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| Section | Comment | Response |
| Objective | The heading and subheadings of this section could be clearer. Suggest calling the whole section "Introduction" and splitting into "Context" and "Objectives" subsections. | We renamed the section and the headings as proposed in review. |
| Part 1: Technical Approach | Overall, the experimental design and associated sampling design are well structured and succinctly described. | Thank you for this feedback. |
| Part 1: Technical Approach | However, given Obj. #1 (effects of climate), I expected to see climate variables featured explicitly in the description of sites \*and\* in the results. However, there does not appear to be any explicit quantification of such variables. | We added a “Climate Data” section to the Technical Approach:  “*We selected DoD installations spanning a climate gradient across the southeastern U.S. to provide a range of climate conditions for modeling relationships between climate factors and tick-borne disease risk under current and future climate. To characterize this climate gradient, we retrieved daily climate data (1980-present) for each installation from the Daymet dataset (Thornton et al. 2016; <https://daymet.ornl.gov/>), which provides daily values for maximum and minimum temperature, precipitation, solar radiation, vapor pressure, and day length, at a 1 km x 1 km resolution. Values were extracted using the R package ‘daymetr’ and then summarized to annual averages to illustrate the climatic variation and gradient of the study region. We are exploring currently the influence of these climate factors on tick abundance, host abundance, vegetation, and prescribed fire management. The exploration of these relationships includes testing different variable aggregations (e.g., annual vs. seasonal averages, days above or below threshold values, etc.).*”  We added to the section “Installation and plot visits” under Results and Discussion 1) a figure illustrating annual averages for temperature, rainfall, solar radiation and vapor pressure at each installation from 1980-2018 based on Daymet data; and 2) text describing these data at the installation level: “*Annual averages of climate variables at the selected installations illustrate the climate gradient across which sampling has occurred (Figure 11). Climate values indicate some interannual variation within installations across factors, though limited for precipitation. The spatial resolution of Daymet data results in small or no difference in values between plots at the same installation, so these data do not capture the “local” microclimate conditions that are influenced by vegetation cover and more directly affect tick survival (see section 2B). Temperature followed an expected latitudinal gradient with the highest average maximum temperatures at Avon Park AFR, the southernmost installation, and lower average maximum temperatures at the northernmost installations in Georgia (Fort Gordon) and South Carolina (Fort Jackson). We do not find an effect thus far of these climate variables on the prescription of fire management at these installations. The temporal scale may be too long and a mismatch with more contemporary factors driving prescribed fire management decisions. Our current results indicate that fire management (i.e. fire frequency) is primarily determined by characteristics of the installation, which would include factors that aren’t climate or weather related, such as preferred management methods, personnel for prescribed fire, and budgetary differences. We are exploring other ways of aggregating these climate data (e.g. seasonally and using threshold values) that may reveal how environmental conditions have affected fire management.*” |
| Part 1: Results and Discussion | Glad to see iNaturalist was leveraged.  However, assuming that this was a 'collateral' or opportunistic product of the work (based on the iNaturalist description and methods not appearing in the "Technical Approach section) with no formal relationship with the stated objectives:  1. It would add clarity to state/explain this 'collateral' role more explicitly.  2. strange to have it sandwiched between other sections reporting formal results of the study.  Also: Minor issue (typo?) "Research grade" observations are described but then the term "research grade" seems to be applied to statistics about a species count rather than observations. Some minor changes could add clarity here. | 1. We added clarifications regarding the role of the iNaturalist project.  “*In order to improve confidence and consistency in plant identifications, we created an iNaturalist [project](https://www.inaturalist.org/projects/serdp-species) (Figure 7) to enable easy reference in the field for identifying species that were not flowering and would have required a taxonomic key.*”  2. We moved the description of the iNaturalist project into the methods section following “ground cover and litter data collection” where we describe understory species identifications.  