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Land Statistics in Norway - Projects and Data Sources

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1. Introduction

Land use statistics were developed in Statistics Norway before Geographical Information Systems (GIS) technology was available and GIS was a well-known concept. *Land use accounts* were established as a part of the general development of Norwegian natural resource accounts around 1980. Land use accounts were based on point sampling techniques on maps and air photographs, and provided a survey of land use in the country as a whole and in urban areas in particular (SÆBØ 1983). For urban settlements tables showing changes in land use from 1955 to 1975 were set up.

Statistics have also been produced and made available for urban settlements on the basis of the 1980 and 1990 Population and Housing Censuses. This includes statistics such as total population and area (only for some years) for the years 1960, 1970, 1980, 1990 and 1994 in urban settlements with 8.000 inhabitants or more. (Statistics Norway also produces statistics on population in densely and sparsely populated areas (on municipality level)).

Statistics Norway produces some land use statistics on municipality level:

- agricultural area
- productive forest area

In recent years, the use of GIS has increased in Statistics Norway. Especially in preparation of Land Statistics including Land-Use, Land-Cover and delimitation of statistical units like Urban Settlements. The use of GIS opens new prospects for developing statistics and analyses. The leading idea is to combine administrative registers with the geography. The objective with this Paper is to give a general view of GIS-related projects and data sources (Administrative Registers) used in Statistics Norway.

2. Projects

Statistics Norway has developed an automatic method for delimitation of the statistic unit "Urban Settlement". This method is now approved and implemented in the statistical system of Statistics Norway. Work is now going on in order to develop a statistical division of major urban settlements into centre and periphery – city centres. Also work with other subdivisions due to specific use of land inside urban settlements is in progress as well as a pilot study on how to link economic parameters to land use activity. Some of the projects are described in more details than others and this is due to the developing-status of the projects.

2.1 Urban Settlements - delimitation

The method for delimitation of Urban Settlements is earlier documented and presented on different international meetings (Schøning 1997) and (Rogstad 1996), and will thus be very briefly described in this paper.

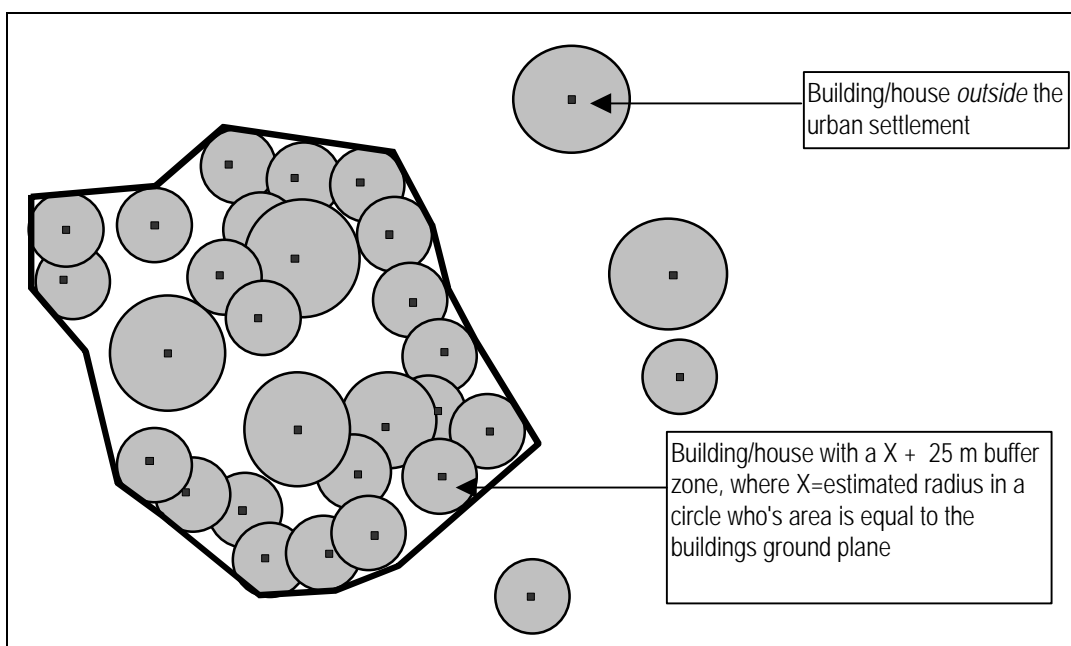
Definition: An *urban settlement* in Norway is defined as an agglomeration having at least 200 residents, and where the distance between the houses - as a rule - does not exceed 50 metres.

