

Conservation Genetics of South Florida
Tephrosia: Shell middens and pine
rocklands

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Thank you!

USFWS, ENP and International Partners

- Vivian Negrón-Ortiz
- Ethan Fried

Fairchild, Montgomery, and Bok Tower

- Joyce Maschinski
- Devon Powell
- Amy Padolf

- Patrick Griffith
- Cheryl Peterson

Conservation Genetics

- Nora Oleas
- Tonya Fotinos
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- Klara Scharnagl
- Vanessa Sanchez
- Emily Warschefskey

Funding

- Everglades National Park

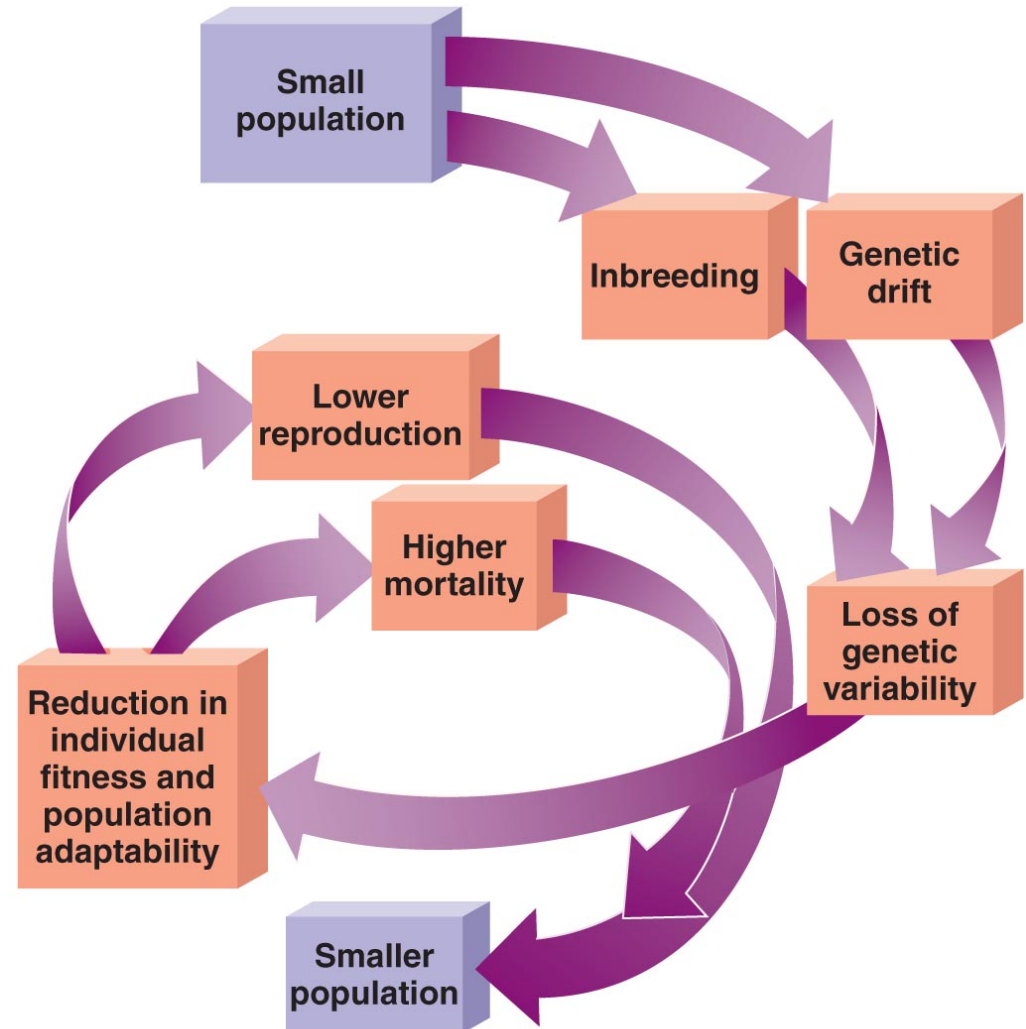
- USFWS
- Mohammed Bin Zayed Species Conservation Fund
- Florida Section Six funds
- Bok Tower Gardens

