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ECOMED

Soil and Water Bioengineering in the Mediterranean Ecoregion

Institut de recherche pour le développement

INRA SCIENCE & IMPACT

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Building a Database of Plant Species for Bioengineering in the Mediterranean context

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ORGANIZED BY AEIP Bioingeniería del paisaje · APENA Associação Portuguesa de Engenharia Natural · ECOMED · Co-funded by the Erasmus+ Programme of the European Union · EFIB · Escuela Técnica Superior de Ingeniería de Montes, Forestal y del Medio Natural

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Why create a plant species database for bioengineers?

The purpose of a species database is to help bioengineers choose which plant species to plant on sites subjected to erosion, landslides, with bioengineering structures etc. The database will allow the users to verify or to make decisions about their project at a preliminary stage.

- Species that comprise the natural vegetation communities of a site, in particular those corresponding to the first successional stages, should be the first choice for species selection
- From these species, the bioengineer needs to select those that possess the necessary technical characteristics

Two databases exist in Europe:

Ecological Engineering 99 (2017) 530–534

Contents lists available at ScienceDirect

Ecological Engineering

journal homepage: www.elsevier.com/locate/ecoleng

Short communication

An open access database of plant species useful for controlling soil erosion and substrate mass movement

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Stability v1.0

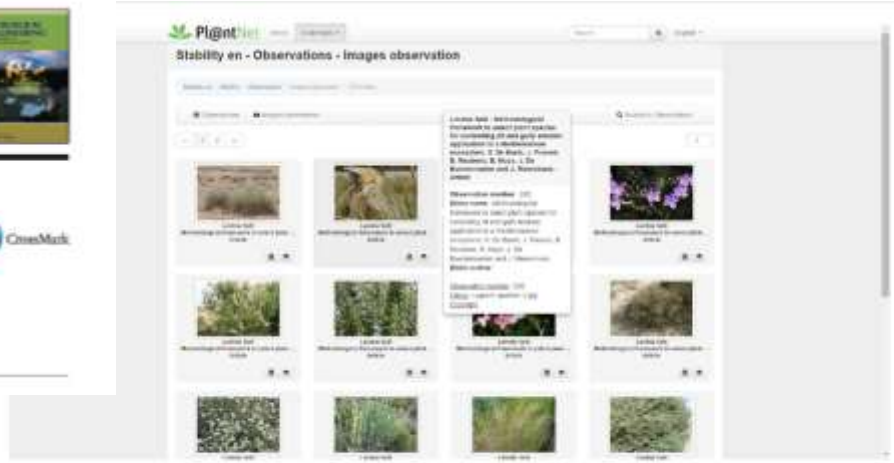

Fig. 2. A tool named PlantNet Publish was developed for simple data searches. Images of plant species included in the database can also be observed, and the name of contributor and associated bibliography will be displayed.

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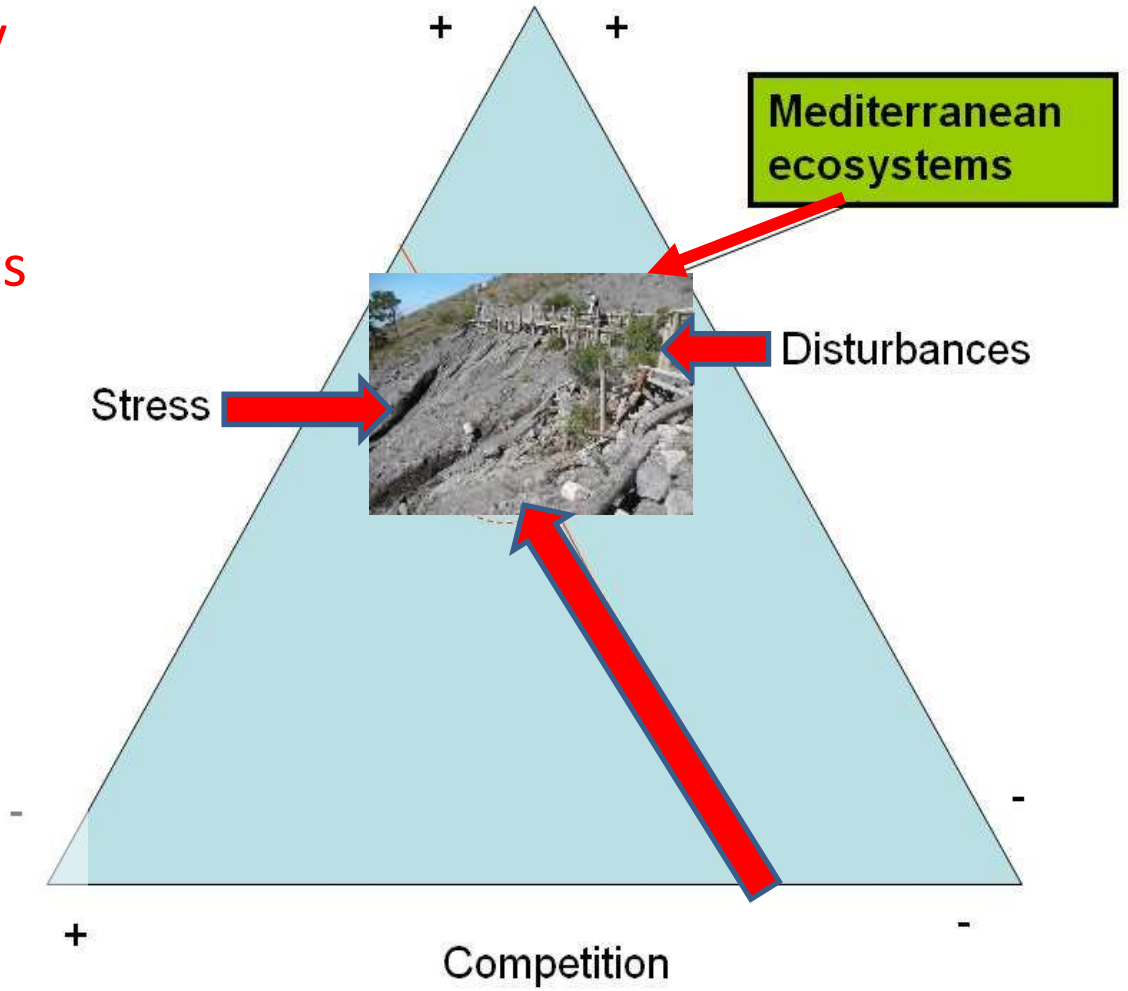
BUT… In Mediterranean areas, stress, disturbance and competition are high

