Development and application of molecular and bioinformatic tools for the genetic monitoring of beets

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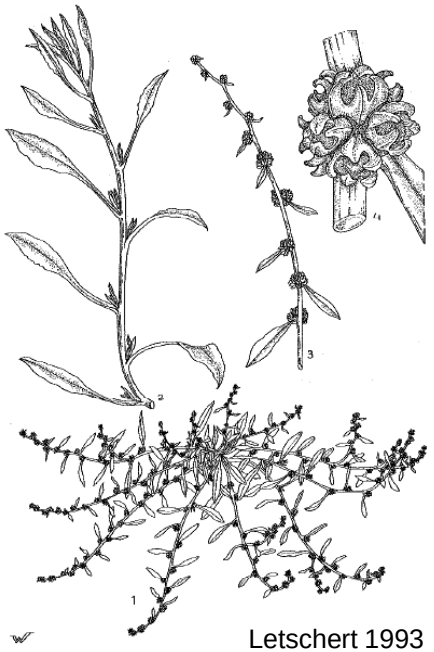
J. Squirmelia

Ulf Bodin 1999



Letschert 1993

Topics

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- **Diversity analysis: *Beta patula* (Ait.) (BP)**

  Objective: Create decision criteria required for the establishment of a genetic reserve for *B. patula*

- **Diversity analysis: *Beta vulgaris* (L.) ssp. *maritima* (Arcang.) (BVM)**

  Objective: Analysis of the genetic structure as a basis for further investigations on *In-situ*-conservation strategies

- **Design and implementation of a database**

  Objective: Development of tools for data storage and the analysis of time series within the framework of genetic monitoring

Overview

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1. Introduction

2. Material and methods

3. Diversity studies (*B. patula, B. vul.* ssp. *maritima)*

4. Monitoring database

Introduction

Crop Wild Relatives (CWR) are species closely related to crops that include crop progenitors, and that may contribute beneficial traits to crops […] (Maxted *et al*. 2008)

Plant genetic resources (PGR) are part of the biological resources and defined as […] genetic material of actual or potential value […] (BGB, 1993, Nr. 32)

Convention on Biological Diversity, CBD

National Strategy on Biological Diversity
Federal Ministry for Environment, Nature conservation and Nuclear Safety, FRG

Agro-biodiversity strategy
Federal Ministry of Food, Agriculture and Consumer Protection, FRG

Law about the Convention on Biological Diversity Article 8:
***In-situ* Conservation should be used to […] Regulate or manage biological resources […]**

Conservation strategies

Ex-situ:	***In-situ:***
Genebank	genetic reserve conservation technique

Genetic reserve conservation technique:
Conservation of wild species in a genetic reserve involves the location, designation, management and monitoring of genetic diversity in a particular, natural location (Maxted *et al.* 1997).

AEGRO:
„An Integrated European *In Situ* Management Work Plan: Implementing Genetic Reserves and On Farm Concepts“ (2007-2011)

AEGRO creates the data- and knowlege baseline for the establishment of genetic reserves for selected crop genepools. **This work conforms to target 7 of the 10. Conference of Parties of the CBD** (Nagoya, 2010)

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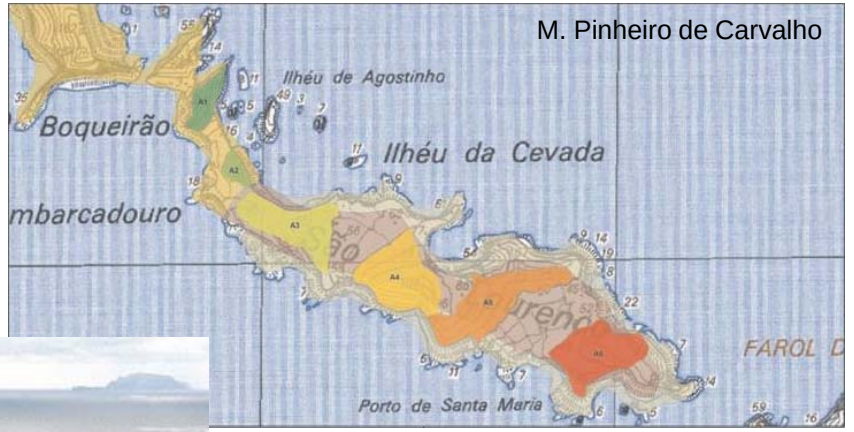
Material: Beta patula (Ait.)

