

Kentucky Journal of Undergraduate Scholarship

Volume 1 | Issue 1

Article 5

May 2017

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Recommended Citation

Summers, James; Bradley, Michael J.; Johnson, Alison; and Sharp, Ryan L. (2017) "Viability of Hunting as a Means of Wild Hog Population Management on Federal Property," *Kentucky Journal of Undergraduate Scholarship*: Vol. 1 : Iss. 1 , Article 5. Available at: <https://encompass.eku.edu/kjus/vol1/iss1/5>

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Viability of Hunting as a Means of Wild Hog Population Management on Federal Property

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Abstract: *Created in 1974, The Big South Fork National River and Recreation Area and Obed Wild and Scenic River (BISO) indications that invasive wild hogs are on property stresses the need for identifying methods to control the continued population growth of these animals. Further damage to park land is possible (spread of parasites and diseases to other animals) as the wild hog population continues to expand. Results from this study show that hunting cannot be a primary hog population management tool. Hunting is a cost efficient way to kill wild hogs, however, it is time consuming and the number of hunters purchasing permits continues to decrease. The National Park Service will need to consider other methods of controlling wild hog populations, perhaps in conjunction with hunting, in order to manage the hog population.*

Keywords: Wildlife Management, Hunting, Invasive Species

Big South Fork National River and Recreation Area and Obed Wild and Scenic River (BISO) was established in 1974 as a National Recreation Area and a National River (Big South Fork, 2017) and is located in southeastern Kentucky and north central Tennessee. It is an important area that protects the free-flowing Big South Fork of the Cumberland River and its tributaries. BISO also contains one of the highest concentrations of natural bridges in the eastern United States, and is rich in history from the pre-historic Paleo Indians to the modern day coal miners (Big South Fork, 2017).

The natural landscape of BISO makes it an ideal location for wildlife to live undisturbed. Unfortunately, it is also becoming a new home to an invasive, non-native wild hog population. It is believed that the wild hog was introduced to the United States in the early 1500s when Spanish explorers brought them to Florida and let them roam freely, and eventually finding new areas to inhabit (Bevins, Pedersen, Lutman, Gidlewski, & Deliberto, 2014). In the past several years, the population of wild hogs in BISO and other areas in the western and southeastern United States has continued to

rise (Bevins et al., 2014). Wild hogs are able to reproduce at a fast rate, have no natural predators except for humans, and have a high survival rate (Mellish et al., 2014).

Most visitors to BISO do not encounter wild hogs, and may not be directly affected by their presence, however, there is cause for concern. Wild hogs damage land and crops by rooting or grubbing, and may transmit parasites and diseases to other animals. Therefore, increased wild hog populations are likely to damage the conserved environment and affect recreation experiences of those visiting BISO (Gortazar et al., 2015).

Due to the invasive wild hogs causing damage to land and animals, it is vital to research ways to control the continued growth of this animal population. Some of the techniques used to control wild hog populations are hunting, poisoning, and trapping (Gortazar et al., 2015), however, little is known whether these techniques for managing populations are working (Massei et al., 2014). Hunting, specifically, is often used as a means of population control for various species, however, there are often conflicting beliefs on whether hunting is the best option for managing population growth (Ransom, Powers, Hobbs, & Baker, 2014). Therefore, this research project will focus on wild hog population management through permitted hunting, specifically on wild hog populations in BISO. Through this research, the researcher seeks to understand if and how permitted hunting is an effective way to control the growing wild hog population.

The hypothesis for this study is that permitted hunting is not a management solution that controls the wild hog population in Big South Fork National River and Recreation Area and Obed Wild and Scenic River (BISO).

Literature Review

Wild hogs were not originally found in the United States, they were introduced in present-day Florida by Spanish explorers in the early 1500s (Bevins et al., 2014). The wild hogs are considered invasive, or have a tendency to spread and cause damage to the environment, because they are known for rooting or grubbing the land, and they have the potential to transmit diseases to other animals (Gortazar et al., 2015).

