Divergence in acquisition and allocation patterns among native and introduced populations of an annual grass contribute to invasiveness

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Background

Impacts:

Community diversity

Disturbance

Background

Native

Invaded

Background

"Are invasive species born or made?"

- Ellstrand and Schierenbeck 2000

Born?

- Enemy Release
- Propagule pressure
- Increased resource availability

Made?

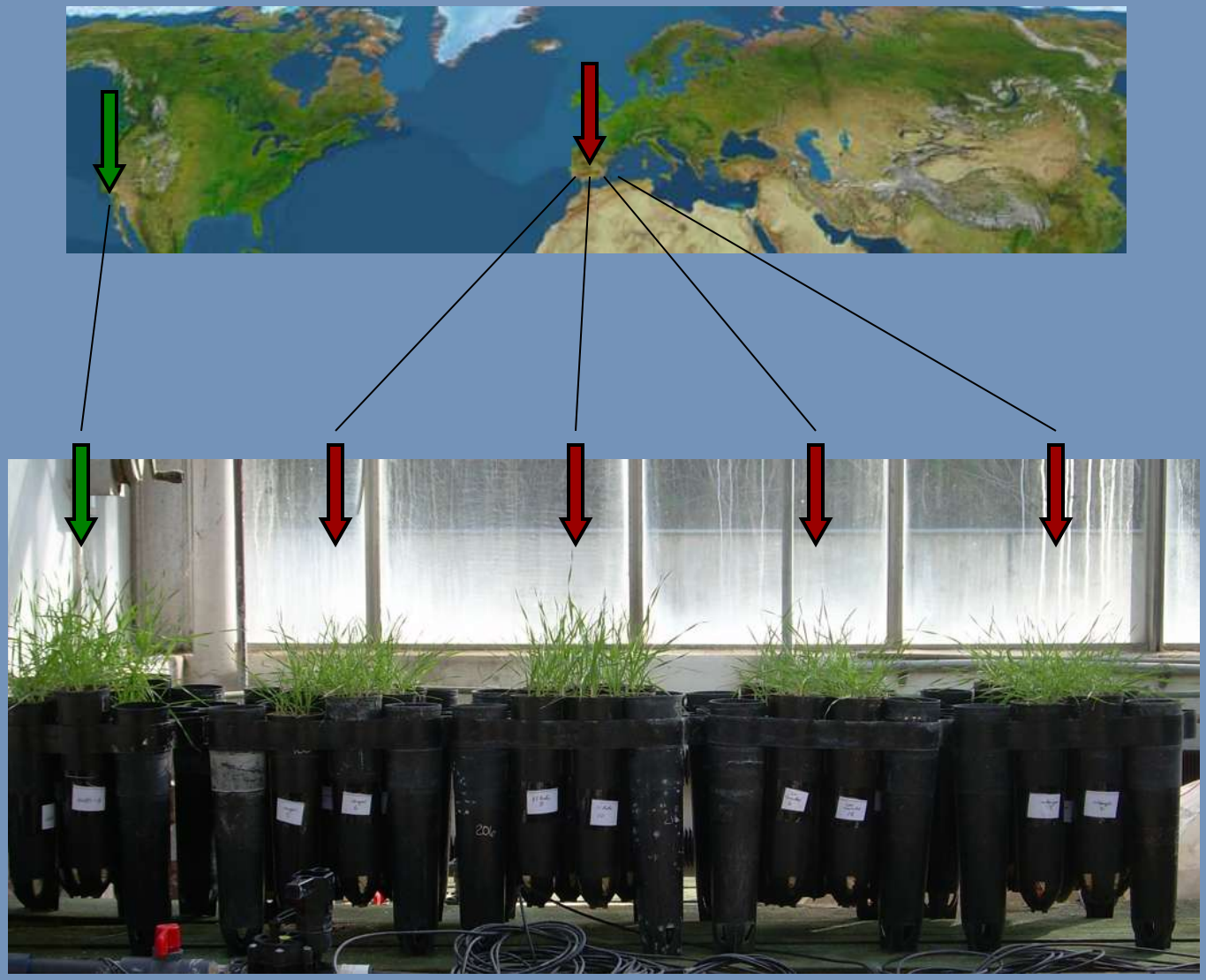
- Hybridization
- Local adaptation
- Evolution of increased competitive ability

Questions

Has post-introduction adaptation occurred in introduced populations?

Do such adaptations confer any competitive superiority?

