

Section 6 (Texas Traditional) Report Review

Form emailed to FWS S6 coordinator (mm/dd/yyyy): 12/6/2012

TPWD signature date on report: 11/8/2012

Project Title: Population supplementation: a proven means toward endangered species recovery for the Houston toad

Final or Interim Report? Interim

Grant #: TX E-127-R

Reviewer Station: Austin ESFO

Lead station concurs with the following comments: NA (reviewer from lead station)

Interim Report (check one):

- Acceptable (no comments)
- Needs revision prior to final report (see comments below)
- Incomplete (see comments below)

Final Report (check one):

- Acceptable (no comments)
 - Needs revision (see comments below)
 - Incomplete (see comments below)
-

Comments:

Please number the pages of the report

Introduction, paragraph 1, sentence 1 – In the literature citation, “Sander” should be “Sanders”

Introduction, paragraph 1 – The statement “...although designation in Harris Co. was later revoked after significant lobbying by real estate interests...” should be cited.

Introduction, paragraph 2, sentence 4 – Please remove the comma after the word “Only.” There are comma errors throughout the document that should be corrected for the final report.

Introduction, project goal #2 – Please delete the hyphen in the word “head-start.” Please make this same correction throughout the document (such as within the section titled “Headstarting 2012 and Future Directions”).”

Please indicate in the Methods section how toads were to be detected (for example, visually?)

Please indicate in the Methods section the soil types for all three habitat treatments (oak, pine, and juniper).

Please discuss any statistical analysis conducted in the Methods and Results sections of the report.

The text on the page beginning with the section titled “Headstarting 2012” ends abruptly in the middle of the page. Please correct this.

Headstarting 2012 – Please indicate how individuals were marked.

In the section titled “Additional efforts relevant to headstarting during 2012” – Please correct the sentence starting with “These areas surveyed (Bastrop State Park and GLR) we heavily impacted...” to “were heavily impacted...”

Please correct spacing issues within the Literature Cited section (See Forstner 2003).

INTERIM PERFORMANCE REPORT

As Required by

THE ENDANGERED SPECIES PROGRAM

TEXAS

Grant No. TX E-127-R

Endangered and Threatened Species Conservation

**Population supplementation: a proven means toward endangered species recovery
for the Houston toad**

Prepared by:

Mike Forstner



Carter Smith
Executive Director

Clayton Wolf
Director, Wildlife

8 November 2012

INTERIM PERFORMANCE REPORT

STATE: Texas GRANT NUMBER: TX E-127-R

GRANT TITLE: **Population supplementation: a proven means toward endangered species recovery for the Houston toad**

REPORTING PERIOD: 1 Sep 11 to 30 Sep 12

OBJECTIVE(S):

Use field and molecular tools to determine the most efficient means of headstarting the Houston toad as one of the few proven methods to lead to recovery of endangered species.

Segment Objectives:

- **Field Surveys for eggstrands** - visit each chorus pond during daylight and half of each eggstrand will be collected, quantified, and transported to the Houston Zoo for rearing. Once hatching is underway begin genetic analyses confirming the genetic background of each strand.
- **Laboratory analyses**
 - Microsatellites will be amplified and analyzed.
 - Genetic clustering analyses will be used to infer the number of clusters (K), or populations, in the dataset and to assign individuals to a cluster. Prior to all releases we follow strict IUCN approved biosecurity protocol that includes veterinary screening and chytrid testing.

Significant Deviations: None.

Summary Of Progress: See Attachment A.

Location: Bastrop County, Texas.

Cost: Costs were not available at time of this report.

Prepared by: Craig Farquhar **Date:** 8 Nov 2012

Approved by:  **Date:** 8 Nov 2012
C. Craig Farquhar

ATTACHMENT A

Population supplementation: a proven means toward endangered species recovery for the Houston toad

Submitted to:

Texas Parks and Wildlife Department

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By

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22 October 2012

Table A. Relevant research completed to date since the initiation of this Traditional Section 6 Grant, and projected results for the upcoming year.

2011 (Prior work now published)

Jones, M. C., D. J. Brown, I. Mali, A. McKinney, and M. R. J. Forstner. 2012. Assessment of public knowledge and support for recovery of the endangered Houston toad in Bastrop County, Texas. *Human Dimensions of Wildlife* 17(3):220-224.

