Copernicus Land Monitoring Services – Netherlands (CopNL Land II)

Inventory of Land Use Attributes and Landscape Characteristics

Technical project The Netherlands

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Project report:

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Date 17 October 2019

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[1] Wageningen Environmental Research is an institute within the legal entity *Stichting Wageningen Research,* (a foundation under Dutch private law).

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CONTENTS

1 Introduction

This report is based on the work done by WENR as described in the technical proposal that was provided as answer to the Request for Services- Framework Service Contract No EEA/IDM/16/009/Netherlands. This service specific contract (No. 3436/R0-COPERNICUS/EEA.57676) was the second Dutch contract for the Copernicus Land monitoring services – NRCs LC (National Reference Centres for Land Cover) Copernicus supporting activities for the period 2017-2021.

The report deals with task VI (Support and testing of future CLC+ (2nd generation CLC methodological improvements and developments) based on CLC2018 products) as identified under section 6.2 of the Tender specifications for the Framework Service Contract (FSC). Primary focus is being to create an inventory of Land Use (LU) information and other landscape characteristics (CH) available at country level.

One of the deliverables as defined in the technical proposal is this technical report. Next to the report, an Excel table containing the Dutch inventory results of Land Use Attribute (LUA) information and other landscape characteristics (CH) available at national level is another deliverable of the project.

The specific contract is implemented by the Dutch NRC Land Cover which is Wageningen Environmental Research. Persons involved were Maarten Storm, Marian Vittek and Gerard Hazeu.

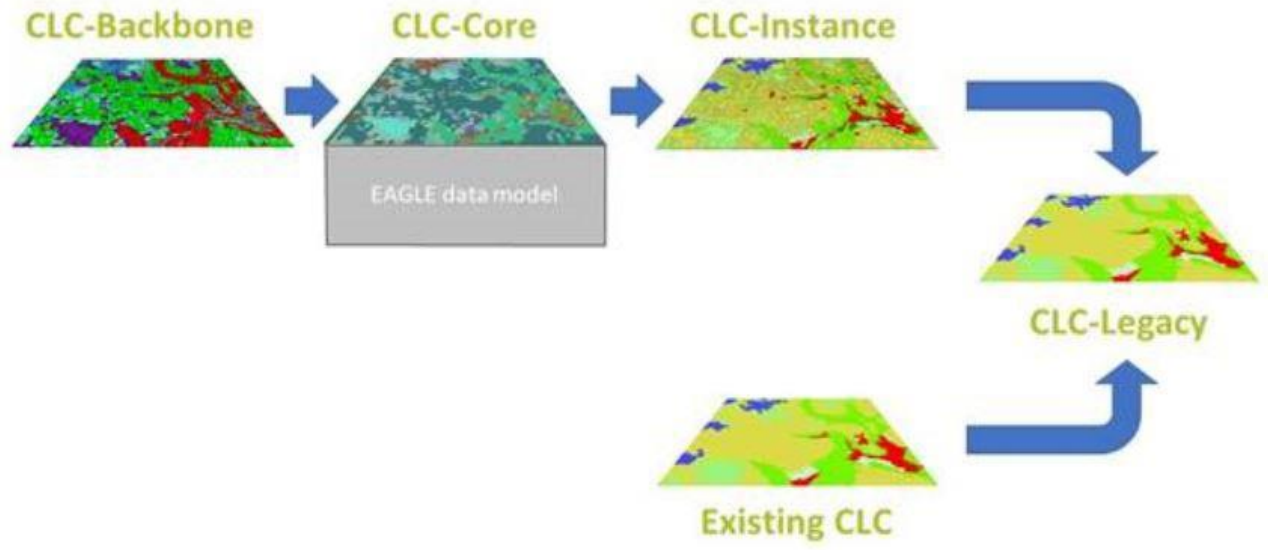
2 Project scheme

2.1 Problem definition

The inventory is a step required in advance of populating CLC-Core developed within the "2nd generation CLC" and under the banner of CLC+ product suite. CLC-Core is a consistent multi-use GRID[1] database repository with a geometric detail of 1.0 ha MMU, 100 m x 100 m grid size for environmental land monitoring information populated with a broad range of land cover, land use and ancillary data from the CLMS and other sources, forming the information engine to deliver and support tailored thematic information requirements. CLC-core is an all-in-one data container for environmental land monitoring information according to the EAGLE data model. Update cycles are dynamic and can happen as new information becomes available. The input data will come from several sources, namely, CLC-Backbone, all available HRLs, hotspot monitoring products, ancillary data, national data provisions (e.g. LU), photointerpretation.

