



# Adaptation of sub-Antarctic plants to climate change, soil-plant dynamics and trajectories



Projet IPEV 1116



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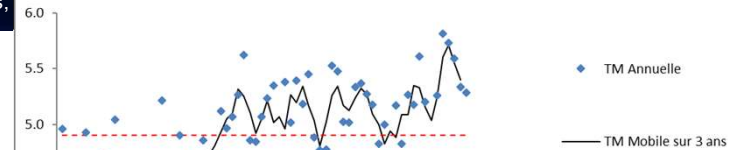


# Iles Kerguelen, sentinels of climate change

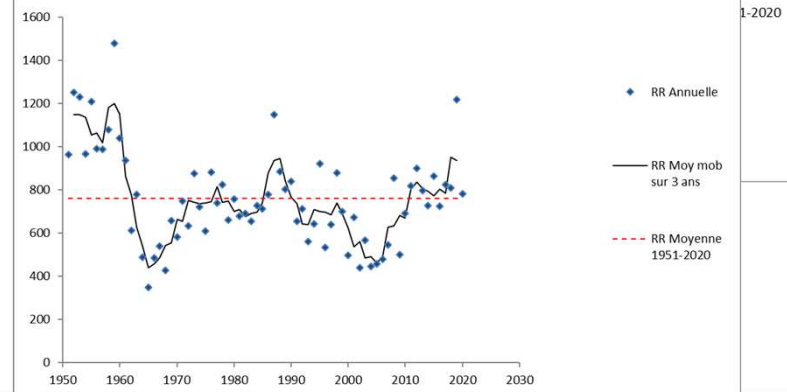


Nasa, Modis,

Température moyenne (°C) à Port aux Français, Iles Kerguelen  
données Météo-France de 1951 à 2020, compilées par UMR 6553 ECOBIO



Pluviométrie (RR) annuelle (mm) à Port aux Français, Iles Kerguelen  
données Météo-France 1951-2020, compilées par UMR 6553 ECOBIO



- Sub-Antarctic region, below the Polar Front
- Cold climate  $\leq 10^{\circ}\text{C}$  and windy all year round
- Rapid climate warming and drying



# Kerguelen biodiversity and ecosystem

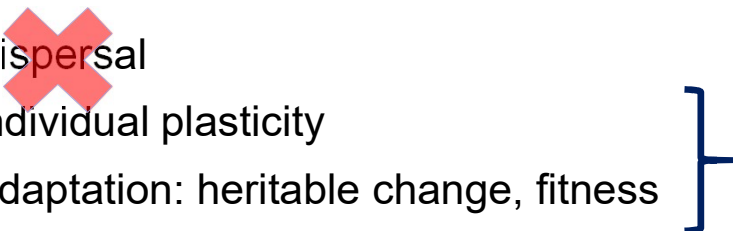
- Only 22 native plant species (e.g. 15000 plant sp. in Europe !)
- BUT 6 endemics (\*) of the SIOP
- Keys, long evolutionary history of the southern flora; patrimonial interest



