Statistics Norway
Statistisk sentralbyrå

Statistics Norway
Division for Information Technology

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Documents

GIS-projects in Statistics Norway 2000/2001

Contents

Preface

The needs for better presentation and interpretation of statistics, together with improved and more available tools for geographical analyses and statistical mapping, have put geographical information systems (GIS) on the agenda in most national statistical institutes. The widespread use of such tools has contributed to increased demand for regional and geo-referenced statistics.

Statistics Norway has taken several steps to meet and to take advantage of this development. Since 1995 Statistics Norway has made use of GIS in different projects in greater or less degree. This document illustrates the main GIS-related projects that are worked out in Statistic Norway during the years 2000 and 2001. Some GIS-related projects, as quality improvement in basic administrative and statistical registers (e.g. Central Population Register (CPR), Official Ground property-, Address- and Building-Register (GAB)) are not included.

The investment of GIS-technology in Statistics Norway has definitely been of good character. Through the GIS-projects described, it is documented that utilisation of GIS contributes to strengthen the statistic data-basis in addition to increase the value of the statistic results.

Some statistic work that was done manually before, required a great deal of resources and thus was occasionally worked out. Now, at the basis of administrative registers and use of GIS, there are possibilities for updating geo-referenced statistics more often. Use of different GIS-functionality (i.e. overlay-, network- and other spatial-functionality) offers possibilities to make new statistics with a minimum of investment.

Map data from Norwegian Map Authority has been used in all the map examples (permission no. LKS 82003-596).

Lars Rogstad (GIS-coordinator in Statistics Norway) has compiled this report, based on contributions from the different contact persons.

Statistics Norway
December 2001

1. Delimitation of urban settlements

Background and objectives

Statistics Norway introduced the term "urban settlement" as a statistical unit for the first time in 1960. The definition of what this is supposed to be has since then evolved, but has now been unchanged since 1980. The actual task of delimiting urban settlements (with basis in the definition) has been done by local administrators throughout municipalities and counties in Norway, with varying approaches, very often manually, and with a resulting problematic degree of subjectivity. These factors have made it difficult to follow urban development over time, as the comparability not only between different areas, but also within, has been questionable. To find a solution to these problems, Statistics Norway, during 1997 and 1998, developed a method for automatic and computerised delimitation of urban settlements.

The definition of "urban settlement" is roughly a hub of buildings with at least 200 inhabitants, where the distance between buildings does not exceed 50 meters. Smaller hubs of buildings that naturally belong to the urban settlement are included if they are situated in a distance of up to 400 meters.

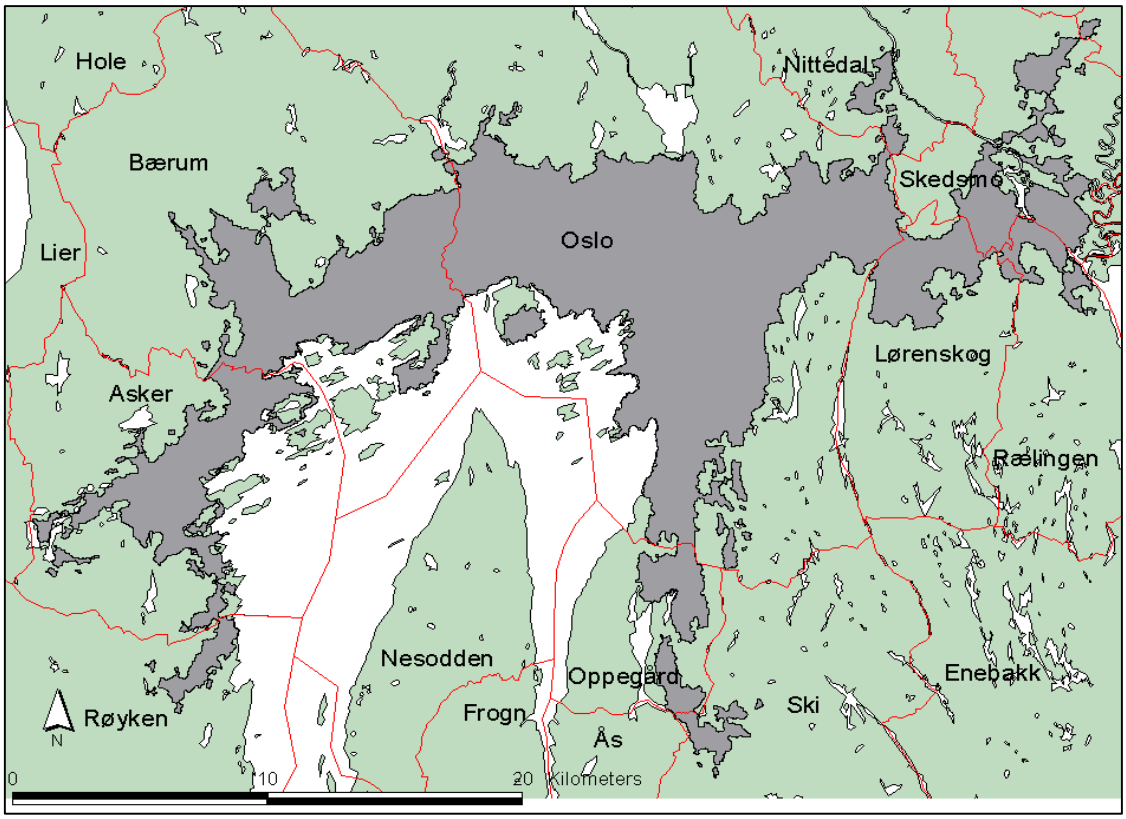

Figure 1. The urban settlement of Oslo.

The red lines in Figure 2 are municipality borders, and the municipality names are written in the figure as well.

Results, data sources and methods

The first and very important part of the delimitation is to geo-reference the Norwegian population (their official place of residence) into a co-ordinate system. This is done by merging the Central Population Register (CPR) and the Official Register on Ground Properties, Addresses and Buildings (GAB).

Using the GIS-software ARC/INFO does the second part. The first step here is the creation of buffers around all buildings, using a radius dependant on the variables "ground surface area" and "type of building". Polygons are then created, where buffers that overlap are merged together. If a polygon has at least 200 inhabitants, it is registered as an urban settlement. This

is of course the simplified version, as many more steps dealing with different factors are needed to obtain a satisfactory result.

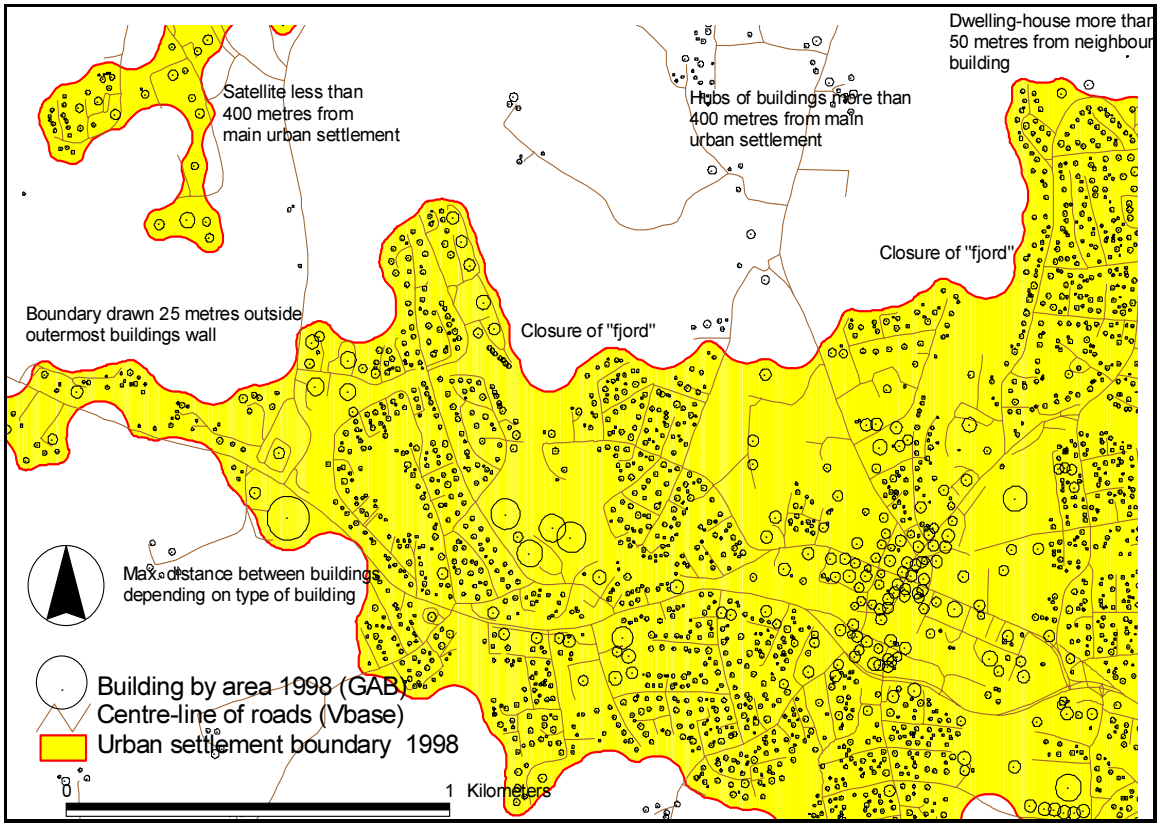

Figure 2: Showing the principles of the automatic method

By using data per 1.1.1999, the new method states that Norway has 910 urban settlements. The largest settlement was Oslo with 763 957 inhabitants, and about 76 per cent of the Norwegian population lived in urban areas. The next delimitation, with data per 1.1.2000, will be ended during 2001.

