

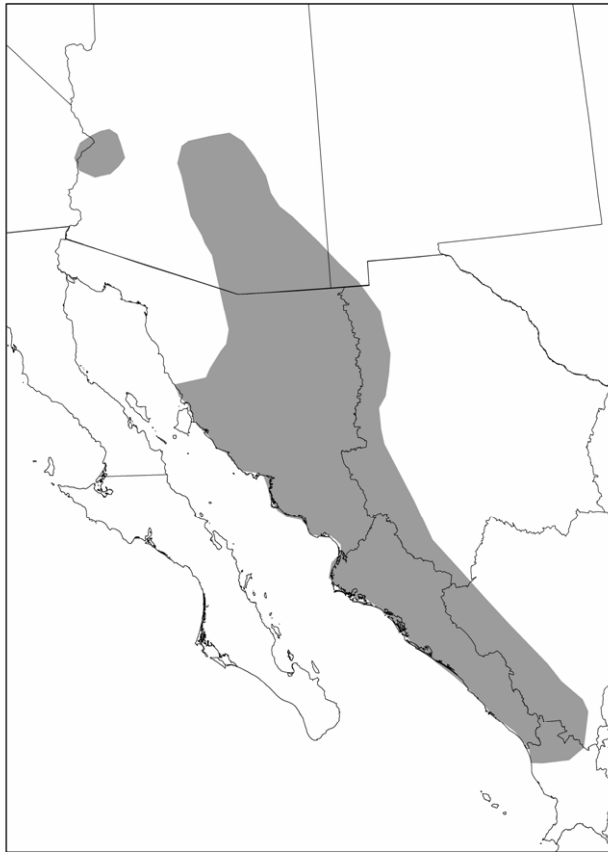
Insight on the biogeography of the Lower Colorado River from the population genetics of *Sigmodon*

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Allen Calvert
Brett R. Riddle

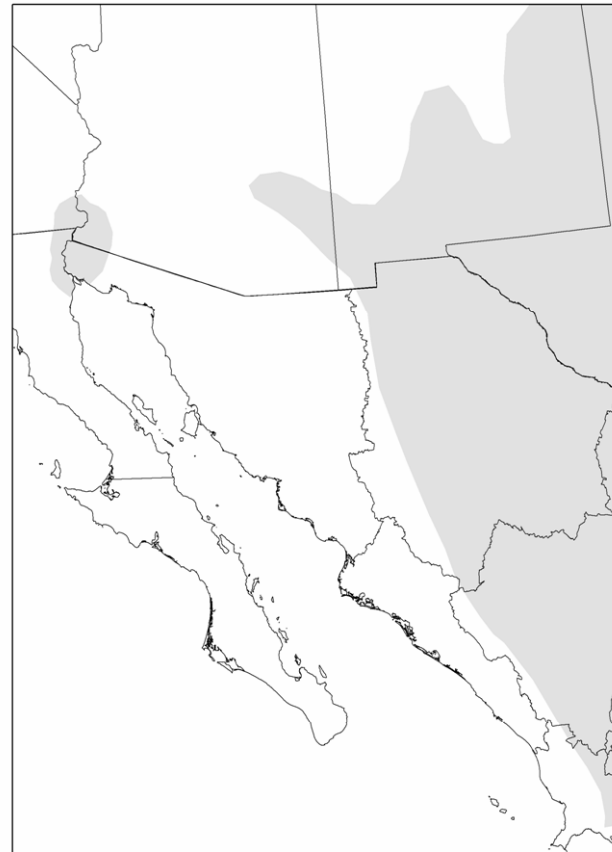


Introduction

- *Sigmodon arizonae*



- *Sigmodon hispidus*



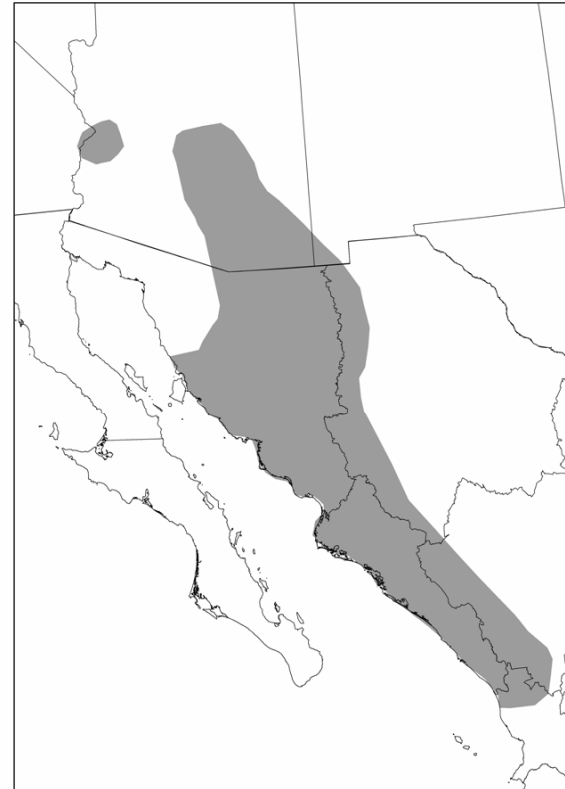
Introduction

- *S. hispidus*
 - McClenaghan 1979
 - Kessler and Avise 1985
 - Pfau et al. 2001
 - Phillips et al. 2007
- *S. arizonae*



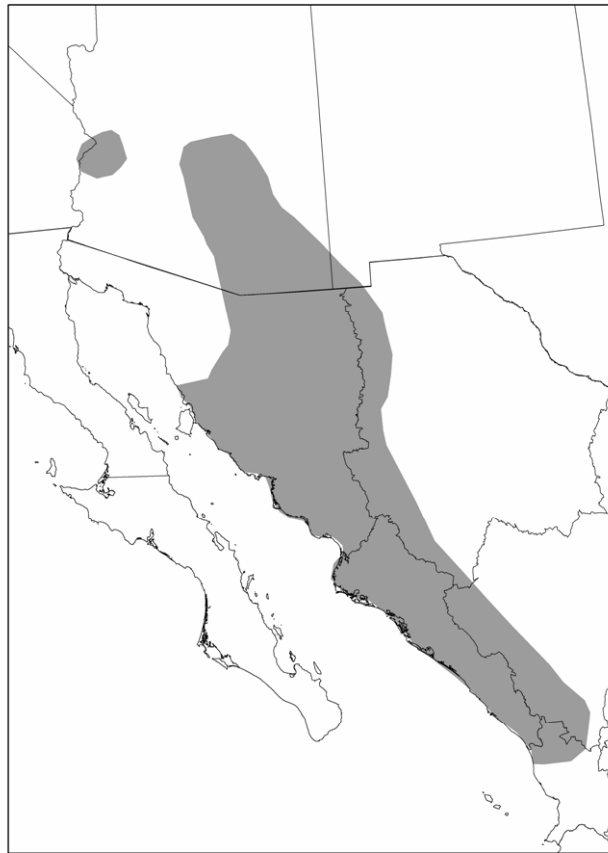
Introduction

- Objectives - *S. arizonae*
 - Identify populations of *Sigmodon* along the LCR
 - Document current and historic distribution
 - Phylogeography / population genetics
 - Point to other taxa that may share congruent history

