Using genomic data to study population structure and adaptive traits of *Physaria globosa*

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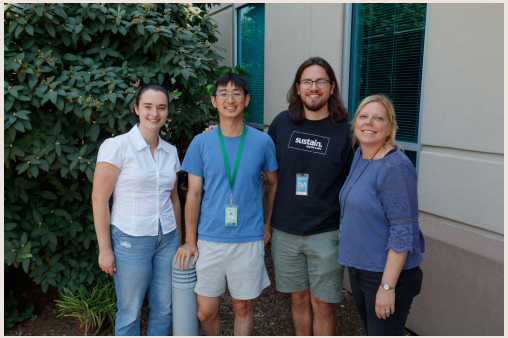


MISSOURI BOTANICAL GARDEN

NSF

MARIST UNIVERSITY


CCSD, Ex Situ Conservation, MBG


CCSD, Ex Situ Conservation, MBG

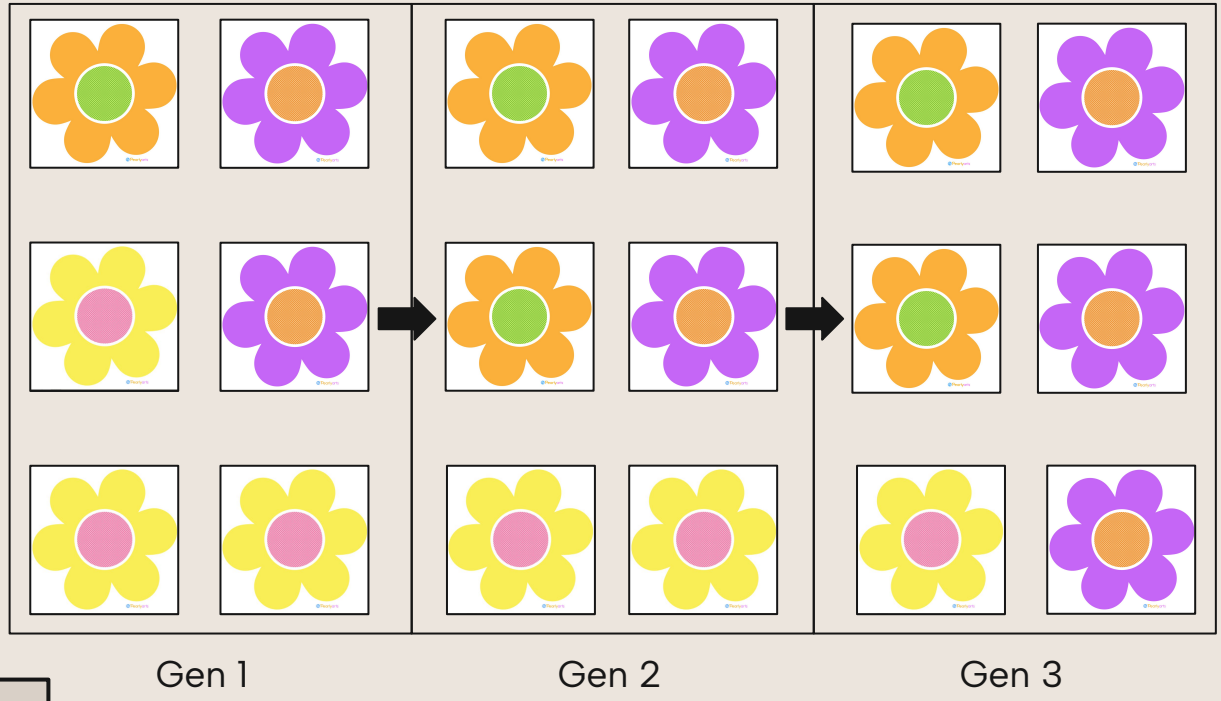
Conserving endangered species with ex situ conservation