Resources and funding

The project is financed on commission, and is supported by the Ministry of the Environment (ME). The Division for Environmental Statistics (S220) at Statistics Norway developed the method, in co-operation with The Division for Population and Education Statistics (S320). S320 is responsible for the annual delimitation.

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2. Land use in urban settlements and peri-urban areas

Background and objectives

The objective for the work with land use statistics as conducted in Statistics Norway is to establish a statistical tool enabling for monitoring effects of the implementation of policies, for comparative analyses and indication of trends in land use. The aim is to cover requested information with statistics of acceptable quality, to produce statistics in a cost-efficient way and to be flexible enough to adapt to future changes in data-sources and tools. We want to establish an overview both over status for the actual land use and to follow the changes.

Results

The main focus of work has so far been to explore the data sources and to develop methodology. However, preliminary figures for some major land cover classes have been produced for all urban settlements in Norway, as well as more detailed statistics is under preparation for settlements with more than 20 000 inhabitants.

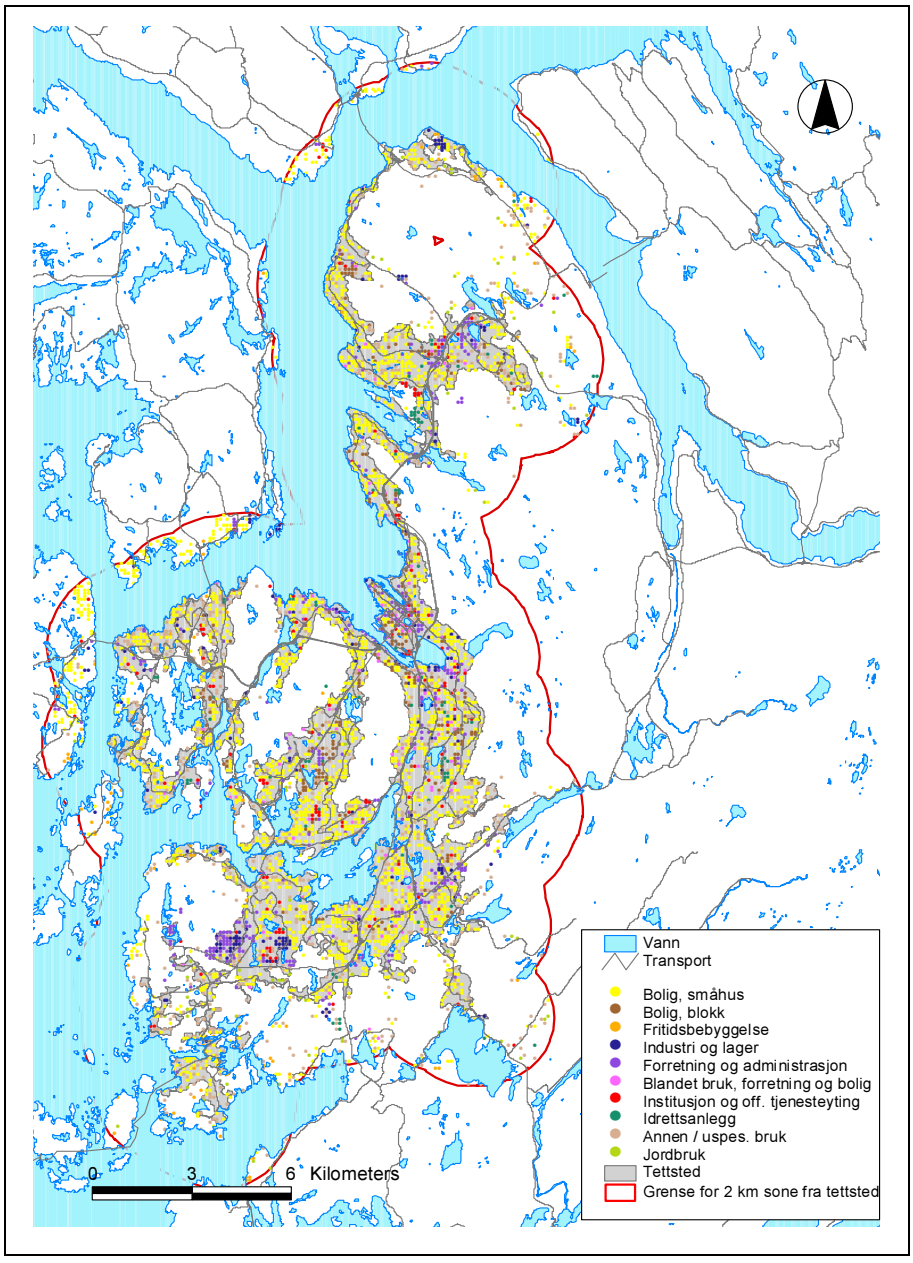

Figure 3: Land use based on point sampling of register information. Bergen urban settlement. 1999*

Documentation

- *Land use statistics for urban settlements*. Methods based on the use of administrative registers and digital maps. Documents 1999/21. Statistics Norway 1999.
- *Land use statistics for urban settlements*. Documents 2000/12. Statistics Norway 2000.
- *Arealbrukstatistikk for tettsteder*. Dokumentasjon av arbeid med metodeutvikling 1999. Notater 2000/12. Statistisk sentralbyrå 2000. (in Norwegian)
- Utvikling av arealstatistikk for tettstedsnære områder - muligheter og begrensninger. Rapporter 2000/19. Statistisk sentralbyrå 2000. (in Norwegian)

- http://www.ssb.no/emner/01/01/20/

Resources/ funding

Partial funding by the statistical office of the European communities (EUROSTAT) and the Norwegian Ministry of the Environment.

Data sources and software

The core system of land use statistics that now is under development in Statistics Norway is mainly based on the following administrative registers and digital maps:

- The Central Population Register (CPR)
- The Official Ground-property-, Address- and Building-Register (GAB)
- The Central Register of Establishments and Enterprises (CBR)
- The official Road Database
- The official register for Sport Grounds
- Digital data from map series (scale 1:50 000 and 1:10 000)

SAS , ARC/INFO and ArcView. (Data processing tools and GIS software).

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3. Statistics for the central business district

Background and objectives

The Norwegian Government has per 8. January 1999 introduced a regulation that prohibits constructions of large shopping centres outside central areas of urban settlements (MD 1999). If new shopping centres are to be constructed they should be well adapted to the size of the settlement, the functions of the settlements and the potential markets in the neighbourhood. The objective with the ban is both to reduce the use of private cars, and thereby improve the air quality, as well as to revitalise the centre areas in the urban settlements.

Statistics Norway conducted a project in order to yield more experience with the term centre, and the possible consequences of the ban introduced. Tasks like operationalisation of the term centre and to analyse localisation of potential consumers in the surrounding of the enterprise were addressed. Therefore it was necessary to link demographic and economic parameters to small regional units. Questions like how big is the influence area /service area of the retail sales enterprises or, opposite, how big should a shopping centre be to cover the local population demands for specified goods, had to be dealt with.

The following four approaches were formulated:

- localise and delimit the centre area
- calculate the turnover in retail sales enterprises within the centre area
- calculate the surrounding purchasing power potentials by distance to the centre area
- calculate the size of population and consumers potentials within the surroundings/service area

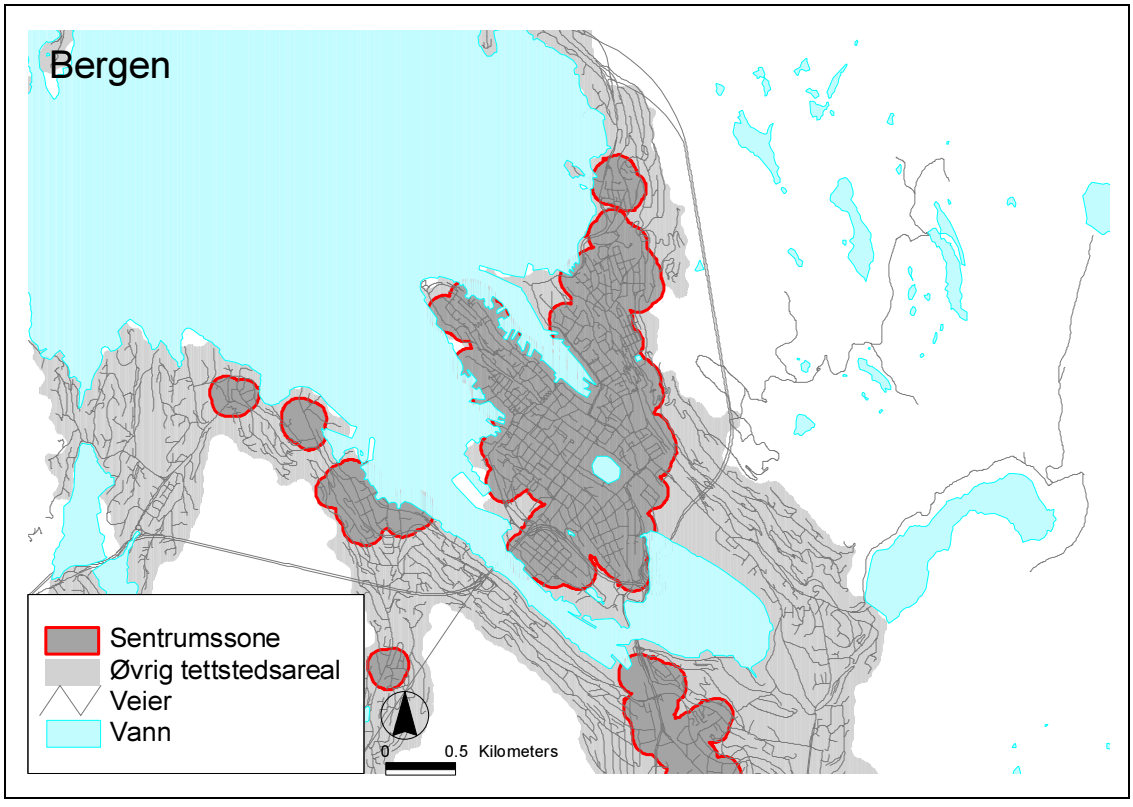

Figure 4. Centre areas and surrounding/service area. Municipality of Bergen. 1999*

Documentation

- Land use statistics for urban settlements. Documents 2000/12. Statistics Norway 2000.
- Sentrumsstatistikk for Oslo og Akershus. Et pilotprosjekt. Notater 1999/76. Statistisk sentralbyrå 1999.