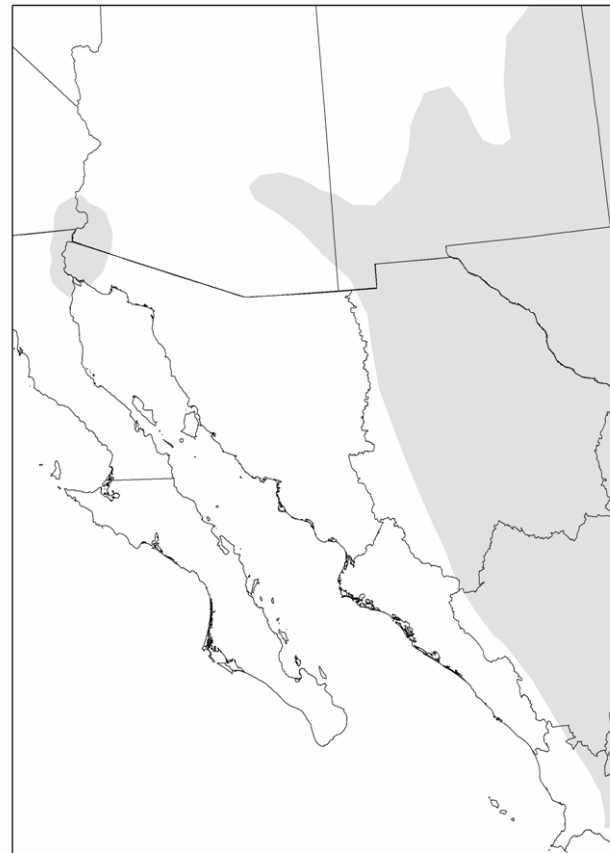


Introduction

- *Sigmodon arizonae*



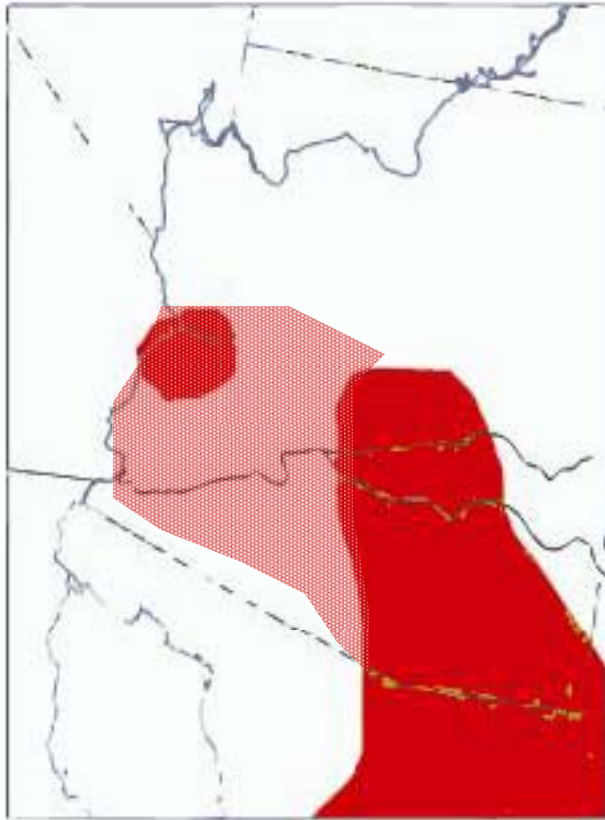
- *Sigmodon hispidus*



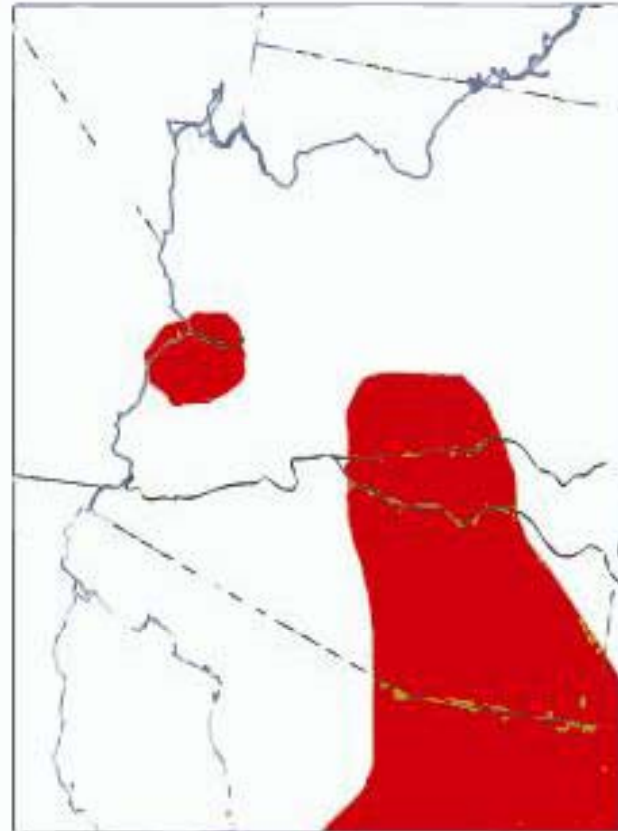
Hypotheses for disjunct population

- Pleistocene connection
 - During cooler/wetter periods the two disjunct ranges were once continuous
- Recent dispersal
 - Recent agricultural practices may allow for connectivity
 - “good years” may lead to population explosions
- Expectations:
 - >18,000ybp
 - Some genetic differentiation
 - Little to no dispersal
- Expectations:
 - <100ybp
 - No genetic differentiation
 - Some to considerable dispersal

Pleistocene Connection



S. arizonae during LGM

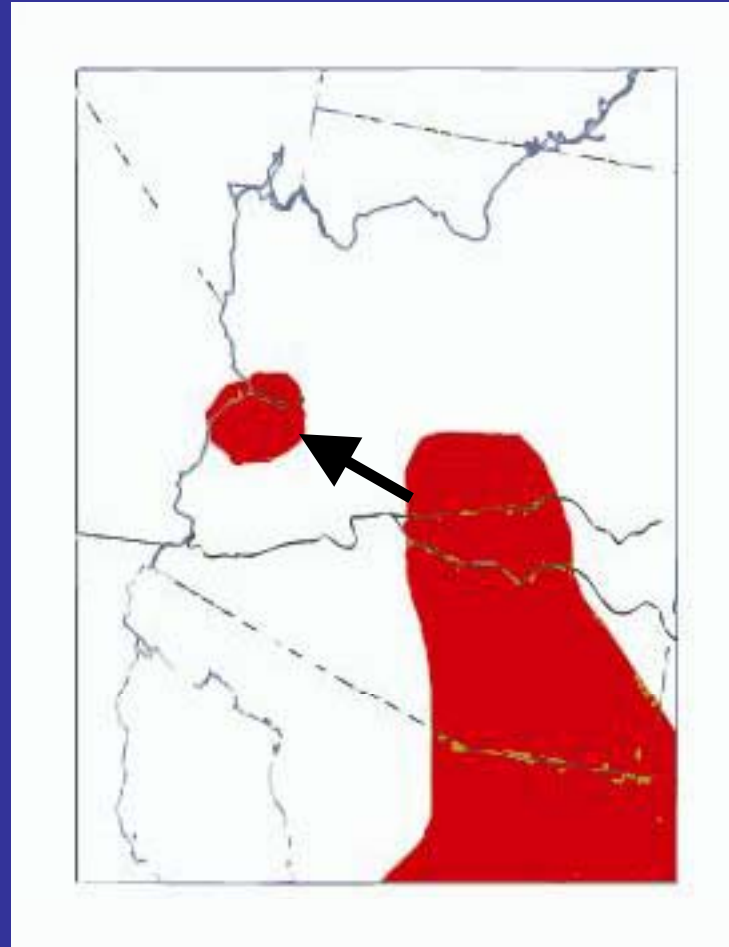


S. arizonae today

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Recent Dispersal



Directional dispersal of *S. arizonae* through agricultural matrix to Bill Williams River

