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Sonoran Desert Conservation Plan

SONORAN DESERT CONSERVATION PLAN STEERING COMMITTEE

EDUCATION SESSION #2

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The Cactus Ferruginous Pygmy-Owl

The Natural History of the
Ferruginous Pygmy-Owl in Texas

Glenn Proudfoot

THE NATURAL HISTORY OF THE FERRUGINOUS PYGMY-OWL IN TEXAS

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Thank you. I would like to begin by thanking Pima County for the opportunity to present some of my research on ferruginous pygmy-owls.

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As mentioned, I will be presenting some of my research in Texas on the natural history of the ferruginous pygmy-owl.

I would like to acknowledge all those who contributed to this project. It was a multifaceted study that could not have been conducted without the cooperation of federal and state agencies and private corporations. Eagle Optics should be added to this list.

The historical range of the ferruginous pygmy-owl included areas of Southern Arizona, Southern Texas extending south along both coasts in Mexico, through Central America into the southernmost population in Argentina. However, over the past 150 years urban and agricultural expansion within the United States has reduced its population to a few isolated pockets of uncertain stability. As you are all aware, in 1994 the U.S. Fish and Wildlife Service acting under petition, proposed listing the species as endangered in Arizona and threatened in Texas. In 1997, it was listed in Arizona as endangered, however, the listing in Texas was withheld until further research was conducted.

My primary study area is located on the Norias Division of the King Ranch. It is approximately 50 km south of Kingsville, Texas, about 100 miles south of Corpus Christi, Texas. The Norias Division is composed of three habitat types which include the coastal sand prairie, the live oak-mesquite forest which makes up about 100,000 acres, and the mesquite bosque or mesquite savannah areas. Norias overall is approximately 240,000 acres.

In 1992, Dr. Sam Beasom set the foundation for a ferruginous pygmy-owl nest box study by establishing 40 next boxes in areas of Norias known to be occupied by pygmy-owls. Now, the logic behind this was first off, to determine if pygmy-owls would use artificial nest structures and then if they would be a viable management tool if the species was listed. This was, as I say, started in 1992.

Secondly, it was to determine if they preferred a specific nest box configuration. They placed the boxes in eight sets of five and within each group, the configuration varied. The entrance diameter and the box depth varied. At this initial study, it was determined that pygmy-owls would use artificial nest structures.

They had three of the sets being used in the first year and they did seem to prefer a specific configuration which was 14 inches deep from the center of the entrance and with a two-inch entrance diameter. Now this information allowed us to expand the project to what became my master's and the objectives were to determine if the availability of cavities controlled pygmy-owl habitat selection, determine nest box placement criteria, physical characteristics of habitat use, food habits and monitoring nesting biology.

Throughout this study, I have now established a little over 200 nest boxes for pygmy owls. I have placed them in various habitat types in areas that contain natural cavities with moderate to dense understory, areas that contain natural cavities with minimal to sparse understory, areas that lacked natural cavities with minimal to sparse understory and areas that lacked natural cavities with dense understory. Now with this study, the information suggests that the pygmy-owls were not selecting areas based alone on cavity availability but on habitat characteristics. They avoided all the areas with minimal to sparse understory and are only uses nest boxes in areas with moderate to dense understory. The age of the stand was not a significant variable since they would use them in young growth or old growth stands. They used them where they were cavities or without cavities.

On this initial study I kept with tradition and for the first six months or so of the study we inspected nest boxes with a ladder. However, in the second year of the study we were concerned that this type of inspection may cause a flushing of the individuals and abandonment of the nest. We incorporated the use of a miniature video camera placed on the end of a telescoping pole. Within that aluminum housing there is a camera that measures 1o" x 1o" x o" in and at the front of it we have a light source. This was then a fairly simple matter to extend the pole and insert the camera into the nest box and via video patch cable we ran the image to a monitor at the ground level. This system was beneficial not only in determining occupancy of nest boxes but it was also applied to natural cavities and in using this system I have as of yet, not had any birds abandon during inspection. I have now monitored 99 nests so far.

