IMPROVING KNOWLEDGE OF THE BIOLOGY AND ECOLOGY OF *ERYNGIUM VIVIPARUM* FOR ITS CONSERVATION AND REINTRODUCTION

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ERYNGIUM VIVIPARUM : DISTRIBUTION, HABITAT, CONSERVATION STATUS, ...

Eryngium viviparum (Apiacea) is a pioneer endemic plant of European Atlantique regions, growing in seasonally flooded open grasslands. With the loss of a large part of its historic populations, due to human activities (drainage, transformation of agricultural systems) and agricultural abandonment causing a dynamic vegetal closure. *Eryngium viviparum* survives only in disjointed and fragmented localities in the N-W of the Iberian Peninsula and W of France (Figure 1). Actually there is one single known population in France (Belz, Morbihan, Brittany), with an area less than 1000m². For these reasons, the species has been listed as “endangered” at France and European level. In order to improve the conservation status of *Eryngium viviparum* in France, a conservation program including a Ph. D. thesis is implemented as part of a National Action Plan (**Magnanon et al. 2013**). This thesis program, presented here, is a partnership between the research team (EA 2219, geoarchitecture) , the “Conservatoire Botanique" of Brest, technical coordinator of the national action plan in favour of *Eryngium viviparum*, the French site manager "Bretagne vivante“(NGO), and the Departmental Council of Morbihan, with the financial support of the Regional Direction of Environment (Brittany) and the Loire-Brittany Water agency..

ERYNGIUM VIVIPARUM IN FRANCE

- ✓ red list: highly threatened species (EN)
- ✓priority species in Annex II of the Habitats Directive
- ✓ a latest population, isolated and in a small area
- ✓ loss of other populations
- ✓managed and protected area
- ✓ urban environment

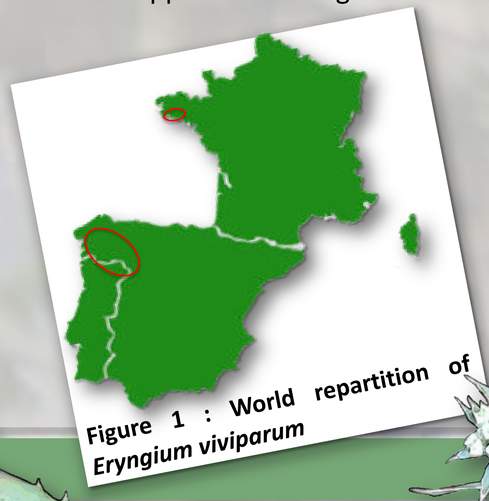


Figure 1 : World repartition of *Eryngium viviparum*

Overview of the french station in flooding period (winter 2015)

AXES OF PH.D – QUESTIONNING AND TOOLS

Through a multidisciplinary approach, the thesis aims to improve the biological and ecological knowledge of the species, including demography, modalities of reproduction and dispersal, as well as the caracterization of the French and Iberian populations genetic structure.

ECOLOGY

What are optimal environmental conditions for *Eryngium viviparum* development ?

- ↳ Precise characterization of the known habitat of *Eryngium viviparum* in France and Iberian Peninsula:
  - *Pedology (soil type)*
  - *Meteorology (influence on the vegetation)*
  - *Hydrology (role and quality of water submersion)*
  - *Topography (identification of heterogeneities)*
- ↳ Cultivation under controlled conditions:
  - behavior test to environmental stress

DYNAMIC & REPRODUCTION

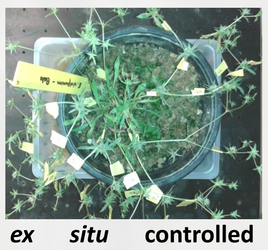
Species demography ?

- ↳ Demographic monitoring:
  - survival by age class
  - phenology
  - recruitment
- ↳ Predictive evolution according life-cycle of *Eryngium viviparum*

Mode of reproduction? Mode of dispersal ?

- ↳ -germination process
  -seed survival in the soil seed bank
  -controlled pollination tests
  -effectiveness of sexual and asexual reproduction
  -identification of pollinators
  -role of grazing

permanent quadrat to locate individuals *in situ*



***ex situ* controlled reproduction test**

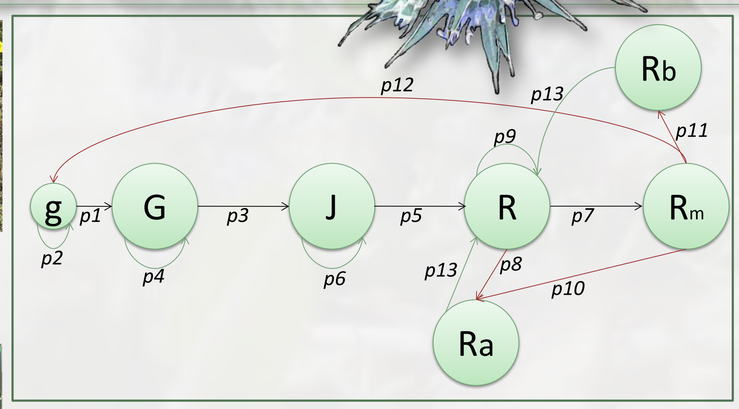


Figure 3: Theorical and simplified life-cycle of *Eryngium viviparum*

G : germination
J : young rosette
R : rosette
Rm : flowering rosette
Ra : individual from bud leaf base
Rb : individual from bud bract base
p : probability of transition

GENETICS

French and Iberian populations homogeneity ?

