Section 6 (Texas Traditional) Report Review

Attachment to letter dated _____

TPWD signature date on report 11/14/06

Project Title: Red Imported Fire Ant Survey and Monitoring to Determine Potential Impacts on the Houston toad and its prey-base at Bastrop State Park

Final or Interim Report? Final

Grant #: E-47

Reviewer Station: Austin ESFO

Lead station was contacted and concurs with the following comments:
☐ Yes ☐ No ☒ Not applicable (reviewer is from lead station)

Interim Report (check one):

- ☐ is acceptable as is
- ☐ is acceptable as is, but comments below need to be addressed in the next report
- ☐ needs revision (see comments below)

Final Report (check one):

- ☒ is acceptable as is
- ☐ is acceptable, but needs minor revision (see comments below)
- ☐ needs major revision (see comments below)

Comments:

FINAL REPORT

As Required by

THE ENDANGERED SPECIES PROGRAM

TEXAS

Grant No. E-47

Endangered and Threatened Species Conservation

Red Imported Fire Ant Survey and Monitoring to Determine Potential Impacts on the Houston toad and its Prey-base at Bastrop State Park

Prepared by:

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TEXAS PARKS & WILDLIFE

Robert Cook
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Division Director, Wildlife

27 September 2006

FINAL REPORT

STATE: Texas **GRANT NUMBER:** E-47

GRANT TITLE: Red Imported Fire Ant Survey and Monitoring to Determine Potential Impacts on the Houston toad and its Prey-base at Bastrop State Park.

REPORTING PERIOD: 1 September 2003 to 31 December 2006

OBJECTIVE(S):

To document population dynamics among red imported fire ants (*Solenopsis invicta*), ground arthropods, including other ants, and Houston Toads (*Bufo houstonensis*) in burned and unburned habitats at Bastrop State Park, Bastrop county, Texas during 2003-2005.

Segment Objectives:

1. Given the well reported negative environmental impact of the RIFA on native arthropods (Porter & Savignano 1990) and on the Houston toad (Freed & Neitman 1988), this study will employ an inventory approach to determine the diversity and abundances of native ants, ground and litter arthropods, and the population dynamics of the red imported fire ant, over a three-year period.

2. A monitoring approach will be employed for an assessment of the impact of fire on the imported and native ants.

Significant Deviations:

None.

Summary Of Progress:

Please see Attachment A.

Location: Bastrop County, Texas.

Cost: Financial Status Report was not available at time of report.

Prepared by: Craig Farquhar **Date:** September 27, 2006

Approved by: **Date:** November 14, 2006

Neil (Nick) E. Carter
Federal Aid Coordinator

Final Report for Section 6 Project (October 31, 2006)

Title: Red Imported Fire Ant (*Solenopsis invicta*) Survey and Monitoring To Determine Potential Impacts on the Houston toad (*Bufo houstonensis*) and its Prey-base at Bastrop State Park

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Submitted on the 1st October 2006 for Dr. L.E. Gilbert and M.A. Quinn by Dr. Richard Patrock 011-54-11-4-252-9355 (patrock@mail.utexas.edu).

Summary

The distribution of the Houston Toad, *Bufo houstonensis* is limited to a small area in east and central Texas with the largest known population residing in Bastrop State Park. Two important constraints with respect to their habitat limitations are first, that they require loose soils for shelter as they are poor burrowers and second, they are found concentrated around water areas. Unfortunately, these constraints overlap with niche preferences for a recognized predator of this toad, the Red Imported Fire Ant, *Solenopsis invicta* (Freed and Neitman 1988). In addition to its role as a predator of the Houston Toad, these ants may impact the toads indirectly by lowering populations of other ant or other invertebrate species that form an important component of the toad's diet. To determine the potential for ecological impact that the imported fire ants might have on this toad at Bastrop State Park, we intensively surveyed for these ants around four bodies of water, using a combination of visual, baiting and litter sampling techniques. Red imported fire ants were found at two of the four sites extensively surveyed in 2003-2005. We had found this exotic ant to be the most common ant at one of the sites during all sampling periods. At the second water body, we found only 2 colonies but their mound sizes were sufficiently large to suggest that they had been present for several years. Many of the specific findings could be generalized over all sampling years, as well. We highlight major points of variation where found and discuss implications of our findings with respect to management of the imported fire ant at Bastrop State Park.

