Using past and present techniques to estimate diet richness and diet resolution for mule deer on the Navajo Nation

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Outline

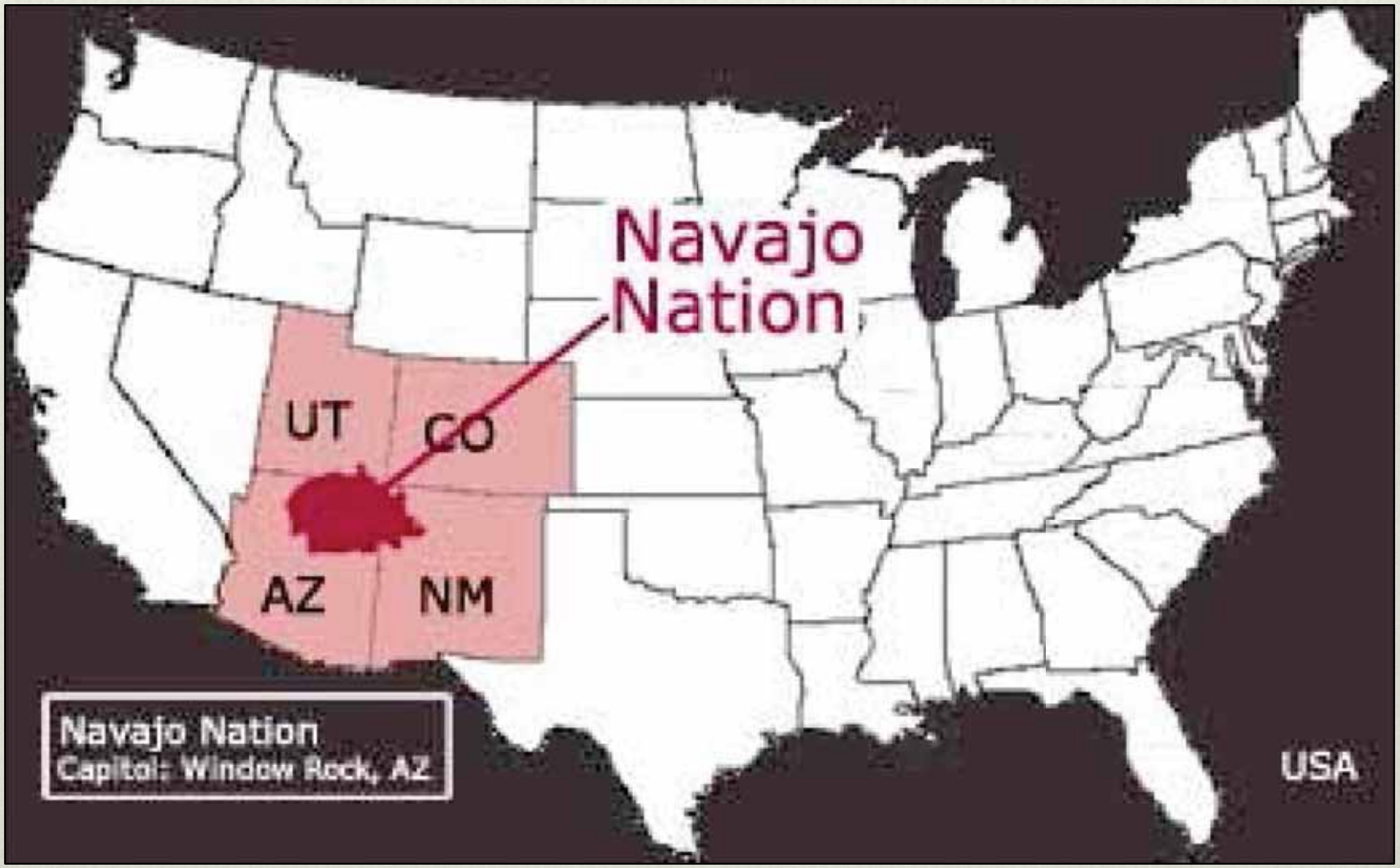
- Diet richness and diet resolution
- Project area and importance
- Diet assessment backgrounds
- Microhistological and genetic diet assessment techniques
- Future research plans
- Preliminary genetics results
- Management implications

What is **Diet Richness** and **Diet Resolution**?

- **Diet richness** = the quantification of unique plant types in mule deer diet.

- **Diet Resolution** = the identification of plant types to the lowest order of taxonomy.

Study Area: Navajo Nation



Why Deer?

- Cultural Importance

- Economic Importance

Use of Diet Richness and Diet Resolution

- Diet preference among differing sex and age classes of mule deer.