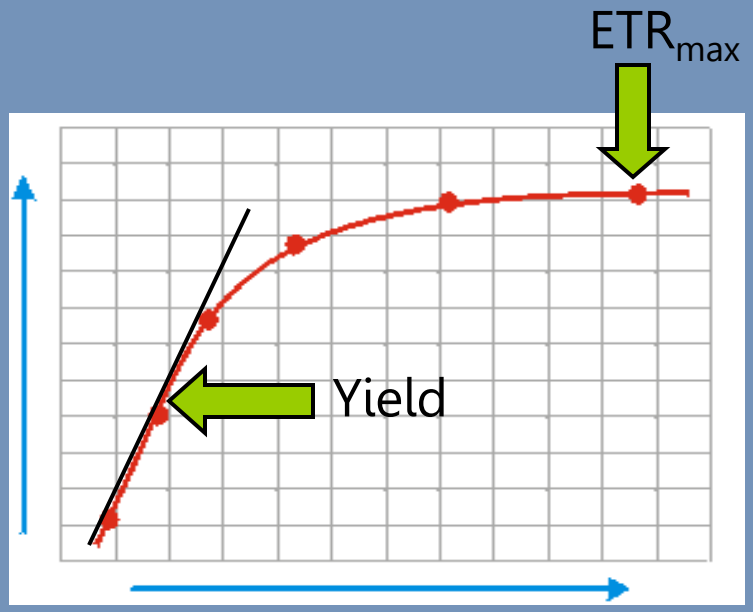
Methods



Methods

Carbon acquisition

Maximum e^- transport rate
- photosynthetic capacity at saturating light



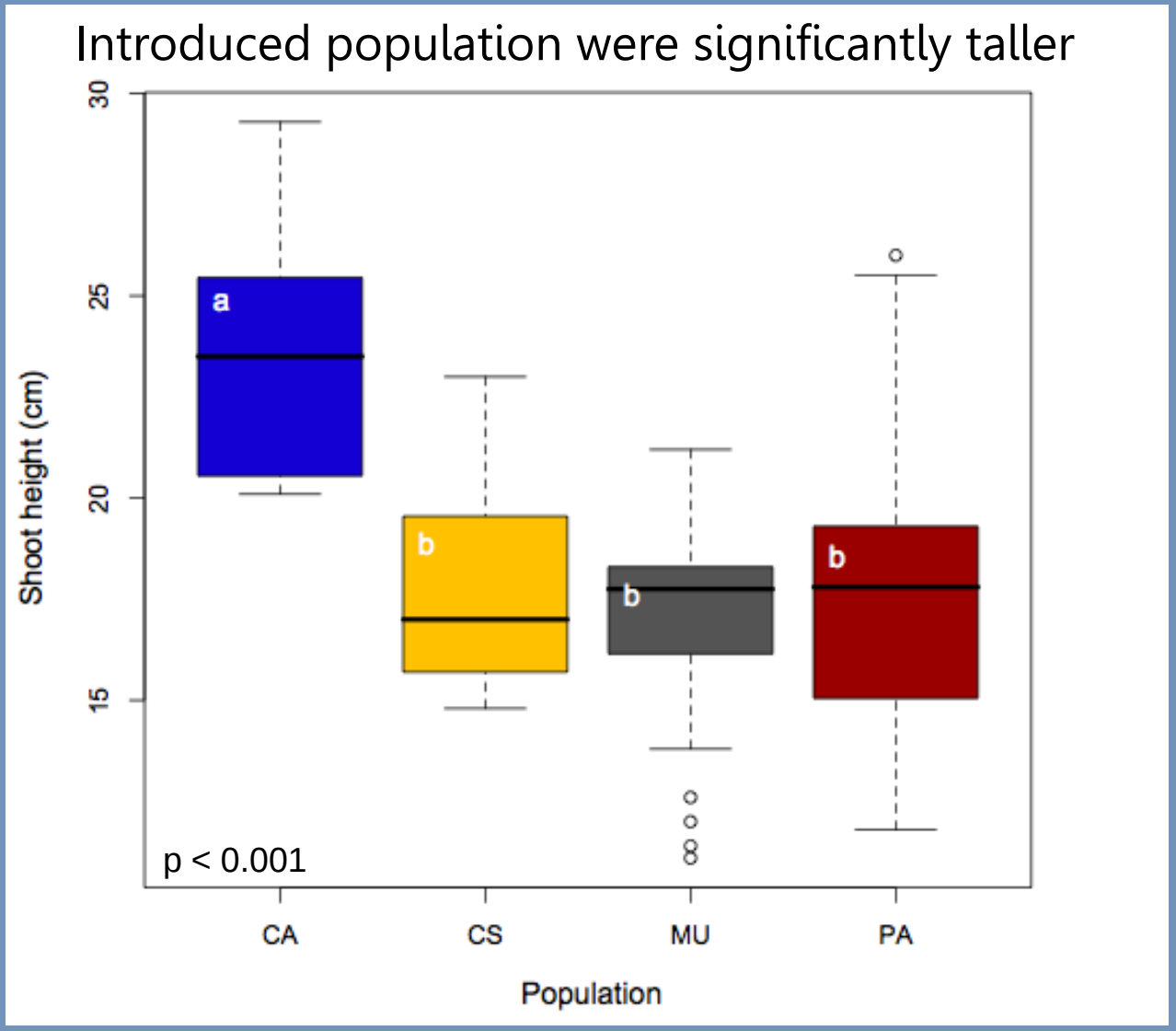
Yield of photosystem II
-photosynthetic activity per light received

Predictions

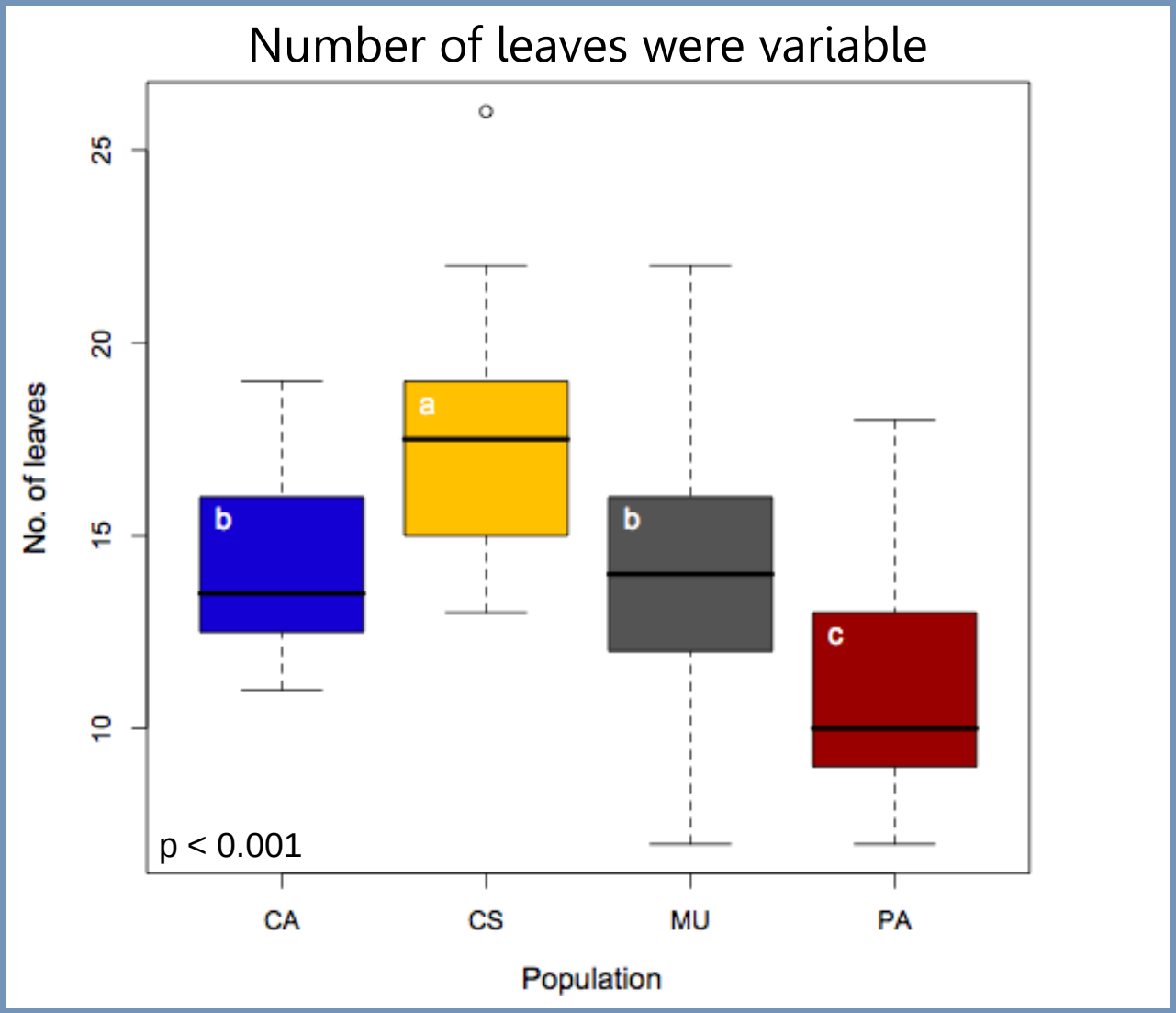
	Introduced	Native
Shoot height	↑	↓
Leaf number	↑	↓
Total mass	↑	↓
Root:shoot mass (RSM)	↓	↑
Shoot mass ratio (SMR)	↑	↓
Root mass ratio (RMR)	↓	↑
Specific leaf area (SLA)	↑	↓
Total leaf area	↑	↓
Leaf mass ratio (LMR)	↑	↓
Leaf area ratio (LAR)	↑	↓
Yield of PSII	↑	↓
Maximum e^- transport rate	↑	↓

