ECPGR Activity Grant Scheme Sixth Call

# *Facilitating use on the European perennial ryegrass collection: improving access to genetic resources and C&E data*

# *(ImprovLoliumCol)*

## Report of the first Activity meeting (6-7 December 2018)

**Participants:**

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*Cannot attend:* Rene Aavola (ECRI - Estonia)

### Task 1 (Inclusion of accessions studied in the frame of the project *GrassLandscape* in the EURISCO database and in the European Forage Collection)

***Objectives of the task:***

Accessions used in the *GrassLandscape* project have been extensively documented with different kinds of information (see presentations of JP Sampoux and E Willner): - genotyping data (GBS and resequencing in candidate genes), - phenotyping in micro-plot field trials in three locations (IPK, ILVO and INRA), - phenotyping on a high-throughput platform at IPK and - environmental data at sites of origin of populations (climatic data, soil and sub-soil data). This large amount of data has enabled to produce substantial original results related to: - the phylogeography of perennial ryegrass, - the genetic bases of natural adaptation and - the genetic determinism of phenotypic variation in this species (see presentations of JL Blanco-Pastor and Thomas Keep). These results open opportunities to conceive future research and breeding projects using original sources of variability in perennial ryegrass. They notably confirm that original sources of variability could be used for adaptation of perennial ryegrass to various climatic conditions in a context of climate change. In order that such future projects can be implemented, it is essential that the perennial ryegrass accessions studied in the frame of the *GrassLandscape* project remain available as genetic sources for the community interested in the genetics and breeding of this species.

The task 1 of the Activity will have the objective to include as many as possible of the perennial ryegrass accessions studied in the *GrassLandscape* project in the EURISCO database and in the European Forage Collection (which is the AEGIS contribution of the ECPGR Working Group for Forages). This is considered as the best mean to secure the long term maintenance of these accessions and to ensure their easy access to a large community.

To help processing the rest of the document, let set the following definitions:

- *the Base set:* including all accessions from *Grasslandscape* that are considered as worthwhile to be maintained and made available for future research, even if they are not eligible for inclusion into EURISCO and/or the EFC
- *The EURISCO set:* only those accessions from the Base set that are eligible to EURISCO (*i.e.* from genebanks of countries contributing to EURISCO). Some of them could be moved back at the end to the Base set if the Activity is not successful to have them included in the EURISCO database
- *The EFC set:* only those accessions from the EURISCO set that are eligible to join the EFC (*i.e.* from genebanks of countries which signed the Memorandum of Understanding of AEGIS).

Some of them can move back to the EURISCO set or the Base set at the end if the Activity is not successful to have them included in the EFC set.

The Base set is only a working set. All accessions considered in the Activity will primarily be included in this working set. The Activity has the objective to push as many as possible of these accessions to the EURISCO and the EFC sets. The maintenance and distribution of accessions finally not included in the EFC set could possibly be taken in charge by the genebanks of some participants involved in the Activity or in the *GrassLandscape* project without the formal and binding commitment of AEGIS.

***Choice of accessions to recover from the GrassLandscape project:***

*Genebank accessions used in the GrassLandscape project*

The *GrassLandscape* project analysed a large set of genebank accessions provided by 15 genebanks relevant to the ECPGR WG for Forages and by the USDA-GRIN. This set comprised:

- 427 accessions from the natural diversity of *Lolium perenne* (phylogeography analyses)

- 11 accessions from the natural diversity of related taxa (*L. multiflorum*, *L. rigidum*, *L. temulentum*, *Festuca pratensis*) (used for phylogeny analyses together with the 427 preceding accessions)

51 additional accessions were also initially included in the *GrassLandscape* project but were not used in data analyses for different reasons: missing information, uncertain taxonomic determination, 4x ploidy level (unexpected in natural populations). These accessions will not be considered in the frame of the Activity.

The Activity partners agree that it would be worthwhile that all the 427 + 11 accessions be secured and maintained in the future. These 427+11 accessions will be included in the Base set. The Activity partners will work to promote the inclusion into EURISCO and the EFC of all these accessions potentially eligible for such inclusion.

Included in the set of 427 + 11 accessions, are 22 accessions received from the USDA-GRIN. These GRIN accessions were obtained by the *GrassLandscape* consortium under signature of a SMTA from the FAO treaty. The *GrassLandscape* recipients of these accessions are thus allowed to multiply these accessions and to distribute seeds to third parties. However, the best option would be that countries of origin propose these accessions for inclusion in EURISCO and the EFC when they are members of the ECPGR network (Greece, Montenegro, Macedonia, Spain, Italy, Serbia, Russia, Turkey). The Activity partners should thus ask these countries whether they would agree to undertake such process, which implies that they would take in charge the maintenance and distribution of these accessions as primary holders. Alternatively, if it is not possible to come on such agreement with the countries of origin (or in the case of accessions from Iran which is not member of the ECPGR network), accessions could be maintained by the genebanks of some of the Activity partners. They could thus be included in the Base set, but not the EURISCO and EFC sets.

