Title: Using the principles of optimal foraging theory to detect the hazel dormouse *Muscardinus avellanarius*: a case of the refinement of nut search techniques, *MSc Dissertation, University of Birmingham, 2009*

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Background to study
Hazel dormice are hard to observe and surveys frequently use nut hunts to determine presence. These are currently unfocused apart from locating hazel trees to conduct the hunt. Optimum foraging theory would predict dormice to feed in resource rich patches of food, containing the most energy for the least energy demands. Under this framework the foraging patterns of dormice were determined to help direct the future of nut hunts for determining dormouse distribution in the UK.

Method
- 10 randomly selected dormouse sites in Surrey and Kent were surveyed during 2008.
- Habitat surveys were conducted around 10 randomly selected hazel trees at each site and consisted of 2 x 20 m perpendicular transects to determine % cover of soil, herbaceous plants, shrub cover, canopy cover, bramble and no. woody contact along transect. In addition the % cover canopy, sub canopy, understorey and ground layer species; density of cover; distance from next hazel stool, distance from and % cover of nearest alternative food plant; no. dead woodland and live woody stems were recorded within a 10 m radius of the sampled hazel tree.
- Gnawed hazel nut surveys were undertaken at ground level within three circular zones (0-100 cm from trunk; 100 cm central area below canopy and the 100 cm far edge of the canopy. Five 50 x 50 cm quadrats were surveyed within each circular zone equating to 15 quadrats per tree.

Key results
- Dormouse gnawed hazelnut shells were recorded from all sites at a frequency of <1% of all shells obtained. The number of nuts did not correlate to the number of dormouse nuts found.
- The number and diversity of alternative food sources did not affect dormouse activity.
- The abundance of dormouse hazelnut shells was positively affected by the diameter of the hazel tree trunks at breast height (DBH); however this did not correlate with the number of hazelnuts recorded around the tree. 85% of dormouse nuts were recorded from trees with a DBH $\geq$170 cm, and trees with a DBH $\geq$ 150 cm supported 98.5% of dormouse nuts recorded.
- 49% of dormouse nuts found were from five trees with an average stool diameter was 2.54 m.
- Dormouse nuts were more likely to be present under dense, wide canopy hazels, increasing the amount of bare ground underneath (>50%). 59% of all dormouse nuts found were where ground cover made up <20% of the search area.
- Dormouse nuts were more likely to be found within 100 cm of the hazel trunk rather than underneath the mid and far side canopy and such nuts were located <2 minutes of searching.

Key messages to landowners and managers derived from these results
- Gnawed hazel nut searches are an effective tool for determining dormouse presence. Survey effort should focus on hazel trees with a stool DBH of >150 cm (optimal >170 cm) and within 100 cm of the trunk. A maximum of 10 such trees should suffice and searching for 5 minute should allow location of dormouse nuts if present.

Key words/phrases
Dormice; *Muscardinus avellanarius;* hazel nut searches; hazel tree diameter; habitat