



# Seed propagation of characteristic loess grassland species and application of high diversity seed mixtures in nature conservation

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# Background

- Several landscape-scale grassland restoration projects across Europe
- Sowing low or high diversity seed mixtures
- Limited availability of locally harvested or produced seeds can be challenging
  - ▣ Better case: available but expensive
  - ▣ The worst case: no available sources
- New efficient technologies are needed for seed production

# Aims of the project

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- Build cooperation across Europe
- Set up a database of potential seed sources
- Establish a propagation site for seed production
- Install establishment windows in restored grasslands
- Knowledge transfer

Project funding: Deutsche Bundesstiftung Umwelt

# Cooperation

- Anhalt University of Applied Sciences
- University of Debrecen, Dept. of Ecology
- Hortobágy National Park Directorate
- Mathias Stolle seed producer
- Salvia Environmental and Nature Protection Association
- Cooperation with several Research Institutes and Governmental Bodies dealing with application of diverse seed mixtures.





# Database

- Set up an inventory of potential natural seed sources
- Location: Hortobágy National Park
- Target species: characteristic alkali and loess grassland species, which are easy to collect and grow
- Data to collect: location, area of the populations; number of individuals; habitat properties; management type; possibilities for seed collection; presence of unwanted species



# Propagation site

- Allows to produce seeds of the local ecotypes
- Characteristic species of alkali and loess grasslands, which are easy to propagate

*Achillea collina*

*Agropyron pectinatum*

*Centaurea scabiosa*

*Dianthus pontederiae*

*Festuca rupicola*

*Filipendula vulgaris*

*Hypericum perforatum*

*Melandrium viscosum*

*Phlomis tuberosa*

*Salvia austriaca*

*Salvia nemorosa*

*Silene vulgaris*

# Propagation site

- ❑ Seed collection 2013 and 2014
- ❑ Transplants were grown in a greenhouse
- ❑ Soil preparation (October 2014)
- ❑ Sowing and transplanting in rows
- ❑ Ecological farming: no chemicals
- ❑ Mulching and weed control is done by hand
- ❑ Promising results
  - ▣ Very good survival ratio of transplants
  - ▣ Most of the sown species could establish, some even flower
- ❑ The most critical point: the weeds



# Establishment rate

	Transplants	Seed sowing
<i>Achillea collina</i>	Excellent	Excellent
<i>Agropyron pectinatum</i>	-	Good
<i>Centaurea scabiosa</i>	Good	Good
<i>Dianthus pontederæ</i>	Excellent	Excellent
<i>Festuca rupicola</i>	-	Good
<i>Filipendula vulgaris</i>	Good	Good
<i>Hypericum perforatum</i>	Excellent	Bad
<i>Melandrium viscosum</i>	Excellent	Excellent
<i>Phlomis tuberosa</i>	Good	Good
<i>Salvia austriaca</i>	Good	Good
<i>Salvia nemorosa</i>	Good	Good
<i>Silene vulgaris</i>	Good	Good

























































# Establishment windows

- Small artificial ‘biodiversity hotspots’, which allow target species to establish and spread to the restored sites
- The aim is to enhance the diversity of formerly restored alkali and loess grasslands
- Location: Egyek-Pusztakócs
- 760 hectares of alkali and loess grasslands were restored
- Sowing 2 types of low diversity seed mixture (2005)
  - ▣ Alkali s.m. (*Festuca pseudovina*, *Poa angustifolia*)
  - ▣ Loess s.m (*Festuca rupicola*, *Poa angustifolia*, *Bromus inermis*)

# Grassland restoration (Egyek-Pusztakócs)

**YEAR1**



**YEAR 3**



**YEAR1**



**YEAR3**



# Grassland restoration (Egyek-Pusztakócs)

	Year1	Year2	Year3
<b>Alkali seed mixture</b>			
Cover of sown grasses	22.6±7.6 <sup>a</sup>	54.7±11.3 <sup>b</sup>	67.6±5.8 <sup>b</sup>
Cover of annual weeds	64.2±9.9 <sup>a</sup>	18.5±6.8 <sup>b</sup>	1.7±0.6 <sup>b</sup>
Species number	15.3±1.1 <sup>a</sup>	9.7±1.4 <sup>b</sup>	6.8±0.9 <sup>b</sup>
<b>Loess seed mixture</b>			
Cover of sown grasses	16.0±5.0 <sup>a</sup>	76.5±6.8 <sup>b</sup>	86.7±3.2 <sup>b</sup>
Cover of annual weeds	69.6±8.5 <sup>a</sup>	4.3±1.2 <sup>b</sup>	1.8±0.6 <sup>b</sup>
Species number	15.4±0.5 <sup>a</sup>	9.0±1.0 <sup>b</sup>	8.1±0.6 <sup>b</sup>