Vandewege, M. W., D. J. Brown, and M. R. J. Forstner. 2012. Head-start juvenile dispersal. *Bufo houstonensis*. *Herpetological Review* 43(1):117-118

2012 (Current work now in review)

Vandewege, M. W., T. M. Swannack, K. L. Greuter, D. J. Brown, and M. R. J. Forstner. **In review**. Breeding site fidelity and terrestrial movement of an endangered amphibian, the Houston toad (*Bufo houstonensis*). *Herpetological Conservation and Biology*.

Brown, D. J., A. Duarte, I. Mali, M. C. Jones, and M. R. J. Forstner. **In review**. Impacts of a high intensity wildfire on abundance, movement, and diversity of herpetofauna in the Lost Pines ecoregion of Texas. *Herpetological Conservation and Biology*.

INTRODUCTION

Bufo houstonensis (Houston toad) was first described from an individual collected near Houston, Texas in 1953 (Peterson et al., 2004; Sander, 1953). The adults of this species are quite often strictly constrained to areas with sandy soils and then also often associated with loblolly pine (*Pinus taeda*) or mixed hardwood forests (Brown, 1971). In 1970, the Houston Toad was the first animal in Texas and the first amphibian federally listed as an endangered species (Peterson et al., 2004). Critical habitat was proposed for designation in Bastrop, Burleson and Harris counties by the U.S. Fish and Wildlife Service (USFWS) in 1978, although the designation in Harris Co. was later revoked after significant lobbying by real estate interests. *Bufo houstonensis* has historically been detected within 12 counties (Austin, Bastrop, Burleson, Colorado, Ft. Bend, Harris, Lavaca, Lee, Leon, Liberty, Milam and Robertson) of south east Texas, yet recent surveys recorded *B. houstonensis* only in Austin, Bastrop, Colorado, Lee, Leon and Milam counties with low numbers in Austin, Colorado and Leon counties (McHenry, 2010). Population estimates suggest there are fewer than 1,000 breeding adults today (Michael R.J. Forstner, unpublished data).

Houston toad populations are in a continual decline due to habitat fragmentation, continued urban growth of the city of Bastrop, red imported fire ants, fertilizers and chemical run off, agricultural practices, wildfire, and drought. Although all these factors negatively impact toad populations and disrupt and alter their natural history patterns, the continued drought and the catastrophic wildfire was our primary concern for the 2012 breeding season. Houston toad breeding was not documented during the 2011 toad survey season (January - June) within Bastrop State Park or the Griffith League Ranch which directly impacted our ability to conduct headstarting efforts for 2011 cohort recruitment. Only, one successful breeding event was documented for sites that we are able to access for eggstrand headstart sources during 2012. That event occurred within the fire zone within Bastrop State Park, but did not subsequently enable successful headstarting due to predation prior to collection.

Recent efforts to offset continued declines of the species have included headstarting of individuals with the intent of “bridging” the populations through the current intense drought conditions while increased stewardship efforts are initiated. Nearly all recovery efforts have centered on the “robust” population remnant in Bastrop County, but now even there, the decline is undeniable. We seek to provide data that is relevant to immediate population remediation, habitat remediation, and also to habitat restoration for the species in Bastrop County

Project goals – .

1. Final results from the habitat preference and suitability study which began in June 2011 and was completed in March 2012 testing adult headstart individuals.
2. Review the 2012 Houston toad breeding survey data and head-start releases.

STUDY AREA

Study Area.— The 34,400 ha Lost Pines ecoregion of Texas is thought to be a remnant of a pine-dominated forest that occurred in east and east-central Texas approximately 14,000 to 10,000 years ago (Bryant 1977, Al-Rabab’ah and Williams 2004). It is now separated from the western boundary of the East Texas Piney Woods ecoregion by approximately 80 km. The primary study sites for these projects is the GLR, a 1,900 ha ranch owned by the Boy Scouts of America and Welsh, a neighboring property approximately 184 ha owned by Bastrop Co. and managed by Texas State University. In addition, we are utilizing data collected at the 2,400 ha Bastrop State Park (BSP).

Habitat suitability and preference of the Houston toad (Bufo houstonensis)

The following are the introduction and methods of our habitat suitability study that began in June of 2011 and was concluded in March of 2012. In the 2011 report we included preliminary results. Here we are presenting the final results which include the work of 2012 to the endpoint for this part of the project.

