

### Rabbits, refuges and resources

**Rabbits, refuges and resources. How foraging of herbivores is affected by living in burrows.**  
J.J.A. Dekker 2007. PhD thesis. Wageningen University, Wageningen, The Netherlands. 144 pp. ISBN 90-8504-611-4.

When walking in the dunes or other areas with a lot of rabbits you will probably notice variations in rabbit grazing intensity: closer to the rabbit burrows there are very short lawns with abundant rabbit droppings, whereas further away the vegetation gets taller with only a few droppings. This is a typical pattern found for herbivores which forage from burrows: a group referred to as "central-place foragers". European rabbits are a good example of this category of, mostly smaller, herbivores. Such species occur all over the world and include: American pikas living in the Rocky Mountains, Daurian pikas on the Asian steppes, hoary marmots in the alpine zone of North-America, rock hyraxes on African savannas and prairie dogs on the North-American prairie. These herbivores share the common feature of living in refuges, mostly burrows, from which they forage.

Jasja Dekker's thesis explores the factors that shape the spatial patterns of foraging activity amongst central-place foraging herbivores. It tests several factors that may explain the gradient of foraging intensity which decreases with distance from burrows. These factors include: vigilance against predators (Chapter 2), variation in food quantity and quality (Chapter 3), seasonal variation in plant growth (Chapter 4), interactions with larger, free-ranging, herbivores (Chapter 5 and 7) and social interactions between rabbits (Chapter 6). To test the importance of these factors he uses a combination of creative experiments and modelling. The experiments used domestic rabbits, as newly caught wild rabbits often experience great stress when kept in experimental conditions.

To test the effect of vigilance on spatial foraging patterns in rabbits (Chapter 2), domestic rabbits were enclosed on uniform grassland and their foraging behaviour was monitored for five weeks. The rabbits first depleted the vegetation close to their artificial refuges. As they moved further from the burrow more time was spent on vigilance in relation to foraging time. Under increased perceived predation risk (induced by playing buzzard sounds) spatial foraging behaviour did not change but the time spent on both foraging and vigilance increased. In a subsequent experiment the effect of food quantity and quality was tested using pellets containing low and high quality grass (Chapter 3). In an indoor setting rabbits were offered trays of pellets of differing quantity and quality, positioned at different distances from their artificial burrows. The rabbits first depleted the nearest trays before moving to the more distant trays. The order of tray visits was determined by both the quantity and quality of the pellets.

Whereas the second and third chapters mostly tested separate mechanisms under artificial conditions, Chapter 4 focuses on the seasonal dynamics of the food source of rabbits. This is a novel approach, and the chapter that I found the most interesting. Seasonally grasses grow at different rates and the interaction between these rates and grazing pressure means that food availability and quality is constantly changing. In an outdoor experiment three pairs of rabbits were each introduced onto an enclosed strip of grassland. After one growing season the rabbits had created a gradient in grass quantity and quality: quantity increased with distance from the burrows, whereas quality declined. The rabbits foraged close to the burrows early in the season, but expanded their foraging area when growth declined and the vegetation close to the burrows became depleted. This experiment illustrates well the dilemma of central-place foragers: when food availability declines they have to go further afield, resulting in more risk and less rewards per unit time spent foraging. Free-ranging

herbivores do not have this problem as they can move to areas where more food is available.

The central-place foragers' dilemma can be resolved when free-ranging large herbivores lower the vegetation height, resulting in a higher intake by rabbits, creating a facilitative effect (Chapter 5). Dekker models this relationship in space, i.e. he predicts that facilitation only occurs in areas which sustain a high plant production. When production is too low central-place foragers do not benefit from the presence of free-ranging large herbivores as they are competing for the same limited food source.

In the synthesis (Chapter 8), Dekker expands on this facilitation effect. Facilitation of small herbivores by large ones has been shown to occur in the field, but only in the sense of increased patch use by rabbits or other small herbivores. However, it would be very interesting to know whether this increased patch use eventually leads to increased numbers of rabbits, i.e. facilitation at the population level. Dekker's model addresses and predicts this issue, which is a highly relevant question for nature conservation. With the decline of rabbit numbers in Western Europe due to the RHD virus, it is useful to know whether the return of rabbits could be facilitated by introducing large herbivores (such as cattle or horses) for nature management purposes. In this case this has to be population facilitation. However, to restore rabbit numbers by introducing large herbivores, facilitation has to occur at the population level. Currently the outcome is unknown, as population facilitation has never been proven. This does not mean that it does not exist; although it is very difficult to prove, doing so involves having replicate populations where the conditions, apart from grazing by large herbivores, are standardized or at least similar. Dekker attempted to create an experimental setting for this, but the difficulties of getting a small founder population of wild-type domestic rabbits to reproduce, combined with problems with predators meant that no useful results could be obtained.

Despite this, the thesis gives a comprehensive overview of the factors affecting the foraging behaviour of central-place foragers. Even though

European rabbits have been intensively studied, especially with relation to social interactions and disease ecology little was known about their foraging behaviour. This is even more the case for almost all other species of central-place foraging herbivores. This thesis therefore represents an important contribution in understanding the ecology of this group of mammals.

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## Pollutants and hedgehogs

**Non-destructive exposure and risk assessment of persistent pollutants in the European hedgehog (*Erinaceus europaeus*).** H. d'Havé 2006. PhD thesis. University of Antwerp, Antwerp, Belgium. 231 pp. ISBN 90-5728-064-7.

At the end of 2006 Helga d'Havé successfully defended her thesis "Non-destructive exposure and risk assessment of persistent pollutants in the European hedgehog (*Erinaceus europaeus*)" at the University of Antwerp. The research was initiated to analyse levels of contaminants in hedgehogs in Flanders, and to assess whether they might be at risk due to exposure to these contaminants. The hedgehog is a good choice for this kind of study because they forage heavily on earthworms, which are very efficient in transferring contaminants from soil to predators. In this way, vermicore predators are generally exposed to rather high levels of contaminants, and are more likely to be at risk.

Hedgehogs are widespread in Flanders, and are often the victims of road kills. These Corpses were used to assess levels of contaminants among hedgehogs. However, the risk assessment had to