However, in some cases separately built-up areas which appear to be closely connected to the main agglomeration are included.

Method: The method for delimitation is based on the definition above and available administrative register data from different sources which is automatically processed in a computer programme. A key element of this method is the use of GIS (NT Arc/Info) for comparing and analysing the register data. The method is called the “buffer method” because it is based on the use of buffer distances between buildings.

A buffer distance is placed around each building, and overlapping (touching) buffer zones will be included in the potential urban settlement area. By matching information from the GAB register with register data on population, using the addresses as common identifier, the population is linked to building co-ordinates. By totalling the number of inhabitants within each potential urban settlement area, one can see whether the area fulfils the urban settlement definition. This is illustrated in the figure below.

Figure 1 - Urban settlement - definition



Results: Per 1. January 1998 there are 952 Urban Settlements in Norway. These settlements occupy only 0.7 % of land, but as much as 74 % of the population are living in these areas.

NB: It is important to note that an urban settlement is a *dynamic definition statistical unit*; the boundaries of an urban settlement will change depending on changes in population and building activity. This is in contrast to municipalities and even smaller basic statistical units, which in principal has a static definition, and where the boundaries *do not* change over time.

2.2 Land Use and Land Cover in Urban Settlements – A Pilot Project

Background

Because of better possibilities of combining register information and GIS systems and increasing interest for land use statistics during recent years, Statistics Norway has just started reconsidering land use statistics. In addition to general co-ordination and standardisation work, Statistics Norway will concentrate on developing land use statistics in urban areas and in the vicinity of urban areas (see chapter 2.5). The idea is to utilise geo-referenced and digitised information from the register for ground properties, addresses and buildings (see chapter 3.1), in combination with basic topographic information (digital vector data) and population statistics.

Project goals

The pilot project has set up the following goals:

1. Development and evaluation of methodology for *continuous* production of land use statistics
2. Evaluation of existing data sources
3. Produce land use statistics for some selected urban settlements
4. Proposal - new project - land use statistics for all urban settlements in Norway

The possibilities of more or less continuous and automatic updating procedures of urban settlement boundaries and main urban area land use classes will be investigated.

The pilot project is a methodological project that will concentrate on 7 selected areas. *Fredrikstad* (in the southern part of Norway) is the biggest area, with a population of about 50,000.

The aim of the project is also to test the possibilities for producing statistics for the following indicators:

1. Total area within the urban settlement
2. Total area per inhabitant
3. Size of ground properties for dwellings
4. Total built-up area
5. Area for transportation
6. "Green areas" - public parks, sports installations, forest

Data sources

The project will use data only from existing administrative systems and other established data sources (see chapter 3). It is also important that the data sources are automatically updated through well functioning routines.

Methodology

The geographical information system *NT Arc/Info* will be used for analyses and *ArcView* for presentation and map production.

Information from the GAB-system about land use for ground properties (on about 130,000 buildings and 112,000 ground properties from the GAB-system.) and the classification of buildings in addition to the digital Road Data Base (see chapter 3.5) will be used to generate land use statistics.

Classification of buildings in the GAB-system:

- building with dwelling
- industry, manufacturing
- commercials
- public institutions
- business services
- agriculture

Classification of ground properties in the GAB-system:

- dwelling properties
- holiday properties
- agricultural and forestry properties
- commercial/office
- industrial
- communication

The land use classification for a specific area will be based on the classification code for the ground property and the corresponding building(s) in the GAB-system. The classification system is derived from the ECE land use classification system.