Background

Genetic Diversity

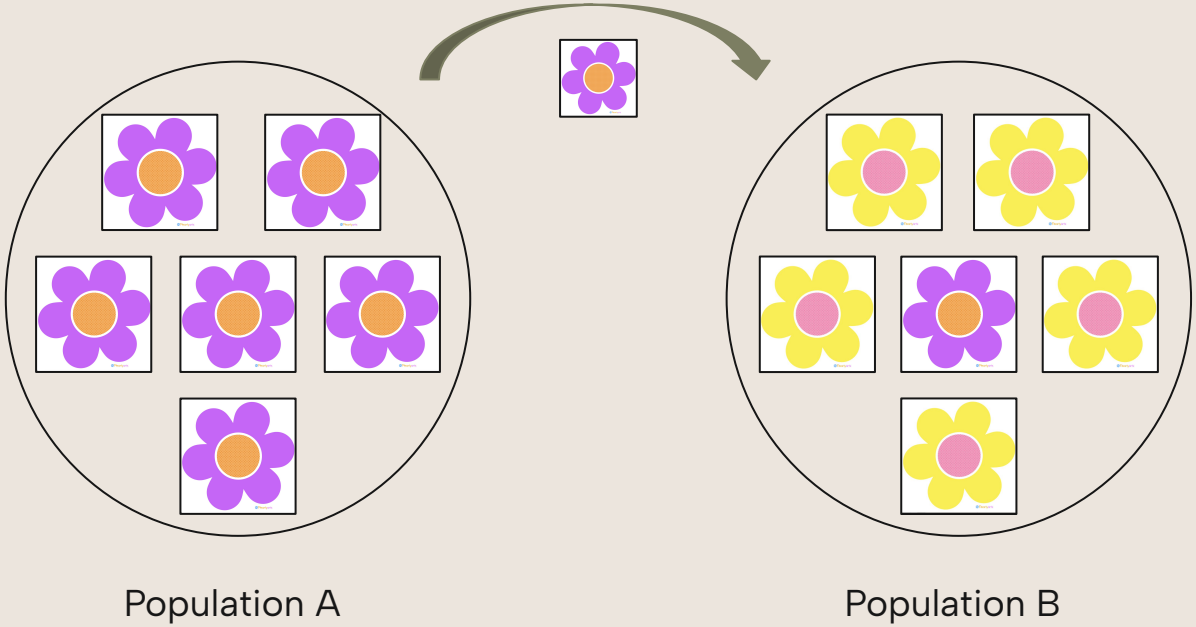
Genetic Diversity

Genetic Drift



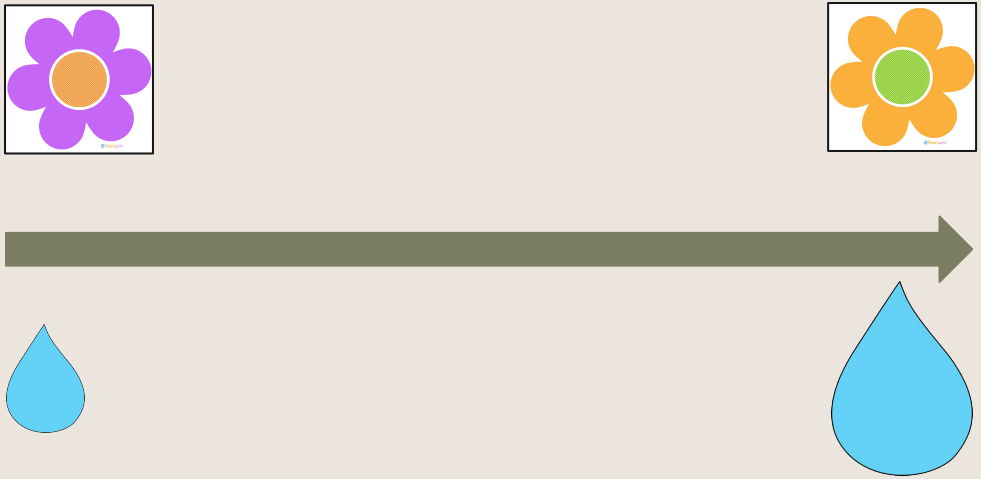
Genetic Diversity

Gene Flow



Genetic Diversity

Natural Selection



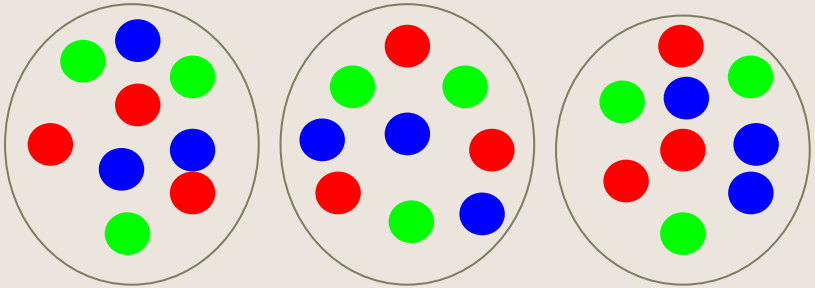
Genetic Structure

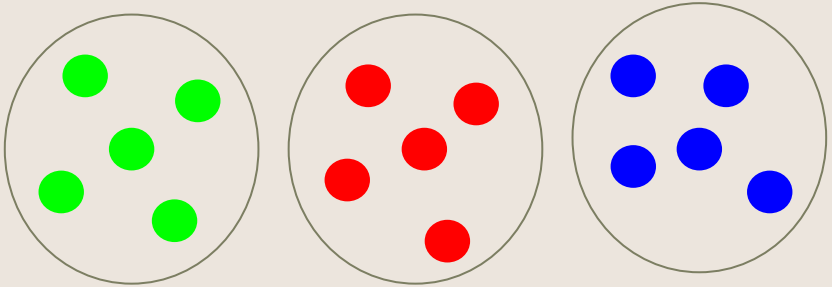