Introduction — The Lost Pines region of Bastrop Co., Texas continues to support the largest known, and best studied, population of *B. houstonensis* (U.S. Fish and Wildlife, 1984; Dixon et al., 1990; Forstner, 2003). First described in 1953 (Sanders, 1953), populations quickly became scarce and while causes are actually unknown many speculate this decline was due to the severe drought of the 1950's and expansion of the city of Houston (U.S. Fish and Wildlife, 1984). Since 1978, Bastrop State Park and the surrounding areas have been designated critical habitat for the Houston toad.

The Lost Pines region of Texas is a loblolly pine (*Pinus taeda*) and oak dominated woodland forest located at the crosswaters of the Colorado river and the Carrizo-Wilcox aquifer (Brown and Mesrobian, 2005), and are currently within Caldwell, Fayette, Colorado, Austin and Bastrop Counties (Youngman, 1965). This region represents the westernmost extension of loblolly pine forests in Texas and are thought to be a refugium population of a once continual extension of the Eastern loblolly pine forest (Correll and Johnson, 1970). The ecoregion is underlain by deep sandy soils of the Patilo-Demona-Silstid Association (Baker et al. 1979). A high correlation has been found between these sandy loam soil formations and Houston toad occurrence (Koepp et al., 2004). It has been suggested the Houston toad is a poor burrower (Bragg, 1960), therefore the sandy soils enable them to bury down and aestivate during the cold winter months. Houston toads are therefore thought to be restricted to areas of sandy loam soils, however not necessarily pine forests (Brown and Thomas, 1982).

Habitat suitability for the Houston toad, although speculated, has not yet been tested. Little is known about the summer and over winter behavior and survivorship of Houston toads across the landscape. Results of previous studies suggest survivorship from metamorphose to adulthood is 15 – 20% (Swanack et al., 2009). The purpose of this study is to test adult headstart survival within three different habitat types in

order to compare those rates to previous studies and further explore habitat selection and suitability for the Houston toad generally, but also specifically for use in subsequent headstarting efforts.

Methods — This study was conducted on two neighboring properties located within Bastrop Co., TX. The Griffith League Ranch is a 1,900 ha ranch owned by the Boy Scouts of America, and Welsh is a 184 ha ranch held by Bastrop Co. and managed by Texas State University. Both properties are designated as critical habitat and are currently being managed for the Houston toad primarily through habitat restoration. Three habitat treatments were selected for this study; oak, pine, and juniper. The oak treatment is located on the GLR property in an Oak dominated upland forest. The pine and juniper treatments are located on the Welsh property. The pine treatment is located in a loblolly pine stand containing deep sandy loam soils and the juniper treatment is located in a late succession juniper dominated cattle field.

Five exclosures were built within each treatment for a total of 15 exclosures. Each exclosure is approximately 10 x 10 m square, built using aluminum flashing. The flashing is buried 4 to 5 inches deep within the soil substrate in order to prevent toads from tunneling under and escaping. Houston toad adults, raised at the Houston zoo, were released within each of the 15 exclosures. A total of four toads are placed within each exclosure. Before release, zoo toads are tested for the presence of *Batrachochytrium dendrobatidis* (Chytrid fungus) using a nested PCR method (Anderson et al., 2003; Annis et al., 2004). Toads that test positive are not used for this experiment.

On June 6, 2011 sixty Zoo raised Houston toads were placed within the 15 exclosures. Upon release, each toad was weighed, SUL measured, and pit tagged using Biomark passive integrated transponder tags (pit tags). As toads were released, pit tag numbers were recorded so the location of each toad is known. The first week after initial release, toads were checked every other day. As toads were found, they were flagged and numbered and movement was recorded (Figure 1). Toads were surveyed 3 to 4 times a month usually following rain events.

Results — Toad Detection – Toad detection remained difficult throughout the study. At the end of the study, detection percentages were 10% in pine treatment, 0% in juniper treatment and 0% in oak treatment. (Figure 2). During the study, detection increased in correlation with rain events during the first few months and then became less predictive. Importantly, when we finally saw substantial rain in March of 2012, there was no increase in detection for any of the treatments. Given these rain events induced breeding behavior in other areas of the county, we conclude the lack of detection reflects survivorship values rather than simply failed detection.

