WESTERN BURROWING OWL POPULATION GENOMICS

Kelly Barr
UCLA

Christen Bossu
Colorado State

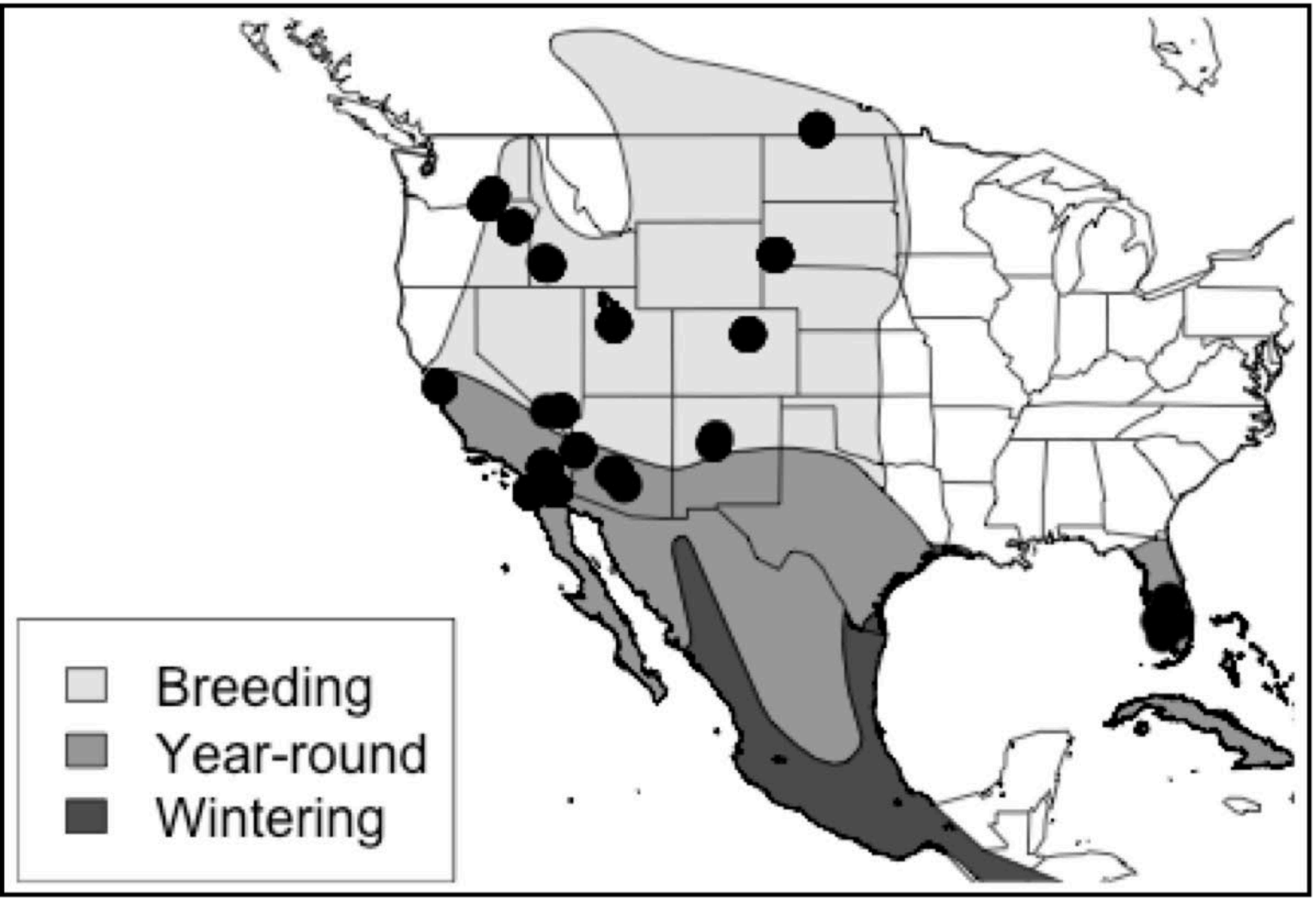
Tom Smith
UCLA

Kristen Ruegg
Colorado State

QUESTIONS

1. Is there any population structure?
    - Gene flow patterns
    - Genetic diversity
2. Is there any evidence for environmental adaption associated with migratory behavior?

SAMPLES



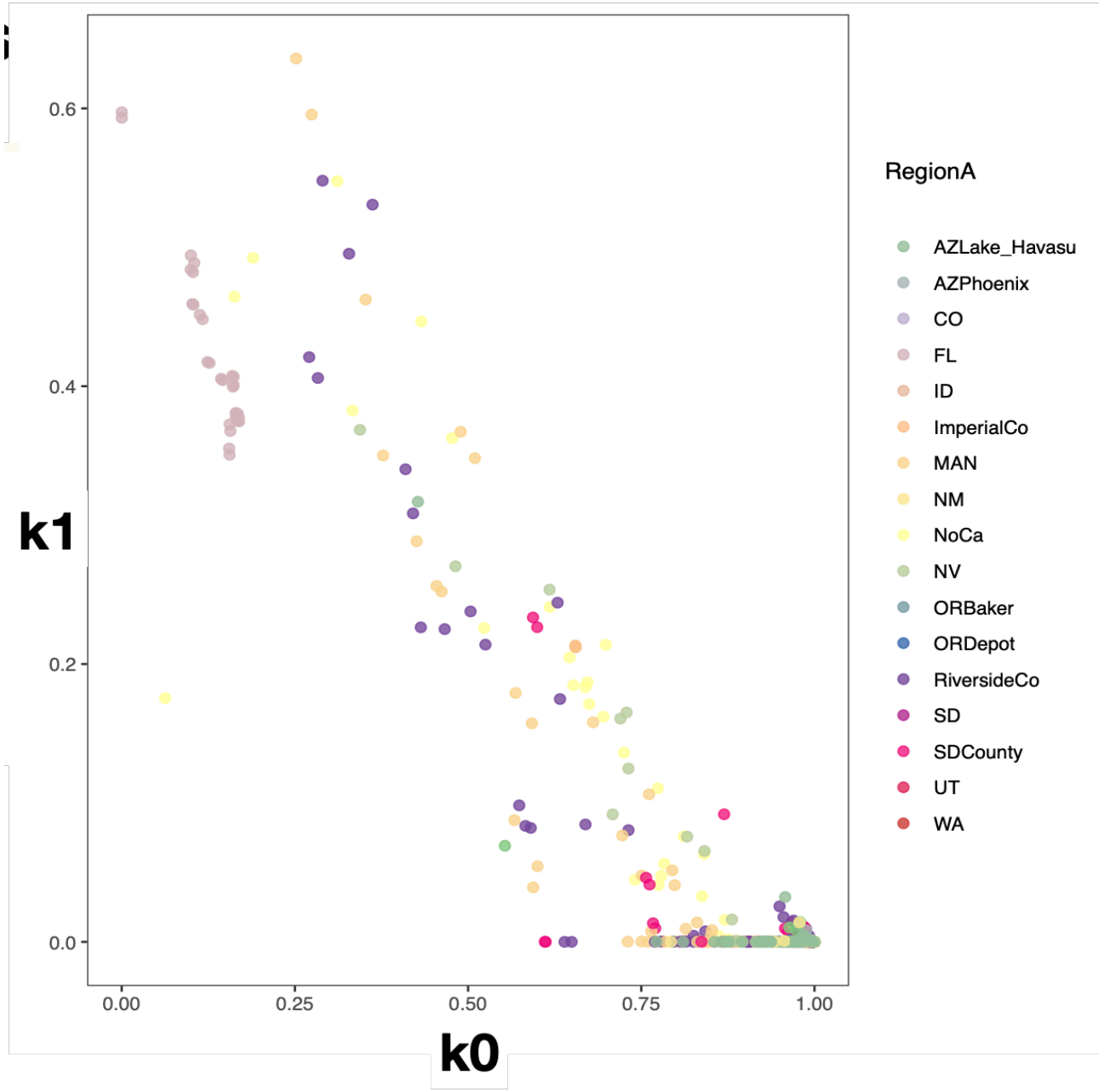
- Jim Belthoff, Boise State
- Lynne Trulio, San Jose State University Todd Katzner, USGS
- David Johnson, Global Owl Project
- Lisa Nordstrom & Colleen Wisinski, San Diego Zoo Institute for Conservation Research
- Lauren Meads, Burrowing Owl Conservation Society
- Stephen Peterson & Lucy Johnson, Assiniboine Zoo
- Troy Wellicome & Tatiana Hayek, Calgary Zoo
- Elizabeth White, University of Florida
- Kerrie Anne Lloyd, ASU-Lake Havasu
- Carl Lundblad, University of Idaho
- Michael Ingraldi & Dennis Abbati, Arizona Game and Fish Department