Due to the particularly difficult ecological conditions, establishment of plants is relatively hazardous

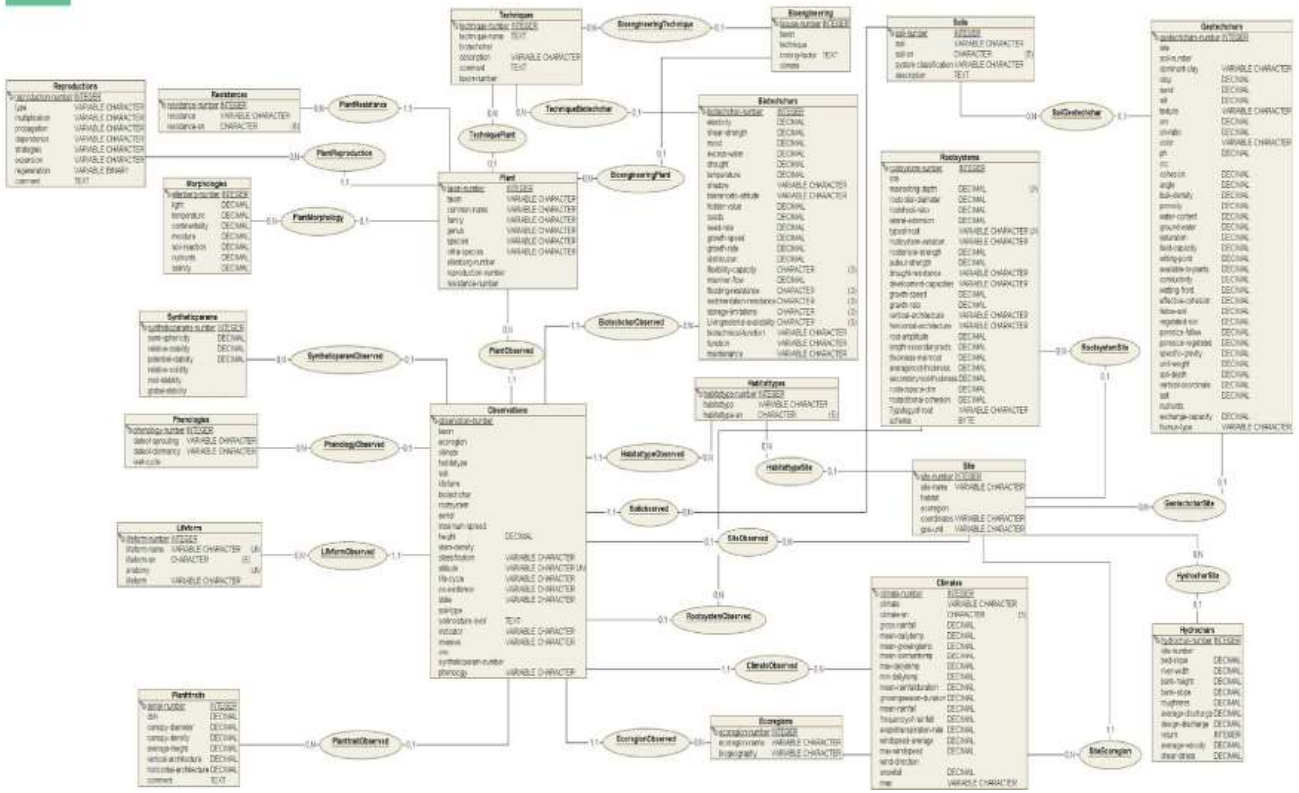
Therefore we need a database dedicated to local species and habitats



