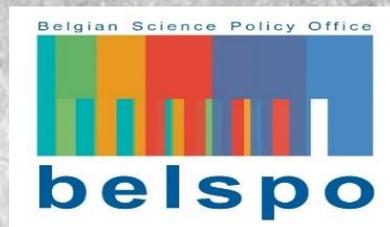# GARMON
A garden map for Flanders.

BEODay 24/11/2020

BELSPO
RESEARCH PROGRAMME FOR EARTH OBSERVATION STEREO III
WWW.LNE.BE/THE-GARDEN-MONITOR-GARMON
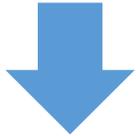
What is a garden? Technically

"An area set aside for the cultivation and enjoyment of plant and other natural life." [1]

A garden parcel is a parcel where *nature is cultivated* and prominently functions for *recreation* and *not production*.

A garden parcel is a parcel that contains a *building* and is not used for *agriculture*.

1 Garden history : philosophy and design, 2000 BC--2000 AD, Tom Turner. New York: Spon Press, 2005.

Selecting Parcels and Adding information

Source Data:

> For selecting:

 ■ Large Scale Database Flanders: administrative *parcels*, *buildings*, roads, …

 > Area Delineation

 > Presence of cultivation

 https://overheid.vlaanderen.be/en/producten-diensten/large-scale-reference-database-lrd

 ■ Agricultural Land Parcel Registration: agricultural land information

 > Presence of recreation = absence of production

 https://lv.vlaanderen.be/en

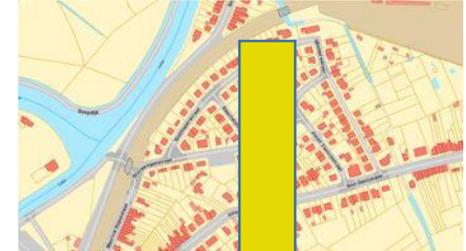 https://ec.europa.eu/jrc/en/research-topic/agricultural-monitoring
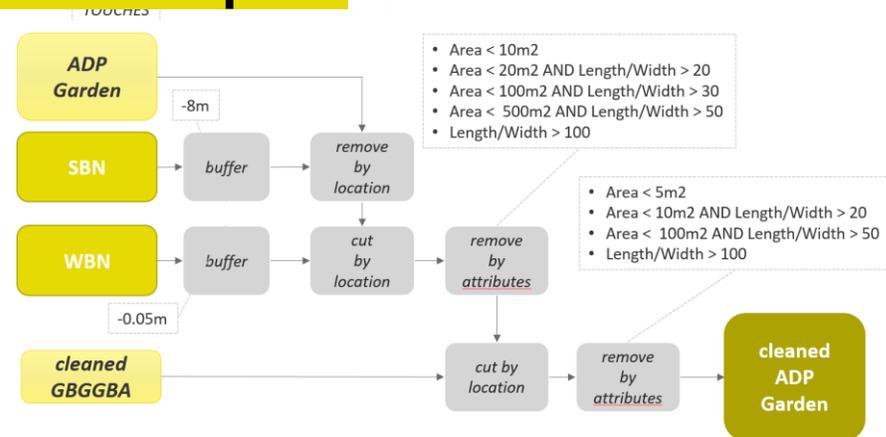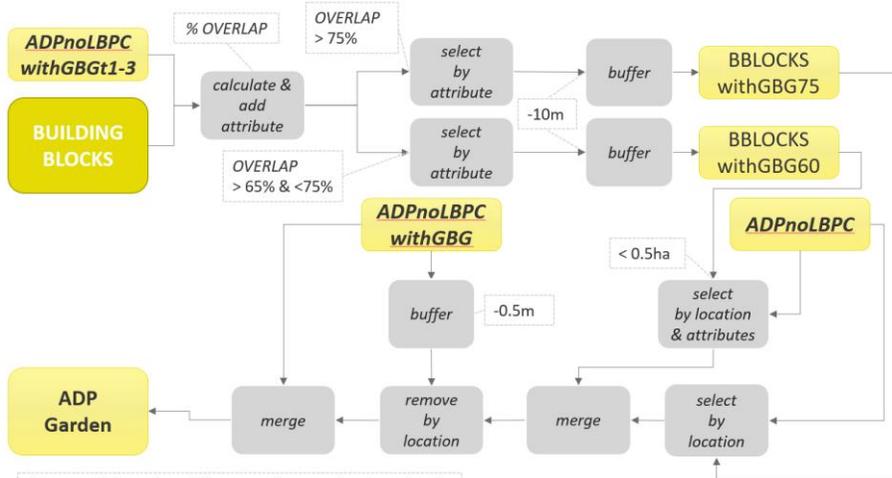
> For adding information:

 ■ Reference: information present in Flanders:

 > Land Cover Map http://www.geopunt.be/catalogus/datasetfolder/0230a22f-51c0-4aa5-bb5d-0d7eeeaf0ce8

 > Land Use Map http://www.ruimtemonitor.be

 ■ Can *satellite data* be a source?

Vlaamse overheid

INFORMATIE
VLAANDEREN

Selecting Parcels and Adding information

workflow for selecting parcels = complex

Selecting Parcels and Adding information

- summer orthophoto, 40cm, 2015
- administrative parcels

Vlaamse overheid

INFORMATIE VLAANDEREN

Selecting Parcels and Adding information

- summer orthophoto, 40cm, 2015
- administrative parcels
- agricultural parcels

Vlaamse
overheid

INFORMATIE
VLAANDEREN

Selecting Parcels and Adding information

- summer orthophoto, 40cm, 2015
- administrative parcels *with no agricultural overlap*

Vlaamse overheid

INFORMATIE VLAANDEREN
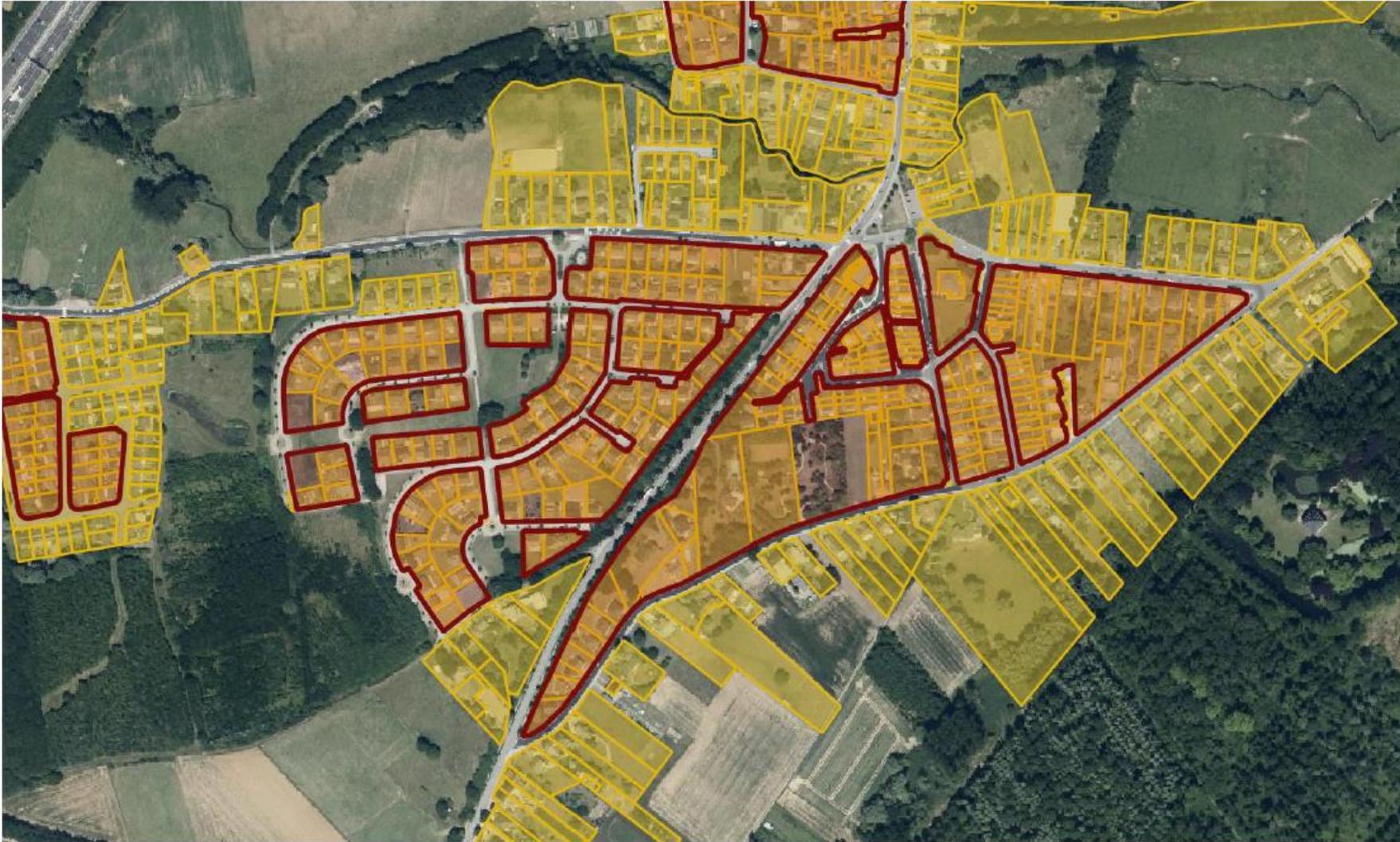
Selecting Parcels and Adding information

