Rapport **Natuurpunt Studie**

Bat research

LIFE

Green Valleys

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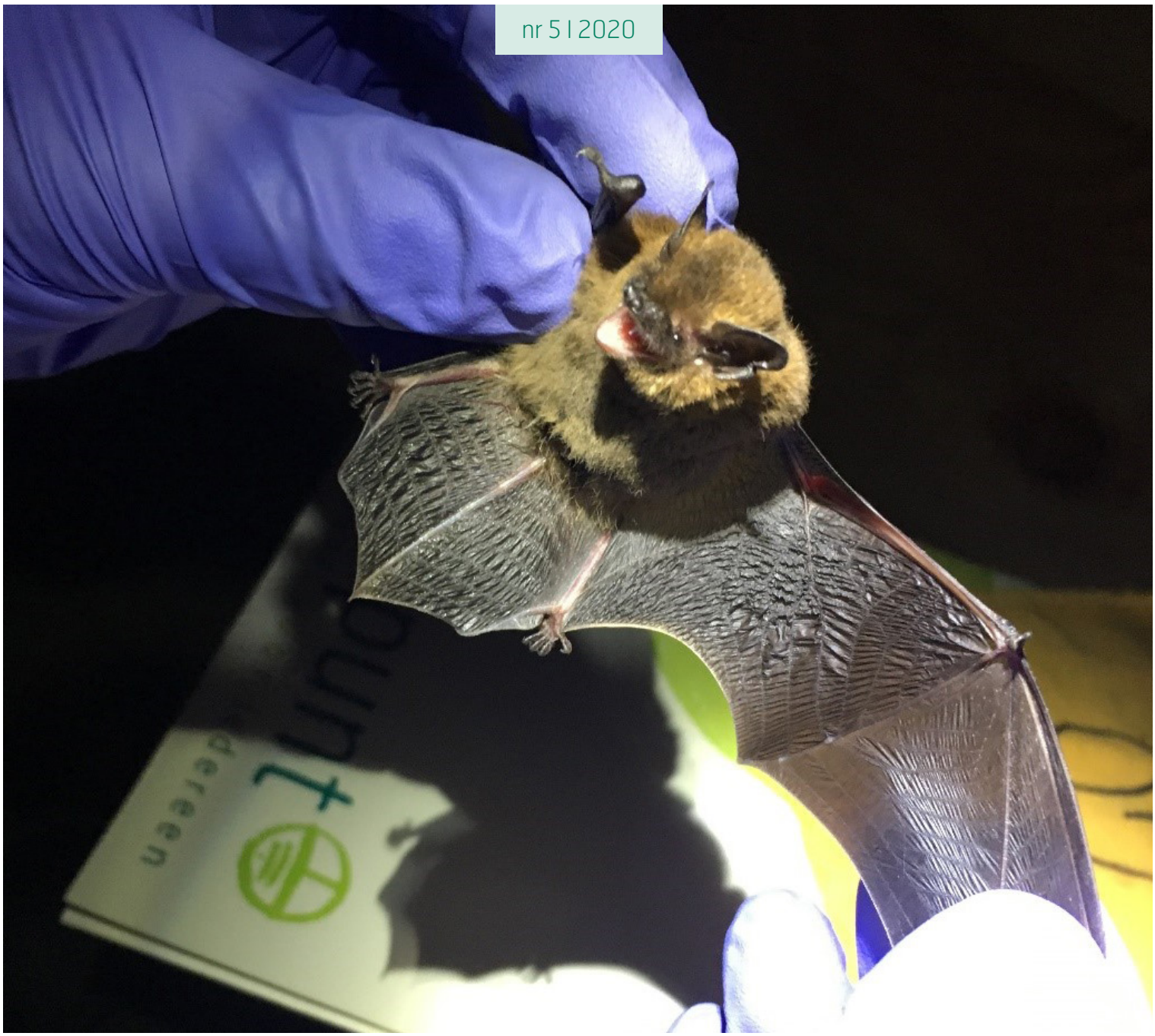

Bat Research
LIFE Green Valleys

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The nature reserves of Green Valleys are part of the Natura 2000-network of European important nature reserves and receive financial support of the LIFE-fund of the European Union.

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Content

1 Introduction

This study is part of the LIFE-project “Green Valleys: connecting habitats' conservation with long term biomass management and multi-stakeholder approach” (LIFE17 NAT/BE/000445).

The nature reserves of Green Valleys are part of the Natura 2000-network of European important nature reserves and receive financial support of the LIFE-fund of the European Union.

The LIFE-project Green Valleys is a collaboration between Belgian and Polish nature organizations. In Flanders, actions are planned in Midden-Brabant, northeast of Brussels. The following nature reserves are part of the project area (in Dutch): Pikhakendonk, Hellebos-Rotbos, Floordambos, Kastanjebos, Torfbroek, Silsombos, Molenbeekvallei and Rotte Gaten. In Poland, actions are planned in the west of the country, close to the German border.

Figure 1: Project locations in Belgium and Poland

In order to reach the project objectives, some trees will have to be removed (Actions C.1 Restoration of open habitats, C.3 Strenghtening forests, and C.5 Restoration of aquatic habitats). Trees are important residences for bats. *Myotis daubentonii*, *Myotis nattereri*, *Pipistrellus nathusii*, *Nyctalus noctula* and *Nyctalus leisleri* are typical treedwelling species (in Flanders), some of them only during summer, some of them whole year round. In order to avoid damage to bats, the present study is carried out. This study involves a first check for the presence of bats in all sub-regions, and in the trees that are planned to be cut down in this project. Where bats are found, proper solutions are provided so that the different species maintain in a favourable condition.

The present study is Action A4 (Research into bats in habitats where trees will be removed). The aim of this action is to avoid damage to all Appendix 2 and Appendix 4 bat species, and therefor contributes reaching the project objectives. The roosts of Appendix 4 species are protected. For Action A4, a screening of all actions where trees are felled will be carried at the start of the LIFE Green Valleys project, as a first assessment of which locations / actions have a potential impact on Appendix IV species. Action A4 includes that all locations where possible a negative impact (e.g. where trees will be cut down and potential bat colony trees are present) can be expected

will be visited by daylight first. The situation will then be assessed and a plan of approach drawn up for optimally efficient further research into bats. At the start of Action A4, not all locations from Actions C.1, C.3 and C.5 were known yet.

Following information was known about bats in the different sub-region before the start of the project.
Data from www.waarnemingen.be showed only 12 observations (Figure 20, attachments). *Pipistrellus pipistrellus* is very common and was considered certainly present in all sub-regions, but only 5 observations were registered within the project area. Other observed species (groups) are *Pipistrellus* species, *Myotis nattereri*, *Myotis daubentonii*, *Nyctalus noctula* and *Plecotus auritus*.
The winter databank from the Bat Working Group from Natuurpunt delivered data for two hibernating sites within the LIFE Green Valleys project area (Figure 20, attachments). In winter site 5021 (Ice cellar 'de Merode'; sub-region Rotte Gaten and Eikelenhof) hibernate some 6 à 16 bats (Figure 21). Observed species (groups) are *Plecotus auritus*, *Plecotus species*, *Myotis daubentonii*, *Myotis mystacinus/brandtii*, *Myotis* species and *Chiroptera* species. In winter site 5024 (Ice cellar 'Wilder/de Broqueville'; sub-region Silsombos) hibernate some 2 à 11 bats (Figure 22). The observed species (groups) are identical as for winter site 5024, with additionally *Myotis nattereri*.

2 Materials and methods

Depending on the situation, one or more of the following methods were used:

2.1 Exploratory: Automatic registration

This method consisted of a continuous registration (from sunset to sunrise) of bats activity by an automatic recorder (type Song Meter SM4BAT from Wildlife Acoustics). All activity of passing bats was registered through continuous recording on 36 different locations. The bat detector placed between 21 September 2018 and 15 July 2019. The number of active nights for each detector location varied between 1 and 21. For all locations together, the detector was placed in the field for 209 recording nights. In total 39.462 bat passages were recorded. The obtained sonograms were manually identified up to species level (or up to species group level, if species not certain) using the software BatSound 4 (Pettersson Elektronik)

The use of automatic detectors has the advantage that these detectors can be placed for a longer period (one or more full nights). This then shows the activity over an entire night, and it is therefore more likely to map all present species. In addition, automatic detectors are an extremely standardized way of working (and therefore also suitable for long-term monitoring), while walking around with manual detectors is more subject to the observer.
However, an automatic detector also has disadvantages. Only a limited number of locations can be investigated with such detectors - making it difficult to integrally investigate a wider area (with many different biotopes). For the present research, this disadvantage does barely apply. Because of the interest in certain specific parcels (where potentially trees can be removed), a very detailed image of the occurring species on that exact location is rather desirable. This is one of the reasons why most of our research is based on automatic registrations. Another reason is that there was enough time for placing the detector on many different locations, so that also a good overview from the different sub-regions could be obtained.

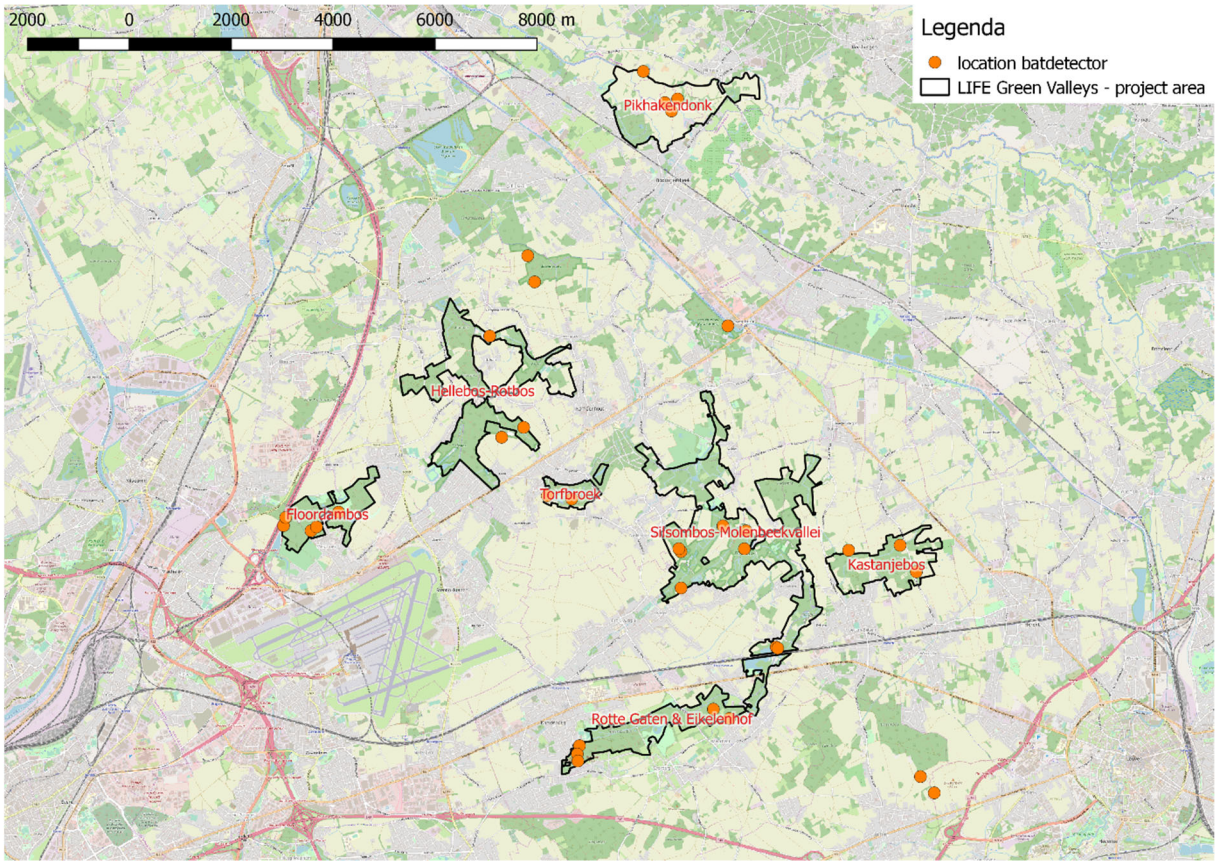

Figure 2: Overview of locations where automatic bat detectors were placed. (© OpenStreetMap-authors)

2.2 Exploratory: Manned inventory

This method uses manual detectors and recording equipment, whereby researchers walk around in the different sub-regions for two to three hours (starting shortly after sunset). This method must be regarded as partly complementary to the unmanned inventory in the sense that it increases the chance of encountering rare species (if visiting areas or habitats where no automatic detectors were placed), and makes visual observations possible (based on numbers, possible resting/roosting spots, etc.). This method appeared to be less beneficial for the given purpose. Walking around for 2-3 hours gave much less chance on encountering bats than an automatic detector recording the whole night through (and at all frequencies). Also, an automatic detector records in this case on our chosen parcel of interest. While walking around, much time is lost by walking from parcel to parcel (but observations done on the way of course indicates that those species most probably also occur on the parcels concerned). For this reasons, manned inventory was limited to observations during catching nights and during a morning visit for swarming at Silsombos. No additional species were found manually, compared to the automatic detectors.
The detectors used were from the type Pettersson D240X (Pettersson Elektronik), the recorders from the Type Edirol Roland R-09.

2.3 Advanced infrared camera and endoscope

An advanced infrared camera (type Pulsar Helion XP50) was used to detect 'hot spots' (in cavities, cracks, etc.) and thus to identify places in trees where bats rest/roost. Additionally, cavities were checked on the presence or use of bats with an endoscope (type Ridgid micro CA300). Hereby the guidelines described in the Bat Tree Habitat Key (2018) were followed.
Because of the small size of the concerned parcels and their distribution over the area, it was doable to check the limited number of potential bat cavities with an endoscope (where within reach, using a ladder). The infrared camera could optimally be used during the morning but was also practical during later day hours. When the trees were warmed up too much from the sun, endoscopic research was done on cavities that were found on sight. Following research was conducted:

Date	Activity	Sub-region
5/1/2019	Controle with endoscope and infrared camera	Silsombos
7/1/2019	Controle with endoscope and infrared camera	Silsombos
13/1/2019	Controle with endoscope and infrared camera	Silsombos
13/1/2019	Controle with endoscope and infrared camera	Hellebos-Rotbos
13/6/2019	Controle with endoscope and infrared camera	Silsombos

2.4 Captures and tagging

In order to find places where bats rest/roost in hollow trees, bats can be caught and tagged with a radiotransmitter. Captures also provide additional information on the presence of species, in particular cryptic species (e.g. *Plecotus auritus* and *P. austriacus*) or species with a particularly silent sonar (e.g. *Myotis emarginatus* and *M. nattereri*). With this purpose, 7 nights were selected for bat catching. Mist nets were placed at carefully selected locations to increase the chance of capture. The nets were opened from sunset until bat activity in the surroundings heavily decreased (in general around 1:30). Next to the nets, a so-called 'acoustic lure' (type UltraSoundGate Player-BL Light, Avisoft Gbr. Germany) was used. This device reproduces social sounds from bats to increase the chance of catching (Hill & Greenaway 2005). In total 30 bats (5 different species) were captured. At three catching locations, an infrared camera was used to observe the behaviour of bats nearby the nets and to limit light disturbance during checking the nets on captured bats.

