Examining Incentives for Landowners to Use Preventative Measures Against Wildfires Through an Experimental Game

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ABSTRACT

There are ever increasing risks and costs of wildfires in the southeastern United Sates due to many climate, environmental, and human factors (Wear & Greis. 2013). These risks and costs correspond with the potential benefits of prescribed burns and other preventative measures. In the southeastern United States, the majority of forest area is privately owned and private landowners implementing a prescribed burn can greatly reduce the risk of a catastrophic wildfire from occurring or spreading. To explore what sort of policy would be effective at encouraging increased use of prescribed fire, an experimental game was developed that considered three policy interventions: providing perfect information about landowners' decisions to all landowners, providing a 50% cost subsidy for prescribed burns, and a combination of these two polices. Preliminary results show that the information treatment was not effective at promoting prescribed burn use, but providing a subsidy was effective at promoting prescribed burn use. The combination of policies did not increase prescribed burn usage relative to providing only a subsidy.

INTRODUCTION

Wildfires are dangerous and potentially destructive phenomena. Wildfires in the southeastern United States and the rest of the world are becoming a bigger threat due to global warming and the expansion of human development into more wildfire prone territories. The southeast's natural environment, weather conditions, and human movements put it at great risk for wildfires (Wear & Greis. 2013). With this increased danger there is also an increased need for fire prevention. There are many possible prevention methods that can decrease the risk of catastrophic wildfires. Among the most prominent methods of wildfire prevention are prescribed burns (Cudmore, 2008). Implementing a prescribed burn should effectively reduce the risk of a catastrophic wildfire from occurring or spreading in the short term, and if they are implemented at regular intervals can be a long-term solution to reducing the risk of wildfires (Brose and Wade, 2002).

In the southeastern United States, the majority of forest area is privately owned by non-corporate entities (Oswalt, et al. 2014). This means that private landowners' cooperation in implementing preventative measures such as prescribed burns is key for preventing forest fires in the southeastern United States. A private landowner's decision to implement preventative measures protects not only their own land but also their neighbors' land and decreases the potential public costs of fire suppression (Mercer, 2000). There is a possibility that such preventative measures are being underutilized because of the external benefits of implementation that are not received by the landowners themselves. There are few policies currently in place regarding preventive forest management. A new policy may be necessary as evidence suggests that prescribed burns will need to be increased as conditions worsen (Wear & Greis, 2013). If preventative measures such as prescribed burning are being underutilized, then the effect of a policy that increases the rate of prescribed burns would also increase social welfare. To correct for this externality and improve resilience against wildfires in the southeastern United States, it is important to examine what tools can be used by policy makers to increase the number of prescribed burns being performed. One way to accomplish this goal is through an experimental game designed to test the effectiveness of information and subsidies that promote landowners' use of prescribed burns in a virtual setting.

Risk and Costs of Wildfires in the Southeastern United States

The southeastern United States is at high risk for wildfires, and there are many conditions that increase this risk. According to the Southern Forest Futures Project Technical Report (Wear & Greis, 2013), the spring and fall wildfire seasons are expected to increase in length and severity. One important condition that is contributing to this is the climate and weather changes in the southeastern United States. Models that predict changes in climate indicate that there will be increases in the seasonal severity rating of fire in North America as a whole, and in the southeastern United States, a model predicts a 30% increase in this rating (Dale, et al. 2001). This is due to factors such as increased temperatures and more variable rainfall frequency leading to dry periods making fire more frequent and severe. Climate change also increases fire risk in several more indirect ways. For example, these dry periods weaken a forest's health and defense against disease and insect infestation. Occurrences of disease and insect infestation increase the amount of dead material which can become fuel for future fires.

Another factor that increases risk for wildfires is the composition of the southeastern United States wildlands and vegetation. The southeast's wildlands and vegetation are such that they can lead to wildfires burning at extremely high intensities (Wear & Greis, 2013). This vegetation is part of an ecosystem that has evolved with wildfires occurring periodically, and fire is a crucial part of the southwestern ecosystem (Lafon, 2010). However, the lack of natural fires, partially due to past fire suppression efforts, has led to this vegetation building up, which in turn can lead to devastating large-scale wildfires (Wear & Greis, 2013). Compounding this risk is the increase of invasive plant species in the southeastern United States. This increase in invasive plants is having an impact on the natural occurrences and spread of fire in the region and can increase the risk and intensity of wildfires even further (Brooks, et al. 2004) (Wear & Greis, 2013).

Humans are another factor that increases the risk of wildfires. The majority of wildfires in the southeastern United States are caused by humans (Wear & Greis, 2013). In recent years more and more human settlements are intermingling with the southeast's wildlands (Karels, 2022). The areas where this is happening is called the wildland-urban interface, and the populations of each of the southeastern states living within the wildland-urban interface range from 30% to 80%. This increases the risk of human-caused fires and puts an ever-increasing amount of people and property at a much higher risk for fire damage.

The cost of wildfires in the southeastern United States is also high. There are many types of costs that are caused by wildfires, which include damage to property and businesses, fire suppression costs, health costs, and ecosystem damage. One example is the timber industry. More timber is produced in the southeast than all of the other regions in the U.S. combined, and the timber industry is particularly vulnerable to wildfire (Howard & Liang, 2019). According to a report by Mercer et al. (2000), detailing the economic effects of catastrophic wildfires, the largest portion of costs (about 69%) from a wildfire in the southeast came from losses for timberland owners. Losses to the tourism industry made up the second largest portion of costs. If the frequency and intensity of wildfires in the southeast increase, then the losses of property and industries can also be expected to increase.

The direct public cost incurred by the response and suppression of wildfires has already been increasing. The average annual federal costs for the suppression of fires that started in the past 15 years is around 2 billion dollars (NIFC, 2021). This is around 133% higher than the previous 15-year average. In the southeast, it has been predicted that if the frequency and intensity of wildfires increase as projected, the local ability to respond to and suppress fires will soon be overwhelmed (Wear & Greis, 2013).

