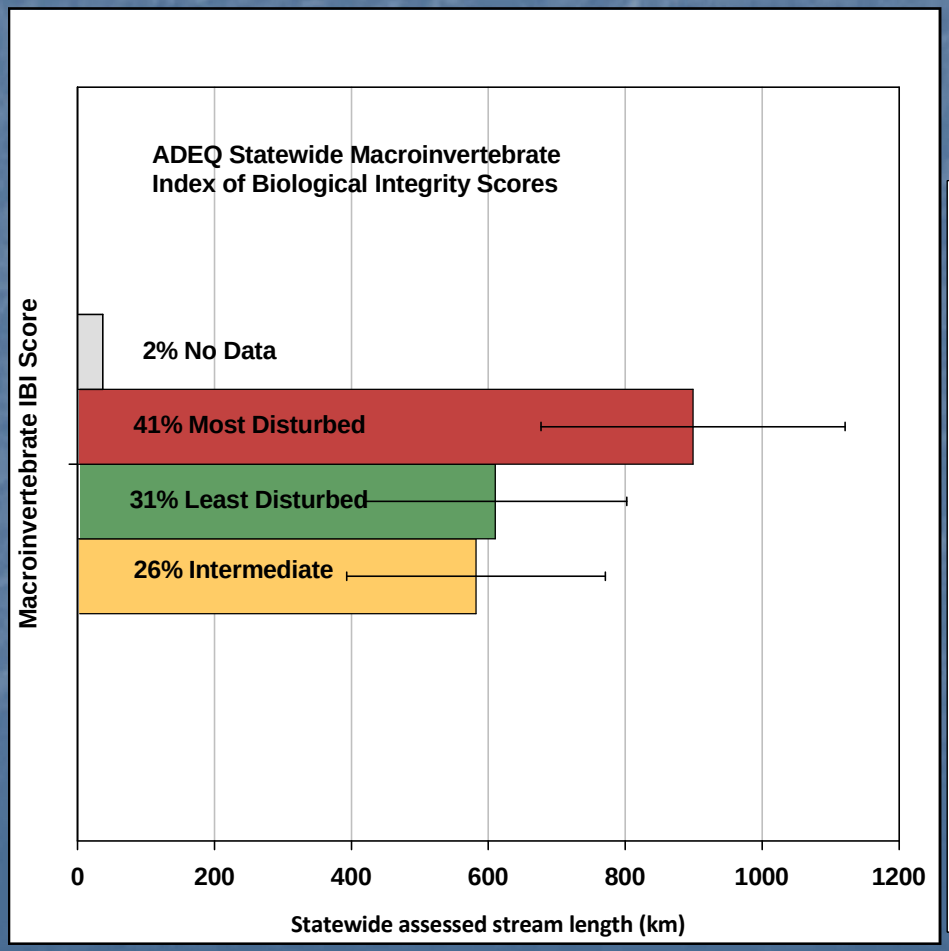
# Probabilistic monitoring of streams in the southwest; what are the chances of finding water?

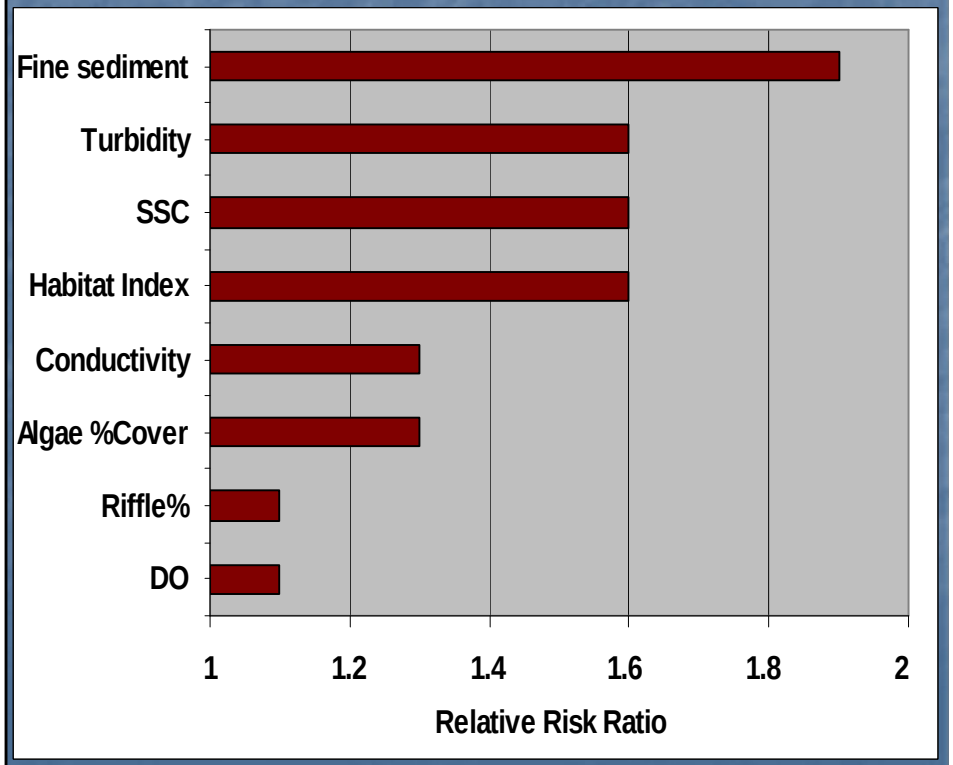
Patti Spindler, AZDEQ

# Overview

- Probability surveys valuable
- Sampling frame doesn't match target population
- Locating target-sampleable stream sites using current RF3/NHD maps is problematic
- AZ efforts to update perennial stream map & improve this monitoring design