THE DATA

1. One High Quality Genome
    - Reference Tool
    - Average Depth 50X

2. Many Low Coverage Genomes
    - Assessing Population Level Genetic Variation
    - 214 BUOWs
    - Coverage: 0.978X (0.0104X - 2.132X)
    - Genetic Variants: 2M – 10M

RELATEDNESS A BIG ISSUE



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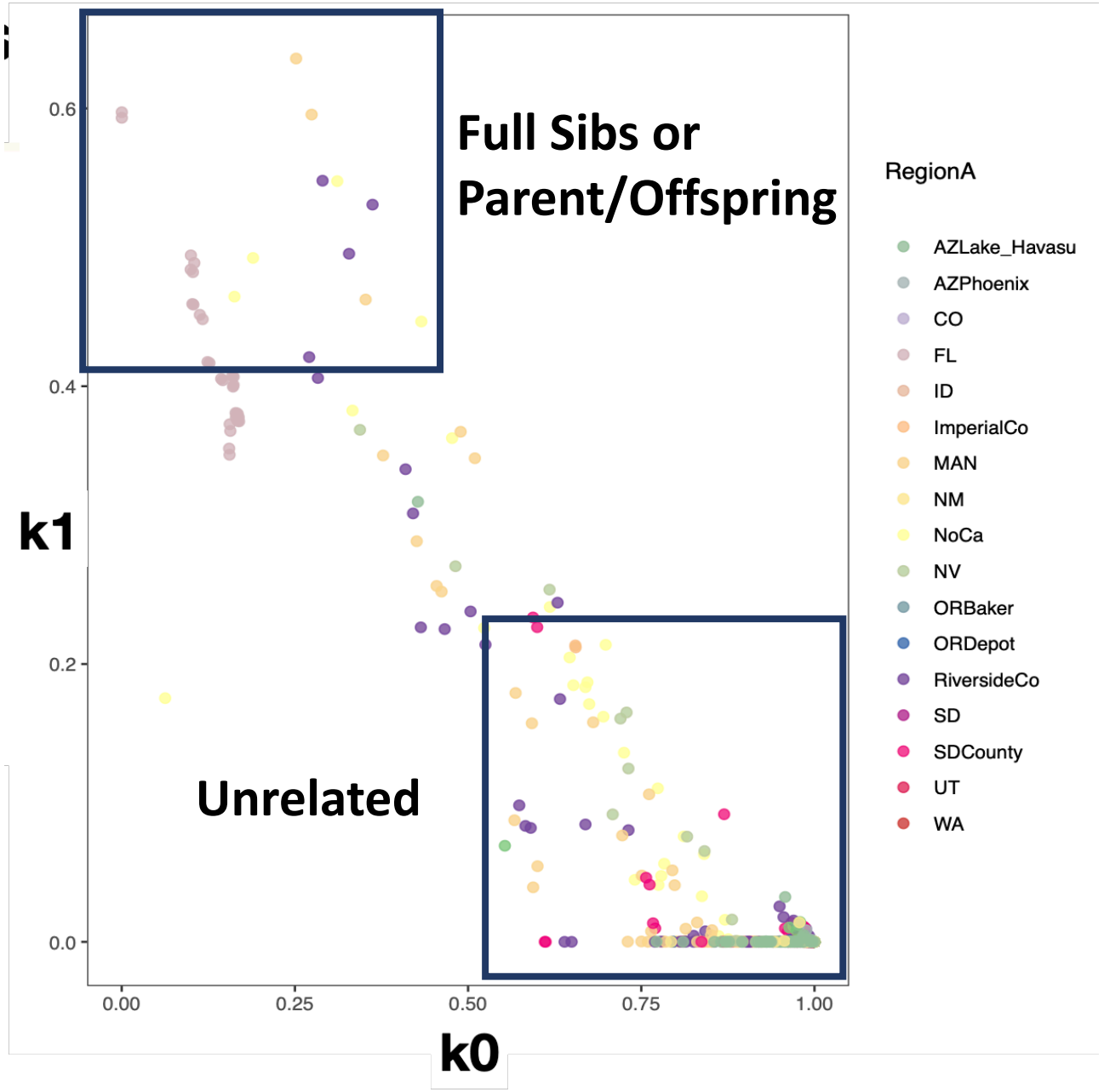
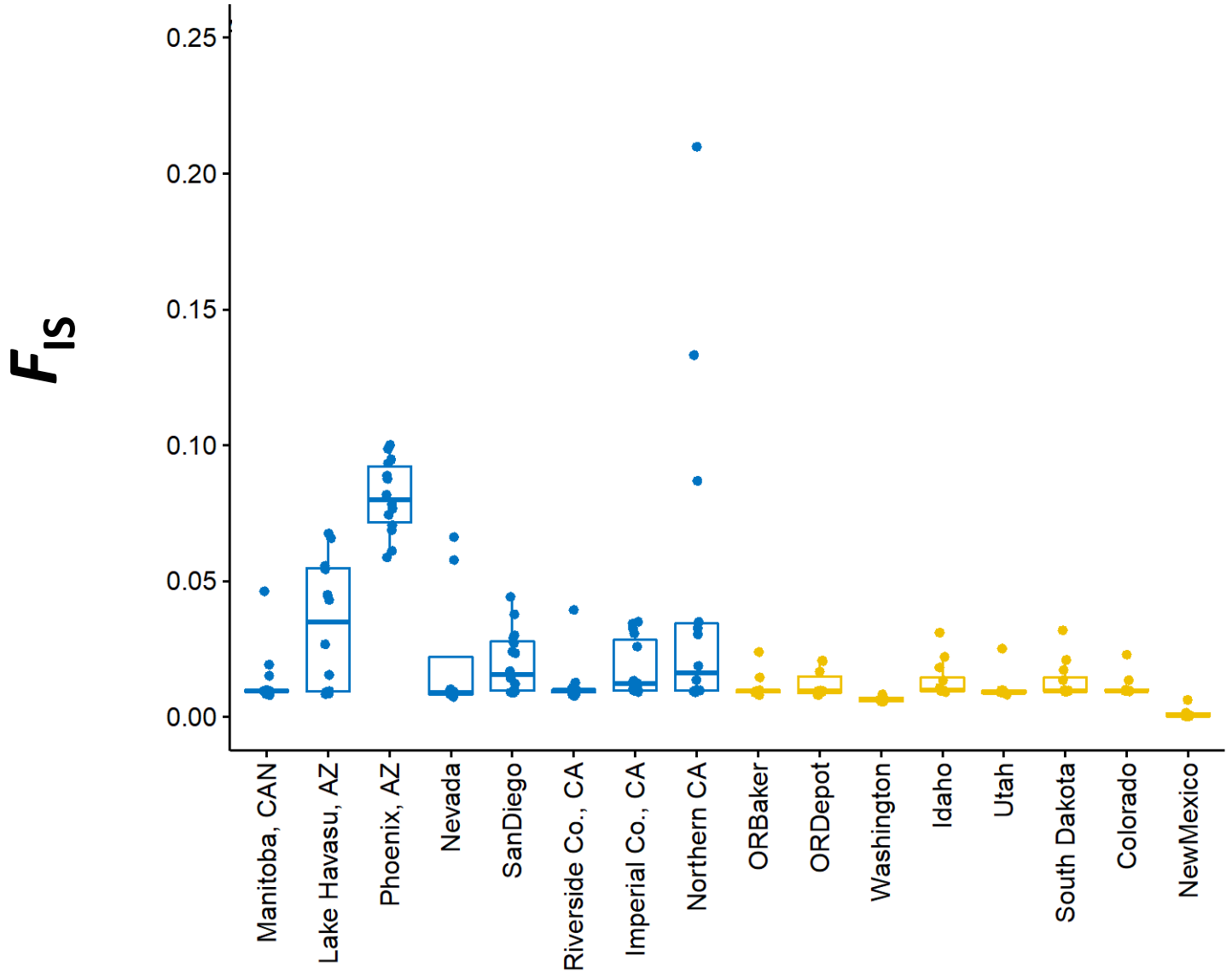
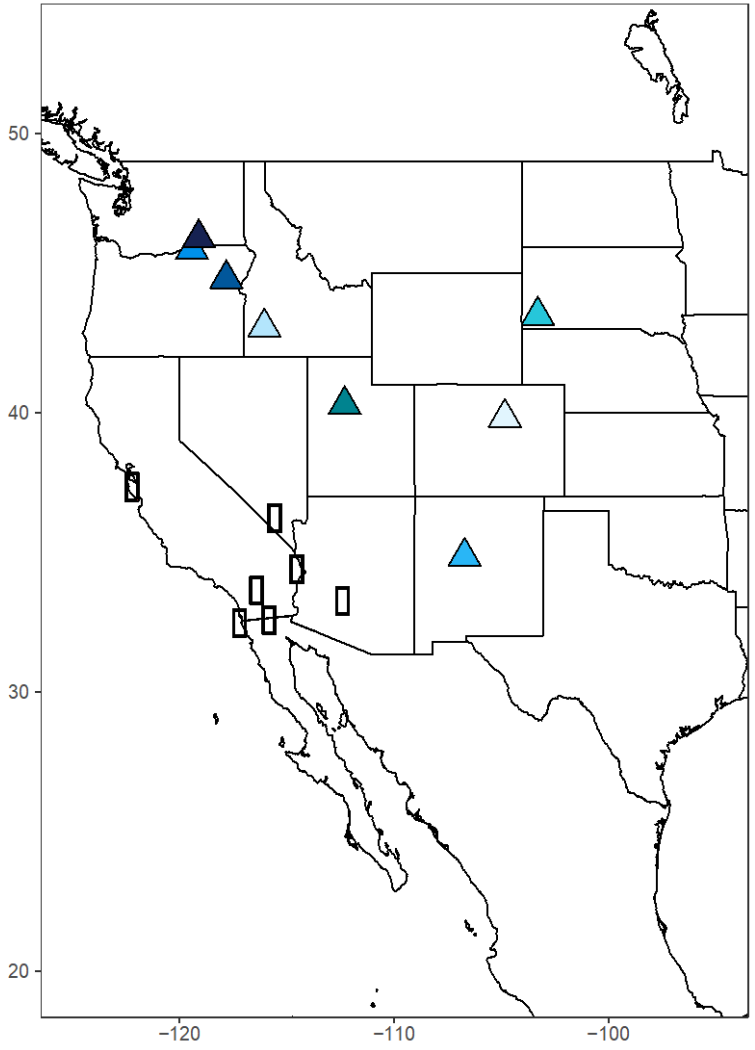


