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# THE ADOPTION OF CONSERVATION PRACTICES AND PROGRAM PARTICIPATION AMONG SOCIALLY DISADVANTAGED AGRICULTURAL PRODUCERS: A META-ANALYSIS

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Master of Science

in

The Department of Agricultural Economics and Agribusiness

by
Myles A. Brown
B.S., Louisiana Tech University, 2019
May 2022

# ACKNOWLEDGEMENTS

I would first like to thank my committee members, Dr. Adusumilli, Dr. Wang, and Dr. Deliberto. I would specifically like to thank Dr. Adusumilli for his role as my major professor and his guidance and knowledge throughout this journey for the past two years. I would also like to thank fellow graduate student, Santosh Pathak, for his role in teaching me the more technical aspects necessary for this research. Additionally, I would like to thank my fellow graduate students in the agricultural economics department for their support, especially during the difficult semesters. Finally, I would like to express my sincerest gratitude and love to my family, particularly my parents, for always being in my corner.

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# ABSTRACT

As climate change has become undeniable in recent years, it has become increasingly important for the agriculture industry to address conservation. Within the agriculture industry, small farmers are usually the ones who take on this burden on a daily basis. However, some socially disadvantaged agricultural producers face unique challenges compared to the average farmer, which may impede their ability to adopt the necessary conservation practices or participate in conservation programs. This review sought to provide a definitive economic analysis on the possible effect of race on conservation adoption and program participation, as there is not much research on this topic. This analysis shows that race alone does not significantly impact on conservation adoption and program participation amongst socially disadvantaged agricultural producers. However, the sample size provided in this analysis is small and does not represent the current reality of socially disadvantaged agricultural producers living in the United States today. Whenever race was observed in the literature, the meta-analysis concluded that race did not significantly influence conservation adoption and program participation. Due to the small sample size and lack of abundant research, this result may not reflect socially disadvantaged agricultural producers living today, who have historically been underrepresented by the agriculture industry at large.

# CHAPTER 1. INTRODUCTION

## 1.1. General Background

In recent years, conservation practices have become increasingly more important to the agriculture industry and society, as the effects of climate change have become undeniable. Dedrick and Mausbach (2004) identified the most beneficial capabilities of conservation practices, including reducing the loss of soil, pesticide, nutrients, and pathogens from agricultural lands. Other key functions of these practices include conserving natural resources, enhancing the quality of the agricultural ecosystem, and improving wildlife habitats (Dedrick and Mausbach 2004). Within the agriculture industry are small farms and small farmers who implement these practices on a daily basis. Small farm productivity and natural resource conservation can be collectively beneficial to one another. Climate-smart conservation, which involves natural resource conservation, is the intentional and deliberate consideration of climate change in natural resource management, realized through forward-looking goals and linking actions to key climate impacts and vulnerabilities (National Wildlife Federation 2013). Due to the linkage between sustained agricultural productivity and the quality of goods and services that natural resources provide, natural resources must be protected at all times in order to sustain the productivity of small farmers (Sarma 2018).

It is important to note the actions taken to address natural resource conservation amongst small farmers, as small farms have become important to rural communities and small farmers play an influential role in natural resource conservation. Outside of the usual benefits from farming, such as food, small farms can provide businesses and jobs, human services, local security, ecosystem services, and functions pertaining to the quality of life for rural communities (Milestad et al. 2010). Natural resource conservation is vital to uphold and maintain in the face

of the threats of climate change. One of the many actions to address natural resource conservation is adoption of conservation through government programs, such as the Conservation Reserve Program (CRP). These practices are crucial for farmers to best manage their crops or livestock. Within some small farms are socially disadvantaged farmers, who operate these farms on a daily basis and incorporate some of these conservation practices to have a successful farm operation. While all farmers face challenges, the challenges faced by socially disadvantaged farmers are quite unique and different from that of the average white small farmer. In order for the agricultural production industry to see continued success in natural resource conservation, these specific challenges should be addressed in order to encapsulate the experiences of socially disadvantaged agricultural producers.

### 1.2. Small Farms and Socially Disadvantaged Agricultural Producers

According to the United States Department of Agriculture (USDA), small farms can be classified as commercial and noncommercial and are defined as an "operation with gross cash farm income under $250,000," (MacDonald 2021). Small farm production in the United States is mainly concentrated on beef, grain or soybeans, poultry, and hay (USDA 2010). Small farms are important in terms of providing for local communities and establishing an agricultural footprint. According to the 2017 Census of Agriculture, 91% of U.S. farms are small, which further highlights their significance (MacDonald 2021). Hazell et al. (2007) identified two key roles of small farms, which are growth and development and potential social contributions. Typically, small farms have lesser resources and smaller financial support when compared to the average large-scale farm, where some are large-family operated, have become corporations or have shareholders (Hoppe and MacDonald 2017). Despite the lesser resources and financial support, as of 2007, small farms in the United States have accounted for 55% of poultry production, 51%

of hay production, 45% of grazing animals other than cattle, and 32% of tobacco production (USDA 2010). Based on these statistics, it is clear that small farms contribute significantly to local and national food supplies across the country while also contributing to economic growth.

### 1.2.1. Socially Disadvantaged Agricultural Producers

Socially disadvantaged agricultural producers face similar challenges as other, predominantly non-minority, or white, small agricultural producers, such as concern over crop yields or finances. However, the challenges they face are unique and can hinder any implementation of conservation practices on their farm operation to accommodate for natural resource conservation. A 2008 research study found that the perception of a soil erosion problem was affected by race or ethnicity amongst Fijian farmers. However, the researchers found that the perception of soil erosion was one of the significant factors affecting the soil conservation effort (Asafu-Adjaye 2008). In understanding the perception of natural resource conservation amongst small agricultural producers, it is important to note any differences in perception and actions based on race, gender, and past experiences. These differences in perception and action may hinder any success in achieving a widespread adoption or adaptation of conservation practices. Non-minority, or white, agricultural producers are also affected by gender and past experiences in terms of their decision making, but historically they face fewer hurdles related to governmental, social, and cultural institutions when compared to minority producers.

Enacted in 2018, the Consolidated Farm and Rural Development Act defines a socially disadvantaged group as one whose members have been subject to racial, ethnic, or gender prejudice because of their identity as members of a group without regard to their individual qualities (U.S. Government Publishing Office 2018). These groups include American Indians or Alaskan Natives, Asians, Blacks or African Americans, Native Hawaiians or other Pacific

Islanders, Hispanics, and women (Key and Todd 2021). Due to the prejudices and discrimination faced by socially disadvantaged agricultural producers, some direct attention from larger agricultural institutions when tackling the broader issue of conservation practice adoption and adaptation among small farmers is warranted. Although minority farmers may still have the capability to use some conservation practices on their farms, there are still some institutional hurdles in the way to truly incorporate any and all conservation practices at their discretion.

According to the Center for American Progress, the USDA has had policies in place that have resulted in black farmers having less access to credit and extension programs than the average white small farmer, that prevented black farmers from modernizing their farms (Cusick 2019). Some of these policies include inflating numbers to better depict black farmers within the USDA and policies resulting in significant class-action lawsuits, such as Pigford v. Glickman. In a 2014 Census of Agriculture report, it was reported that the USDA witnessed a 9% increase in farming amongst African-Americans. However, after a two-year investigation by The Counter, the editors found the data to be inflationary and it depicted a fictional renaissance in black farming (Rosenberg and Stucki 2019). These exaggerated numbers helped to obscure any discriminatory practices by the USDA. Some examples of these discriminatory practices included forcing black farmers off of their land, subjecting them to hostility in federal offices, and conspiring against them with banks to steal their property (Rosenberg and Stucki 2019). In regards to the class-action lawsuit, Pigford v. Glickman, a group of black farmers sued the USDA due to allegations of discrimination by the USDA between 1983 and 1997 (Castro and Willingham 2019). Eventually in 1999, these claimants were awarded $1.06 billion in cash relief (Castro and Willingham 2019). As a result of these policies and practices, priorities may often

shift to other issues such as crop yields or farm finances, and seldom on ways to incorporate conservation practices or participate in conservation programs.

