

# Hunter motivations and use of wild pigs in Texas, USA

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**Abstract:** Wild pigs (*Sus scrofa*) are a widespread exotic, invasive species that pose ecological, agricultural, and human health risks in their invaded range. Wildlife managers must manage wild pig abundance and range expansion to mitigate these risks. The diversity of stakeholders involved in the issue of wild pig management complicates efforts to manage the species, and, to be successful, wildlife professionals must consider the human dimensions associated with wild pig management. The prevalence of privately owned lands in Texas, USA necessitates cooperation to enact effective management policies. In this study, we investigate the impact of hunter motivations on wild pig harvest quantity. Motivations driving wild pig hunting are diverse. While the majority of wild pig hunters in Texas are motivated by trophy value, meat-motivated hunters harvest more wild pigs per day afield. Wildlife managers should develop plans that include various management techniques to control wild pig population growth and damage. Education and outreach will continue to be important for involving private landowners in effective wild pig management.

**Key words:** big game, feral hogs, hunting, invasive species, motivations, *Sus scrofa*, Texas, wild pigs

**HUNTERS ARE** primary benefactors of wildlife management efforts in the United States, generating funds for conservation through the purchase of hunting licenses and the payment of taxes under the Federal Aid in Wildlife Restoration Act of 1937 (Pittman-Robertson Act; Mahoney 2009). Nevertheless, only 11% of Americans participate in hunting, and the number of hunters nationwide has steadily declined since 1980 (Brown et al. 2000, U.S. Fish and Wildlife Service and U.S. Census Bureau 2016). Individual hunters often pursue multiple satisfactions based on personally valued motivational aspects of their hunt (Decker and Purdy 1988, Bissell et al. 1998, Gigliotti et al. 2000). Hunters may value and be motivated by different aspects of a hunt, such as the number of animals harvested, the perceived availability of trophy animals, the presence or absence of

other hunters, or, simply, time spent in nature (Decker and Purdy 1988).

Hunting has long been considered both a tool for wildlife management and a benefit of successful wildlife management programs. However, as Brown et al. (2000) predicted, many game animals that were traditionally managed in the context of low population densities are now overabundant in some areas of their range. Further, hunters who are motivated by trophy value, which places incentive to allow animals to reach older ages and only harvest relatively few, may not harvest animals important in population management efforts (Brown et al. 2000). The management of wild pigs (*Sus scrofa*) in their invaded range illustrates a similar paradox in which wild pigs may be a desirable hunting quarry, but management is often necessary to mitigate ecological

and agricultural damage caused by the species (Rollins et al. 2007).

The issue of wild pigs in Texas, USA provides an opportunity to investigate hunter motivations for participating in hunting activities involving an exotic, invasive animal. Recognized as the largest wild pig population in the United States (Mayer 2014), despite continued efforts by various organizations to control wild pig population abundance and range expansion, the species is now found in all but 1 county in Texas (Timmons et al. 2012, Bevins et al. 2014, Snow et al. 2017, U.S. Department of Agriculture [USDA] 2018). Due to legal ownership of wild pigs by landowners (Texas Administrative Code 2019), this species provides a year-round resource for hunting with no harvest limits (Timmons et al. 2011). Because wild pigs act as both a pest and a resource in the state, hunters may participate in wild pig hunting activities for multiple reasons, and differing motivations may impact their harvest success. As wild pigs cause an estimated \$25 million in losses and medical expenses each year to Texas livestock production, landowners and managers often employ management-focused hunting in an attempt to reduce wild pig abundance and mitigate damage (Higginbotham et al. 2008, Timmons et al. 2012, Anderson et al. 2019). However, the maintenance of wild pig populations for recreational, meat, and trophy hunting use may foster greater wild pig abundance and broader spread of the species. Wildlife managers and decision makers must understand wild pig hunters' motivations and harvest success to assess their impacts on wild pig management efforts in the state. An optimal management program for wild pigs should strike a balance between the damages caused by the species and the benefits generated by maintaining populations for hunting use and market sale (Zivin et al. 2000).