- Diet overlap of mule deer and wild, feral, and livestock herbivores.



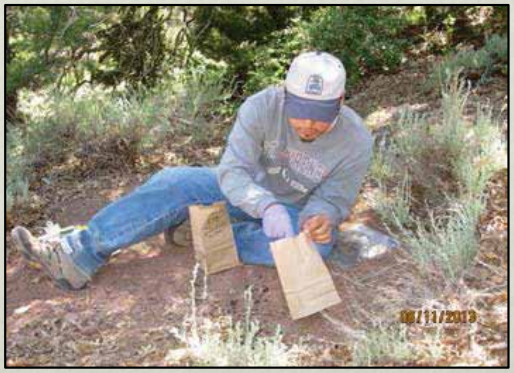
- Change in mule deer diet in correlation with the presence of predators.

Historical Diet Analyses

- Observational
  - Lack of resolution

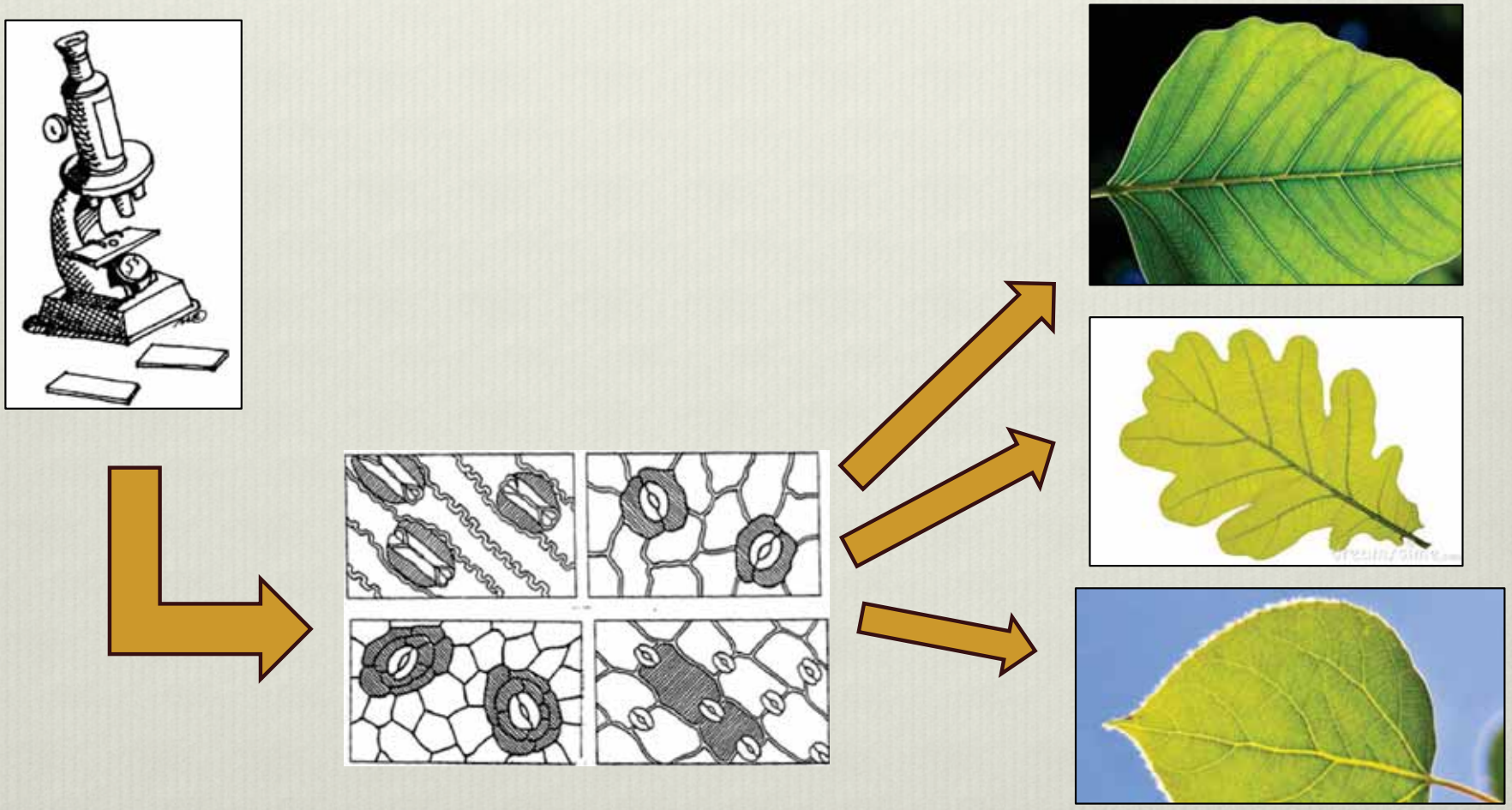
- Rumen (Gut) Sampling
  - Invasive

- **Fecal Sampling**
