

Appendix 14. The 2020 small mammal survey

The 2020 small mammal field survey was a continuation of the study started in 2012 and continued through 2013, 2014, 2015, 2016, 2017 and 2019 in order to identify focal species. The fieldwork was conducted in three crop groups (surveyed crops in parenthesis): Grass (timothy and reed canary grass), legumes (red clover) and conifer trees (ornamental/nursery).

Focal species (summary)

Based upon the result from this study wood mouse (*Apodemus sylvaticus*) is proposed as focal species for all three crops. In addition, field vole (*Microtus agrestis*), Eurasian water vole (*Arvicola amphibius*) and common shrew (*Sorex araneus*) are proposed as focal species for trees (ornamental/nursery).

The other small mammal trapped or photographed in this study was bank vole (*Myodes glareolus*) and brown rat (*Rattus norvegicus*). They were caught or photographed in such small numbers that they did not qualify as a focal species.

These recommendations are mainly based on fieldwork during a number of seasons. The population density of most small mammal species in Norway may vary considerably from one year to another. Of the species occurring in the study area, field vole, bank vole and wood mouse generally fluctuates most from year to year, and for the 2020 season, the wood mouse was very abundant.

Methods and study area

Study area

The fieldwork was conducted between May 22nd and August 27th 2020 at six different localities/farms in the municipalities of Råde, Sarpsborg and Fredrikstad in Southeast Norway (Table 1). The total area of each crop was obtained by the aid of georeferenced aerial photographs on the web page www.norgebilder.no and later verified by the respective farmers.

Table 1 Location and area of fields surveyed in 2020

Crop	Area (ha)	Locality/ farm	Municipality	Coordinates	Photos
Grass Timothy (A)	7,5	Rød farm	Råde	59° 19' 26" N 10° 49' 39" E	
Grass Reed Canary Grass (B)	10,3	Nøysom farm	Råde	59° 19' 38" N 10° 49' 52" E	
Red clover (A)	1,4	Nøysom farm	Råde	59° 19' 40" N 10° 50' 23" E	
Red clover (B)	3,9	Myre farm	Råde	59° 19' 46" N 10° 50' 14" E	
Trees (A)	1,4	Ødegård farm	Sarpsborg	59° 19' 48" N 10° 58' 54" E	

Trees (B)	0,2	Kjølsund farm	Sarpsborg	59° 13' 13" N 11° 03' 27" E
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Field survey methods

All localities were surveyed with scouting cameras during most of the growth season, and grass and legumes with traps at three different time periods during the growth season. Each camera capture/visit was correlated with a predetermined approximate stage of the BBCH-scale (Wikipedia 2013b, 2014b and c, 2016, 2019, Meier 2018 and Enriquez-Hidalgo et al. 2020) to cover the exposure scenarios in EFSA's Guidance document Risk Assessment for Birds and Mammals (EFSA 2009). Table 2 denotes the specific BBCH-values at trapping dates while Table 3 show the date intervals for scouting camera in each crop.

Table 2 BBCH-stage of the crops at the time of trapping

Crop	BBCH during 1 st trapping (Scenario covered) (Date of trapping)	BBCH during 2 nd trapping (Scenario covered) (Date of trapping)	BBCH during 3 rd trapping (Scenario covered) (Date of trapping)
Grass (A)	23 (20-29) (May 10 th – 26 th)	39 (30-39) (May 27 th – June 4 th)	65 (>40) (June 5 th - >)
Grass (B)	23 (20-29) (May 10 th – 26 th)	39 (30-39) (May 27 th – June 4 th)	57 (>40) (June 5 th - >)
Legumes (A)	23 (20-39) (May 10 th – June 7 th)	45 (40-49) (June 8 th – July 1 st)	65 (≥50) (July 2 nd – >)
Legumes (B)	23 (20-39) (May 10 th – June 7 th)	45 (40-49) (June 8 th – July 1 st)	65 (≥50) (July 2 nd – >)

Table 3 Date intervals for scouting camera in each crop

Crop	Field cameras and bat detectors (operating days)
Grass Timothy (A)	May 23 rd – August 27 th (96)
Grass Reed Canary Grass (B)	June 3 rd – August 27 th (83)
Red clover (A)	June 3 rd – August 27 th (85)
Red clover (B)	June 3 rd – August 27 th (85)
Trees (A)	May 23 rd – August 27 th (96)
Trees (B)	May 23 rd August 27 th (96)

Traps

At each field there were used 20 Ugglan traps (Grahnb (Gnosjö, Sweden) and 10 Heslinga traps (Groningen, The Netherlands) (see also photos in Appendix 7, 8, 9, 10, 11 and 12). Along the borders 10 Ugglan traps were used in addition. Each trap was baited with a piece of apple and/or carrot, some oatmeal, sunflower seeds and mealworms as suggested in the Practical Guide to Live Trapping of Small Mammals (Gurnell and Flowerdew 2006). The field traps were placed in two trap lines with a minimum of 10 meters between each trap, a minimum of 10 meters between each trap line and a minimum of 10 meters to the field border. The border traps were placed along the borders with at least 10 meters between each trap. During each trapping session the traps were open for 34 to 36 hours and checked three times a day during this time period. It was important to cover two subsequent nights, as nighttime has shown to be the most efficient time of small mammals trapping. The mammals caught were identified to species, and species and number of individuals from each field/field border was recorded.

Scouting cameras

Scouting cameras were used to record the presence of small mammals in all fields (Ltl Acorn 5210MC 12MP, Ltl Acorn 6210MC 12MP, Ltl Acorn 6310MC 12MP and Browning Spec Ops Advantage 20MP). As of previous years, the cameras were placed on small rocks, poles or trees and directed at bait on the ground. The bait was covered with some grass in order to reduce the probability of birds finding it.

The animals were identified to species and the number of individuals was recorded. The number of individuals recorded is a minimum estimate as there are no ways to separate identical looking individuals.

Bat recorders

By using sound recorders, we could monitor bat activity during the growth season. We used three bat recorders called "Song meter mini bat ultrasonic recorder" from Wildlife Acoustic. The recorders were used between June 2nd and July 22nd. The recordings were analysed by the use of a software called Kaleidoscope Pro which is developed by the manufacturer of the bat recorders.

The fields

Here is a location map of all the six farms from the 2020 survey:
<https://kart.gulesider.no/m/PTEEs>.

Grass (A) (Rød farm)

The grass field at Rød farm is located here: <https://kart.gulesider.no/m/JZxwm>. The grass timothy (*Phleum pratense* "Liljeros") was sown as a crop cover in May 2019. The field is 7.5 ha, and it is part of a crop rotation program. The borders consist of one side with paved road, one side with gravel road, one grass-covered border close to a garden, and a different crop on the last side.

The field camera was placed in the middle of the field on a rock, while the border camera was placed on a tree close to the gravel road and a small creek.

Grass (B) (Nøysom farm)

The grass field at Nøysom farm is located here: <https://kart.gulesider.no/m/hFuiG>. The grass reed canary grass (*Phalaris arundinacea* "Lara") was sown as a crop cover in May 2019. The field is 10.3 ha, and it is part of a crop rotation program. The borders consist of one side with paved road, one side with gravel road, a forest on the third side, and a different crop on the last side.

The field camera was placed in the middle of the field on a pole, while the border camera was placed on an electric pole alongside the gravel road.

