

TPWD Call for Pre-Proposals

Study Title: *Effects of Oil Exploration on Herpetofaunal Communities in South Texas with an Emphasis on Threatened Species.*

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Introduction

Oil and natural gas exploration and development has seen tremendous growth in South Texas over the past several years. In 2008, Petrohawk drilled the first highly successful well in the Eagle Ford shale formation in La Salle County. Within the Eagle Ford shale, the Railroad Commission of Texas has issued 26 drilling permits in 2008, 94 in 2009, 1010 in 2010 and 2347 in Jan-Oct 2011 (Railroad Commission of Texas 2011). Wildlife habitat is being replaced and fragmented by new roads, pipelines and well pads at an increasing rate. It is unclear how this disturbance is affecting the native floral and faunal communities. Of greatest concern are small resident sensitive or declining ground-dwelling reptiles and amphibians which may have limited ability to avoid such changes.

Mineral development is imminent on the Chaparral Wildlife Management Area (WMA). This WMA consists of about 6,150 ha in Dimmit and La Salle counties in South Texas. Numerous research projects examining effects of land use practices on herpetological communities have taken place. Three state threatened and protected species have been studied - Texas tortoise (*Gopherus berlandieri*), Texas horned lizard (*Phrynosoma cornutum*) and Texas indigo snake (*Drymarchon melanurus*). Another less commonly found state threatened species occurring on the area; the reticulate collared lizard (*Crotaphytus reticulatus*) has not been studied at this location. One candidate for federal listing, the spot-tailed earless lizard (*Holbrookia lacerata*) has been documented on the WMA and surrounding areas (Duran et al. 2010).

Western diamondback rattlesnakes (*Crotalus atrox*), while not threatened, could be effected by mineral exploration. Populations have crashed following a wildfire in 2008 and several years of subsequent drought (TPWD, unpublished data). Further habitat loss and other pressures could hinder any kind of population recovery.

Additional studies of these species and others will offer insight for planning, avoiding, mitigating or adapting to forthcoming mineral exploration and development (surface, structural, acoustic and atmospheric disturbance) on the WMA. Inferences may also be made for surface

management for other areas of the Eagle Ford Shale formation, providing guidelines to land managers and mineral exploration planners to minimize impacts on these species.

Texas horned lizards prefer areas consisting of a mosaic of bare ground, herbaceous and woody vegetation for proper thermoregulation, foraging, locomotion and predator avoidance (Burrow et al. 2001). Texas tortoises and Texas indigos will avoid large, open areas (Kazmaier et al. 2001, Montandon 2005). Large areas of cleared vegetation associated with oil and gas exploration could be detrimental to these species.

DeGregorio et al. (2010) suggested that snake road mortality was related to life history characteristics (activity patterns, movements, dispersal). Some of the species on the WMA can move great distances and utilize a large portion of habitat in their home range. Dispersing individual Texas tortoises can move up to 8 km in 22 days (Kazmaier et al. 2002), while Texas indigos can move up to 3.2 km/day foraging (Montandon 2005). Texas tortoise home ranges can be as large as 46 ha for male tortoises (Kazmaier et al. 2002) and were up to 250 ha for Texas indigo snakes (Montandon 2005). Highly mobile smaller, but slower, species with large home ranges are very likely to encounter more roads and higher probabilities of being struck.

In addition, some individuals may be attracted to roads for a source of calcium. Texas tortoises have been observed consuming the caliche road base on the Chaparral WMA (Hellgren et al. 2000). Tortoises attracted to the roads will be more exposed to predation and to oilfield traffic. One study found that roads account for the most tortoise losses in Texas (Auffenberg and Weaver 1969).

Other studies show that snakes and turtles avoid roads (Shepard et al. 2008, Boarman and Sazaki 1996). Boarman and Sazaki (1996) found that desert tortoises (*Gopherus agassizii*) were in reduced number up to 0.8 km away from roads. Such barriers can lead to genetic isolation or reduced gene flow (Boarman and Sazaki 1996, Andrews et al. 2008).

Roads and pipelines cutting through habitat could have an edge effect and could increase predator search efficiency. Raptors and other avian predators of tortoises can be more concentrated along roads and powerlines (Knight and Kawashima 1993). It is possible that the increase in roads could attract more crested caracaras (*Polyborus plancus*), one of the Texas tortoise's leading predators (Hellgren et al. 2000), which could lead to higher predation rates. Thus, roads might serve as barriers to life requisite and genetic exchange, 'dead zones' or sinks for subpopulations on either side.