Black small farmers face additional hurdles in financial agriculture regarding heirs' property laws and discriminatory lending. Heirs' property is a type of collective ownership when land passes down without a will through generations. A lack of clear ownership means heirs' property operators cannot qualify for certain federal programs. Discriminatory lending occurs when lenders base financial, or credit, decisions on factors other than the borrower's creditworthiness, such as race, religion or age (Folger 2020). Minorities and women face more difficulties securing ownership and operational loans and credit from the federal Agriculture Department and other lenders (Boyanton 2020). According to the National Sustainable Agriculture Coalition, as of April 2021, overall participation in conservation and other USDA farmer programs by farmers of color and limited-resource farmers has lagged behind the enrollment of white farmers (National Sustainable Agriculture Coalition 2021). This statement suggests that decades of discrimination by the USDA and the U.S. government towards minority farmers have had a significant negative effect on participation and engagement in conservation programs amongst minority producers. In 2008, the low adoption of conservation practices by small and limited-resource farmers in the southern United States was attributed to factors such as "limited management skills, risk-aversion preferences, small size of operation, and limited income," (Bergtold and Molnar 2010). Many of these factors stem back to discrimination from the USDA and other government agencies and how it has affected minority farmers' ability to adequately survive and compete.

As the number of minority farmers (specifically African-American) across the United States has decreased over the years, it is even more crucial to emphasize greater inclusion in

agriculture to make the agriculture industry more strong, creative, and innovative (Heim 2019). Although this research is not exclusive to just African-American small agricultural producers, their challenges in regards to conservation practice adoption and implementation must be highlighted and represented properly.

According to the 2017 Census of Agriculture conducted by the USDA, while the number of black producers increased from 2012 to 2017, black-operated farms decreased between the same years (USDA NASS 2017). Texas had the highest number of black producers as of 2017, with Tennessee coming in last place. Out of the $1.4 billion sold in agricultural products in 2017 by agricultural producers, 61% came from crop sales and 39% came from livestock sales. Of the total U.S. agricultural sales in 2017, 0.4% originated from black farms. Within the 0.4% of total U.S. agricultural sales originating from black farms, 57% of sales and government payments were of $5,000 or less (USDA NASS 2017). Out of the total U.S. agricultural farmland in acres, farms operated by black farmers accounted for 0.5% or 4.7 million acres. In terms of farm specialization, 48% of black-operated farms specialized in cattle and dairy production in 2017 (USDA NASS 2017). The majority of these farmers participate in beef cattle production.

### 1.3. Consequences of Climate Change for Small Farmers

Climate change impacts, in the form of soil loss and water degradation, will continue to evolve in the years to come and as a result, it will continue to have devastating impacts on the farming industry. Rising temperatures throughout the summer are likely to reduce the yields of corn and rice and reduce livestock productivity (U.S. Environmental Protection Agency 2016). Specifically, in Louisiana the most pressing consequences of climate change are rising sea levels and the intensity of weather events, such as hurricanes and tropical storms. According to the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center

(NCDC) in 2014, the entire coast of Louisiana displayed a very high susceptibility and vulnerability to sea-level rise. This is showcased in Figure 1.1. Also, from the NOAA, Figure 1.2 showcases a comparison between Key West, Florida and Grand Isle, Louisiana regarding the rate at which sea levels have risen. The graph showed a faster rate of rising sea levels in a shorter period for Grand Isle, Louisiana. Figure 1.2 is displayed on the next page.

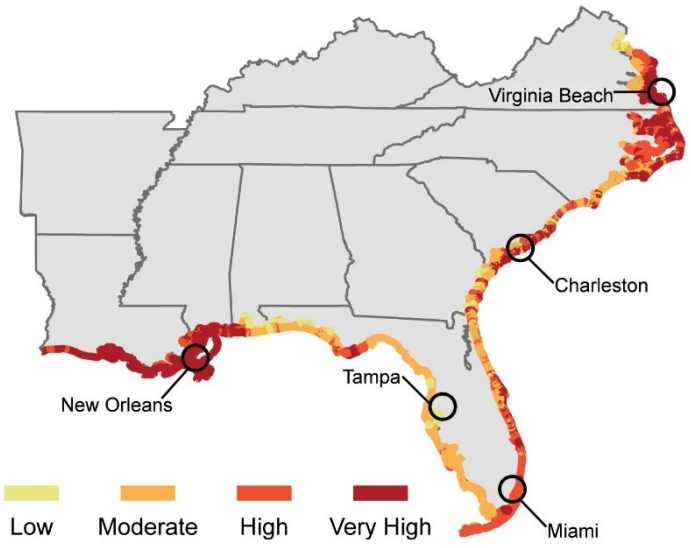


Figure 1.1. Areas with the Greatest Vulnerability to Sea Level Rise
*Source*: NCDC

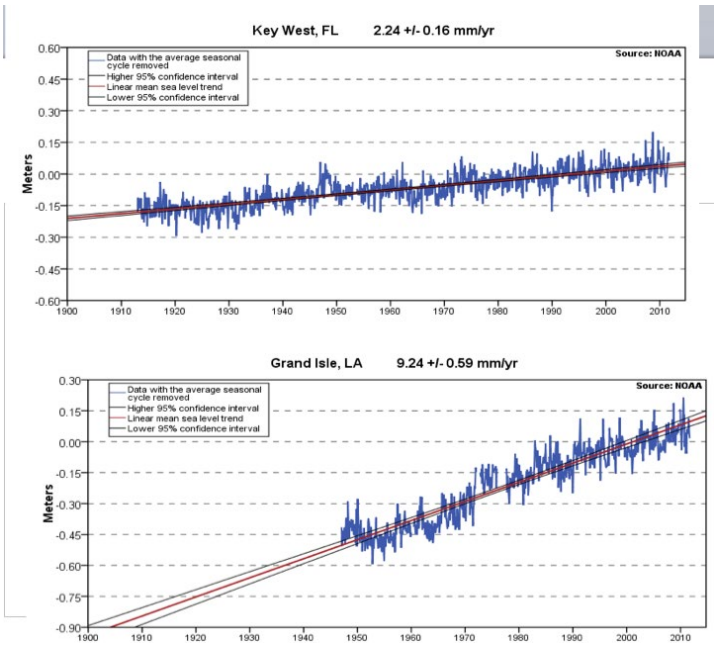


Figure 1.2. Sea Level Rise Comparison between Louisiana and Florida
*Source*: NOAA

Rising sea levels are one of the major consequences of climate change and its effects are generally felt by producers in coastal areas and states. However, there are some major consequences of climate change, such as rising temperatures or changes in extreme weather events, that farmers across the country have to deal with currently, no matter the area. According to the United States Environmental Protection Agency (EPA), extreme weather events, such as floods and droughts, can harm crops and reduce crop yields (U.S. Environmental Protection Agency 2016). Additionally, rising carbon dioxide levels can reduce the concentrations of protein and essential minerals in many plant species, such as wheat, soybeans, and rice (U.S. Environmental Protection Agency 2016). In regards to livestock, increased temperatures can impact livestock productivity. Based on these findings, it is clear that climate change has various devastating effects on all agricultural producers and every aspect of conservation could be implemented to lessen the impacts as much as possible.

### 1.4. Importance of Resource Conservation and Conservation Practices

To retain sustainable agriculture and conserve natural resources, it is important that conservation practices be at the forefront for agricultural producers, among other things. Regardless of finances, these practices should also be made more easily accessible to minority farmers. Conservation practices have the intended goal of improving soil health or water quality. Successful conservation practices can lead to sustainable agriculture (Doran 2002). In regards to soil health, soil health and the changes in the quality indicators can be a significant link between the strategies of conservation management practices and achievement of the substantial goals of sustainable agriculture (Doran 2002). Sustainable agriculture involves making sure that the farmers are benefitting from the practices and that the local environment is benefitting as well. In order to stress the importance of conservation practice adoption amongst minority farmers, it is also important to have an accurate representation of what actions have been taken and what can be done in the future.

### 1.5. Benefits of Conservation Assistance Programs

Along with the data collected from farmers related directly to the use of conservation practices, another useful data source is whether or not these farmers participate in programs that encourage conservation. One can assume that if farmers are engaged, or participating, in a cost-share program that encourages conservation, they are most likely to incorporate or increase the number of conservation practices on their farm (Pathak et al. 2021). However, not every participant in these conservation programs is involved solely in adopting conservation practices. As evidenced by the multiple surveys included in the literature for the meta-analysis, there are many reasons for minority and non-minority farmers to participate in such programs. These

reasons are complex and detailed and could also justify their own meta-analysis. The USDA's Farm Service Agency (FSA) has seven programs centered around conservation. Some of these programs include the Conservation Reserve Program (CRP) and the Conservation Reserve Enhancement Program (CREP), among others (USDA: Farm Service Agency). Specifically, in Louisiana, the USDA sponsors 20 different loans and programs, covering a wide array of issues (USDA: Farm Service Agency). Although not all small farmers rely on assistance programs, these programs provide monetary incentives and support for farmers who do need assistance. While agricultural agencies, such as the USDA, recognize the needs of socially disadvantaged farmers by establishing assistance programs, some of these programs, grants, or loans are not beneficial to all, especially in timing and allocation in comparison to non-minority farmers (Peters 2021). Historically, black farmers have had longer processing times to receive loans when compared to white farmers, and as recently as the 1990s, black farmers had an average processing time of 220 days while white farmers had an average of 60 days (Castro and Willingham 2019). For conservation initiatives to be successful, these programs (and the institutions which distribute assistance) could be reassessed to better meet the needs of minority farmers in a timely manner.