Materials and Methods

Overview: Sampling of ants or other invertebrates is done on a semi-annual basis, once in the spring (April and May) and once in the fall (September-November). These samples are

temporally positioned to best evaluate population numbers of the imported fire ant since this species mounds are best exposed during these periods (Tschinkel 2006). During the spring and fall more tumulus (brought up soil) is found following rains as the ants descend in the soil profile. This is less the case in summer and winter when the temperatures are less favorable for the ants. We tried to time the samples to follow coincidental rains but the occurrence of these is capricious in Central Texas. In addition, movement of young frogs out of winter shelters is primarily in the early spring so knowledge of locality and population levels of the imported fire ants around this time was considered to be most useful in any subsequent management decisions.

The spring sample includes baits, mound counts (belt transects) and litter samples, while the fall sample included baiting and mound counts. Baiting and mound searches are useful in determining the presence and describing aspects of the population of imported fire ants. We assume that the higher the population of fire ants present, and the broader its distribution at a site, the greater the possibility of its negative interactions, either directly with the Houston toad or more amorphously, indirectly with this amphibian's resource base.

The first and continuing decision we needed to make was whether the red imported fire ant was present at any of the ponds, and which of the ones where the toad has been found. We chose four of the largest of these water sources. Often fire ants may be present in an area but are not detected by one or the other of our monitoring instruments (baiting or mound counts), depending on a multitude of factors, including weather conditions, population size and density, litter cover, soil type and terrain. Given our wish to identify incipient populations we employed both methodologies. Mound counts and metrics give estimates of ant population age structure not possible using bait

methods while baiting offers complementary information as to likelihoods of resource interactions among ants (and sometimes other animals) in the community. For example, we found imported fire ants in our second year's sample at one of the ponds where we had not been able to find it the first year. We found ants both by mound counts and by baits. The sizes of the ant mounds were too large to represent yearlings and so we knew that 1) we had missed these ants in the previous surveys and 2) the colonies were mature and capable of reproducing sexually. Litter samples are useful in describing general diversity in soil communities (Hall 1996) and were considered the least likely to trap toads of the various methods available. Litter samples are the most labor-intensive of the methods and are only done once per year.

Goals towards management. The goals of this study can be summarised as follows:

1) To determine at which, if any of the ponds, *S. invicta* is present. If not present, there would only be a need to develop a proactive management plan for this pest. If present, then further information would be required to help assess the nature of the pest problem.

2) If *S. invicta* was found, we wished to categorize the extent of infestation around the pond(s). Categorical questions included the following. Could the infestation be considered localized, and if so where? Was the population density greater around water lines and therefore more likely to to have fire ants encountering toads than elsewhere? Could the ant population be considered high? Could the population age structure be such that it could be considered juvenile and therefore more likely to be eliminated feasibly?

3) If the population was extensive, how might this affect the community of invertebrates? Would there be a significant and observable impact on diversity of ants or other invertebrates? If there wass a marked reduction or displacement of any of these invertebrates, is this taxon(a) a common food item for the toads? We did not suspect that any of the other ants, with the exception of *S. geminata*, the tropical fire ant, is likely to kill healthy toads, or otherwise negatively affect them. We therefore assessed the presence, numbers and interactions of these ants with the imported fire ants since their low or absent population levels can signify the extent to which the imported fire ants lack the natural regulation of an ant community. We assumed that the higher the level of such a 'renegade' status of the imported fire ant, the faster its' possible population increase and the more important it would be to install measures to reduce the fire ant's numbers.

4) This study did not assess the Houston Toad population, the behavior of the toads nor attempt to observe interactions of ants with the toads at the park. The information on the imported fire ant that we provide here is to be incorporated into the Houston Toad database of Andy Price who leads the research project on the toads at the park.

5) A common research line is to examine the secondary succession of species following a burn. In addition, after burns fire ants are often observed to be in higher numbers as a result in easier visualization and other factors. One of our goals was to follow the dynamics of the ants in the presence or absence of recent burns. All of the areas we are surveying have been burned, however

which makes detection of the ants easier but confounds any cross-site comparison between burned and non-burned areas. As such, this goal was abandoned.

