STATISTICS DENMARK

Documentation of statistics for Land Accounts 2021

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STATISTICS DENMARK

1 Introduction

These statistics concern the size of the land area of Denmark, how it is covered and how it is used. Land cover estimates how Denmark is covered by roads, buildings, crops, forests, lakes etc. Land use estimates for what purpose the land area of Denmark is used, e.g. for housing, industry, trade, recreation etc. Land accounts are part of the the Environ-mental-Economic Accounts (Green National Accounts).

2 Statistical presentation

Land accounts has three parts. Denmark's area in square kilometers in total and by municipalities and regions, land by land cover and land use by industry. Land by land cover and land use by industry are stated in square kilometers, square meter per capita and in percentage of the total land area, geographically divided by provinces and regions.

2.1 Data description

Land accounts has three parts. Denmark's area in square kilometers in total and by municipalities and regions, land by land cover and land use by industry.

Denmark's area

These statistics show the size of Denmark's land area in total and by municipalities and regions, per 1st of January. As of 2011, these statistics are based on data from the Danish Geodata Agency's cadastral register. Only matriculated areas are included, which means that many lakes are not covered. For municipalities with un-matriculated lakes, the area will therefore be smaller compared with previous figures. Per 1 January 2011-2013, roads in Copenhagen and Frederiksberg are not matriculated and therefore not included in the measured area.

Land by land cover

Land by land cover is an estimate of how much of Denmark is covered by roads, buildings, agricultural crops, forest, different types of habitats, lakes, etc. Land by land cover is estimated based on the consolidation of several map sources. These statistics are published both as absolute figures (square kilometers), in percent and as square meter per capita.

Land use by industry

Land use by industry is an estimate of how much land is used for different purposes, i.e. housing, industry, trade, recreational facilities, etc. This is based on a number of administrative sources (registers) in combination with the land register. These statistics are published both as absolute figures (square kilometers), in percent and as square meter per capita.

2.2 Classification system

Land cover is classified based on UN's SEEA (System for Environmental-Economic Accounting), with some adaption for Danish context. An overview of the classification is available in this file arealdække_nøglefil.pdf.

Land use is classified based on UN's SEEA, but with modifications to harmonise to industry groupings used in Danish National Accounts.

The geographical classification is according to Danish administrative units by regions, provinces and municipalities. Area not part of the cadastral map is not assigned to the administrative level, and thus not included in municipalities.

2.3 Sector coverage

Land use by industry cover all sectors.

2.4 Statistical concepts and definitions

Land Use: The functional or socio-economic use of land, e.g. for dwellings, for production or for recreation.

Land Cover: The physical or biological surface

Built-up areas:

Buildings: Areas covered by buildings of all types. The source is Kort10.

Woody crops: Orchards, Christmas trees, etc. Does not include permanent extensive crops like grass.

Unclassified: Areas for which the sources do not have information on land cover, even after methods to remove small slivers of unclassified areas have been applied.

Agricultural crops: All agricultural crops, including permanent crops such as orchards and Christmas trees - as well as fallow.

Crops, unspecified: Areas covered by the field block map, but not covered by the field parcel map containing crop codes.

Herbaceous crops: All intensively grown, annual crops - like cereals, tubers, vegetables, seeds etc.

Other artificial surfaces: Contains the 2 subcategories of land cover: 'parks, sports facilities and recreational areas', and 'pits and quarries'.

Parks, sport facilities and recreational areas: Areas with public access used mainly for recreational purposes. Includes burial sites, camping grounds, zoological gardens, amusement parks etc.

Permanent grass and other extensive crops: Permanent grass, fallow as well as fields that are left unplowed for environmental protection purposes. The technical report lists all the crop codes which are classified as extensive.

Forest: Area covered with trees. Christmas trees and orchards are not included, these are classified as 'woody crops'. Also lakes, streams, bogs, unpaved road etc. inside forests are classified as respectively lake, stream, bog etc. as these map layers take priority in BASEMAP03.

2.5 Statistical unit

Land cover is classified by 10×10 meter raster cells.

Land use is classified by land parcels in the Cadastre. The unit is however 'shares of land parcels', as the area of a parcel is distributed to several uses, if there are more than one registered use (as described under 'Statistical processing').

2.6 Statistical population

Land area of Denmark

2.7 Reference area

Denmark (Greenland and the Faeroe Islands are not included).

