

Mountain goat population structure: signs from the past, inferences for the future

Aaron Shafer
Steeve Côté
Dave Coltman



Photo: Andrew Shirk

GOABC 2008

Aims of the project

Actively began soliciting samples 2003/04

1) Population structure

- Use genetic markers to look at population differentiation

2) Phylogeographic history

- Examine effects of past refugia

Potential broad implications for management

- Local adaptation
- Dispersal and habitat fragmentation

Outline

- Sampling strategy and localities
- Microsatellite genotyping
- Identification of structure
- Differentiation of subpopulations
- Future directions of the study



Photo: Steeve Côté

Samples used in study

- Focused on native range
- Collected primarily by F&W managers

State/Province	No. of samples used in this study	Estimated population
Alaska	255	24000-30000
Alberta	81	2500
British Columbia	449	36000-63000
Idaho	9	2700
South Dakota	2	160
Montana	24	2800
Washington	28	4000
Yukon	5	1400
NWT	4	400
BC/AB	6	
Total	863	100000

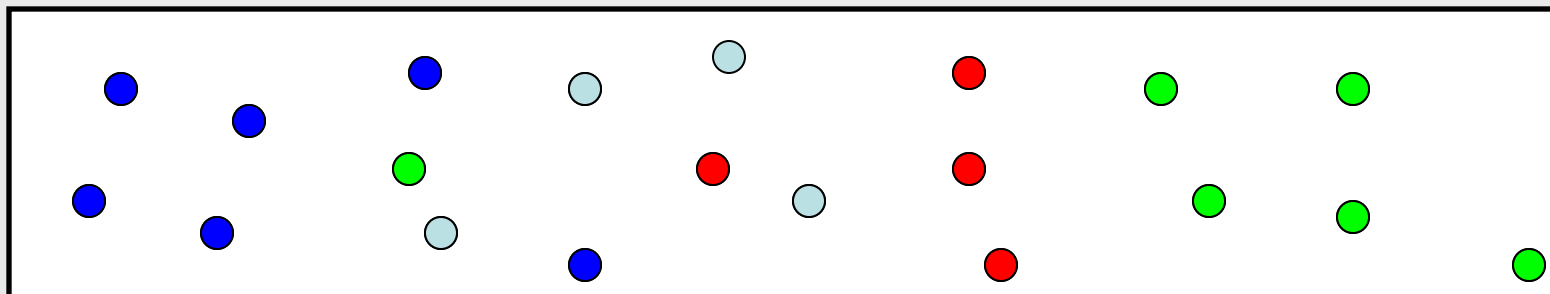
Microsatellite genotyping

- Genotyped 21 loci in all individuals
- Tested for completeness and standard population genetic statistics
- 20 markers deemed appropriate to use