Details of methods.

Baiting consisted of the following:

"Ant baits will be set out as follows. The bait (spam cubes) will be placed on the upside-down lid of a condiment cup marked with a surveyor's flag. Samples will be collected by inverting a fitted condiment cup over the lid in situ and after marking and snapping close the cup, the container will be placed in a $4^{o}C$ cooler to prevent the ants from dismembering each other in transit to the laboratory. At the Brackenridge Field Laboratory in Austin, each sample will be examined and the species and abundances of all ants will be recorded. Numbers classes will follow that of Porter and Savignano (1990) (1, 2, 5, 10, 20, 50, 100, 200, and 300 individuals). Voucher specimens will remain at the curated Brackenridge Field Laboratory Insect Collection.". Fifty bait samples are run per transect/visit.

Dominance hierarchies are determined on a per bait and per transect basis. The algorithm used on these end-point samples to determine the ant community dominance hierarchy is quantity of ants/bait or transect with higher numbers representing greater dominance.

Litter samples consisted of the following:

"One square meter sample of leaf litter will be taken using a prefabricated square. The leaf litter will be sifted through a screen in the field to remove extraneous material, including amphibians, and the resultant loose material will be burlesed at the Brackenridge Field Laboratory. Ants and other invertebrates will be collected from these samples, counted and identified to the lowest taxonomic level appropriate for the specimen. Ants, will be identified to species, and all other invertebrates to order or family before being assigned to morphospecies." We are doing 30 litter samples altogether (10/year).

Belt transects are detailed as follows:

"For each 20 linear m of belt transect, the number of RIFA mounds visible for 3m of each line transect, will be recorded within mound class sizes (<15cm, 15-30cm, 31-45cm, >45cm diameter mounds). These size classes are roughly associated with colony age and worker numbers, giving us a refined record of the population structure and

dynamics of the fire ant population.”. At least 5 belt transects are run per transect.

GPS Coordinates of the water features are as follows:

Location	N	W
C Line End	30.1066446276	97.262869739
TL1 END	30.1171732811	97.268018315
TLAKE END	30.1148293923	97.274203645
Pond	30.1209042954	97.264089728

Results

Goal One (Presence). The sites sampled are depicted on Figure 1. *Solenopsis invicta* was found only at the two sites (squares) on the immediate left during any sampling time.

Goal Two (Extent of infestation). Red imported fire ants were found in all sampling periods only at the main lake in the center of the park. Two colonies were found at the second site in 2005 only. Since these sites represent quantitatively different findings, we separate these below.

a) Main Lake population.

The general trend of this population was a substantial decline over the period of the study. There was a large decrease in the numbers of Imported fire ant mounds reported in the 2003-2004 report and that found in 2005 and 2006. Belt transects suggested relatively high densities in 2003-2004 a with approximately 281 ± 107 mounds/acre. In the spring of 2005, we found about 102 ± 148 mounds per acre and in the fall we found 28 ± 73 mounds/acre. In the fall of 2006, the number of mounds was

similar to that found in fall of 2005 (29 ± 98 mounds/acre). In this last sample all mounds discovered were around the picnic area. We suspect that the major contributing factor to the reduction in mound counts was related to the low rainfall during period of 2005 and 2006.

b) Small pond.

Solenopsis invicta was found only in samples taken in 2005 at this pond. Both mounds had maximum areas greater than 45 sq. cm indicating they were at least 2-3 years old. This observation implies that the colonies had been missed in previous searches. This omission is not surprising since there is a thick covering of leaf litter throughout the park and with the sandy soils, the mounds were shallow and may not have been exposed or easily found. In addition because of the large area to be surveyed, baits and litter samples are inadequate to estimate such a low population level. Adjacent bait and litter sampling did not support the hypothesis that there were other cryptic nests nearby.

We did not encounter mounds nor imported fire ants at baits in our fall 2006 sample. Two possibilities exist for this finding. The first is that given the extensive drought of the summer of 2006 both colonies perished. The second is, that the colonies were inactive (on a operative basis) during the sampling. There had been a slight rain on the weekend before the sampling (11th September 2006) but even for the mounds at the large infestation described above, new tumulus was slight to none.