Clover A (Nøysom)

The red clover field at Nøysom is located here: <https://kart.gulesider.no/m/qrBrl>. The red clover (*Trifolium pratense* "Gandalf") was sown as a crop cover in May 2019. The field is 1.4 ha and part of a crop rotation program. The borders consist of three sides with a forest/trees, and the last side with a different crop. The field camera was placed on a small rock, while the border camera was placed on an electric pole.

Clover B (Myre farm)

The clover field at Myre farm is located here: <https://kart.gulesider.no/m/ZS9lm>. The red clover (*Trifolium pratense* "Gandalf") was sown as a crop cover in May 2019. The field is 3.9 ha and part of a crop rotation program. One of the borders is a dirt road, the second on a paved road, the third on a line of trees, and the last on a garden/forest. The field camera was placed on a small rock, while the border camera was placed on a tree.

Trees A (Ødegård)

The Christmas conifer tree farm at Ødegård is located here: <https://kart.gulesider.no/m/XG9fm>. The field was planted with Subalpine fir (*Abies lasiocarpa*) in 2007. The field is 1.4 ha, and its borders consist of gravel roads on two sides, a forest on a third and a cereal field on the last side. All tree cameras were placed on poles or trees within the field. The border camera was placed on pole close to the field.

Trees B (Kjølsund)

The Christmas conifer tree farm at Ødegård is located here: <https://kart.gulesider.no/m/IZMS7>. The field was originally planted with Subalpine fir (*Abies lasiocarpa*) in 2005 and later supplemented with Norway spruce (*Picea abies*) and Bosnian spruce (*Picea omorika*). The field is 0.2 ha, and the field is enclosed with big pine and spruce trees on all sides. All tree cameras were placed on poles or trees within the field. The border camera was placed on a rowan tree close to the field.

Results and discussion

Rodents and shrews

In the period from May 22nd to July 19th 2020 a total of 421 trap hours and 1431 days with scouting cameras were carried out in six different fields of three different crop groups (Table I). 1431 active camera days gave 66698 images and films, most of them with other moving objects than mice. As there are no ways to separate similar looking small mammals on pictures/films, the number of certainly specific individuals is as low as 37, but it could be a lot higher if there was a way to identify each individual mouse.

Even though the cameras yielded a great amount of results there are some important limitations. As for 2013 to 2019 there could probably have been more and better results. The batteries and memory cards lasted sometimes shorter than expected due to waving vegetation and flickering shadows (resulting in thousands of uninteresting pictures and films), and a fast-

growing vegetation obstructed a clear view of the bait and therefore the foraging animals were hidden. Also, the quality of the pictures and films sometimes made it hard to determine the species, especially at night during night vision with a too strong infrared light on the cameras. As in 2014 to 2019 the focus was adjusted down to approximately 40 cm from a standard focus distance of 3 m on the older cameras, but not on the new cameras, as this process increases the danger of getting water into the cameras.

Trapping gave 73 small mammals and cameras gave 37 individuals (Table 4).

Table 4 Summary of the number of trapped and photographed animals

Crop	Date	Field					Border							
		Apodemus sylvaticus (Wood mouse, småskog-mus)	Microtus agrestis (Field vole, markmus)	Sorex araneus (Common shrew, krattspissmus)	Myodes glareolus (Bank vole, klatremus)	Arvicola amphibius (Eurasian water vole, vånd)	Apodemus sylvaticus (Wood mouse, småskog-mus)	Microtus agrestis (Field vole, markmus)	Sorex araneus (Common shrew, krattspissmus)	Myodes glareolus (Bank vole, klatremus)	Rattus norvegicus (Brown rat, brunrotte)	Arvicola amphibius (Eurasian water vole, vånd)		
Rød (grass seeds) timotei	22.5.-24.5.	1					5							
	2.6.-4.6.						5	1						
	3.6.-26.8.						1							
	4.6.						1							
	5.6.-11.6.									1				
	7.6.-9.6.							1						
	20.6.-22.7.	1												
	29.6.-1.7.	2	1				7	1						
	22.5.-24.5.	2												
	4.6.-2.8.						1							
Nøysom (strandrør)	5.6.-23.7.									1				
	6.6.-12.8.	1												
	29.6.-1.7.	6												
Nøysom (red clover)	28.5.-30.5.	1					1							
	6.6.-20.7.						1							
	10.6.-19.7.	1												
	14.6.-7.7.							1						
	22.6.-24.6.	8					3			1				
	3.7.-16.7.											1		
	17.7.-19.7.	4					3							
	Myre	28.5.-30.5.												
		4.6.-21.7.						1						
5.6.-14.6.										1				
5.6.-27.8.		1								1				
8.6.										1				
12.6.														
22.6.-24.6.		8					2	2						
29.6.-3.7.		1												
4.7.-15.7.											1			
17.7.-19.7.		6					3							
Kjølsund (trees)	24.5.-8.7.		1											
	29.5.-1.6.	1												
	2.6.-7.6.	1												
	5.6.-21.8.						1							
	12.6.		1											
	3.7.-19.7.	1												
	11.7.									1				
	11.7.-12.7.			1										
	18.7.								1					
Ødegård	11.6.-18.7.	1												
	17.6. og 5.7.					1								
	19.6.											1		
	17.6.-29.7.		1											
	18.6.-22.8.	1												
	20.6.-17.7.						1							
	22.6.-16.8.	1												
	25.7.-27.7.	1												
	15.8.-19.8.			1										
Grass seeds		13	1	0	0	0	20	3	0	2	0	0		
Clover		30	0	0	0	0	14	4	0	3	1	1		
Trees		7	3	2	0	1	2	1	1	0	0	1		
Total		50	4	2	0	1	36	8	1	5	1	2		
Cameras		Total field					57					Total border		53
Traps												Total		110

Field vs border

There was a total of 57 small mammals found, captured or filmed in the fields altogether. The distribution of the 50 wood mice, 4 field voles, 1 Eurasian water vole and 2 common shrews