- summer orthophoto, 40cm, 2015
- administrative parcels *with no agricultural overlap*
- buildings

Selecting Parcels and Adding information

- summer orthophoto, 40cm, 2015
- administrative parcels *with no agricultural overlap, and containing buildings*

Selecting Parcels and Adding information

- summer orthophoto, 40cm, 2015
- administrative parcels *with no agricultural overlap, and containing buildings*
- buildings blocks containing more than 60% previously selected administrative parcels

Selecting Parcels and Adding information

- summer orthophoto, 40cm, 2015
- *selected garden parcels*

Selecting Parcels and Adding information

- summer orthophoto, 40cm, 2015
- *selected garden parcels*
- buildings > 20m2
- roads
- Railroads (not shown)

INFORMATIE
VLAANDEREN

Vlaamse
overheid

Selecting Parcels and Adding information

- summer orthophoto, 40cm, 2015
- *cleaned selected garden parcels*

Selecting Parcels and Adding information

Validation:

> Sample design:
  - 1197 ADP polygons
  - Random stratified

> Response design
  - 3 operators
  - majority vote

> Garden ADP class:
  - 80% correctness
  - 88% completeness

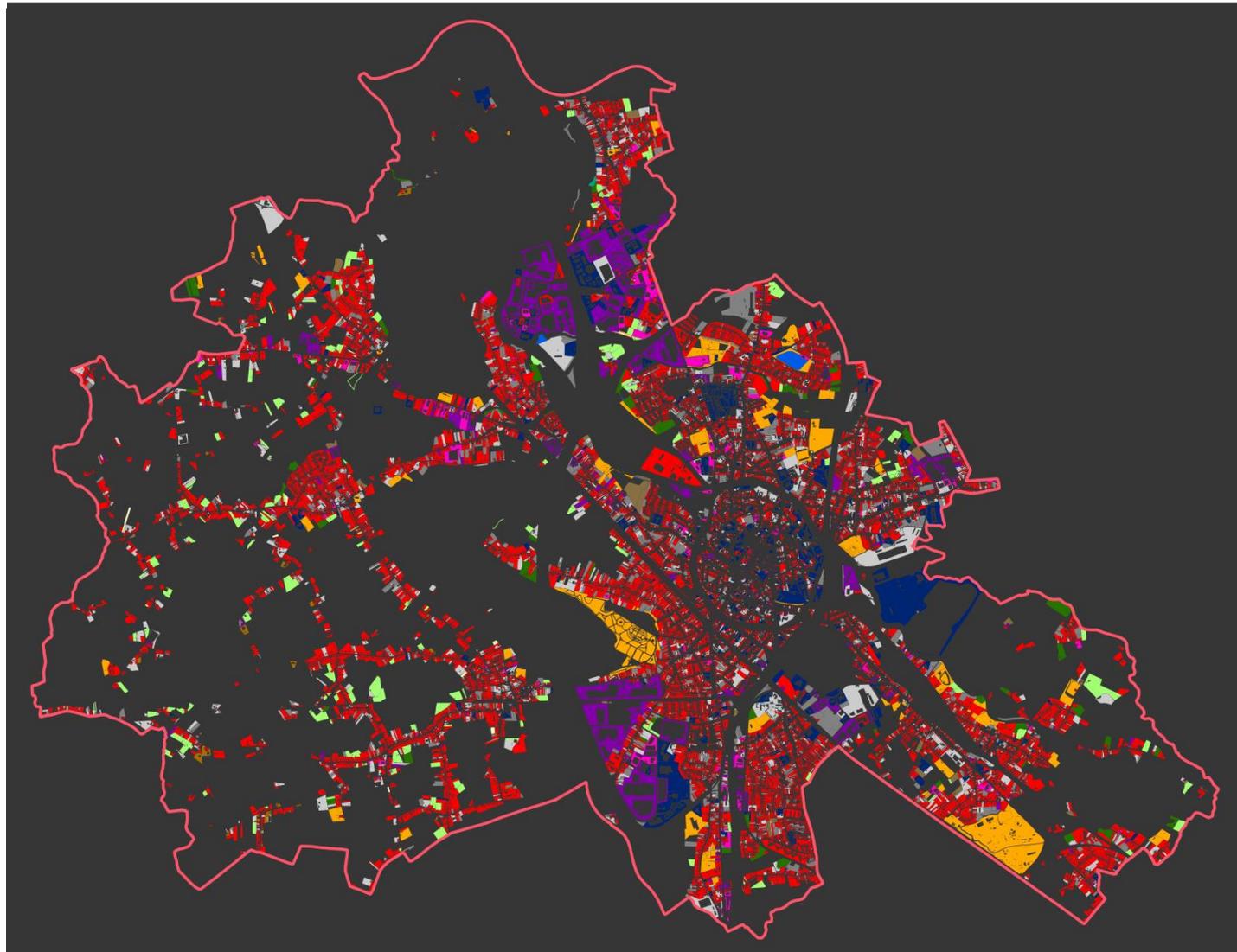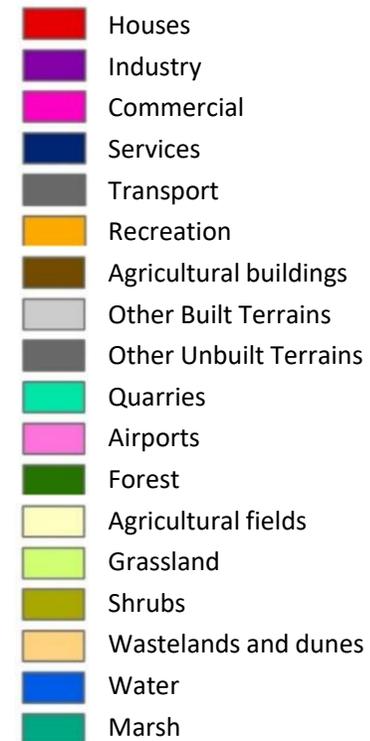|	Reference			
	Garden	No Garden		
Garden ADP	402	102	504	79.8%
Other ADP	57	636	693	91.8%
	459	738	1197	
	87.6%	86.2%		86.7%

