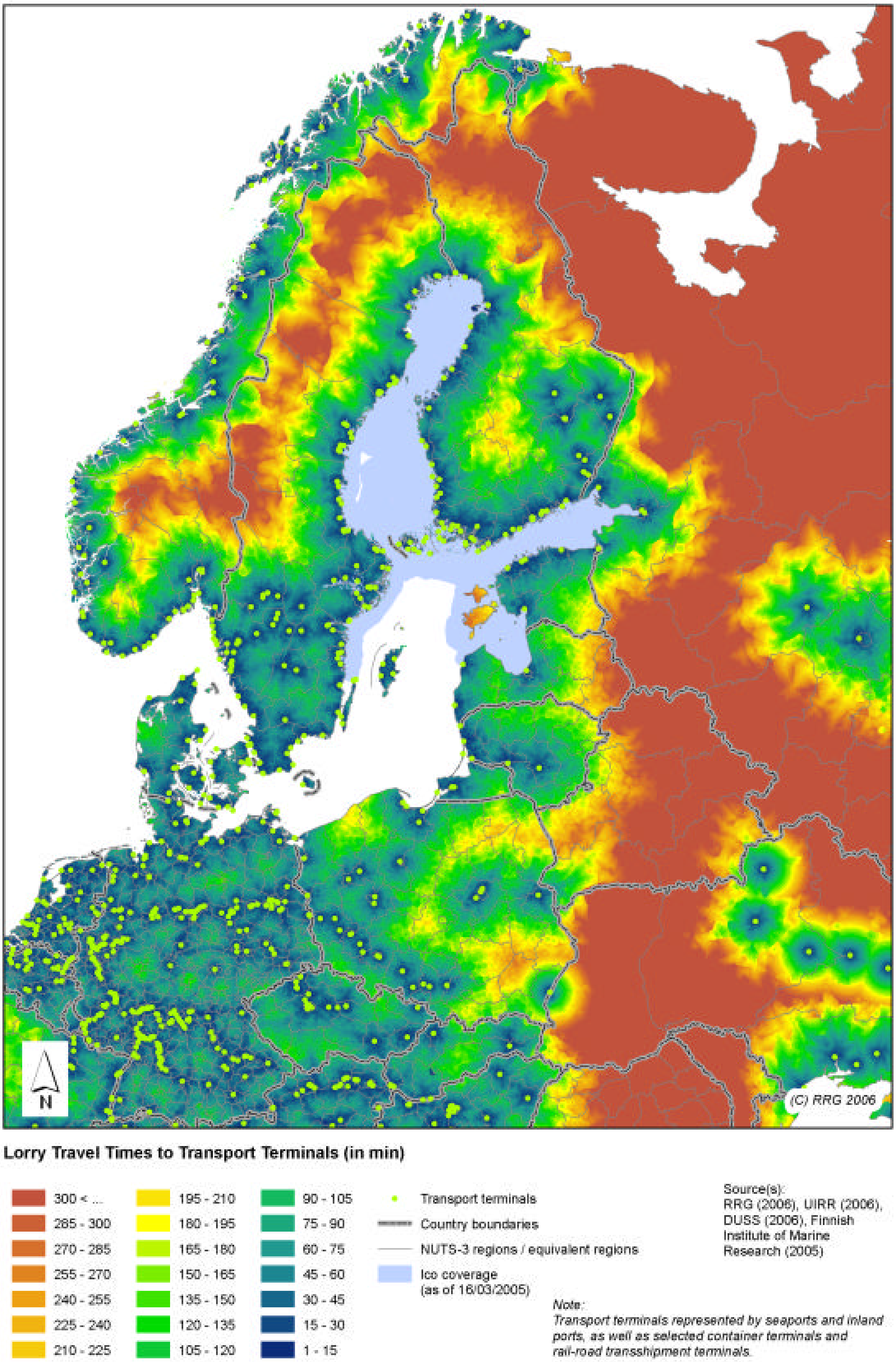

Figure 12. Lorry travel times to transport terminals (raster level).