are shown in

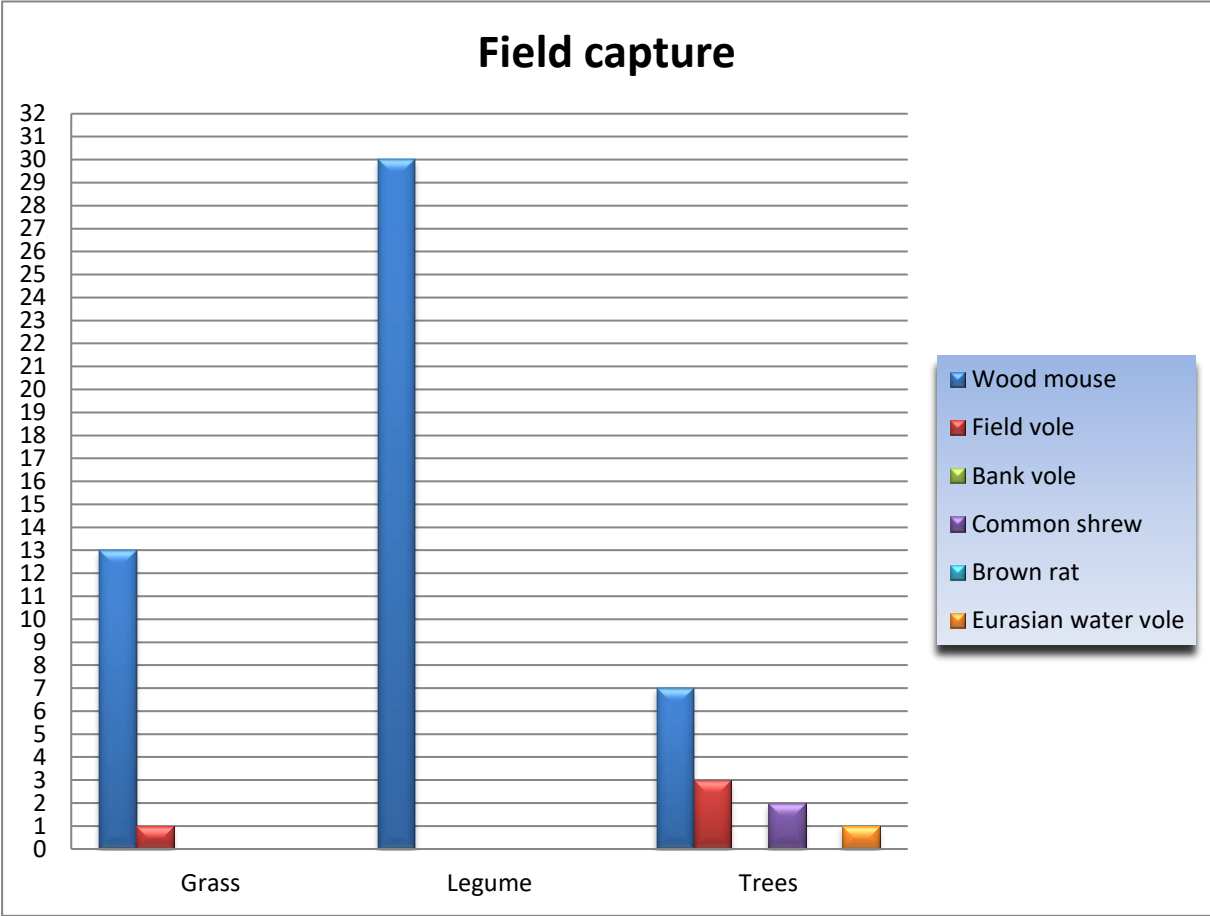


Figure 1 and Table 4.

Along the borders the total recorded small mammals were 53 divided into 36 wood mice, 8 field voles, 5 bank voles, 2 Eurasian water vole and 1 common shrew (Figure 2).

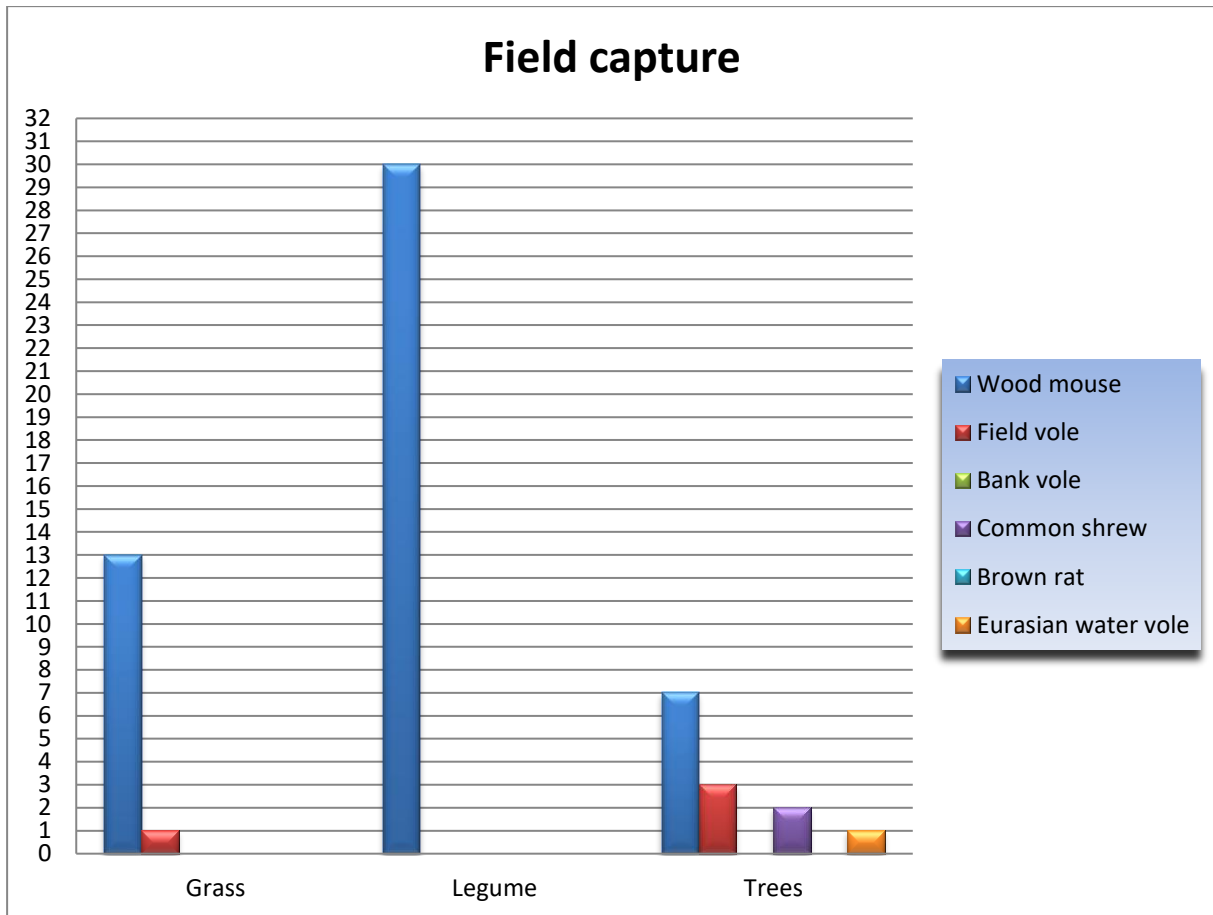


Figure 1 Number of individuals trapped or filmed in the fields.