### 1.6. Individual Conservation Programs

The USDA's FSA oversees several programs that address many conservation issues. The main programs include the Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Emergency Conservation Program (ECP), Emergency Forest Restoration Program (EFRP), Farmable Wetlands Program (FWP), Grassland Reserve Program (GRP), and the Source Water Protection Program (SWPP), among others. Also administered by the USDA, the Working Lands Conservation Program (WLP) includes the Conservation

Stewardship Program (CSP), Environmental Quality Incentives Program (EQIP) and the Wildlife Habitat Incentives Program (WHIP). These programs were further supported by the 2018 Farm Bill passed by the United States Congress, with protections to ensure their integrity as unique programs (National Sustainable Agriculture Coalition, 2019). A majority of the farmers and foresters included in the meta-analysis, participate in these programs to enhance their operations.

The most commonly used programs within the literature include the CRP and EQIP amongst agricultural producers. Administered by the FSA, the CRP is a land conservation program where in exchange for a yearly rental payment, farmers agree to remove environmentally sensitive land from agricultural production and subsequently plant species that will improve environmental health and quality (Farm Service Agency: USDA 2021). The CRP has an overall long-term goal of re-establishing valuable land cover to help enhance the quality of water, reduce the loss of wildlife habitat, and prevent soil erosion. As of September 2021, national producers enrolled 5.3 million acres through CRP signups, which surpassed the USDA's goal of 4 million acres (Farm Service Agency: USDA 2021). Administered by the Natural Resources Conservation Service (NRCS), the EQIP is a voluntary conservation program designed to provide financial and technical assistance to agricultural producers and forest managers. Along with the financial and technical assistance, the NRCS helps to plan and implement conservation practices for its producers and forest managers. Benefits of the EQIP include the reduction of contamination from agricultural sources, efficient utilization of nutrients, and increased soil health (Natural Resources Conservation Service: USDA 2021). The 2018 Farm Bill expanded the eligibility criteria for EQIP to allow water management entities to assist private agricultural producers with better managing water distribution (Natural Resources Conservation Service: USDA 2021).

## 1.7. Problem Statement

Based on the previous information given, one can assume that race may play a significant role in adopting conservation practices or participation in conservation programs. However, it is not clear with certainty what specific impact race may or may not have on the adoption of conservation practices or participation in conservation programs. If race does have some impact on these two areas of conservation, it is not clear to what economic extent. This research seeks to understand the economic impact of race on adoption and participation through a meta-analysis.

There is a lack of substantial agricultural economic research pertaining to not only minority farmers and conservation practice adoption or program participation, but on race itself generally. The proper literature on this issue is also not easy to find. The data that is available in these economic research articles are limited in terms of the states that the minority farmers represent. For example, many of the research articles on this specific topic contain data representing some southern states, such as Alabama and Georgia. There is not a plethora of data representing minority farmers across multiple states in the United States. However, the data pertaining to majority white farmers and conservation practice adoption or program participation is overwhelming. This is in part due to the fact that many minority farmers have lost land over the decades. According to the vice president of Race and Ethnicity Policy at the Common Agricultural Policy (CAP), Danyelle Solomon, "'between 1920 and 2007, black farmers lost 80 percent of their land,'" (Cusick 2019). This can partly explain the lack of substantial data pertaining to minority farmers and conservation practice adoption. It is important to include minority farmers, as climate change and assistance programs affect them as well.

## 1.8. Objectives

The general objective of this research is to economically analyze whether race may inhibit or encourage the use of conservation practices and participation in conservation programs among minority farmers using a meta-analysis. The specific objectives include:

1. Examine the average impact of race and its effects on conservation adoption and program participation amongst socially disadvantaged agricultural producers
2. Examine how programs concentrated on conservation may affect the use of conservation practices among minority farmers

In order to accomplish these objectives, meta-analysis is incorporated into the research. All of the data included in the literature comes from the United States, so the data represented in the meta-analysis is representative of a small sample of socially disadvantaged agricultural producers in the United States. Once an adequate representation of program participation and adoption of conservation practices is collected amongst socially disadvantaged agricultural producers, then policy recommendations can be made to improve the utilization of conservation practices and also make the policies and programs more beneficial to minority producers, as well as the surrounding environment.

## 1.9. Research Questions and Hypotheses

The specific research questions throughout the research are:

- Does race have an impact on the adoption of conservation practices and program participation?
- Besides race, what other factors may impact the adoption of conservation practices? If so, what is the impact?

- Does the presence of a conservation assistance program affect the implementation of a conservation practice?
- Do conservation assistance programs encourage and incentivize conservation practices to socially disadvantaged agricultural producers?

The hypotheses will consist of three null and four alternative hypotheses:

- $H_{1O}$: The null hypothesis states that race will have an impact on the adoption of conservation practices and program participation.
- $H_{1A}$: The alternative hypothesis states that race will not have an impact on the adoption of conservation practices and program participation.
- $H_{2O}$: The null hypothesis states that there are other factors besides race that impact the adoption of conservation practices and program participation.
- $H_{2A}$: The alternative hypothesis states that there are no other factors besides race that impact the adoption of conservation practices and program participation.
- $H_{3O}$: The null hypothesis states that the presence of a conservation assistance program will affect the implementation of a conservation practice.
- $H_{3A}$: The alternative hypothesis states that the presence of a conservation assistance program will not affect the implementation of a conservation practice.
- $H_{4O}$: The null hypothesis states that conservation assistance programs encourage and incentivize conservation practices to socially disadvantaged agricultural producers.
- $H_{4A}$: The alternative hypothesis states that conservation assistance programs encourage and incentivize conservation practices to socially disadvantaged agricultural producers.

## 1.10. Rationale

A meta-analysis is necessary for this research because there is not a definitive conclusion as to what the economic impact of race has on the adoption of conservation practices and program participation among socially disadvantaged agricultural producers. A meta-analysis draws data from multiple sources, or articles, before stating a conclusion. Due to the fact that there is not a definition conclusion as to what the economic impact of race is, a meta-analysis can help provide a conclusion using the data that is already available. There is a knowledge gap on this topic as well, in terms of what these socially disadvantaged producers are experiencing and what the federal and local agricultural agencies are recommending or allocating. The information on this topic does not reflect the current period in time and it also does not reflect large swaths of socially disadvantaged agricultural producers across the United States. Along with the knowledge gap, there is a lack of certainty on the economic impact of race. The lack of certainty could lead to a sense of complacency on this issue if the results show that race has no impact on the adoption of conservation practices or program participation. This sense of complacency among the USDA and officials overseeing this area would be ill-advised in the face of the realities of socially disadvantaged agricultural producers today.

# CHAPTER 2. LITERATURE REVIEW

The following 12 articles are included in the meta-analysis. The data embedded in these articles will be analyzed, with the most important variable being "race." These 12 articles consist of the necessary coefficients and logistic regressions to do a proper meta-analysis. These articles include the following listed in Table 2.1:

Table 2.1. Article Names and Author(s)

| Title | Author(s) |
|---|---|
| "Core Conservation Practices: Adoption Barriers Perceived by Small and Limited Resource Farmers" | Molnar et al. (2001) |
| "Determinants of Participation Behavior of Limited Resource Farmers in Conservation Reserve Program in Alabama" | Gyawali et al. (2003) |
| "Limited Access to Conservation: Limited Resource Farmer Participation in the Conservation Security Program in the Southeast" | Bergtold and Molnar (2010) |
| "Farmers' Willingness to Participate in Best Management Practices in Kentucky" | Zhong et al. (2015) |
| "Factors Affecting Participation Behavior of Limited Resource Farmers in Cost-Share Programs in Alabama" | Onianwa et al. (2003) |
| "An Empirical Analysis of Louisiana Small Farmers' Involvement in the Conservation Reserve Program" | McLean-Meyinsse et al. (1994) |
| "Does Race Matter in Landowners' Participation in Conservation Incentive Programs?" | Gan et al. (2005) |
| "An Analysis of Factors affecting Participation Behavior of Limited Resource Farmers in Agricultural Cost-Share Programs in Alabama" | Onianwa et al. (2004) |
| "Internet Access, Practice Adoption, and Conservation Program Participation in Three Alabama Watersheds" | Tallant (2006) |

(table cont'd)

| Title | Author(s) |
|---|---|
| "Minority Family Forest Owners in the United States" | Butler et al. (2019) |
| "Perspectives on Heavy Metal Soil Testing Among Community Gardeners in the United States: A Mixed Methods Approach" | Hunter et al. (2019) |
| "Black Belt Landowners Respond to State-Sponsored Wildland Fire Mitigation Policies and Programs" | Johnson-Gaither et al. (2011) |

The following paragraphs about the articles are in the order in which they are listed in Table 2.1.