# Probability surveys valuable for water quality assessment



# Sampling frame doesn't match Target population

- Streams target population = all perennial stream miles in the state
- Sampling frame = GIS representation of known perennial stream miles in each state
- Expect some differences
- In AZ, difference is significant

# Probabilistic monitoring design

- Random site selection depends on NHD medium-resolution maps for sample frame
- Flow regime data (perennial, intermittent, ephemeral) outdated in NHD
- High error rates in locating perennial monitoring sites in dry western states

# Probabilistic design – Monitoring costs

- High percentage of non-target sites using old RF3 & NHD map information
- More effort, staff time, cost per site than targeted monitoring
- 32 person-hours or $1100/site spent in staff & travel to conduct recon
- 2-3 failed recon sites = cost of 1 multiprobe sonde!

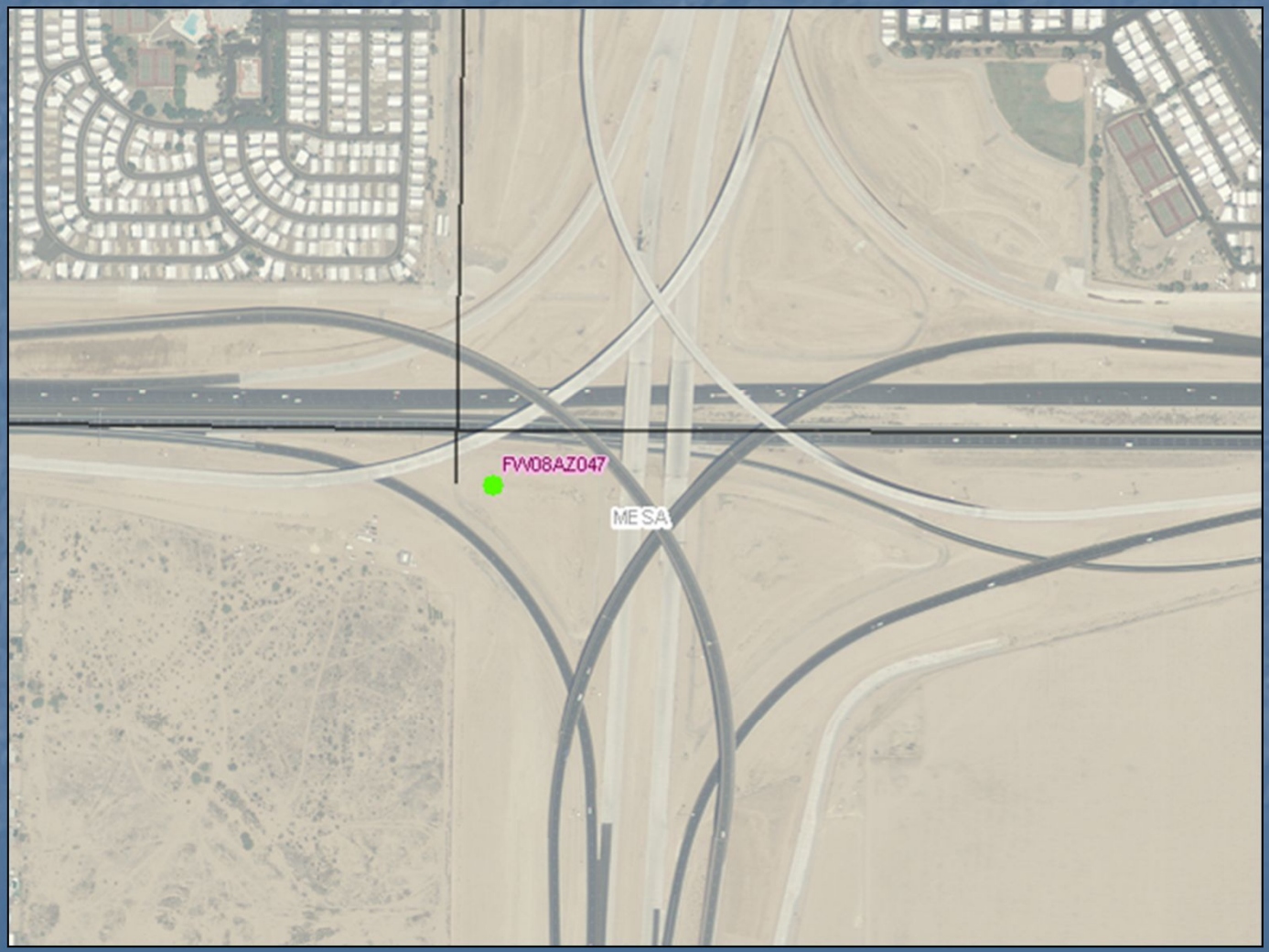
# Story of site 063, Clear Creek

- Two recon visits
- Sampling trip = overnite campout w/ 5 staff, 3 hr hike roundtrip
- Stream dried to pools in mid-summer
- IBI score violating biocriteria due to intermittency

