



FA1203: Sustainable management of *Ambrosia artemisiifolia* in Europe (SMARTER)
Short Term Scientific Mission Report

Designing experiments on invasion resistance of plant communities

STSM details

COST STSM Reference Number: COST-STSM-FA1203-26690

Timing of STSM: 17-05-2015 to 22-05-2015

Applicant details

Rea Maria Hall

University of Natural Resources and Life Sciences in Vienna (BOKU), Austria (AT)

rea.hall@boku.ac.at

Host details

Prof. Dr. Johannes Kollmann

Restoration Ecology, Technische Universität München

Emil-Ramann-Straße 6; 85350 Freising, Germany

jkollmann@wzw.tum.de

Summary of the STSM

The aim of the STSM was to develop grassland communities with a high resistance against invasive alien plants, particularly *Ambrosia artemisiifolia* and *Solidago gigantea*. Greenhouse experiments were designed based on the principles of limiting similarity and competitive exclusion. Both trait-based and phylogenetic approaches were used for species selection. During my visit in Freising I participated in the set up of the experiment including preparation of the trial-trays, the seed selection and the sowing. These activities were done in close cooperation with PhD student Florencia Yannelli. Furthermore, I participated in the preparation of an experiment supervised by postdoctoral researcher Dr. Tina Heger on regeneration of native and introduced *Populus* species under abiotic stress.

Purpose of the STSM

- 1) Literature survey on applying trait-based models to achieve functional targets for ecological restoration and how the response-and-effect trait framework provides a conceptual foundation for translating restoration goals like the management of invasive alien species.
- 3) Species selection, seed selection and composition of the seed mixtures for grassland restoration with a view to competitive exclusion of *Ambrosia artemisiifolia* and *Solidago gigantea*.
- 2) Discussion of the experimental design and preparation of the trial-trays in which the various seed mixtures of the grassland species as well as the seeds of *A. artemisiifolia* and *S. gigantea* were sown.
- 4) Preparation of the tube-bundels for the experiment on *Populus* species.
- 5) Plantation of the scions of *Populus* species.

7) Formulation of a detailed programme for the SMARTER Summer School which takes place between 27th July and 1st August 2015.

Description of the work carried out during the STSM:

Main activities and results obtained

Sunday, May 17th and Monday, May 18th

On the first day I did a literature survey and got an overview over the experiment on the competitive exclusion of *A. artemisiifolia* and *S. gigantea*. Furthermore, I got to know all sites which belong to Technical University Munich in Freising and received an introduction to the experiments which are carried out at the moment on invasive alien species like *Ambrosia artemisiifolia*, *Solidago gigantea* or *Erodium cicutarium*. Furthermore, I booked a hotel for the participants of the forthcoming Summer School.

Tuesday, May 19th

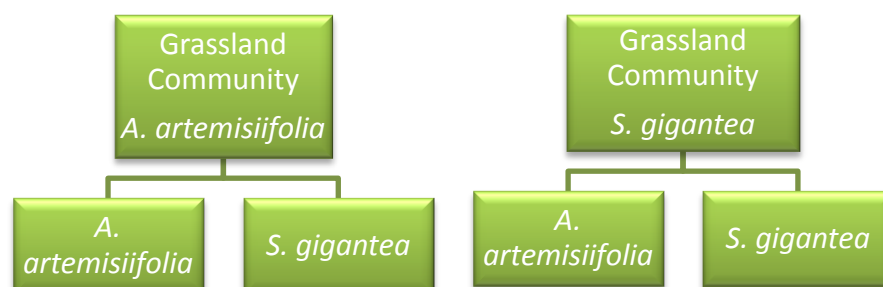
After species selection, PhD student Florencia Yanelli and me selected the seed and prepared the seed mixtures for the experiment which deals with the possible competitive exclusion of *Ambrosia artemisiifolia* and *Solidago gigantea*. We developed the following experimental design:

- Grassland communities: 2
- Invasive alien species: 2
- Controls: 2 (single stands of *A. artemisiifolia* and *S. gigantea*)
- Replicates: 6
- Total number of trays = 36 trays

Community for <i>A. artemisiifolia</i>			Community for <i>S. gigantea</i>	
No	Species	Proportion	Species	Proportion
1	<i>Centaurea scabiosa</i>	0.4	<i>Galium album</i>	0.44
2	<i>Medicago lupulina</i>	0.29	<i>Achillea millefolium</i>	0.43
3	<i>Teucrium montanum</i>	0.25	<i>Poa angustifolia</i>	0.12
4	<i>Galium album</i>	0.05	<i>Veronica chamaedrys</i>	0.003
5	<i>Linum perenne</i>	0.004	<i>Festuca rubra</i>	0.002
6	<i>Betonica officinalis</i>	0.002	<i>Agrostis capillaris</i>	0.001
7	<i>Veronica chamaedrys</i>	0.001	<i>Bupthalmum salicifolium</i>	0.001
8	<i>Peucedanum oreoselinum</i>	0.001	<i>Filipendula vulgaris</i>	0.001
9	<i>Campanula rotundifolia</i>	0.001	<i>Campanula rotundifolia</i>	0.001
10	<i>Dactylis glomerata</i>	0.001	<i>Dactylis glomerata</i>	0.001

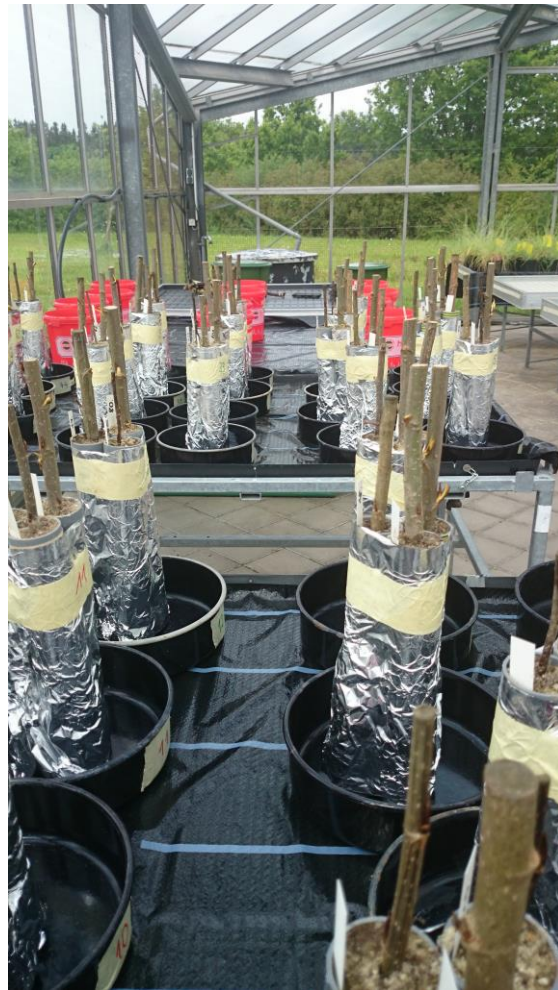
Seed density: 0.03 g m⁻²

Design



Wednesday, 20th May

Together with Dr. Tina Heger and Master student Pamela Baur the tubes for the *Populus* experiment were prepared. The background of this experiment is, that the regeneration of poplars is strongly dependent on the presence of pioneer habitats on which this species can establish and thus influence the dynamics of these habitats. Regulations of rivers among Europe has led to a severe decline of the number of tidal plains and gravel banks thus leading to marked decrease in biodiversity and poplar populations, respectively, as well as to a loss of ecosystem functions. The experiment we prepared at the experimental farm of TU Munich was to test methodology for the forthcoming project “Establishment and novel plant-mutualist interaction along a stress gradient – the case of poplar regeneration in restored floodplains”.