Molnar et al. (2001) examined areas with low adoption rates of four core conservation practices among small and limited resource farmers. These practices included conservation tillage, crop nutrient management, weed and pest management, and conservation buffers. The geographical scope included Alabama, Georgia, and Mississippi. The researchers conducted a mail survey and made sure to receive adequate responses from both white and black farm operators. Each conservation practice was measured by four variables, including familiarity and practicality. In terms of conservation tillage, black farmers were least familiar with this practice when compared to white farmers across all three states. A lack of information on how to implement conservation tillage was cited as a reason for the low adoption rate among black farmers. Soil testing is required in order to facilitate proper crop nutrient management. The researchers found that many of the farmers, both black and white, were unaware and uncommitted to this specific practice and that these farmers needed more extended outreach. In terms of weed and pest management, the researchers found that this particular practice was the least understood amongst most of the small and limited resource farmers. The most well-known and understood practice turned out to be conservation buffers. From the survey, the researchers found that there was much variation in education between black and white farmers, with most

black farmers in this sample having less than a high school education. In identifying perceived barriers and disadvantages to the core conservation practices, the researchers found obstacles to implementation for all four practices, ranging from limits to the applicability of each practice to a farmer's own interests at the time. The researchers also found that simple and direct communication of information worked best for small and limited resource farmers. The researchers recommended that the Natural Resources Conservation Service (NRCS) could do more in developing "working relationships with community-based organizations and educational institutions that could help communicate programs to small and limited resource farmers," (Molnar et al. 2001). From this article, it can be concluded that small and limited resource farmers have unique needs that require special attention in order to see improvements in technology, education, and conservation practice adoption.

Gyawali et al. (2003) examined the determinants to improve participation in the Conservation Reserve Program (CRP) in Alabama among limited resource farmers. The researchers conducted a mail survey and obtained a sample containing both minority and non-minority farmers. They used a logit model to assess the characteristics of participants and non-participants of the CRP, and then determine the probability of participation and non-participation. The independent variables included gender, race, education, age, full-time or part-time farmers, total acreage, minority-owned acres, income source, participation in other government programs, direct contact for program information, and interest in receiving program information. The results showed that males and minorities were less likely to participate in the CRP. The results showed the same for the effect of minority-owned acres and a direct method of program information. The researchers concluded that limited resource farmers participating in the CRP was influenced by gender, race, part-time occupation, amount of acreage owned, and

farm income. They also concluded that the strongest determinants of participation behavior of limited resource farmers were "gender, farm size, part-time occupation, method of receiving information, interest in receiving information, and participation in other government programs," (Gyawali et al. 2003).

Bergtold and Molnar (2010) examined the adoption of three specific conservation practices among small and limited resource farmers in the southeast United States. The researchers submitted mail surveys via the National Agricultural Statistical Service (NASS) of the USDA to limited resource farmers across Alabama, Georgia, and Mississippi. A similar number of black and white farmers were included in the sample data. The three specific conservation practices were conservation tillage, crop rotations, and soil testing. The researchers used a multinomial logistic regression model to estimate factors affecting conservation practice adoption. Within the model, they also combined some practices into three more management plans. These combinations included soil testing and crop rotation, soil testing and conservation tillage, and soil testing, crop rotations, and conservation tillage. Some of the variables included race, participation in the Environmental Quality Incentive Program (EQIP), contact with the NRCS, whether or not a farmer has a conservation plan, and farm sales, among others. The researchers found that the presence of a conservation plan and contact with the NRCS both increased the likelihood of a farmer adopting conservation practices. Black farmers were less likely to adopt either of the three conservation practices. They also found that farmers with a college education were less likely to adopt the practice of crop rotations. The researchers concluded that conservation programs, such as the Conservation Stewardship Program (CSP), should recognize the special needs of limited resource farmers, especially black farmers, in order to avoid low rates of participation (Bergtold and Molnar 2010).

Zhong et al. (2015) examined the factors influencing farmers' use of best management practices (BMPs) and the farmers' willingness to implement best management practices through a water quality trading program (WQT). The researchers sent out mail surveys to farmers across counties in the Kentucky River watershed area. The race variable in this research was not explicitly described as a representation of minority farmers, but it was rather described as a percentage of white farmers. The researchers also included a variable of socially disadvantaged farmers, which defined itself as the farm operator's race not being white. Other notable variables included land size, farms with crops or livestock, education, farming experience, participation in the CRP or Working-Land Program (WLP), among many others. The first part of the empirical model estimated the farmers' current use of BMPs. Included in the first part were six regressions. The second part of the empirical model estimated the farmers' willingness to adopt additional BMPs given different levels of compensation. Despite non-white farmers being included in this research, the results and conclusion sections of this research article concluded that there was not any explicit impact of race on the adoption of BMPs. The most significant finding from the first part of the empirical model was that farmers who are already participating in conservation programs are more likely to adopt and use BMPs. In terms of race, the researchers state that "targeted farmers who are limited in their production and social reach do not have any different preference to adopt BMPs compared to other farms," (Zhong et al. 2015). However, it is not clear if these "targeted farmers" are meant to represent non-minority farmers. The most significant finding from the second part of the empirical model was that experience with BMPs was more effective in influencing farmers to implement additional BMPs as opposed to the compensation they could receive.

Onianwa et al. (2003) examined the participation behavior of Alabama farmers in cost-share programs. The researchers utilized a mail survey through the USDA's NASS and identified limited resource farmers as those with annual gross farm sales of less than or equal to $40,000. Both white and minority farmers were included in this survey. A binary logit model was incorporated into the research to analyze the data. Notable independent variables included race, education, part-time occupation, participation in other non-cost government programs, membership in any conservation organization, and total acres owned and rented by minority farmers. After doing the analysis, the researchers found that the variables gender (males), minorities, part-time farming, and participation in other non-cost share government programs were not significant on the probability of participating in cost-share programs. The most significant variables were age, education, and total acres owned and rented regardless of race. The race variable had a positive but non-significant sign on participation. The researchers suggested that this could be due to the "differential effect of higher participation rates of minorities among members of conservation organizations," (Onianwa et al. 2003). The researchers found that cost-share program participation was higher among those who were members of conservation awareness organizations than those who were not, regardless of race. In order to increase cost-share conservation program participation, the researchers concluded that more inclusive membership campaigns by way of formal conservation organizations could help (Onianwa et al. 2003).

McLean-Meyinsse et al. (1994) examined the small farmers' reasons for not participating in the CRP, their awareness of the CRP, and their willingness to participate in the CRP. The researchers conducted a mail survey that focused on small farmers in the Franklin, Richland, and West Carroll parishes of northeast Louisiana. A great number of respondents (64%) were black

farmers. The researchers used a binominal-logit model to examine the influence of socioeconomic characteristics on the awareness of and willingness to participate in the CRP. Notable variables included education, farm size, race, ownership, and income. More educated and higher income farmers had a greater sense of awareness of the CRP. Black farmers had a lesser sense of awareness of the CRP. Race was not positively significant for the willingness to participate. Willingness to participate in the CRP was positively influenced by payment per acre, age, and farm status. Like previous articles, the researchers concluded that further educational outreach was needed to increase program participation and even suggested that involving "civic, social, and religious groups, and community leaders in the outreach programs," could help in doing so (McLean-Meyinsse et al. 1994).

