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Agri-environment schemes - what have they achieved and where do we go from here?

Agri-environmental schemes for the Common hamster (*Cricetus cricetus*). Why is the Dutch project successful?

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Summary

The Common hamster (*Cricetus cricetus*) is a rodent, which inhabits arable land across Europe. Over the last decades, West European populations declined with more then 95%, which resulted in numerous local and regional extinctions. In the Netherlands the species went extinct in the wild in 2002, but the same year a research and reintroduction programme was started. The combination of research on the ecology of the species, monitoring, and translation of the results into practical Agri-environmental schemes (AES), resulted in a rapid population growth over the last 7 years. The Dutch project is one of the few projects in Europe which shows positive results of AES on the target species.

Key words: Rodent, harvest restrictions, reintroduction, transmitters, adaptive management

Introduction

The Common hamster (*Cricetus cricetus*), a rodent inhabiting farmland on loess and loamy soils across Europe, has declined significantly in Western Europe (Nechay, 2000). In several countries the hamster can also be found in urban areas (Franceschini-Zink & Millesi, 2008). The hamster prefers crops such as Lucerne (*Medicago sativa*) and cereals, while other crops are avoided (Kupfernagel, 2007). This preference is probably related to the cover and forage possibilities offered by Lucerne and cereals.

The species is protected under the EU Habitat Directive and numerous local and regional conservation projects are running nowadays. The results of these projects, however, are disappointing and almost no positive results are reported. The Dutch hamster conservation project seems to be an exception with a strong growth of the population in the period 2002–2009.

The Common hamster is in the Netherlands limited to the southern part of the province of Limburg, because this is the only part of the Netherlands with widespread loess and loamy soils. The hamster has been protected in the Netherlands since 1970, but despite several alarming reports in the 1980s and 1990s addressing a sharp decline, no specific conservation measures were taken. In 1999 it became apparent that only one population was left with less then 25 individuals. A decline in range of more then 99% had occurred: from 250 km^2 to less than 25 hectares. The Dutch Ministry of Agriculture, Nature and Food Quality (LNV) decided to trap all remaining individuals, to start a breeding programme and to launch a Hamster Conservation Plan (Krekels, 1999). In this plan

42 conservation measures were formulated and a research budget was allocated to a scientifically supported reintroduction and monitoring programme.

In 2002 the last signs of hamster activity were found near Maastricht and the species was declared extinct in the wild. Fortunately, the breeding programme was successful and the captive population had grown to more then 130 individuals in the spring of 2002. A substantial part of the captive population was reintroduced in the wild the same year, because of the limited capacity in the breeding units. A major part of the released hamsters was equipped with an implant transmitter and monitored until death or final loss of the radio-signal.

The reintroduction had two main objectives 1) to establish viable hamster populations and 2) to determine the key-factors for the long term survival of wild hamster populations. Although the reintroduction in the period 2002–2004 proceeded well, the population of hamsters really started to increase when in 2005 the first conservation plan was replaced by the 'Dutch Hamster Experiment' (La Haye & Jansman, 2005). In this paper we will present an overview of the key-factors leading to the success of the 'Dutch Hamster Experiment'.

Materials and Methods

Breeding programme

The breeding programme started in 1999 with 15 individuals that were trapped in the last Dutch population near Maastricht (De Vries, 2003). Ten individuals successfully produced off-spring. In the years that followed a few wild hamsters were added to the breeding programme from nearby and also highly threatened Belgian and German populations (La Haye, submitted). Between 7–34 litters were produced each breeding season, resulting in a yearly production of 34–201 hamsters (Table 1). The breeding programme will be continued until at least 2012.

Table 1. *Number of litters and juveniles produced in the hamster breeding program between 2002 and 2009*

Year	Total	
	N_{lit}	N_{ind}
2000	7	34
2001	19	99
2002	23	115
2003	17	82
2004	20	109
2005	34	201
2006	25	164
2007	22	114
2008	11	57
2009	20	115
∑	198	1090

Releases and transmitters

The reintroduction started in 2002, when the first captive-bred hamsters were released in Sibbe, a farmland reserve covering 50 ha. In 2003 a second group of hamsters was released in Amby. In the years thereafter new releases were started in another six areas, including releases in two ecological corridors (Table 2). A total of 762 hamsters was released in the period 2002–2009. In the same

period 323 captive-bred hamsters and 292 wild hamsters were equipped with a transmitter and followed until death or until the transmitter failed (Kuiters *et al*., 2007). The number of hamsters with a transmitter differed between areas and years. Although it was tried to follow at least 10 hamsters in each area per year.