Although it worked well, it did have its limitations and that being the depth of field and the field of view of the camera limited the use to cavities that were only of a cylindrical configuration. When I came across natural cavities that had somewhat of a curvature to them I would use a flexible fiber optics stratoscope. With this system I could insert a lens that measures less than a quarter inch in diameter to a depth of eight feet inside the cavity to determine occupancy. Once occupancy was determined, they system was also used to monitor the nest sites to determine things such as incubation, hatching efficiency, nestling development and provide information that allowed me to determine when it was time to come out and band the young.

To obtain information on physical characteristics, of course, we first had to trap some of the birds and I used two capture techniques. The primary techniques used were mist nets. Mist nets were placed in areas known to be occupied by pygmy-owls and they are set up in various configuration, usually either a V-shape or a triangle. I would establish a net around either a mesquite or catclaw and then I would place a Johnny Stewart bird and animal caller at the center of the mist net configuration and broadcast specific calls.

The logic behind this was the territorial aggressive behavior of the pygmy-owl that would draw them into the mist nets responding to the call. In some instances, they will respond to the call and come in but they do not display enough aggressive behavior to get drawn into the nets so then I would establish baited bownets at the interior and exterior of the mist net configuration hoping that they would be drawn in and may not go into the net but that they may opt to try capturing the prey item.

Once captured, whether it was in the bownet or mist net, they were removed and each individual was equipped with a U.S. Fish and Wildlife Service aluminum leg band for identification so we could obtain information on site fidelity, life expectancies, dispersal, movement patterns and physical measurements were taken which included the wing cord, the tail measurement, the (?) beak from the (?) down, tarsus and individuals were weighed.

Here, I have a 1.5" PVC for a restraining device to hold the birds. Initially, I started out -- to give you an idea of their size -- I started out using a 6 oz juice can for a restraining device, however, the first bird I put in it crawled out, there was so much room he just turned around and took off. So the very first pygmy-owl I caught, I lost. In addition to obtaining information on physical characteristics and after I trapped the birds during the first two years of the study, I would also collect blood samples to test the birds for hematozoa, blood parasites. This was done following veterinarian techniques. I would clip one toenail back until I obtained enough of the pulp to make blood flow and I made four smears.

They were separated into two sets. One set was sent to the International Reference Center for Etian Hematozoa at St. Johns University in Newfoundland and examined by Dr. Bennett who was the premier researcher on hematozoa at the time, he is now passed away. The other set was examined in-house at the Kleberg Institute. Throughout the study I have examined blood smears from 64 individuals and none of them have contained any blood parasites, hematozoa, plasmodium and luckocytazoan so this suggests that at least during the time of the study, blood parasites were not affecting the population.

In addition to making blood smears I also collected serum and this was to compare the mitochondrial DNA and in the initial study, we compared samples from birds in Texas as well as birds collected from northeastern Mexico and Argentina.

This was done to determine if possible geographic variation has affected the genetic variability within the population. In Texas, there was also concern the population we were looking at was separated from the continuous population down in Mexico due to the urban and agricultural expansion along the Rio Grande River which between 1940 and 1970, over 90% of the habitat was removed.

Now when we compared our samples, looking at the Cytochrome B in the MD loop, it showed that all of the birds within Texas had basically no variation at all, there was absolutely no difference in their genetic makeup and they could have all been clones of one another. This started throwing up red flags about inbreeding and we were concerned that this was actually showing some reduction in genetic variability.

However, when we compared them to the population from northeastern Mexico which is also considered the cactus ferruginous pygmy-owl, there again, there was no variation in the genetic make up and in fact, there was no variation between the populations. The birds in Texas were similar to the birds in northeastern Mexico. This suggested that this might be a species specific physiology characteristic that the birds just do not have much variation within their genetic make up. However, when we looked at the birds from Cordova, Argentina, there was a 1.6% variation.

Now depending upon which geneticist you talk to this is enough of a variation to list a separate subspecies and when we compared it to the birds from (?) Argentina, we had a 2.1% variation which according to some geneticists, Dr. Kunig from the Stuttzgart Museum of Germany suggest that there is enough variation to list a separate species. Now we also were able to obtain one sample from Arizona during this analysis and we had a 1% variation so it suggests that there may be a difference between the Arizona population and the Texas population. However, more importantly, it suggests that additional research needs to be conducted when you are dealing with a sample of one.

Each individual was then affixed with a clotting agent and released.

