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Factors Affecting Hedgehog (*Erinaceus europaeus*) - Presence in Residential Areas in Southern Norway Assessed by a Questionnaire Survey

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Animal biology

Acknowledgments

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Abstract

The European hedgehog (*Erinaceus europaeus*) is a nocturnal small-sized mammal, 25-40cm, which is only active, from April to September. The purpose of this study was to investigate the various factors that may affect a hedgehog's choice of habitat and factors that could influence the hedgehog's presence and distribution. A survey from Questback for all citizens in Ås municipality was completed, giving a total of 441 answers.

Studies suggest that hedgehogs have changed their habitat from being primarily a deciduous forest species, to living in habitats in urban areas. In total 69.9% of the respondents had observed hedgehogs, and 65.8% had observed them in the last twelve months (n=430). This indicates that there is a viable hedgehog population in Ås. By using R software (R Development Core Team 2015), the overall observations of hedgehogs, both cubs and adults on the property and for those who had hedgehogs permanently residing, ("yes" vs. "no", logistic regression with binomial distribution), were tested against a total of 21 variables with sufficient data from the survey. I found highest probability of hedgehog presence in gardens with flowers, located in residential areas. There was also a higher probability of observing hedgehog on the property is their were supplementary feeding, and positive correlated with pets like dogs. Hedgehog cubs on the property, had a higher probability if the garden had facilities like terrace for shelter, and bushes or hedges for connections between gardens. In addition, observed badgers was significant in the same gardens as hedgehog cubs. The use of residential gardens by hedgehogs is therefore dependent upon habitats outside the garden, including connectivity. Habitats within the garden; facilities and the availability of natural and artificial food sources within the garden; patterns of use by pets like dogs, and tolerance of proximity to humans.

Urban areas are predicted to expand significantly in the future due to the increasing human population. This will increase the pressure on the landscape in both natural and cultural environments. Fragmentation in urban areas is prominent and involves three main components; the loss of the original habitat, reduction of patch size and isolation of habitat, which are limited by roads and traffic that have a major impact on hedgehogs. However, fragmentation may also give rise to new habitats; that may affect the population of hedgehogs, which are adapted to urban areas.

Sammendrag

Det europeiske piggsvinet (*Erinaceus europaeus*) er et nattaktivt lite pattedyr, mellom 25–40 cm, som kun er aktivt, fra april til september (Johansen, 2000). Hensikten med denne studien var å undersøke ulike faktorer som kan påvirker piggsvinets valg av habitat, og faktorer som kan være med på å påvirke piggsvinets tilstedeværelse og utbredelse. En spørreundersøkelse fra Questback, åpen for alle innbyggere i Ås kommune, ga totalt 441 svar.

Studier tyder på at piggsvin har endret sitt habitatbruk fra primært å være en løvskogart, til å leve mer i urbane områder. Totalt har 69,9% av de som har svart observert piggsvin og 65,8% har observert piggsvin i de siste tolv månedene (n = 430). Dette indikerer at det er en betydelig populasjon i Ås. Ved å bruke R-programvare (R Development Core-teamet 2015), ble alle samlede observasjoner av piggsvin, både unger og voksne, og for de som hadde piggsvin permanent, ("ja" vs. "nei", logistisk regresjon med binomial distribusjon), testet mot totalt 21 variabler med tilstrekkelige data fra spørreundersøkelsen. Resultatene viste høyest sannsynlighet for å ha piggsvin i hager med blomster som ligger i boligfelt. Det var også en høyere sannsynlighet for tilstedeværelse av piggsvin hvis de ble tilleggsfôret og var positivt korrelert med kjæledyr som hunder. Det var økt sannsynlighet for observasjon av piggsvinunger hvis respondenten hadde fasiliteter som terrasse, som kan fungere som ly, eller busker og hekker som binder hagene sammen. Observasjoner av grevling var signifikant i de samme hagene som piggsvinunger. Piggsvinets bruk av hager i boligområder er derfor avhengig av habitater utenfor hagen, inkludert tilkobling mellom disse. Habitater innenfor hagen; fasiliteter og tilgjengeligheten av naturlige og menneskelige utsatte matkilder i hagen; selskapsdyr som hunder og toleranse for nærhet til mennesker.

Urbane områder forventes å ekspandere betydelig i fremtiden på grunn av befolkningsvekst. Dette vil øke presset på landskapet natur- og kulturmiljøer. Fragmentering i urbane områder er fremtredende og innebærer tre hovedkomponenter; tap av det opprinnelige habitat, reduksjon av størrelsen på området og isolering av habitatet, som begrenses av veier og trafikk som også har stor innvirkning på piggsvin. Imidlertid kan fragmentering også gi opphav til nye habitater, som vil påvirke bestanden av piggsvin som er tilpasset urbane leveområder.

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1 Introduction

On a global scale, climate has a large influence on the distribution of species, and climate change is considered as a key pressure on biodiversity by affecting the species' range of habitat (Hughes, 2000; McCarty, 2001; Walther et al., 2002). On a local scale, a large number of ecological factors will affect an animal's presence. In urban areas, habitat fragmentation is considered as a key pressures on biodiversity. Here, patches varying in size and shape are surrounded by roads and buildings, and the vegetation is often changed and modernized (Kunick, 1982). Some wildlife species e.g. the European hedgehog (*Erinaceus europaeus*), European badger (*Meles meles*), red fox (*Vulpes vulpes*) and red squirrel (*Sciurus vulgaris*), are characterized as urban adapters because they manage to live in fragmented habitats, and use natural resources close to humans (Blair, 1996, 2001). Although these artificial environments are often small and isolated (Cousins, 1982), they are still important habitats for these animals (Cotton, 1981).

Urban areas are increasing and predicted to expand significantly in the future because of the human population growth (World Urbanization Prospects, 2008). With urbanization, many animals have adapted to a life in these areas, possibly because their original habitats have become less available (Baker & Harris, 2007). With an increasing number of wildlife species in urban areas, it is essential to develop a better understanding of the ecology of urban mammals in order to reduce human-wildlife conflicts. Fragmentations caused by buildings, roads, fences and other man-made features will influence the areas utilized by animals (Baker & Harris, 2007). Reduced connections between habitats and thus increased isolation will have a large-scale impact on landscape dynamics (Baker & Harris, 2007). Cities substitute other habitats even though the inhabitants have to live with the negative environmental effects that cities provide, such as pollution, traffic and lack of nesting places (Huijser & Bergers, 2000; D'Have, 2006; Dowding, 2007). In addition to the influence of urbanization, also climate affects how animals adapt and which variables are important for their use of the habitat.

In Norway, the climate is relatively warm compared to other countries on the same latitude, due to winds and oceans currents, but the weather conditions can sometimes be harsh. Since we are at the northern latitudes, the summer season has a short growing period, starting around April/May and ending in August/September. During these months, the animals must reproduce, take care of their offspring and look after their own welfare so they can survive the

winter months. They also have to develop different strategies for surviving a long and cold winter, when there is less food available and the temperatures are below zero.

Animals are affected by several environmental conditions such as where resources are located, the size of an area, the amount of food resources available, the risk of predation, and both intra- and inter-specific competition. The same also applies to habitats, where it should find shelter, be safe from predators and find potential mates to reproduce. This surmounts to an animal´s struggle through a lifetime, trade-offs between costs and benefits within all these factors and for their survival (Morris, 1987). In my thesis, I will focus on the European hedgehog as an urban adapter.

1.1 THE EUROPEAN HEDGEHOG

The European hedgehog is a generalist in the order insectivore, and is proclaimed to be a primitive species, as the family Erinaceidea has the oldest history of all mammals in Norway (Johansen, 2000). In Norway, the hedgehog has existed since the early stone age according to a study where findings were from "Vislehulen" on Jæren (Lie, 1990). There are few local, regional or national studies of hedgehogs in Norway. Johansen (1995) held a larger nationwide survey concerning hedgehogs to evaluate the distribution, population fluctuations and density. In the wild, the average life expectancy of a hedgehog is around 5 years, and the first year has the highest mortality rates (Reeve, 1994; Johansen, 2000). The hedgehogs' distribution, from along the coast north of Bodø to areas east in Østfold (figure 1), is affected by humans (Johansen, 2000). Today it is prohibited to release or move hedgehogs to new areas. The species was most abundant in some of the same areas that were inhabited by people, but was still common in natural habitats as well, although the population level fluctuated from year to year (Johansen, 2000).

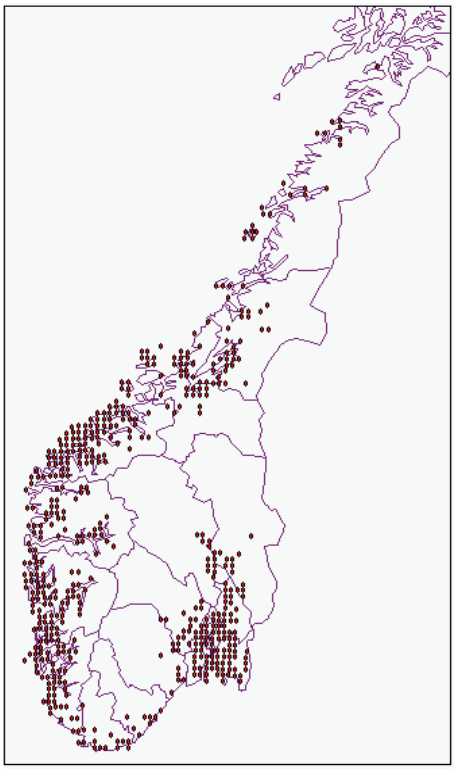


Figure 1: Map of Norway showing the hedgehogs distribution; 1980-1997 (Johansen, 2005; NZA Project Mammal Atlas, unpublished data.

Hedgehogs are nocturnal animals and spend most of their active time on foraging (Reeve, 1994; Riber, 2006). The hedgehog is only active for a short period of the year from springtime in April to September in autumn (Johansen, 2000). The most important food resources are macro-invertebrates, which contains larger insects, larvae, snails and earthworms (Johansen, 2000). Foods such as windfall, berries and mushrooms, are often found in gardens, and preferable for the hedgehog as well. Even though the hedgehog is an insectivore, they can also hunt for fledglings, reptiles, amphibians or carrion (dead or decaying flesh) (Johansen, 2000).

The hedgehogs natural habitats includes grassland, woodland and rural areas (Corbet, 1988), but urban areas have become an important habitat, especially domestic gardens. There, the animals are under pressure from negative effects of pollution, traffic and habitat fragmentation (Huijser & Bergers, 2000; D'Have, 2006; Dowding, 2007). In order to ensure a sustained viable population, there is a great need for data on the ecology and behavior of hedgehogs in urban areas. The hedgehog has never been on the Norwegian red list, but it has not been risk assessed since 2006 and 2010. In 2007 the hedgehog was rated as a "native species scattered in Norway", since it was largely spread by humans. It was therefore, assessed for potential ecological impacts on the native biodiversity where it occurs outside its natural range, according to S. Henriksen (mail, 13.04.15). In the 2015 assessment, the hedgehog was categorized as viable, category LC (Henriksen et al. 2015), with a wide distribution (figure 1). Today the hedgehog is protected, and hedgehog hunting is not allowed. The population of reproductive individuals assumed to exceed 2000 individuals.

The objective of this thesis is to identify factors that may affect a hedgehog's choice of habitat and the occurrence of hedgehogs on private properties in Ås municipality. I conducted a survey to obtain data on whether hedgehogs have been observed or not, together with information about habitat qualities associated with the private properties from which the observations originated. In relation to the use of habitat, I also focus on the consequences that can adversely affect the hedgehog population. The following questions where formulated to this project:

- What influences the probability of observing a hedgehog on a property?
- What influences the probability of having a hedgehog permanently on a property?
- What influences the probability of observing a hedgehog cub on a property?

2 Methods

2.1 AREA DESCRIPTION

Ås municipality is part of the Follo-region (coordinates: 59°39′50″N 10°47′30″E), which consist of Ski, Vestby, Oppegård, Frogn, Nesodden and Enebakk municipalities, in Akershus County, southern Norway. The municipality has a land area of 103 km², with a human population of 18 992, where 84 % of the citizens live in the central urban areas (SSB, 2015). Ås has had an almost continuous population growth in more than one hundred years, and during the last 10 years there has been a considerable focus on the development of housing and larger apartment complexes (Oblad, 2006). In Ås, the residential areas are dominated by detached houses with gardens, also in the central areas. The municipality is also well known for the Norwegian University of Life Sciences, NMBU, which is one of eight Norwegian Universities, with 5200 students and 1700 employers (nmbu.no). In 2019, the University will expand when the veterinary institute and clinics will move from Adamstuen in Oslo to Ås and become one Campus. This university is unique in that the campus additionally includes a large park and the buildings have a long history, as well as the "Ås farm", where they have research facilities and teach animal husbandry. The area of campus covers 6000 acres, which makes it a hotspot in Ås.

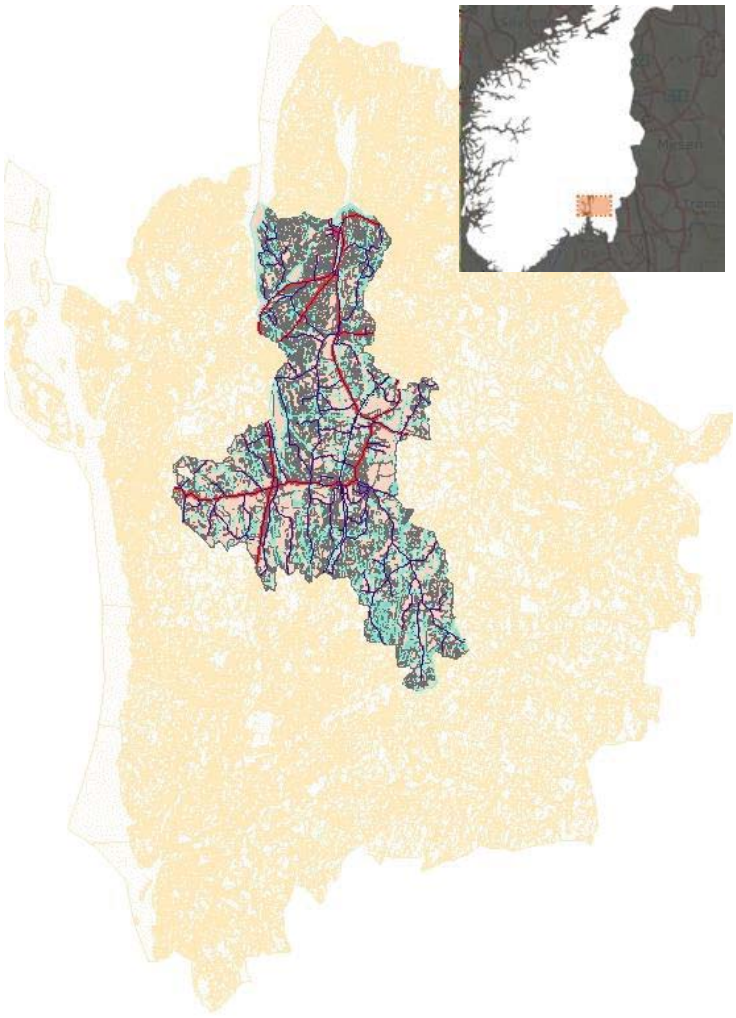


Figure 2: Map of Ås municipality in Follo-region in Southern Norway

2.2 CHOICE OF METHOD

The method of data collection used for this study has been a survey developed online by Questback, which is a feedback software for surveys (www.questback.com). The survey was designed to acquire quantitative data, thereby enabling statistical analysis (Johannessen 2010). The survey has its advantages in that it is standardized and shows differences and similarities between the various respondents. In addition, the results can be generalized and make it possible to collect a lot of data in a short time (Johannessen 2011).

2.2.1 Survey layout

When designing a questionnaire, it was important to design questions that apply to those corresponding with decent language, as well as clear and unambiguous questions (Johannessen 2011). The survey has to be structured, and have a simple and straightforward layout. In this task, I have prepared several questions concerning both the respondents residence, garden and about the hedgehogs. The survey was compiled both in Questback as an online survey with feedback management, and in paper form using Microsoft Publisher.

Surveys can be used for given, or open answers (Johannessen 2011). In this study, the main options used were given-answer-options (also called pre-coded). An open-ended question "*other*" was provided to most of the questions, with the purpose to find any variables of interest. After going through the data, all of these, except for one, were removed from the analysis as they did not provide sufficient information. One fruit tree species was not represented in the survey, and it seemed that ***cherries*** had some sufficient information and were placed as a variable within the category "fruit trees", since these actually were present in many gardens and had an effect when running the tests. The question in the survey about the fences in the garden had to be removed and not included in the tests, because the data was not accurate and therefore not reliable. Therefore, the survey was called a semi-structured questionnaire, consisting of both open and given alternatives answers (Johannessen 2011).