Selecting Parcels and Adding information
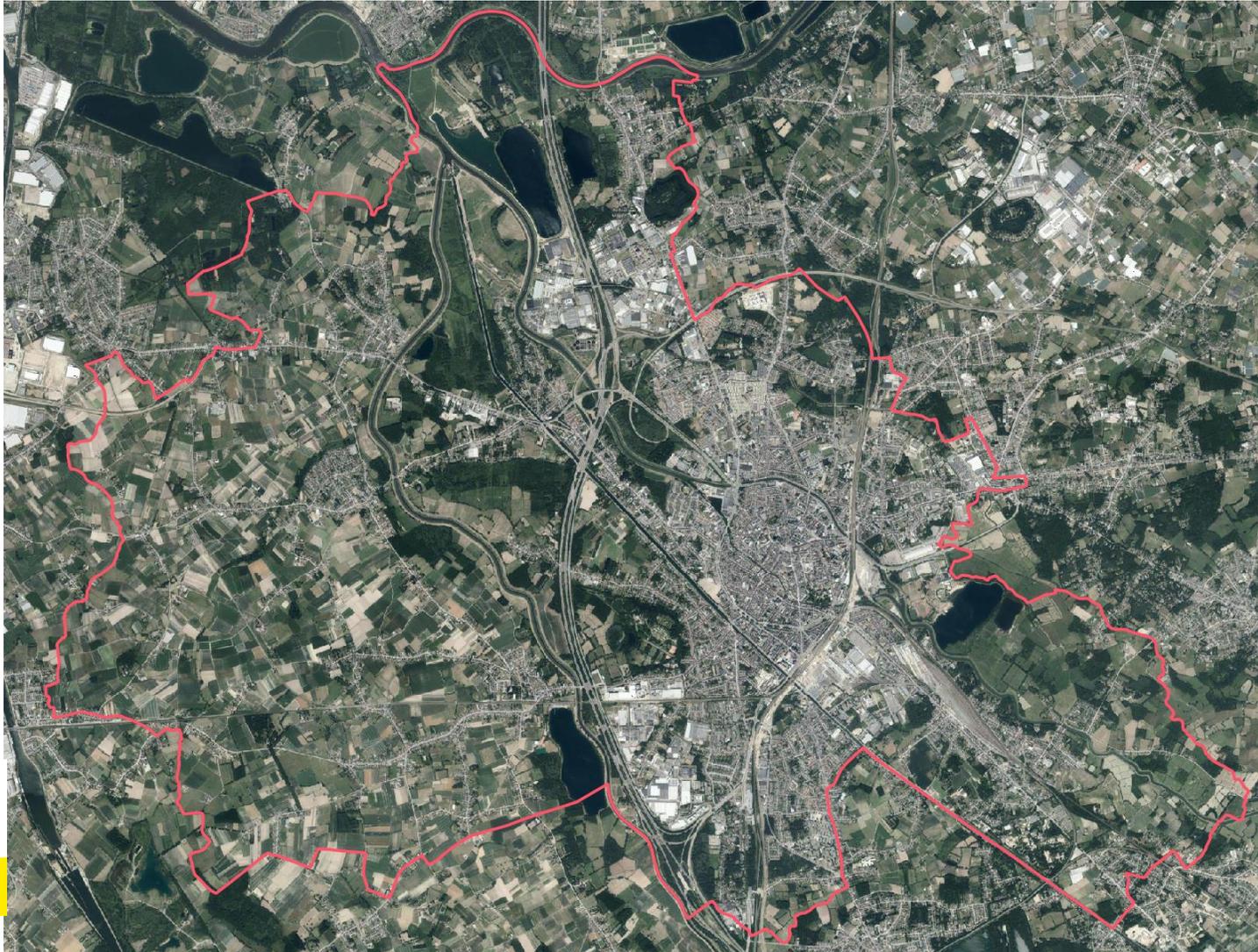
- Border municipality of Mechelen/Malines
- Summer orthophoto, 40cm, 2015

Selecting Parcels and Adding information

- Border municipality of Mechelen/Malines
- Adding Land Use information from reference data: Landgebruikskaart, 2016

Legend:
- Houses
- Industry
- Commercial
- Services
- Transport
- Recreation
- Agricultural buildings
- Other Built Terrains
- Other Unbuilt Terrains
- Quarries
- Airports
- Forest
- Agricultural fields
- Grassland
- Shrubs
- Wastelands and dunes
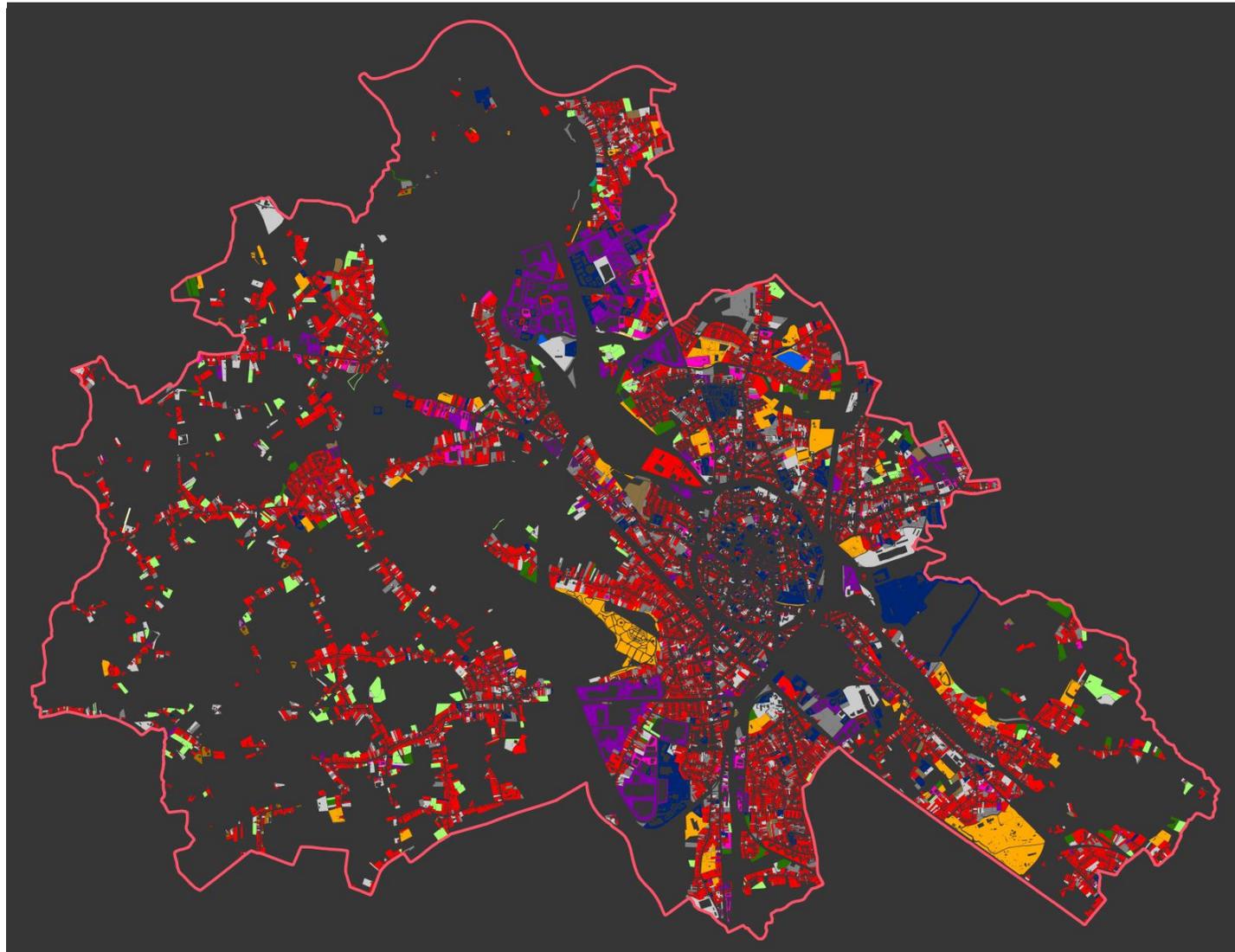- Water
- Marsh

Vlaamse overheid

INFORMATIE VLAANDEREN

Selecting Parcels and Adding information

- Border municipality of Mechelen/Malines
- Adding Land Use information from reference data: Landgebruikskaart, 2016

Legend:
- Houses
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- Quarries
- Airports
- Forest
- Agricultural fields
- Grassland
- Shrubs
- Wastelands and dunes
- Water
- Marsh

Habitation	Reference		
	Garden	No Garden	
Garden ADP	215	6	221	97.3%
Other ADP	11	48	59	81.4%
	226	54	280	
	95.1%	88.9%		93.9%