All hamsters with a transmitter were year-round located each week. Hamsters were not followed during activity, but only located when resting in their burrows. Transmitters were temperature sensitive, which allowed us to distinguish dead from living hamsters and to collect freshly predated hamsters and their remains. Most transmitters could be located to a maximum distance of 150–200 m, even when hamsters were underground. Fifteen percent of all transmitters were lost without knowing the fate of the hamster.

Table 2. *Number of hamsters that were released in the various core areas in the province of Limburg between 2002 and 2009*

Area \ Year	2002	2003	2004	2005	2006	2007	2008	2009	Total
Sibbe	44	42	13	7				4	110
Amby		67	10	2	20		12	12	123
Heer			48				5		53
Corridor Bemelen							32		32
Sittard				56	29				85
Puth					72	20			92
Koningsbos					50	33	28	9	120
Wittem						39	33	14	86
Corridor Heerlen							61		61
Total	44	109	71	65	171	92	171	39	762

Hamster reserves and hamster-friendly agreements

Releases took place in hamster-friendly managed fields, which were farmland reserves or conventionally managed fields of farmers who had signed a hamster-friendly management contract. In this paper we refer to the management of both types of field as Agri-environmental schemes (AES). At the start of the project the available budget allowed 200 ha of hamster-friendly management on farmland reserves and 300 ha of hamster-friendly management by farmers. Farmland reserves were established by buying regularly managed farmland by the government and by delivering these fields to nature conservation organisations. Farmers in selected core areas were visited and asked if they were interested in a hamster-friendly agreement. A few farmers asked themselves for the possibilities of signing a contract. Farmers were financially compensated for their loss of income, whereas nature conservation organisations were only paid for the management costs because they had no loss of income. Total costs of all hamster-friendly management amounted to k€ 755 each year, this is without the additional costs of research and monitoring practices. At the end of 2009 24 farmers had signed contracts for an area of 300 hectares, and 106 hectares were established as farmland reserve, managed by three nature conservation organisations.

Management and programme coordination

The hamsters were monitored using transmitters (see above), but the agricultural management of all fields was also monitored each year by the researchers. We advised the farmers how to manage their crops in a hamster-friendly way. The management advices altered during the project as a consequence of increased insights. It was possible to change the management guidelines during the project, because the project was officially an experiment under EU-regulations, allowing the involved parties to change regulations and management prescriptions.

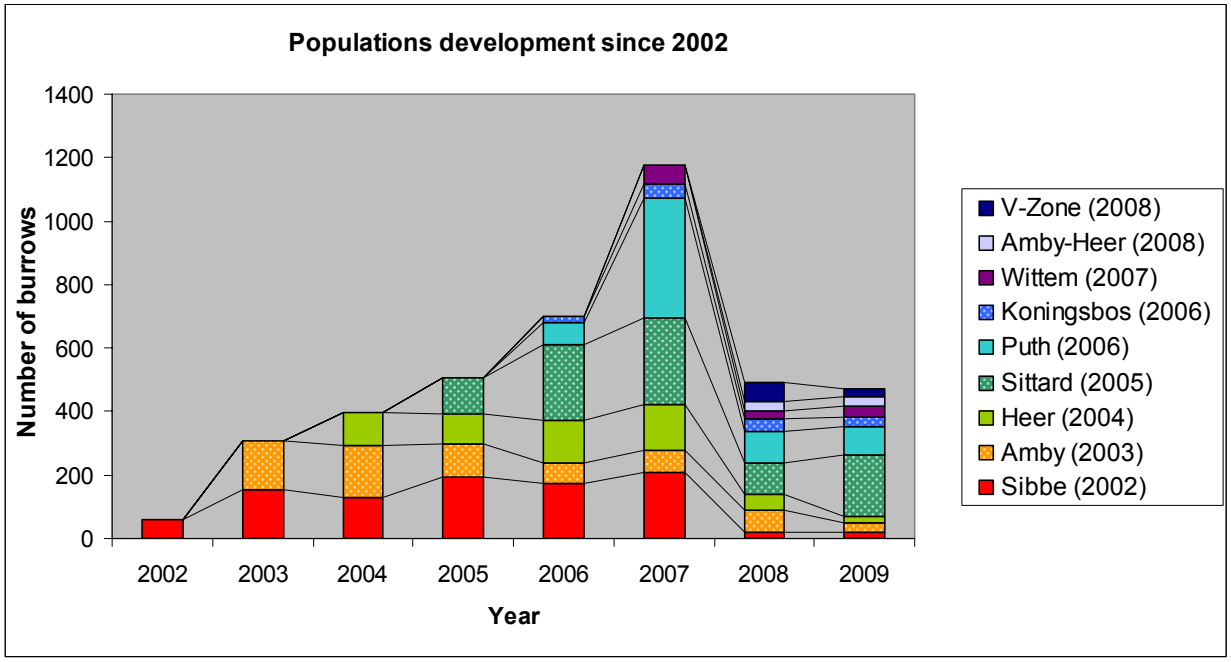

Fig. 1. Number of hamster burrows in the Netherlands since 2002. Between brackets the first year of release of hamsters in a specific area.

