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## Poster Session 2 – Conservation and Ecosystem Services

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### **93 Testing the “density-benefit” relationships for invasive alien species: does black rat density influence their role as pollinators?**

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Alien species that have both positive and negative impacts in ecosystems are complex to manage. A way to do this could be to use “density-benefit” curves that describe the relationship between the density of an alien and the positive services it provides. We investigated how the density of alien black rats (*Rattus rattus*) affects their efficacy as pollinators of a native plant in Sydney, Australia. First, we used chew cards to determine the densities of black rats in bushland fragments. Then, we created artificial pollination networks and used wildlife cameras to investigate the pollination behaviour of visiting black rats. Pollination potential was measured by the number of black rat visits, the total time they spent foraging on inflorescences, and the number of deposited pollen grains on flowers. We show how these pollination metrics vary with rat density by fitting a “density-benefit” curve and identifying any thresholds in pollination services. This is the first time that alien black rats have been observed successfully pollinating a native plant, which creates a management challenge: do we remove the rats to mitigate their other impacts or do we allow them to persist for the pollination services they provide? Our experiments will provide helpful data that will assist in tackling these thorny management problems.

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### 94 Habitat preferences of small mammal species distributed in the eastern Black Sea region in Turkey

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Turkey has rich mammalian fauna due to geographic location and various environmental factors (climate, such as topography and vegetation). Over the last 100 years, more than 160 mammalian taxa have been identified in Turkey by both foreign and Turkish scientists. This work was carried out on the borders of Trabzon and Rize, covering İyidere and Solaklı Basins. Within the boundaries of the planned study area, it is fully revealed that terrestrial small mammal fauna and species are associated with habitats. The study was conducted between June and September 2012. Sherman traps were used to catch small mammal species. Specimens that cannot be identified are embalmed and moved to the laboratory. The standard 4 external dimensions (total length, tail length, hind and ear lengths) and weights (g) were measured according to Harrison and Bates (1991). Habitat types found in the study areas with an altitude of the basin under 1,000 m are: aquatic areas (streams, tea and rivers), agricultural areas (large-scale tea cultivation and little nuts and similar gardens), settlements, beech forests. Species sampled from these habitats are: *Rodentia*: *Apodemus flavicollis*, *Apodemus mystacinus*, *Apodemus uralensis*, *Apodemus sylvaticus*, *Rattus norvegicus*, *Myodes glareolus*, *Muscardinus avellanarius*, *Soricomorpha*: *Crocidura suaveolens*, *Sorex raddei*, *Talpa levantis* and *Erinaceomorpha*: *Erinaceus concolor*. The habitat types encountered over 1,000m are: step, mountain and alpine meadow, rocky, mixed forest ecosystems. The species found in these ecosystems are: *Rodentia*: *Apodemus flavicollis*, *Apodemus uralensis*, *Myodes glareolus*, *Microtus daghestanicus*, *Sciurus vulgaris*, *Chionomys roberti*, *Chionomys gud*, *Apodemus mystacinus*; *Soricomorpha*: *Crocidura suaveolens*, *Sorex raddei*, *Sorex volnuchini*, *Sorex satanini*, *Talpa levantis*; and *Erinaceomorpha*: *Erinaceus concolor*. In the study area, habitat types, EUNIS habitat classes were excluded and habitat preference of small mammal species was determined.

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### 95 Coarse woody debris in home ranges of bank vole *Myodes glareolus*

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The role of coarse woody debris in the functioning of small mammal populations of the order *Rodentia* has already been rather well examined in north America, but still requires research in Europe. As coarse woody debris in different stages of decomposition perform an important role in the functioning of ecosystems and constitute a significant and often indispensable component of habitats for many species of small mammals, an attempt was made to analyse the way of area usage within the context of the habitat's local heterogeneity, with particular consideration of coarse woody debris. In August 2017, pilot telemetry studies were performed on 6 individuals of bank vole *Myodes glareolus* (1 male, 5 females) in the commercial forest stands of the Białowieża Forest. Within the 1-hectare research area and within the borders of home ranges extending beyond the designated area, a detailed inventory of both standing and lying coarse wood debris was made. The collected data about coarse wood debris were mapped together with the home ranges of the examined bank vole individuals. The size of the areas determined for each individuals was between 214 and 589 m<sup>2</sup> for females and 2,276 m<sup>2</sup> for the males (areas determined with the Core Convex Polygon method, TRACKER 1.0). It was noticeable that among the total number of bearings for each of the individuals, the situations in which the animal was directly on, beneath or inside coarse woody debris – stump, log or branch pile – constitute a relatively high proportion (between 38% and 64.8% of all collected bearings). This research is an introduction to a project concerning the role of coarse woody debris in shaping the species diversity, population factors and in the usage of forest complexes by small mammals *Micromammalia*.

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### **96 A review of methods for studying the seed-rodent interaction**

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Although seed dispersal by rodents is one of the most important mechanisms in the ecology and evolution of mutualistic systems, we still have very limited knowledge about the seed dispersal systems due to limitation of research methods of identifying the relation between seeds and rodents at individual level. Most of previous methods in studying seed-rodent interactions , e.g. direct observation, metal-tagged, oil paint-marked, thread-marked, fluorescent-pigment, radioisotope- labeled method, are not able to track the individual or species hoarding seeds. Recently, we developed a method combing seed tagging and infrared cameras tracking methods which could identify the individual relation between seeds and rodents. Our method allows us to estimate the seed-rodent interaction strength, and to assess the benefits and losses of scatter hoarding and conspecific or interspecific seed pilferage, which is essential for exploring the mechanism of species coexistence and network stability of seed-rodent systems.