Bioengineers, computer scientists and academics have worked together to produce a framework for a new database dedicated to the Mediterranean region

Model of the database

Stability v2.0



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The selection criteria of species adapted to Bioengineering are very diverse:

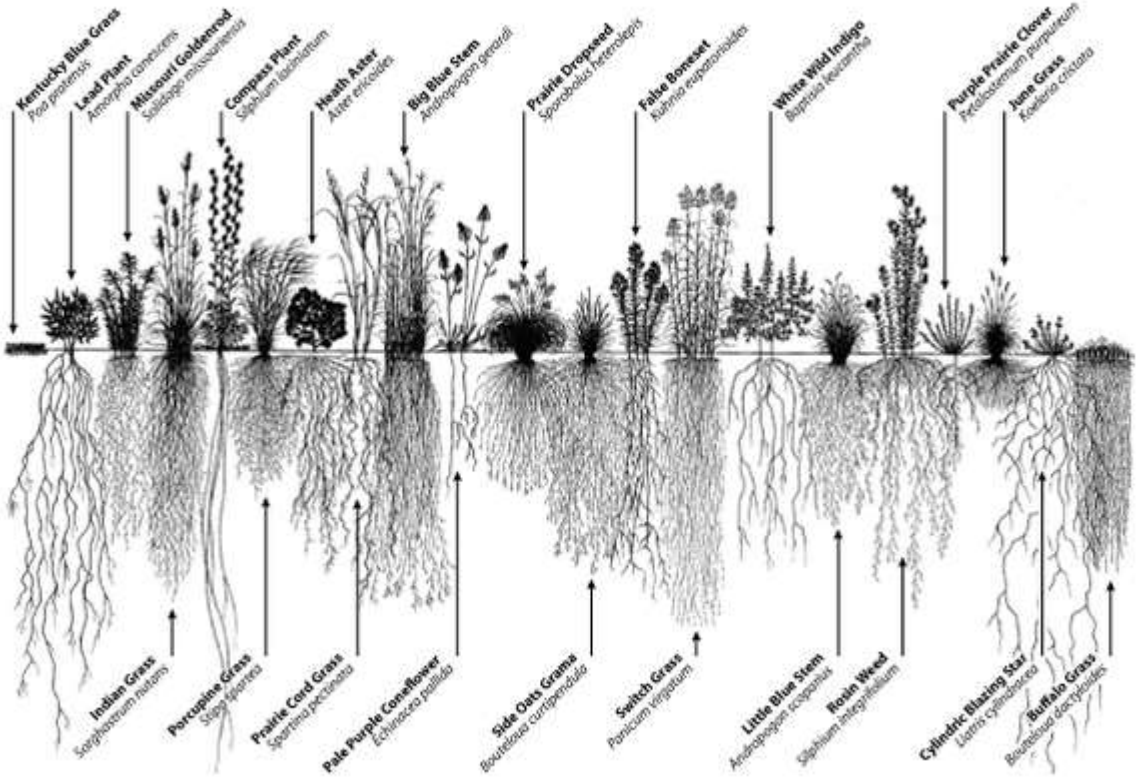
- **Pioneer character** (ecological strategy);
- **Adaptation to the site and the projected ecological community** (functional, ecological and genetic)
- **Adaptation to the local stress factors** (soil and climate)
- **Resistance / resilience to disturbances**
- **Resistance to local pathogens**
- **Guarantee that the selected species combination ensures a balanced succession**
- **Existence of development and dispersal conditions** (mycorrhizae, pollinators, dispersers)
- **Typology of vegetative propagation and establishment** (seed, vegetative cutting, rooted plant, etc.);
- **Availability of establishment material** (ease to obtain and to establish on site or nursery);
- **Establishment and development speed**;
- **Technical functionality** (cover, typologies of root growing and development, influence on the balance of nutrients, absorption and retention of contaminants, etc.)
- **Ease of maintenance**.
- **Correspondence or adaptation to the site**, ensuring that the selected plant material correspond to the ecological conditions of the site and the local vegetation communities and that all plant material is obtained in the vicinity in order to prevent genetic contaminations.