Although a critical need for effective management, existing research on wild pig use and management in Texas is restricted to landowners, land managers, and pesticide applicator license holders at Texas A&M AgriLife Extension Service educational seminars (Adams et al. 2006, Kubecka 2016). Further, data are limited in geographic extent and may not be representative of diverse publics within the state. In particular, comprehensive knowledge of

hunter attitudes and motivations on the subject of wild pigs is not available (Beasley et al. 2018). Given that hunters are a highly engaged stakeholder group that can present significant barriers to wild pig management when motivated to do so, wildlife managers must better understand the motivations of wild pig hunters to create durable, effective management solutions. Effective and well received management plans for the species should rely on sound wild pig population or damage management methods while reasonably accommodating the values of various stakeholder groups, including wild pig hunters.

In this study, we analyzed wild pig hunter motivations to generate a greater understanding of the impact of those motivations on effort and wild pig harvest in Texas. Specifically, our research objectives were to (1) categorize and describe wild pig hunters by their motivational attributes, and (2) compare hunter effort and wild pig take among these motivational groups. This study concludes with a discussion of the implications for those seeking to manage wild pig abundance in the context of recreational harvest.

## Methods

This study was reviewed by Texas A&M University Institutional Review Board and determined to meet the criteria for exemption (IRB ID: IRB2018-1219M). We developed the online version of the Texas A&M Human Dimensions of Wild Pigs Survey questionnaire using Qualtrics Survey Software (Provo, Utah, USA). We also developed a paper version of the questionnaire to mirror the online version as closely as possible to accommodate respondents with limited internet access or technological proficiency (Appendix 1). The questionnaire contained 79 items, although instructions directed respondents to answer only the items applicable to them.

Our sample was comprised of all Texas hunting license holders above the age of 18 who provided an email address ( $n = 169,619$ ), representing 15.3% of total non-youth Texas hunting license sales in 2018 ( $n = 1,106,625$ ). Our sample also included a randomly selected subset of 2,615 licensed Texas hunters who did not provide an email address. We acquired mail and email contact information for all Texas hunting

license holders in 2018 from the Texas Parks and Wildlife Department (TPWD). Following Dillman’s tailored design method (Dillman et al. 2008), we contacted potential respondents through both email and physical mail. Members of the email sample group received an email invitation to participate in the online survey on June 4, 2019. We sent reminder email messages to email group non-respondents 3 and 5 days after the initial invitation (June 7 and June 10, 2019). We contacted physical mail group sample members through an invitation letter sent on June 5, 2019. We followed the invitation letter with a reminder postcard to 1,000 randomly selected mail group non-respondents 21 days later on June 26, 2019. The survey remained open for response submissions from both email and mail respondents until August 13, 2019.

The survey asked respondents to answer items related to their hunting activity, landownership status, attitudes toward and knowledge about wild pigs in Texas, several demographic variables, and their area of residence. We developed a relational database to organize and manage response data using FileMaker Pro Advanced 17 (Claris International Inc., Cupertino, California, USA). We manually entered paper survey responses into the database as we received the completed survey packets. We downloaded electronic response data to the database on August 13, 2019 for cleaning and analyses, and we conducted data analyses in Program R (R Development Core Team 2018).

### Data analyses

We asked respondents to rank the animals they hunted most often in Texas and used these responses to identify hunters who participated in wild pig hunting. Our survey measured respondents’ motivations for wild pig hunting by asking respondents to rate the level of importance to them of 5 different reasons for hunting wild pigs (e.g., “meat,” “recreation”). Response options ranged from 1, representing a reason that was “not at all important” to the respondent, to 5, representing a reason that was “very important” to the respondent (Appendix 1, item 3). Respondents that indicated they hunt wild pigs reported the number of days they spent hunting wild pigs and the number of wild pigs they harvested in 2018 (Appendix 1, items 4 and 5). Responses to these items supported