(Slide)
This is a little indication of their size and this is not their typical behavior. Usually if they have a chance to put their talons on you, it is putting them in you and not just on you. Now while I was obtaining information on the physical characteristics I noticed a plumage difference between the males and the females.

Out of all the individuals that I have trapped so far in Texas which now this year I approach #400 I believe I was running 387, the females display more of a cinnamon rufous colortone than the males in the wrinkle in the back in the upper wing and there is less of a drastic variation in the tail vine, between the dark and the cinnamon rufous colortones. The male is more of a chocolate brown and has more of a variation in the tail vine. The males is basically like comparing Hershey's Cocoa and Hershey's Nestle's Quik, the female being Nestle's Quik of course.

Now this information was obtained from the birds in Texas and after looking at a few of them, I suspect I have looked at approximately 18-20 pair that first year. I decided that we should expand this study so I, like Russell, contacted museums throughout the U.S. and I obtained 703 study skins to compare this characteristics to the identifications made by museum preparator as far as sexual differences.

When I looked at the species throughout their range from Texas, Arizona all the way down to Argentina there was a 68% correlation between plumage characteristics and sex which really is not all that substantial. When I separated out the northern population the cactus ferruginous pygmy-owl, the correlation raised up to 82%, there was an 82% correlation between plumage, colortones and sex. With the few birds that we have been able to look at here in Arizona there also seems to be these sexual dimorphic plumage characteristics.

(Slide)
Now here we have a test, how many females and how many males do we have?

(Audience response) Six females.

Correct. This slide also shows a little variation in the plumage characteristics throughout their range. You will notice that some of the individuals like this one lacks the cinnamon rufous colortones that are actually used to distinguish the ferruginous pygmy-owl from the northern

pygmy-owl or the eastern pygmy-owls. The characteristics we have here in the tail barring are similar to the Arizona population. The Arizona birds seem to be a little fainter than the Texas birds, the Texas birds as you saw before have more of the cinnamon rufous colortone in their tail.

(Slide)
To obtain information on habitat use, I established transmitters on selected individuals captured. Now the first year, I only placed transmitters on adults and I monitored them in the fall and during the breeding season. However, during the second year I included juveniles and this was done because I felt that tracking adults would buy us more information, it would provide habitat and aerial use from the adults, but it would not provide the information needed to determine how much of an area you need to bring off a successful brood.

What do you need for a nesting season for a nesting pair to be successful?

So far I have monitored 69 individuals of which 26 have been juveniles. They are tracked using portables receivers and yagyi antennas, using compass bearings and pace factors to estimate geographic location along with GPS units, satellite imagery. Satellite location, when you are working with it has its limitations because when you are in a heavy canopy, you cannot receive enough satellites to actually get a location so then I would use the compass bearing and pace factors.

To obtain information on habitat use, on each visual siting I would establish a tenth acre plot beneath the perch of each individual and collect information on habitat characteristics which included the number of trees, the species of the tree and the diameter at breast height of each tree. It also included understory values. There was a density board placed at the center of the tenth acre plot and each of the eight panels was read for the percentage of vegetation covering the panel. Now these readings were taken at the four cardinal directions; north, south, east and west. All of this information was logged for habitat characteristics of areas used.

Now for a comparative study then, I collected similar information throughout the study area. I ran a systematic random sample, I placed a grid over the study area, assigned numbers to each of the intersections and then I used the random numbers table to select the areas for sampling. I then went out and conducted similar tenth acre plots to determine the habitat use versus its availability on the study area.

Some of the results indicate aerial use of the adult males in the fall of 1994, that initial year, they were using between 19.6 and 116 hectares. You multiply these numbers by 2.47 and you get the acreage. So they were using fairly large areas, especially the top two at approximately 250 acres.

During the spring of 1995, their aerial use was drastically reduced to only 1.34 to 8.52 and just a little hypotheses, we think this may be due to variations in prey availability during the spring during nesting season, you have an influx of grasshoppers, lizards and everything coming out, birds are moving through during migration which may require less foraging and they like to maintain proximity to the nest site for territorial defense.

As you move through into the fall, even in south Texas and Arizona you have a reduction in the grasshopper numbers, the lizards during the cool periods go into a pseudo hibernation and what remains then will be the birds that are left in the area and small mammals so they have to increase their foraging to get food.

