



SSSB excursion to the Northern Campine, 12 May 2023

Interaction between human settlers and the soilscape from late -glacial times till today

Excursion Guide by:

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Foreword

Dear Participants,

Welcome to the annual excursion of the Soil Science Society of Belgium 2023 to the Northern Campine area during which we shall investigate the interaction between human settlers and the soilscape from late-glacial times till today. On the program are the following excursion stops:

- Geo-archeological excavations in the cover sands of Lommel Kristalpark: during this visit Prof. Bart Vanmontfort and Marjolein van der Waa will unearth on the remnants of a hunter-gatherers society from late-glacial to early Holocene times. The excavations with huge horizontal sections not only show early human history, but also reveal numerous late-glacial soil- and terrain features which have marked past and present soil genesis. Take a stroll through truly spectacular Podzols and Allerød ice-features, set foot in a prehistoric camp or take refuge in a 20th century ammunition bunker.
- University forest Beverbeek, Hamont-Achel: Dr. Stefaan Dondeyne will take us on a below-ground trip to the Middle Ages with Plaggic Anthrosols along with related landscape and land use features such as Pine forest with human disturbed Podzols and outfields, separated from the infields by a ditch and an earthen bank (Dutch: 'wolvensprong').
- A final stop at the Achelse Kluis for our society's famous 'Sundowner'!

The aim of this excursion guide is to provide baseline maps and data and a geo-archeological report in support of what will be on display in the many soil profile pits of the day

The organizing team

Karen Vancampenhout, Bart Vanmontfort, Marjolein Van Der Waa, Stefaan Dondeyne, Seppe Deckers

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1. A late-glacial soil level in the cover sands of the Lommel Kristalpark

1.1. Introduction

Since 2009 KU Leuven is conducting geo-archeological field surveys in a large hunter-gatherer site complex along the Mol-Nete at Lommel. This research frames in a land development program for the purpose of an industrial complex, called Lommel-Kristalpark.

During the first phase of the geo-archeological research, remnants of hunter-gatherers from the late-glacial and early Holocene were mapped and excavated from thousands of augerings, test-profile pits, and observation trenches.

In 2022 the research focused on a zone where remnants of hunter-gatherer-activities are located in a shallowly buried landscape from late-glacial times (Allerød, 13,9 ka -12,8 ka CAL BP), below the Holocene Podzol soil.

The reconstruction of the hunter-gatherer activities, the occurrence and genesis of the buried soils and by extension, the surrounding landscape, are important pillars of the research.

The vastness of the research area allows mapping of variations related to landscapes at various scales. The many open profile pits provide a unique insight into the complexity of early human activities and soil development over a long time-span.

Reference publication in Annex:

Landscape development and hunter-gatherer activity in Lommel Molse Nete (BE) during the Late Glacial and early Holocene. First results of an extensive survey. Bart Vanmontfort, Marjolein van der Waa, Koen Verbeeck, Shanah De Boeck, Ann Van Baelen, Mark Willems & Ferdi Geerts

Notae Praehistoricae, 42/2022:1378-148.

1.2. General setting

The current excavations are located in the southeastern corner of the total project area as indicated in the following maps.

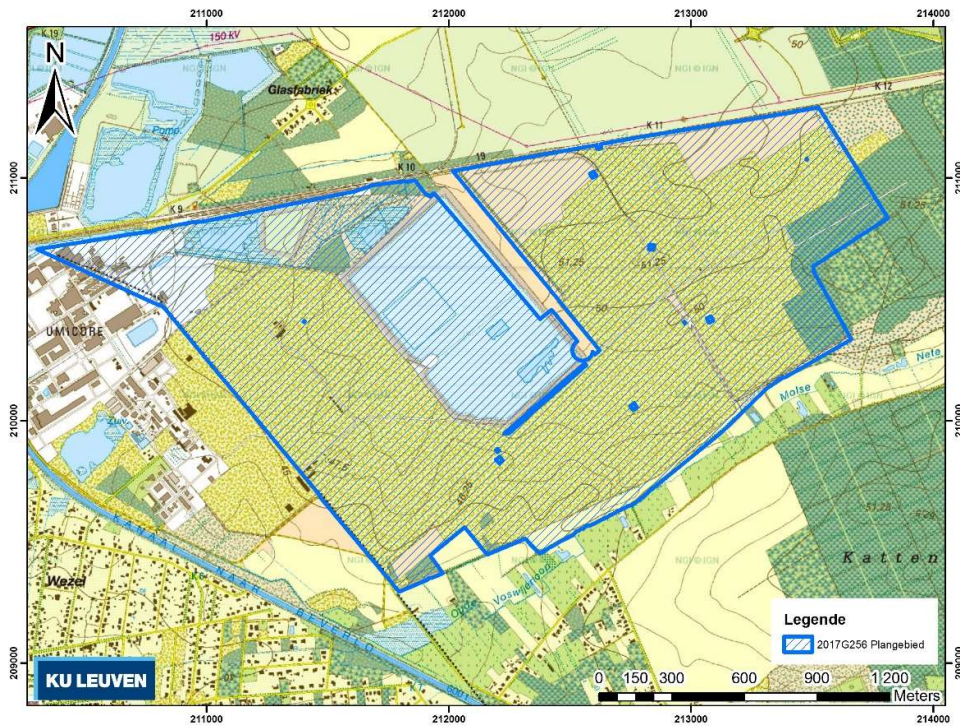


Figure 1. Topographical map of Belgium 1:10.000 (© NGI).