# Establishment windows

- 8 sites (October 2013)
- 16m<sup>2</sup> (fenced and not fenced), 4m<sup>2</sup> and 1m<sup>2</sup> (not-fenced)
- Tilling and seed bed preparation
- Sowing diverse seed mixture with loess and alkali species
  - ▣ 35 species
  - ▣ Sowing density 10g/m<sup>2</sup>













# Establishment windows

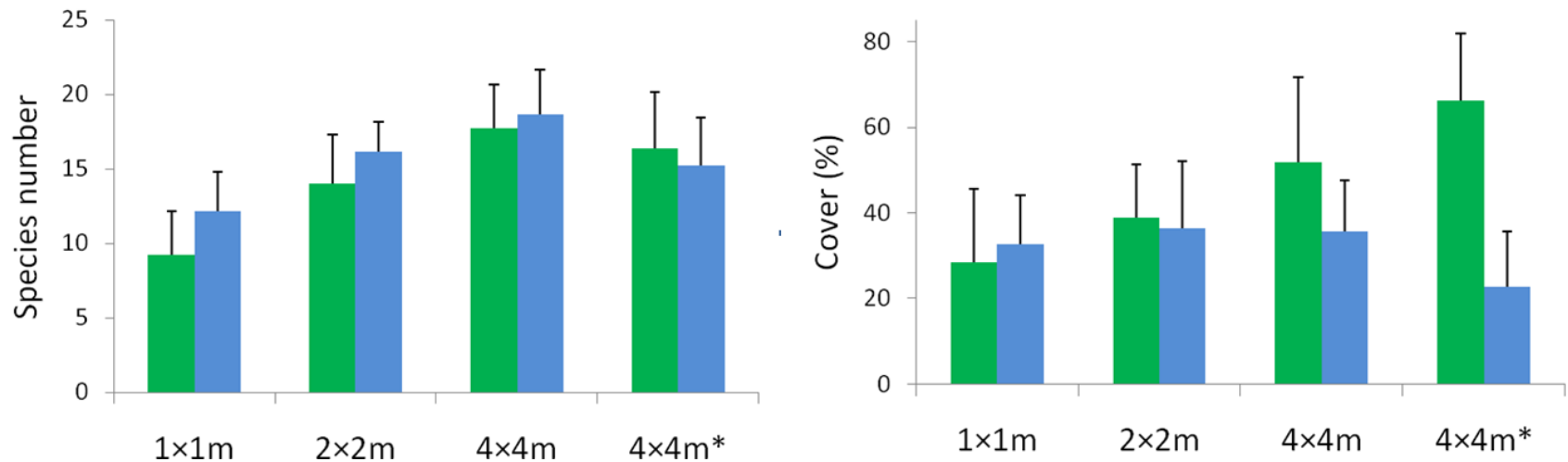
## □ Study questions

- ▣ Which size of establishment windows is the most proper for the establishment and dispersal of sown target species?
- ▣ How does the management regime (with or without grazing) influences the establishment rate and seed production of sown species?



# Establishment windows

- 33 out of 35 sown species were established in the first year



Green = sown; blue = spontaneously immigrated; \* = fenced sites.





*Centaurea solstitialis*

*Scorsonera cana*

*Silene vulgaris*

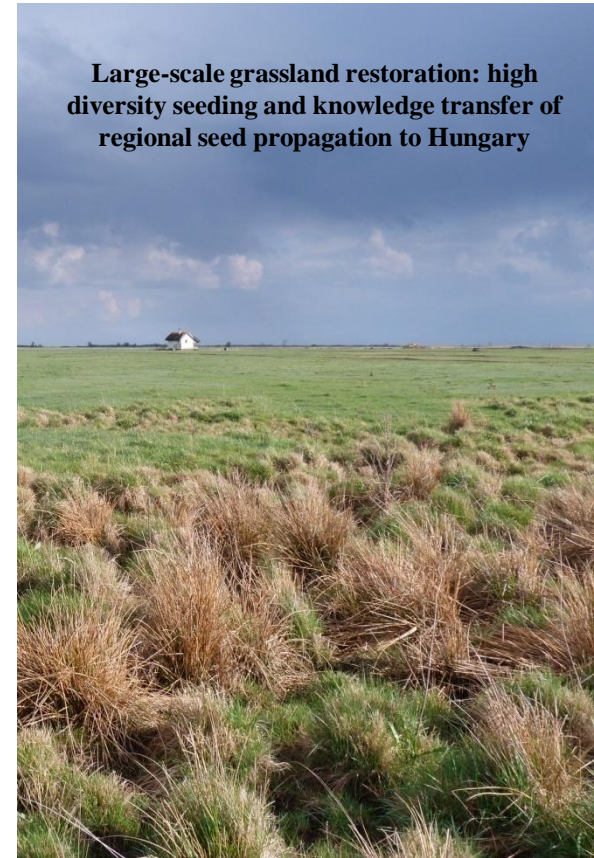
*Achillea collina*





# Knowledge transfer

- Project brochure
- Handbook for farmers and seed producers
- A book with detailed information on grassland restoration and seed production





# Thank you for your attention!