INBREEDING HIGHER IN RESIDENTS



STRUCTURED RESIDENTS
VS.
HIGH GENE FLOW MIGRANTS

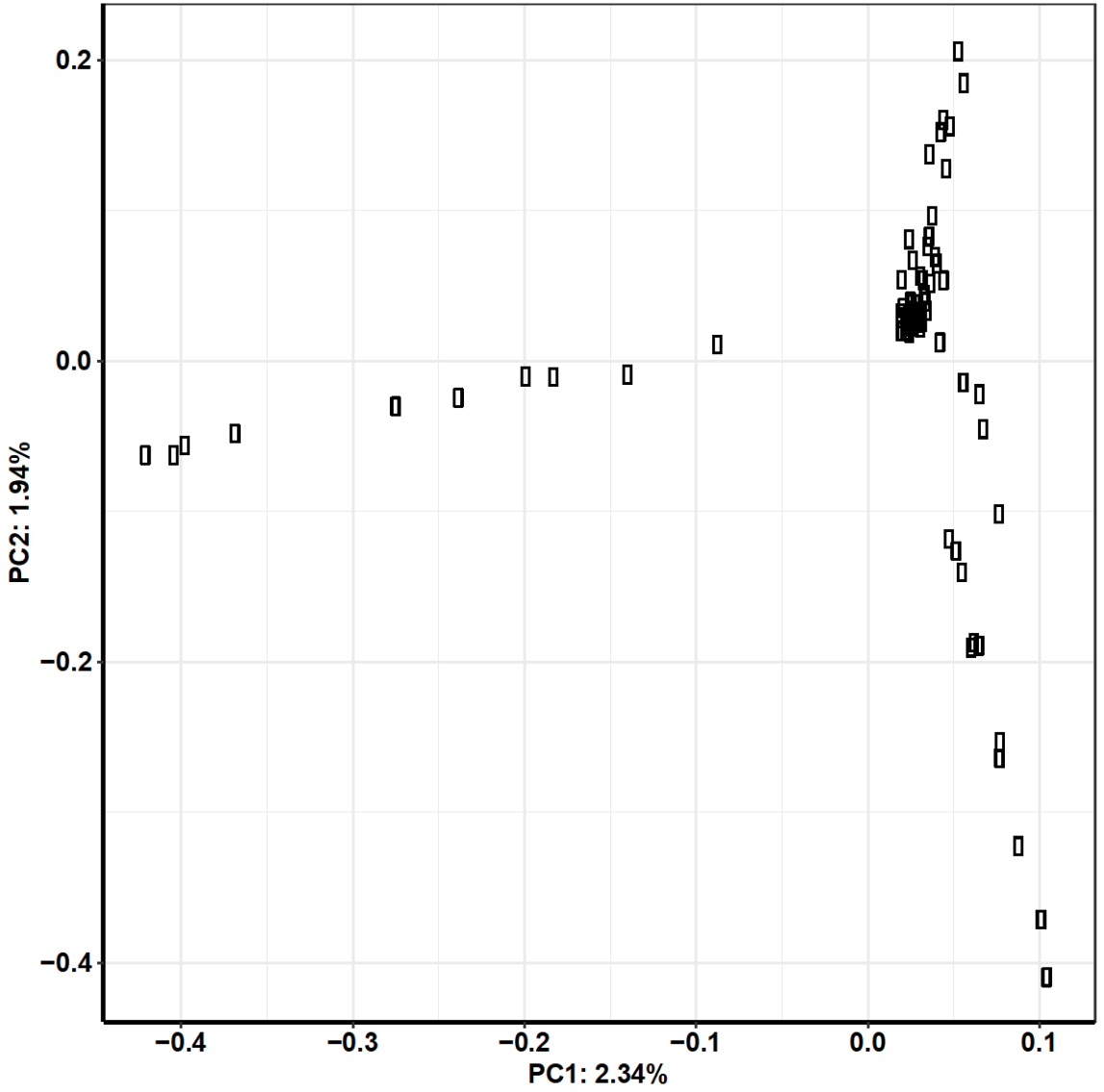


MIGRATORY

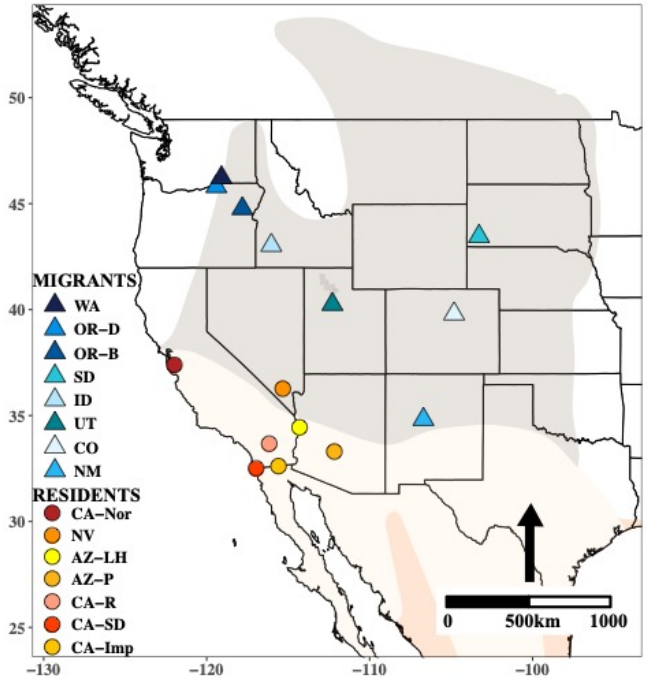
- WA
- OR–D
- OR–B
- SD
- ID
- UT
- CO
- NM