(\*) Species restricted to a specified region or locality – UN, 1997

# Plant species' responses to climate change

## Islands, climate change

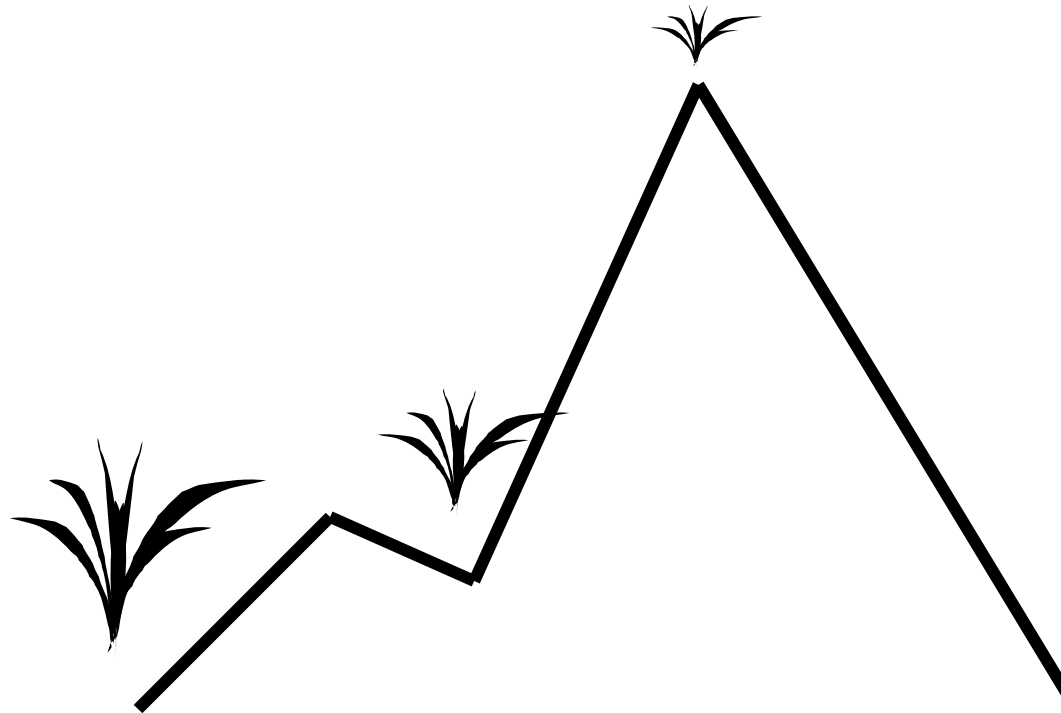
1. Dispersal
  2. Individual plasticity
  3. Adaptation: heritable change, fitness
- 

Holobiont : plant with its microbial communities, above- and below-ground

Role in plant adaptation to environmental change ?