- FIU and FTBG

Extinction Vortex: Genetic concerns for rare species



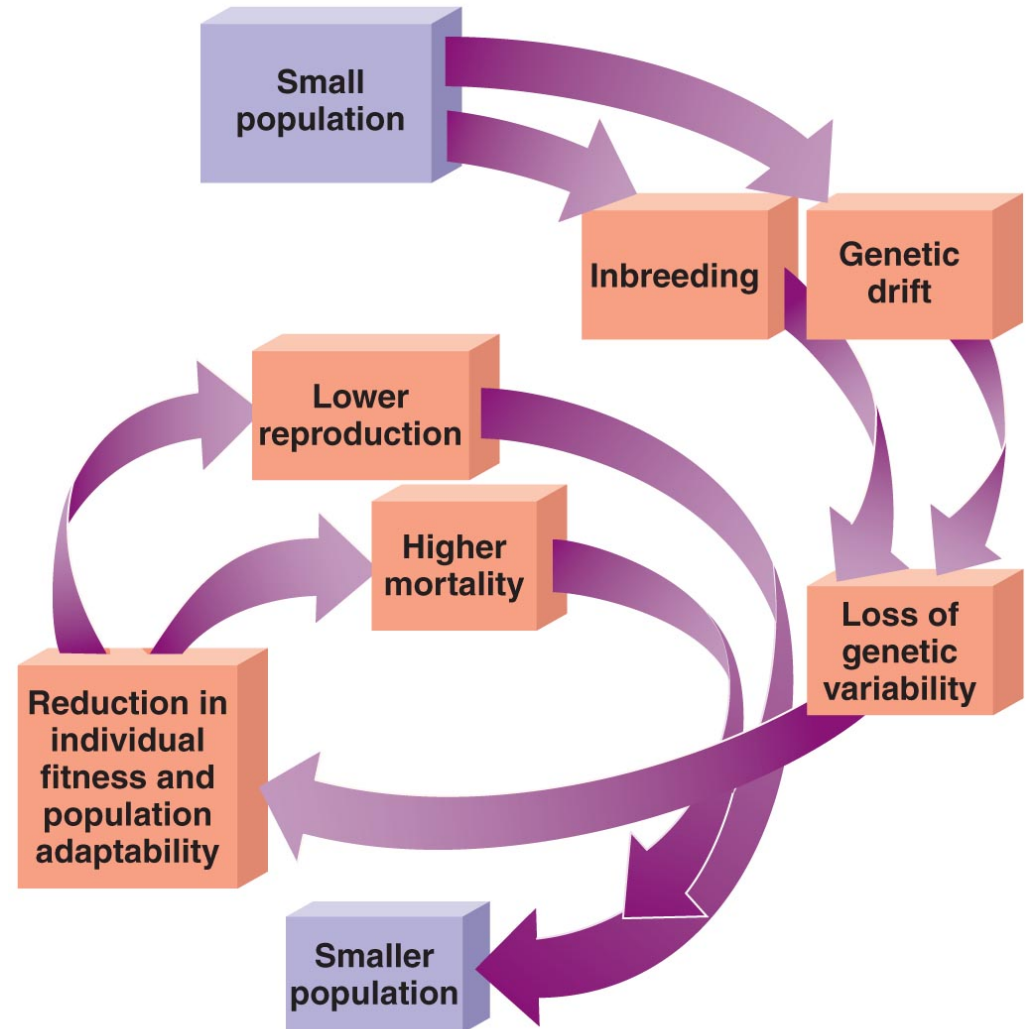
- Goal: Preserve the evolutionary potential of species
- Loss of genetic diversity = decrease in fitness = decrease in ability of a population/species to evolve
- Environmental heterogeneity further complicates this concern