2.8 Time coverage

Denmark's area cover the time period from 2007 and onwards.

Land by land cover is estimated for 2011, 2016, 2018 and 2021.

Land use by industry is estimated for 2016.

2.9 Base period

Not relevant for this statistics.

2.10 Unit of measure

Figures are published in sqaure kilometres, percentages as well as square meter per capita.

2.11 Reference period

The reference time differs slightly for the different source maps used for the land cover account. In all cases, the newest map available mid 2022 has been used. See more under 'sources'. For land use (2016), the reference time is registers as of 1 Jan 2016.

2.12 Frequency of dissemination

The accounts do not have a regular frequency, but have been published every 2-3 years.

2.13 Legal acts and other agreements

All data are from registers or public data. There is no separate data collection for this statistics.

There is no EU regulation for this statistics.

2.14 Cost and burden

The statistics are based on already available data sources and registers. Therefore, there is no direct response burden.

2.15 Comment

For more information contact Statistics Denmark directly.

STATISTICS DENMARK

3 Statistical processing

The land cover accounts have been produced from consolidating a number of source maps, all of which shows aspects of Danish land cover. All the maps have been overlaid using GIS techniques and aggregated into one map. The main part of the GIS-related work has been carried out by DCE, Århus University.

The land use accounts have been produced by combining the Cadastral map with the registers on buildings, dwellings, businesses, municipal plans etc. The classifications from the registers have been combined and prioritized to create the classification of land by land use.

3.1 Source data

The compilation of statistics on land cover is based on a several maps on land coverage. The maps are all produced outside Statistics Denmark and are used for a variety of administrative purposes. Sources are:

- GeoDanmark - a Danish topographical map, maintained by the municipalities and the Agency for Data Supply and Infrastructure.
- The Danish Cadastral Map from the Danish Geodata Agency
- Fields and field blocks, an agricultural map from the Danish Agriculture Agency.
- Management plans state forests
- Management plans Danish Defense
- Map of Natura2000 habitat types
- Map of protected habitat types

For land use, the sources used are:

- The Danish Cadastral Map from the Danish Geodata Agency
- The Danish register of buildings and dwellings
- The Danish register of businesses, as well as the register of agricultural establishments
- The civil registry
- Municipal plans
- The Danish Tax authorities register on properties

Number of inhabitants is from FOLK1A as of 1 Jan.

3.2 Frequency of data collection

Statistics Denmark does not collect primary data for these accounts. The sources for the land cover accounts have their own, separate update frequencies, independent of the statistical use. Land use is based on registers/data already in Statistics Denmark.

3.3 Data collection

No separate collection of primary data for this statistics. Data has been downloaded from other public authorities.

3.4 Data validation

Land cover: As the source maps are put together and overlaid, a number of corrections and filterings are done to remove inconsistent geometrical features. For instance when different sources have slightly different mappings of the same lake or other feature. Also small 'slivers' created in the overlaying of maps are removed. All the corrections and manipulations of the source maps are documented in details and with illustrations in the technical report.

Land use: Data has been validated throughout the process of developing the method for classification of land use based on registers. This includes plausibility checks of results for land where use is well-known, as well as checks of relative sizes of different uses, in relation to each other as well as in relation to employment.

3.5 Data compilation

Land cover: First, data are collected, i.e. downloaded from a number of sources (se 'sources'). Then the many source maps are put together through GIS techniques. This part of the processing is done by DCE, Århus University and documented in a technical report. Statistics Denmark receives data as one consolidated map of land cover. Then the map data are aggregated to tables by land cover category and geographical regions. Finally, calculations of shares (percentages) and areas per capita by regions are done.

Land use: Data on land use from the registers have been linked to land parcels through coordinates of addresses, and in some cases other GIS-techniques. The result is a data set where each parcel is assigned one or more land uses - a number of parcels have no uses registered. In the cases of more than one use for one parcel, the area is distributed between different uses (e.g. dwelling and business, or two different kinds of business) using information from the buildings register (when applicable, otherwise, equal distribution is assumed). The largest parcels (>5 km²) are classified in a manual process. Finally, data are aggregated from the detailed use information to the land use classes used for publication.

3.6 Adjustment

No corrections are made besides what is described under statistical processing and data treatment.