In 1996, we had a significant increase in aerial use by the adult males. Here they were using 6.7 to 110 hectares. Although we do not have enough to substantiate this, we feel this may be due to the drought we were experiencing over that time because there was less biomass out there, there wasn't any grass, less insects, etc. so it may have required increased foraging.

(Slide)
Here we have one bird during the nesting season using 110 hectares during that time, almost double to what they were using the year before. When I ran the statistical analysis comparing the habitat use to its availability on the study area the results suggest they were avoiding areas with small trees and using areas with larger trees which seems logical. They were avoiding areas that were not old enough to contain natural cavities. The understory values, we have a range between 1 and 192 for zero to 100% coverage.

They were using areas that were almost twice as dense as the average throughout the study area so they were selecting foraging areas with the moderate to dense understory. This also proved out in 1996, they were using areas with fewer of the small trees in significantly greater number of the large trees and again, much denser understory. Here the understory value being low and again, we attribute that to the drought that we were experiencing since there was not as much vegetation in the area.

(Slide)
To obtain information on the food habits, I kept with tradition and established a blind in proximity to a natural cavity and from this vantage point I was able to view the adults as they brought prey into the young and make identification. Here we have a ground skink. There are three different species of ground skink they are foraging on, however, when you are dealing with a small cavity nesting species in many instances, they would enter the cavity before identification could be made, especially when you are dealing with small prey such as grasshoppers and beetles.

(Slide)
Here again, I incorporated the use of artificial nest structures and miniature video cameras and established miniature video cameras in the top of the nest boxes and recorded all the activity that took place 24 hours a day from incubation through fledgling. It was then a fairly simple matter to take the tapes into my studio which is a reclining chair and the television and make identification which included the adults bringing the prey into the young, you could easily do your fast forward, stop and make identification.

(Slide)
In addition, I also collected prey remains. Here again, nest boxes proved beneficial. Pygmy-owls are not clean. They let prey remains accumulate in the bottom of the nest structure and

by the time these young are old enough to leave the nest, there will be prey remains stacked up to here, about three inches of it. With nest boxes then, it is a fairly simple matter to go out and once the young are fledged, remove the prey remains and bring them into the laboratory for analysis.

(Slide)
During the food habit study for the first two year period, we cataloged 36 different prey species in the diet of the pygmy-owl suggesting that they are a generalistic predator. They are also an opportunistic predator, I think they basically take anything that moves. In the class of mammals they were taking common evening bats, Mexican free-tailed bats and I cannot imagine them taking a bat on the wing, I believe they take them when the bats are roosting inside natural cavities during the day. I viewed the adults going around checking out cavities and removing young woodpeckers so I feel that is probably how they get their bats also. They are also taking kangaroo rats, northern pygmy mice and the largest prey taken was a hispid cotton rat which on average, outweighs the pygmy-owl by about twofold and when they take them they have to sever them to get the load down so they can carry it up to the nest.

(Slide)
In the class of birds, they were again taking bird species that were much larger than themselves. Pygmy-owls were taking northern mockingbirds, cardinals, paraloxias (sp?) and right here, we have the remains of an eastern meadowlark, grosbeaks, finches, they seem to really like sparrows.

(Slide)
In the reptile class, they are taking small and large prey, whatever moved they would grab it. They are taking a Texas spiny lizards with the largest one being about 8o" I guess but they were taking a keel deerless lizard, three or four different species of skinks, whiptail lizards, race runners, etc.

(Slide)
The insect class was the most diverse as far as numbers and as far as prey deliveries, however, I do not believe it is the most significant as far as nutritional contributions. It takes a lot of grasshoppers to make up one kangaroo rat.

(Slide)
Here again, we have a little indication of size, that grasshopper is probably about an inch and a half I would guess. The opportunistic thing here again in the insect field, they were taking walking stick and I do not know what you could get out of a walking stick but they were bringing them into the nest. They were also taking fireflies.

(Slide)
Just after they fledge, notice the young attempting to capture insects but they really are not successful until they are about a week out of the nest.

(Slide)
Using artificial nest structure again was a benefit in collecting information such as laying sequence, the pygmy-owls areas asynchronous since they put one egg down about every 30-39 hours. They are also asynchronous in hatching, there are some nests that would hatch the entire brood in one day while others span out their hatching over a week's time and it will be 24 to 26 hours between egg hatching.