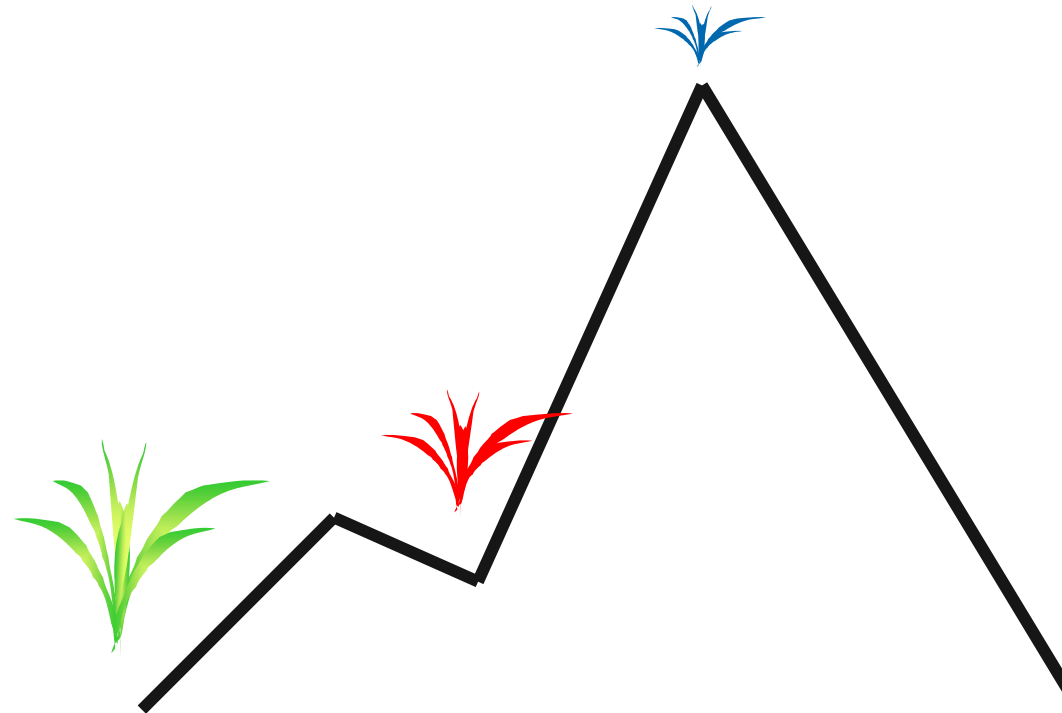
# Adaptation and phenotypic plasticity

**Observation:** traits are different depending on the environment



# Adaptation and phenotypic plasticity

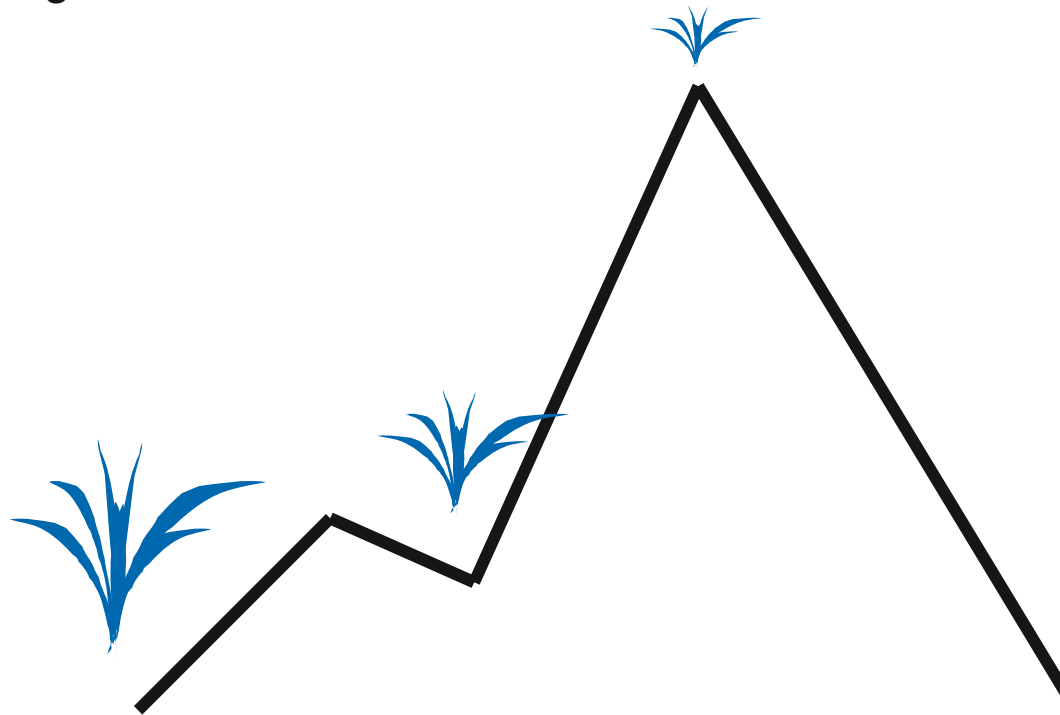
- Observation:** traits are different depending on the environment
- Genetic adaptation to local conditions: different genotypes depending on conditions