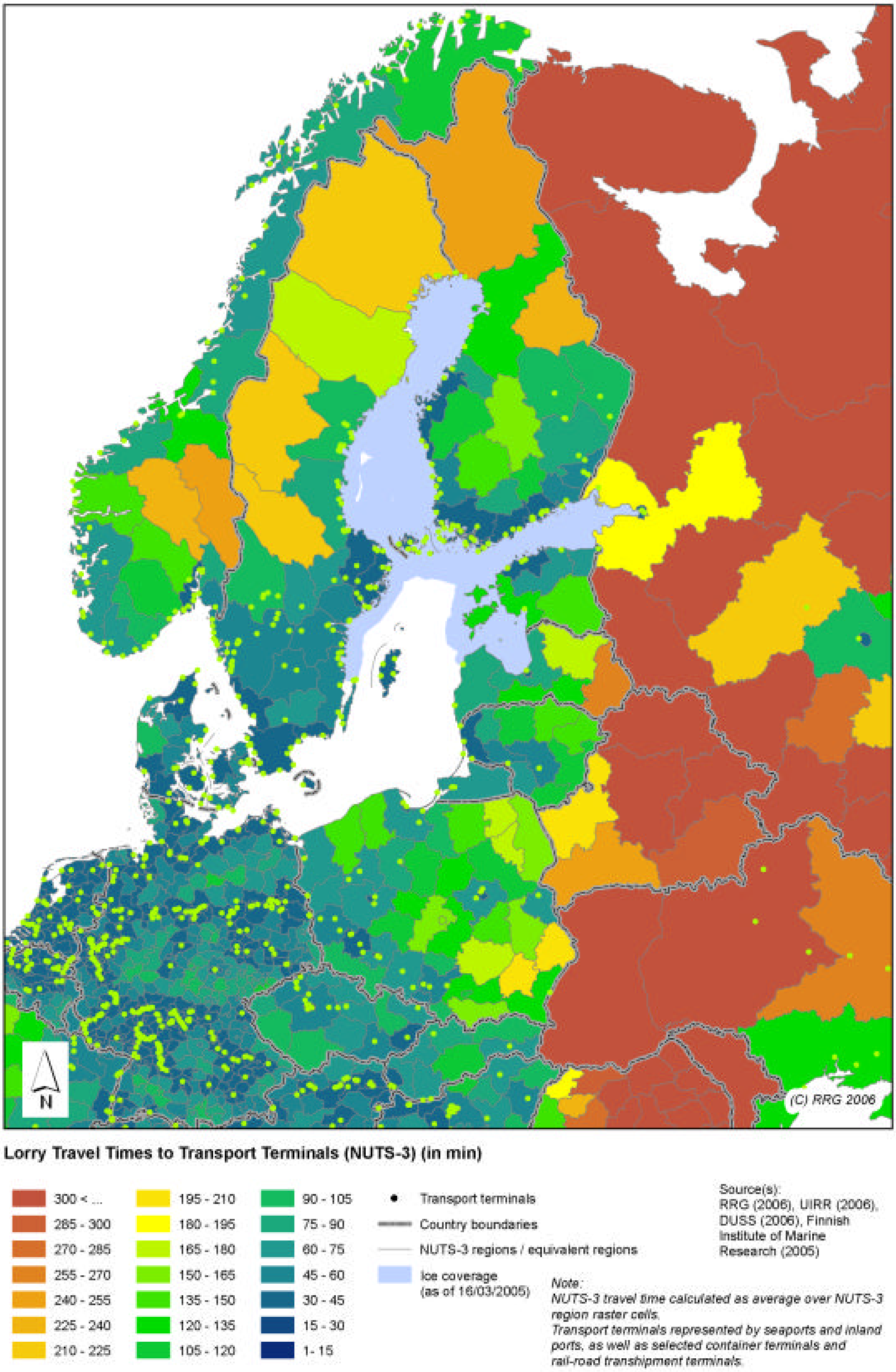

Figure 13. Lorry travel times to transport terminals (NUTS-3 level).

4.4 Mobile Telephone Penetration and Internet Access

This group of endowment indicators is different from the other accessibility indicators in two respects. First, instead of being concerned with transport it addresses the spatial diffusion and the adoption of new communication technologies. Second, whereas the other indicators are calculated by utilising spatial databases and accessibility models, the indicators of this group are coming from collected data which automatically leads to the issue of data availability, particularly at the regional level. Here, the problem is that there is almost no (regionalised) information available on the information society, However, at the same time the main differences in ICT endowment are to be observed between countries, the regional spread then follows the classical way from the national centres to the periphery (Richardson et al., 2005; ESPON 1.2.3, 2006)

For this indicator group two maps are presented, one addressing the mobile telephone penetration and one addressing access to the internet taking the fastest available technology, broadband connection, as example.

Figure 14 shows the mobile phone penetration rate for the BSR and other European countries for the year 2004. Most countries of the BSR do have more than 800 mobile phones per 1,000 inhabitants; in Norway and Sweden there are already more mobile phones than inhabitants. Poland and Latvia fall behind having only about 600 mobile phones per 1,000 persons; Russia has a mobile penetration rate of about 500 and Belarus of 250, but both countries experienced an enormous growth during the last couple of years . Table 4 gives more information by providing past data on mobile phone penetration. Almost ten years ago, the Nordic countries were the early adapter of this new communication technology with penetration rates of between 300 and 400, whereas Germany had only 100 and the eastern countries of the BSR only between twenty and forty mobile phones per 1,000 population. The exception in the eastern BSR is Estonia with already a penetration rate of 100 in 1997 and of almost 1,000 per 1,000 population in 2004. Given this temporal spatial development of the introduction of a new technology, it can be expected that in most countries the saturation level has already been reached and that the countries currently lagging will catch up very soon.

Table 4. Mobile phone penetration rate

Country	Mobile phones per 1,000 inhabitants		
	1997	2000	2004
Belarus	:	5	249
Denmark	270	630	957
Estonia	100	407	967
Finland	410	721	863
Germany	100	586	858
Latvia	30	169	673
Lithuania	40	150,	829
Norway	380	750	863
Poland	20	175	603
Russia	:	24	517
Sweden	360	718	1026

Source: Eurostat (2006b) for 1987; World Bank (2006) for 2000 and 2004

Table 5 presents broadband connection available at home. There are clear disparities in availability of fast internet access. Again, the Nordic countries are early adapters of the new technology; up to nearly 40 percent of the households have broadband at home. Germany and Estonia do follow with every fifth having broadband at home. In Poland, Latvia and Lithuania less than ten percent of the households do have fast internet access in their place of living. Table 5 gives also information on the spatial diffusion of broadband based on population density. In all countries the highest shares of broadband connection at home can be found in the densely populated areas, the lowest in the rural areas. However, it can also be seen that the share of households in the rural areas of more advanced countries are clearly higher than in the urban areas of less advanced countries with respect to the provision of broadband internet access.