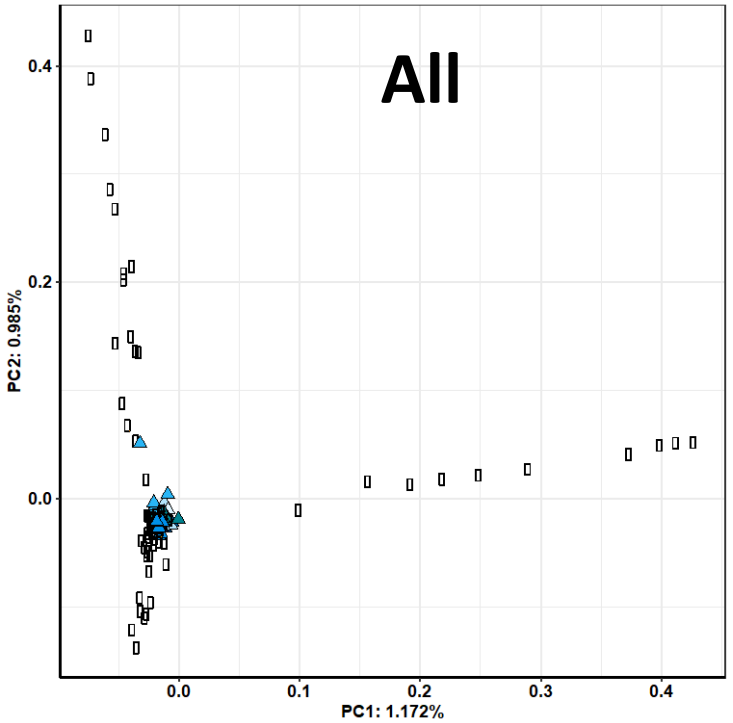
RESIDENT

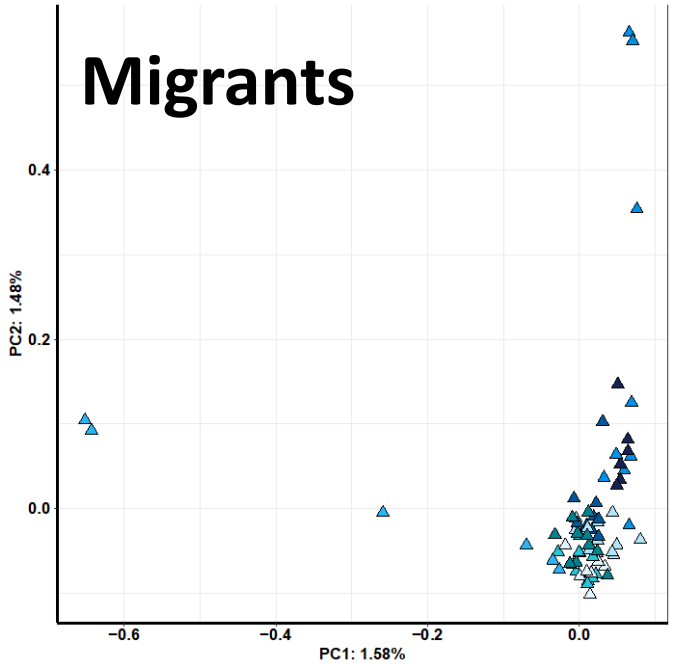
- CA–Nor
- NV
- AZ–LH
- AZ–P
- CA–R
- CA–SD
- CA–Imp