Gan et al. (2005) examined the differences and similarities between minority and white farmers in terms of their participation behavior. The data within the research was based on the mail survey administered by the USDA's NASS in the previous article, (McLean-Meyinsse et al. 1994). This research also utilized a logit model but included many more variables to describe participation in various programs, such as the Agricultural Conservation Program (ACP) or the Emergency Conservation Program (ECP). From the analysis, the researchers found the CRP to be the most popular program between both minority and white farmers, but the length of participation and amount of acreage enrolled in the CRP differed between both groups, with white farmers taking the advantage. The most perceived benefit of participation specifically among minority farmers identified in this research was the value of livestock grazing. The primary reason for not participating in the conservation programs among both groups was unfamiliarity with the programs. Another primary reason for not participating in the programs among minority farmers was the lack of finances to support, as evidenced by the researchers

stating that “significantly more minorities than whites said that they could not afford their cost share for these programs,” (Gan et al. 2005). For both farmer groups, farmers with larger acreage size were most likely to participate in the conservation programs. These farmers were also in a better position to make investments and afford cost shares for the various programs. Specifically for the CRP, the significant determinant for participation amongst minority farmers was farming income, not acreage size. For the overall programs, the significant determinants for participation amongst minority farmers were education, membership in farmer associations, and gender. The researchers concluded that options needed to be developed in order to specifically address the “needs and constraints of socially and economically disadvantaged landowners,” (Gan et al. 2005). The researchers noted that due to the low response rate to their survey, the results on gender could have been biased because of a low number of female participants.

Onianwa et al. (2004) examined the factors affecting participation behavior via a mail survey. Like previous articles, the researchers administered their survey with the help of the USDA’s NASS to ensure adequate representation of both white and minority farmers. Within the logit model, independent variables included race, education, participation in other non-cost share government programs, and membership in any conservation organization, among others. The single dependent variable was participation in at least one cost-share government program. The researchers divided their data based on the six different districts that the various farm operators represented. The results showed that the variables gender, race, part-time farming, and participation in other non-cost share government programs were not significant. The significant predictors of participation were found to be education, age, the ratio of owned to total acres, rented acres, the gross value of sales, and membership in a conservation organization. The results also showed that limited resource farmers, who were members of any conservation organization,

had a higher probability of participating in agricultural cost-share programs. This finding was similar in previous research articles, noting that this could be due to limited resource farmers who are members of any conservation organization being more "environmentally conscious, and therefore much more likely to participate in conservation programs," (Onianwa et al. 2004). A consistent conclusion with the other articles mentioned is noted by the researchers stating that "government agencies may find collaborations with nongovernmental conservation organizations an effective means through which farmer stewardship of land and water resources could be encouraged while simultaneously reducing environmental costs to the larger community," (Onianwa et al. 2004). They also concluded that different strategies need to be designed in order to target specific groups of farmers.

Tallant (2006) examined the use of the Internet by small and limited resource farmers and how that may affect the adoption of conservation practices and participation in the NRCS. The researcher conducted a mail survey and received over 1,000 responses, both white and minority farmers, across the three different Alabama watersheds. However, only five percent of the limited resource farmers surveyed were African-American. The relevant independent variables included education, age, gender, race, operation size, and total gross value of sales. The relevant dependent variables included rotational grazing, conservation tillage, soil testing, integrated pest management, and program participation. The results showed that the race variable was significantly negatively correlated for all four of the core conservation practices. With all of the independent variables considered, the researcher found that education, age, gender, and race did not have a significant effect on a farmer's participation in NRCS programs. The only variables found to be significantly related to conservation practice adoption and NRCS program participation were the total gross value of sales and operation size. The researcher concluded that

race was still a barrier to conservation adoption and NRCS participation due to the "significant positive correlation that exists between total gross value of sales, operation size, and adoption," (Tallant 2006).

Butler et al. (2019) examined the characteristics, behaviors, and attitudes of minority family forest owners across several states in the United States. These states include every state with the exception of Wyoming, Alaska, and Hawaii. The reasoning behind the research was that the researchers felt that they had a lesser understanding of minority family forest owners on a national level. Similar to the previous articles, the importance of program participation was highlighted. Similarly, the researchers noted that "minority landowners are less aware of policies and programs intended to assist with forest management and planning, and they are less involved in these programs," (Butler et al. 2020). Along with the lack of awareness, most of the programs and policies are focused generally on family forest owners, particularly nonminority family forest owners (Butler et al. 2020). The researchers obtained data from a survey administered by the USDA Forest Service's Forest Inventory and Analysis (FIA) program. Multiple races participated in this survey, with white forest owners taking the majority. A bivariate analysis was used along with a descriptive logistic regression model. Notable variables included the size of forest holdings, race, ownership type, and use of cost-share programs. The results showed that program participation was low among all minority groups, with the exception of Hispanic family forest owners. The minority family forest owners were more likely to have smaller forest holding sizes than their non-minority counterparts. Minority family forest owners were also less likely to be enrolled in cost-share or tax programs than non-minority family forest owners. Additionally, minority family forest owners were less likely to carry out forest-management activities when compared to non-minorities. The researchers conclude that the first step to engaging these

minority family forest owners is to understand the differences and similarities between them and non-minorities (Butler et al. 2020).

Hunter et al. (2019) examined the use of heavy metal soil testing in community gardens in Atlanta. The researchers led in-person focus groups and online questionnaires based on their knowledge about soil contaminants, gardening behaviors, and beliefs about soil testing, among other things. 26.9% of the focus group participants were black and 4.8% of the questionnaire participants were black. Participants from the focus group suggested that clear language regarding soil test results should be available and that further guidance on the next steps after testing would encourage more gardeners to test their soil. Most focus group participants exhibited strong intentions to conduct heavy metal soil testing. The researchers ran bivariate analyses to analyze the data and found that the intention in soil testing increased with a positive attitude, stronger subjective norms, and a higher perceived behavioral control. Along with these factors, education and income statistically significantly influenced soil testing intention. Gardeners with a complete college degree or some college were found to be less likely to have a higher intention to test their soil when compared to gardeners with only technical school training (Hunter et al. 2019). The researchers conclude that theory-based interventions based on improving attitudes, subjective norms, and perceived behavioral control could help influence soil testing. They also conclude that the goal of community gardening training should not only be about improving soil contaminant knowledge, but it should also address the Theory of Planned Behavior variables such as perceived behavioral control.

Johnson-Gaither et al. (2011) assessed the awareness and responsiveness of African-American and white landowners to state-sponsored wildland fire mitigation policies and programs. These landowners were located in the southern Black Belt region of the United States,

and these states included Alabama, Florida, Georgia, Mississippi, and South Carolina. In consultation with state foresters from each of the five states, the researchers conducted a survey to obtain information regarding land ownership characteristics, demographics, awareness of programs and policies, and actions taken to reduce wildland fire hazards, among other things. Multiple efforts were made by the researchers to increase the number of African-American participants in each state by way of telephone and mail surveys. Altogether, the researchers collected 835 participants, with 29.5% being African-American. In the analysis, logistic regression models were used to test for racial differences in fire mitigation awareness, information use and request, and other factors. The study found that African-American landowners requesting information about fire mitigation were less likely to use said information than white landowners. The researchers also found that African-Americans stated a lack of awareness about mitigation information as a barrier to requesting fire mitigation information. The study concludes by stating that African-American landowners in the Black Belt were not disadvantaged with respect to information awareness or acquisition (Johnson-Gaither et al. 2011).

# CHAPTER 3. CONCEPTUAL FRAMEWORK

A meta-analysis provides weighted, or combined, effect size estimates. An effect size is a dependent variable in a meta-regression. In this scenario, the effect size or dependent variable is race. A meta-regression analysis was created with the help of the coefficients from the "race" variable from the literature. A meta-regression analysis explains heterogeneity with the help of moderator variables. Heterogeneity occurs when there is variation in effects or results. The meta-regression analysis accounts for how the weighted effect size is calculated based on the effect size's underlying variance.

## 3.1. Dependent Variable: Agricultural Producer Characteristics, Race

The dependent variable in this meta-analysis consists of agricultural producer characteristics, but the main dependent variable examined in this meta-analysis is race. The race variable specifically focuses on African-Americans, but there are other minority groups present in this singular variable as well, such as Asian-Americans and Hispanic-Americans. Due to the lack of substantial data that includes only African-American agricultural producers, and minority groups generally, there are times within the literature where the researchers only distinguish between minority and white farmers. They did not specify which minority groups were included. In the times in which the researchers did specify which minority groups were included in their analysis, they did not provide any coefficients for any specific minority group from a regression analysis and instead grouped all the minorities together to provide one coefficient.

### 3.2. Independent Variables: Adoption of Conservation Practices and Program Participation

The conservation practices examined in this meta-analysis are not specific to the conservation of soil, water, or any natural resource useful to agricultural producers. All of the conservation practices mentioned in the meta-analysis have the overall goal of improving the quality of the land and conserving natural resources to help the surrounding environment. Some of these practices include conservation tillage and rotational grazing.