Table 5. Broadband connection at home

Country	Percent of households (2004)			
	All	Densely-populated areas	Intermediate areas	Thinly populated areas
Belarus	:	:	:	:
Denmark	36	41	40	26
Estonia	20	33	n/a	15
Finland	21	25	18	12
Germany	18	29	18	13
Latvia	5	9	2	2
Lithuania	4	7	n/a	1
Norway	30	43	34	23
Poland	8	12	0	1
Russia	:	:	:	:
Sweden	:	:	:	:

Source: Eurostat (2005)

Figure 15 presents the spatial distribution of broadband subscribers per 1,000 population by country. Table 6 adds information on the temporal development depict enormous growth rates during the last couple of years in almost all countries. .

Table 6. Broadband subscription

Country	Broadband subscribers per 1,000 population		
	2000	2004	2005
Belarus	0.0	0.0	:
Denmark	10.6	168,8	250.0
Estonia	12.7	103.1	:
Finland	3.9	149.6	225.0
Germany	3.2	83.6	130.0
Latvia	0.1	16.9	:
Lithuania	0.0	37.5	:
Norway	5.2	87.4	219.0
Poland	0.0	32.7	24.0
Russia	0.0	0.9	:
Sweden	9.3	152.7	203.0

Source: World Bank (2006) for 2000 and 2004; OECD (2006) for 2005

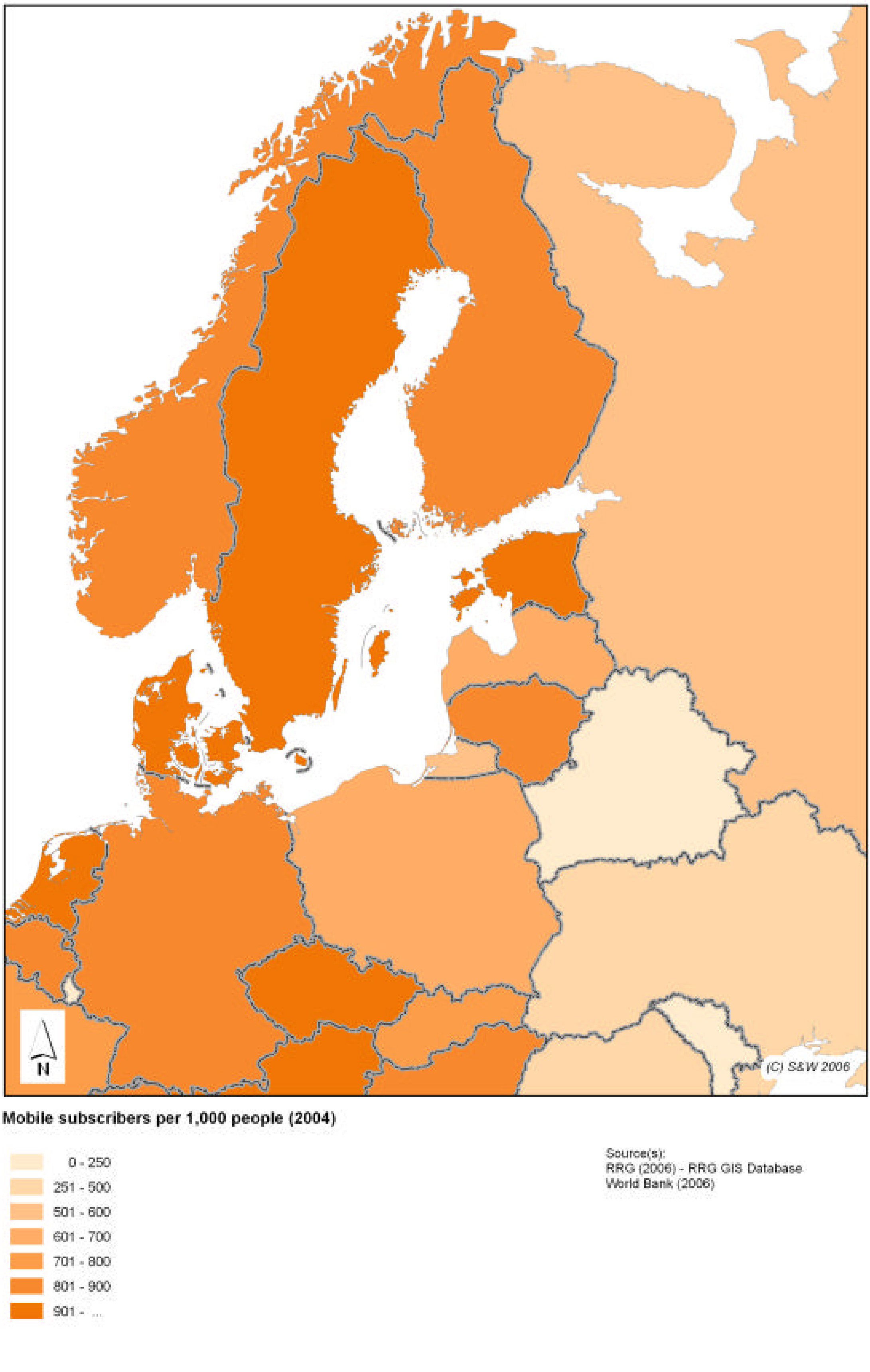

Figure 14. Mobile phone penetration.