These animals have been accused of being a threat to other species since the 1950s. Even years later in the 1980s when stomach contents of wild hogs were studied, they were found to contain 131 species of plants and animals. In the 1990s, studies showed the cost of agriculture losses due to the wild hogs, combined with cost of control, reached over one billion dollars. It was also during this time that endangered animals were found to have diseases likely linked to contact with the infected wild hogs. In the 2000s, the wild hogs were associated with the decline of at least 26 plant and animal species (Bevins et al., 2014). One specific example of damage caused by the wild hogs during this same time was found through a study researching the endangered Houston toad habitat in Texas. Research

found that wallowing by the wild hogs rapidly degraded the toad's breeding habitat and threatened the already endangered population of toads (Brown, Jones, Bell, & Forstner, 2012).

Wild hogs exhibit one of the highest reproductive rates of any ungulate, or hoofed mammal (Mellish et al., 2014). According to research done in the 1990s, one reason for their ability to reach the high level of reproduction is that female wild hogs can reach breeding age in less than a year. They can also have multiple litters (4-10 piglets) annually (Bevins et al., 2014).

Wild hogs have been reported in many locations in the United States and throughout the world. The adaptable biology of the wild hogs and the deliberate introduction of the wild hogs to other locations by humans has aided wild hog range expansion. For hundreds of years, the wild hog distribution in the United States was primarily limited to Hawaii, California, and the southeastern United States. However, the range of the wild hogs in the United States has expanded from 17 to 38 states over the past 30 years (Bevins et al., 2014). In 2014, findings from a Texas study showed that population projections for wild hogs in that state would quintuple within a 5-year period (Mellish et al., 2014).

The methodology used for estimating wild hog population numbers is usually done by: 1) reported estimates, which are reported by a state or federal agency, or an academic or extension researcher; 2) harvest based estimates, which are counting the statewide sport hunting harvest of wild hogs; or 3) bounding estimates, which are anecdotal estimates of wild hogs in the area. Based on research in the 2000s, the total nationwide population of wild hogs in the United States numbers approximately 6.3 million (Mayer, 2014).

The evidence that wild hogs are invasive (causing damage to land, crops, and more), is a reason for identifying methods to control the continued population growth of these animals. Some of the control methods that were used in the early years were hunting and bounty programs, use of toxicants and poisons, and trapping (Bevins et al., 2014). In 2010, attempts were made to control the population increase of the wild hogs by orally delivering cycloaliphatic epoxide resin (ERL-4221), a fertility control agent (Sanders et al., 2011). In 2012, there was development of a toxic bait that was used on wild hogs in an effort to control population growth. The name of the toxic bait being used was Hog-Gone, and it was delivered in a bait hopper called the Hog-Hopper (Lapidge, Wishart, Staples, Fagerstone, & Campbell, 2012). A recent study investigated a combination of baiting with oral contraceptives and hunting to control wild hog populations. The research was encouraging, but the method was not deemed cost effective due to the high amount of baits that are required for success (Burton, Westervelt, & Ditchkoff, 2013).

Early on, many bounty programs were started as a way to enlist public help in reducing the numbers of wild hogs. The method produced mixed results. One early bounty program paid hunters to submit tails from each wild hog that was killed. The program resulted in paying out large sums of

money to people, sometimes to those that had gotten hog tails from meat processors, but the numbers of wild hogs did not seem affected (Bevins et al., 2014).

In that bounty systems were inadequate, game managers investigated other methods for population control. The use of toxicants was controversial when first used, and is still questioned now. Early studies revealed that the toxicants had limited impacts on the population size of the wild hogs (Bevins et al., 2014). The research done in 2010 that involved ERL-4221, an ovotoxin, followed studies that had been done earlier in the 2000s. Use of previous chemicals, such as 4-Vinyl-1-cyclohexene diepoxide (VCD) had been used in research on mice to determine the process of menopause in humans. The researchers had considered using that same chemical on the wild hogs, but VCD was discontinued in 2005. ERL-4221 is structurally similar to VCD, so researchers thought its use would reduce ovulation of wild hogs. ERL-4221 was administered orally through bait. After the study was completed, the researchers found that the oral administering of ERL-4221 through bait did not reduce fertility in wild hogs (Sanders et al., 2011).

