

Dear Reviews and Editors,

Thank you for the opportunities to address your feedback in our manuscript. We have revised our manuscripts and addressed your concerns. Please find our responses below:

Reviewer Comments:

Reviewer 1

Comment from Reviewer: This paper addresses an interesting topic—active management, in an interesting geographic area—parts of Oklahoma where cedar is reforesting previously prairie or pasture lands.

Response from Authors: We appreciate that you find value in our research in the field of “active management of ecosystem” as well as in Oklahoma where ecosystem is rapidly changing towards closed canopy forests.

Comment from Reviewer: Theoretically, it provides an interesting comparison of the Theory of Planned Behavior and the Theory of Reasoned Action, while also investigating the addition of moral norms to these models. The resulting comparative analyses are quite interesting and help us understand how different elements of these models influence behavior through extensive statistical analysis. I do think the theoretical comparisons are interesting, and the paper may help refine other research projects that use one or more of these theories.

Response from Authors: Our goal through this paper is to advance these two theories, broaden the applicability of these theories in wildlife management research, and help future researchers to guide their research. We believe that our research adds value and advances these two theories and. We sincerely appreciate you for realizing the positive contribution of our research in this field.

Comment from Reviewer: I note that, as primarily a qualitative researcher, I am unable to adequately evaluate the soundness of the statistical analyses.

Response from Authors: We have presented Model fit statistics of models in Table 3. All fit indicators show that our model is statistically sound. Further we have followed standard Structural equation model procedure suggested by Anderson and David (1988). Therefore, we have a reasonable belief that our analysis is robust.

Comment from Reviewer: From a practical standpoint, the extensive statistical analyses provide limited new understandings of landowner behavior. None of the findings are particularly novel, in terms of past research on forest landowner behavior. This is not necessarily a deficiency in and of itself, although it may make the paper, as now written, of greater interest to those using the theories than those working with landowners.

Response from Authors: We appreciate your feedback and an opportunity to clarify the novelty of our research. Our efforts are focused on advancing these theories with respect to landownership realities in the forestland-grassland ecotone of Oklahoma. The founder of these theories suggested advancing theories by adding additional attributes such as moral norms (Ajzen, 1991). As we have highlighted in the last paragraph of the revised manuscript (line 378-380), none of the past research, to the best of our knowledge, has explored the interrelationship between landowner’s perceived ability to manage their land, past experiences, family and peer pressure, and moral values concerning their intentions towards active management.

Given the reviewer’s comment concerning novelty, we have provided novel management implications of our findings in the revised manuscript. Since landowner behavior is among the most widely studied area of forest economics after Faustmann, it may sound reasonable that there is nothing left to study on landowner behavior (Amacher et al. 2003). Amacher et al. (2003) concluded, this is far from true because the empirical investigations of theoretical models provide new insights that contribute to the existing body of knowledge. Accordingly, we are testing the importance of attitudes, behavior control, and moral norms on landowner

behavioral intentions in the grassland-forestland ecotone, where active forest management needs to act on socially-influenced motivations rather than direct financial incentives coming from timber sales.

The grassland-forestland ecotone provides a unique context for landowner behavior because the region is facing the severity of woody plant encroachment and the cost-effective active management tool such as a prescribed fire has yet to receive broader social acceptance. Deer habitat management is a reasonable motivation for landowners to conduct any form of active forest management in this region.

Our research found that landowners have several positive motivations (positive peer and family pressure, positive feelings about active management, and positive perceived ability to manage). Negative relationship between attitudes and intentions, however, suggests that landowners negative experience such as financial burden, degraded habitat quality, redcedar encroachment from past and current land management practices might have demotivated landowners to invest in active management. These findings uniquely reflect the reality of grassland-forestland ecotone where landowners feel that timber-oriented forest management requires active management tools such as thinning, prescribed fire, or herbicide applications. We have added these practical findings to the revised manuscript. Please see our revision in line 349-357.

Ajzen, I., 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Process* 50, 179-211.