# Flow regime data outdated in NHD

- AZ flow regime data as old as 1950s
- Flow regime data never updated in NHD
- Streamflow conditions not accurately mapped or have changed in AZ
- Random selection of "perennial" monitoring sites problematic

# Map error-no channel



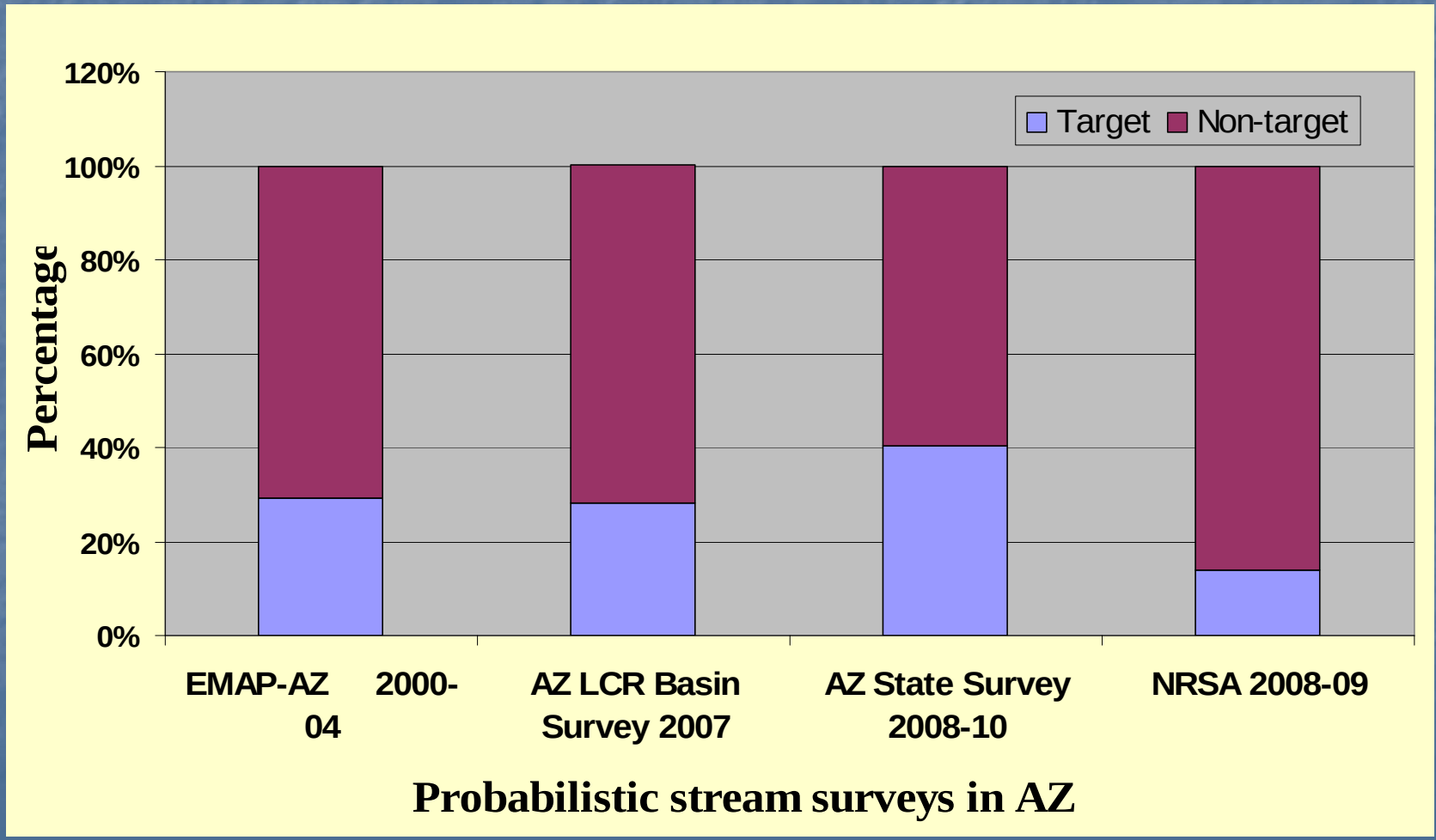
# Dry - Ephemeral wash

# Dry - Intermittent

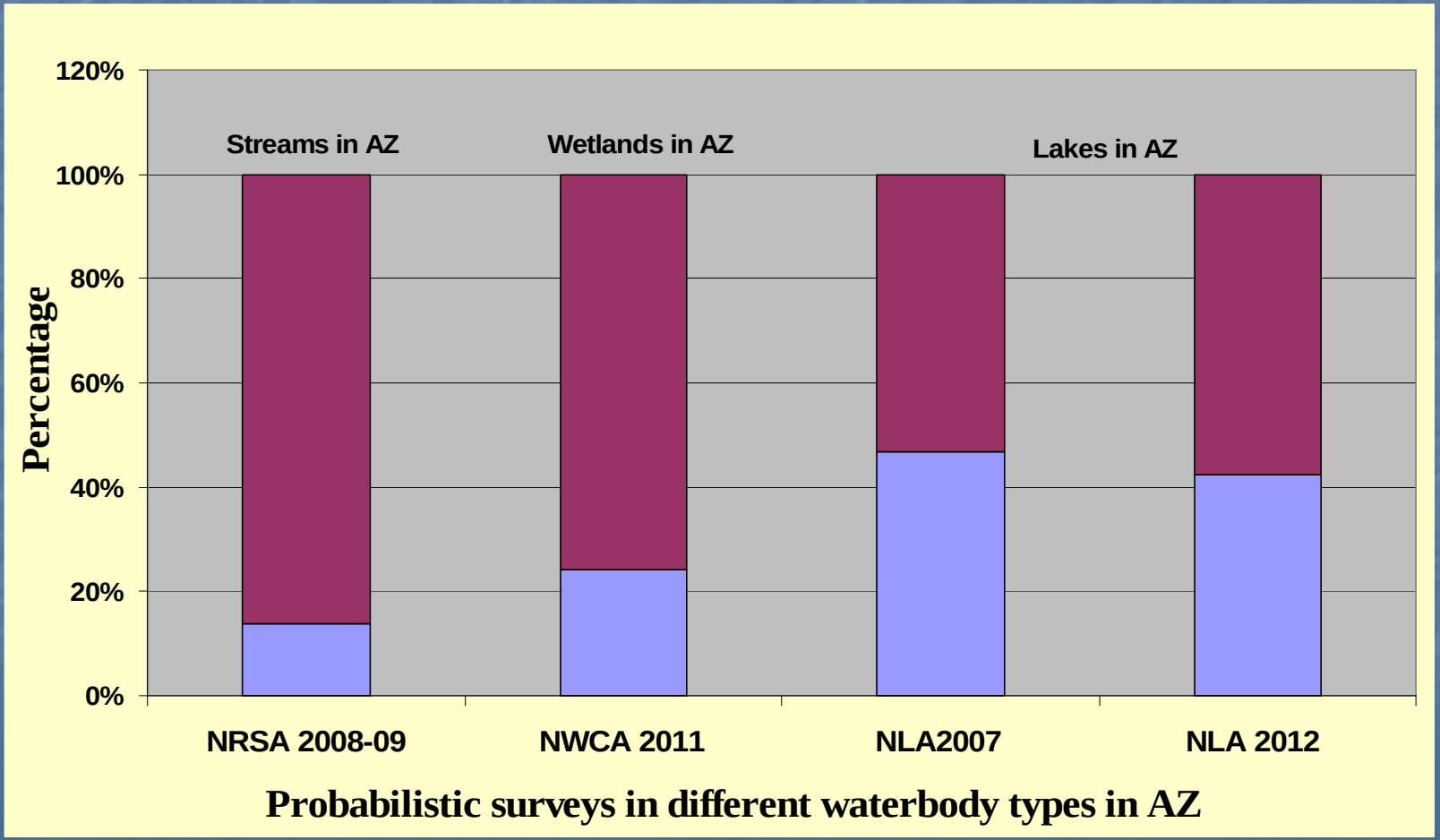