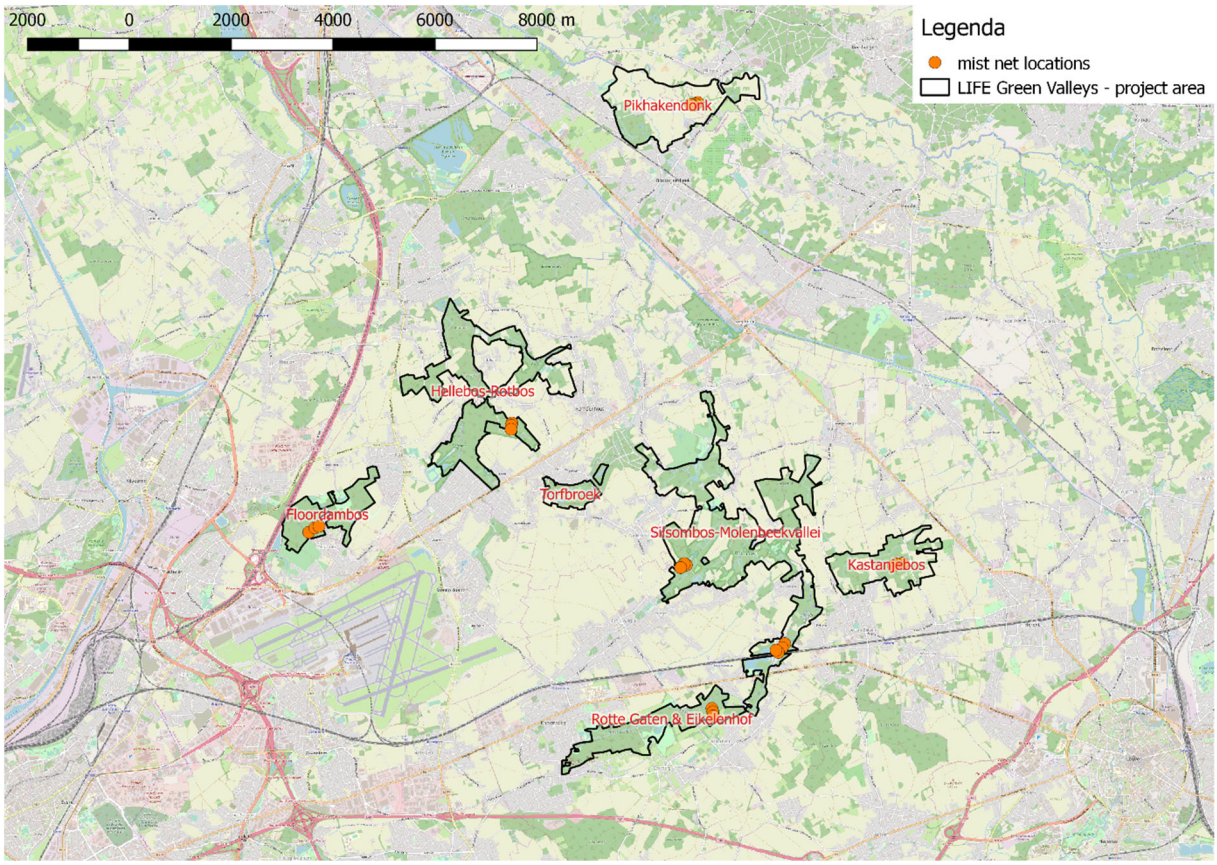

Figure 3: Overview of locations where mist nets were placed. (© OpenStreetMap-authors)

Table 1: overview of bat catching nights with number of captured bats

sub-region	date	# captured bats
Floordambos	31/5/2019	4
Hellebos	23/8/2019	2
Kastanjebos	1/6/2019	5
Molenbeekvallei	1/6/2019	3
Pikhakendonk	23/8/2019	10
Rotte Gaten & Eikelenhof	31/5/2019	1
Silsombos	24/8/2019	5

Considering the aim of the research, finding colony and roosting trees, it was not useful to tag bats that are not dwelling in trees (e.g. *Pipistrellus pipistrellus*) or male individuals. From tree dwelling species, we did not tag highly pregnant or lactating females to avoid a negative impact on their pups. This resulted in one female Plecotus auritus from Floordambos (31/5/2019) that could be tagged with a transmitter type V3 400 mikrowatt 0,35g (Telemetrie-service Dessau), and followed through the night till the colony tree.

3 Results per sub-region

3.1 Pikhakendonk

At Pikhakendonk an automatic detector was placed on 4 different locations, for a total of 1037 recorded bat passages. The placement of 4 mist nets delivered 4 caught bats.
It is worth to mention that, when analysed with the method 'Barataud' (Barataud 2012) one of the records from *Plecotus* species possible concerns *Plecotus austriacus*. Full certainty could however not be given (pers. not. M. Van De Sijpe).

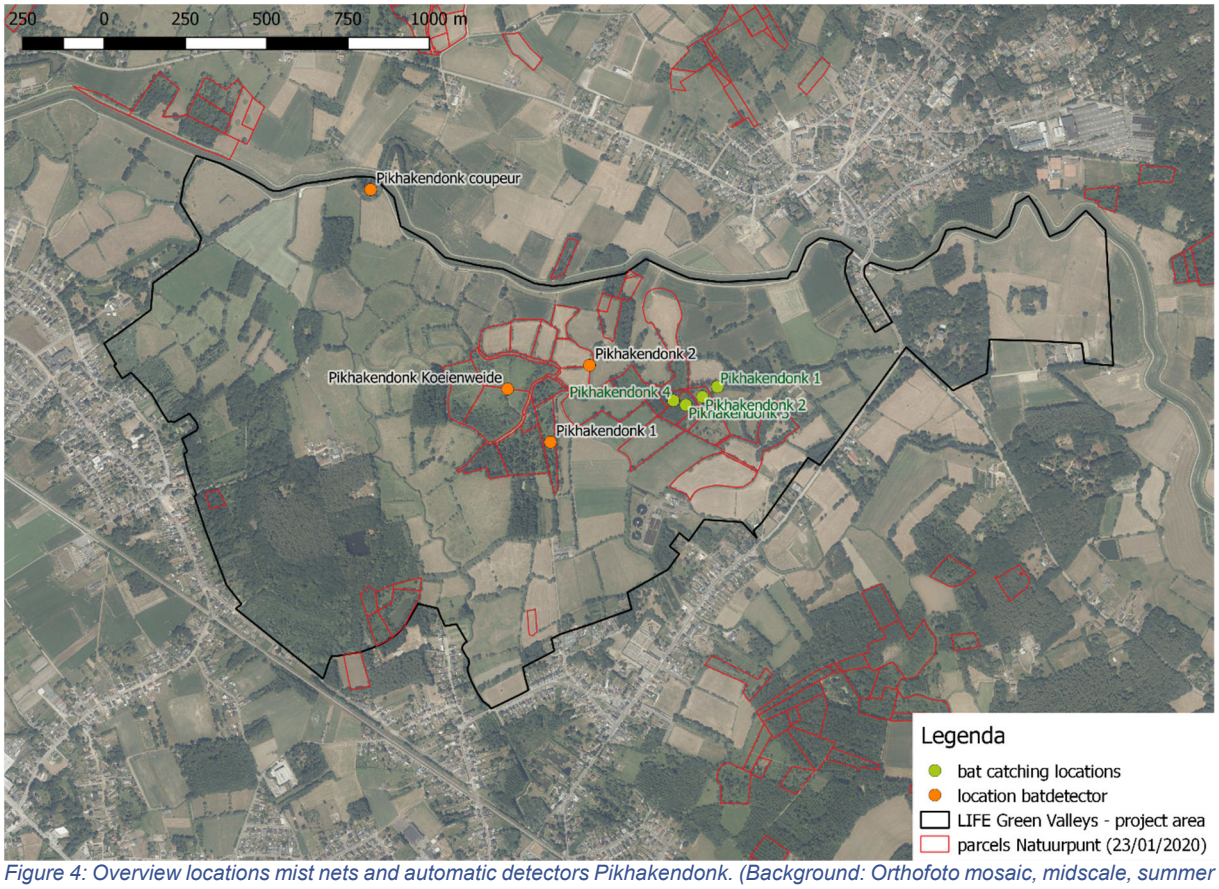

Figure 4: Overview locations mist nets and automatic detectors Pikhakendonk. (Background: Orthofoto mosaic, midscale, summer shots, color, 2018 (AGIV)).

Table 2: results automatic bat detector Pikhakendonk

Bat detector	*Pipistrellus pipistrellus*	*Pipistrellus nathusii*	*Myotis daubentonii*	*Myotis spec.*	*Nyctalus leisleri*	*Nyctalus spec.*	*Eptesicus/Nyctalus/Vespertilio spec.*	*Plecotus spec.*	*Chiroptera spec.*	**Total**
Pikhakendonk coupeur	402	2	1	1	2	1	3		1	413
Pikhakendonk Koeienweide	8	4		4					1	17
Pikhakendonk 1	63	2								65
Pikhakendonk 2	489	8	1	1	1	13	10	2	17	542
Total	**962**	**16**	**2**	**6**	**3**	**14**	**13**	**2**	**19**	**1037**

Table 3: results bat catching Pikhakendonk

Date	Hour	Sub-region	Net	Species	gender
31/05/2019	22:40	Floordambos	Floordambos 1	*Pipistrellus pipistrellus*	f
31/05/2019	22:45	Floordambos	Floordambos 1	*Pipistrellus pipistrellus*	m
31/05/2019	23:30	Floordambos	Floordambos 3	*Plecotus auritus*	f
1/06/2019	1:07	Floordambos	Floordambos 1	*Myotis mystacinus*	m

3.2 Hellebos-Rotbos

At Hellebos-Rotbos an automatic detector was placed on 3 different locations, for a total of 9163 recorded bat passages.

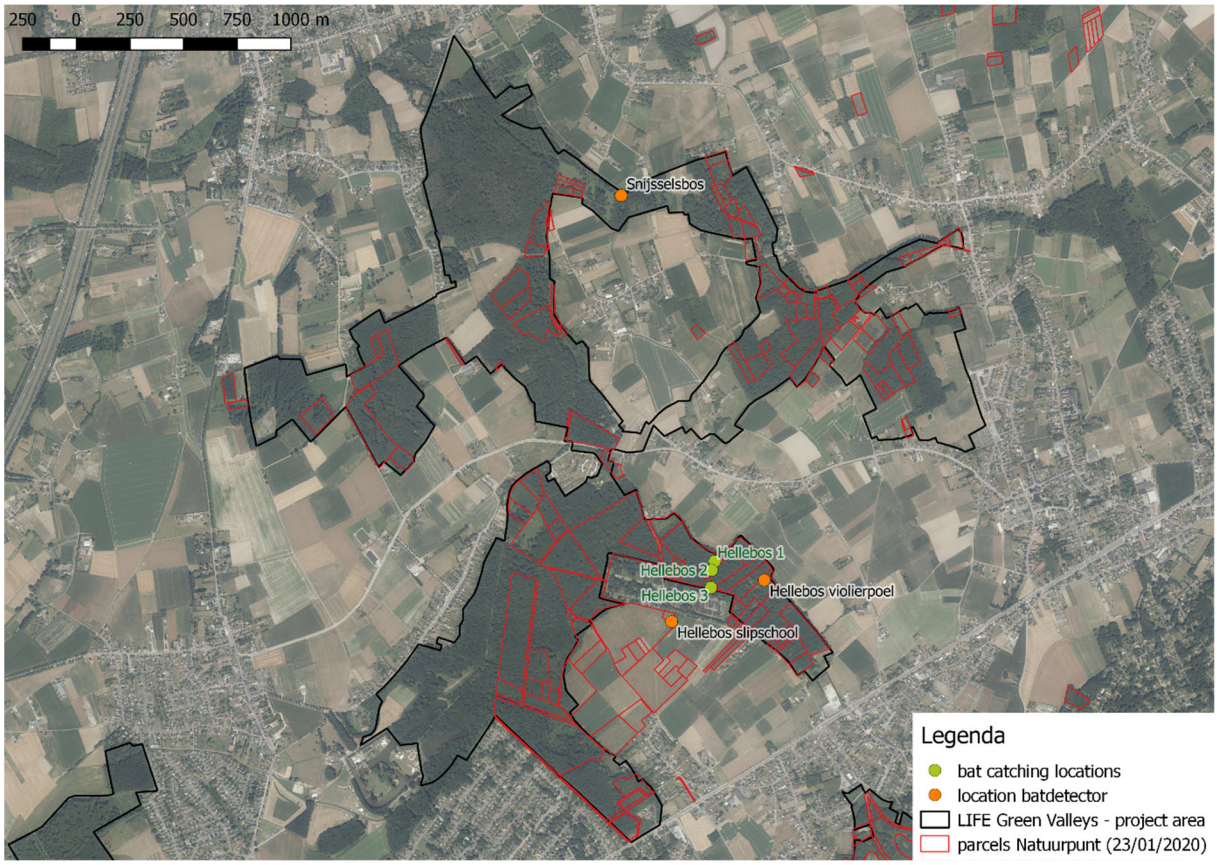

Figure 5: Overview locations mist nets and automatic detectors Hellebos-Rotbos. (Background: Orthofoto mosaic, midscale, summer shots, color, 2018 (AGIV)).

Table 4: results automatic bat detector Hellebos-Rotbos

Bat detector	*Pipistrellus pipistrellus*	*Pipistrellus nathusii*	*Myotis daubentonii*	*Myotis mystacinus/brandtii*	*Myotis spec.*	*Nyctalus noctula*	*Nyctalus leisleri*	*Nyctalus spec.*	*Eptesicus/Nyctalus/Vespertilio spec.*	*Plecotus auritus*	*Plecotus spec.*	*Chiroptera spec.*	**Total**
Hellebos slipschool	347	419	1		14	6		5		1	1	2	796
Hellebos violierpoel	2284	2		62	28			8	16				2400
Snijsselsbos	5315	48	7	2	322	93	16	98	48		7	11	5967
Total	**2631**	**421**	**1**	**62**	**42**	**6**	**16**	**13**	**16**	**1**	**1**	**2**	**9163**

It was not immediately clear why there were seven recordings from *Myotis daubentonii* on detector Snijsselsbos. Other detectors where more than 2 records were made of this species, were all situated near larger water bodies (ponds or canal), while this detector is placed near a crosspoint of two ditches. We therefor had a look at the

time schedule of the recordings (Figure 6). It appears that 5 of the 7 passages are made in the evening (between 22:00 and midnight) – but divided over several nights. This can be interpreted as a commuting route from 1 or 2 individuals, whereby the ditches and adjacent vegetation function as linear beacons to follow.

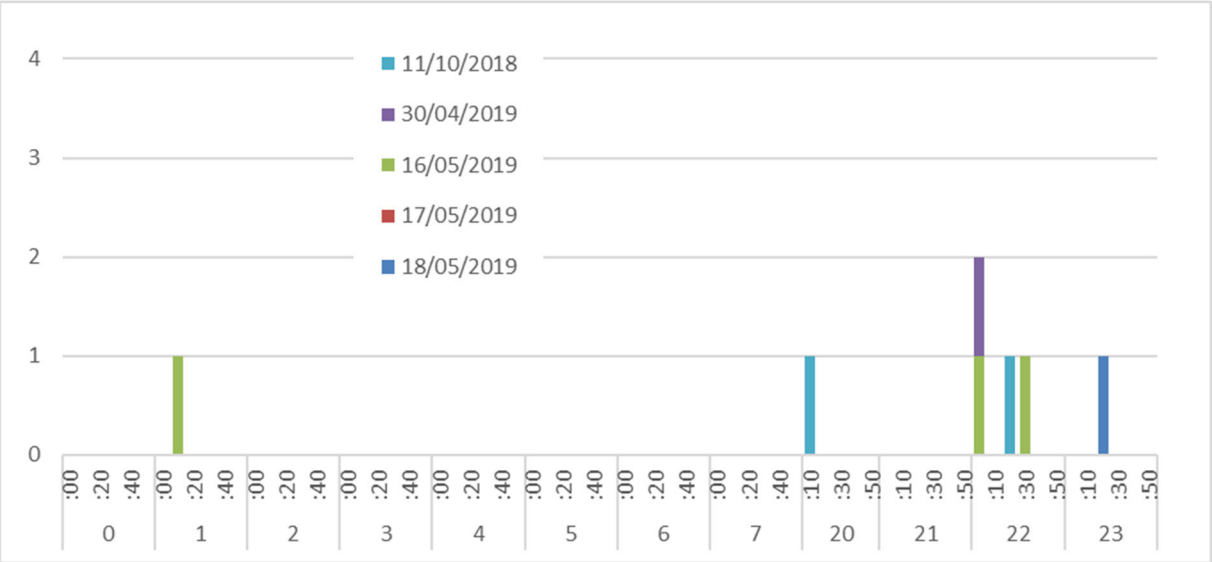

Figure 6: Time schedule from Myotis daubentonii at detector Snijsselsbos. X-axis: time (hour and minutes), in time blocks of 10 minutes. Y-axis: number of bat passages.

