

Treating Northern Bobwhite for Parasitic Infection Supports Sustainable, Huntable Populations

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The decline of the Northern bobwhite has been one of the most significant losses the hunting community has faced in the 21st century. Today, populations are non-sustainable or absent in most of the bobwhite's historical range. Economic loss due to the decline of this species has been felt by rural economies, many of which depended on the once grand annual influx of hunters seeking these gamebirds. Millions of dollars of revenue are generated each year in Texas alone from hunters in the form of hunting licenses, equipment, lodging, and more. However, if bobwhite numbers continue to decrease, so will the hunters. Ecosystems have felt the bobwhite decline as well. Bobwhite are umbrella species, which means managing habitat for these birds provides suitable habitat for most, if not all, of the rest of the ecosystem. When bobwhite populations are not seen as sustainable, landowners are less likely to sacrifice the time, money, and energy to manage habitat for these birds, leading to a subsequent loss of habitat other species rely on. The bobwhite decline has also been felt culturally. There are those today who no longer remember the "poor-bob-white" call that cuts through the cool morning air, greeting the day. Bobwhite hunting has become less accessible to the average hunter, so most travel considerable distances to find suitable hunting territory. Furthermore, fewer and fewer youth and young hunters participate in the season.

Not only have the overall bobwhite population numbers been declining over the last few decades, the population has also been following a peculiar "boom and bust" pattern. Populations would rapidly increase for one or two years (the "boom") before rapidly crashing to a "bust" period of low, unhuntable levels for a few years before the cycle repeated. This pattern even occurs in one of the last strongholds for the species, the Rolling Plains of Texas. This ecological region, about the size of the state of Michigan, is not heavily associated with many factors thought by many to contribute to bobwhite decline elsewhere, like pesticides, fire ants, and extreme predator abundances. The rangeland can also provide a pristine bobwhite habitat. The fact that population crashes also occur in this ecoregion cannot be ignored. However, hope is on the horizon for the return of the once-great bobwhite populations. Through a decade of immense work, some ranches are experiencing a near-unbelievable resurgence of bobwhite numbers.

This success story began in 2010 after landowners noticed a bobwhite decrease of up to 90% from the previous year despite favorable rainfall and other environmental conditions. Before this, it was widely thought that the bobwhite's "boom and bust" population cycles were driven solely by climate. However, this discovery revealed that more factors likely influence these cycles. Operation Idiopathic Decline (OID) was a multi-institutional effort launched to determine these additional factors. In 2012, one of the collaborators, Dr. Kendall and his team at the Texas Tech Wildlife Toxicology Laboratory (WTL), made a landmark discovery: parasitic infection may be driving the bobwhite population fluctuations. Studies have associated eyeworm (*Oxyspirura petrowi*) infections in bobwhite with damage to the cornea and eye ducts, while intestinal parasites like the cecal worm (*Aulonocephalus pennula*) found in bobwhite have been reported to cause significant digestive harm, weight loss, growth inhibition, and even death in other fowl and game birds (Figures 1, 2). Epidemics of eyeworm and cecal worm infections have also coincided with documented bobwhite population crashes. In 2017, before another bust, the average number of parasites in each bobwhite tested was 14 eyeworms and 290 cecal worms. In 2018, the average number of parasites in each bird increased to 35 eyeworms and 413 cecal worms. In some areas, 100% of sampled bobwhite had parasites. This is when the bobwhite population crashed again. When parasitic infection levels increased, the bobwhite began to disappear.



Figure 1. Side-by-side comparison of a hunter-harvested bobwhite heavily infected with cecal worms (right) compared to a healthy hunter-harvested bobwhite (left).



Figure 2. A female bobwhite heavily infected with eyeworms.

States Food and Drug Administration (USFDA). This was an intense, scrutinizing process. Only about 10% of potential drugs make it through the FDA approval process, which takes, on average, 10-15 years to complete. Yet, the WTL, primarily composed of students, and its collaborators got it done in 9 years. Throughout this period, several landowners allowed the WTL to conduct field studies on their ranches, designated by the USFDA as demonstration sites, to determine the effects of the feed on bobwhite populations. The medicated feed was administered to wild bobwhite on these properties twice a year for three weeks, initially using modified dog kennels and poultry feeders which developed into QuailSafe® feeders (Figure 3).