Results

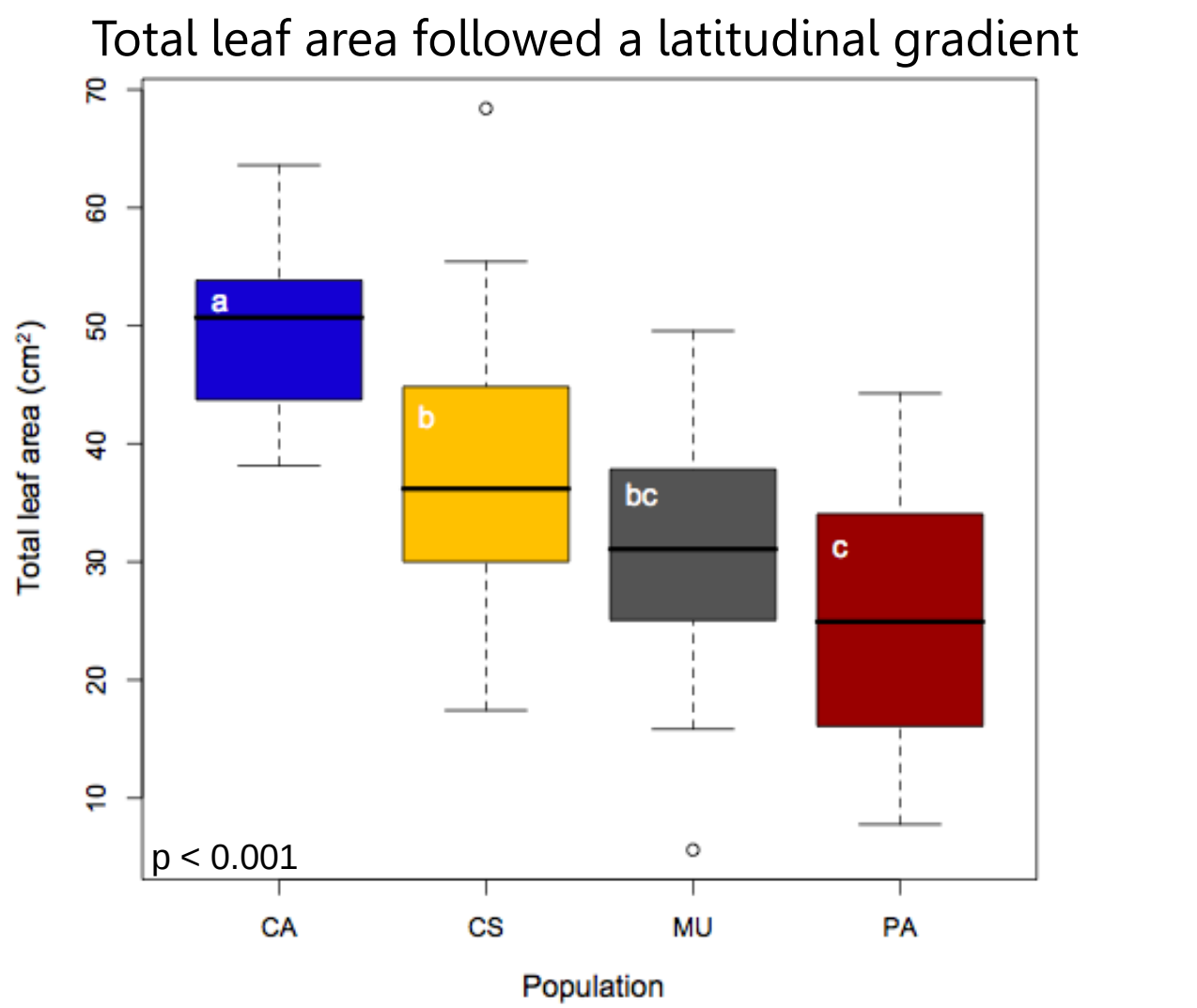
Introduced population were significantly taller