(Slide)
Nestling development is about 28-31 days for nestling development before they fledge. We were able to determine that the females are the sole incubators, they have a very distinct brood patch on the female. They are also basically the sole provider of piecemeals. The female is the only one that I have seen tear a prey apart to feed the young, the male will bring it in, drop it off and take off. The male has also been recorded, after the female would bring in a cardinal or something, on three occasions I observed the male coming in and taking it away and going out and feeding on it.

(Slide)
At four days the young are covered in white down, they are unable to hold their heads erect, their eyes are closed and they still have remnants of an egg tooth on their beak. At 12 days they now respond well to movement. The primary and secondary feathers are beginning to erupt from their feather sheath.

(Slide)
At 20 days, their primary and secondary wing feathers are about half of their adult length and the tail feathers are just starting to emerge. There are approximately three millimeters, they have little remnants of the down left on their crown, however, on their back in the scapular region most of the down is absent.

(Slide)
When they do fledge one of the distinguishing characteristics between adults and juveniles is the streaking on the crown. This adult female has very distinctive streaking, the juvenile is just starting to develop some streaking in the crown.

(Slide)
Now post-fledgling, the young remain in proximity to one another for about the first week. Usually if you find one you are going to find all of them and very often, they will sit just like this, just side by side with their mouths open, begging.

(Slide)
At about 3-4 weeks, they begin to separate a bit and it is closer to four weeks and you will still find them in the same tree but they have started to separate. These are both hatchlings of the year at five weeks I believe is what they were and their tails are now the adult length and they are displaying much of the adult characteristics. In other words, Scott pointed out to me something that I missed until he came across it. The juveniles also display these white teardrops along the crease of the wing and they were more distinctive in the juveniles than the adults. The adults have them, however, they just are not as distinctive.

(Slide)
Since Scott pointed that out I have now for the last two years, I have been trying to catch adults and young at the same time just so I could have a photographic record of it but I am not real successful. I am getting some photos but they just do not satisfy me. That was basically what I did before my master's.

(Slide)
Now while I was conducting that research we had a high level of nest predation. We have the nest cavity, this was the nest owl of a pygmy-owl and it was opened up by a raccoon. The first year I had 75% nest predation which is fairly high. Of course, that was due in part to sample size. Over the past six years now it has gone down to just a little over 40% which is still high.

After that first year in the high level of nest predation, we are very concerned with nest predation and we were wondering exactly who the culprits were. We had evidence here that definitely a raccoon, bobcat, ocelot or something was up there tearing the cavities open. We also had cavities where no disturbance was really observed, we could not find any eggshells so what we have done for a couple of years now is establish time lapse recording units at the nest cavities and record all the activity that takes place. This is somewhat of an ongoing project. I have now been able to establish recording units at nine nest cavities and with that, I have just under 9,000 hours of video footage that needs to be analyzed to determine the cause of predation and monitor activity patterns and so forth but with what I have been able to run, I have monitored a little over 3,000 hours and we have determined that raccoons are the number one predator basically in that initial analysis.

(Slide)
I started another little nestbox project that we are hoping would deter and reduce predation by raccoons. I established nestboxes in sets of three and the first box was just a fascial board. The second box, I placed another box over the fascial board and this was to increase the entrance the entrance depth. On the third box I placed a 2 x 4 over the entrance so it would get it from three quarter to an inch and a half to a 2o" entrance depth before you get into the cavity. Now the logic behind this was that raccoons, being the primary predators the ones we were able to identify so far, the raccoon would stick his arm into the entrance and because of the depth he would not be able to bend it to get down and predate the cavity. I have established 120 nestboxes in 40 sets of three like this to first off, determine if the pygmy-owl would use one of these boxes with the deep entrance and then its viability as a management tool. I have found that pygmy-owls will use those nestboxes with a deep entrance so there is a possibility that we could establish nestboxes with a deep entrance and reduce predation by raccoons, which is a good thing.

(Slide)
It does not deter predation by snakes. This snake happens to be a five foot, eight and a half inch bullsnake. He is inside that box which is just six inches by six inches and this is just after he had a six pygmy-owl lunch. There were six young in that nestbox the day before and I was able to get a photographic record of where they went.