Differentiation of populations: an added concern



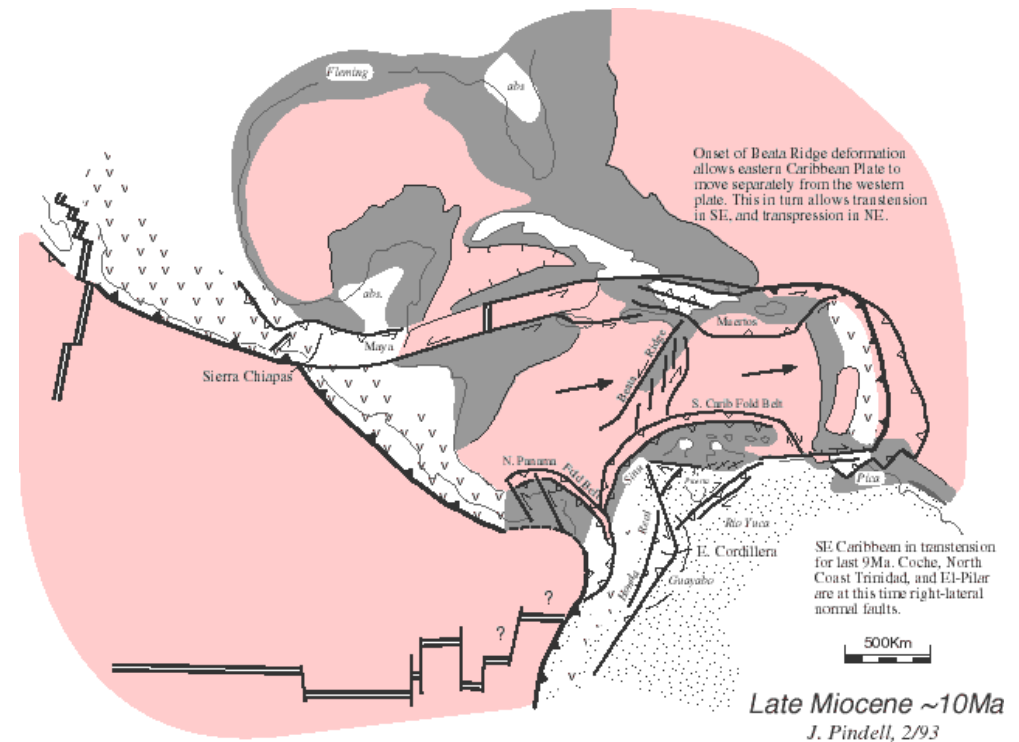
- Differentiated populations may represent drift or adaptive differences
- Other populations could restore genetic diversity
- Or could lead to loss of local adaptation
- We can say whether populations are different- but does it matter?



Southern Florida: Where three floras meet



- Southern Florida is geological new land
- Three groups of plant species
 - Caribbean
 - North American
 - Cosmopolitan



<http://www.dep.state.fl.us/geology/geologictopics/movies/paleogeo.mov>

Sinking Ships: The Keys and South Florida



- Low lying islands and coasts of Florida pose a special conservation problem
- Colonization bottleneck in the Keys for Caribbean species – general decline elsewhere?
- As Florida terrestrial habitats go underwater, do we move the species?

Maschinski et al. 2011. Sinking ships. *Climatic Change*

South Florida substrate diversity

- Pine rocklands
- Shell middens
- As Florida terrestrial habitats go underwater, do we move the species among remaining habitats?