The layout of the survey was divided into four main categories, which made it easy to follow for the respondents. The first section concentrated on where the property was located in Ås, choosing from categories like urban or rural areas, and whether the respondent lived in a house, apartment etc. It also included whether the house was nearby a major road with heavy traffic, or had various facilities on the property such as a garage, terrace or pets. For all instances where the house had a garden, the respondent was also required to answer the

second section, whereas those respondents who did not have gardens or outdoor areas, jumped to section three in the survey. The second section, which asked about the garden, incorporated questions that could have some relevance, such as trees, flowers, use of pesticides and potential nesting places that can be important for the presence of hedgehogs. The third section enquired only about hedgehogs, and asked the most important question, whether the respondents had observed hedgehogs on their property or not. The fourth and final section asked for their personal opinion, if they had the impression that hedgehogs had become less common in the last 5–10 years, or if they had observed other wild species on the property. The entire survey is in paper form made in Microsoft Publisher are attached (appendix X).

2.2.2 Pretest

Upon completion of the survey, a pretest was carried out before publishing it online. To get the best results from the pretest, some people living in the study area was asked to respond. The purpose of the pretest was to check whether the respondent understood the questions and whether the questions achieved the purpose for which they were intended (Kajala et al. 2007). In this case, the supervisors and some fellow students did the pretest.

The survey was voluntary and with a general submission form intended to reach all citizens in Ås municipality. The importance of completing the survey even if one had not observed hedgehogs on own property was highlighted. The main point was to collect all relevant information about gardens and the property, in relation to whether they had observed hedgehogs or not.

2.2.3 Timing and response

The survey was available from 1st of May to 1st of September 2015 when hedgehogs had their active period. In the end I had 441 responses to the survey received, and 389 of the responses answered from the published online link using Questback.

The link from Questback was mainly published on websites like Facebook, and published in both "Østlandets blad" and "Ås Avis" with the headings *"How many hedgehogs are there in Ås and where are they?"* and *"Here they put out the camera for the hedgehogs"*. Highest response was from the Facebook group "*Ås kommunes venner*" from where over 100 replies came in the first twenty-four hours. During the summer, a day in the local mall provided some responses to the survey, and a lecture on a Sunday morning at the Science Center with the theme "Hedgehog Sunday" open for everyone, gave the last responses.

Of all 441 answers, 42 were excluded because they contained a lot of empty columns, and twelve because of duplicated addresses, suggesting that two or more people in the same household responded to the survey. Hence, a total of 387 answers were used for the analyses. However, the total number of respondents will vary from test to test, since not all of them answered all questions. Several respondents also sent emails and shared their experiences and pictures of hedgehogs (Figure 3).

Figure 3: Example of image sent by a respondent. Foto: Jørgen Sand Sæbø

2.3 PROPERTY VARIABLES

Information about the property and its location from the survey were merged into 21 different variables, and carefully divided in two categories where 15 different variables is "overall", and 7 is "garden". The overall variables are qualities of the property in general and explained in table 1. The garden variables are linked to the facilities in the garden, and only for those respondents who had a garden, explained in table 2.

2.3.1 Overall variables

Table 1: Variables for Test 1, 3 and 5. The response variable was either a) observed hedgehog on the property (yes or no), b) hedgehogs' permanent on the property (yes or no) or c) observed hedgehog cubs on the property (yes or no).

Explanatory Variables	Type of variable	Explanation
House	Yes	Detached, semidetached, terraced house
House	No	Apartment, dorm
Garden	Yes/No	If the property has a garden
Residential area	Yes/No	If the house is in an urban area
Woodland	Yes/No	If the house is located near a forest
Rural area	Yes/No	If the house is located on farmland
Traffic	Yes/No	If the house is located near roads like freeway or other heavily trafficked roads
Pets	Yes/No	If there are pets in the household
Dog	Yes/No	If the person owned one or several dogs
Cat	Yes/No	If the person owned one or several cats
Building	Yes/No	Includes facilities such as garage, playhouse, doghouse or any storage
Terrace	Yes/No	Any kind of terrace
Compost	Yes/No	Either a bin or compost with waste
Feeder	Yes/No	If there is pet food outside directly for hedgehogs or other animals such as dogs/cats
Badger	Yes/No	If the owner has observed this species near or within the property
Fox	Yes/No	If the owner has observed this species near or within the property

2.3.2 Garden variables

Table 2: Test 2, 4 and 6 for those who had garden. The response variable was either a) observed hedgehog on the property (yes or no), b) hedgehogs' permanent on the property (yes or no) or c) observed hedgehog cubs on the property (yes or no).

Explanatory variables	Type of variable	Explanation
Fruit trees	Yes/No	All fruit trees and berries present in the garden like apples, pears, plums, strawberries, (black) currants, cherries and gooseberries
Grass	Yes/No	If the property has a lawn
Bushes and hedge	Yes/No	If the property has one or several bushes and hedges
Trees	Yes/No	If trees were present in the garden
Flowers	Yes/No	If the garden had flowerbeds, boxes and pots
Herbicides	Yes/No	If the owners had used this kind of pesticide
Insecticides	Yes/No	If the owners had used this kind of pesticide

The test results are represented either graphically, or by a ranked matrix to show the importance of the different combinations. In the appendix, the parameter estimates and predictions of the models are shown for the lower ranked models provided when the p-value was less than 0.10 (appendices I–III).

2.4 STATISTICAL ANALYSIS

All statistical tests were run in the statistical program R (R Development Core Team 2015). The data set was divided into two sets, the first data set called "overall" refers to all the data, whereas a subset called "garden" only includes those who have garden. The response variable was a) whether the respondents had observed hedgehogs on the property or not, b) whether they had hedgehog's permanently or not on the property and c) whether they had observed hedgehog cubs on the property or not ("yes" vs, "no", logistic regression with binomial distribution). This was tested against all the variables with sufficient data from the survey.

To predict the probability of having hedgehogs on the property, I used generalized mixed models (GLM´s), in R (Version 3.2.3) to decide the most descriptive variables in a property. Based on these variables, I constructed a set of candidate models in a biological relevance. Selections of models were based on AICc (Aikake information criterion corrected for small sample size), within 4 delta AIC (appendices IV-IX). The models was compared against the results from a fully automated model selection procedure using "dredge". Dredge generates a set of models with combinations (subsets) of terms in the global model, with optional rules for model inclusion. To find the most parsimonious model, the package Multi-Model Inference "MumIn" in R, to test all combinations against one another. This forms the basis in the best fitted models and makes up the parameter estimates, and the predicted value for the new variables, and the results. In addition, the predicted values, the 95 % confidence interval were presented to indicate the variations around the estimates.

2.4.1 Tests

In total, I ran six different tests (figure 4), with all the explanatory variables listed and explained in table 1 and 2.

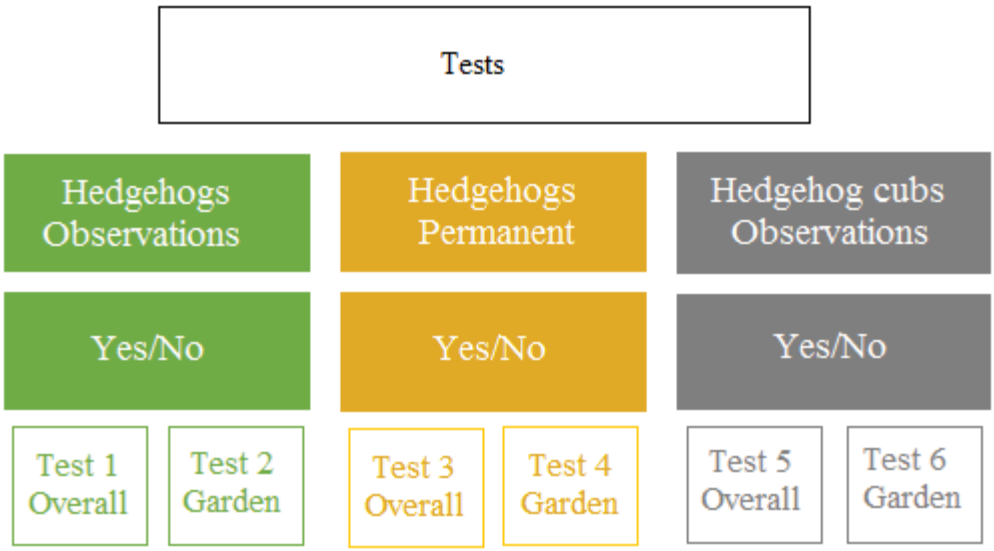


Figure 4: The green - hedgehog's observations, pertains to whether the respondents have observed hedgehogs on their own private property or not. The orange – illustrates those who had hedgehogs permanently on their property. The gray – cubs observations on property or not. "Overall" is all the data and "garden" is subset with only those who have a garden.

2.4.2 GIS software

To visualize the distribution of hedgehogs and some of the best explained variables that can have an affect the presence in Ås municipality, the geographic information system (ArcGIS, ArcMap version 10.3.1, 2015) was used to create a distribution map of the response from the survey. GIS was used to illustrate the "overall" variables that had an effect. Subset called "garden" only includes those who have garden, and therefore not included in GIS.

3 Results

3.1 TEST 1 – OBSERVATIONS OF HEDGEHOGS ("OVERALL")

The probability of observing a hedgehog on a property was best explained by the variables whether respondents had a dog, a terrace, whether respondents lived in a residential area, or whether there was a feeder for dogs, cats or hedgehogs (table 3).

Table 3: Parameter estimates for the best fitted model (AIC 1, model 3098, table 1) for the probability of observing a hedgehog on a property (n=367).

Model 3098	Estimate	SE	z	P	
Intercept	2.5391	0.4268	5.950	< 0.001	***
Residential "No"	-0.9391	0.3166	-2.966	0.003	**
Dog "No"	-0.7065	0.3245	-2.177	0.029	*
Terrace "No"	-0.5987	0.2670	-2.242	0.025	*
Garden "No"	-1.2946	0.4165	-3.108	0.001	**
Feeder "No"	-0.9518	0.3654	-2.605	0.009	**

The ranked matrix (table 4) shows how the different combinations of the variables in table 3 affect the presence of hedgehogs. The highest probability is 92.68 % for observing a hedgehog on the property, this was for the combination of having a dog, a terrace, living in a residential area and supplementary feeding outdoors (e.g for their dogs, cats or hedgehogs). In contrast, the lowest probability was 12.44% for the combination of not having a dog, no terrace, and living outside residential area and no supplementary feeding outdoors (e.g. for their dogs, cats or hedgehogs).

Table 4: Predicted probability of having observed hedgehogs on the property, with the different combinations of variables based upon the best fitted model (AIC 1, model 3098, table 1) and upper- and lower 95 % confidence interval.

Rank	%	Lower and upper 95 % confidence interval		Residential**	Dog*	Terrace*	Garden**	Feeder**
1	92,68 %	87,00 %	98 %	Yes	Yes	Yes	Yes	Yes
2	87,44 %	77,33 %	97,55 %	Yes	Yes	No	Yes	Yes
3	86,21 %	77,77 %	94,64 %	Yes	No	Yes	Yes	Yes
4	83,20 %	69,88 %	96,53 %	No	Yes	Yes	Yes	Yes
5	83,02 %	74,28 %	91,77 %	Yes	Yes	Yes	Yes	No
6	77,45 %	63,62 %	91,28 %	Yes	No	No	Yes	Yes
7	70,96 %	52,64 %	89,29 %	No	No	Yes	Yes	Yes
8	65,66 %	48,35 %	82,98 %	No	Yes	Yes	Yes	No
9	65,61 %	38,91 %	92,31 %	Yes	Yes	No	No	Yes
10	63,14 %	38,31 %	87,96 %	Yes	No	Yes	No	Yes
11	57,58 %	26,72 %	88,43 %	No	Yes	Yes	No	Yes
12	57,32 %	34,74 %	79,90 %	No	No	No	Yes	Yes
13	57,27 %	32,24 %	82,29 %	Yes	Yes	Yes	No	No
14	57,00 %	45,02 %	68,99 %	Yes	No	No	Yes	No
15	51,24 %	30,62 %	71,85 %	No	Yes	No	Yes	No
16	48,54 %	32,89 %	64,19 %	No	No	Yes	Yes	No
17	48,48 %	22,38 %	74,58 %	Yes	No	No	No	Yes
18	42,41 %	17,62 %	67,20 %	Yes	Yes	No	No	No
19	34,38 %	9,51 %	59,25 %	No	Yes	Yes	No	No
20	26,90 %	4,64 %	49,16 %	No	No	No	No	Yes
21	26,65 %	10,98 %	42,32 %	Yes	No	No	No	No
22	22,35 %	3,85 %	40,86 %	No	Yes	No	No	No
23	20,54 %	4,79 %	36,29 %	No	No	Yes	No	No
24	12,44 %	2,53 %	22 %	No	No	No	No	No

3.1.1 Map of hedgehogs observations

Figure 5 and 6 shows whether hedgehogs were observed or not on the respondents property. The effect of residential properties was significant (table 3). In fact, 89.42 % was observed in residential gardens.

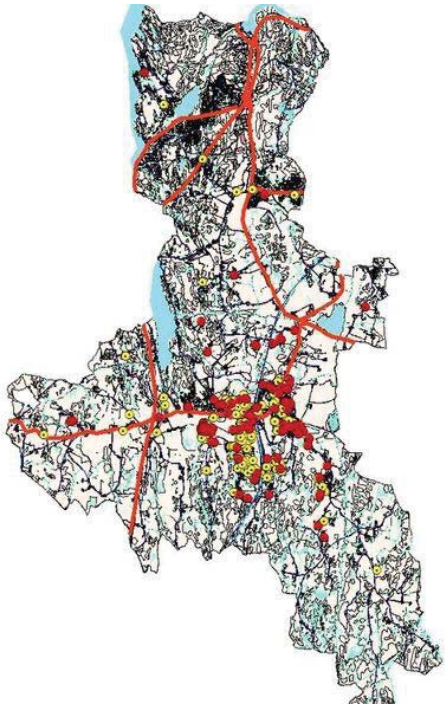


Figure 5: The respondents' properties, given as yellow spots if they had observed hedgehogs and as red spots if they had not (n=367) in Ås municipality.

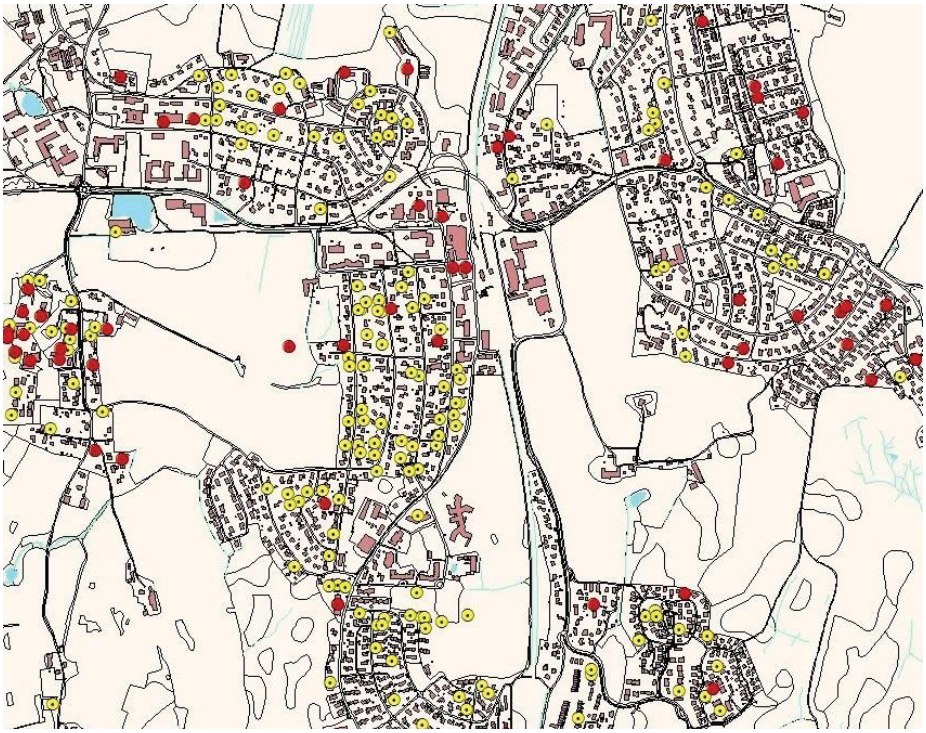


Figure 6: The respondents' properties, given as yellow spots if they had observed hedgehogs and as red spots if they had not (n=367) in Central Ås.

The probability of having hedgehogs increased if the respondents conducted supplementary feeding, either to a dog, cat or directly to hedgehogs. The spatial distribution of those who supplementary feed is given in figure 7 and/or if the respondents had a dog (figure 8).

