

We are unable to supply this entire article because the publisher requires payment of a copyright fee. You may be able to obtain a copy from your local library, or from various commercial document delivery services.

From Forest Nursery Notes, Summer 2009

8. © Artificial dispersal as a restoration tool in meadows: sowing or planting?

Wallin, L., Svensson, B. M., and Lonn, M. Restoration Ecology 17(2):270-279. 2009.

RESEARCH ARTICLE

Artificial Dispersal as a Restoration Tool in Meadows: Sowing or Planting?

Lotta Wallin,^{1,2} Brita M. Svensson,¹ and Mikael Lönn³

Abstract

Habitat fragmentation and the abandonment of former agricultural practices have led to extremely low dispersal rates for plant species growing in traditionally managed hay meadows in Sweden. Historically, seed dispersal between populations was maintained by hay movement, grazing animals, and farmers sharing their equipment. Because these means of dispersal typically are no longer occurring, artificial dispersal using seeds and plug-plants is tested here as a restoration tool. In this study, we chose two perennial herbs commonly occurring in meadows as test species, viz, *Hypochoeris maculata* L. (Asteraceae) and *Succisa pratensis* Moench. (Dipsacaceae). We found that plug-plant transplants were twice as effective as seed sowing for both species. The seed collection site was found

to be important for seed-based establishment and survival; consequently, the choice of donor meadow is important when acquiring seeds used for restoration. We also found that survival of plants introduced as seeds was generally lower at sites harboring species favored by nitrogen as well as at sites in later successional phases. Both methods of introducing meadow species worked well, even though long-term establishment may well be more successful with the plug-plant method due to higher plug-plant establishment 2 years after introduction in the field.

Key words: hay meadow, *Hypochoeris maculata*, plug-plant transplantation, population augmentation, seed sowing, *Succisa pratensis*.

Introduction

The inability to disperse between habitat patches is a problem for many organisms in the modern agricultural landscape in western Europe today. Dispersal is mainly hindered by the fragmentation of the formerly more or less continuous seminatural grasslands that formed the base for the farming communities up until the end of the nineteenth century (Poschlod & Wallis DeWries 2002). As an example of the magnitude of habitat loss, at the end of the nineteenth century, Sweden had approximately 1.2 million ha of traditionally managed hay meadows of which only about 3,000 ha remain today (Anonymous 1994; Martinsson 1999). Furthermore, the remaining meadows are both small and isolated (Anonymous 2001). According to metapopulation theory, dispersal between suitable habitat patches drives a dynamic of colonizations and extinctions for many organisms (Hanski 1999). Although most studies have been made on animals so far, increasing evidence suggests that also plant populations are behaving as metapopulations (Eriksson 1996; Husband & Barrett 1996; Ouborg & Eriksson 2004).

Many plants are long lived, and their populations may persist for a long time, even if they are sink populations

and dispersal between them is almost nonexistent (Eriksson 1996). Decreased dispersal leads to a reduction in genetic exchange between populations, which can accelerate a negative population trend through inbreeding depression (Lienert 2004) and lead to an extinction vortex (Gilpin & Soulé 1986). Small populations may suffer from decreased dispersal abilities due to both lower seed production and reduced germination abilities of the seeds (Soons & Heil 2002).

Recolonization after restoration can occasionally happen through recruitment from the seed bank, where seeds of some species persist during unfavorable periods for long periods of time (Thompson & Grime 1979). However, many grassland species do not have persistent seed banks and are lost if the habitat changes (Milberg 1995; Bakker et al. 2002).

Seed addition experiments have shown that seed limitation may often be the reason behind the absence of species in habitable sites (Eriksson 1997; Turnbull et al. 2000; Franzén & Eriksson 2003). Seed introduction studies have shown that seed sowing can result in establishment of desired plant species in restored grasslands (Kiehl et al. 2006; Lindborg 2006). Walker et al. (2004) suggested that restoration by seed sowing of typical grassland species is a common and usually cost-effective technique to diversify a restored grassland. Long-term establishment is, however, not always successful after seed sowing (Primack & Miao 1992; Bischoff 2002; Mitlacher et al. 2002; Banerjee et al. 2006). One method to assist species establishment is to use plants that have been nursed, e.g., in a greenhouse, before being transplanted into the field.

¹ Department of Plant Ecology, Evolutionary Biology Centre, Uppsala University, Villavägen 14, SE-752 36 Uppsala, Sweden

² Address correspondence to L. Wallin, email lotta.wallin@ebc.uu.se

³ Södertörn University College, School of Life Sciences, SE-141 89 Huddinge, Sweden