Case studies on Florida endangered taxa

- The Miccosukee Gooseberry, *Ribes echinellum*
- Sargent's Cherry palm, *Pseudophoenix sargentii*
- Ocala vetch, *Vicia ocalensis*
- The Keys Tree Cactus, *Pilosocereus robinii*
- Harper's Beauty, *Harperocallis flava*
- Hoary pea, *Tephrosia angustissima*



Sampled Tephrosia taxa

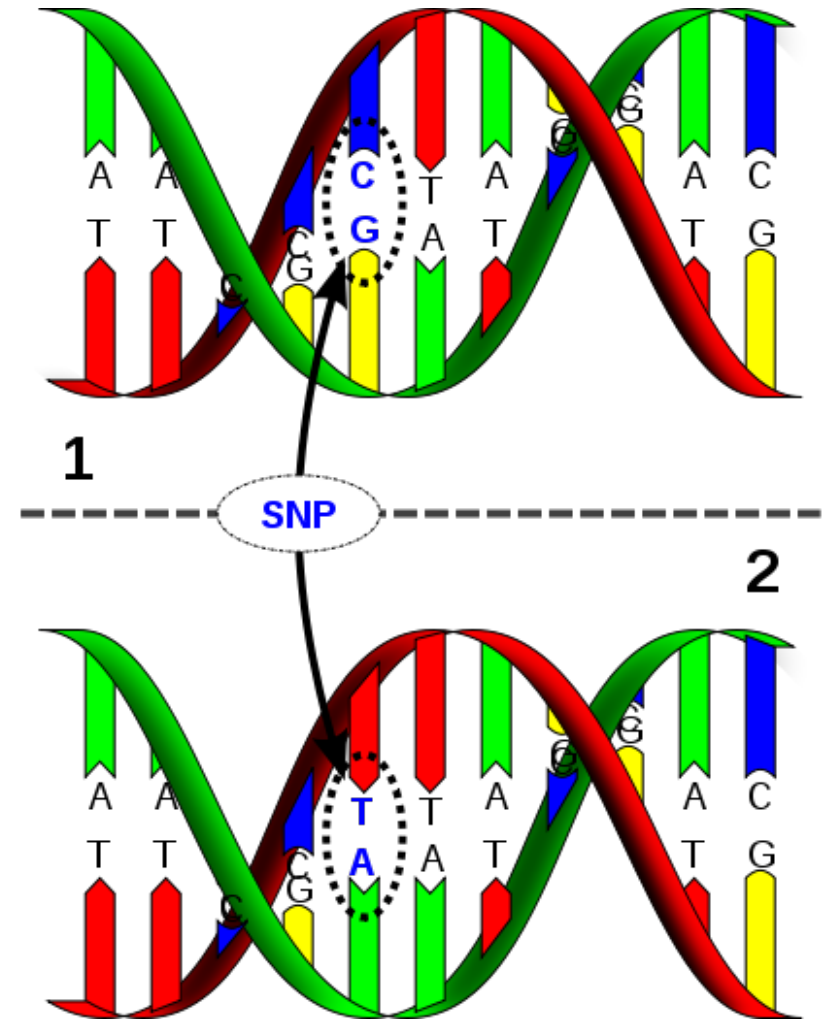


- *T. angustissima*
- Russel Key (Shell Midden)
- Chapman Field (Pine rockland)
- Haulover Beach
- *T. angustissima* Puerto Rico
- *T. seminole/curtissi/?*
- 3 locations in Big Cypress
- *T. floridiana*
- Ludlum pineland