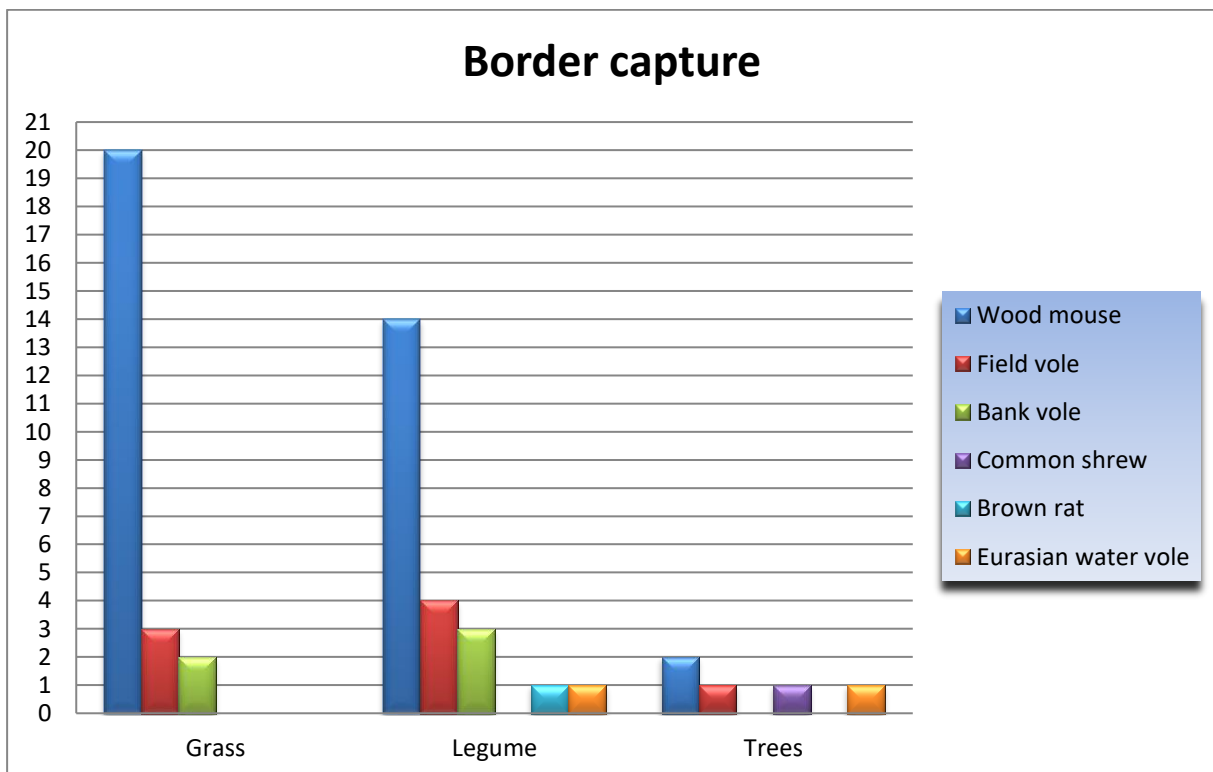


Figure 2 Number of individuals trapped or filmed in the field borders.

In the following, each field will be presented separately with the results from both fields and borders. We also present the recommended focal species for each crop.

Grass

This crop was surveyed by cameras from May 23rd to August 27th (Table 3), and by traps from May 22nd to July 1st. The total number of individuals recorded in this crop field were 14 represented by 13 wood mice and one field vole, while the total number recorded along the borders where 25 (20 wood mice, 3 field voles and 2 bank voles) (

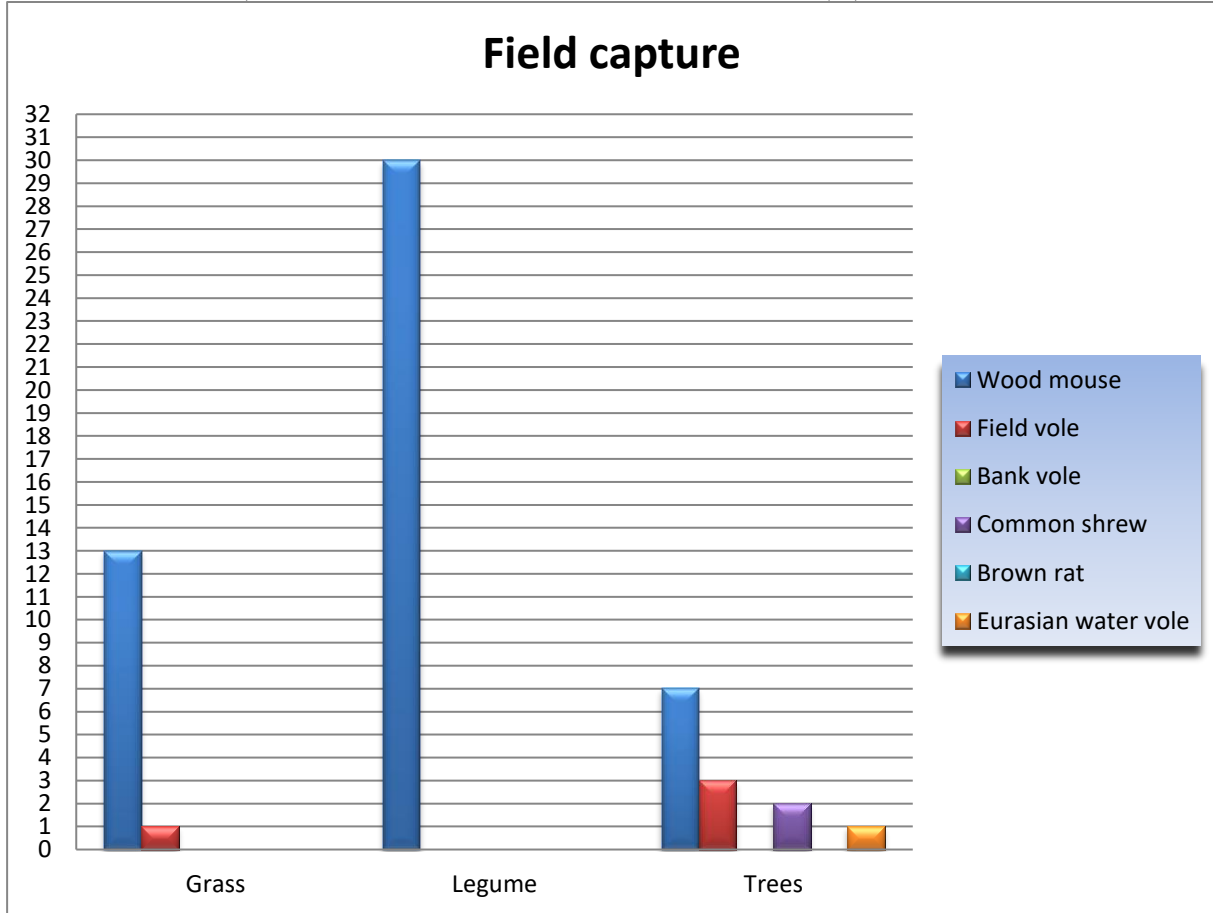


Figure 1, Figure 2 and Table 4). Figure 3 and Figure 4 shows the distribution of these mice related to the BBCH scale.

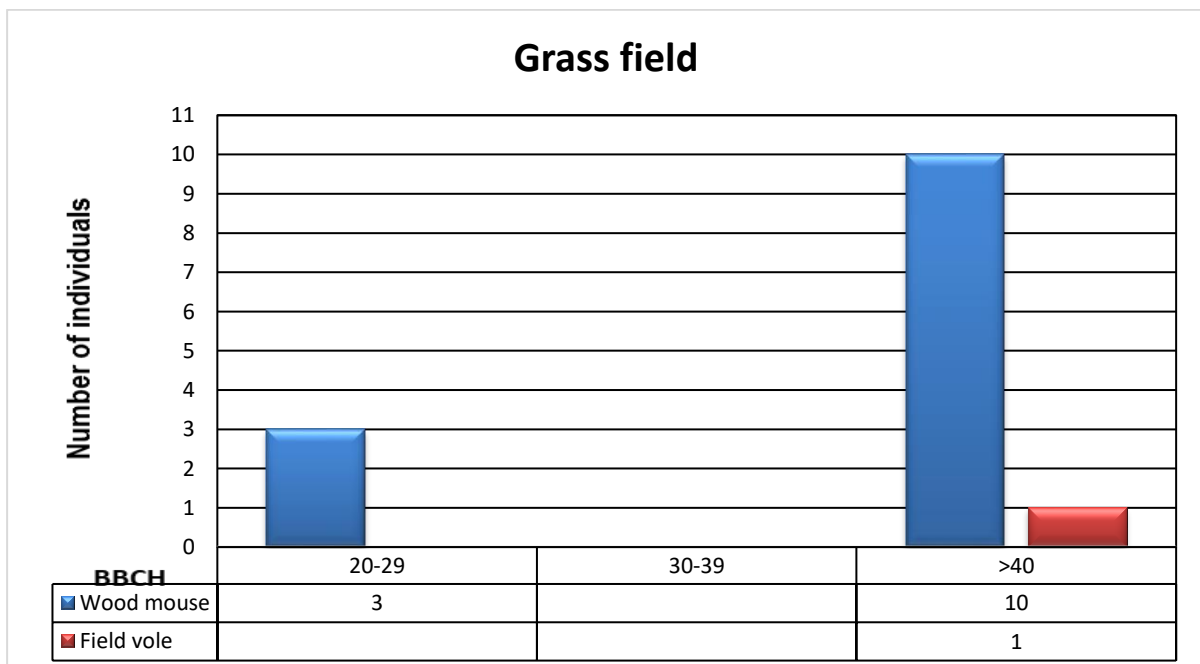


Figure 3 The total number of small mammals recorded in the two fields of grass.