Program participation refers to socially disadvantaged producers participating in government cost-share programs centered around conservation. The government programs examined in this meta-analysis are not specific to one particular program. Within the literature, the government programs examined encouraged conservation and the use of conservation practices in some form. In many cases, the participants in these government programs receive technical or financial assistance.

### 3.3. Moderator Variables

A moderator variable is a variable that is used to temper or control the magnitude of an effect of an independent variable on a dependent variable (Judd 2001). The purpose of moderator variables in this particular meta-analysis is to help determine the strength of an effect between race and conservation practice adoption and program participation. Through the meta-regression analysis, the moderator variables can also help to determine any other effects on conservation practice adoption and program participation. In this meta-analysis, six moderator variables were used: survey type, program type, peer-reviewed journal article, function form, unique study, and location.

The moderator variable "survey type," or "0.surtype" as abbreviated in the analysis, is a dummy variable. This variable describes the use of surveys distributed either via physical mail or some other form of distribution, such as electronic or an in-person interview. An observation from an article equaled one if the article utilized a mail survey and zero if an article did not.

The moderator variable "program type," or "protype" as abbreviated in the analysis, is a dummy variable. This variable describes the use of the government-sponsored program CRP in the various articles used. An observation from an article equaled one if the researchers from said article used the CRP to measure program participation among agricultural producers and equaled zero if the researchers instead used another program.

The moderator variable "peer-reviewed journal article," or "peerjo" as abbreviated in the analysis, is a dummy variable. This variable describes whether an article used in the meta-analysis was or was not peer-reviewed upon publication. An observation from an article equaled one if the article was peer-reviewed and equaled zero if otherwise.

The moderator variable "functional form," or "funcform" as abbreviated in the analysis, is a dummy variable. This variable describes the type of model used by the various researchers to analyze the data. Due to a logistic type model being the most commonly used among the 12 articles, an observation from an article equaled one if the article used a logistic model and zero if an article used something else, such as a multivariate linear model.

The moderator variable "unique study," or "uniquestudy," as abbreviated in the analysis, is a dummy variable. This variable describes when an article is used in the metadata for the first time. The first observation from an observation equaled one, as it is the main observation from the article. The rest of the observations from the article equaled zero. As there are 12 articles

used in the metadata, there are 12 separate observations from these articles that equal one individually.

The moderator variable "location," or "location1," as categorized in the analysis, is a dummy variable. This variable describes when an article utilizes data from agricultural producers within a single state or across multiple states. An observation from an article equaled one if the data utilized within an article originated from a single state and zero if the data originated from multiple states. A description of all of the moderator variables is given in Table 3.1.

Table 3.1. Variable Descriptions

| **Variables** | **Description** |
|---|---|
| Survey type or "0.surtype" | 0 if an in-person survey, 1 if otherwise |
| Program type or "protype" | 1 if CRP is utilized, 0 if otherwise |
| Peer-reviewed journal article or "peerjo" | 1 if an article was peer-reviewed. 0 if otherwise |
| Functional form or "funcform" | 1 if logistic model used, 0 if otherwise |
| Unique study or "uniquestudy" | 1 if first observation in an article, 0 if otherwise |
| Location or "location1" | 1 if study area is a single state, 0 if otherwise |

# CHAPTER 4. RESEARCH METHODS

The research methods utilized in the research consisted of meta-regression analysis and the use of the Stata program. In order to find useful data and information, the beginning stage of the meta-regression analysis involved searching for the necessary research articles with the correct coefficients to run an analysis in Stata. Using the websites Google Scholar and ProQuest, the following random combinations of keywords were placed into the search engine to get the best results: "socially disadvantaged farmers," "minority," "program participation," "conservation," "conservation practice adoption," and "agricultural producers." The articles produced from either one or different combinations of these keywords in the initial search produced over 700 results. However, the articles produced were not all useful. The inclusion criteria for these articles were that they conducted some type of survey or questionnaire and included regression estimates from either a logistic or linear model and/or marginal effects on race. The exclusion criteria for these articles were that they did not conduct some type of survey or questionnaire and did not include any regression estimates from either a logistic or linear model. Some of the articles were focused on the right topic, such as race and program participation, but did not offer any economic analysis and therefore no coefficients were offered as well. Some of the other articles did offer an economic analysis but did not include any coefficients or marginal effects for the "race" variable. Due to the lack of substantial economic research data on this topic, the number of useful articles and observations equaled 12 and 57, respectively. The marginal effects were the most important to collect and analyze because they are useful in quantifying effects and avoiding identification problems when comparing regression coefficients between logit and probit models (Mize et al. 2019).

### 4.1. Data Collection

After the collection of useful articles and its data, the data was then organized into a Microsoft Excel spreadsheet. Outside of the race variable and the moderator variables, the other important items to collect were: names of authors, whether an article originated from a journal or not, year of publication, sample size, source of data, and type of race variable. These items were important to note in Excel in order to make the individual data easy to identify and verify. Aside from the sample size, the rest of the identifiable elements of the articles collected in Excel were used to help identify and source the articles. Sample size, however, is important to meta-analysis as a quantitative meta-independent variable. As mentioned previously, the race variable coefficients within the 12 articles were the most important to collect. However, the key component to collect from the different articles were the marginal effects. The articles contained either odds ratios, marginal effects, or both. In order to make a more precise meta-analysis, the marginal effects were the most important to collect. The marginal effects were prioritized over odds ratios because marginal effects are measured on a probability scale and they work best when estimating a logistic model, which is being utilized in this instance (Perraillon 2021). For the articles that contained only odds ratios, the following equation, eq. (4.1), was used to convert odds ratios into marginal effects.

$$ME = \beta p(1 - p) \tag{4.1}$$

In this formula, $\beta$ equals the odds ratio coefficient and $p$ equals the number of minority agricultural producers divided by the total sample size used in the individual articles. Although the marginal effects were the most important to obtain in the meta-analysis, the odds ratios were also kept in case of any problems with running a regression in Stata. Once all of the correct information was collected in Excel into the right columns, the attention shifted into how

to analyze the information and data into Stata. Stata is a computer software package used for statistical analysis. The important variables to place into Stata were race, sample size, and the moderator variables.

### 4.2. Meta-Regression Analysis: First Model

Due to the different articles collected for the meta-analysis and the different contexts in which race was observed, the statistical model used in this meta-analysis is a random-effect model. A random-effect model assumes the observed estimates of a treatment effect can vary across studies due to real differences in the treatment effects in the individual studies and sampling variability as well (Riley et al. 2011). With all of the appropriate data organized into Excel, Stata was utilized to help analyze the data. First, a standard error, squared standard error, and precision squared were generated to produce a confidence interval and a probability value (Higgins and Green 2011). A standard error was necessary to generate because it can help to predict the precision of an estimate (Frost 2022). The standard errors were generated by dividing one over the square root of the individual sample sizes. The squared standard errors were generated by squaring the value of standard errors. The precision squared values were generated by dividing one over the squared standard errors. The generated standard errors were then used to create the first regression-based model to test for publication bias. Using a weighted least square (WLS) version, this test is known as a FAT-PET. A FAT is a funnel asymmetry test that tests for publication bias. Publication bias is defined as the "tendency on the parts of investigators, reviewers, and editors to submit or accept manuscripts for publication based on the direction or strength of the study findings," (Dickersin 1990). A PET is a precision effect test that tests whether or not a true effect is significant. The reasoning behind the use of the weighted least square (WLS) version was to account for any heteroskedastic data (Data Mining 2009).

Heteroskedastic data refers to error variance within a particular sample (Hayes 2020). To account for FAT-PET in Stata and make the model a WLS version, the command "[aweight = pre_sq]" was added to the end of the regression function. This command weighted the function by way of the precision squared values. Table 4.2 showcases the results of the first regression-based model testing for publication bias. The results from this test, particularly the probability value, were used to determine the strength of the data against the null hypothesis.

As shown in Table 4.2, this model underwent two different variations: one "robust" variation and one "robust cluster" variation. The purpose of the "robust" and "robust cluster" variations were to provide better coefficient estimates and provide more accurate estimates of the standard errors. A robust regression can provide better coefficient estimates when outliers are present in a model (NCSS Statistical Software). Although obvious outliers were removed from the data before any regression analysis, the robust function was included in Stata. The cluster function in Stata was used due to the model being a random-effect model and to account for more accurate standard errors. According to authors researching the use of clustering for standard errors, they concluded that standard errors did not have to be adjusted for clustering if fixed effects were included in the model (Abadie et al. 2017). This particular regression was clustered by study, or article, due to the model being a random-effect model and to also be sure of the results. The following equation, eq. (4.2) shows the way in which this model was tested for publication bias (Stanley and Doucouliagos 2012).

$$t_i = \beta_1 + \beta_0 \left({}^{1}/_{SE_i}\right) + v_i \tag{4.2}$$

In this equation, $t_i$ represents the estimate's t-value, $SE_i$ represents the estimate's standard error and $v_i$ represents the error term. For the funnel asymmetry test, $\beta_1 = 0$, and for the precision effect test, $\beta_0 = 0$ (Stanley and Doucouliagos 2012).