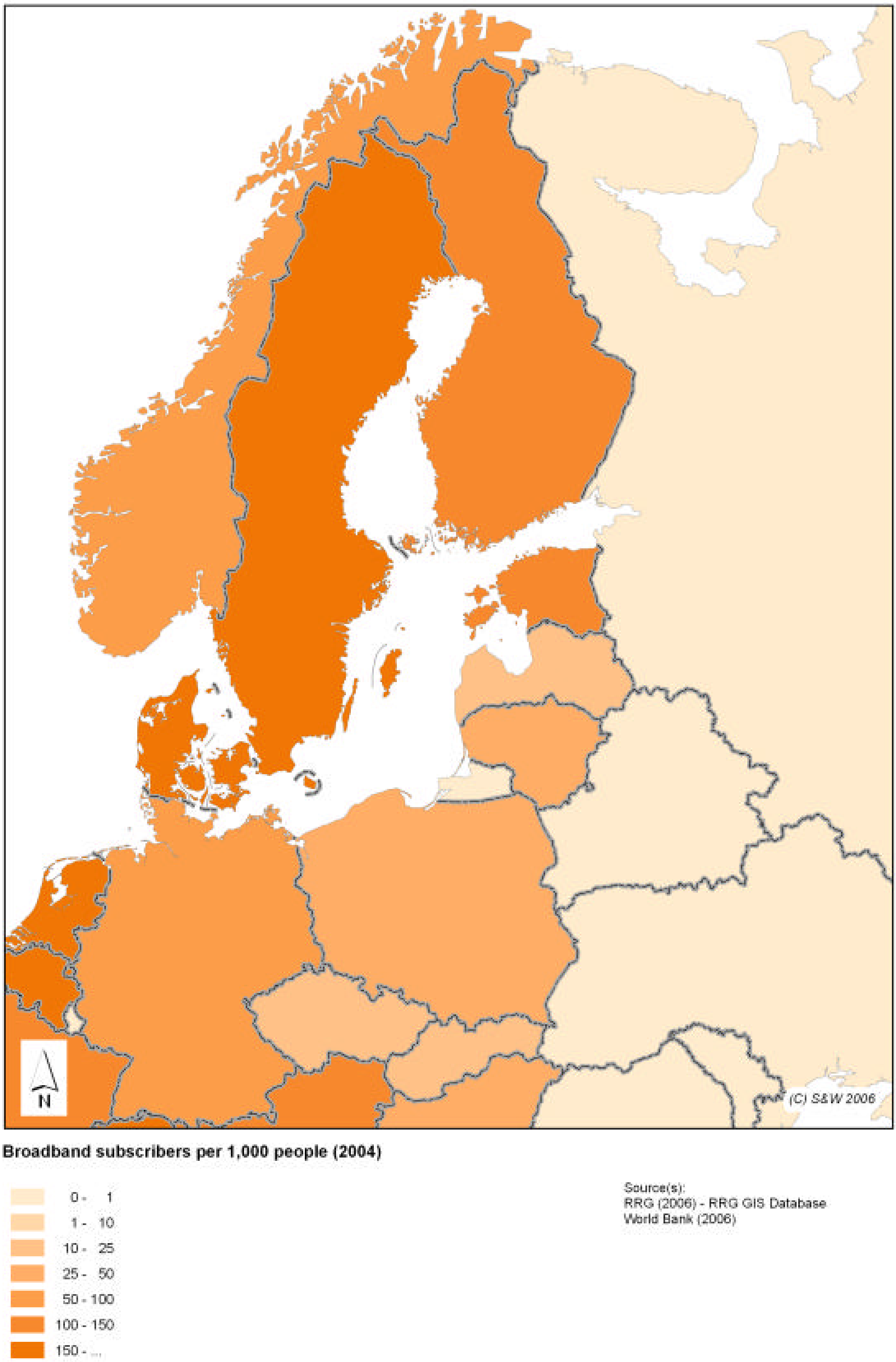

Figure 15. Broadband penetration.

4.5 Car and Rail Travel Times to Large Cities

This indicator belongs to the travel cost indicators of the more complex group of accessibility indicators. It shows travel times to reach the next city. In BSR all cities with more than 50,000 inhabitants as well as smaller university cities are considered, while outside the BSR all cities with more than 100,000 inhabitants are taken into account.

The indicator is calculated separately for car and rail travel times. Again, a series of maps (Figures 16 to 19) is produced showing the results at raster level and at NUTS-3 level for both car and rail. It has to be noted that rail travel times include car access time to the next rail station; and in case there is no rail station, the time indicated might be only a car ride calculated with a very low average speed. The maps show travel times in classes of fifteen minutes going up to more than five hours. However, it should be taken into account when interpreting the results that travel times of more than three hours (indicated in yellow and red) mean that those areas practically do not have good car or rail access to a larger city which might be caused by a lack of cities in that part of the BSR or by a lack of appropriate transport infrastructure and services.