In summary, potential significant threats to population viability include avoidance due to increased vehicle traffic, construction of new roads or modification of existing ones, well pads and pipelines; all of this development can lead to further fragmentation and degradation of habitat, blocking dispersal routes limiting gene flow, increased exposure to predators and direct mortality of individuals.

Justification

Although the extent of mineral development that will occur on the WMA as a result of the Eagle Ford Shale exploration is unknown, preliminary plans include horizontal drilling from 36 pads of approximately 1.2 -2.0 ha/each (3-5 ac/ea) with 3-5 wells/pad. In addition, 10 central processing facilities of about 0.6 ha/ea minimum (1.5 acs/ea) and three (3) central gathering facilities of about 1.4 ha (3.5 acs)/each minimum may be required. It is further anticipated that three (3) freshwater wells and corresponding ponds of about 16 acres each may be required to provide water used in the fracing process. Finally, exploration activities will require the construction of numerous roads and both above- and below-ground pipelines. Previous research results cited here cause great concern about the impacts of this development on wildlife in this area.

Baseline Wildlife Inventory. A total of 127 drift fences with pitfall traps already exist on the WMA. They have been irregularly monitored for herpetofauna and small mammals since 1992. A subset has been monitored continuously since 2008. Forty-one were opened during the summer of 2008 for a total of 11,748 hours, 41 during 2009 for a total of 9,772 hours, 41 during 2010 for a total of 9,782 hours and 25 during 2011 for a total of 5,745 hours. Data collected included species captured, time of capture, sex, body measurements and recapture information.

Additionally, 48 of 96 originally installed vegetative transects have been monitored annually since 1970. During the mid-1980s, 10 deer and cattle proof enclosures were constructed on the area. Within these exclosures, a total of 20 additional transects were set up (2/exclosure) and monitored along with the 48 aforementioned transects. A total of 68 transects have been monitored since the mid-1980s. Herbaceous vegetation is monitored beginning in February and woody plants during August each year. A map of the locations and open dates of drift fences and vegetative transects will be provided with the Call For Proposals.

As part of on-going research on the Chaparral WMA, the Texas horned lizard, Texas tortoise, Texas indigo snake and western diamondback rattlesnake have been continuously monitored since the early 1990s. Since 1991, 3,500 Texas horned lizards have been captured and marked via toe clippings initially and also with PIT tags beginning in 1993. We have also recaptured over 375 individuals. Marking of Texas tortoises was initiated in 1990, and since then 3,500 captures and over 2,000 recaptures have been made. Marking of Texas indigo snakes and western diamondback rattlesnakes with PIT tags began in 1996 and has resulted in 100 and 800 captures and over 25 and 80 recaptures, respectively. For these species, data collected includes capture date, time, location, sex, body measurements, and capture/recapture. Maps of locations of these individuals along with sampling data may be provided with the Call For Proposals.

Research to determine the effects of oil exploration on WMA herpetofaunal communities with an emphasis on threatened species fulfills the first goal of TPWD's 2010 Land and Water Conservation and Recreation Plan. We must have knowledge of status of aforementioned

species in order “to practice, encourage and enable science-based stewardship of natural and cultural resources.” “Science-based stewardship” requires the highest level of scientific validity and credibility. TPWD has a statutory responsibility to protect and assist in the recovery of threatened, endangered and high-priority species.

Additionally, the potential for thousands of hectares of South Texas habitat, ecosystems and associated rare, sensitive and endemic wildlife to be impacted by mineral exploration demands scientifically-based research. This will provide the basis for factual information and recommendations to landowners and managers in the immediate future.