Materials and Methods

- Trapping
 - Known localities
 - Suitable habitat
- Goal
 - Maximize number of localities sampled
 - Up to 15 individuals per locality
- Map historic museum samples



Materials and Methods

- Sequenced mitochondrial (mt)DNA
 - Noncoding control region (presented here)
 - Cytochrome oxidase B (cyt b)
- Phylogenetic and Population genetic analyses
 - Phylogenetic trees
 - Haplotype Networks



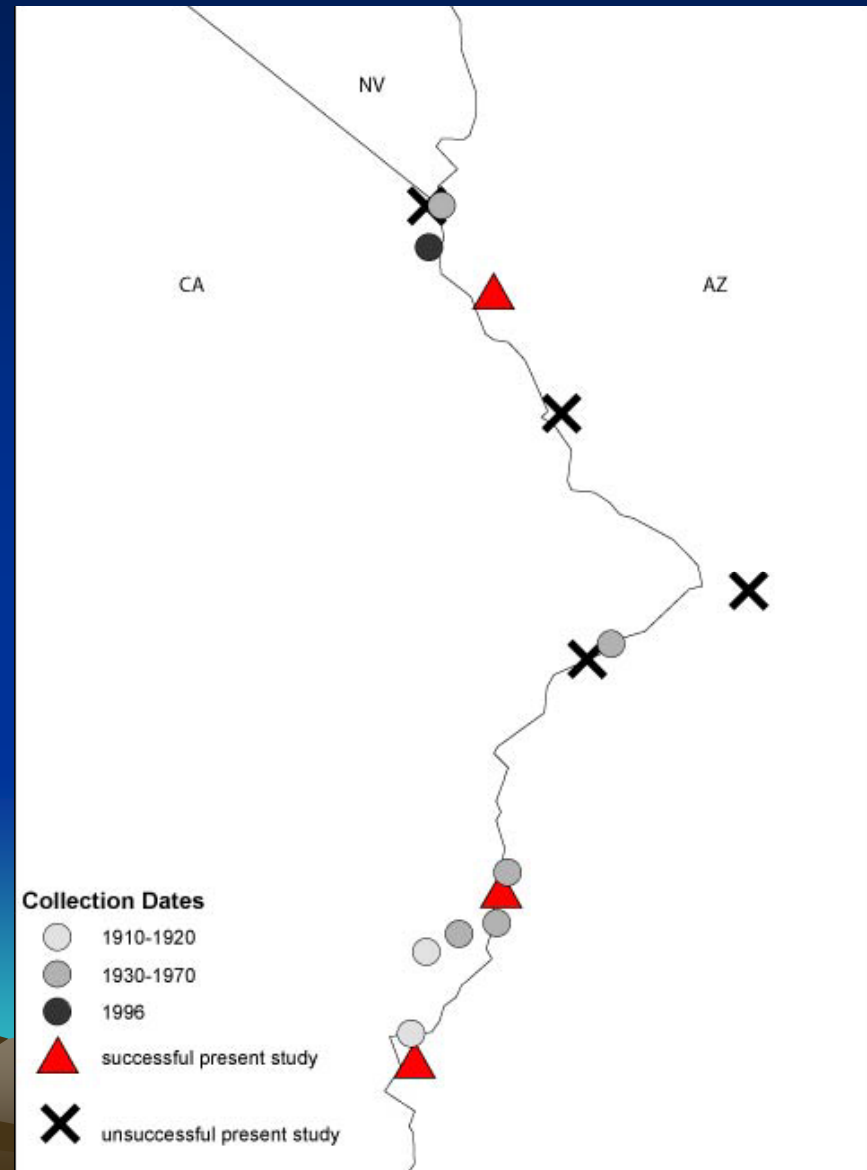
Materials and Methods

- Ecological Niche Modeling
 - WorldClim dataset ~ 5km
 - 19 climatic variables
 - Pleistocene climate data
 - Same 19 variables as WorldClim
- Build current niche model using MaxEnt
 - Project into past