At raster level very distinct patterns emerge (Figures 16 and 18). For Germany and Poland, as the two countries with the highest density of regional cities, most of their territories experience very good access of less than 75 minutes to the next city, often even less than 45 or less than 30 minutes. Belarus and Lithuania both also have several regional cities and so great parts of their territory also have good access to them, while the other two Baltic countries have only few regional cities, so that consequently most of their territory experiences medium access quality. Greatest contrast between areas with good access and areas with poor access can be found in the Nordic countries and in Russia, but with individual patterns each. In Finland the regional cities are concentrated in the southern and eastern parts of the country, but they are located in such a manner that their service areas do not overlap. Areas between these service areas experience travel times of more than two hours. In Sweden the situation is somewhat different: The situation in southern Sweden can be compared with southern Finland including areas with good access quality and intermediate areas with rather medium or poor access quality.

However, the situation is changing drastically north of the Malaren Sea where regional cities can only be found scattered along the Baltic Sea coast. Consequently most of the territory has very long access times of more than three hours to the next regional city for both road and rail. This basically is also describing the situation of the whole of Norway, where the few regional cities are scattered along the coastlines, leading to good access times around these cities but poor or even very poor access times in between the fjords. The main difference between the car and rail modes is that for rail the rail corridors with shorter travel times are more pronounced while for the car the isochrones extend much more in all directions. Moreover, the railway isochrones are generally smaller than those for the cars.

These distinct patterns are also reflected at NUTS-3 level (Figures 17 and 19). In general, most of the regions in Germany, Poland and also Denmark have short access times. Most of the regions in the Baltic countries have intermediate access times, while for Sweden and Finland again a south-north gradient can be observed with good access qualities in the south and rather poor qualities in the north. Norway in general has only medium to poor access times to regional cities with the exception of the Oslo and Molde areas. Substantial differences between the accessibility patterns for cars and railways cannot be recognised, except that for the latter one the differences (disparities) between the least and best accessible regions are somewhat more pronounced.

Tables 7 and 8 aggregate the information of the maps by country. Comparing both road and rail modes, it is obvious that the average travel times for rail is higher than for road for all countries, and so are the maximum travel times and also the standard deviations. However, the overall results for the BSR (118 minutes travel time for cars on average and 143 minutes for rail) are to a large degree determined only by Norway and Russia, being the only two countries with average travel times below the BSR average. The differences between rail and road access are also visible in the share of the national territories that have access to the next city within two hours; for road almost all countries have more than 90 percent in this travel time class, for rail only Denmark, Germany and Poland.

*Table 7. Car travel times to large cities. **

Country	Travel times			Share of territory with travel time (%) of			
	Average travel time (min)	Standard deviation travel time (min	Maximum travel time (min)	< 2h	2h < 3h	3h < 4h	> 4h
Belarus **	56	24	163	99.3	0.7	0.0	0.0
Denmark	48	32	235	98.5	0.1	1.4	0.0
Estonia	91	65	302	89.7	1.9	2.4	6.0
Finland	108	78	417	68.2	14.0	8.1	9.7
Germany **	38	15	124	99.9	0.1	0.0	0.0
Latvia	66	27	143	99.1	0.9	0.0	0.0
Lithuania	50	18	126	99.9	0.1	0.0	0.0
Norway	159	113	571	42.9	26.4	13.1	17.6
Poland	42	18	128	99.9	0.1	0.0	0.0
Russia **	183	129	645	42.0	17.7	11.0	29.3
Sweden	117	81	410	56.8	18.1	14.0	11.1
BSR area	*118*	*103*	*645*	*65.8*	*13.2*	*8.2*	*12.8*

[*] statistics calculated based on raster cells:
*** only those parts of the countries considered which are eligible under BSR Programme*

*Table 8. Rail travel times to large cities. **

Country	Travel times			Share of territory with travel time (%)			
	Average travel time (min)	Standard deviation travel time (min	Maximum travel time (min)	< 2h	2h < 3h	3h < 4h	> 4h
Belarus **	76	35	213	89.1	10.6	0.3	0.0
Denmark	56	35	230	95.2	3.5	1.3	0.0
Estonia	109	54	337	62.7	28.7	7.5	1.1
Finland	147	128	594	58.5	13.6	6.5	21.4
Germany **	48	24	142	99.7	0.3	0.0	0.0
Latvia	107	53	236	58.7	31.6	9.7	0.0
Lithuania	80	34	171	85.3	14.7	0.0	0.0
Norway	181	142	682	37.8	24.4	16.4	21.4
Poland	53	26	144	99.2	0.8	0.0	0.0
Russia **	220	141	691	29.6	18.4	14.4	37.6
Sweden	131	90	426	51.8	16.1	15.8	16.3
BSR area	*143*	*123*	*691*	*57.2*	*15.1*	*9.9*	*17.8*

[*] statistics calculated based on raster cells:
*** only those parts of the countries considered which are eligible under BSR Programme*