The placement of 3 mist nets delivered 2 caught bats.

Table 5: results bat catching Hellebos-Rotbos

Date	Hour	Sub-region	Net	Species	gender
24/08/2019	0:30	Hellebos	Hellebos 2	*Myotis mystacinus*	m
24/08/2019	1:30	Hellebos	Hellebos 3	*Nyctalus leisleri*	m

There were only few cavities found on this location. Research with endoscope and infrared camera gave following results:

Parcels	Observations
B98/A, B77, E54, E53, B98/B and B105	Parcels with thin Poplar trees, with few or no cavities. One hollow tree (near small house next to a large Willow tree) could eventually be preserved (for now unmarked)

3.3 Floordambos

At Floordambos an automatic detector was placed on 5 different locations, for a total of 3704 recorded bat passages.

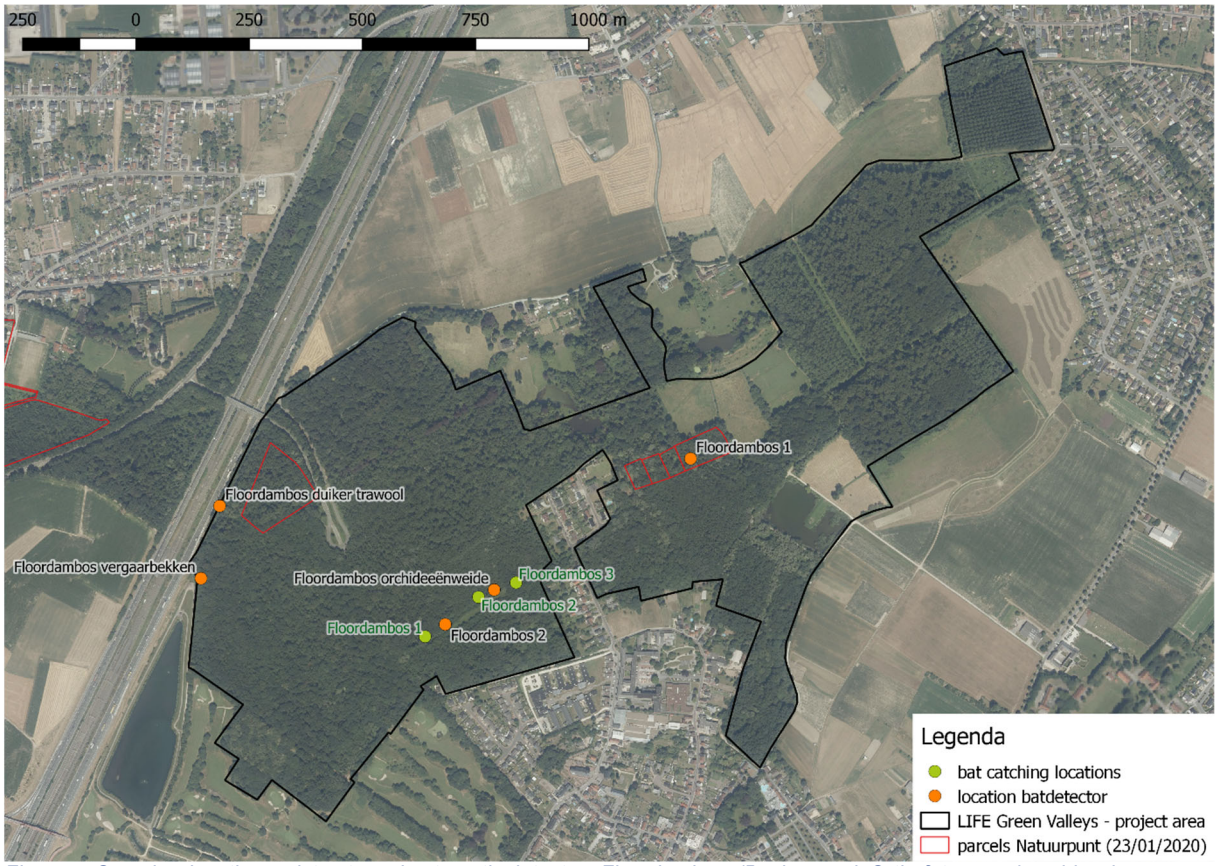

Figure 7: Overview locations mist nets and automatic detectors Floordambos. (Background: Orthofoto mosaic, midscale, summer shots, color, 2018 (AGIV)).

Table 6: results automatic bat detector Floordambos

Bat detector	*Pipistrellus pipistrellus*	*Pipistrellus nathusii*	*Myotis daubentonii*	*Myotis mystacinus/brandtii*	*Myotis nattereri*	*Myotis spec.*	*Nyctalus noctula*	*Nyctalus leisleri*	*Nyctalus spec.*	*Eptesicus/Nyctalus/Vespertilio spec.*	*Plecotus auritus*	*Plecotus spec.*	*Rhinolophus hipposideros*	*Chiroptera spec.*	Total
Floordambos vergaarbekken	57	23			1	6			2	1					90
Floordambos duiker trawool	160	1	41	22	1	260	3		6	16	45	17		2	574
Floordambos 1	32	10	1			1	2			1					47
Floordambos orchideeënweide	1838	6	1	12		56	26	22	37	4			29		2031
Floordambos 2	650	2		29		245	6	1	16	12				1	962
Total	**2737**	**42**	**43**	**63**	**2**	**568**	**37**	**23**	**61**	**34**	**45**	**17**	**29**	**3**	**3704**

Most surprising is the presence of *Rhinolophus hipposideros*. The species was recorded three nights is a row, at three time slots: between 22:05 and 22:28, between 1:53 and 1:54, and between 4:05 and 4:33 (Figure 8). For this species, there is no misidentification or confusion with other species possible (Figure 11).

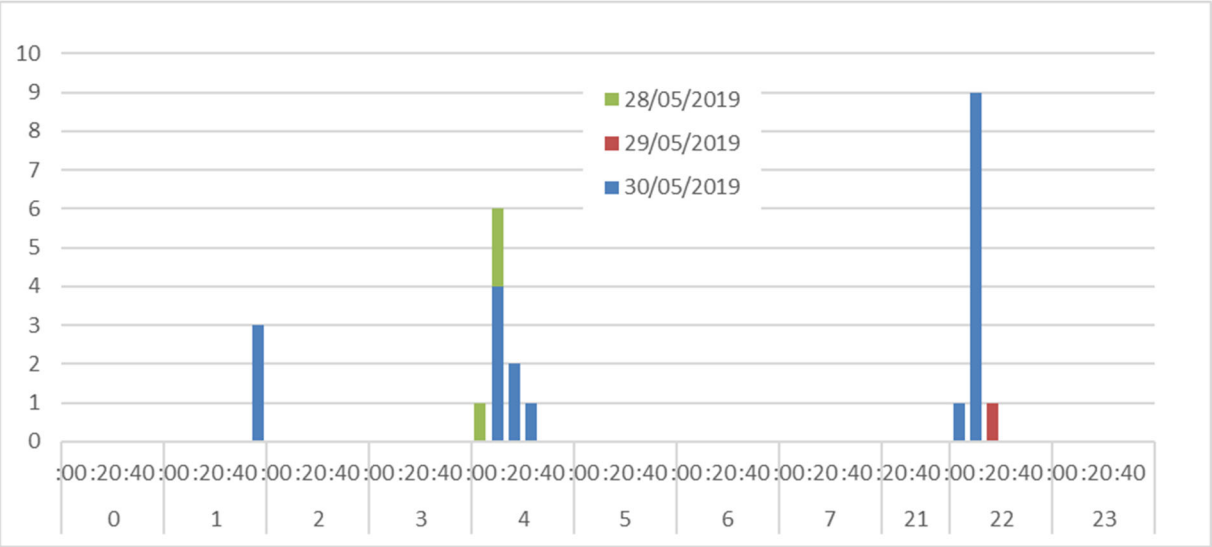

Figure 8: : Time schedule of Rhinolophus hipposideros, recorded at detector Floordambos orchideeënweide. X-axis: time (hour and minutes), in time blocks of 10 minutes. Y-axis: number of bat passages.

Less spectacular, but also remarkable is the high number of *Plecotus auritus* (and *Plecotus* species) at detector location 'Floordambos, duiker trawool' (the Dutch term 'duiker' refers to the quite large and long culvert under the highway). The time schedule from this location for this species shows that the activity there is not just a one-night phenomenon (Figure 9). The highest activity is observed from 22:10 till 23:40, but regular activity can on some nights continue still till 1:30 or 3:00. This activity is too high for being a passage for this species, so we presume this indicates rather a place for social activity (evening swarming) – which implicates that a colony of this species might be located in the vicinity of this detector location. Also several species of *Myotis* (*M. daubentonii*, *M. mystacinus/brandtii* and a high number of unidentified *Myotis* bats) show a high activity nearby this detector location. This could indicate social behaviour, foraging or passage through the culvert under the highway, but most likely a combination of those three possibilities.

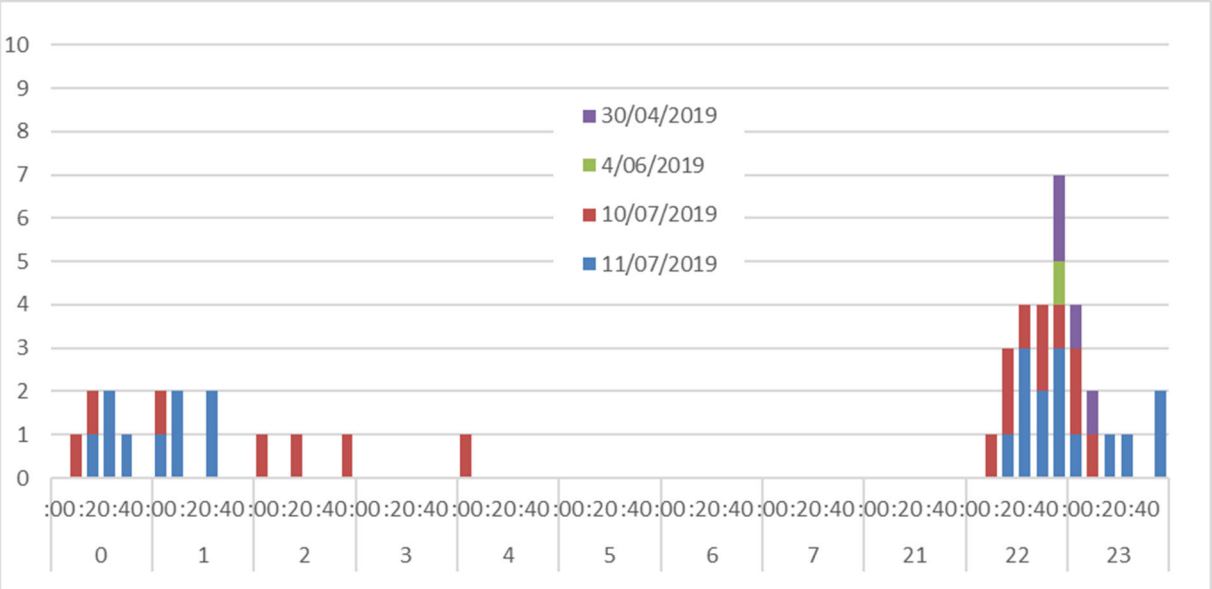

Figure 9: Time schedule of Plecotus auritus, recorded at detector Floordambos, duiker trawool. X-axis: time (hour and minutes), in time blocks of 10 minutes. Y-axis: number of bat passages.

The placement of 3 mist nets delivered 4 caught bats. A caught *Plecotus auritus* was tagged with a transmitter, which allowed to map her foraging areas, commuting routes and colony tree (Figure 10).

Table 7: results bat catching Floordambos

Date	Hour	Sub-region	Net	Species	gender
31/05/2019	22:40	Floordambos	Floordambos 1	*Pipistrellus pipistrellus*	f
31/05/2019	22:45	Floordambos	Floordambos 1	*Pipistrellus pipistrellus*	m
31/05/2019	23:30	Floordambos	Floordambos 3	*Plecotus auritus*	f
1/06/2019	1:07	Floordambos	Floordambos 1	*Myotis mystacinus*	m

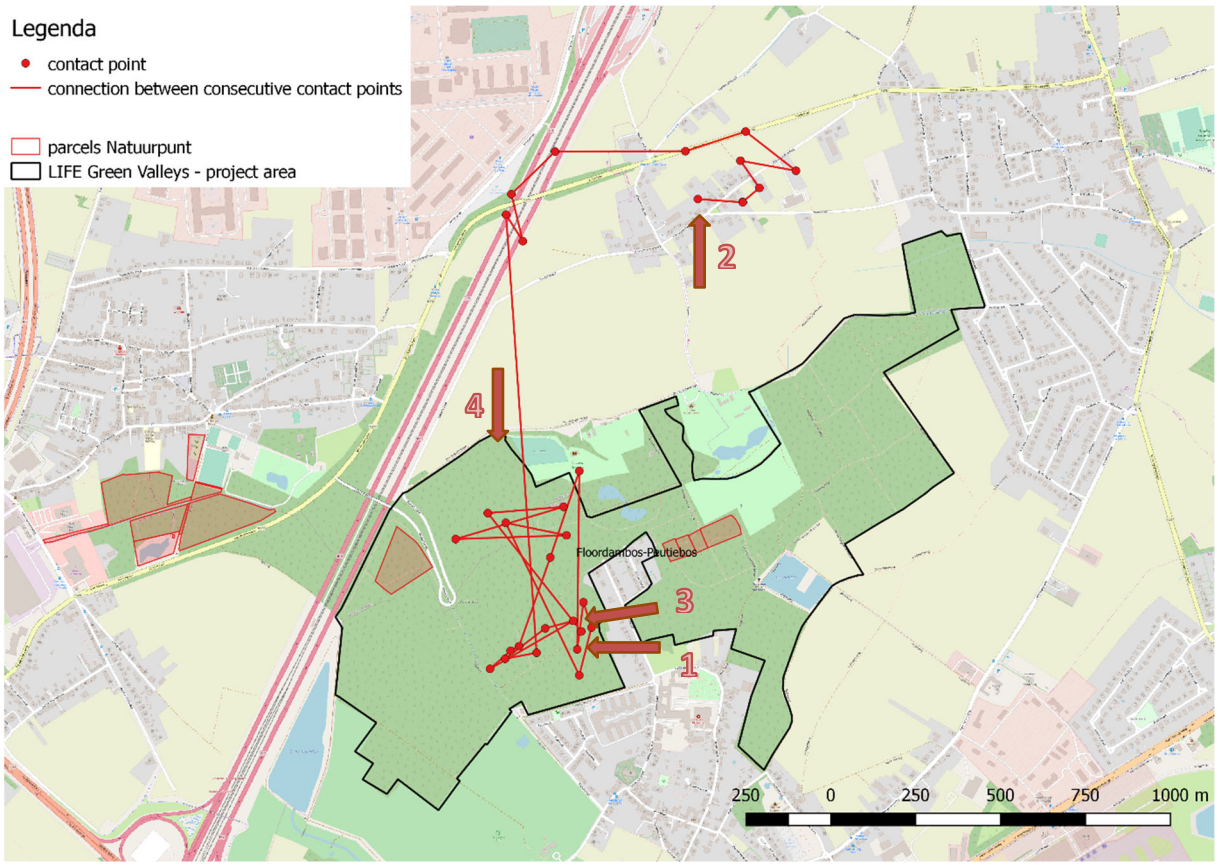

Figure 10: results telemetry tagged Plecotus auritus. 1: location of capture & release; 2: start telemetry (ca 2h after release); 3: (proximity of) colony tree 1/6/2019; 4: (proximity of) colony tree (3/6/2019 & 13/6/2019). (© OpenStreetMap-authors).