Figure 2 - Urban settlement - classification of land use - example 1

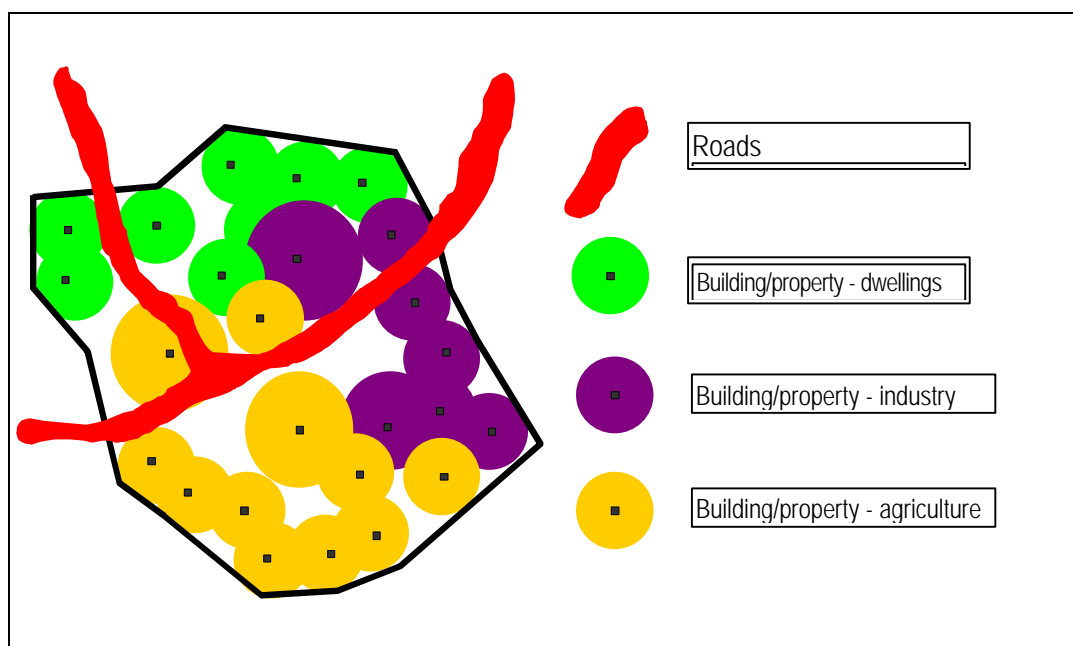
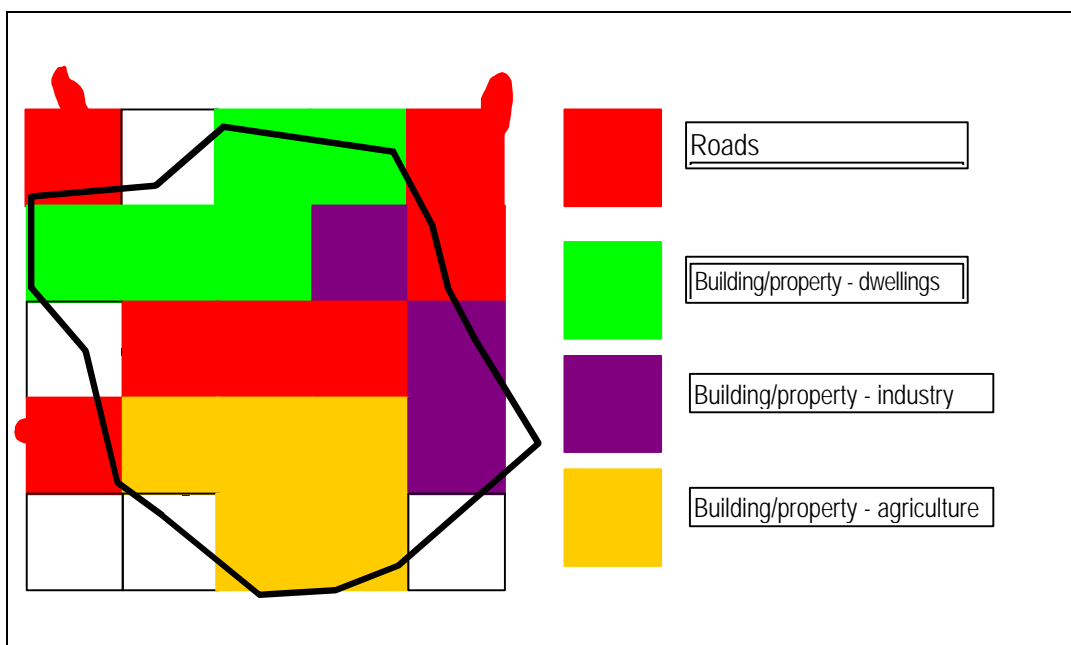


Figure 3 - Urban settlement - classification of land use - example 2



Standard overlay-techniques in NT Arc/Info will also be used to combine and compile information from the different data sources.