# Adaptation and phenotypic plasticity

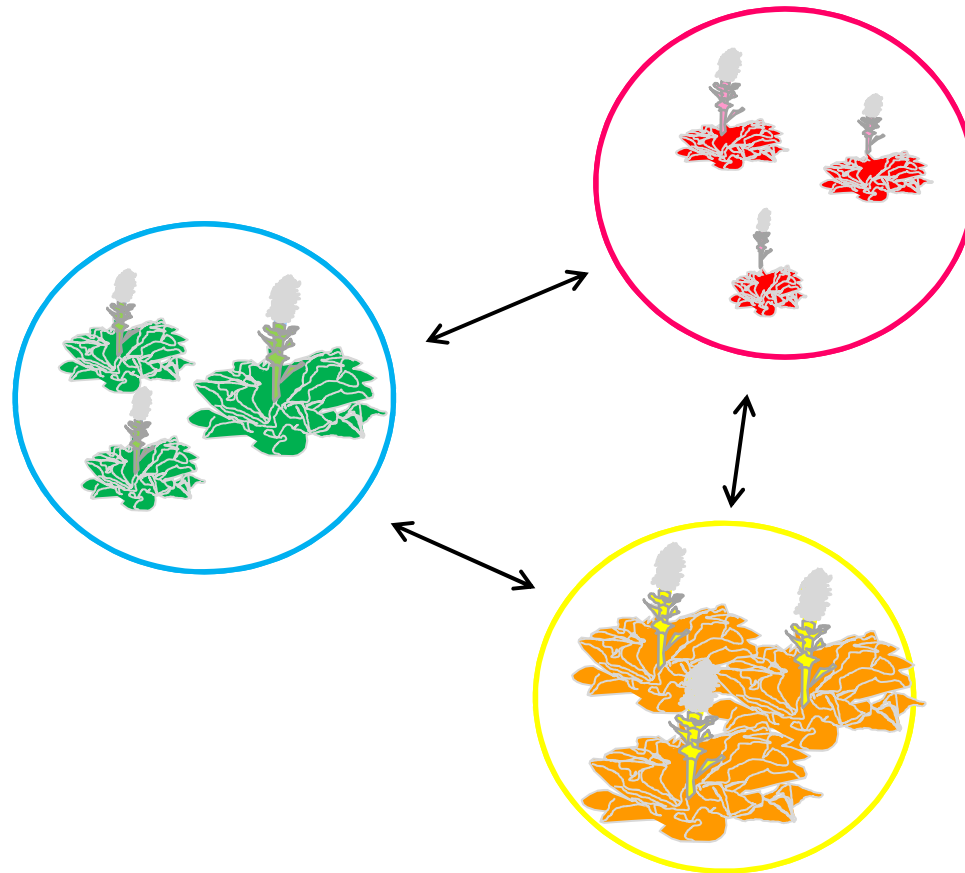
**Observation:** traits are different depending on the environment

- Genetic adaptation to local conditions: different genotypes depending on conditions
- Phenotypic plasticity: ability of a genotype to express different phenotypes depending on conditions



# Plant species' responses to climate change

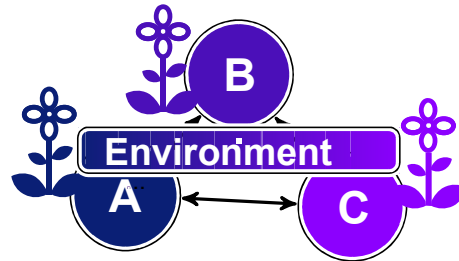
**Observation :** Phenotypic trait variability  
Inter- , intra-population





# Adaptation and phenotypic plasticity

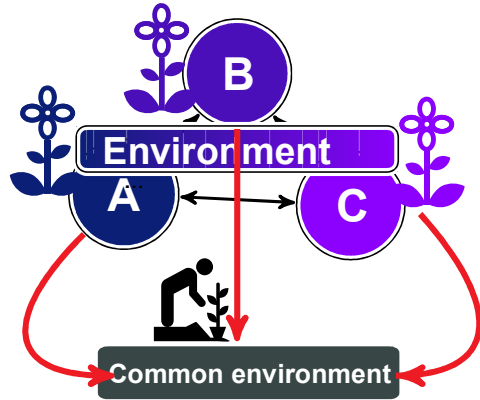
**The solution:** the Common Garden Experiment



Pierre de Villemereuil

# Adaptation and phenotypic plasticity

**The solution:** the Common Garden Experiment



Pierre de Villemereuil

- (Semi-)experimental environment
- Progeny from different natural populations



Uniformity: phenotypic plasticity



Variability: genetic differences between populations

# PlantADAPT: Adaptation, soil-plant dynamics and trajectories



Common garden Experiment

Plasticity / genetic adaptation ?