The health costs of fires can also be very significant. As more and more people begin living in the wildland-urban interface there will be a corresponding rise in health costs associated both directly with wildfires and indirectly through the worsening of air quality. Outside of direct deaths and injuries due to wildfires, research indicates that wildfires are likely responsible for increases in a large number of health issues which include all-cause mortality, respiratory morbidity, and worsening conditions of asthma, chronic obstructive pulmonary disease, and infections (Cascio, 2017). Research done on the health impacts of wildfires estimated that the yearly economic health costs of short-term exposure to adverse air quality in the United States was between $11 and $20 billion dollars, while the costs of long-term exposure was between $76 and $139 billion dollars (Fann, et al. 2017). Certain populations such as children, the elderly, those who are pregnant, and those with preexisting conditions such as chronic lung disease and heart disease are more susceptible to indirect damage to their health from wildfires (Cascio, 2017). When taking these factors into consideration, research shows that the southeast appears to be the most at risk area in the United States for health issues caused by wildfires.

Catastrophic wildfires can also cause large amounts of damage to the environment. The southeast's ecosystem has adapted to low-level wildfires which benefit the ecosystem (Lafon, 2010). However, higher intensity, catastrophic wildfires will damage the environment through soil erosion, water contamination, air pollution, and a loss of biomass (Chen, 2006). The damage to the environment is much harder to quantify than other types of damage, yet it can still be very impactful.

Preventive Measures for Wildfires

The increased risk and high cost of wildfires indicate a need for increased preventative measures to reduce their risk and cost. There are two main types of measures that help prevent catastrophic fires. One involves the thinning of trees underbrush and debris removal, and the other type involves prescribed burns (Cudmore, 2008). Both thinning and prescribed burning can reduce wildfire occurrences and severity, but research shows that prescribes burning is generally the most cost effective and provides additional ecosystem benefits to environments that have adapted to some amount of wildfires (Wear & Greis. 2013). Additional evidence suggests that a combination of methods can also be effective (Cudmore, 2008).

In southeastern United States over half of all forest land is privately owned (Oswalt, et al. 2014). This means that landowners in the southeastern United States have the potential to greatly reduce the risk of wildfires within the state by using preventative measures that include prescribed burns. The benefits of implementing such measures are widespread. Taking preventative measures on one's own land would not only reduce the risk of fire on their land but would also reduce the risk of a wildfire spreading from their land to their neighbor's land. Their actions would also reduce the potential costs of fire suppression taken on by the public. These excess benefits consisting of reduced risk to neighbors and costs to the public create the potential for a positive externality regarding wildfire prevention performed by private forest landowners and it suggests that a less than optimal number of preventative measures may be undertaken by these landowners. If this is the case, then the current policy in southeastern United States regarding prescribed burns could be revised to internalize the positive externalities associated with prescribed burns.

To protect against damage in the event of a catastrophic fire, defensive space can also be created by removing vegetation around specific buildings or other structures. Unlike thinning and prescribed burns which can positively impact landscape-level wildfire risk, defensive space largely only protects the landowner who created the defensible space. The fire may still continue to spread around structures on the property to neighboring properties.

LITERATURE REVIEW

To the best of our knowledge, there has been limited research that analyzes landowner decision-making in the context of taking measures to prevent wildfires. However, there is a substantial body of literature on forest management and conservation behavior and how policies can be used to influence behavior. First, I will examine research which compares the effectiveness of different policies. Next, I will examine research which determines how aspects of payments for ecosystem services can influence their effectiveness. Then I will look at the research done on how policies can affect motivation. Finally, I will inspect research which was concerned with how risk interacts with such policies and people's conservation behavior.

Experiments Examining Forest Management Incentives

This discussion starts with the first class of literature that examines how different types of policies are able to change conservation behavior. These policies include payments for ecosystem services, facilitating information sharing and communication, and punishment (usually in the form of regulations and fines). These policies have been compared based on how efficiently they promote conservation behavior and on what impact they have on people's motivations for said behavior.

Within this class of literature, d'Adda (2011) describes an experimental game done with participants from two communities in an area with high levels of deforestation. The participants were given a limited endowment and were given the option of contributing some or all of that endowment towards a reforestation project. The experiment utilized the following treatments: keeping the participants' contributions private (private treatment), showing each participant the same amount and telling them it was the previous person's contribution, regardless of the actual contribution (information treatment), making participants' contribution amounts public (public treatment), and allowing participants to choose to punish each other at a cost to themselves for making low contributions. The participants from all treatment groups also made guesses as to what they thought the majority of participants had contributed. Interestingly, the information treatment group led to the lowest average contribution to the reforestation project. The highest average contribution was observed in the private and public treatment groups. Lowest average guesses came from the punishment treatment group while the highest guesses came from the informational treatment group.

Andersson et al. (2018) studied how PES payments and the facilitation of communication affect conservation behavior towards a common pool resource conducted with an experimental game. They selected participants from communities located near tropical forests in 5 countries to participate. Groups of participants were given a fictional communal forest from which they could harvest trees. The participants would earn money from each tree they harvested. Depending on how many trees remained in the forest the group could also receive extra payments. The experiment had three stages: a pretreatment stage, a treatment stage, and a post treatment stage, and the groups of participants were given three different treatments. The first treatment (Treatment B) consisted of a bonus that had a higher chance of being paid with a higher number of trees remaining in the forest. The second treatment (Treatment C) consisted of giving the participants the opportunity to communicate. The third treatment (Treatment BC) consisted of both a bonus and communication opportunity. The participants also took a survey meant to measure their level of trust. The results showed that all three treatments increased conservation behavior by a significant amount. In terms of effectiveness, treatment B was slightly less effective than treatment C. Treatment BC was more effective than both B and C. This implies that communication was more effective than PES and that it could significantly enhance the effects of PES.

Bednarik et al. (2019) studied the management of a common pool resource and how such behavior was affected by risk within the context of an experimental game utilizing students. Participants were separated into groups and given a fictional communal forest to manage. The students could earn money thought the harvesting of trees from their group's forest. The forest would regrow based on how many trees were remaining after each round of harvesting. Additionally, there was a risk of flooding from rainfall runoff, but leaving more trees in the forest reduced the risk of flooding. If a flood occurred, flood damage would reduce the participants' earnings from harvesting trees. The groups of students were assigned one of seven different treatments which consisted of different combinations of rainfall regularity and flood loss. Additionally, some groups were given the option to communicate throughout the experiment using a chat box and the other groups were not allowed to do so. Participants also filled out a questionnaire used mainly to assess their world views. They found that average levels of remaining trees was higher in groups that had the option for communication (Treatments 1, 2, 3, 4, 5) compared to groups that did not have such an option (Treatments 6, 7). Additionally greater amounts of cooperation were correlated with longer chat communication within groups. This indicates that communication is important for facilitating cooperation in the management of common resources.