- An endemic species distributed on two islets off Madeira



M. Pinheiro de Carvalho

Ilhèu do Desembarcadouro

(Foto: Ulf Bodin)

M. Pinheiro de Carvalho

M. Pinheiro de Carvalho

Ilhèu Chão

Material: B. vul. ssp. *maritima*

- Distributed along the Mediterranean Basin, the European Atlantic sea shores as well as in the western part of the Baltic Sea area

(Google Earth™-Kartenservice)

Motivation:

-Will the global climate change shift the distribution area towards the northern latitude and how will this affect genetic diversity?

-How will the loss of habitats in the South and gain in the North influence the conservation of important traits for breeding?

Methods

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- 25 SSR markers covering all linkage groups
- Approximately 2 SSR markers for each linkage group

- 242 samples of *B. patula* were collected in the natural habitat
- 316 samples of *B. vul.* ssp. *maritima* were sampled in the natural habitat

- All sampling plots were georeferenced
- Coordinates of 227 individual plants for *B. vul.* ssp. *maritima* were registered

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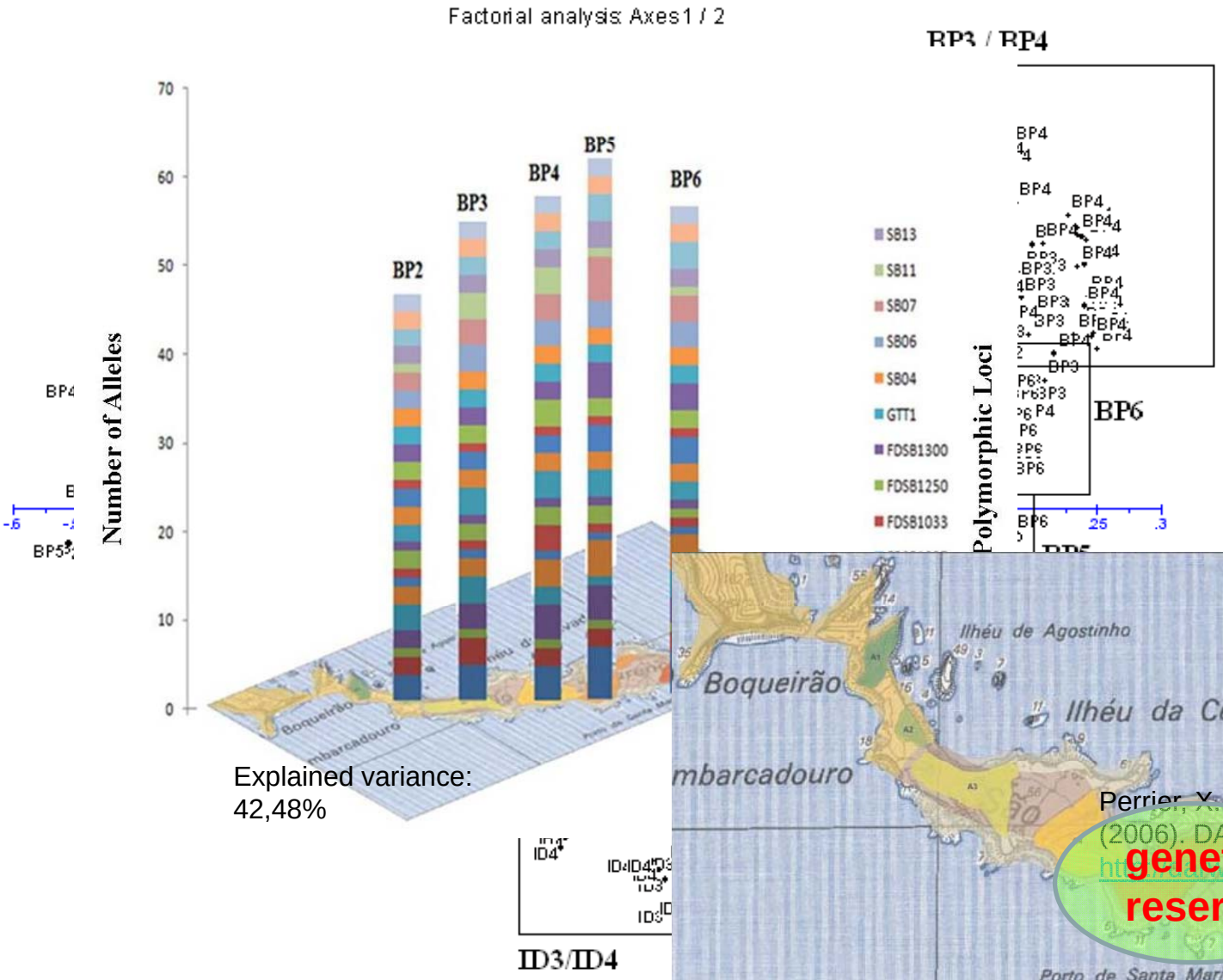
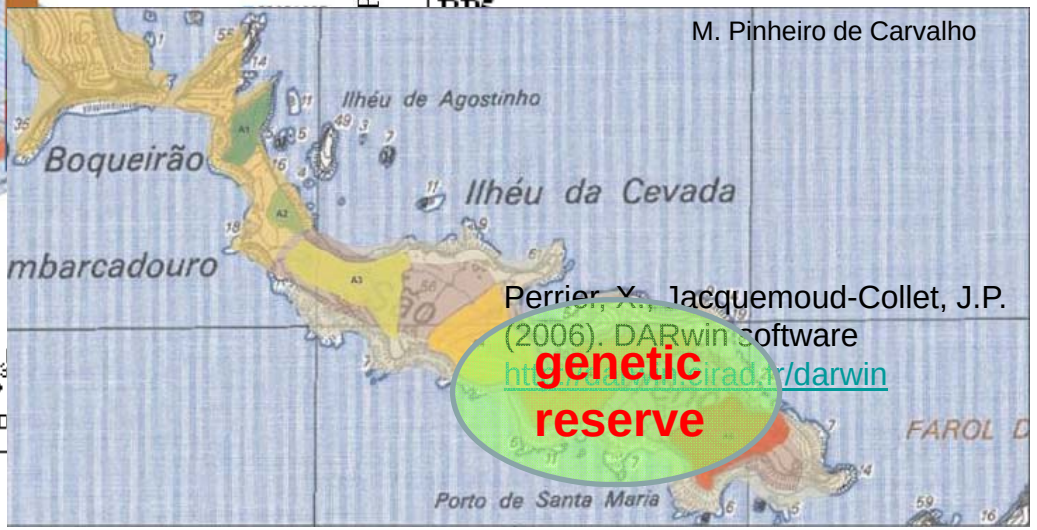
B. patula diversity study