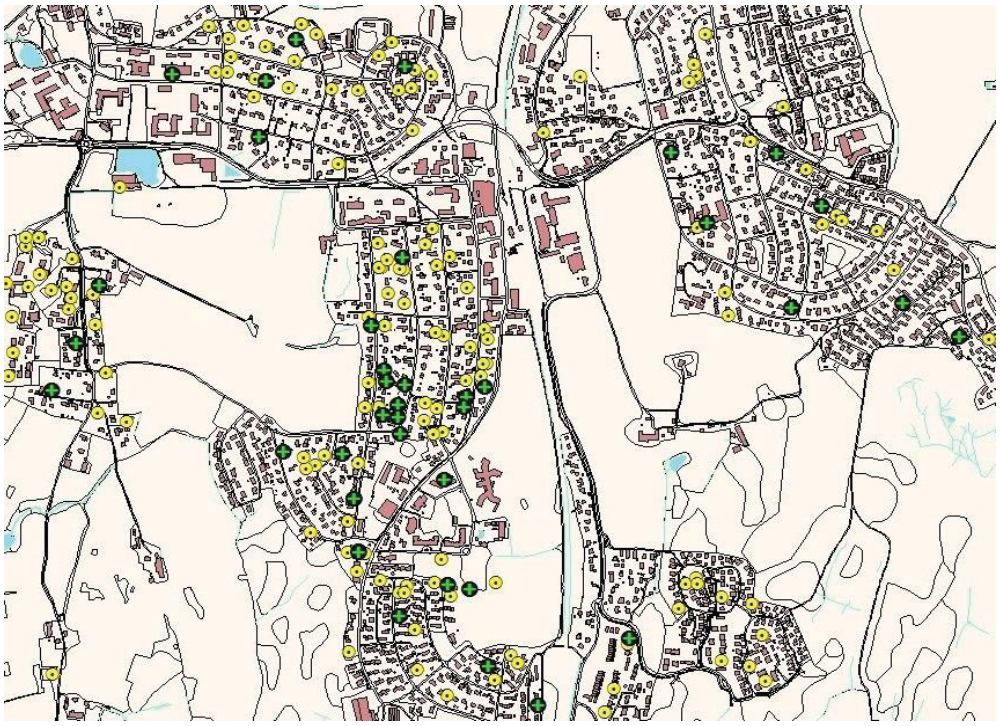


Figure 7: Yellow spots indicate the properties that have observed hedgehogs, while the black spots with green cross indicate the ones who put out food for either cats, dogs or hedgehogs.

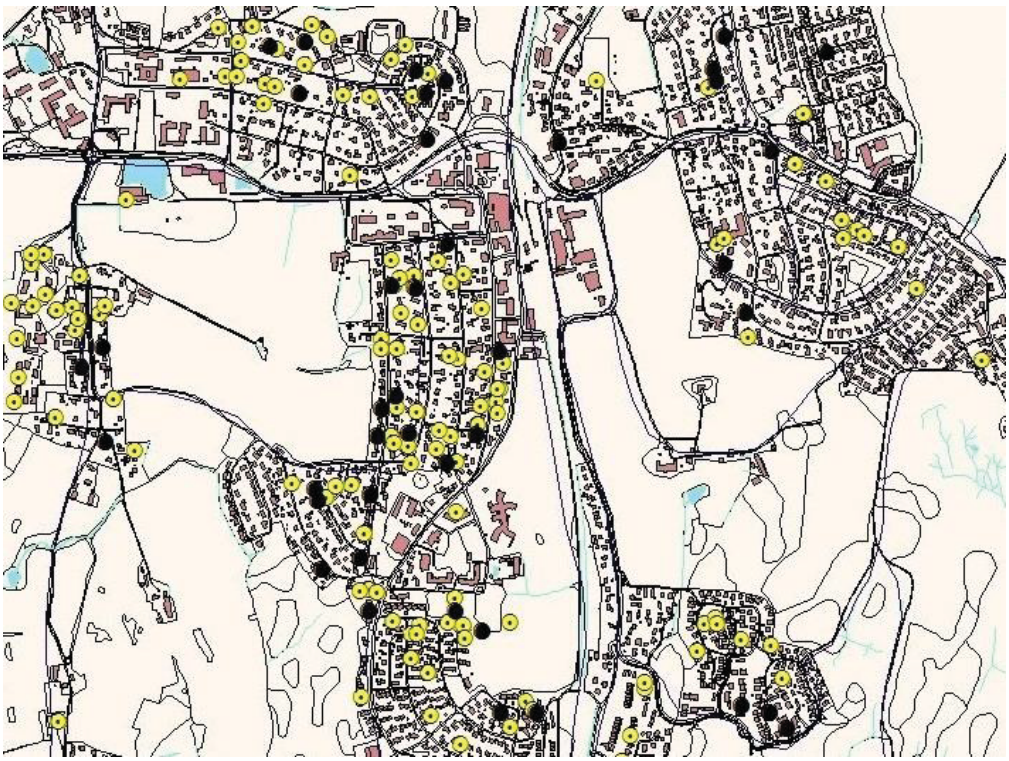


Figure 8: Yellow spots indicate the properties that have observed hedgehogs, while the black spots indicate the property with dogs.

3.2 TEST 2 – OBSERVATIONS OF HEDGEHOGS ("GARDEN")

The probability of observing a hedgehog for respondents who had a garden was best explained by the variables whether they had "flowerbeds and flowerpots" or not, and whether they had lawn or not (table 5, figure 9).

Table 5: Parameter estimates for the best fitted model (AIC 2, model 2, table 2). With the probability of observing hedgehogs in the garden (n=312).

Model 2	Estimate	SE	z	P	
Intercept	1.2287	0.1482	8.293	< 0.001	***
Flowers "No"	-1.3567	0.2613	-5.192	< 0.001	***
Lawn "No"	-0.9735	0.4883	-1.994	0.046	*

The highest probability (77.36 %) of observing a hedgehog in the garden was if respondents had "flowerbeds and flowerpots" and a lawn, and in contrast the lowest probability was if respondents had no "flowerbeds and flowerpots" and no lawn (24.95 %).

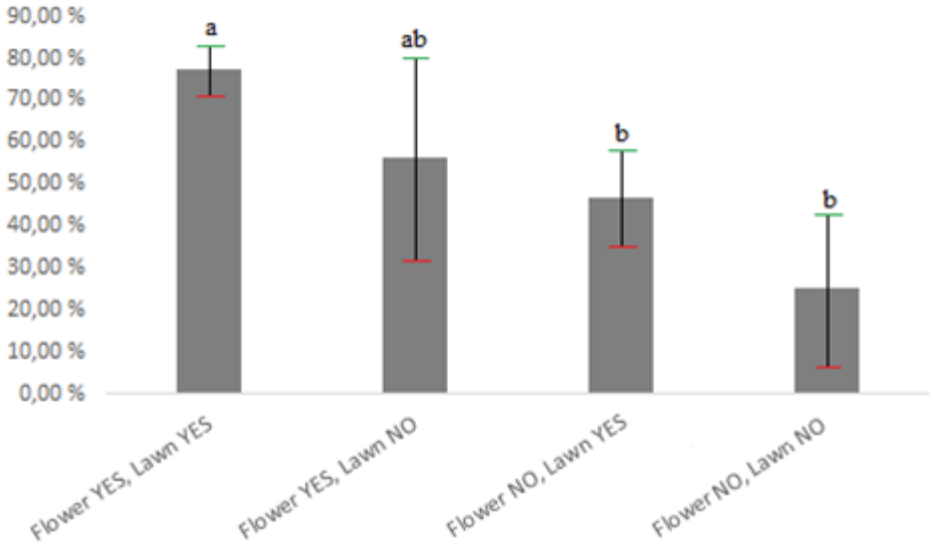


Figure 9: Predicted probability of observing a hedgehog on the property with upper- (green) and lower (red) 95 % confidence interval, based upon the best fitted model (AIC 2, model 2, table 2). Different letters above the bars indicates that the difference is significant.

3.3 TEST 3 – HAVING HEDGEHOG PERMANENT ON THE PROPERTY ("OVERALL")

The probability of having hedgehogs permanently on a property was best explained by whether the respondent's property was in a rural area or not. There was only a tendency for a lower probability in rural areas in the best-fitted model (table 6, figure 10).

Table 6: Parameter estimates for test 4 (overall) for the best fitted model (AIC 3, model 65, table 1) with the probability of having hedgehogs permanently on the property (n=218).

	Estimate	SE	z	P	
Model 65					
Intercept	-1.3863	0.3727	-3.720	< 0.001	***
Rural area "No"	0.7018	0.4060	1.729	0.083	.

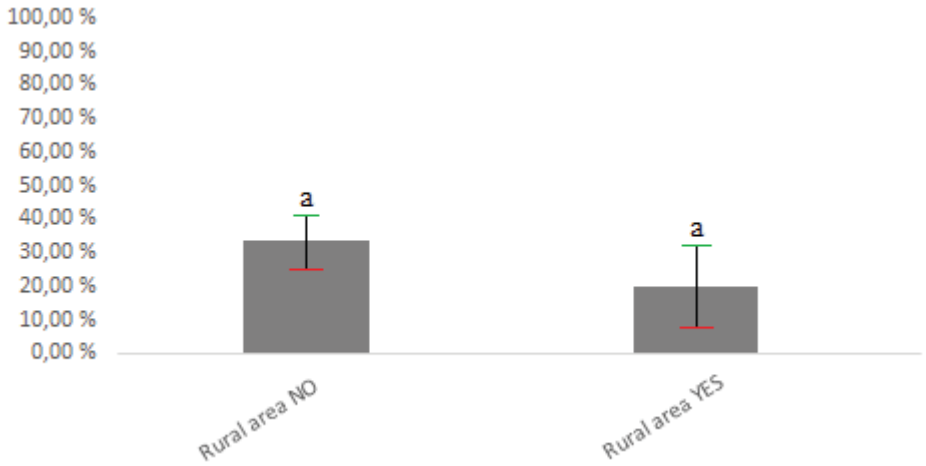


Figure 10: Predicted probability of having hedgehogs permanently, with upper- (green) and lower (red) 95 % confidence interval based upon the best fitted models (AIC 3, model 65, table 1).

3.3.1 Map of hedgehogs permanently

The number of properties having hedgehog's permanently in Ås municipality was higher west of Central Ås compared to east (figure 11 and 12).

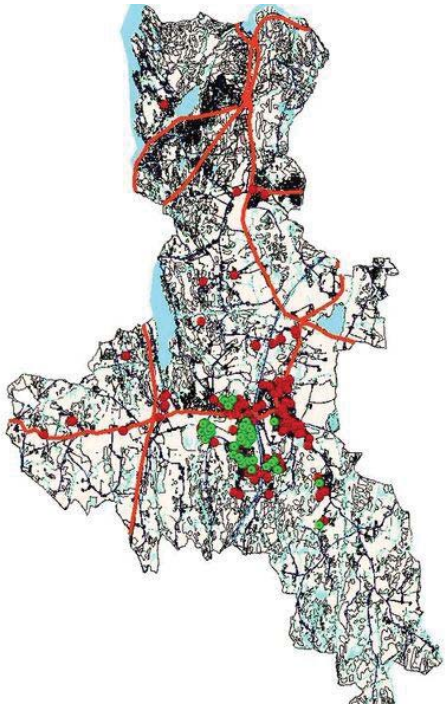


Figure 11: Green spots indicate the properties that have permanent hedgehogs, while the red spots indicate the ones who had not Ås municipality (n=218).

Figure 12: Green spots indicate the properties that have permanent hedgehogs, while the red spots indicate the ones who had not in central Ås (n=218).

3.4 TEST 4 – HAVING HEDGEHOG PERMANENT ON THE PROPERTY ("GARDEN")

For the subset of those who had a garden, there was a significant higher probability of having hedgehogs permanently on the property if there were flowers in the garden, compared to those who did not have flowers (table 7, figure 13).

Table 7: Parameter estimates for the best fitted model (AIC 4, model 3, table 2) with the probability of having hedgehogs permanently in the garden (n= 209).

Model 3	Estimate	SE	z	P	
Intercept	-0.5213	0.1672	-3.118	0.001	**
Flower "No"	-1.1316	0.4004	-2.826	0.008	**

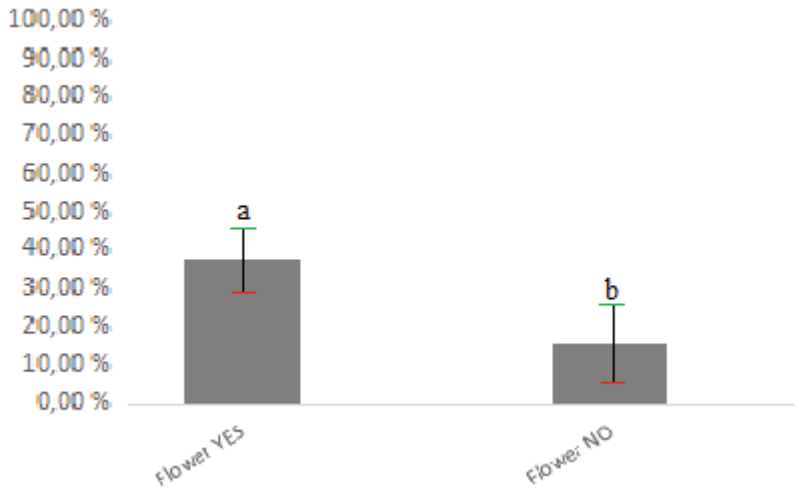


Figure 13: Predicted probability of having hedgehogs permanently in the garden, with upper- (green) and lower (red) 95 % confidence interval based upon the best fitted model (AIC 4, model 3, table 2). Different letters above the bars indicates that the difference is significant.

3.5 TEST 5 – OBSERVATION OF HEDGEHOG CUBS ON A PROPERTY ("OVERALL")

The probability of observing a hedgehog cub on a property was best explained by the variables whether there was a terrace and in addition that a badger was observed on the same property (table 8, figure 14).

Table 8: Parameter estimates for the best fitted model (AIC 5, model 1027, table 1) with the probability of observing a hedgehog cub on the property (n=122).

Model 1027	Estimate	SE	z	P	
Intercept	1.1551	0.3725	3.101	0.002	**
Badger "No"	-1.5339	0.4340	-3.534	< 0.001	***
Terrace "No"	-1.2475	0.5313	-2.248	0.019	*

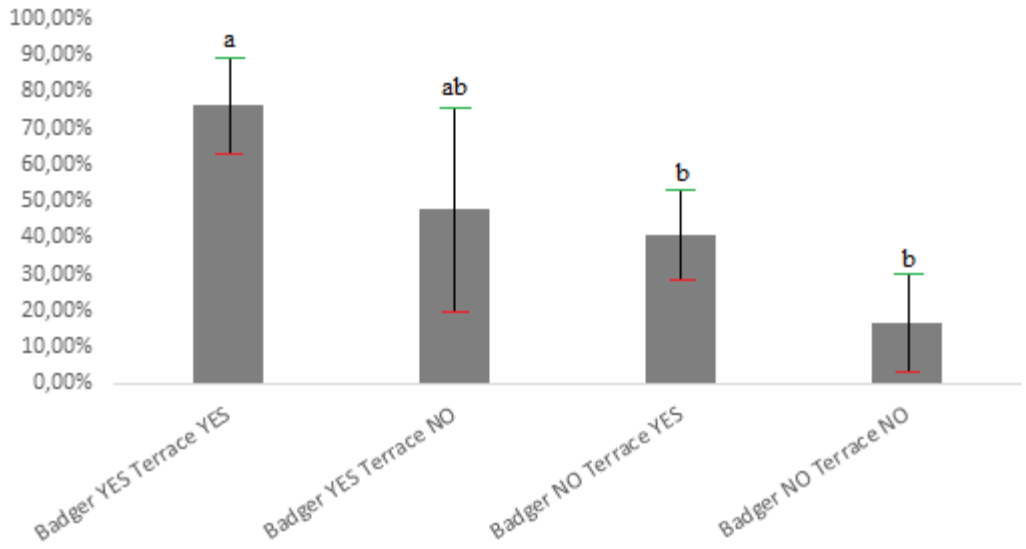


Figure 14: Predicted probability of observing a hedgehog cub on the property with upper- (green) and lower (red) 95 % confidence interval, based upon the best fitted model (AIC 5, model 1027, table 1). Different letters above the bars indicates that the difference is significant.

3.5.1 Map of hedgehog cubs and badger observations

Figure 15 shows the distribution of properties who do not have a terrace on the property, and observations of hedgehog cubs. Observations of badgers and hedgehog cubs at the same time may indicate where the hedgehog's nests are (figure 16).