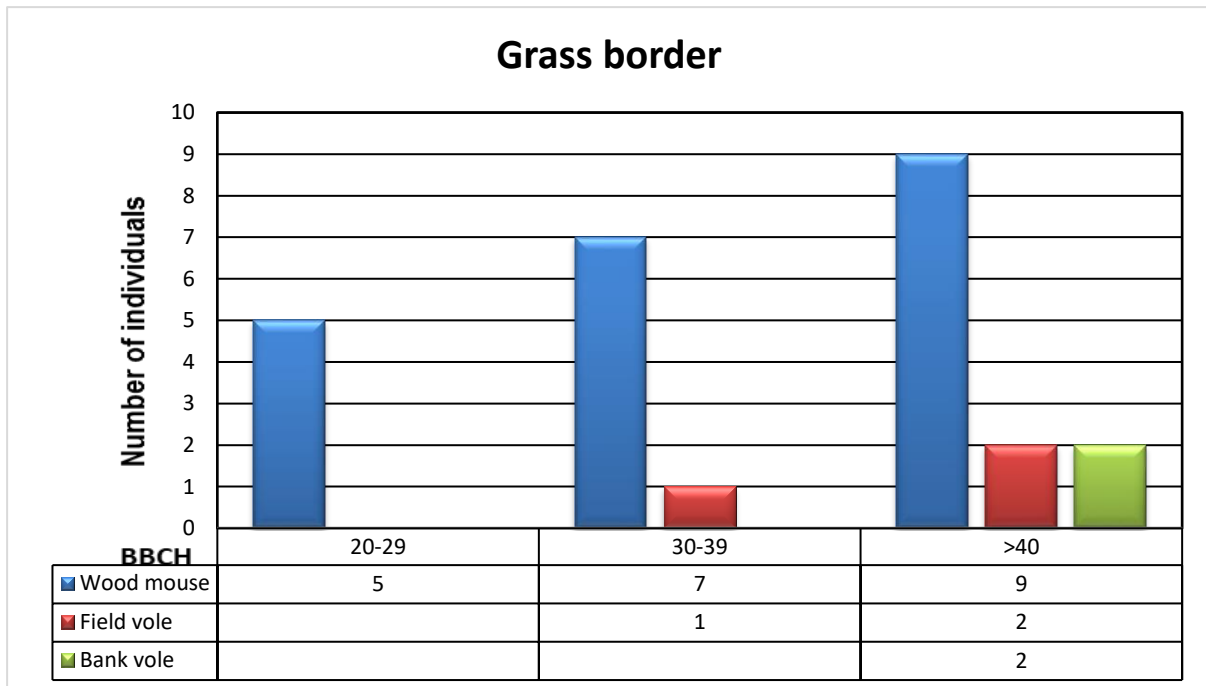


Figure 4 The total number of small mammals recorded in the two borders of grass

Including the results from earlier surveys, the recommended focal species in potato is wood mouse.

Additional observations in legumes

In addition to mice/shrews, some European roe deer, two badgers, a short-tailed weasel and some yellowhammers were recorded.

Legumes (red clover)

This crop was surveyed by cameras from June 3rd to August 27th (Table 3), and by traps from May 28th to July 19th. The total number of individuals recorded in the cabbage fields were 30 represented by wood mice only. Along the borders, we found 14 wood mice, 4 field voles, 3 bank voles, 1 brown rat and 1 Eurasian water vole (

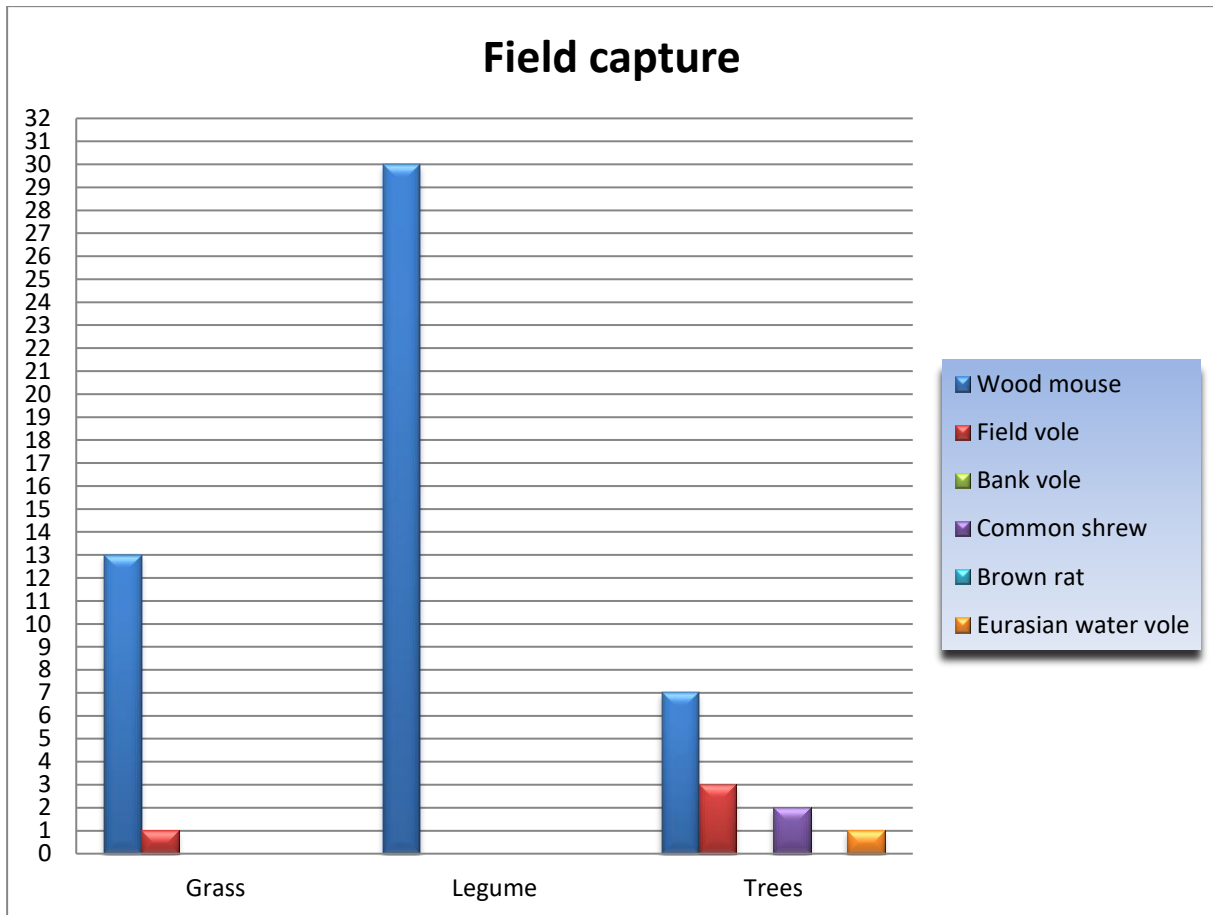


Figure 1, Figure 2 and Table 4). Figure 5 and Figure 6 shows the distribution of these mice related to the BBCH scale.