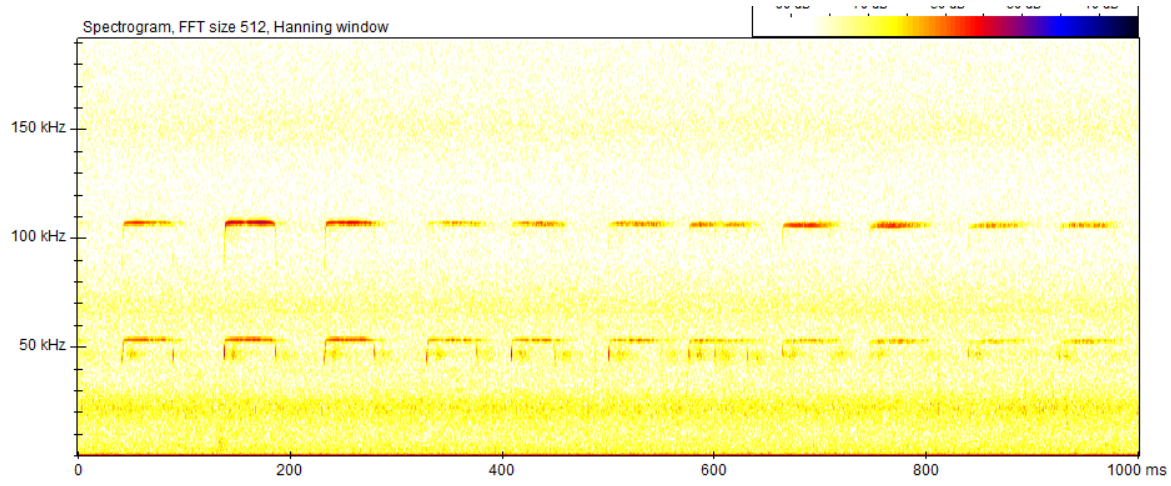

Figure 11: Spectogram of Rhinolophus hipposideros, Floordambos, May 2019.

3.4 Kastanjebos

At Kastanjebos an automatic detector was placed on 3 different locations, for a total of 1334 recorded bat passages. The placement of 4 mist nets delivered 5 caught bats.

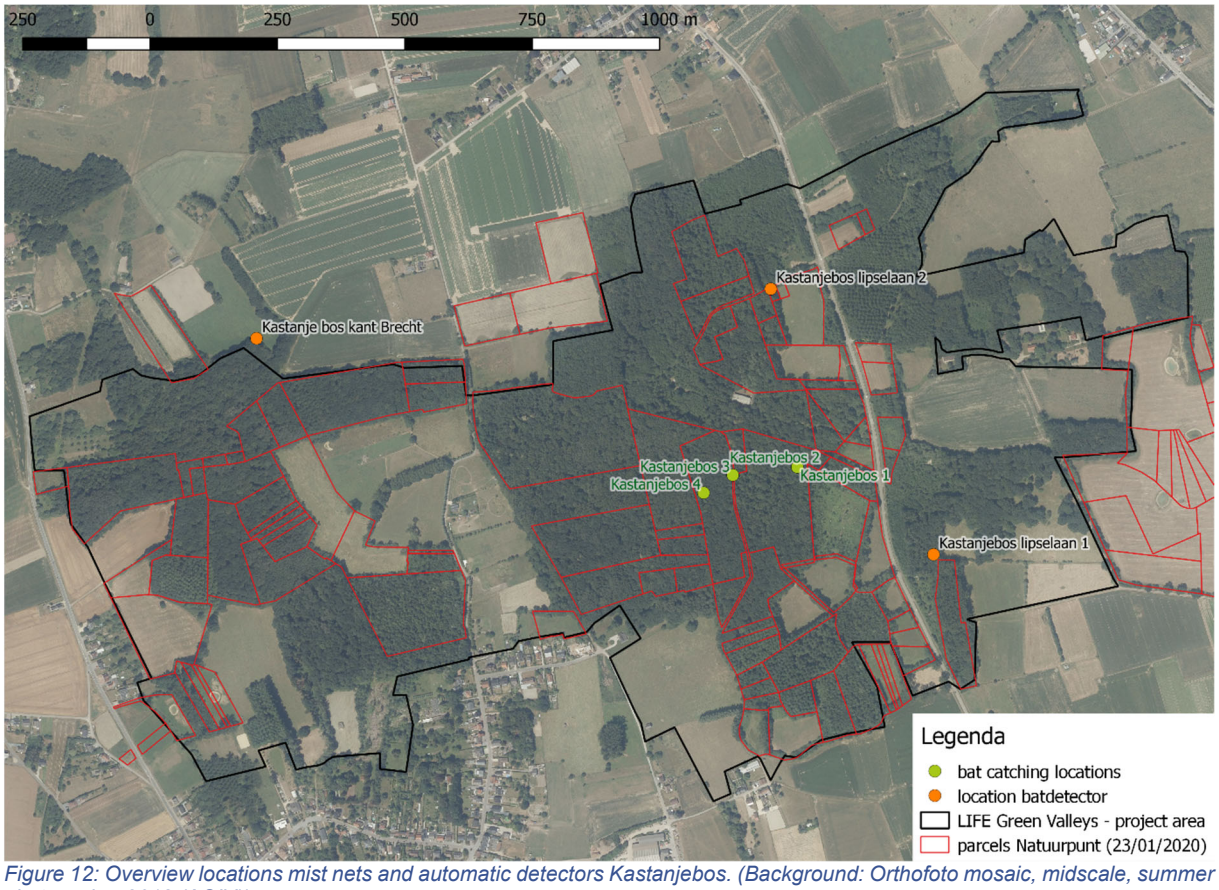

Figure 12: Overview locations mist nets and automatic detectors Kastanjebos. (Background: Orthofoto mosaic, midscale, summer shots, color, 2018 (AGIV)).

Table 8: results automatic bat detector Kastanjebos

Bat detector	*Pipistrellus pipistrellus*	*Pipistrellus nathusii*	*Myotis daubentonii*	*Myotis mystacinus/brandtii*	*Myotis nattereri*	*Myotis spec.*	*Nyctalus noctula*	*Nyctalus leisleri*	*Nyctalus spec.*	*Plecotus auritus*	*Plecotus spec.*	*Chiroptera spec.*	Total
Kastanje bos kant Brecht	564		2			66	2	8	4				646
Kastanjebos lipselaan 1	293	4			1	27			1				326
Kastanjebos lipselaan 2	197	7		8		35	1	69	35	1	8	1	362
Total	**1054**	**11**	**2**	**8**	**1**	**128**	**3**	**77**	**40**	**1**	**8**	**1**	**1334**

Table 9: results bat catching Kastanjebos

Date	Hour	Sub-region	Net	Species	gender
1/06/2019	23:00	Kastanjebos	Kastanjebos 1	*Plecotus auritus*	f
2/06/2019	0:00	Kastanjebos	Kastanjebos 1	*Plecotus auritus*	m
2/06/2019	0:11	Kastanjebos	Kastanjebos 1	*Pipistrellus pipistrellus*	f
2/06/2019	0:55	Kastanjebos	Kastanjebos 1	*Pipistrellus pipistrellus*	m
2/06/2019	1:15	Kastanjebos	Kastanjebos 1	*Myotis mystacinus*	f

3.5 Torfbroek

At Torfbroek an automatic detector was placed on 2 different locations, for a total of 9163 recorded bat passages.

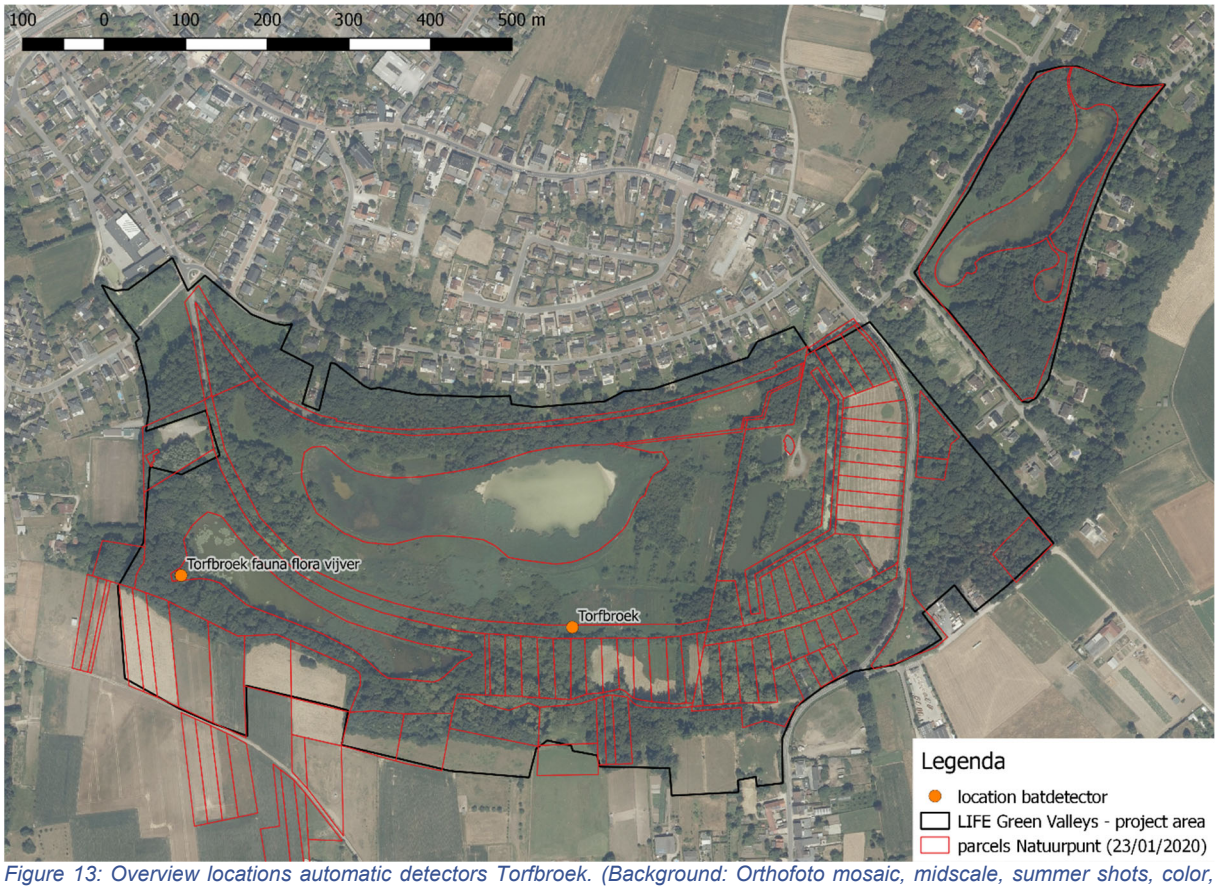

Figure 13: Overview locations automatic detectors Torfbroek. (Background: Orthofoto mosaic, midscale, summer shots, color, 2018 (AGIV)).

Table 10: results automatic bat detector Torfbroek

Bat detector	*Pipistrellus pipistrellus*	*Pipistrellus nathusii*	*Myotis daubentonii*	*Myotis mystacinus/brandtii*	*Myotis spec.*	*Nyctalus noctula*	*Nyctalus leisleri*	*Nyctalus spec.*	*Eptesicus/Nyctalus/Vespertilio spec.*	*Plecotus auritus*	*Plecotus spec.*	*Chiroptera spec.*	Total
Torfbroek	45	28		2	2	56				3	6	1	143
Torfbroek fauna flora vijver	3972	723	118		17	7	62	6	3	1			4909
Total	**4017**	**751**	**118**	**2**	**19**	**63**	**62**	**6**	**3**	**4**	**6**	**1**	**5052**

Mentionable is that one of the recordings from detector 'Torfbroek fauna flora vijver' could possibly be *Myotis emarginatus* (pers. not. M. Van De Sijpe). Full certainty could however not be given, and the record is classified as '*Myotis* species'.

3.6 Silsombos

At Silsombos an automatic detector was placed on 6 different locations, for a total of 924 recorded bat passages. A walk with manual detector for finding swarming bats on 9/7/2019 resulted in a zero observation. The placement of 3 mist nets delivered 5 caught bats (of which one escaped before identification of the species).

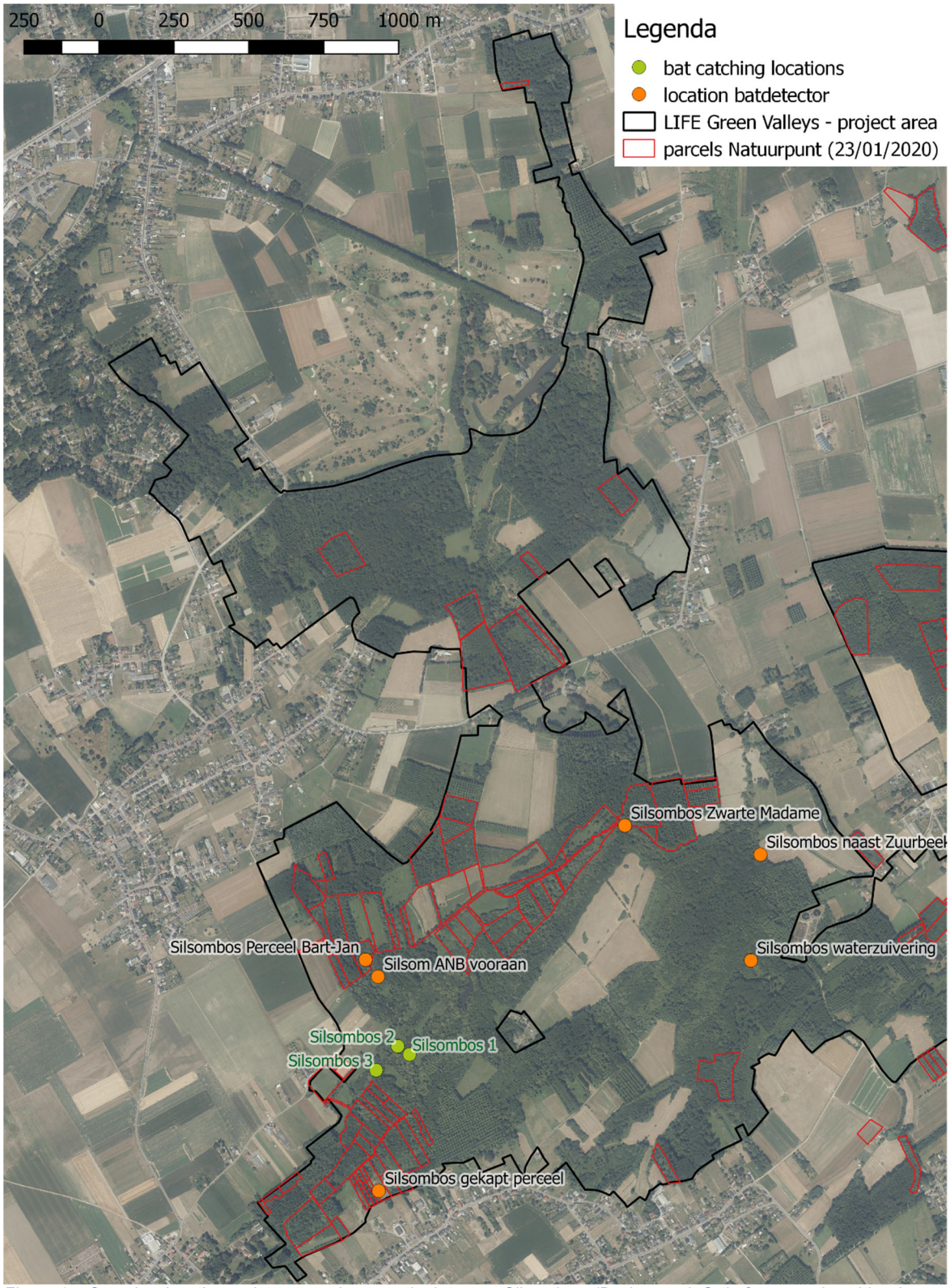

Figure 14: Overview locations mist nets and automatic detectors Silsombos. (Background: Orthofoto mosaic, midscale, summer shots, color, 2018 (AGIV)).