One WTL peer-reviewed and published study in Oklahoma demonstrated that bobwhite populations on a ranch treated with the medicated feed grew to be 3 times larger than a nearby reference site and had better overwinter survival despite drought conditions. Furthermore, the bobwhite on the treated site were less infected with parasites than the reference site, and adult survival was higher on the treated site. Before treatment, the property had very few quail and several overgrazed pastures, yet the quail population grew 500% in a few years after the medicated feed was administered. Another peer-reviewed and published study in Texas Rolling Plains demonstrated similar results. The sizable property was divided into three study transects. One area received medicated feed, another supplemental feed, and another no feed. The bobwhite population receiving the medicated feed grew to be nearly 300% greater than in the untreated areas. These findings collectively highlight the significant positive impact of medicated feed on bobwhite population growth, demonstrating its potential as an effective tool for quail population recovery even in subpar environmental conditions.



Figure 3. Wild Northern bobwhite consuming medicated feed inside a QuailSafe® feeder on one of the Wildlife Toxicology Laboratory's demonstration ranches.

Now, on another demonstration site in the Texas Rolling Plains, Snipes Ranch, we have preliminary evidence that suppressing infection leads to not only population growth but also the sustainment of those populations through the years. Despite immense habitat management efforts on this property since the '90s that led to the landowners receiving the prestigious Lone Star Land Award for habitat quality and conservation efforts, the bobwhite population still crashed in 2010. Quail hunts did not occur on this land until the population boomed again in 2015. The robust and methodical treatment of wild bobwhite with the medicated feed began after the population crashed in 2018. The property was treated twice a year in three-week intervals, once in the spring and once in the fall, using feeders placed approximately every 200 acres. Along with medicated feed treatment, WTL researchers started collecting bobwhite population data in 2019 via covey call counts. In fall, bobwhite join together in larger groups called coveys to increase the chance of overwinter survival. Each morning, the coveys call out to each other to regroup before the day begins. Call counts have been relied upon as crude predictors of autumn quail abundance for decades and are an excellent way to compare population trends between sites and years. An observer arrives before sunrise in the fall and counts the number of coveys heard calling at a predetermined point (Figure 4). This is repeated over several days at several points. The average number of coveys heard per point compares different years and properties. The treated property call counts were compared to those of the Rolling Plains Quail Research Foundation (RPQRF), a well-renowned bobwhite research ranch 60km away that has also won the Lone Star Land Award. The Texas Parks and Wildlife (TPWD) quail roadside surveys were also used as a reference to compare bobwhite population fluctuations to the study sites. These numbers are calculated by averaging the number of bobwhite seen on randomly selected, 20-mile roadside survey lines from each ecological region in Texas.

As Figure 5 demonstrates, the bobwhite populations on the reference site exhibit fluctuation patterns that closely follow those observed in the TPWD Rolling Plains roadside counts, a key indicator of the region's quail population dynamics. When the roadside counts rise and fall, the covey counts on the reference site rise and fall. In contrast, the bobwhite populations on the treated site show a much more stable pattern, maintaining consistent levels that remain high enough to be considered huntable. These stable populations are notably comparable to the "boom" years of 2016 and 2017 observed on the RPQRF site, a period of

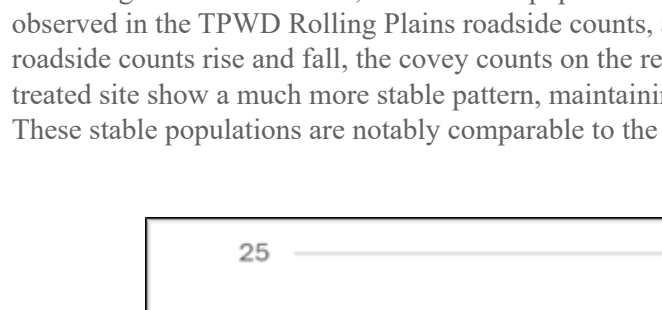


Figure 4. A student from the Wildlife Toxicology Ranch conducting a fall covey count.