Results

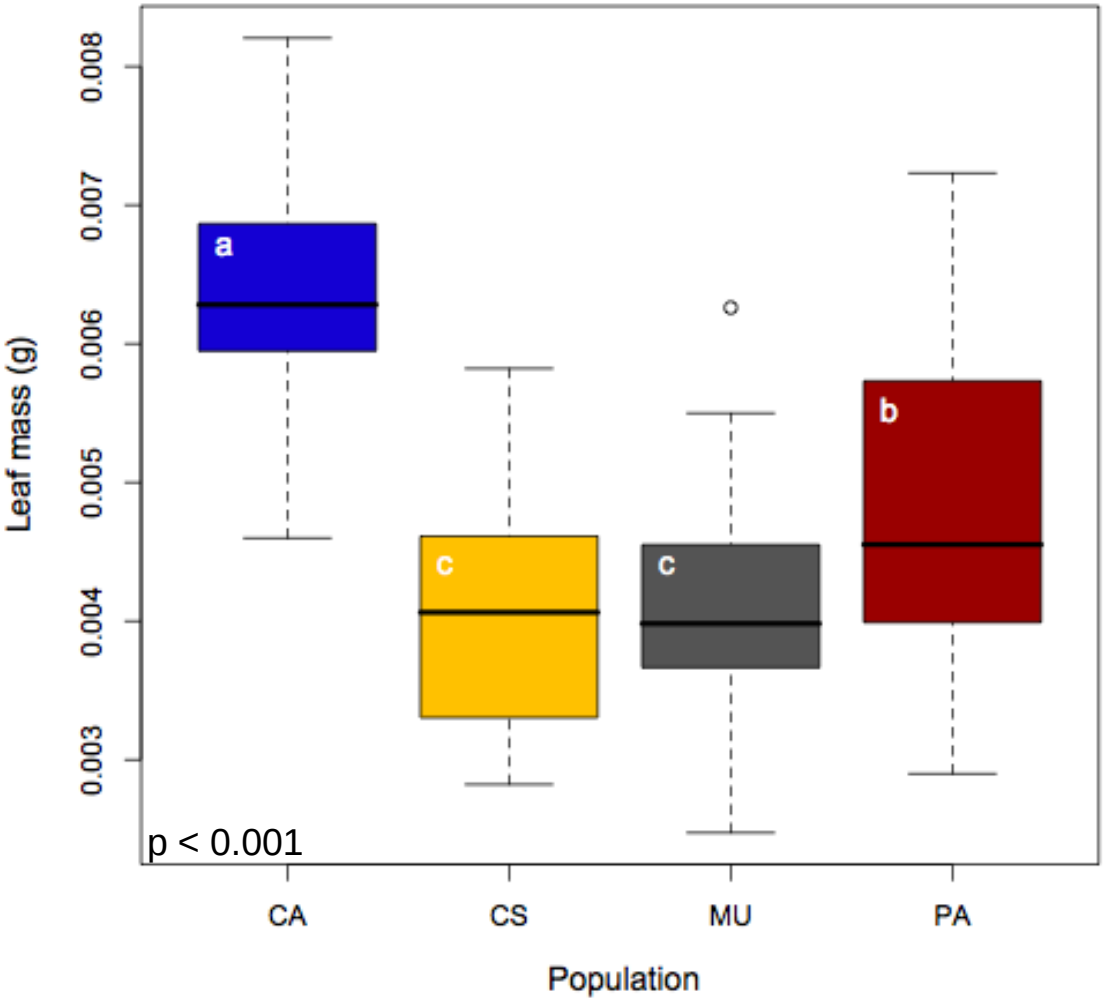

Number of leaves were variable
No. of leaves
10
15
20
25
b
a
b
c
p < 0.001
CA
CS
MU
PA
Population

Results


Total leaf area followed a latitudinal gradient
Total leaf area (cm²)
10
20
30
40
50
60
70
a
b
bc
c
p < 0.001
CA
CS
MU
PA
Population