Objectives

The exact number and details of the final overall research project objectives will be determined in collaboration with the TPWD Research Project Coordinator during Phase I (see definition of phases below): However, they may include some subset of the following:

Determine-:

1. the effects of increased use and modification of WMA roads (widening, excavating or raising of road bed, road construction materials and chemical or physical composition) and their locations on endemic herpetofauna and threatened (rare, sensitive or limited) species movements, home range sizes/shapes/quality, reproduction, avoidance, attraction, and risks or probability of direct and indirect (i.e. predation, disease) mortality.
2. the effects of the number, size, location and juxtaposition of WMA well pad sites on endemic herpetofauna and threatened species movements, home range sizes/shapes/quality, reproduction, avoidance, attraction, and risks or probabilities of direct and indirect (i.e. predation, disease) mortality.
3. the effects of traffic volume, density and rate on endemic herpetofauna movements, home range sizes/shapes, reproduction, avoidance, attraction, and risks or probabilities of direct and indirect (i.e. predation, disease) mortality.
4. the effects of WMA construction and post-construction oil, gas or water pipelines and collection facilities on herpetofauna movements, home range sizes/shapes, reproduction, avoidance, attraction and risks or probabilities of direct and indirect (i.e. predation, disease) mortality.
5. estimates of the accumulative effects of objectives 1-4 on population abundance, diversity, density or viability by species before and after construction adjusted for other influential factors (i.e., precipitation, temperatures, major predator densities, etc). We desire a rigorous experimental design (i.e., a minimum of a Before: After, Control: Impacts design) that will allow inferences to be made about potential specific causal factors affecting certain sensitive endemic herpetofauna and threatened target species identified in the Introduction of this pre-proposal request.

This call for pre-proposal addresses exclusively the first (Phase I) of three phases of research investigating the impacts of oil and natural gas exploration, production and associated activities on the herpetofaunal community at the Chaparral WMA.

Phase I

Phase I includes sampling or survey design for pre-construction monitoring or obtaining baseline data on endemic herpetofauna and threatened (i.e., rare, sensitive or limited) species and population demographics. This may include diversity, densities, movements, reproduction and home range characteristics (i.e., sizes, shapes, homogeneity, quality, vegetative structure and composition). It includes formulation of hypotheses to be tested or models to be validated regarding the vulnerability of various species to potential threats (i.e., road, pipeline, pads or gathering facility temporary construction and permanent infrastructure).

Phase I Objectives:

1. Develop meaningful or relevant theoretical hypotheses for testing or models for validation from the literature, historical data and risk or vulnerability assessment of the impact of construction and post-construction infrastructure and oil or gas extraction operations on selected representative or keystone endemic herpetofauna and threatened species. These may include threat, risk or vulnerability assessments of direct and indirect mortality factors based upon literature reviews, existing empirical data from similar studies or sites or observations on the WMA. These may include increased probability of
 - visual, auditory or olfactory exposure to predators as a result of construction activities or fragmentation and surface vegetative structure and composition changes,
 - changing permeability, friability or chemical composition of fill material (tendency to create dust or retain water, supplement dietary requirements for minerals, etc),
 - debilitation due to inhalation or consumption of contaminants on food or water (dust, oil, road or drilling chemicals),
 - behavioral avoidance or physical barriers to movement for reproduction, feeding or meeting other life requisites,
 - reduction or displacement of thermoregulatory cover,
 - exposure to diseases such as upper respiratory tract infections from chemical or particulate (dust) inhalation or introduced exotic pathogens, etc.

Some subset of these hypotheses and models will be tested or validated under Phases II or III.

The effects of these proposed oil and gas development activities and habitat changes may need to be assessed on the same subset of variables or parameters on the same suite of species on the same study sites in Phases II and III as are developed in Phase I in order to objectively test the relevant hypotheses or validate the meaningful models developed in Phase I

2. Develop experimental or survey design, population attributes, parameters and sampling methods. This may incorporate as much of the pre-existing exclosures, pit trap arrays and vegetative transects as possible with the goal of assessing the long-term effects of oil and gas development on certain endemic herpetofauna and threatened target species. The temporal and spatial scope and scale of existing data and locations of exclosures, arrays and transects on the WMA will be provided in the Call for Proposals.
3. Use the design and methods to determine key parameter estimates as accurately and precisely as possible in the natural or pre-construction phase. These parameters may include:
 - a. species diversity and densities (e.g., differential catch per unit effort, presence-absence occupancy modeling, mark-recapture, etc),
 - b. population structure (age and gender as indicators of recruitment and survival, population replacement or growth- surrogate attributes for survival and recruitment rates),
 - c. condition, movement rates/extent and home range characteristics of these target species on replicate sites within pastures prior to the construction of roads, wells, pipelines and collection facilities,
 - d. positive impacts including new water sources in the form of frac water retention ponds, leaks along water pipelines, creation of underground crevices, etc.