Cardenas et al. (2000) analyzes the effect rules and regulations implemented by an outside source would have on conservation decisions. Participants, selected from three villages in Columbia, were split into groups and were given limited amount of fictional time which they could choose to either spend collecting firewood from a fictional forest or providing labor elsewhere. The act of collecting firewood has a negative effect on the groups' water quality through soil erosion. More time collecting firewood increases the payoff a player gets from firewood collection. However, the more firewood that is collected by the group the lower that payoff will be. To maximize the payoff earned by the whole group firewood collection must be limited, but the best individual strategy is to spend more time harvesting wood than is socially optimal.

The study considered two treatments. One treatment was to install an individual quota. If a participant collected more wood than the quota allowed, there was some probability they would be caught and have their payoff reduced. The second treatment was to allow participants to communicate with each other in between rounds of harvesting. In the first round of the treatment, groups with the quota greatly decreased the average time spent collecting firewood. As the rounds progressed the average times gradually increased and near the end of the treatment stage the quota had little to no effect on the participants' behaviors. In contrast, the groups treated with the option for communication showed a somewhat stable decrease in the units of time they spent collecting wood from pre-treatment to treatment stage. There was no significant change between the averages for the first and last three rounds in the treatment stage for this group. The authors hypothesize that the opportunity to communicate influenced participants to make choices that were more socially efficient while the quota influenced participants to make less efficient, more individualistic choices.

Handberg and Angelsen (2015) tested the effectiveness of three different treatments meant to realistically emulate tactics for conservation promotion used. The participants were selected from 7 villages in 3 different regions in Tanzania. The villages chosen were all within walking distance of a tropical forest. The participants were split into groups and each group was given an endowment of tokens that represented trees and could be exchanged for money at the end of the game. The participants could choose how may trees (within limits) that they wanted to harvest each round. After each round, new trees were added based on the number of trees remaining. The first treatment was a command-and-control approach (CAC) that limited the number of trees that could be harvested per individual. If a participant was caught harvesting over the limit, they would lose the trees they had harvested in that round in addition to ten other tree tokens they had harvested during the game. The second treatment introduced PES. These payments paid individuals 80% of what they would get for harvesting a tree, for each tree the participant chose not to harvest relative to their limit. The third treatment (CFM) allowed participants to communicate collectively and privately in between rounds. The results showed that the CFM treatment significantly decreased the harvest rate compared to the pretreatment stage by the largest amount. The CAC treatment also significantly decreased the harvest rate compared to the pretreatment stage by a smaller amount. The CAC treatment had a harvest rate below the rate imposed by the quota. The authors hypothesize that CAC had a prosocial influence relating to norm compliance. The PES treatment appeared to decrease the harvest rate, but by a lesser amount than CFM or CAC, but when regression was used to control for outside variables, the PES treatment's effect was not significant.

Ngoma et al. (2020) investigated the effects of policies meant to prevent deforestation through an experimental game. The participants in this game were selected from 4 Zambian villages near forests. The participants were split into groups and each group collectively received tokens representing trees in a fictional forest designed to be a common pool resource. In each round participants were allowed to harvest up to a certain number of trees from the forest. Participants would receive a private payment for each tree they harvested. The trees remaining in the forest after a round of harvesting would produce a public good which would result in an equal payment being made to each member of the group. There were five treatments applied to the groups. The first, open access (OA) was a control group. The second treatment community forest management (CFM) gave the participants the option to communicate at the start of each round. The third command and control (CAC) introduced a maximum limit that participants could choose to ignore. If caught harvesting over this limit participants received no benefits for that round. The fourth treatment introduced individual payments for ecosystem services (PES). These payments paid individuals 80% of what they would get for harvesting a tree, for each tree the participant chose not to harvest. The fifth treatment introduced collective PES. If the group's harvest was below a predetermined limit, participants were paid a bonus at the same rate. After the game's completion, the participants filled out a survey analyzing their attitudes regarding risk, time, and social preferences. The authors found that harvest rates for all groups tended to decrease with successive rounds. The group receiving the individual PES treatment showed the largest decrease in harvesting rates, and this decrease was significant. The CFM and CAC treatments were less effective than the individual PES treatments. The collective PES treatments were less effective than the individual PES, CFM and CAC treatments; the decrease for collective PES was not significant. Not surprisingly, the OA treatment had the highest harvest rate.

With regards to different policies' effects on conservation behavior, several of the papers found allowing communication, often meant to represent community forest management programs, to be a highly effective way to promote conservation behavior. Andersson et al. (2018), Bednarik et al. (2019), and Cardenas, et al. (2000), found communication to be the most effective influence on conservation behavior. Handberg and Angelsen (2015) found that communication and a command-and-control approach were the best ways to promote conservation behavior. Additionally, Andersson et al. (2018), and Handberg and Angelsen (2015), determined that PES were the least effective at promoting conservation behavior compared to alternative treatments. One exception was Ngoma et al. (2020) which found that individual PES were more effective than communication and a command-and-control approach and collective PES were the least effective.

Payments for Ecosystem Services

In addition to comparing different approaches to influencing conservation behavior, there has also been research done specifically on different forms of payments for environmental services (PES). The types of payments for ecosystem services that were tested include PES that pay different percentages of the revenue that could be gained from not partaking in conservation behavior, PES that are paired with varying levels of communication, and PES that are paid to either individuals or groups.

Handberg, and Angelsen (2016) investigated the effects of PES through a framed field experiment. Participants were selected from 15 villages in Tanzania located near forests. The participants were separated into groups and each group was collectively assigned a fictional forest. In each round of the game a participant could choose how many trees they wanted to harvest from the group's forest and would be compensated for each tree that they harvested. After each of these rounds the forest would regrow depending on how many trees remained. There were 4 treatments assigned to the groups. The first treatment was a control. The second, third, and fourth treatments introduced PES where participants received 20%, 60%, or 100%, respectively of the value of each tree they chose not to harvest. After the experiment, participants were asked to fill out a questionnaire in order to obtain supplementary information about the participants including their opinion on PES. Predictably, the harvest rate for groups with no PES was the highest followed by 20% PES, 60% PES, and 100% PES. The change in harvesting rates between no PES groups and 20% PES groups was not a significant one. The differences of harvesting rates between groups of all other treatments were significant. The rates for no PES, 20% PES, and 60% PES were all lower than what would be predicted for purely profit motivated individuals, but the rate for 100% PES was higher than what was predicted.