optimal bobwhite numbers. Despite occasional fluctuations, the bobwhite population on the treated site has remained resilient, even in years with severe environmental challenges. During the "bust" years after the 2016 "boom," the treated site saw a substantial increase in bobwhite populations from 2019 to 2020. This boost was not short-lived, as the populations remained stable at these elevated levels throughout the subsequent years. Furthermore, in 2022, a year marked by extreme drought conditions, the treated site still managed to sustain huntable populations. This is particularly significant given that the TPWD roadside counts during this time recorded the lowest bobwhite numbers ever documented for the Rolling Plains, further emphasizing the effectiveness of the treatment in maintaining a robust population.

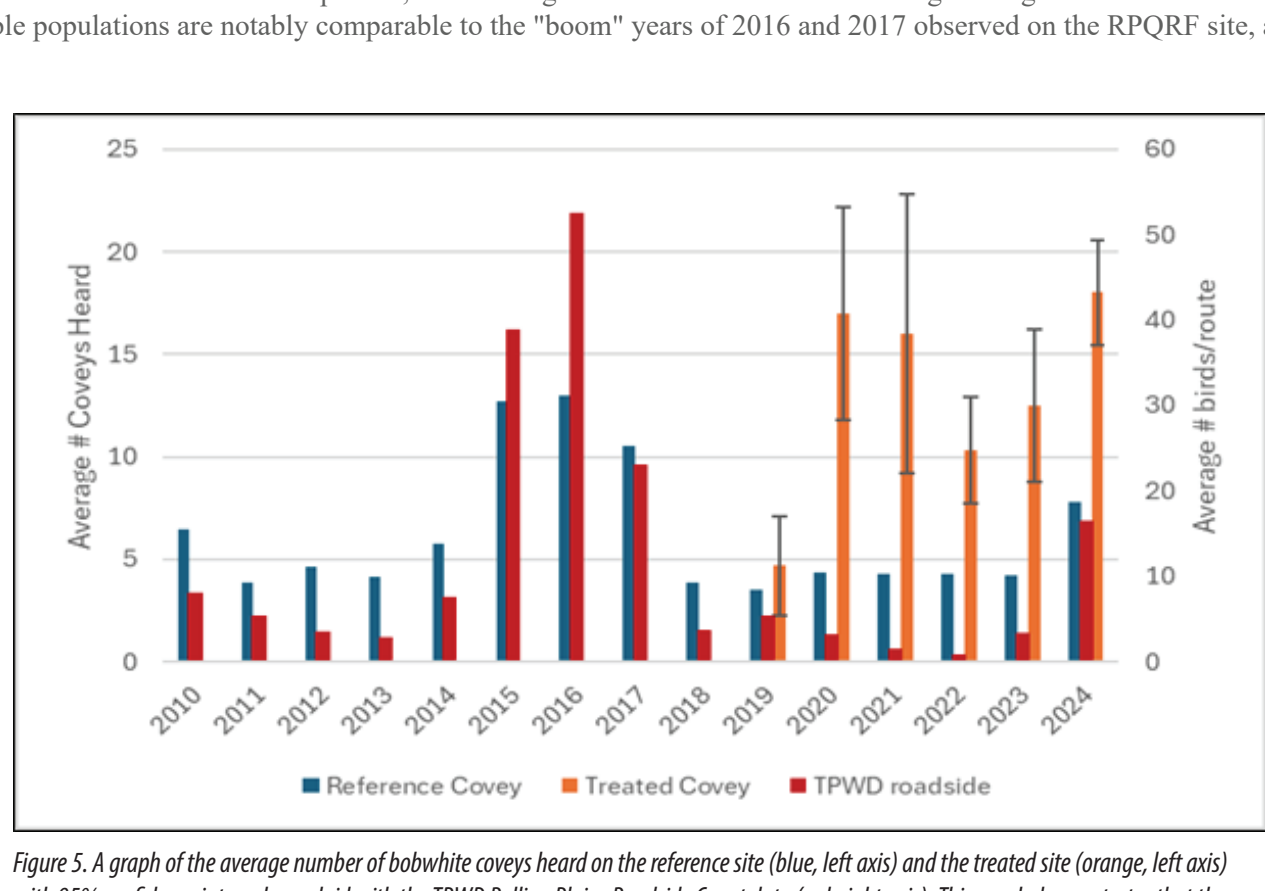


Figure 5. A graph of the average number of bobwhite coveys heard on the reference site (blue, left axis) and the treated site (orange, left axis) with 95% confidence intervals overlaid with the TPWD Rolling Plains Roadside Count data (red, right axis). This graph demonstrates that the bobwhite population on the untreated site followed the "boom and bust" cycle of the greater ecological region while the bobwhite population on the treated site remained at higher levels.

These observations suggest that when parasites, which can negatively impact wild bobwhite quail, are suppressed through controlled interventions such as medicated feed, the population can avoid the extreme "boom and bust" cycles commonly observed in wild quail. The ability to maintain sustainable, huntable bobwhite populations across multiple years, even in the face of unfavorable environmental conditions like drought, provides compelling evidence that such interventions can play a critical role in stabilizing populations and ensuring their sustainability. This reinforces the notion that proactive management, including the use of medicated feed, can mitigate the impacts of environmental stressors and support the persistence of huntable quail populations year after year.

This is not the first instance showing that parasites can have regulatory effects on wildlife. The red grouse (*Lagopus lagopus scoticus*) of Scotland was experiencing the "boom and bust" population cycling as well. However, in the '90s, researchers determined that treating the birds for parasites suppressed population crashes, increased population growth, and reduced declines. This was after parasitic infection in the grouse was