Genetic Structure

High Within Population Variation

vs

High Among Population Variation





-**High** variation **IN** populations
-**Low** variation **BETWEEN** populations

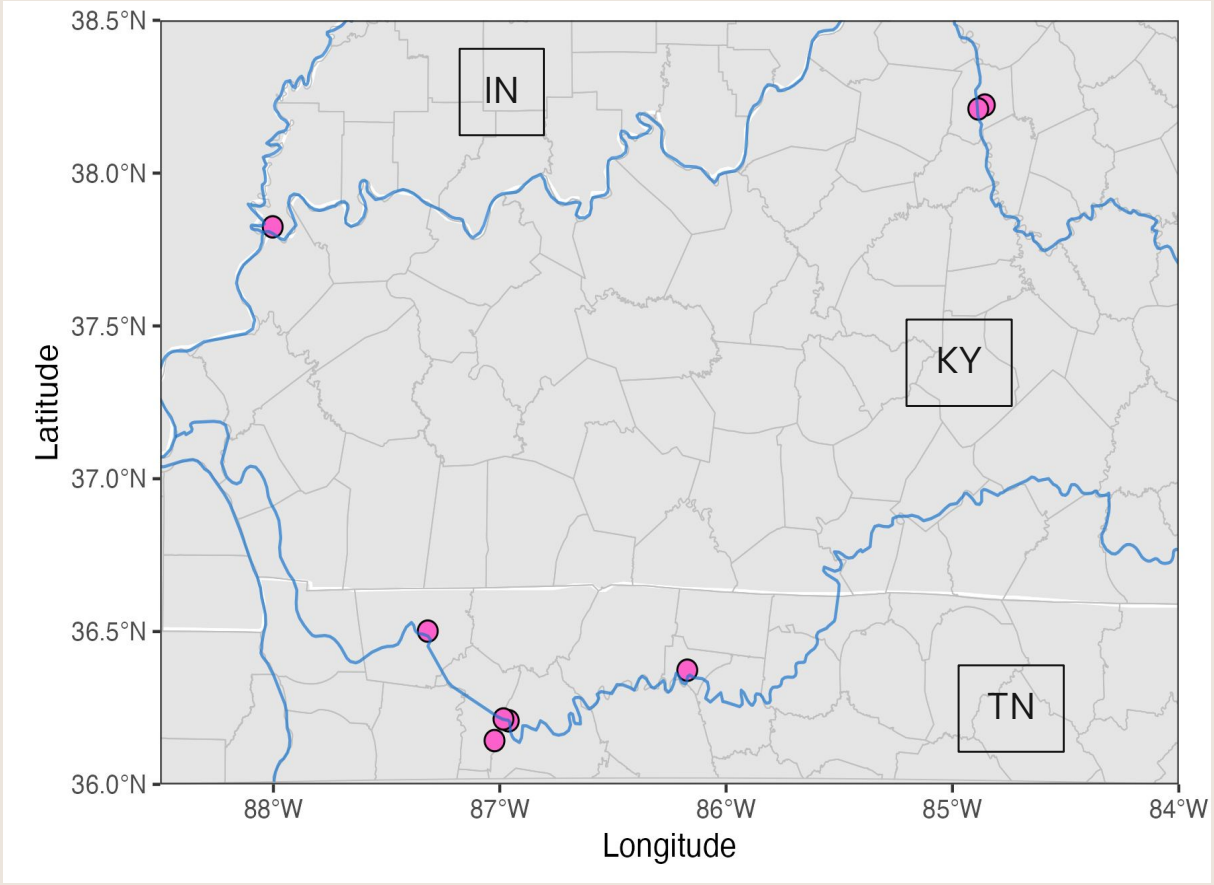
-**Low** variation **IN** populations
-**High** variation **BETWEEN** populations