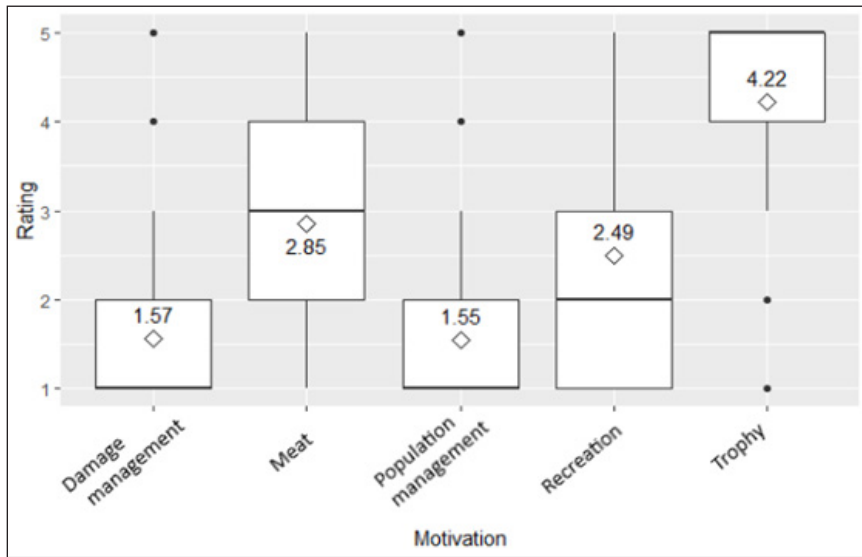
our calculation of the number of wild pigs each hunter harvested per day spent afield in 2018. To control for respondent over-reporting and reporting errors, we removed responses that exceeded the 99th percentile of wild pig harvest and days spent afield for wild pig (Appendix 1, items 4 and 5). We then removed all incomplete responses from analysis.

We analyzed wild pig hunters’ responses to the motivational categories using k-means cluster analysis methods, then identified an optimal number of clusters in the data using elbow and silhouette methods. This approach clustered hunters into groups based on their responses to the motivational items and described the groups based on the group average responses to each item. We created a negative binomial regression model to compare the differences in wild pig harvest among hunters in different motivational groups. We included an interaction term between motivational group and the number of days spent afield hunting wild pigs to control for variation in days afield between motivational groups. We conducted a chi-square test on the estimated marginal means of wild pig hunter harvest numbers in each motivational group and followed with a Tukey test to detect differences between the groups.

## Results

### Survey response

We contacted 159,420 licensed hunters through email and 2,494 through conventional mail methods (total  $n = 161,914$ ). We received 37,225 total responses to the survey for a combined response rate of 23.0%. Participants in the email contact group responded at the rate of 23.2% to the survey, while 7.1% of those in the conventional mail group responded. We intended to test for mode bias; however, low response rates within the conventional mail group prevented us from conducting meaningful comparisons between the 2 groups. Overall, non-response was high but not unexpected given declining response rates to surveys over time (Connelly et al. 2003). Of all survey respondents, 93.6% indicated they hunted in Texas ( $n = 34,827$ ); 77.8% of those who identified themselves as hunters also indicated they hunt wild pigs ( $n = 27,100$ ). Trophy value was the highest rated motivation among Texas hunters, and population management was the lowest rated



**Figure 1.** Motivation ratings among licensed wild pig (*Sus scrofa*) hunters displayed in a box plot. Mean ratings labelled and represented by a diamond. Black dots represent outliers in the data.

(Figure 1). After removing outliers and incomplete records, 21,031 complete responses from wild pig hunters were available for use in further analysis.

Although we did not conduct a formal non-response bias analysis due to logistical constraints due to large sample size, we regressed several key items (items 1, 2, 31, and 73 in Appendix 1) on the number of days to response as an indicator for potential non-response bias. While responses were different by the number of days to response ( $P < 0.05$ ), effect sizes were small ( $r^2 = 0.0003$ ). We therefore assumed no significant effect of non-response bias and that results could be generalized to the target population (Lindner et al. 2001).

### Cluster analysis

Elbow and silhouette cluster identification tests indicated that 6 clusters existed within the data. We used k-means cluster analysis to categorize respondents into 1 of 6 clusters. We calculated the mean response for each motivational item within each cluster (Table 1). We defined and described each cluster group based on the mean response to each motivational item by hunters within each group.

All groups demonstrated multiple motivations for hunting wild pigs, and motivations overlapped among most groups. We charac-

terize these according to the most strongly reported motivation(s) within each group, recognizing no single motivation characterized each group. Group 1 represents wild pig management hunters. Hunters in this group placed a moderately high level of importance on managing wild pig population numbers and wild pig damage as well as hunting for trophy animals. Group 2 represents trophy hunters. Hunters in this group assigned a high level of importance to wild pig trophy hunting and a low level of importance to all other provided reasons for wild pig hunting. Group 3 represents recreational trophy hunters. Hunters in this group also assigned a high level of importance to hunting for trophy animals, but unlike those in group 2, they also assigned moderately high importance to hunting for recreational purposes. Group 4 represents non-recreationally motivated, use-based hunters. Hunters in this group placed high levels of importance on hunting for both trophies and meat, but they placed relatively little importance on hunting for recreation and population and damage management. Group 5 represents recreational, use-based hunters. Hunters in this group assigned high levels of importance to hunting wild pigs for meat, trophies, and recreational purposes. Group 6 represents low-motivation, use-based hunters. Hunters in this group did not assign a

