Valuation of Ecosystem Services and Hunting Leases:

A Review of Valuation Methods and Meta-Analysis

by

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ABSTRACT

This thesis reviewed valuation methodologies for ecosystem services and land in general, and hunting activities and their economic implication in the United States in particular. After reviewing hunting activities from ecosystem services of wildlife and wildlife habitats, this thesis focused on an empirical study of hunting lease rates on private lands to assess various high-quality land sites and their different hunting lease rates. Meta-analysis was used and twenty-two observations from 13 publications were collected through systematic reviews. Hunting lease rate on private lands at the Mississippi Delta was used as the control group and other 21 private lands' hunting lease rates ($ per acre) were used as the treatment group in the meta-analysis. All hunting lease rates were converted to the 2013 price. A random-effects model was used to calculate the effect sizes of the observations with Hedge's score with a 95% confidence interval. The DerSimonian-Laird model was used to calculate the tau score (τ) using the Stata statistic program. Statistically significant result was found and null hypothesis was rejected ($p = 0.00 < \alpha = 0.05$). The result implies that the hunting lease rate of the Mississippi Delta land is $2.22 greater than the other observed lands' hunting lease prices on average. Hunting lease rate and variation for the private lands were found, suggesting better quality through habitat management would be beneficial not only to wildlife but also to landowners and hunters. Scientific management would increase social welfare, including landowners, hunters, and wildlife. This study will be beneficial for researchers who are interested to conduct a meta-analysis with a clear explanation of meta-analysis steps and interested in valuation methodologies for land and ecosystem services. It is also hoped to be useful to formulate policy implication by policymakers, and private landowners.

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CHAPTER 1

INTRODUCTION

1.1. Background

Humans have been benefiting from the ecosystem since the hunter-gatherer age. Modern living is facing new challenges on how we can use our natural resources more effectively and sustainably. Valuation of ecosystem services, which would help us to make better choices of the trade-off between different ecosystem services, has gained importance. Hunting, a socio-economic activity using ecosystem services, has evolved from subsistence hunting to secure food to mostly a recreational pursuit to enjoy the outdoors.

Land value sometimes affects the value of the ecosystem services generated. Broadly speaking, land includes all the natural resources found on the surface. Land can be used for different purposes, such as industrial, residential, agriculture, amenities, recreation, biodiversity conservation, and carbon storage, among others. In its simplest form, land can be considered as a physical place where economic activity takes place. Land can also be used for consumption. The increased interest in the use of land for recreational purposes has led to a significant boost in the revenues generated in the market. Jones (2001) postulated that wildlife recreation on private land has increasingly become a source of income for the landowners. Activities such as fishing, hunting, and non-consumptive events such as bird watching can provide revenues to the landowners. Jones (2001) further noted that the landowners engaged in habitat and forest management practices such as vegetation planting and prescribed burnings can improve the overall ecosystem value. The rising trend of recreational land use has been precipitated by

voluntary conservation and restoration measures implemented by the owners (Farmer et al., 2016). According to Jones (2001), most of the private land conservation practices are devoid of state or government support and a majority of landowners have taken the initiative of managing the land to improve the productivity of forests.

The incentive programs provided by the state are mainly limited by state funding and mainly used in the conservation of marginal lands belonging to the state. However, there are many conservation programs, supported by the U.S. Department of Agriculture (USDA) such as Conservation Reverse Program(CRP), Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP), Agricultural Conservation Easement Program (ACEP), Agricultural Management Assistance (AMA), Conservation Operations (CO), Conservation Innovation Grants, Emergency Watershed Protection (EWP) Program, etc., aim to conserve soil, water, wildlife, and other natural resources on privately owned agricultural lands to limit environmental impacts of production activities both on and off the farm, while sustaining or enhancing the production of food and fiber (Stubbs, 2010). Additionally, endangered species are equally protected by federal laws such as the clean water and Endangered Species Act (Webster, 1987). The animals are considered endangered and the wetlands are sufficiently protected from loss or overuse. Hunting services, therefore, make land increasingly valuable as the owners engage in practices that augment the overall worth through the various maintenance practices.

Decision-making on land resources mainly bases on three-fold perspectives spanning physical and biological practicality, economic feasibility, and institutional acceptability (Butterfield et al., 2016). The physical and biological practicality focuses on the vast physical resources or salient aspects of land, such as soil, climate, water, air, appropriate plants and animals, and human communities existing in the environment. The

physical and biological practicability defines the ecology of the environment, which translates to its ecosystem value. Economic feasibility analyzes four factors, spanning useful input/output associations, proper marketing, transport arrangements, and acceptable distribution of income and various benefits accrued from the land. The concept of economic feasibility aligns with the utility of land as a factor of production, equitably used to raise income. The relationship between input and outputs should be congruent to the levels of utility derived. The final element comprises institutional acceptability, where policy programs are established to determine land use within the given system. Through these policies, the owners can engage in activities such as planting trees, water conservation, and preservation of endangered animal species in the ecosystem.