The conservation of the Common Hamster in the Netherlands is the responsibility of the Ministry of Agriculture, Nature and Food Quality (LNV). The practical aspects of the project are done by third parties. To exchange information between all parties and to discuss problems, failures and successes, a Hamster-committee was installed chaired by a farmer. Researchers, nature conservation organisations, farmers, hunters, the Ministry, the Government Service for Land and Water Management (DLG), and the province of Limburg had their representative in the committee. There were meetings every two months where all relevant events and aspects of the project were discussed.

Results

The reintroduction of captive-bred hamsters resulted in a rapid increase of hamster populations in the core areas over the first 6 years (Fig. 1), with peak numbers in 2007. The number of burrows increased in each area in the first year after releasing the hamsters, after which the number of hamsters more or less stabilised. In 2008 a crash was observed in all areas. The wild population sharply decreased with an overall decline of 60%.

Predation turned out to be the main mortality factor (Table 3), with different survival rates of captive-born and wild hamsters and of males and females. Wild-born female hamsters had the highest survival (Table 4) with a yearly survival rate of 29% (95% confidence interval of 19–43%).

At the start of the Hamster Conservation Plan in 2000 the AES were rather complicated with many restrictions for the farmers: at least 15 different herbs had to be present on fields with an AES-agreement and almost no harvesting was allowed, fields had to be small-scaled and farmers had to monitor the presence of hamsters. These AES were not effective. Only three farmers participated. Agricultural management restrictions, such as a ban on the use of fertilisers and herbicides, resulted in open crops and an explosion of unwanted weeds, especially *Rumex spec*. and Couch grass (*Elymus repens*). Within a few years most fields with hamster-friendly management were unsuitable for hamsters and the weeds had to be suppressed with conventional herbicides.

Table 3. *Main causes of death (percentage) in captive-bred hamsters and wild hamsters in the core areas (period 2002–2008)*

	Captive females (n=81)	Captive males (n=130)	Wild females (n=39)	Wild males (n=71)	All groups (n=321)
Fox	24	37	26	37	31
Mustelids	25	22	21	27	24
Birds of prey/raptors	12	12	28	18	18
Mouse/rat/hamster/dog/cat	6	15	5	6	8
Diseases	9	5	3	4	5
Management activities	3	2	5	4	3
Unknown	21	7	12	4	11

Table 4. *Yearly survival rates (percentage) of males and females in captive-bred and wild hamsters*

Group	Surival rate	95% range
Captive females	5	3–8
Captive males	1	0–1
Wild females	29	19–43
Wild males	8	5–15

Discussion

Survival rates

Monitoring of hamsters with radio-transmitters (Table 4) provided insight in the current bottlenecks in the population dynamics of the Common hamster. A high mortality is no problem if the reproduction is high enough to compensate losses (Ulbrich & Kayser, 2004). In the Netherlands a stable hamster population is achieved in most years when every female raises two litters per season. Under favourable conditions it is even possible for some individuals to raise three litters per year (Franceschini-Zink & Millesi, 2008; Harpenslager, 2009). A female can raise a litter within 40 days, and the breeding season runs from the beginning of May till late September, a period of more then 150 days. In theory it should be no problem for females to raise three litters. There are however several restrictions preventing females to raise three litters. Crop management is one of the limiting factors (Kupfernagel, 2007). Harvesting of the cereals and mowing of the Lucerne reduces the amount of cover and food and increases the predation risk and mobility of hamsters, including pregnant or lactating females. In fact the reproduction abruptly stops on fields which are harvested or mowed, because females are predated or move to surrounding fields. The harvest of cereals on conventional managed fields starts in the first week of July and comes to an end in the first weeks of August. This is in the middle of the hamster breeding season. Only in some exceptional cases, such as high precipitation preventing early harvesting, it is possible for hamsters to raise two litters on conventionally managed fields. In practice most female hamsters raise only one litter, which is not enough for a stable population. The results of our monitoring program clearly indicate that conventional farming with early harvesting, is detrimental for a stable hamster population.

Hamster-friendly AES therefore should aim at providing food and cover during summer and in the period before hibernation. This goal is achieved by applying suitable crops such as cereals and

Lucerne, with harvesting limitations. Cutting of Lucerne should not be allowed after 15th June and cereals may not be harvested at all. The hamster populations strongly profited from these measures (La Haye, 2008) and increased significantly.