Jayachandran et al. (2017) evaluated a program taking place in Uganda through a randomized controlled trial. The purpose of this program was to reduce the levels of CO_2 in the atmosphere by reducing deforestation in the country. To achieve this, the program made payments to the private forest owners in randomly selected villages in Uganda in return for not cutting down trees. These forest owners were surveyed before (baseline) and after (end line) the program was implemented. Satellite imagery was used to measure levels of tree covering in the areas around the villages. The authors found that the control villages had an average tree cover loss of 9.1% compared to the treatment villages which had a loss of 4.2%, and this reduction was statistically significant.

However, this reduction in harvest surrounding treatment villages could lead to an increase in deforestation in parts of the forest not covered by payments within the village. There were three possible forms of spillover. First, participants could have harvested in forests that were owned by those in the treatment village who chose not to enroll in the program. The village-wide data show that there was still less deforestation in treatment villages compared to non-treatment villages, even if this form of spillover was occurring. The second possible spillover was to government forest reserves. The authors did not find that treatment effects were larger in villages near forest reserves, suggesting that participants with this option did not shifted harvest towards these reserves. The third possible spillover was a shift to nearby control villages, but the data showed that there was not an increase in deforestation in control villages that were near treatment villages. The authors were unable to assess if deforestation might have shifted to areas outside the region where the study took place.

Moros et al. (2019) tested the effects of three different types of PES using participant who live in an area in Columbia that is vulnerable to deforestation. Most participants used plots of land for farming which contained portions of forest. The participants were separated into groups of 4. Each individual participant received 4 fictional units of land and had the choice to use each unit for either crops or forest. Units converted to crop land provided the participants with larger compensation compared to units where the forest was conserved. If the group's total forest units were 7 or more, they received an ecosystem benefit referred to as ‘water’ which resulted in each participant being paid a bonus for each unit of forest in the group regardless of how many units of forest they personally conserved. The groups received 1 of 5 treatments. The first treatment consisted of the groups receiving no PES. The second consisted of private payments for each unit of forest individually conserved if 7 or more units of forest were conserved by the group in addition to compensation from land units and water benefits. The third treatment had groups who would receive an additional collective payment for each unit of land conserved by the group if 7 or more units of forest were conserved by the group. The fourth treatment had groups who would receive an additional crop price premium payment for each unit a participant converted into cropland if 7 or more units of forest were conserved by the group. The fifth type of treatment had groups who would vote for their preferred payment option (no payment, collective payment, or individual payment) at the beginning of the treatment stage. After the experiment, the participants were given a survey investigating their motivations and the effect PES might have had on them. For groups with no PES, the average units of forest conserved decreased by an insignificant amount. For groups with PES treatments, excluding crop price premiums, there was a general increase in units of forest. However, individual treatments varied in their effects on forest conservation. There was a significant decrease with the groups treated with crop price premium payments between stages. There was a significant increase with the groups treated with collective and private payments through voting. The increases for non-voting collective and individual PES were not significant.

Muradian et al. (2010), outlined a theoretical approach to the analysis of programs that provided payments for ecosystem services (PES). The authors started by describing the mainstream, pure market conceptualization of PES which tends to be viewed through the lenses of Coasean economics. This approach assumed that as long as there are clear and thorough property rights, a price exists that will achieve a Pareto efficient level of the environmental good, and that this price and social optimum could be reach via bargaining between stakeholders. The authors deduced that there are several conditions that need to be met for this to hold and argued that most PES programs do not precisely comply with these conditions. This might be problematic because many PES programs might be unnecessarily deemed failures, or be changed to the detriment of the program to better fit with these conditions. The authors then explored the different contexts for PES and developed an alternative conceptualization of PES. The authors argued that the main goal of PES programs should be, "the creation of incentives for the provision of such goods, thereby changing individual or collective behavior that otherwise would lead to excessive deterioration of ecosystems and natural resources." They used this goal as a basis for redefining PES as a transfer of assets with the purpose of aligning people's decisions regarding land use with the social interests relating to managing natural resources. These transfers of assets can include monetary and non-monetary assets and are not limited to simple market transactions. For example, they may also take the form of public subsidies. Such PES programs would also acknowledge that economic incentives are not the sole drivers of conservation activities.

Based on this new characterization of PES, programs can be categorized and evaluated using three criteria. The first is, "the importance of the economic incentive" referring to the role PES can play in driving conservation compared to other motivations people may have. The second is, "the directness of the transfer" referring to the transfer of resources from the environmental stakeholder to the person who actually provides the environmental services and the path those resources take to ultimately benefit the end provider. This can change depending what intermediaries these resources might go through. The third is, “the degree of commodification of environmental services” referring to how the compensation and environmental services can be defined as something that can be clearly defined and traded at a fixed rate, or as something that is less easily defined and harder to trade at a fixed rate as a commodity. Based on the facts above, the authors argued that PES providers need to focus more on developing local and regional networks for PES programs that are better able to adapt to more the complex and diverse contexts and acknowledge the PES can and sometimes need to have purposes outside of achieving efficient outcomes.

As was mentioned above, Andersson et al. (2018) and Ngoma et al. (2020) implemented experimental games with more than one type of PES. The game performed by Andersson et al. (2018) compared the effectiveness of communication alone, PES alone, and the combination of communication and PES in promoting conservation behavior. They found that PES alone was the least effective, communication alone was more effective than PES alone, and a combination of both was the most effective. The game performed by Ngoma et al. (2020) compared individual and collective PES payments. They found that individual PES was more effective than collective PES, and collective PES did not have a significant influence on conservation behavior.

To summarize, the findings from Andersson et al. (2018) and Jayachandran et al. (2017) both indicate that PES were effective at increasing conservation behavior. The findings from Handberg and Angelsen (2016) indicate that in their particular circumstances, PES above a certain amount are effective and below a certain amount are ineffective. The findings from Moros et al (2019) indicate that certain types of PES are effective, but found that PES paid as crop price premiums were ineffective. Ngoma et al. (2020) finds that individual PES are effective, but that collective PES are ineffective. This contradicts the findings from Moros et al. (2019) regarding the effectiveness of collective payments.