Background

Objectives

1) To investigate the patterns of genetic diversity and structure in *P. globosa*
2) To investigate whether the species exhibits local adaptation across its geographic range
3) Use the data to inform conservation efforts

Sample Collection of *Physaria globosa*



Methods

Analysis

Genetic Structure

- Principal Component Analysis (PC
- ADMIXTURE
- Pairwise Fst Estimation

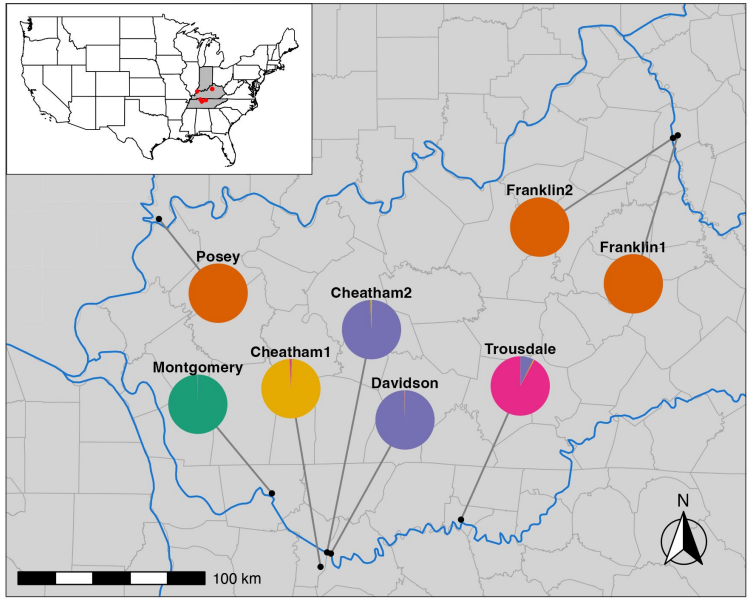
Genetic Diversity

- Inbreeding Coefficient

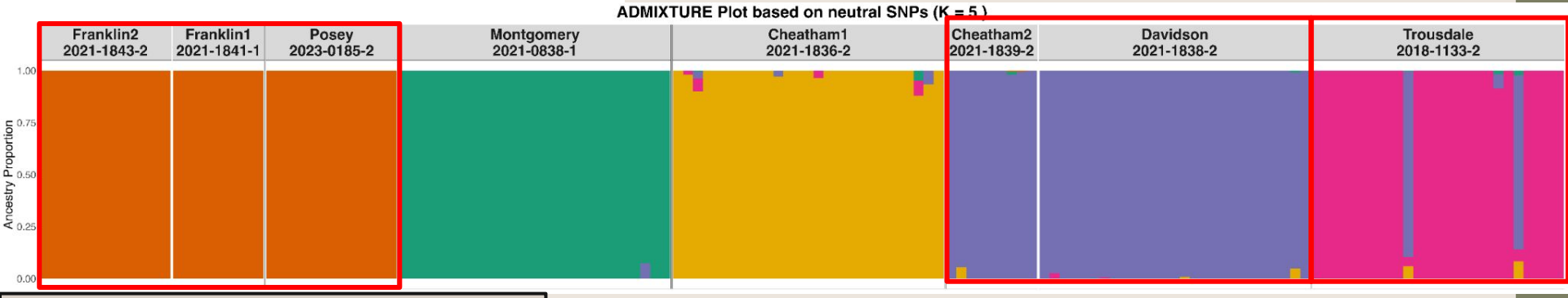
Environmental Associations

- Associations between Fst and Environmental Distances

CCSD, The Development of Plant Conservation, Role of Conservation Genetics

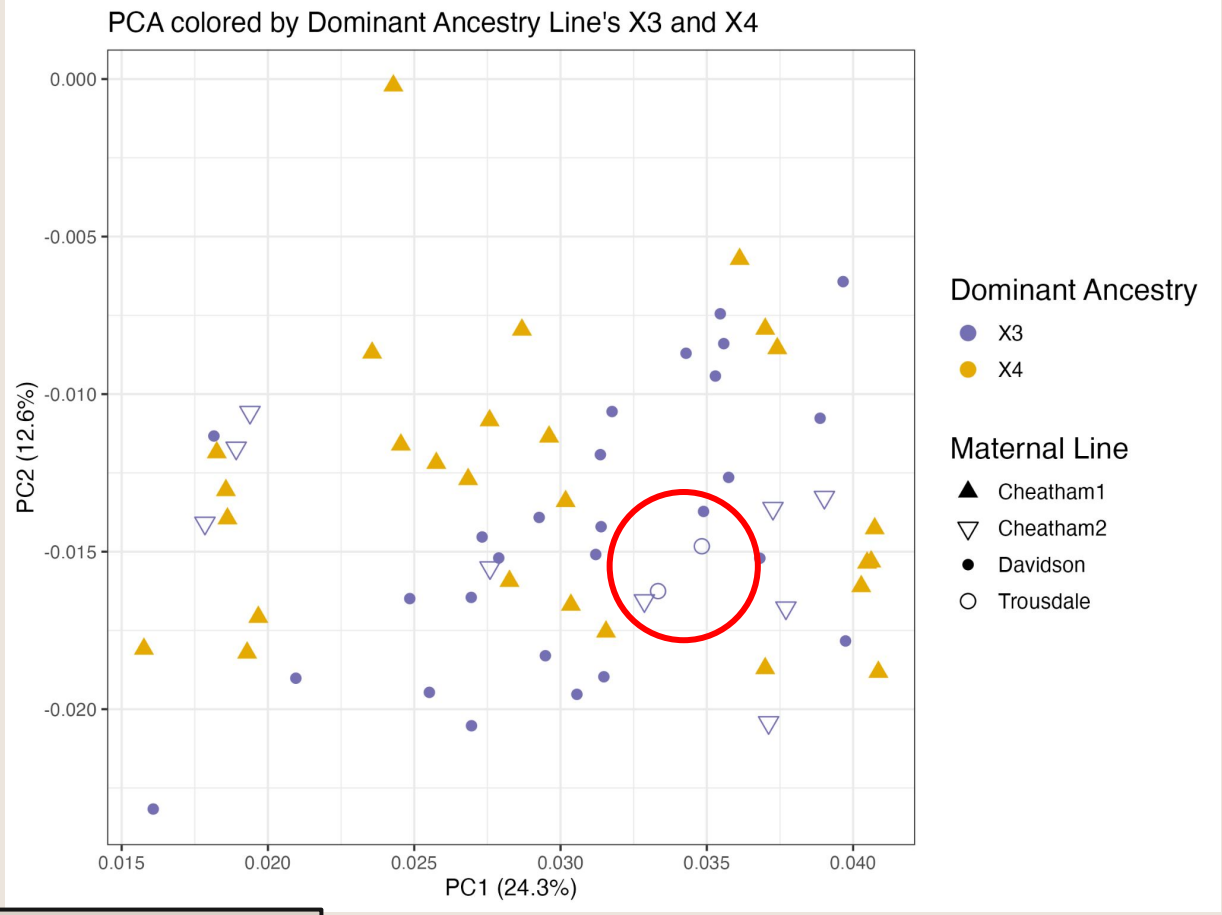