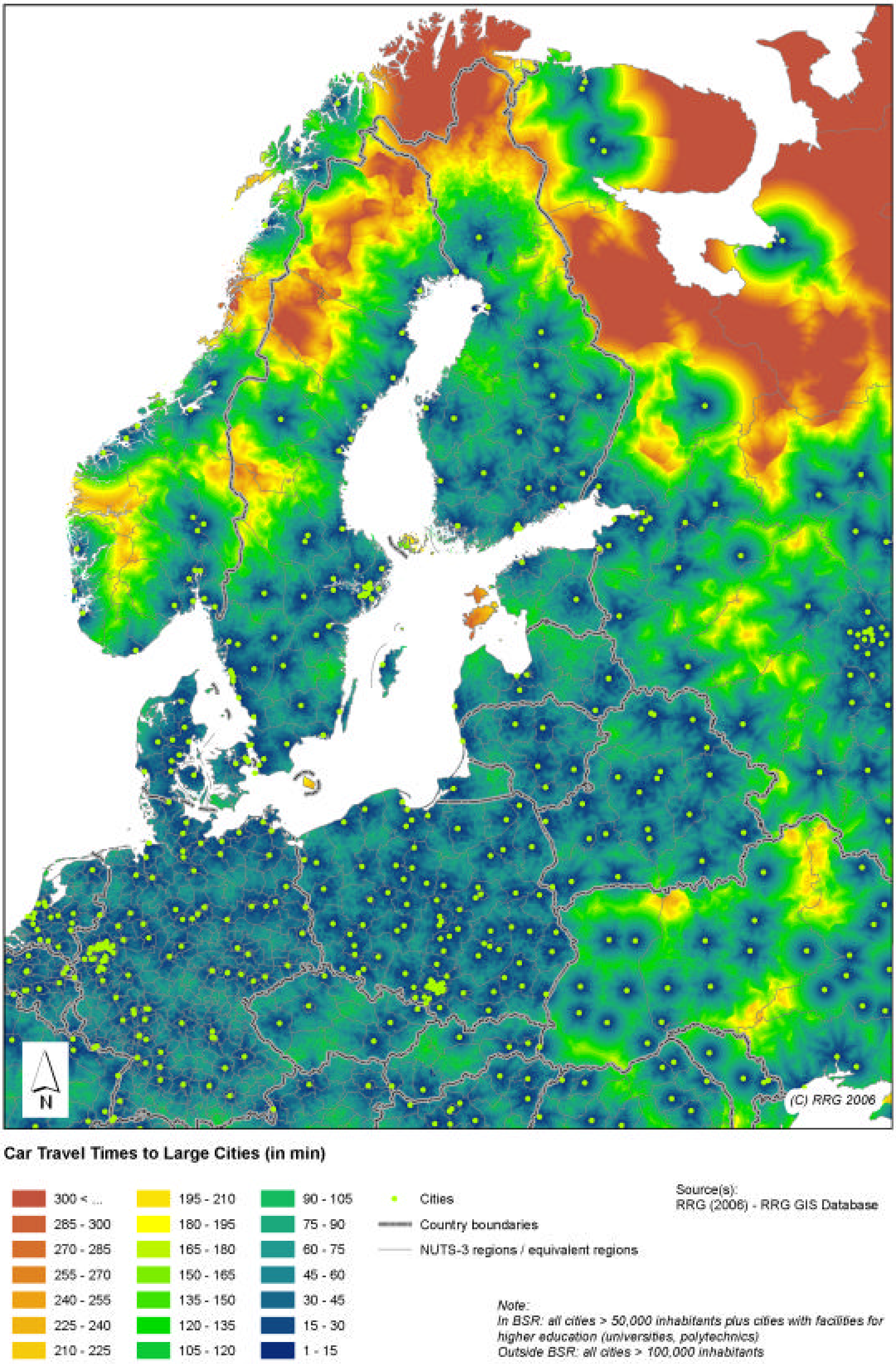

Figure 16. Car travel times to large cities (Raster level).