- ↳ Studies of karyotype, genome size, genetic homogeneity and inheritance (NAD, TrnK, ITS)

Interpopulational genetic diversity and relationship ?

- ↳ Use of microsatellite markers, highly polymorphic DNA sequences, with European sampling

Genetic diversity and population health in Belz ?

- ↳ Use of microsatellite markers, and finer sampling, to detect or not polymorphism

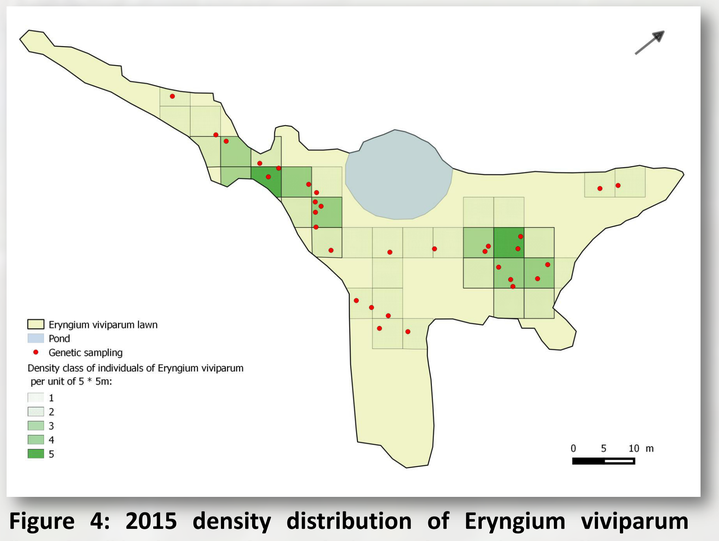


Figure 4: 2015 density distribution of Eryngium viviparum "patches“ in the French population and genetic sampling

RESTORATION & REINTRODUCTION

A reintroduction project is also envisaged as part of the national action plan, involving reintroduction experiments starting this year (autumn 2015) on two historical stations of the species. Such experimentation will help develop a functional method of reintroduction, by answering the following questions:

Where to reintroduce?

- ↳ - historic or new sites ?
  - priority to managed and monitored sites

What to reintroduce ?

- ↳ - seeds, young individuals, adults, or propagules ?
  - French or Spanish genetic origin ?

How ?

- ↳ - site preparation before implantation
  - test of differents ecological conditions and seasons
  - regular monitoring after implantation

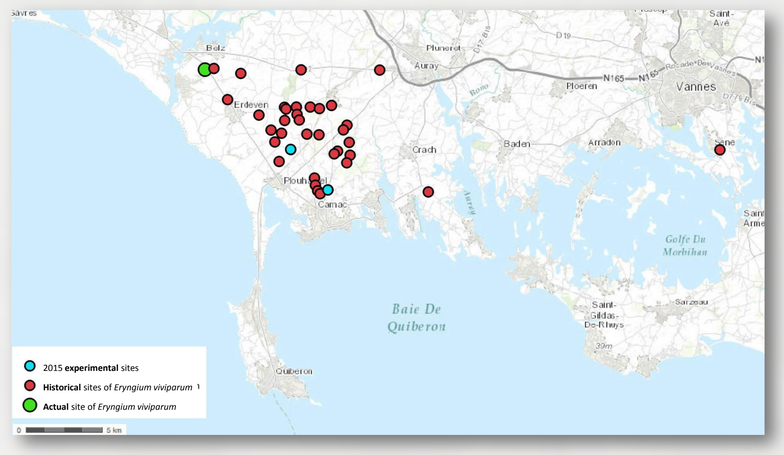


Figure 5: Actual, historical and 2015 experimental sites repartition of *Eryngium viviparum* in France, (PNA data; Geoportail base map)

CONCLUSION

As well as supporting and enhancing existing information, the data collected during this study will bring key elements on the functioning of *Eryngium viviparum* populations, its ecology and its history. These data will allow to develop a method of preservation, restoration and monitoring population in order to establish a long term sustainable and viable metapopulation of the species in France.

PARTNERS:

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REFERENCES: **Magnanon S., Guillevic Y., Hardegen M. 2013.** Plan national d'actions en faveur du Panicaut vivipare, Eryngium viviparum J. Gay. 2012-2017. Paris, ministère de l'Ecologie, du Développement durable et de l'Énergie. 92p.