Resources/ funding

Partial funding by the County Administration of Akershus and the Norwegian Ministry of the Environment.

Data sources and software

The statistics for the central business district is mainly based on the following administrative registers and digital maps:

- The Central Population Register (CPR)
- The Official Ground-property-, Address- and Building-Register (GAB)
- The Central Register of Establishments and Enterprises (CBR)
- The official Road Database

SAS , ARC/INFO and ArcView. (Data processing tools and GIS software).

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4. Towards a more differentiated content of the terms urban and rural - needs and possibilities for development

Background and objectives

The term "urban settlement" was introduced for statistical use for the first time in with Population and Housing Census year 1960 (PHC). The original delimitation was at that time based on several morphological and functional criteria. Since 1970 Statistics Norway (SN) chose a purely morphological method for delimitation of urban settlements. However, for many analytical and research purposes more nuances with respect to localisation, functionality etc. are required i.e. a better expression for variety inside urban settlements (centre areas, dwelling areas etc) as well as terms for better reflecting of the diversity in rural areas. Thus a pilot study was initiated year 2000. The objective for this study was to start a discussion on needs and possibilities - especially for awareness for publishing purposes of PHC 2001 results.

Results

After a brief study of literature, and by testing several data sets and digital regional divisions, a short and problem-oriented note was distributed to experts within SN late year 2000. Comments are now received, but unfortunately still not analysed properly. Several comments support the idea of combining functional criteria and centrality with the term urban settlements for a better tool for socio-economic and environmental analyses. However, further work has to be done before it is possible to be more specific on recommendations.

Documentation

"Mot et differensiert innhold i SSB's tett/spredt-begrep? Behov og muligheter for utvikling. Per Schøning 11/12-2000. In Norwegian, unpublished paper..

Resources/funding

A total of 90 man hours were used on the project in year 2000, with work starting in September
The project was conducted by the Division of Environmental Statistics (220), and it was funded by the PHC.

Data sources

The main data sources were: Results from the delimitation of urban settlements 1999 and several digital regional maps. Misc. Literature.

Tools

ArcView 3.2

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5. Travel to work statistics based on the use of GIS and registers - a pilot project

Background and objectives

Access to a well-qualified work force is an important precondition for regional economical growth and social well fare. Optimal localisation of enterprises both in relation to the market and to the work force is therefore stressed in regional planning activities and high quality and timely data are requested.

Traditionally the main data source for travel to work statistics, as it is produced by Statistics Norway, is response to questionnaires from the Population and Housing Censuses (PHC) conducted every 10th year. However, onwards from the PHC 2001, travel to work statistics will have to be based mainly on administrative registers, due to changes in methodology in the PHC. The objective of the pilot project as described here is thus contributed to establish better know-how on the use of registers for production of travel to work statistics with emphasis on the use of GIS.

Results

In addition to a register-match covering all employees and enterprises, a more in-depth study was conducted for the municipality of Bærum (close to Oslo). For 63.3 percent of the total population of 1.2 mill., it was possible to establish a link between the geo-coded residential address and the geo-coded place of work. The main reason for a relative high non-match is considered to be that the pilot was based on the use of the not yet fully established geo-reference in the Central Register of Establishment and Enterprises (expected to be finished with a first version April 2001).

For the case study of Bærum, an extension to ARC View Network Analyst was developed and used in order to calculate travel to work distances (metres and hours) along the digital road network for each job and worker. Finally an example map for extent and direction of travel to work in the three counties Telemark, Vestfold and Buskerud was produced to gain experience with maps as information-carrier.

Documentation

An interim report was delivered for documentation of work conducted during the autumn year 2000. This report describes the contents and the quality of the registers used as well as methodology and experiences achieved during the project period. ("Arbeidsreiser og GIS - muligheter og begrensninger" Dokumentasjon av prosjektarbeid utført 2000. Marianne Vik Dysterud og Per Schøning 20/12-200. In Norwegian, unpublished paper)

Resources/funding

A total of 363 man-hours were used on the project in year 2000, with work starting in September. The project was organised as a co-operation between Division 710 and Division 220 in Statistics Norway. The project was funded by the PHC.

Data sources and software

The main data sources were: The Central Population Register, The Official Employee Register, The Central Register of Establishment and Enterprises and finally The Digital Road Database (ELVEG).

ArcView 3.2 with a modified extension of Network Analyst and SAS as a tool for register match.

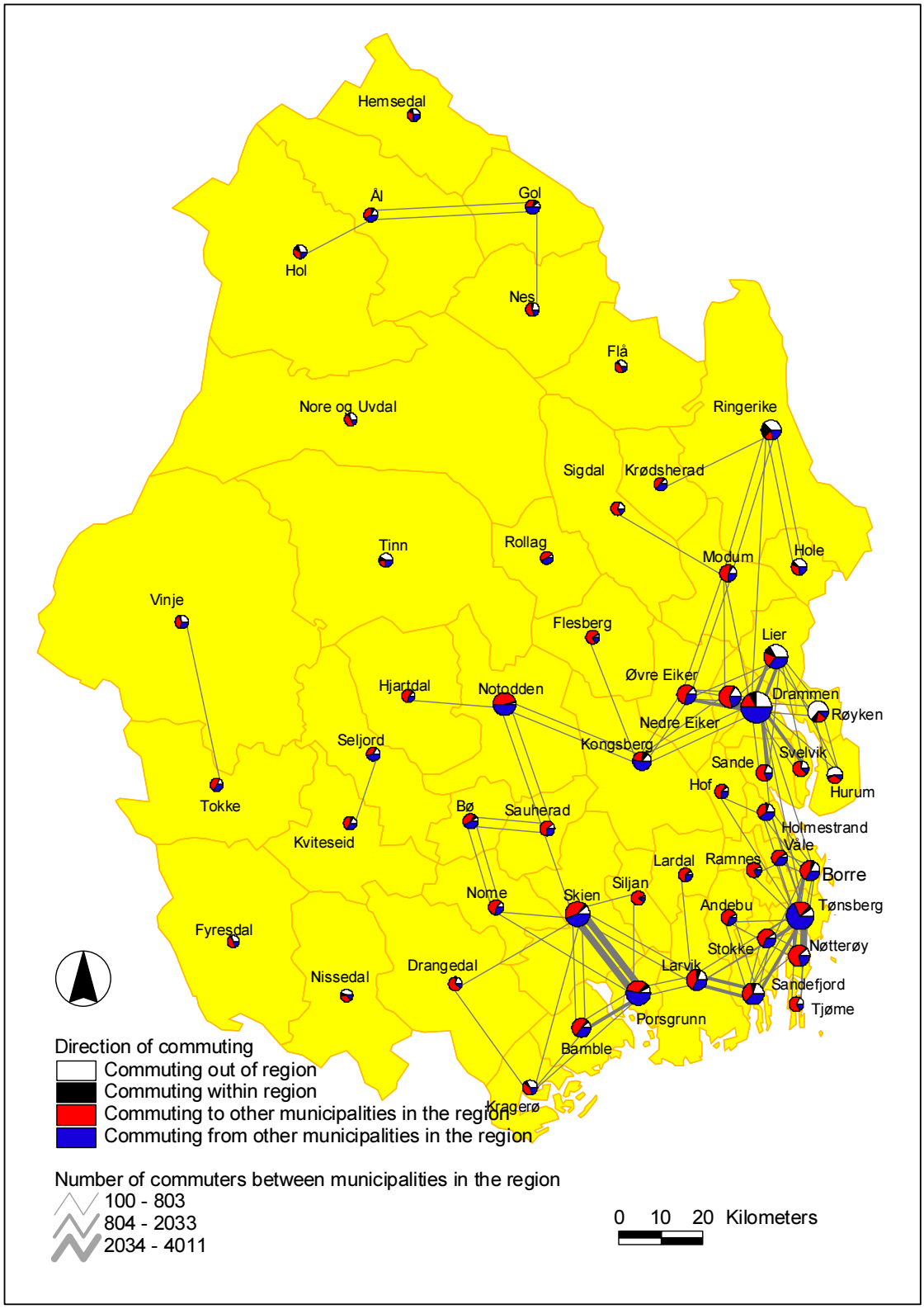

Figure 5: Travel to work 1999. Buskerud, Vestfold and Telemark counties

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6. Geo-referencing the national inquiry of travelling habits

Background and objectives

In 2001 the national inquiry of travelling habits (RVU 2001) are conducted for the fourth time. The three previous inventories were carried out in 1984/85, 1991/92 and in 1997/98. Statistics Norway did not take part in the 1997/98 inventory. The RVU 2001 is the most comprehensive interview-based inquiry conducted by Statistics Norway on commission in 2001. Statistics Norway has been commissioned the data-gathering part of the project. The Institute of transport economics (TØI) has the professional responsibility for the project, while The Transport ministry and The Directorate of public roads are funding the project. The Division for environmental statistics is carrying out the computer-based geo-referencing of the travels.