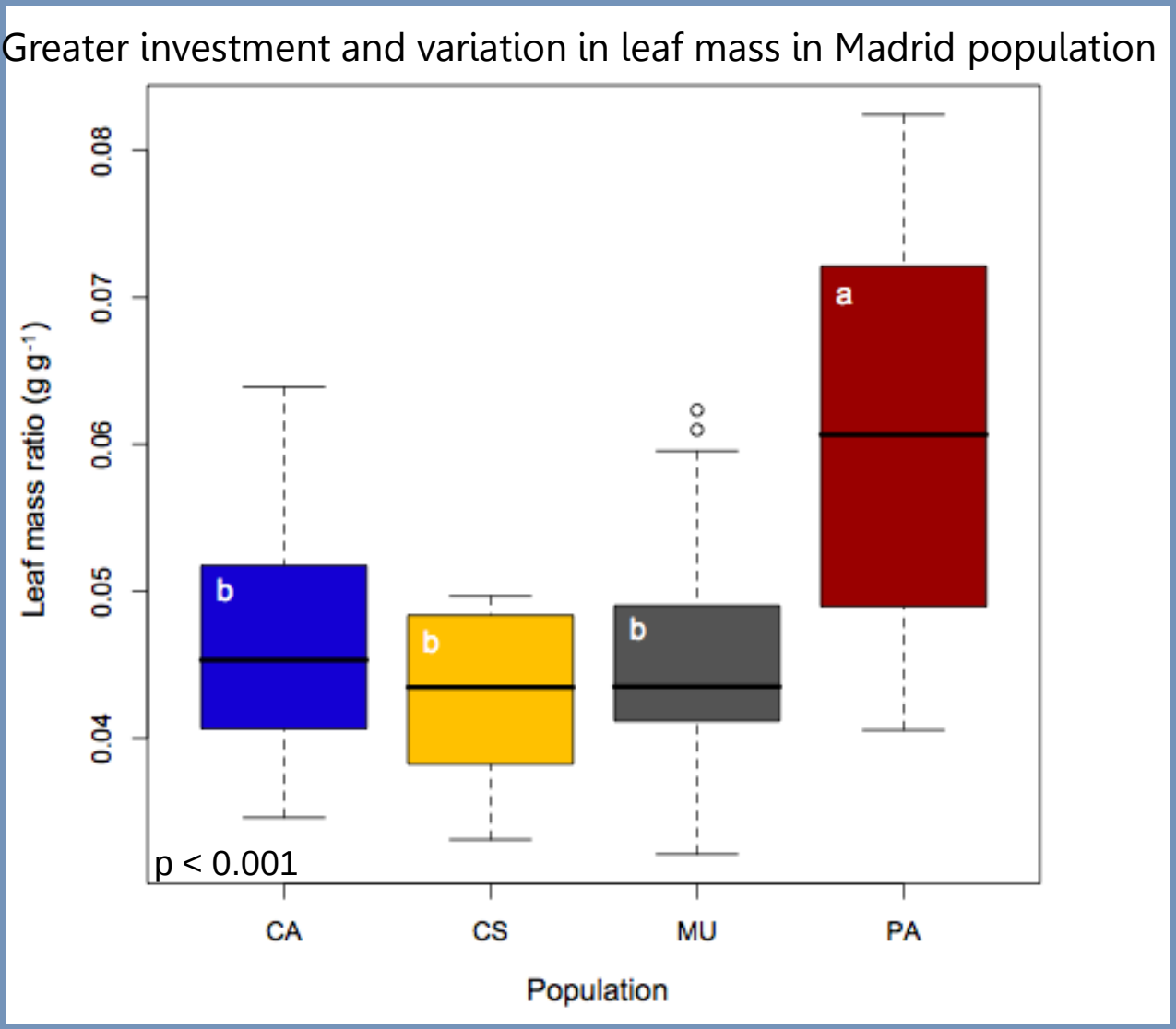
Results

Introduced population were significantly larger



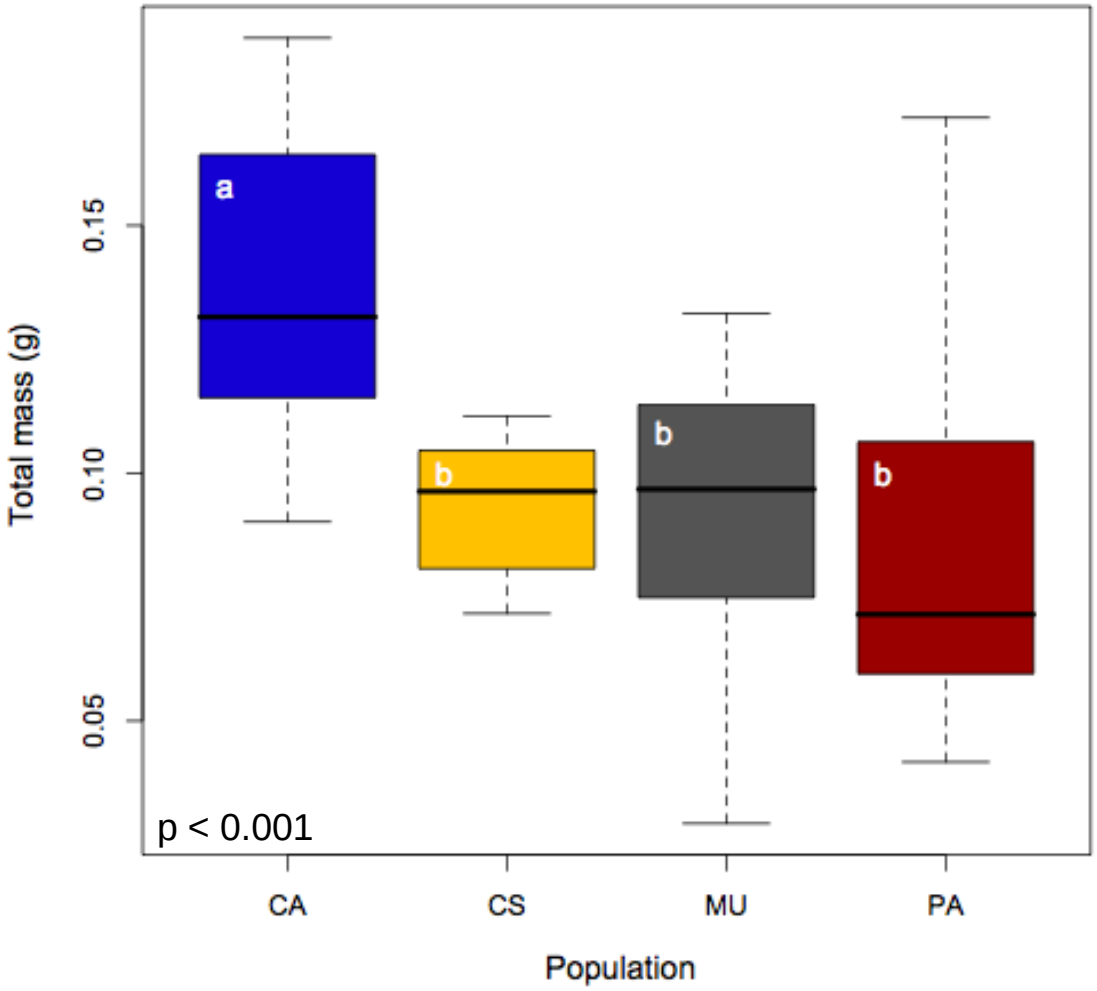
Results

Greater investment and variation in leaf mass in Madrid population

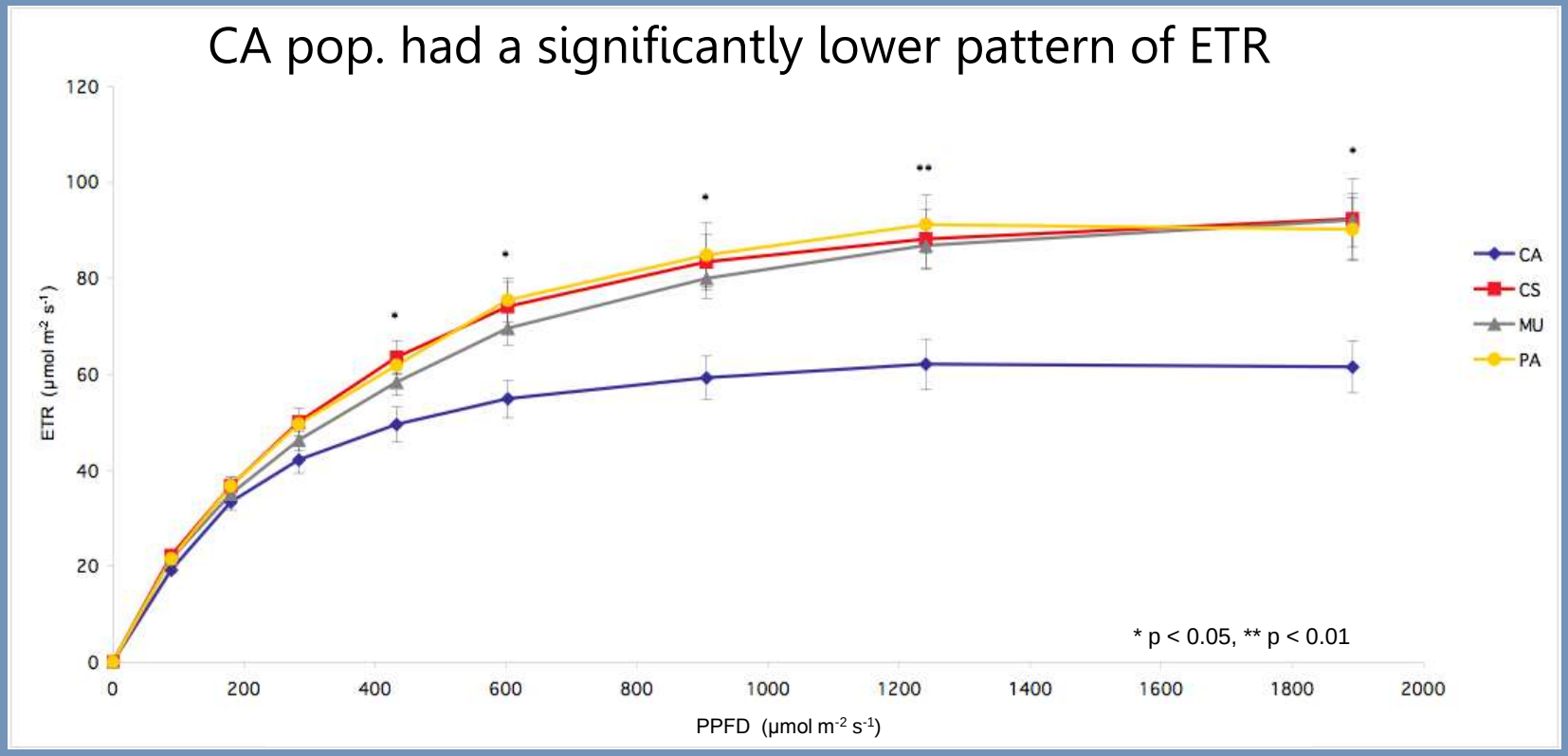


Results

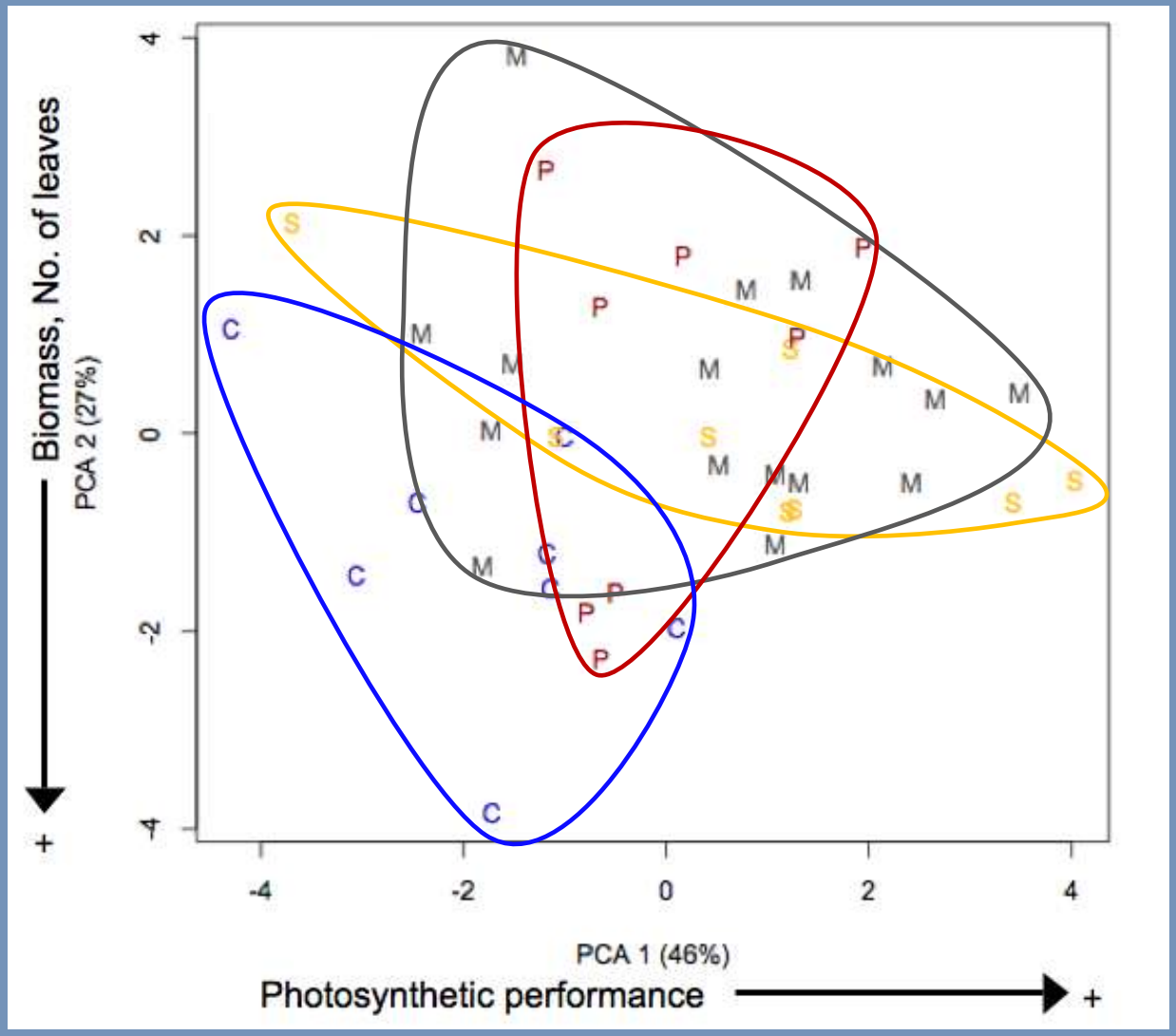
Greatest total biomass in introduced population



Results


CA pop. had a significantly lower pattern of ETR
ETR (µmol m-2 s-1)
PPFD (µmol m-2 s-1)
0
20
40
60
80
100
120
0
200
400
600
800
1000
1200
1400
1600
1800
2000
CA
CS
MU
PA
* p < 0.05, ** p < 0.01

Results



CA pop. primarily differs from native pop.'s based upon **photosynthesis** and **biomass**

Variable	PCA 1	PCA 2
ETR_{max} (µmol m^{-2} s^{-1})	**0.445**	0.145
ϕ_{PSII} (µmol m^{-2} s^{-1})	**0.457**	0.123
NPQ	0.340	-0.404
qP	**0.489**	-0.119
qN	0.329	-0.435
Total mass (g)	-0.207	**-0.550**
No. of leaves	-0.315	**-0.660**
Leaf mass (g)	-0.286	**-0.450**

Results: Summary

	Introduced	Native	Agreement
Shoot height	↑	↓	✓
Leaf number	↑	↓	✗
Total mass	↑	↓	✓
Root:shoot mass (RSM)	↓	↑	ND
Shoot mass ratio (SMR)	↑	↓	ND
Root mass ratio (RMR)	↓	↑	ND
Specific leaf area (SLA)	↑	↓	ND
Total leaf area	↑	↓	✓
Leaf mass ratio (LMR)	↑	↓	✗
Leaf area ratio (LAR)	↑	↓	ND
Yield of PSII	↑	↓	✗
Maximum e^- transport rate	↑	↓	✗