Table 11: results automatic bat detector Silsombos

Bat detector	*Pipistrellus pipistrellus*	*Pipistrellus nathusii*	*Myotis daubentonii*	*Myotis mystacinus/brandtii*	*Myotis nattereri*	*Myotis emarginatus*	*Myotis spec.*	*Nyctalus noctula*	*Nyctalus spec.*	*Eptesicus/Nyctalus/Vespertilio spec.*	*Plecotus auritus*	*Plecotus spec.*	*Chiroptera spec.*	Total
Silsombos gekapt perceel	68	14					1							83
Silsombos naast Zuurbeek	15													15
Silsombos waterzuivering	117	5			4		34	4	1	1	2	24	3	195
Silsombos Perceel Bart-Jan	220	6	1	1		1	40	2	2		3	6	1	283
Silsombos Zwarte Madame	279	1	1	1			23						2	307
Silsombos ANB vooraan	32	2					2				2	3		41
Total	**731**	**28**	**2**	**2**	**4**	**1**	**100**	**6**	**3**	**1**	**7**	**33**	**6**	**924**

Table 12: results bat catching Silsombos

Date	Hour	Sub-region	Net	Species	gender
24/08/2019	21:00	Silsombos	Silsombos 1	*Pipistrellus pipistrellus*	m
24/08/2019	21:30	Silsombos	Silsombos 1	*Pipistrellus pipistrellus*	m
24/08/2019	21:45	Silsombos	Silsombos 3	*Pipistrellus pipistrellus*	f
24/08/2019	22:00	Silsombos	Silsombos 1	*Pipistrellus pipistrellus*	f
24/08/2019	22:32	Silsombos	Silsombos 3	*Chiroptera spec.*	

Research of about 40 cavities with endoscope and/or infrared camera gave following results:

Parcel	Observations
146/A	Many cavities, no bats observed. After debate, it was agreed to preserve a part of the trees with cavities
319/A, 295/C, 215/B, 314/D, 314/E, 313/E	Few or none cavities observed
2/B	Only 1 tree with cavities; no undergrowth
15/C	2 hollow trees. Marked to be preserved.
450	Few or none cavities observed (in Poplar tree)
336, 199	10 cavities checked, and trees marked to be preserved

Most of the trees with cavities on the investigated parcels were marked to be preserved.

3.7 Molenbeekvallei

At Molenbeekvallei an automatic detector was placed on 2 different locations, for a total of 963 recorded bat passages. The placement of 4 mist nets delivered 3 caught bats.

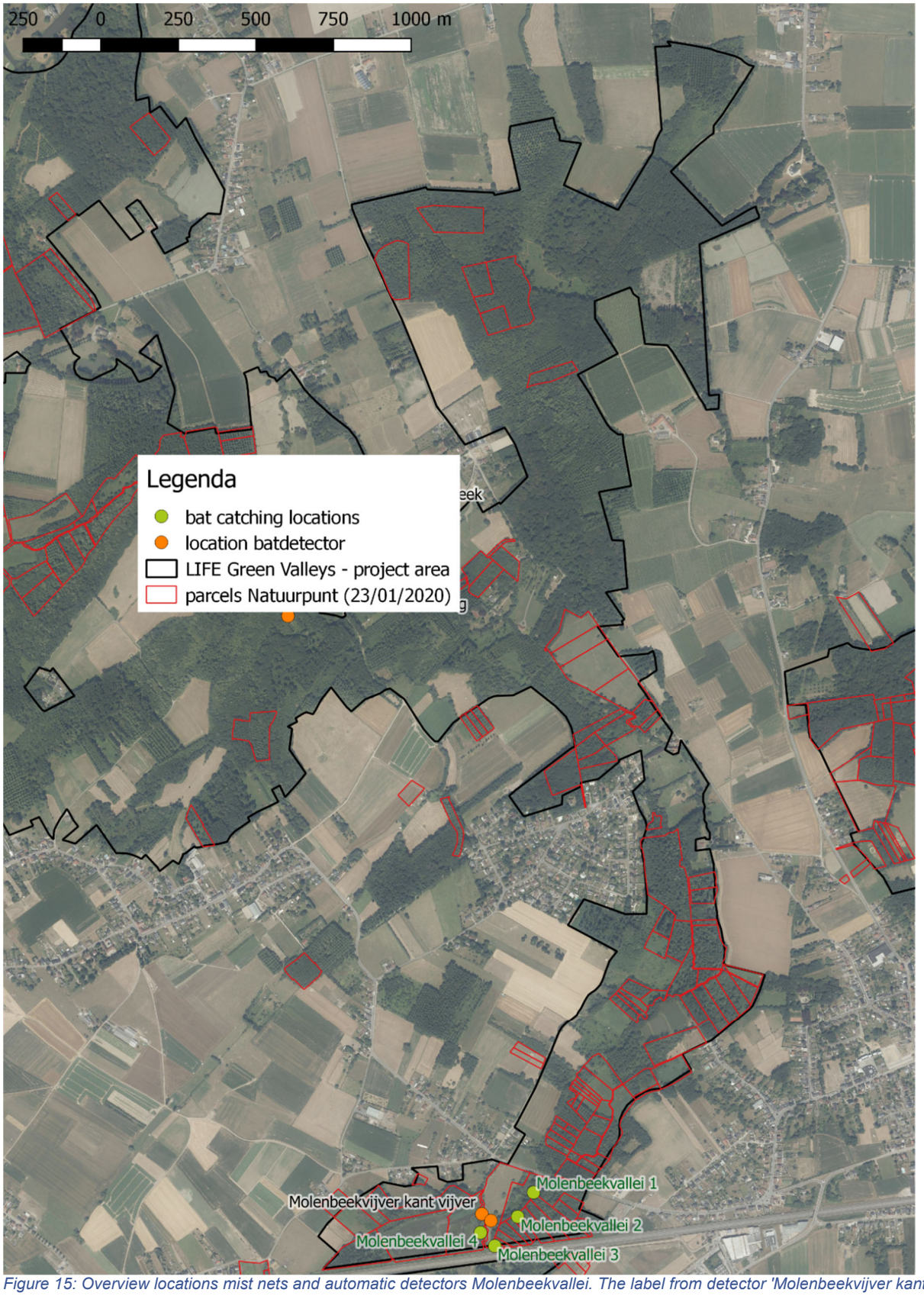

Figure 15: Overview locations mist nets and automatic detectors Molenbeekvallei. The label from detector 'Molenbeekvijver kant weide' (eastern detector) is not displayed. (Background: Orthofoto mosaic, midscale, summer shots, color, 2018 (AGIV)).

Table 13: results automatic bat detector Molenbeekvallei

Bat detector	*Pipistrellus pipistrellus*	*Pipistrellus nathusii*	*Myotis daubentonii*	*Myotis mystacinus/brandtii*	*Myotis nattereri*	*Myotis spec.*	*Nyctalus noctula*	*Nyctalus spec.*	*Eptesicus serotinus*	*Chiroptera spec.*	Total
Molenbeekvijver kant vijver	404	145	3	1	1	34	218	2	5	1	814
Molenbeekvijver kant weide	78	6				2	59	4			149
Total	**482**	**151**	**3**	**1**	**1**	**36**	**277**	**6**	**5**	**1**	**963**

Table 14: results bat catching Molenbeekvallei

Date	Hour	Sub-region	Net	Species	gender
1/06/2019	23:54	Molenbeekvallei	Molenbeekvallei 2	*Pipistrellus pipistrellus*	m
2/06/2019	0:12	Molenbeekvallei	Molenbeekvallei 2	*Pipistrellus pipistrellus*	f
2/06/2019	0:20	Molenbeekvallei	Molenbeekvallei 2	*Pipistrellus pipistrellus*	f

3.8 Rotte Gaten and Eikelenhof

At Rotte Gaten and Eikelenhof an automatic detector was placed on 5 different locations, for a total of 9142 recorded bat passages. The placement of 3 mist nets delivered 10 caught bats.

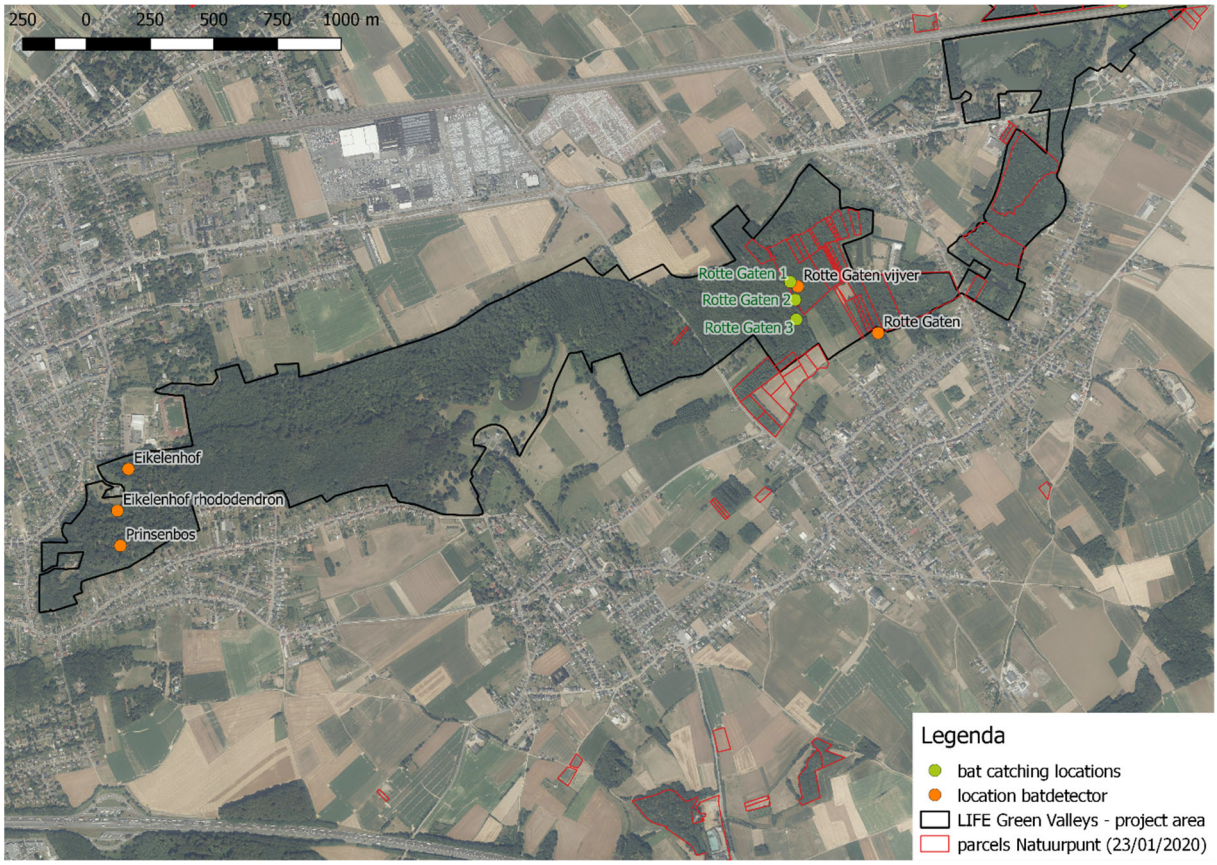

Figure 16: Overview locations mist nets and automatic detectors Rotte Gaten and Eikelenhof. (Background: Orthofoto mosaic, midscale, summer shots, color, 2018 (AGIV)).

Table 15: results automatic bat detector Rotte Gaten and Eikelenhof

Bat detector	*Pipistrellus pipistrellus*	*Pipistrellus nathusii*	*Pipistrellus spec.*	*Myotis daubentonii*	*Myotis mystacinus/brandtii*	*Myotis nattereri*	*Myotis spec.*	*Nyctalus noctula*	*Nyctalus leisleri*	*Nyctalus spec.*	*Eptesicus serotinus*	*Eptesicus/Nyctalus/Vespertilio spec.*	*Plecotus auritus*	*Plecotus spec.*	*Chiroptera spec.*	**Total**
Eikelenhof	2534	357	6	1	29		95	1	6	7	8	43				3087
Eikelenhof rhododendron	785	1	1				4	5	16	25		10	6	3		856
Prinsenbos	3011	14	1	2		1	1		6	7		53	4		4	3104
Rotte Gaten	116	1					4	1				1		1	1	125
Rotte Gaten vijver	1427	163		125			54	126		31		28	3	5	8	1970
Total	**7873**	**536**	**8**	**128**	**29**	**1**	**158**	**133**	**28**	**70**	**8**	**135**	**13**	**9**	**13**	**9142**

Table 16: results bat catching Rotte Gaten and Eikelenhof

Date	Hour	Sub-region	Net	Species	gender
31/05/2019	22:40	Rotte Gaten and Eikelenhof	Rotte Gaten 1	*Pipistrellus pipistrellus*	m
31/05/2019	22:40	Rotte Gaten and Eikelenhof	Rotte Gaten 3	*Pipistrellus pipistrellus*	f
31/05/2019	23:02	Rotte Gaten and Eikelenhof	Rotte Gaten 3	*Pipistrellus pipistrellus*	f
31/05/2019	23:15	Rotte Gaten and Eikelenhof	Rotte Gaten 3	*Pipistrellus pipistrellus*	f
31/05/2019	23:36	Rotte Gaten and Eikelenhof	Rotte Gaten 2	*Myotis mystacinus*	f
31/05/2019	23:36	Rotte Gaten and Eikelenhof	Rotte Gaten 3	*Pipistrellus pipistrellus*	m
31/05/2019	23:36	Rotte Gaten and Eikelenhof	Rotte Gaten 3	*Pipistrellus pipistrellus*	m
1/06/2019	0:30	Rotte Gaten and Eikelenhof	Rotte Gaten 1	*Pipistrellus pipistrellus*	m
1/06/2019	1:05	Rotte Gaten and Eikelenhof	Rotte Gaten 1	*Pipistrellus pipistrellus*	f
1/06/2019	2:00	Rotte Gaten and Eikelenhof	Rotte Gaten 3	*Pipistrellus pipistrellus*	m

3.9 Extra locations near the concerned Natura 2000-sites

3.9.1 Koeheide

At Koeheide an automatic detector was placed on 2 different locations, for a total of 2710 recorded bat passages.

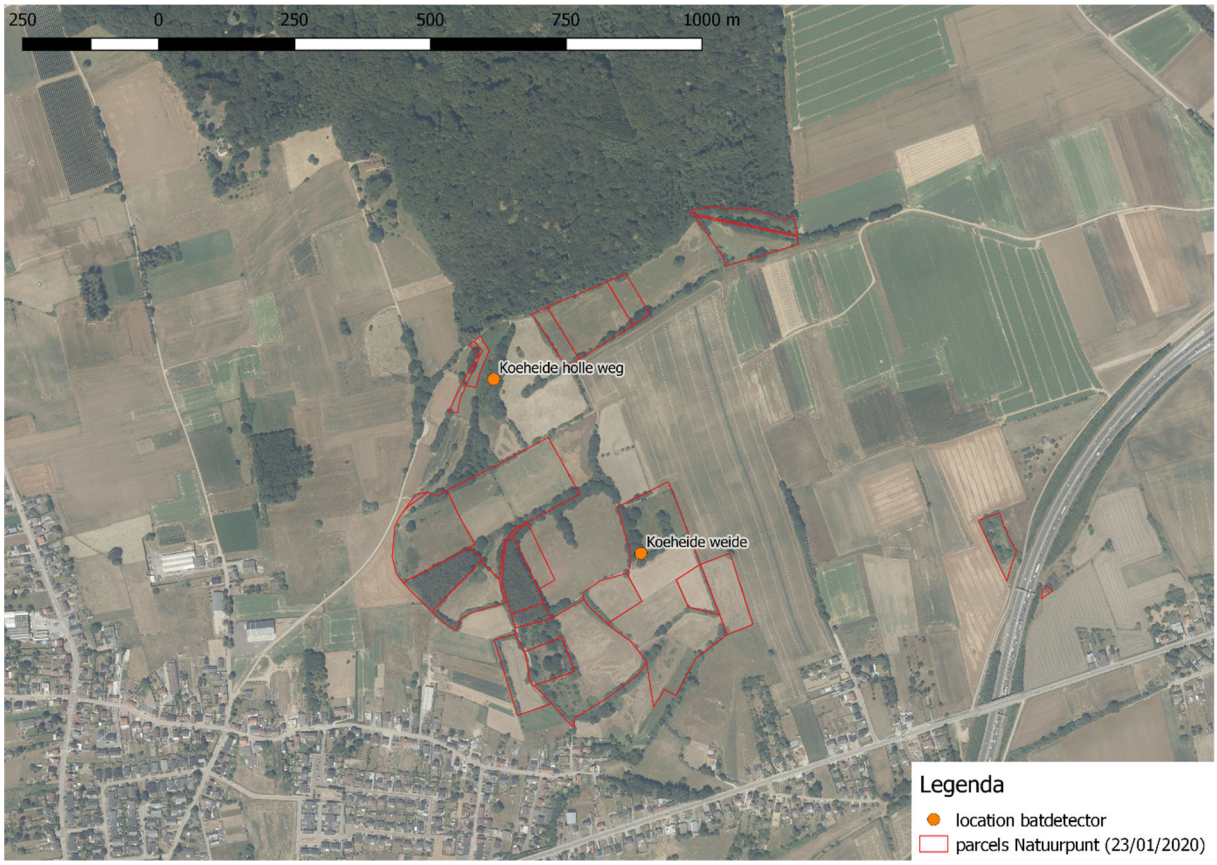

Figure 17: Overview locations automatic detectors Koeheide. (Background: Orthofoto mosaic, midscale, summer shots, color, 2018 (AGIV)).