Table 4.2. Regression Based Test of Publication Bias for Race

| Variables | Robust FAT-PET | Robust Cluster FAT-PET |
|---|---|---|
| **SE (standard error)** | 0.609<br>(0.779) | 0.609<br>(0.985) |
| **Intercept (constant)** | -0.018<br>(0.029) | -0.018<br>(0.034) |
| **N** | 57 | 57 |
| **$R^2$** | 0.014 | 0.014 |
| **F-statistic** | 0.61 | 0.38 |

### 4.3. Meta Regression Analysis: Second Model

The second model in the analysis involved only the significant moderator variables. In order to identify the most significant moderator variables, a "stepwise" function was utilized in Stata to identify and extract any insignificant moderator variables. First in Stata, a "global moderator" function was constructed using all six moderator variables. Then the "stepwise" function was utilized, with the intention of keeping the standard error in the regression. In addition to keeping the standard error in the regression, the same command ("[aweight = pre_sq]") was added to the regression function to make it a WLS version. The results of this model, using a robust and non-robust regression, are found below in Table 4.3.

Table 4.3. Meta-Regression Results of Only Significant Moderator Variables

| Variables | Normal Regression | Robust Regression |
|---|---|---|
| **SE (standard error)** | 0.328<br>(0.632) | 0.326<br>(0.443) |
| **Functional form (funcform)** | $0.096^{***}$<br>(0.014) | $0.110^{***}$<br>(0.021) |
| **Program type (protype)** | $0.097^{***}$<br>(0.020) | $0.096^{***}$<br>(0.020) |
| **Survey type (in-person)** | $0.086^{**}$<br>(0.033) | $0.074^{**}$<br>(0.025) |
| **Peer-reviewed journal article (peerjo)** | -- | -0.015<br>(0.016) |
| **Unique study** | $-0.039^{**}$<br>(0.018) | $-0.039^{**}$<br>(0.019) |

(table cont'd)

| Variables | Normal Regression | Robust Regression |
|---|---|---|
| **Intercept (constant)** | $-0.139^{***}$<br>(0.031) | $-0.139^{***}$<br>(0.026) |
| **N** | 57 | 57 |
| **$R^2$** | 0.516 | 0.517 |
| **F-statistic** | 10.86 | 11.35 |

$p < 0.10: *, p < 0.05: **, p < 0.01: ***$

### 4.4. Meta Regression Analysis: Third Model

The third and final model in the analysis incorporated all six of the moderator variables. As in the previous model, the "global moderator" function was used in order for Stata to recognize all six moderator variables. In order to keep all three models similar in nature, the same command was used in this regression to account for the FAT-PET and WLS version. Also, in keeping all of the models similar, a robust and non-robust regression was utilized in this analysis. The final results from these regressions are displayed in Table 4.4. The following equation, eq. (4.3), shows the way in which all moderator variables were included (Stanley and Doucouliagos 2012).

$$t_i = \beta_0 \left(1/_{SE_i}\right) + \beta_1 + \sum \beta_k Z_{ki} + u_i + v_i \quad (4.3)$$

In this equation, $t_i$ represents the estimate's t-value, $SE_i$ represents the estimate's standard error, and $\sum \beta_k Z_{ki}$ represents the collection of moderator variables. Similar to the first model, the funnel asymmetry test is represented by $\beta_1 = 0$, and the precision effect test is represented by $\beta_0 = 0$ (Stanley and Doucouliagos 2012).

Table 4.4. Meta-Regression Results of All Moderator Variables

| Variables | Normal Regression | Robust Regression |
|---|---|---|
| **SE (standard error)** | 0.474<br>(0.793) | 0.474<br>(0.581) |
| **Functional form (funcform)** | $0.112^{**}$<br>(0.042) | $0.112^{***}$<br>(0.024) |
| **Program type (protype)** | $0.101^{***}$<br>(0.024) | $0.101^{***}$<br>(0.025) |
| **Survey type (in-person)** | 0.076<br>(0.046) | $0.076^{*}$<br>(0.026) |
| **Peer-reviewed journal article (peerjo)** | $-0.014$<br>(0.040) | -0.014<br>(0.017) |
| **Unique study** | $-0.038^{**}$<br>(0.018) | $-0.038^{**}$<br>(0.018) |
| **Location** | $-0.006$<br>(0.019) | -0.006<br>(0.019) |
| **Intercept (constant)** | $-0.146^{***}$<br>(0.040) | $-0.146^{***}$<br>(0.034) |
| **N** | 57 | 57 |
| **$R^2$** | 0.518 | 0.518 |
| **F-statistic** | 7.52 | 9.35 |

$p < 0.10: *,\ p < 0.05: **,\ p < 0.01: ***$

# CHAPTER 5. RESULTS

## 5.1. Descriptive Statistics

Out of the articles used in the meta-analysis, the average value of the marginal effects was nearly 0.01 or 1%. The average sample size was about 920.48 people within the literature. Nearly 0.65, or 65%, of the articles used a logistic model as its functional form. Nearly 0.77, or 77%, of the articles used the CRP as their program of interest. About 0.11, or 11%, of the articles used incorporated some type of in-person survey questionnaire. About 0.54, or 54%, of the articles used were peer-reviewed journal articles. About 0.17, or 17%, of the articles used had multiple observations. Nearly 0.51, or 51%, of the articles used incorporated data from a single state. These numbers are evidenced in the below table, Table 5.1.

Table 5.1. Descriptive Statistics

| **Variables** | **Mean** | **Standard Deviation** |
|---|---|---|
| **DV1 (dependent variable)** | 0.01 | 0.07 |
| **Sample size** | 920.48 | 1332.83 |
| **Functional form** | 0.65 | 0.48 |
| **Program type** | 0.77 | 0.42 |
| **Survey type (in-person)** | 0.11 | 0.32 |
| **Peer-reviewed journal article** | 0.54 | 0.50 |
| **Unique study** | 0.17 | 0.38 |
| **Location** | 0.51 | 0.50 |

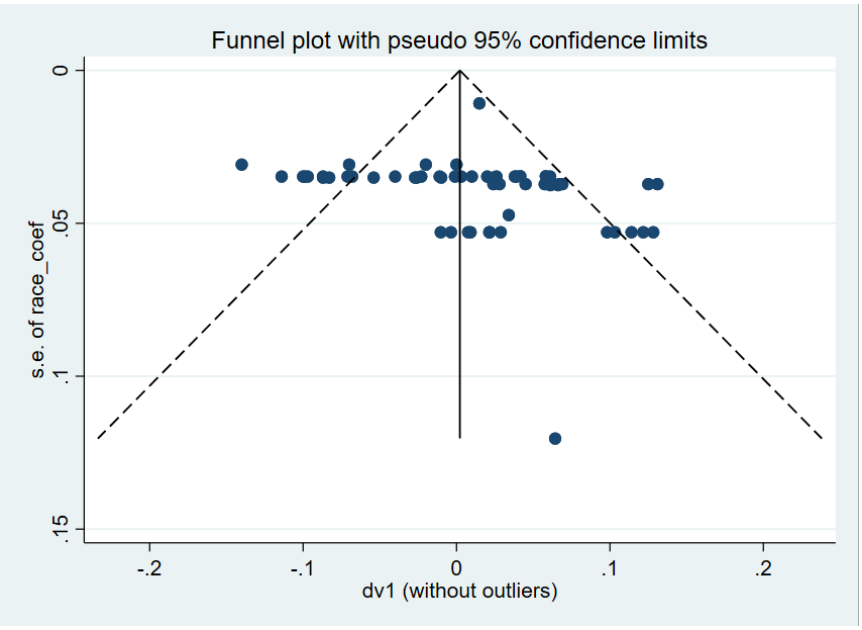


Figure 5.1. Funnel Plot

### 5.2. Funnel Plot

Figure 5.1 displays the funnel plot, with the marginal effects of the race coefficient representing the x-axis and the standard error of the marginal effects representing the y-axis. The x-axis can also represent the results of a study, while the y-axis can also represent the precision of a study (Bradburn). The marginal effects appear to be evenly distributed across the overall effect, both positively and negatively. On both sides of the overall effect, there are marginal effects above the 95% confidence intervals. Due to the relatively even distribution of the marginal effects, there is no apparent publication bias.