Discussion

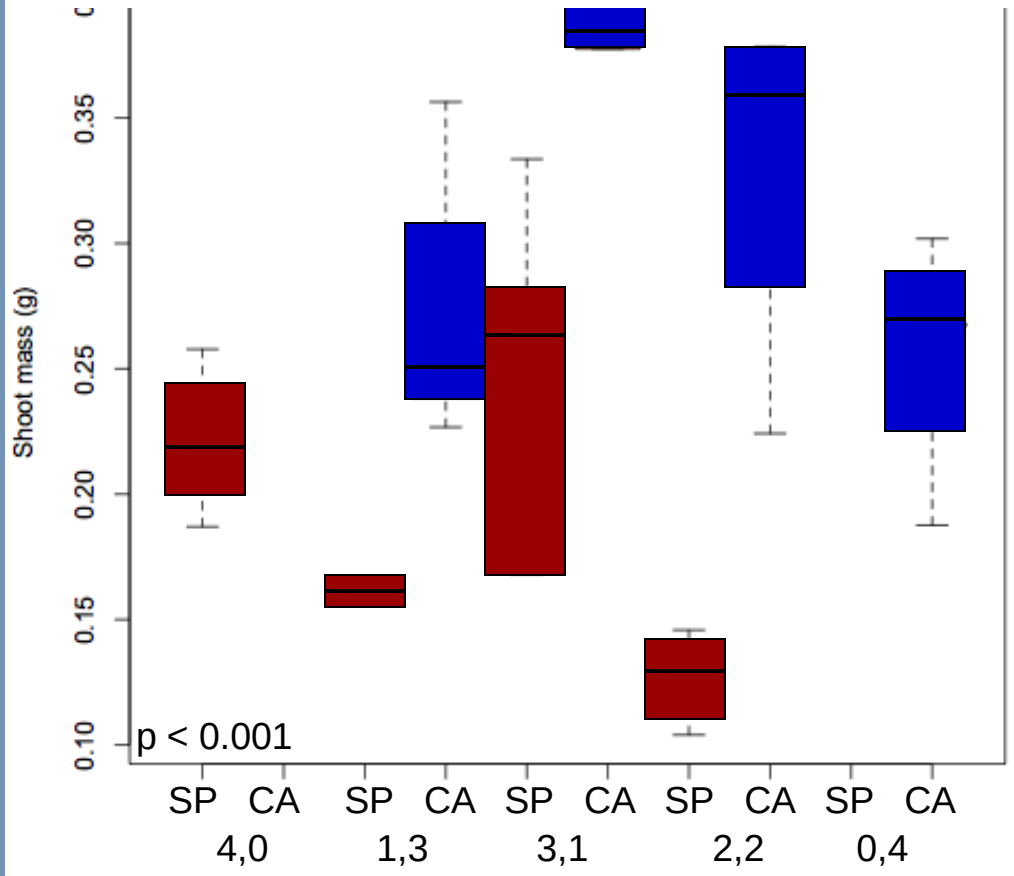
Has differentiation occurred in the introduced range?

Adaptations that confer competitive superiority?

Shoot height	↑
Total mass	↑
Total leaf area	↑

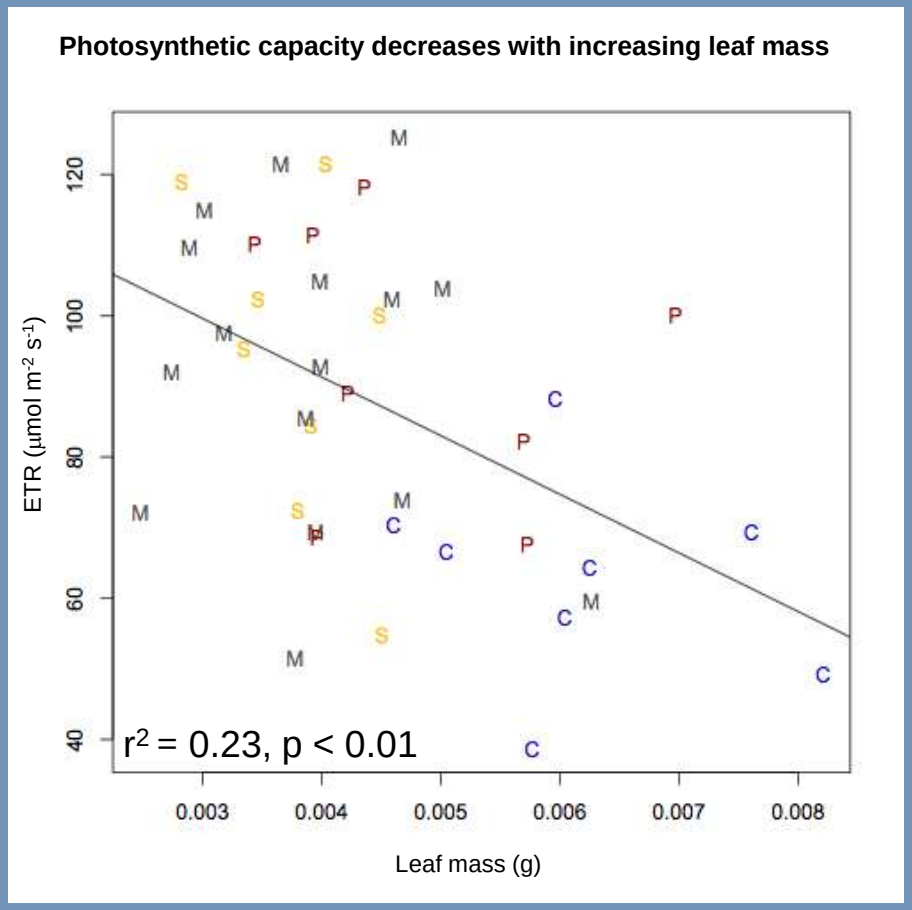
Discussion

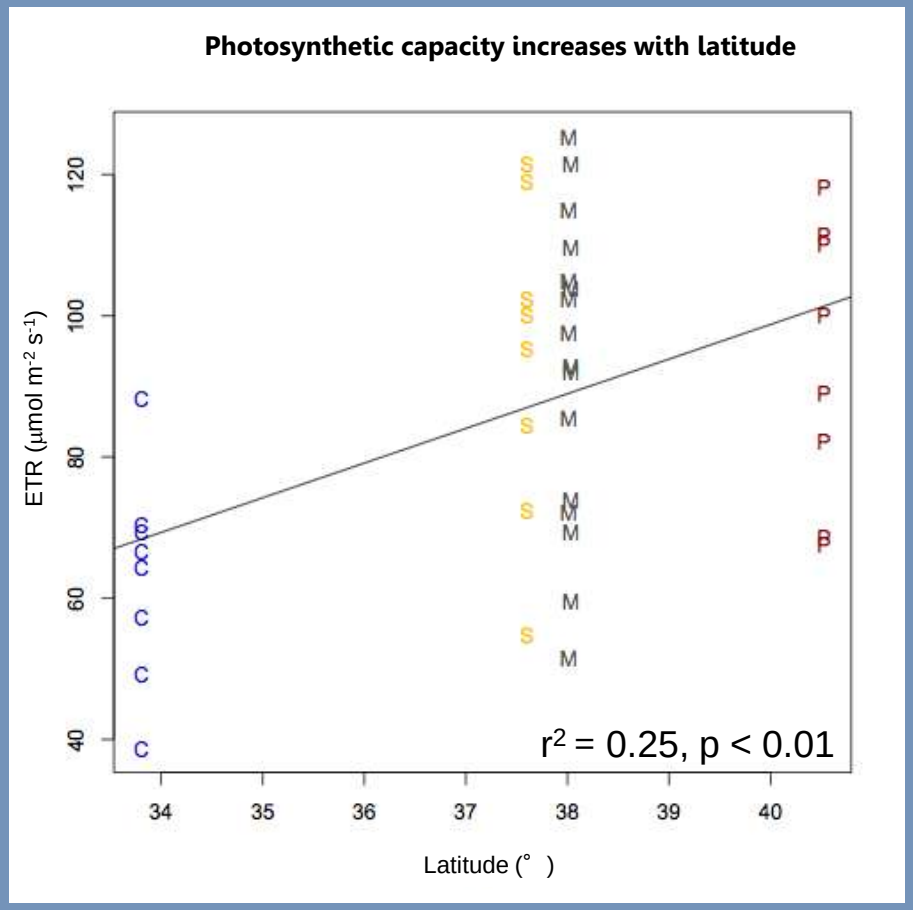
CA pop. consistently out competes native pop.'s