Minor issue: We clarified the sections that refer to research grade:  “*Species identifications in iNaturalist may be tagged as “Research Grade” when the specimen was observed in the wild, includes a relatively accurate location and date, and the identification is supported by at least two members of the community. During our field surveys, we identified over 270 species and currently ~50% of these observations have become certified as “Research Grade.” In the cases of rare and protected species, such as pitcher plants, we either excluded coordinates or included coordinates that were imprecise (resolution reduced to approximately 1500 m) using functions built into the iNaturalist application. The “Research Grade” observations are accessible by other databases such as the Global Biodiversity Information Facility, which is used for analyzing species distributions, so a collateral benefit of this effort will be the availability of important data to other members of the scientific community.*” |
| Part 1: Results and Discussion | This section doesn't include much interpretation or discussion--perhaps the plan is to work this up only for the final report?  Additional (even if cursory) data interpretation and discussion comments would help the reader understand what the PIs feel are important conclusions from the various results shared. | Yes, we intend to provide most interpretation and discussion of results in the final report. However, we made revisions here to provide interpretation and further highlight some of the results we expect to be most interesting. Added text highlighted below.  “Installation and plot visits” section: “*With relatively few invaded plots sampled at this stage it is important to interpret comparisons between cogongrass-invaded and -uninvaded areas with caution.*”  “Trees and shrubs” section: “*Plots with low overstory tree and shrub density are likely to be less hospitable for ticks because incoming solar radiation reaches the ground and herbaceous layer resulting in higher temperatures. Fewer trees and shrubs also results in less buildup of litter that can provide refuge for ticks from high temperatures and low humidity.*”  “Understory herbaceous cover and species” section: “*Herbaceous vegetation cover may play an important role in regulating near-ground microclimate conditions that are experienced by ticks. Greater cover may provide more hospitable conditions that enhance tick survival.*”  “Litter cover, mass, and moisture content” section: “*Litter moisture depends on the prevailing weather conditions, so these results must be interpreted within the context of our sampling time in the southeastern U.S. (June - October), when vegetation and litter can dry very rapidly even following rainfall. Litter moisture was predominantly <50% across all samples (Figure 17c), and, given the daily variation that can occur in litter moisture, the lack of relationship between our point estimate of moisture content and years since last fire is unsurprising.*”  “Host abundances” section: “*All of these host species may influence tick abundances and the risk of exposure to tick-borne pathogens, but via different pathways as either hosts for different life stages of ticks or reservoirs for infectious agents. White-tailed deer and eastern cottontail rabbits are important hosts for nymph and adult life-stage A. americanum and both host species may serve as reservoirs for zoonotic diseases that threaten human health (Allan et al. 2010b). Though encountered at low relative abundance in our surveys, feral hogs (Sus scrofa) also are hosts for multiple tick species and reservoirs for tick-borne pathogens (Allan et al. 2001). Dung from domestic cattle were the only domesticated host species encountered in our surveys and are interesting hosts for their potential negative effect on tick abundances. Cattle typically are treated with topical acaricides to prevent ticks from feeding and, if present in sufficient densities, can reduce environmental tick abundance (Keesing et al. 2018).”*  “Tick abundances” section: “*Among the lowest tick abundance observed for both sample years was at Avon Park AFR, which may be partly attributable to habitat management resulting in poor microclimates for ticks at this installation which also experiences the highest temperatures (Figure 11). An additional factor that may contribute to the low tick abundance at Avon Park AFR is the presence of cattle likely treated with acaricide.