

**Documentation of statistics for
Land Accounts 2016**

1 Introduction

The Land Accounts are part of the Green National Accounts. They were first published in 2017. The purpose is to account for changes in land cover and land use in Denmark.

2 Statistical presentation

The Land Accounts cover two dimensions: land cover and land use. Land cover is about how much of Denmark is covered by infrastructure, buildings, crops, forests, different habitat types, lakes, etc. Land use is about how much land is used for different purposes, such as housing, trade, manufacturing, recreational facilities, agriculture etc. Land cover is accounted for at two points in time: 2011 and 2016, based on a consolidation of a number of map sources. Land use has so far only been accounted for in 2016. The Land Accounts are published in News from Statistics Denmark in aggregates, as well as in detailed form in the StatBank (including a regional dimension).

2.1 Data description

The Land Accounts describes land cover, i.e. how much of Denmark is covered by roads, buildings, crops, forests, different habitat types, lakes, etc. Land cover is accounted for at two points in time: 2011 and 2016, based on a consolidation of a number of map sources. The Land Accounts also describe land use, i.e. how much of Denmark is used for different purposes such as housing, trade, manufacturing, recreation, agriculture etc. Land use has only been accounted for in 2016, based on a number of administrative sources (registers) and the cadastral map. The accounts are published in absolute figures (square kilometres), in shares (percentages) and as area pr. capita.

2.2 Classification system

Land cover is classified based on UN's SEEA (System for Environmental-Economic Accounting), with some adaptations for Danish context. An overview of the classification is available [here](#).

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 NUTS 1, 2 and 3. Further details [here](#).

2.3 Sector coverage

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

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

Built-up areas:

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.

Windmill parks: This land cover category in the table AREALDK1 covers only areas of windmill parks, that are not simultaneously classified as agricultural crops.

Other artificial surfaces: Contains the 3 subcategories of land cover: 'parks, sports facilities and recreational areas', 'windmill parks' and 'pits and quarries'.

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

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

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

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

Forest and other tree-covered area: Area covered with trees. Christmas trees and orchards are not included, these are classified as 'woody crops'.

Open dry habitats: Heathers, dunes, etc.

Open wet habitats: Meadows, bogs, etc.

Unmapped: 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.

2.5 Statistical unit

Land cover is classified by 10x10 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

The population is the total area in the Danish cadastre, as of 1 Jan 2016.

2.7 Reference area

Denmark, defined as the Danish land area registered in the Danish Cadastral Map. Areas not registered in the Cadastre are thus not included - this is mainly some lakes as well as areas along the coast. It is an important difference between the land accounts and the land cover map that the accounts cover only the total area from the cadastral map. This facilitates comparisons over time, as well as linking the accounts to other data through the Cadastre. The area not covered by the cadastral map is mainly covered by lakes, but also some areas of open habitats along the coast are outside.

2.8 Time coverage

2011 and 2016. For land use, only 2016.

2.9 Base period

Not relevant for this statistics.

2.10 Unit of measure

Figures are published in square kilometres, percentages as well as square metres per inhabitant.

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 2016 has been used. See more under 'sources'.

2.12 Frequency of dissemination

The land cover accounts have been produced and published for 2011 and 2016 at the same time (Feb 2017). It has not been decided if, or how often, it will be published for new reference 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

The statistics are available through a [subject page](#).

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

Opgørelsen af arealdækket er baseret på en række kilder i form af kort, der belyser forskellige arealdækker. Kortene er alle produceret uden for Danmarks Statistik, og bruges til en række administrative formål. Det drejer sig om:

- [Kort10](#) which is the Danish topographical map, maintained by the municipalities and the Danish Geodata Agency.
- [The Danish Cadastral Map](#) from the Danish Geodata Agency
- [Fields and field blocks](#), an agricultural map from the Danish AgriFish 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

The source material for land cover (the maps mentioned under 'sources') have been collected once, mid 2016, for the reference year 2016. 2011 sources were collected in 2011/12 by DCE. The sources 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. Some corrections are then done, to allow for comparability to the land area of the cadastral map. 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

For 2011 a correction has been made to the data. This is required because the roads in Copenhagen, as well as a number of lakes in different parts of the country, were not part of the Cadastral Map in 2011 - but are included in the 2016 Cadastral Map. To make the data from the two years comparable, the 2011 data have been corrected by adding area, corresponding to the additions to the Cadastral Maps.