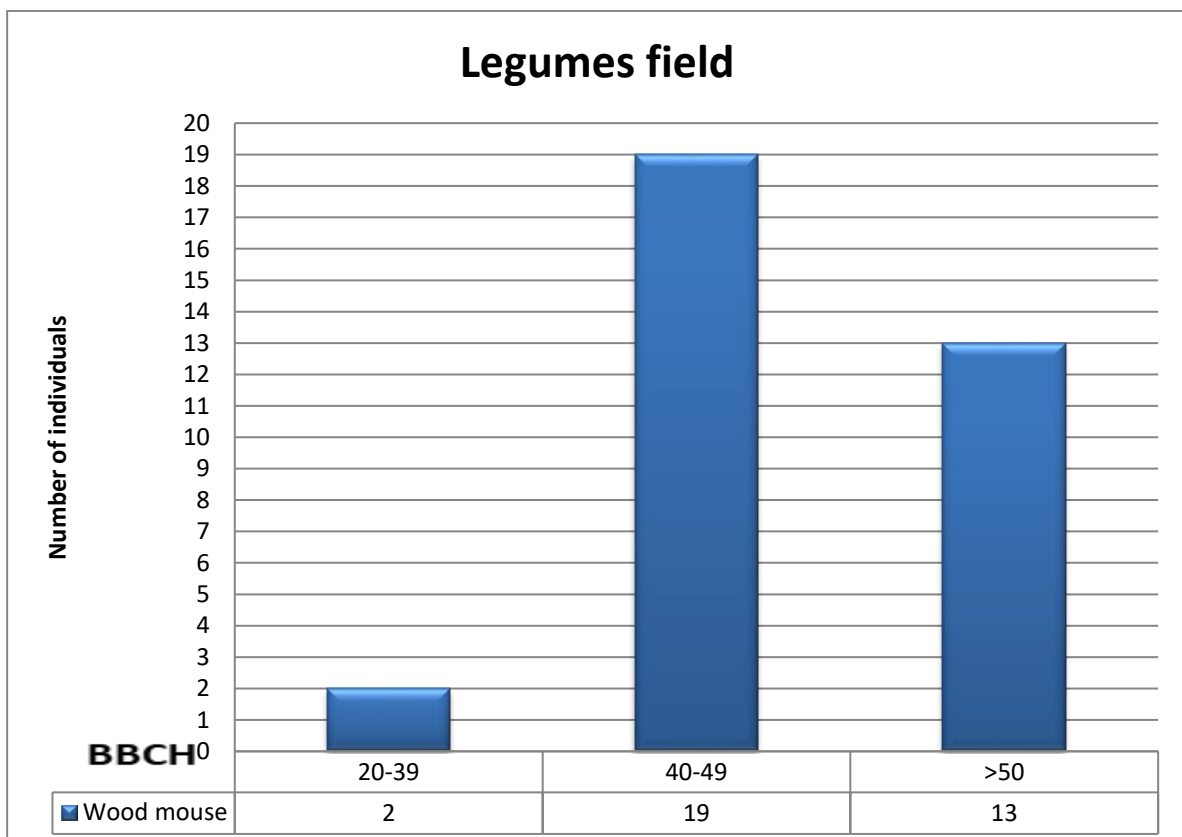


Figure 5 The total number of small mammals recorded in the two fields of legumes.

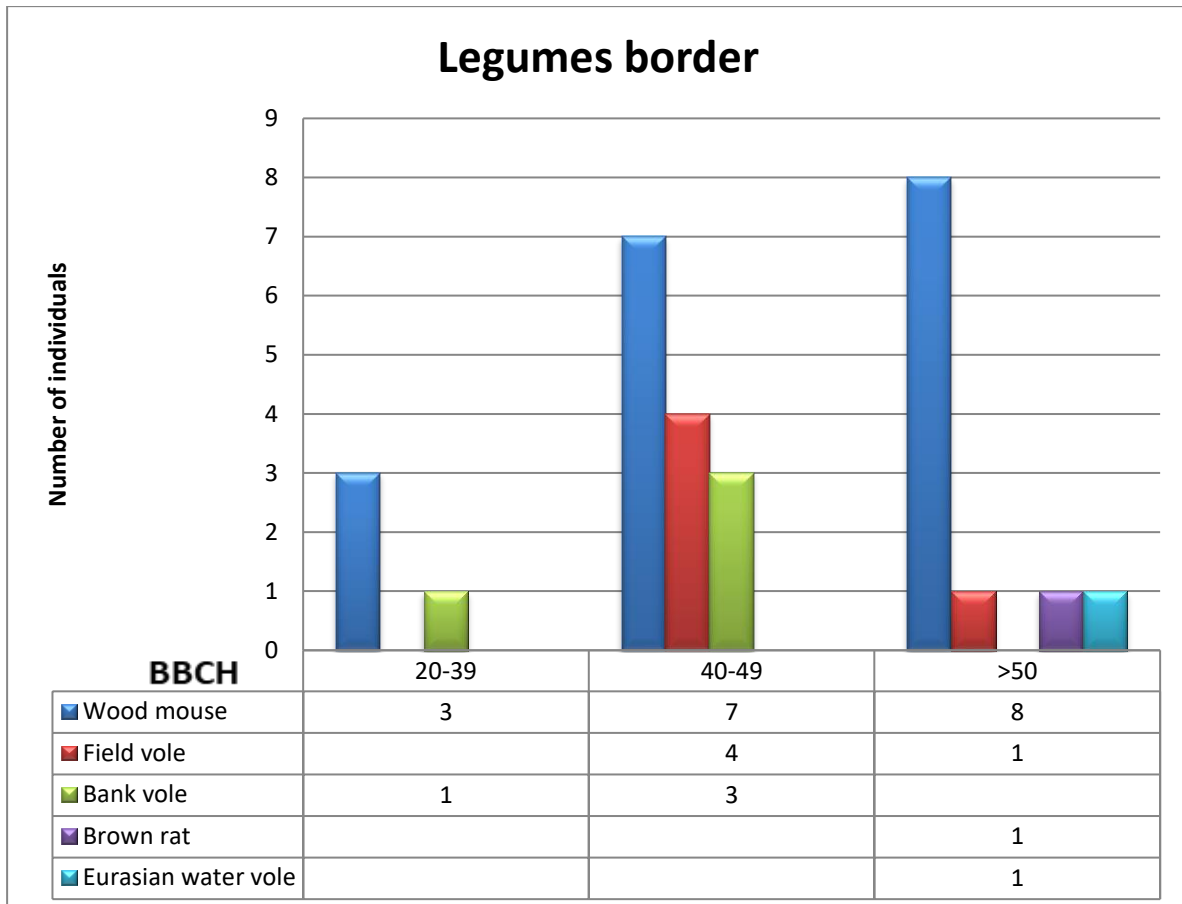


Figure 6 The total number of small mammals recorded in the two borders of legumes.