Garden ADP in Habitation:
- 97% correctness
- 95% completeness

Vlaamse overheid

INFORMATIE VLAANDEREN

Selecting Parcels and Adding information

- Border municipality of Mechelen/Malines
- Adding Land cover information from reference data: Bodembedekkingskaart 2015
  - % Low green (= Grass and shrubs)
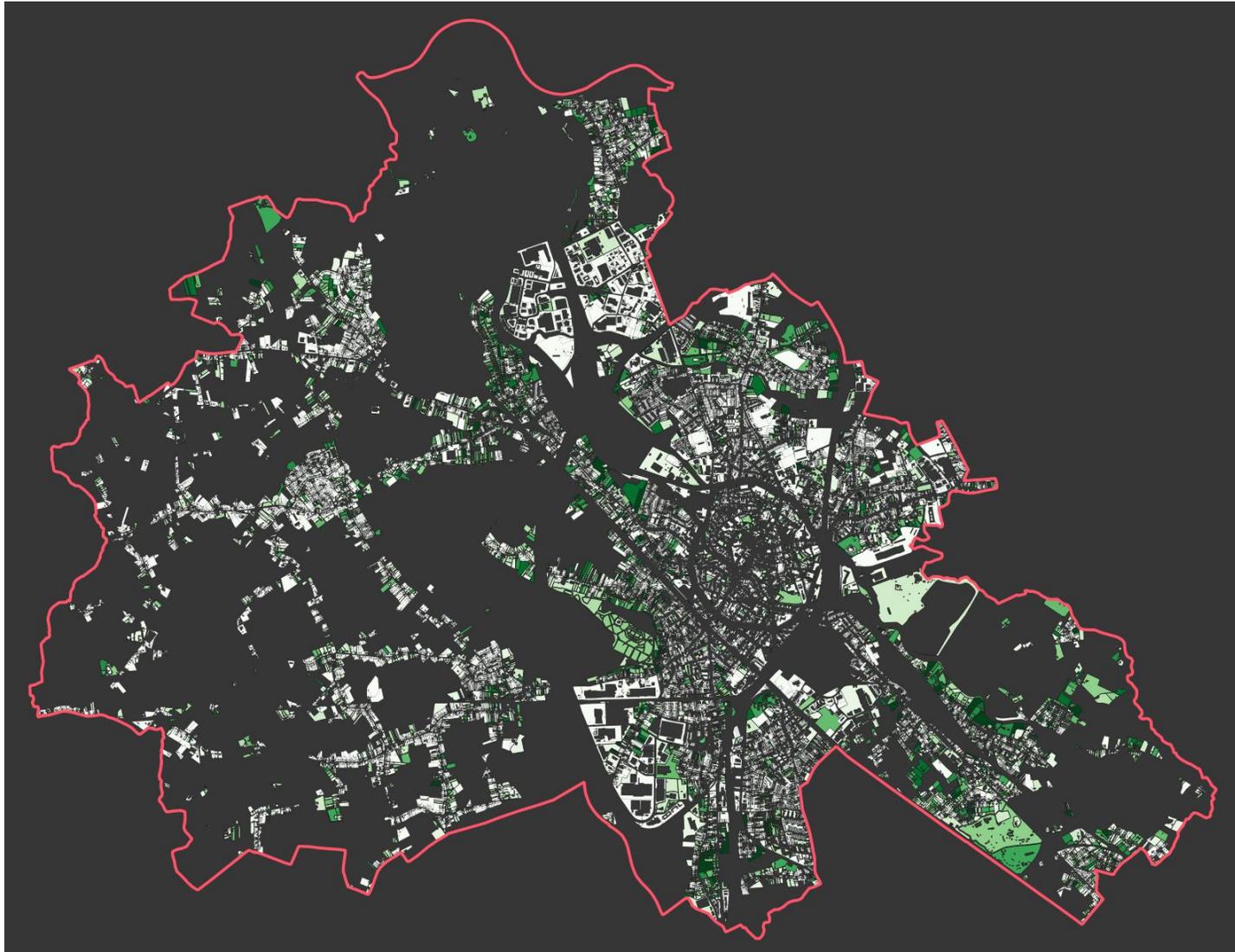
Vlaamse
overheid

INFORMATIE
VLAANDEREN

Selecting Parcels and Adding information

- Border municipality of Mechelen/Malines
- Adding Land cover information from reference data: Bodembedekkingskaart 2015
  - % High green (= trees)

Conclusion

- Garden map : correctness 80%, use

  > global : general added value (see further)

  > local : a starting point to create more "detailed" garden map

- Adding extra attributes

  > Land use 'Landgebruikskaart" or Habitation (Houses and Garden)

  > Land cover 'Bodembedekkingskaart' or High / Low green

Vlaamse overheid

INFORMATIE
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Satellite image processing:

an added value for the garden map?

Selecting Parcels and Adding information

> Satellite image processing: an added value for the garden map?

Pleiades **High resolution** **Orthophoto**
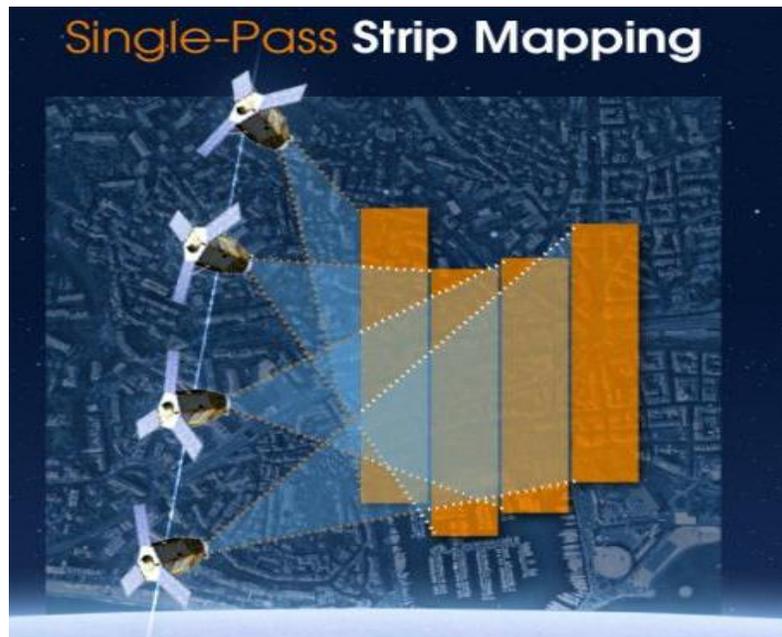

- **Spatial Resolution**- 0.5m <-> 0.4m
- **Spectral resolution**-4 bands <-> 4 bands
- **Temporal resolution**- Days <->Years

Selecting Parcels and Adding information

> Satellite image processing: an added value for the garden map?

3D information
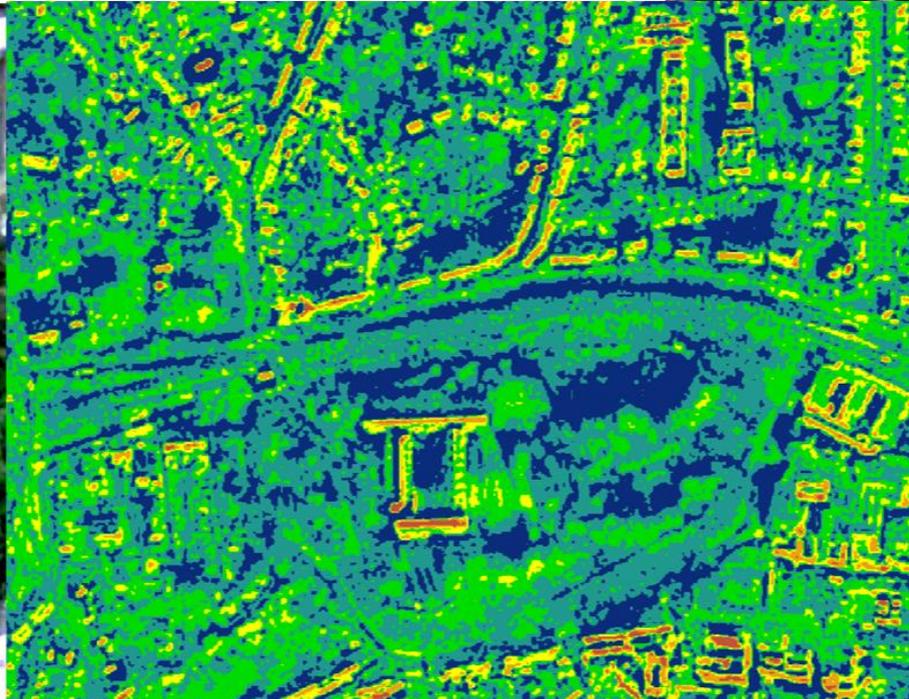
Pleiades

Selecting Parcels and Adding information

> Satellite image processing: an added value for the garden map?