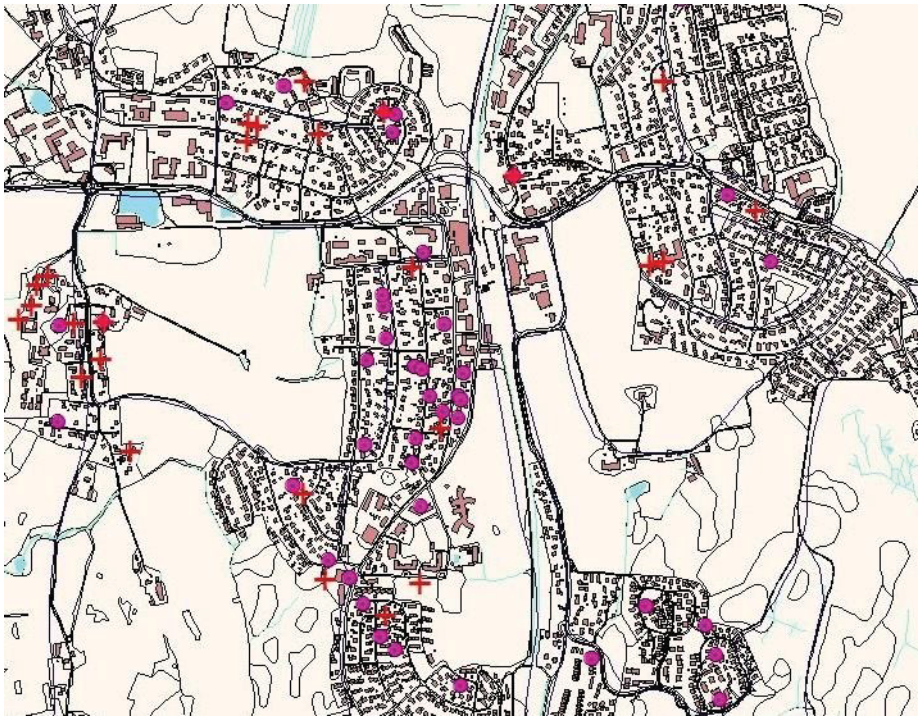


Figure 15: Pink spots indicate observed hedgehog cubs, and red crosses are the properties who do not have a terrace in Central Ås. In all other properties, terrace was present.

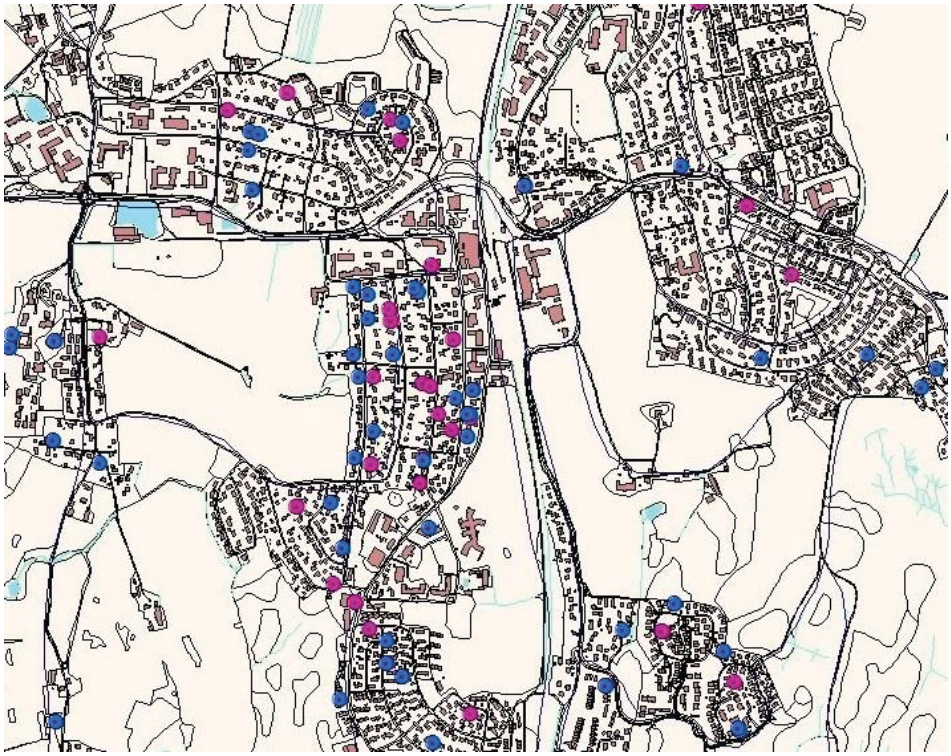


Figure 16: Dark blue spots are observed badgers, and pink spots hedgehog cubs in Central Ås.

3.6 TEST 6 – OBSERVATION OF HEDGEHOG CUBS ON A PROPERTY ("GARDEN")

The probability of observing a hedgehog cub on a property (for the subset of those who had a garden) was best explained by the variables whether respondents had "flowerbeds or flowerpots" and "bushes and hedges" (table 9, figure 17).

Table 9: Parameter estimates for the best fitted model (AIC 6, model 4, table 2) with the probability of observing a hedgehog cub on the property (n=122).

Model 4	Estimate	SE	z	P	
Intercept	0.1087	0.2083	0.5220	0.602	
Flower "No"	-2.6413	0.8144	-3.243	0.001	**
Bushes & hedge "No"	1.5378	0.8310	1.850	0.064	.

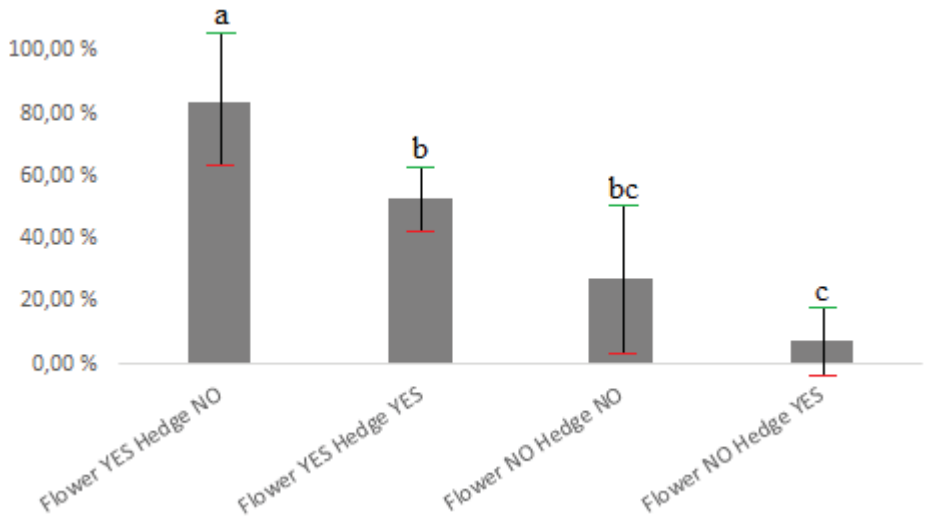


Figure 17: Predicted probability of observing a hedgehog cub in the garden with upper- (green) and lower (red) 95 % confidence interval, based upon the best fitted model (AIC 6, model 4, table 2). Different letters above the bars indicates that the difference is significant.

3.7 RESPONSE TO THE SURVEY

The response extracted from Questback graphic gave indications about the hedgehog population in Ås municipality. In total, 325 adults and 119 cubs were reported. Within the last 12 months, 65,8 % of the citizens in Ås had observed a hedgehog, and only 19,1 % had not observed hedgehogs during the last 1–3 years (figure 18).

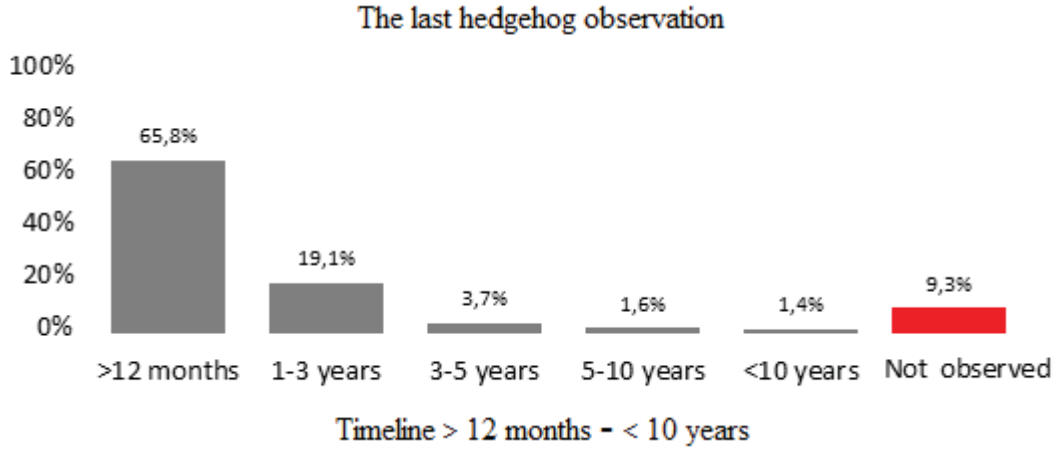


Figure 18: Hedgehog observations in relation to the time since the observation was done (n=430).

The observations on private properties vs. general observations was very similar (figure 19a and 19b). The observations on private properties were localized by adressess, while general observations are not analyzed, but supplementary to five categoried areas (figure 20). "Central core" is in urban areas with heavy traffic, typically a central area with stores and the train station. "Parks" refers to open grass areas and "residential areas" around private houses, and respondents could answer more than one of the options. Woodland and rural areas had the fewest observations while residential areas had the most.

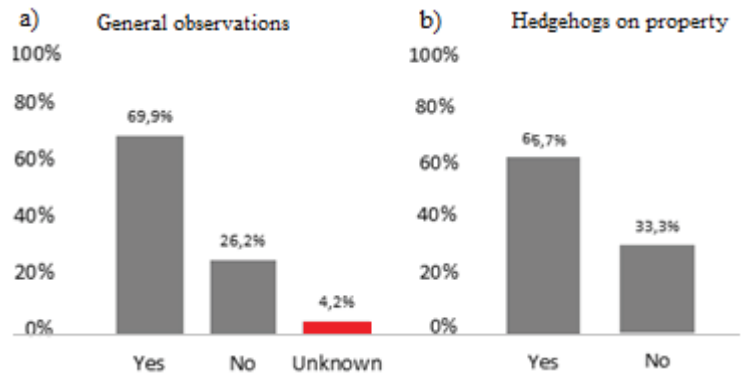


Figure 19: a) The observations of hedgehogs generally in Ås municipality, and b) observed hedgehogs on private properties.

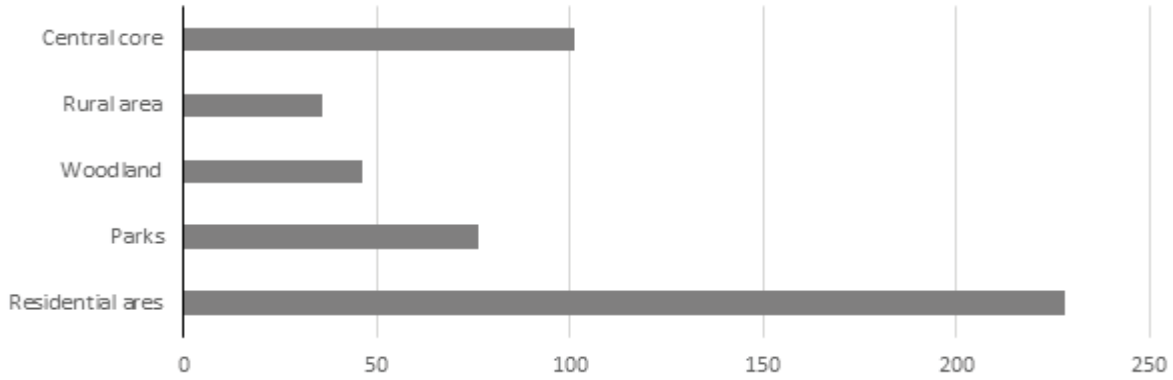
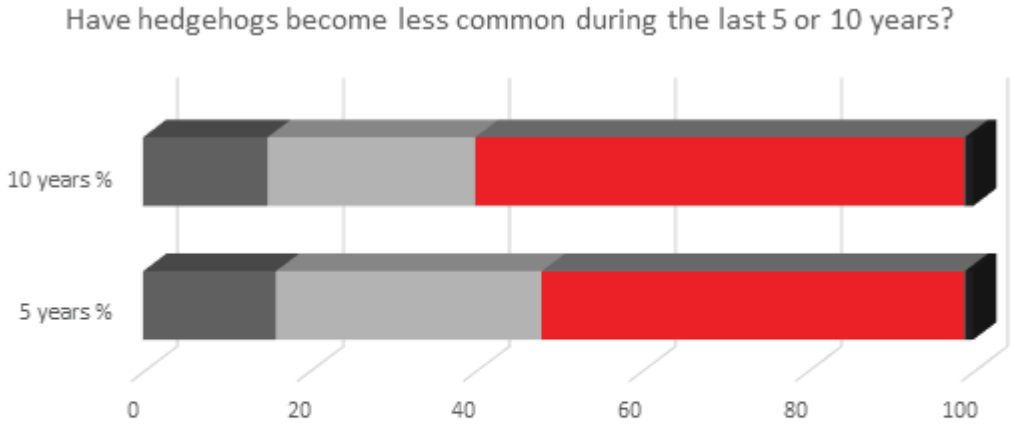


Figure 20: General observations of hedgehogs in Ås, where residential areas has the most observations and rural areas has less (n=360).

Only 16 % of the respondents thought that hedgehogs had become less common during the last 5 years, and 15 % thought that they have become less common during the last 10 years (figure 21).



	5 years %	10 years %
Yes	16	15
No	32	25
Dont know	51	59
NA	1	1

Figure 21: Results from section four of the survey, which asked people in Ås whether they thought hedgehogs had become more or less common during the last 5 or 10 years (n=391).

4 Discussion

4.1 HEDGEHOGS (“OVERALL”)

The probability of observing hedgehogs increased if the respondent had a dog, a terrace, if they lived in a residential area with a garden, and if they gave supplementary feeding. All these factors combined gave the highest probability of observing hedgehogs. Other combinations of these variables gave lower probability of observing a hedgehog on a property. For having hedgehogs permanent, the best predictor was if the property was not located in the rural areas, whereas the probability of observing a hedgehog cub increased if the respondent had a terrace. Among properties with observation of cubs, 81% were located in residential areas, and most of them were situated more than 100m away from major roads with heavy traffic. In addition, observing a hedgehog cub was also significant with observations of badgers on the same property.

4.1.1 Dogs and gardens

Reeve (1994), alleges that dogs can predate hedgehogs, this is probably limit to certain dog breeds. In my study, there was a tendency for a positive relationship between dogs and hedgehogs. Most properties in these areas have gardens, which also increase the probability of observing hedgehogs on the property. Respondents with dogs might have bought houses with larger gardens, so that the dogs had more space. Therefore, observation of hedgehogs on the property is not necessarily negative correlated with a dog. Gardens with dogs may in general also be more "messy", since dogs often dig holes or can destroy fine ornamental shrubs, and the availability of food and water outside for the dogs may be present in a higher degree. This is beneficial for the hedgehogs, and the garden will be more heterogeneous as well. People with dogs may also spend more time outdoors, in the garden with the dog, increasing the chance for observing hedgehogs versus those who do not have a dog.

4.1.2 Supplementary feeding

Supplementary feeding of dogs, cats or hedgehogs seem to have a very positive effect on hedgehog presence. Areas around the feeding places, either had a hedgehog on the same property, or no more than 100m away. The density of hedgehog were also higher here, suggesting that supplementary feeding is attractive for hedgehogs and if its provided in a particular garden, they don’t need to go anywhere else. Therefore, I suggest that regular

feeding may result in local enhancement of the population density due to reduced risk of starvation and/or may enhanced reproductive performance. This is also supported by a study by Cassini and Krebs (1994), where food sources provided by humans changed the spatial pattern and habitat use in hedgehogs. This was associated with searching behavior, as hedgehogs learned to associate food with visual stimuli. Since hedgehogs are hibernating, supplementary feeding can also provide a better winter survival. In birds, supplementary feeding influences almost every aspect of their ecology, including reproduction, behavior, demography, and distribution (Robb et. al 2008). Other studies have also shown that supplemental feeding of humans can benefit some species, especially in urban habitats (Tryjanowski et al., 2015). Also areas around properties where supplementary feeding is provided, has a higher density of hedgehog.

Despite many benefits, there are also potential risks connected to hedgehog feeding. The higher aggregations of hedgehogs suggesting an increased risk of disease transmission, where hedgehog are known to host the salmonella bacteria, *Salmonella typhimurium* (Woodward et al, 1997). A study from Norway, showed that salmonella-infected hedgehog populations most likely constituted the primary source of infection during human disease outbreaks, and a significantly higher carrier rate of *S. typhimurium* occurred among hedgehogs sampled at feeding places, compared to those caught elsewhere (Handeland et al. 2002). In the Follo-region from Moss, 39 % of 99 hedgehogs were carrying the salmonella bacteria. Another potential negative impact is that supplemental feeding may actually increase predation. The hedgehogs have to maintain a limited network of escape trails, since they often have nests near feeders.