*”  Added a Summary to the end of the Results and Discussion: “*From data collected and analyzed thus far, fire management appears to be the strongest determinant of tick abundances in southeast pine habitats, with fewer ticks observed from more recently burned plots. The relationships between litter biomass and tick abundance and litter biomass and time since last fire also suggest there are both direct and indirect effects of prescribed fire management. Prescribed fires can directly reduce overall tick abundance through the destruction of ticks during fires. Fires also have an indirect effect by reducing the amount of litter and vegetation cover, which provide ticks with a daily refuge from inhospitable conditions. Thus far we have detected no large-scale effects of climate variables on relationships between fire management, vegetation characteristics, and tick abundances. We have explored effects of long-term averages (30- and 15-years) and the coefficient of variation of the annual averages over these time periods for maximum and minimum temperature, and annual totals for precipitation. None of these aggregated variables had a statistically significant effect on tick abundances, host abundances, vegetation metrics, or time since fire. It may not be surprising that long-term aggregations of values did not explain much variation in tick or host abundances in these areas that are predominantly under intense management; management may be the driving factor and overrides any climate signal. In the same vein, the ability to apply prescribed fire depends on a complex combination of factors including current weather conditions that determine whether a fire falls within the prescription and can be conducted that day. Among these factors are relative humidity, smoke dispersion (wind speeds and atmospheric mixing), precipitation, and air temperature. We are currently working on aggregating variables in different combinations, such as seasonally and days per year that are potentially acceptable “burn days,” in order to link weather conditions to fire frequency and use this relationship to make projections under future climate scenarios. In current models of fire frequency, the installation accounts for the greatest amount of variation, which is indicative in part of the logistical capacity of an installation to use prescribed fire as a management technique. For example, we learned from communications with land managers that Fort Benning, one of the larger and busier installations in our study, maintains nearly every management unit on an 18- to 36-month fire return cycle and is equally capable of conducting prescribed fires during the dormant or growing season. In comparison, Moody AFB, the smallest installation, has a small natural resources management staff and are limited to conducting dormant season burns.”* |
| Part 2A: Experimental Design: Experimental Apparatus | Confusing: description of FABIO in first sentence describes a piece of equipment; in second sentence it is referred to as "experimental fires". | We revised this sentence to be clearer about referring to the small scale apparatus and not to experimental fires:  “*The small-scale (1 m2) experimental apparatus enabled repeated fires and measurements of fire characteristics across multiple fuel loads without the onerous task of establishing all experimental plots prior to a large-scale prescribed fire.*” |
| Part 2A: Experimental Design | The statement:  "We qualitatively compared the statistically modeled relationships of the measurements recorded during the five experimental fires using the FABIO with the average values of the seven locations that we measured during the prescribed fire."  ...is confusing because:  1. it comes under the heading "Statistical Analyses"; and  2. the nature of the qualitative comparison indicated needs further elaboration to be understood and to link to the associated discussion in the Results and Discussion section. | We revised the sentence to be clearer about the importance of the prescribed fire for comparison to our small scale fires, and added additional information about this comparison in the discussion:  “*In order to compare measurements from our small scale fires to fires in natural settings, we visually compared average values from the seven locations where we recorded measurements during the prescribed fire to the statistically modeled relationships of the measurements recorded during the experimental fires using the FABIO.*”  “*However, in comparison to the fires with both fuel structures combined, which is more representative of natural fuel conditions for cogongrass, the relationship from the experimental fires using piled fuel likely isn’t representative of fires in natural settings. Therefore, experiments that manipulate fuel loads with disregard to vertical fuel structure may produce inaccurate predictions of the ecological effects of fire due to inaccurate estimates of how fuel loads affect fire temperatures and residence time (Fernandes and Cruz 2012).*”  “*When the interest is in the ecological effects of fire, reconstruction of natural fuel structure is paramount in bridging the gap between field studies and laboratory flammability assessments (Fernandes and Cruz 2012). By controlling for standing fuel structure, our device provides a more realistic substitute for full-scale experimental fires.*” |