The purpose of the investigation is to make an inventory of the population's travel- activity and pattern. The investigation will serve as a basis for describing the dimension of travel, why people travel, how they travel, which part of the population undertake what kind of travels and variations in travel habits by place of residence.

The data obtained is vital for national and local transportation planning. The results are being used as a foundation for the development of transportation models, calculations of exposure regarding transportation safety and various research projects.

Documentation

The project is carried out at present and no documentation is available.

Resources/ funding

Funding by The Transport ministry and The Directorate of public roads.

Data sources

The Central Population Register (CPR)
The Official Ground-property-, Address- and Building-Register (GAB)
The Official register of place names.

Tools

SAS and ArcView. (Data processing tools and GIS software).

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7. Stedfesting av bedrifter

Geo-referencing industrial estates, business enterprises and places of work; text only in Norwegian

I mange sammenhenger ser Statistisk sentralbyrå at det er behov for en detaljert stedfesting av bedriftene i Norge, bl.a. til bruk i folke- og boligtellingen i år (FoB2001). Stedfesting av bedriftene er viktig for å kunne stedfeste arbeidsplassene, og dermed også utlede data om arbeidsreiser og pendling. I tillegg er stedfesting av bedrifter viktig for å kunne lokalisere områder for handel, produksjon og verdiskapning. SSB har registrert en økende etterspørsel etter denne typen data både fra offentlige og private miljøer. Et register med stedfestede bedrifter vil blant annet være et nyttig hjelpemiddel for kommunene i arbeidet med å lage oversikts-, areal- og transportplaner og analyser av miljøkonsekvenser.

På et seminar i desember 1999 med deltagelse fra flere fylkeskommuner, kommuner, departementer og forskingsinstitusjoner, ble man enige om at SSB skulle starte et landsdekkende prosjekt for stedfesting av bedrifter. Prosjektet finansieres med midler fra SSB, Kommunal- og regional departementet, Miljødepartementet og Nærings- og handels-departementet.

Målsetningen er koordinater via offisiell adresse på så mange bedrifter som mulig. Bedrifter som på grunn av adressekvaliteten ikke kan tildeles koordinater skal tildeles en grunnkrets.

Kilder som blir brukt for å etablere et stedfestet bedriftsregister er:

GAB:	Offisiell adresse
BoF:	Bedrifter med adresse
Enhetsregisteret:	Opplysninger om eiere
Det Sentrale Folkeregister:	Personer med kommunekode og gnr/bnr
Landbruksregisteret:	Eiendommer med koordinater, kommunekode og gnr/bnr

Stedfestingen skjer hovedsakelig gjennom maskinelle kjøringer. Den første gjennomkjøringen basert på data fra juni i fjor ledet til stedfesting av ca. 75% av alle bedrifter i Norge. I tillegg blir det utført manuelt arbeid for å forbedre adressekvaliteten på de som ikke ble stedfestet gjennom de maskinelle rutinene. Det er bl.a. foretatt en utsending til alle landets kommuner der kommunene bistår oss i å stedfeste bedrifter med dårlig adressekvalitet. Restmengden som ikke blir stedfestet maskinelt etter ny gjennomkjøring vil bli statistisk kodet med grunnkrets ut fra postnummeret.

Selve hovedprosjektet vil avsluttes rundt 1. kvartal 2001. Oppdatering vil i 2001 skje kvartalsvis. Fra 2002 skal det være etablert rutiner som er knyttet opp mot registrering av en ny/endret adresse, og stedfestet informasjon skal dermed automatisk kunne knyttes til bedriften.

Illustrasjonen under viser lokalisering av bedrifter og arbeidsplasser innen sekundærnæringene i Bergen. Sirklenes størrelse indikerer antall arbeidsforhold på et sted.

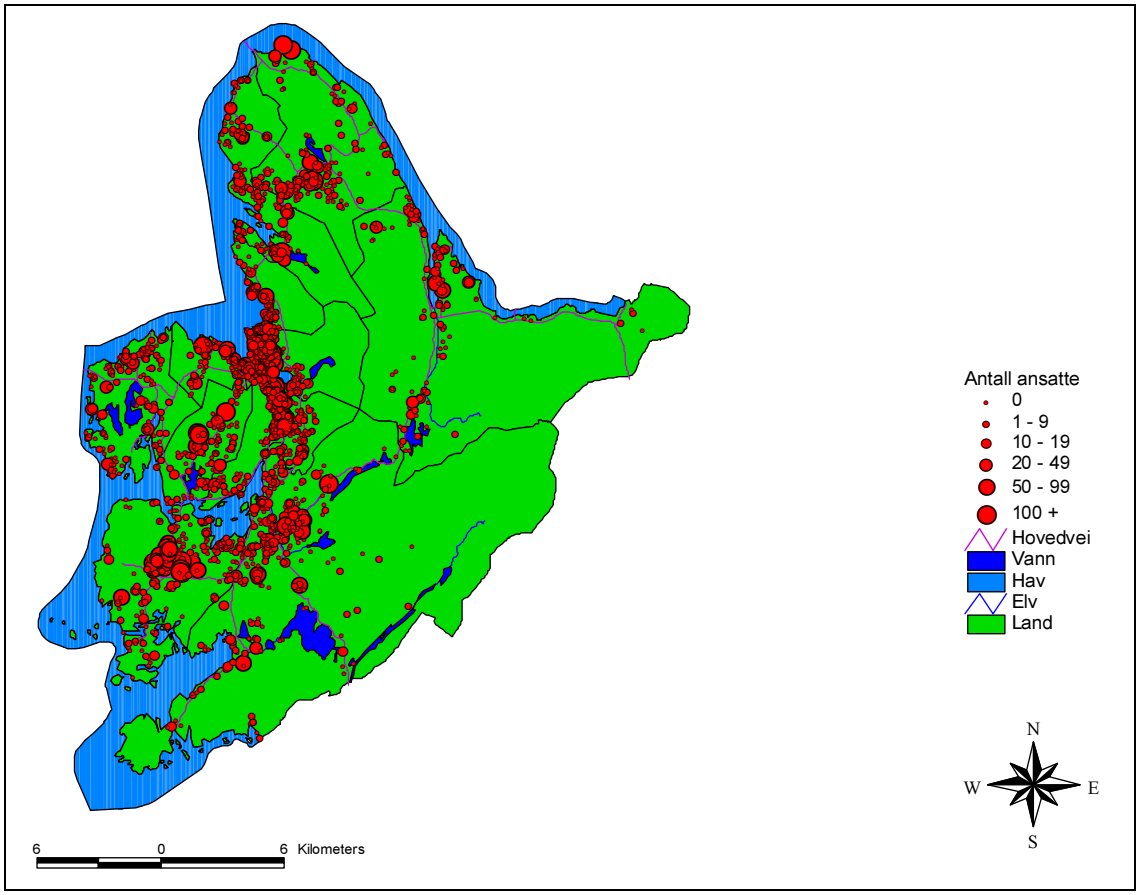

Figure 6: Lokalisering av bedrifter innen sekundærnæringene i Bergen kommune (Localisation of enterprices in secondary industries in Bergen municipality)

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8. An indicator for population dispersion - a part of the government grants to the municipalities

Background and objectives

The Ministry of Local Government and Regional Development finance the project on commission, and has its basis in the Norwegian authorities' policy of giving economical aid to municipalities with relatively higher expenditures connected to delivering essential municipal services. This can be due to factors such as a relatively high proportion of the population being mentally handicapped, or of old age, or in the case of the indicator described here, having relatively higher expenditures due to travel distances.

Travel distance is in this context seen as the amount of time needed in attaining or offering a municipal service, which can be travel-time needed from a municipal service-centre to the population (for example a community nurse travelling from a health-centre to an inhabitant), or from population to service centre (school buses to a school). The notion "time is money" is therefore relevant here, and in obtaining an indicator which attempts to describe travel distances within a municipality, one is obtaining an indicator for use in quantifying the relative expenditure a municipality has due to travel distances, allowing comparison between municipalities.

Methods and results

The indicator is actually three indicators, which reflect either travel distances between people, or distances from people to service-centres within the municipality. Digital road data is used for finding "shortest path" transport routes, with the options of road and car ferry. If no transport routes are available within a certain radius, the "as the crow flies"-distance multiplied with a certain factor is used instead. The total number of inhabitants, giving the final indicator for that municipality, then divides the resulting sum of travel minutes for all inhabitants.

The indicator is therefore a function of the municipality's infrastructure, geography and population pattern (by location), and has for many years been implemented without the use of any GIS. Paper maps showing population settlements, administrative borders and roads were formerly used, with for example visual tracking of roads to obtain distances. Statistics Norway are however now for the first time using GIS and digital data in the calculation of the indicator, revolutionising the whole process. The new indicator was released in April 2001, and has by comparison shown to be a great improvement to that of the former method.

Steps taken in the calculations: Firstly, using population co-ordinates and basic statistical unit boundaries (figure 7), a geometrical centre of gravity for the population in each unit is calculated, weighted by the location and number of persons at each co-ordinate (figure 8).