The DB will sample the plants plants suitable for Bioengineering interventions according to habitat, biogeography, soil, technical characteristics (root systems, aerial characteristics, form of implantation and development…), biotechnical functions (cover, consolidation, anchoring, agregation, biodrainage, fertilization and soil improvement…)

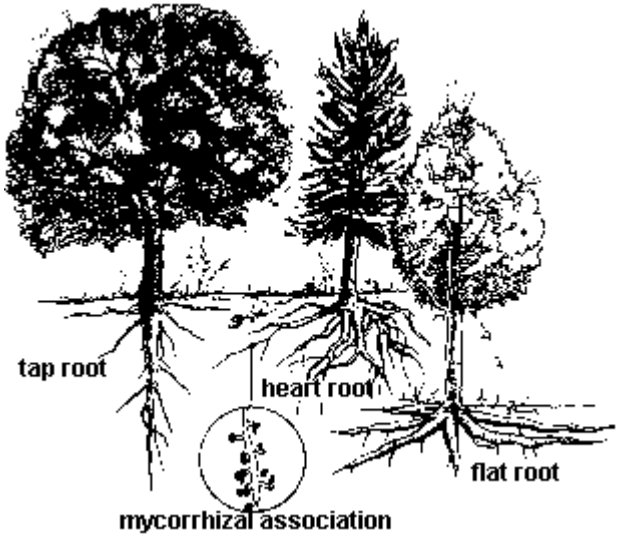
- **Ecological characteristics**
  - Type of habitat and ecological region
  - Indication values (Ellenberg)
  - Biotechnical characteristics
  - Ecological strategies
- **Morphometric characteristics**
  - Leaves, branches and trunk
  - Roots
  - Root parameterization
- **Technical characteristics**
  - As building material
  - Regarding environmental factors

Same species at 1000 m altitude apart

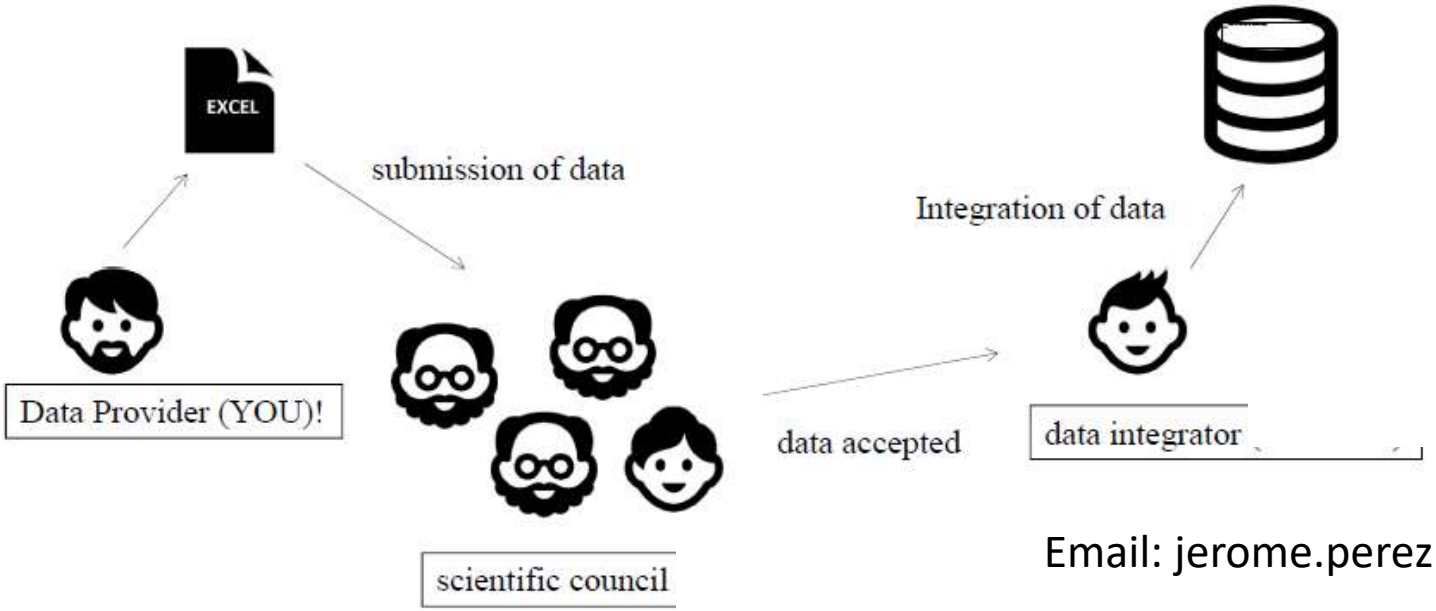
For ex. critical information on roots



But also:
- pull out resistance
- bending ability
- tensile strength
- root thickness
- shallow / deep roots
- root length
- root length density
- root density
- production of adventitious roots
- root clustering
- response of roots to soil stresses
- root decay rate
- root interaction with mychorrizas and other symbionts
- …