| Part 2A: Title, Technical Approach, and Results and Discussion | The title and the discussion comment here that the FABIO apparatus "may improve scaling small-scale fire experiments" imply that the focus of this section is on improving methods for measuring fire intensity. However:  1. This objective is not included in the list of objectives in the "Objective" section.  2. The technical approach does not provide any comparison with other methods--so does not inform this question.  The presentation of results focuses on the relationship between fuel characteristics and fire intensity and height.  \*\*Recommend revising the title to be consistent with stated objective 2A and removing or revising discussion of methodological improvements to avoid the implication that this work demonstrates methodological improvements in recreating or measuring fire characteristics more than anecdotally. | 1. Due to the importance of measuring the impact of invasive cogongrass on fire dynamics in southeast pine habitats, we added experimental measurement of fire characteristics as a specific objective in the list of objectives:  “*2) Conduct field experiments to determine the A) effect of fuel structure on fire temperature and residence time of invasive cogongrass, including relationships between fuel load, flame height, and fire intensity…*”  2. We provided a conceptual figure that illustrates how our methodology bridges the gap between laboratory (flammability) studies and outdoor large-scale field studies (see Fig. 25).  We revised the title to be more consistent with the new objective #2 and clarify that this is a new methodological approach to measuring fire characteristics while maintaining vertical fuel structure.  New title: “*An experimental method for testing the effects of fuel structure on fire temperature and residence time*” |
| Part 2A: Results and Discussion | "We demonstrated our methodology with cogongrass, a widespread and problematic invader in the Southeast USA, and report the most ...accurate measurements to date..."  This statement is not supported by experimental design (i.e. no counterfactual) or sufficient citations. | We reorganized this section to include a paragraph that describes other research efforts to quantify maximum temperature of cogongrass fires under different methodologies and how our results compare to these findings.  “*To date, most reports on the effects of cogongrass on fire behavior in the USA have been qualitative. Only one peer-reviewed study we are aware of has compared temperatures from cogongrass fires to native vegetation fires in the same landscape (Lippincott 2000). They reported a maximum temperature of 458ºC in a cogongrass fuel bed versus 318ºC in native vegetation using temperature-indicating paints. Maximum temperatures >260ºC at 91 cm above ground level were reported by Enloe et al. (2013), also using temperature-indicating paint. In comparison, the highest maximum temperature we estimated was 985ºC at 50 cm above ground level. In addition to maximum temperature, we report the first estimates of temperature residence time for fires where cogongrass is the dominant fuel. Interestingly, the temperature residence time from our experimental fires with standing fuels was similar to that of the prescribed fire in a native long leaf pine ecosystem within the same range of fuel loads. This similarity suggests that the negative impacts of cogongrass via effects on fire behavior in the Southeast USA is driven by the higher fuel loads it generates compared to native vegetation.*” |
| Part 2B | Acknowledging that the underlying experiment here is a work in progress, the structure of the approach here is focused and concise.  Ultimately, unless additional work is able to discern a meaningful relationship between cogongrass and host densities, the potential secondary relationships and cycles here should be presented as requiring further study. | We revised this section of the manuscript to be clearer that these relationships should be viewed as possibilities and that future work is needed to determine these relationships.  “*This research may reveal an additional mechanism by which plant invasion may alter tick abundance by directly impacting tick survival. However, potential indirect effects of plant invasion on tick abundance include changes in host density. The combined understanding of these direct and indirect effects will allow us to determine the net outcome for changes in tick-borne disease risk. While further study is needed to determine these relationships, we propose a list of possible scenarios of the potential impacts on tick abundance given an increase in tick survival (Figure 36).*” |
| Part 3 | I feel this part especially would benefit from a concise but informative introduction that sets out some of the known context for the experiments and results presented including:  --expected tick diversity and occurrence at different sites referencing documented range of different species  --basic known relationships between tick spp. and associated TBAs  --expected TBA diversity and occurrence in different tick spp. and perhaps at different sites based on documented associations and ranges | We added the following introduction:  “*Several of the most rapidly emerging vector-borne diseases in the U.S. are caused by zoonotic pathogens transmitted by the lone star tick (Amblyomma americanum), including Ehrlichia chaffeensis and E. ewingii, both agents of ehrlichiosis, Rickettsia rickettsii, the agent of Rocky Mountain spotted fever (Stromdahl et al. 2011), and Francisella tularensis, the