Niche change

Holobiont adaptation

F. Hennion



C. Bertrand

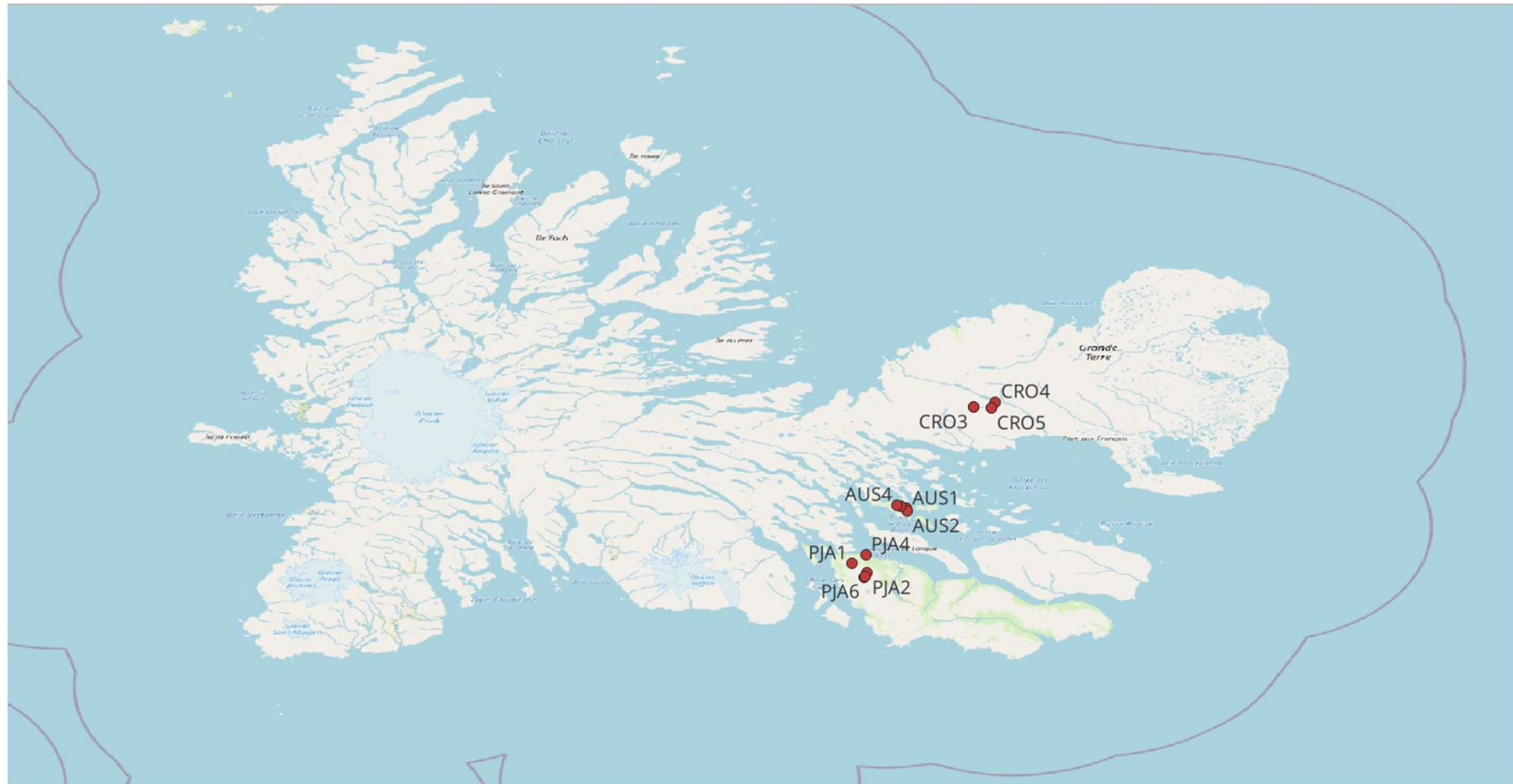


F. Binet



## Set-up of stations

PhD, F. Binet, R.  
Marmeisse, F.Hennion





F. Hennion



C. Bertrand



F. Binet



## Set-up of stations





F. Hennion



C. Bertrand



F. Binet



## Set-up of stations

### Ile Australia



*Lyallia kerguelensis*





F. Hennion



C. Bertrand