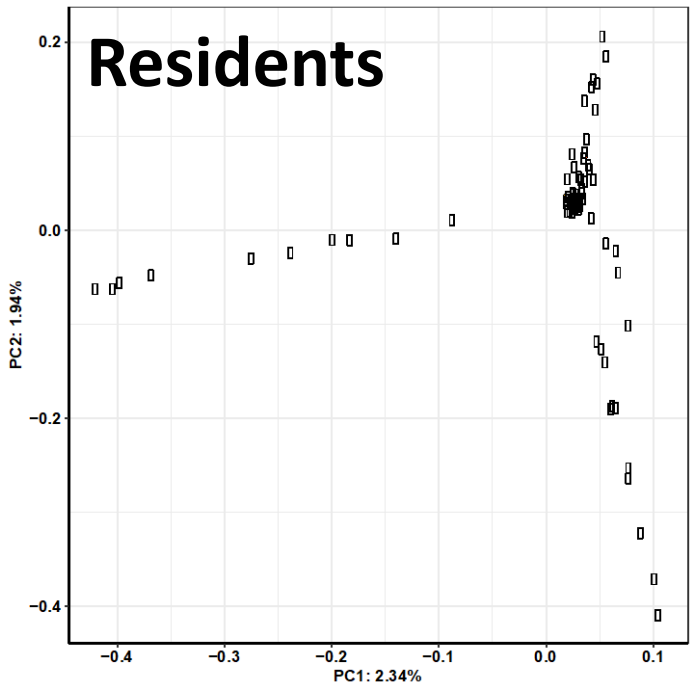


Clear Panmixia Among Migrants and Structure Among Residents

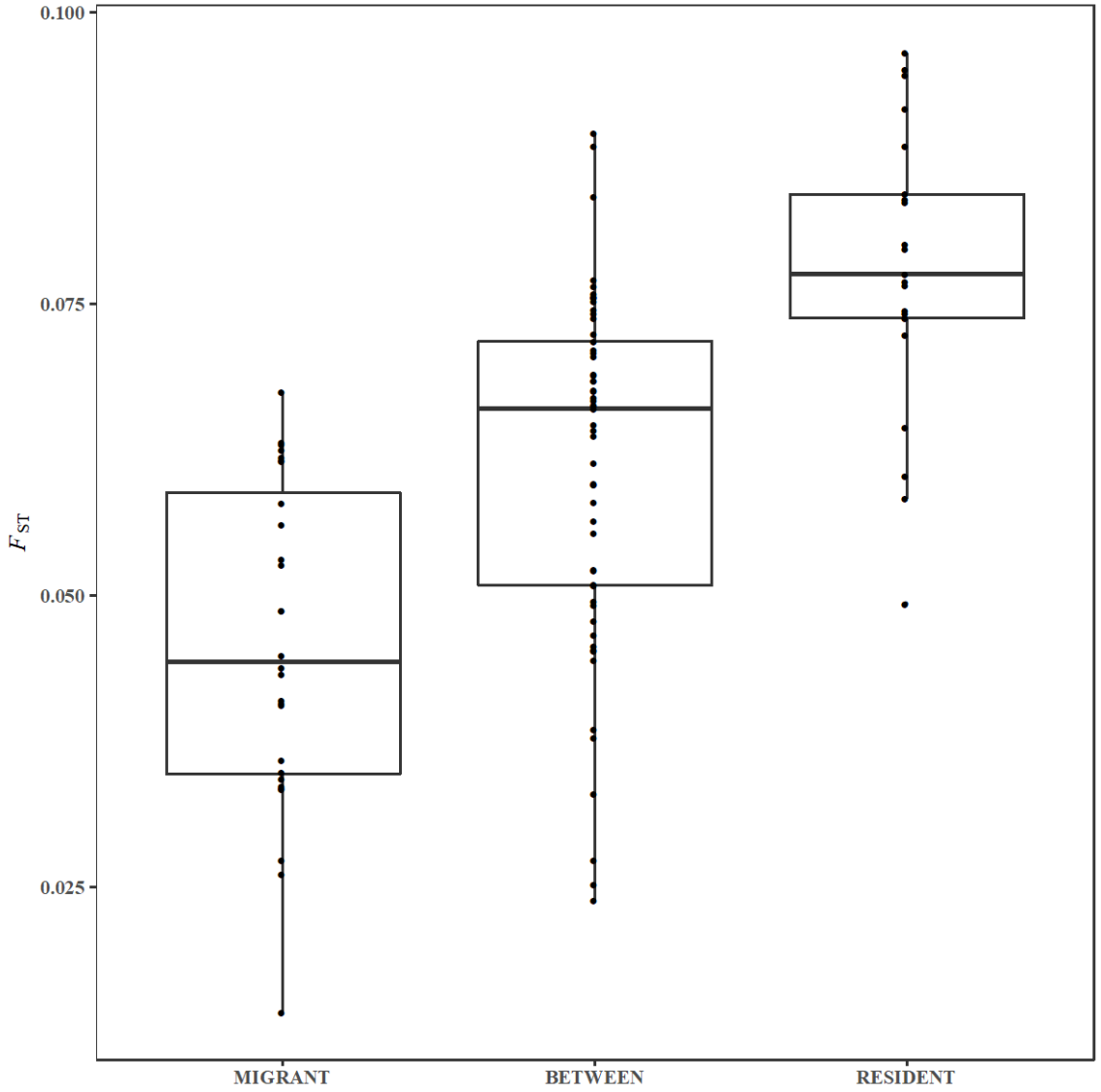






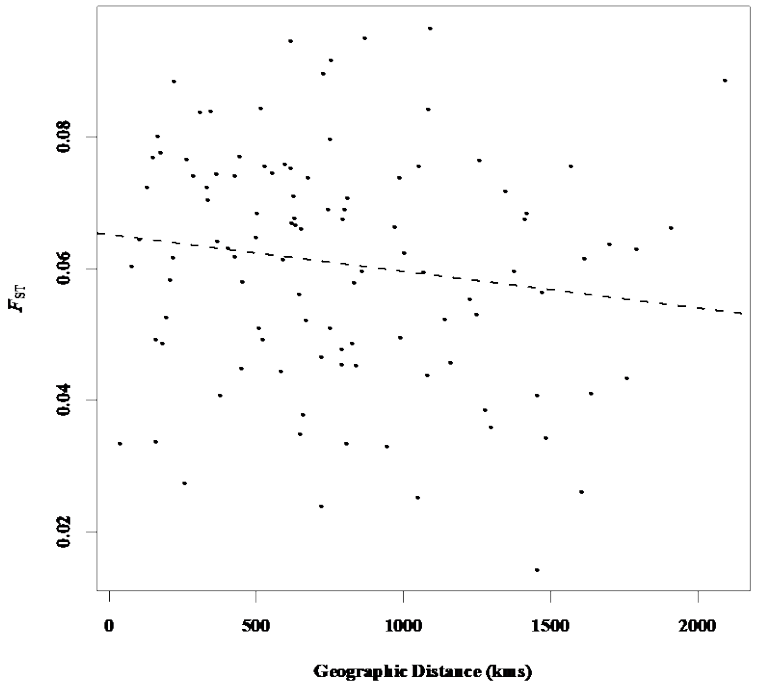


STRUCTURED RESIDENTS
VS.
HIGH GENE FLOW MIGRANTS:
GENETIC DIFFERENTIATION

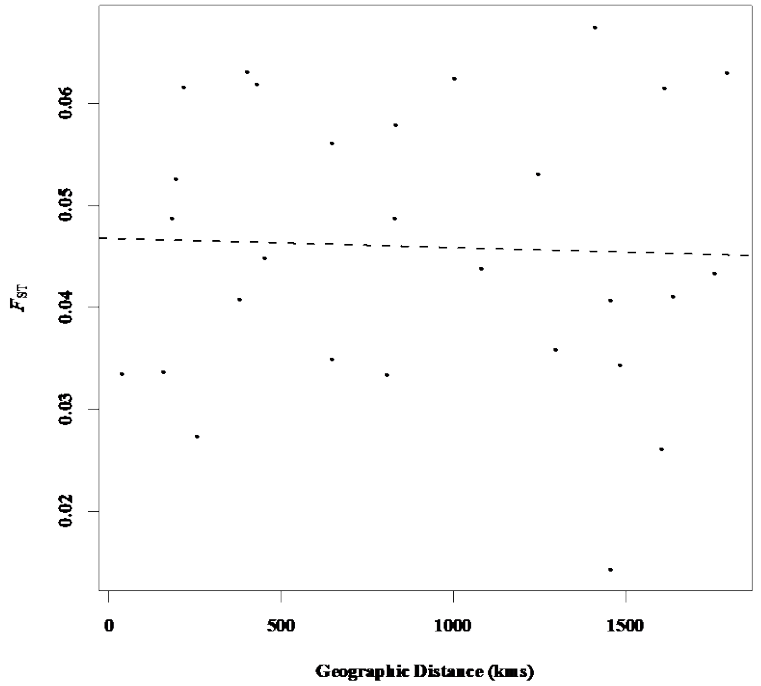


STRUCTURED RESIDENTS
VS.
HIGH GENE FLOW MIGRANTS:
ISOLATION BY DISTANCE

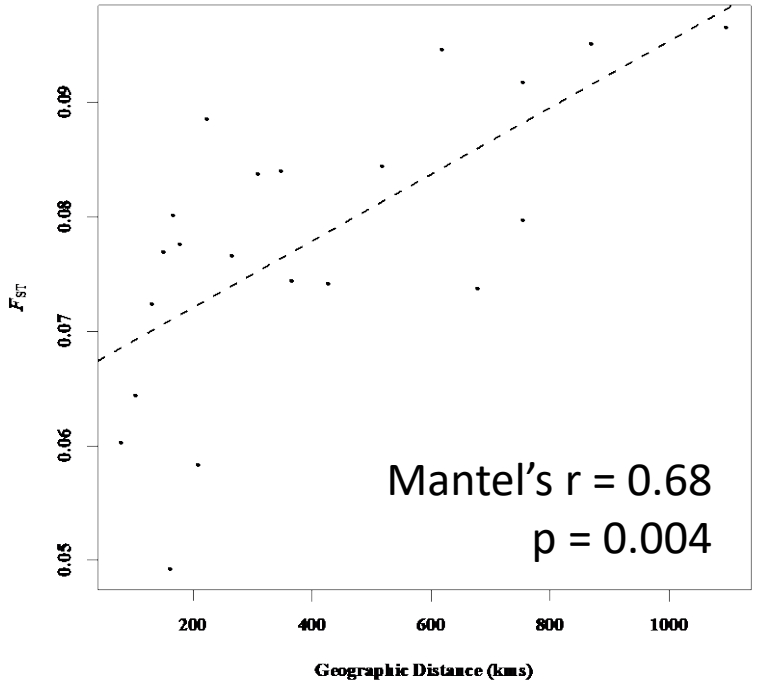
ALL



MIGRATORY



RESIDENTS



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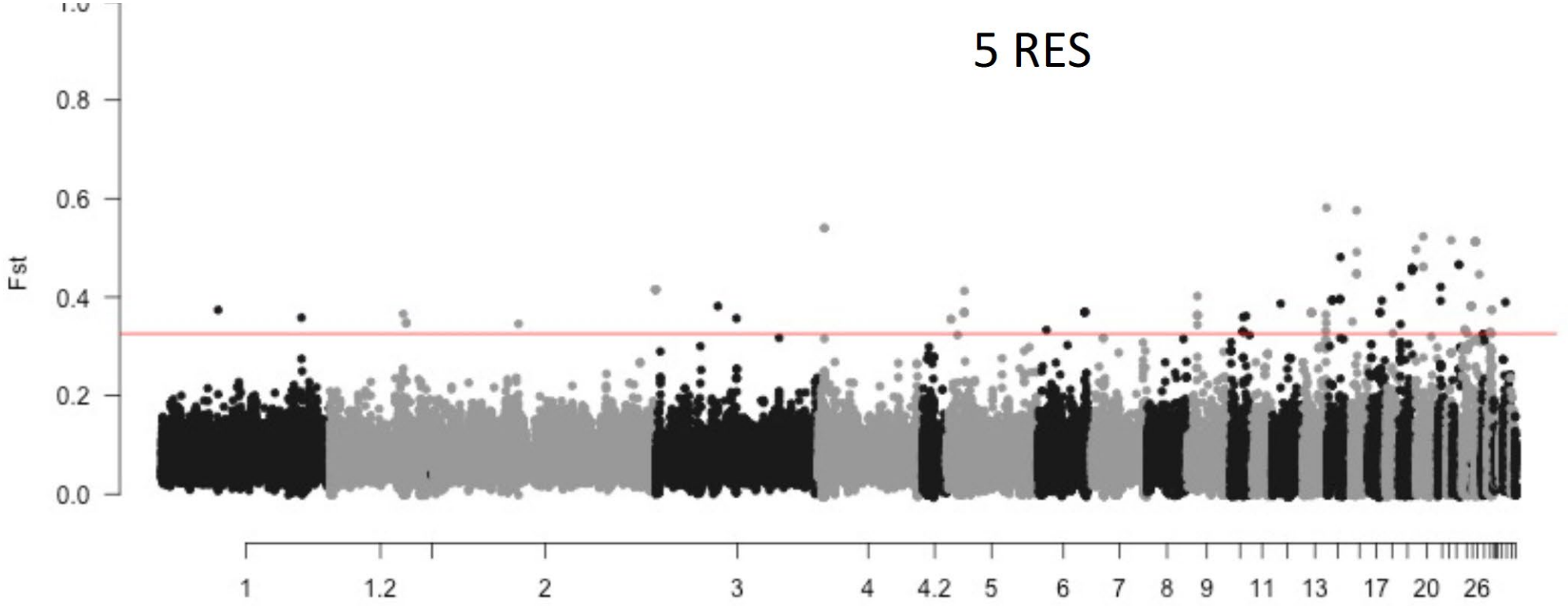
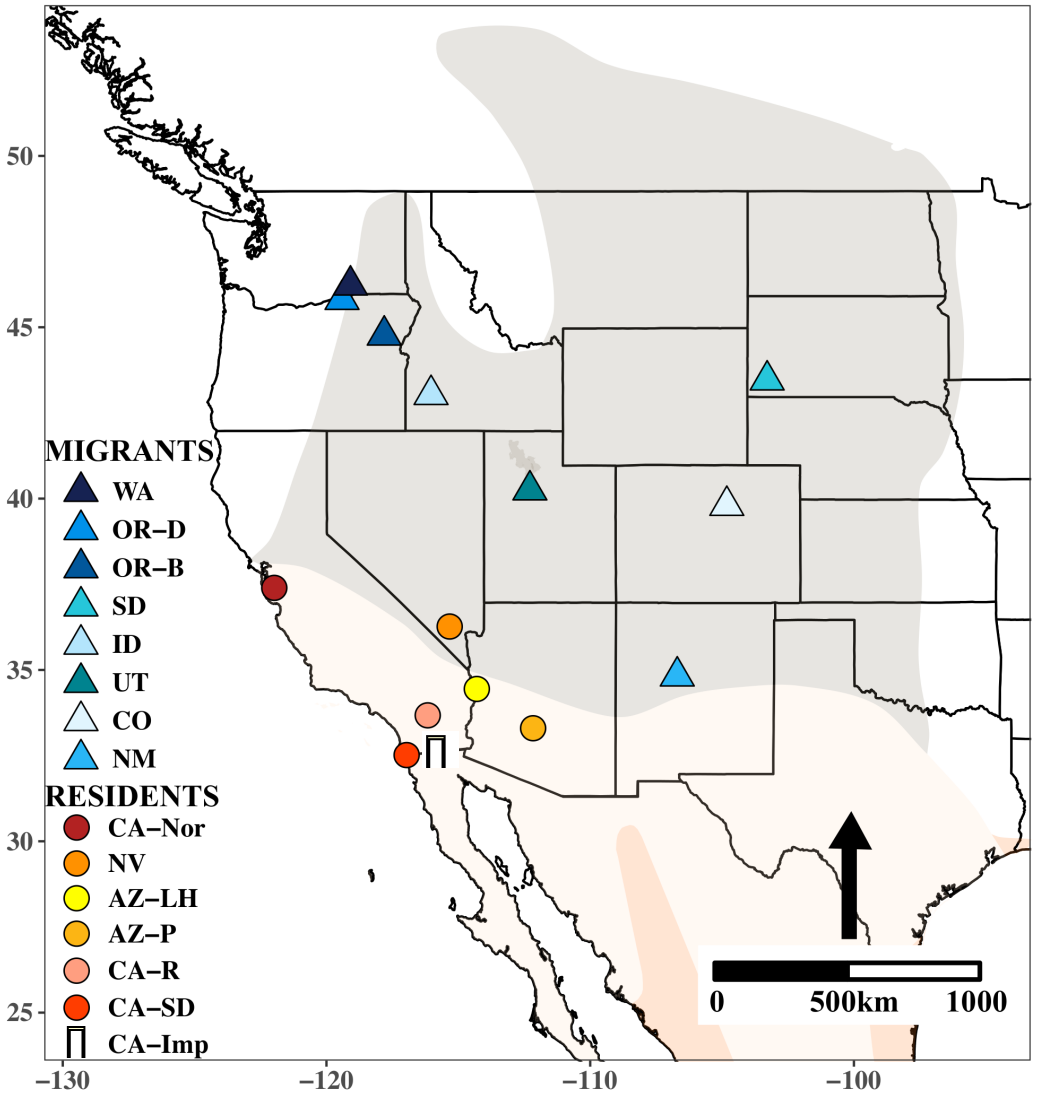
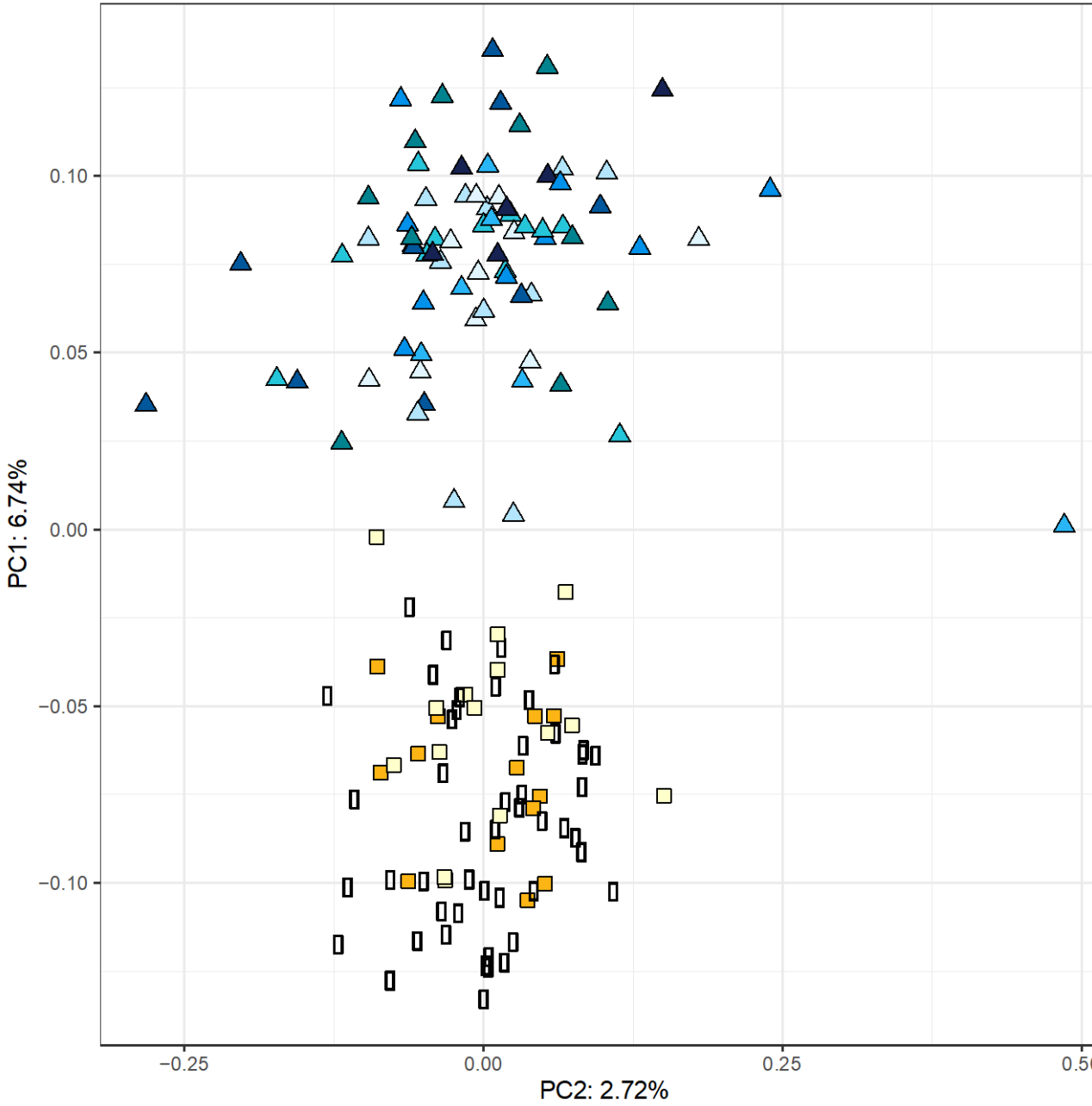
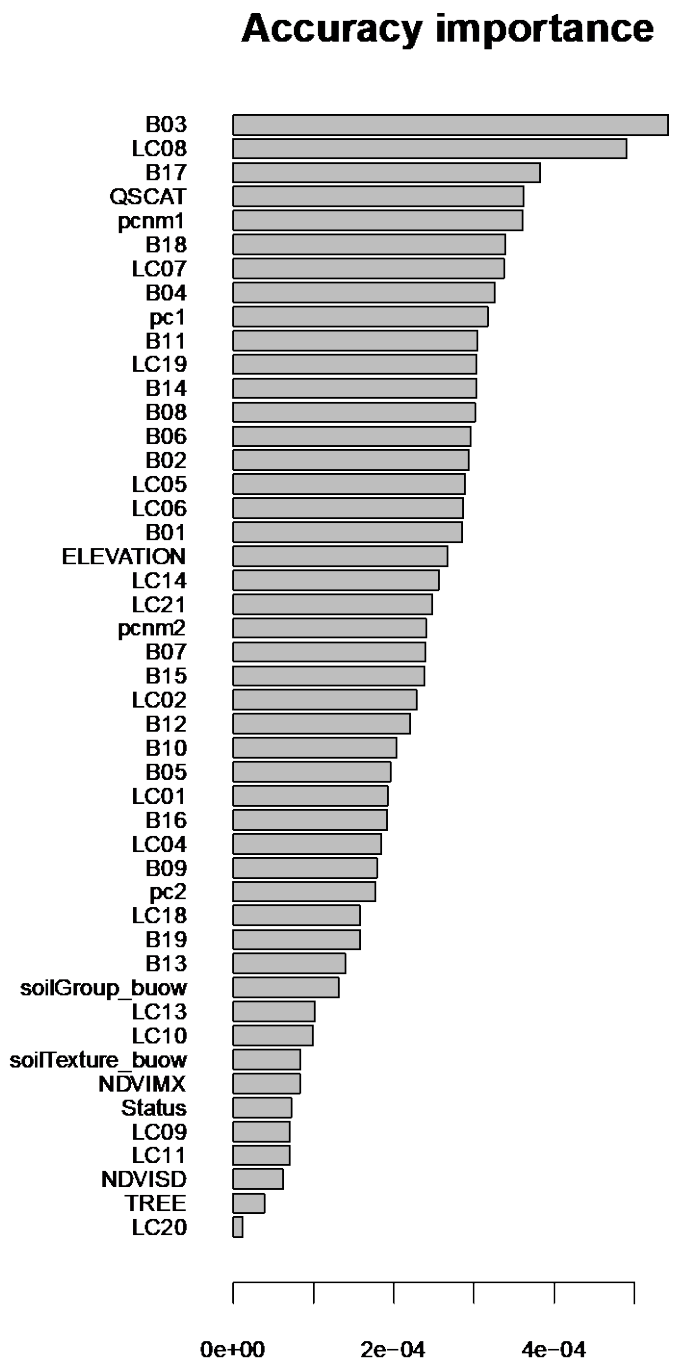
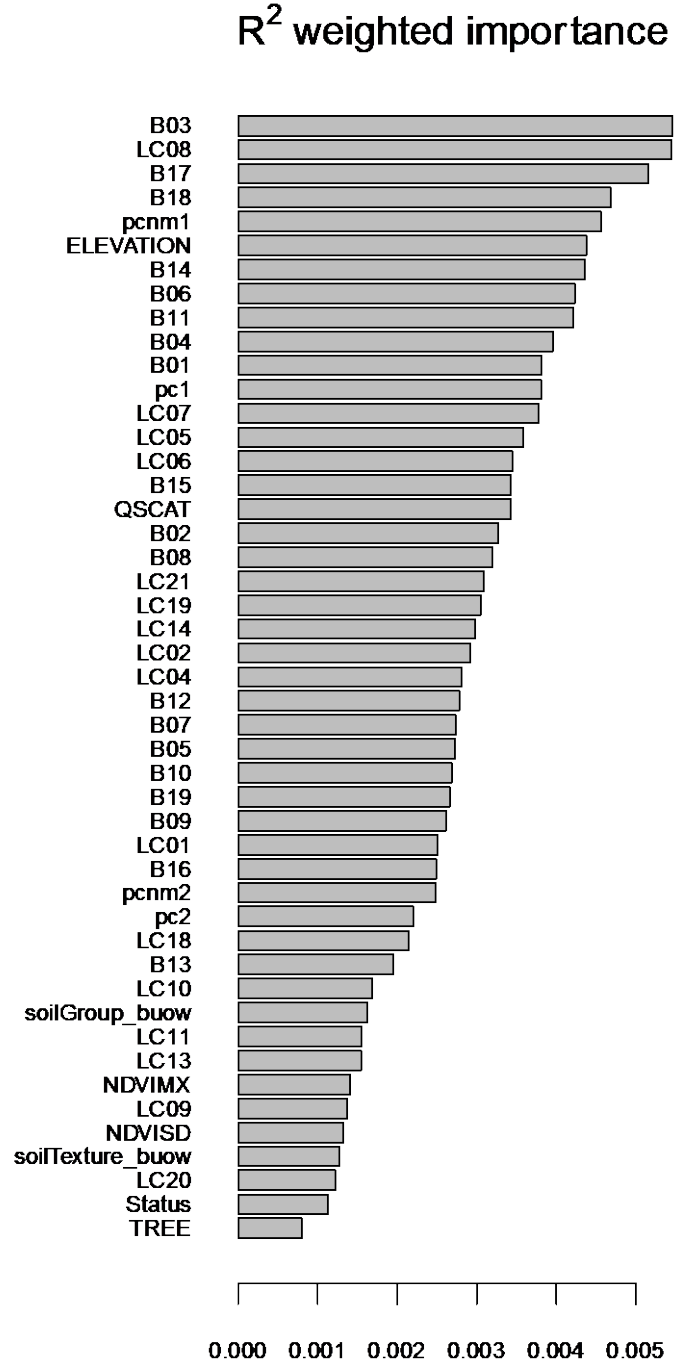