agent of tularemia (Childs & Paddock 2003). Amblyomma americanum is distributed broadly across the southeastern U.S. and along the eastern seaboard; in the southeastern U.S. it is the primary vector of TBDs to humans (Demma et al. 2005). Also occurring in the southeastern U.S. is the gulf coast tick (Amblyomma maculatum), an important vector of R. parkeri, the American dog tick (Dermacentor variabilis), an important vector of R. rickettsii, and the brown dog tick (Rhipicephalus sanguineus), a species capable of transmitting a variety of pathogens particularly affecting canids (Demma et al. 2005). The black-legged tick (Ixodes scapularis), vector of Borrelia burgdorferi, the causative agent of Lyme disease, also occurs in this region. However, this species is considerably less important in the southeastern U.S. as a disease vector, and is not efficiently sampled via carbon dioxide-baited traps. While several studies have assessed the distribution of some tick-borne agents (TBAs) in the species mentioned above across portions of the southeastern U.S. (e.g. Mixson et al. 2006), there has been no comprehensive analysis of field-collected tick specimens for all known TBAs due to the lack of an effective system for performing such an analysis. Here, we describe the development of a system using Fluidigm Access Array combined with Illumina HiSeq to analyze all nymph and adult life stage ticks collected in this study for an unprecedented diversity of TBAs that imperil human, domestic animal and wildlife health.*” |
| Part 3: Results and Discussion | (either here or in some sort of intro): Since a key part of this section relates to imperilment of humans and wildlife, it would be good to include some statements about the relative risk to these groups (at least humans and perhaps selected wildlife spp.) from some or all of the ticks and/or TBAs expected and found to be present in these areas and how much (hypothetically if necessary), densities of ticks might correlate with risk of disease or mortality. | We added a “*Summary and Interpretation of Preliminary Results*” subsection, where we include the following interpretations of our findings to date:  “*Our preliminary results indicate a high diversity but low prevalence of human pathogens, suggesting that entomological exposure risk will be more strongly driven by tick abundance than tick infection rates. However, several important pathogens have been detected thus far that may cause serious morbidity or mortality in humans, including E. ewingii (a causative agent of ehrlichiosis), A. phagocytophilum (a causative agent of anaplasmosis), and R. parkeri (a causative agent of rickettsiosis). We also detect a surprisingly high prevalence of “E. muris subsp. eauclairensis subsp. nov.” in A. americanum, which thus far has been reported only in I. scapularis, and likely is an important emerging agent of ehrlichiosis in humans. Finally, among potential human pathogens, as expected we detect a high prevalence of R. amblyommatis in A. americanum, although this TBA likely only causes disease in humans rarely despite presumably high exposure rates. We also detect a high prevalence of wildlife pathogens, such as Theileria spp., and as expected a very high prevalence of non-pathogenic endosymbionts such as the Coxiella endosymbiont of A. americanum.*”  We will include precise estimates of exposure risk for each installation in the Final Report once all pathogen analysis is completed and final metrics of exposure risk may be calculated. |
| Part 4: Overall | I found the overall storyline of this section hard to follow. While there are many important insights, I think the section would benefit by better organization of 1. the objectives of this section (there are many explicit and implicit that are not included in the "Objective" section of the report), 2. Technical approach (generally structured so that a reader can understand what parts of the modeling work correspond with specific objectives, and 3. Results and discussion (which again should be structured so that results can be associated with specific objectives and discussion related to specific results).  Additionally, I was surprised (both in this section and others) to find little if any discussion of the current and potential future climate context of the various sites (bases) from which data were collected. Since there are many stated and implied management implications of this work overall, it seems that some discussion of the contrasting contexts and futures of the different bases should be an important parts of discussion. | **I found the overall storyline of this section hard to follow. While there are many important insights, I think the section would benefit by better organization of 1. the objectives of this section (there are many explicit and implicit that are not included in the "Objective" section of the report.**  *We added a separate and more explicit “Objectives” subsection which divides our modeling objectives into more identifiable tasks. We refer back to these listed sub-objectives throughout the Technical Approach and Results and Discussion.