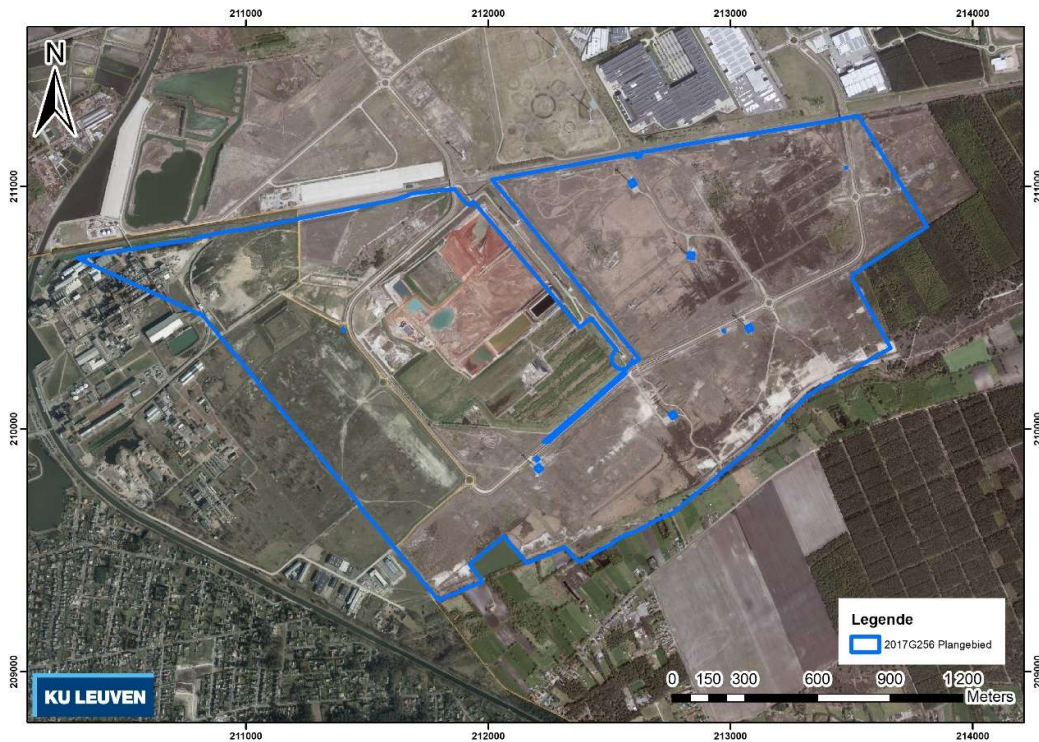


Figure 2. Orthophoto Agiv (situation 2017)

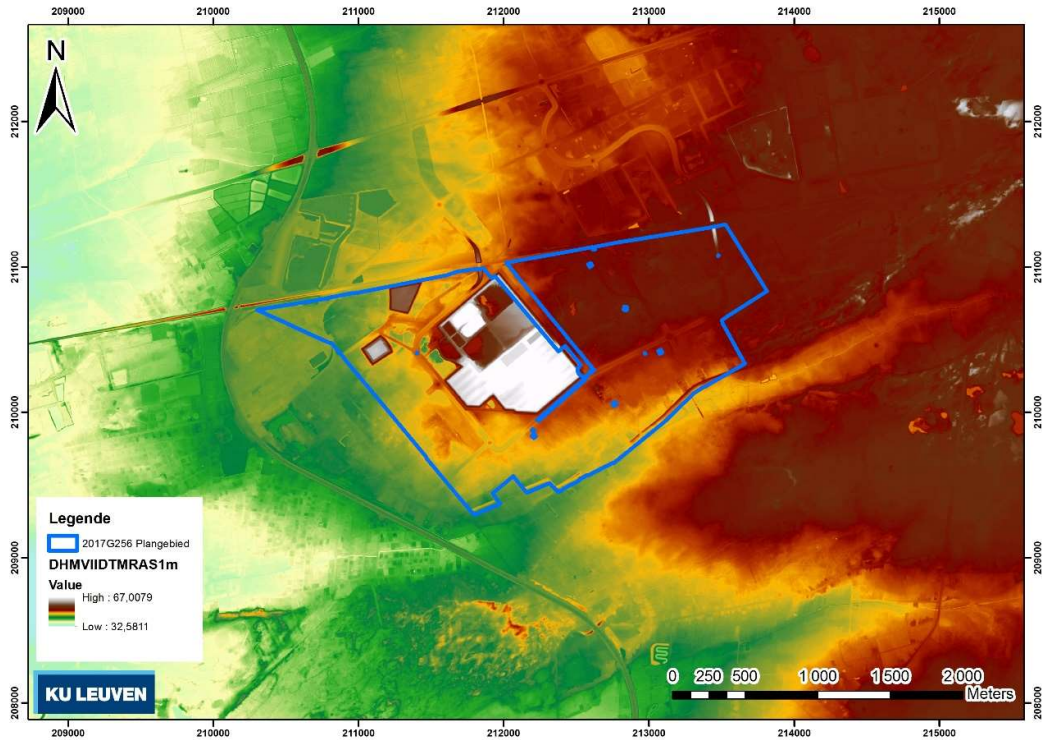


Figure 3. Digital terrain model (LiDAR data GDI-Vlaanderen)

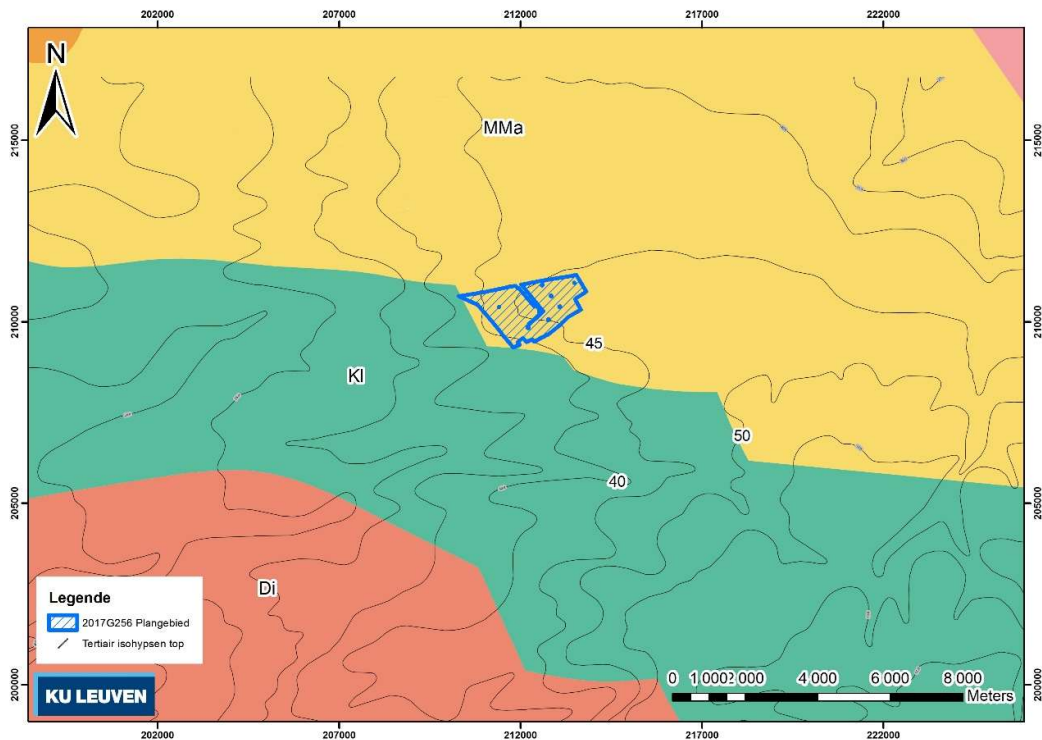


Figure 4. Geological map of Tertiary deposits (Agiv). Mma – Mol Formation, Maat member; KI – Kasterlee Formation; Di – Diest Formation