35 *L. perenne* cultivars were used as controls in the *GrassLandscape* project and were documented with same information as natural populations. Some of these cultivars are registered and even protected (UPOV); they are consequently not eligible for maintenance and distribution as genebank accessions. Other control cultivars are withdrawn from national lists and no more protected and can be considered for addition in the Base set. Their maintenance and distribution could be taken in charge by the genebanks of some Activity partners. These cultivars could thus be included in the Base set, and possibly in the EURISCO and EFC sets (if National Focal Points agree to register them into EURISCO).

Note that seed backups of genebank accessions stored at IPK are small (less than 1g for some accessions) and were only considered as a provision in case the *GrassLandscape* investigations would need additional experiments. They are not targeted to long term maintenance and distribution.

*Accessions from in situ collection of the GrassLandscape project*

*In situ* collection was performed by partners of the *GrassLandscape* project in 2015 in 55 sites across Europe. Some sites were discarded because of taxonomy problems (other species than *L. perenne* or mixture of taxa) or of unexpected ploidy level (4x instead of 2x). 42 *L. perenne* 2x natural populations were finally scored in a spaced plant trial at IPK. Seed production was also performed for these 42 populations by IPK. For each population, the seed sample harvested by IPK will be shared between IPK and the genebank of the country of origin of the population.

All 42 new accessions resulting from this *in situ* collection will be included in the Base set and will be considered for inclusion in the EURISCO and EFC sets.

Regarding populations collected in Belgium, Portugal, Serbia, Lithuania and Estonia, genebanks from these countries are welcome to become the primary holders of resulting accessions and to forward them to EURISCO and the EFC. For populations collected in other countries, IPK will remain the primary holder of accessions (unless the genebank from the country of origin would prefer to assume this responsability) and will take in charge the process of inclusion into EURISCO and the EFC.

***Other issues related to task 1***

IBERS contributed a large number of accessions to the *GrassLandscape* project. After the recent retirement of Ian Thomas, the Activity partners wonder about the future of IBERS collections. Who is now the curator of IBERS genebank? What are the views of IBERS for the future of their genebank? Who to contact for inclusion of IBERS accessions into the EFC? Anna Palmé will write to the UK National Coordinator with copy to L Maggioni to query about these issues and to emphasize the need of an IBERS commitment in our Activity.

After inclusion into EURISCO, all accessions from *GrassLandscape* (*i.e*. the EURISCO set) should be identified by a special flag in EURISCO. Additional flags could also indicate several nested levels of core-collection (task 3 of the Activity). Stephan Weise (EURISCO coordinator) pointed out that it is not possible to make easy addition to the official list of EURISCO passport descriptors (MCPD standard). He suggested the alternative development of a Crop Group Descriptors-specific extension, which will be more flexible without changing the well-established upload process of passport data. This extension could be used to set up the necessary flags and to include other important information such as confirmation/update of taxonomy and controlled ploidy level.

Stephan Weise also proposed to create a forage portal which would automatically receive data from EURISCO . This portal could be built in a similar way as the one created for the *Poa* collection.

Ana Maria Barata is to attend the AEGIS meeting on 10-11 December. She will try to contact National coordinators /genebank curators from countries which provided accessions to *GrassLandscape* to promote the inclusion of accessions from their country into EURISCO and the EFC.

***Workplan to move forward task 1***

1. Jean-Paul Sampoux and Evelin Willner will write a memorandum to explain the relevance of including accessions studied in *GrassLandscape* in EURISCO and the EFC. To be done by beginning of January 2019.
2. From January to May 2019, curators of genebanks that provided accessions to the *GrassLandscape* project will be contacted by the Activity partners in order that they undertake necessary actions for inclusion of their accessions into EURISCO and the EFC. The objective is to have the agreement of genebank curators by end of May at the latest.
3. From May 2019 onwards, National Focal Points and National Coordinators will be solicited for addition of accessions in EURISCO and the EFC.
4. As many as possible accessions should already be included in EURISCO in September 2019 in order that task 2 (upload of C&E data into EURISCO) can be processed.

## Task 2.1 - Upload of phenotypic data recorded in the frame of *GrassLandscape* as C&E data into EURISCO

### *Phenotypic data from field trials of genebank accessions*

Jean-Paul Sampoux gave an overview of phenotypic data collected on the field trials sown to assess genebank accessions. Genebank accessions and control cultivars were experimented in three locations (IPK Island of Poel, ILVO Melle, INRA Lusignan). In each location, genebank accessions and cultivars were sown in 1m² micro-plots in three complete blocs in 2015. The objective was to obtain a plant density similar to the one usually used in perennial ryegrass agronomic trials. The sowing density was tuned according to previously known germination rate of accessions. Various traits were recorded from 2015 to end of 2017.