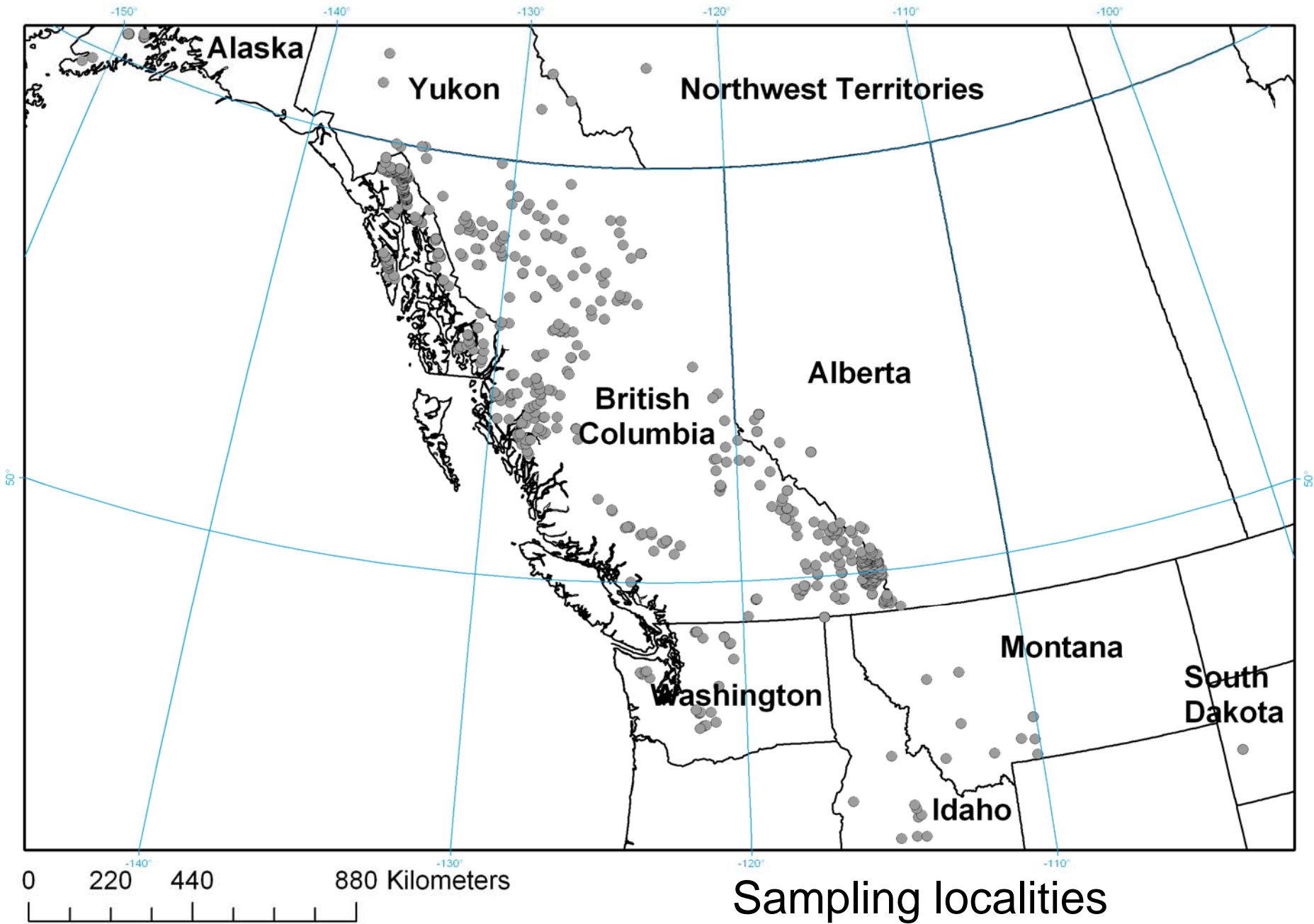


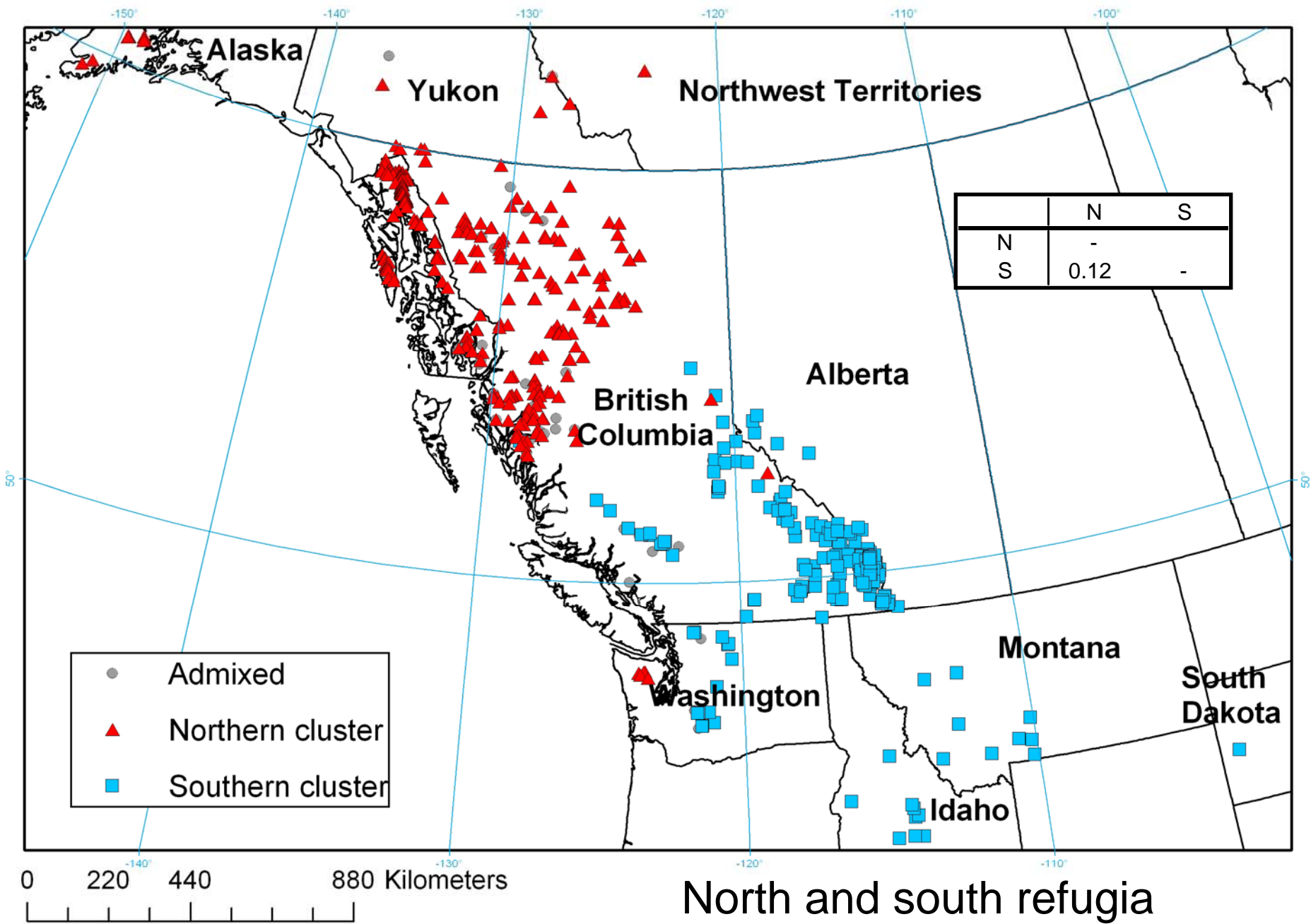
Population structure

- Analyzed with the software STRUCTURE
 - No consideration of geographic locality
 - Individual assigned to cluster when $Q > 0.8$