Motivation for Conservation Behavior and Forest Management

Many of the studies done on the effectiveness of forest management and conservation related policies also tested the effect of these policies on participant's motivations. These motivations are usually categorized as external (extrinsic) motivations and internal (intrinsic) motivations. Included in the categorization of external motivations are economic and fear-based motivations. Included in the categorization of internal motivations are social norms and more altruistic motivations. A common concern addressed in these studies was motivational crowding. Motivational crowding refers to the phenomenon of more economic and extrinsic motivations reducing and replacing intrinsic motivations after they are introduced. Several studies looked at whether introducing such policies induced motivational crowding including Agrawal et al. (2015) who performed a quasi-experiment to do so, as well as many of the experiments mentioned above including, d'Adda (2011), Andersson et al. (2018), Handberg and Angelsen (2016), Moros et al. (2019), and Muradian et al. (2010). Jayachandran et al (2017) didn't directly study motivational crowding but did perform a cost benefit analysis that is relevant to the subject.

Agrawal et al. (2015) studied the effects of PES on forest conservation through quasi-experiment utilizing participants from several communities in the Himachal Pradesh state in northern India. The state government implemented the Mid-Himalayan Watershed Development Project in this region with the purpose of protecting the area's natural resources and improving people's incomes. People received combinations of community benefits such as concrete footpaths or irrigation canals, private individual benefits like seeds or livestock, and informational benefits which included attendance in planning meetings or environmental education training from the project. The authors selected a sample of participants from communities within and outside of the projects influence. These participants were given a survey by the authors before and after the benefits were dispensed to determine the impact of the project on conservation motivations which could be categorized into environmental or economic motivations.

The authors found that benefits introduced as a way to influence conservation behavior did have some impact on participant's motivations. Within the communities who participated in the program 47% of participants indicated that their motivations didn't change. In the treatment groups 63% of those who changed switched from intrinsic motivations to economic motivations. In the control groups 45% of those who changed switched from intrinsic motivations to economic motivations. Analysis show that the difference in the portions of people who switched in the treatment and control groups was statistically significant indicating some level of motivational crowding. Additionally, the authors found that the average treatment effect from receiving information benefits was that the participants were more likely to switch to economic motivations from environmental motivations. This effect was classified as negative and significant. The average treatment effect from receiving private benefits also showed that the participants were also more likely to switch to economic motivations which was negative but smaller in absolute value than the information treatment. When comparing the results of people who only received private benefits, the effect is greatly lessened and is not significant. The average treatment effect from receiving communal benefits was positive and significant indicating that this activated more environmental or communal motivations. The results also showed evidence that motivations had an impact on actual conservation behavior.

d'Adda (2011) found that between two communities (upstream and downstream) where their experiment took place, there were differences in the effects of treatments on contributions made. The authors determined that the upstream community had more existing norms of cooperation compared to the downstream community. In the downstream community participants contributed the most with public treatment, while the rest of the treatments showed no significant differences. In the upstream community, contributions from all treatment groups, except for the public one, were higher than the downstream community, and there was no significance in the differences between research groups. From this, the authors inferred those treatments have less effect on a community where there are existing norms of cooperation. In a community that doesn't have such norms public treatment was more effective. The authors also looked at levels of civic engagement and individualism in the communities and found that treatments tended to negatively affect the contributions made by participants with higher civic engagement and positively affect those with higher levels of individualism. This all implies that there is a motivational crowding effect.

Andersson et al. (2018) found that during the post treatment phase the number of units harvested on average increased but did not reach the level it had in the pre-treatment stage. This implies that the monetary incentives and communication treatments could increase conservation behaviors even after they were discontinued. In the post treatment stage, the continued effect of Treatment C seemed stronger than the effect of Treatment B, and the effect of Treatment BC was stronger than Treatments B or C. This implies that there was not a motivation crowding effect. Higher levels of trust also played a significant role in the post treatment phase.

Handberg and Angelsen (2016) performed analysis that showed that the change in harvesting rates between no PES groups and 20% PES groups was not a significant one. The differences of harvesting rates between groups of all other treatments were significant. This supports the primary hypothesis of the authors which says that low PES do not have an effect on the motivations of forest users. Additionally, based on the questionnaire results, the authors found that the participants' attitudes towards PES did not change how effective different amounts of PES were in changing conservation behavior.

Moros et al. (2019) indicated that the crop price premium treatment and the ability to vote on types of payment systems is correlated with a decrease in intrinsic motivations. The crop price premium treatment was also shown to have a negative impact on guilt/regret motivations. The collective payment treatment was shown to have a possible positive effect on social motivations. Extrinsic motivations regarding payments and fines did not seem to be affected by the treatments.

Muradian et al. (2010). looked at an aspect of PES programs that indicated that PES and economic incentives for conservation might crowd out existing motivations. This includes authorities such as local rules and norms or people's intrinsic motivations. The authors use this additional context in part to create the new definition of PES as a transfer of assets with the purpose of aligning people's decisions regarding land use with the social interests relating to managing natural resources.

Jayachandran et al. (2017) performed a cost benefit analysis to assess the effectiveness of the program. The authors considered four scenarios for after the program ended. The first was that private forest owners will increase deforestation and undo 2 years of the program's effects over 4 years to catch up to their control group counterparts. The average delay in deforestation in this case is 3 years. The benefit of delaying CO_2 release though the program in this scenario would be 2.4 times the program costs. The second was that private forest owners will immediately catch up on their delayed deforestation. The average delay in deforestation in this case would be 1 year. The benefit cost-ratio in this scenario would be 0.8. The third was that private forest owners will resume their normal rate of deforestation. This would result in a permanent 2-year delay in deforestation. The benefit cost ratio in this case would be 14.8. If the program did not end, then the net cost to permanently avert a metric ton of CO_2 would be $2.60 which is far less than the EPA social cost of carbon which was $39. While motivation crowding was not directly addressed in this analysis, the cost benefit ratios for the scenarios where deforestation increased after the end of the program might resemble scenarios where motivation crowding occurred. In this context, the cost benefits analysis of the first scenario was promising, but the second, modeling a much steeper increase in deforestation, was less so.

To summarize, Agrawal et al. (2015), d'Adda (2011), and Moros et al. (2019) found evidence indicating that certain policy interventions did cause motivational crowding. Agrawal et al. (2015) found that such crowding was especially likely to be present with their information benefits treatment, d'Adda (2011) found that there was the possibility that their public treatment, information treatment, and punishment treatment caused motivational crowding, and Moros et al. (2019) found that crowding was especially likely to be present with their crop price premium treatment, the treatments that participant chose through voting. On the other hand, Andersson et al. (2018) did not find evidence of motivational crowding for PES and communication treatments and Handberg and Angelsen (2016), did not find evidence of motivational crowding for low levels of PES. Additionally, Muradian et al. (2010) stresses the importance of considering the possibility of motivational crowding when developing a PES system, and Jayachandran et al.