Pooled Migrants Together and Residents Together --> Genomewide FSTs → Top 0.1% Loci in Top 0.01% 50kb Windows

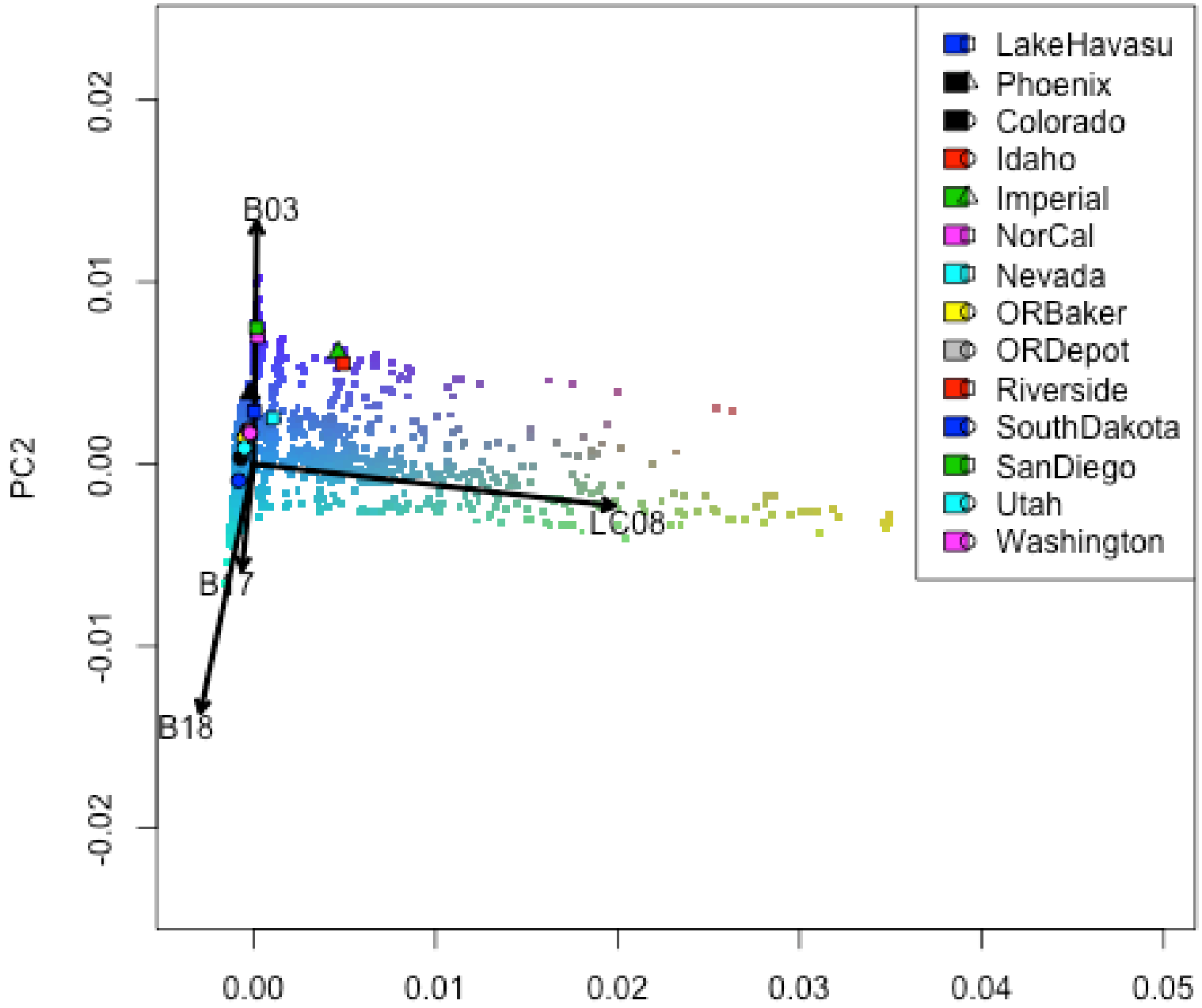

MIGRANTS
WA
OR–D
OR–B
SD
ID
UT
CO
NM
RESIDENTS
CA–Nor
NV
AZ–LH
AZ–P
CA–R
CA–SD
CA–Imp
0
500km
1000
50
45
40
35
30
25
−130
−120
−110
−100

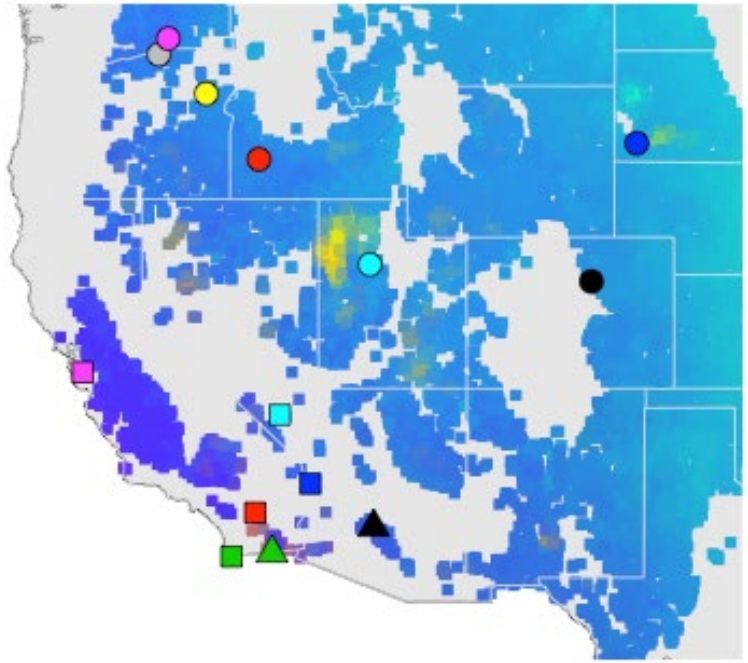

0.10
0.05
0.00
−0.05
−0.10
PC1: 6.74%
−0.25
0.00
0.25
PC2: 2.72%





B03 = Isothermality
LC08 = Barren/Open Area
B17 = precip driest quarter
B18 = precip warmest quarter


