Fire effects on *tinajas* and amphibian habitat at Saguaro National Park

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Outline
Saguaro National Park – east and west
Saguaro National Park – east – Rincon Mountain District
Sky Island ecological zones
Fire in Rincon Mountains and other Sky Islands

- Historic fire return interval ~ 10 years
- Periodic fire stimulates regeneration, promotes nutrient recycling, protects forests from catastrophic fire
- Increase in very large wildfires during past few decades
Surface water - intermittent streams

Springs and tanks
Tinajas – “earthenware jar” in Spanish
Major source of water in Rincons during dry season
Value for people, past and present
Essential for wildlife

Bobcats

Canyon treefrog

Single-celled algae

Dragonfly

Mallard

Gary Slaten photo
Lowland leopard frog
(*Lithobates [Rana] yavapaiensis*)

- **Webbed feet**
- **Tadpoles ~ 9 months in water**
- **Jumps!**
Declining amphibians – globally and locally

Stopping the Next Amphibian Apocalypse

Tarahumara frog (extirpated in US)
Local declines of the lowland leopard frog

- Major known populations of Lowland Leopard Frogs extirpated since 1940s near Tucson
American bullfrog (non-native)
Crayfish (non-native)
Disease
Habitat loss
Tamarisk: Follow-Up Surveys

Legend
- Undergoing Treatment
- Drainages Surveyed
- Drainages
- 5000ft elevation
- 6000ft elevation
- State Trust Land
- Private Inholding
- RMD Boundary
- Forest Service Land
- Private Land

Park-wide, biannual surveys

Produced by Justin Kolb, Biological Technician
Data Source: Saguaro National Park

July 2011
Visual encounter surveys for leopard frogs and other aquatic species

Photograph and record water status of each tinaja (>240)
Results 1996-2011 (Zylstra et al. 2015)

Mean frog counts per biannual survey, 1996-2012

Average # Lowland Leopard Frogs Per Survey

Adults
Pools where frogs observed, 1996-2011 (green); pools where frogs always observed (red)
More water = more frogs

**Figure 1.** Predicted number of recruits (a) and monthly survival (b) of adult lowland leopard frogs (with 95% confidence intervals) as a function of surface water availability, with other model variables held constant. Zylstra et al. 2015.
Water available to frogs in tinajas is related to rain, but not always
Example: Box Canyon Fire - 6,500 acres June 16 1999

NPS photo
Large areas of moderate-high severity
March 12 1997 – Loma Verde Pool 10, below fire perimeter
July 7 1997 – ash in water, water temps 35-36°C (95-97°F), tadpole mortality
October 14 1999 (filled after rain of 1.2 - 2.7” on July 15 1999)
Pool 1 (about 1 mile downstream of Pool 10) filled with ash on July 12, 1999 but did not receive sediment until winter rains of 2000.
June 2002 – all pools in Loma Verde dry due to 1-2 meters of sediment – last leopard frogs died
Number of frogs observed, Loma Verde Canyon, 1996-2013

Loma Verde Lowland Leopard Frog Survey Data: 1996-2013

Box Canyon Fire
July 1999

All pools dry;
Frogs disappear
Spring 2002

Frogs re-appear fall 2007

Disappear early 2012
Example: 2003 Helen’s 2 Fire – 3,600 acres
2003 Helen’s 2 Fire – Joaquin Canyon
Erosion pillars created by sheetwash

Course, poorly-sorted overbank deposits, Joaquin Canyon

From Parker (2006)
Repeat photos – Joaquin Canyon (2003 Helen’s 2 Fire)

July 4 2003

July 19 2003

November 2, 2005
Number of adult and juvenile frogs observed on surveys in Joaquin Canyon following 2003 Helen’s 2 Fire

- Helen’s 2 Fire, June 2003
- Summer 2005, no frogs detected
- 2007-2009; frogs returned, then disappeared again
How long does sediment persist in tinajas?

Sediment surveys at SNP, 2005-present
Sediment surveys

Bedrock contours, Madrona #2
Sediment surveys

Bedrock contours, Madrona #2

Sediment contours 2005

42%

Sediment contours 2007

79%

Sediment contours 2010

33%
How long does sediment persist?

Shorter duration – high energy areas, larger watersheds

Repeat photos – Loma Verde Canyon (1999 fire)
Longer duration – pools in smaller, less steep watersheds

Repeat photos – Loma Verde Canyon (1999 fire)
Longer duration – pools in low energy areas

Repeat photos – Wildhorse Canyon (1989 Chiva Fire)
Mean sediment volume/pool by stream, 2005-2013

- Loma Verde – 68% burned (1999 fire)
- Rincon – 73% (1994 fire)
- Chimenea – 11.8% (misc. small fires)
- Wildhorse – 31% 1989 fire
Changes in tinaja sediment volume, all combined 2005-2013

Percent Sediment Volume Average for All Pools
(+/- one standard error)

Year of Survey

2005-2006
2007
2010
2013

Percent Sediment Volume (%)

34.8
41.0
36.9
28.3
Fire, floods, and sediment good for frogs – issue of scale
Fire effects on other frogs in Arizona

Chiricahua leopard frog - threatened
Photo by J. Rorabaugh

Tarahumara frog – extirpated/reintroduced
AGFD photo.
Management – what can we do as land, fire, and wildlife managers?
a. Measures to prevent post-fire erosion

- Log erosion barrier
- Staw bale erosion barrier

**Wood strand mulch**

Robichaud (2009)
Robichaud et al. (2012)
b. Habitat restoration

Miller Canyon frog habitat restoration (AGFD photo).
b. Habitat restoration

Pool 1 being excavated partially (left) and fully (right) in 2005
Pool 1 on July 8, 2006

Pool 1 – dry on June 6, 2013

Lowland Leopard Frog in Loma Verde on October 15, 2006
c. Salvage and re-introduction

Chiricahua leopard frog salvage and release, Miller Canyon. Glendale Community College photos.
Backyard pond project near Saguaro National Park
d. Pre-fire actions
Letting natural fires burn

Deer Head Fire, 2014
General concepts for conservation/management

How great is the risk?

How important is the population?

Consider the “no-action” alternative where ever possible

Erik Enderson photo
Long-term view – ecological change and “management”

- *Time’s circle*: What are the natural patterns over time?
- *Time’s arrow*: What are the long-term trends?
  - Potential threats
  - When to respond
Healthy forests, healthy frogs
“Stand on Tanque Verde Ridge in Saguaro National Park and see, in one compelling panorama, all that makes fire management in the western U.S. problematic...Saguaro will have to be lucky as well as good.”

--Steve Pyne, A Fire History of America (2012)