Tools for the improvement of the burrows diagnosis in the field.

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ABSTRACT

The common hamster (*Cricetus cricetus*), still present at the end of the XIXth century around Paris, would probably have disappeared from its last French territory, Alsace, if he hadn't been declared protected species. Now protected at European level (Appendix IV of the "lived Fauna and Flora") and France level (decree of April 23, 2007), the hamster is the subject of a national policy of action to try to restore viable populations. One of the actions, coordinated by ONCFS, the French national service of the hunting and wild fauna, consists in establishing the annual inventory range of populations of the hamsters. This action follows a protocol based on counts of burrows that the common hamster digs in the ground. The burrows are identified by clues of presence but can certain times be confusing and engender errors of diagnosis. The destruction of a suitable habitat to common hamster by a proposed development leads special procedures. The ONCFS must establish reliable diagnoses approaching 100% on the identification of hamster's habitats. The study shows that is a combination of tools that can achieve such reliability without complicating the initial process. In fact, a diagnosis including the successive steps can accumulate a maximum of clues at each level. The process relies on a homogenization of the diagnosis by making available to prospectors, a dichotomous key based on clues of presence tested on local populations of common hamster. This step is completed by the second opinion with predictive models in support, then as a last resort, if the identification is not still decisive, the method anticipates the use of photographic traps.

KEY WORDS: Common hamster, *Cricetus cricetus*, population monitoring, burrow, clues of presence.

INTRODUCTION

The burrow of common hamster is an important element for the protection of the species because it's the only clue of presence which is observable on the field.

It breads in France several issues:

- A biologic issue :

Burrows are the principal element to establish the natural range of the population (Wencel, 2000). The knowledge of the area allows to target actions of preservation (Diren Alsace and MEDAD, 2007). For example: A village where the population of common hamster is very reduce, the right diagnosis of burrows is decisive for the local survival of the population.

- A juridical issue :

The presence of one burrow on a territory allows creating immediately an area of protection.

- An economic issue :

The creation of protection area involves the modification of town planning and soactivities on the territory.

That's why it's very important to make a correct and reliable diagnosis.

Since 2006, these issues are amplified because of bone of contention between France and European commission. The ONCFS must establish reliable diagnoses approaching 100% on the identification of hamster's habitats.

MATERIALS AND METHODS

Before this study, burrows of common hamster are determined by bibliography and field work. We knew that the gallery diameter range from 6 to 8 cm (grown up), the main entrances presented soil excavation and the apparent depth of the burrows reached 40 cm to 1.5 m (Einsentraut, 1928 et Grulich, 1981). But sometimes, a few burrows have another aspect and mistakes can be done.

To improve the diagnosis of burrows on the field, we aimed to have a better knowledge of burrows variability in Alsace (France). For this, we described 145 burrows of several micro-mammals may be in the same habitat of common hamster (*Microtus sp., Apodemus sp., Rattus norvegicus*). Parameters were taken into account because they best reflect, *a priori*, the characteristics of common hamster's burrows: the gallery diameter, the gallery incline, the gallery depth, the excavation size, the presence or absence of faeces, the presence or absence of damage area.

Each species living in the burrows were checked using traps (photo trap, track trap) or by identifying the droppings.

A first phase was to analyze the typical characteristics and variations of hamster burrows. Simple descriptive analysis was applied to each parameter identified on the field.

In a second step, we applied a predictive model to estimate what are the best parameters to determine burrows in the field. We used the classification trees and the random forest (De'ath and Fabricus, 2000).

RESULTS

Descriptive analysis

Features of the 145 burrows studied in 2010, 109 belonged to common hamster, 26 to *Microtus sp,* 2 to *Apodemus sp* and 4 to *Rattus Norvegicus*.

The main diameter of hamster's gallery is 6.9 cm (SD=0.95 – figure 1), the mean apparent depth is 53 cm (SD=23.4) and the mean incline of the oblique gallery reaches to 38° (SD=12.5). 50% of entrances present excavation and 32% present faeces. Measurement accuracy reaches +/- 1.3 cm for the diameter, +/- 2.2° for inclination and +/- 1.3 cm for the depth.

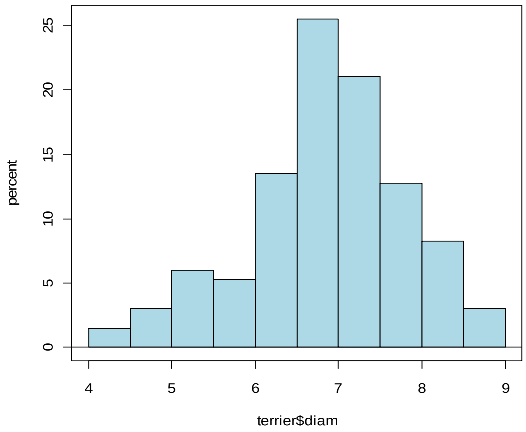

Figure 1: Dispersion of the gallery diameter

Predictive model

The classification trees have identified the first four most discriminate parameters: the depth, the inclination, the excavation size and the diameter. We have developed a key who decide according to parameters the affiliation of the burrow to common hamster or not (Figure 2).