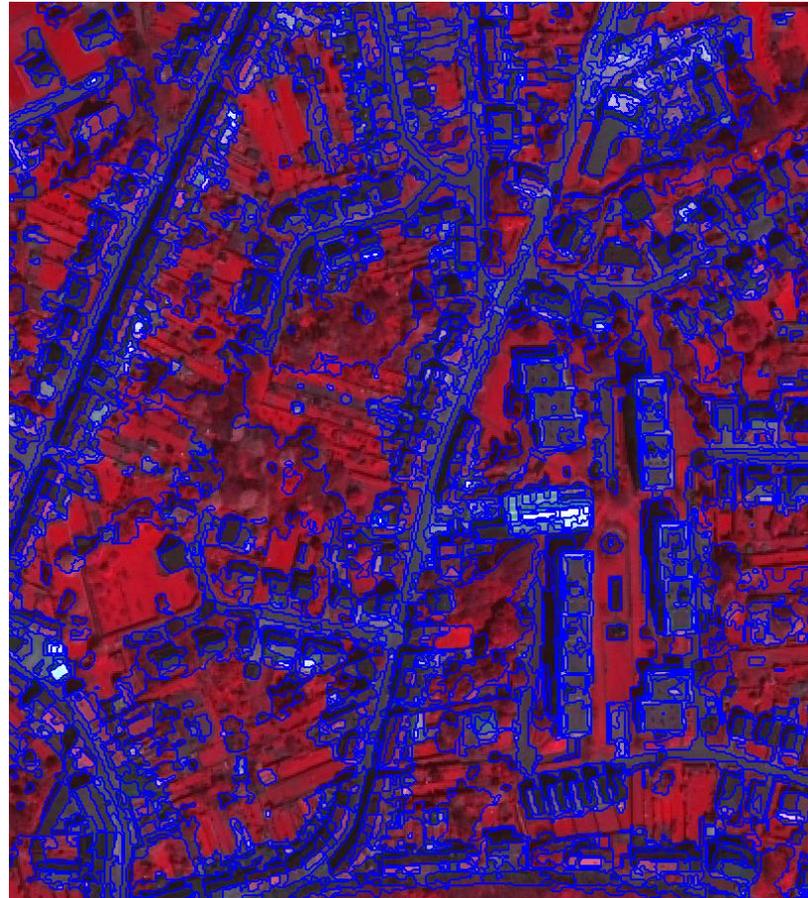## Time series

| September | NDVI difference | January |

Methodology:
Object-based Classification

Study area – Leuven, Belgium

Flemish region

Pleiades

Jan SPOT-6 Sep

NDVI variance

High : 1.55
Low : -1.56

nDSM

High : 24.65
Low : -0.14
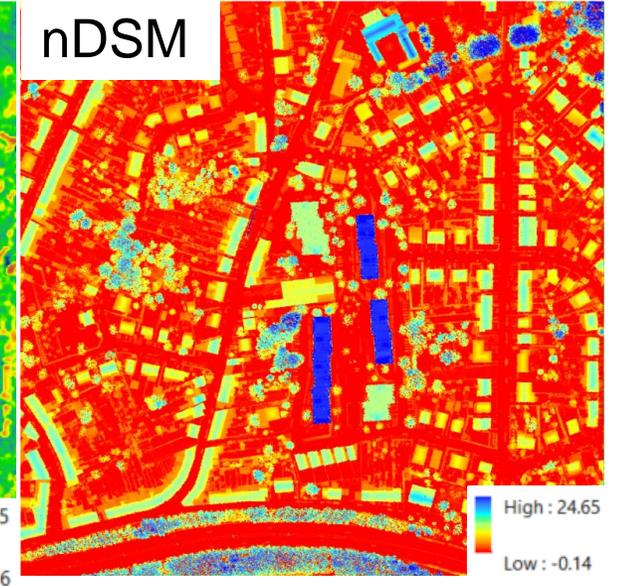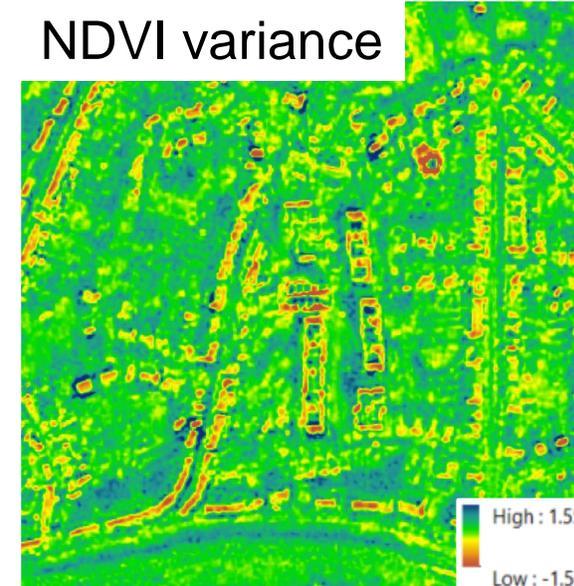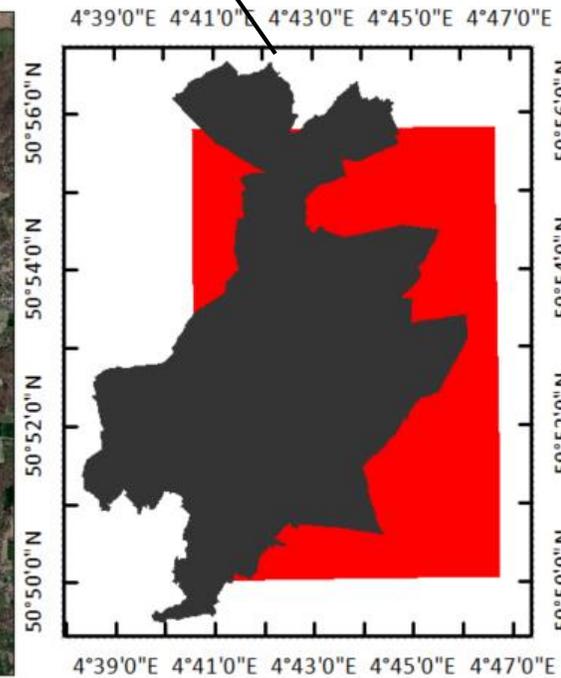
Field inventory
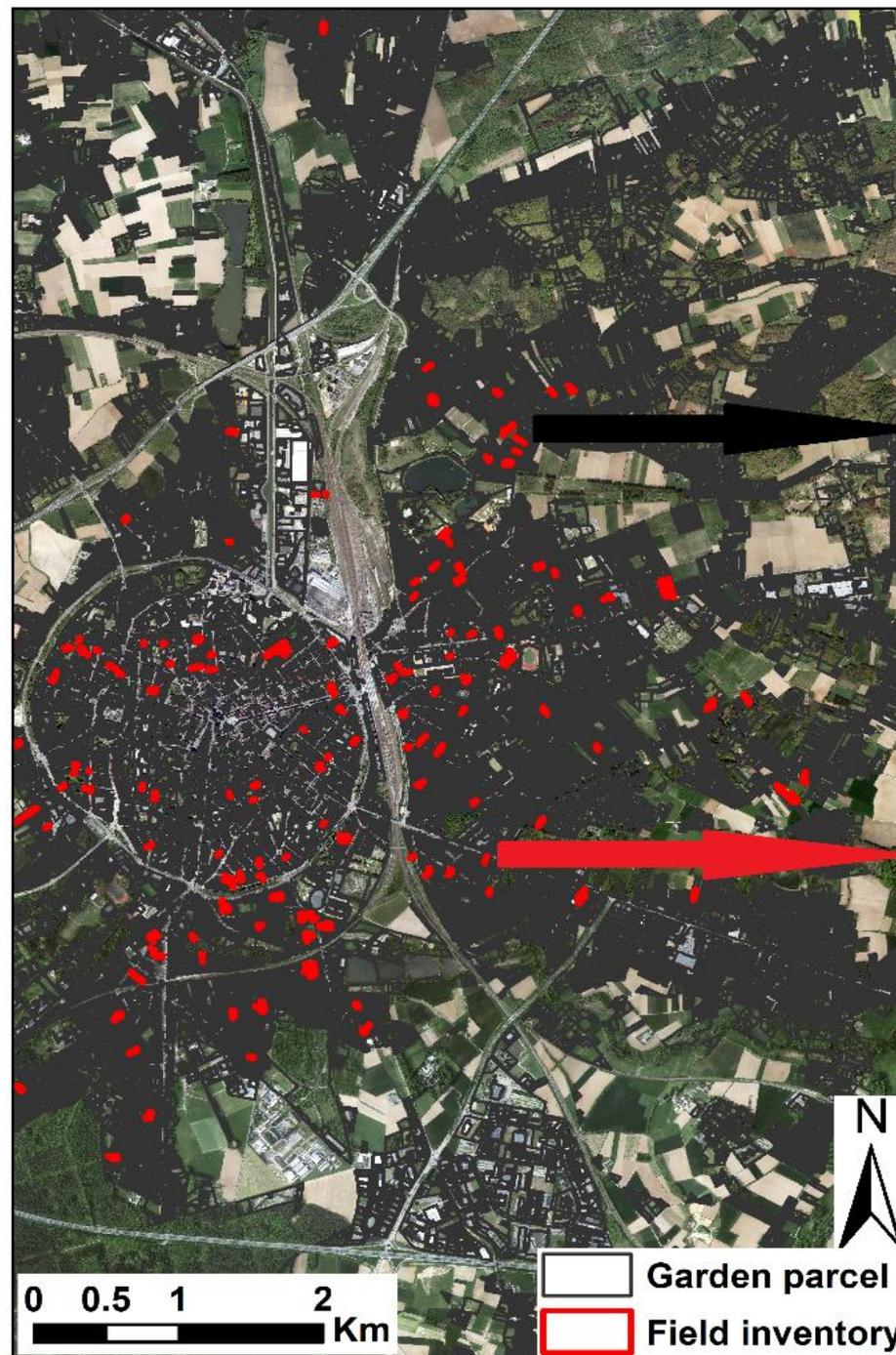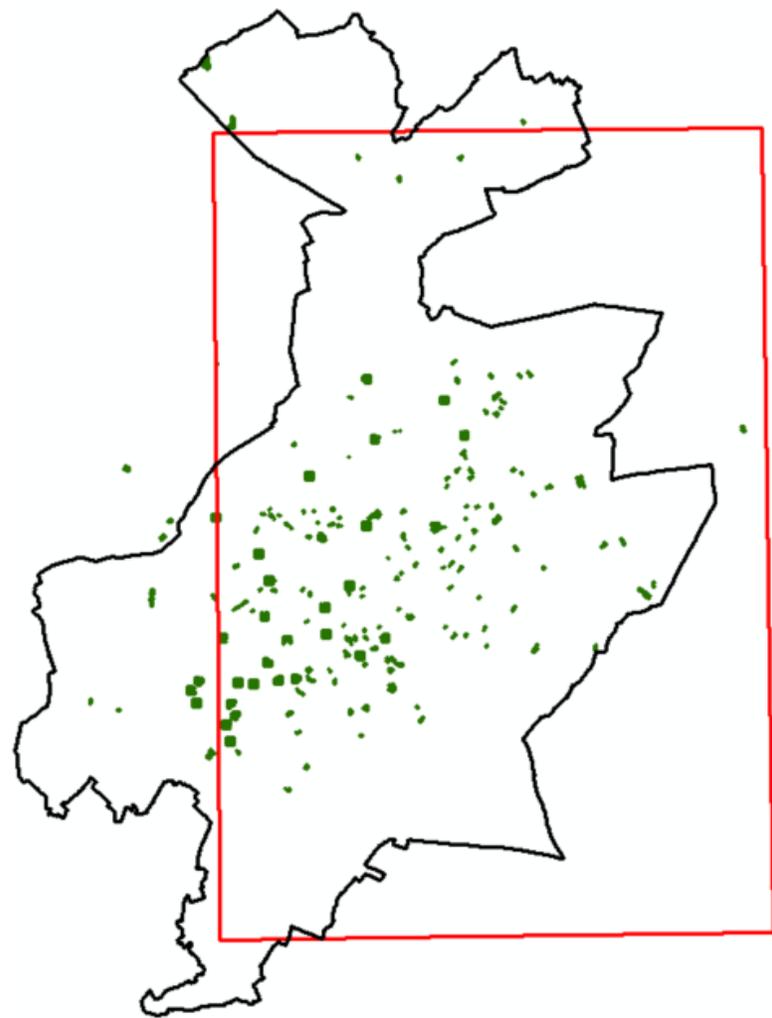
Public space 30 plots (100*100m2)
Private space 198 gardens