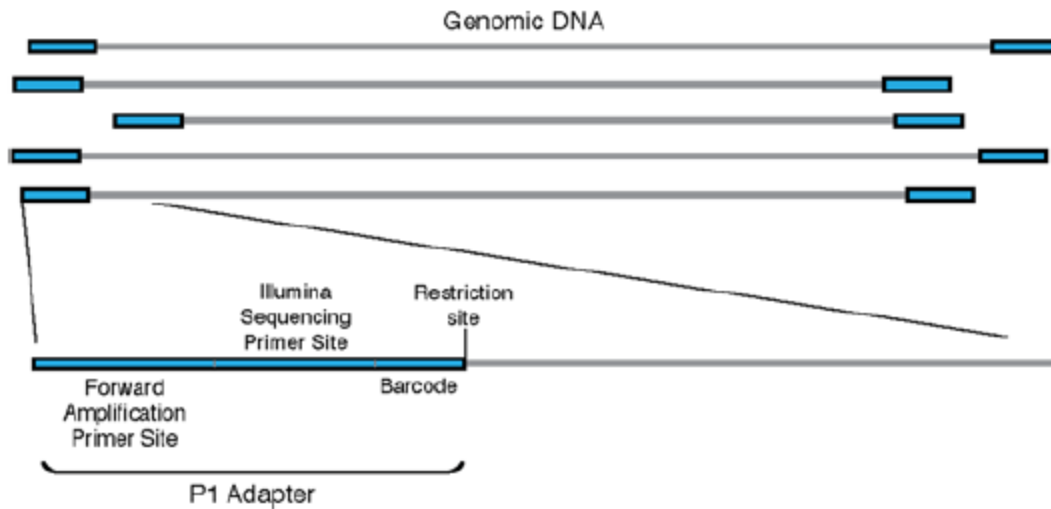


Restriction Site Associated DNA sequencing

- RAD – restriction site associated DNA – short fragments of DNA adjacent to a restriction enzyme recognition site
- Discover hundreds to thousands of SNPs on one Illumina run *de novo*
- Powerful, less labor intensive, order of magnitude for discovery of characters very high, cost relatively high so decreases sample size



