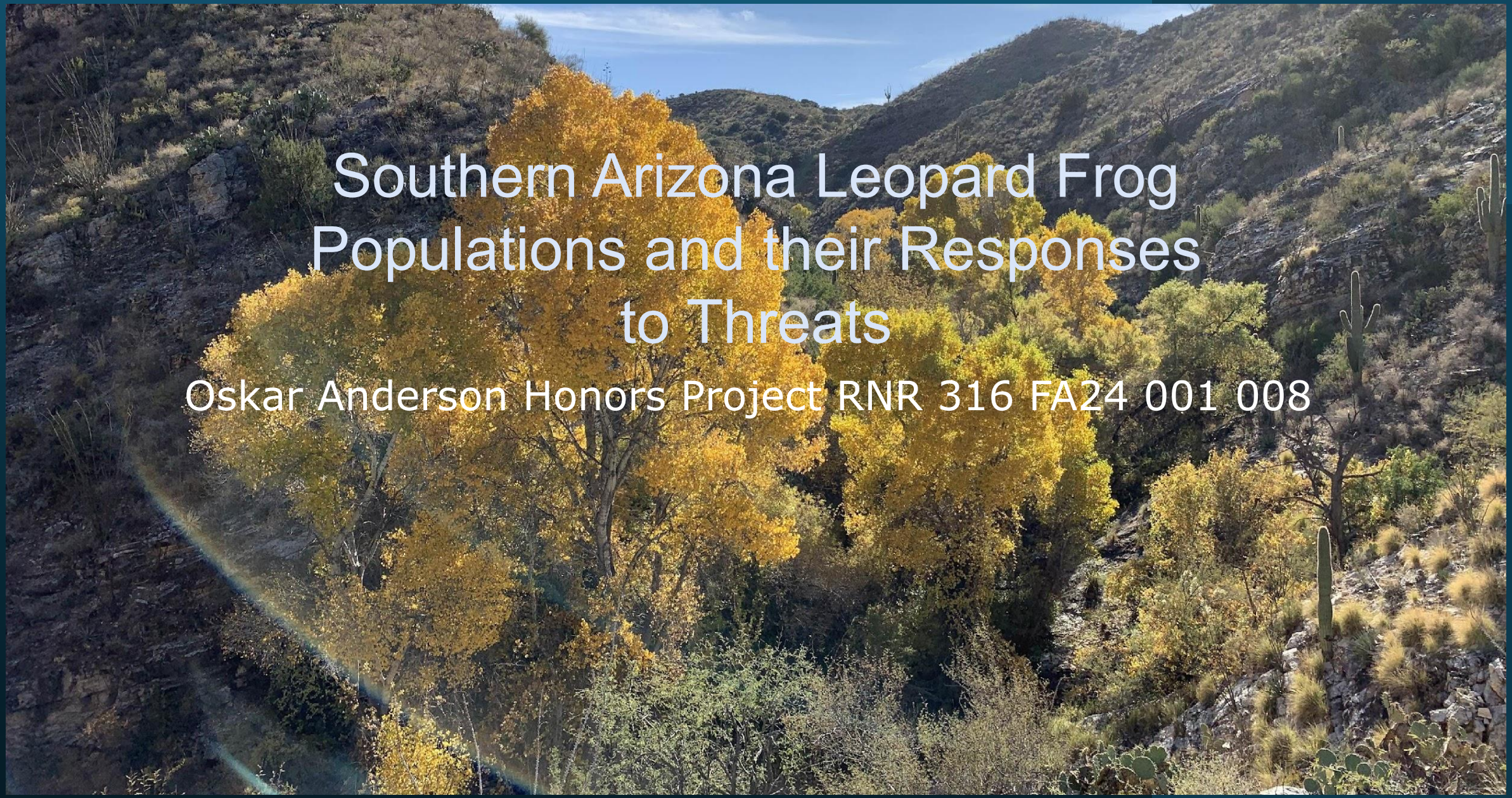


Southern Arizona Leopard Frog Populations and their Responses to Threats

Oskar Anderson Honors Project RNR 316 FA24 001 008

Meet the Frogs

Photo: Pima County CLR

Lowland Leopard Frog
(*Lithobates yavapaiensis*)
- Small frog of perennial waterways in the SW
- Of interest under Pima County's MSCP (Multi-Species Conservation Plan)

Photo: USFWS

Chiricahua Leopard Frog
(*Lithobates chiricahuensis*)
- Larger, federally protected frog
- Mostly extirpated in the US, persists primarily in manmade waterways like stocktanks
- Very few in Southern AZ

Meet the Frogs

Canyon Treefrog
(*Hyla arenicolor*)
- Much smaller, more common frog of rocky canyons
- Not as high priority, but generally recorded when monitoring and cool to see