Garden parcel
Field inventory

No seasonal Stereo Pleiades images?
What data were eventually used?

SPOT-6 (1.5m)   Pleiades-1A (0.5m)   LiDAR (0.25m)   Orthophoto (0.4m)

Results - *Pleiades+nDSM vs Land cover Flanders*

Garden parcel

% green (HG + LG)
- 0 - 20
- 20.00000001 - 40
- 40.00000001 - 60
- 60.00000001 - 80
- 80.00000001 - 100

66.8%
Land Cover Flanders

62.4%
Pleiades + nDSM

Results - *green maps vs field inventories*

	scheme b Pleiades	scheme c Orthophoto	scheme f Pleiades + nDSM	scheme g Orthophoto + nDSM	LCF Land Cover Flanders
OA	72.15	74.05	87.6	89.27	90.03
Kappa	0.547	0.576	0.797	0.826	0.837

scheme b

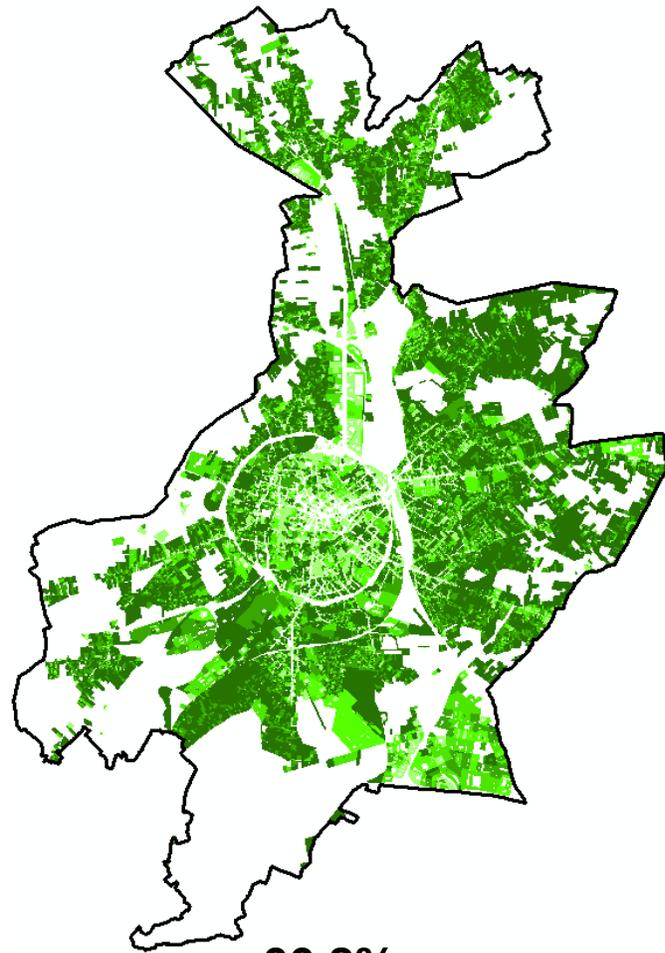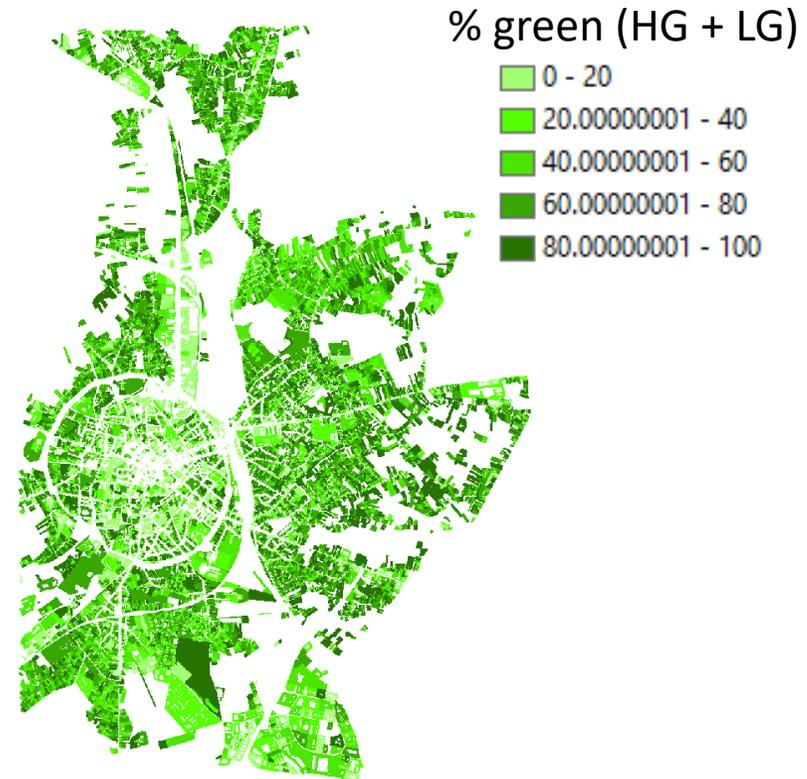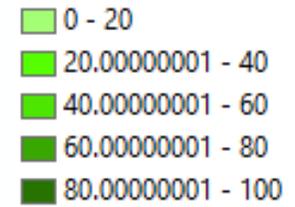|		Reference			UA%
		High green	Low green	Other	
Classified	High green	**359**	118	29	70.98
	Low green	127	**451**	29	74.3
	Other	28	35	**138**	68.65
PA%		69.85	74.67	70.41	

scheme c

		Reference			UA%
		High green	Low green	Other	
Classified	High green	**377**	119	24	72.52
	Low green	114	**455**	31	75.83
	Other	23	30	**141**	72.68
PA%		73.34	75.33	71.94	

scheme f

		Reference			UA%
		High green	Low green	Other	
Classified	High green	**459**	50	18	87.1
	Low green	38	**535**	21	90.07
	Other	17	19	**157**	81.34
PA%		89.28	88.58	80.1	

scheme g

		Reference			UA%
		High green	Low green	Other	
Classified	High green	**465**	42	16	88.91
	Low green	37	**548**	20	90.58
	Other	12	14	**160**	86.02
PA%		90.47	90.73	81.63	