Strong genetic structuring

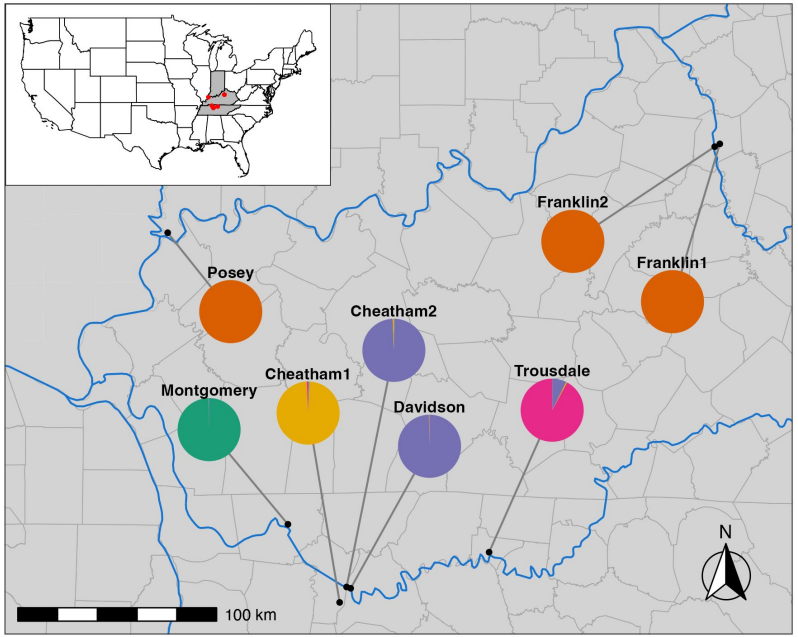


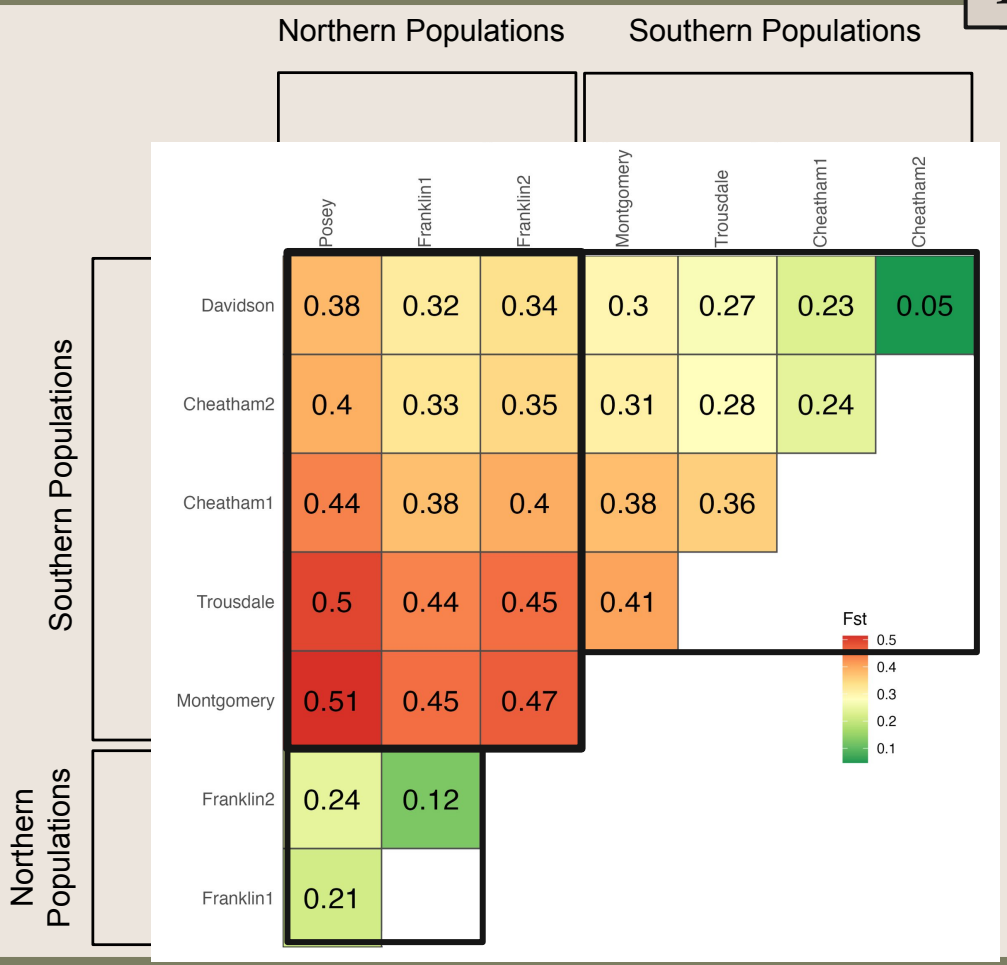
Results

Strong genetic structuring


PCA colored by Dominant Ancestry Line's X3 and X4
0.000
-0.005
-0.010
-0.015
-0.020
PC2 (12.6%)
0.015
0.020
0.025
0.030
0.035
0.040
PC1 (24.3%)
Dominant Ancestry
X3
X4
Maternal Line
Cheatham1
Cheatham2
Davidson
Trousdale