**Table 1.** Mean rating of each motivational category<sup>a</sup> by group.

Group no.	Group	Mean motivation rating					<i>n</i>
		Meat	Trophy	Recreation	Population management	Damage management	
1	Management hunters	2.0	3.9	2.1	3.6	3.7	2,901
2	Trophy hunters	2.0	4.6	1.6	1.3	1.3	5,268
3	Recreational trophy hunters	2.1	4.7	3.7	1.4	1.3	4,301
4	Non-recreational use-based hunters	4.6	4.4	2.1	1.2	1.2	5,522
5	Recreational use-based hunters	4.4	4.8	4.6	1.1	1.1	2,730
6	Low-motivation use-based hunters	1.0	2.4	1.7	1.4	1.4	3,273

<sup>a</sup>Motivational categories based on responses to item 3 in Appendix 1.

**Table 2.** Wild pigs (*Sus scrofa*) harvested and days afield in 2018 per hunter within each motivational group.

Group no.	Group	<i>n</i> <sup>a</sup>	Wild pigs harvested			Days afield		
			Mean	SD	Median	Mean	SD	Median
1	Management hunters	2,591	6.8	20.8	2.0	13.5	28.2	5.0
2	Trophy hunters	3,208	16.4	47.7	5.0	17.6	33.0	8.0
3	Recreational trophy hunters	3,673	17.9	50.5	5.0	36.8	58.9	10.0
4	Non-recreational use-based hunters	2,970	13.4	42.8	4.0	20.2	38.6	10.0
5	Recreational use-based hunters	3,971	10.5	32.8	3.0	18.6	39.7	7.0
6	Low-motivation use-based hunters	4,618	9.6	29.0	3.0	15.6	30.0	7.0

<sup>a</sup>Total number of hunters within each group who provided a valid response to both items 4 and 5 in Appendix 1.

high level of importance to any of the provided reasons for hunting wild pigs, though they indicated somewhat higher levels of importance for hunting for meat and trophies.

### Differences between groups

We calculated the estimated marginal means for the annual take of wild pigs for hunters within each group (Table 2). A chi-square test indicated differences in wild pig harvest between motivational groups when days afield are held constant ( $df = 5$ ;  $SD = 681.5$ ; residual  $df = 20,961$ ; residual deviance = 24,002;  $P < 0.001$ ). The average number of wild pigs harvested per hunter varied between each motivational group when controlling for days afield (Table 3). Tukey post-hoc tests indicated that, when controlling for days afield, differences in wild pig harvest exist

between all motivational groups except between groups 2 and 3 and groups 4 and 5 (Table 4).

### Discussion

Texas wild pig hunters illustrate the wide diversity of motivations among a single subset of a much broader stakeholder group, Texas hunters. Among licensed Texas wild pig hunters, our analysis identified 6 unique motivational groups, offering some insight into why wild pigs have become, and remain, popular hunting quarry in the state. Our work demonstrates that single-motivation categorization schemes do not apply to the wild pig hunter in Texas; the motivations of these hunters are complex and must be treated as a multivariate concept. Further, nearly all groups demonstrated considerable overlap in motivations,



**Table 3.** Wild pigs (*Sus scrofa*) harvested per hunter within each group, controlled by days afield<sup>a</sup>.

Group no.	Group	Wild pigs harvested			
		Mean	SE	LCL <sup>b</sup>	UCL <sup>b</sup>
1	Management hunters	5.5	0.14	5.2	5.8
2	Trophy hunters	7.4	0.13	7.1	7.6
3	Recreational trophy hunters	7.4	0.15	7.1	7.7
4	Non-recreational use-based hunters	10.4	0.18	10.0	10.7
5	Recreational use-based hunters	10.9	0.28	10.4	11.5
6	Low-motivation use-based hunters	8.2	0.18	7.8	8.5

<sup>a</sup>Wild pig harvest estimated per hunter within each group at a constant value of 17.7 days afield.

<sup>b</sup>LCL: lower confidence limit; UCL: upper confidence limit.