4 Relevance

The land accounts have been presented for selected users during the development, mainly at meetings in the [User committee for environmental-economic accounts and statistics](#).

4.1 User Needs

The expected 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.

4.2 User Satisfaction

The land accounts have been presented for selected users during the development, mainly at meetings in the [User committee for environmental-economic accounts and statistics](#). 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

Quality of the land cover accounts is considered to be high. 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

Sample-based error is zero, as there is no sampling

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 and 2016. It 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 2016. 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

Quality of the land cover accounts is considered to be high. 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 metre 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.

Quality of the land use accounts is considered to be good. 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

The statistics 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.

6 Timeliness and punctuality

The land accounts have been published in two steps, in February (land cover) and May (land use) 2017.

6.1 Timeliness and time lag - final results

Only final figures are published for land cover, approx. six months after the end of the reference time. Land use has been published for the first time in May 2017, using a newly developed method. It can therefore be expected that future developments in methods and quality assurance may lead to revisions in the published data.

6.2 Punctuality

Not calculated, as there has been only two publications (both on time as scheduled).

7 Comparability

The land cover accounts is fully compatible between 2011 and 2016. 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.

7.2 Comparability over time

The land cover accounts for 2011 and 2016 are fully compatible. The 2011 map has 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 (link to be inserted).

7.3 Coherence - cross domain

The land accounts are fully compatible with the statistics on areas by region, as published in the StatBank table ARE207 for the year 2016. For 2011, it is not compatible - the 2011 figures from ARE207 have not been used, as the roads in Copenhagen are excluded. For 2011, in the accounts, the 2016 area has been used instead. This is based on the assumption that changes are from administrative changes in the cadastre, not reflecting actual changes to the total land area.

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.

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 (cover and 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

The Land Accounts are published in News from Statistics Denmark, the StatBank and as part of the book on the green national accounts (March 2017). The land accounts are part of the subject page for [natural resources](#).

8.1 Release calendar

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

8.2 Release calendar access

The Release Calendar can be accessed on our English website: [Release Calendar](#).

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.

8.4 News release

News from Statistics Denmark, published 6 Feb (Land cover) and 16 May (Land use) 2017, only in Danish, available from [this page](#).

8.5 Publications

The Land Accounts are part of the March 2017 [publication on the Green National Accounts for Denmark](#). An updated and English version of this book will be published early 2018. The Land Accounts are also included in the next issue of the Statistical Yearbook (June 2017).

8.6 On-line database

The statistics are published in the StatBank under the subjects [Natural resources](#) in the following tables:

- [AREALDK1](#): Land by land cover, region, unit and time
- [AREALAN1](#): Land use by industry group, region, unit and time

8.7 Micro-data access

Micro-data can be made available to researchers through Statistics Denmark's researcher service.

8.8 Other

The land accounts are part of a project to establish full green national accounts for Denmark. This project has its own [webpage](#).

The map of land cover will be made available through the website of DCE in 2017.

8.9 Confidentiality - policy

Statistics Denmark's 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., Iosub, C.-I. & Jepsen, M.R., 2017, [Basemap02. Technical documentation of a model for elaboration of a land-use and land-cover map for Denmark - Technical Report from DCE - Danish Centre for Environment and Energy No. 95](#)

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

Administratively, the statistics belongs to the unit National Accounts. The contact person is Ingeborg Vind, +45 3917 3328, inv@dst.dk

9.1 Contact organisation

Statistics Denmark

9.2 Contact organisation unit

National Accounts, Economic Statistics

9.3 Contact name

Ingeborg Vind

9.4 Contact person function

Responsible for the statistics

9.5 Contact mail address

Sejrøgade 11, 2100 Copenhagen

9.6 Contact email address

inv@dst.dk

9.7 Contact phone number

+45 39 17 33 29

9.8 Contact fax number

+45 39 17 39 99