4 Relevance

The land accounts are relevant for users interested in how Danish land is used, and how this changes over time - including analyses of how different land covers and land uses may compete as demand for more urban land or more protected nature will have to mean less of other uses.

4.1 User Needs

The users of the land accounts are experts in government, administration, organisations, research etc., as well as citizens interested in environment, economy and the linkages between them.

STATISTICS DENMARK

4.2 User Satisfaction

The land accounts have been presented for selected users during the development, mainly at meetings in the Committee of experts for environmental-economic accounts and statistics (only in Danish). This will continue, so the committee will be used to collect information about how users' evaluate the land accounts now that they have been published.

4.3 Data completeness rate

There are no requirements from EU regulations for this statistics.

5 Accuracy and reliability

The statistics are well documented and transparent, building on all relevant map sources for the land cover of Denmark. Quality of the land use accounts is considered to be good, but the uncertainties are bigger than for the land cover. This is because the method is new and these accounts are the first published of their kind. As for many other statistics, the higher level of detail, the higher the uncertainties.

5.1 Overall accuracy

No quantitative assessment of the accuracy has been made. The statistics are based on all relevant map sources for the land cover of Denmark. The quality is thus inherited from the sources: the Danish topographical maps, the field map, the habitat mapping by the municipalities etc.

At the level of detail used for publication, accuracy is assumed to be high. As for many other statistics, the higher level of detail, the higher the uncertainties.

5.2 Sampling error

Not relevant for these statistics.

5.3 Non-sampling error

Land cover: Measurement error in the land cover account stems from the original map sources. The methods used to consolidate the source maps reveal some measurement errors - and, to some extent, corrects them. The significance of measurement errors for the final accounts is assessed to be minimal. The most significant errors are associated with the comparison between 2011/2016/2018 and 2021. Is is difficult to do such comparison without measuring many 'changes' that are not real, but caused by improved mapping techniques etc. The method applied accounts for this by 'filtering out' some apparent changes, with the risk of underestimating changes from 2011 to 2021. Details on the method are available in the technical report, published by DCE.

Land use: There is an error source in the distribution of land in cases where one parcel has more than one use. The distribution is done using a simple model, which will not always reflect actual distribution of land use on the parcel.

5.4 Quality management

Statistics Denmark follows the recommendations on organisation and management of quality given in the Code of Practice for European Statistics (CoP) and the implementation guidelines given in the Quality Assurance Framework of the European Statistical System (QAF). A Working Group on Quality and a central quality assurance function have been established to continuously carry through control of products and processes.

5.5 Quality assurance

Statistics Denmark follows the principles in the Code of Practice for European Statistics (CoP) and uses the Quality Assurance Framework of the European Statistical System (QAF) for the implementation of the principles. This involves continuous decentralized and central control of products and processes based on documentation following international standards. The central quality assurance function reports to the Working Group on Quality. Reports include suggestions for improvement that are assessed, decided and subsequently implemented.

5.6 Quality assessment

The statistics are well documented and transparent, building on all relevant map sources for the land cover of Denmark. The quality is thus inherited from the sources: the Danish topographical maps, the field map, the habitat mapping by the municipalities etc. At the level of detail used for publication, accuracy is assumed to be high. As for many other statistics, the higher level of detail, the higher the uncertainties. An important strength of the land cover account is that it is a consolidated map, meaning that each area (10 x 10 meter cell) is assigned to just one land cover type. An expert assessment have defined the priorities used when the source maps are conflicting. The methods and assumptions made are documented in the technical report from DCE, as it is researchers from DCE that have delivered the expert assessments as well as the technical implementation.

The method is well documented, but it is also a newly developed method and there are few ways to assess the quality through comparisons (to earlier data or to other countries, as few countries have similar accounts yet). The data sources have very good coverage, but sometimes the data sources are conflicting and expert judgements have been made to prioritize between them. There is also an uncertainty stemming from the geo data not always having same reference.

5.7 Data revision - policy

Statistics Denmark revises published figures in accordance with the Revision Policy for Statistics Denmark. The common procedures and principles of the Revision Policy are for some statistics supplemented by a specific revision practice.

5.8 Data revision practice

Land use accounts have only been published once, so there have been no revisions. It has not been decided if there will be revisions along with (eventual) future publications.

Land cover accounts have been published four times - with the second, third and fourth publication the full time series have every time been revised to ensure comparability.