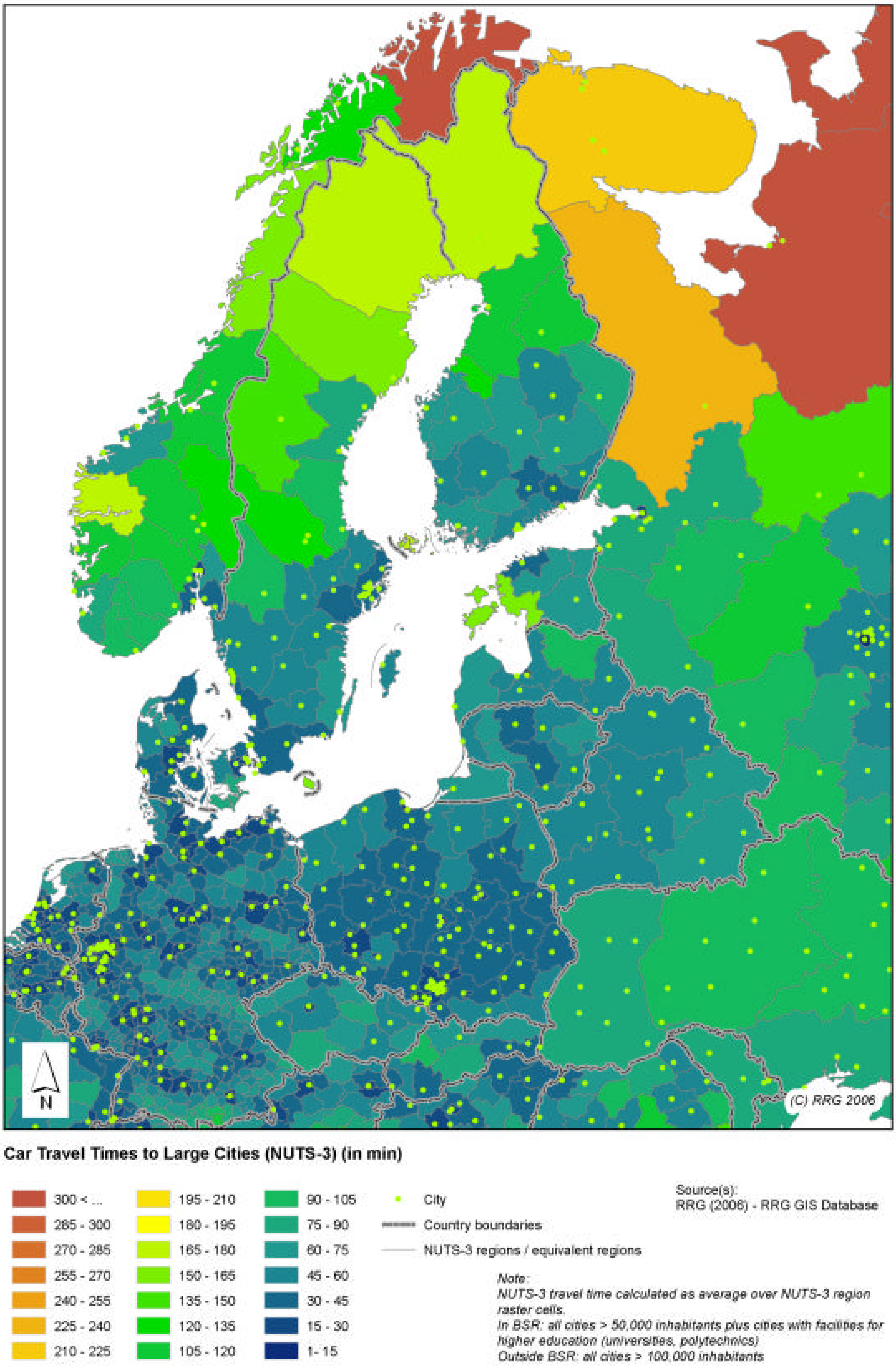

Figure 17. Car travel times to large cities (NUTS-3 level).