A 2012 study focused on a toxic bait for wild hogs (Hog-Gone) and a suitable bait delivery vehicle (Hog-Hopper) as a means of population control. Most of the research was done in Australia, with few studies in the United States due to researchers facing some resistance related to animal welfare. Since the bait was left on the ground, it had a chance of washing into close water bodies, potentially becoming toxic to aquatic organisms. The bait hopper, called Hog-Hopper, was used in the United States to protect the bait from contaminating the ground or area water bodies. Although testing of this toxicant is still being conducted today in the United States, and the prolonged outcome of the study is still in question, it appeared that the beginning findings of the research showed that the Hog-Gone could possibly help in reducing wild hog numbers (Lapidge et al., 2012).

Research at Fort Benning, Georgia (Burton et al., 2013), showed that a combination of methods was more likely to reduce the population growth of wild hogs than using just one method by itself. The research done at Fort Benning used a combination of hunting and contraceptive techniques to reduce the population growth of wild hogs. The contraceptives were administered orally through baits, with approximately 7500 baits being used. Although the research was encouraging, it was not deemed cost effective due to the high amount of baits that are required for success (Burton et al., 2013).

Hunting

The most discussed method for controlling the wild hog population growth is hunting. However, research results show that hunting has never been a successful method of controlling the growing wild hog populations throughout the United States. One issue, revealed in a 2012 study, showed that there was a years-long decline in Americans' participation in hunting

(Robinson & Ridenour, 2012). A later study showed that hunting as a means of reducing deer populations may be difficult to achieve. The efficiency of the method had rarely been tested in the wild (Simard, Dussault, Huot, & Cote, 2012).

In the 2013 Fort Benning study, wild hogs were able to withstand hunting without a decrease in population growth rates. They found that immigration and increased reproductive rates factored into their ability to withstand the hunting efforts. The study showed that even high-intensity hunting ultimately had little impact on reducing the wild hog population (Burton et al., 2013). A study later that year continued to show that hunting as a means of reducing the wild hog populations was ineffective to reduce densities to a level that resulted in acceptable wild hog impact. This study revealed that hunting by humans is often predictable and therefore, the wild hogs are intelligent enough to avoid being killed (Cromsigt et al., 2013).

A study in 2014 reported that wild hog populations were increasing. Therefore, hog hunting seasons were created to enlist the public help in population-control efforts. Unfortunately, this resulted in illegal transport and release of wild hogs to new areas to create local, easily accessible hunting opportunities. Specifically, in Tennessee, wild hog populations were found in only six counties from the 1950s through the 1980s. In 1999, a statewide, year-round, no-limit hunting program was started to enlist the public in controlling wild hog expansion in the state. Still today, the population of wild hogs continues to grow in Tennessee, and numerous new populations have been established. Nearly 70 Tennessee counties had documented pockets of wild hogs by 2011 (Bevins et al., 2014).

Studies continued in 2014, and results consistently showed that hunting of wild hogs may have immediate local impacts, but do not contribute to reducing wild hog population growth in the long term (Mellish et al., 2014). As studies continued to be conducted in an effort to find a solution to the increasing wild hog population, a 2015 study conducted on reducing the spread of wildlife diseases showed that hunting has limitations in its ability to control wildlife populations. The effects of hunting wildlife are only temporary if population control is not sustained over time (Gortazar et al., 2015). Hunting continues to carry with it the belief by many that it is an inhumane means of population control. A 2015 study showed that only 6 percent of United States residents participated in hunting. However, the same study showed that 93 percent of United States residents reported being unconcerned with the welfare of deer, wild hogs, farmed pigs, chickens, wild turkey, and catfish. Based on the response percentages, concern for wild hogs and catfish were at the lowest end of the scale (Byrd & Widmar, 2015).