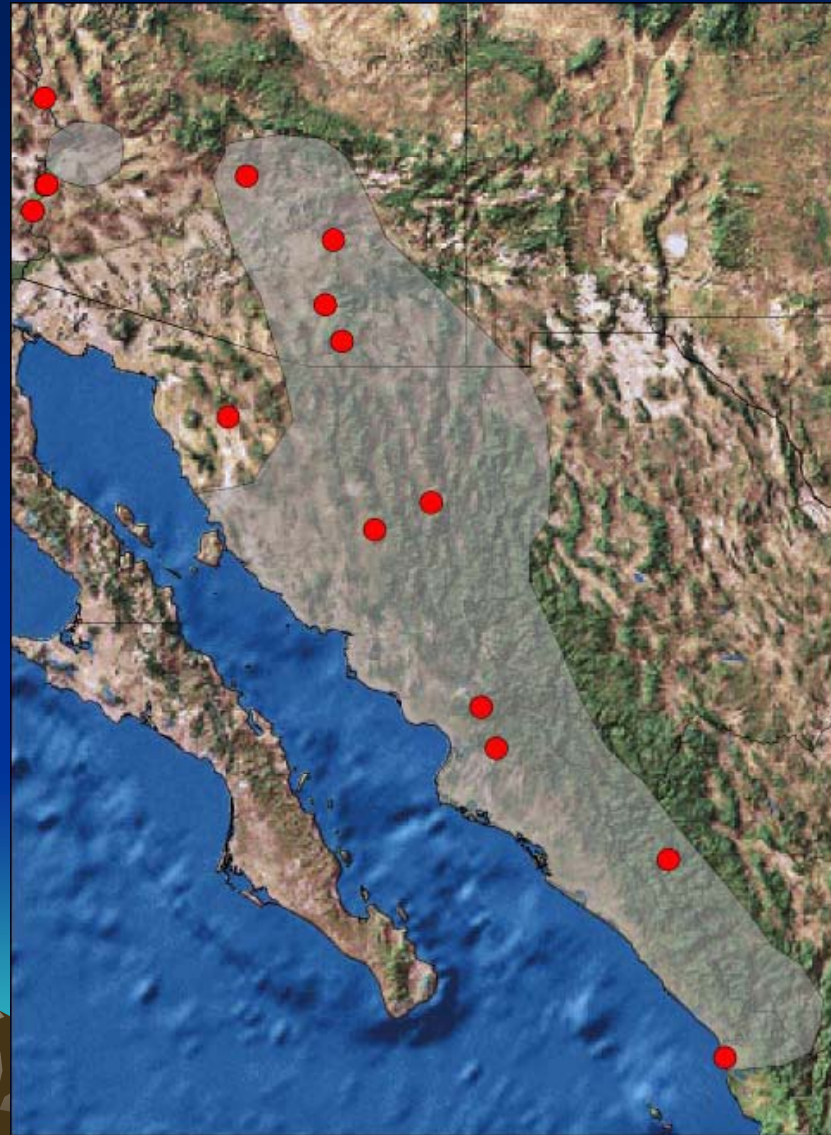
Results

- Map of historic and present day collecting localities

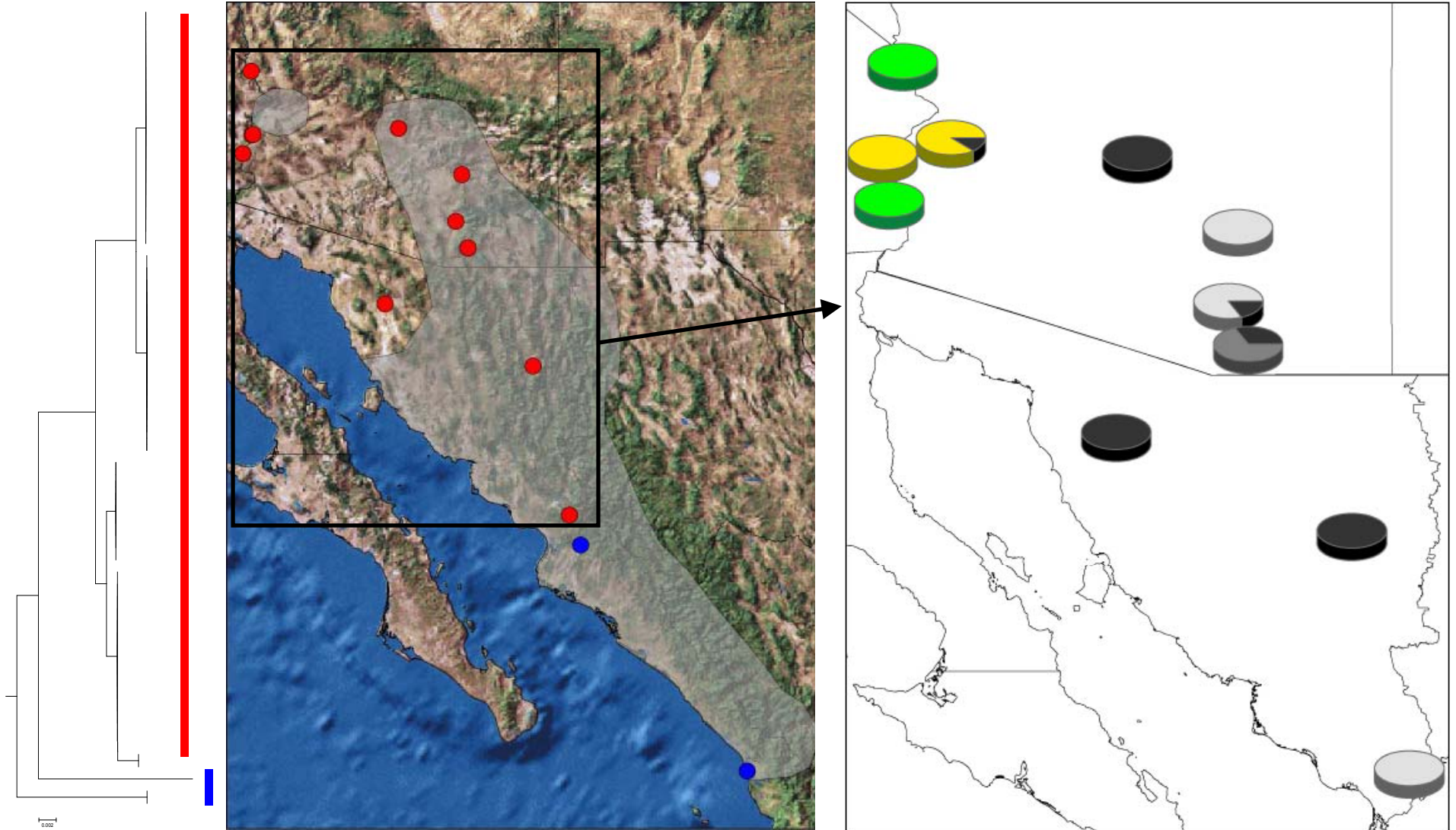


Sequencing Results

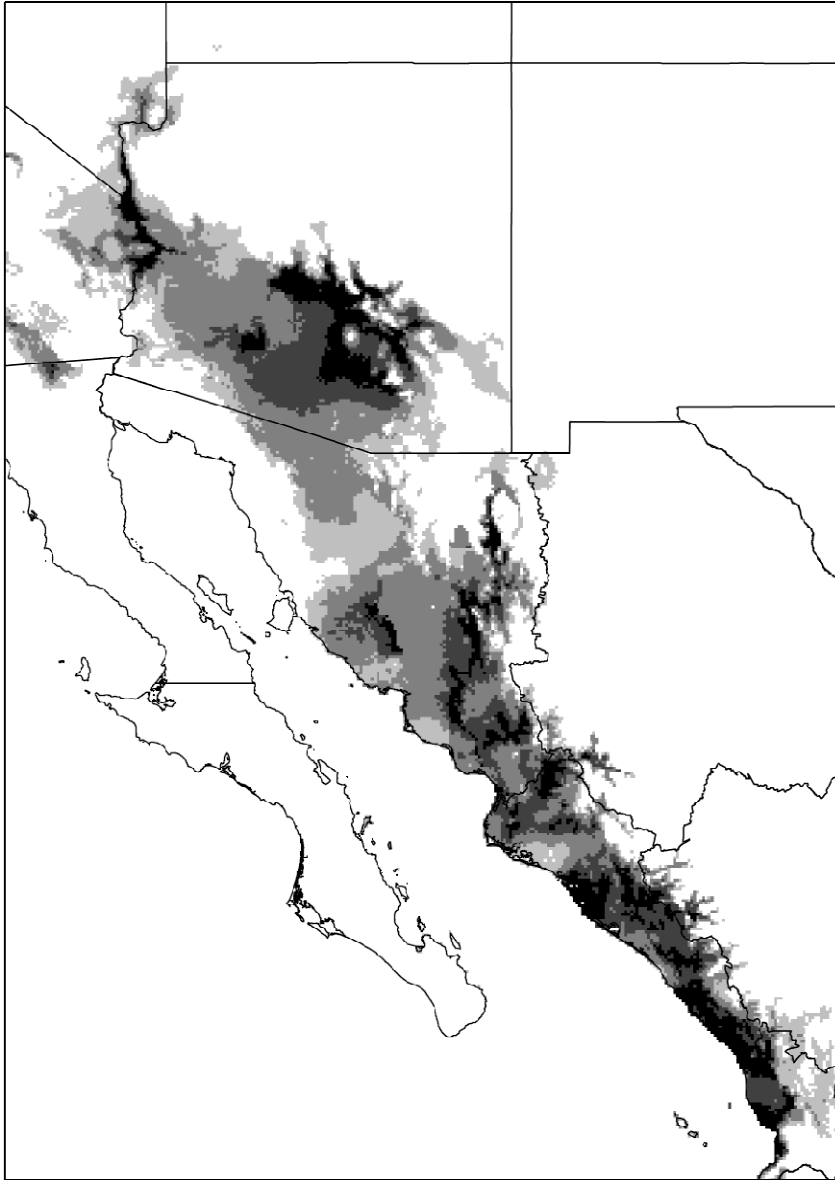
- *S. arizonae*
 - 68 ind.
 - 14 localities
- 7 haplotypes
 - 3 LCR
 - 2 unique