F. Binet



## Set-up of stations

Mont Crozier

*Poa kerguelensis*



*Poa cookii*





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C. Bertrand



F. Binet



## Set-up of stations





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## Established station





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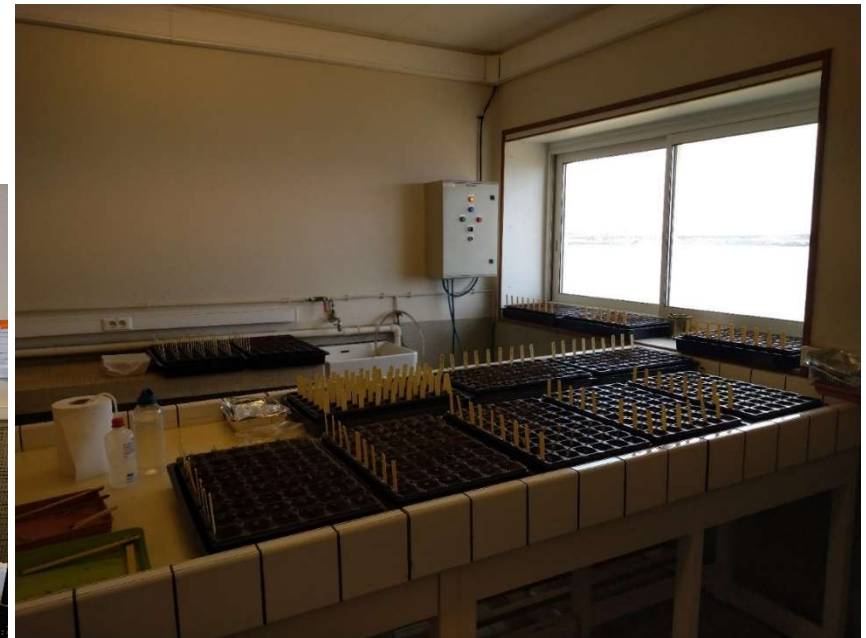
C. Bertrand