(2017) showed that depending on how intense the effect of motivational crowding is, the policy interventions causing it may still be viable for archiving their intended outcomes.

Risk's Relationship to Conservation Behavior

Some of the studies related to policies made to influence conservation behavior also looked at risk. These studies, including Bednarik et al. (2019), Muradian et al. (2010), and Ngoma et al. (2020) explored risk's potential impact on decisions people made about conservation behavior. Risk is explored both through people's propensity for risk as well as the risk present or created in situations involving conservation. Frey et al. (2017) additionally looks at how risk is measured and how dependable different types of measurements are.

Bednarik et al. (2019) found that average forest condition, which was represented by the number of trees remaining, was lower for the groups with Treatment 1 and 6 where there was no possibility of flooding. It was higher for groups with Treatments 2, 3, 4, 5, 7 which did have the possibility of flooding bringing the number of trees closer to the optimal number for the group as a whole. This implies that participants valued risk reduction over higher payouts in a situation where they were managing a common pool resource. There were also differences between the behavior of groups with regular rainfall (Treatments 1, 2, 3, 6, 7) and irregular rainfall (Treatments 4, 5). In the first round, most groups harvested the entire forest. 7 groups out of 64 did not harvest the entire forest. 5 of these groups were in groups that experienced irregular rainfall. Additionally, only 3.5% of the groups that were treated with regular rainfall harvested a number of trees below the optimal number for the group. 24.7% of groups treated with irregular rainfall harvested below the optimal number. These differences between groups with different treatments indicates that uncertainty might influence conservation behavior.

One of the contexts for PES that Muradian et al. (2010) examine is the high levels of uncertainty that are present with the recipients of PES and with the providers of PES. This uncertainty in part stems from incomplete information especially in the realm of ecological knowledge and the large number of variables that affect the outcome of environmental services performed. Collecting knowledge of the impacts of such services can be very costly and the authors determine that this puts actual PES at odds with the Coasean assumption of complete knowledge that is used for the traditional conceptualization of PES.

Ngoma et al. (2020) found that there were not any significant differences in overall harvest rate that were caused by participants attitudes towards risk. However, there were differences when looking at these attitudes in groups that received certain treatments. Risk loving participants within the CFM and CAC treatments had significantly higher mean harvest rates. Risk adverse participants within the PES and CAC groups had lower harvest rates. Impatient participants within the individual PES treatment groups harvested at significantly higher rates.

Frey et al. (2017) explains the psychological factors or risk preferences and how they were tested. There were three general categories for tests of risk that the authors were interested in. These were propensity measures of risk (peoples states preference for risk), behavioral measures of risk (tests designed to reveal a person’s risk preferences through giving a person task with actual stakes such as monetary incentives), and frequency measures of risk (where the frequency of risky actions a person has taken in their everyday lives is measure). The authors studied the how closely the outcomes of different measures of risk followed each other and how stable those outcomes were over time. The did this by amassing a sample of 1507 people whose risk preferences were measured using 39 different methods. They also retested 109 of these participants six months later.

The authors found that there was a substantial difference between the propensity measures of risk and the behavioral measures of risk. The correlations between the measures in these two categories of risk were very weak. The correlation between the different behavioral measures of risk were also weaker than the correlations between the propensity measures of risk and the frequency measures of risk. The correlations between the frequency measures of risk and the propensity measures of risk were stronger. When looking at consistency between the different measures of risk, behavioral measures had the lowest consistency and was almost identical to the random ranking. Frequency measures had somewhat higher consistency. Propensity measures had the highest consistency by far, but still did not fall on the completely consistent rankings. When investigating the presence of a general risk factor (R), the authors found that R accounted for a large portion of the variance with propensity measures and frequency measures, but very little variance with behavioral measures. When the authors compared the relationship of R and participants' personality characteristics, they found that R was positively related to openness to experience and extroversion and negatively related to conscientiousness and agreeableness. They also found that socioeconomic and cognitive characteristics were not linked to R.

To summarize, Bednarik et al. (2019) found that treatments with higher levels of risk in general showed higher levels of conservation behavior, and Ngoma et al. (2020) found that risk loving participants reacted differently to some treatments compared to risk adverse participants. Muradian et al. (2010) pointed out that risk related to PES programs can affect how they are implemented and their success. Finally, Frey et al. (2017) found that different methods for assessing risk preferences can have varying levels of reliability internally and when compared to other methods, which could impact the reliability of the results of studies like Ngoma et al. (2020).

METHODS

Subjects for this experiment were drawn from three sources. This was to ensure that we had as large a pool of subjects as possible, but it does have the potential to introduce some bias into the sample. A portion of the subjects were drawn from a pool of landowners who completed a previous survey which gathered data on their current forest management practices, impacts of wildfires on their land, and preferences about cost-share programs designed to reduce the risk of wildfires. The landowners in question were drawn from counties with more than 50% average tree canopy cover within thirteen southeastern states which include Alabama (AL), Arkansas (AR), Florida (FL), Georgia (GA), Kentucky (KY), Louisiana (LA), Mississippi (MS), North Carolina (NC), Oklahoma (OK), South Carolina (SC), Tennessee (TN), Texas (TX), and Virginia (VA). Non-industrial private forest landowners that had at least five acres of land with some amount of forest on that land were selected form these counties. The selection of landowners was weighted by wildfire occurrence in the counties, where half were randomly selected from counties that experienced no wildfire and half were randomly selected from counties that experienced wildfires. Of the landowners who were from counties that experienced wildfire, half were from counties that experienced only one wildfire and half were from counties that experienced two or more wildfires. Emails were sent to those respondents who completed the survey and who provided their email addresses for follow-up questions. These respondents were asked to complete the experimental game. The data from the experiment was combined with these subjects’ survey responses when analyzing the results.

Another portion of the experiment's subjects were recruited from the student population. These students were asked to both play the game and complete a follow up survey relating to their experiences, if any, with forest management. This survey was designed to mimic the survey the landowners participated in so as to give comparable data to analyze. A final portion of the subjects were recruited from a pool of people who receive emails from the Southern Fire Exchange. They consisted of a mix of landowners and non-landowners. They also both played the game and took a supplemental survey.