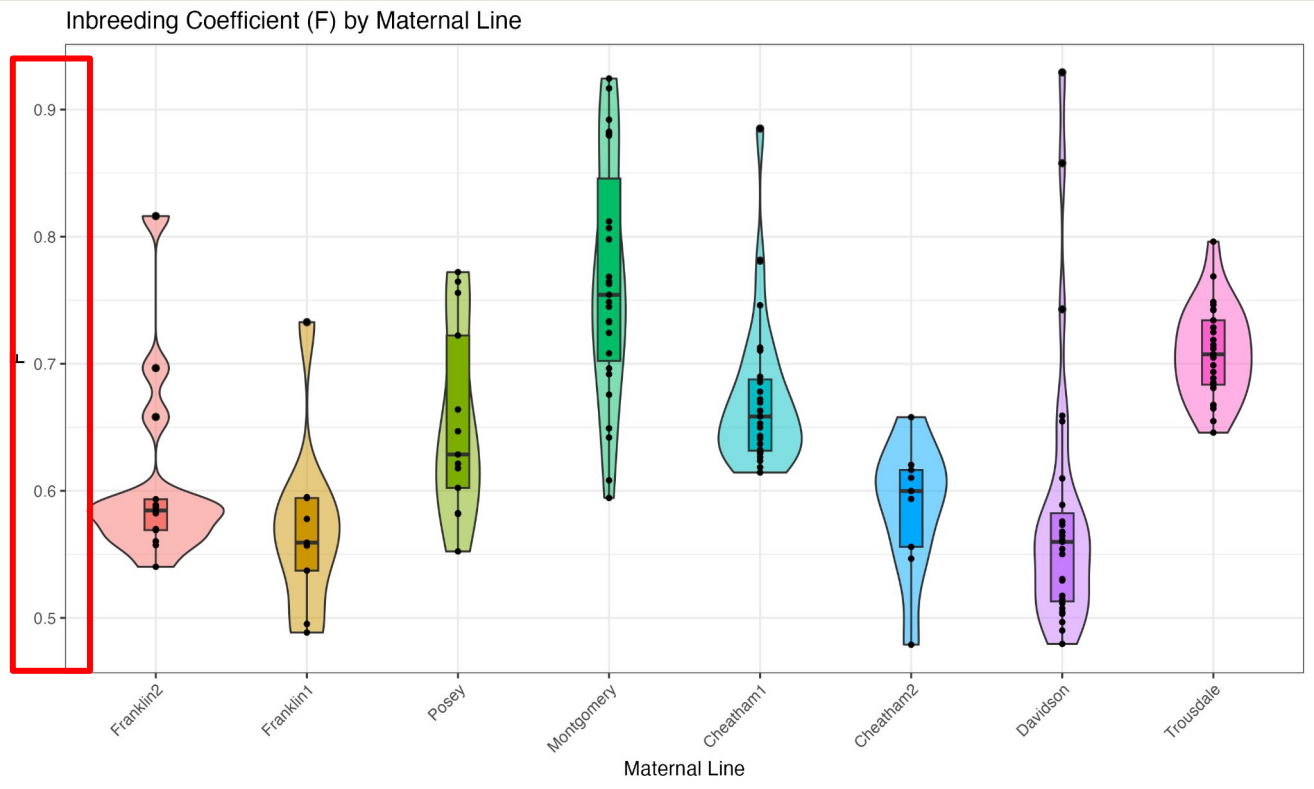
Results


Posey
Franklin2
Franklin1
Cheatham2
Cheatham1
Montgomery
Davidson
Trousdale
N
100 km


Northern Populations
Southern Populations
Southern Populations
Northern Populations
Posey
Franklin1
Franklin2
Montgomery
Trousdale
Cheatham1
Cheatham2
Davidson 0.38 0.32 0.34 0.3 0.27 0.23 0.05
Cheatham2 0.4 0.33 0.35 0.31 0.28 0.24
Cheatham1 0.44 0.38 0.4 0.38 0.36
Trousdale 0.5 0.44 0.45 0.41
Montgomery 0.51 0.45 0.47
Franklin2 0.24 0.12
Franklin1 0.21
Fst
0.5
0.4
0.3
0.2
0.1