  - **Non-invasive and potentially more informative**



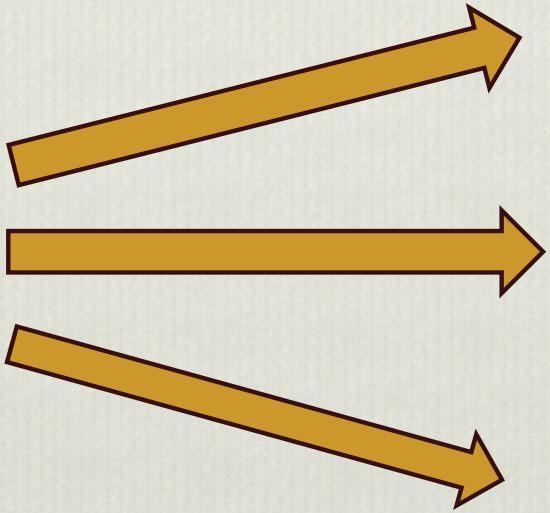
Common Fecal Diet Analysis

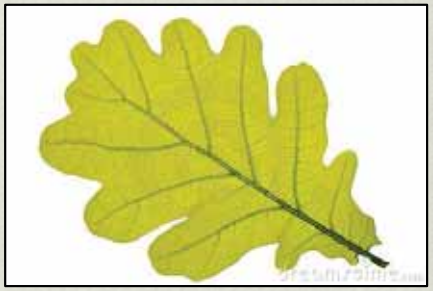
- Microhistology



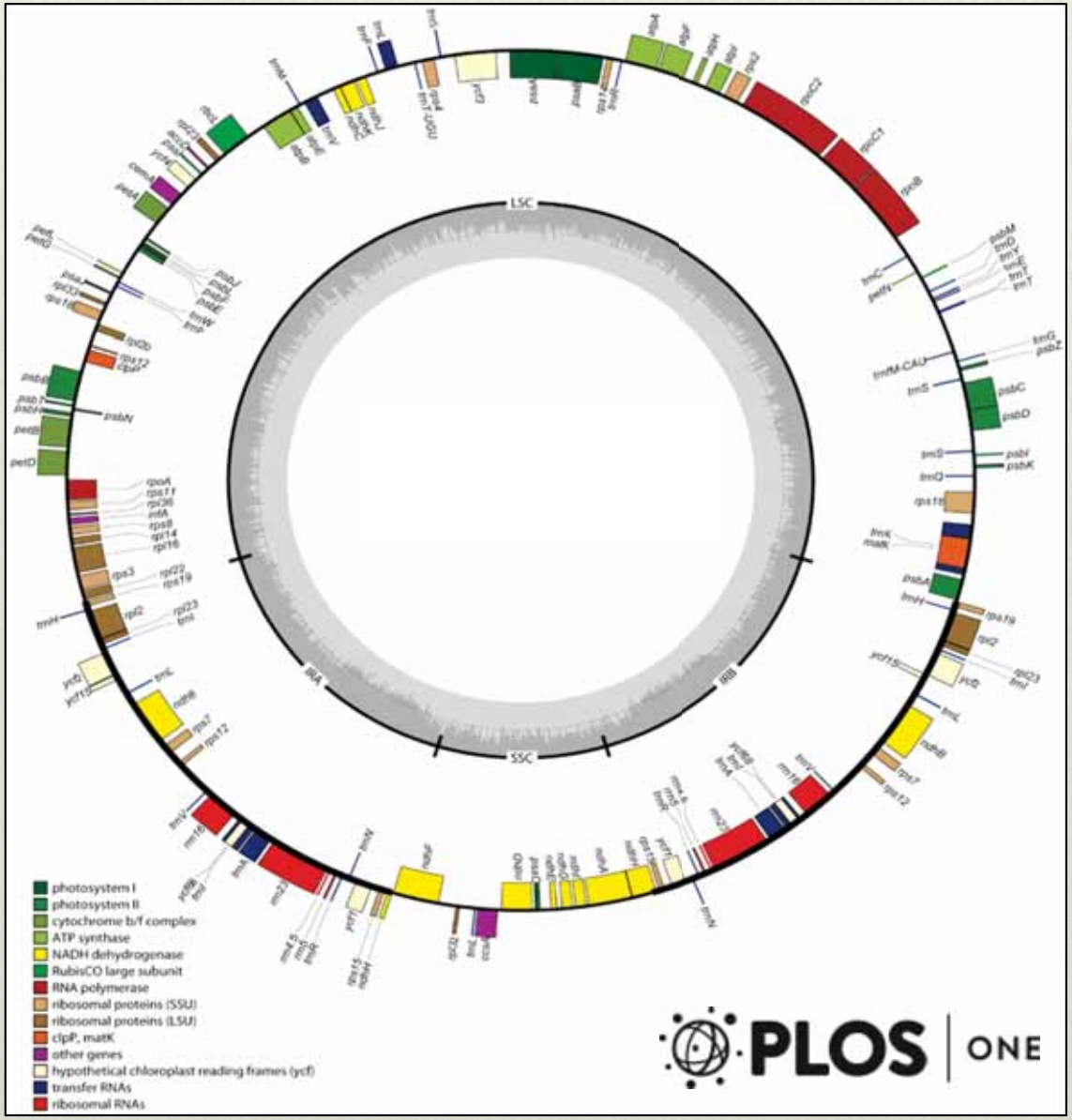
Genetic Dietary Assessment

- Next-Generation Sequencing (NGS)





Chloroplast Genome



Genetic Sequencing

unique **sequences** = unique **plant species**

GATTAGGATAAG

GGAGTTTAAGAA

AGGAAAGGGTTA

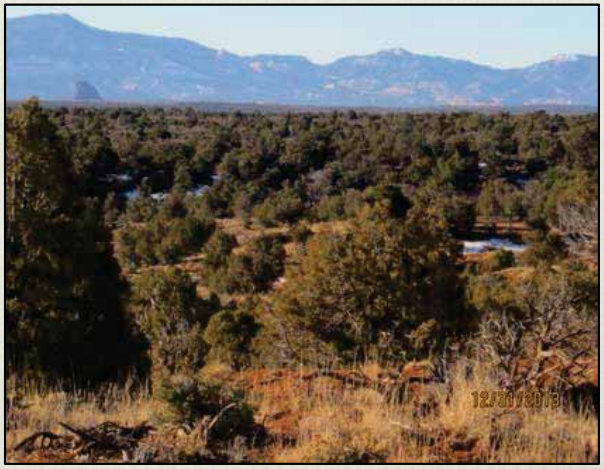
Research Goal and Hypothesis

- Objective:
  - Compare diet richness and diet resolution results between NGS and microhistology at both the individual and population levels.
- Hypothesis
  - Genetics will show greater diet richness and diet resolution than microhistology at both the individual and population levels.