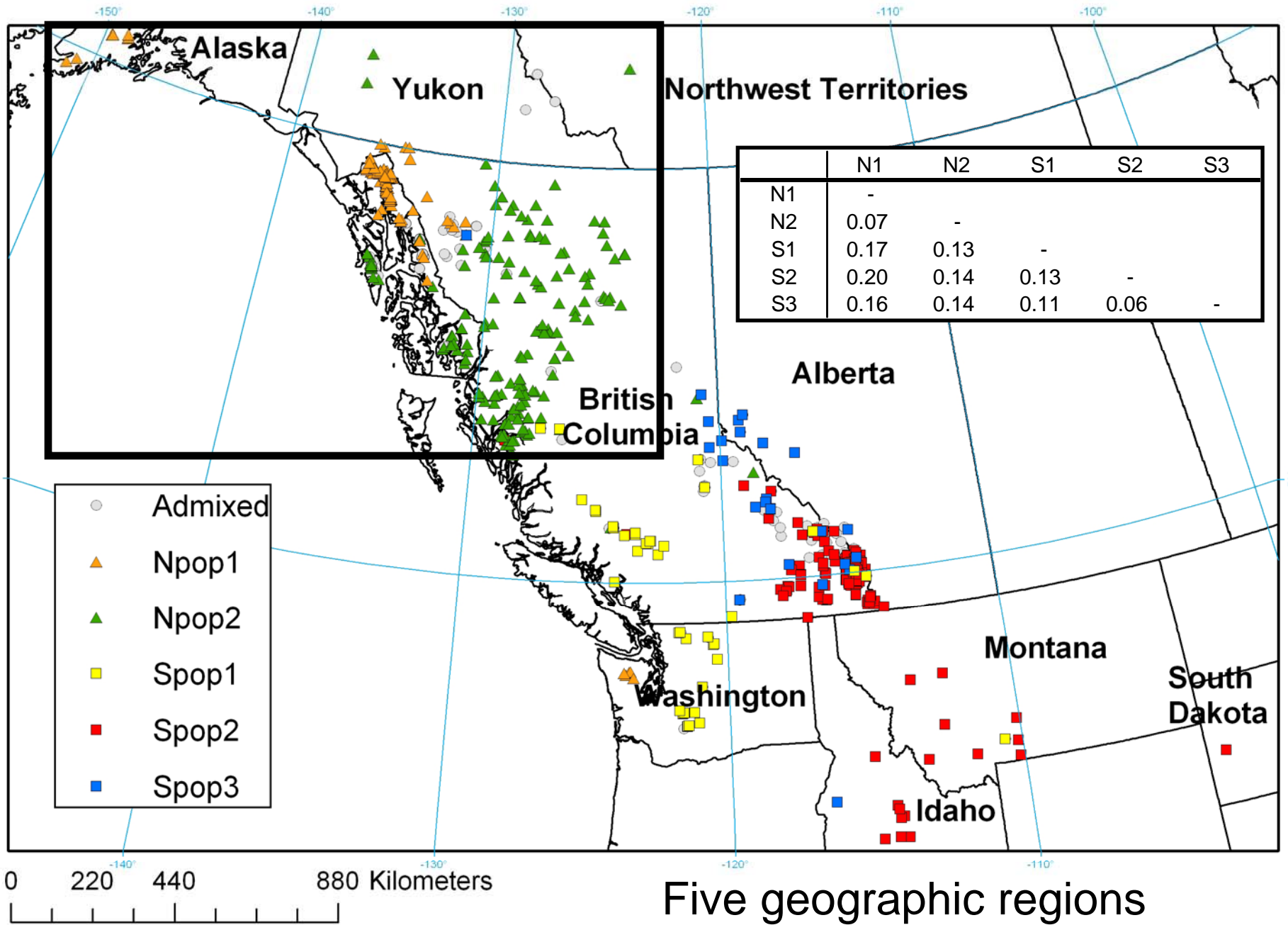


- F Statistics
 - “percent difference between groups”
 - 0 - 5%, 5 - 15%, 15 - 25%, >25%
(low) (high)