More research is needed to understand hunting as a means of controlling wild hog populations, especially in BISO. Little research has been done on wild hog control, and even less is available regarding controlling the wild hog population in BISO, especially in recent years as the population continues to grow. Therefore, this study was done to understand if hunting

is a viable management option in controlling wild hog populations in BISO.

Method

For the purpose of this study, and to find out whether hog hunting was a management solution that controls the wild hog population in BISO, the method used to obtain the needed data was conducted via phone surveys. The inclusion criterion was: 1) only adults, over the age of 18, with hog hunting permits for BISO could participate; 2) only the adults with their names on the hog hunting permits for BISO could answer questions over the phone; and 3) only those adults that marked their hog hunting application that they would allow someone to contact them about their hunting experience were to be contacted for the survey.

Researchers conducted the phone surveys at secured various locations, this enabled the researcher to have limited interruptions while conducting the survey. The survey administrator was a student from Eastern Kentucky University who was given training before administering the surveys. The administrator was given a script to ensure that the results gathered through the survey were not biased.

Any adult, over the age of 18, who obtained a hog hunting permit for BISO in the year 2014-2015 was contacted by phone using the phone number that the permit holder provided on the hog hunting permit application. The hog hunting permit provided a place for the applicant to check whether they would be willing to answer follow-up questions about their experience hunting wild hogs. There was also a place to check what time of day they would prefer a call, and a sample of potential questions was listed at the bottom of the application.

The applicants were contacted by phone and asked a series of pre-written questions that went along with the questions that were listed on the application. The survey typically took 5-10 minutes to complete. The answers were then recorded using a computer data entry program. If no one answered at the first call, then a note was made and at least two more attempts were made to contact the applicant. After that time, a "did not answer" was recorded.

Since the applicants knew from what was printed on their application that they had a choice to participate in the survey, it helped alleviate possible issues and rejected solicitations. The applicants willingly participated in the survey. By doing a phone survey, it was also less intimidating for the person being surveyed. They did not have to meet face-to-face, have a researcher in their home, or be inconvenienced in any way except to answer a few questions at their leisure.

A total of 260 hunters purchased hog permits for BISO during the 2014-2015 season. A total of $N = 173$ hunters at BISO agreed to be surveyed by phone sometime after their hunt. 7 hunters provided their contact information, but did not indicate whether they gave permission to be contacted for the survey. Therefore, they were included in the survey

respondent pool for a total of $N = 180$. In addition, a total of 79 permit holders did not provide contact numbers or otherwise elected to not be included in the phone survey and therefore, were removed from the sample. The adjusted sample was $N = 173$. The response rate for this survey was 37.57% ($N = 65$), but this number includes hunters with permits that did not go hunting. A total of 108 permit holders did not take the survey, due to various reasons such as: wrong number was printed on permit, or person was not home when called.

The entire process of contacting permit holders encompassed three weeks during the month of June, 2015. The survey questions approved by the Office of Management and Budget (OMB), and asked during the phone interview were:

1. Total days hunted?
2. Total hogs killed?
3. Sex of hog(s) killed?
4. Maximum length of hunt (days and hours option)?
5. Number of hog(s) seen per hunt?
6. Date of most recent hunt?
7. Area in which kill occurred (four options)?
8. Open section for qualitative comments.

Results

Basic frequency and descriptive analysis were conducted using SPSS 21. Results of the study on hog hunting as an adequate management solution for wild hog populations in BISO showed there were numerous signs wild hogs were in BISO. The majority of the hunters who responded to the survey (93.8%) reported hunting for hogs between 1 and 12 total days, with an average of 2.7 days on their last hunt. Further, a majority of those surveyed (89.2%) reported hunting between 1 and 24 hours, with an average of 8.93 hours on their last hunt. Most hunters surveyed spent over 8-10 hours (41%) on their longest hunts, with 7.2% reported 1-3 hours, 33.9% reporting at 4-8 hours, and 16.1% reported hunts lasting longer than 10 hours.