Table 17: results automatic bat detector Koeheide

Bat detector	*Pipistrellus pipistrellus*	*Pipistrellus nathusii*	*Myotis mystacinus/brandtii*	*Myotis spec.*	*Nyctalus noctula*	*Nyctalus leisleri*	*Nyctalus spec.*	*Eptesicus/Nyctalus/Vespertilio spec.*	*Plecotus auritus*	*Plecotus spec.*	*Chiroptera spec.*	Total
Koeheide holle weg	1308	1		18		23	26	8	2	16	16	1418
Koeheide weide	1232	13	1	1	9	7	12	15	1	1		1292
Total	**2540**	**14**	**1**	**19**	**9**	**30**	**38**	**23**	**3**	**17**	**16**	**2710**

3.9.2 Steentjesbos en Weisseterbos

At Steentjesbos an automatic detector was placed on 2 different locations and at Weisseterbos on 1 location, for a total of respectively 1640 and 3793 recorded bat passages.

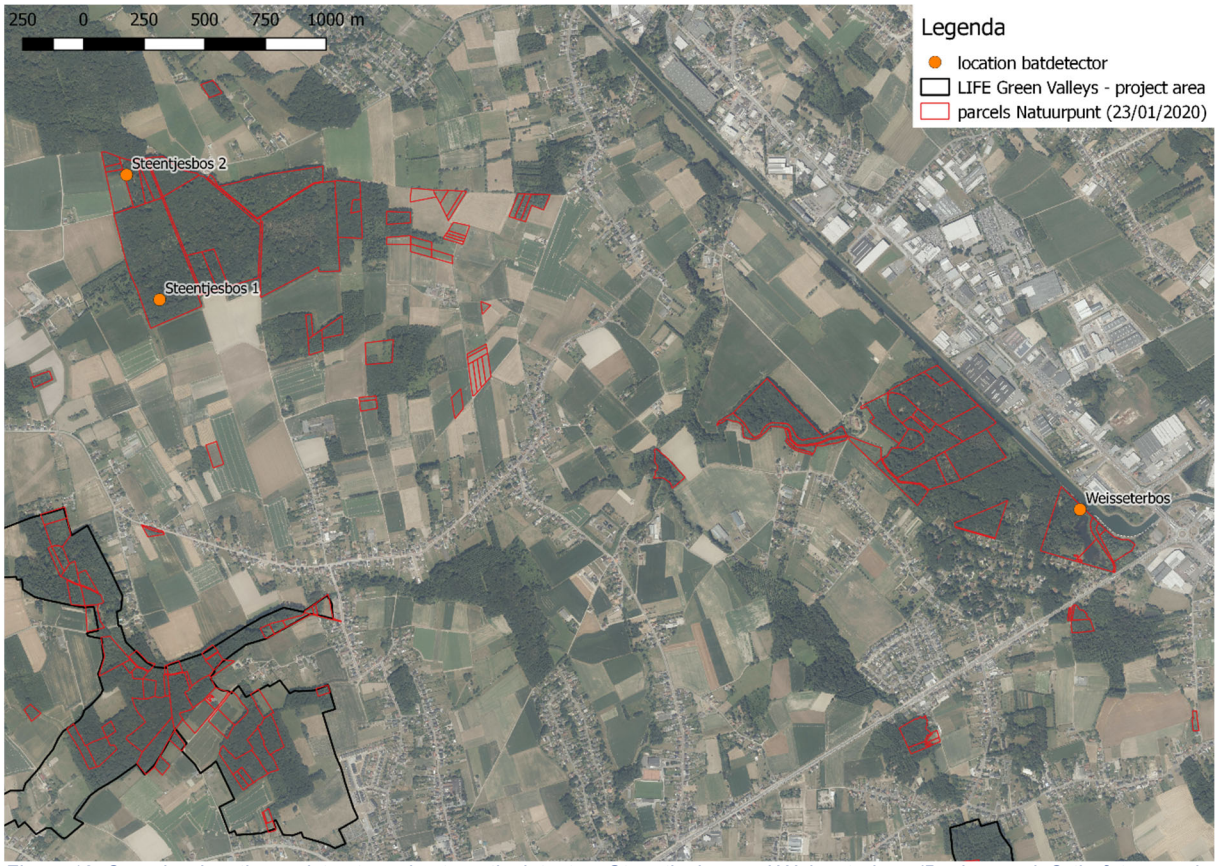

Figure 18: Overview locations mist nets and automatic detectors Steentjesbos and Weisseterbos. (Background: Orthofoto mosaic, midscale, summer shots, color, 2018 (AGIV)).

Table 18: results automatic bat detector Steentjesbos and Weisseterbos

Bat detector	*Pipistrellus pipistrellus*	*Pipistrellus nathusii*	*Myotis daubentonii*	*Myotis spec.*	*Nyctalus noctula*	*Nyctalus spec.*	*Eptesicus/Nyctalus/Vespertilio spec.*	*Plecotus spec.*	Total
Steentjesbos1	414		2	3	2		10	1	432
Steentjesbos2	1009	10	151	16	1	2	19		1208
Weisseterbos	3224	511	30	2	10	7	9		3793
Total	**4647**	**521**	**183**	**21**	**13**	**9**	**38**	**1**	**5433**

4 Discussion

4.1 Discussion of the results

4.1.1 Species' occurrence in the different sub-regions

In total 11 different bat species were with certainty encountered during this research. Also, a lot of bat recording where exact species identification was not possible were assigned to one of the 7 bat species groups. An overview of the different species(groups) present per sub-region can be found in Table 19.

Table 19: presence of bat species per sub-region. D: detector recording; C: capture; O: old observation from www.waarnemingen.be (2009-2016); W: hibernating data from winter databank (till 2017).

Sub-region	*Pipistrellus pipistrellus*	*Pipistrellus nathusii*	*Pipistrellus spec.*	*Myotis daubentonii*	*Myotis mystacinus*	*Myotis mystacinus/brandtii*	*Myotis nattereri*	*Myotis emarginatus*	*Myotis spec.*	*Nyctalus noctula*	*Nyctalus leisleri*	*Nyctalus spec.*	*Eptesicus serotinus*	*Eptesicus/Nyctalus/Vespertilio spec.*	*Plecotus auritus*	*Plecotus spec.*	*Rhinolophus hipposideros*	*Chiroptera spec.*
Pikhakendonk	DCO	D		D					D	O	D	D		D		D		D
Hellebos-Rotbos	DO	D		DOW	C	DW			DW	DO	DC	D		D	DW	DW		DW
Floordambos	DC	D		D	C	D	D		D	D	D	D		D	DC	D	D	D
Kastanjebos	DCO	D		D	C	D	D		D	D	D	D			DC	D		D
Torfbroek	D	D		D		D			D	D	D	D		D	D	D		D
Silsombos	DCO	D	O	DW		DW	DW	D	DW	D		D		D	DW	DW		DCW
Molenbeekvallei	DC	D		D		D	D		D	D		D	D					D
Rotte Gaten and Eikelenhof	DCO	D	D	D	C	D	D		D	D	D	D	D	D	DO	D		D
Extra locations	D	D		D		D			D	D	D	D		D	D	D		D

Pipistrellus pipistrellus
Pipistrellus pipistrellus is numerously present in all areas. This species lives almost exclusively in buildings (mostly houses). There is no impact to expect on this species from the works for the project LIFE Green Valleys.

Pipistrellus nathusii
This species has been observed in all sub-regions. The detector locations with most recordings of this species (Torfbroek fauna flora vijver, Weisseterbos, Hellebos slipschool, Eikelenhof, Rotte Gaten vijver and Molenbeekvijver kant vijver) are all places that provide an ideal foraging habitat for this species: edges of ponds or riversides, and humid places in or next to forests. The species is mostly known as a migratory species in autumn and spring, has hardly any known maternity colonies in Flanders. This species dwells whole year round in trees (in cavities, but also very often in cracks of branches and behind loose bark), and can also be found behind shutters or (in hibernation) between stacked firewood. We assess cutting trees for the project LIFE Green Valleys on roosts from *Pipistrellus nathusii* of low impact, due to the low number of potential bat trees and the low presence of the species during midsummer. To lower the potential impact, nearly all trees with visible cavities or cracks are up to now saved during felling.

Pipistrellus species

This species group contains unidentified Pipistrellus species. We refer to *Pipistrellus pipistrellus* and *Pipistrellus nathusii* for an assessment of the impact from the works for the project LIFE Green Valleys.

Myotis daubentonii
This species was found in all sub-regions, and on a bit more than half of the detector locations. Those locations with most recordings of *M. daubentonii* were situated nearby ponds or riversides, and can be considered foraging areas: Steentjesbos2 and Weisseterbos (extra locations), Rotte Gaten vijver (Rotte Gaten and Eikelenhof), Torfbroek fauna flora vijver (Torfbroek), and Floordambos duiker trawool (Floordambos). A commuting route from 1 or 2 individuals was found near detector Snijsselsbos (Hellebos-Rotbos).
We assess cutting trees for the project LIFE Green Valleys on roosts from *Myotis daubentonii* of limited impact, due to the low number of potential bat trees. To lower the potential impact, nearly all trees with visible cavities or cracks are up to now saved during felling.

Myotis mystacinus* and *Myotis mystacinus/brandtii
We discuss *Myotis mystacinus* and the species group *Myotis mystacinus/brandtii* together, because identifying records from the latter group till species level is barely possible. Unlike recordings, identification till species level could easily be done at mist net captures.
It is remarkable that captures of *M. mystacinus* were done in those sub-regions where also most recordings were made of the *M. mystacinus/brandtii* group: Hellebos-Rotbos, Floordambos, Kastanjebos and Rotte Gaten and Eikelenhof. Other sub-regions had only 1 or 2 recordings (Torfbroek, Silsombos, Molenbeekvallei, extra locations) of this species group, and Pikhakendonk even none.
We assess cutting trees for the project LIFE Green Valleys on roosts from *Myotis mystacinus(/brandtii)* of limited impact for the sub-regions Hellebos-Rotbos, Floordambos, Kastanjebos and Rotte Gaten and Eikelenhof, due to the low number of potential bat trees. The potential impact is estimated lower for sub-regions with less observations of the species (group), where we presume the chance on roosts are therfore lower too: Torfbroek, Silsombos, Molenbeekvallei and Pikhakendonk. To lower the potential impact, nearly all trees with visible cavities or cracks are up to now saved during felling.

Myotis nattereri
Myotis nattereri is present in de area, and has been recorded in 5 sub-regions. The numbers are estimated very low, as only 9 records were made – of which 4 in Silsombos.
We assess cutting trees for the project LIFE Green Valleys on roosts from *Myotis nattereri* of low impact, due to the low number of potential bat trees. The impact on the species might be higher in Silsombos, where *Myotis nattereri* seems to be more present – which increases consequently the chance on colony trees. To lower the potential impact, nearly all trees with visible cavities or cracks are up to now saved during felling.

Myotis emarginatus
Only 1 certain records was made of this species, at detector Silsombos Perceel Bart-Jan (Silsombos, September 2018). A possible record of *Myotis emarginatus* (classified as '*Myotis species'*) was made at detector Torfbroek fauna flora vijver (Torfbroek, April 2019). The nearest known maternity colony of this species in Flanders is situated in the church of Lovenjoel (at a distance of respectively 16 and 19 km). Those distances are not uncommon for commuting routes (Boers & Willems, 2019).
Since *Myotis emarginatus* is known in Flanders to have roosts exclusively at larger attics, there is no impact to expect on this species from the works for the project LIFE Green Valleys.

Myotis species
The *Myotis species* group contains the observations of the genus "*Myotis*" that could not be further identified to species (group) level. Most of the different species of these group (and in particular those that can be presumed to be accountable for most of the recordings) are for the major part tree dwelling species.
We refer to the different identified species from the genus *Myotis* for an assessment of the impact from the works for the project LIFE Green Valleys.

Nyctalus noctula
Nyctalus noctula was recorded in all sub-regions, with exception of Pikhakendonk. The detectors with most recordings of this species were foraging areas, located nearby larger open water bodies or humid open spaces in forests.

The removing of trees for the LIFE Green Valleys project can have a negative impact on *Nyctalus noctula*, as the species lives exclusively in trees. We assess cutting trees for the project LIFE Green Valleys on roosts from *Nyctalus noctula* of rather low impact, due to the low number of potential bat trees. To lower the potential impact, nearly all trees with visible cavities or cracks are up to now saved during felling.

Nyctalus leisleri

Nyctalus leisleri was recorded in all sub-regions, with exception of Silsombos and Molenbeekvallei. The detectors with most recordings of this species were foraging areas. Unlike *N. noctula*, the sites with most activity of *Nyctalus leisleri* are less often open water bodies but rather humid forest, open spaces in forests, and humid meadows near forests.

The removing of trees for the LIFE Green Valleys project can have a negative impact on *Nyctalus leisleri*, as the species lives exclusively in trees, and is for his roosts generally bound to larger, old deciduous forests. This roosts can be situated a few tens of kilometres from the foraging areas (Janssen *et al., in prep.*).

We assess cutting trees for the project LIFE Green Valleys on roosts from *Nyctalus leisleri* of rather low impact, due to the low number of potential bat trees. To lower the potential impact, nearly all trees with visible cavities or cracks are up to now saved during felling.

Nyctalus species

This species group contains unidentified *Nyctalus species*. We refer to *Nyctalus noctula* and *Nyctalus leisleri* for an assessment of the impact from the works for the project LIFE Green Valleys.

Eptesicus serotinus

This species could only be found (with certainty) in sub-regions Molenbeekvallei and Rotte Gaten and Eikelenhof. For both regions, it concerned a short period of a foraging animal on one detector location only. This species is rather hard to identify with high certainty on automatic recordings. Presumably most recordings on this species will end up in the *Eptesicus/Nyctalus/Vespertilio species* group. *Eptesicus serotinus* only roosts in building. Therefore no impact is to expect on this species from the works for the project LIFE Green Valleys.

Eptesicus/Nyctalus/Vespertilio species

This species group contains unidentified bats from the genus *Eptesicus, Nyctalus* or *Vespertilio*, that have often very similar recordings. We refer to the species from the genus *Eptesicus* and *Nyctalus* for an assessment of the impact from the works for the project LIFE Green Valleys. The genus *Vespertilio* is in Belgium only represented by the vagrant migratory species *Vespertilio murinus*, who is unlikely to be present in the LIFE Green Valleys project area.