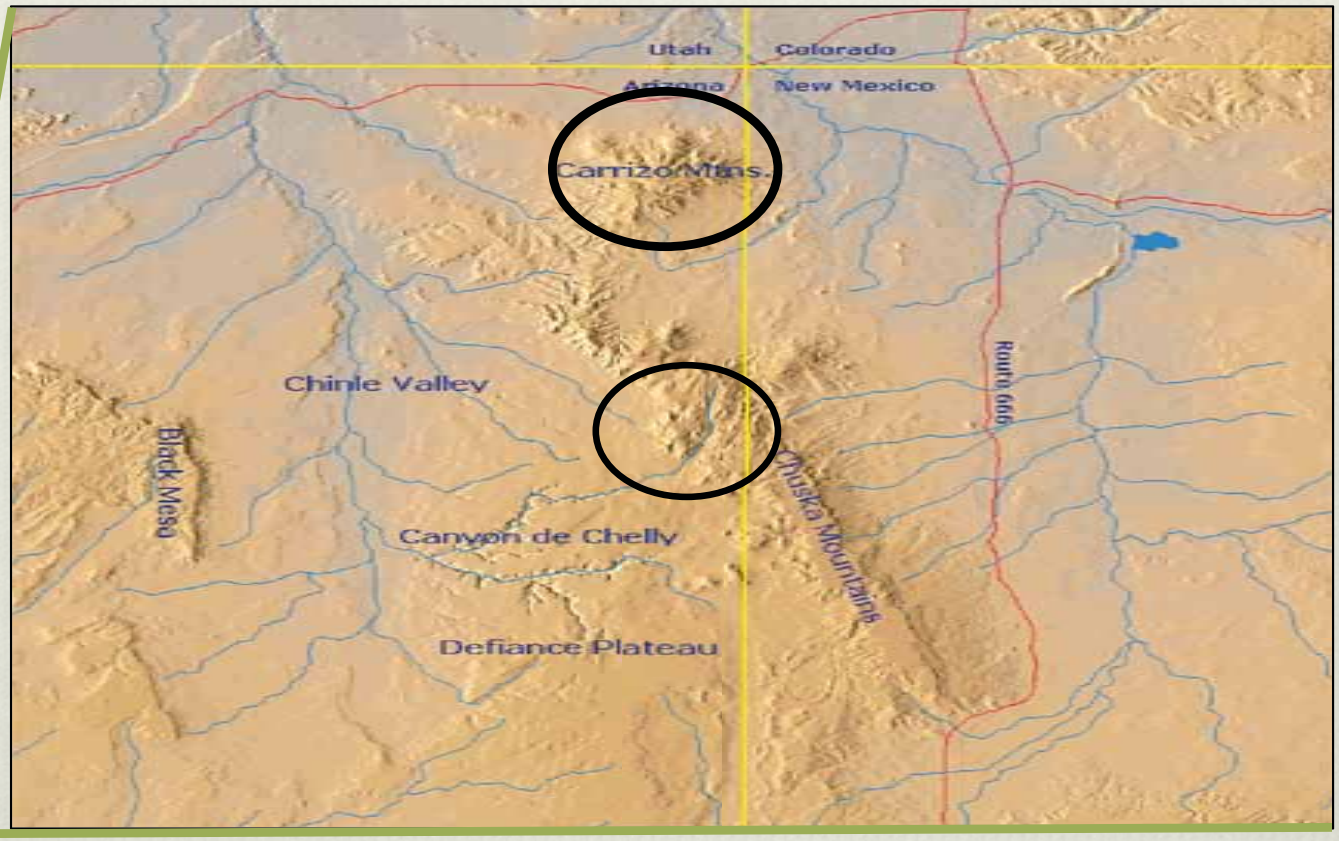
Expected Results: Microhistology vs NGS

- Total number of unique plant species per sample (i.e. total **diet richness**).
- Total **diet resolution** of all plants in each sample (species, genus, family).
- Frequency of occurrence of unique plant species between individuals.
- Comparison of diet richness discovered between each population, within seasons.

