Book Reviews

Seed dispersal (1)

Seed dispersal by large herbivores: Implications for the restoration of plant biodiversity. M.A. Mouissie 2004. PhD thesis. Rijksuniversiteit Groningen, Groningen, The Netherlands. 120 pp. ISBN 90-367-2172-5. Available online at: http://www.ub.rug.nl/eldoc/dis/science/a.m.mouissie/. A paper version can be ordered from the same internet address.

In the highly fragmented West-European landscape, where the connections between semi-natural habitats have been drastically reduced, seed availability is becoming a bottleneck for long-term plant survival. Hence, current efforts to preserve or restore plant biodiversity are frequently confronted with seed dispersal limitation. Nature management measures affecting seed dispersal opportunities thus deserve the attention of ecologists. Despite the increasing demand for reliable autoecological information on dispersal related topics of the native West-European flora, most of this information is scarce or inadequate. Certainly this is true regarding zoochory, i.e. internal or external seed transport by animals (respectively endo- and epizoochory). However, because of their mobility, large wild and domesticated herbivores are potential long-distance seed dispersal vectors. Hence, they can play a key role in seed dispersal dynamics.

'Seed dispersal by large herbivores' is a dissertation by M. Mouissie, which addresses several questions involving zoochory. The author demonstrates that this seed dispersal mechanism is an important biotic factor of semi-natural ecosystems, e.g. heathlands. The dissertation consists of seven chapters including a brief introduction to seed dispersal and a synthesis of the PhD study. In chapter 3 and 4, Mouissie and collaborators take a look at 61 plant species and the number of seeds per species that are dispersed internally by Scottish Highland cattle (*Bos taurus*), Exmoor ponies (*Equus caballus*), and Drenthes heathland sheep (*Ovis aries*) and three wild ungulates: red deer (*Cervus elaphus*), fallow deer (*Dama dama*) and roe deer (*Capreolus capreolus*) in an extended heathland in the Netherlands. The authors stress the potential importance of endozoochory for far more plant species than previously thought from only a seed morphology point of view. Originally, plausible dispersal modes were derived from seed morphology. For example plant species bearing fruits or seeds with a fleshy coat were considered to be dispersed endozoochorically by birds or frugivorous mammals. In the same context a lot of seeds were categorised as 'unassisted'. These seeds, which do not show any obvious adaptation to a specific dispersal mode, now, seem to be able to get dispersed endozoochorically. Or as the authors state themselves 'The potential for endozoochory should hence be viewed as a continuous rather than as a discrete variable'. It also became clear that cattle disperse far more seeds (4.6 seeds/g dry weight of dung or 2.5 million seeds animal^{-1} year^{-1}) than the smaller sized pony (0.9 seeds/g dry weight of dung or 0.5 million seeds animal^{-1} year^{-1}), sheep (1 seed/g dry weight of dung or 40.000 seeds animal^{-1} year^{-1}) and wild ungulates (ranging from 0.036 (roe deer) to 1.3 (red deer) seeds/g dry weight of dung). In chapter 5 the authors report on the results of a seed feeding experiment with fallow deer: A known number of seeds (usually 1000) of 25 plant species were fed to five fallow deer. During four days, following the seed feeding event, all dung pellets were collected. After a standardised treatment, dung was spread out on a potting soil substrate in a greenhouse. All emerging seedlings were identified and counted. Such experiments contribute to our understanding of the possible factors influencing the dung germinable seed content. Seed characteristics are one set of variables influencing seed survival. Small and round seeds are better survivors than elongated, large seeds. There is also an interesting positive relationship with the ability to survive in the soil seed bank, i.e. with seed longevity. Furthermore, such an experiment provides information on seed retention time, which enables to calculate potential seed dispersal distances.

Herbivores may also transport seeds externally when attached to their fur. In chapter 2, Mouissie and collaborators report on some nice experiments. Long PVC-tubes, covered with sheep fur (the sheep dummy) or calf fur (the cow dummy) were attached to a bicycle, 5 cm above the ground. The authors then cycled through a heathland, following a random selected route. Afterwards all seeds which were attached to the fur were collected and counted. The same dummies were used to study the seed detachment characteristics of smooth, coarse and bristly seeds. These experiments provided insight in how seed attachment is affected by animal (e.g. fur structure) and plant characteristics (plant height and seed morphology).

They further combined this information with a model for epizoochorous seed dispersal, based on correlated random walks. Then, using simple distribution functions, the authors offer some nice examples of potential seed dispersal distances by different species of herbivores. Sheep are the best long distance seed dispersers, with a large fraction of the seeds transported further than 1 km from the seed source. Cattle and fallow deer also are potential long-distance seed dispersers with some seeds dispersed up to 1 km from the seed source. Wood mice are only important within small distances (10-12 m) from the seed source. While this model is not yet validated, chapter 2, 3, 4 and 5 hold a convincing plead to consider domestic and wild herbivores as important (long-distance) seed dispersers for a considerable number of plant species. Yet, the relative importance of zoochory in relation to other seed dispersal mechanisms remains to be elucidated.

In chapter 6 attention is given to the habitat use of herbivores and its possible consequences for seed dispersal patterns. Directed seed dispersal is the disproportionate deposition of seeds in suitable habitat. Because most herbivores show selective habitat use, they potentially can induce directed seed dispersal. For example: herbivores prefer to graze on short patches which in most cases are the result from previous grazing. In fact they can create and subsequently maintain, such preferred grazing lawns for several years. From the used model it is hypothesized that seeds of light demanding plant species, which are characteristic for short grazed patches, can disperse from one to the other short patch. However, this very intriguing result of the modelling needs confirmation from field research.

Given the potential of large herbivores to act as ‘mobile links’ or ‘dynamic ecological corridor’ between isolated habitat patches by means of seed dispersal, nature managers and policy makers should consider the implications for ecological restoration. In chapter 7, Mouissie briefly discusses these implications, ending with some recommendations. To cite the author: ‘When used with care, large domestic herbivores can increase the availability of target seeds in ecological restoration sites’. Indeed, to get the best results one should be aware of the animals’ grazing behaviour in relation to the spatial configuration of the different habitats.

Wild herbivores, such as red deer, are able to connect habitat restoration sites with more distant plant communities. The author’s plead for the creation of ‘deer corridors’ as a more parsimonious measurement than plant corridors should be interpreted within this context.

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