Depending on which of the three indicators one is calculating, distances from gravity centres to other gravity centres are then measured. For the first indicator this is from all gravity centres to the gravity centre in the unit where the town hall resides. Measurements are done using the digital road database (Elveg) and the ArcView optimal-route-finding extension, Network Analyst (figure 9).

The second indicator allows for many service-centres in the municipality, and not necessarily where the town hall resides, whilst the third does not use the notion of service centres at all, utilising instead average distances to neighbouring units in its description of population dispersion.

Finally, the distance for its relevant population multiplies each gravity centre, summed up for each unit in the municipality, and divided by the municipality's population, resulting in that municipality's indicator. The whole process is automatic, all calculations and summations being written to log files, while optimal routes are drawn on the screen for visualisation and inspection.

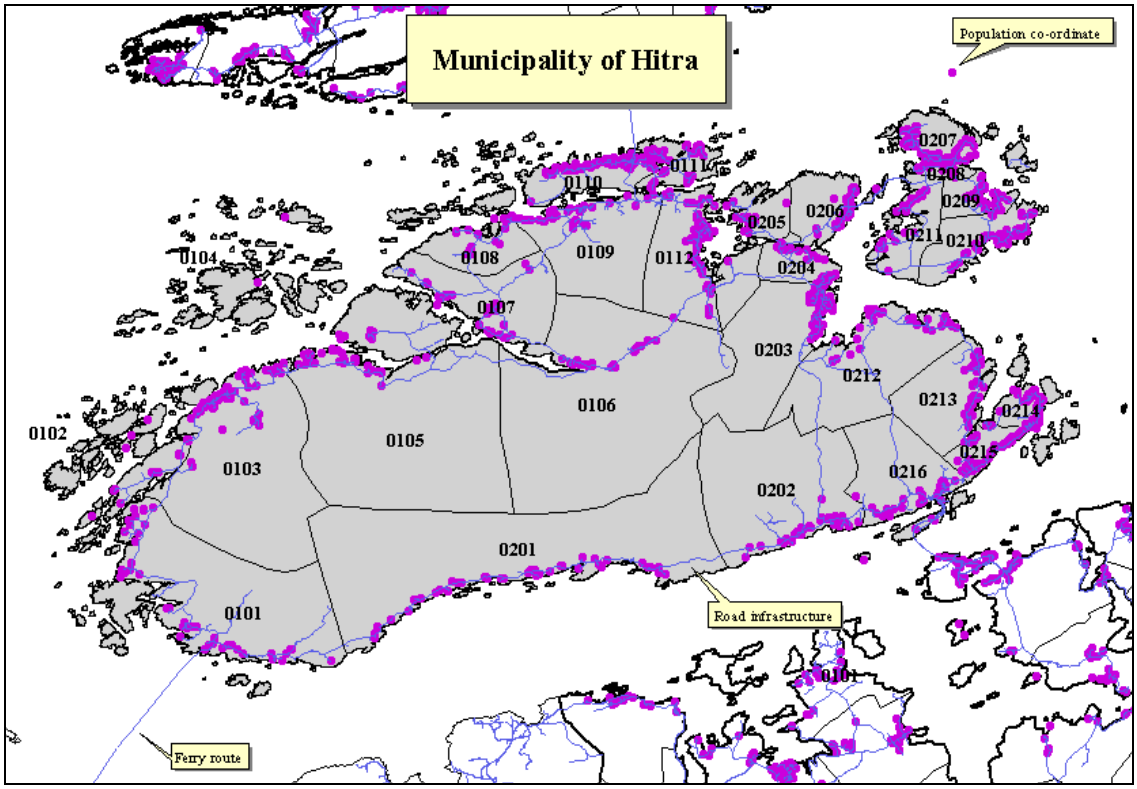

Figure 7. **The municipality of Hitra, with population co-ordinates, road and ferry infrastructure, basic statistical unit borders and identification numbers. Note how the population co-ordinates coincide with the road system.**

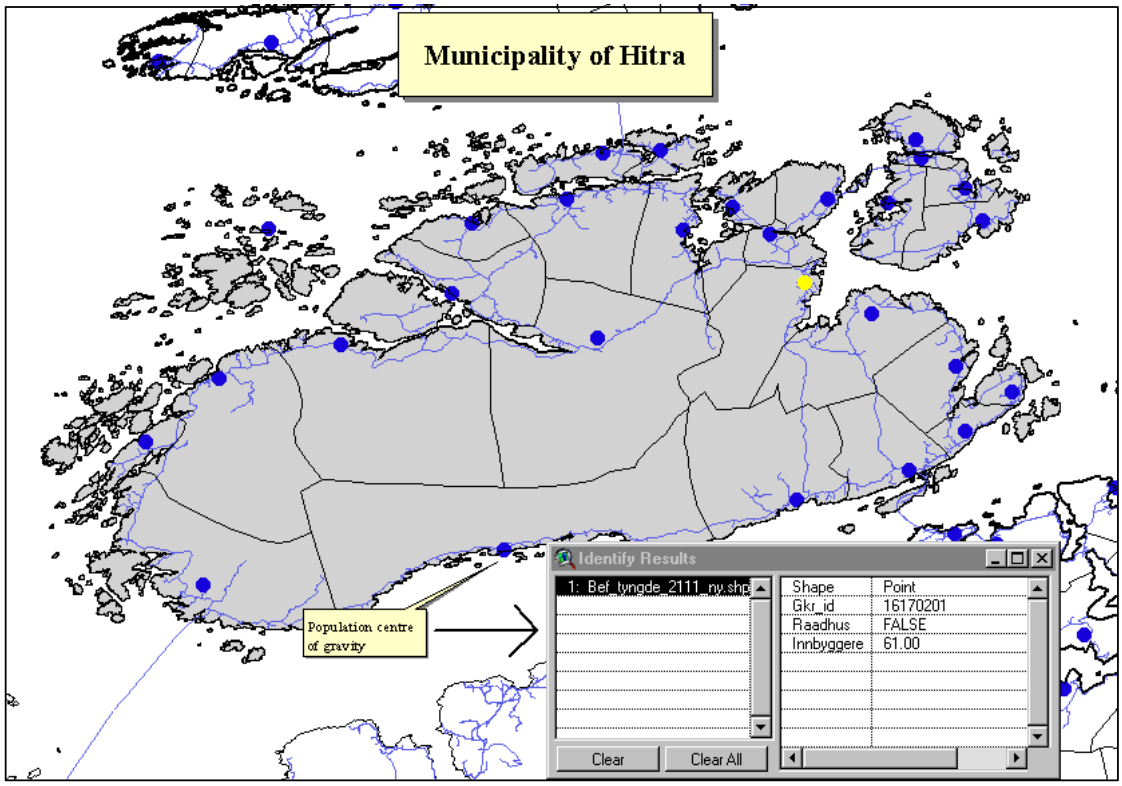

Figure 8. **A geometrical population centre of gravity is calculated for every basic statistical unit. The information pertaining to the gravity centre selected on the map is unit number 16170201, 1617 being the municipal id., FALSE for the occurrence of a town hall, and sixty-one for population.**

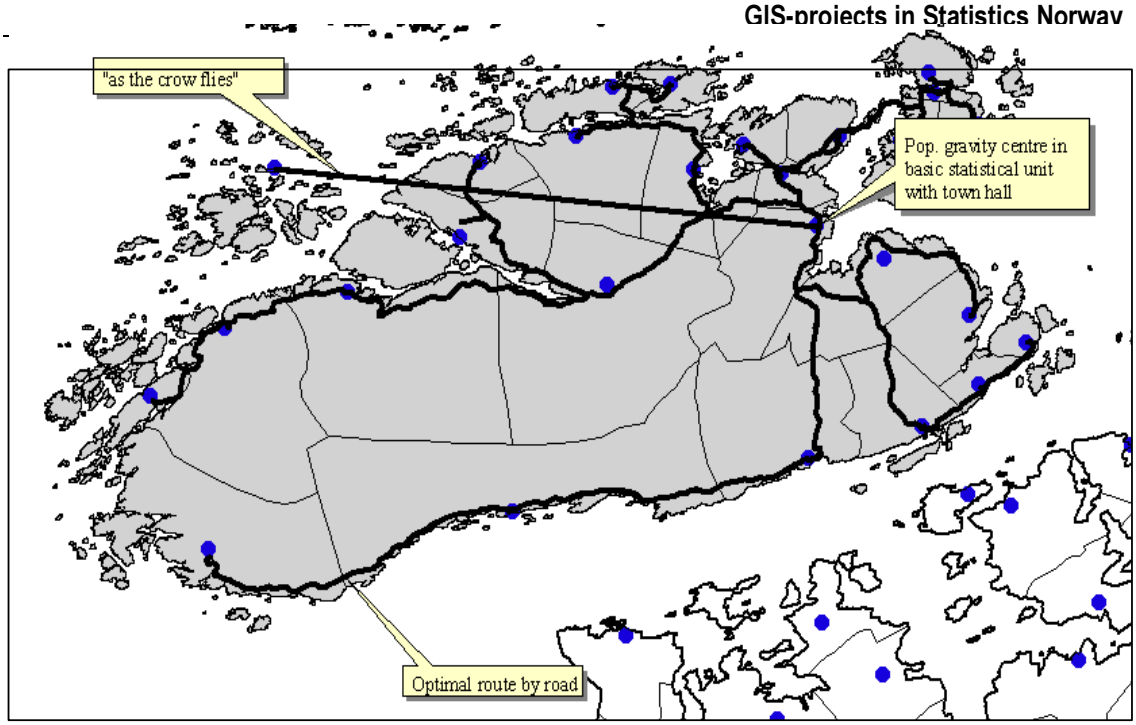

Figure 9. Optimal routes are chosen from each basic statistical unit's population gravity centre to the unit containing the municipality's town hall. If no transport routes are available within a certain radius, the "as the crow flies"-distance multiplied with a certain factor is used instead.