This diversity in the use complicates land valuation and estimation of its value. A land endowed with natural resources tends to experience a significant rise in value. Lands with vast economic activities often experience increased worth due to the value derived from constant use over time (Mingie et al, 2019). The ecosystem includes the biological community within a given land and the way the ecosystem components interact with the physical environment (Binder et al., 2017). Ecosystem valuation aids in the depiction of real values of a given land or property depending on the levels of biodiversity. The rising demand levels for hunting land have triggered increased cases of skyrocketing prices, a factor that could influence the overall population interest in engaging in hunting and other recreational activities (US Fish and Wildlife Service, 2016). The transformation of the ecosystem alongside the willingness of the owners to invest has been cited among the factors for improving valuation.

While we attempted to understand how ecosystem services influence land value, the gist of the study will be on how the ecosystem and wildlife habitats influence the

hunting rental price of the land. The hunting value has been largely influenced by the quality of land in terms of diversity and abundance of game, recreational amenities, size, and access (US Fish and Wildlife Service, 2016). According to Mingie et al. (2019), trips to publicly owned and leased hunting grounds increased remarkably during the past year in Georgia due to the strategies improved with The National Hunting & Shooting Sports Action Plan and the Georgia Hunting Action Plan and implemented in 2018.

Wildlife and wildlife habitats are an essential part of the forest ecosystem. Hunting leases are an important factor in private land value (Hussain et al., 2013). According to the US Department of Interior Bureau of Land Management United States (Bureau of the Census, 1996), hunting is strongly engraved in the United States culture, and therefore, unparalleled opportunities for hunting are available. Due to the strong hunting tradition, the National Wildlife Refuge System was formed to conserve wildlife while at the same time permitting recreational activities. Private lands, on the other hand, have relatively experienced increased use, leading to appreciation in value. The rise in demand for recreational land has triggered immense changes in the socio-economic perspectives (US Fish and Wildlife Service, 2016).

Hunting as a recreational activity has, over the years, transformed into an important socio-economic activity in the United States and many other countries (Yamane, 2017). Hunting activities have created hundreds of thousands of jobs and billions of dollars in tax and other revenues in the USA (Arnett, et al. 2015). Apart from timber production, a large amount of timberland is therefore used for hunting, fishing, and outdoor recreation (US Fish and Wildlife Service, 2016). The value of land in any social setting has been attributed to the levels of ecosystem management which determines the overall biodiversity. Utility depends on the overall satisfaction derived

from using the given piece of land. Animal abundance is an important factor that increases the benefits acquired from the land. The economics of game hunting has revealed that it is economically viable and forms a major source of income for landowners (Mingie et al., 2019).

1.2. Objective of the Study

The aim of this thesis is to analyze how the forest land, more specifically the wildlife and ecosystem values, contribute to the land value of private landowners. This analysis delves into land valuation from the perspectives of both the ecosystem and leases worth alongside the impacts on the lease prices of private timberland across different regions in the US. To reach this aim, the ecosystem services and valuation methodologies were reviewed in the context of the green economy. More specifically hunting in the US is reviewed before the empirical study of hunting lease is conducted using meta-analysis in which how hunting lease rates vary across the private timberland in the US.

Hunting has always been a common practice in the US since the arrival of European settlers to North America. For this reason, management of hunting land is important both for the government and private landowners. According to the US Department of Interior Bureau of Land Management (2019), the National Park Service manages 76 areas, the national wildlife refuges has 336 areas, and the US Fish and Wildlife Service manages 36 wetland districts. Furthermore, there exists the Bureau of Reclamation lands, which also permits hunting on lands depending on the Federal and State regulations.

Relatively, private landowners have increasingly engaged in land management routines and lease practices that have revealed a significant rise in land valuation (Gooden & Grenyer, 2019). A knowledge gap, however, exists on whether the ecosystem service

quality of a land site influences its rental price. To answer this question hunting lease rates of private lands in the USA were used as a tool to compare the random hunting lease rates with a benchmark land. The hunting lease rates of the Mississippi Delta lands were determined using this as a benchmark of the meta-analysis for comparison due to its high quality of ecosystem services (Hussain et al., 2013). This area has a high-quality ecosystem that leads to service-rich hunting opportunities. The ecosystem quality of a hunting land can be determined based on accessibility to the hunting area, the density of game species, variety of game animals, trophy & antler sizes of animals (Jones et al., 2001). In this way, it is aimed to demonstrate how much ecosystem quality of land site can create price difference on hunting lease rates for private lands.