The CLC-Core product should be seen as an underpinning, semantically and geometrically, harmonized "data container" and "data modeller" that holds, or allows referencing of, land monitoring information from different sources in a grid-based information system. The grid as a spatial model consists of square spatial units of uniform size and shape that can have an (internally) heterogeneous thematic composition, i.e. the grids are "geometrically uniform polygons". Each grid cell has a unique ID that is related to a database containing the attribute data.

The role of Member States, as stated on pages 14 to 15 of the technical specifications for implementation of a new land-monitoring concept based on EAGLE[2], clearly points to the need to populate CLC-core with national datasets containing land use information and other landscape characteristics.



The thematic content of CLC-Core should include the elements needed to derive CLC-Instances (as one implementation of the CLC+ product suite) and CLC-Legacy, as depicted in the image shown below showing the interlinked elements required for improved European land monitoring (2nd generation CLC) which has to be able to ensure a possible maximum of backwards compatibility with standard CLC data.

[1] A data structure whose grid cells are linked to a data model that can be populated with the information from the different sources

[2] https://land.copernicus.eu/user-corner/technical-library/upcoming-product-clc

For the sake of harmonization of country replies, the strategy for collecting information about available datasets at national level containing LUA and CH information relies on the Land Use Attributes and Other Characteristics components of the EAGLE matrix. The collection of national information in an harmonised way is needed to produce e.g. the CLC-legacy and to elaborate strategies to overcome existing gaps.

2.2 Background

WENR has a long standing tradition in land cover and land use mapping. Since 1986 at regular intervals of 3-5 years an update of the national land use/cover database was produced. The database is a grid database of 25m×25m reflecting the land use/cover for 39 classes. Today there are eight versions of the LGN database (LGN1-LGN7 and LGN2018) based on satellite imagery, topographical data (Top10vector/Top10NL), and land use statistics from the Office of Statistics (CBS). Specific attention is given to agricultural and semi-natural areas. LGN2018 is thematically and spatially (5mx5m) more detailed than its predecessors. The dataset is based on the integration of several national datasets like, in addition to the already mentioned datasets, national height model, national LPIS system, national land use database (BBG2015).

Since the beginning of CORINE Land Cover (CLC) in the nineties we are involved in the production of all CLC versions (CLC1990, CLC2000, CLC2006, CLC2012 and CLC2018). Also we were involved in the verification of various HRL with reference years 2012 and 2015, Hotspot Components (Urban Atlas, Riparian Zones) and the enrichment of Urban Atlas 2012.

WENR is also one of the active partners in the EAGLE consortium which is developing the specifications for a new European land monitoring system. This second specific contract has, as stated above in section 2.1, the aim to make an inventory of LU and CH within the EEA countries so the future CLC-core can be fed with LU and CH data harmonised according to the EAGLE nomenclature.

2.3 Results of CopNL Land II project

The final result of this specific contract is :

1. An excel table containing the land use and other characteristics availability at national level that matches the EAGLE LU and CH + resource description conform the template delivered by the EEA
2. A final report

3 Activities

3.1 General phases

All activities that took place in this 2nd specific contract fall under task VI (Support and testing of future CLC+ (2nd generation CLC methodological improvements and developments) based on CLC2018 products) as identified in the tender specifications for the Framework Service Contract (FSC).

The following three different phases were identified:

1. Inventory of spatial datasets
2. Matching national data with EAGLE nomenclature
3. Final report

3.2 Inventory of spatial datasets

The first step in this specific contract was the inventory of datasets. Hereby the focus was on the following:

- What are the (potential) national spatial datasets with relevant information in relation to the land use attributes (LUA) and landscape characteristics (LC) according to the EAGLE nomenclature as presented in the Excel Table delivered by EEA?
- What are the most important national datasets (ranking)?

As the Netherlands is a country rich in spatial data it is difficult to check all data sources. For that reason we followed a stepwise approach. We started screening the data sources that are designated as INSPIRE datasets[3], national data sources available in CORDA[4] and the national datasets falling under the "Basisregistraties" (datasets with legal status). Also we had a look at the other datasets registered in the National GeoRegister (NGR) (www.nationaalgeoregister.nl) and available under "Publieke Dienstverlening Op de Kaart" (PDOK) (www.pdok.nl). Primarily we focussed on the datasets having information on the obligatory LUA and LC.