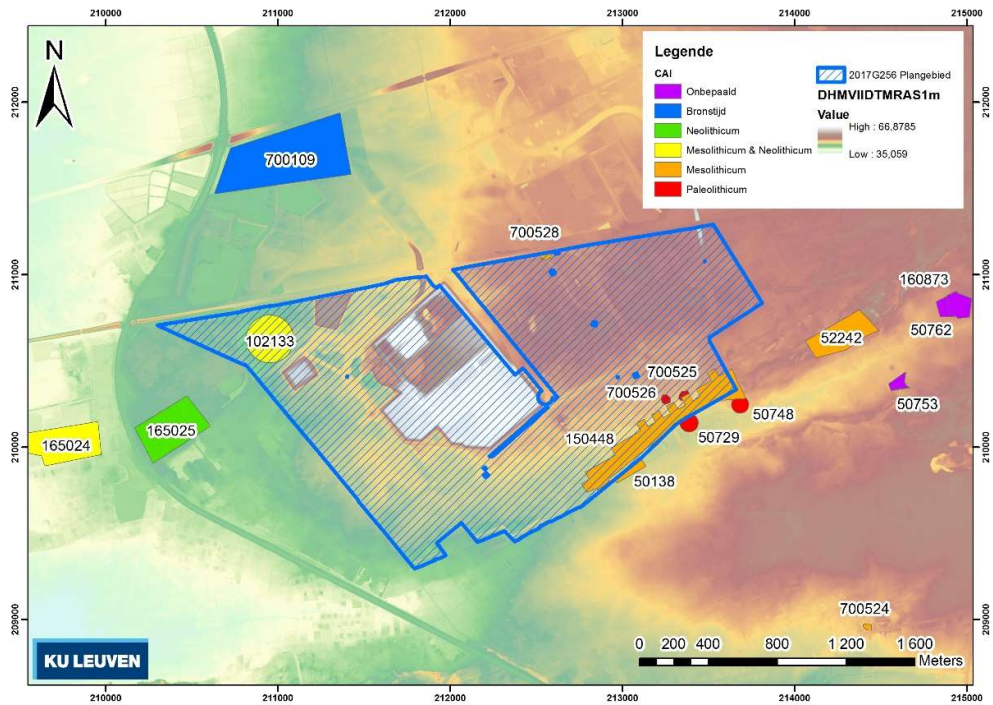


Figure 7. Prior archaeological information (Flemish archaeological inventory – CAI)

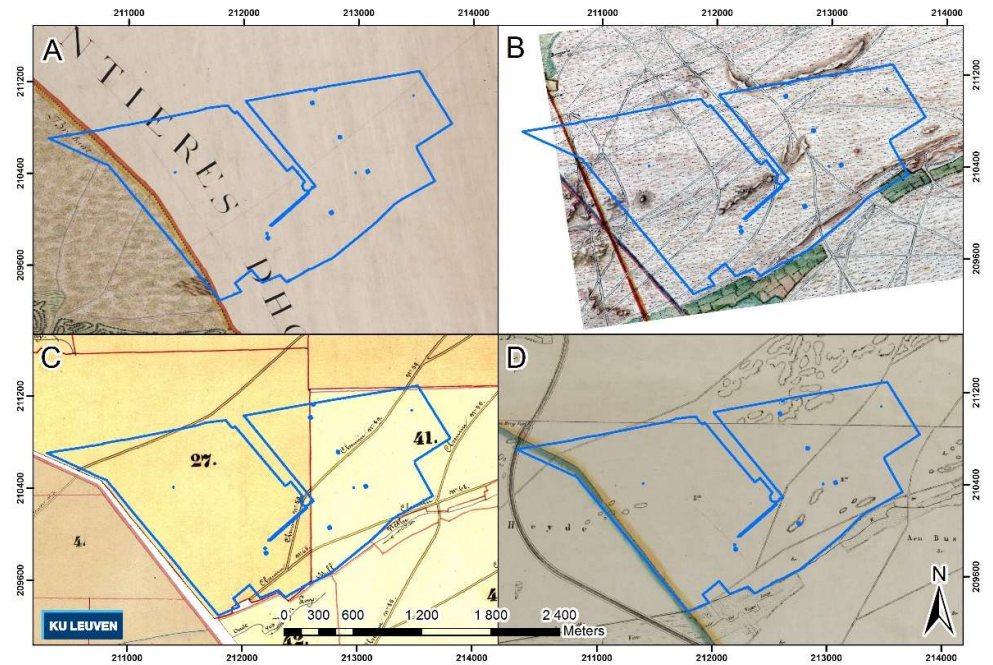


Figure 8. Historical maps. A. Ferraris (1771-1778, © KBR), B. Degault (1786), C. Atlas der buurtwegen (1841, © AGIV), D. Vandermaelen (1846-1854, © AGIV)

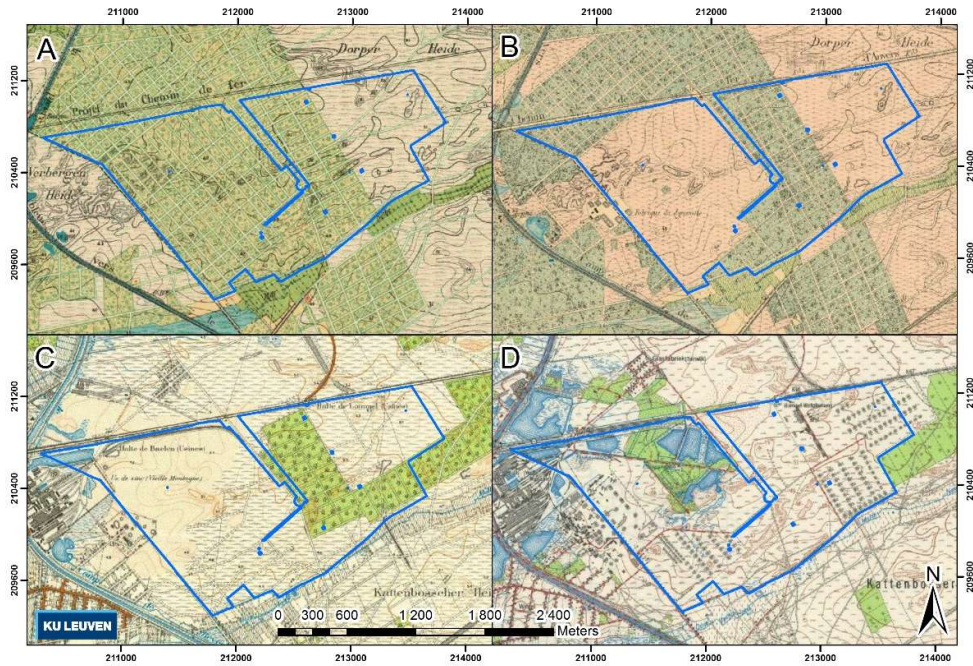


Figure 9. Historical series of topographical maps of Belgium. A. 1873 series, B. 1904 series, C. 1939 series, D. 1969 series