The Experiment

During the experiment groups of nine subjects entered a zoom session where they were given a brief description of the experiment and were presented with the instructions for the experimental game. At the end of the instructions, the subjects were instructed to ask any questions they had regarding the game rules or mechanics. After that, nine links were distributed to each of the subjects, which connected the subject to their parcel of land within the experiment. The game began with two questions in a short quiz to determine each subject's understanding of the game rules and mechanics. After all of the subjects answered each question, the experimenter reviewed the answer to each question with the subjects. After the subjects had completed the quiz questions, they were directed to start one of three practice rounds of the game.

The experiment consisted of three practice rounds followed by forty rounds in total. Each round represented six years. Each subject was instructed to manage ten acres of forest land containing a home in the forest for the forty rounds of the game. Each of the forest pieces managed by the subjects were part of a three-by-three grid where the subject had one to four neighbors depending on their position on the grid. Each of the subjects' positions in the game were randomized.

Each round contained two parts. In the first part of the round, the subject was prompted to make a decision regarding the management of their land. During this time, the subject was able to see an abbreviated version of the instructions as well as a map of the forest layout which showed the position of their forest land relative to the other subjects' land. Once every subject had made a choice, they were able to move on to the second part of the round. In the second part of the round the subject saw the outcome for the round. Outcomes included: a fire starting on their property, a fire spreading to their property from a neighboring property, or no fire. After all of the rounds were completed, the subjects were prompted to answer a post-game survey. The survey included questions about the reasoning behind their actions in the game, an assessment of their risk preferences, forest use preferences, and their experiences regarding fire outside of the game as well as damages resulting from said fire.

Forest layout:

Forest 1	**Forest 4**	**Forest 7**
Forest 2	**Forest 5**	**Forest 8**
Forest 3	**Forest 6**	**Forest 9**

Figure 1. The forest layout map from the perspective of the subject.

In the first part of every round of the game, each of the subjects had the option to maintain a defensible space around their home, implement a prescribed burn, or do nothing. They were only allowed to select one of these options. A defensive space cost the subject three hundred in game dollars to maintain. If a subject decided to maintain a defensible space their home was protected in the event of a fire, but the forest they were managing was destroyed if a fire occurred on their property. A prescribed burn cost the subject four hundred in game dollars to perform. If a subject decided to perform a prescribed burn, both their home and the forest they were managing were protected in the event of a fire, but the utility they got from their forest decreased due to the aesthetic impact of prescribed burns. If a subject decided to do nothing, then it did not cost them anything. However, in the event of a fire the subject's home and forest were destroyed. These options were selected in part to mimic the choices available to landowners outside of the game and were in response to the preliminary results of the previous survey which indicated that landowners preferred programs that involved the use of defensive space over the use of prescribed burns (Hilsenroth et al., n.d.).

In each round there was a one in nine chance of a fire starting on each of the nine pieces of land. If a fire started on a piece of forest land, or spread to it, and a prescribed burn was not performed on the land, then the fire would spread to the pieces of forest which shared a horizontal or vertical border with the land above, below, to the left, or to the right of it. The fire did not spread diagonally. There was no limit to how many pieces of land the fire could spread to in the absence of prescribed burns. Prescribed burns did not allow a fire to spread from the piece of land the burn was performed on. In each round, in the absence of fire or a prescribed burn, the utility (described as enjoyment in the game) a subject received from their forest was equivalent to five hundred in game dollars. If a subject chose to perform a prescribed burn on their forest land, the utility a subject received from the forest was reduced to three hundred in game dollars. If the subject's piece of forest land was destroyed in a fire, they did not receive any utility from their forest. The utility a subject received from their home was equivalent to three thousand in game dollars. If the home was destroyed in a fire the subject did not gain any utility from their home. The individual profit that could be gained each round can be calculated by the following equation:

$$P(U_H + U_{FB} - C_P) + D(U_H - F(U_F) - C_D) + N\big((1 - F)(U_H + U_F)\big) \qquad (1)$$

where *P* is a dummy variable that takes the value of 1 when the subject used a prescribed burn and 0 when they did not. Similarly, *D* and *N* are dummy variables representing the choices to maintain a defensive space and do nothing respectively. *F* is a dummy variable that takes the value 1 when there was a fire and 0 when there was no fire. U_H was the utility gained from the home in the subject's forest. U_F was the utility gained from the piece of forest that is being managed by the subject in the absence of a prescribed burn. When a prescribed burn was performed U_{FB} was the utility a subject received form their piece of forest. C_P and C_D were the costs of performing a prescribed burn and maintaining a defensive space respectively.

Table 1. Definitions and values of each variable used in equation 1.

Variable	Definition	Value
P	Subject used prescribed burn	Yes = 1, No = 0
D	Subject maintained a defensive space	Yes = 1, No = 0
N	Subject did nothing	Yes = 1, No = 0
F	Fire on the subject's land	Yes = 1, No = 0
TU_H	Utility gained from subject's home	$3000
U_F	Utility gained from subject's forest with no prescribed burn	$500
U_{FB}	Utility gained from subject's forest with a prescribed burn	$300
C_P	Cost of performing a prescribed burn	$400
C_D	Cost of maintaining a defensive space	$300

In the second part of every round each subject was shown the outcome of the round which was dependent on their own choice, the other subjects' choices, and the occurrence of fire. The base information given to each subject included reminders of which piece of forest land they are managing, what their choice was, and the cost of their choice. It then told them whether or not there was fire on their piece of forest and whether the fire started on their piece of forest. Next it told them what utility they gained from their forest and home. Finally, it told them their profit for the round and their average profit across rounds. There were six possible outcomes that could occur based on the occurrence of fire and the choices made which can be derived from equation 1 and are shown in the table below. At the end of the game, the average value of each subject's total profit across all rounds was divided by one hundred. They received payment equal to this amount.

This game was a within-subject experiment. Each group of nine subjects played the game exactly as described above for the first ten rounds of the game. This served as a control for the rest of the experiment. Every ten rounds of the game a new treatment was applied. The order of treatments one and two were varied. Starting in round eleven, either treatment one or treatment two was applied to all subjects. In round twenty-one, if treatment one was applied in the last ten rounds, then treatment two was applied, and conversely if treatment two was applied in the previous ten rounds, then treatment one was applied next. In round thirty-one treatment three was applied.