Next to the screening we made a kind of "light" ranking of the datasets. Primary focus was on datasets containing the "CLC-Legacy compulsory elements". Furthermore we avoided spending time to find and screen datasets that contain relative limited information, that are difficult to access (not open/free), outdated or not regularly updated. So the matching of national information with the EAGLE nomenclature focussed on datasets containing the "CLC-Legacy compulsory elements" and on those datasets that are open, have a long history, have frequent updates, and contain recent information.

3.3 Matching national data with EAGLE nomenclature

The most important phase within this specific contract was the filling of the Excel table sheets EAGLE LUA, EAGLE CH and Resource description.

The EAGLE LUA sheet is an extract of the Land Use attributes section of the EAGLE matrix where LU attributes are organised in four nested levels. Each level contains a check box that is checked with Yes/No whenever an existing national dataset contains information regarding the LU attribute. It is followed by the Resource title (or code) of the dataset which makes the link to another sheet (Resource description) containing the description of the national dataset. And the third box is the box in which the relevant class(es), field(s) and/or attribute(s) of the national datasets are filled in.

The EAGLE CH sheet contains the landscape Characteristics section of the EAGLE matrix and is also organised in four nested levels. Each level contains a check box that is also be checked with Yes/No whenever an existing

[3] http://inspire-geoportal.ec.europa.eu/tv_home.html

[4] https://corda.eea.europa.eu/

national dataset contains information regarding the CH attribute. It is followed by the Resource title (or code) which makes the link to another sheet (Resource description) containing the description of the national dataset. The third box is the box in which the relevant class(es), field(s) and/or attribute(s) of the national datasets are filled in.

In the Resource description sheet the national data sources containing relevant information are registered. The registration is done according to a template containing the following fields:

- Resource title
- Resource abstract
- Temporal extent
- Update frequency
- Language
- Coverage
- CRS (Coordinate Reference System)
- Representation type (vector, raster, tabular)
- Format (e.g. GDB, ESRI shapefile, SQLite, etc.)
- Spatial Resolution (Scale or grid size)
- MMU (Minimum Mapping Unit)
- INSPIRE theme (extracted from annexes 1, 2 and 3 of the INSPIRE directive)
- Access conditions
- Proliferation in CLC+ instances allowed?
- Data costs
- Resource locator (URL)
- Resource provider
- INSPIRE locator
- CORDA locator (URL of CORDA if the resource is made available through CORDA)
- Comments

Some of the fields of the Resource description sheet are filled with fixed/predefined values as defined in the "Look up table" that was provided as Annex A together with the Request for Service.

3.4 Final report

The report which you have at hand is next to the Excel file (Annex A) one of the outcomes of the project. It contains main findings of the inventory (missing national information, interpretation issues etc.), explanatory notes related to the Excel table and raise other additional relevant issues.

4 Results and discussion

4.1 Inventory of spatial datasets

A complete list was made of all relevant national **spatial** data with focus on the obligatory LUA and LC available. This list contained datasets from INSPIRE, CORDA, "Key Registries" (datasets with legal status), National GeoRegister (NGR) dataportal and available under "Publieke Dienstverlening Op de Kaart" (PDOK). Focus was on datasets containing the "CLC-Legacy compulsory elements" and on those datasets that are open, having a long history, frequent updates, sufficient spatial and thematic detail and contain recent information. E.g. for this reason all European datasets were not taken into account. The only exception is the 'EEA Ecosystem types of Europe' that we mentioned under the EAGLE LC 'Ecosystem Types'. We are doubting about the usefulness of this dataset, however, we do not know of any alternative.

The following 8 Dutch datasets used were ranked on basis of the longstanding history, actuality, update frequency, level of spatial detail and the thematic information. For more information on the datasets we refer to the Excel Table.

Resource title	Temporal extent	Update frequency	Spatial Resolution (Scale or grid size)
Basisregistratie Topografie (BRT) - TOP10NL	2019	5x / year	1:10.000
Basisregistratie Grootschalige Topografie (BGT)	2019	daily / half year	~1:1.000
Basisregistratie Adressen en Gebouwen (BAG)	2019	daily	~1:1.000
Basisregistratie Gewaspercelen (BRP)	2019	yearly	1:10.000
Natura2000	2018	if needed	1:10.000
Ramsar	2016	if needed	1:10.000
CBS Basisbestand Bodemgebruik (BBG)	2015	Every 2 or 3 years	1:5.000 – 1:20.000
LGN2018	2018	Yearly	5m*5m