Sequencing Results

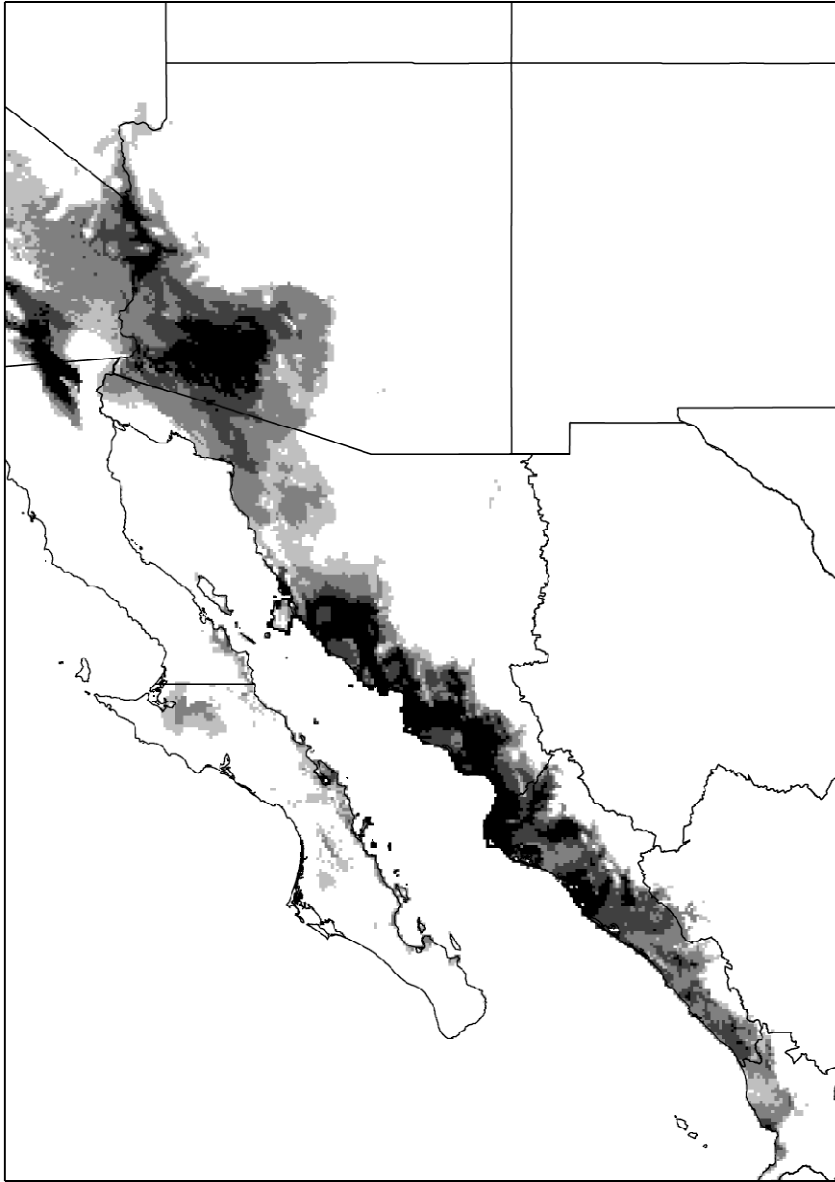


MaxEnt Results



Current model for *S. arizonae*

MaxEnt Results



Pleistocene model for *S. arizonae*

Discussion

- LCR Populations
 - Support sub-specific status of populations
 - Late Pleistocene Divergence
 - Niche Modeling
 - Dispersal to LCR probably uncommon
 - Distribution persistent through last century
- Low variability within populations
 - Each locality = single haplotype
 - Likely due to small founder populations
 - Natural history



Discussion

- Biogeography of LCR
 - Pleistocene connection
 - refugia
- Other taxa
 - *S. hispidus*
 - *Rana yavapiensis*
 - *M. occultus*
 - Others?





Questions?

Habitat characteristics and adaptive management of *Sigmodon arizonae plenus*

S. A. Neiswenter



Problems

- No basic natural history for *S. arizonae*
 - Assumed to be similar to *S. hispidus*
- No quantitative habitat data either
 - On or off LCR
- Conservation efforts along LCR
 - Marsh?

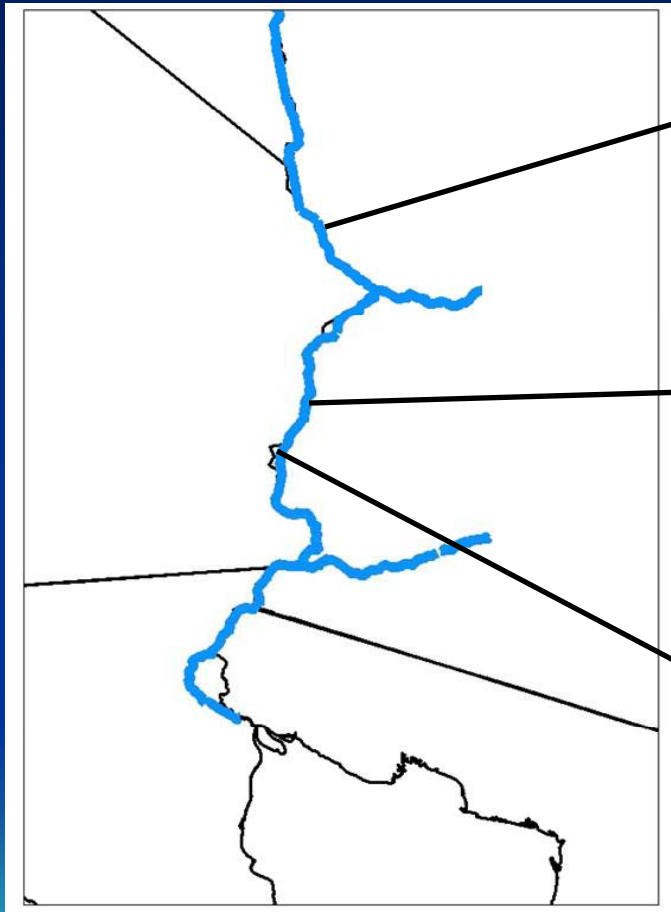


Research Goals

- Document demographics of known populations
 - Population size, survival, space use (over time) etc.
- Quantify habitat utilized by *S. arizonae*
 - Restoration
 - Adaptive management



Study Design



Study Design

- Permanent grids at each site
 - Spring and Fall 2 yrs
- 2 sites will serve to build model
- 3rd site will test predictive capabilities



Demographic Analyses

- PIT tag Siggies
 - Mark-Recap
- MARK
 - Powerful modeling program
 - Cormack-Jolly-Seber
 - est. survival and recap
 - Model effects (GLM, GAM)
 - Group (sites, age classes, sex)
 - Covariates