Access for maintenance



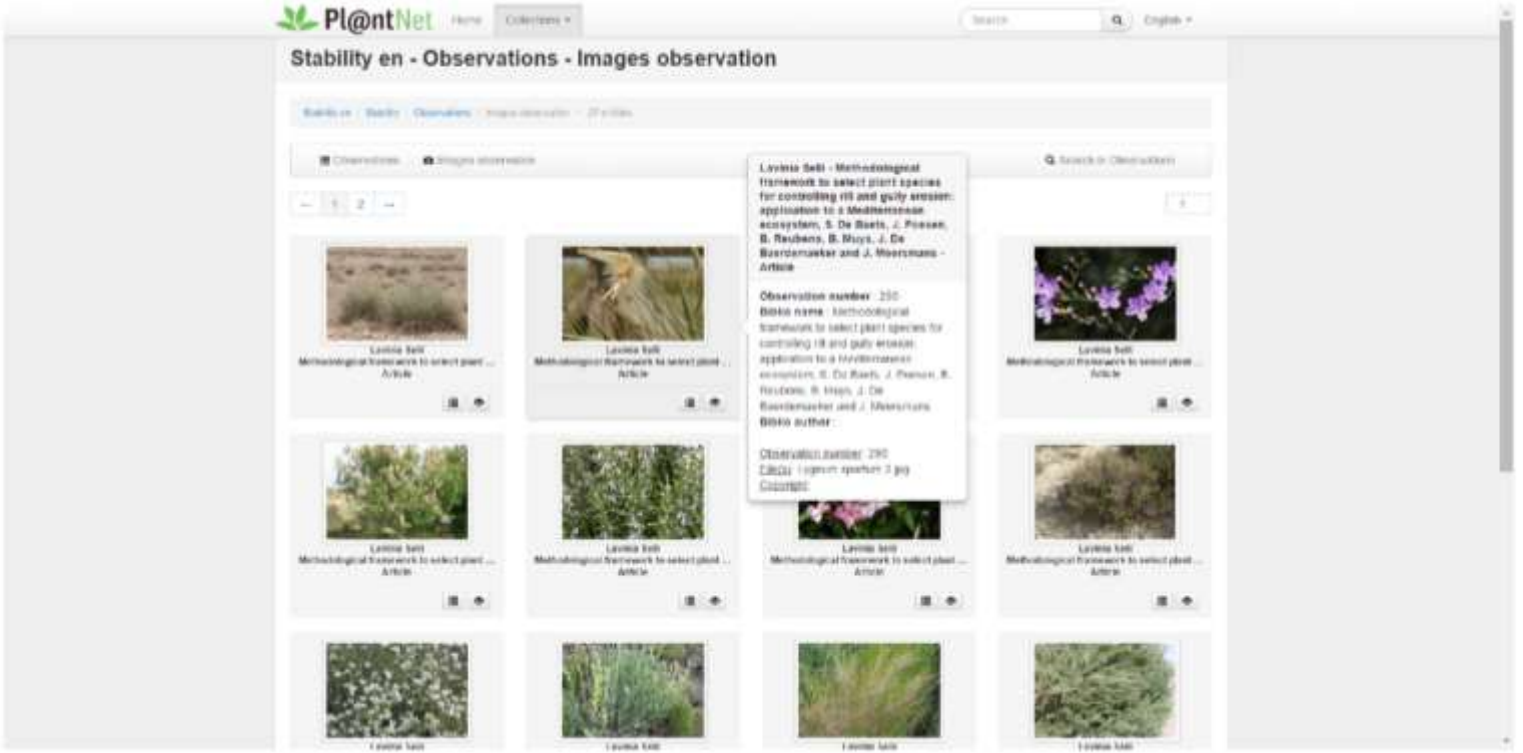
Email: jerome.perez@ird.fr

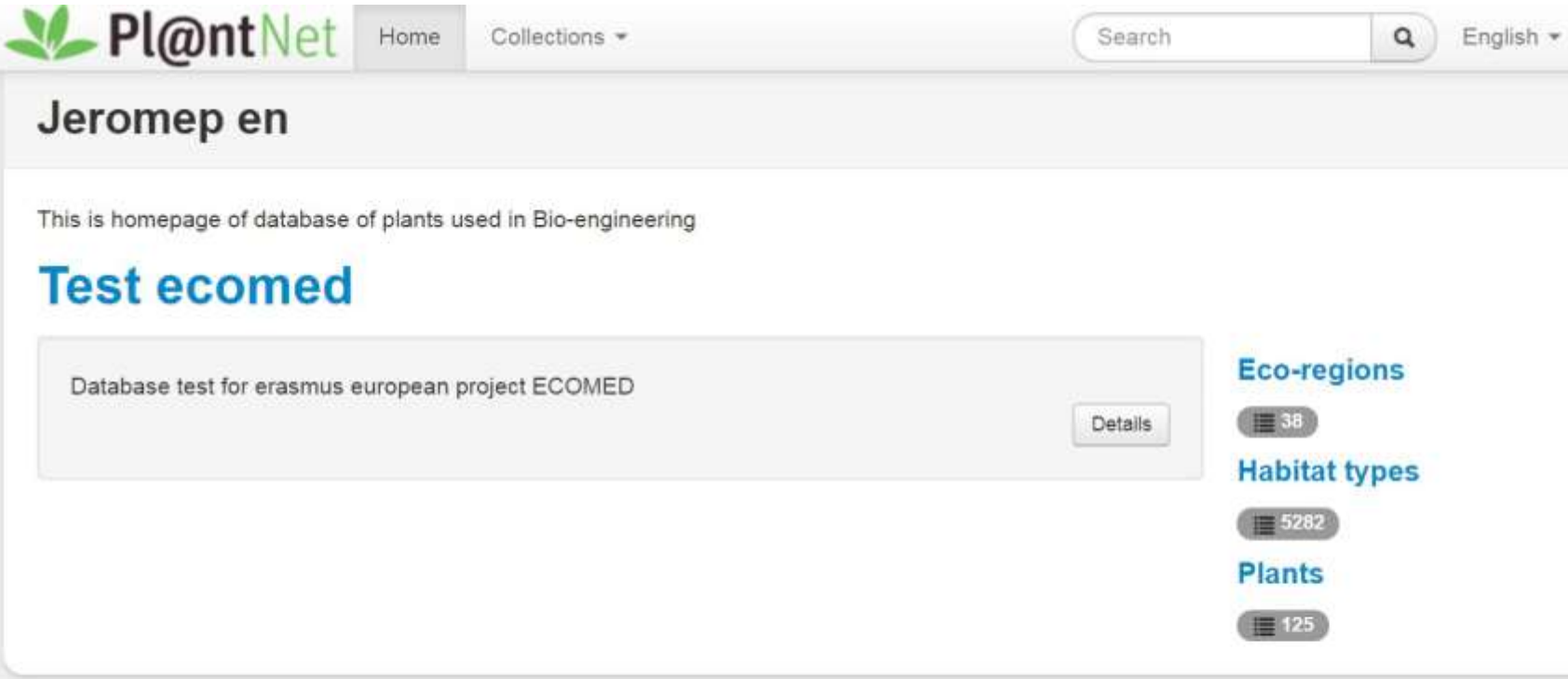
Public access

Please see link on Ecomed website