associated with increased predation likelihood, reduced overwinter survival, and decreased breeding success. With the current data supporting the notion that heavy parasitic infections affect bobwhite populations and knowledge this occurs in other species, we can confidently suggest that wild bobwhite may need to be treated for parasites if their populations are to be maintained at sustainable, huntable levels.

This year, the WTL's collaborators administering the feed are reporting some of the best hunting results their properties have ever experienced. On Snipes Ranch, the treated property used for the study described in this article, over 20 coveys were encountered within the first three hours of the hunting this season. The landowner shared this sentiment after his years of using the feed:

"Everyone has an opinion, and they are fully entitled to that opinion. However, we have evidence and proof of the effectiveness of the medicated feed. On the Snipes Ranch, the infection rate has fallen from 100% in 2017 to less than 10% today. We have lots of birds, and they are very healthy. In fact, we have harvested birds over 200 grams. Here in the Rolling Plains, we have happy hunters and happy landowners."

Joe Crafton, founder of the Park Cities Quail Coalition, corroborated this experience after hunting on the property this year:

"The last three trips we pointed 113 coveys in 23 hours at Snipes Ranch! The good ole days have returned where habitat meets healthy birds... Based on conversations with other Rolling Plains hunters, I have no doubt that this feed is a difference maker."

A nearby 2000-acre property, Ribelin Ranch, is estimated to hold over a bird an acre after a few years of methodical treatment, which is a remarkable density. On a hunt toward the end of the season, 11 coveys were found in less than 4 hours of hunting on foot. Two of those coveys contained over 30 birds each, and several large covey roosts were found during the hunt (Figure 6). The property owners have shared with the WTL that they have seen improvements in quail behavior and population size on their land:

"Since we started using Quail Guard, quail very rarely fly into our windows and die anymore, which in the past was a common occurrence. We are consistently seeing and hearing quail every day and hunting has been consistently good year to year since we began using Quail Guard. When we hear so many hunters complaining how there are no quail to hunt and you know your ranch is flush with them, you realize what you are doing is working."