Comment from Reviewer: In terms of the survey, sample size calibration and the underlying information are inadequate. We know that 2500 surveys were mailed, but not how many were returned as undeliverable. These numbers should all be in the two paragraphs that span pages 11 and 12, and the response rate should be clearly stated. 508 completed surveys put the response rate around 20%, which is on the low side for forest owner surveys (which typically exceed 35%). This may improve if undeliverable surveys were subtracted from the 2500 mailed out.

Response from Authors: Thank you. While we acknowledge that our response rate is below that of similar studies (Caplenor et al. 2017, Riley and Decker 2000b, Zajac et al. 2012). A trend of declining response rates that has been observed in other studies over the last 30 years. Our response rate is still comparable to natural resource social science research. For instance, Joshi and Arano (2009) reported a 20% usable response rate in their survey conducted among forest landowners in West Virginia. Aguilar (2008) reported 19% of adjusted response rate in his survey. Mehmood et al. (2003) received a 13% response rate in their survey conducted in Alabama. Thompson and Hansen (2012) reported 15.9% of the response rate in their survey amongst NIPF landowner in the US. Pokherel et al. received 20% response rate in their survey of forest mill owners in southern United States.

Nonetheless, following reviewer advice, we added “undeliverable” information and response rate in the manuscript as below: “The survey was then bulk mailed to 2,500 randomly selected Oklahoma landowners out of which, 16 were unable to participate because of missing address, deceased, refused to participate, and no longer managing land reducing total sample to 2,484.” A total of 508 responses, a response rate of 20.45%, were obtained after the second round of the survey. (Line 137-139)

Likewise, we have added that “Socio-demographics of our survey respondents are similar to average family forest landowners in Oklahoma, although the numbers are not directly comparable as we limited our sample pool to those having 160 acres. Likewise, there was no statistical difference in socio-demographics between early and late respondents, which is a commonly used method for non-response bias analysis (Joshi et al. 2019). Nonetheless, our response rate is less than desirable, causing some concern for non-response bias”. Please see our revisions line 361 - 366.

Comment from Reviewer: Furthermore, at the top of page 12, it is stated that the results were compared with the NWOS, but no results of this comparison are presented. This comparison should be briefly summarized or not mentioned.

Response from Authors: We agree. We have now made a brief statement comparing our results with the NWOS database. Of note, NWOS data suggest that average age of landowners having 10+ acres of forestland in Oklahoma was 66 years and that about 53% had college degree and 24% were minorities. To this end, our results are similar to average family forest landowners in Oklahoma although the numbers are not directly comparable as we limited our sample pool to those having 160 acres. Please see our revision in line 142-145 and line 206-208.

Comment from Reviewer: On page 16 I was a little surprised to see the word “wilderness” included in one of the questions, since I think few would characterize medium-sized, managed private lands as wilderness. This likely cannot be changed now, although it might be worth thinking about how this may have been interpreted by respondents.

Response from Authors: Good point. In the revised manuscript, we have acknowledged that “In one of the statements defining attitude, we asked respondent to reveal whether they are satisfied with the wilderness of forest, rangeland and deer habitat. Although the very high value of Cronbach’s alpha (0.87) suggests that the landowner responses to this statement were mostly consistent with other statements, landowners may not characterize medium-sized, managed private land as wilderness”. Please see our revisions in line 363-366.

Comment from Reviewer: There are numerous contradictions and things to sort out in the results and discussion. On page 18, it is said that 65% of landowners stated that they were satisfied with the overall characteristics of their forest and rangelands, and only 13% were not satisfied with the number of deer and wildlife observed based on their management effort overall characteristics of the forest and rangeland they manage. (Yet on page 29, it is said that “Many landowners were not satisfied with the characteristics of their forest and rangeland, the number of deer and wildlife observed ...” This seems unsupported by the earlier numbers.)

Response from Authors: Thanks. Following reviewer comments, we divided these statements into positive (strongly agree or agree), Neutral, and negative (strongly disagree or disagree). We agree that sentence “many landowners....” was confusing. Accordingly, we have revised the sentence as “Still, more than one-third of landowners were not satisfied with the characteristics of their forest and rangeland, the number of deer and wildlife observed, and the overall benefit they are receiving from their property”.