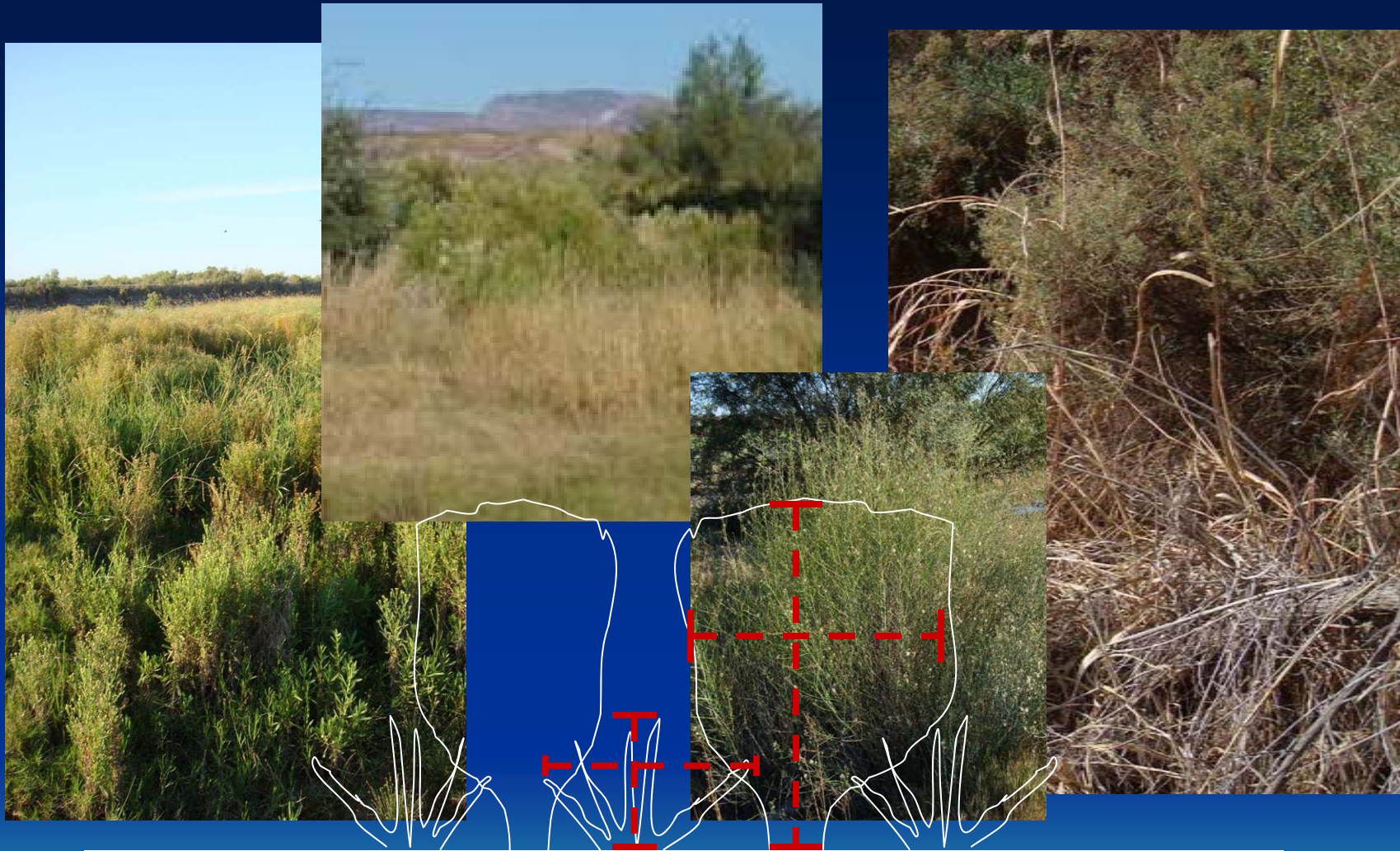
Pictures!!!



Study Design

- Habitat variables measured
 - during week long trapping sessions at each plot
 - Vertical and horizontal characteristics
- Sites differ compositionally...





...habitat utilized by *Sigmodon* may not differ structurally

More Pictures!!!



ARRRRRGGGGGHHHH!!!!!!