In the enrichment of the Urban Atlas 2012 dataset with national land use data we used 'Bestand BodemGebruik 2012 (BBG2012)' for the enrichment of Urban Atlas polygons with national land use data. We converted the BBG land use classes to LUA. On basis of the BBG classes we could link them to a total of 16 LUAs at level 1 and 2. More information about the link between BBG classes and LUA's we refer to the final Dutch MS reporting of the first Copernicus FSC. Important considerations to use BBG2012 in the enrichment task were wall-to-wall coverage concerning land use for reference year 2012. Also BBG is the Dutch INSPIRE dataset on land use. In this assessment we also used BBG as national data source (version BBG2015), however the information is less recent and not yearly updated in contrary to the Top10NL, BAG and BGT datasets. Although for specific EAGLE LUAs/LCs it can have, in addition to the other more recent datasets, additional information.

The following feature classes of the BRT/Top10NL, BRT and BAG datasets were used.

BRT/Top10NL	Functioneel gebied, Gebouw, Geografisch gebied, Inrichtingselement, Plantopografie, Spoorbaandeel, Terrein, Waterdeel, Wegdeel
BGT	Functioneel gebied, Kunstwerkdeel, Overig bouwwerk, Spoor, Wegdeel
BAG	Verblijfsobject

4.2 Matching national data with EAGLE nomenclature

4.2.1 Land Use Attributes (LUA)

The inventory was preliminary focussed on the obligatory LUAs that are masked green in the Excel sheet. It are the following LUAs ranked according to the hierarchy levels:

- Level 0:
  - Industries

    - Residential
- Level 1:
    - Commercial Services
    - Financial, Professional and Information Services
    - Accommodation and Food Services
    - Community Services
    - Cultural, Entertainment and Recreational Services
    - Logistics and Storage
    - Utilities
    - Nature Protection
- Level 2:
    - Farming Infrastructure
    - Surface Mining
    - Salines
    - Sports Infrastructure
    - Open Recreational Areas
    - Other Recreational Services
    - Road network
    - Railway network
    - Air transport
    - Water transport
- Level 3:
    - Cemetery
    - Dump sites
- Level 4: none

In the above list the green, yellow and turquoise coloured markings indicate which LUAs are belonging hierarchically to each other, i.e. the level 2 and 3 LUAs falling under level 1 LUA have the same colour. Relevant fields/classes mentioned at level 2 or 3 are a selection of the fields mentioned at level 1.

A few 'obligatory' LUAs marked green in the Excel table are not present or almost absent in The Netherlands like salines and surface mining (only one location). Under water mining is more prominent and the BBG dataset is added as relevant data provider for this LUA.

The classes in red in the above listing of LUAs are mismatches between the Excel file and the nomenclature as described in "Explanatory Documentation of the EAGLE Concept" (2016) and/or on the website https://land.copernicus.eu/eagle/content-documentation-of-the-eagle-concept/manual/content-documentation-of-the-eagle-concept/b-thematic-content-and-definitions-of-eagle-model-elements/part-ii-land-use-attributes. The description or hierarchical levels do not fit 1:1 which makes the work of filling in the Excel file not easier. Some examples:

- The grouping of classes under industries at level 1 is different from the descriptions on the website and/or documentation.
- Accommodation and Food Services are listed at level 1 in the Excel sheet. In the descriptions on the website and/or documentation they are mentioned under commercial services at level 2.
- Nature protection is not mentioned under Other Uses in the descriptions on the website and/or documentation.
- Surface mining and salines are in the documentation not at the 2nd level.

How to read the excel table

In the Excel for a specific LUA sometimes more than one dataset provides information. The feature class, attributes and attribute values per dataset are separated by a &/en passant and the different datasets are separated by +/plus. Furthermore, feature classes with their fields of interest (or attributes) and attribute values are presented as follows: preliminary the feature class followed by the field of interest, followed by specific

attribute values (if applicable). The feature class is written **bold**, the attribute underlined and the attribute values *italic*. A simple example: **Gebouw** – typeGebouw: *fabriek* & *werf*. A more complex example: **Gebouw** – typeGebouw: *fabriek* & *werf*, **Functioneel gebied** – typeFunctioneelgebied: *productie-installatie* & *bedrijventerrein* + **Verblijfsobject** – gebruiksdoel: *industriefunctie* which means from feature class "**Gebouw**" (building) the objects with values "*werf*" and "*fabriek*" for attribute "typeGebouw", from the feature class "**Functioneel gebied**" the objects with values "*productie-installatie*" and "*bedrijventerrein*" for attribute "typeFunctioneelgebied", and from another dataset the objects from feature class "**Verblijfsobjec**t" with the value "*industriefunctie*" for attribute "Gebruiksdoel".