2. University Forest Beverbeek, Hamont-Achel

2.1. General setting

The KU Leuven University Forest Beverbeek is a landscape complex of some 140 ha of which 80 ha are under forest. The main forest was planted to pine trees eighty years ago.

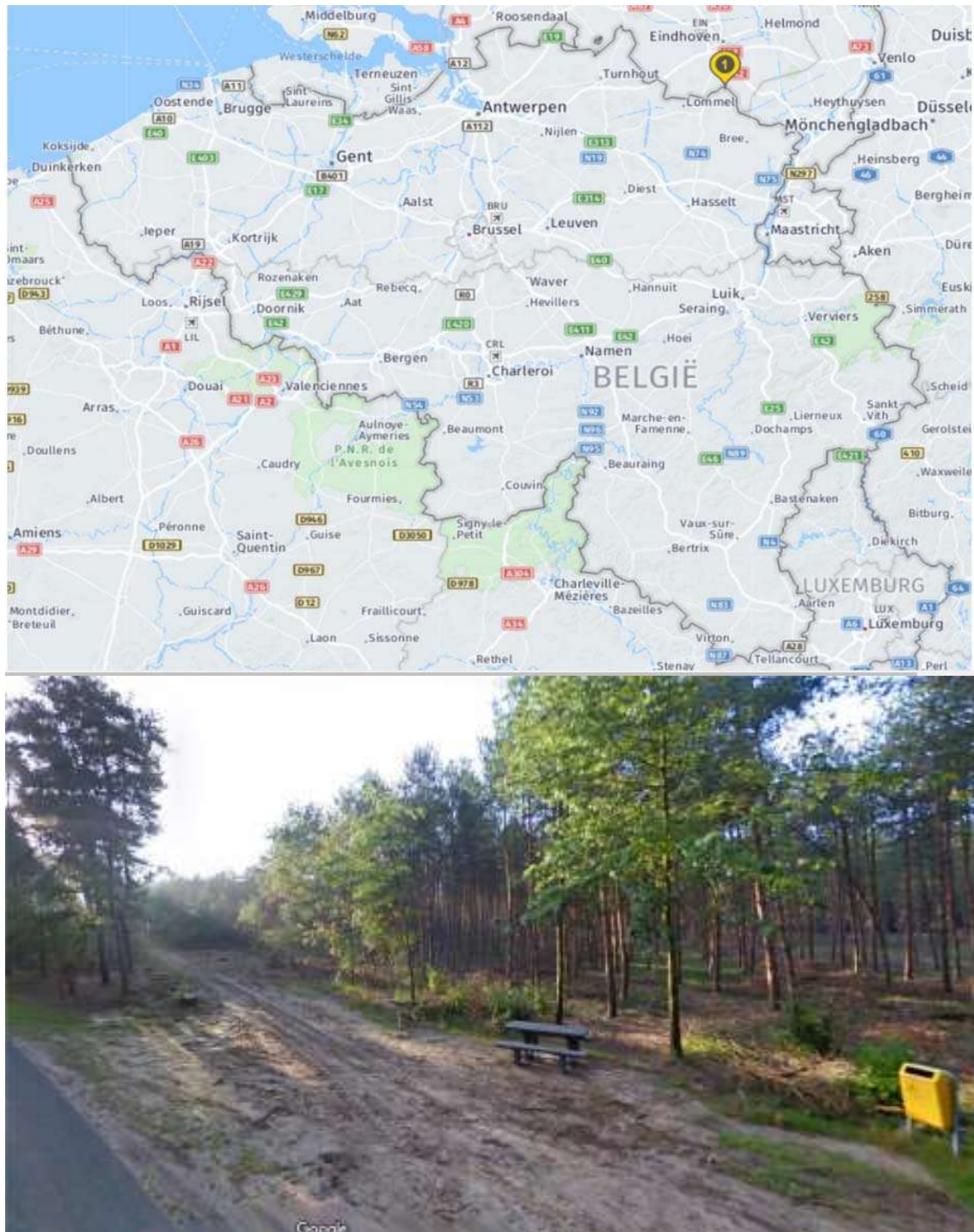


Figure 10. Site location



Figure 11. The Feraris map (1771-1778) of Hamont Achel shows agricultural fields around the Beverbeek farm, which is isolated in a vast area of heathlands. Profile P-01 is located in what is mapped as agricultural fields lands; P-02 in heathlands

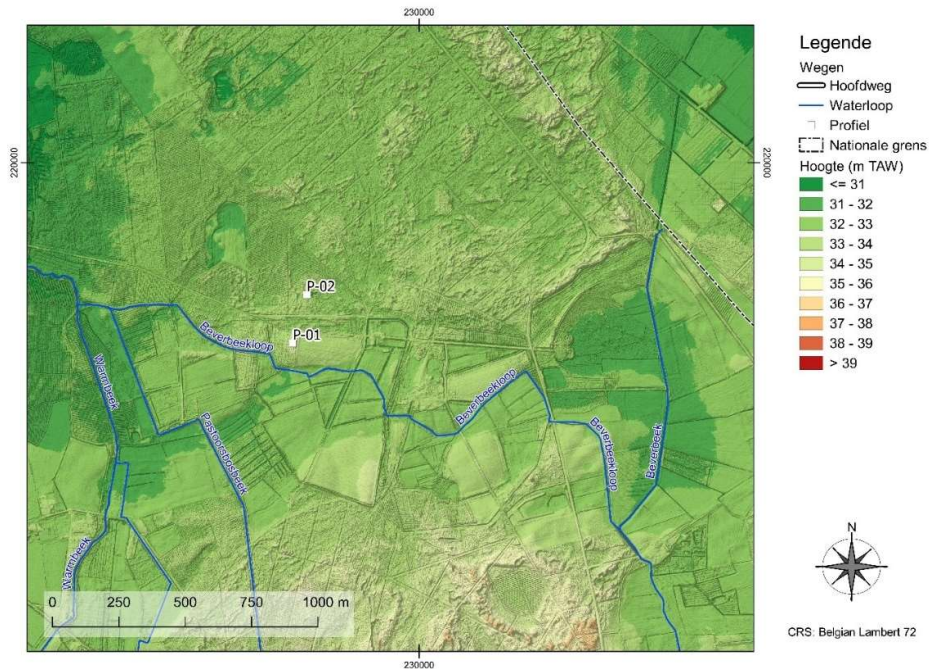


Figure 12. Shaded terrain image based on 1 m resolution Lidar data. P-01 is located on the highest part of a rather smooth, convex elevation; P-02 is in a flat, rather rough landscape