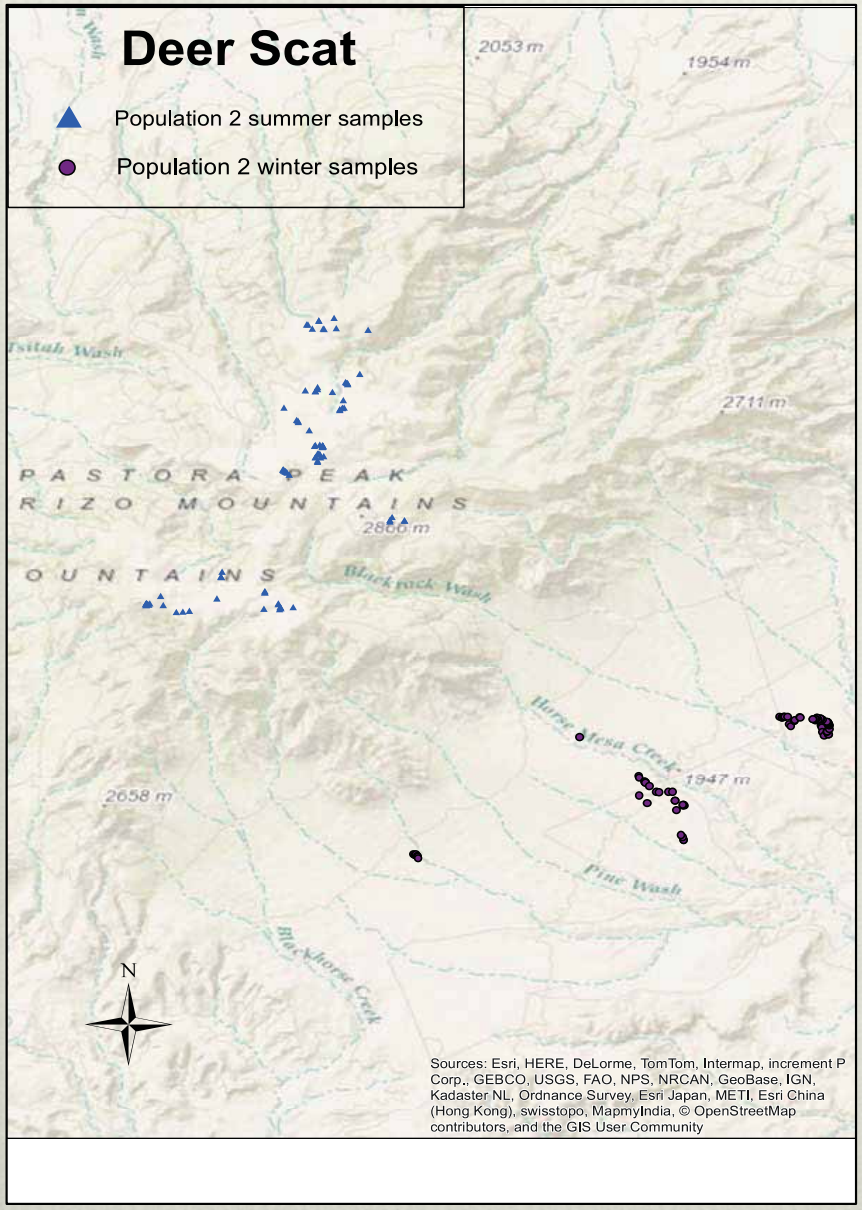
Fieldwork



Study Area: Navajo Nation



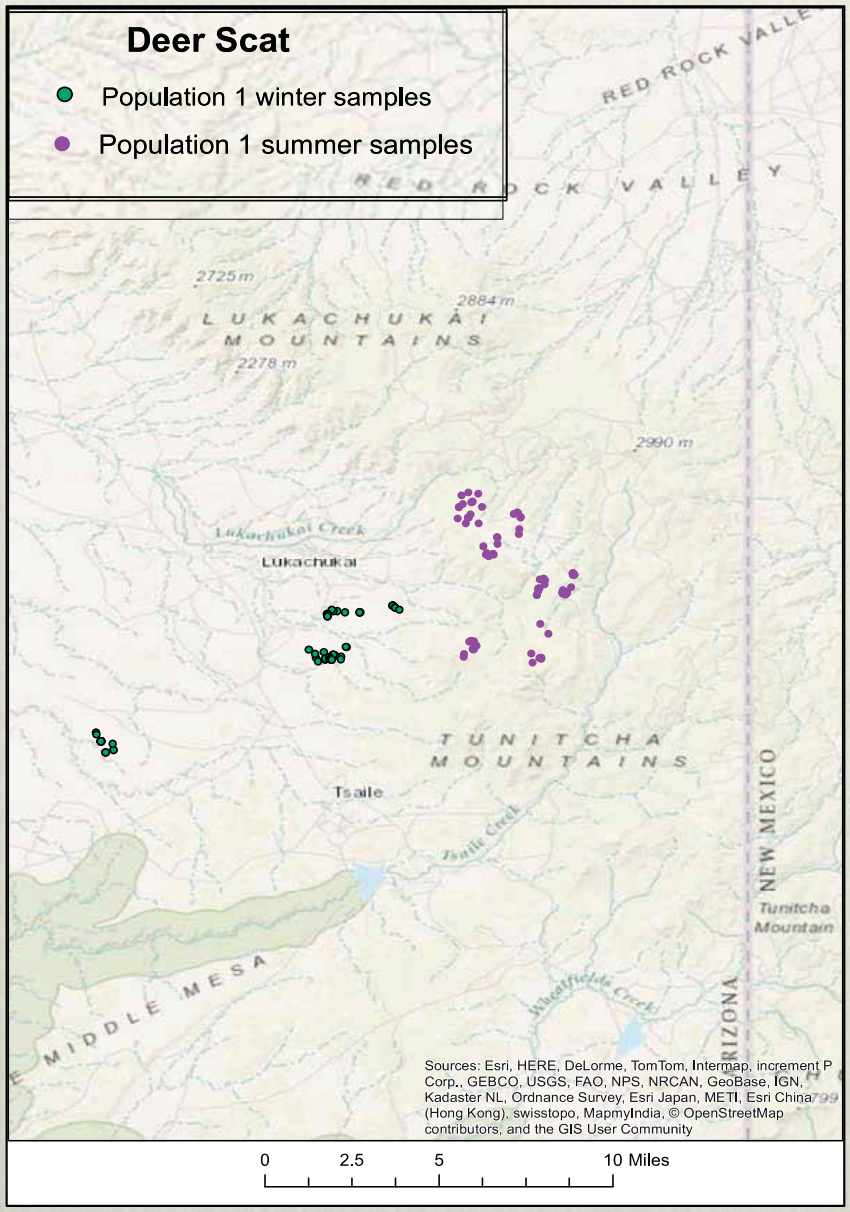
Carrizo Mountain Study Area



n (summer) = 101 samples

n (winter) = 82 samples

Chuska Mountain Study Area



n (summer) = 101 samples

n (winter) = 70 samples

