# Demography Response of *Lithobates pipiens* to Agriculture, Climate Change, Channelization, and an Invasive Species

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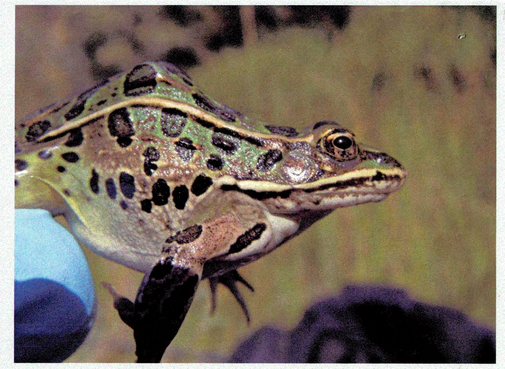


## Abstract

The combined effects of agriculture, climate change, and river channelization have left native Northern New Mexico species vulnerable to predation and competition from invasive species. This study examines the demographic changes of the native Northern leopard frogs after the removal of the invasive species the American Bullfrog. A section of the Mora River was divided in 2000-meter long section. One control region where no bullfrogs were eliminated and an experimental region where we eradicated Bullfrogs. Fifty one Leopard frogs were captured, pit tagged, and processed for demographic data. Control and experimental regions did not differ in the relative abundance of leopard frogs. We did not find significant difference in the mass of frogs from the two regions either. This preliminary data does show lower average mass and greater abundance in the experimental region suggesting an increase in recruitment of metamorphosis frog into the population. A change in demography within a year of bullfrog removal shows how fast a species can react to environmental changes.


## Introduction

Since the early 1800 agricultural practices in Northern New Mexico have removed water from the Mora River. Climate change has produced a synergistic effect with agriculture further reducing river flow with temperature increases and extended drought conditions (NMAISAC 2008). Furthermore, channelization of the Mora River has reduced the number of aquatic ecosystems available to the native flora and fauna. These combined effects have left native species vulnerable to predation and competition from invasive species. Introduced Invasive species have no natural control and prey on species with no adaptive defenses (Adams 1999; Diaz de Pascual 2008) . The experimental removal of bullfrogs has been undertaken at the Wind River Ranch in Northern New Mexico. The Mora River has been divided into an experimental and control region (Figure 1). We propose to investigate the demography of Northern Leopard Frog (*Lithobates pipiens* ) in the presence and absence of American Bullfrog (*Lithobates Catesbeianus* ). The change in demography of leopard frogs could provide insight into the decline of amphibian's world wide.

## Methods

The removal of bullfrogs is an ongoing process to keep the experimental site free of invasive bullfrog. Any bullfrog seen in the experimental region is captured and euthanized by immersion in a 10% ethanol solution (AVMA 2007). Northern Leopard Frogs are surveyed by conducting visual surveys along the banks of the Mora River. The Mora River (Figure 1) was divided and marked into 200m reaches to ensure accurate survey lengths. Surveys were conducted by counting every frog seen in a reach and totaling the count at the end of the reach. The sampling effort was done with three people walking in a line at a average rate of 200 meters in 13 minutes. Gloved hands are utilized when capturing and handling leopard frogs to minimize the potential spread of *Batrachochytrium dendrobatidis* (*chytrid fungus)*. We changed gloves after processing each individual.