4.1.3 Terrace

Terrace on the property is a variable that seemed to have a positive effect for observing hedgehog. Terrace was also one of the best explanatory variables for the probability of observing a hedgehog cub. Since hedgehogs are nocturnal animals they must have a hiding place where they can rest during the day. A terrace provides both shelter from the weather and predators. It may also be important for hedgehogs those months they hibernate, when the terrace often have mainstays underneath, it would be quite sheltered from any exposures. In addition, it is often completely at ground level, so that no larger animals can enter. Hedgehogs have not permanent nesting places and will commonly build several nests or use each other's (Johansen, 2000).

4.1.4 Residential areas vs rural areas

The probability of observing hedgehogs was significant if the property were in residential areas, and the probability of having hedgehogs permanently on a property was best explained if the property was not in a rural area. The difference between the two (yes/no), in rural areas was non-significant, but there was a tendency. Even though the property in rural areas shares the same facilities that had an effect on the presence of hedgehogs, they will be more isolated with longer distances and includes too small patches, to serve a vital hedgehog population. These variables are related to human occupation, which means areas with green-space, private gardens and garbage production that can also serve as a food source for hedgehogs (Reeve, 1994).

A preference for residential areas means that hedgehogs experience increased fragmentation. Habitat fragmentation is a landscape-level process, not a patch-level process, as fragmentation alters the spatial configuration of habitat patches within a broader habitat mosaic. Fragmentation disrupts existing patterns and is expected to have large, negative effects on biodiversity (Haila 2002), but the majority of theoretical studies suggest that the effect of habitat fragmentation is weak relative to the effect of habitat loss (Fahrig 1997, Henein et al. 1998, Collingham & Huntley 2000, Flather & Bevers 2002). In extremely fragmented environments, locale populations often have a risk of inbreeding depression or risk of extinction at low density (Goodman, 1987). It is important to recognize that since organisms perceive and respond to habitats differently, not all organisms will be affected in similar ways by the same landscape changes. Hedgehogs are habitat generalists and can exploiting the wide range of foods present in residential areas. From the hedgehog perspective, residential areas with gardens are heterogeneous with beneficial facilities and can be considered as a landscape with shorter distances between good habitats, in contrast to rural areas.

4.1.5 Badger

An interesting result was that observations of hedgehog cubs were significant related to observations of badgers. Although, the badger seems to be observed in the edge of residential areas, which may indicate that they do not live there permanently. They may pull in to find food like human waste, other animals or earthworms, as an important food source for both hedgehogs and badgers (Reeve 1994; Doncaster 1994). Both species are categorized as omnivorous, and the supply of food alters the relationship among species, especially the relationship between predators and prey (Faeth et al. 2005; Fischer et al. 2012).

In Ås, hedgehogs prefers residential areas, while badgers seems to be less tolerant to human occupation. The question is whether the badger is a real threat for the hedgehog, or a reason habitat preferences.

If the density of badgers is too high, the hedgehog may move to more central urban areas, which are avoided by badgers (Doncaster 1992; Doncaster et al. 2001). The hedgehog's olfactory sense is well developed and most likely it is the most important of its sensory system. In a study it were found that hedgehog uses smell to recognize if there is or has been a badger close by (Monclús et al. 2006; McEvoy et al. 2008). Ward et. al (1997) revealed that hedgehogs actually show an innate reaction to the odor of badger feces. This can give the hedgehog a benefit, so it avoids being be in the same garden at the same time as the badger and thus reduce the risk of predation. Badgers may have a negative effect on hedgehogs, a hypothesis that is supported by several other studies carried out in the United Kingdom (Doncaster 1992, 1994; Micol et al., 1994; Doncaster et al., 2001; Young et al. 2006; Hof and Bright 2010; Hof et al. 2012). Doncaster (1992, 1994) and Micol et al. (1994) found that the hedgehog's survival seemed to diminish the further distance they were to these urban areas. Therefore, the density of hedgehog in central urban areas will be higher, since there is almost no predation and this is especially important for reproductive females and the cubs (Doncaster 1992; Micol et al., 1994; Young et al. 2006). The latter suggests that urban areas can serve as shelter for hedgehogs where terrace is an important factor for the presence of hedgehog and their cubs.

Figure 22: To the left: A badger at nighttime sniffing under some concrete in one of the respondents gardens, where hedgehogs have been resting in the daytime. To the right: The hedgehogs the previous morning returning from the night activities. Foto: Tanya Tysnes

4.2 HEDGEHOGS ("GARDEN")

The results showed that there was a higher probability of observing hedgehogs in those properties that had flowers. This variable had an effect on both observing hedgehogs, having permanent hedgehogs and observing hedgehog cubs. There also was an increased probability of observing hedgehogs if the property had a lawn and especially for the hedgehog cubs if the property had bushed and hedges.

4.2.1 Lawn and flowers

Ås is a typically mosaic landscape with a high density of houses, but they also have relatively large gardens. Lawn is an important for the earthworms as a detritivore animal and has a keyrole in nutrient cycling which affect plant growth by burrowing, and affect the soil structure and infiltration of water (Scheu, 2003; Wurst et al., 2005; Partsch et al., 2006). Earthworms are one of the major food resource for the hedgehog (Reeve, 1994). The lawn has a minority of barriers since the grass is flat, and will make transport and locomotion around the garden faster since the hedgehog is a plantigrade (they walk fully on the soles of the feet).

If the garden does not have flowers, the probability of hedgehog presence is half of that compared of gardens with flowers. Heterogeneous gardens also provide habitats for a wider variety of insect species, making them more attractive for hedgehogs. Use of chemical herbicides or insecticides, may be present at higher concentrations in gardens, and can reduce food availability and pose a risk of secondary poisoning for the hedgehogs (Keymer et al. 1991; Blanchoud et al. 2004). In my study these variables did not have an effect, which may indicate that the minority of the respondents don't uses pesticides in higher concentrations, or provide these negative effects. However, fertilizers for plants as an example, can improve the soil and are associated with increases in earthworm population density (Smetak et al. 2007), which is a valuable food recourses for hedgehogs. The provision of flowers can encourage insects and thus benefit the hedgehog. Garden owners, who have flowerbeds, may have a more heterogeneous garden with a wider variety. Often they enjoy gardening and spend a lot of time during the spring and summer when the hedgehogs have their active period as well, which will increase the probability of observing a hedgehog.

4.2.2 Bushes and hedges

Urban areas cover a large areas of greenspace and are a significant habitat resource that provides a range of benefits like a network of patches and corridors. Bushes and hedges are important natural corridors used by hedgehogs to move between gardens, and serve as natural transects without being exposed. It is common to grow hedges in the edge of the garden, which frames the garden from the other properties and link together fragments of habitats as a "green infrastructure". This connectivity of habitat patches is important to hedgehogs to access food, find mates for reproduction and as refuges from predators (Taylor et al. 2006). A result of impervious areas can be reduced gene flow, that in the longer term can lead to reduced fitness, recused ability to adapt or in worst case extinction (Reed, 2004). Hence, barriers for movement may be reflected by the population status. A study by Jackson (2001), suggests that a vertical barrier of netting 0.4 m high and sealed to the ground is impassable to hedgehogs. Bushes and hedges are permeable, at least for hedgehogs. If most properties had been completely fenced or had other barriers that would make it impossible to move from one property to another, the probability of having hedgehogs in the residential areas would be dramatically reduced. This is supported by a study by Braaker et al. (2014) where hedgehogs preferred urban green spaces with structures, and where impervious areas were least preferred.

4.3 CONSEQUENCES OF A HABITAT IN RESIDENTIAL AREAS

Woodland and rural areas had the fewest hedgehog observations, and the residential areas the highest. Hedgehogs are under pressure from negative effects of pollution, traffic and habitat fragmentation and isolation (Huijser & Bergers, 2000; D'Have 2006; Dowding, 2007) as they prefer residential areas as a habitat.

4.3.1 Isolated hotspot

The typical residential areas in Ås are limited to some extent. It is apparent from the visualizations related to hedgehogs, either those who had been observed on private property, permanent residents or had observed hedgehog cubs, that there is consistently one area that is designated, which has a considerably higher density. Figure 23 shows this area as an isolated hotspot in central Ås. The main road borders the area in the north (red line), the railroad borders it in the east (blue line) and otherwise this oblong residential area is surrounded by rural areas, as showed in every tests and maps. This area has also a higher proportion of

badgers and feeding places. Hedges and bushes indicated that if the property has a natural fenced garden, the hedge serve as natural transects between the properties and connect this area together as one patch. This may benefit not only hedgehogs, but also other urban adapters (Goddard et al. 2010). This connectivity is important to access food, both insects and the supplementary feeding from humans in these areas. The hedgehogs are relatively stationary within an area, but can move 2–3 km in one night (Hof, 2009; Morris, 1987). Hedgehogs often have several nests at different locations during the summer, and it has been showed that individuals can move up to 3.8 km (Doncaster et al. 2001), and the natural movement is longer for males, than for females (Morris, 1987). This area seems to have a good enough quality and connections to serve a viable population. However, it is likely to depend on the colonization from other nearby patches (Fahrig & Paloheimo, 1988) to maintain genetic diversity. The perimeter around this area is 4.2 km and has a land area on 245.62 acres. The gardens also have facilities that are preferable for hedgehog like terrace, which provides shelter and refuge from predators (Taylor et al. 2006) and additionally has both flowers and lawns. This offer more variation and provides a more suitable area for a hedgehog. Residential areas are clearly important to maintain biological diversity in urban areas, but their ecological functions depend critically on their configuration and composition (Loram et al. 2008). Although each individual garden may be relatively small, the composition of the aggregate impact has a value for hedgehog if the right elements are present. Rapid expansion of urban areas can have diverging effects on the urban ecosystems, especially increasing habitat fragmentation.

Figure 23: The blue frame marks the hotspot of higher species density in Ås. The red lines show the main road across central areas in Ås (fv 152), while the blue line is the railway.

4.3.2 Infrastructure

Roads, railways and traffic are not just a threat for animals directly, but also defragment ecological communities that previously were connected. The increasing development of the infrastructure is one of the negative factors affecting hedgehog's presence, supported in a study from Britain (Hof, 2009). This will make it worse for people and animals to move freely as they did before fragmentation and therefore reduce their quality of life. A study found that habitats surrounded by roads would have negative consequences to populations due to isolation (Jeager et al. 2005). Hedgehogs are living in these areas where there is a huge amount of traffic, because of the close proximity to houses and gardens. Through Ås the railway (Østfoldbanen), E6 and E18 are the most important public roads and transport systems. There also are major roads heading west to Drøbak and north to Ski (Fv. 152), both of which are connected with the main roads to the capital Oslo (32 km).

Figure 24 shows the main road across central areas in Ås (fy 152). It seems quite obvious that hedgehogs avoid the main roads and the likelihood of having hedgehogs permanently in the garden increases the further the property is located from the main road. The minor roads do not seem to limit the hedgehog distribution. This is also supported by the study of Rondinini and Doncaster (2002), which showed that increased traffic and road width, had some influence as to whether hedgehogs avoided the road or not. Since hedgehogs seem to pull towards urban areas, with more traffic than rural areas, they are vulnerable to be killed by cars. In Sweden the numbers of birds and small animals that have been killed by cars is roughly estimated to nearly 10 million (Seiler 1995; Svensson 1998; Seiler et al. 2004). This is not just an issue of safety and welfare anymore, it is also a problem from the management and conservation perspective, because traffic will account for an increasing part of the mortality of wildlife. Many studies show that hedgehogs are one of the most commonly killed mammals along roads (Sleeman et al. 1985; Huijser et al. 1998; Holsbeek et al. 1999; Smiddy 2002). As urban areas are increasing and predicted to grow significantly in the future because of the human population growth, investments on major roads and railways are expected to increase, especially in- and around the big cities. This will increase the pressure on the landscape, both in natural and cultural environments.

4.4 THE SURVEY

In any survey, those with special interest for the topic are likely to be overrepresented among the respondents. In electronic surveys, there may also be a predominance of young people. In my study, many respondents had properties with gardens, indicting that they were house owners. A total number of 441 answers is however, a good response that could indicate a wide selection, making up for a possible predominance of special groups of respondents. Unfortunately, the survey revealed some minor errors. Pre-given answers alternatives are less costly than open-ended questions, but in some cases, can also give inconclusive and less informative answers (Johannessen 2011). Some of the questions may have been leading, and there were also some small nuances in the answers that may not fit with how the respondent probably wanted to respond (yes-no questions), but overall there was a lot of questions that gave good, reliable data. It was made apparent in the survey that it was equally important to respond even if no hedgehogs were observed, but still, I assume that a higher number was motivated to respond if they had seen a hedgehog. Hedgehogs are primarily a nocturnal mammal and people that do not move much outside when it is dark, will naturally have less chance of seeing hedgehogs (Bjärvall & Ullström 2005; Johansen 1998).

This study confirms that many people are concerned with nature and wildlife in the city, reflected by the great willingness and desire to share information. This is supported in a recent study by Hjort, (2015) of hedgehogs in Oslo by assessment of methods for surveying. Several respondents expressed that they were concerned about hedgehogs and claimed that these animals are generally friendly without any conflict for humans.

5 Conclusion

The results of the surveys showed that hedgehogs are more attracted and had a higher density in urban- and residential areas. It is apparent in general that gardens with a wider variety are preferable, and that dogs do not necessarily have a negative effect, but rather a positive and the house owners may put out water and/or food to a greater degree. More varied gardens support greater insect diversity, and especially flowers or flowerbeds appeared to be important for the presence of hedgehogs. From the hedgehog's point of view, it would be better to follow directions like natural paths (bushes and hedges) in the gardens and in between houses, than to move across large open spaces. If the property had a facility such as a terrace, the probability was higher for both observing adult hedgehogs and hedgehog cubs, probably because it provides shelter from predators like the badger, and weather conditions. It is easier for hedgehogs to maintain a viable population in central urban areas rather than rural areas, since rural areas has longer distances between habitats, and suitable areas are too small and isolated. All maps showed that the further you came from the central areas, the less likely it was to observe hedgehogs. This is supported in my results that hedgehogs preferred residential areas over rural areas.

Figure 24: From 09.08.2015 kl 16:51, hedgehog is feeding on dogfood in one of the gardens on a private property. The owner here does also have a German shepherd dog.

The presence of hedgehogs was influenced both by characteristics of the habitat, and of qualities in areas surrounding the habitat. A garden with the "right" elements does not attract hedgehogs, if the surroundings are not appropriate for the species (Hof, 2009).

Urban areas do not represent a habitat of homogeneous quality. Instead, biophysical, ecological and anthropogenic factors vary on a human-specified scale, where homeowners intensively manage properties in different ways so they offer potential areas of different quality (Loram et al. 2011; Mikula et al. 2014). With an increasing human population, the challenges of the future will be that larger residential complexes with smaller gardens may reduce much of the urban areas that are clearly important to maintain biodiversity. Hence, due to the ongoing urbanization, the biological diversity is at risk of declining as the patches will be too small to meet all the criteria's for a viable population.

Species with populations that are especially prone to traffic are typical generalists and K-strategies that are long-lived and have slow reproduction (Verkaar & Streams 1991; Forman et al., 2003). Animals typical of such behavior and life history are the badger (Anderson & Trewhella 1985, Seiler et al. 1995) and hedgehogs (Huijser, 2000) and this may be responsible for a decline in local populations. The Hedgehog is, however, a species with large annual variations in population size and distribution (Johansen et al. 2003). Although most of the respondents believed that the hedgehog was threatened or endangered, I found that only 15–16 % thought hedgehogs had become less common during the last 5 or 10 years. But even though the species is not threatened, we should manage nature in compliance with the law and based knowledge from research.

There is great interest in contributing with information to Government agencies, including contributing to increased knowledge and awareness of wildlife. The most important focus areas of the negative effects are traffic, barriers, disabilities, mortality rate and habitat fragmentation. The great interest in nature in urban areas is shown by the response to my survey and the enjoyment of those experiencing the wildlife here, which highlights the fact that people have a strong connection to nature, and that wildlife is important for people in this region (Bird 2007; Hansen & Nielsen 2005). This study also shows that it is possible to collect large amounts of data from the contributions of willing citizens. Agencies should therefore collect information; encourage people to report observations in existing databases, such as *Artsdatabanken*. This could contribute to an updated knowledge about different species, as well as increased awareness of wildlife in towns.

Results found in my this study may provide a basis for where one would expect to observe or find the greatest population of hedgehogs, and what qualities a garden must possess to influence nest building, or having hedgehogs permanently. One important aim for further studies should be to obtain more information about the hedgehogs' movement patterns, as they often cross roads at certain locations, resulting in a high mortality in both young and adult animals (Haigh et al. 2012, 2013). In order to put a plan into action for the prevention of hedgehogs being killed in traffic, it is especially important to identify these areas and if necessary, the possibility of creating intersections that enable hedgehogs to cross without going directly across the road. Use of cameras for monitoring can be an important tool in future studies, as hedgehogs are primarily nocturnal, although they are also known to move in daylight hours, especially if they have regular "feeding places".