Including the results from earlier surveys, we recommend wood mouse as focal species in cabbage.

Additional observations in legumes

In addition to mice/shrews, a European roe deer, a blackbird, a wood pigeon, several great tits and a European robin were recorded.

Trees

This crop was surveyed with by cameras from May 23rd to August 27th (Table 3). The total number of individuals recorded in this crop were 13 represented by 7 wood mice, 3 field voles, 2 common shrews and 1 Eurasian water voles. Along the borders we recorded 5 small mammals represented by 2 wood mice, 1 field vole, 1 common shrew and one Eurasian water vole (

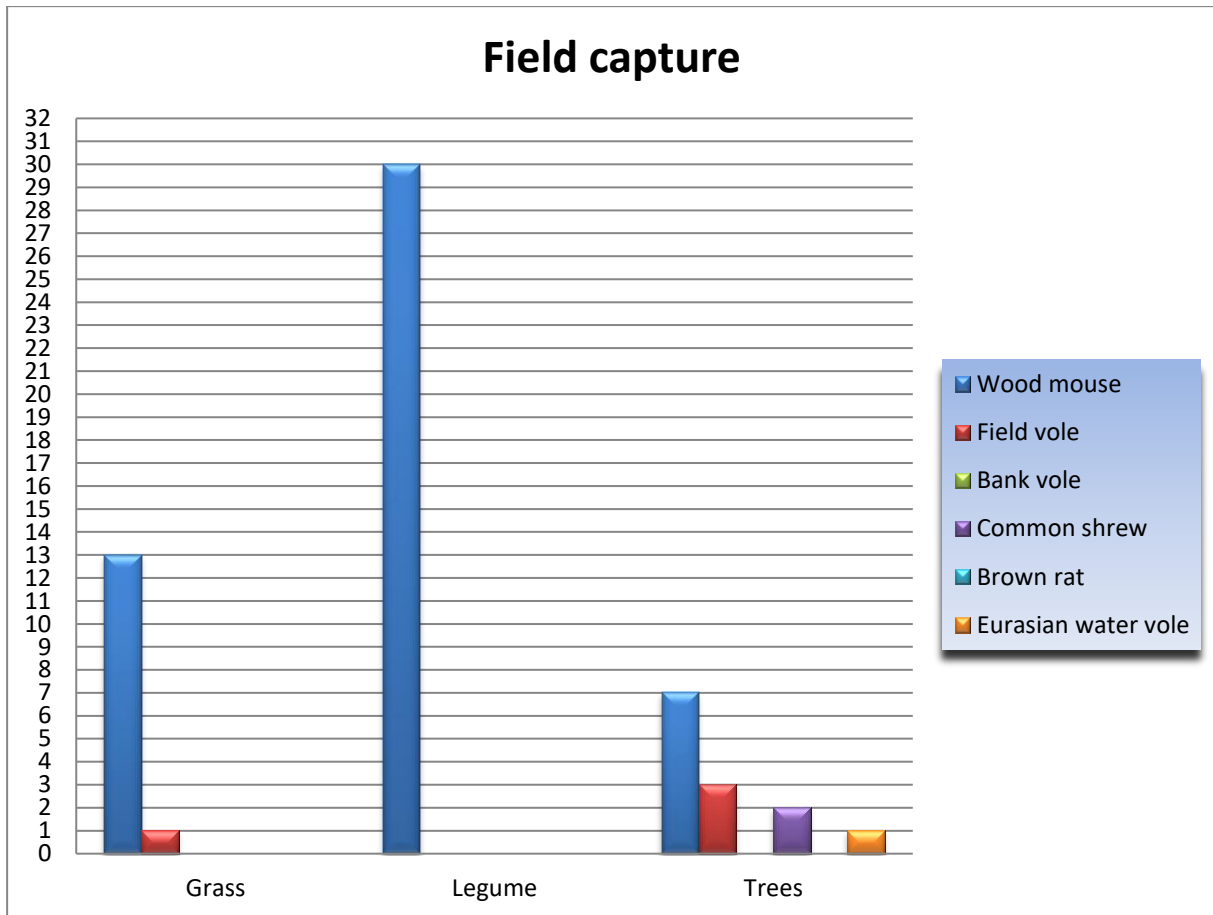


Figure 1, Figure 2 and Table 4). Figure 7 and Figure 8 shows the distribution of these mice related to the BBCH scale.

The BBCH scale used for this crop is the one used for grassland as this is the most dominant vegetation cover underneath these trees.