**Table 4.** Tukey post-hoc comparisons of wild pig (*Sus scrofa*) harvest between groups<sup>a</sup>.

Group no.	Contrast	Ratio	SE	z ratio	P-value
1 / 2	Management hunters / Trophy hunters	0.75	0.02	-9.27	<0.001
1 / 3	Management hunters / Recreational trophy hunters	0.75	0.02	-8.98	<0.001
1 / 4	Management hunters / Non-recreational use-based hunters	0.53	0.16	-20.50	<0.001
1 / 5	Management hunters / Recreational use-based hunters	0.51	0.18	-18.79	<0.001
1 / 6	Management hunters / Low-motivation use-based hunters	0.68	0.02	-11.52	<0.001
2 / 3	Trophy hunters / Recreational trophy hunters	1.00	0.03	-0.08	1.00
2 / 4	Trophy hunters / Non-recreational use-based hunters	0.71	0.02	-13.62	<0.001
2 / 5	Trophy hunters / Recreational use-based hunters	0.68	0.02	-12.42	<0.001
2 / 6	Trophy hunters / Low-motivation use-based hunters	0.90	0.03	-3.51	0.006
3 / 4	Recreational trophy hunters / Non-recreational use-based hunters	0.71	0.02	-12.75	<0.001
3 / 5	Recreational trophy hunters / Recreational use-based hunters	0.68	0.02	-11.89	<0.001
3 / 6	Recreational trophy hunters / Low-motivation use-based hunters	0.91	0.03	-3.28	0.013
4 / 5	Non-recreational use-based hunters / Recreational use-based hunters	0.95	0.03	-1.62	0.585
4 / 6	Non-recreational use-based hunters / Low-motivation use-based hunters	1.27	0.04	8.49	<0.001
5 / 6	Recreational use-based hunters / Low-motivation use-based hunters	1.34	0.05	8.51	<0.001

<sup>a</sup>Wild pig harvest estimated per hunter within each group at a constant value of 17.7 days afield.

suggesting that motivations stretch along a continuum rather than within stark categories. To consider wild pig hunters as contributors to conservation goals, wildlife managers should develop an understanding of the motivations that underlie each group.

Only management hunters (group 1; Table 1)

reported high motivations to remove wild pigs for the purpose of abating damages or reducing abundance or range of the species. The diverse, moderately valued motivations of this group exemplify the complex nature of wild pig hunting. Interestingly, no other group demonstrated strong, overlapping motivation to take

wild pigs for management purposes, regardless of harvest levels. Further, hunters within 4 motivational groups held high trophy-oriented motivations for participating in wild pig hunting activities. This revealed the ancillary value of trophies taken while pursuing other motivations to hunt wild pigs, including meat and recreation. Trophy hunters (group 2; Table 1) were strongly motivated by trophy value and did not hold a strong motivation for any other factor. Recreational trophy hunters (group 3; Table 1) were strongly motivated by trophy value but also held moderate motivation for recreational value, interpreted as the recreational pursuit of quarry as well as time afield. Although one might be tempted to cast both trophy and recreational trophy hunters as stereotyped trophy hunters, we must consider that management hunters, trophy hunters, and recreational hunters each report similar, moderate values for wild pig meat-hunting motivation, indicating that use of wild pigs for meat was not insignificant among hunters more strongly motivated by management, trophies, or recreation.

Hunters typically cast as “meat hunters” are represented in 2 groups in our study (groups 4 and 5; Table 1). Both use-based hunter groups displayed strong motivations to hunt for meat and trophy value yet were distinguished by differences in recreational motivations. Recreational use-based hunters held high recreational motivations (group 5; Table 1) while non-recreational use-based hunters did not (group 4; Table 1). Within these groups, interestingly, meat was only marginally more highly ranked than trophy motivations. Finally, low-motivation, use-based hunters (group 6; Table 1) held overall low motivations for participating in wild pig hunting activities and held only slighter higher motivations for trophy value.