Toad Survivorship – At the close of this study toad survivorship was low in all of the habitat types but was generally higher for pine dominated habitats (Figure 3). To date we have confirmed 13 toad mortalities within the pine treatment, five mortalities at the juniper treatment, and 1 confirmed mortality at the oak treatment. Although we have only 19 confirmed mortalities (physically located a dead toad) we feel that detection reflects survivorship as a sufficient proxy. In an attempt to exhaustively confirm this, we disassembled the exclosure retreats, raked the exclosures and verified that no toads were present during the normal spring activity period. We report a 4.4% decrease in survivorship per visitation event for pine and a 6.1% decrease in survivorship in juniper and oak (Figure 3). Detection and survivorship remained above 50% for the pine treatment until observation visit 13 (September 17th 2011). Detection and survivorship fell below 50% for juniper and oak by visit 4 (June 26th 2011). At the end of the study the exhaustive search of all 15 exclosures produced only a single individual from the pine treatment. This individual was then released on the GLR at pond 12 in March 2012. Although we were unable to locate all 60 toads subsequent to release within the exclosures, we are confident that these detections reflect survivorship and that there are no remaining toads within the exclosures.

Results from this study suggest pine to be the more suitable habitat among the three treatments. Detection was the highest in the pine treatment, and detection remained above 50% for over half of the study. Reasons for suitability could be due to the characteristics of the thick duff layer or the soft sandy loam soils, allowing them appropriate movement during environmental changes. These results must be

taken in context to the environmental conditions challenging the headstarts during the study period. We can only suspect that the 2011 drought had a severe negative impact on survivorship of these toads. We support that estimate by noting that for those toads found dead, most mortalities (out of the 19) appeared to be due to desiccation (Figure 4). These desiccation events were more commonly seen in the pine treatment. We suspect that the soil conditions were more conducive to movement therefore enabling the toads to more actively seek cool moist soils. The lack of detection and of confirmed mortalities are much lower in the other two treatments, possibly a result of the toads desiccating below the surface and beyond our detection.



Figure 1. Example of habitat test enclosure for Houston toad headstarted adults. This unit represents one replicate from within the pine treatment. Pink flags represent last known location of each toad.

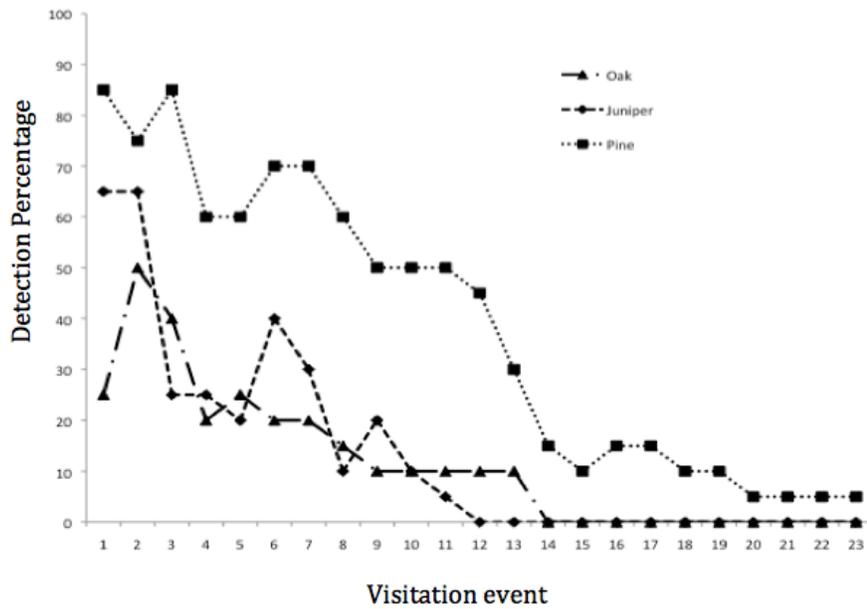


Figure 2. Detection percentage for pine, oak, and juniper treatments per enclosure visit. First visit was June 7th 2012 and last visit was March 22nd 2012. Significant rain events occurred on June 5nd (day before release) 2011; June 22nd (visit 6); August 2th (visit 9); March 9th and 11th 2012 (visit 21); and March 20th 2012 (Visit 23).