In the Excel file we did put the Dutch names of the relevant fields/classes as this will facilitate later the connection between the CLC Core and the Dutch datasets with their relevant classes. However, it will make comparison with other national inventories difficult. The comparison with other national inventories will be anyway difficult without the exact definition of the field/classes. A link to the national catalogues where the nomenclature is described would be helpful for later implementation. E.g. Basisregistratie Topografie: Catalogus en Productspecificaties, Versie 1.2.0.1 (Kadaster, 2019), Basisregistratie Grootschalige Topografie. Gegevenscatalogus BGT 1.1.1 (Ministerie van Infrastructuur en Milieu, 2013), Catalogus Basisregistratie Adressen en Gebouwen (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, Directoraat-generaal Bestuur, Ruimte en Wonen, Directie Ruimtelijke Ordening, 2018) and Bestand Bodemgebruik. Productbeschrijving (CBS, 2010) for respectively the BRT, BGT, BAG and BBG datasets.

Specific issues/considerations

1. **Differences in definitions between national land use attributes and LUAs as defined by EAGLE.** National data presented in the Excel sheet are sometimes only delivering a subset for a specific LUA. In those cases the national data does not cover the complete definition of the LUA as presented on the nomenclature documentation (report/webpage). Several reasons exist for the discrepancy between the definition of the LUA and the national data offered as input for representing the LUA is manifold:
    a. Mismatch in definitions between LUA and national data available
    b. Lack of national data covering entire LUA
    c. Different national sources of different quality
    d. Difficult querying and/or combining national data to extract the right information conform LUA definition

E.g. for the LUA farming infrastructure in the Netherlands the dataset with the most recent and regular updates/information is the Top10NL/BRT dataset. It contains *greenhouses, storage facilities* ("*silo's*") and *sheepfold* ("*schaapskooi*") and buildings (under feature class "**Gebouw**"). However, if you include the feature class "**Gebouw**" all buildings and not only farm dwellings/houses and animal dwellings will be included in the EAGLE LUA "Farming infrastructure". There is no indication in the Top10NL dataset if a building is used for farming purposes or not. It will result in an overrepresentation if you include them without a kind of smart selection procedure. Also not all farming infrastructure according the LUA definition is covered by the BRT dataset (or other Dutch datasets). E.g. barns are not included in the Top10NL/BRT dataset, although the BGT includes them but as optional data which means you cannot be sure they are present in an harmonised way covering the entire NL.

2. **Different geometries and minimum mapping unit.** Another important consideration in collecting national data representing LUAs is the geometry in which the information is available (point, line, polygon). Should the national data having a specific minimum mapping unit taking into account the spatial resolution of 100*100m of the CLC Core datacube? What to do with point data indicating the use or land use function of a building (e.g. office, sport, living, education, health etc.)? Should the point information be combined with the buildings or should the point information be combined with larger topographical/terrain units? And should on basis of the most prominent land use within the chosen geometry the object be labelled with the relevant/corresponding LUA? See the example in the figure below.

In the case of The Netherlands sometimes additional processing of national data is needed to fit the need of CLC Core for LUA as defined in the Excel table. To know the land use or function of buildings a combination with point data should be made. Combining of point data with objects/polygons or larger (terrain, topographical, buildings) units can mean that you have to present only the majority LUA class or you have to split large objects on basis of the different thematic content of the point data. Should the buildings be labelled according to their dominant use or should the large "*Bedrijventerrein*" be labelled according the dominant land use based on the "Gebruiksdoelen" of the BAG points (see Figure 1)?

Figure 1. "**Functioneel gebied**" (feature class) with "*Bedrijventerrein*" (attribute value) as background with on top "**Gebouw**" (feature class - not differentiated to type) and the points indicating different "Gebruiksdoelen" according to the BAG.

Furthermore, for most of the buildings ("**Gebouw**" – typeGebouw) the use is indicated in the national BRT/Top10NL data set (and/or by the BAG "**Verblijfsobject**–gebruiksdoel"). The buildings are however in most cases small objects which will disappear when aggregating the information to 100*100m grid cells. How to keep this national information available for the CLC Core dataset and differentiate between the different uses of the buildings (e.g. commercial services, community services etc.)?