Table 1 – Total Kills Reported Per Hog Sex

Number of Kills Reported	Males	Females
1	2	1
2	0	4
3	2	0
5	0	1
8	0	0
15	1	1
Total Hogs Killed	23	29

Even with the amount of time recorded for hunting, the number of hogs being reported as killed was low, with 87.7% (N = 57) stating they had zero kills (Table 1). The findings show that 52 hogs in total were reported as killed, but one permit holder noted total kills at 30. Of those surveyed that reported the sex of the killed hogs, 23 hogs were said to be male and 29 hogs were said to be female.

Table 2 - Month of Most Recent Hunt

Month	Frequency
January	3
February	17
November	23
December	8
Year Round	56

Table 3 – BISO Areas Hog(s) Seen Count

Hogs Seen	Frequency	Total Hogs Seen
1-5	10	19
6-10	10	81
11-20	1	17
21-50	1	50
Total		167

Table 2 shows that 31 total hunters, A majority of hunters (N=31), reported hunting in BISO in November or December (Table 2) and twenty hunters reported that they went hunting in January or February. Only five hunters reported going hunting year round. There were three main areas where wild hogs were reported killed, Northern BISO, Central BISO, and Southern BISO. No hog killings were reported in the OBED area of BISO. The results show in Table 3 that the majority of hunters (60.8%) did not see any hogs while hunting in BISO. 39.2% (N = 22) of hunters reported seeing an average of 7.6 hogs during their time in BISO. 167 total hogs were seen during hunting trips in BISO.

Discussion

Based on the results of the collected data from the phone surveys of wild hog hunting permit holders in BISO, the majority of permit holders were unsuccessful in killing a wild hog. Many hogs were seen in BISO by a few individuals, as well as many signs of hog inhabitation, however, the majority of hunters did not see any hogs while in BISO. A total of 52 wild hogs were killed, with the majority of the hogs being killed in Northern Tennessee, which is the central region of BISO. The average hunter was in

BISO about 3 days a year, for about 9 hours at a time during late fall and most of the winter season. There was limited previous research on managing wild hog populations through hunting at BISO. Research had been done on managing wild hog populations in Europe via hunting, but there was a lack of information about the management of wild hogs in the United States and BISO specifically using this method. Therefore, more research will need to be done in the various areas of BISO so that natural resource managers will be able to make accurate decisions about how to properly manage wild hog population. With the information that was gathered from this study, the researchers are able to determine that there continues to be evidence of invasive wild hogs in BISO, and more research is needed to identify proper ways to handle the growing population of wild hogs.

The National Park Service is facing further damage to park land and possible spread of parasites and diseases to other animals in the park, as the wild hog population continues to expand throughout BISO. Hunting is one of the most cost efficient ways to kill wild hogs, however, it is time consuming and the numbers of hunters purchasing permits continues to decrease. The National Park Service will need to consider adding another method of controlling wild hog populations, perhaps in conjunction with hunting, in order to be more effective in maintaining control over the hog population. A longitudinal study may be necessary to properly analyze and understand the situation, and it is recommended that this study be repeated in the future.

Some limitations to the study were the amount of time that it took to call each hog permit holder, and the need to call some permit holders two or three times in order to reach them. Also, there was no definite way to know that the person answering questions over the phone was the actual one who used the permit. However, all the permit holders that were spoken to on the phone seemed willing to participate in the survey and were comfortable sharing answers. Therefore, a suggestion to help with future data collection time restraints is to group together all permits from similar time zones so that the survey administrator is better able to manage time when calling permit holders. Another limitation was the discrepancies in some of the data that was collected, such as misinterpretation of hours and days in regards to most recent hunt. In order to help with more accurate data collection in future, the wording of the survey questions can be simplified so that there is no confusion as to what information the question is asking for. In the future, the survey could ask total days hunted and average hours of hunting per trip. It is recommended that this study continue in the future, with modifications to allow more accurate data collection, so that the long-term trends and patterns related to wild hog hunting in BISO can be measured.

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