LCF

		Reference			UA%
		High green	Low green	Other	
Classified	High green	**471**	40	14	89.71
	Low green	33	**551**	21	91.07
	Other	10	13	**161**	87.5
PA%		91.63	91.23	82.14	

Results – *deciduous vs evergreen*

Legend:
- High evergreen
- High deciduous
- Low evergreen
- Low deciduous
- Water surface
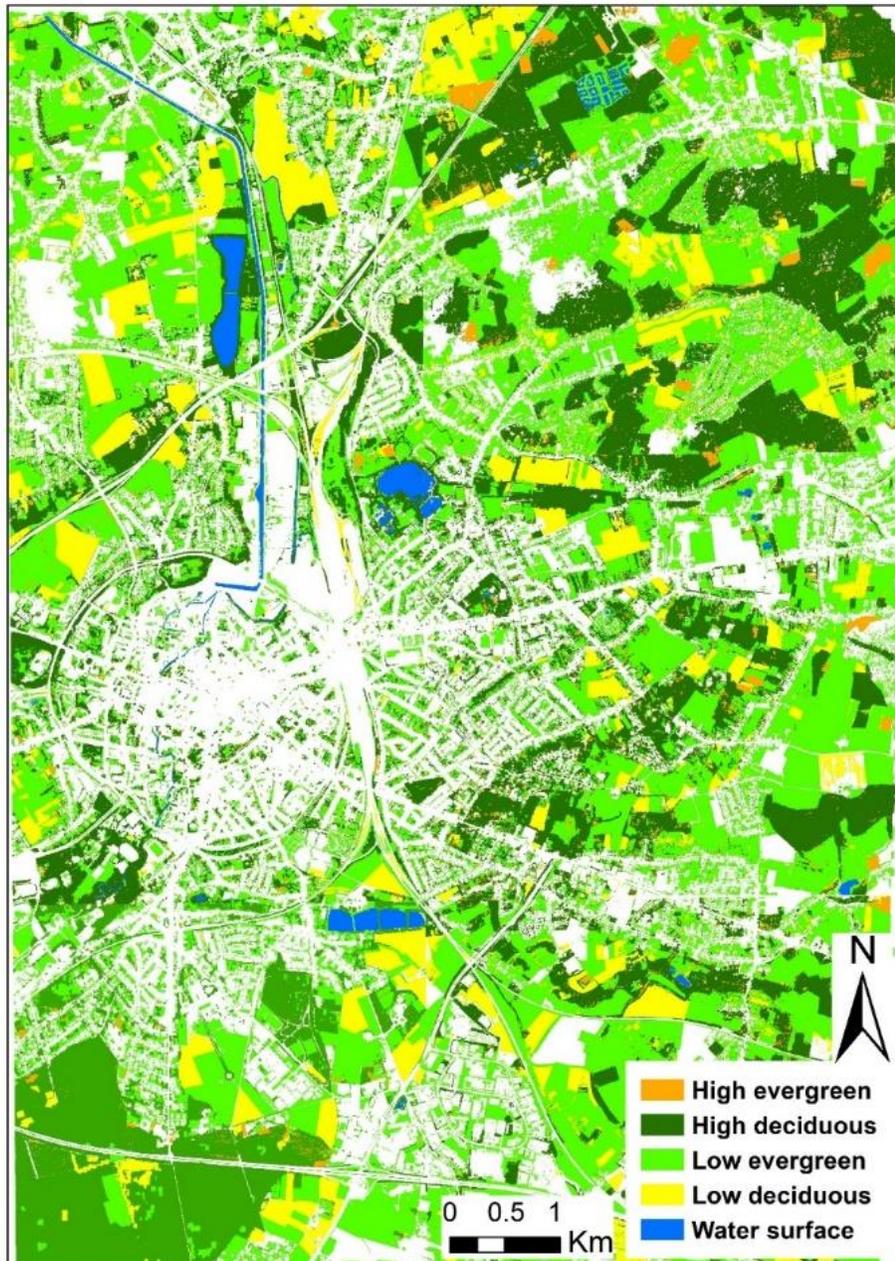
Results – *deciduous vs evergreen*

	OA	Kappa	User's accuracy				Producer's accuracy			
			High Deciduous	High Evergreen	Low Deciduous	Low Evergreen	High Deciduous	High Evergreen	Low Deciduous	Low Evergreen
Pleiades + nDSM	79.22	0.716	**82.90**	54.29	60.45	**86.09**	**82.12**	64.04	66.94	**81.99**
Pleiades + nDSM + SPOT6	**87.29**	**0.825**	**89.47**	**74.73**	77.42	**89.32**	**88.00**	76.40	**79.34**	**90.06**
Pleiades + nDSM + Sentinel2	**82.19**	0.755	**84.73**	67.02	66.67	**86.79**	**85.35**	70.79	69.42	**85.71**

Conclusions

- Optical satellite data, including stereo pairs, allows to produce green maps of high and low green with a comparable accuracy as the current land cover map derived from orthophotos