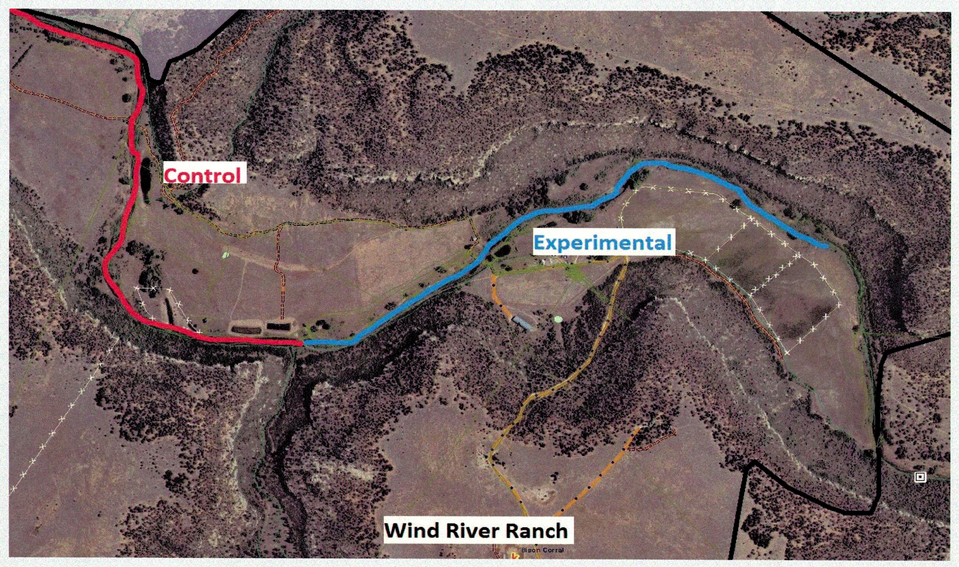


Figure 1 Study site in the Mora River. The experimental region is where the Bullfrogs were eradicated while the control is where the bullfrogs population was not affected.

We collected measures of snout to vent length (SVL), left hind foot length (LH), and mass and implanted a passive integrated transponder with a unique identifying number in each captured frog (Figure 2). The location of capture is taken with a GPS and the vegetation type is recorded along with the time of capture. The closest type of aquatic habitat is also recorded (riffle, pool, pond, etc.).

Figure 2 . Left: Measuring the left hind (LH) foot of a bullfrog. Center: The injection of a PIT tag in ventral region of a Northern Leopard Frog. Right: Examining the hind thigh of a Leopard frog to identify its species. Northern leopard frogs have spots .

## Results

Northern Leopard Frog demography seem to have changed in one summer after the removal of bullfrogs when comparing the experimental and control regions, however the changes are not statistically significant. A total of fifty-one frogs were captured and processed between the control (27 frogs) and the experimental (24 frogs) regions. Frogs in the control region were slightly heavier (22.15 g) than frogs in the experimental (20.73 g) region (Figure 3). While, the average abundance per 200 meter reach was larger in the experimental (4.85 frogs) than in the control (3.08 frogs; Figure 4). Statistical analysis fail to detect any significant differences between control and experimental regions for mass or abundance.

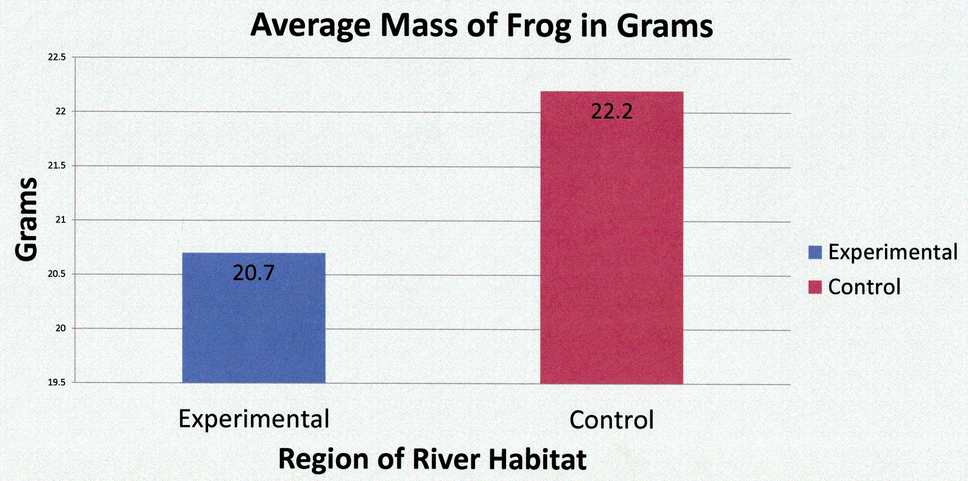


Figure 3 The Average Mass of Leopard frogs captured and processed in the experimental region where Bullfrogs had been eliminated (20.73 grams) was lower than the average in the control (22.15 grams ) that coexisted with bullfrogs. However this difference was not statistically significant (t=1.770, p>.05).