The main hypotheses are:

- 1) Native poplar species have a better survival rate and growth under abiotic stress than introduced poplar species.
- 2) Introduced poplar species develop more effectively when growing conditions are favourable.

Preparation work

For the experiment cultivation tubes (30 cm length and 5 cm diameter) were used (see photo above). These were filled with substrate (sand and perlite) which was autoclaved on two consecutive days. The tubes were covered with breathable pond-nonwoven so that external contamination (seeds, spores) is reduced.

Treatments***Flooding fluctuation:***

- 1 x week, 24 hours flooding (water level 30 cm) – apart from that low water level of 5 cm
- Every 2 week 24 hours flooding (water level 30 cm) – apart from that low water level of 5 cm

Nutrition

- Yes
- No

Inoculation with microorganisms

- Soil deriving from Isar floodplain
- Sterilized soil from Isar floodplain

To test all treatments, 8 buckets (for the flooding) and 8 shallow trivets (for low water level) for each of the 6 replications were prepared, as well as 144 cultivation tubes which were filled with perlite and sand as well as with one spoon of sterilized or non-sterilized Isar-soil (picture 1)

Thursday, 21st May

On Thursday Dr. Tina Heger, Pamela Baur and me finished the preparation of the popular experiment and implemented the bundles of the cultivar tubes in the greenhouse. Furthermore, Dr. Tina Heger, PhD student Florencia Yanelli and me discussed the possible schedule for the Summer School, especially the measurements which the participants can do as well as the statistical analyses.

The planned measurements are:

- Seed mass
- Canopy height
- Specific leaf area
- Dry leaf mass
- Flowering time
- Growth form
- Reproduction: seed vs. vegetative
- Life form (sensu Raunkiær)
- Nitrogen content in leaves
- Leaf area index
- Soil temperature
- Soil humidity

Friday, 22nd May

Prof. Dr. Johannes Kollmann, Dr. Tina Heger, Florencia Yannelli and me discussed the programme and time schedule for the Summer School. To get an idea of the participants experience in working with invasive alien species we decided to prepare a questionnaire which will be sent to the participants in the next days.

Currently, we have agreed on following time table:

Sunday July 26th

Meeting in Vienna and travel to Freising by bus

Monday July 27th

Morning: Presentation of the theoretical background of the experiment
Start of measurement in the greenhouse

Afternoon: Continue of measurements in the greenhouse

Tuesday July 28th

Morning: Data analysis of the collected data

Afternoon: Excursion to Isar riverside and experimental plots at Marienhof

Wednesday July 29th

Morning: Discussion of the results

Pro and cons of greenhouse experiments

Afternoon: Departure to Vienna

After that, Florencia Yannelli and me sowed the grassland species in the prepared trays as shown in the photo below.



Further use of data within SMARTER

This STSM clearly contributes to the goals of the WG2 especially in terms of optimizing the non-chemical control. Numerous theories seek to explain why species like *A. artemisiifolia* can be so invasive outside their native range, including the functional traits of the species. Assuming that functional traits are reliable proxies for comparing resource acquisition and utilization, land users/mangers may be able to seed or plant native species with trait values that are optimally similar to the invader to competitively exclude the invader. Additionally, we try to select native species that inhibit the early developmental stages of common ragweed (germination, seedling, establishment growth). They must not necessarily represent the same functional group like ragweed. The experiment will be part of the PhD project of Florencia Yannelli. Furthermore, after the summer school a paper with the results will be prepared.

Foreseen publications/articles resulting from the STSM

The results of the experiment which will be analysed by the participants of the forthcoming summer school will be subject to an expected paper, which will be issued after the summer school.

Confirmation by the host institution of the successful execution of the STSM

Copy of the e-mail sent to Dr. Maurizio Vurro, the Training Coordinator of the COST Action FA1203, is to find attached.

Vienna, 26.05.2015

Rea Maria Hall