Wild pig harvest differed significantly among these groups, as did hunter effort, measured in days afield. When controlling for hunter effort, trophy and recreational trophy hunters (groups 2 and 3; Table 1) harvested significantly fewer wild pigs than non-recreational and recreational use-based hunters (groups 4 and 5; Table 1), who reported high levels of motivation to hunt for both meat and trophies (Table 3). Generally, primarily trophy-motivated hunters harvest game more selectively and spend more time seeking animals that meet trophy

desirability—typically larger, male individuals with antlers, horns, or tusks (Festa-Bianchet and Lee 2009). Thus, trophy-motivated hunters may be expected to selectively harvest larger, male wild pigs. Hunters selectively harvesting mature males fail to reduce recruitment rates within species exhibiting polygynous mating habits (Milner et al. 2007). As wild pigs can begin breeding as early as 6 months of age (Taylor 2003), trophy-motivated hunters may fail to harvest young, female wild pigs that are important reproductive units in the population. Conversely, young female wild pigs are often desirable quarry for hunters highly motivated by the ability to use the meat of wild pigs. As our motivational groups demonstrated diverse interests in addition to the desire to take trophies, we cannot assume that this dynamic will apply to wild pigs as it has in native wildlife.

A closer examination of the use-based hunters (groups 4 and 5; Table 1), who hold high motivations for both meat and trophy, yields they harvest significantly more wild pigs than do hunters in any other group when controlling for effort (Tables 3 and 4). Interestingly, we did not identify a group that was significantly and primarily motivated to harvest solely for meat use. The diverse uses of wild pigs by meat-oriented hunters lends credence to the assertion that Texas wild pig hunter groups pursue their quarry for diverse reasons. Trophy and recreational trophy hunters (groups 2 and 3; Table 1) and use-based hunters (groups 4 and 5; Table 1) represent a progression along the continuum of hunter motivations. Our results suggest that meat-motivated wild pig hunters may remove more wild pigs from the landscape than those motivated more strongly by trophy, recreation, or even management factors (e.g., groups 1–3; Table 1). Ryan and Shaw (2011) note that, even when wild game meat is not less expensive to procure than commercially available meat, hunters may value it for reasons beyond subsistence needs. Peterson et al. (2009) explain that cultural and social norms may be strong motivators for meat hunters. We posit that wild pig hunters motivated by meat harvest opportunity may value the ability to provide food for their families from local sources or non-commercial environments or may simply engage in cultural traditions that surround hunting, whether wild pigs are the primary or ancillary quarry.

However, as Holsman and Petchenik (2006) explain, hunters may impose personal limitations on harvest to not exceed personal abilities to use this resource. These personal harvest thresholds can create de facto harvest limits below regulator allowance, or even where none exist, due purely to strong beliefs about the ethics of wanton waste. This ethic is a basic, underlying principle of most modern hunters pursuing native wildlife and may present challenges when attempting to rely on hunter take of wild pigs to achieve reductions in wild pig abundance. As none of our motivational groups demonstrated single-motivation orientations to either trophy or meat take, it is possible the diverse motivational underpinnings of wild pig hunter groups will avoid such personal harvest limitations. Those interested in increasing take of wild pigs to achieve conservation goals should work to avoid either selective harvest for trophy characteristics or limitations based on personal meat use.

Wildlife managers may expect management-motivated hunters (group 1), unfettered by personal harvest limitations or the desire to selectively target trophy animals, to be more effective in wild pig population reduction. However, management-motivated hunters harvested significantly fewer wild pigs than hunters in any other group (Tables 3 and 4). Notably, hunters in this group harvested 67.6% fewer wild pigs than low-motivation hunters (group 6) who spent the same number of days afield. While seemingly counterintuitive, it is possible the individuals in Texas who harvested greater numbers of wild pigs for management purposes in 2018 may not have been licensed hunters, as take of wild pigs solely to manage damage caused by the species did not require a hunting license and these individuals would not have been included in our sample. In this context, group 1 may represent hunters motivated to harvest wild pigs for management reasons ancillary to their trophy value rather than individuals solely removing wild pigs as a damage management activity.

Private citizen harvest of native wildlife has traditionally been a large part of wildlife management. In Texas, both wild pigs and white-tailed deer (*Odocoileus virginianus*) are popular quarry among licensed hunters. In white-tailed deer management, hunters both generate fund-