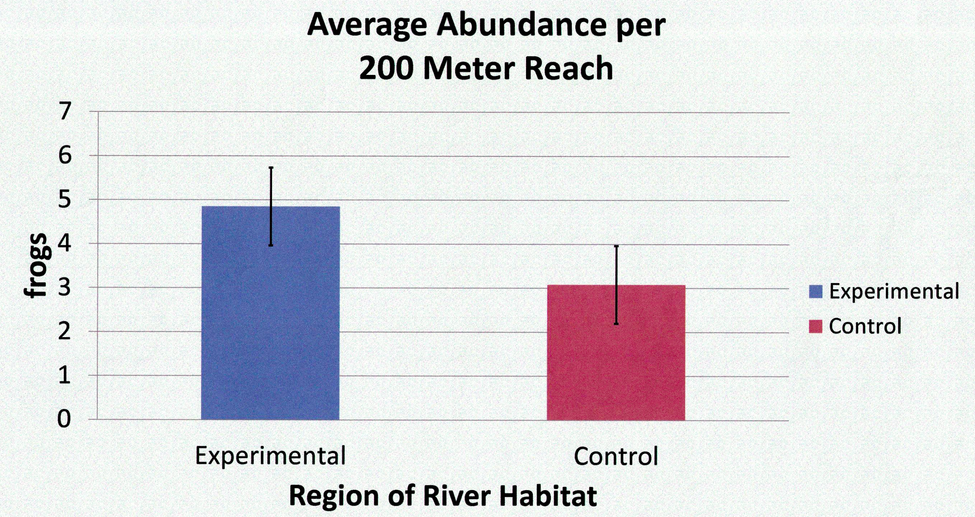


Figure 4 The Average number of Leopard frogs seen while conducting frog surveys in each 200 meter reach. The experimental average was 4.85 frogs per 200 meters and the control average was 3.08 frogs per 200 meters. There difference was not statistically significant (t= -.425, p>.05).

## Discussion

We did not see any significant difference between abundance or size of frogs in both populations. However, the eradication of bullfrogs is a recent environmental factor affecting this population and the changes might not be strong enough as of yet, to produce a statistically significant trend. Demographic responses usually take years to see in a population, and no response was expected from the initial sampling. However, the lower average mass of Northern leopard frogs and the increase in abundance per 200 meter reach in the experimental region are encouraging.

It seems contradictory that metamorphosis frogs seem smaller in the experimental region where there is no competition or predation from bullfrogs. A possible explanation is that survival of new individuals is higher when bullfrogs are not present. This increase in survival would produce a large number of new metamorphosed frogs which artificially draws down the average mass. This thesis is supported by the larger number of metamorphosed frogs found in the experimental region compared with control.

The experimental population is showing signs of demographic change within one year of bullfrog removal, which happened sooner than we expected. The change shows how resilient populations can be when natural balance is restored.

## References


Adams, M. J. (1999). Correlated factors in amphibian decline: exotic species and habitat change in Western Washington. Journal of Wildlife Management. 63: 1162-1171.

AVMA, American Veterinary Medical Association 2007. AVMA guidelines on euthanasia (formerly Report of the AVMA panel on euthanasia): Jun 2007 update

Díaz de Pascual, A. D., and C. Guerrero. 2008. Diet composition of bullfrogs, *Rana catesbeiana* (Anura: Ranidae) introduced into the Venezuelan Andes. Herpetological Review. 39:425-427

NMAISAC. 2008. New Mexico Aquatic Invasive Species Management Plan. New Mexico Aquatic Invasive Species Advisory Council, Santa Fe. ed


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