Data sources and software

The GIS tool ArcView is now used in implementing the method, all parts of the project being programmed externally by a GIS software and consulting company. The primary data are mainly the following:

Digital road database: The database holds all roads and ferry-routes for Norway, with speed limits, road types, restrictions, etc.

Population co-ordinates: Every Norwegian citizen is registered with a co-ordinate, which is his/her place of official residence (digital data).

Digital map boundaries: Municipal boundaries, but more importantly the boundaries of the "basic statistical units", which municipalities subdivide into.

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9. The Nordic population on grids

Background and objectives (text from Tammeloude 2000)

. Grid data generally refer to those statistics on population, labour force and employment in which a regular grid square constitutes the statistical area. The location of the squares is pinpointed with map coordinates. The most frequently used square size is 1km x 1km.

Data by grid square have been available for longest in the Nordic Countries in Finland where they have been available since the 1970 population census, where coordinates have been added to the pertinent register-based statistical data using the centre point coordinates of buildings.

Grid square data are regarded as the most flexible statistical basic geographical data unit. The square is a spatial stable. It does not move from one year to the next, as administrative areas may do. Thus, it is independent of any regional changes. Data by small squares can easily be summed up to form larger areas.

Due to the availability of geo-coded register-based data, the opportunities for exploiting socio-economic geographical data are exceptionally good in the Nordic Countries. However, the use of geographical data produces several major problems, or challenges, relating to such issues as data security, data quality, know-how of thematic mapping/visualisation and copyright.

Between 1995 and 1997, Statistics Finland and Statistics Sweden ran the first co-operation project on the usage of grid data and GIS. This first study involved a small number of variables from both countries' data records for the purpose of determining the viability of joint use of these data. As a matter of research interest, the objective was to analyse the similarities and differences in the spatial structure of the population between the two countries (Rusanen et al. 1997). The study showed the functional distribution of the population in large areas containing both urban and rural districts.

Results

This Nordic co-operation entered its next phase in the year 2000 with the first efforts aimed toward constructing a joint map of the population density in the Nordic Countries by using grid data from the four countries concerned. At the same time, active co-operation is pending in many fields, including studies into the harmonisation and standardisation of grid type data, harmonisation of the methods for delimiting urban settlements and co-operation for the development of data dissemination processes and tools.

Thus far, a common population data set based on 1km x 1km grid squares has been compiled using data from three Nordic national statistical institutes. The geo-coded grid data are presented in a common Universal Transversal Mercator projection, zone 33, WGS84 datum. They are presented as a map, with additional data describing the national borders, sea areas, major lakes and the NUTS3 and NUTS5 units.

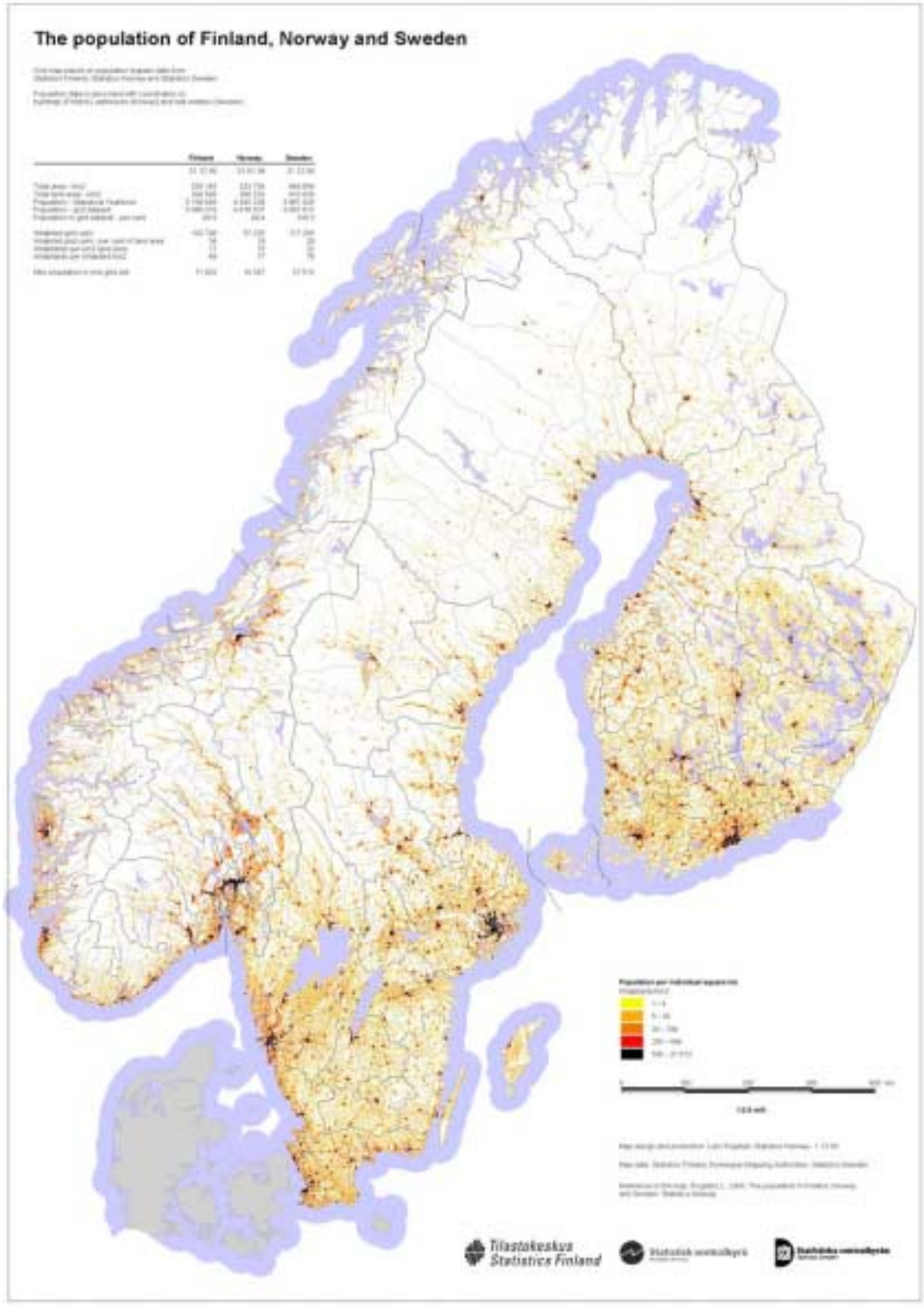

Figure 10: The population of Finland, Norway and Sweden. Grid map (1km x 1km), based on population register data

The map can be ordered from Statistics Norway, see Contact below. The map can also be downloaded from www.ssb.no/grids (PDF-file).

The table shows some results from the statistical analyses of the data, including some particularly interesting figures on differences in the spatial distribution of population in the three countries.

Country	Finland	Norway	Sweden
	31 Dec. 1998	1 Jan. 1999	1 Jan. 1999
Total area - km2	338,145	323,758	449,964
Total land area – km2	304,593	306,253	410,934
Population – Statistical Yearbook	5,159,646	4,445,329	8,861 426
Population in grid data set	5,086,018	4,416,527	8 861 417
Population in grid data set - per cent	98.5	99.4	100.0
Inhabited grid cells	103 798	57 325	117 288
Inhabited grid cells – proportion of land area	34	18	29
Inhabitants per km2 land area	17	15	22
Inhabitants per inhabited km2	49	77	76
Population in urban settlement areas[1]	81	75	84
Maximum population in one grid cell	20,948	14,347	21,209

Documentation

Backer, L., Rogstad, L., Tammilehto-Luode, M. (1999). Use of grids to improve the comparability of statistical data. Working document E/GIS/17. Meeting of the Working Party. "Geographical Information System for Statistics". Luxembourg, 21-22 October 1999.

Rusanen, J., Naukkarinen, A., Colpaert, A., Muilu, T. (1997). Differences in the spatial structure of the population between Finland and Sweden in 1995. Research Reports 221. Statistics Finland.

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[1] For Norway, population in agglomerations with at least 200 inhabitants and 50 metres or less distance between houses. Data for Finland and Sweden from 1995; for Norway from 1999.

10. The Norwegian population on grids

Background and objectives

One of the purposes of this project is to provide the customers with population statistics at a more detailed geographical level than traditional administrative and statistical units (municipalities and basic statistical units). In addition to this, the uniformity in size and shape of the statistical units makes the system well suited for comparisons, analysis and visualization.

Statistics Norway expects the product to be of special interest in the fields of marketing, research, planning etc. It must however be stressed that GIS tools will be needed to obtain maximum benefit of the product.

Statistics Norway already participates in a common Nordic project on population on grids (see chap. 9). The cooperation between the Nordic Statistical Institutions has been very useful, and hopefully the sharing of experiences will continue.

The product

The product consists of a digital grid, and population statistics that can be connected to it. Initially the size of the grid cells are 1km * 1km for the whole country, and 100m *100m for the most densely populated areas (the four largest cities).

An "empty" digital grid net in shape-format will be available at Internet (http://www.ssb.no), free of charge. The statistics, however, must be ordered from Statistics Norway at some expense. A common ID is used to connect the statistics to the grid.