# Unwadeable - Colorado River

# Wrong waterbody - Canals

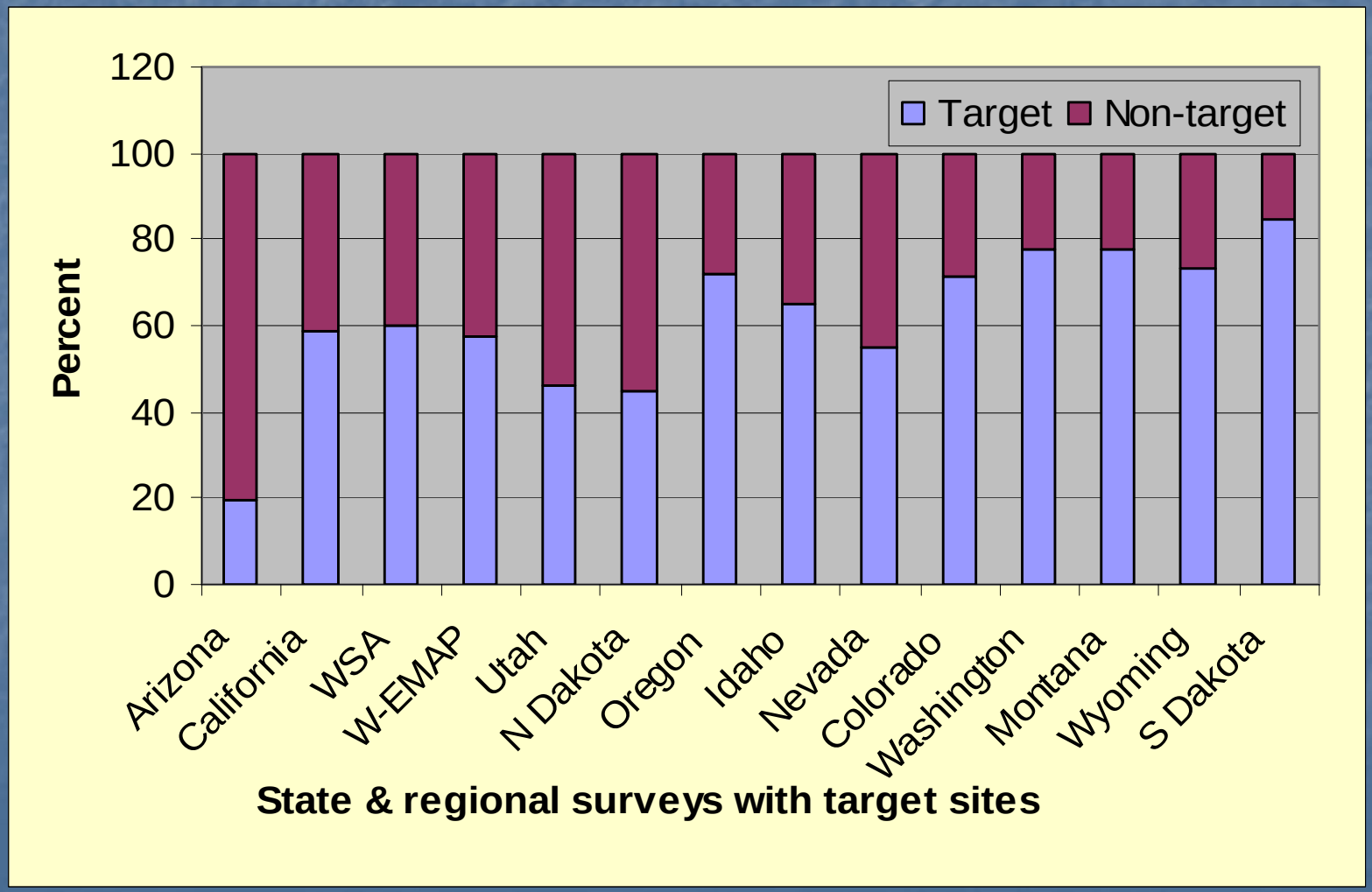
# Non-target percentages in stream probability surveys in AZ