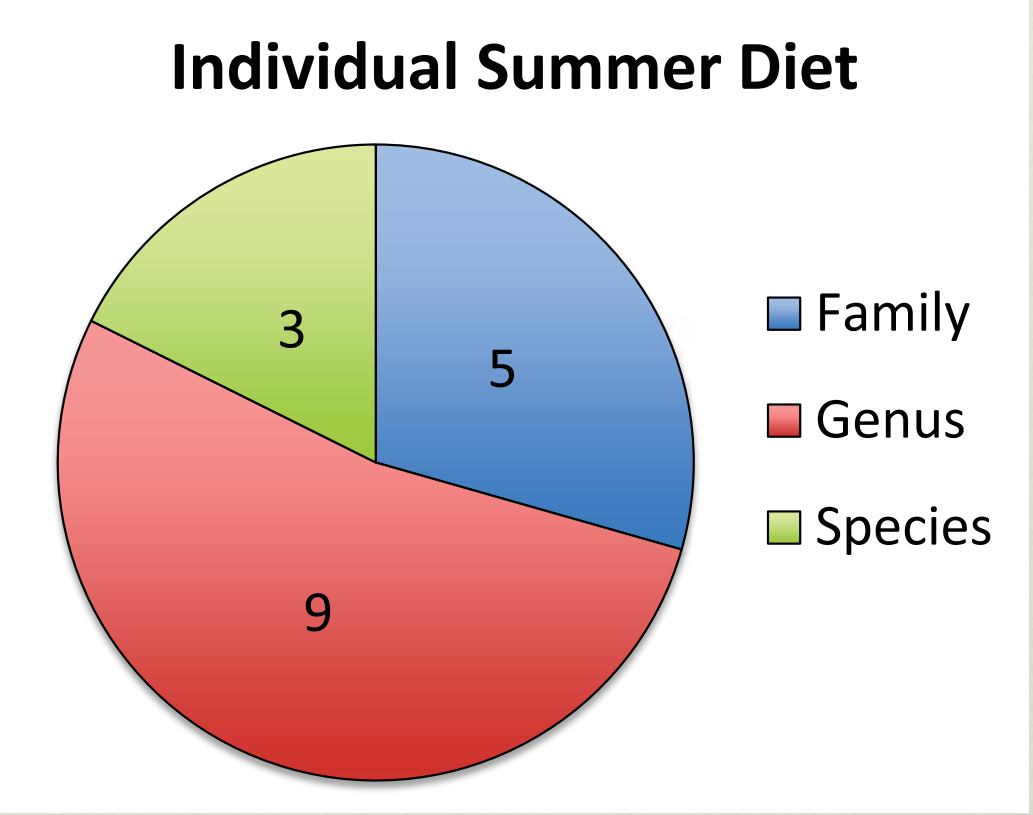
Results: Individual Summer Diet

n = 1 individual

Species
Rumex acetosella
Taraxacum laevigatum
Plantago major

Genus
Geum
Lathyrus
Lonicera
Micranthes
Persicaria
Pyrus
Taraxacum (2)
Triosteum

Family
Fabaceae
Polygonaceae (4)