Photo: Alan D. Wilson

American Bullfrog
(*Lithobates catesbeiana*)
- Gigantic, hungry frog with invasive introduced populations in much of the US west
- Major threat to other amphibian populations as predator and disease vector

Meet the Threats

This photo from the Pima County CLR shows the "patient zero" lowland leopard frog first recorded to have ranavirus in the Cienega Creek Natural Preserve (October 2022)

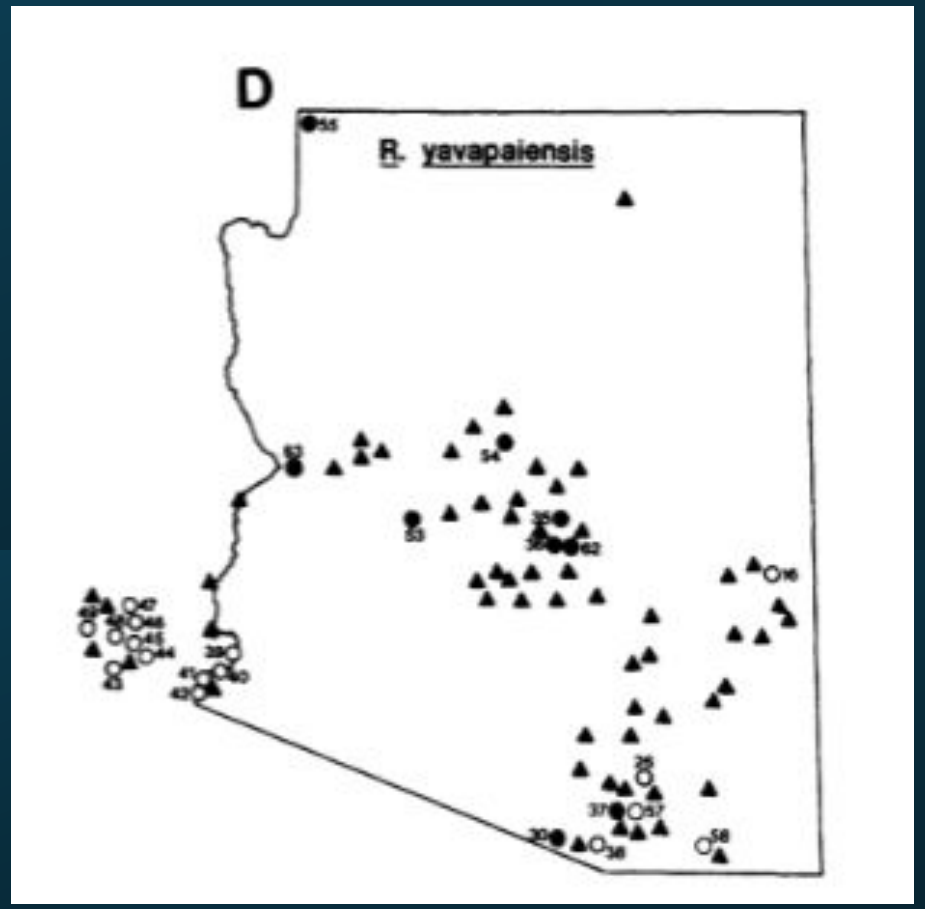
Chytridiomycosis

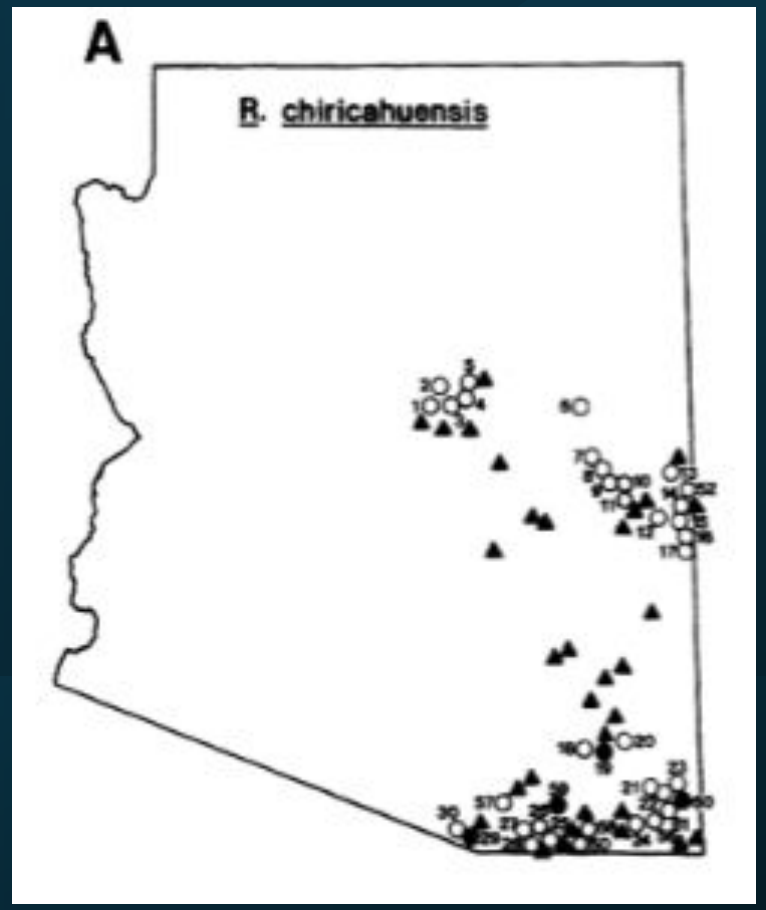
- Disease responsible for amphibian diversity loss worldwide
- Caused by *Bd* (*Batrachochytrium dendrobatidis*) fungus
- Visible yellowing of legs in leopard frogs