Plecotus auritus

Plecotus auritus has been found in all sub-regions, except for Pikhakendonk and Molenbeekvallei. Recordings from this species are low in numbers, due to the soft calls the species (or genus in general) produces – which requires the bat to come very close to a detector before getting registered. Additionally, only in optimal records is identification from *Plecotus* bats till species level possible.

Plecotus auritus is known to roost as well in buildings (mostly larger attics: churches, castles, …) as in tree cavities. We assess cutting trees for the project LIFE Green Valleys on roosts from *Plecotus auritus* of limited impact, due to the low number of potential bat trees. To lower the potential impact, nearly all trees with visible cavities or cracks are up to now saved during felling.

Plecotus austriacus

Only one possible observation was made from this species: a record on detector Pikhakendonk 2 on May 3, 2019. Identical to *Plecotus auritus*, this species is less easy to register on detector and even harder to identify to species level. *Plecotus austriacus* roosts in Belgium exclusively in buildings (mostly larger attics: churches, castles, …). Therefore no impact is to expect on this species from the works for the project LIFE Green Valleys.

Plecotus species

This species group contains unidentified *Plecotus* species. We refer to *Plecotus auritus* and *Plecotus austriacus* for an assessment of the impact from the works for the project LIFE Green Valleys.

Rhinolophus hipposideros

This presence of this species is most spectacular, since the species haven't been observed in Flanders since 1975 and was considered to be regionally extinct. Even in Wallonia the number of roosts and hibernating sites is limited, and the species is considered very rare (300-350 animals). The species only migrates over short distances (mostly less than 20 km, with exceptions till 50 km (Dietz *et al.* 2011) and this observation appears to be really far exceeding the maximum migration distance (counted from the known colonies) (Figure 19).
A special news item about this find was delivered to the press (in Dutch):
https://www.natuurpunt.be/nieuws/uitgestorven-gewaande-vleermuis-duikt-op-steenokkerzeel-20190604.

In the northern part of the species' distribution area, *Rhinolophus hipposideros* roosts exclusively in buildings, mostly on larger attics (Dietz *et al.* 2011). Therefore no impact is to expect on this species from the works for the project LIFE Green Valleys.

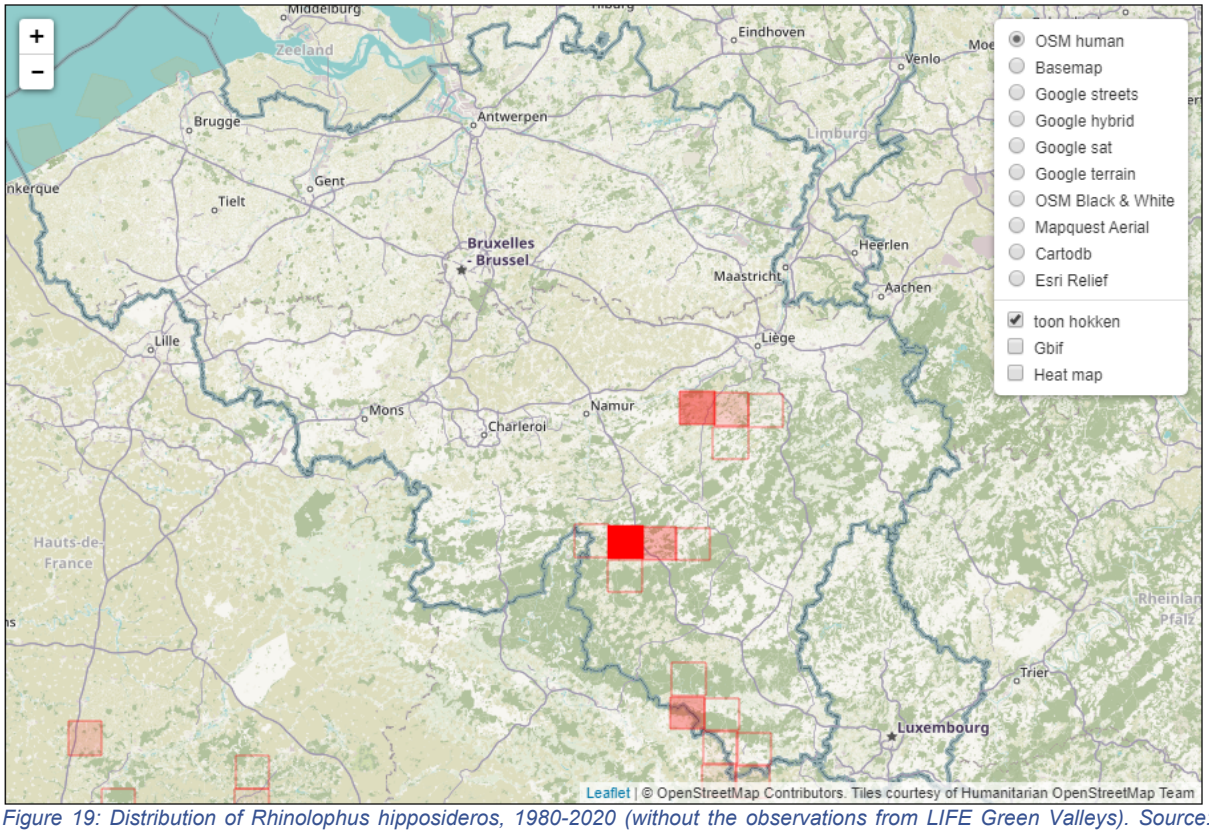

Figure 19: Distribution of Rhinolophus hipposideros, 1980-2020 (without the observations from LIFE Green Valleys). Source: www.observation.org, 29/01/2020. (© OpenStreetMap-authors)

Chiroptera species
This species group contains all bat observation where further identification till species level or even (group of) genus level was not possible. In case of recordings, it mostly concerns very weak calls or social calls.

4.1.2 Bat roosts in parcels where some trees will be removed

In general, the parcels that have been investigated showed only very few trees that could be of any importance for bats as a roosting place. All found tree cavities were, where possible, investigated with an endoscope and/or infrared camera on the presence of bats or traces from their presence.

There were no cavities where the use by bats could be confirmed.

Most trees that were assessed to have potentially cavities that could be of any interest for bats were marked to be preserved. That preservation also includes a small buffer from trees around the marked tree, so that the conditions in the immediate surroundings remain unchanged.

4.2 Gaps in the knowledge

At the moment of conducting the research, it was not known which trees will be removed, and was only partly known in which parcels felling of trees is planned. This means that, despite the very elaborated studies we did on bat presence and the checking of tree cavities, we could not focus on those parcels or trees where effectively changes will take place. The lack of that specific background information leads to rather general recommendations, there were more specific recommendations would have been possible (and advisable) to prevent or limit the negative impact on bat populations. Such specific advises were given already for the visited parcels in Silsombos and Hellebos-Rotbos, where potential colony trees were marked for not being cut

The presence of *Rhinolophus hipposideros* in Floordambos is a very valuable find, as it is the first observation of this species of Annex II of the Habitats Directive in Flanders in 45 years. However, till now the only thing we know is that the species regularly passed at one (detector) location. A lot of important questions still have to be answered. Is it a single animal, or is it a small population? If a population, is it a relict population or are it bats that recently moved to the region? What are the roost, foraging sites and flying routes?

Another gap in the knowledge is the use of the landscape in and around the project area by bats. As connection between their roosts and their foraging sites, or between different foraging sites, bats use (mostly linear) elements like lanes and tree rows, bushes, small streams, canals etc. we mention this gap in the knowledge because of the importance for the local bat population. Closing this gap however is not one of the aims of the LIFE Green Valleys project, as works for this project do not include the removing of lanes or other green linear elements.

4.3 Bottlenecks in the existing situation

There are no immediate bottlenecks found concerning bats for the LIFE Green Valleys project. There are still gaps in the knowledge which could potentially lead to negative effects. But when those gaps are filled and appropriate advise about bats is given and followed, negative effects on bats can be limited or prevented.

There exist bottlenecks for bats in and around the project area, but those are not caused or affected by the LIFE Green Valleys project. The largest bottleneck for bats in the existing situation is fragmentation of their habitat. Difficulties rise especially there were forested areas are smaller and more scattered over the landscape. Sub-region Pikhakendonk for instance has smaller forested zones, and the connection between them (and also between other forested zones outside this nature reserve) is rather weak. There probably is a causality between this fragmentation and the low number of bat records and bat species (compared to the other investigated sub-regions).
Related to fragmentation, is another bottleneck the gap in the knowledge concerning the use of landscape by bats in the project area. If for instance trees are felled that are part of a flying route from bats, the connection between fragmentated habitat can get broken.

4.4 Recommendations for development and management

4.4.1 Closing gaps in the knowledge and bottlenecks in the existing situation

Two of the in 0 mentioned gaps in knowledge are so important for the success and the objectives of the LIFE Green Valleys project, that we have kept part of the planned time for action A4 available to close those gaps.
In the first instance, it concerns a detailed research on those specific parcels were felling will be planned (but which were only partly known at the time of our research in 2019).
Secondly a research on *Rhinolophus hipposideros* is necessary. It was impossible to predict in advance that this Appendix 2 species would pop up in the project area, since the species has been unseen in Flanders for more than 40 years and the region is not within the range from where the species could be expected to migrate in the short term. More research is needed to provide adequate protection for this species. This further research focuses on the methods: 1) bat detectors can provide more information of the presence of the species nearby

the only known location at this moment, and 2) visiting attics that are potentially suited for the species (combined with DNA-analyses on found droppings) can hopefully lead to the colony place of *Rhinolophus hipposideros*. Depending on the new information, mistnetting to catch and release a *Rhinolophus hipposideros* with a transmitter might be an option. We do not consider telemetry as the first option, as *Rhinolophus hipposideros* is a species which is hard to catch. The other two methods are considered more appropriate for the questions that need to be answered: was the *Rhinolophus hipposideros* recorded in 2019 an individual, or member of a larger group wherefor adequate protection measurements could be needed?

We do not consider closing the gap in the knowledge concerning the use of landscape by bats in (and around) the project area as one of the aims of the LIFE Green Valleys project, as works for this project do not include the removing of lanes or other green linear elements. We would like to mention though the desirability of such research, because specific advise can prevent the loss of connections between bat habitats, and prevent further fragmentation of bat habitats.

4.4.2 Recommendations for forest management and limiting the impact of removing trees on bats

The suitability of a forest for bats is not determined by the type of tree, but by its age, the structure richness and (partly depending on these) the availability of prey. A bat-friendly forest management therefore strives for a wide variation in forest structure: unevenness, inequality in age, and mixing by stem or group, combined with an extended availability of tree cavities (such as woodpecker holes, burrow holes, cracks and crevices).
To provide sufficient tree cavities for a population of tree-dwelling bats, it is recommended to preserve (especially living) old trees. To achieve a sufficient supply of suitable tree cavities, a minimum of 16 (living) trees with cavities per hectare are optimal, with a minimum of 20 suitable cavities.
In order to obtain a sufficient number of suitable bat trees, it is advised to select successors in time: trees that exhibit incipient cavities or potential for it (e.g. lightning damage), that may grow old. Leaving standing and lying dead wood in situ promotes the presence of woodpeckers in general, with a direct consequence of a higher number of tree cavities.
When choosing successors, it is best to opt for long-lived, large tree species with a hard type of wood such as oak and beech. Cavities in these tree species provide often ideal circumstances for bats: they rot more slowly, remain suitable for longer and provide a better temperature buffering.

If old trees (with tree cavities) must necessarily be felled, this is by preference done between September 15 and October 15. At that time, the risk for the bats is smallest. If the tree is a mating place of *Pipistrellus nathusii* or *Nyctalus noctula*, then the best period for that tree is between October 15 and November 15.

Bats in tree cavities hide high up in ascending crevices. When cutting a tree with holes, it is therefore important that the cuts are made just below and well above the cavities. That way it is possible to prevent bats from being sawn. With safety pruning, specific attention must be paid to longitudinal cracks in the tree or in large side branches. These cracks can close during sawing work. This could lead to bats being crushed. This can be avoided by hitting one or a few wedges in the crack before sawing so that it cannot be closed.
Bats do not fly away when cutting into a tree, and wake up (especially in winter) only very slowly. Therefor sawn tree parts with cavities will preferably be put aside for a night, in such a way that the animals can crawl out of the cavity themselves and look for an alternative roosting place.

5 Conclusions

During our research, we found at least 11 different bat species in the different sub-regions from the LIFE Green Valleys project area. Most notable was the discovery of *Rhinolophus hipposideros*, which has not been found in Flanders for 45 years.
From those 11 species, four are (almost) exclusively living in buildings: *Pipistellus pipistrellus*, *Myotis emarginatus*, *Eptesicus serotinus* and *Rhinolophus hipposideros* (with un uncertain *Plecotus austriacus* as possible fifth species). Six species are living (mostly or exclusively) in tree cavities: *Pipistrellus nathusii*, *Myotis daubentonii*, *Myotis mystacinus*, *Myotis nattereri*, *Nyctalus noctula* and *Nyctalus leisleri*. One species lives both in buildings and tree cavities: *Plecotus auritus*.

The removing of trees for the LIFE Green Valleys project can have a negative impact on bat populations. The impact could be especially high for the six species that live most or even exclusively in trees, and additionally for Plecotus auritus, because they may lose roost sites. They even can become direct victims when trees are felled when bats are present. However, when the gaps in the knowledge are closed and recommendations are followed, the potential impact on bats is considered as very low.

The cutting of trees without cavities obviously does not lead to the loss of roosting sites (as long as a buffer of trees around potential roosting trees are preserved). However, the cutting of those trees could in principle have a negative impact on the bat habitat, when the removing of trees over larger areas, of from linear elements such as lanes or tree rows, leads to fragmentation of bat habitat. But this does not apply to the LIFE Green Valleys project, since the places were trees are removed are there all rather small and with a long-term forest objective and the intention is to get a forest with a more rich structure. Linear elements are not planned to be removed.

6 Non-technical summary

This study is part of the LIFE-project “Green Valleys: connecting habitats' conservation with long term biomass management and multi-stakeholder approach” (LIFE17 NAT/BE/000445), with financial support of the LIFE-fund of the European Union. In Flanders, actions are planned in seven nature reserves northeast of Brussels: Pikhakendonk, Hellebos-Rotbos, Floordambos, Kastanjebos, Torfbroek, Silsombos, Molenbeekvallei and Rotte Gaten.

In order to reach the project objectives, some trees will have to be removed. Trees are important residences for bats. In order to avoid damage to bats, the present study is carried out. The aim of this study is to avoid damage to the occuring bat species, and therefor contributes reaching the project objectives.

Depending on the situation, different methods were used.

An automatic detector was placed between 21 September 2018 and 15 July 2019 on 36 different locations, recording on each locations between 1 and 21 nights. For all locations together, the detector was placed for 209 nights and recorded 39.462 bat passages. The obtained sonograms were manually identified up to species level (or up to species group level, if species not certain).

Manned inventory with manual detectors was used as method, but limited to observations during catching nights and during a morning visit for swarming. No additional species were found manually, compared to the automatic detectors.

With infrared camera, ‘hot spots’ on trees were detected for identifying bat roosts. Found cavities were (where possible) checked on the presence or use of bats with an endoscope. No cavities were found were the use by bats could be confirmed, but trees with potentials for it were marked.

Captures provided additional information on the presence of species, in particular cryptic species or species with a particularly silent sonar. During 7 nights, a total of 30 bats (5 different species) were captured. In order to find places where bats rest/roost in hollow trees, one *Plecotus auritus* was tagged with a radiotransmitter. Two roosts from this bat were located, outside the areas where the LIFE Green Valley works are planned.

All methods combined gave an overview of the bat species occurring in the seven different sub-regions. From those 11 species, four are (almost) exclusively living in buildings: *Pipistellus pipistrellus*, *Myotis emarginatus*, *Eptesicus serotinus* and *Rhinolophus hipposideros* (with un uncertain *Plecotus austriacus* as possible fifth species). Six species are living (mostly or exclusively) in tree cavities: *Pipistrellus nathusii*, *Myotis daubentonii*, *Myotis mystacinus*, *Myotis nattereri*, *Nyctalus noctula* and *Nyctalus leisleri*. One species lives both in buildings and tree cavities: *Plecotus auritus*.
Most notable is *Rhinolophus hipposideros*, a species that hasn’t been found in Flanders for about 45 years, and *Myotis emarginatus* – both Habitat Directive Species annex II.

