CLIMAGIE: A French INRA project to adapt the grasslands to climate change

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Introduction

Climate change in France, central and southern Europe is expected to provoke more frequent and more intense summer water deficits, with increased amplitude in temperatures, exposing the same perennial crops to frosts as well as to heat waves and severe droughts. The impacts on sown monospecific grasslands have been assessed using crop models (Durand *et al.* 2010) but with less accuracy in extreme situations. Since less work has been done on intra-specific genetic variability there is urgent need to investigate both ranges of climate conditions and genetic variability (Poirier *et al.* 2012). Phenology and plant productivity responses to water, temperature and nitrogen (N) in particular need to be re-assessed over the full range of temperatures projected in the future.

What is CLIMAGIE?

The multidisciplinary Institut National de la Recherche Agronomique (INRA) research program CLIMAGIE aims to improve our knowledge and provide innovations for adapting grasslands to climate change. Collaboration between community and functional ecologists, eco-physiologists and quantitative geneticians will provide new rules for species and cultivars ecotypes assembling. That framework will be tested experimentally and *in silico* with the models under construction by our teams. It will contribute to the definition of new ideotypes and breeding schemes of major species, in close collaboration with seed companies on the one hand and directly with end users through participatory breeding programs on the other hand.

Organizing investigations and sharing results

Three integrated groups of tasks (work packages) are defined (Fig. 1):

- Analysis of the genetic intra- and inter-specific variability of the physiological responses to temperatures and droughts in grassland species (legumes and grasses). In particular, the morphogenetic response of various populations in 6 important grassland species to the full range of temperature (5-45°C) will be studied. The evolvability of populations under severe drought conditions will be studied in grasses. New method-ologies for measuring the genetic variability of water use, water use efficiency and summer dormancy will be tested.
- Modelling of the dynamics of the long-term production of sown grasslands. Three models will be tested for: (1) spatially explicit tillering of multispecies grass swards; (2) individual based competition including legumes and grasses; and (3) complex grassland community dynamics using functional ecological modelling.
- Operational selection schemes, ideotypes and assembling rules for mixed grasslands. This includes: (1) novel methodologies to assess and manage of both the *ex situ* and *in situ* genetic resources including biogeographical approaches; (2) building of selections procedures for mixed sown grasslands; (3) construction of an internet dynamic data base for assembling cultivars under various management and climate conditions.

References

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http://www.inra.fr/climagie

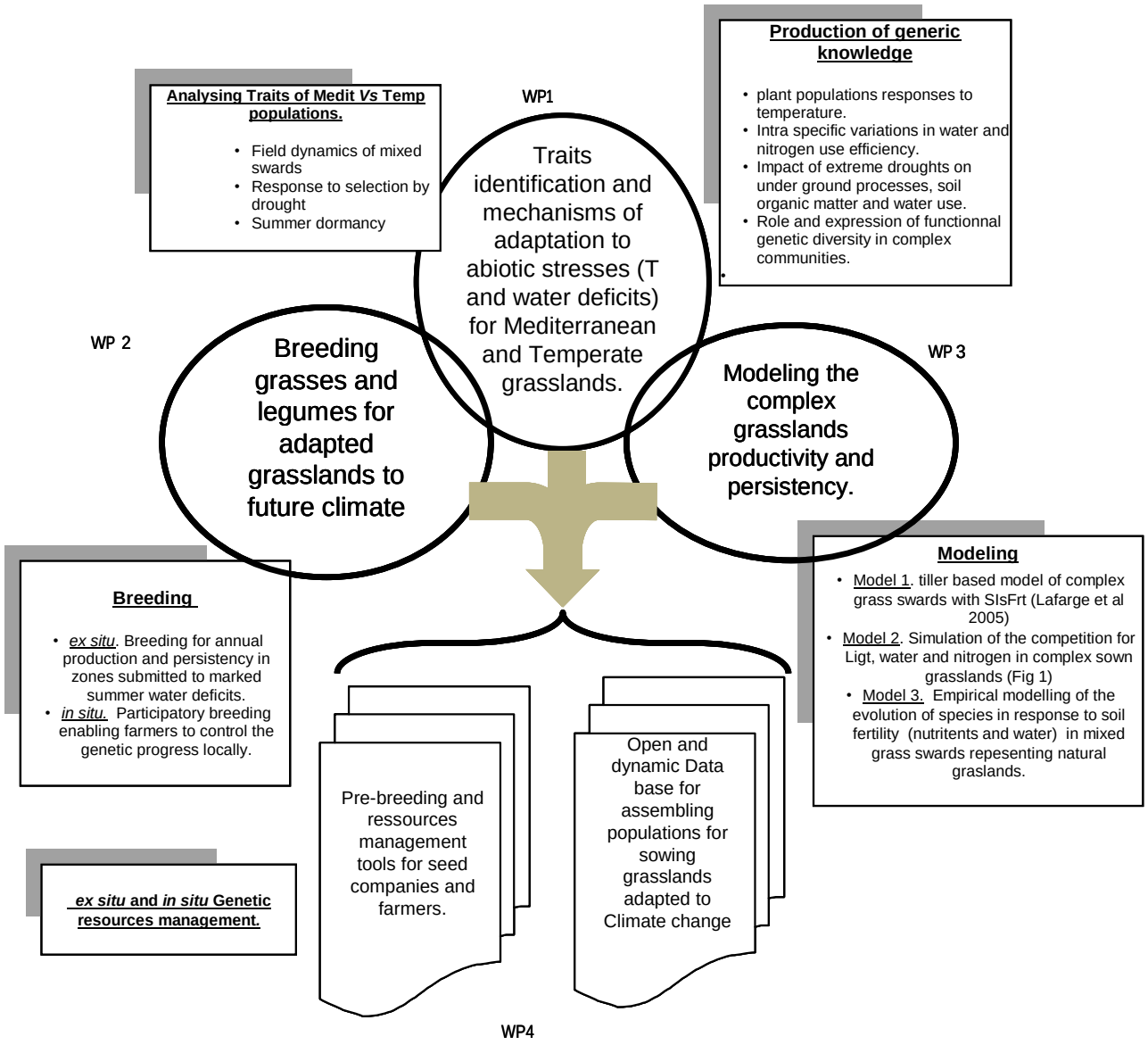

Figure 1. The Structure of the French INRA Project CLIMAGIE.