Ranavirus

- Genus of DNA viruses more recently introduced in the SW
- Spread with organisms and equipment, practically impossible to remove from watersheds
- Red spots visible on leopard frog legs

Decline from Historical Range





These graphs from Clarkson and Rorabaugh (1989) show that population extirpations for both species were already being recorded 35+ years ago!

= species not found, previously present

= species present

= sites not surveyed with historical presence

Response to *Bd*: Cienega Creek

Cienega Creek Natural Preserve is a county monitored site containing all previously listed threats to lowland leopard frogs as well as flooding events and other changes to physical habitat.

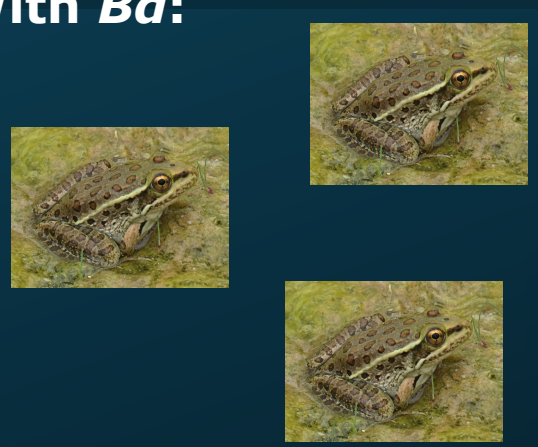
Photo: Caldwell and Rosen (2008)

Response to *Bd*: Cienega Creek

The most prominent change brought on by chytridiomycosis is a seasonal shift in population age structure.

No *Bd*:

With *Bd*:



Stress of cold winter + chytridiomycosis kills adults, only some tadpoles overwinter

Response to *Bd*: Hot Springs

Research shows a strong negative correlation between water temperature and *Bd* infection in leopard frogs, suggesting that **geothermal hot springs may be helping keep the fungus at bay.**

Relation between temperature and heightened immune system defenses makes warmer microhabitats unavailable for *Bd,* and therefore chytridiomycosis.

It's possible that frogs are seeking out warmer waters in response to *Bd* presence, a behavior that could be very important to their survival.