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7 Appendices

APPENDIX I

TEST 1 - OBSERVATIONS OF HEDGEHOGS ("OVERALL")

	Estimate	SE	z	P	
Model 3098 (AIC 1)					
Intercept	2.5391	0.4268	5.950	< 0.001	***
Residential "No"	-0.9391	0.3166	-2.966	0.003	**
Dog "No"	-0.7065	0.3245	-2.177	0.029	*
Terrace "No"	-0.5987	0.2670	-2.242	0.025	*
Garden "No"	-1.2946	0.4165	-3.108	0.001	**
Feeder "No"	-0.9518	0.3654	-2.605	0.009	**
Model 3130					
Intercept	2.5883	0.4304	6.013	< 0.001	***
Residential "No"	-0.9290	0.3169	-2.932	0.003	**
Dog "No"	-0.6603	0.3274	-2.017	0.044	*
Terrace "No"	-0.5015	0.2754	-1.821	0.069	.
Garden "No"	-1.0349	0.4482	-2.309	0.002	*
Feeder "No"	-0.9414	0.3667	-2.567	0.011	*

TEST 2 - OBSERVATIONS OF HEDGEHOGS ("GARDEN")

	Estimate	SE	z	P	
Model 2 (AIC 2)					
Intercept	1.2287	0.1482	8.293	< 0.001	***
Flowers "No"	-1.3567	0.2613	-5.192	< 0.001	***
Grass "No"	-0.9735	0.4883	-1.994	0.046	*
Model 18					
Intercept	0.5072	0.5472	0.927	0.345	
Flowers "No"	-1.4340	0.2861	-5.012	< 0.001	***
Insecticides "No"	0.8291	0.5598	1.481	0.139	
Model 34					
Intercept	1.2124	0.1661	7.301	< 0.001	***
Flowers "No"	-1.5723	0.3087	-5.094	< 0.001	***
Trees "No"	0.4059	0.3137	1.294	0.196	

APPENDIX II

TEST 3 - HAVING HEDGEHOG PERMANENT ON THE PROPERTY ("OVERALL")

	Estimate	SE	z	P	
Model 65 (AIC 3)					
Intercept	-1.3863	0.3727	-3.720	< 0.001	***
Rural area "No"	0.7018	0.4060	1.729	0.083	.
Model 321					
Intercept	-1.6122	0.4071	-3.96	< 0.001	***
Rural area "No"	0.7425	0.409	1.815	0.069	,
Pets "No"	0.4514	0.3001	1.504	0.133	
Model 193					
Intercept	-0.9790	0.4574	-2.140	0.032	*
Rural area "No"	0.7042	0.4078	1.727	0.084	.
Cat "No"	-0.5257	0.3508	-1.499	0.134	
Model 16449					
Intercept	-1.0528	0.4231	-2.488	0.013	*
Rural area "No"	0.6623	0.4084	1.622	0.105	
Traffic "No"	-0.4898	0.3032	-1.615	0.106	

TEST 4 - HAVING HEDGEHOG PERMANENT ON THE PROPERTY ("GARDEN")

	Estimate	SE	z	P	
Model 3 (AIC 4)					
Intercept	-0.5213	0.1672	-3.118	0.001	**
Flower "No"	-1.1316	0.4004	-2.826	0.005	**
Model 4					
Intercept	-0.5629	0.1717	-3.278	0.001	**
Bush & hedge "No"	0.5527	0.4799	1.152	0.249	
Flower "No"	-1.3922	0.4724	-2.947	0.003	**
Model 19					
Intercept	-0.6114	0.1878	-3.255	0.001	**
Flower "No"	-1.3253	0.4415	-3.002	0.003	**
Trees "No"	0.3919	0.3576	1.096	0.273	
Model 7					
Intercept	-0.5917	0.1829	-3.236	0.001	**
Flower "No"	-1.2520	0.4221	-2.966	0.003	**
Fruit trees "No"	0.3596	0.3635	0.989	0.323	

APPENDIX III

TEST 5 – OBSERVATION OF HEDGEHOG CUBS ON A PROPERTY ("OVERALL")

	Estimate	SE	z	P	
Model 1027 (AIC 5)					
Intercept	1.1551	0.3725	3.101	0.002	**
Badger "No"	-1.5339	0.4340	-3.534	< 0.001	***
Terrace "No"	-1.2475	0.5313	-2.248	0.019	*
Model 1035					
Intercept	1.7517	0.5413	3.236	0.001	**
Badger "No"	-1.6366	0.4468	-3.663	< 0.001	***
Dog "No"	-0.7251	0.4533	-1.600	0.109	
Terrace "No"	-1.3290	0.5390	-2.466	0.014	*
Model 1155					
Intercept	0.8376	0.4167	2.010	0.044	*
Badger "No"	-1.5471	0.4391	-3.523	< 0.001	***
Pets "No"	0.6507	0.4053	1.605	0.108	
Terrace "No"	-1.270	0.5392	-2.355	0.018	*

TEST 6 – OBSERVATION OF HEDGEHOG CUBS ON A PROPERTY ("GARDEN")

	Estimate	SE	z	P	
Model 4 (AIC 6)					
Intercept	0.1087	0.2083	0.5220	0.602	
Flower "No"	-2.6413	0.8144	-3.243	0.001	**
Bushes & hedge "No"	1.5378	0.8310	1.850	0.064	.
Model 20					
Intercept	-0.0255	0.2368	-0.1080	0.914	
Flower "No"	-2.8428	0.8519	-3.3370	< 0.001	***
Bushes & hedge "No"	1.4721	0.8275	1.7790	0.075	.
Trees "No"	0.5366	0.4524	1.1860	0.236	
Model 36					
Intercept	0.4812	0.4694	1.0250	0.305	
Flower "No"	-2.5568	0.8162	-3.1330	0.002	**
Bushes & hedge "No"	1.5302	0.8350	1.8330	0.067	.
Pesticides "No"	-0.4640	0.5199	-0.8930	0.372	
Model 8					
Intercept	0.1821	0.2276	0.8000	0.424	
Flowers "No"	-2.5669	0.8115	-3.1630	0.002	**
Bushes & hedge "No"	1.6302	0.8477	1.9230	0.055	.
Fruit trees "No"	-0.3870	0.4776	-0.8100	0.418	

Model selection table - AIC 1 - TEST 1 - Observed hedgehogs "overall"

APPENDIX IV

Parameter estimates (appendix)
Best-fittet model (graphic)

Model	(Int)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	df	logLik	AICc	delta	weight
3130	2.588	+			+	+	+					+	+				7	-204.875	424.1	0.00	0.034
3098	**2.539**	+			+	+						+	+				6	-206.052	424.3	0.28	0.030
19514	2.760	+			+	+	+					+	+			+	8	-204.317	425.0	0.97	0.021
19482	2.729	+			+	+						+	+			+	7	-205.393	425.1	1.03	0.021
1082	2.524	+			+	+	+					+					6	-206.506	425.2	1.18	0.019
7226	2.342	+			+	+	+					+	+	+			8	-204.455	425.3	1.25	0.018
3100	2.589	+	+		+	+						+	+				7	-205.556	425.4	1.36	0.017
3134	2.720	+		+	+	+	+					+	+				8	-204.623	425.6	1.58	0.016
3102	2.702	+		+	+	+						+	+				7	-205.672	425.7	1.59	0.016
3132	2.613	+	+		+	+	+					+	+				8	-204.709	425.8	1.76	0.014
17466	2.721	+			+	+	+					+				+	7	-205.760	425.8	1.77	0.014
7194	2.334	+			+	+						+	+	+			7	-205.766	425.8	1.78	0.014
3258	2.503	+			+	+	+		+			+	+				8	-204.759	425.9	1.86	0.014
3386	2.744	+			+	+	+			+		+	+				8	-204.801	426.0	1.94	0.013
11322	2.531	+			+	+	+					+	+		+		8	-204.855	426.1	2.05	0.012
3194	2.557	+			+	+	+	+				+	+				8	-204.869	426.1	2.08	0.012
3642	2.580	+			+	+	+				+	+	+				8	-204.872	426.1	2.08	0.012
3226	2.481	+			+	+			+			+	+				7	-206.000	426.3	2.25	0.011
3114	2.146	+			+		+					+	+				6	-207.044	426.3	2.26	0.011
23610	2.517	+			+	+	+					+	+	+		+	9	-203.918	426.3	2.28	0.011
3162	2.463	+			+	+		+				+	+				7	-206.015	426.3	2.28	0.011
3354	2.645	+			+	+				+		+	+				7	-206.016	426.3	2.28	0.011
11290	2.477	+			+	+						+	+		+		7	-206.028	426.4	2.31	0.011
3610	2.558	+			+	+					+	+	+				7	-206.039	426.4	2.33	0.011
19486	2.893	+		+	+	+						+	+			+	8	-205.009	426.4	2.36	0.011
5178	2.278	+			+	+	+					+		+			7	-206.073	426.5	2.39	0.010
1086	2.698	+		+	+	+	+					+					7	-206.078	426.5	2.41	0.010
19484	2.752	+	+		+	+						+	+			+	8	-205.034	426.5	2.41	0.010
1084	2.570	+	+		+	+	+					+					7	-206.098	426.5	2.44	0.010
7230	2.466	+		+	+	+	+					+	+	+			9	-204.016	426.5	2.47	0.010
19518	2.896	+		+	+	+	+					+	+			+	9	-204.055	426.6	2.55	0.010
23578	2.527	+			+	+						+	+	+		+	8	-205.123	426.6	2.59	0.009
7198	2.473	+		+	+	+						+	+	+			8	-205.183	426.8	2.71	0.009
7196	2.370	+	+		+	+						+	+	+			8	-205.221	426.8	2.78	0.009
19642	2.669	+			+	+	+		+			+	+			+	9	-204.170	426.8	2.78	0.009
19770	2.972	+			+	+	+			+		+	+			+	9	-204.193	426.9	2.83	0.008
3104	2.732	+	+	+	+	+						+	+				8	-205.255	426.9	2.85	0.008
19516	2.769	+	+		+	+	+					+	+			+	9	-204.218	426.9	2.88	0.008
1052	2.527	+	+		+	+						+					6	-207.398	427.0	2.97	0.008
19738	2.893	+			+	+				+		+	+			+	8	-205.316	427.0	2.97	0.008
19610	2.663	+			+	+			+			+	+			+	8	-205.316	427.0	2.97	0.008
7228	2.364	+	+		+	+	+					+	+	+			9	-204.272	427.0	2.99	0.008
17470	2.896	+		+	+	+	+					+				+	8	-205.329	427.1	3.00	0.008
27706	2.688	+			+	+	+					+	+		+	+	9	-204.285	427.1	3.01	0.008

27674	2.652	+			+	+						+	+		+	+	8	-205.355	427.1	3.05	0.007
21562	2.479	+			+	+	+					+		+		+	8	-205.361	427.1	3.06	0.007
19578	2.736	+			+	+	+	+				+	+			+	9	-204.314	427.1	3.07	0.007
19546	2.663	+			+	+		+				+	+			+	8	-205.366	427.1	3.07	0.007
20026	2.755	+			+	+	+				+	+	+			+	9	-204.317	427.1	3.07	0.007
19994	2.751	+			+	+					+	+	+			+	8	-205.374	427.1	3.09	0.007
1210	2.460	+			+	+	+		+			+					7	-206.439	427.2	3.13	0.007
1050	2.434	+			+	+						+					5	-208.522	427.2	3.15	0.007
5182	2.435	+		+	+	+	+					+		+			8	-205.408	427.2	3.16	0.007
7354	2.278	+			+	+	+		+			+	+	+			9	-204.371	427.2	3.18	0.007
19498	2.318	+			+		+					+	+			+	7	-206.472	427.3	3.19	0.007
1338	2.616	+			+	+	+			+		+					7	-206.480	427.3	3.21	0.007
1594	2.550	+			+	+	+				+	+					7	-206.484	427.3	3.22	0.007
1146	2.475	+			+	+	+	+				+					7	-206.491	427.3	3.23	0.007
3228	2.510	+	+		+	+			+			+	+				8	-205.456	427.3	3.25	0.007
9274	2.518	+			+	+	+					+			+		7	-206.506	427.3	3.26	0.007
7482	2.465	+			+	+	+			+		+	+	+			9	-204.416	427.3	3.27	0.007
17434	2.664	+			+	+						+				+	6	-207.560	427.4	3.29	0.007
3082	2.056	+			+							+	+				5	-208.600	427.4	3.30	0.007
17468	2.741	+	+		+	+	+					+				+	8	-205.489	427.4	3.32	0.007
3262	2.630	+		+	+	+	+		+			+	+				9	-204.441	427.4	3.32	0.007
15418	2.312	+			+	+	+					+	+	+	+		9	-204.448	427.4	3.34	0.006
3356	2.723	+	+		+	+				+		+	+				8	-205.500	427.4	3.34	0.006
7738	2.330	+			+	+	+				+	+	+	+			9	-204.450	427.4	3.34	0.006
7290	2.362	+			+	+	+	+				+	+	+			9	-204.451	427.4	3.34	0.006
3164	2.504	+	+		+	+		+				+	+				8	-205.510	427.4	3.36	0.006
3370	1.958	+			+		+			+		+	+				7	-206.577	427.5	3.40	0.006
3136	2.737	+	+	+	+	+	+					+	+				9	-204.484	427.5	3.41	0.006
11292	2.548	+	+		+	+						+	+		+		8	-205.545	427.5	3.43	0.006
3390	2.938	+		+	+	+	+			+		+	+				9	-204.498	427.5	3.44	0.006
3612	2.590	+	+		+	+					+	+	+				8	-205.556	427.5	3.45	0.006
3230	2.630	+		+	+	+			+			+	+				8	-205.557	427.5	3.45	0.006
23614	2.643	+		+	+	+	+					+	+	+		+	10	-203.474	427.6	3.50	0.006
3358	2.882	+		+	+	+				+		+	+				8	-205.585	427.6	3.51	0.006
23582	2.667	+		+	+	+						+	+	+		+	9	-204.545	427.6	3.53	0.006
3122	2.681	+				+	+					+	+				6	-207.682	427.6	3.53	0.006
3260	2.519	+	+		+	+	+		+			+	+				9	-204.563	427.6	3.57	0.006
11294	2.616	+		+	+	+						+	+		+		8	-205.619	427.6	3.58	0.006
3166	2.619	+		+	+	+		+				+	+				8	-205.627	427.7	3.59	0.006
11326	2.643	+		+	+	+	+					+	+		+		9	-204.582	427.7	3.61	0.006
5180	2.318	+	+		+	+	+					+		+			8	-205.642	427.7	3.62	0.006
3646	2.704	+		+	+	+	+				+	+	+				9	-204.605	427.7	3.65	0.006
17594	2.649	+			+	+	+		+			+				+	8	-205.663	427.7	3.67	0.006
3198	2.681	+		+	+	+	+	+				+	+				9	-204.613	427.7	3.67	0.006
3614	2.704	+		+	+	+					+	+	+				8	-205.671	427.7	3.68	0.005
1066	2.059	+			+		+					+					5	-208.791	427.7	3.69	0.005
3388	2.780	+	+		+	+	+			+		+	+				9	-204.624	427.8	3.69	0.005
17436	2.710	+	+		+	+						+				+	7	-206.721	427.8	3.69	0.005
17722	2.876	+			+	+	+			+		+				+	8	-205.692	427.8	3.72	0.005
7210	1.926	+			+		+					+	+	+			7	-206.738	427.8	3.73	0.005

3498	1.498	+			+		+		+	+		+	+				8	-205.727	427.9	3.79	0.005
17978	2.750	+			+	+	+				+	+				+	8	-205.731	427.9	3.80	0.005
7322	2.295	+			+	+			+			+	+	+			8	-205.734	427.9	3.81	0.005
3118	2.285	+		+	+		+					+	+				7	-206.781	427.9	3.81	0.005
1088	2.725	+	+	+	+	+	+					+					8	-205.745	427.9	3.83	0.005
1054	2.657	+		+	+	+						+					6	-207.831	427.9	3.83	0.005
11324	2.569	+	+		+	+	+					+	+		+		9	-204.697	427.9	3.84	0.005
3644	2.597	+	+		+	+	+				+	+	+				9	-204.697	427.9	3.84	0.005
3196	2.572	+	+		+	+	+	+				+	+				9	-204.698	427.9	3.84	0.005
7450	2.409	+			+	+				+		+	+	+			8	-205.751	427.9	3.84	0.005
17530	2.684	+			+	+	+	+				+				+	8	-205.751	427.9	3.84	0.005
7706	2.352	+			+	+					+	+	+	+			8	-205.753	427.9	3.85	0.005
25658	2.695	+			+	+	+					+			+	+	8	-205.755	427.9	3.85	0.005
15386	2.296	+			+	+						+	+	+	+		8	-205.756	427.9	3.85	0.005
21566	2.635	+		+	+	+	+					+		+		+	9	-204.706	427.9	3.85	0.005
7258	2.304	+			+	+		+				+	+	+			8	-205.758	427.9	3.86	0.005
19488	2.900	+	+	+	+	+						+	+			+	9	-204.720	427.9	3.88	0.005
23580	2.536	+	+		+	+						+	+	+		+	9	-204.722	427.9	3.89	0.005
7200	2.498	+	+	+	+	+						+	+	+			9	-204.728	428.0	3.90	0.005
11450	2.466	+			+	+	+		+			+	+		+		9	-204.749	428.0	3.94	0.005
3116	2.175	+	+		+		+					+	+				7	-206.851	428.0	3.95	0.005
3770	2.493	+			+	+	+		+		+	+	+				9	-204.755	428.0	3.95	0.005
3322	2.482	+			+	+	+	+	+			+	+				9	-204.756	428.0	3.95	0.005
3514	2.533	+			+	+	+		+	+		+	+				9	-204.758	428.0	3.96	0.005
3338	1.839	+			+					+		+	+				6	-207.900	428.0	3.97	0.005
19466	2.250	+			+							+	+			+	6	-207.906	428.0	3.98	0.005