LakeHavasu
Phoenix
Colorado
Idaho
Imperial
NorCal
Nevada
ORBaker
ORDepot
Riverside
SouthDakota
SanDiego
Utah
Washington
B03
B07
B18
LC08
PC2
0.02
0.01
0.00
-0.01
-0.02
0.00
0.01
0.02
0.03
0.04
0.05



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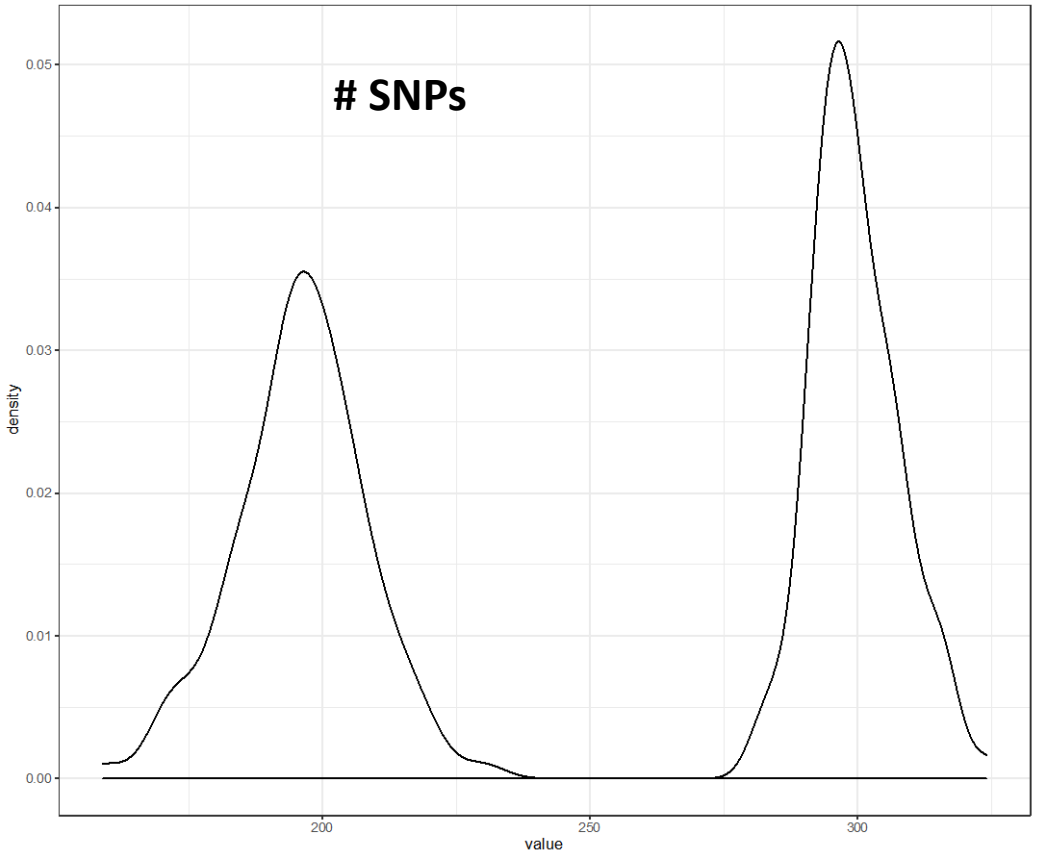
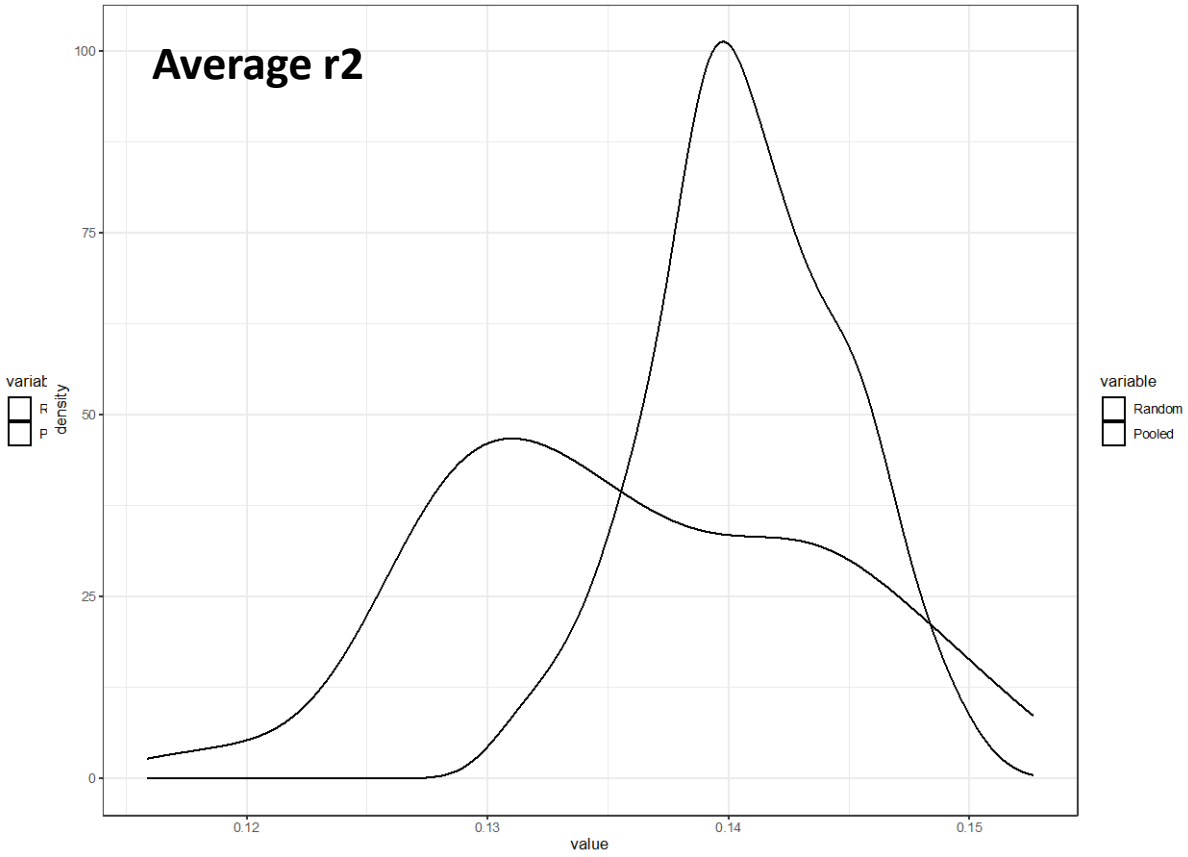
   - Gene flow patterns – migrants panmictic, residents in IBD
   - Genetic diversity – higher inbreeding among residents
2. Is there any evidence for environmental adaption associated with migratory behavior?
   - There seems to be!

Questions?





100 gradient forests with ”environmental” variables shuffled
100 gradient forests with the data

FSTs	Colorado	Idaho	Imperial	LakeHavasu	LasVegas	NewMexico	NorCal	Oregon-Baker	Oregon-Depot	Phoenix	Riverside	SouthDakota	Utah	Washington	SanDiego
Colorado	0.000														
Idaho	0.053	0.000													
Imperial	0.055	0.068	0.000												
LakeHavasu	0.060	0.077	0.080	0.000											
LasVegas	0.046	0.072	0.078	0.072	0.000										
NewMexico	0.027	0.044	0.050	0.045	0.033	0.000									
NorCal	0.066	0.090	0.092	0.095	0.080	0.064	0.000								
Oregon-Baker	0.041	0.062	0.066	0.067	0.051	0.036	0.075	0.000							
Oregon-Depot	0.041	0.063	0.068	0.069	0.052	0.034	0.075	0.049	0.000						
Phoenix	0.060	0.076	0.074	0.089	0.084	0.067	0.097	0.071	0.074	0.000					
Riverside	0.039	0.058	0.060	0.058	0.049	0.025	0.074	0.044	0.047	0.074	0.000				
SouthDakota	0.053	0.068	0.068	0.077	0.072	0.045	0.089	0.062	0.063	0.076	0.056	0.000			
Utah	0.049	0.062	0.065	0.070	0.064	0.035	0.084	0.056	0.058	0.074	0.049	0.062	0.000		
Washington	0.026	0.041	0.048	0.045	0.038	0.014	0.061	0.034	0.033	0.066	0.024	0.043	0.033	0.000	
SanDiego	0.060	0.076	0.077	0.084	0.077	0.052	0.095	0.068	0.069	0.084	0.064	0.076	0.071	0.051	0.000