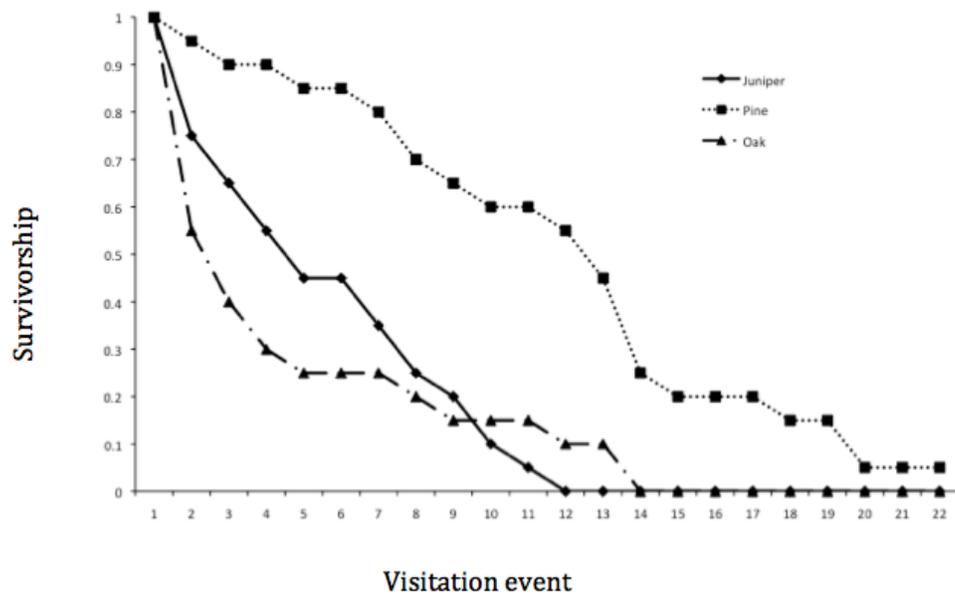


Figure 3. Survivorship estimates among pine, oak, and juniper treatments. The y-intercept values from the linear regression are 0.44 (Pine) 0.61 (Juniper) and 0.61 (Oak).



Figure 4. The drought of 2011 led to the desiccation of at least 19 toads. This figure shows a pine toad that desiccated while coming out of his burrow.

Headstarting 2012

Head-starting of wild Houston toads was not conducted in 2012. The 2012 breeding season yielded only one detected breeding event in Bastrop State Park. On February 29th, tadpoles were discovered at Pond 8 in Bastrop State Park. A small sample of these individuals were collected and genetically analyzed and were determined to be Houston toads. On March 7th, approx 150 – 200 tadpoles were removed from the park and placed at the head-start facility. We returned to BSP on March 8th and discovered the remaining tadpoles had succumbed to avian predators (Figure 5).

In May we also received captive propagated toads from the Houston Zoo, however, we did not have the appropriate captive propagation release program in place at that time and were unable to release those individuals. We received all required release permits in August and will be able to utilize either wild headstarted eggstrands or captive propagated individuals for spring 2013. In September 55 large metamorphs (from the



Figure 5. Bastrop State Park Pond 8 Houston toad reproduction site, with waterbird tracks and very few remaining tadpoles. Orange flags mark the location of the center of the cohort the day prior to this photo. We believe the cohort was exposed and predated by an avian predator.

March individuals) were released as head-starts at the Welsh property in Bastrop County. Each toadlet was individually marked, measured, and photographed. A few (less than 20) headstart toads are currently being held at the head-start facility and will be released early spring of 2013 at the pond of origin, now that vegetation and regrown cover is present at the site.

Additional efforts relevant to headstarting during 2012

On September 4th, 2011 the Bastrop County Complex fire resulted in the loss of 36,000 acres of Lost Pines habitat. This catastrophic fire impacted approximately 40% of the remaining high-suitability habitat patch of the Houston toad for this County (Wallace et al., 2011). With the majority of Bastrop

County's Lost Pines region now altered, little is known how native species living within these pine forests will adapt to the changed landscape, nor do we have data on how best to respond in our management of the changed landscape to the benefit of native wildlife. In total in 2012, following the fire, we collected and sampled 13 Houston toad adults from Bastrop State Park, along with the Pond 8 tadpoles, 13 adult toads on the GLR property, and 32 toads recovered from the FEMA efforts across all of Bastrop County. Currently all of these individuals are being genotyped to determine if any of these individuals represent adults or offspring from prior years of our population supplementation efforts. All individuals collected in 2012 were located in burned habitats. These areas surveyed (Bastrop State Park and GLR) were heavily impacted by the fire with 98% of the habitat in Bastrop State Park consumed and 50% of the GLR habitat consumed by the fire (Figure 6). No Houston toad was detected on the unburned habitats of the GLR in 2012. Documenting a successful breeding event following the catastrophic wildfire is encouraging in that we now know individuals survived the fire and resumed breeding behavior in an unfamiliar and altered habitat.

