Seed dispersal (2)

Ungulate seed dispersal. Aspects of endozoochory in a semi- natural landscape. E. Cosyns 2004. PhD thesis. Ghent University, Ghent / Institute of Nature Conservation, Brussels, Belgium. 178 pp. ISBN 90-403-0211-1. Available online at http://www.instnat.be/content/page.asp?pid=PUB_Doctoraten.

Although the study of seed dispersal by animals already started in the age of Darwin, it is again a topical issue. Current levels of habitat fragmentation in northwest Europe limits colonization rates of ecological restoration sites and may also frustrate the ability of plant species to survive climate change. Furthermore, the use of domesticated cattle (*Bos taurus*), sheep (*Ovis aries*) and horses (*Equus caballus*) has become increasingly popular in northwest European nature management of semi-natural landscapes. The aim of this thesis was to get insight in the ecological significance of endozoochory (internal seed dispersal by animals) in grazed ecosystems.

Eric Cosyns conducted his PhD study at four sites in coastal dunes of Belgium and northern France. The method used is the collection of dung and counting of seedlings germinating on the dung after placement in a greenhouse. These estimates of germinable seed content of ungulate dung was then related to the diet of cattle and horses, the abundance of the plant species and seed characteristics. Furthermore Cosyns conducted a feeding experiment to investigate the survival of seeds through the guts of ungulates and rabbits and a field experiment to assess the establishment of plant species after dung deposition. Although there are several earlier publications on the seed contents of herbivore dung and seed survival in herbivore guts, some of the data analyses in this thesis are novel.

This thesis is divided into seven chapters including an introduction and a synthesis. It also contains a summary in Dutch (Flemish). Chapter 1 gives an overview of the study aims and introduces the study areas and research methods. Chapter 2 describes the density and species composition of cattle and horse dung collected at two coastal dune sites. In 51 dung samples Cosyns and co-workers found almost 60 thousand seeds of 117 plant species (27% of all species occurring at the sites), showing that ungulates are potentially important seed dispersers. In chapter 3 these results are related to seed characteristics and feeding behaviour aiming to answer the question: which plant species are the most successful endozoochores? The authors conclude that the seed characteristics of the successful endozoochores were well predicted by the so called 'foliage is the fruit hypothesis' of Daniel Janzen: small, persistent seeds are more successful than big short-lived seeds. However, there is no relationship between success as endozoochore and the attractivity of a plant ('as a fruit') for ungulates. Chapter 4 has a similar content as chapter 3, dealing with the relationship between horse dung germinable seed-content, plant species abundance, diet composition and seed characteristics. In general, chapters 2, 3 and 4 look somewhat repetitious and could also have been combined into one chapter.

Chapter 5 is in my opinion scientifically the strongest of Cosyns' thesis. It is recently published in the *Journal of Ecology* and describes survival rates of 19 plant species in cattle, sheep, horse, donkey (*Equus asinus*) and rabbit (*Oryctolagus cuniculus*) guts. Seed feeding trials have been conducted before, but always with fewer plant and animal species. Thanks to this experiment relationships between seed survival rates and plant and animal characteristics could be tested better than in previous experiments. Seeds fed to sheep had a lower survival rate than seeds fed to the other animals. In all animals seed survival rate was positively related to the persistence of seeds in the soil (seed longevity index).

Chapter 6 deals with the establishment of plants after dung deposition. This is a relatively little studied subject, but important to answer the question whether endozoochory actually contributes to a local increase in number of plant species in the vegetation. The authors compare seedling emergence in sod-cut plots and undisturbed plots with and without dung addition. Af-

ter one year more seedlings were recorded in the plots with dung deposition, particularly of generalist plant species. However, establishment in undisturbed plots was problematic. They conclude that dung deposition is indeed a seed supplying mechanism, but is less powerful in creating regeneration niches. I wonder whether the introduction of intact dung pats rather than spreading a layer of dung would lead to the same conclusion. Chapter 7 is the synthesis and provides a good review of the implications of endozoochory by ungulates for nature conservation.

In conclusion, 'Ungulate seed dispersal aspects of endozoochory in a semi-natural landscape' is a sound scientific contribution. Several chapters are already accepted for publication in international peer-reviewed journals. Cosyns confirms that endozoochory is an important seed dispersal mechanism, but stresses that establishment under natural conditions may be fairly low. Furthermore, there are high costs involved for the plants due to low survival rates after gut passage. The results of this study are also relevant for the management of grazed ecosystems. Several species of conservation interest were found in the dung and ungulates may function as mobile links between plant habitats. Therefore, I would recommend this thesis to any scientist interested in dispersal ecology or plant-herbivore interactions, but also to policy makers and managers of semi-natural nature reserves.

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