*  *“****Modeling Objectives***  *The fourth objective of this project is to model how vegetation will respond to future climate scenarios, fire, management, and invasion, and to connect these projections to our understanding of the environmental controls of tick abundance and TBD risk (vegetation, climate, fire), in order to connect future climate scenarios and management decisions to ticks and TBD outcomes. Modeling future vegetation in the southeastern U.S. under different climate, fire, management, and invasion scenarios requires the development of new tools and techniques. To organize how each development contributes to our ultimate goal, we subdivide this task into six sub-objectives. Specifically, because the possible number of scenarios to consider under all factorial combinations of native vegetation, invasive vegetation, climate, management, and fire is exceedingly large (both to produce and understand), we approach the problem by adding each factor incrementally, analyzing the key dimensions of ecosystem response and sensitivity, and then carrying forward a reduced set of scenarios when adding the next factor.*  *4 A) Analyze ED2 projections for southeastern pine forests under different climate scenarios*  *4 B) Develop and validate cogongrass Plant Functional Type (PFT)*  *4 C) Use ED2 to explore different invasion & climate scenarios*  *4 D) Couple ED2 to a more advanced fire model and run ED2 under different fire scenarios*  *4 E) Upgrade the representation of management techniques in ED2 and test effects on forests, invasion, fire, and climate*  *4 F) Produce an interactive tool for land managers to interactively explore effects.”*    **2. Technical approach (generally structured so that a reader can understand what parts of the modeling work correspond with specific objectives,**  In addition to in-text references to specific sub-objectives, we added sub-objectives into our heading titles.  “*Objective 4 A: Southern Pine Forest Under Different Climate Scenarios*”  “*Objectives 4 B & 4 C: Cogongrass Plant Functional Type Development and Analysis*”  *“Objectives 4 D & 4 E: Representation of Disturbance (4 D) and Management (4 E) in ED2”*  *“Objective 4 F: Produce an Interactive Tool for Land Managers to Interactively Explore Effects”*  **3. Results and discussion (which again should be structured so that results can be associated with specific objectives and discussion related to specific results).**  Like above, we changed the Results and Discussion section to include headings matching those in the Technical Approach section. As in the Technical Approach, we also referred to the sub-objectives in line.  **I found the overall storyline of this section hard to follow. While there are many important insights, I think the section would benefit by better organization**  We additionally attempted to address this comment by paring down text in the Technical Approach & Results for section “Objectives 4 D & 4 E: Representation of Disturbance (4 D) and Management (4 E) in ED2” to make our narrative cleaner. We cut two figures, a table, and reduced the text by about 60%, Because a published paper exists documenting our work, we attempted to summarize and highlight how this paper fit into project objectives.   **Additionally, I was surprised (both in this section and others) to find little if any discussion of the current and potential future climate context of the various sites (bases) from which data were collected. Since there are many stated and implied management implications of this work overall, it seems that some discussion of the contrasting contexts and futures of the different bases should be an important parts of discussion**  As described above, we added a figure and text to the Technical Approach in Part 1 to better characterize the variation in climate across the installations sampled in this project. Additionally, here we added a figure (Figure 39) that plots future meteorological scenarios used to drive ED2 when simulating future pine forests, and we describe the parametrization of cogongrass PFT in ED2 using data collected from Avon Park AFR. Because we have not yet run ED2 incorporating data specific to all of the installations, including Daymet climate data and field-collected environmental data, we will reserve further discussion of the contrasting contexts of the different sites for the Final Report. |
| Overall | This study can provide managers with specific, defensible tools to better manage DoD properties to benefit natural communities and reduce disease risk to humans and wildlife.  Tightening the organization of the technical approaches and current (interim) data will increase the clarity of this important work and provide 1) provide managers in the areas included in the study and 2) managers in other areas with related conditions with more actionable information upon which to base management actions. | We appreciate the feedback and hope that the many changes and additions made to this new version of the Interim Report will so benefit land managers in the areas included in the study and in other areas with related conditions. |