To facilitate reading, we explicitly answers the questions posed above for this

goal.

a) Could the infestation be considered localized, and if so where? Yes, the populations were localized both within the park and within sites.

b) Was the population density greater around water lines and therefore more likely to to have fire ants encountering toads than elsewhere? Yes, the population densities were much greater around the water lines within area. That is, when we ran belt transects in parallel within 5m lakeline (only at the big lake), at 20 m above and 40 m above, the mound densities along the 5 m lakeline transect were significantly higher than at 20m and 40 m above the lakeline except at the picnic area. At the picnic area, the highest densities were in the picnic area and not along the shore. The picnic area also had the most enduring (we always found mounds here, where along other transects, mound may or may not have been found) as well as the highest densities of ants.

c) Could the ant population be considered high? In 2003-2004, yes, the population at the picnic area were high. In 2005-2006, the population was not high but likely to grow.

d) Could the population age structure be such that it could be considered juvenile and therefore more likely to be eliminated feasibly? There are two categorical aspects to this. The first is whether the mounds found were sexually reproductive. In both areas, mounds were old enough to reproduce sexually. The second criterion we used was whether the age structure of the population was mixed, that is with nests of varying ages. At the small pond, we were able to find only reproductive mounds, suggesting that there had been only one

influx of reproductives and that the infestation was more limited. At the large pond, all size classes of mounds were found, suggesting more difficulty in finding and therefore targetting of colonies for elimination.

Goal Three (Impact on other ants)

This study was unable to determine any statistical impact of the fire ants on ant diversity in the park for the following reasons. The initial surveys were done well after the infestation of imported fire ants had established around the picnic area and a diversity baseline for this area was not available. Fire ants were found at the second pond, however, before they became an extensive element of this area and the details of our results could be used as a baseline for later studies. Comparisions across time within the park and within site are compromised by the extensive effect that the drought has had on the vegetation and the ant communities, specifically on the imported fire ant. For instance, while abundance of fire ants and other ants was substantially less in September than in April of 2005, diversity measures, such as species richness and Simpson's D and Equitability, Shannon's H and Equitability for both time periods were similar to that in 2003-2004. While the least number of ant species (richness) and eveness were measured around the central lake during 2003-2005, relative to the other sites, in 2006, no differences in richness nor evenness was found in our bait studies among the sites. All were significantly less than in the preceding time periods, presumably because of the drought.

An inventory of the ant species found during the study is given in Table 1.

Suggestions for management.

The red imported fire ant is either not present or is a minor element of the ant community throughout most of the park and its water features. We suggest that given the very low to absent numbers of *S. invicta* at all water features except the large lake that these other water features be surveyed at regular intervals. If red imported fire ant colonies are found, each should be thoroughly excavated and steamed-killed, scalding both the excavation material as well as ants in the surrounding soil (Tschinkel 2006). The position of these 'killed' colonies should be marked and the area searched intensively in follow-up surveys to eliminate any survivors.

The management of S. invicta around the large tank is a more perplexing problem because of its extent and population density(es). Presently, the drought has eliminated, reduced or otherwise sent underground the majority of colonies. The colonies present around the picnic area and along its adjacent road could be eliminated with some effort using excavation and steaming. These colonies should be eliminated since they are likely to be a source of reproductives for the surrounding area, as well as a painful nuisance for park visitors. The surrounding area of the lake is likely to have a population that is entrenched, however and while barely visible now, their numbers may flare when given good rains. The proximity to water precludes the use of any biocide but excavation and steam could be used around the lakeline areas since almost all of the colonies observed were found in this strata.

Table 1. Ant species found during the study as well as those previously recorded from the county.