Application Requirements and Guidelines. Send a pre-proposal by email to wildlife.research@tpwd.state.tx.us. You may also hand deliver or send by common commercial carrier or US Postal Service to Jay Roberson, TPWD, 4200 Smith School Road, Austin, Texas 78744. Mr. Roberson must receive by midnight, 12am CST, Wednesday, **February 1, 2012** or it may be rejected.

The pre-proposal should be no more than three pages in length, not including figures and appendices. It should outline the objectives, approaches, procedures, or methods, expected results, and estimated budget for Phase I. It should address all objectives listed in this Call for Pre-proposals for Phase I. Pre-proposals that do not meet these guidelines may be rejected.

Questions and comments may be directed to Daniel Walker (daniel.walker@tpwd.state.tx.us or 830-676-3413). Mr. Walker may provide existing maps, habitat descriptions, and other site specific information upon request.

Pre-proposals will be scored and ranked on the basis of

- inclusion of one or more of the following species:
 - Texas tortoise (*Gopherus berlandieri*),
 - Texas horned lizard (*Phrynosoma cornutum*)
 - Texas indigo snake (*Drymarchon melanurus*),
 - reticulate collared lizard (*Crotaphytus reticulatus*),
 - the spot-tailed earless lizard (*Holbrookia lacerata*),
 - western diamondback rattlesnake (*Crotalus atrox*),
- feasibility of experimental design and proposed approaches, procedures and methods consistent with stated Phase I objectives,
- appropriate or reasonable budget estimate consistent with the scope of work and funds available, and
- inclusion of an acceptable date when field work could reasonably commence.

Depending upon market and other forces beyond our control, construction will likely extend for several years. Thus, the experimental or survey design must be flexible and adaptable enough to take into account limited changes in number and location of well pads, roads, and water pipelines consistent within a rough framework of incremental or sequential construction chronology.

There may be only a few months of preconstruction monitoring available at the first exploration site (e.g. May-August 2012). We have detailed information regarding the location of the first entry road, oil well pad location, reservoir, and central gathering facility. However, we do not have currently the same for the remaining sites. There is a tentative plan for future development, but it may change. Researchers can contact Daniel Walker to receive a copy of a mineral exploration and infrastructure development plan. Final locations for development will be provided to Performing Entities as soon as they become known to TPWD.

In such case, it may be necessary to establish larger paired control and ‘treatment’ sites that are greater than 0.2 km across. Obviously, the larger the experimental sites the fewer replicates that can be established and monitored with the same resources.

Research results must be directly applicable to populations on the Chaparral WMA. Therefore, it is expected that all research and study plots will exist within the boundaries of the WMA.

A call for formal proposals will be sent no later than February 15, 2012 to selected successful pre-proposal applicants who have met the guidelines and minimal standards. The deadline for receipt of formal proposals is tentatively set for **March 15, 2012**.

Available funding is expected to not exceed \$100,000/year for two years for the pre-construction phase (Phase I). However, construction may begin as early as April 2012 and as late as 2014. In the later scenario, the Phase I contract may be extended. Pre-proposal budgets should be estimated on the basis of scope and scale of Phase I work even if it is less than or exceeds funds available.

Performing entities will be requested to provide not less than 25% nonfederal funding match by fiscal year in the budget request as part of the final proposal. This will allow the option of using federal funds to support this research, if necessary. Nonfederal match may include donated or volunteer time [including donation of a proportion of PI summer salary, differences in federally negotiated institutional Facilities and Administrative (indirect) fees in excess of 15%, and donated equipment and supplies as allowed by state law and policies]. The maximum indirect (F&A) rate allowed for TPWD reimbursement for this project is 15% without special approval.

Some on-site lodging for researchers is available at no-cost and at the discretion of the WMA manager.

The deadline for completion of these contract deliverables may be negotiable after proposal submission but before final contract approval. However, in a worst case scenario, we expect the first draft of the Phase I final report of the experimental or survey design and methods and preliminary list of 3-4 hypotheses or models for key species responses (in response to estimated number and location of pads, roads, pipelines and collection facilities) to be provided by August 31, 2012 or commencement of active construction, whichever occurs last.