### 5.3. Regression Based Test of Publication Bias for Race

As evidenced in Table 4.2, both versions of the model proved to have no significant variables. The variable of interest in this particular model was the standard error. None of the coefficients for the standard error were significant at the 0.10, 0.05, or 0.01 probability values.

All of the coefficients were relatively the same between both versions with the exception of the standard errors. It is expected for the standard errors to be different due to the "cluster" function directly affecting the standard errors, causing them to increase in this model. Both $R^2$ values are relatively the same but the F-statistic value decreases in the robust cluster version. With the decreased F-statistic values and the non-significant standard error coefficient values, it is clear that the model was not significant. In regards to publication bias, the model displayed no obvious signs of it due to no statistically significant variables, even after clustering the standard errors. This was true in the application of both the FAT and PET. This overall model illustrated that race has no significant impact on conservation adoption and program participation and no publication bias was present.

### 5.4. Meta-Regression Results of Only Significant Moderator Variables

As shown in Table 4.3, in the normal regression, the stepwise function removed the survey type and location variables. In the robust regression, the stepwise function got rid of only the location variable. In both regressions, the location variable proved to be the least significant. However, in both regressions, the functional form, program type, survey type, and unique study variables proved to have some significance. Within the meta-analysis, the functional form had an impact on conservation adoption and program participation. In this particular scenario, the use of a logistic model in the data analysis had an impact. The use of the CRP within the literature had significance upon conservation adoption and program participation. Amongst the literature, the CRP was the most widely recognized and used within the data. The value of the race coefficient pertaining to the survey type displayed some significance. This variable emphasized in-person surveys or questionnaire. It is notable that this value is high and significant because an in-person, or face-to-face, survey would allow for a more personable, realistic flow of information. The

negative, yet significant, coefficient value of the unique study suggests a negative relationship between the number of observations in a study and conservation adoption and program participation. As the number of observations increased from any article within the literature, there was a lesser likelihood that race would have any significant impact on conservation adoption and program participation when race was observed in the literature. The number of observations pertaining to race did not have any influence over conservation adoption and program participation.

### 5.5. Meta-Regression Results of All Moderator Variables

Within Table 4.4, these set of regressions found the same moderator variables to be significant as the previous set of regressions. Both the functional form and program type were found to also be significant in these set of regressions, but the survey type was only found to be significant at the 10% level in the robust regression. Like the previous set of regressions, the unique study variable coefficients were found to be negative and significant. These set of regressions kept the location moderator variable, but it was found to be not significant. Due to the location variable being found to be not significant in both sets of regression, it can be concluded that the location of the data did not make a statistical difference. Whether the data from an article originated from one state or multiple states, the geographic area in which data was obtained had no impact on conservation adoption and program participation when race was observed in the literature. The standard error and intercept coefficient values were found to be non-significant and significant, respectively, in both sets of regressions.

# CHAPTER 6. DISCUSSION

Due to the nature of the meta-analysis, this research was only able to answer the first research question. The first research question asked if race had any economic impact on the adoption of conservation practices and program participation among socially disadvantaged agricultural producers. This research concluded that the race variable, alone, did not play a significant economic factor in conservation adoption and program participation among socially disadvantaged agricultural producers. Whenever race was observed in the literature, the meta-regression analysis showed no economic impact on conservation adoption and program participation among socially disadvantaged agricultural producers. As a result, the first null hypothesis is rejected and the first alternative hypothesis is accepted. The first alternative hypothesis stated that race would not impact the adoption of conservation practices and program participation among socially disadvantaged agricultural producers. However, this research partially answered the question as to whether or not any other factors may impact the adoption of conservation practices and program participation among socially disadvantaged agricultural producers.

Within this specific meta-analysis, the data showed that the program type and survey type do significantly affect conservation adoption and program participation among socially disadvantaged agricultural producers. This could be interpreted as whenever race was observed within the literature, using participation in the CRP and in-person surveys to analyze data, then this meta-analysis found those two factors to be statistically significant. However, this is only relevant within the 12 articles collected for the meta-analysis. While it may be possible, without having a larger sample size or a larger collection of data and observations, it is not evident that these same factors would be relevant or statistically significant with certainty. This meta-analysis

explicitly focused on race, so there was not enough information gathered to analyze whether the presence of a conservation assistance program affected the implementation of a specific conservation practice or whether these programs incentivized or encouraged conservation practices to socially disadvantaged agricultural producers.

As previously stated, this research does conclude that race does not play a significant role in conservation adoption and program participation among socially disadvantaged agricultural producers. However, in running an ordinary least squares (OLS) regression, the results displayed a different story. The results from the OLS regression showed the race variable to have some significance. However, due to this research being a meta-analysis, it was important to keep the WLS version. This meta-analysis only contained 12 articles and as a result, did not contain data from all socially disadvantaged agricultural producers currently in the United States. There are also not enough articles and observations to make the analysis a true meta-analysis. Consequently, this research cannot definitively conclude that race does not play a significant economic role in conservation adoption and program participation among these producers.

In doing the preliminary search for the literature review, there were very few articles pertaining to the effect of race on conservation adoption and program participation. There were also very few articles on conservation adoption and program participation that included abundant data from solely minority agricultural producers. The lack of substantial data pertaining to minority agricultural producers is a result of minority agricultural producers facing discriminatory and institutional hurdles that are sometimes too difficult to overcome on a regular basis. When access is difficult to attain for minority agricultural producers or when these producers are ignored altogether, it is not surprising for there to be a lack of substantial economic data on minority agricultural producers and their attitudes towards conservation adoption and

program participation. Given the lack of substantial data, it is also not surprising that overall participation in conservation programs by minority agricultural producers has lagged behind non-minority, or white, agricultural producers (National Sustainable Agriculture Coalition 2021).

In order for there to be an increased amount of data pertaining to the effect of race on conservation adoption and program participation or data pertaining to socially disadvantaged agricultural producers generally, the USDA and other governmental agriculture agencies could better prioritize and educate these producers. In terms of education, there remains an information gap with potential black farmers due to a lack of adequate funding for agricultural programs in historically black colleges and universities (Aminetzah et al. 2021). A recommendation to better improve education and participation among socially disadvantaged agricultural producers would be to hold educational events and provide interactive formats, among other things (PennState Extension 2018). This could help ensure that these producers know what is available to them and how to best utilize their options. The organizations (universities, colleges, governmental agencies, etc.) who do research on these topics could also take some initiative to increase engagement and education with the minority farming community, which would benefit the USDA and their efforts as well.

The use of the CRP, in-person surveys, and a logistic model were the only consistently positive, statistically significant moderator variables across all meta-regressions. In focusing on the use of the CRP and in-person surveys, there are recommendations as to how to better utilize these methods to continue to display some statistical significance when analyzing race among socially disadvantaged agricultural producers. Although information is available as to the amount of acres enrolled through CRP signups in 2021, which was 5.3 million acres, there is not information widely available as to what percentage of that acreage originated from minority

farms or even the percentage of CRP signups from minority farmers (USDA 2022). In case this information is only available internally within the USDA, it would be beneficial to make this information more widely or publicly available so other organizations who interact with socially disadvantaged agricultural communities can better adjust their methods in regards to the CRP. It would also be beneficial to know if the USDA's data also supports the popularity of the CRP among socially disadvantaged agricultural producers as evidenced in this meta-analysis.

When collecting data among socially disadvantaged agricultural producers, utilizing in-person surveys or questionnaires whenever possible would most likely encourage greater response rates and allow for a greater exchange of information. Due to the statistical significance of in-person surveys in the meta-analysis, it appears that this method garners the most success when interacting with these producers. In terms of the statistical significance of the type of functional form used, the data within this meta-analysis supports the usage of a logistic model to analyze the marginal effects. It is not clear that the usage of a linear model would bring about the same results or statistically insignificant results, but due to the common usage of a logistic model amongst the literature, it would be best to use a logistic model.

When race was observed within the literature, this meta-analysis concluded that race was not statistically significant in analyzing the use of conservation practices and program participation amongst socially disadvantaged agricultural producers. Although that may not reflect the current realities of these producers, it was important to not let this meta-analysis become biased in any way and use the readily available data on this topic. In order to amplify the number of observations and research articles on this topic, more research could be prioritized to better include socially disadvantaged agricultural producers.

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# VITA

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