STATISTICS DENMARK

6 Timeliness and punctuality

Statistics on the size of Denmark's land area is published by the end of February, in the year following the reference year. On the other hand, land by land cover and land use by industry do not have a fixed publishing rhythm, but have so far been published at years intervals. These statistics are published without delay, with reference to the announced time of publication in the release calendar.

6.1 Timeliness and time lag - final results

Land accounts do no have a set publication schedule but have been published every 2-3 years. There is no established practice for final data, but developments of methods and sources will likely mean future revisions of published data.

6.2 Punctuality

These statistics are published without delay, with reference to the announced time of publication in the release calendar.

7 Comparability

The land cover accounts is fully compatible between2011, 2016, 2018 and 2021. Compatibility with older statistics on land cover is limited, as there have been major changes to sources as well as methods. Land use has so far only been measured for one reference year.

7.1 Comparability - geographical

The land accounts have been designed to be internationally compatible, by following the guidelines in System of Environmental-Economic Accounting - the UN statistical standard. The accounts are not fully comparable with Eurostat (LUCAS) data on Danish land cover, as these are based on different sources and methodology.

7.2 Comparability over time

The land cover accounts for 2011, 2016, 2018 and 2021 are fully compatible. The 2011, 2016 and 2018 maps have been constructed with compatibility in mind, using methods to clear out changes caused purely by technical reasons. The methods for this are documented in the technical report.

7.3 Coherence - cross domain

There are important differences between the land cover accounts and the land covered with forest as measured in the National Forest Inventory. These differences are discussed and described in quantitative terms in the technical report on BASEMAP04, in the section on tree cover.

The industry groups are the same as in the National Accounts, making it possible to compare land use to e.g. production or employment using National Accounts data.

STATISTICS DENMARK

7.4 Coherence - internal

Full internal consistency within, respectively, the data set for land cover and the data set for land use. This is a defining characteristic of the land accounts for land cover, that all the source maps have been consolidated to construct one single map, where all land is assigned to exactly one category of land cover.

The two data sets (land cover and land use) are not fully consistent with each other, as they are created from different sources and with different methods. Read more under 'accuracy and reliability'.

8 Accessibility and clarity

Statistics on the size of Denmark, land by land cover and land use by industry are published in the StatBank under Area and Natural ressources. Furthermore, Land accounts is part of the Environmental-Economic Accounts (Green National Accounts).

8.1 Release calendar

The publication date appears in the release calendar. The date is confirmed in the weeks before.

8.3 User access

Statistics are always published at 8:00 a.m. at the day announced in the release calendar. No one outside of Statistics Denmark can access the statistics before they are published.

8.2 Release calendar access

The Release Calender can be accessed on our English website: Release Calender.

8.4 News release

Land by land cover and land use by industry are published in two separate Danish press releases.

8.5 Publications

The Land Accounts are included in publication on Green national accounts, accessible through dst.dk/groentnr

8.6 On-line database

The statistics are published in the StatBank in the following tables:

- AREALDK: Land by land cover, region and unit
- AREALAN1: Land use by industry group, region and unit
- ARE207: Area 1. January by region

8.7 Micro-data access

Micro-data can be made available to researchers through Statistics Denmark's researcher service (relevant only for the land use accounts).

8.8 Other

The source map of land cover (BASEMAP04) is available through the website of DCE.

8.9 Confidentiality - policy

Statistics Denmarks general policy on data confidentiality (in Danish only).

8.10 Confidentiality - data treatment

No measures have been necessary, as the statistics are created from source data which are publicly available.

8.11 Documentation on methodology

The land cover account has been produced with technical and expert support from DCE, Århus University. Their work is documented in Levin, G. (2022): Basemap04 - Documentation of the data and method for the elaboration of a land-use and land-cover map for Denmark. Aarhus University, DCE - Danish Centre for Environment and Energy, 80 pp. Technical Report No. 252..

8.12 Quality documentation

Results from the quality evaluation of products and selected processes are available in detail for each statistics and in summary reports for the Working Group on Quality.

9 Contact

The administrative placement of these statistics is in the division of National Accounts, Climate and Environment, Economic Statistics. The contact person is Michael Berg Rasmussen, tel.: + 45 5146 2315, and e-mail: MBR@dst.dk.