Total # of unique sequences = 17

Preliminary Results: Population Summer

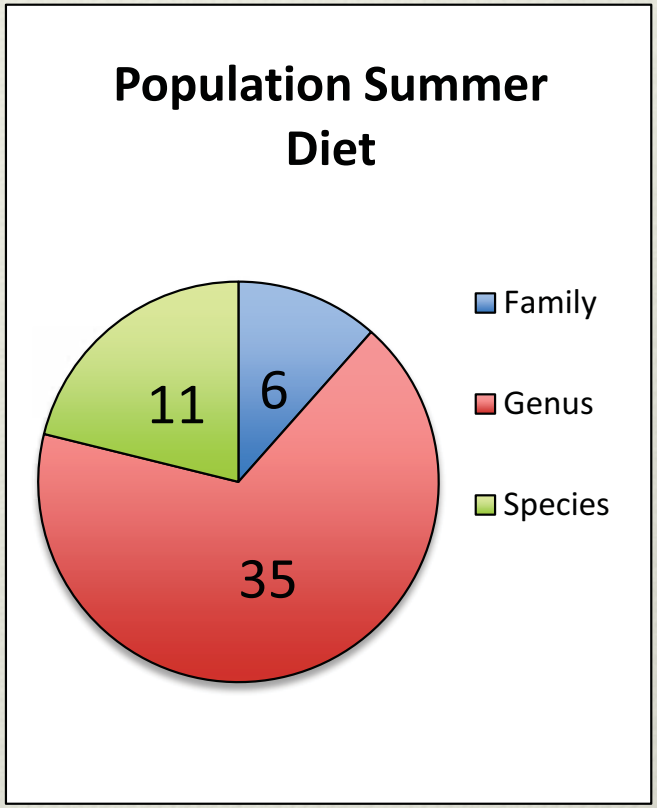
n = 15 individuals

Species
Heuchera micrantha
Lobelia cardinalis
Malus pumila
Osmorhiza longistylis
Picea engelmannii
Poa pratensis
Poa trivialis subsp. sylvicola
Pseudotsuga menziesii var. menziesii
Pteridium aquilinum
Rumex acetosella
Taraxacum laevigatum

Genus
Abies (3)
Amelanchier (2)
Arctostaphylos
Ceratodon
Erodium
Eustigma
Geum
Heterotheca
Lathyrus
Limonium

Genus
Lonicera
Micranthes (2)
Muraltia
Packera (2)
Pentactina
Pinus (2)
Polygonum
Populus (2)
Portulaca
Prunus
Pyrus
Quercus
Rumex
Sorbus (2)
Symplocos
Triosteum
Taraxacum

Family
Fabaceae family
Polygonaceae (5)



Total # of unique sequences = 52

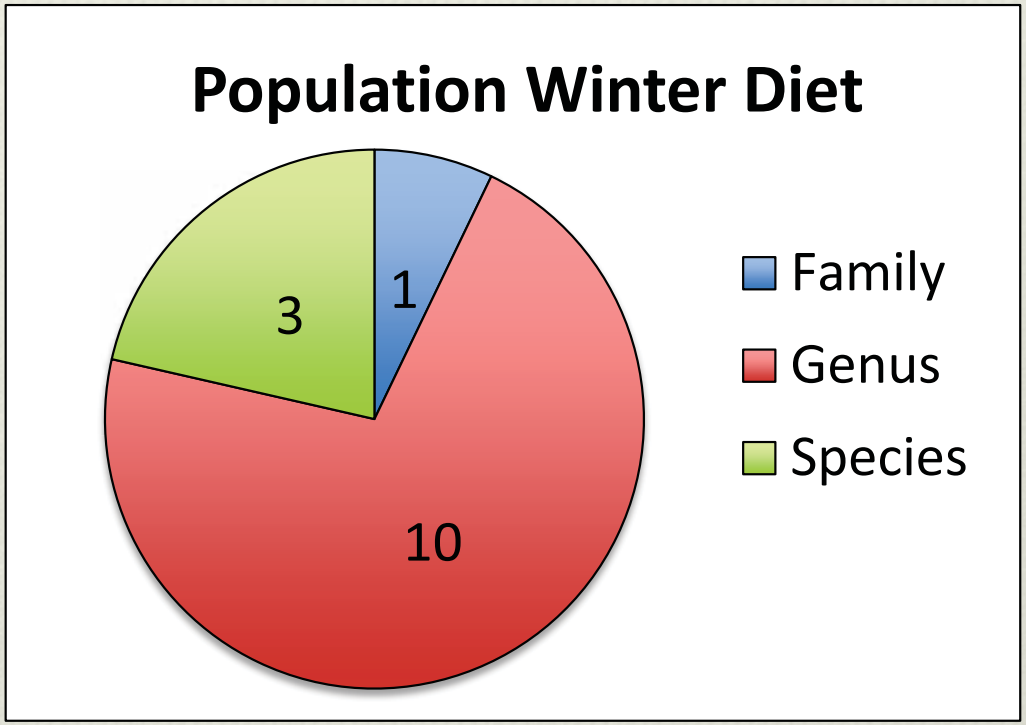
Preliminary Results: Population Winter

n = 15 individuals

Species
Juniperus monosperma
Pinus edulis
Purshia tridentata

Genus
Artemisia
Atriplex
Boechera
Chenopodium
Crucihimalaya
Erodium
Halobacillus
Pachycladon
Pinus
Portulaca

Family
Polygonaceae



Total # unique sequences = 14

Potential Management Implications

- Provide a more informative and efficient technique to assess diet richness and diet resolution for mule deer.
- Provide a tribal wildlife management agency biological information regarding one of their most important natural resources.
- Possible applications among other herbivorous species.

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Questions?