F. Binet



## Cutting and planting





F. Hennion



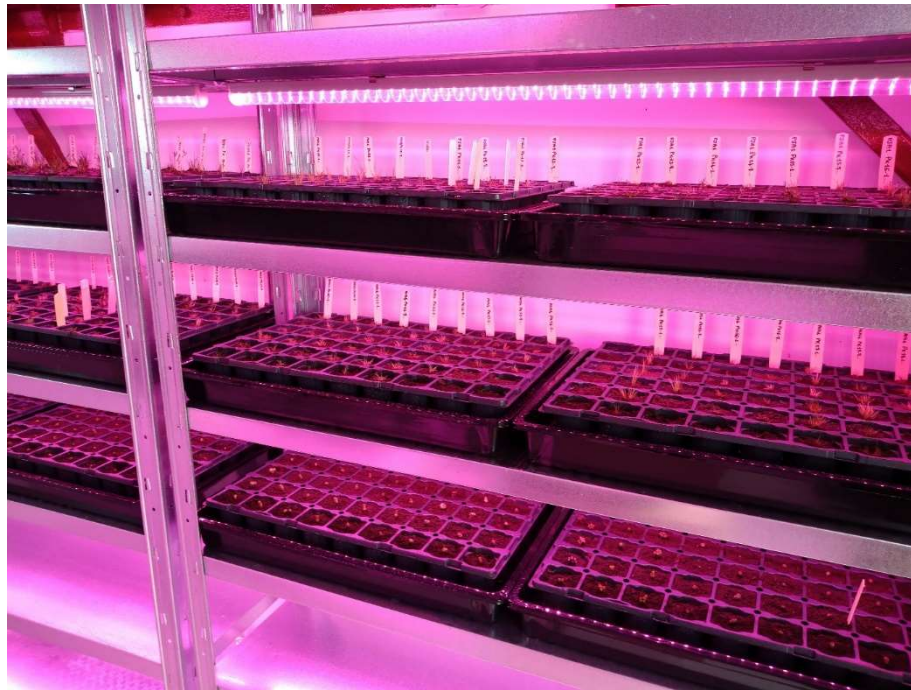
C. Bertrand



F. Binet



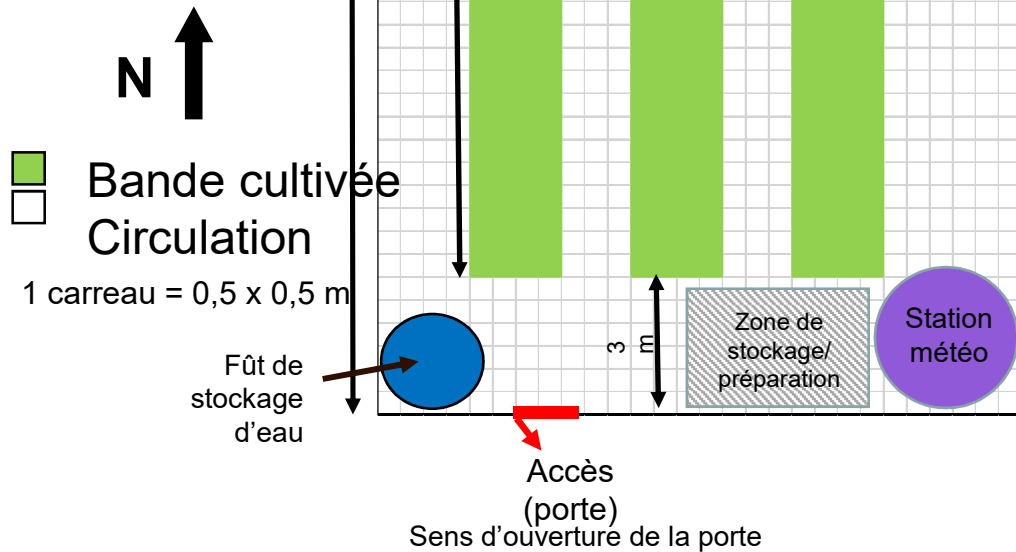
## In-door cultivating



> 1200 cuttings



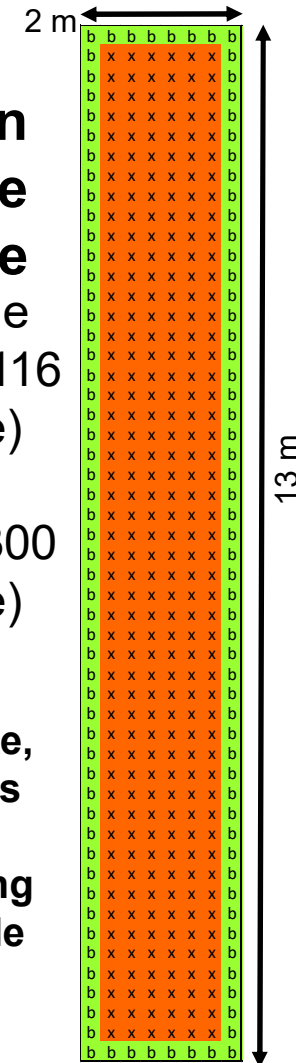
## Plan général d'un jardin - Station météo dans le jardin



## Plan d'une bande

**b** : plante de bordure (116 par bande)  
**x** : plante étudiée (300 par bande)

En cas de terrain en pente, orientation des bandes cultivées le long des courbes de niveau