# Non-target percentages among waterbody surveys in AZ



# Non-target rates in the *Wadeable Streams Assessment* Report

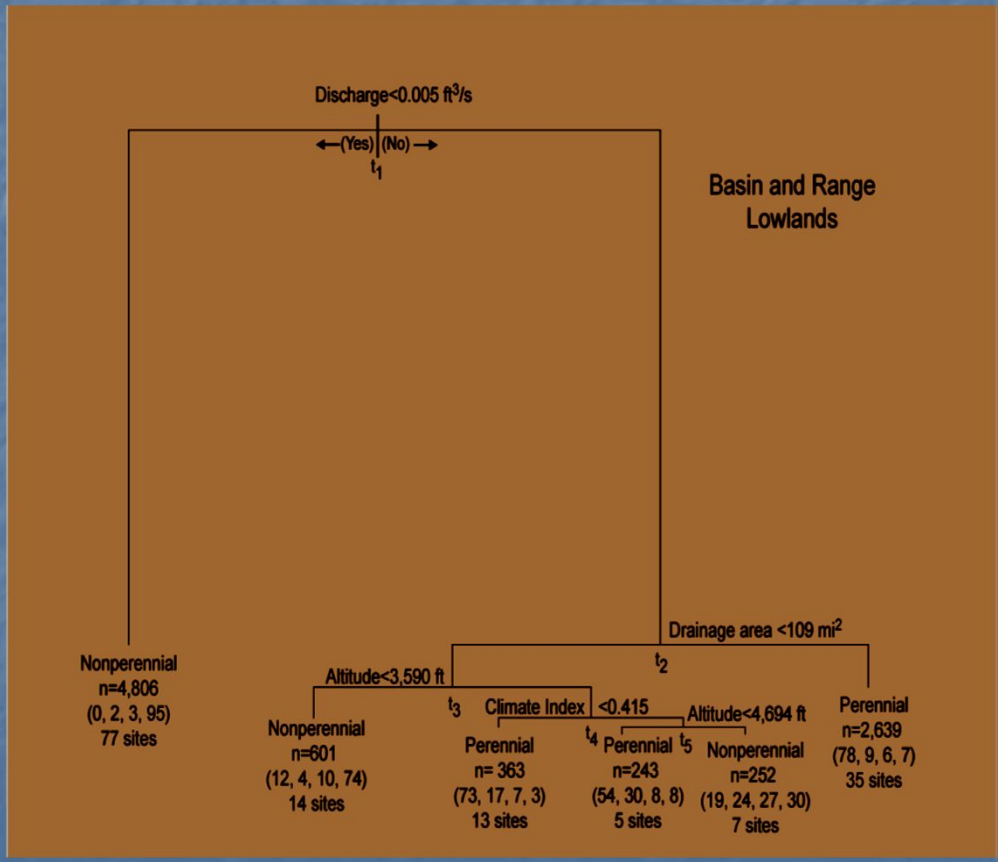


# REMAP Project; Refine AZ Perennial Map

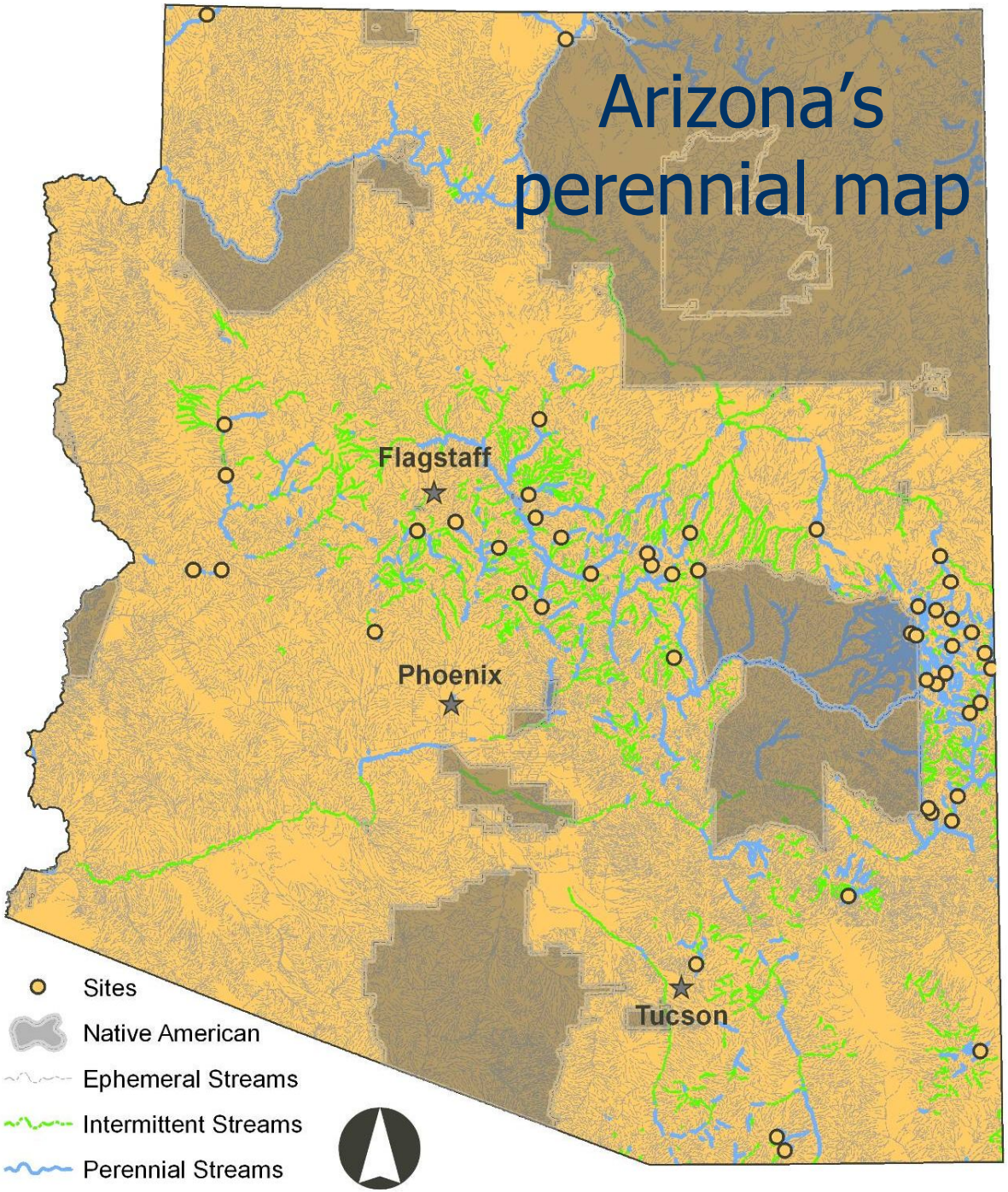
- Base map = AZ Game & Fish 1993 perennial map
- USGS models
- The Nature Conservancy wet/dry maps for San Pedro River
- ADEQ annual updates – recon data