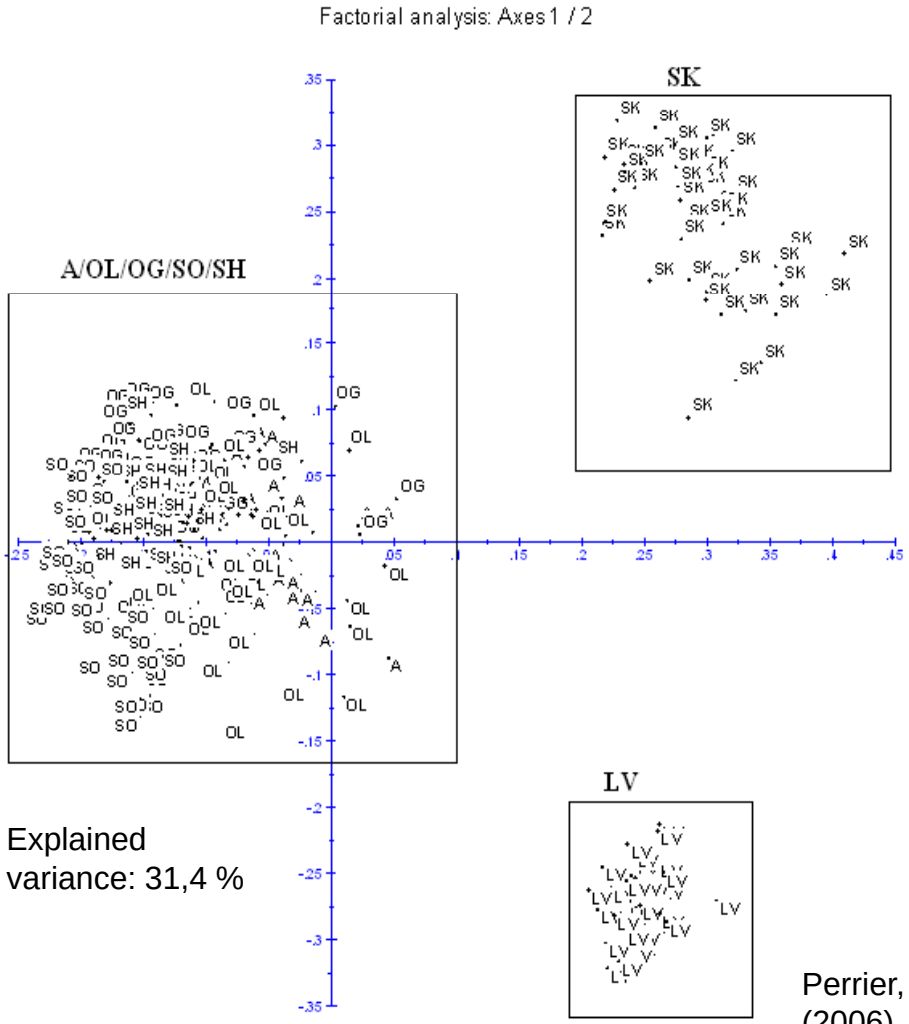


Explained variance:
42,48%



Perrier, X., Jacquemoud-Collet, J.P. (2006). DARwin software http://darwin.cirad.fr/darwin

B. vul. ssp. *maritima* diversity study



Explained variance: 31,4 %

(Google Earth™-Kartenservice)

Perrier, X., Jacquemoud-Collet, J.P. (2006). DARwin software http://darwin.cirad.fr/darwin

B. vul. ssp. *maritima* diversity study

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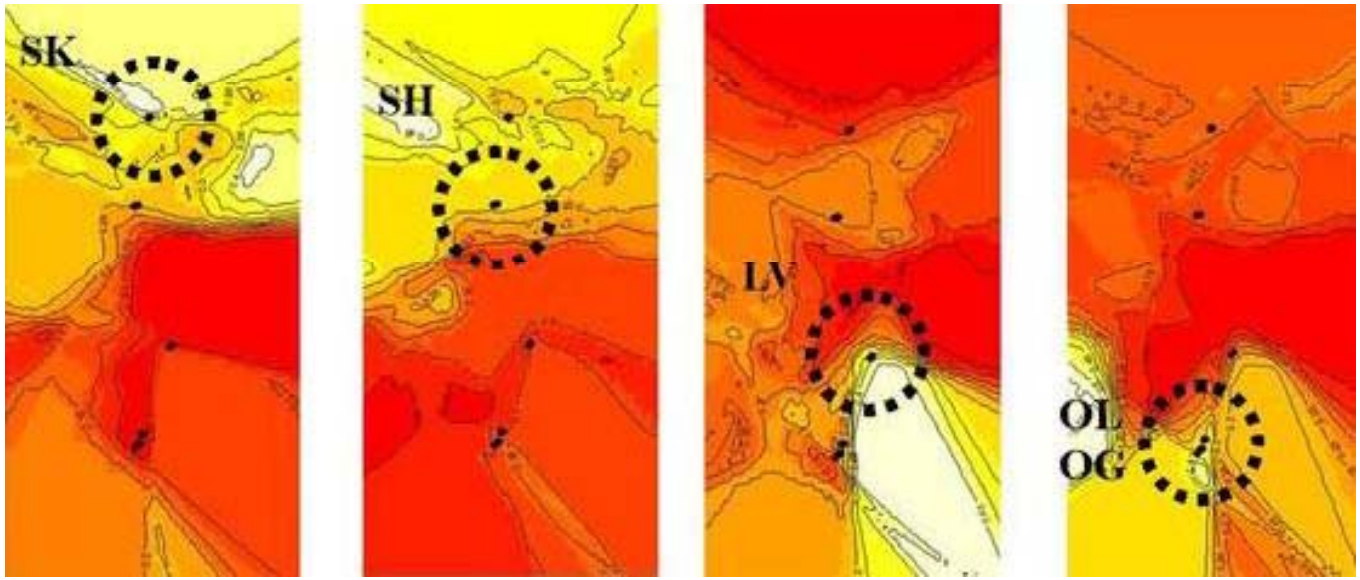
Geneland (Guillot et al. Mol. Ecol. Notes 5, 712-715, 2005)

- assigns individuals to clusters and identifies migrants
- investigates the most likely number of populations
- combines geographic coordinates with a colored probability map of the cluster membership