In order to avoid uploading a too large amount of data and reprocessing of data by users of EURISCO, the Activity partners agree that it is preferable to upload data already processed to some extent. Scores or measurements will be averaged over replicates *per* location. It is preferred to provide data *per* location and *per* date within location in order that EURISCO users can assess performances in the different climatic conditions of the three field trials. From the monitoring of canopy height growth in spring, the *GrassLandscape* consortium will deliver estimates of canopy heights at several reference dates (in growing degree days) comparable between trial locations instead of the weekly recorded measurements.

### *Phenotypic data from in situ collection field trials*

Evelin Willner gave an overview of phenotypic data collected on plants grown from populations sampled *in situ*. 30 plants from each of the 42 natural population sampled *in situ* were planted in a spaced-plant field trial at IPK on the island of Poel in 2015. Various traits were recorded from 2015 to 2017. Again to avoid uploading too much data, the *GrassLandscape* consortium can provide data averaged over the 30 plants grown *per* population.

### *Inclusion of C&E data into EURISCO*

Stephan Weise advised to use the already recognised Crop Ontology[1] to harmonise phenotypic data for uploading to EURISCO. After inclusion of C&E data into EURISCO, they will be automatically displayed through the portal (as it works with the existing Poa portal). Additional use-cases for visualisation and search need to be discussed.

### *Workplan for uploading C&E data into EURISCO*

1. *First quarter 2019:* The *GrassLandscape* consortium will write a description of the processed phenotypic data they propose for uploading to EURISCO . This description will be submitted to Activity partners in March 2019 for discussion and agreement.
2. *Second quarter 2019:* After agreement upon phenotypic data to upload (latest May 2019), the Activity partners will look for compliance with available crop ontology
3. *Third quarter 2019:* Stephan Weise will give a small training to the Activity partners about how to prepare data for inclusion into EURISCO (training to be delivered during the second meeting of the Activity)
4. *Fourth quarter 2019:* C&E data will be uploaded to EURISCO in connexion with National Focal Points (who can delegate the uploading task to the Activity partners)

[1] http://www.cropontology.org/

## Task 2.2 – Delivery of environmental descriptors collected in the frame of *GrassLandscape*

***Available environmental descriptors***

The *GrassLandscape* consortium acquired fine resolution grids (0.05° resolution) of climatic variables across Europe. These data are 1989-2010 daily norms averaged *per* period of 14 days along the year (25 periods of 14 days and one period of 15 days). Standard deviations across the period 1989-2010 are also available. The base climate variables acquired are average daily temperature (mean, minimum and maximum), cumulated rainfall *per* period of 14 days, average daily solar radiation. The consortium acquired similar grids of 1989-2010 norms and standard deviations for ETCCDI indices.

The consortium computed BIOCLIM indices and ecophysiological indices expected to report environmental factors likely to impose natural selection pressures on wild perennial ryegrass. 1989-2010 norms, but not standard deviations, are available for these computed indices.

The consortium finally mined European databases to extract soil and sub-soil (geological) information. Only information pertaining to sites of origin of accessions was extracted (not full grids over Europe).

***How to deliver environmental descriptors?***

Stephan Weise pointed out that it is difficult to include such new environmental descriptors in EURISCO. When uploading C&E data to EURISCO, it is possible to document Experiment description files as supplementary files. Stephan suggests that these files could include tables of environmental descriptors collected in the frame of *GrassLandscape*.

We agreed that climate data will be provided only for sites of origin of accessions. The full climate grids will be made available by the *GrassLandscape* consortium *via* other ways (data paper?).

***Workplan for uploading C&E data into EURISCO***

Tables of environmental descriptors will be prepared by the *GrassLandscape* consortium and will be made available before the second meeting of the Activity (September 2019).

## Next meetings of the Activity

A Skype meeting is planned in May 2019 (to be fixed according to the needs and the progress of the Activity).

The second meeting of the Activity is fixed on 17 September 2019 at IPK in Gatersleben. A full day meeting is preferred instead of two half-days over a night. The training for formatting C&E data will be given by Stephan Weise during this meeting. It remains possible that members of the WG for Forages that are not official participants in the Activity attend as self-funded participants. In her letter to the UK National Coordinator, Anna Palmé will propose that a representative of IBERS attend this second meeting (as funded attendant). Otherwise, the UK National Focal Point could be invited.

**Documents provided as annexes to this report** (already provided to participants in previous emails)

- Presentation of the *GrassLandscape* project by JP Sampoux (slides)
- Presentation of the *ImprovLoliumCol* Activity by JP Sampoux (slides)
- Presentation of Evelin Willner (slides)
- Presentation of the research of JL Blanco-Pastor (slides)
- Presentation of the research of Thomas Keep (slides)
- List of genebank accessions used in *GrassLandscape* (xls)
- List of in situ collections performed in *GrassLandscape* (xls)
- Description of bioclimatic indices (xls)