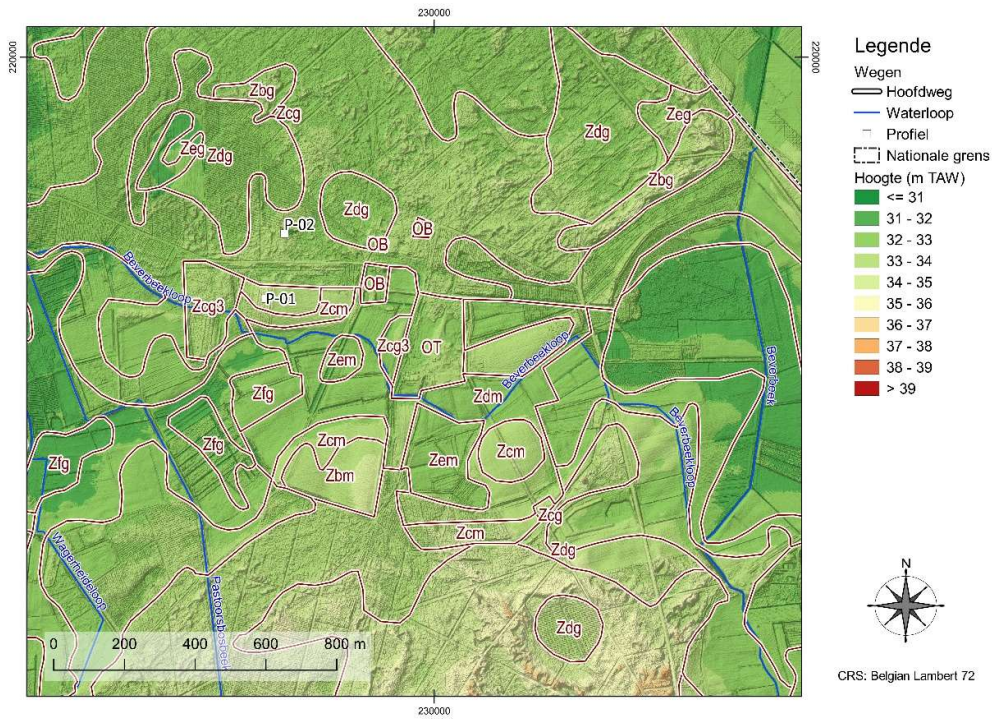


Figure 13. Hamont-Achel, Lidar topo x soil types

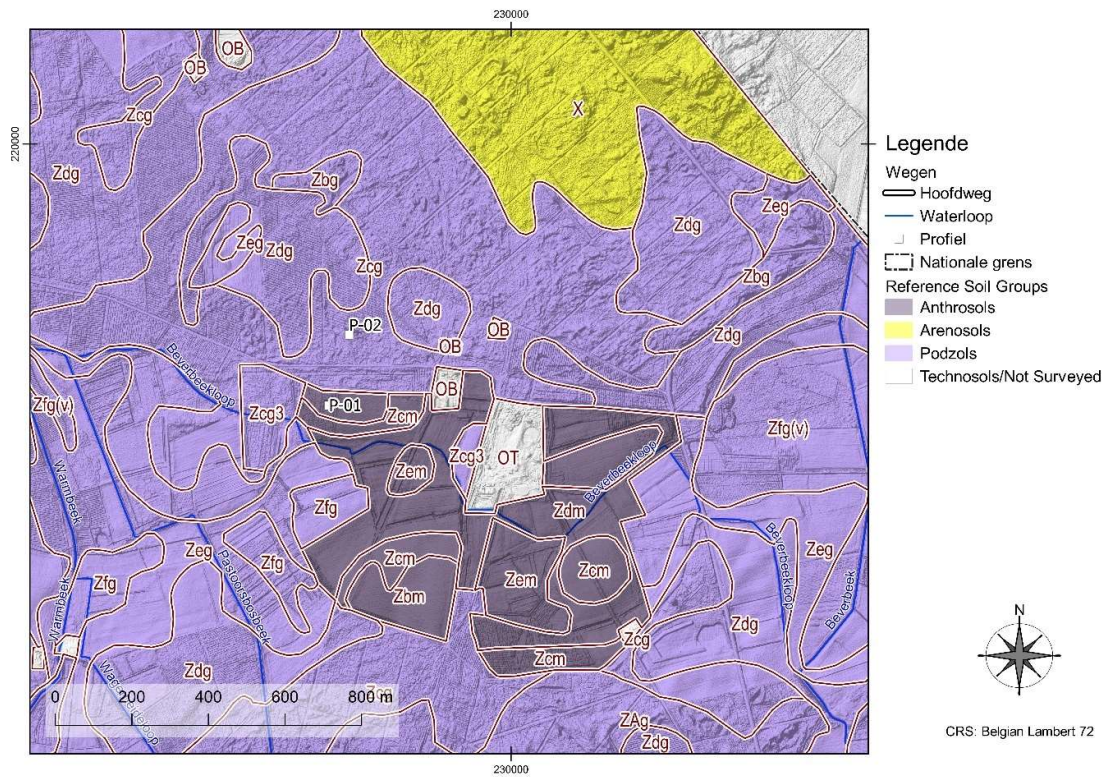


Figure 14. Hamont-Achel Lidar x Soil types in WRB

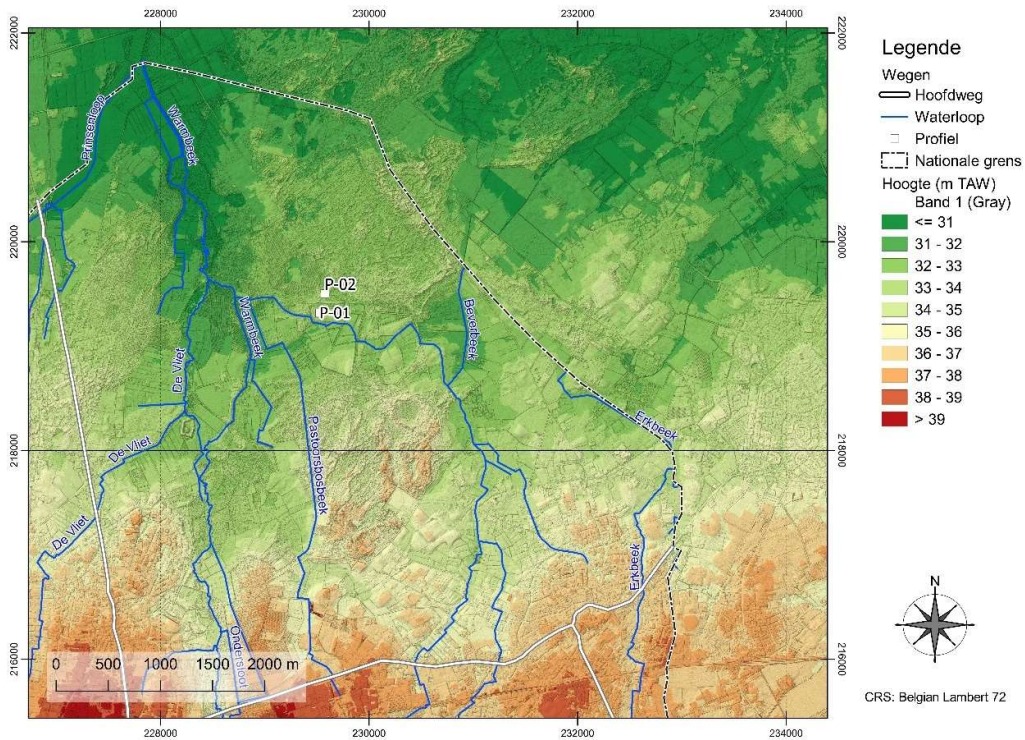


Figure 15. Hamont-Achel Topography

2.2. Hamont-Achel Profile 1

The Lidar images show a smooth, slightly elevated terrain just south of the Beverbeek ditch, and west of the Beverbeek farm. On the Ferraris map, the area is indicated as a farm area, surrounded by heathlands. The farm is still surrounded by moats, hedges and trees and its history dates back to the 14th century. In 1754, L.A. Lepas, a canon of the Saint-Martin's Church in Liège, bought the property, partly renovated the farm. Successive new owners, in 1786 and in 1874, also did some renovation work. In 1936, the Catholic University of Louvain (KU Leuven), acquired the farm and adjacent farmland and forests as a bequest. In the 1960s the university sold the farm and only retained the forest, which it manages partly under a sustainable production forest and partly as a nature reserve.

The Soilscape is indicative of old farmland while it is now in the middle of a nature conservation area.

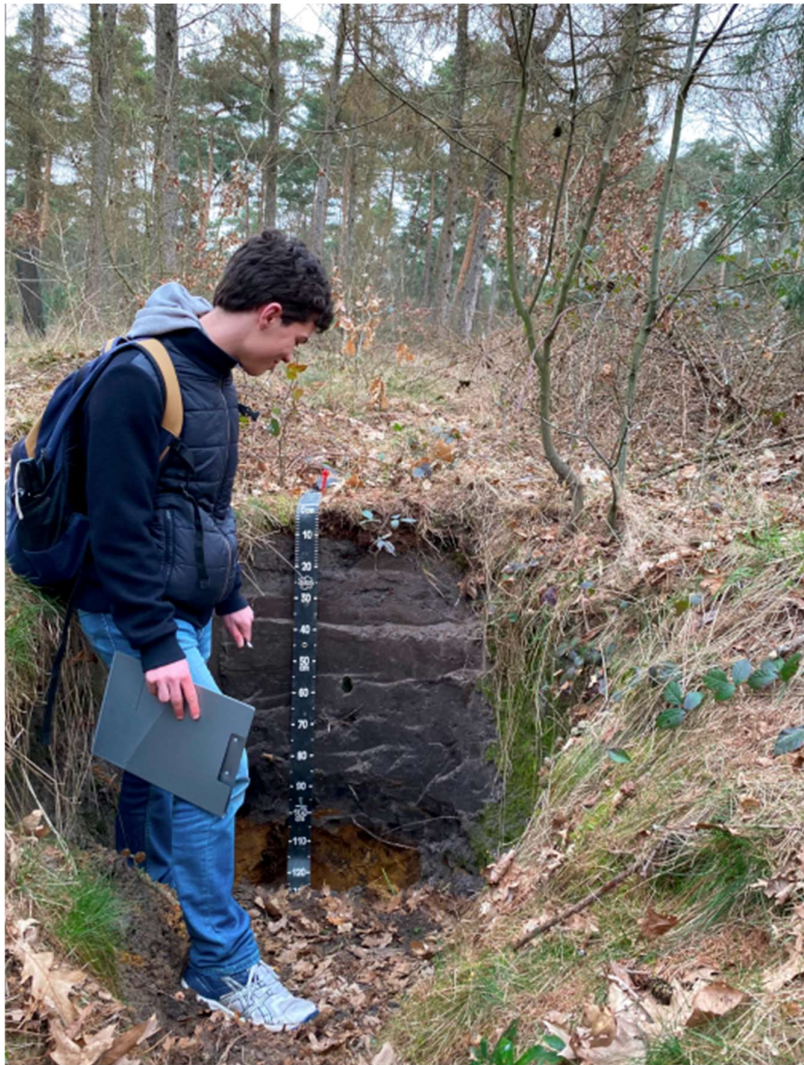


Figure 16. View of Hamont Achel Profile 1 anno 2012