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### **97 When will beavers build a dam? A study in Belgian lowland**

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Beavers have returned to Belgium after more than 150 years of absence and are now spreading along waterways in the densely populated landscape. While their presence is applauded for nature conservation reasons, there is also a serious concern about the damage beavers may cause by their burrowing activity, by destroying crops or by constructing dams that may cause flooding upstream. Beavers, however, do not always build dams and in this study, we investigated under which conditions they do. We took measurements in 28 beaver territories in Flanders in 2013, 13 of them without dams and 15 with one or more dams. We measured river water depth in Summer, river width, bank height, stream velocity and distance to woody vegetation. Of these, water depth turned out to be the most important one and in fact the best predictive model for dam construction was one in which water depth was the only variable. A significant logistic regression showed that if river depth in late Summer was less than 68 cm, probability for dam construction was high, of it was more than 68 cm, dam building was unlikely. If a dam was constructed, water level rose on average 47 cm, indicating a risk for flooding if bank height was less than that. These results provide a simple tool to assess the probability of floodplain inundation by beaver dam building, that can help to identify where beavers may constitute a real risk for flooding in the densely populated Flemish landscape where often agriculture, houses and industry are situated close to rivers.

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### 98 The effect of urbanization on the growth indices and parasite infestation of wild brown rats, *Rattus norvegicus*

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Currently, urbanization has been blooming all over the world, especially in developing countries. The process of urbanization could not only alter the natural environments but also impact the life of urban animals. The brown rat (*Rattus norvegicus*) is commonly observed in both urban and rural areas, and it is reasonable to argue that there could be differences based on its living environment. To test this hypothesis, the body condition and parasite infestation of wild brown rats captured from urban and rural areas in Henan Province, China were analyzed. The results demonstrated that, 1) the urban brown rats showed bigger body length (urban:  $18.8 \pm 2.2$  cm; rural:  $16.9 \pm 1.6$  cm), heavier body mass (urban:  $147.0 \pm 51.2$  g; rural:  $105.1 \pm 27.7$  g), and higher body mass index (urban:  $0.401 \pm 0.067$  g/cm<sup>2</sup>; rural:  $0.360 \pm 0.044$  g/cm<sup>2</sup>) than that of the rural counterparts; 2) the cysts of *Taenia* sp. were found in the brown rats' liver, and the prevalence was 20.0% (5/25) in urban brown rats and 8.3% (2/24) in rural brown rats; 3) the blood parasite *Trypanosoma* sp. was observed in the brown rat, and the prevalence was 4.3% (1/21) in urban brown rats and 37.5% (9/24) in rural brown rats. Urbanization may affect the body condition through changing the food resources offered by human activities. Moreover, urbanization also could influence the life cycle of some parasites, therefore it could alter the infestation with these parasites. Therefore, increasing attention shall be put on investigating the relation between urbanization and urban wildlife. The study was financially supported by Undergraduate Training Project of Zhengzhou University (2016XJXM282).

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### **99 Intraspecific pilferage and pilferage avoidance in *Sciurotamias davidianus***

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Pilferage by conspecifics is one of the causes of food loss in food-hoarding animals. The reciprocal pilferage hypothesis states that animals keep high intensity of scatter hoarding under the conditions of high pilferage because they can compensate for food loss through pilfering from others, but it is not well tested by experimental evidence. *Sciurotamias davidianus* is a good model to test the reciprocal pilferage hypothesis because individuals live in solitary with overlapped home ranges and primarily hoard plant seeds in scatter. Here, we tracked seed-hoarding and pilferage (nuts of *Juglans regia*) between paired squirrels using far-infrared camera traps in a semi-natural enclosure (50 m × 40 m). We tested whether food loss through pilferage by other individuals could be compensated by pilfering from others (reciprocal pilferage hypothesis), harvesting from seed sources, or both of the two ways. We found that 1) caches animals pilfered from others were not different from those pilfered by other individuals, supporting the reciprocal pilferage hypothesis; 2) seeds animals harvested from the seed sources were more than those pilfered by others, suggesting that *Sciurotamias davidianus* tended to compete for food sources rather than to steal from others' stores, under the conditions of high pilferage; 3) total caches harvested from seed sources and pilfered from others was much more than food loss pilfered by other individuals, suggesting that food loss by pilferage can be compensated by competing for food sources and pilfering from others in *Sciurotamias davidianus*. We propose the pilferage-source compensation hypothesis and that scatter-hoarding animals compensate for food loss through pilfering others' food, and competing for food sources under the conditions of high pilferage.

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### **100 Manipulation of plants based on seed survival rates: complex spatial patterns delay seed retrieval in rodents**

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Spatial heterogeneity is generally deemed a central causal factor influencing the physiology and behavior of animals in ecological systems. However, knowledge remains limited about how such patterns influence seed recovery by animals. We hypothesized that variation in spatial patterns benefits seed survival. To prove this hypothesis, we tested seed retrieval parameters by *Apodemus agrarius* and *Lasiopodomys brandtii* in different heterogeneous environments. Our results showed that seed retrieval time increased with increasing spatial heterogeneity. Furthermore, the frequency of invalid excavations was exponentially correlated with spatial heterogeneity. Finally, spatial heterogeneity significantly influenced the frequency heterogeneous objects were explored. Our results indicate that spatial heterogeneity significantly influences the foraging behavior of animals. Consequently, increased spatial heterogeneity will impair the seed retrieval success of rodents. In conclusion, this phenomenon might be an effective strategy of plants to manipulate the seed recovery rates of hoarders, which would ultimately enhance seed survival and the establishment of seedlings.