3. **Overlapping national feature classes and/or datasets.** The same area is often covered by different national datasets/feature classes. Some national datasets are covering the country wall-to-wall, others are covering only specific areas. Another possibility is that only specific attribute values of a feature class/dataset are of interest for deriving land use information. The consequence of overlapping land use information could be that the same area is covered with different information sources indicating different EAGLE LUA for the same area. What to do when the datasets or feature classes indicate different LUAs? If the datasets are of different actuality it is clear to take the most recent information. However, what to do if the feature classes come from the same dataset?

The LUA "Manufacturing / producing industry" is described with the following national data: BRT/Top10NL feature class "**Gebouw**" with attribute values "*fabriek* & *werf*" under attribute "Type Gebouw", feature class "**Functioneel gebied**" with attribute classes "*productie-installatie* & *bedrijventerrein* & *werf*" under attribute "typefunctioneelgebied" and the BAG feature class "**Verblijfsobject**" with attribute class "*industriefunctie*" under attribute "gebruiksdoel". Overlap between e.g. feature classes "**Gebouw**" and "**Functioneel gebied**" exist, but they also give additional information. Regarding the BAG feature class the same may occur. In addition the point information should be linked to a building ("**Gebouw**" feature class) or terrain ("**Functioneel gebied**" feature class) geometry (see also above and figure 1) and processed so the building or the terrain unit could be labelled with a specific LUA.

The Figures 1 and 2 are examples. In Figure 1 the feature class "**Gebouw**" is overlapping with "*Bedrijventerrein*" which is an attribute value of the feature class "**Functioneel Gebied**". Should the area be seen as the EAGLE LUA "Manufacturing/producing industry" or subdivided into different EAGLE LUAs on basis of the "Gebruiksdoelen" of the BAG points? E.g. into EAGLE LUAs "Commercial service", Community Services, etc. Or should only the building ("**Gebouw**") feature class be used and define the EAGLE LUAs for the different buildings. Figure 2 shows the same area as in Figure 1, however the feature class "**Functioneel gebied**" is replaced by feature classes "**Wegdeel**" and "**Terrain**". The "*Bedrijventerrein*" or EAGLE LUA "Manufacturing/producing industry" of Figure 1 is now partly mapped as roads (or EAGLE LUA "Road network") or other terrain (no equivalent with an EAGLE LUA). Which national data should be used as land use information?

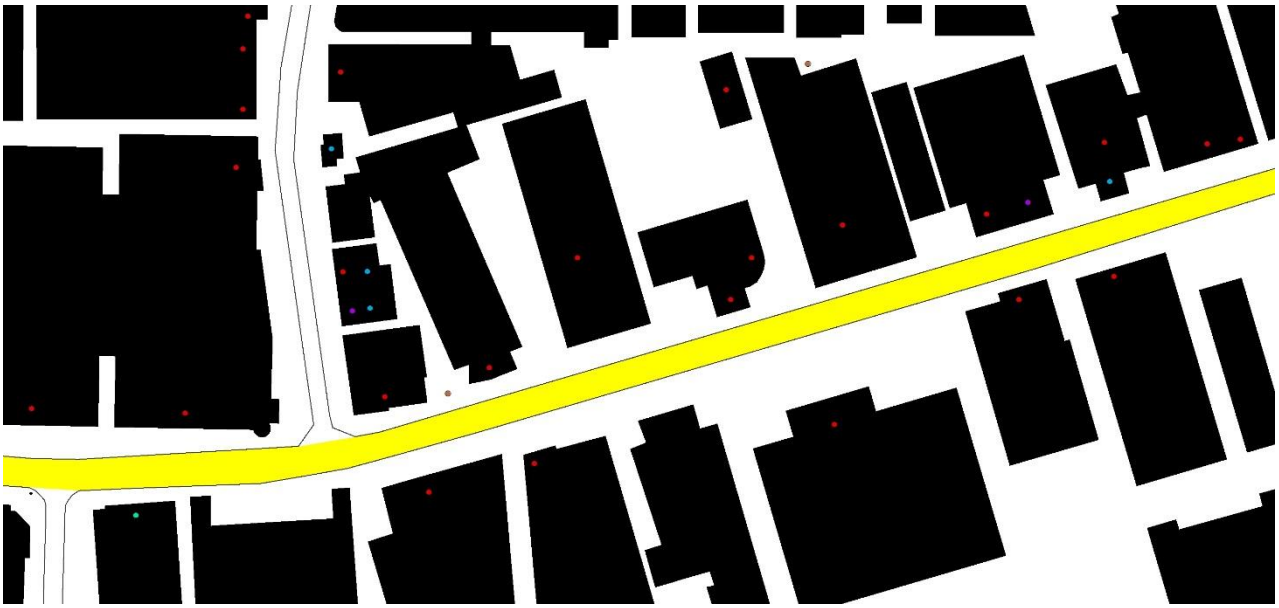


Figure 2. "**Gebouw**" (black – not differentiated by type) with the points indicating different "Gebruiksdoelen" according to the BAG. "**Functioneel gebied**" is replaced by feature classes "**Wegdeel**" and "**Terrein**". Same area as Figure 1.