Hamont Achel Profile 1 : Soil profile description

1.1 Location	Hamont Achel; LB72: 229524, 219319; E 5.50846; N: 51.27824
1.2 Date of description	16/3/2012
1.3 Authors	Nico Hick, Vincent Smets, Stefaan Dondeyne, Laura Vanierschot
1.4 Geographical region:	Campine region (Limburg)
1.5 Soil type (Belgian classification)	Zbm(g) : sandy soil, well-drained, with thick anthropogenic humus rich A horizon (as indicated on the Belgian soil map)
1.6 International soil classification (WRB-2022)	Plaggic Anthrosol (Pantoarenic; Dystric, Thapto-albic, Thapto-spodic)
2.1 Geology:	Cover sands, formation of Wildert
2.2 Parent Material:	Sand
2.3 Topography:	Convex, raised field
2.4 Landform	Plain
2.5 Elevation	34 m above sea level (TAW)
2.6 Land-use/Vegetation	Plantation of <i>Larix</i> sp.
3.1 Condition during description:	Moderately dry
3.2 Groundwater depth	> 1m 40
3.3 Drainage class (Belgian)	b (well drained)
3.4 Runoff:	Good
3.5 Internal drainage:	Good
3.6 Risk for floods:	None
5.1 Effective soil depth:	> 1 m
5.2 Roots:	Most of the roots are in the plaggen. Some roots can still be found in deeper horizons.
5.3 Human influence:	It is a plaggen soil. The topsoil is rich in humus due to centuries of fertilization organic matter-rich stable waste