FUTURE DIRECTIONS

Head-starting Adult Houston toads – The majority of head-start releases for this study thus far have been either tadpoles or juveniles. Given the low survivorship of both tadpoles (Greuter, 2004) and juveniles, it may be inefficient or unpractical to release these age groups. Modeling has suggested the most advantageous method of head-starting for the Houston toad is adult female releases (Dunham et al., unpublished data). Therefore the next step in this head-starting program is to test the efficiency of releasing adult sized individuals. Adult headstart Houston toads raised at the Houston Zoo are scheduled for release at GLR and BSP in the spring of 2013. During the spring of 2013, all captures of wild toads will be sampled from toads ponds located across both properties. There is no doubt that the drought and fire have set back this project and the overall recovery effort, but we hope to be able to redouble our efforts in the spring of 2013 and then evaluate the situation once again during the spring of 2014.

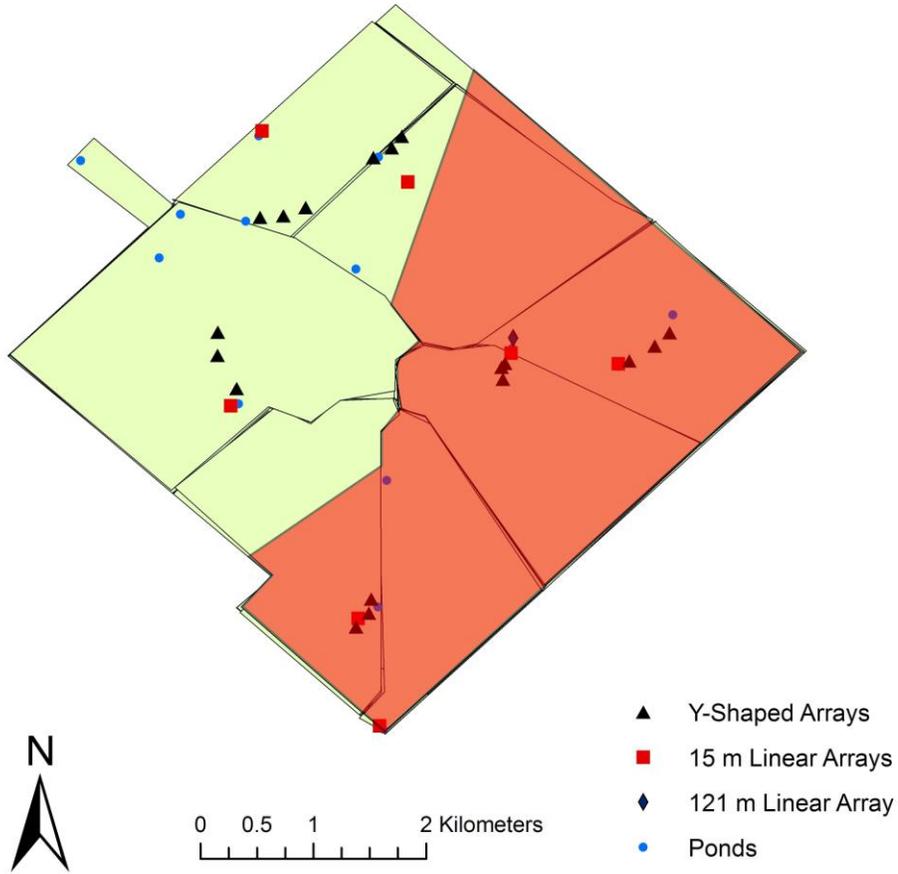


Figure 6. Map showing burned areas of the Griffith League Ranch from the Sept 4th 2011 wildfire. Area shaded in red represents burned landscape in context to Houston toad breeding ponds and experimental trap locations on the tract.

AKNOWLEDGEMENTS

We thank both Texas Parks and Wildlife and US Fish and Wildlife Service for providing funding, access, and support that allowed these projects to take place. The efforts of Paul Crump, his staff, and the Houston Zoo enable the individuals required for release and tracking in our research. Appreciation goes to the following: for allowing access to property used in these studies: Jim Small, Bob Long, Bastrop State Park, LCRA, the Boy Scouts of America and Blue Bonnet Electric Cooperation. Activities associated with this research were permitted under the IACUC permits 0713_0428_07 and 0810_0208_11, and United State Fish and Wildlife Service permit TE039544-0.

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