ing for and actively participate in the management and research of white-tailed deer populations (Hewitt 2015). White-tailed deer hunters spearheaded early conservation efforts that supported the species' population growth, and they continue to foster responsible hunting cultures to maintain those populations for continued hunting use. Like wild pig populations, white-tailed deer populations have become overabundant in many areas due largely to the success of those early conservation programs and selective hunter harvest focused on mature bucks, thereby necessitating changes in hunting culture and activities to reduce their abundance. Efforts to increase doe harvest effectively involve white-tailed deer hunters in these management programs. While encouraging doe harvest among white-tailed deer hunters was initially challenging, educational efforts and incentives for antlerless deer harvest have successfully engaged hunters to help manage these overabundant populations (Hewitt 2015). However, wild pigs are a much more prolific species and require intensive, constant harvest pressure to manage population growth (Timmons et al. 2012). Further, as they are not managed under any regulatory construct, there are no incentive-based management options available as in white-tailed deer management to encourage hunters to harvest more wild pigs. Rather, unlimited year-round wild pig harvest opportunity in Texas incentivizes the expansion and persistence of wild pig populations for their continued use (Zivin et al. 2000). Similarly, wild pig range expansion in the United States is largely associated with human translocations (Caudell et al. 2016). The human-aided spread of invasive wild pigs to new areas for hunting purposes poses a challenge for wildlife managers, who must disincentivize the introduction and spread of invasive and ecologically dangerous species.

Intensive efforts to control wild pigs could engender conflict among hunters and managers, given the level of harvest needed to effect population-level change. Landowners and hunters on private lands must be key participants in broad scale efforts to reduce wild pig abundance and range in Texas due to the extensive private land ownership in the state. Those seeking to manage wild pig damage, range expansion, and abundance on private lands must look critically at the



influence of wild pig hunting and how they may actively shape hunter habits to aid management efforts in the future. We recommend fostering a culture among all hunters that encourages the removal of wild pigs to benefit conservation. We acknowledge the inherent complexities implicit in this statement. An ideal type of wild pig hunter may identify the ethical obligation to remove wild pigs for population management and damage mitigation that benefits conservation of natural resources, agriculture, and human health and safety as their primary hunting motivation. Thus, ideal wild pig hunters may fulfil meat, trophy, and recreation motivations secondarily to actively participating in management solutions. An ideal wild pig hunting culture values conservation goals and seeks to achieve them through a complete, diverse use of their quarry. This ideal bears some resemblance to the conservation-oriented hunting culture for overabundant native wildlife to manage populations within carrying capacity of habitats. The two diverge in that hunters pursuing wild pigs seek to achieve conservation benefits to native wildlife through the active removal of wild pigs.

We posit that hunting alone cannot solve the wild pig problem. Hunting alone has been largely ineffective at broadscale wild pig reduction in Texas, as hunters are unable to remove adequate numbers of wild pigs to reduce abundance even when incentivized by a bounty program (Ditchkoff et al. 2017). Successful wild pig management efforts should follow integrated pest management approaches by using multiple lethal wild pig management activities, including trapping and professional gunning as well as extensive fencing (Seward et al. 2004, McCann and Garcelon 2008, Parkes et al. 2010). Ultimately, managers must achieve landscape-scale removal of wild pigs using various methods if they seek long-term abatement of ecological and agricultural damages due to wild pigs.

## Conclusions

This study represents an attempt to understand the relationships between hunter motivation, effort, and harvest success among Texas wild pig hunters. We describe a variety of motivational factors driving participation in wild pig hunting activities. We found that wild pig harvest differs significantly among motivational groups yet does not follow traditional single-

motivation paradigms often ascribed to groups of hunters. Thus, those seeking to use hunter harvest to manage wild pigs, especially on private lands, must further examine the forces that drive hunters to remove wild pigs, and more importantly, those that limit their take or give incentive to maintain wild pig populations. Given that the wild pig population in Texas continues to grow in abundance and range, despite widespread hunting of the species over the last several decades, one may conclude that hunting alone is not effective in wild pig population management efforts in Texas. Rather than reliance on hunter harvest alone, those concerned with the effects of wild pigs on natural resources, agriculture, and human health and safety should work to both increase the adoption of diverse management methods to remove more wild pigs while fostering a hunter culture that supports the conservation goal of widespread removal of wild pigs. More detailed information on hunter wild pig harvest, including age and sex ratios, is necessary to better understand the current population-level impact of recreational, meat, and trophy hunters on wild pig populations in their invaded range. Findings from this study serve to inform and improve management efforts for wild pigs in areas where they are valued as hunting quarry yet pose risks ecological systems, agricultural production, and human health.

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## Appendix

Appendix 1 can be viewed as a supplemental file download at <https://digitalcommons.usu.edu/hwi/vol15/iss1/10>.

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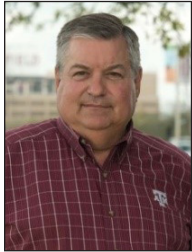


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