



**HAL**  
open science

## Genetic architecture of water use efficiency and related traits in maritime pine

Marina de Miguel, Hélène Lagraulet, Justine Laoue, Raphael Segura, Régis R. Burlett, Jérôme Bartholomé, Laurent Bouffier, Grégoire G. Le Provost, I. Aranda, M.T. Cervera, et al.

### ► To cite this version:

Marina de Miguel, Hélène Lagraulet, Justine Laoue, Raphael Segura, Régis R. Burlett, et al.. Genetic architecture of water use efficiency and related traits in maritime pine. Genomics and Forest Tree Genetics Conference, May 2016, Arcachon, France. , 134 p., 2016, Book of abstracts. hal-02742744

HAL Id: hal-02742744

<https://hal.inrae.fr/hal-02742744v1>

Submitted on 2 Oct 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License



# Genetic architecture of water use efficiency and related traits in maritime pine

de Miguel M<sup>1</sup>, Lagraulet H<sup>1</sup>, Laoué J<sup>1</sup>, Segura R<sup>1</sup>, Burlett R<sup>1</sup>, Bartholomé J<sup>1</sup>, Bouffier L<sup>1</sup>, Le Provost G<sup>1</sup>, Aranda I<sup>2</sup>, Cervera M-T<sup>2</sup>, Marguerit E<sup>3</sup>, Brendel O<sup>4</sup>, Gion J-M<sup>1,5</sup>, Plomion C<sup>1</sup>, Porté A<sup>1</sup>.

<sup>1</sup>BIOGECO, INRA, Univ. Bordeaux, 33610, Cestas, France; <sup>2</sup>INIA-CIFOR, Ctra. de la Coruña km 7.5, 28040, Madrid, Espagne; <sup>3</sup>ISVV, INRA, Univ. Bordeaux, 33140, Villenave d'Ornon, France; <sup>4</sup>EEF, INRA, Nancy Université, 54280 Champenoux, France; <sup>5</sup>AGAP, CIRAD, 33612 Cestas, France.

## Introduction:

✓ Water use efficiency (WUE), a trait related to plant water economy, could be important in water-scarce environments since it allows maximizing growth with regard to the amount of water available.

✓ However, the adaptive value of WUE in maritime pine is still a matter of debate as no clear correlation of this trait with biomass production or environmental conditions has been determined [1,2].

$$WUE = \frac{\text{Carbon assimilated}}{\text{Water lost}}$$

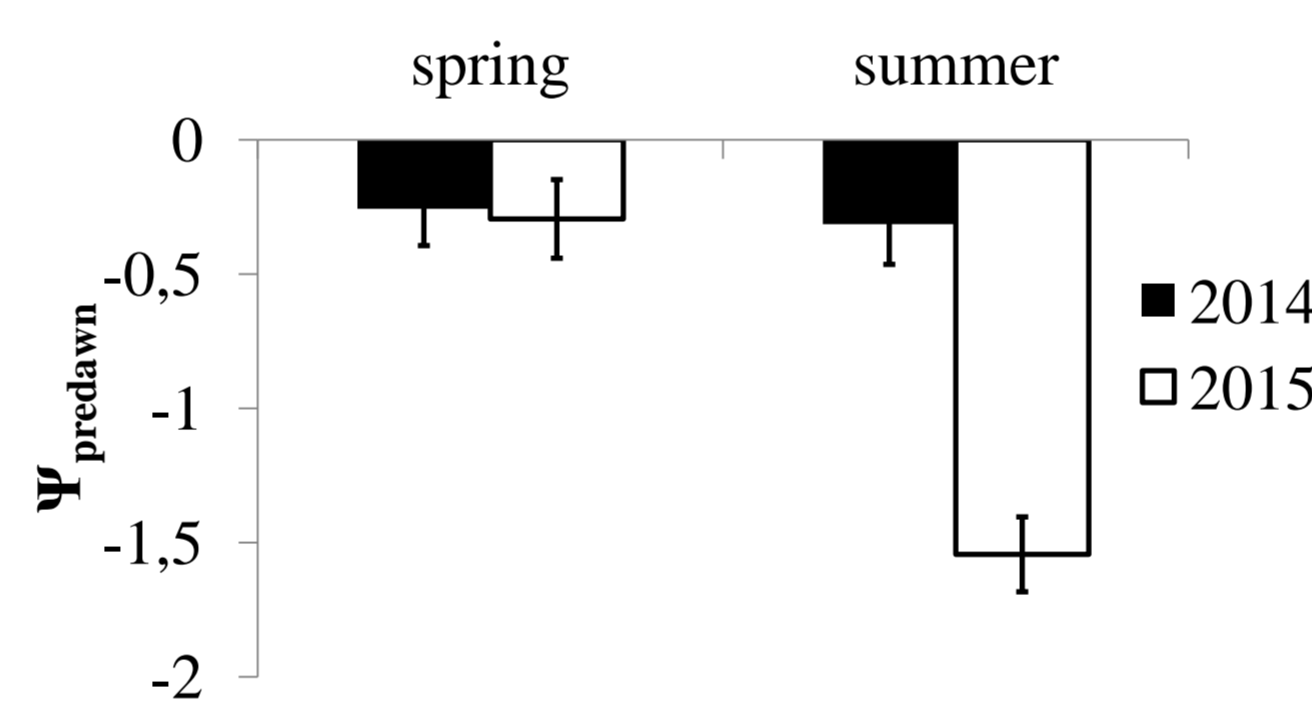
### Objectives:

- Study the relationship between WUE and photosynthesis related traits
- Disentangle the genetic architecture of these complex functional traits.

- ✓ across different years
- ✓ at different levels of water availability

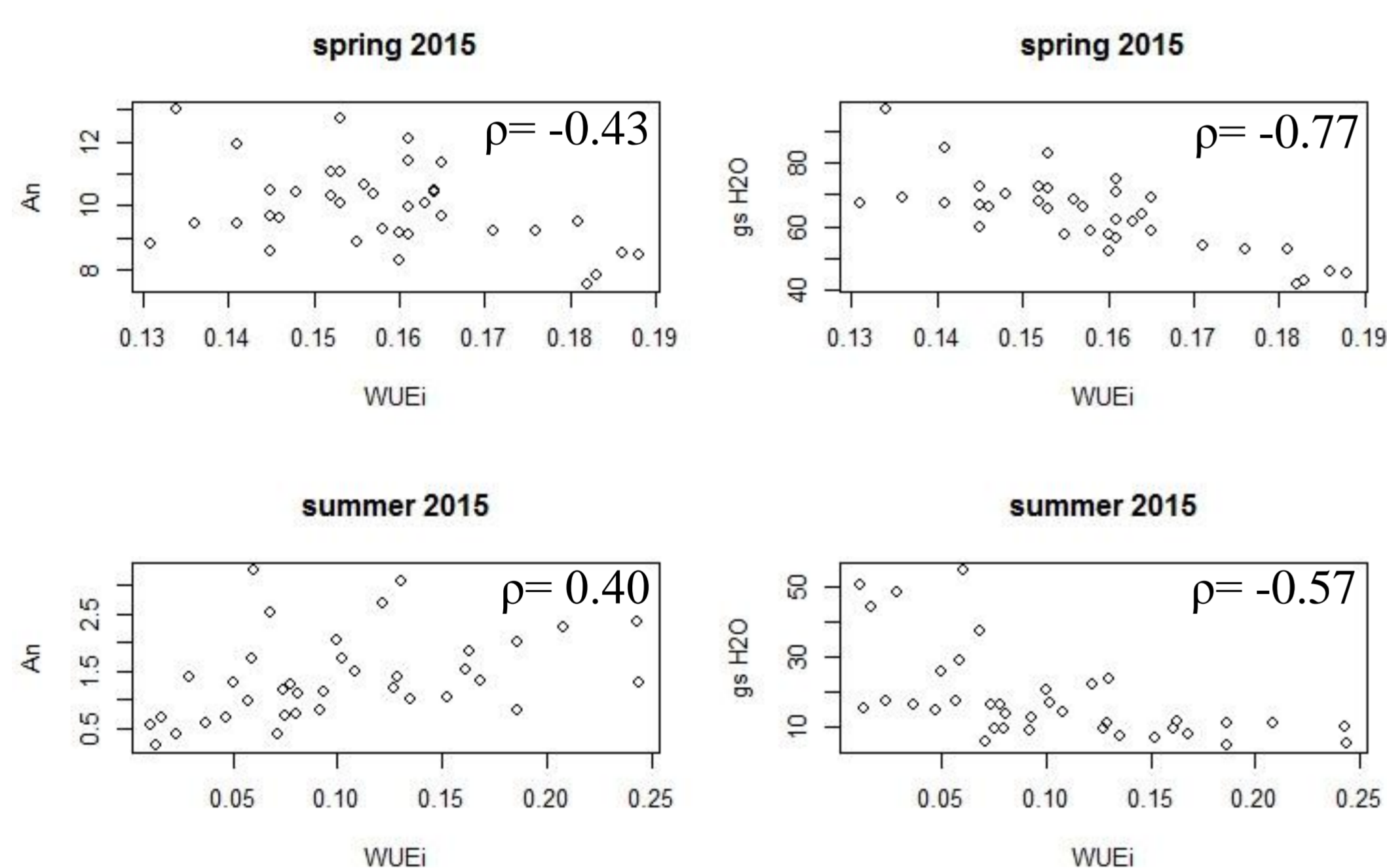
## Materials and Methods:

- ✓ 108 F<sub>1</sub> full-sibs from a controlled cross between two contrasted provenances **Morocco x Landes**
- ✓ Experimental plot established in 2007 in Aquitaine (France).
- ✓ Chlorophyll fluorescence and gas exchange measurements in spring and summer of 2014 and 2015.
- ✓ High density SNP genotyping [3].
- ✓ Environmental characterization.



2015 dry summer

## Results:



Higher correlation of WUE<sub>i</sub> with g<sub>sH2O</sub> than with A<sub>n</sub>

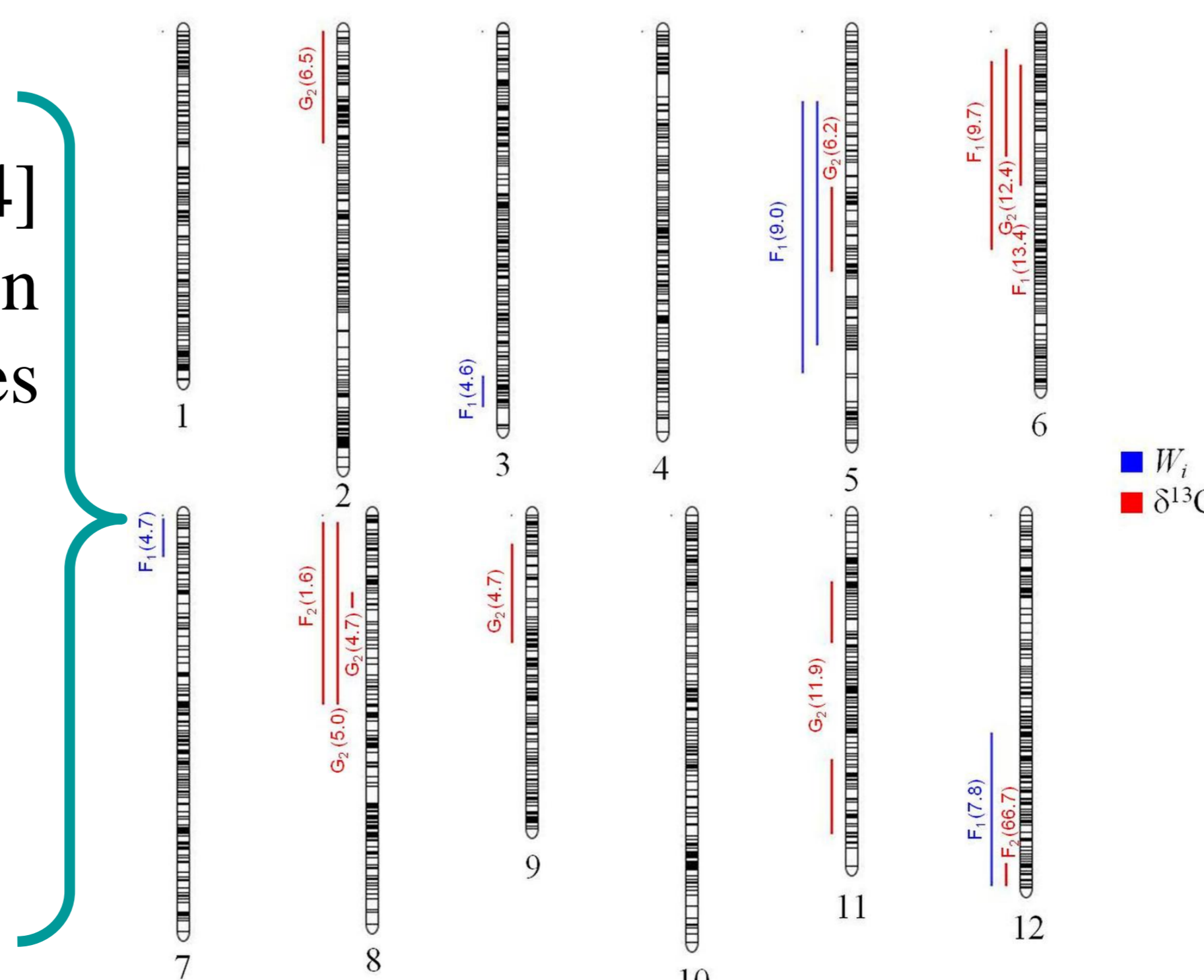
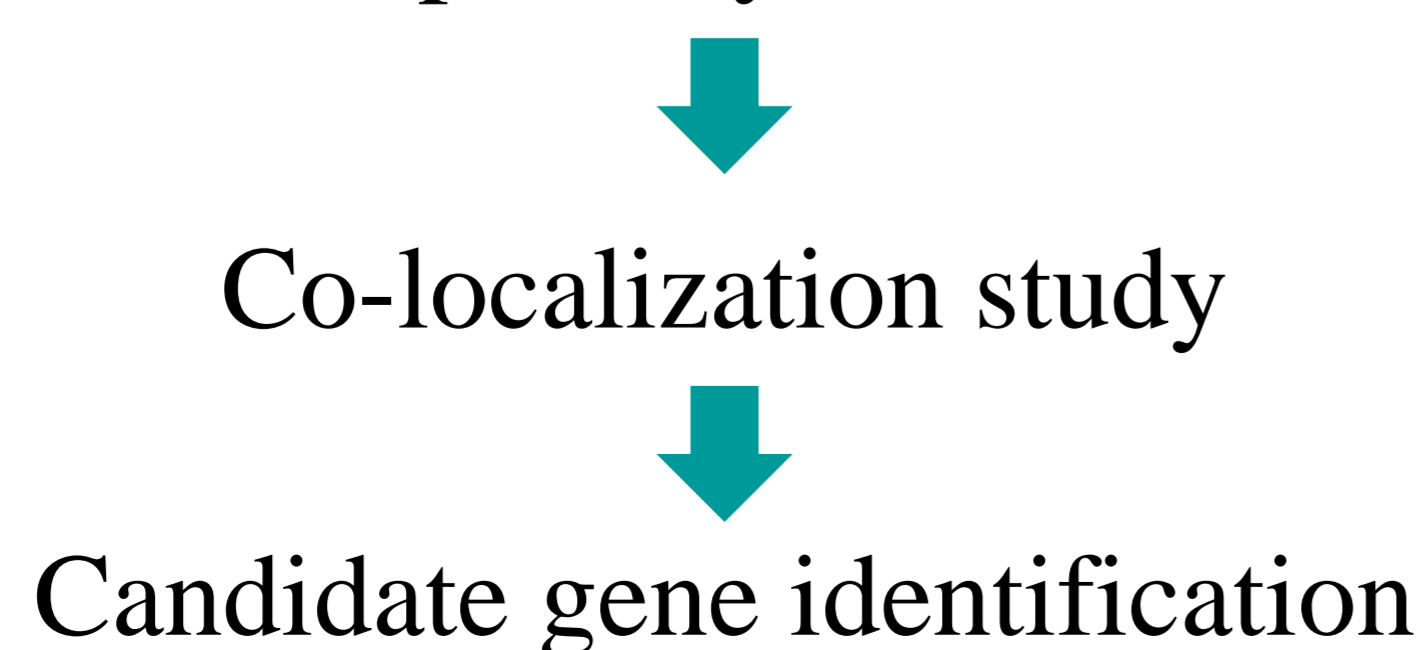
Preliminary QTL analysis  
Composite Interval Mapping

Trait	Parent	Year	season	LG	LOD	PEV	Position	CI (cM)	P-value
Ψ <sub>predawn</sub>			summer	6	5.2	12.4	113	109-115	0.007
F <sub>m</sub> '	L	2015	spring	11	4.7	15.1	113	106-115	0.026
E			spring	2	4.7	10.3	167	163-170	0.027

Detected QTLs with moderate effect for chlorophyll fluorescence traits and transpiration rate in Landes parental tree

## Perspectives:

Projection of QTLs on *P. pinaster* composite map [4] and comparison with previously detected QTL in maritime pine for :WUE from three independent studies F<sub>1</sub>, F<sub>2</sub>, G<sub>2</sub>[2]; and for photosynthesis related traits [5]



- ✓ New measures in 2016
- ✓ Analysis of δ<sup>13</sup>C, cavitation resistance and growth in progress

### References

- [1] Aranda et al. 2010. TGG
- [2] Plomion et al. 2016 JPH
- [3] Plomion et al. 2016 Mol Ecol Res
- [4] de Miguel et al. 2015 GBE
- [5] de Miguel et al. 2014 BMC Genomics