1 Residential area
2 Building
3 Badger
4 Garden
5 Dog
6 House
7 Rural area
8 Cat
9 Pets
10 Compost
11 Feeder
12 Terrace
13 Fox
14 Woodland
15 Traffic

Model selection table - AIC 2 - TEST 2 - Observed hedgehogs "garden"

APPENDIX V

Parameter estimates (appendix)
Best-fittet model (graphic)

Model	(Int)	1	2	3	4	5	6	7	df	logLik	AICc	delta	weight
18	0.5072	+				+			3	-173.660	353.4	0.00	0.103
2	**1.2910**	+							**2**	**-174.718**	**353.5**	**0.08**	**0.099**
50	0.4374	+				+	+		4	-172.819	353.8	0.37	0.085
	1.2120	+					+		3	-173.851	353.8	0.38	0.085
20	0.5047	+	+			+			4	-173.569	355.3	1.87	0.040
4	1.3000	+	+						3	-174.662	355.4	2.00	0.038
52	0.4288	+	+			+	+		5	-172.604	355.4	2.01	0.038
26	0.4999	+			+	+			4	-173.646	355.4	2.02	0.037
22	0.5129	+		+		+			4	-173.656	355.4	2.04	0.037
82	0.5157	+				+		+	4	-173.660	355.4	2.05	0.037
66	1.2070	+						+	3	-174.687	355.5	2.05	0.037
6	1.2970	+		+					3	-174.713	355.5	2.11	0.036
10	1.2890	+			+				3	-174.715	355.5	2.11	0.036
36	1.2240	+	+				+		4	-173.691	355.5	2.11	0.036
38	1.2310	+		+			+		4	-173.784	355.7	2.30	0.032
54	0.4574	+		+		+	+		5	-172.762	355.7	2.32	0.032
98	1.1420	+					+	+	4	-173.829	355.8	2.39	0.031
58	0.4340	+			+	+	+		5	-172.815	355.8	2.43	0.030
114	0.4531	+				+	+	+	5	-172.817	355.8	2.43	0.030
42	1.2120	+			+		+		4	-173.851	355.8	2.43	0.030
28	0.4963	+	+		+	+			5	-173.552	357.3	3.90	0.015
24	0.5089	+	+	+		+			5	-173.567	357.3	3.93	0.014
84	0.5187	+	+			+		+	5	-173.567	357.3	3.93	0.014
56	0.4478	+	+	+		+	+		6	-172.553	357.4	3.98	0.014
68	1.2210	+	+					+	4	-174.634	357.4	4.00	0.014

1 Flowers
2 Bushes and hedge
3 Fruit trees
4 Grass
5 Insecticides
6 Trees
7 Herbicides

Model selection table - AIC 3 - TEST 3 - Permanent hedgehogs "overall"

APPENDIX VI

Parameter estimates (appendix)
Best-fittet model (graphic)

Model	(Int)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	df	logLik	AICc	delta	weight
16449	-1.053000							+								+	3	-131.567	269.2	0.00	0.006
16577	-0.667100							+	+							+	4	-130.559	269.3	0.06	0.006
321	-1.612000							+		+							3	-131.734	269.6	0.33	0.005
193	-0.979000							+	+								3	-131.765	269.6	0.39	0.005
16705	-1.283000							+		+						+	4	-130.736	269.7	0.41	0.005
16481	-0.896600						+	+								+	4	-130.786	269.8	0.51	0.005
65	**-1.386000**							**+**									**2**	**-132.865**	**269.8**	**0.54**	**0.005**
97	-1.190000						+	+									3	-131.902	269.9	0.67	0.004
16417	-0.370300						+									+	3	-131.926	270.0	0.72	0.004
17473	-0.676700							+				+				+	4	-130.916	270.0	0.77	0.004
16385	-0.490600															+	2	-132.992	270.0	0.79	0.004
16513	-0.104800								+							+	3	-131.973	270.1	0.81	0.004
17409	-0.105900											+				+	3	-132.027	270.2	0.92	0.004
16609	-0.568300						+	+	+							+	5	-129.972	270.2	0.98	0.004
225	-0.853600						+	+	+								4	-131.045	270.3	1.03	0.004
18529	-1.009000						+	+					+			+	5	-130.025	270.3	1.09	0.004
1089	-0.973600							+				+					3	-132.115	270.3	1.09	0.004
353	-1.416000						+	+		+							4	-131.114	270.4	1.17	0.004
33	-0.652300						+										2	-133.180	270.4	1.17	0.004
17441	-0.024730						+					+				+	4	-131.119	270.4	1.18	0.003
16386	-0.417300	+														+	3	-132.160	270.4	1.19	0.003
18657	-0.650000						+	+	+				+			+	6	-129.021	270.4	1.19	0.003
16545	-0.040700						+		+							+	4	-131.142	270.5	1.22	0.003
18625	-0.742100							+	+				+			+	5	-130.113	270.5	1.26	0.003
16418	-0.301600	+					+									+	4	-131.165	270.5	1.27	0.003
16457	-0.980300				+			+								+	4	-131.199	270.6	1.34	0.003
1057	-0.275200						+					+					3	-132.266	270.6	1.40	0.003
16514	-0.054290	+							+							+	4	-131.242	270.7	1.43	0.003
16737	-1.115000						+	+		+						+	5	-130.200	270.7	1.44	0.003
2145	-1.303000						+	+					+				4	-131.257	270.7	1.45	0.003
1121	-0.818300						+	+				+					4	-131.265	270.7	1.47	0.003
16641	-0.668300									+						+	3	-132.306	270.7	1.48	0.003
17505	-0.553400						+	+				+				+	5	-130.222	270.7	1.48	0.003
2273	-0.941700						+	+	+				+				5	-130.223	270.7	1.48	0.003
2401	-1.581000						+	+		+			+				5	-130.240	270.8	1.52	0.003
18753	-1.438000							+		+			+			+	5	-130.260	270.8	1.56	0.003
18497	-1.142000							+					+			+	4	-131.309	270.8	1.56	0.003
1025	-0.385700											+					2	-133.378	270.8	1.57	0.003
16450	-0.915400	+						+								+	4	-131.323	270.8	1.59	0.003
129	-0.405500								+								2	-133.391	270.8	1.59	0.003
161	-0.316200						+		+								3	-132.367	270.8	1.60	0.003
18785	-1.279000						+	+		+			+			+	6	-129.239	270.9	1.63	0.003
2369	-1.763000							+		+			+				4	-131.349	270.9	1.64	0.003
34	-0.583600	+					+										3	-132.406	270.9	1.68	0.003

16585	-0.634900				+			+	+							+	5	-130.327	270.9	1.69	0.003
17410	-0.076690	+										+				+	4	-131.377	270.9	1.69	0.003
16393	-0.445900				+											+	3	-132.419	270.9	1.70	0.003
18465	-0.420400						+						+			+	4	-131.385	271.0	1.71	0.003
16451	-1.009000		+					+								+	4	-131.402	271.0	1.75	0.003
17601	-0.510100							+	+			+				+	5	-130.357	271.0	1.75	0.003
73	-1.303000				+			+									3	-132.446	271.0	1.76	0.003
1	-0.812600																1	-134.496	271.0	1.76	0.003
16578	-0.558200	+						+	+							+	5	-130.384	271.1	1.80	0.003
2241	-1.053000							+	+				+				4	-131.444	271.1	1.83	0.003
16833	-0.899700							+	+	+						+	5	-130.423	271.1	1.88	0.002
257	-0.987900									+							2	-133.540	271.1	1.89	0.002
19553	-0.645400						+	+				+	+			+	6	-129.373	271.1	1.90	0.002
16673	-0.527500						+			+						+	4	-131.482	271.2	1.91	0.002
449	-1.286000							+	+	+							4	-131.489	271.2	1.92	0.002
18593	-0.061430						+		+				+			+	5	-130.443	271.2	1.92	0.002
18466	-0.350700	+					+						+			+	5	-130.451	271.2	1.94	0.002
201	-0.941400				+			+	+								4	-131.505	271.2	1.95	0.002
1345	-1.317000							+		+		+					4	-131.506	271.2	1.95	0.002
16465	-0.967700					+		+								+	4	-131.512	271.2	1.97	0.002
16546	0.006109	+					+		+							+	5	-130.466	271.2	1.97	0.002
329	-1.533000				+			+		+							4	-131.516	271.2	1.97	0.002
19489	-0.053950						+					+	+			+	5	-130.469	271.2	1.97	0.002
16593	-0.553500					+		+	+							+	5	-130.472	271.2	1.98	0.002
16961	-0.987200							+			+					+	4	-131.527	271.2	1.99	0.002
1217	-0.804700							+	+			+					4	-131.527	271.2	1.99	0.002
16642	-0.591500	+								+						+	4	-131.528	271.2	2.00	0.002
24641	-0.980400							+							+	+	4	-131.529	271.2	2.00	0.002
289	-0.815000						+			+							3	-132.568	271.2	2.00	0.002
17729	-0.982100							+		+		+				+	5	-130.501	271.3	2.04	0.002
2	-0.734000	+															2	-133.619	271.3	2.05	0.002
17537	0.068790								+			+				+	4	-131.553	271.3	2.05	0.002
16581	-0.724200			+				+	+							+	5	-130.514	271.3	2.06	0.002
322	-1.489000	+						+		+							4	-131.563	271.3	2.07	0.002
16579	-0.661400		+					+	+							+	5	-130.517	271.3	2.07	0.002
67	-1.316000		+					+									3	-132.603	271.3	2.07	0.002
20545	-1.061000							+						+		+	4	-131.567	271.3	2.07	0.002
16453	-1.049000			+				+								+	4	-131.567	271.3	2.08	0.002
16713	-1.206000				+			+		+						+	5	-130.520	271.3	2.08	0.002
17442	0.000975	+					+					+				+	5	-130.522	271.3	2.08	0.002
20673	-0.727000							+	+					+		+	5	-130.527	271.3	2.09	0.002
130	-0.348400	+							+								3	-132.613	271.3	2.09	0.002
66	-1.253000	+						+									3	-132.617	271.3	2.10	0.002
16521	-0.100000				+				+							+	4	-131.580	271.3	2.10	0.002
3169	-0.913300						+	+				+	+				5	-130.533	271.3	2.10	0.002
209	-0.800700					+		+	+								4	-131.581	271.3	2.10	0.002
16482	-0.753100	+					+	+								+	5	-130.536	271.4	2.11	0.002
194	-0.872300	+						+	+								4	-131.587	271.4	2.11	0.002
24769	-0.626400							+	+						+	+	5	-130.544	271.4	2.12	0.002
17089	-0.639100							+	+		+					+	5	-130.550	271.4	2.14	0.002

16706	-1.153000	+						+		+						+	5	-130.560	271.4	2.16	0.002
19521	-0.754000							+				+	+			+	5	-130.570	271.4	2.18	0.002
17417	-0.099680				+							+				+	4	-131.619	271.4	2.18	0.002
337	-1.793000					+		+		+							4	-131.647	271.5	2.24	0.002
1026	-0.350900	+										+					3	-132.690	271.5	2.25	0.002
323	-1.559000		+					+		+							4	-131.657	271.5	2.26	0.002
1058	-0.247700	+					+					+					4	-131.658	271.5	2.26	0.002
98	-1.055000	+					+	+									4	-131.659	271.5	2.26	0.002
16721	-1.492000					+		+		+						+	5	-130.615	271.5	2.27	0.002
8385	-0.863400							+	+						+		4	-131.667	271.5	2.27	0.002
2113	-1.464000							+					+				3	-132.709	271.5	2.28	0.002
162	-0.266300	+					+		+								4	-131.671	271.5	2.28	0.002
16394	-0.377400	+			+											+	4	-131.677	271.5	2.29	0.002
8257	-1.230000							+							+		3	-132.715	271.5	2.30	0.002
195	-0.963100		+					+	+								4	-131.678	271.5	2.30	0.002
258	-0.906800	+								+							3	-132.722	271.6	2.31	0.002
8513	-1.515000							+		+					+		4	-131.685	271.6	2.31	0.002
325	-1.703000			+				+		+							4	-131.686	271.6	2.31	0.002
81	-1.240000					+		+									3	-132.725	271.6	2.32	0.002
17481	-0.640100				+			+				+				+	5	-130.643	271.6	2.32	0.002
2081	-0.707900						+						+				3	-132.733	271.6	2.33	0.002
18594	-0.010270	+					+		+				+			+	6	-129.595	271.6	2.34	0.002
20513	-0.602400						+							+		+	4	-131.702	271.6	2.34	0.002
20609	-0.338300								+					+		+	4	-131.703	271.6	2.35	0.002
4417	-1.675000							+		+				+			4	-131.714	271.6	2.37	0.002
3105	-0.313200						+					+	+				4	-131.714	271.6	2.37	0.002
833	-1.570000							+		+	+						4	-131.719	271.6	2.38	0.002
197	-1.032000			+				+	+								4	-131.726	271.6	2.39	0.002
16707	-1.245000		+					+		+						+	5	-130.686	271.7	2.41	0.002
18561	-0.125400								+				+			+	4	-131.737	271.7	2.41	0.002
16709	-1.371000			+				+		+						+	5	-130.691	271.7	2.42	0.002
4289	-1.023000							+	+					+			4	-131.749	271.7	2.44	0.002
705	-0.950600							+	+		+						4	-131.755	271.7	2.45	0.002
20801	-1.356000							+		+				+		+	5	-130.707	271.7	2.45	0.002
17474	-0.563700	+						+				+				+	5	-130.716	271.7	2.47	0.002
9	-0.755700				+												2	-133.834	271.7	2.48	0.002
17217	-1.241000							+		+	+					+	5	-130.721	271.7	2.48	0.002
577	-1.312000							+			+						3	-132.814	271.7	2.49	0.002
17665	-0.300800									+		+				+	4	-131.777	271.7	2.49	0.002
2209	-0.348200						+		+				+				4	-131.777	271.7	2.49	0.002
24897	-1.255000							+		+					+	+	5	-130.731	271.7	2.50	0.002
16489	-0.887000				+		+	+								+	5	-130.732	271.7	2.50	0.002
18505	-1.084000				+			+					+			+	5	-130.735	271.8	2.51	0.002
8289	-1.057000						+	+							+		4	-131.787	271.8	2.52	0.002
18633	-0.716500				+			+	+				+			+	6	-129.682	271.8	2.52	0.002
16387	-0.447000		+													+	3	-132.833	271.8	2.53	0.002
24673	-0.835000						+	+							+	+	5	-130.757	271.8	2.55	0.002
18530	-0.850300	+					+	+					+			+	6	-129.700	271.8	2.55	0.002
2082	-0.641400	+					+						+				4	-131.807	271.8	2.56	0.002