OR: Email: jerome.perez@ird.fr

End-users can make requests via a web site

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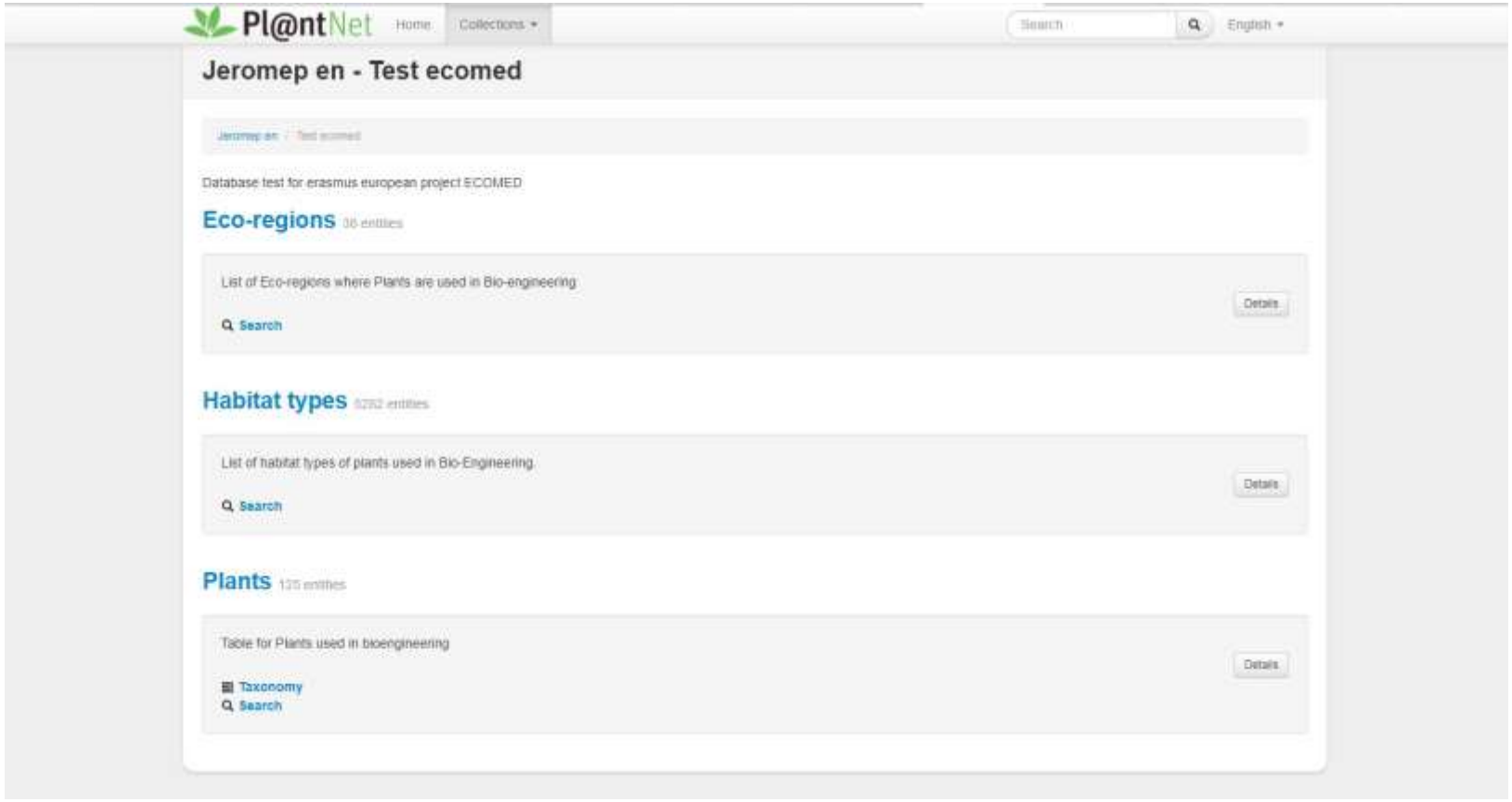