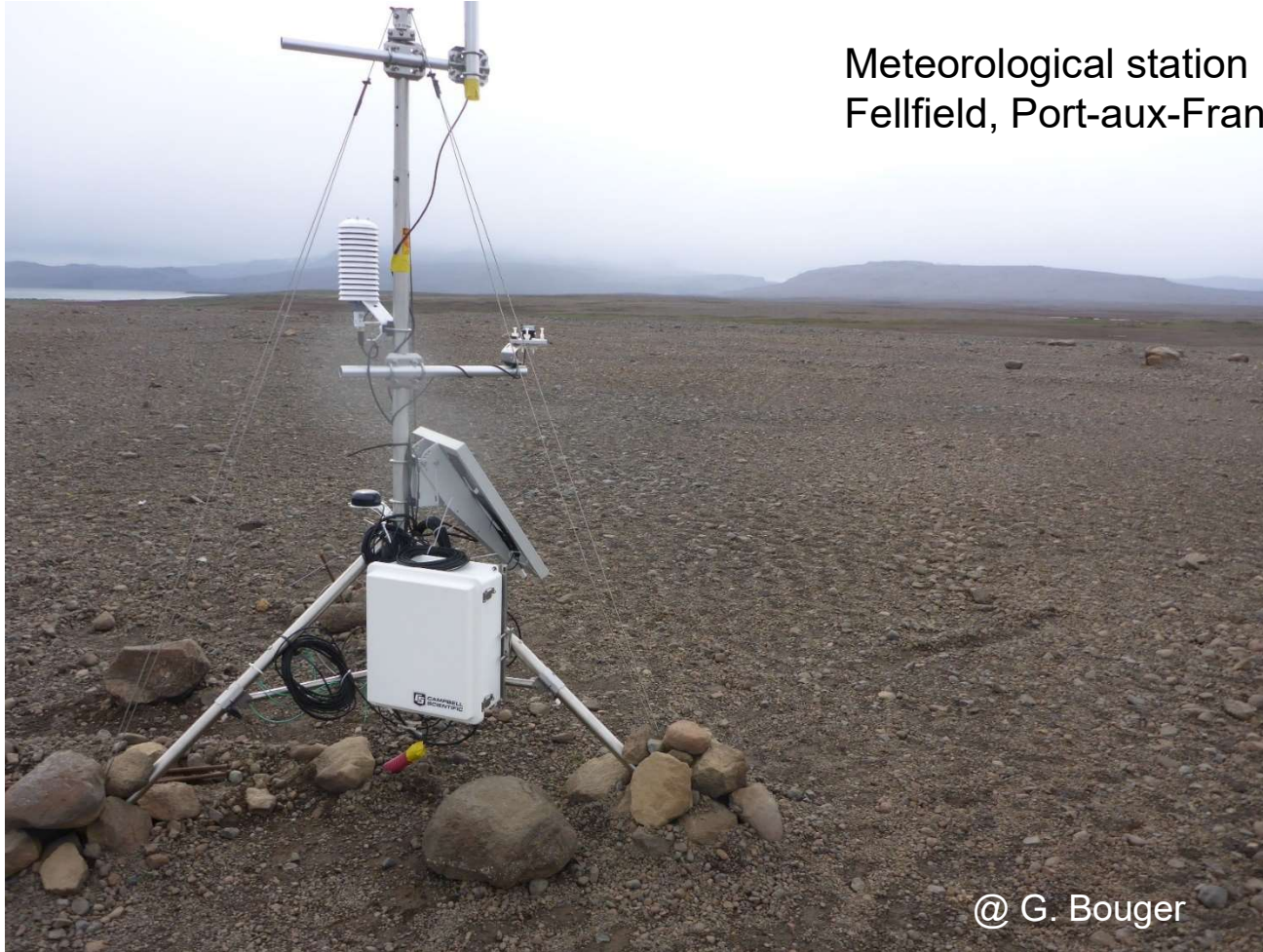




# PlantADAPT: common gardens



# PlantADAPT: common gardens



Meteorological station  
Fellfield, Port-aux-Français

@ G. Bouger





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Thank you for your attention!