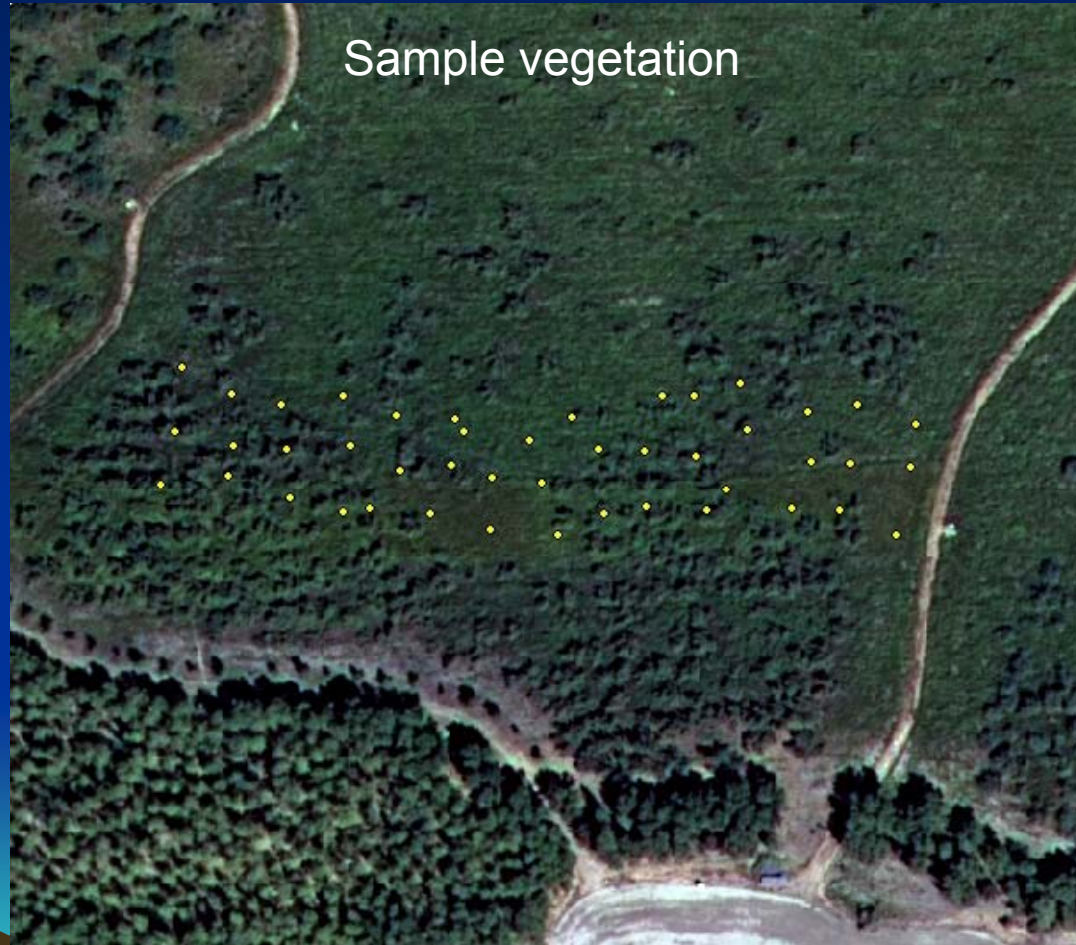


Habitat Analyses

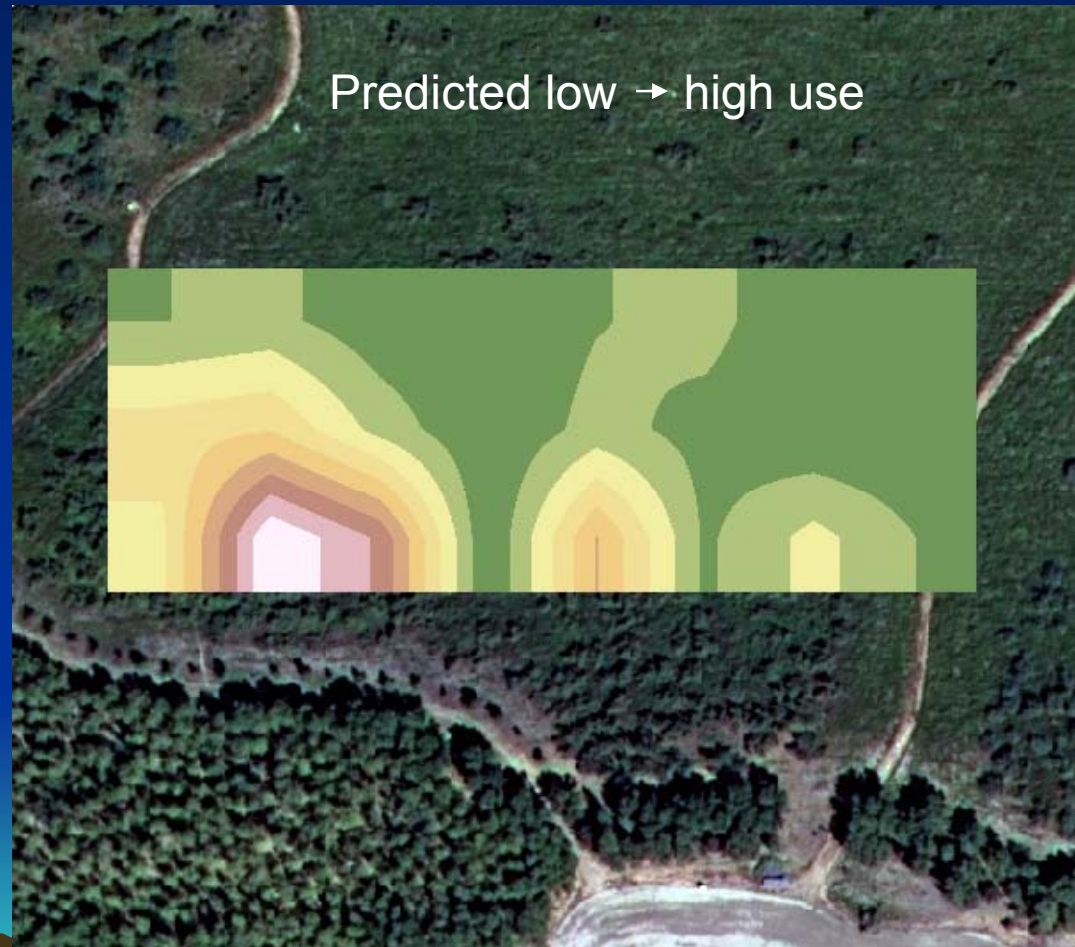
- Polytomous Logistic Regression
 - Avoids assumptions of “classic” multivariate analyses (MANOVA, DFA, etc.)
 - Only uses presence data
 - Model use-intensity
 - Provides predictive model applicable to adaptive management
 - $\pi_i (X)$
 - GIS raster-based predictive use
 - “So easy even a caveman can do it”