Horizon.	Depth	Description	Diagnostics
Oi	+10–0	Undecomposed organic material, mainly needles and mosses; abrupt regular transition	Folic “material” Arenic
Ap1	0–20 cm	Sand; Brownish black 7.5YR 3/1 (moist); weak, coarsely crumbly; loose, not sticky, not plastic; organic matter locally embedded; many fine and thick roots; abrupt regular transition	Plaggic horizon Arenic
Ap2	20–52 cm	Sand; Black 7.5YR 2/1 (moist); weak, coarse angular blocky; loose, not sticky, not plastic; small piece of charcoal and bits of brick enclosed; few thick roots; clear regular transition	Plaggic horizon Arenic
Ap3	52–78 cm	Sand; Black 7.5YR 2/1 (moist); weak, medium subangular blocky; loose, not sticky, not plastic; many fine and thick roots; mixture of plaggen and remains buried of Ah/Ap horizons, abrupt regular transition	Plaggic horizon Arenic
2E (/2Ah)	78–83 cm	Sand; Brownish grey 7.5YR 4/1 (moist); very weak, finely blocky; loose, not sticky, not plastic; remains of a once ploughed 2Ah, black 7.5YR 2/1 (moist); few fine roots; abrupt regular transition	Albic horizon Arenic
2Bhs/C	83–100+ cm	Sand; Light brown 7.5YR 5/8 (moist); loose, not sticky, not plastic with some very dark brown 7.5YR 2/3 spots; few fine roots, abrupt regular transition	Spodic horizon Arenic

All medium fine, well-sorted, rounded sand

Hamont Achel Profile 1, analytical data

	amm.acet. pH7				Mg	Na	K	Exchang..	Exchang.	Total	%N	%C	C/N
	pH H ₂ O	pH KCl	CEC	Ca				H+	Al	P			
	1:1	1:2.5						cmol _c /kg	cmol _c /kg	cmol _c /kg			
Ap1	3.64	2.91	6.69	0.11	0.04	0.01	0.07	1.87	1.01	0.03	0.09	1.84	21.1
Ap2	4.01	3.30	5.52	0.01	0.01	<0.01	0.03	1.68	1.27	0.03	0.06	1.27	20.9
Ap3	4.30	3.81	10.60	<0.01	0.01	0.04	0.03	2.96	2.89	0.03	0.14	3.61	25.6
2E	4.71	4.04	2.09	<0.01	<0.01	0.01	<0.01	0.93	0.75	0.01	0.02	0.89	48.3
2Bs	4.59	4.30	3.02	<0.01	<0.01	0.01	0.02	1.09	1.01	0.02	0.01	0.34	24.6

	clay	silt			total silt	sand					total sand	Texture classes
	<2 μm	2-10 μm	10 - 20 μm	20 - 63 μm	2 - 63 μm	63 - 100 μm	100 - 250 μm	250 - 500 μm	500 - 1000 μm	1000 - 2000 μm	63 - 2000 μm	FAO/ Belgian
Ap1	2	1	1	5	7	12	65	12	2	0	91	Sand/Z
Ap2	2	1	1	6	8	12	64	12	2	0	90	Sand/Z
Ap3	1	2	2	9	13	11	60	13	2	0	86	Sand/Z
E	1	0	1	6	7	12	65	13	2	0	92	Sand/Z
Bs	1	0	1	5	6	12	69	11	1	0	93	Sand/Z

2.3. Hamont-Achel, Profile 2

This profile shows a weakly developed soil, developed in aeolian sand deposits of, at least in part of reworked fluvial deposits. These cover sands cover deeper-seated fluvial sand and gravel deposits from the Rhine and Meuse Rivers. The origin of the parent material in the top 150 cm in this profile has been a matter of debate. The overall morphology of a horizontal layering with variable silt and clay-content is indicative for an aeolian origin of the entire profile. The upper 50 cm of the profile is rather homogenous sandy as a result of biological activity which qualifies for a 'weathering' horizon. Yellow-orange colors of iron precipitates are a witness of seasonal groundwater stagnation on the clay lamellae. This profile also shows a sizeable late-glacial ice-wedge which has been pushing existing clay bands aside and upwards in some places.

For land use this soil is considered as rather poor, however for forestry species like *Pinus spp.*, it belongs to a higher productivity class compared to dry Podzols of the area..



Figure 17. Hamont-Achel , Profile 2: Picture

Hamont-Achel, Profile 2, Soil Profile Description

1.1 Location	Hamont Achel LB72: 229577, 219502; E 5.50925; N: 51.27988
1.2 Date of description	18 April 2023
1.3 Authors	Stefaan Dondeyne, Seppe Deckers
1.4 Geographical region:	Campine region (Limburg)
1.5 Soil type (Belgian classification)	Indicated as Zcg on the soil map: sandy soil, moderately well-drained, with spodic horizon
1.6 International soil classification (WRB-2022)	Dystric Brunic Arenosol (Pantoarenic; Claric, Hydrophobic, Stagnic, Relictiturbic)
2.1 Geology:	Cover sands, formation of Wildert
2.2 Parent material:	Sand
2.3 Topography:	Flat land (old sand quarry)
2.4 Landform	Plain
2.5 Elevation	32 m above sea level (TAW)
2.6 Land-use/Vegetation	Plantation of <i>Pinus</i> sp.
3.1 Condition during description:	Moist
3.2 Groundwater depth	around 1m50
3.3 Drainage class (Belgian)	.d. (somewhat poorly drained)
3.4 Runoff:	Good
3.5 Internal drainage:	Good
3.6 Risk for floods:	None
5.1 Effective soil depth:	> 1 m
5.2 Roots:	Roots have difficulty infiltrating, some are concentrated along stratigraphic layers, or shear planes.
5.3 Human influence:	Some traces of ploughing