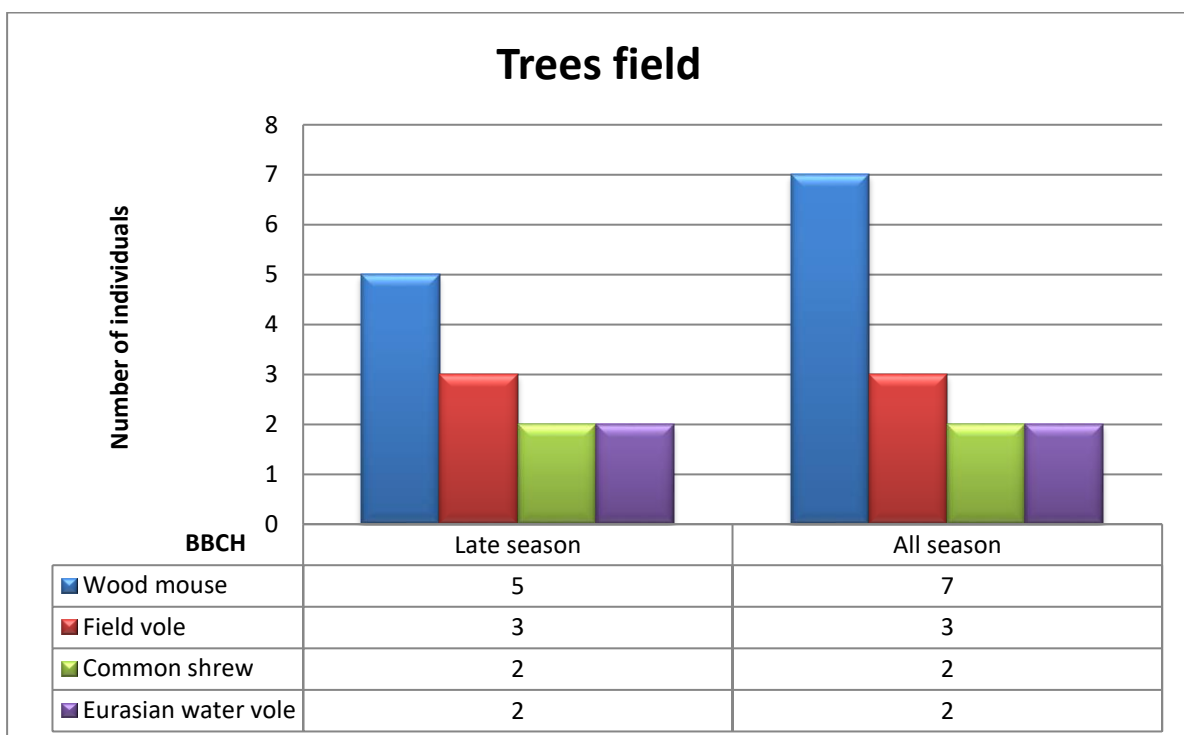


Figure 7 The total number of small mammals recorded in the two fields of trees

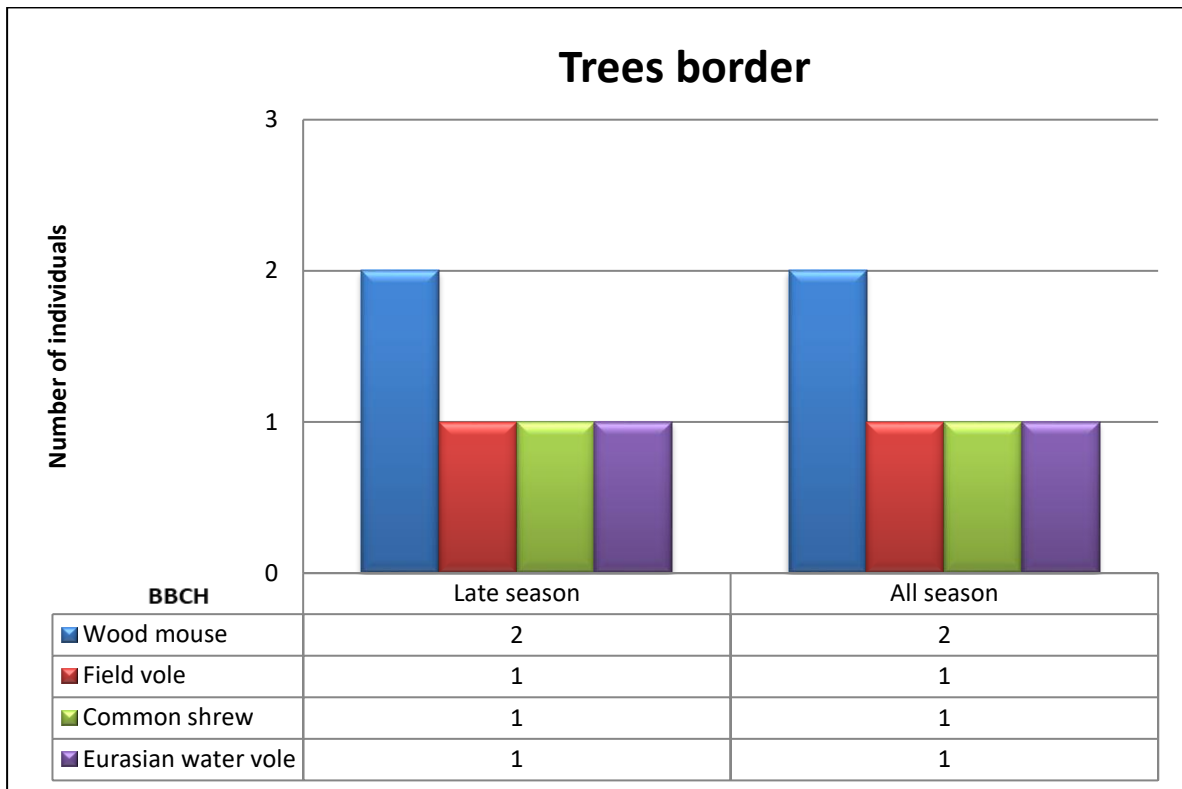


Figure 8 The total number of small mammals recorded in the two borders of trees

At Ødegård farm we also found many big holes in the ground, most likely from European water vole (*Arvicola amphibious*).

We recommend wood mouse and Eurasian water vole as focal species in trees. In addition, common shrew has been proposed as focal species. Common shrews prefer dense and tall grass (Northern Zone Birds & Mammals guidance document 2013). It is not as common as wood mouse in arable land, but common enough to be considered as focal species.

Additional observations in trees

In addition to mice/shrews, some European roe deer, and got a cat, a song thrush and some European robins on camera.

Bats

The bat recorders resulted in 2663 recordings, but only half of them contained recordings of bats. The other ones consisted mostly of wind, rain and birdsongs.

To determine what kind of bats we had recorded, we used Wildlife Recordings own software called Kaleidoscope. It can process a huge number of recordings in a few seconds, and the results given comes with a specific degree of certainty ranging from 12,5% to 100%. In this material we have separated the results with 60-100% certainty (Table 5).

Table 5 The number of bat recordings separated by species, date and species certainty determined by the software Kaleidoscope in the tree fields of Ødegård and Kjøsund farms.

Species Dato	Parti-coloured bat <i>Vespertilio murinus</i> (skimmelflaggermus)	Soprano pipistrelle <i>Pipistrellus pygmaeus</i> (dvergflaggermus)	Brandt's bat * <i>Myotis brandtii</i> (skogflaggermus)	Northern bat <i>Eptesicus nilssonii</i> (nordflaggermus)	Common noctule <i>Nyctalus noctula</i> (storflaggermus)
90-100% certainty					
12.06.2020		1			
03.06.2020					
06.06.2020			1		
3.-17.6.2020				126	
3.-17.6.2020					17
80-89% certainty					
4.-15.6.2020				5	
17.06.2020					2
70-79% certainty					
7.-15.6.2020				3	
17.06.2020					1
60-69% certainty					
3.-11.6.2020	2				
8.-17.6.2020					8

* *Myotis* species are difficult to determine only by recordings, so it would be more precise to put *Myotis* sp. on this one.

Table 6 The number of bat recordings separated by species, date and species certainty determined by the software Kaleidoscope in the clover fields of Myre and Rød farms.

Species Dato	Parti-coloured bat <i>Vespertilio murinus</i> (skimmelflaggermus)	Soprano pipistrelle <i>Pipistrellus pygmaeus</i> (dvergflaggermus)	Brandt's bat * <i>Myotis brandtii</i> (skogflaggermus)	Whiskered bat * <i>Myotis mystacinus</i> (skjeggflaggermus)	Daubenton's bat * <i>Myotis daubentonii</i> (vannflaggermus)	Northern bat <i>Eptesicus nilssonii</i> (nordflaggermus)	Common noctule <i>Nyctalus noctula</i> (storflaggermus)
90-100% certainty							
9.-12.6.2020	3						
3.-25.6.2020		3					
6.-20.7.2020			3				
3.6.-21.7.2020						498	
7.-19.7.2020				11			

23.6.-19.7.2020					4		
09.06.2020							1
80-89% certainty							
6.-17.7.2020			4				
15.06.2020							1
21.6.-18.7.2020					5		
18.-19.7.2020				3			
5.6.-18.7.2020						39	
70-79% certainty							
6.-15.7.2020			3				
21.06.2020							1
7.-18.7.2020					6		
6.-19.7.2020				10			
11.6.-18.7.2020						10	
60-69% certainty							
12.06.2020	1						
09.06.2020							1
6.-19.7.2020					10		
21.6.-18.7.2020						5	
6.-19.7.2020				12			
4.6.-21.7.2020			11				

* *Myotis species are difficult to determine only by recordings, so it would be more precise to put Myotis sp. on this one. Nevertheless, we leave it like this as this could be the task for further fieldwork to determine the correct Myotis species in these areas.*

Final notes

The numbers of wood mice are very good, as reported in several medias this year, but the number of the other species could have been higher.

We also had some trouble with fast growing leafy vegetables that covered the lens multiple times.

At last, but not least: there are no ways to tag the animals operating in front of the camera. When we registered only one mouse throughout the whole season in one crop, it could be several identical looking mice visiting the bait. We had two mice in one image less than ten times out of all the over 66000 images/films.