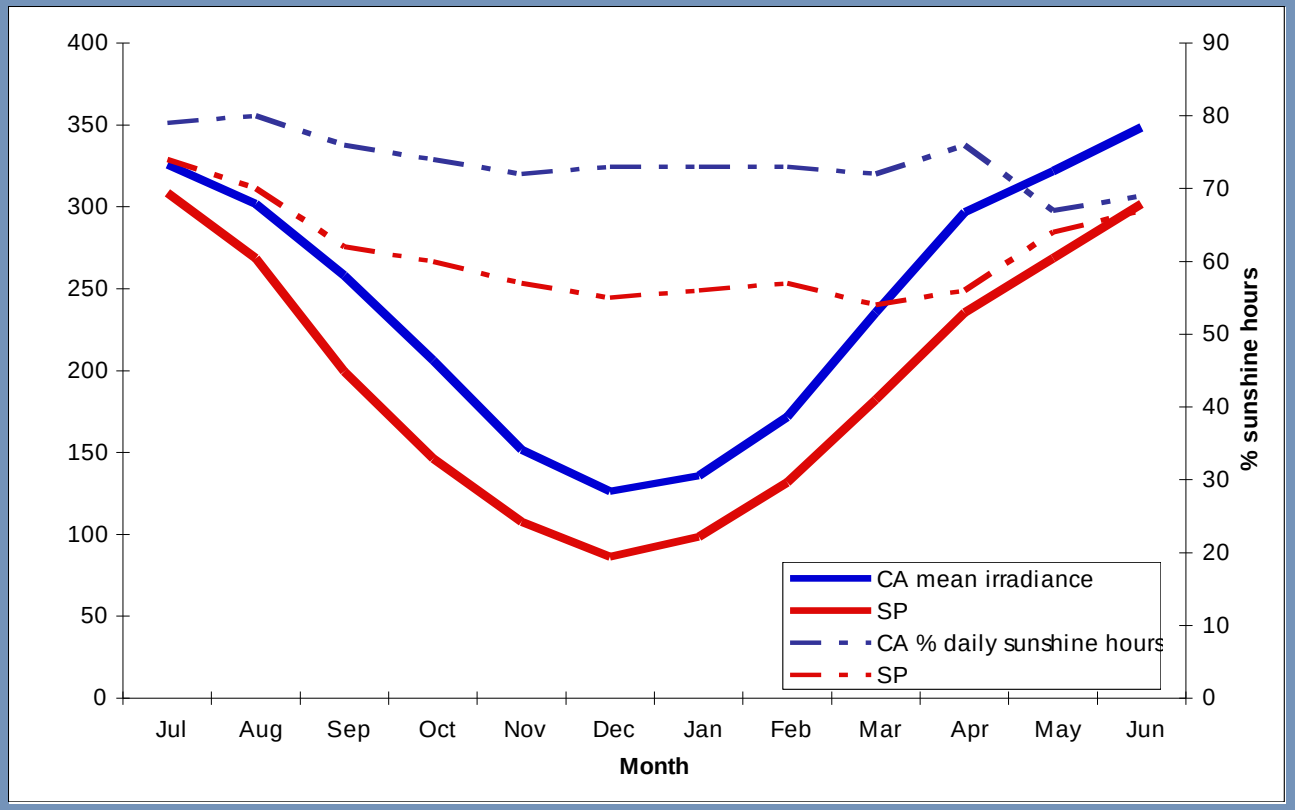
Discussion

Adaptive trade-off of leaf size to photosynthetic capacity along a latitudinal gradient?





Discussion



Larger biomass may be an indirect result of selection on photosynthetic physiology

Conclusion

Invasive populations:

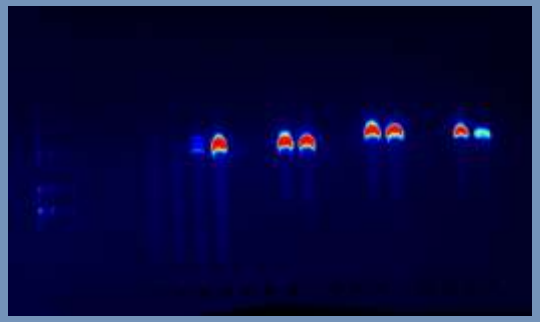
adaptive capacity, competitive ability, abiotic factors

Riverside, CA

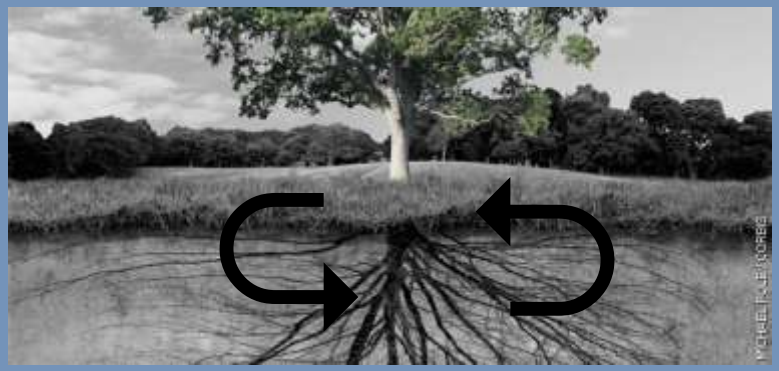
Murcia, Spain

Next steps…

1.) Identify source populations and quantify genetic variation



2.) Investigate biogeographical variation in plant-soil feedbacks



Thank You!

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TIFF (Uncompressed) decompressor
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