Comment from Reviewer: Interestingly, there was strong support for active management (76% thought it was needed, and 73% thought it would bring economic and environmental benefits; p 29), yet on page 31 it is said that landowners are not satisfied with management results.

Response from Authors: The undertone behind the above verbiage was to capture the negative rating (strongly disagree or disagree) expressed by more than 1/3 survey respondents. This issue has now been addressed in the revised manuscript.

Comment from Reviewer: Not contradictory, but interesting—it appears that active management is not producing desirable results. This all suggests a fairly high level of current satisfaction that perhaps may not leave much room for further action, action that is not believed to produce satisfactory benefits. Next, while restoring fire regimes may be ecologically desirable (page 28), it is not clear how much landowner interest there is in this. This should be discussed. Most of the social variables line up well to support active management, with risk and cost seemingly the main obstacles. What is the relationship of moral norms to cost?

Response from Authors: The relationship between moral norms and the behavior intent to invest more in superior wildlife habitats is positive. We have added this in the paragraph where practical implications are added.

Comment from Reviewer: This seems to be the key element that needs to be balanced and should be discussed. What I take from all this is: (1) landowners do not necessarily have a problem with their land

management and wildlife situations; (2) there is landowner and social support for active management; (3) active management does not produce desired results and is both risky and expensive. This more clearly points us toward extension and outreach approaches that the current discussion.

Response from Authors: This is an excellent summary of our findings. We have paraphrased these findings now in the second last paragraph of the manuscript as below (line 400 - 404).

“In summary, landowners are generally appreciative of active management, which is further supported by their family and peers. However, landowners seemed to be content with the existing conditions of wildlife habitats and do not see a need for additional investments. Although, the management cost associated with active management can be in part offset through hunting leases; improved deer habitat through active management could motivate deer hunters to pay more money per acre as a lease fee”.

Comment from Reviewer: Theoretically, among the models, “TRA was best supported by [the] data,” (Page 29). But the paper claims to have “broadened the scope of wildlife management research through the inclusion of moral norms,” (Page 30). That may be true, but should we include them in future research? All these issues seem to contain some contradictions that are not discussed in the paper. This should be sorted out. Despite these issues, the discussions of the various aspects of the models are interesting and something we can learn from. Given the modest practical results and more interesting theoretical aspects of this research, it would seem important to add a discussion of the theories to both the discussion and conclusions (rather than saying this is beyond the scope of this paper—page 30).

Response from Authors: Thanks, and we appreciate the opportunity to clarify this sentence. The sentence in the previous submission seemed to limit the scope of our work, which clearly was not our intention. As we pointed out earlier, the theoretical contribution of our study is primarily focused on exploring the role of moral norms in the traditional realm of TBP and TRA. Therefore, we meant to recommend that future studies should explore the similarly mediating role of socio-demographic attributes. Accordingly, we have now revised this sentence.

Reviewer 2

General

Comment from Reviewer: I believe that the word “however” was frequent throughout the article and in some sections (such as Introduction lines 27-28) the word was used when it was not necessary.

Response from Authors: Thank you, addressed thoroughly.

Comment from Reviewer: I would be careful with having too many acronyms throughout the paper, there seems to be quite a few and I had to refer up to the introduction section throughout reading.

Response from Authors: We agree that there are quite a few acronyms throughout the paper. This was because there are four models in the paper that have their own components. Unfortunately, there is no easy solution as removing acronyms from manuscripts would also make model names too long. Nonetheless, we changed ERC to redcedar throughout the manuscript, which will help with the overall readability.

Abstract (pg 4)

Comment from Reviewer: Lines 7-9: I would suggest either changing the sentence to state “which creates” or “and create suitable habitat”

Response from Authors: Corrected, thank you.