The data in the grid project are population statistics per 1 January each year, with 2000 as the first year. For each grid cell the user will have information on total population and population by sex and age groups (0-5, 6-15, 16-19, 20-39, 40-66 and 67 years and more).

Statistics Norway faces a challenge in terms of disclosure control of such detailed data. At this point, no conclusion has yet been reached, but the product can be delivered *unsuppressed to special users* (public planning and researchers). Hopefully the product will be available to all user groups in the beginning of 2002.

The product has potential for further development. For instance, it can be extended to include other types of statistics, as education or income statistics. Other sizes of the grid cells may also be developed later.

Data recourses and software

The primary data used in the product is coordinates representing the residence for every Norwegian citizen.

Statistical data is processed using SAS software. The processing includes the establishment of an ID. ArcInfo is used to construct the grid, and the ID of each grid cell is established using ArcView.

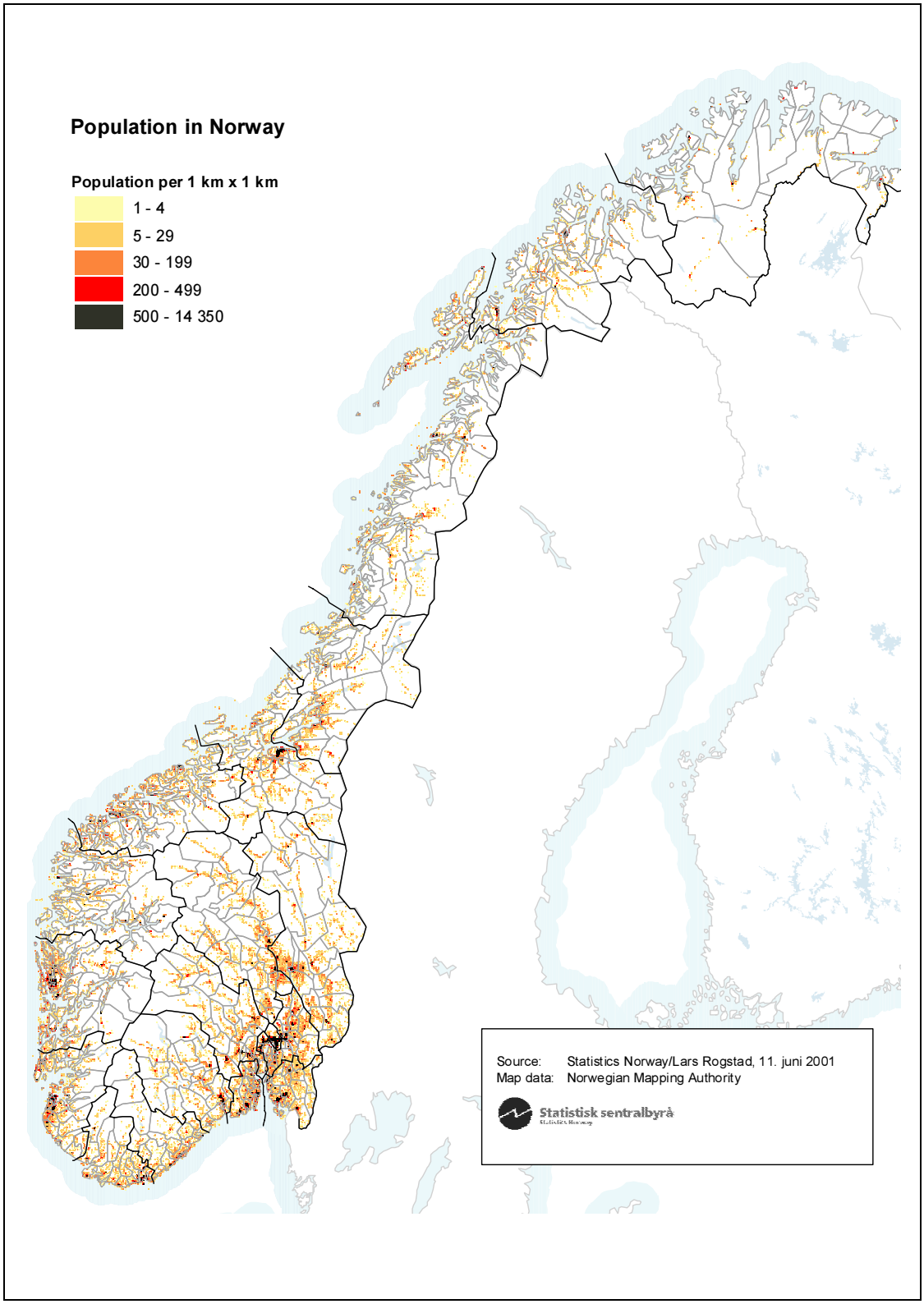

Figure 11: Population on grid cells 1km*1km, Norway. 1 January 1999.

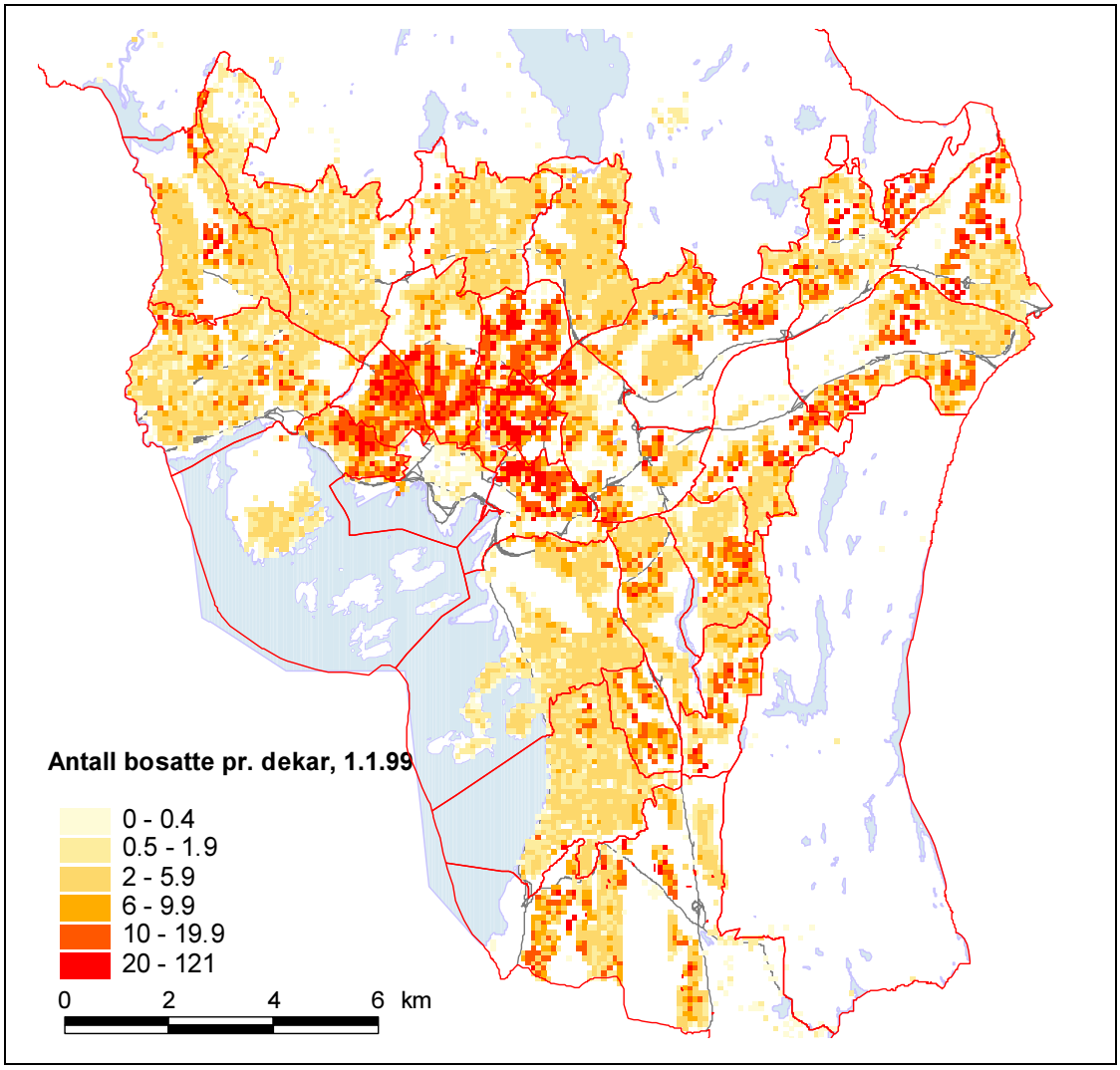

Figure 12: Population on grid cells 100m*100m, Oslo. 1 January 1999.

The red lines in figure 7 are boundaries of Urban Districts (townships).

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11. PX-Map - thematic mapping in a wink

Background and objectives

PX-Map is a tool for presenting statistical data as thematic maps. PX-Map is a map-module within the PC-Axis software family. PX-Map can also be used as stand-alone software for making thematic maps.

PX-Map is a very easy to use piece of software able to make thematic maps of all PC-Axis files containing a regional variable. The PX-file format is an information rich file format used by the PC-AXIS program family. PX-files are ANSI or ASCII text-files that can be edited in a text editor. PX-Map can also read semicolon-delimited txt-files.

Results

PX-Map is distributed together with some illustrative sample data (municipalities in Norway and the Nordic Countries, Europe, both countries and NUTS level 2 for the EU countries, and a dataset with countries of the world). PX-Map is available at no costs (no charge), and can be downloaded from www.ssb.no/px-map.