The Phase I final report of the experimental or survey design and list of 3-4 hypotheses or models for key species responses to Phase II (construction) and Phase III (long term monitoring of infrastructure impacts) should be provided by October 31, 2013 or completion of 50% of the roads, pads or pipelines on the WMA, whichever occurs first. The final survey methodology to assess long-term effects shall be clear and simple enough that volunteers, summer interns or WMA staff might accomplish the work with minimal supervision, equipment and support.

Phase II

Phase II construction effects may include monitoring direct (i.e., road kills, drowning in fracking water retention ponds, etc) and indirect effects due to construction. Indirect effects includes secondary mortality due to any process used in the development of roads, pipelines or drilling

identified in Phase 1 threat, risk or vulnerability assessments and articulated in hypotheses or models to be tested or validated under this phase.

Phase II timeline may overlap with Phase I depending upon construction timelines of the oil and gas companies and completion of archeological assessments and surface use agreements.

A separate and independent Call for Proposals may be published on TPWD's website in 2012 for Phase II depending upon the exploration schedule and scale and rate of construction activities.

Phase III

Phase III will consist of post-construction monitoring of long term direct and indirect effects of permanent habitat loss and fragmentation. The effects of residual infrastructure will be tested or evaluated on the basis of those identified in the 3-4 hypotheses or models developed in Objective 1 of Phase I

Phase III may overlap chronologically Phase II on some portion of the WMA. However, it is assumed that construction and development will be spatially and temporally sequential progressing from east to west and not haphazard or random.

A separate and independent Call for Proposals for Phase III is tentatively scheduled for publishing on TPWD's website in October 2012 for funding in 2013.

The final report of findings of impacts of oil and gas development (Phase III) is negotiable but tentatively scheduled to be due by December 31, 2017.

General Guidelines for Phases I, II and III.

We expect a minimum total of five years of data collection including three years of post construction evaluation. Funds available may determine the extent of this study.

In such case where Phase I, Phase II and Phase III contracts overlap temporally and spatially and are awarded to different Performing Entities, it is expected that all personnel from each Entity will communicate, cooperate, collaborate, share information and work closely together. Failure to do so will be grounds for immediate contract termination and recovery of data and equipment allowed consistent with the State of Texas Uniform Grants Management Standards (UGMS).

Phases I and III are considered most critical to the study purpose because they deal with the characteristics and long-term effects of development on infrastructure and surface characteristics. This includes topographic, physical, chemical and vegetative changes. As such, those phases will receive priority for funding and resources should such funding become limited. In such case, Phase II may be eliminated or skipped. Funding for Phases II and III are contingent upon sufficient funds being available.

At least one TPWD permanent classified employee familiar with the WMA and these research needs will be assigned to serve as research project coordinator on each Phase of this project. This person will serve as TPWD's first point of contact with the Performing Entity and Principal Investigator on all matters related to this project from support to contract development, negotiations, amendments and approval of all deliverables including final reports. The Project Coordinator may serve informally on graduate research committee but shall be a coauthor on any publication resulting from this research.

Research proposals addressing potential impacts of mineral activities on WMA wildlife and habitat resources should take into consideration that ongoing management activities will continue during the period of research. Rotational livestock grazing will continue with about 800 stocker animals in one herd and six pastures. Timing of grazing will be dependent on herbaceous vegetation availability. Additionally, discing, aeration and prescribed burning of pastures will be ongoing. The use of these habitat/maintenance/enhancement activities are necessary to demonstrate management purposes of the WMA in addressing one of its major goals of providing management information to land managers in the South Texas Ecosystem

Expected Management Implications

This research will shed light on the impacts that oil and gas exploration have on herpetofauna. This group of animals is frequently overlooked in terms of conservation directed at specific threats and supporting research. Worldwide, populations of amphibians and reptiles are declining at an alarming rate. Usually there is no cause identified. With 4 state-threatened species occurring on the Chaparral WMA, it is important to understand what anthropogenic impacts are taking place. It is imperative to examine the effects of mineral exploration on these organisms to properly manage for them and mitigate the damages on the WMA and surrounding areas. With the discovery of new shale gas plays and all other mineral activity, there is no doubt that there will be other large areas that will be heavily impacted by development. It is important to understand what the effects will be on the ecosystem. This research will help land managers set management goals and procedures to help reduce the impact on the herpetofaunal communities and the South Texas ecosystem as a whole.

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