Probability of the membership of individuals to a cluster



Propability

High Average Low

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Monitoring database

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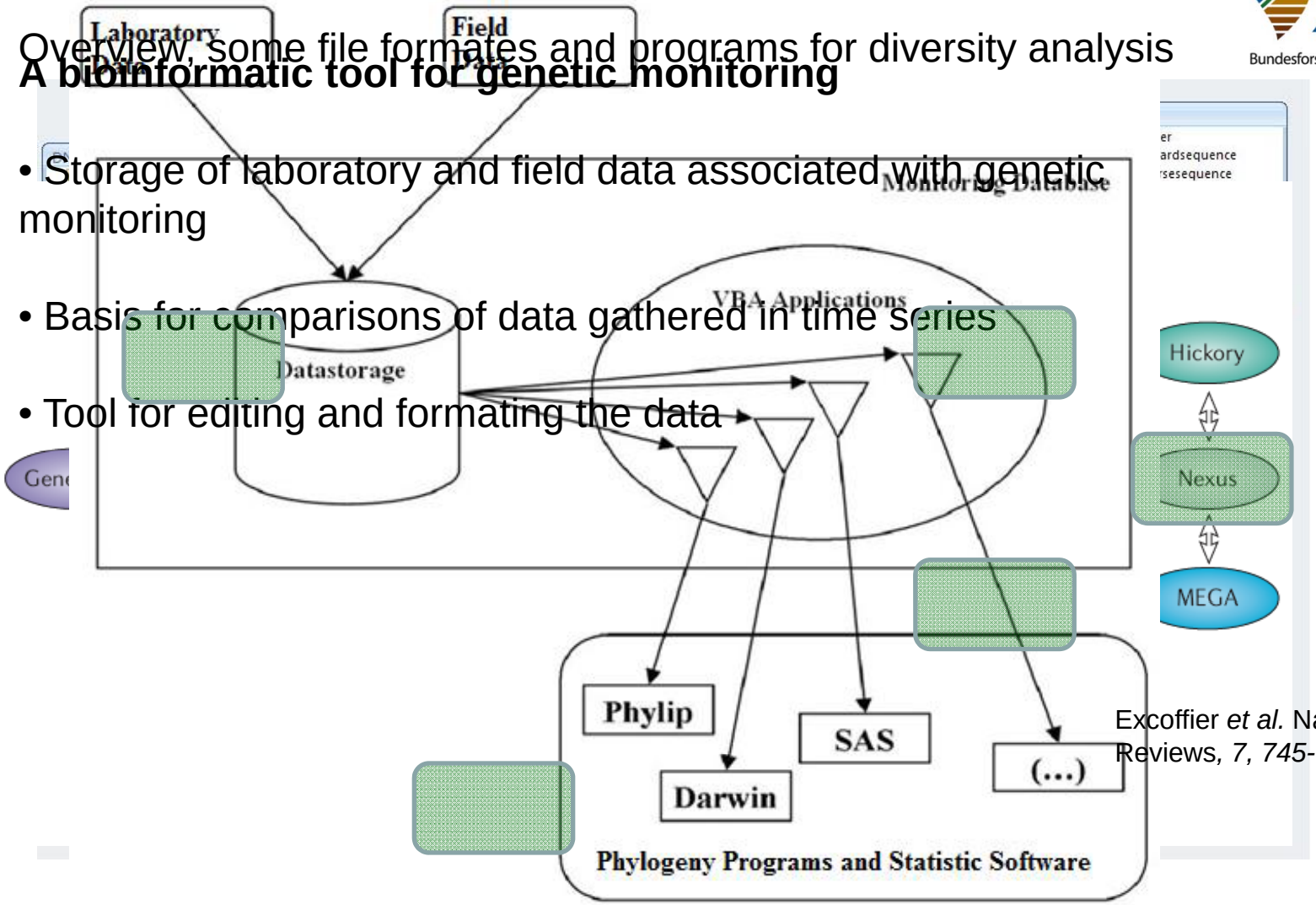
Overview, some file formates and programs for diversity analysis

A bioinformatic tool for genetic monitoring

- Storage of laboratory and field data associated with genetic monitoring
- Basis for comparisons of data gathered in time series
- Tool for editing and formating the data



Excoffier *et al.* Nature Reviews, *7, 745-758,* 2006

Summary

• First description of the geographic patterns of genetic diversity in the wild beet *B. patula*

• Genetic data required as decision criteria for the establishment of a genetic reserve for *B. patula* were produced.

• Consolidation of the knowledge of geographic patterns of genetic diversity in the wild beet *B. vul.* ssp. *maritima*. This gives a baseline for further examinations on the potential influence of the geographic range shift on genetic diversity.

• Development of a database capable to store and process field and laboratory data associated with genetic monitoring

Acknowledgement

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