4. **Double use of attribute values for different LUAs.** Some attribute values for feature class "**Functioneel Gebied**" like *bedrijventerrein, bungalowpark, nationaal park, natuurgebied & vakantiepark*) are used for delivering information to different LUAs. Also feature class "**Gebouw**" with attribute value *silo* (LUA's Farming Infrastructure & Logistics and storage) and BAG's "Verblijfsobject" with attribute value *logiesfunctie* (LUA's Accommodation and Food Services & Other Residential) are delivering information to more than one LUA. BBG2015 classes are used as national data source for delivering information to different LUA's. The classes 24-Industrial areas and offices (Manufacturing/producing industries and Commercial Services), 21-Retail trade, hotel and catering (LUA's Commercial Services and Accommodation and Food Services) and 44-Holiday recreation (LUA's Accommodation and Food Services, Cultural, Entertainment and Recreational Services and Other Residential) are serving multiple LUA's.
5. **Gaps in land use information.** As we focussed on finding national data regarding EAGLE LUAs marked in **green** in the Excel table the table does not give a complete wall-to-wall coverage of the land use in the Netherlands. Also the not all attribute values of the datasets that were taken into consideration could be translated into EAGLE LUAs as well as some of the selected feature classes were not covering the entire country (wall-to-wall) which makes a wall-to-wall coverage difficult. So combinations are needed of feature classes or datasets to have full coverage which however will result in overlap (see point 3).
6. **Land Use Attribute "Residential".** The three types of residential LUAs at level 1 can be discerned on basis of the datasets of BRT/Top10NL, BAG and BBG. Important is the attribute "gebruiksdoel" of the BAG feature dataset "V**erblijfsobject"**. "Permanent residential" is defined by **Gebouw** combined with "**Verblijfsobject** – gebruiksdoel: *woonfunctie"*. For the EAGLE LUA "Residential Use with Other Compatible Uses" at least the "**Verblijfsobject** – gebruiksdoel: *woonfunctie"* combined with other

attribute values of the BAG dataset is present. The EAGLE LUA "Other Residential" is defined by the combination of **Gebouw** from BRT/Top10NL and **Verblijfsobject** – gebruiksdoel: *logiesfunctie* within Top10NL **Functioneel gebied** – typeFunctioneelgebied: *vakantie & bungalow parken*.

7. **Feature class/attribute "Verblijfsobject – gebruiksdoel".** The national land use function for buildings coming from "**Verblijfsobject** – gebruiksdoel" of the BAG is used for the delivering national information for the following EAGLE LUA's: Manufacturing/ producing industries, all Services (Tertiary Sector) and the Residential subdivisions. The combination "**Verblijfsobject** – gebruiksdoel" of the BAG and "**Gebouw –** typeGebouw" of BRT/Top10NL is delivering national information regarding this LUA's.
8. **Feature classe/attribute value Functioneel gebied – type Functioneelgebied.** The BRT/Top10NL dataset feature class **Functioneelgebied** – typeFunctioneelgebied delivers national information related to all EAGLE LUAs with exception of "**Logistics and Storage**" and some "**Residential**" LUAs.
9. **Bestand BodemGebruik (2015):** In this assessment we used BBG as national data source (version BBG2015), however the information is less recent and not yearly updated in contrary to the Top10NL, BAG and BGT datasets. Although for specific EAGLE LUAs/LCs it can have, in addition to the other more recent datasets, additional information. BBG has information on the green marked LUAs (Excel file) Mining and Quarrying; Industries; Residential use; Commercial Services; Accommodation and Food Services; Community Services; Cultural, Entertainment and Recreational Services; Transport networks; Cemeteries and Dumpsites and partly on Farming Infrastructure (i.e. Greenhouses).
10. **Nature protection.** For Nature protection the N2000 and RAMSAR datasets are used in combination with Top10NL national parks. However, this LUA and the linking with national data largely depends on what is defined as nature protection Does it contain only areas with legal protection or also other forms of protection?
11. **"Geografisch gebied".** The feature class " Geografisch Gebied" of the BRT/Top10NL datasets is delivering information for the LUAs Cultural, Entertainment and Recreation and for Water transport. This feature class is covering very large areas which have at least several land use functions**.**