- Combined with seasonal spectral information the traditional green map can be extended with info on deciduous vs evergreen vegetation
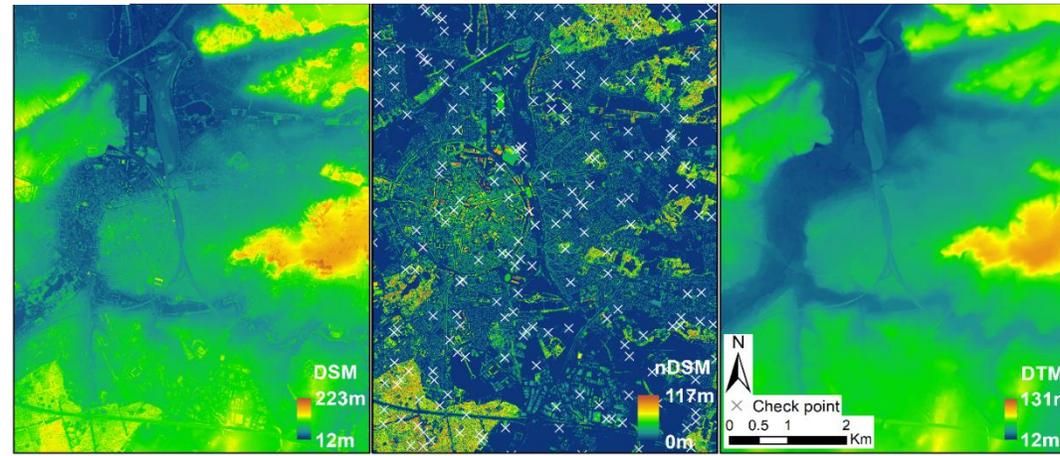
Intermezzo: DSM derived from LiDAR vs DSM/DTM from Stereo-Pleiades imagery (31 July, 2020)
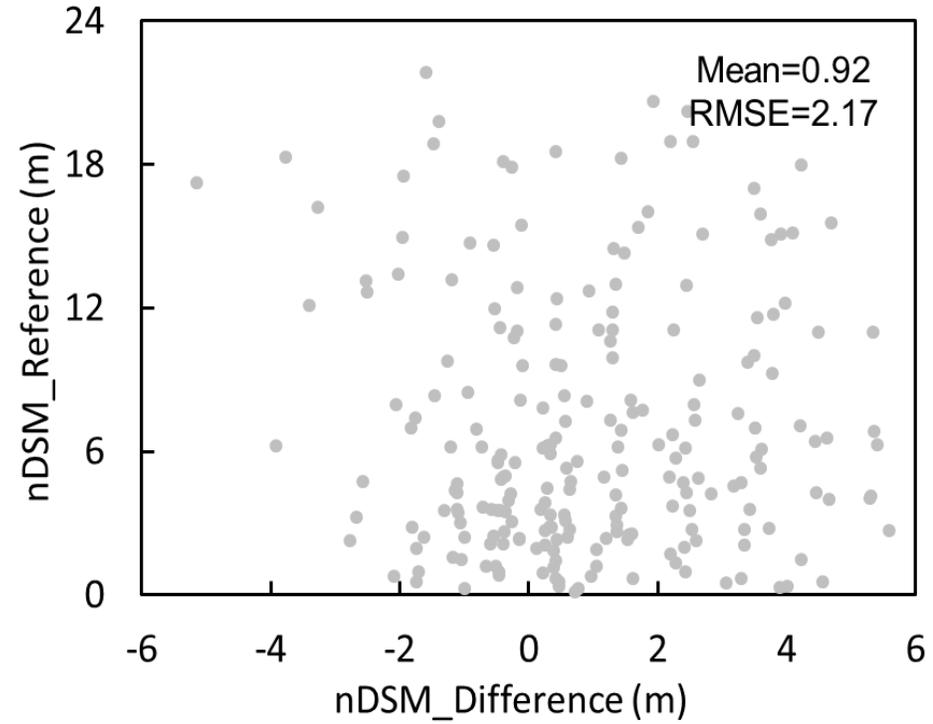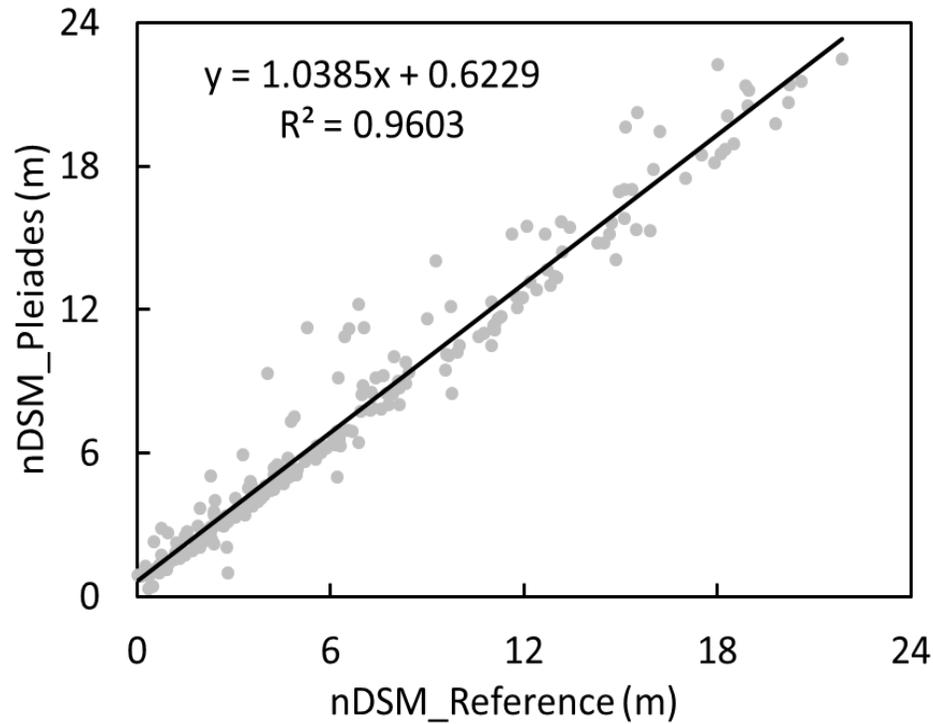
nDSM=DSM-DTM

Reference:
DSM/DTM
From DHMV II_LiDAR

GARVAL – help us validate the garden map!

Do you live in Flanders or Brussels?

Please draw your garden via the following link:

https://mijntuinlab.be/projects/5/

Hoe teken je jouw tuin in?

Leuk en eenvoudig! Open de <u>tekenmodule</u> en zoom eerst in op je adres. Je duidt aan wat je wil tekenen: bijvoorbeeld gras, struiken, bomen of verharding. Dan teken je een veelhoek op de kaart die overeenkomt met dit tuinonderdeel. Om je te helpen bij het intekenen, krijg je als achtergrond een luchtfoto van je tuin te zien.
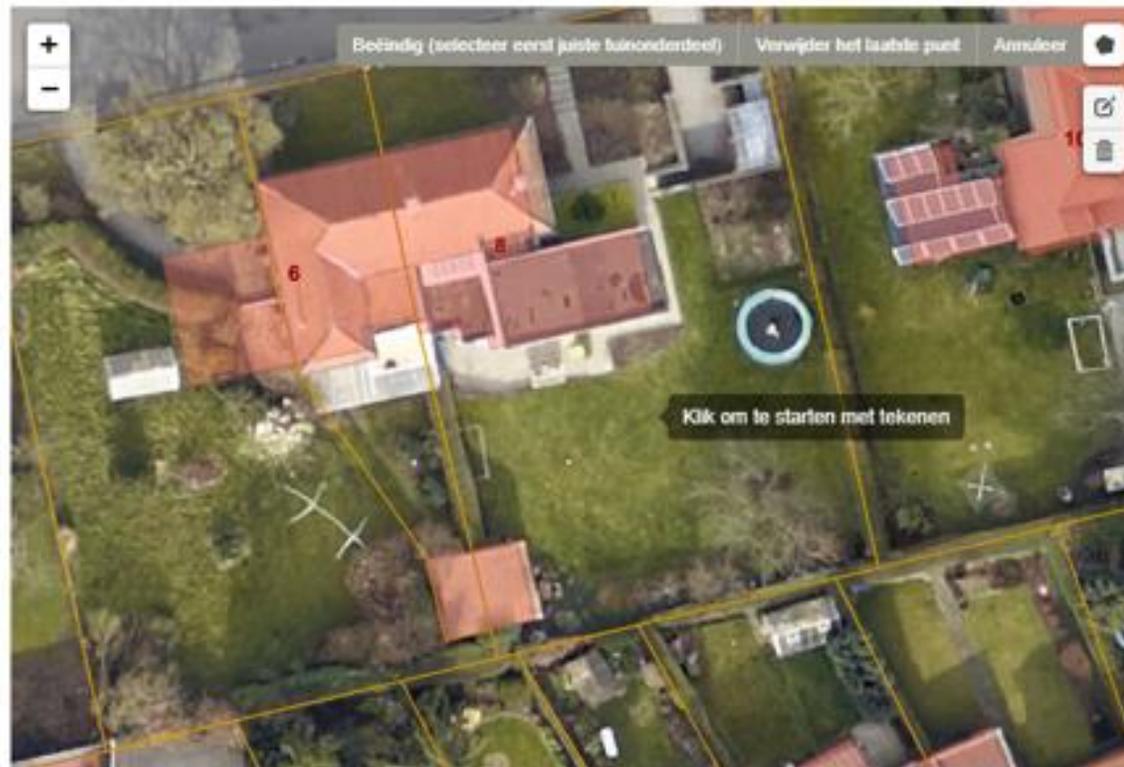
Teken het tuinonderdeel

Zoom in op je tuin:

Straat: straat   Huisnummer: huisnummer   Gemeente: gemeente

Beëindig (selecteer eerst juiste tuinonderdeel)   Verwijder het laatste punt   Annuleer

Klik om te starten met tekenen

Selecteer het tuinonderdeel

Let op: tuinonderdelen kunnen overlappen. Bijvoorbeeld een boom die op gras staat. Om bomen te tekenen neem je de volledige kruin.

Verharding (inclusief tuinhuis of ander afdak en kunstgras)
- ● Verharding - hemelwater stroomt van de verharding af ■
- ○ Verharding - hemelwater loopt door de voegen of stenen weg ■
- ○ Verharding met veel gras (bv. grasdallen) ■
- ○ Kiezelstenen of grind ■
- ○ Houtsnippers of boomschors (inclusief houtstapel niet onder een afdak) ■

Water
- ○ Artificiële waterpartij zonder planten ■
- ○ (Semi-)natuurlijke waterpartij met planten ■

Gras (gazon en weide) en aarde
- ○ Kortgemaaid gazon (inclusief objecten op het gazon zoals speeltoestellen) ■
- ○ Bloemrijk of soortenrijk grasland (ook indien occasionele maaibeurt) ■
- ○ Graasweide voor dieren (inclusief kippenhok) ■
- ○ Naakte bodem of compost ■

MijnTuinlab.be

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natuurpunt

DEPARTEMENT ECONOMIE WETENSCHAP INNOVATIE

N Het Nieuwsblad

24-11-2020