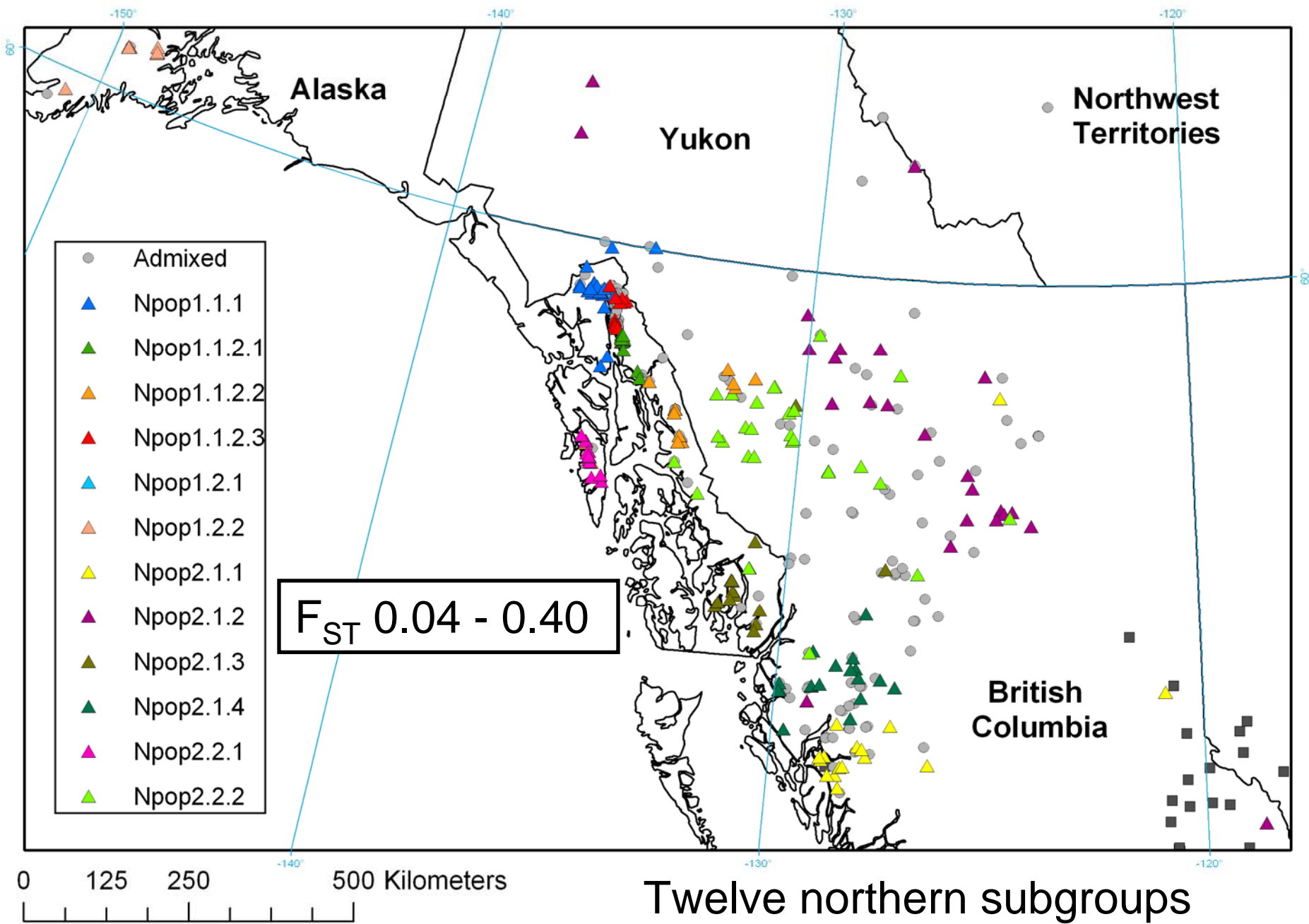


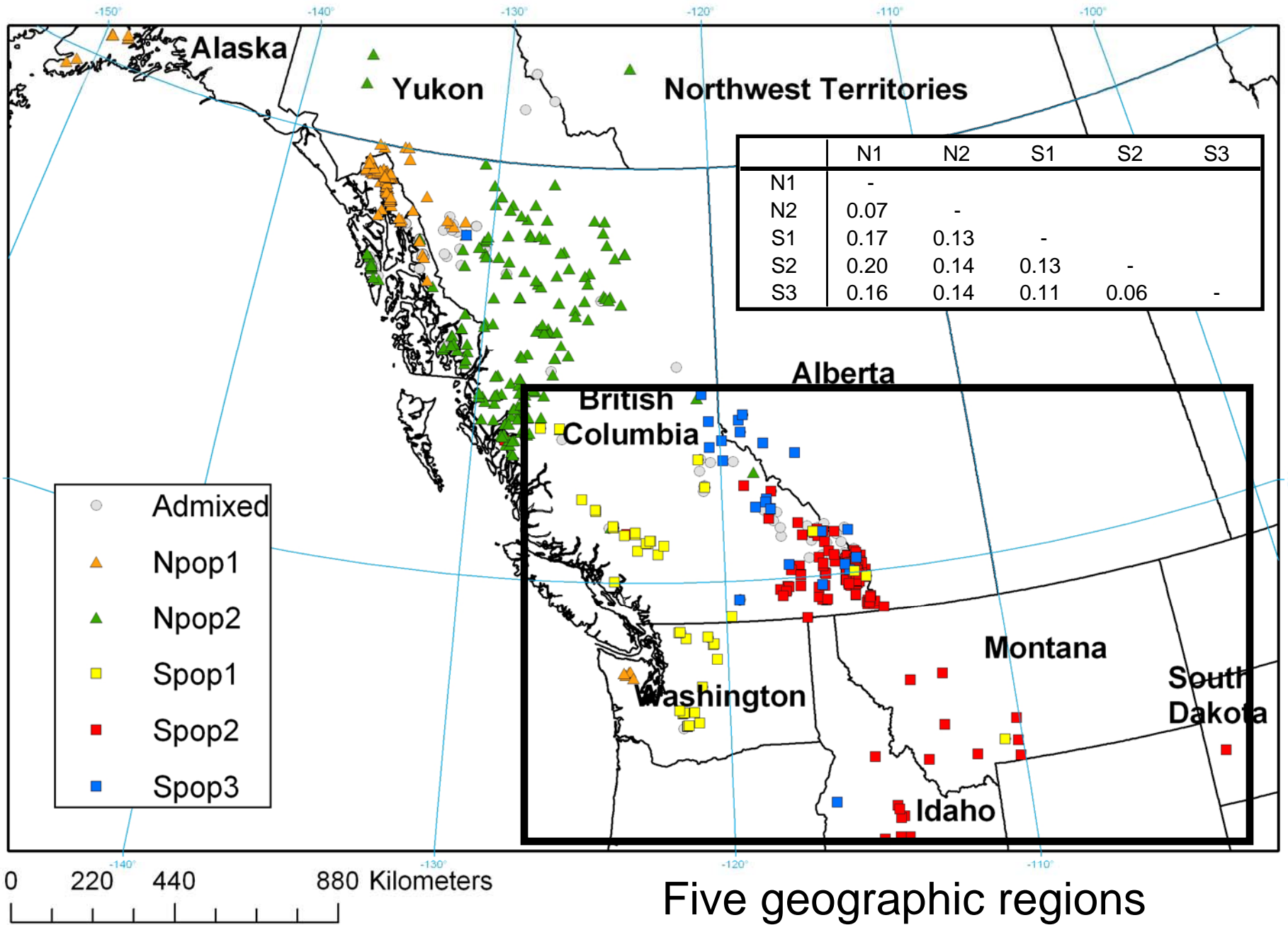


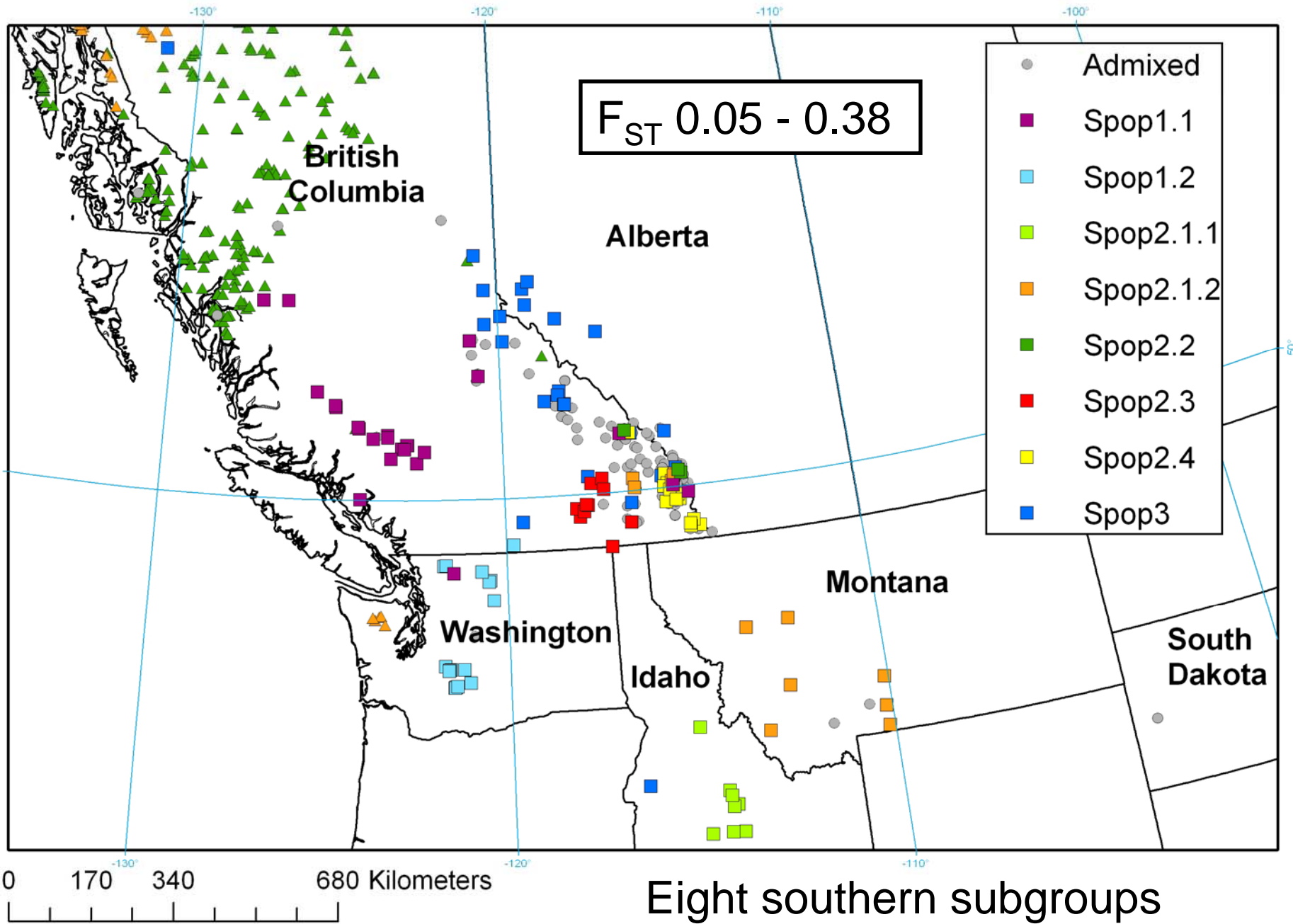
North and south refugia



Five geographic regions







Conclusions

- Population structure revealed
 - Evidence for glacial refugia
 - Geographic clusters
 - 20 subgroups identified
 - No strong evidence of inbreeding*
- F_{ST} ranged from high to low
 - Potential for local adaptation
 - Isolation by distance pattern



Photo: Andrew Shirk

Future Directions



- Impacts of mountain ranges on structure
- Broader scale analysis of barriers, corridors, connectivity, and dispersal
- Landscape genetic analysis of Alaskan mountain goats
- Phylogeographic analysis
- Range wide MHC diversity

Acknowledgements



Alberta - K. Smith, M. Ewald, R. Jobin, H. Schindler, J. Nelson

Alaska - K. White, T. McDonough, B. Porter, P. Koehl, K. McCoy

BC - H. Schwantje, C. Thiessen, M. Gillingham, P. Hengeveld, A. Thorgensen, K. Poole, M. Wood, R. Marshall, A. McMillan

Yukon - J. Carey, P. Merchant

NWT - A. Veitch, R. Popko, K. Hickling

Washington - A. Shirk, C. Rice, D. Wallin

Idaho - T. Keegan

South Dakota - T. Benzou

Montana - N. Anderson, J. Striebel, K. Aune,

Additional thanks -

J. Poissant, C. Cullingham, S. Nakada, C. Davis, J. Northrup, K. White, J. Mainguy, S. Hamel,