Map data are held in the shape format used by ESRI ArcView. The map has to be a set of regions described by polygons. Every region has to have a unique code property, which has to be the same as the region code in the statistical data.

PX-Map allows producing two types of thematic maps:

- Choropleth Maps (Colour Shaded Maps or Hatch Maps)
- Symbol Maps (sized circle)

Figure 2 shows the main window in PX-Map with a choropleth map showing total fertility rate for European countries.

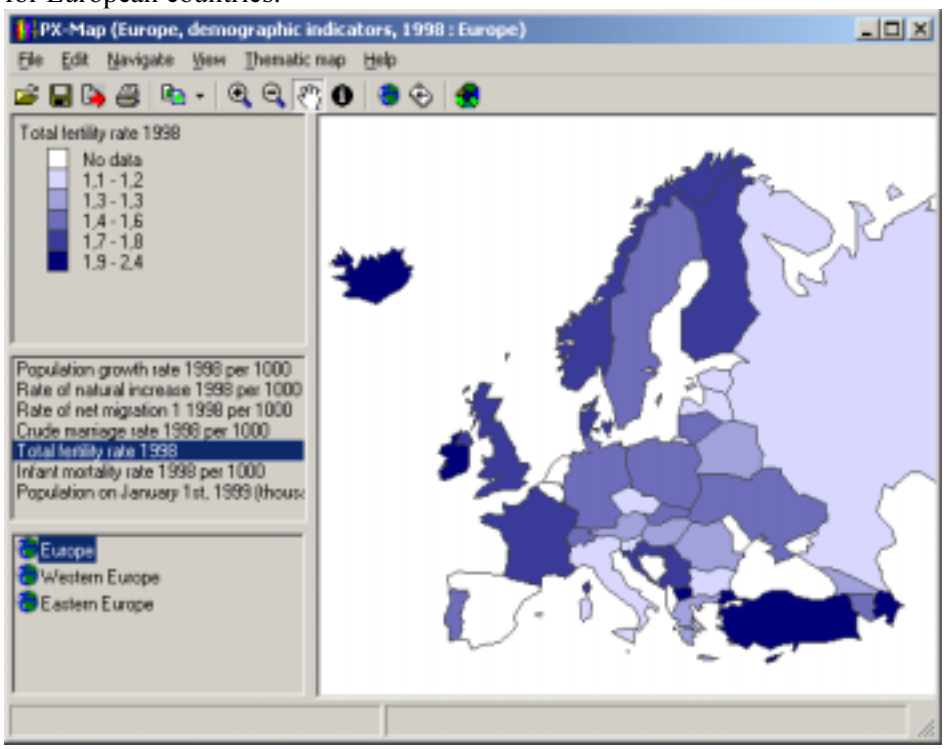

Figure 13: PX-Map - main window. Total fertility rate 1998, European countries

In developing PX-Map it is carefully considered the choices of default values for the map-attributes. Anyway, there are some possibilities for the user to manipulate map-attributes, such as classification method, number of classes and colours for choropleth maps, and symbol size and colour for symbol maps.

The user can save the settings of the map in an option file (PXO-file) for later use. The map and all its attribute settings included the connection to the data-file, will be stored. The option-file is a text-file that can be edited in a normal text-editor, which makes it easy to do some changes in the initial values. The Export utility makes it possible to store the map picture and the legend of the map in three different picture formats - Bitmap (.bmp), Windows metafile (.wmf) and Portable Network Graphics (.png). The map picture can also be printed and copied into other Windows programs.

All text in PX-Map can be viewed in an unlimited number of languages. Default language is English, and it is very simple to produce a language file for another country.

PX-Map runs under Windows 95/ME/2000, and Windows NT 4.0 SP5 or higher. Since May 2001 when PX-Map was released in version 1, there has been approx. 600 downloads of the application. Current version is 1.06, September 2001. PX-Map is available at no costs (no charge), and can be downloaded from www.ssb.no/px-map.

There is an on-going work to make PX-Map as a Web-based tool for interactive use on Internet. This will make it possible for the user to make her own maps 'on the fly' based on interactive selection of data from dissemination database or other data sources on Internet.

Software

PX-Map is based on ESRI MapObjects, and is developed by Statistics Norway and the private company Geodata AS.

Resources and founding

Statistics Norway

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www.ssb.no/px-map

12. Nordic municipalities - basic coordinate dataset

Background and objectives

The Nordic National Statistical Institutes has for several years produced a CD containing both regional statistics and the software PC-Axis. In the 2000 issue a Nordic municipality coordinate dataset has been included, and in the last issue the mapping feature with PX-Map has been included.

Results

The data set is organised in three separate parts describing the administrative borders for nations, counties and municipalities in the Nordic countries. The dataset also include separated parts for each Nordic country. The data set has been put together according to the administrative division of January 1 2000.

Iceland and Faroe Island has been moved from its original position, and Faroe Islands is enlarged twice the size. Aaland is represented as both as a part of Finland and as a separate nation. Island and Greenland are represented as separate nations and not as part of Denmark.

Regional polygons are delimited by coastline. In Sweden, the largest lakes are not included in the land area.

The dataset is presented in coordinate system UTM zone 33, date EUREF 89 (exept from Iceland, Faroe Islands and Greenland), and in ESRI Shape-format.

These sets of coordinates are only to be used together with Statistics Across Borders or other regional statistics from the Nordic countries. Each statistical office may also distribute the coordinate data to other users, but please refer to correct source: S*tatistics Across Borders 2001/Norwegian Mapping Authority.*

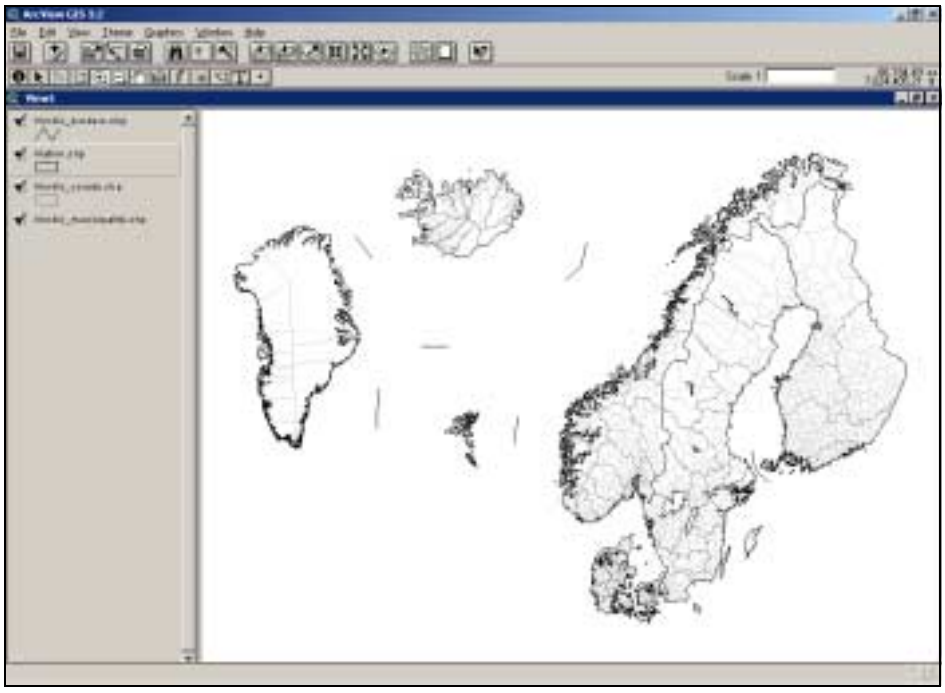

Figure 14: Nordic municipalities - basic coordinate dataset

Documentation

The dataset is distributed as an integrated part of *Statistics Across Borders. Nordic Regional Statistics 2001*. The dataset is also included as sample data in the mapping software PX-Map (www.ssb.no/px-map).

Data sources

The dataset has been developed from the basic product "Nordic Map Dataset" from the Nordic Mapping Authorities. Se details in the table below:

Nation	Sources	Comments
Denmark	”Nordic Map Dataset”	
Faroe Islands	”Nordic Map Dataset”	Enlarged, twice the size. Moved from its original position. Argir and Tórshavn aggregated.
Iceland	Data from Iceland (LMI, 1:750 000).	Generalized coastline. Moved from its original position.
Norway	The product ”N5000 MapData” from Norwegian Mapping Authority.	
Greenland	”Nordic Map Dataset”	Generalised coastline. Reduced scale to 1/3, rotated 7 degree and moved from its original position.
Finland	Material from Statistics Finland.	Adjusted national border.
Sweden	Material from Statistics Sweden.	Adjusted national border accordingly to Norwegian and Finnish data.
Aaland	See Finland	

The representation of counties are classified as follows:

Nation	Unit
Denmark	Amt - NUTS3
Faeroe Islands	The level does not exist (in statistics)
Iceland	The level does not exist (in statistics). "Umdæmni sýslumannsins" – included in the level of counties
Norway	Fylke - NUTS3
Greenland	The level does not exist (in statistics)
Finland	Maakunnaat - Major regions - NUTS 2
Sweden	Län - NUTS3
Aaland	The level does not exist (in statistics)

Attribute data fields for municipalities:

Field	Explanation
Country	Name of the nation - local language
Country_en	Name of the nation - English
Code_count	ISO country code - two letters
Code	<Code_co>-<Code_local>, e.g. NO-0301
Name	Name of the region – local language.
Code_local	The regional code used in the nation.

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