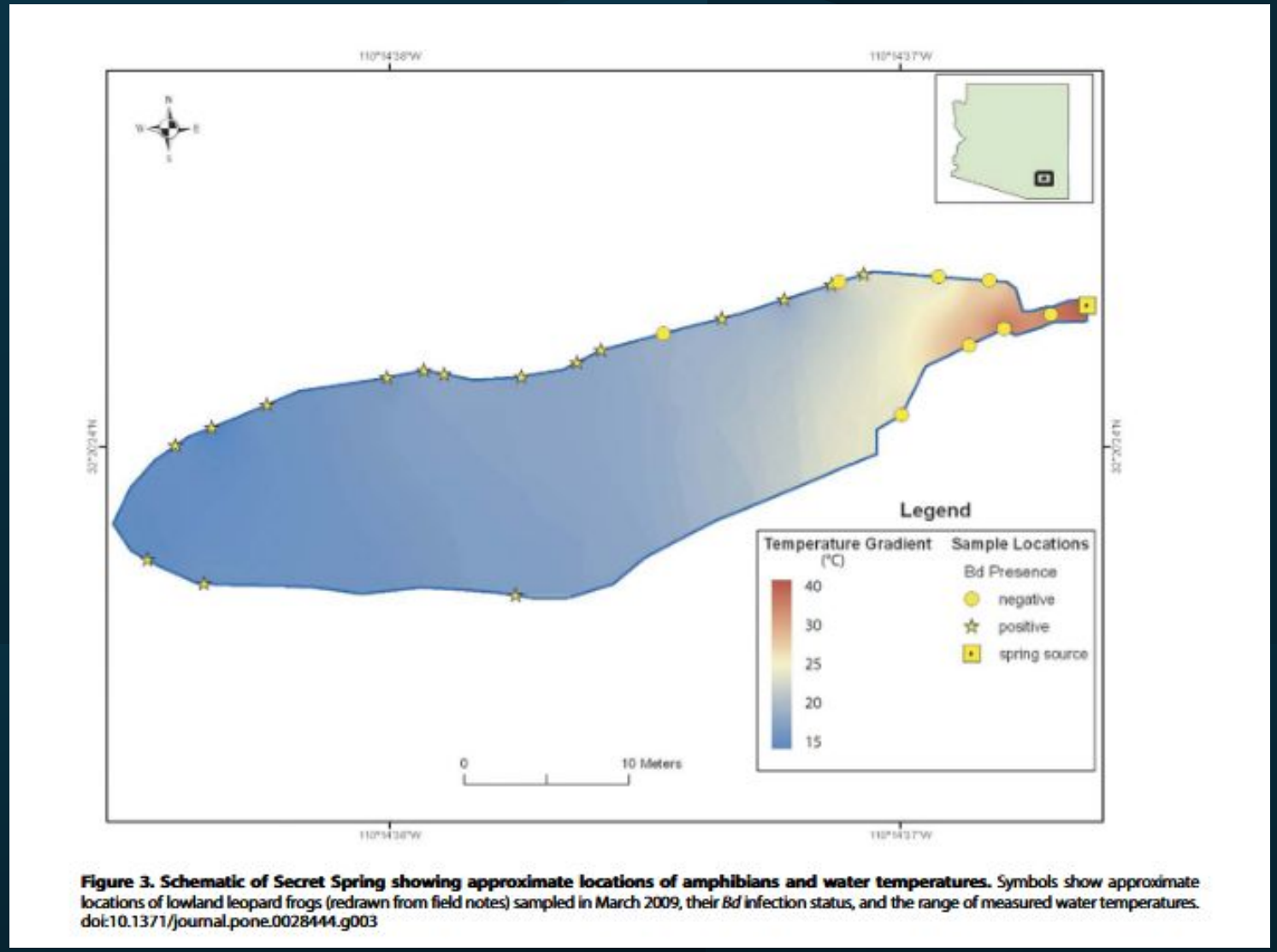


Figure 3. Schematic of Secret Spring showing approximate locations of amphibians and water temperatures. Symbols show approximate locations of lowland leopard frogs (redrawn from field notes) sampled in March 2009, their *Bd* infection status, and the range of measured water temperatures.
doi:10.1371/journal.pone.0028444.g003

Photo: Forrest and Schlaepfer (2011)

Response to Threats: Comebacks

Photo: Dave Foc

New research shows that populations of frogs (*Rana sierrae* in the case of the study) found to be resistant to *Bt* can thrive after intervention programs reintroduce them to vacant habitat (Knapp et. al 2024).

Could this be the way forward to save our lowland and chiricahua leopard frog populations?

Knapp et. al's research in California was on a plan that took 15 years of dedicated intervention and monitoring. What do we have in Arizona?

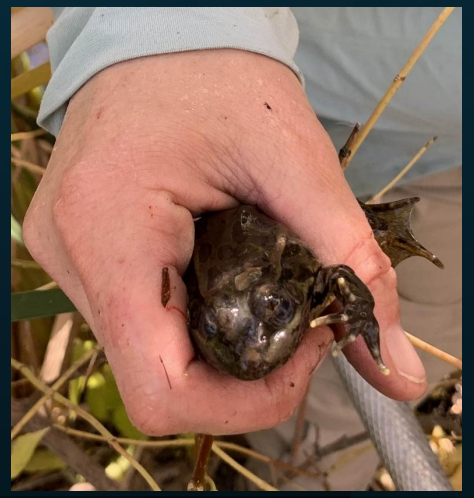
Pima County's Monitoring Program

Measuring depth of a canyon pool for wet/dry habitat monitoring

In the last 3 months I've had the opportunity to go out with Pima County's CLR (Conservation Lands and Resources) department to monitor lowland leopard frog populations.

We hike along stretches of known habitat and collect data on conditions of pools and numbers of frogs and tadpoles observed (dead or alive).

These field days also collect genetic data for a lab here at the UofA with the goal of learning more about what populations are most resilient to the diseases we've detected.



L. yavapaiensis individual suddenly aware she may have to lose a toe clipping for science

Conclusion

- Populations of leopard frogs in southern Arizona are threatened by diseases (especially chytrid) invasive species, and land use change.

- Responses to these threats are varied, and some populations show interesting forms of resistance.

- Harnessing the disease resilience adaptations of stable populations may be the pathway to reintroduction and protection of the species.


Questions?

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