Introduction (pg 6-7)

Comment from Reviewer: Lines 43-44: What are landowners positive about? Positive attitudes/feelings/perceptions/etc, please specify

Response from Authors: Thank you. Deleted “positive about” and replaced “supportive of”.

Comment from Reviewer: Lines 45-46: I would suggest that you specify what region you are talking about in this section

Response from Authors: Corrected, thank you.

Comment from Reviewer: Lines 58-60: Please change to “No previous studies”, make study plural

Response from Authors: Corrected, thank you.

Methods (pg 7-14)

Comment from Reviewer: -I would be careful with flipping between the acronyms for the two theories—

Response from Authors: Thanks for a careful look at this section. We noticed that there were some typos in the previous submission, which is corrected.

Comment from Reviewer: I found that I had to refer to the introduction section multiple times, so I suggest either defining them again in this section or just removing the acronyms and writing them out fully.

Response from Authors: Thank you. Following your advice, we have now added defined acronyms in the title of section 2.1. We hope that it will help with the overall readability of this manuscript.

Comment from Reviewer: Clear and concise definitions for the different types of beliefs

Response from Authors: Thank you. We agree that some definitions became unclear during paraphrasing. Nonetheless, we have now thoroughly edited these definitions and provided more clarity now. Please see our revision in line 116-121.

Comment from Reviewer: -Lines 110-111: This phrasing feels a bit awkward and does not flow. I would suggest a sentence such as “Randomly selected landowners were each sent two rounds of surveys....”

Response from Authors: Corrected, thank you.

Comment from Reviewer: -Lines 110-111: Also, I am a bit confused. Is this Dillman 5-point contact? If so, make sure you list the survey mailing order in the correct order.

Response from Authors: Excellent comment. Yes, we meant 5-point contacts. However, we slightly modified Total Design Method (TDM) recommendations. We skipped the first one (i.e., pre-notice letter), but other four contact points recommended in TDM were followed. We have now revised our manuscript to this effect.

Comment from Reviewer: -Lines 112-113: This sentence reads a bit awkward; I suggest rewording this sentence

Response from Authors: Rephrased, thank you.

Results (pg 14-27)

Comment from Reviewer: -Lines 171-178: I would be interested in seeing how your sample demographic is similar/different from the National Woodland Owners Survey Database

Response from Authors: Thanks. Following your and another reviewer’s advice, we have now compared the socio-demographic results of our survey with those of NWOS. Please see our revisions in line 206-208.

Comment from Reviewer: -Lines 192-210: Don’t need the results in both the table and listed out in sentences

Response from Authors: We agree that directly repeating results from tables won’t give any additional information. Therefore, we have now deleted the table showing the distribution of landowner responses to the observed variables. Also, we have now revised some of the socio-demographic information to compare our findings with those coming from the NWOS survey. Although description of structural variables and associated factor loading is a standard practice in SEM-based research.

Discussion (pg 28-30)

Comment from Reviewer: Lines 302-303: Please change to “active management.”

Response from Authors: Corrected, thank you.

Comment from Reviewer: Lines 301-305: Don't need the results in both the table and listed out in sentences. Also, shouldn't these results be in the results section?

Response from Authors: Thanks. Following reviewer advice, we have now deleted these sentences.

Comment from Reviewer: Lines 306-308: Please change to "Addressing associated risk, liability issues, and financial burdens...."

Response from Authors: Corrected, thank you.

Comment from Reviewer: Lines 308-309: Please change to "...liability issues."

Response from Authors: Corrected, thank you.

Comment from Reviewer: Lines 324-326: I would change 'SEM and broadened the scope of wildlife management' to "SEM which broaden the scope of wildlife management"

Response from Authors: Corrected, thank you.

Conclusion and Management Implications

Comment from Reviewer: Lines 339-343: Change "a financial burden" to "financial burdens"

Response from Authors: Corrected, thank you.

Figures

Comment from Reviewer: Figure 4 seems to be a bit off in the full manuscript--in the document titled Figures it seems to be appropriate--double check figures in manuscript please.

Response from Authors: Fixed, thank you. We have attached an additional file of figures only as well.