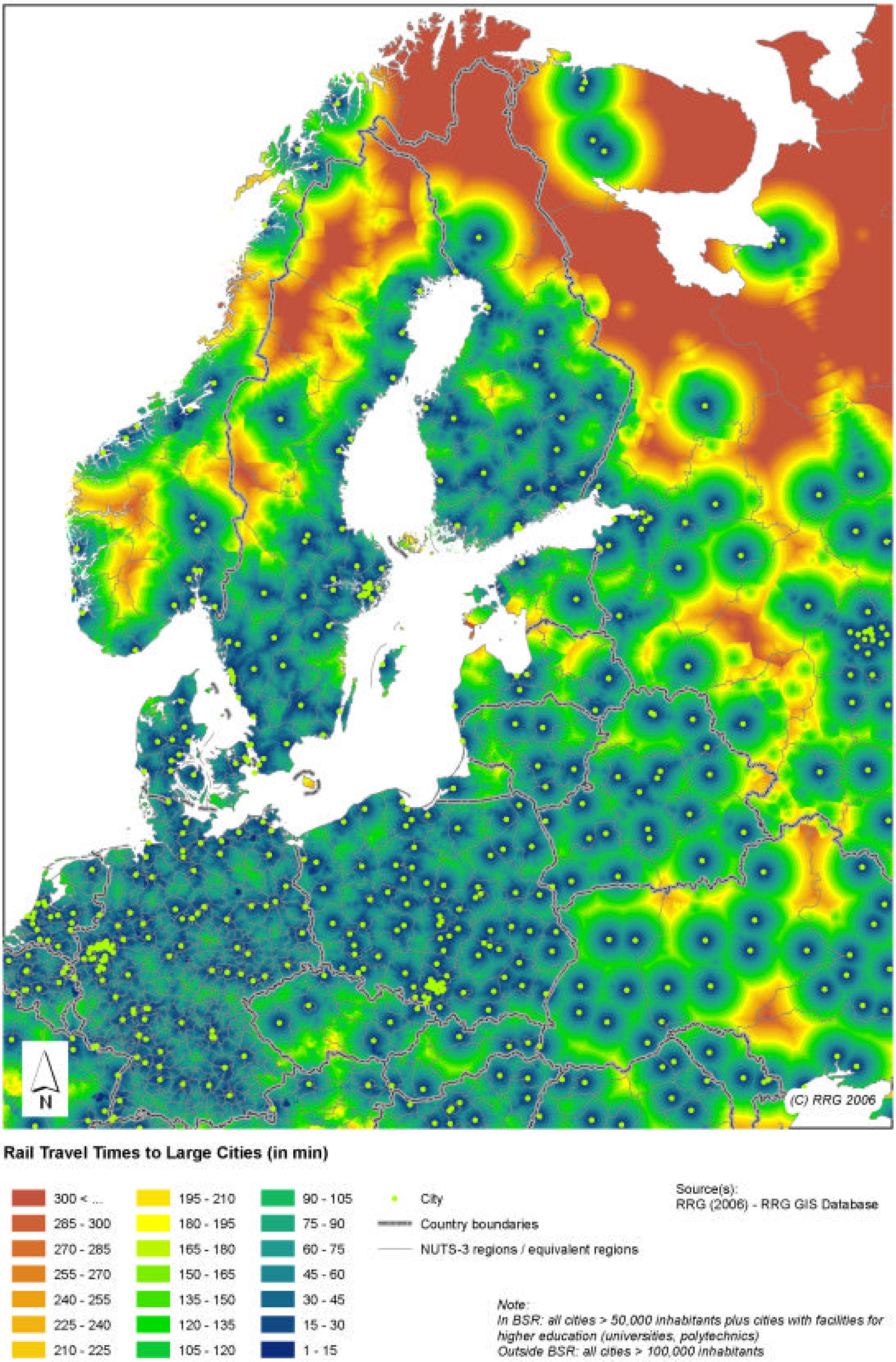

Figure 18. Rail travel times to large cities (raster level).

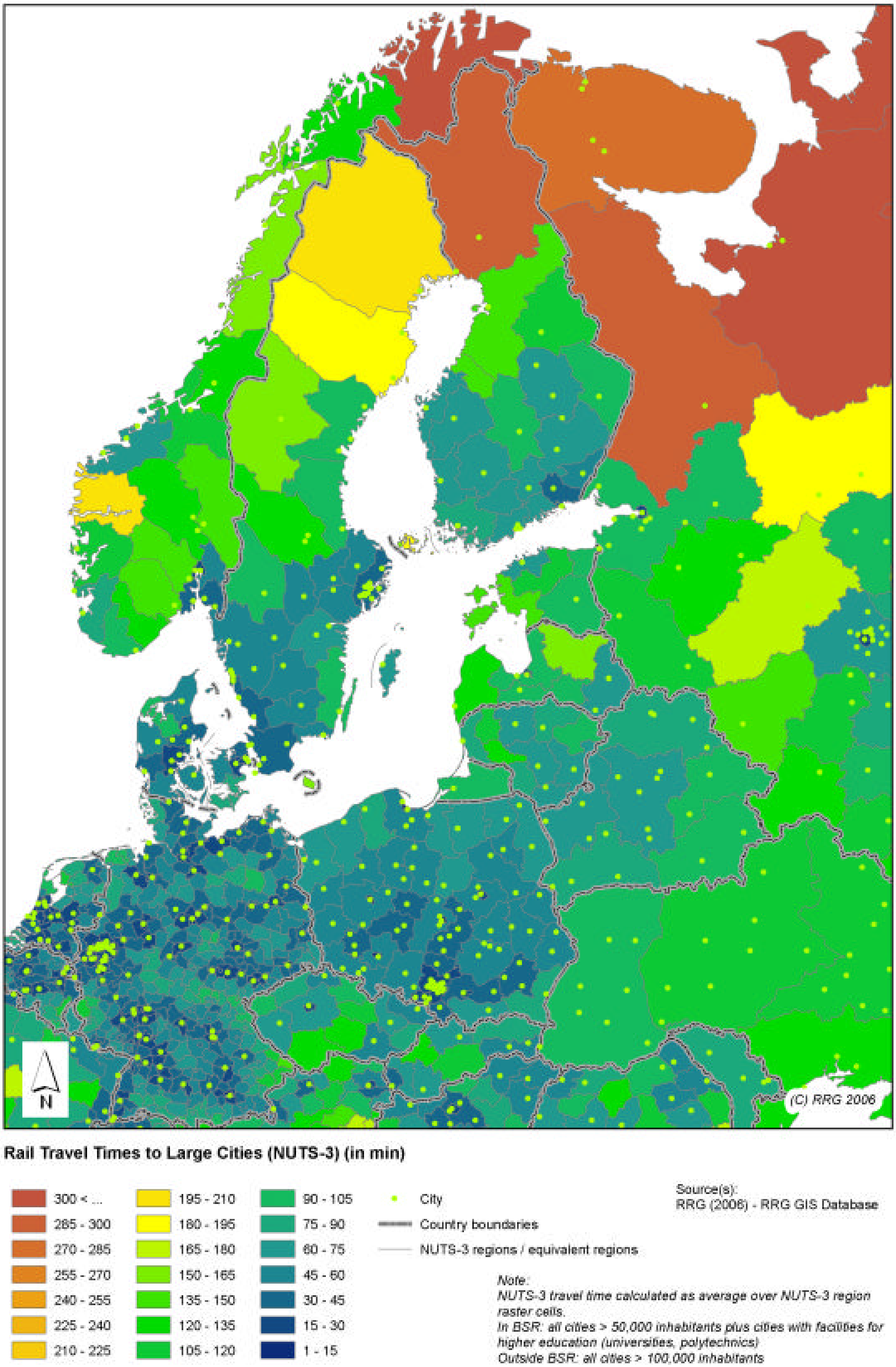

Figure 19. Rail travel times to large cities (NUTS-3 level).