Found in survey	**Known from Bastrop Co.[a]**
Aphaenogaster treatae	*Aphaenogaster treatae*[b]
Atta texana	*Atta texana*[a]
Brachymyrmex depilis	
Brachymyrmex sp. A	
Camponotus festinatus	*Camponotus festinatus*[a]
Crematogaster laevisculus	
Crematogaster minutissima	
Cyphomyrmex rimosus	
	Dorymyrmex bicolor[a]
Dorymyrmex flavus	*Dorymyrmex flavus*[a]
Forelius maccooki	
Forelius pruinosus	
Hypoponera opacior	
Hypoponera punctatissima	
	Labidus coecus[a]
Leptogenys elongata	*Leptogenys elongata*[a]
Leptothorax sp. A	
Monomorium minimum	*Monomorium minimum*[b]
Myrmecina americana	*Myrmecina americana*[a]
	Neivamyrmex harrisii[a]
	Neivamyrmex pilosus[a]
	Neivamyrmex swainsonii[a]
Odontomachus clarus	*Odontomachus clarus*[a]
Paratrechina vividula	*Paratrechina vividula*[a]
Pheidole dentata	Pheidole *dentata*[b]
Pheidole diversipilosa	
Pheidole hyatti	*Pheidole hyatti*[b]
Pheidole metallescens	
Pheidole sciophila	*Pheidole sciophila*[a]
Pogonomyrmex barbatus	*Pogonomyrmex barbatus*[a]
Pogonomyrmex comanche	*Pogonomyrmex comanche*[a]
Pseudomyrmex brunneus	*Pseudomyrmex brunneus*[a]
Pseudomyrmex gracilis	
Solenopsis geminata	*Solenopsis geminata*[b]
Solenopsis invicta	*Solenopsis invicta*[a]

Solenopsis nr. molesta	
Strumigenys sp. A	
	Tetramorium guineense[a]
Trachymyrmex septentrionalis	

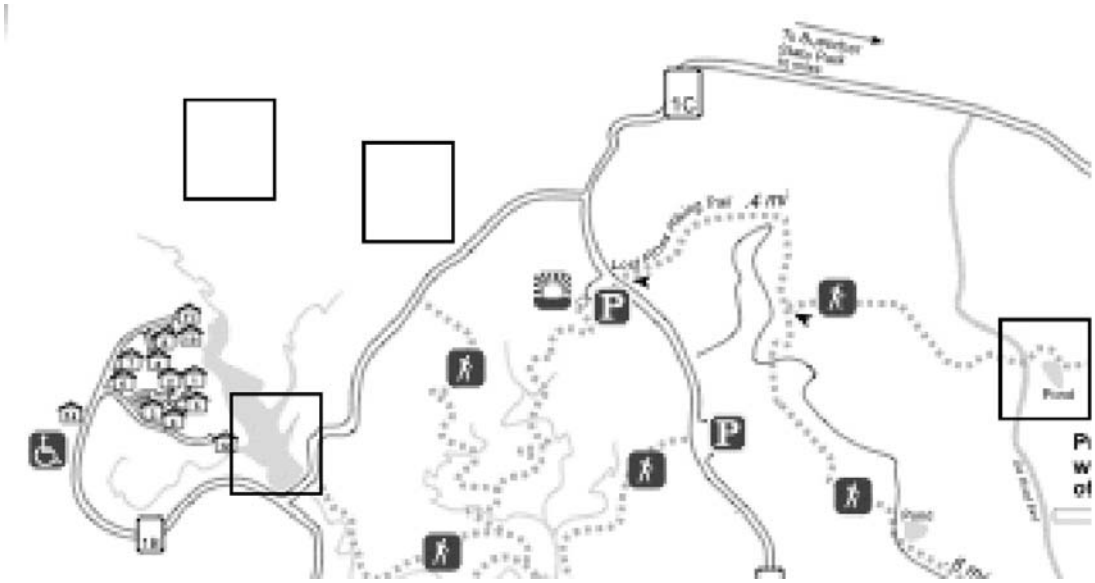
[a](O'Keefe et al. 2000)

[b] Tabor and Fleenor (2003) studied the insects of the Lost Pines. We assume that some of these species were found in Bastrop Co. as well as Bastrop State Park but they reported no locality records.

This increases the number of species found in Bastrop County by 14 taxa.

Figure

Figure 1. Map of Bastrop State Park with locations of sampling areas (Rectangles). This shows a section of the map of the Bastrop State Park available to the public at: http://www.tpwd.state.tx.us/spdest/findadest/parks/bastrop/



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