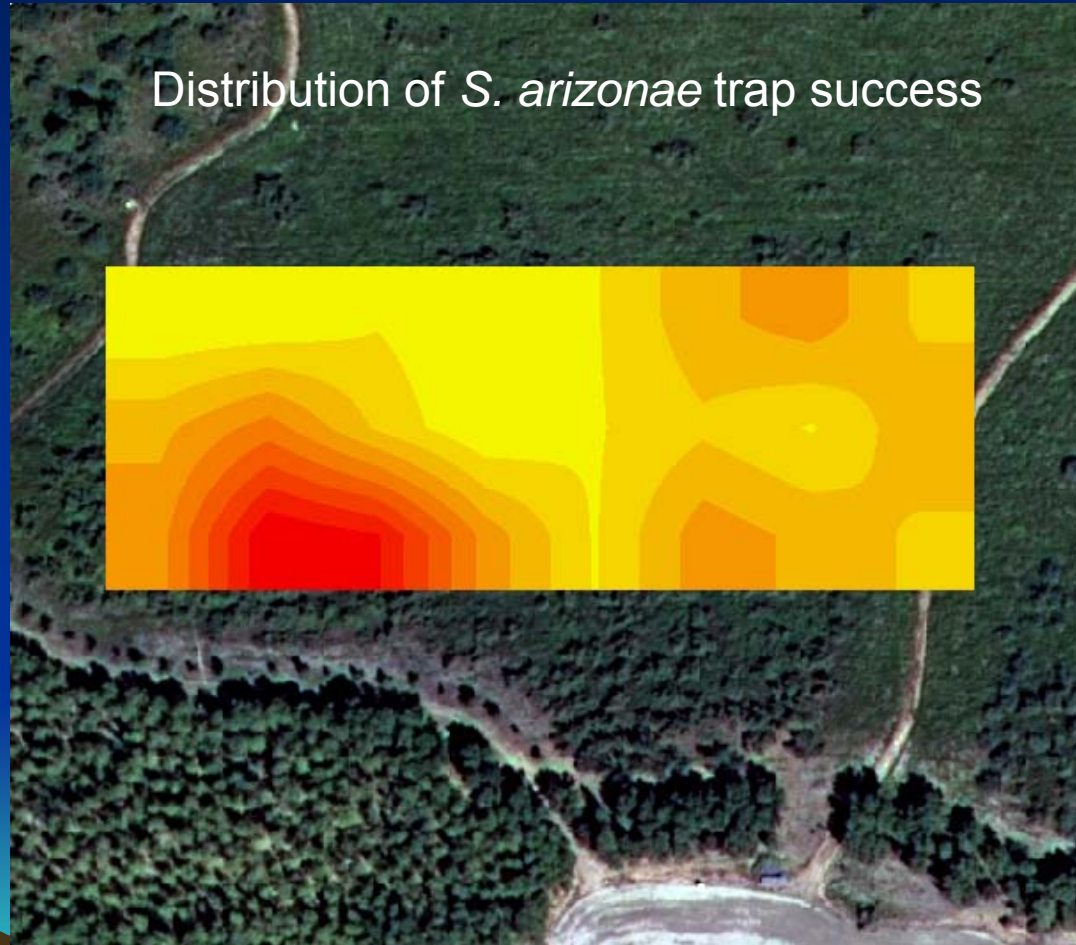
GIS predictive Layer



GIS predictive Layer



Other GIS fun



Adaptive Management

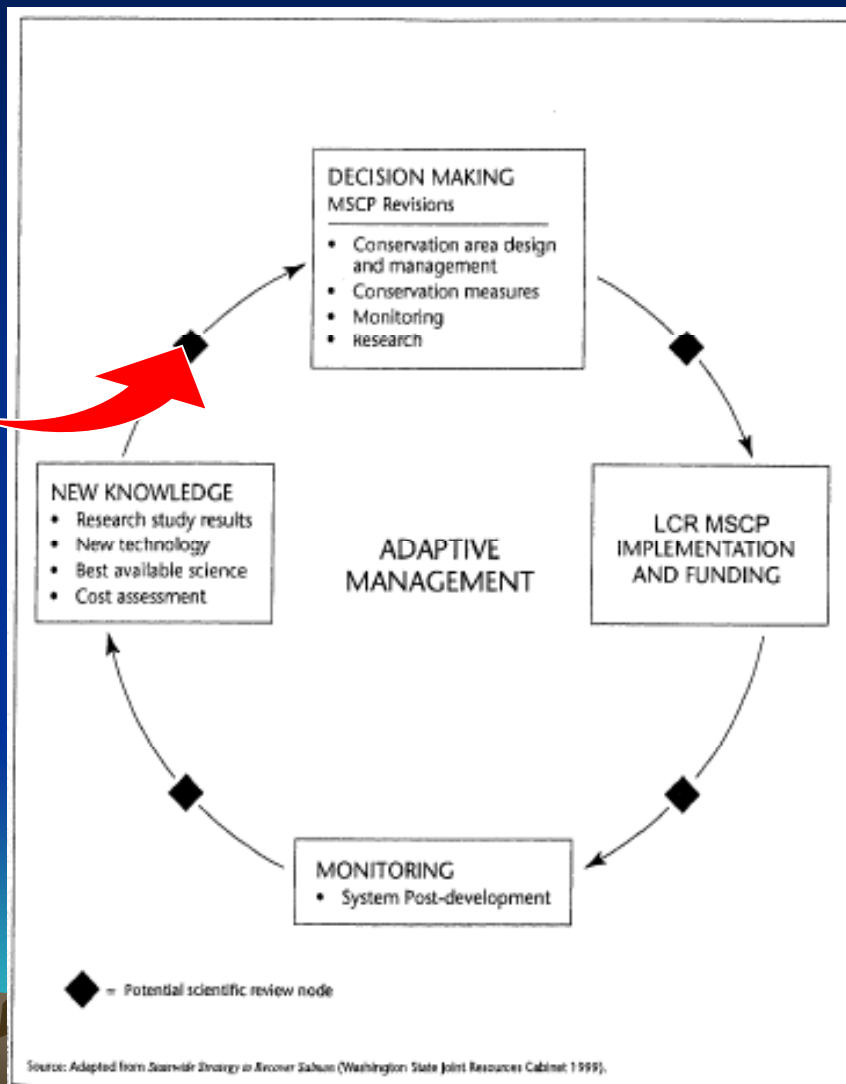
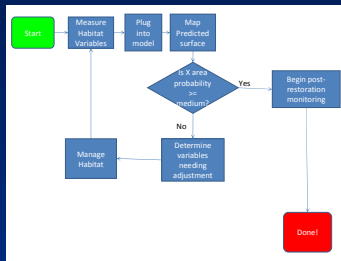
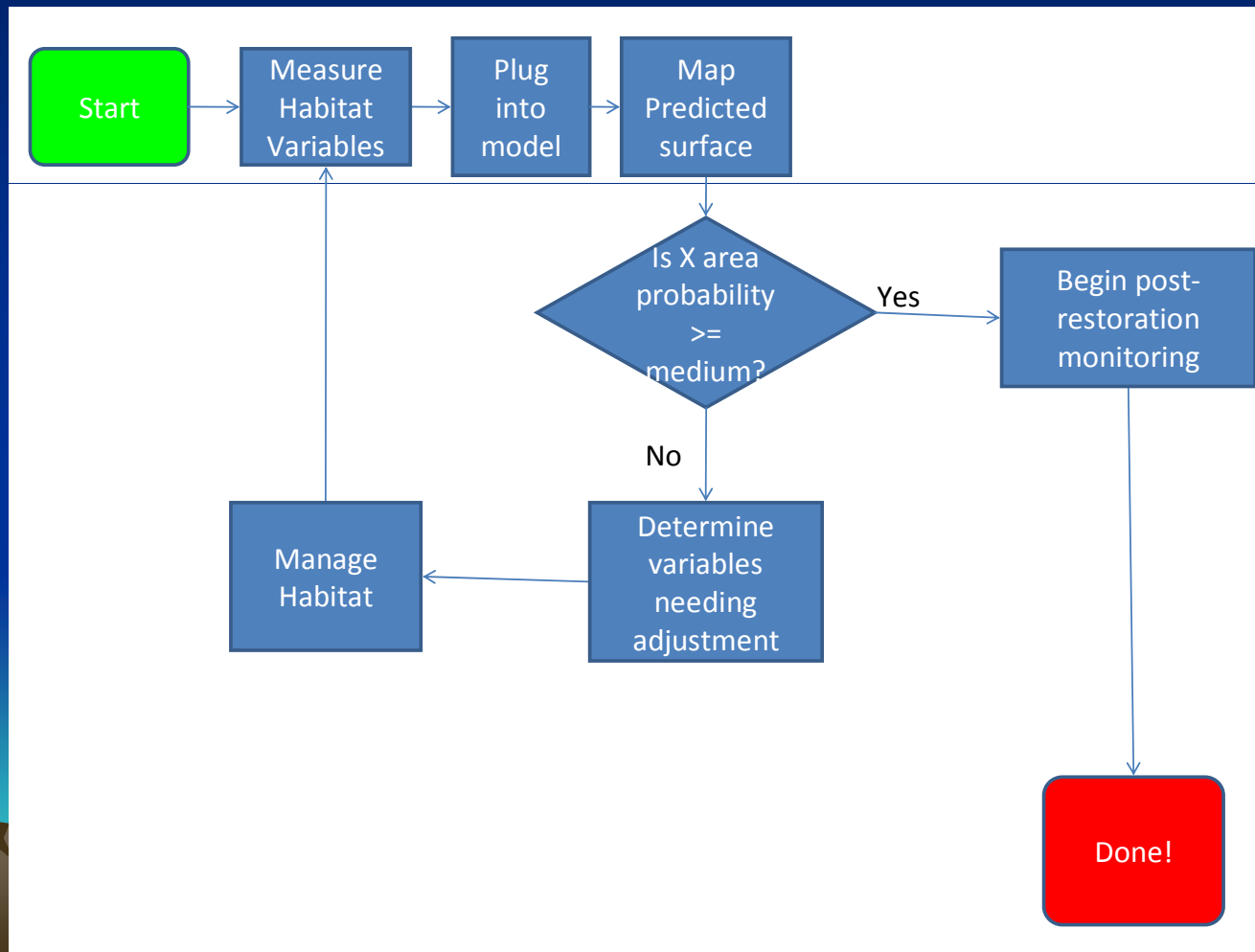


Figure 5-4
Adaptive Management Process

Adaptive Management

- Flow chart!



So far, So good...

- Total tagged
 - 45 PIT tagged at PVER
 - 31 PIT tagged at Cibola
 - 21 PIT tagged at Pintail Slough
- Habitat quantified for Fall 09



Acknowledgements

- D. Bangle
- B. Barrows
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- C. Dodge
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- SCA from Cibola



Thanks!