A gap in the collected knowledge is detailed information of a part of the parcels where trees will be removed. The lack of that specific background information leads for the parcels concerned only to rather general recommendations to prevent or limit the negative impact on bat populations. Conducting detailed bat research on those specific parcels would close the gap, and can limit or prevent negative effects from the project on bats.
Another gap in the knowledge is information about *Rhinolophus hipposideros*. This species was unexpected, and more research is needed to provide adequate protection for this species.
Another gap in the knowledge concerning the use of landscape by bats in (and around) the project area is from importance to maintain a favourable condition of the bats in the region, but is not considered as one of the aims of the LIFE Green Valleys project, as works for this project does not affect the larger landscape.

We concluded that the removing of trees for the LIFE Green Valleys project can have a negative impact on bat populations. The impact could be especially high for the six species that live most or even exclusively in trees, and additionally for *Plecotus auritus*, because they may lose roost sites or become direct victims when trees are removed. However, when the gaps in the knowledge are closed and recommendations are followed, the potential impact on bats is considered as very low.
The cutting of trees without cavities does not lead to the loss of roosting sites (as long as a buffer of trees around potential roosting trees are preserved).

7 References

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8 Attachments

8.1 Observations prior to the LIFE Green Valleys project

8.1.1 Observations from www.waarnemingen.be

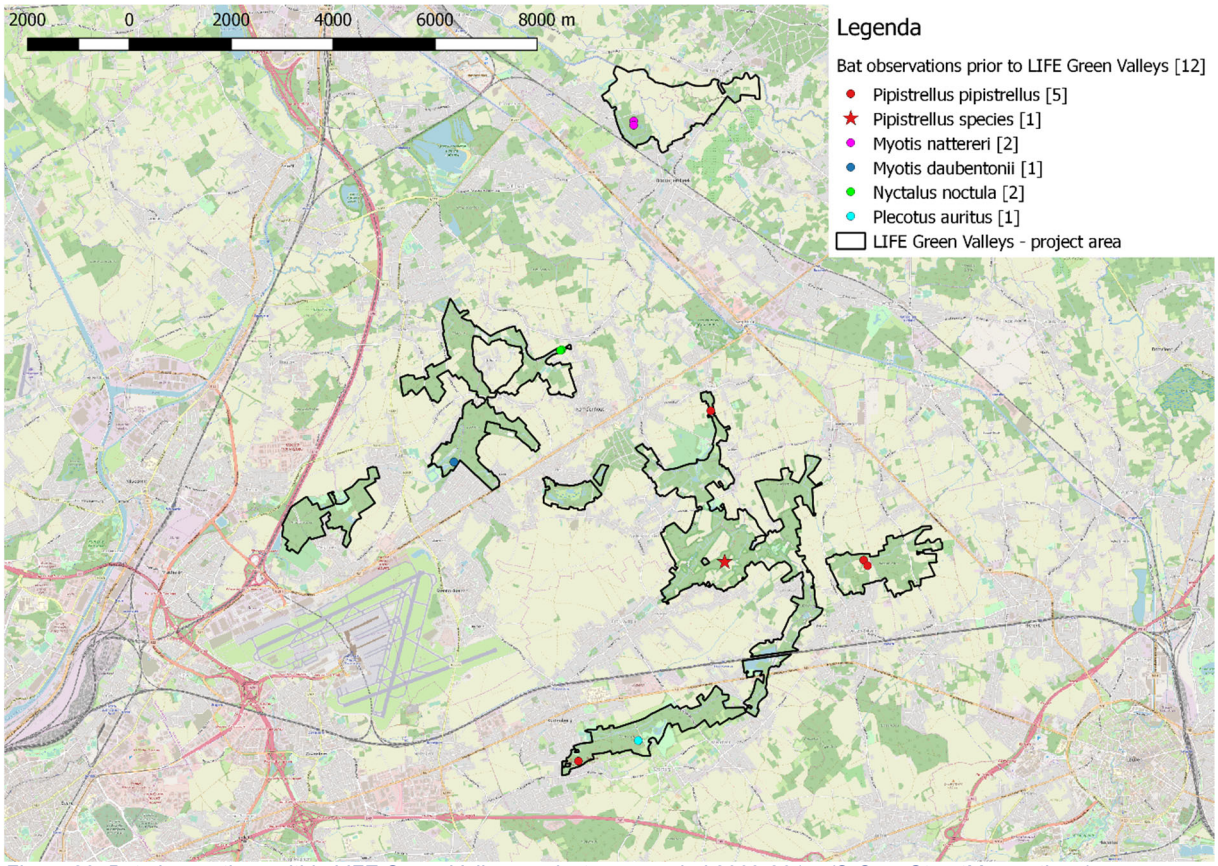

Figure 20: Bat observations within LIFE Green Valleys project area, period 2009-2017. (© OpenStreetMap-authors)

8.1.2 Data from winter databank Natuurpunt Bat Working Group

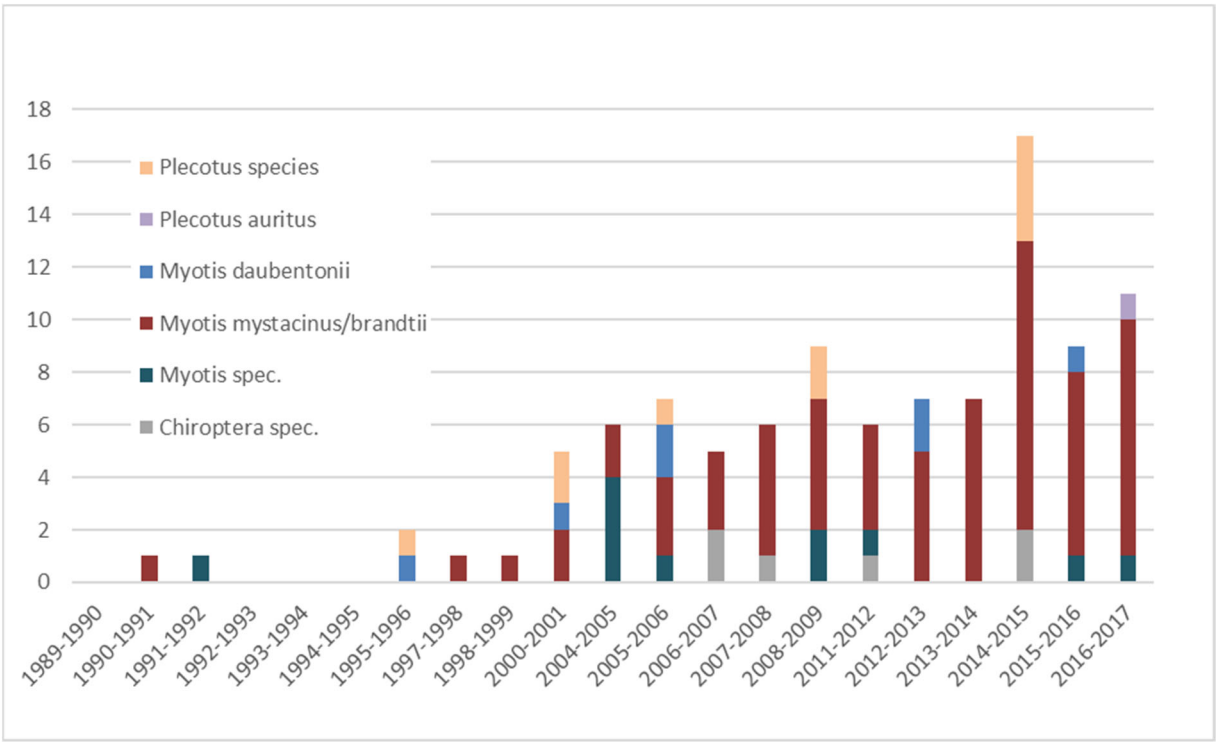

Figure 21: Evolution of hibernating bats in winter site 5021: Ice cellar 'de Merode'. All data till 2017.

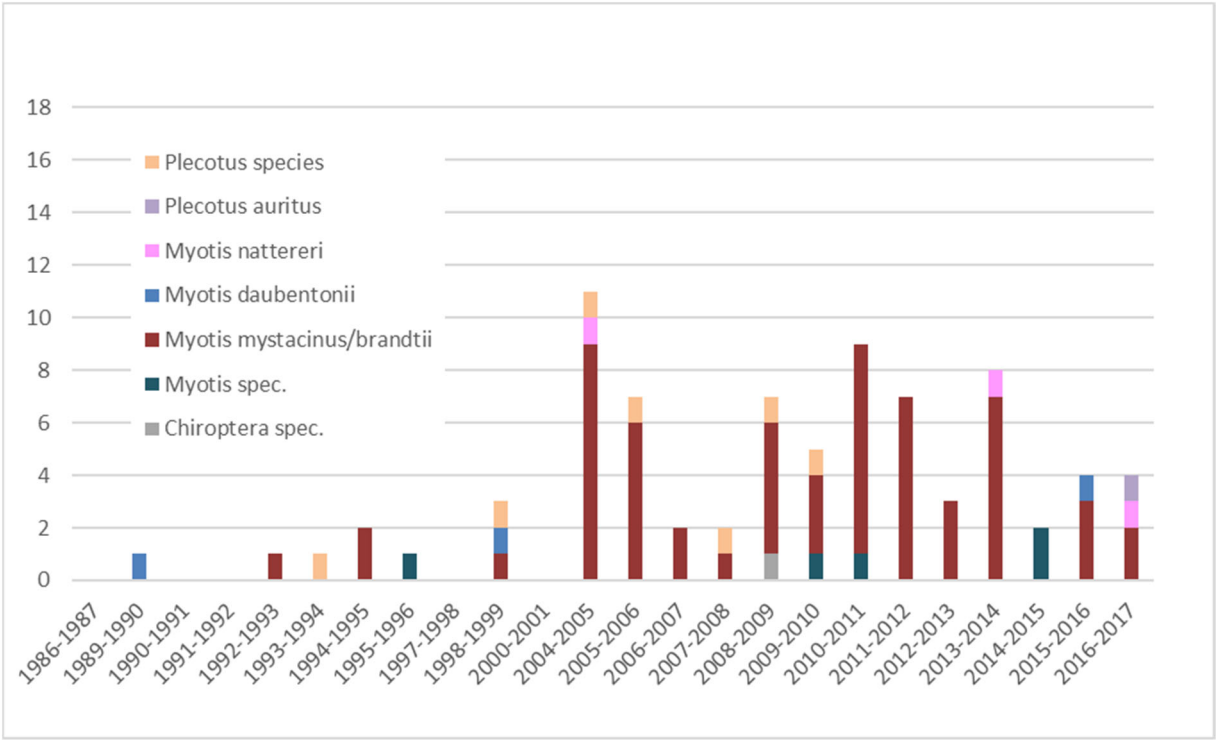

Figure 22: Evolution of hibernating bats in winter site 5024: Ice cellar 'Wilder/de Broqueville'. All data till 2017.

8.2 Photos

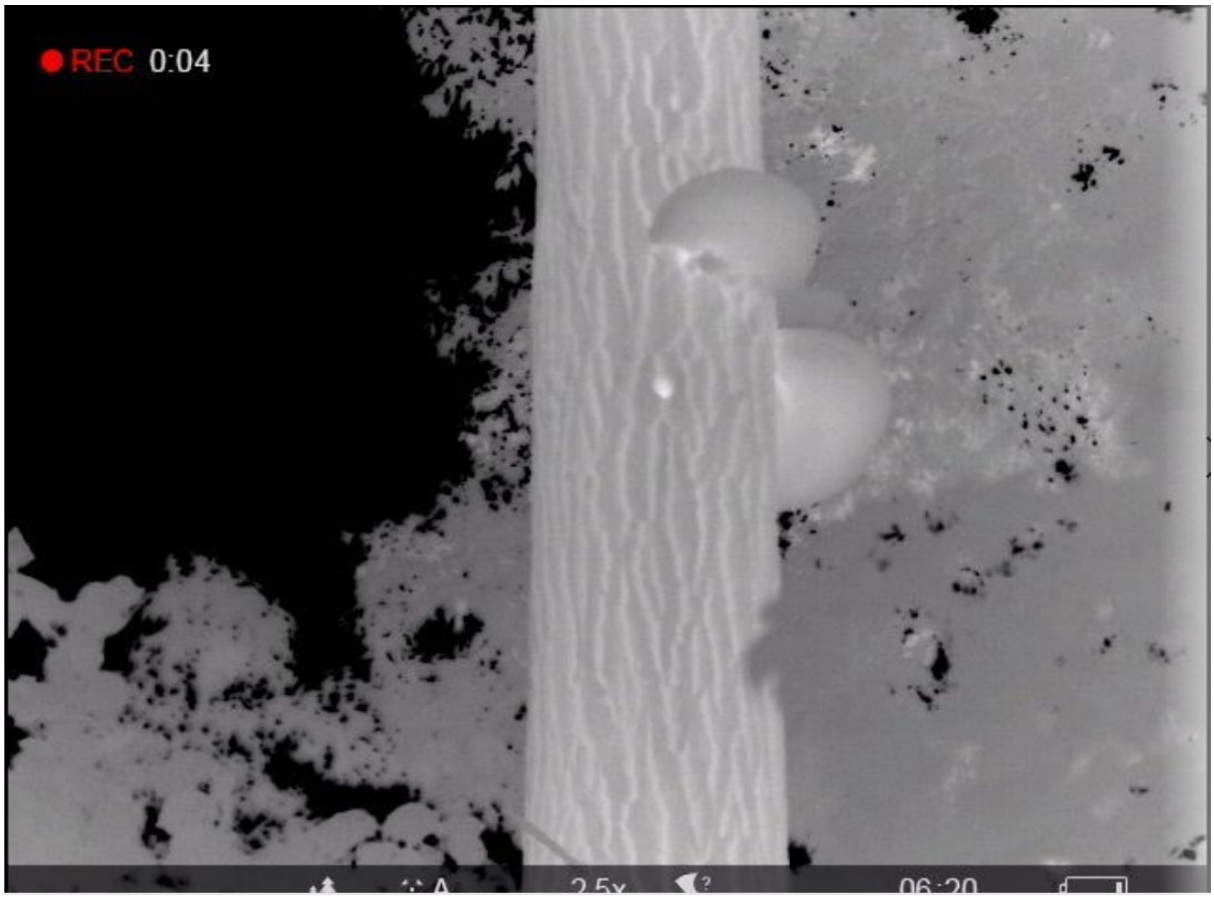

Photo 1: Infrared image of a tree cavity. Floordambos, July 9, 2019, 6:21 (photo K. Boers)

Photo 2: Investigation of tree cavities. Silsombos, January 5, 2019, 12:53 (Photo K. Boers)

Photo 3: Endoscopical view in a tree cavity. 31/12/2018 11:37 (Photo: K. Boers)


Photo 4: Akinesis as defence mechanism by Pipistrellus pipistrellus. Bat catching Pikhakendonk, August 23, 2019 (Photo W. Willems)

Photo 5: Checking of wing membrane from Pipistrellus pipistrellus on parasites. Bat catching Molenbeekvallei, May 3, 2019. (Photo: S. Ribbens)

Natuurpunt is de grootste natuurvereniging in Vlaanderen. Duizenden vrijwilligers en 400 professionele medewerkers werken voor de bescherming van belangrijke leefgebieden, soorten en landschappen. Om dit doel te bereiken beschermt de vereniging de resterende natuur in Vlaanderen door gebieden aan te kopen en beheren, door soorten en leefgebieden te bestuderen en monitoren, door mensen kennis te laten maken met de natuur en door beleidsbeïnvloeding op lokaal, regio-naal en Europees niveau. Natuurpunt beheert meer dan 22.800 ha natuur verspreid over 500 natuurgebieden. 110.000 families zijn lid van Natuurpunt.