A *Ligate P1 Adapter to digested genomic DNA*



DNA digested with restriction enzyme & adapter ligated to fragments

B *Pool barcoded samples and shear*



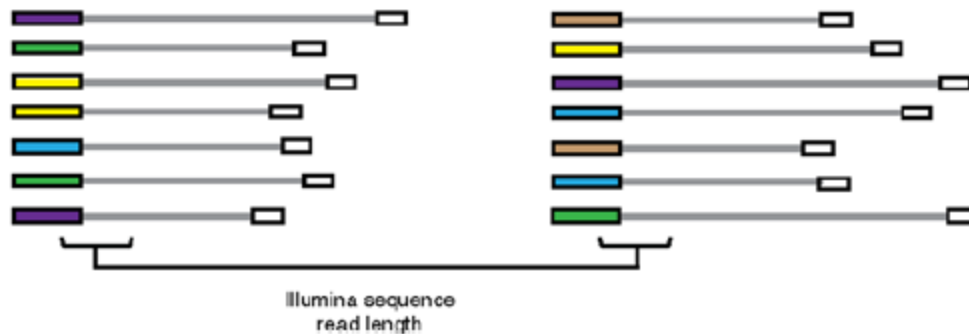
Ligated fragments combined, sheared

C *Ligate P2 Adapter to sheared fragments*



Ligated to 2nd adapter –
prevent amplification of
fragments lacking an adapter

D *Selectively amplify RAD tags*



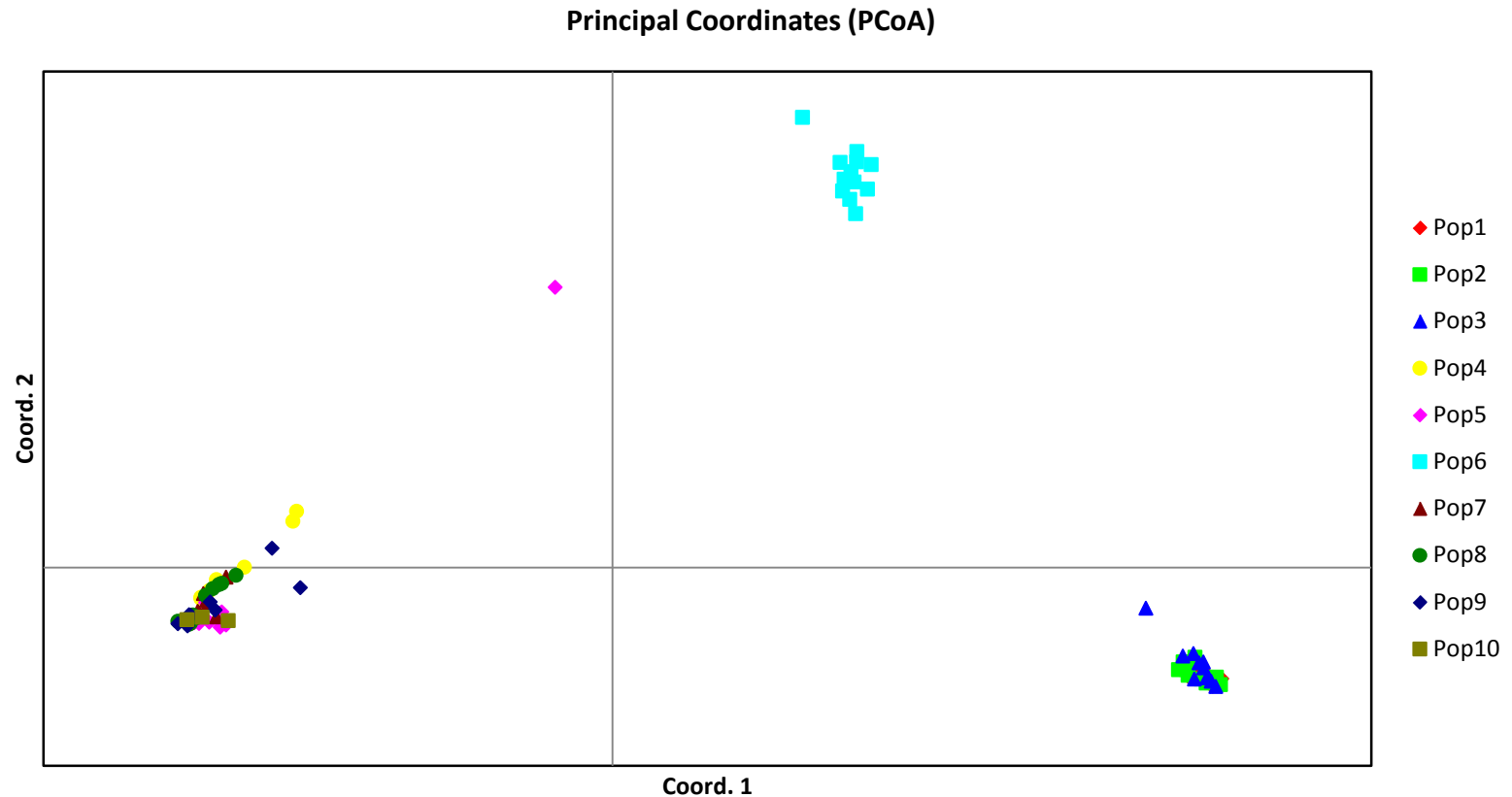
RAD tags enriched

Restriction Site Associated DNA

sequencing

- 6278 genetic markers (single nucleotide polymorphisms) recovered in *Tephrosia*