# USGS Flow regime modeling for AZDEQ

- Classification tree model (measured discharge, drainage area, altitude, location, climate index)
- Reclassified approx 700 sites/reaches
- Categories:
  - Perennial – flows 99%
  - Nearly perennial 90-99%
  - Weakly perennial 80-89%
  - Non-perennial <80%
- *Predictive models of the Hydrological regime of unregulated streams in AZ* (Anning & Parker, 2009)



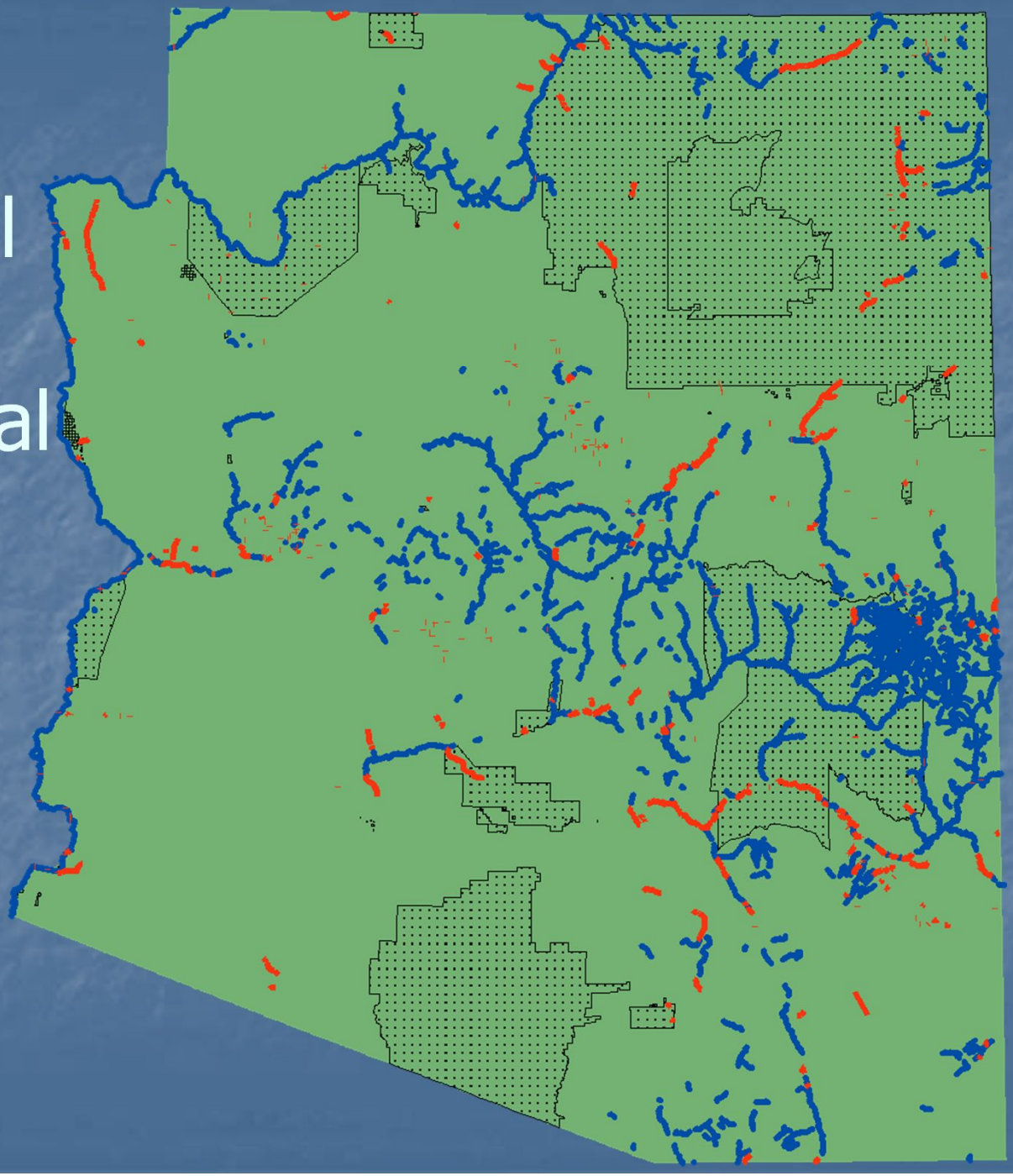
# Arizona's perennial map

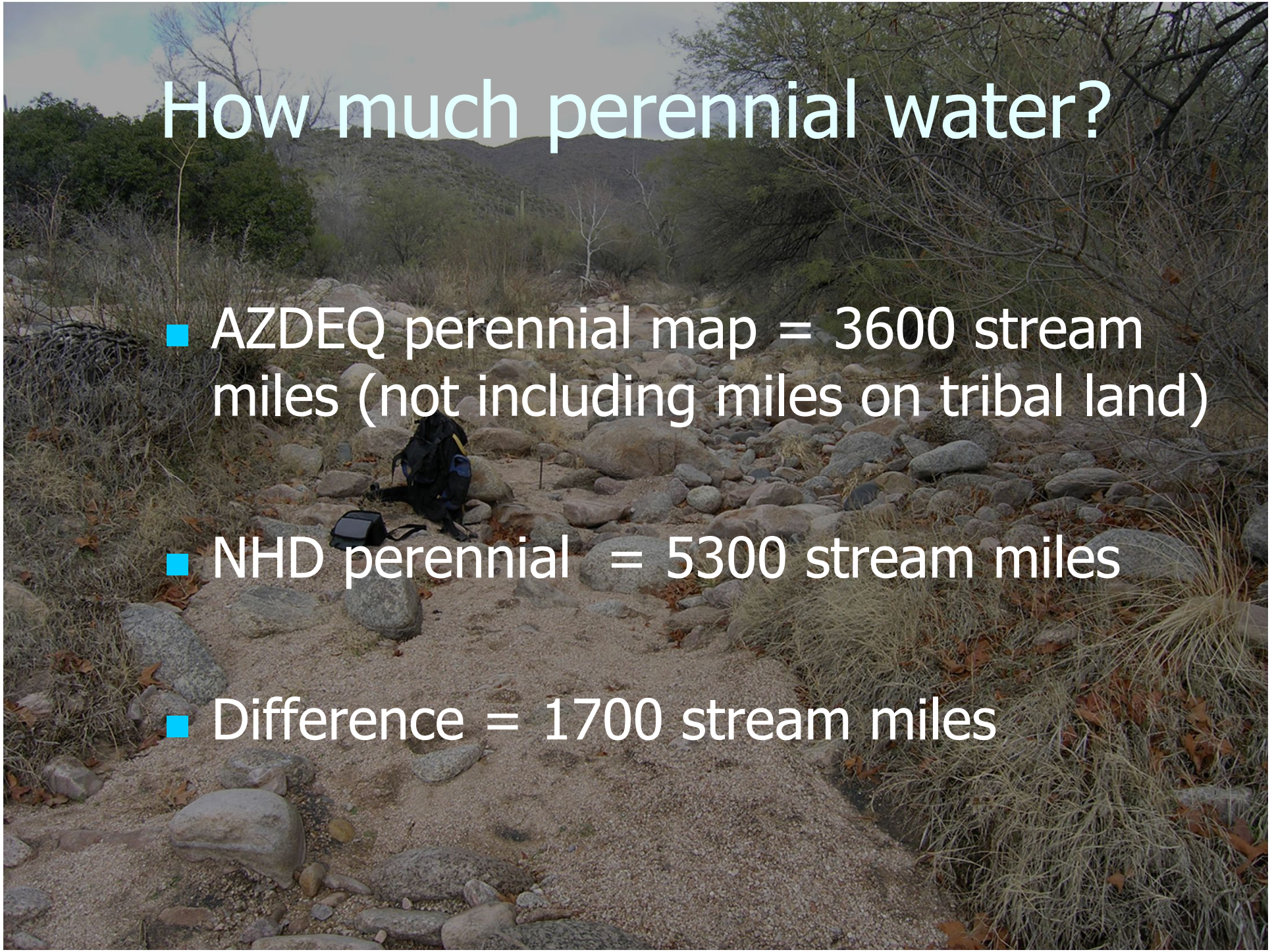


# Map Errors reduced with AZ perennial map

| Non-target category | AZ LCR Basin Survey 2007, using RF3 | AZ State Survey 08-10, using Updated AZ Perennial map |
|---|---|---|
| Dry (%) | 20 | 29 |
| Map errors (%) | 30 | 2.3 |
| Non-wadeable (%) | 2.1 | 8.4 |
| Total | 52.1 | 39.7 |

# Mapping differences; AZ perennial vs NHD perennial





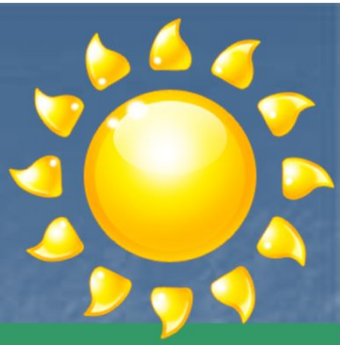
# How much perennial water?

- AZDEQ perennial map = 3600 stream miles (not including miles on tribal land)
- NHD perennial = 5300 stream miles
- Difference = 1700 stream miles

# Recommendations

- NHD databases need updating!
- Recon data on flow conditions being collected by state/tribal/locals
- USGS - NHD Stewardship program?
- In the meantime, send shape files EPA

# The forecast is sunny!



- Chances of finding water at random selected stream sites is improving!
  - Maps updated
  - Revisits to resample sites
- But… Climate change and increased human water use will likely cause waterways to dry up in the future.
- How do we track changes in aquatic life with loss of flowing water?