In some case, the model predict with a rate of 100% that the burrow belong to the common hamster. If the diameter are higher than 5 cm and the gallery incline are higher than 27°. But in other case, the model can't predict efficiently the affiliation of the burrows.

The other method test is the random forest. It allowed us to obtain the probability that a burrow belong to common hamster or not through 4 parameters (example in the figure 3). The error rate prediction reaches 17%.

DISCUSSION

The most difficult point of the study was the data collect. For this study, the collection has expanded over time (2-3 months). External factors may influence the pattern of burrows in a limited time (weather, predators, frequentation of the burrow). In fact, the activity of the common hamster can vary from month. That's why it's necessary to take the information of the burrow in a limited time and in large quantities to reduce error.

The standard dimension of burrow of common hamster seems to be a little smaller than the reference on the bibliography (gallery diameter in Alsace: 6.9 cm against 8 cm for Einsentraut, 1928 and Grulich, 1981). But the limited data (n=109) does not compare to the burrows of other countries. The study must be completed by other data. However, we note a large variation of parameters. For example, 75% of burrows which have been described match with the "normal" description found in bibliography (between 6 to 8 cm) but 15 % of diameter would have led to a false identification of the burrow because there are lower than 6 cm (figure 2). This demonstrates that there are "atypical" burrows in the territory of Alsace and they must be taken into account into detail.

The clue of presence the most effective is the faeces. This is the fastest and safest on the field. To find it, must be exploring carefully the excavation by raking.

The reliability of predictive models looks good (about 17% incorrect predictions). The model can be greatly improved by incorporating a larger amount of burrows of other small mammals (*Microtus sp, sp Apodemus* and *Rattus norvegicus*). Is the target for next season population

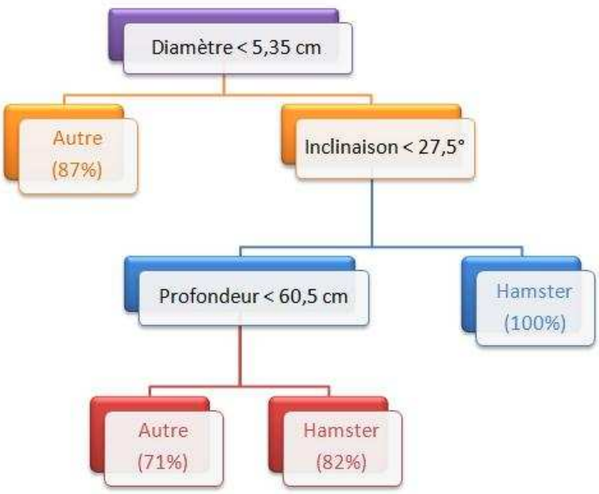

Figure 2: Classification tree obtained thanks to data on parameters of burrows

	Gallery diameter (cm)	Excavation Height (cm)	Gallery inclination (°)	Depth (cm)	Probability to belong to common hamster (1)	Probability to belong to another species (2)	Predict group
Burrow 1	6,5	1	31	26	23,75%	76,25%	2
Burrow 2	5,3	0	32	52	17,39%	82,61%	2
Burrow 3	4,1	0	12	23	0,97%	99,03%	2

Figure 3: Result of the random forest

monitoring.

The research of clue of presence requires considerable attention on the immediate environment of the animal. Sometimes, the first observation is not sufficient to identify the animal's burrow. It is necessary to take time to gather further clue when the individual will be more active.
The diagnostic strategy should be carried out in several steps to maximize the chances of collecting clue of animal's presence. Following the study, several processes can be set up for the next monitoring session of 2011.

PROPOSED TOOLS FOR POPULATION MONITORING

For the first contact with the burrows on the field, we offer a key of determination (like figure 2) of burrows that will standardize the diagnosis. This key will assess at first seen if the burrow belong to hamster. For ambiguous burrows, the key classify the burrow in "questionable". A second step consists to analyze all the questionable burrows with the statistics tools. For this, we use the random forest. It necessary to come back on the field to take the 4 parameters (gallery diameter, excavation height, gallery inclination and gallery depth). If the predictive model predict with a good probability (>80%), we can estimate that the diagnosis is correct. For other cases, the last resort is to use photo trap.

This new protocol of burrow diagnosis allow to identify with reliability close to 100%, the objective of the National Agency of Hunting and Wildlife.

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