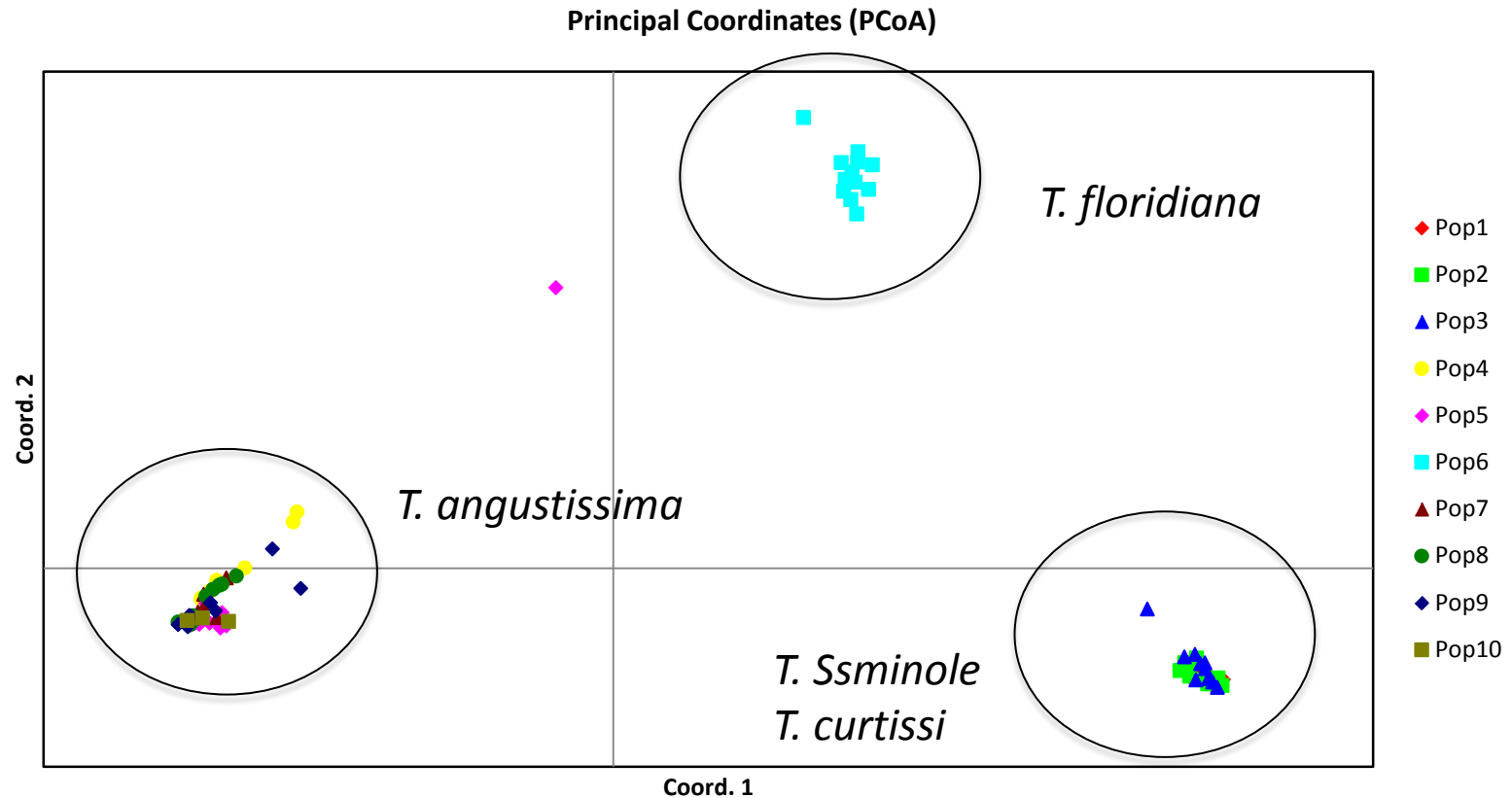
Restriction Site Associated DNA sequencing