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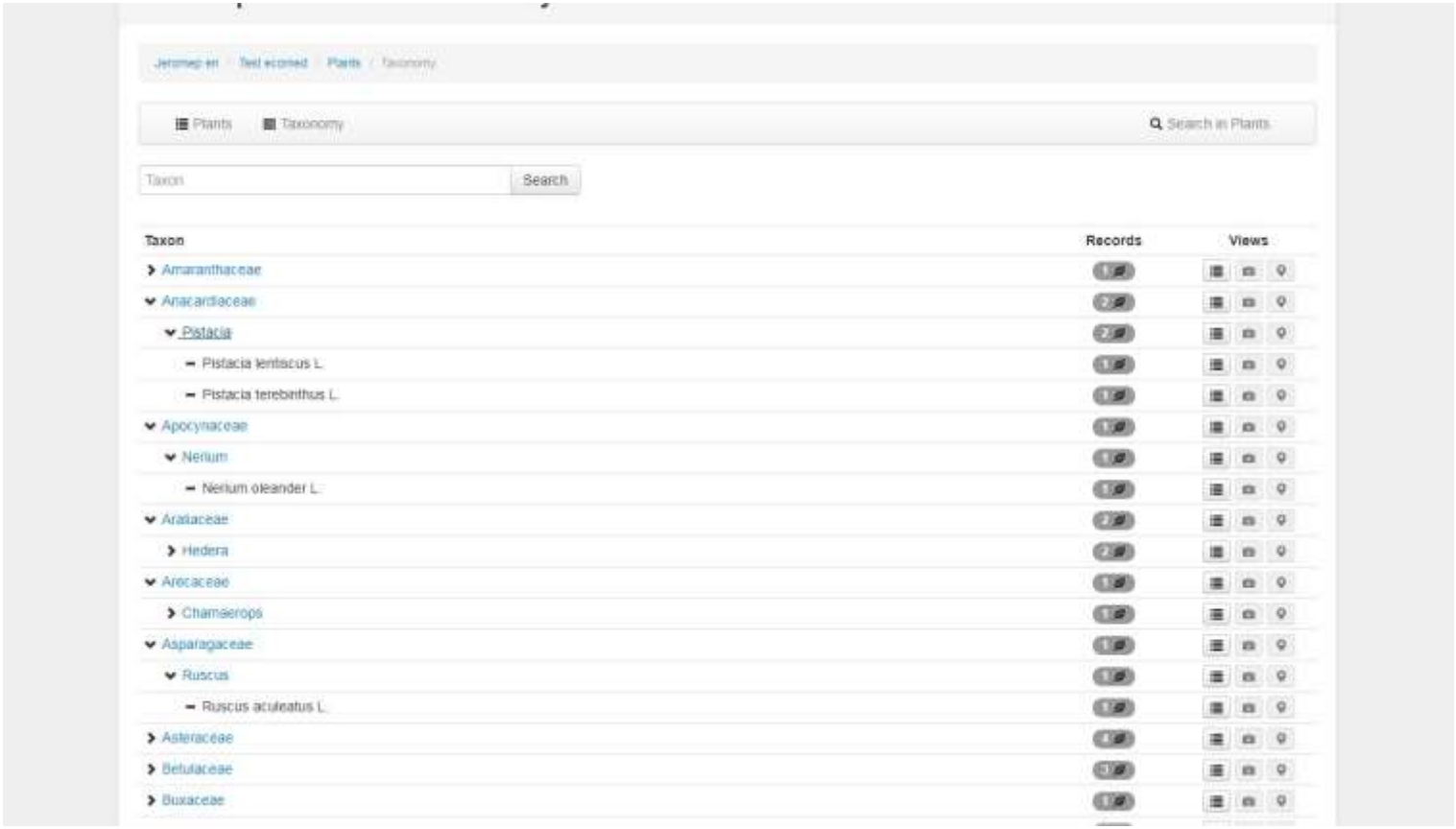
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Pistacia terebinthus L.
Apocynaceae
Nerium
Nerium oleander L.
Araliaceae
Hedera
Arecaceae
Chamaerops
Asparagaceae
Ruscus
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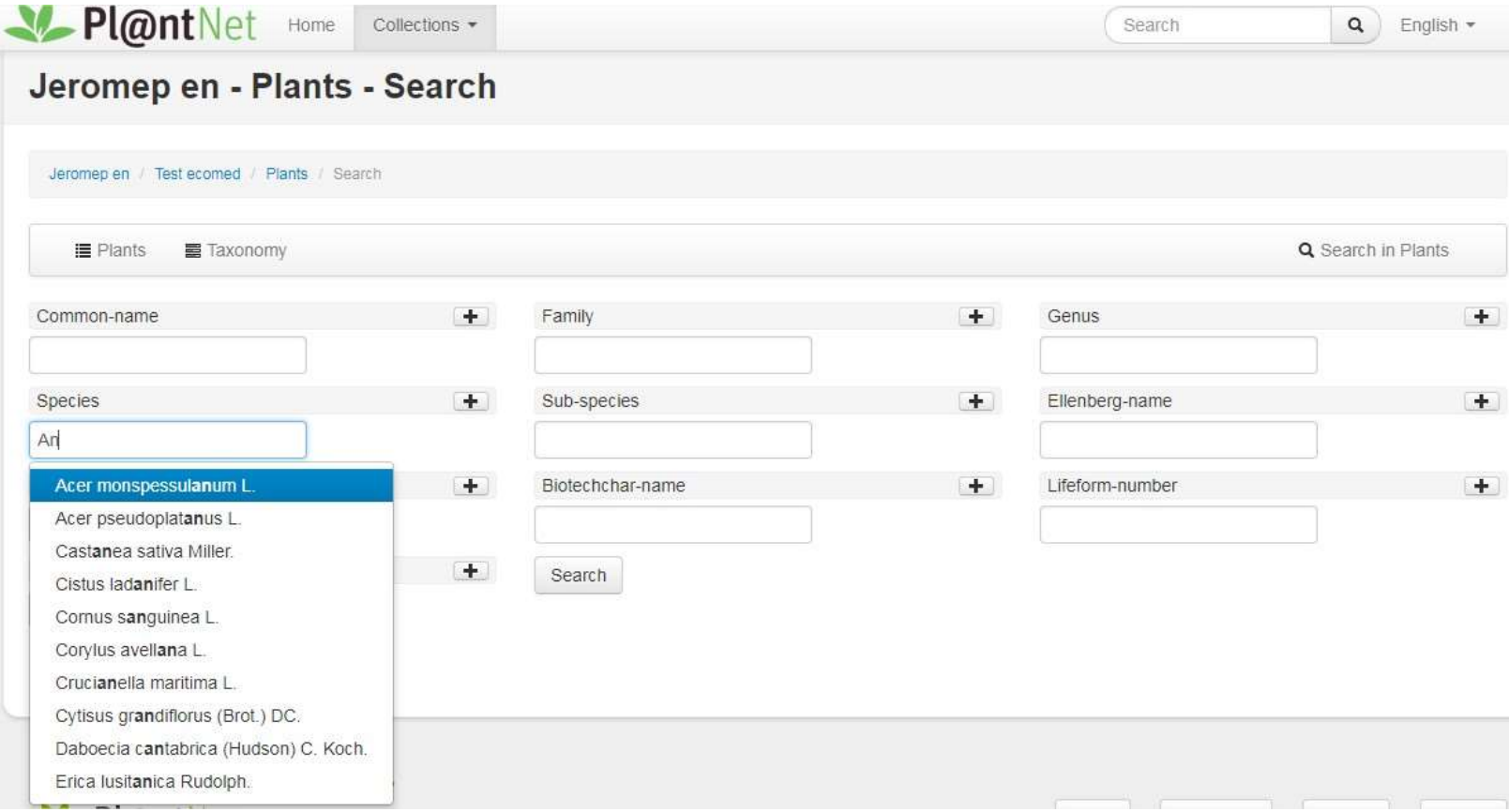
Asteraceae
Betulaceae
Buxaceae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Acer pseudoplatanus L.
Castanea sativa Miller.
Cistus ladanifer L.
Cornus sanguinea L.
Corylus avellana L.
Crucianella maritima L.
Cytisus grandiflorus (Brot.) DC.
Daboecia cantabrica (Hudson) C. Koch.
Erica lusitanica Rudolph.

Important observations

- Only a small percentage of the necessary information is available – therefore all new data must be submitted to introduction
- Data on technical application varies with the site and technical purpose, therefore a diversity of possibilities will be presented
- Field data including sample location and all observed characteristics will also be able to be introduced
- New fields, descriptors and perspectives will be added with the growing experience of use of the database

Thank you for your attention!

A little publicity…

Bern University of Applied Sciences

School of Agricultural, Forest and Food Sciences HAFL

Soil Bio- and Eco-Engineering: The Use of Vegetation to Improve Slope Stability

Bern, Switzerland, June 20-28, 2020

Contact: Dr Massi Schwarz
massimiliano.schwarz@bfh.ch

https://www.hafl.bfh.ch/de/forschung-dienstleistungen/waldwissenschaften/gebirgswald-naturgefahren-und-gis/sbee.html