20577	-0.953600					+	+						+		+	5	-130.762	271.8	2.56	0.002
1097	-0.931600				+			+				+				4	-131.810	271.8	2.56	0.002
16674	-0.454700	+				+			+						+	5	-130.765	271.8	2.57	0.002
17569	0.122000					+		+				+			+	5	-130.766	271.8	2.57	0.002
20481	-0.675400													+	+	3	-132.855	271.8	2.57	0.002
16485	-0.933400			+		+	+								+	5	-130.773	271.8	2.58	0.002
69	-1.371000			+			+									3	-132.863	271.8	2.59	0.002
16497	-0.866600				+	+	+								+	5	-130.778	271.8	2.59	0.002
4161	-1.374000						+							+		3	-132.864	271.8	2.59	0.002
20641	-0.308600					+		+						+	+	5	-130.779	271.8	2.59	0.002
16425	-0.369000				+		+								+	4	-131.829	271.8	2.60	0.002
19490	-0.029840	+				+						+	+		+	6	-129.727	271.9	2.61	0.002
16993	-0.891700					+	+			+					+	5	-130.786	271.9	2.61	0.002
16483	-0.896700		+			+	+								+	5	-130.786	271.9	2.61	0.002
19457	-0.131000											+	+		+	4	-131.835	271.9	2.61	0.002
290	-0.743500	+				+			+							4	-131.839	271.9	2.62	0.002
105	-1.180000				+		+	+								4	-131.850	271.9	2.64	0.002
18433	-0.523800												+		+	3	-132.888	271.9	2.64	0.002
18721	-0.610400						+			+			+		+	5	-130.803	271.9	2.64	0.002
1153	-0.209700								+			+				3	-132.891	271.9	2.65	0.002
16897	-0.403900										+				+	3	-132.898	271.9	2.66	0.002
113	-1.117000							+	+	+						4	-131.861	271.9	2.66	0.002
17475	-0.658900		+						+				+		+	5	-130.814	271.9	2.66	0.002
1249	-0.683800						+	+	+				+			5	-130.819	271.9	2.67	0.002
1033	-0.374700				+								+			3	-132.916	271.9	2.70	0.002

1 Residential area
2 Building
3 Badger
4 Garden
5 Dog
6 House
7 Rural area
8 Cat
9 Pets
10 Compost
11 Feeder
12 Terrace
13 Fox
14 Woodland
15 Traffic

Model selection table - AIC 4 - TEST 4 - Permanent hedgehogs "garden"

APPENDIX VII

Parameter estimates (appendix)
Best-fittet model (graphic)

Model	(Int)	1	2	3	4	5	df	logLik	AICc	delta	weight
3	**-0.5213**		**+**				**2**	**-125.713**	**255.5**	**0.00**	**0.181**
4	-0.5629	+	+				3	-125.048	256.2	0.73	0.126
19	-0.6114		+			+	3	-125.112	256.3	0.86	0.118
7	-0.5917		+	+			3	-125.227	256.6	1.09	0.105
20	-0.6443	+	+			+	4	-124.536	257.3	1.78	0.074
8	-0.6287	+	+	+			4	-124.608	257.4	1.93	0.069
11	-0.5233		+		+		3	-125.711	257.5	2.05	0.065
23	-0.6503		+	+		+	4	-124.840	257.9	2.39	0.055
12	-0.5611	+	+		+		4	-125.045	258.3	2.80	0.045
27	-0.6097		+		+	+	4	-125.108	258.4	2.93	0.042
15	-0.5898		+	+	+		4	-125.220	258.6	3.15	0.037
24	-0.6819	+	+	+		+	5	-124.281	258.9	3.37	0.033
28	-0.6414	+	+		+	+	5	-124.513	259.3	3.84	0.027
16	-0.6259	+	+	+	+		5	-124.576	259.4	3.96	0.025

1 Bushes and hedge
2 Flowers
3 Fruit trees
4 Grass
5 Trees

Model selection table - AIC 5 - TEST 5 - Observed cubs "overall"

APPENDIX VIII

Parameter estimates (appendix)
Best-fittet model (graphic)

Model	(Int)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	df	logLik	AICc	delta	weight
1035	1.7520		+		+							+				4	-71.780	151.9	0.00	0.040
1155	0.8376		+						+			+				4	-71.782	151.9	0.00	0.040
1027	1.1550		+									+				3	-73.091	152.4	0.48	0.031
1039	1.7560		+	+	+							+				5	-71.042	152.6	0.70	0.028
1159	0.8973		+	+					+			+				5	-71.103	152.7	0.82	0.027
1031	1.1980		+	+								+				4	-72.202	152.7	0.84	0.026
1163	1.3240		+		+				+			+				5	-71.495	153.5	1.60	0.018
1099	1.9720		+		+			+				+				5	-71.543	153.6	1.70	0.017
1547	1.8940		+		+						+	+				5	-71.633	153.8	1.88	0.016
5251	0.5432		+						+			+		+		5	-71.642	153.8	1.90	0.016
1219	0.6485		+					+	+			+				5	-71.714	153.9	2.04	0.014
9227	1.6970		+		+							+			+	5	-71.717	154.0	2.05	0.014
3083	1.9570		+		+							+	+			5	-71.720	154.0	2.06	0.014
1667	0.9605		+						+		+	+				5	-71.721	154.0	2.06	0.014
5131	1.5590		+		+							+		+		5	-71.730	154.0	2.07	0.014
1036	1.7600	+	+		+							+				5	-71.731	154.0	2.08	0.014
1539	1.3760		+								+	+				4	-72.825	154.0	2.09	0.014
1156	0.8613	+	+						+			+				5	-71.752	154.0	2.12	0.014
3203	0.9531		+						+			+	+			5	-71.762	154.0	2.14	0.014
1051	1.7500		+		+	+						+				5	-71.767	154.1	2.15	0.014
1171	0.8231		+			+			+			+				5	-71.773	154.1	2.16	0.014
1291	1.7650		+		+					+		+				5	-71.776	154.1	2.17	0.014
9347	0.8285		+						+			+			+	5	-71.778	154.1	2.17	0.014
1067	1.7150		+		+		+					+				5	-71.778	154.1	2.17	0.014
1411	0.8485		+						+	+		+				5	-71.780	154.1	2.17	0.014
1187	0.8452		+				+		+			+				5	-71.782	154.1	2.18	0.013
1091	1.3460		+					+				+				4	-72.892	154.1	2.22	0.013
5123	0.8753		+									+		+		4	-72.954	154.3	2.35	0.012
1028	1.1870	+	+									+				4	-72.981	154.3	2.40	0.012
9219	1.1000		+									+			+	4	-73.003	154.3	2.44	0.012
1167	1.3780		+	+	+				+			+				6	-70.825	154.4	2.48	0.012
3075	1.3490		+									+	+			4	-73.029	154.4	2.50	0.012
3087	2.1650		+	+	+							+	+			6	-70.841	154.4	2.51	0.011
1103	1.9500		+	+	+			+				+				6	-70.856	154.4	2.54	0.011
3079	1.5950		+	+								+	+			5	-71.987	154.5	2.59	0.011
1283	1.1800		+							+		+				4	-73.080	154.5	2.60	0.011
1043	1.1640		+			+						+				4	-73.084	154.5	2.61	0.011
1059	1.1900		+				+					+				4	-73.089	154.5	2.62	0.011
5127	0.8832		+	+								+		+		5	-72.027	154.6	2.67	0.011
1543	1.3730		+	+							+	+				5	-72.030	154.6	2.67	0.011
5255	0.5781		+	+					+			+		+		6	-70.935	154.6	2.70	0.010
1095	1.3600		+	+				+				+				5	-72.055	154.6	2.72	0.010
1551	1.8640		+	+	+						+	+				6	-70.954	154.6	2.74	0.010

5135	1.5210		+	+	+							+		+		6	-70.966	154.7	2.76	0.010
9231	1.7080		+	+	+							+			+	6	-70.993	154.7	2.81	0.010
3207	1.2000		+	+				+				+	+			6	-70.994	154.7	2.81	0.010
9223	1.1500		+	+								+			+	5	-72.137	154.8	2.89	0.009
1055	1.7540		+	+	+	+						+				6	-71.032	154.8	2.89	0.009
1223	0.7095		+	+			+	+				+				6	-71.036	154.8	2.90	0.009
1071	1.6970		+	+	+		+					+				6	-71.036	154.8	2.90	0.009
1040	1.7540	+	+	+	+							+				6	-71.040	154.8	2.91	0.009
1295	1.7530		+	+	+				+			+				6	-71.042	154.8	2.91	0.009
1671	0.9840		+	+				+		+		+				6	-71.072	154.9	2.97	0.009
1047	1.2080		+	+		+						+				5	-72.194	154.9	3.00	0.009
1032	1.2010	+	+	+								+				5	-72.201	154.9	3.02	0.009
1287	1.2030		+	+					+			+				5	-72.202	154.9	3.02	0.009
1063	1.2010		+	+			+					+				5	-72.202	154.9	3.02	0.009
1175	0.8850		+	+		+		+				+				6	-71.098	154.9	3.02	0.009
1160	0.8899	+	+	+				+				+				6	-71.099	154.9	3.03	0.009
9351	0.8901		+	+				+				+			+	6	-71.101	154.9	3.03	0.009
1415	0.8912		+	+				+	+			+				6	-71.103	154.9	3.03	0.009
1191	0.8818		+	+			+		+			+				6	-71.103	154.9	3.03	0.009
7	1.0650		+	+												3	-74.425	155.1	3.15	0.008
135	0.7838		+	+				+								4	-73.438	155.2	3.32	0.008
15	1.5050		+	+	+											4	-73.602	155.5	3.64	0.006
5259	1.0490		+		+			+				+		+		6	-71.412	155.6	3.65	0.006
1675	1.4760		+		+			+		+		+				6	-71.419	155.6	3.67	0.006
5195	1.7040		+		+		+					+		+		6	-71.426	155.6	3.68	0.006
1611	2.0620		+		+		+			+		+				6	-71.448	155.6	3.72	0.006
3211	1.4960		+		+			+				+	+			6	-71.460	155.7	3.75	0.006
1164	1.3450	+	+		+			+				+				6	-71.467	155.7	3.76	0.006
1179	1.3150		+		+	+		+				+				6	-71.473	155.7	3.77	0.006
9355	1.3200		+		+			+				+			+	6	-71.478	155.7	3.78	0.006
1227	1.5160		+		+		+	+				+				6	-71.483	155.7	3.79	0.006

1 Residential area
2 Badger
3 Garden
4 Dog
5 House
6 Rural area
7 Cat
8 Pets
9 Compost
10 Feeder
11 Terrace
12 Fox
13 Woodland
14 Traffic

Model selection table - AIC 6 - TEST 6 - Observed cubs "garden"

APPENDIX IX

Parameter estimates (appendix)
Best-fittet model (graphic)

Model	(Int)	1	2	3	4	5	6	df	logLik	AICc	delta	weight
4	0.10870	+	+					3	-75.692	157.6	0.00	0.152
20	-0.02554	+	+			+		4	-74.971	158.3	0.70	0.108
36	0.48120	+	+				+	4	-75.286	158.9	1.33	0.078
8	0.18210	+	+	+				4	-75.361	159.1	1.48	0.073
24	0.04864	+	+	+		+		5	-74.354	159.2	1.64	0.067
12	0.12000	+	+		+			4	-75.603	159.5	1.96	0.057
2	0.18610	+						2	-77.809	159.7	2.13	0.052
52	0.33390	+	+			+	+	5	-74.607	159.7	2.14	0.052
18	0.03928	+				+		3	-76.909	160.0	2.43	0.045
28	-0.02068	+	+		+	+		5	-74.766	160.0	2.46	0.044
40	0.58720	+	+	+			+	5	-74.903	160.3	2.74	0.039
56	0.44570	+	+	+		+	+	6	-73.929	160.6	3.00	0.034
44	0.51160	+	+		+		+	5	-75.166	160.8	3.26	0.030
34	0.56860	+					+	3	-77.355	160.9	3.33	0.029
16	0.18360	+	+	+	+			5	-75.333	161.2	3.60	0.025
32	0.04642	+	+	+	+	+		6	-74.271	161.3	3.69	0.024
50	0.41770	+				+	+	4	-76.480	161.3	3.71	0.024
22	0.09863	+		+		+		4	-76.535	161.4	3.83	0.023
60	0.35840	+	+		+	+	+	6	-74.370	161.5	3.88	0.022
6	0.23480	+		+				3	-77.668	161.5	3.95	0.021

1 Flowers
2 Bushes and hedge
3 Fruit trees
4 Grass
5 Trees
6 Pesticides

APPENDIX X

DEL 1 BOSTED

Skriv inn adressen din i Ås:

(vi trenger den for å plotte inn observasjoner/ikke observasjoner av piggsvin på kartet)

.....

Hvordan bor du?

Leilighet ☐ Enebolig ☐ Tomannsbolig ☐

Rekkehus ☐ Sokkel/andre ☐ Gårdsbruk/småbruk ☐

Hvordan vil du kategorisere området du bor i? (kan krysse av fler)

Sentrum ☐ Villa/boligfelt ☐ Skogsområde ☐

Jordbruksområde ☐ Annet.....

Er boligen i nærheten av trafikkert hovedvei?

(med vei menes riksvei, motorvei/hovedvei og andre sterkt trafikkerte veier)

Ja ☐ Nei ☐ **Hvis ja,**

> 50 m ☐ 50-100 m ☐ 100-200 m ☐ 200-300m ☐ 300-500m ☐

Har du kjæledyr?

Hund ☐ Katt ☐ Annet .....

Hvilke fasiliteter er det på eiendommen?

Ingen ☐ Platting/terrasse ☐ Garasje ☐ Dukke/hundehus ☐

DEL 2 HAGEN

Har du hage?

(De som ikke har hage/uteareal knyttet til eiendommen kan hoppe til del 3 om piggsvin)

Ja ☐ Nei ☐ **Hvis ja,**

Er den inngjerdet?

Ja ☐ Nei ☐ Delvis ☐ Har ikke hage ☐

Frukttrær/bærbusker?

Ingen ☐ Eple ☐ Pære ☐ Plomme ☐

Rips ☐ Solbær ☐ Stikkelsbær ☐ Bringebær ☐

Annet ....

Beplantning?

Ingen ☐ Gress ☐ Busker/hekk ☐ Blomsterbed ☐

Trær ☐ Blomsterkasser/krukker ☐ Annet.....

Har du benyttet deg av sprøytemidler?

Ja ☐ Nei ☐ **Hvis ja,**

Ugressmidler ☐ Insektsmidler ☐

Har det blitt brukt de siste 3 årene? (for de som har benyttet sprøytemidler)

DEL 3 PIGGSVIN

Har du observert piggsvin på egen eiendom?

(Det er like viktig at du svarer på resten av undersøkelsen selv om piggsvin ikke er observert. Dette vil gi oss informasjon om det er noe spesielt som begrenser utbredelsen)

Ja ☐ Nei ☐ **Hvis ja,**

Antall observerte på egen eiendom (siste 10 år)

Voksne .... Unger ....

Har du piggsvin permanent?

Ja ☐ Nei ☐ Vet ikke ☐

Har du fôret/satt ut mat? (direkte til piggsvin eller andre dyr som hund/katt)

Aldri ☐ Ofte (ukentlig)? ☐ Moderat (månedlig)? ☐ Sjeldent (noen få ganger i året)? ☐

Har du observert piggsvin generelt i Ås?

Ja ☐ Nei ☐ Vet ikke ☐

Hvor ble det/de observert? (kan krysse av flere)

Villa/boligfelt ☐ Park/grøntområde? ☐

Skogsområde? ☐ Åker/eng? ☐

Urbant/trafikkert(e)gate(r)? ☐ Annet.....

Antall observerte utenfor egen eiendom (siste 10 år)

Voksne .... Unger ....

DEL 4 ANNET

Synes du at piggsvin har blitt mindre vanlige hvor du bor siste 5 år?

Ja ☐ Nei ☐ Vet ikke ☐

Synes du at piggsvin har blitt mindre vanlige hvor du bor siste 10 år?

Ja ☐ Nei ☐ Vet ikke ☐

Har du observert noen av følgende arter i nærheten av eiendommen?

Ikke observert andre arter ☐ Grevling ☐ Mår ☐ Rev ☐ Rådyr ☐ Elg ☐

Annet.....

Har du andre kommentarer du vil dele med oss kan du skrive det her:

.....

.....

.....

.....

.....

.....

.....

Tusen takk for hjelpen!

APPENDIX XI

At the end of the survey was an open comments section where people were encouraged to share their experiences, which have been useful, and here are some examples;

“The hedgehogs come out after dark in the summertime. We hear the rustling on the patio and it is not scared at all. When the porch door has been left open it has tried to get in the house several times and once it went into the bedroom so we had to carry it out. The neighbor also has two cats and puts out food regularly for the cats”.

“Waiting anxiously to see whether as many hedgehogs return this year, as the years before. We have had up to five adults here every evening / night. They drink from the water bowl we have out in the summer. All summer we have put out puppy food and they eat plenty. The little cubs we see occasionally, but mostly on our evening walk around in the residential area”.

“Have many hedgehogs in the garden, once I had 9 of them, they tend to get dog food. My dog does not chase them, and they are almost tame. The hedgehog once ate from the same bowl as my dog, while she was lying beside it”.

“They had courtship right outside my bedroom window two nights in a row. One standing still, while the other was continuously circling around the other. They also made some grunting noises”.

”*We had a hedgehog who lived in our yard last summer, but it disappeared when my husband unfortunately cleared out the entire twig heap where the hedgehog lived (nearly a reason for divorce). Before this hedgehogs were often seen in our garden and our neighbors, almost every day in periods. It went in and out of our garage as well, so I would not use the garage for fear that something would happen to the hedgehog. It seemed like they enjoyed themselves both in the garage (with an open floor) and in a pile of twigs where they can move in and out”.*

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