Three genetically distinct groups

von Wettberg et al 2016, and von Wettberg et al in prep

Restriction Site Associated DNA sequencing

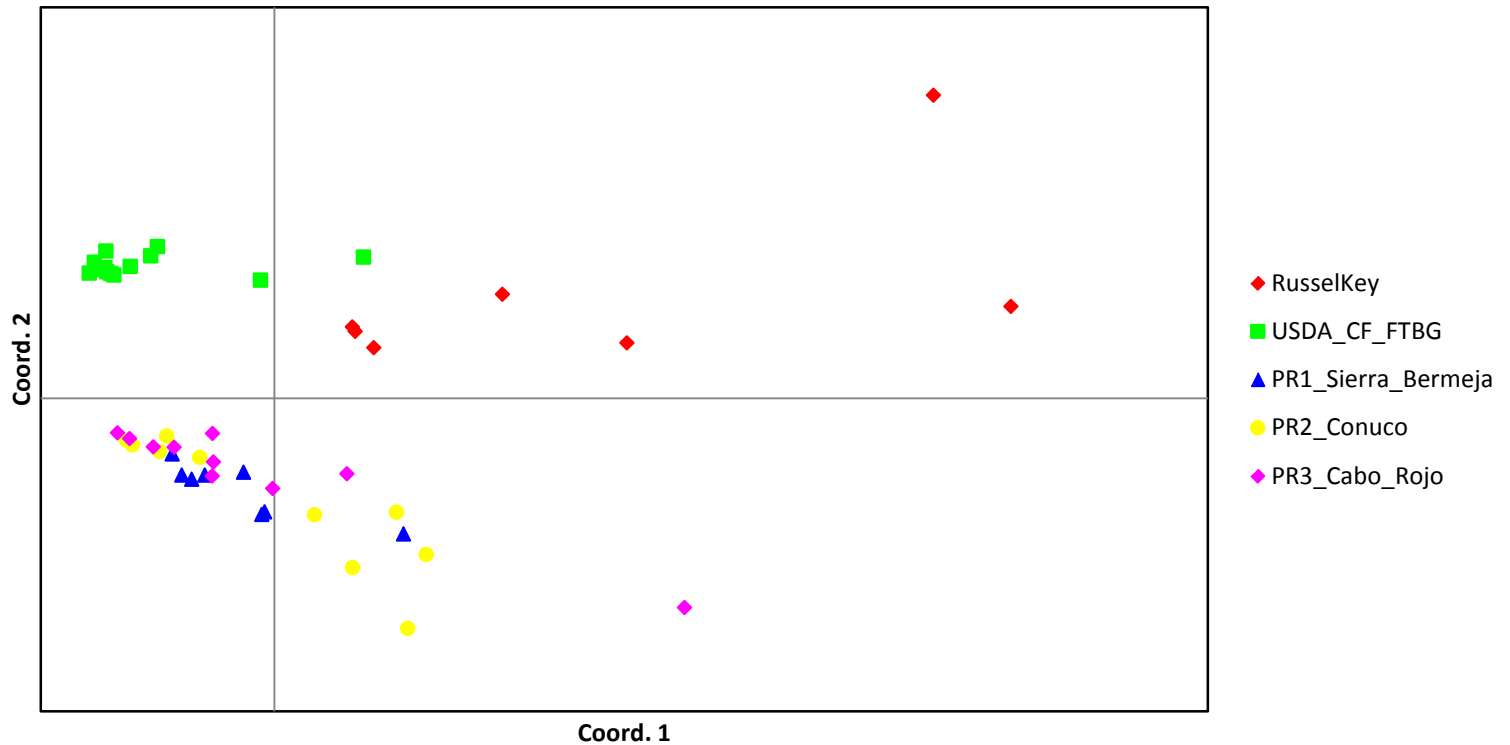


Three genetically distinct groups

von Wettberg et al 2016, and von Wettberg et al in prep

Differentiation of *Fl* and *PR T.* *angustissima*

Principal Coordinates (PCoA)



More analysis

underway

- Bayesian Demographic Inference and improved population size estimates (G-Phocs)
- Estimates of potential hybridization (Treemix)

Take home points

- At least three taxa in South Florida
 - Feasible, but expensive and the benefit is unclear
- Unusual affinity of a shell midden site with pine rockland
- Need to understand connection to the wider Caribbean basin

Looking

forward

- Using whole genome data rather than a fraction of the genome?
 - Feasible, but expensive and the benefit is unclear
- Can we distinguish selective differentiation from genetic drift from sequences, to better understand when population differentiation is adaptive

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