Status and schedule (plan)

The project was established in 1998, and will be finished in 1999. The objective is to develop a method that is applicable nation-wide. However, the quality of data-sources becomes better all the time (specially a register including landed properties) and thus the method will have to be further developed in the future.

Future aspects and further work include the following activities:

- evaluate the method and the quality of the data sources
- verify the results - data on land use statistics versus "actual" land use
- linking Land Use to economic activities
- build a Land Account system with link to the National Accounts (this will be in context to international work)

2.3 Environmental Indicators

For one Urban Settlement in southern Norway some Environmental Indicators were determined with use of Network Analyses in a GIS. Some of these indicators are listed below:

- The Population's accessibility to different Service Facilities like kindergarten, schools, post office, doctor office, local food-shop, bus-stop .
- The Population's accessibility to areas like playground, touring grounds like small areas (often parks inside the Urban Settlement and close to dwellings) and greater areas in the Vicinity of the Urban Settlement

The aim was to put a figure on how many of the inhabitants have walking-possibilities (500 m, 1000 m) along the road-network, to the different Service Facilities from their dwellings. In addition to the whole Population, there was made a corresponding exercise distributed on different groups of ages.

2.4 Centre/periphery - delimitation

Background

A new temporary law, which is adopted by the Norwegian Authorities, prohibits the establishment of new shopping-centres outside central business districts. Thus it became urgent to be able to define the term centre and Statistics Norway was engaged in this work.

Centre Characteristics

We have not found a clear definition of the term centre. Other institutions (both national and international) have done some efforts to determine centre-characteristics.

- diversity of land use
- intensity of use
 - high property value
 - high building density
- low resident population
- high turnover for retail- and entertainment uses
- visitor attraction
- publicly accessible floor-space
- high accessibility

Method

Combining administrative registers for buildings and industries and use of GIS, is the basic method. Use is also being made of the experiences from the Urban Settlement-Project to make an automatic method for delimitation of a centre. The first step of the method is to delimit possible centre-polygons. This is done by buffering buildings with certain functions (NACE-codes), and accept only small distances between the buildings. The second step is to overlay these polygons with industry-attributes and add up totals for turnover, employees, diversity in industrial classes. Finally a reselection of those polygons that fulfil a minimum of these characteristics are conducted.

The method gives interesting results, and the method will probably be further developed to give centre as a statistic unit in Statistics Norway.

2.5 Areas in the vicinity of Urban Settlements

Ongoing project

This project is a natural follow up on the work with delimitation of urban settlements. The areas adjacent to the urban settlements are under varying pressure for being taken into use for building purposes or in other ways being artificially sealed. This often in conflict between user purposes such as agriculture and recreation.

The purpose of the project is to develop a cost efficient statistical system that makes it possible to follow the development of areas adjacent to urban settlements.

In order to establish the statistical system, several data sources will have to be combined; GAB register, the Road Database, digital maps etc will be used.

2.6 Land Use and Economic Activity

Coming project

Co-financed project by EFTA/EEA

As a further development of the method for dividing urban settlements areas into land use classes, it is now started a pilot project for linking activity and economics to the land use. A link between the NACE nomenclature will be the first step. This project will be co financed by both the Ministry of Environment and Eurostat/EFTA.

2.7 Rural areas

Coming project

The objective of this project is to develop statistics in order to focus on regional processes and changes of land use for build-up and non build-up areas outside urban settlements. This can be development of smaller agglomeration of houses and population as well as changes of land due to agricultural activity or construction of cottages, roads etc. This statistics will, in addition to statistics for urban settlements yield a complete statistical tool for following total building activity and changes of land use.

3. Administrative Registers

3.1 GAB - Ground properties, Addresses and Buildings

GAB is an acronym (**G**round properties, **A**ddresses and **B**uildings) for the official Norwegian information system for real estate, addresses and buildings. The GAB-system was initiated in 1980 by the Ministry of Environment. The System is administrated by the Norwegian Mapping Authority. The system covers data about 2,3 million ground properties, 1,7 million address-units and 3,2 million buildings.