(Slide)
To try and develop a management tool to reduce predation, the last year I established nestboxes on metal poles to determine if pygmy-owls will first off, use a nestbox on a metal pole and if they will, then we can establish these metal poles with the nestboxes out in the areas where pygmy-owls are and hopefully reduce predation. Raccoons and snakes would hopefully not be able to climb or slither up the metal poles. Establishing nestboxes on metal poles would reduce the impact to trees and we would no longer be putting nails or climbing trees. If this does not deter predation and if a snake can still squiggle up it, it would be a very simple matter to put a cone on it so this is what I am looking at right now. It is just in its infancy. I established six sites last year and I had one of them used by pygmy-owls so with a small sample anyway, it is suggesting that pygmy-owls will use artificial nest structures established on metal poles.

(Slide)
Just a little shot to show the cryptic coloration of juveniles. Even if you have a transmitter on these little owls it is sometimes hard to find them. A juvenile about five and a half weeks to post fledgling and he is sporting a radio transmitter. At this age, they are just starting to develop the eye patches on the back of the neck in the nap. When they become adults they will be lined with that white ring. Here again, we have this very distinctive color pattern of the white teardrops along their upper wing.

(MR PROUDFOOT BEGINS SHOWING A FILM OF THE PYGMY OWL AT THIS POINT)

This is some of the typical habitat I find them in. Now here you can see the ants crawling up into the cavity, all of the prey remains attract a large number of ants and they are basically foraging on what the birds are leaving. I have not recorded any negative impact on the birds from the ants as of yet. Every nest that I have visited has ants going in and out of them eating the prey remains and I never have as yet noticed red ants taking any of the young.

This is recorded from the blind that you saw in the earlier blind in the slide. It's not quite time, he jumped the next day and he fledged. Some of the nests are situated on the underside of the upward/outward sloping limb and from this blind it was interesting to watch the adults as they would fly in there, they would go in there in almost an inverted flight to get into the cavity. This nest is approximately 20 feet off the ground I would say, it is in a live oak tree that measured almost five foot across.

Now here I tried to give you a little image of what I see when I look inside with a stratoscope. It is a lot different when you put your own eye up there, you get a much wider field of view.

This real-time footage, unlike the time lapse of which I have way too much of was recorded in a little over 200 hours so far.

One of these has a transmitter so beneficially you get the whole brood. This is a juvenile and it is about six weeks old doing his begging call which is what they do most of the time. They just sit there and chitter.

Now here we have an adult female in the fall in August, the adults go through a full tail molt, here is all the tail feathers and here is the transmitter on the bird. Now this molt of the tail feathers coincides with the dispersal of the young. Within a week after they lose their tails the young disperse. That was a juvenile that took off.

I'm not sure if you can pick this out but on the top of the crown of all the juveniles, the nestlings, I mark them so that I can do a little study on dominance that develops within the brood and there is definitely a dominance.

There is definitely aggression that develops, or a dominance that develops within the brood. In one instance we recorded siblicide where the older ones predated on the younger. When they hatch over the wide span, for example one every day and you have one week's difference between the hatching of the first egg and the last, there is definitely a size difference that develops. It can be up to say 12-14 grams which is a lot considering the birds only weigh 50 grams.

Even at this age they are beginning to show some of the plumage characteristics of the adults where there is a little more similar rufous colortones beginning to develop so when you have two of them together, you can confidently sex them.

Nest boxes are good for providing opportunities such as this to record behaviors, activities and getting the basic nesting ecology. I have placed cameras at nine nests now and I have yet to have any of them abandon when I am doing the recording. I am sure there is individual variation but so far it has not seemed to affect them.

Another fledgling, this about one week after dispersal when it left its natal site, it is another bird with a transmitter on it of course. It was doing well foraging on its own. Lizards, in Texas seem to make up a significant part of their diet. As far as nutritional value I think it is the most significant as far as the five classes that I have identified. One that I did not have a slide on was amphibians. I recorded them taking a narrow mouth toad.

They have over 150 windmills on the Norias Division so there is always a water source within two miles of the next. Before the King Ranch established itself and started drilling for water there was absolutely no riparian areas, there are no creeks, rivers or anything on this 240,000 acres. There are possibly five freestanding water pools but I have not as yet run an analysis to determine if there is a correlation between nest site location and proximity to water. It is something that can be done but time is needed to do that.