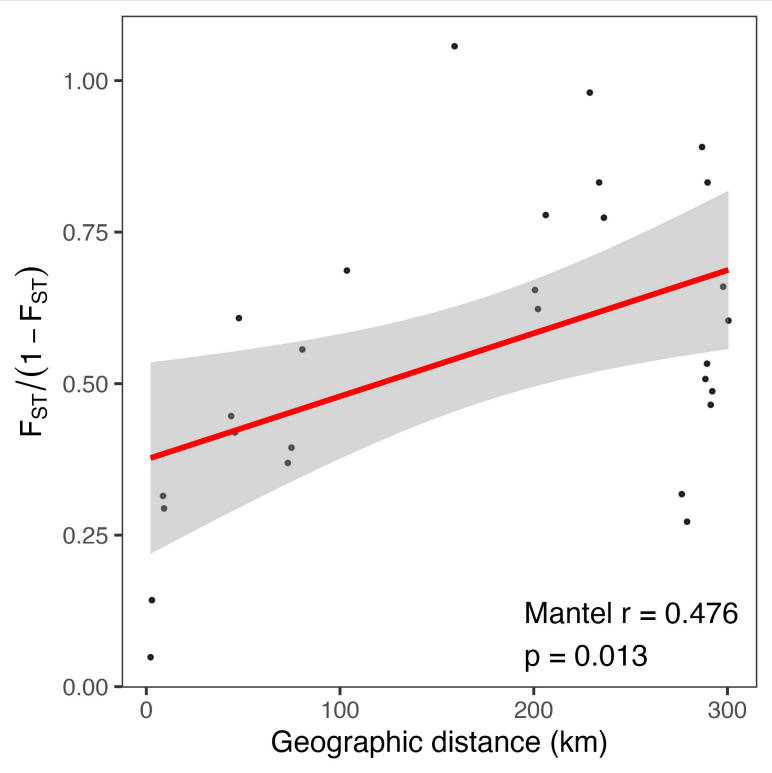
Results

High inbreeding coefficients

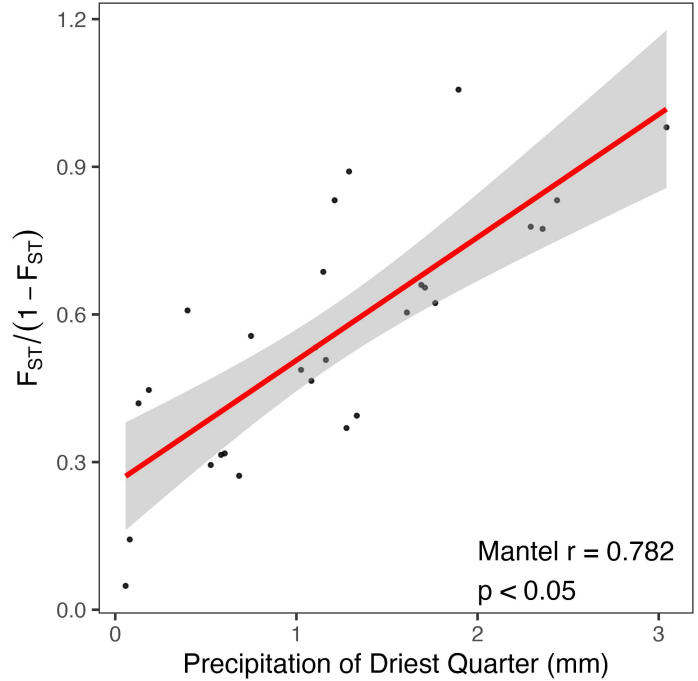


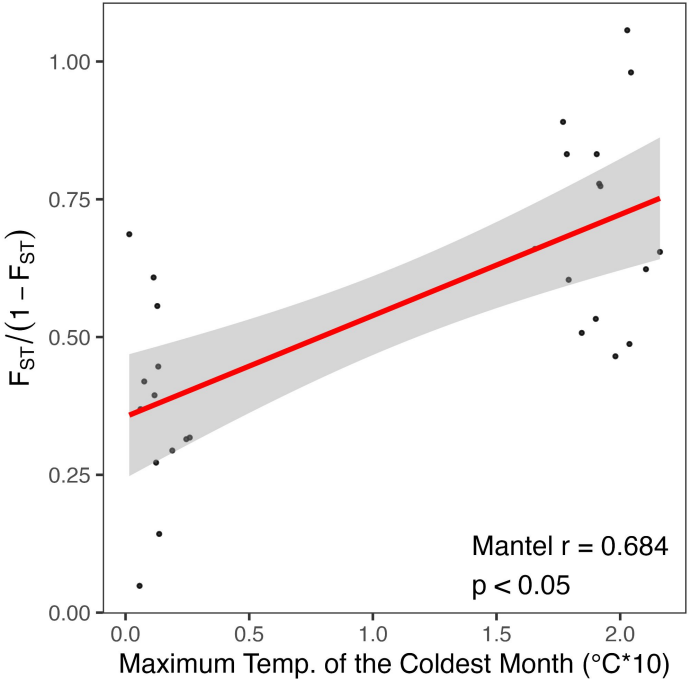
Results

Significant relationship for Genetic Isolation by Distance



Stronger Genetic Isolation by Environment than by Distance





Results

Conclusions

- *P. globosa* populations exhibited **highly positive inbreeding coefficients** (ranging from 0.571–0.766)
  - Suggesting species is **self–compatible**
- Exhibits **strong genetic structuring** according to geography and **significant isolation by distance**
- However, exhibits **stronger genetic isolation by environment**, suggesting local adaptation
  - Strong influence from precipitation and temperature

Conservation Recommendations

- Conservation efforts should focus on preserving **many populations** throughout the range of *P. globosa* to conserve both neutral and adaptive genetic diversity.
- Additional research is needed to assess how **climate change** may affect locally adapted populations.
- For **future reintroductions**, we recommend using genotypes that are “pre-adapted” to the expected future conditions.

Thank you!

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