4.2.2 Land Characteristics

The inventory was preliminary focussed on the obligatory LCs that are masked green in the Excel sheet. It are the following LCs ranked according to the hierarchy levels:

- Level 1:
  - Arable crops (Crop type)
  - Pasture/Meadow (Crop type)
  - Permanent crops (Crop type)
  - Constructed, industrial and other artificial Ecosystem Type (ET)
  - Regularly or recently cultivated agricultural ET
  - Grassland and tall forb ET
  - Agricultural mosaics ET
  - Heathland, shrub and tundra ET
  - Transitional woodland ET
  - Inland unvegetated or sparsely vegetated ET
  - Coastal salt marshes ET
  - Intertidal flats ET
  - Coastal lagoons ET
  - Estuaries ET
  - Marine ET
  - Under construction (Status)
  - Damaged (Status)
  - Height (General parameter)
- Level 2:
  - Mixed (Spatial distribution patterns)
  - Mosaic (Spatial distribution patterns)
  - Urban (Spatial context)
  - Coastal (Spatial context
  - Inland (Spatial context)

  - Olive plantations
  - Vineyards
  - Inland marshes ET
  - Peatbogs ET
  - Wetness (Water characteristics)
  - Salinity (Water characteristics)
  - Tidal influence (Water characteristics)
  - Snow avalanche (Damage reasons)
  - Fires (Damage reasons)
  - Tornados, hurricanes, strong winds (Damage reasons)
  - Biological (Damage reasons)
- Level 3:
  - Arable crop land (Agricultural land type)
  - Permanent crop land (Agricultural land type)
  - Permanent grassland (Agricultural land type)
  - Crop rotation (Cultivation practices)
  - Plantation (Cultivation practices)
  - Agroforestry (Cultivation practices)
  - Intercropping(Cultivation practices)
  - Paddy field cultivation (Cultivation practices)
  - Fertilizer activity (Cultivation measures)
  - Irrigation (Cultivation measures)
  - Mowing (Cultivation measures)
  - Grazing (Cultivation measures)
  - Rice
  - Hops
  - Needle leaved (Leaf form)
  - Broad leaved (Leaf form)
  - Sclerophyte (Leaf character)
  - Evergreen (Foliage persistence)
  - Ephemeral (Hydrological persistence)
  - Intermittent (Hydrological persistence)
  - Perennial (Hydrological persistence)
  - Saline (Salinity)
  - Brackish (Salinity)
  - Fresh (Salinity)
- Level 4:
  - Intensive (Grazing)
  - Extensive (Grazing)

In the above list the green, yellow, red, purple and turquoise coloured markings indicate which LCs are belonging hierarchically to each other, i.e. the level 2 and 3 LUAs falling under level 1 LC have the same colour. Relevant fields/classes mentioned at level 2 or 3 are a selection of the fields mentioned at level 1.

Clarifications:
The Land Characteristics (LCs) that are not applicable for the Netherlands are olive plantations, rice, snow avalanche (Damage reasons) and Paddy field cultivation (Cultivation practices).

The Ecosystem Types can be derived from an existing European (EEA - Ecosystem types of Europe) dataset. At national level no such dataset is available although some of the Ecosystem Types can be derived indirectly.

Information on rotation is not available in the Dutch LPIS (BRP) but by combining different reference years such information could become available.

The definition of LC Plantation is not clear. Are monocultures of non-permanent crops also seen as plantations? E.g. large cereal fields? Or should it be woody, permanent crops like palm oil.. However, in The Netherlands no information is available on plantations.

Regarding the LC Fertilizer the only information from BRP dataset is on green manure. There is no register on the use of other type of fertilizers available or known by the authors. So there is no complete overview for LC Fertilizers available. We propose to not using the information on green manure and leave input from national side on this LC empty.

4.2.3 Resource description

Nine datasets were used in the inventory of which 8 were national datasets. In the Resource description TAB of the Excel file the datasets are described. Most datasets are from 2018-2019, they are national vector datasets, spatial detail <1:10.000, and available as full, free and open data or with minor constraints. The only dataset which ask cost for data use are LGN2018 and in some cases the BAG dataset.

5 Contact details

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