Detailed soil description

Horizon	Depth	Description	Diagnostics
Oe	+5–0 cm	Weakly decomposed organic material, Pine needles still recognisable	Folic “material”
Ap	0–20 cm	Sand; Very dark greyish brown 7.5YR 2/2 with coarse light brownish-yellow patches 7.5YR 3/4(moist); weak, coarsely subangular block structure; non-sticky, non-plastic; loose to very friable; clearly hydrophobic; few interstitial pores; common to many fine and medium roots; abrupt wavy boundary	Arenic material Hydrophobic
Bw	20–40 cm	Sand; light reddish-brown 7.5YR 5/6; massive/structureless; non-sticky, non-plastic; loose; weakly hydrophobic; no pores; common fine and medium roots; abrupt smooth boundary	Arenic; Brunic ”horizon”
Cg/E@	40–90 cm	Sand; layers of dark yellowish-brown 5YR 4/8, to light reddish-brown 7.5YR 5/8, alternating with pinkish grey 7.5YR 7/2 layers. A sub-vertical streak of, 20 to 30 cm wide, is present in both this and the underlying soil horizons. This material is pale brownish-grey 10YR 7/3 (<i>claric</i> material). Locally there are small (<~5 mm dark Fe-Mn mottles), and very fine layers that can be seen as clay migration bands; structureless; non-sticky, non-plastic; loose; no pores; few fine and medium roots concentrated on some shear planes; abrupt smooth boundary	Arenic Stagnic Claric material Relictiturbic features
C11/E@	90-110 cm	Sand; more homogenous yellowish brown 10YR 5/8, with diffuse, coarse strong brown 7.5YR 5/8 mottles alternating with very pale brown 10YR 7/3 patches; structureless; non-sticky; non-plastic; loose; no pores; no roots; abrupt smooth boundary	Claric material; Relictiturbic features
C12/E@	110-150	Sand; yellowish brown 10YR 5/4 to light yellowish brown 10YR 6/4; structureless; non-sticky; non-plastic; loose; no pores; no roots; reaching to groundwater	Claric material; Relictiturbic features

Hamont-Achel, Profile 2, analytical data

	Depth (cm)	pH H ₂ O 1:1	pH KCl 1:2.5	Walkley &Black	Kjeldahl	amm.acet. pH7				
				OC %	N %	CEC	Ca	Mg	Na	K
Ap	0-20	3.74	2.64	1.2	0.06	11.91	0.33	0.12	0.05	0.09
Bw	20-40	3.85	3.25	0.1	0.03	3.63	0.03	0.02	0.01	0.03
Cg/E@	40-90	4.53	4.19	0.1	0.01	1.97	0.01	<0.01	0.01	0.01
Cl1/E@	90-110	4.62	4.38	<0.1	0.02	1.37	<0.01	<0.01	<0.01	0.01
Cl2/E@	110-150	4.58	4.45			1.47	0.01	<0.01	0.01	0.02
Cr	>150	4.67	4.48			1.83	0.01	<0.01	0.01	0.02

	Depth (cm)	exchang.	exchang.	P (%)
		H ⁺ cmol _c /kg	Al cmol _c /kg	
Ap	0-20	1.70	0.65	0.01
Bw	20-40	1.44	1.05	0.01
Cg/E@	40-90	1.04	0.96	0.01
Cl1/E@	90-110	0.77	0.70	0.01
Cl2/E@	110-150	0.82	0.79	0.01
Cr	>150	0.72	0.65	0.01

	clay	silt			total silt	sand					total sand	Texture classes
	<2 µm	2-10 µm	10 - 20 µm	20 - 63 µm	2 - 63 µm	63 - 100 µm	100 -250 µm	250 - 500 µm	500 - 1000 µm	1000 - 2000 µm	63 - 2000 µm	FAO/ Belgian
Ap	2	0	1	3	4	8	62	18	5	1	94	Sand/Z
Bw	2	0	0	2	2	9	72	13	2	0	96	Sand/Z
Cg/E@	1	0	0	5	5	13	65	14	2	0	94	Sand/Z
Cl1/E@	1	0	0	2	2	11	77	8	1	0	97	Sand/Z
Cl2/E@	1	0	0	8	8	27	60	3	0	1	91	Sand/Z
Cr	1	0	0	7	7	19	61	8	2	2	92	Sand/Z

2.4. Hamont-Achel, land management

2.4.1. Farming on poorly endowed soils of the Campine

Plaggic Anthrosols have the characteristic 'plaggic horizon' produced by long-continued addition of 'pot stable' bedding material, a mixture of organic manure and earth. The formation of most plaggic horizons started in medieval times when farmers applied a system of 'mixed farming', combining arable cropping with grazing of sheep and cattle on communal pasture land. During the night and in winter time, sheep and cattle were kept in stables with bedding material of thin sods of heath and/or forest litter. Fresh bedding material was regularly provided until the bedding became too thick and had to be removed. It was then spread out on the arable fields as an 'organic earth manure'. This addition of organic manure raised the surface level of the (only!) arable fields by some 0.1 cm per annum. In places, the system was in use for more than a thousand years, evidenced by a plaggic horizon of more than 1 meter in thickness (Driessen et al.. 2001).



Figure 18. The practice of plaggen farming on poorly endowed Podzols



Figure 18. Continued



Figure 19. Hamont-Achel farm with a mediëval wulf fence. 'Wolvensprong' in the forefront (behind the water ditch)



Figure 20. Artistic depiction of a wulf fence (<http://home.kpn.nl/egkats/Mottekastelen.htm>)

2.4.2. Today's forest reversion plan and forest management

Classical rejuvenation of pine trees is done by clear-cutting, followed by either allowing pine (*Pinus sylvestris*) seedlings to grow up or by planting genetically improved tree species such as improved pine varieties, hybrid larch (*Larix* or *Douglas* species. An alternative to clear-cutting is to allow some 30 pine trees to remain on the land, which serve as seed source. In between winter oak and douglas is planted (protected by a bark-protection for wildlife damage).

A third alternative of forest management is 'group-cutting' of the old pine forest. Summer oak (*Quercus robur*) and winter oak (*Quercus petraea*) is then planted in clear-cut land patches in between the old pine trees.

A last alternative for forest rejuvenation is by steadily thinning out the old forest and allowing birch and oak trees taking over.

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4. Annex:

Landscape development and hunter-gatherer activity in Lommel Molse Nete (BE) during the Late Glacial and early Holocene First results of an extensive survey Bart Vanmontfort, Marjolein van der Waa, Koen Verbeeck, Shanah De Boeck, Ann Van Baelen, Mark Willems & Ferdi Geerts Notae Praehistoricae, 42/2022:1378-148.