All the municipalities in Norway report to the system about changes concerning property boundaries, changes of addresses and building activity. The local court offices (approximately 100) report information about change of ownership and costs for properties and flats.

Table 1 shows the most important information in the GAB-system.

Table 1: GAB-system - most important information

	Identification info.	Location data	Descriptive data	Reference data
G <i>Ground properties</i>	Number	Coordinates (one point of representation) Municipality id. Basic unit id.	Owner - name and address Date of establishment Size of area Classification of land use	Key to the A and B register
A <i>Address units</i>	Number Name of road/street House number Secondary numbers	Coordinates (one point of representation) Municipality id. Basic unit id.	Information about situation related to constituency, school district, mailing address, etc.	Key to the G and B register

B Buildings	Number	Coordinates (one point of representation) Municipality id. Basic unit id.	Classification: <ul style="list-style-type: none"> • dwelling • industry • manufacturing • commercials • agriculture Year of construction Size Number of flats Number of floors Etc.	Key to the A and G register
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3.2 DSF - Central Population Register

This Register is the National Register from the Directorate of Taxes. It includes information of the population like Name, date of Birth, Address, municipality code, family-relation numbers etc. The Population Register is under contiguous updating.

3.3 BoF - Central register of Establishments and Enterprises

This register includes information of Norwegian Enterprises and their Establishments.

Establishments are normally defined as Local Kind of Activity Units. The register contains information like Establishment Unit Identification, address, Industrial code (NACE Rev. 1), Sector code (legal entity), number of Employees, turnover.

For the moment the addresses in the register of Enterprises and Establishments is not geo-referenced. A Pilot-project trying to link co-ordinated addresses (for one county) from the GAB-register to the register of Enterprises and Establishments concluding positive results, and it is expected that this exercise will be done

3.4 DMK – Digital Land Type Map

DMK - Digital Land Type (DLT). The Land Type maps of the Economic Map Series (EMS) are the database for assessing the quality and condition of agricultural land, forest land and other categories of land at a national scale. A Land Type is unambiguously defined with regards to condition of land, soil quality and site class.

Digital Land Types (DLT) contains segments of Land Types with digital borders and codes of properties attached to each separate figure. DLT is a basic product for planning purposes, analysis and presentation of details and survey planning. DLT can be used in Geographic Information systems for data processing (map production, visual presentations), data analysis (conflict and transport analysis), administration of natural resources in Information Systems and in combination with other databases (overlay).

3.5 VBASE - The Road Database

VBASE is a Road Database containing centreline of all roads extending 50 metres.

Information is organised in thematic groups by road category (European routes, state, county, district and private roads) and with attributes (bridge, tunnel, road barrier, snow-shed, level crossing and car-ferry). All European routes, state and county roads have an unique identity

connecting them to the data bank at the Public Roads Administration. The data are annually updated.

3.6 Other registers and land use statistics

DEK - Digital Property Map. This map includes land properties with geographic extent and other attributes, and is the digital/geographic expression on the Ground properties from the GAB register.

Basic topographic information

The Norwegian Mapping Authority produces basic topographic information as digital vector data. The project will use digital data adapted for presentation in scale 1:50.000 ("N50") and scale 1:250.000 ("N250").

The Norwegian Mapping Authority produces land use statistics on municipality level. The statistics cover the following subjects:

- total area
- area in different elevation levels (0-60 m a sea level, 60-160, 160-300, 300-600, ...)
- land area
- islands in sea - number of islands and area
- length of coastal line
- glaciers - number and area
- lakes (fresh water area) - number and area
- wooded land
- marsh area

The Norwegian Institute of Land Inventory (NIJOS) produces land use statistics on municipality level.

These data are not consistent, and the statistic products are based on different methods, standards and definitions, which generate several problems when combining data from different data sources.

References

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| Sæbø 1983 | Land use and environmental statistics obtained by point sampling. Hans Viggo Sæbø, Article 144. Statistics Norway, Oslo - Kongsvinger. |
| Rogstad 1996 | Land Use Statistics for Urban Settlements. Paper for the Eurostat Seminar Statistics, Baden, Austria, 6 - 8 March, 1996 |
| Schøning 1997 | Land use statistics for cities and urban settlements in Norway. Paper for the ECE Work Session on Geographical Information Systems (GIS) in Brighton, 22 - 25 September, 1997 |