In 2008 a sharp population decline was detected (Fig. 1). The main reason turned out to be an increased predation rate in April–May, in comparison with same period in previous years. This reduced the reproduction capacity of the population and could not compensate predation losses during the rest of the season. In 2009 several core areas showed a population increase again. Others decreased even further in 2009 showing that the hamster populations are still vulnerable and that extinction of the reintroduced populations is still a realistic scenario.

The increased predation rate that was observed in early 2008 was most likely a combination of unfavourable weather conditions in spring and a low availability of alternative prey species. The population of common voles (*Microtus arvalis*) crashed in the same period, forcing predators (foxes, mustelids, raptors) to predate on hamsters.

The best option to cope with large population fluctuations for the Common hamster as observed over the last few years is by achieving large and vital populations of at least 1500 individuals (autumn density) (Kuiters *et al*., 2010).

Commitment of farmers

At the start of the first Hamster Conservation Plan in 2000, the Limburg Farmers Association (LLTB) was asked to play a role in the process of hamster conservation. Not in the role as advisor, but as part of the discours around the conservation of the Common hamster in the Netherlands. However, until 2005 the attitude of the LLTB was rather a sceptical one. With the start of the 'Hamster Experiment' in 2005, a new platform was established chaired by a prominent farmer. The farmers were now directly involved and responsible for the success of the project. This provided the opportunity to create understanding for the points of view of all stakeholders and to rebut prejudices among farmers.

Initially farmers in the Netherlands feared the presence of this highly protected species on their land, because specific farming practices might be forbidden by the government. The research and monitoring programme showed, however, that without appropriate agricultural management and suitable crops, the species will almost totally disappear within one season. Besides that, it is juridical and practically impossible to force farmers to cultivate Lucerne or cereals. The only realistic way of supporting a hamster population is to stimulate the presence of certain crops in combination with a suitable management by subsidising hamster-friendly AES (Wildlife and Sustainable Farming Initiative, 2008). The acceptance of such schemes depends on several factors of which the financial compensation and the complexity are very important. At the start of the Conservation Plan in 2000 the AES were rather complicated with many restrictions for the farmers. These AES were not very effective. Only by adapting the schemes by making them more easily integrated in current agricultural practices, the number of farmers that wanted to participate in hamster protection increased.

Management problems and solutions

The experiences of the first AES and experiences in the Sibbe-reserve showed that a conventional agricultural management of crops with harvest restrictions was the best strategy for the conservation of hamsters.

The development of a more or less conventional management during the hamster project was very helpful to get the hamster-friendly AES accepted by farmers, although it is still rather difficult for farmers to accept that harvesting is restricted. Farming cereals for farmland birds, hamsters and rats is controversial and although farmers get well paid for their efforts, it is difficult to convince farmers to put as much effort into their fields with hamster AES, as to their other conventionally managed fields. Communication and advising farmers with hamster-friendly management is therefore crucial. The new hamster-friendly agreements were very attractive and farmers have signed agreements

for hamster-friendly management for the maximum of 300 hectares at the end of 2009 and even more farmers are interested. The Hamster-Committee as platform for the exchange of information between all stakeholders has also played an important role in the acceptance of the hamster-friendly AES by farmers and will continue her tasks in the future.

European scale

Although many other conservation projects for the Common hamster have been implemented in Europe, the Dutch project is, to our knowledge, the first to report positive results. However, the Dutch approach may not work as well in other countries. There are large differences between Western and Eastern European countries. Not only the ecological amplitude of the species might be different, cultural aspects, i.e. the way of farming, or climate factors may have significant effects on hamster populations as well. It is therefore important to test conservation measures for their effects before implementing them country-wide. The support of organisations representing the farming community should be ensured. Financially attractive AES are a prerequisite to get conservation measures accepted.

Conclusions

The hamster reintroduction in the Netherlands was successful and resulted in a sharp increase of the wild hamster population (Fig. 1) with peak numbers in 2007. Monitoring of the population showed that the survival rate was low, but that enough litters were born to compensate the losses. On arable fields with special hamster-friendly AES it is possible for hamsters to raise a sufficient number of litters. The prescriptions of the AES have changed drastically during the project as a result of the scientific research and monitoring programme. Adaptive management based on gained insight in the ecology of the hamster and in the impact of agricultural measures on its survival appeared very successful. At the start of the project the AES were very difficult to apply and ineffective and only a few farmers signed a contract. Nowadays the AES are simple, ecologically effective and farmers are willing to implement these hamster schemes on their land. Most important, the hamster populations are increasing, although still vulnerable. The positive results are unique within Europe: the Dutch project is the first to report positive results with increasing populations of the Common hamster. Summarizing we can conclude that the Dutch reintroduction, so far, is a success due to the following key-factors:

1) commitment and active involvement of the farmers,
2) scientifically based monitoring,
3) the possibilities for adaptive management,
4) financially adequate resources for a sufficiently long period of time.

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