Another collaborator in the Rolling Plains, W7/Williams Ranch, reported 16 coveys after 3 hours of hunting on foot. When hunting via truck, hunting dogs would find quail within 5 minutes each time the vehicle stopped. On this particular property, the increase in bobwhite populations is notable, but there has also been a rise in the number of scaled quail, which has added to the overall success of the efforts. Mr. Williams described his experience with the lab working to restore the ranch's bobwhite habitat while concurrently administering the medicated feed:

"I remember one weekend I took friends from Plainview to the ranch (in 2000) to hunt for the weekend, and we easily took 200 birds – without dogs. I stopped hunting quail at the Ranch in 2017. We would occasionally see a covey or two, but essentially the quail were gone... First year of the program there was little success; however, each year thereafter, quail populations have steadily increased. Now, we expect to push 15 – 20 coveys on two (2) 2/2.5 hr. hunts a day. We also estimate that our quail population is 80/20; bobs to blues... We've completely turned around the Ranch's quail populations, in just over 4 years. W7's quail are back. The ranch will continue to work with Dr. Kendall, TTU Wildlife Toxicology and Quail Safe to further enhance W7's quail population."

Finally, our USFDA demonstration site in southwestern Oklahoma had extraordinary quail numbers this year. Our collaborators found 85 different wild coveys during the first 32.5 hunting hours of the season, all while hunting on foot. Mr. Gary Willson, who heads the quail hunting operations at the Oklahoma FDA demonstration site, said this is among the best years in his over 20-year involvement with quail hunting and management on the ranch. He has kept meticulous records of covey numbers and sizes throughout the years. Along with the increased numbers of coveys found, the size of the coveys has also grown substantially. Before treatment, coveys of 8-12 birds were considered favorable sizes. However, after treatment, witnessing coveys of 20-25 birds is commonplace, and in some cases, even larger groups of over 30 birds have been observed. The ranch has been using QuailGuard for over 4 years as prescribed by the FDA for a three-week treatment in early spring and for a three-week treatment in the fall. Mr. Willson said they will continue to use QuailGuard in their quail management program. These changes emphasize the successes observed on every property that has treated quail for parasites, resulting in increased quail populations and an improved hunting experience.



Figure 6. One of the large covey roosts found on Ribelin Ranch.

Furthermore, not only has the feed been highly successful in restoring bobwhite populations, it is also more economically feasible than alternative recommendations. Supplemental feeding, as recommended by some prominent research organizations to aid bobwhite populations, costs approximately \$42/acre. However, the medicated feed costs only \$1/acre to administer annually and has a plethora of data and anecdotal evidence supporting its efficacy. On a 6000-acre ranch, this would translate into a \$250,000 annual feed bill versus a \$6,000 bill.

The restoration of once-thriving bobwhite populations remains within reach. While the "boom and bust" cycles of bobwhite numbers have long been regarded as an unavoidable reality, recent insights suggest that this may not be the case. Although population fluctuations will continue in response to factors such as weather patterns and food availability, addressing parasitic infections appears to mitigate the severity of these fluctuations. We can now reduce the pressures on bobwhite populations by alleviating the burden of parasitism, enabling them to withstand harsher conditions and preserve a stable breeding base. This, in turn, ensures the sustainability of huntable populations from year to year. Maintaining suitable bobwhite habitat and decreasing other pressures like agrochemicals are still critical parts of this process, but the medicated feed, when used as prescribed 2x/year for 21 days, may provide an effective way to maintain populations while the time-intensive solutions to other pressures are addressed. The journey is far from over. It relies on the continued dedication of American landowners, whose efforts are crucial to restoring and maintaining the Northern bobwhite.



Figure 7. (From left to right) QuailSafe® founder Ron Kendall Jr., Wildlife Toxicology Laboratory Head Dr. Ronald J. Kendall, Wildlife Toxicology Laboratory collaborator Rick Snipes, and Chris Dorsey of Sporting Classics TV filming a quail hunt on Snipes Ranch.

This work would have been impossible without the significant financial support and collaboration from the Park Cities Quail Coalition and the Rolling Plains Quail Research Foundation. We at the Wildlife Toxicology Laboratory are immensely grateful for these organizations and all their efforts in the realm of quail conservation.