Table 2. Summary of all possible profit outcomes of a round of the game:

	No Fire	Fire

Prescribed Burn	$2900	$2900
Defensive Space	$3200	$2700
No Action	$3500	$0

Treatment One

Treatment one employed perfect information. At the start of treatment one the subjects were informed that for the next ten rounds they would be able to see what choices the other subjects made and on which piece(s) of land fires started. This was shown to them through two three by three grids in the second part of each round. By knowing that the other subjects saw what actions a subject takes, it was hypothesized that they would experience social pressure. It was possible that this pressure and knowledge of other subjects' actions would increase prosocial behavior and result in an increase in the use of prescribed burns which would have the positive externality of protecting their neighbors' land in addition to the subject's own land.

The table below shows forest management actions taken this round:

Forest 1: Defensive Space	**Forest 4: Defensive Space**	**Forest 7: Defensive Space**
Forest 2: No Action	**Forest 5: Prescribed burn**	**Forest 8: No Action**
Forest 3: Defensive Space	**Forest 6: Defensive Space**	**Forest 9: No Action**

Figure 2. The grid shown to subjects informing them of what choices each subject made.

The table below shows where fires started in this round:

Forest 1: Fire Started	**Forest 4: Fire did not Start**	**Forest 7: Fire did not Start**
Forest 2: Fire did not Start	**Forest 5: Fire did not Start**	**Forest 8: Fire did not Start**
Forest 3: Fire did not Start	**Forest 6: Fire did not Start**	**Forest 9: Fire did not Start**

Figure 3. The grid shown to subjects informing them of where fires started.

Treatment Two

Treatment two consisted of a subsidy. In the first part of treatment two subjects were informed that for the next ten rounds if they choose to perform a prescribed burn during a round then a subsidy would be applied to the subjects that chose to use a prescribed burn. This subsidy was worth 50% of the cost of using a prescribed burn. In other words, they would receive a subsidy of two hundred in game dollars. It was hypothesized that the subsidy would also increase the number of prescribed burns being performed compared to the control amount. This is because the subsidy had the potential to reduce the cost of using a prescribed burn and increase profit.

Treatment Three

Beginning in round thirty-one and continuing to round forty treatment three was applied. Treatment three consisted of a combination of both treatment one and treatment two. In this treatment subjects had access to perfect information regarding what choices everyone made and where fires started, and the subjects were provided a subsidy with the same conditions as in treatment two. It was hypothesized that these two treatments would complement each other and result in an increase in subjects choosing to perform prescribed burns. Additionally, it was hypothesized that the rate of prescribed burn usage during this treatment could be higher than in the treatment one and treatment two rounds. Combined, these two treatments could have both incentivized subjects individually and applied social pressure.

Empirical Model

The primary information that was collected from the experiment were the management choices of the subjects (Prescribed burn, Defensive space, No action). The primary goal of future analysis will be to determine what effect the treatments had on the management choices of the subjects. There is a secondary goal of determining what effect player location, round number, and landowner information from the previous survey will have on the choices the subjects made and how they will influence the effectiveness of the treatments. An alternative-specific conditional logit model will be used to analyze the data and uncover this information. An assumption that will be made for the discrete choice model is that the subject will select the management option that provides them with the highest utility, which is not necessarily the same as the option that gives them the highest expected payoff. The unobservable utility (U) the subject (i) gained from the choice (j) will be made up of the observable management choice (M) and a random unobserved component (ε) as can be seen in equation 2.

$$U_{ij} = M_{ij} + \varepsilon_{ij} \tag{2}$$

The management choice in turn will be a function of the three treatments ($T1_{ij}, T2_{ij}, T3_{ij}$), number of neighbors as was determined by the player location on the three-by-three grid (L_{ij}), round (R_{ij}), the past instances of fire on the subject's real property (F_i), and the landowner information gathered from the previous survey (D_i).

$$M_{ij} = F(T1_{ij}, T2_{ij}, T3_{ij}, L_{ij}, R_{ij}, F_i, D_i) \quad (3)$$

Based on the assumption that the parameters are linear, β_0 through β_7 will be estimated in the model presented in equation 4:

$$M_{ij} = \beta_0 + \beta_1 T1_{ij} + \beta_2 T2_{ij} + \beta_3 T3_{ij} + \beta_4 L_{ij} + \beta_5 R_{ij} + \beta_6 F_i + \beta_7 D_i \quad (4)$$

PRELIMINARY RESULTS

Thirteen experimental game sessions were completed with nine participants in each session. Preliminary analysis of the results shows that in the control stage, 48.55%, 32.82%, and 18.63% of decisions made were prescribed burns, defensive space, and no action, respectively. In the treatment 1 stage, these rates were 49.57%, 32.05%, and 18.38%, respectively; there was very little change between management choices in the control and treatment 1 stages. The difference between the prescribed burn usage in the control and treatment 1 stage was not significant at a 95% confidence level. This indicates that making the subjects' actions public knowledge was not an effective way to increase prescribed burn usage.

In the treatment 2 stage, the rate at which prescribed burns were being performed increased to 67.86%, while the rate at which defensive spaces were being maintained decreased to 16.15%, and the rate at which no action was taken decreased to 15.98%. There was a significant increase in the prescribed burn usage during the treatment 2 stages, relative to the control stages at a 95% confidence level. This indicates that a subsidy that covers fifty percent of the cost of performing a prescribed burn was effective at increasing prescribed burn usage. There was also a significant decrease in the defensive space maintenance in the treatment 2 stages relative to the control stages at a 95% confidence level. This suggests that a portion of subjects who initially preferred maintaining defensive spaces switched to performing prescribed burns with the inclusion of a subsidy.

In the treatment 3 stage, 64.36%, 18.55%, and 17.09% of decisions included prescribed burns, defensive space, and no action, respectively. These rounds closely mirror the treatment 2 rounds. This indicates that a combination of treatments was also effective. There was no significant change in the prescribed burn usage from treatment 2 to treatment 3, which implies that the addition of perfect information to the subsidy did not increase the effectiveness of the subsidy.

Table 3. Summary of management choices within each treatment:

	Control	Treatment 1	Treatment 2	Treatment 3
Prescribed Burn Rate	48.55%	49.57%	67.86%***	64.36%***
Defensive Space Rate	32.82%	32.05%	16.15%***	18.55%***
No Action Rate	18.63%	18.38%	15.98%*	17.09%

*, **, and *** indicate statistical significance at the 0.1, 0.05, and 0.001 levels for a comparison of the treatment rate vs. the control rate.

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