Understanding the existing trends on land valuation forms the basis upon which a relationship between ecosystem quality based on the site of the land and hunting lease rates can be analyzed. If the ecosystem quality of the land has an important influence on the rental price of the hunting lands, there is a potential to build win-win situations and improve ecosystem sustainability for the stakeholders. This market potential can be used for private landowners, hunters, and wildlife conservation. Despite the lack of common standards to measure the worth of wildlife in different parts of the US, landowners are believed to hold the key to the maintenance and production of the game animals inhabiting their lands. The study outcome could encourage the private landowners to increase the ecosystem qualities of their lands and make an investment for their wildlife habitat, in this way, a win-win approach of green economy for sustainability could be applied not only for private landowners but also hunters and wildlife species.

The study methodology and design entail the use of secondary research and meta-analysis. I used already published information to perform a literature review and meta-

analysis of the sources. Meta-analysis enables the researcher to examine multiple studies on the same subject to determine common or distinctive perspectives. Through the meta-analysis, it was possible to examine how hunting lease rates affect land value research question will be analyzed. The literature review will also present the distinct perspectives of the subject from multiple authors.

The research study will include five chapters; the first chapter presented an introduction and background and research objective of the study and offers justification and significance attached to the research. The second chapter reviewed ecosystems and their valuation, the third chapter reviewed hunting activities and their economic implication in the United States. The fourth chapter used meta-analysis to analyze multiple hunting lease rates to better understand the variation of the hunting lease rates and variations. The final chapter presented conclusions, recommendations, and limitations of the study.

CHAPTER 2

ECOSYSTEM SERVICES AND THEIR VALUATION

2.1. Ecosystem Services

Ecosystem services, as defined by the Millennium Ecosystem Assessment (MEA) report published by the World Resources Institute in 2015, represent benefits from ecosystems. The concept of ecosystem services has been dealt with, interpreted, and defined in different ways, mostly in relation to ecosystem processes and biodiversity issues. Ecosystem services are basically defined as "situations, processes, functions, benefits, and products offered by ecosystems to sustain human life and ensure human welfare" (Costanza et al., 2014). Ecosystems produce countless services, many of which are vital to the health and well-being of society. Benefits from ecosystems emerge in many ways, such as food, water, fresh air, medical raw materials, recreation, and cultural values, and these benefits of nature are vital for humans like other living creatures on earth (Hjerpe et al., 2015). Many studies in the literature on ecosystem services address, define and classify ecosystem services from an ecological, economic, and social perspective (Häyhä et al. 2015; Knoche & Lupi, 2007; Ma & Swinton, 2011).

Despite the ecological, cultural, and economic importance of ecosystem services, ecosystems, and biodiversity supporting them are decreasing and disappearing on an unprecedented scale. One of the main reasons is that the value of ecosystems for human welfare is not sufficiently considered and not fully recognized during the planning and decision-making stages (Blumstein & Thompson, 2015). In other words, the benefits of ecosystem services are either not addressed at all or partly addressed in the traditional market economy. On the other hand, while the costs of external effects of economic development, such as pollution and deforestation, are generally not considered, and tax

and government support systems encourage excessive and unsustainable use of natural resources and ecosystem services at the expense of future generations (Blumstein & Thompson, 2015).

From an economic point of view, while it is the tangible benefits that people use directly, it is considered as the raw material and service that is ecologically dependent on the processes and functions of the ecosystem (Ma & Swinton, 2011). However, ecosystem services offer products and services to people and other ecosystems they interact with, from untouched natural areas to landscapes under human intervention. Not only is it under human intervention and pressure, but it also affects each other positively or negatively with the ecosystems it interacts within the landscape. Ecosystem services are the benefits and products that are directly or indirectly presented to people, which are the result of the functions and processes of ecosystems, whose capacities and interaction relationships should be revealed to ensure the sustainability of natural and cultural ecosystems and to protect natural resources (Mutandwa et al., 2016). In MEA (2005), ecosystem services are classified under four headings.

Provisioning Services: Provisioning ecosystem services are the services that ecosystems provide directly to people. Food, biological raw materials, decorative sources, genetic sources, freshwater, biochemical and medicinal products can be included in this group (Russo et al.,2017).

Regulating Services: Regulatory ecosystem services are services that control water, air, and soil resources. Examples of these services include regulating extreme climatic events, cleaning, and purification of water, erosion prevention, micro-conditioning, carbon sequestration, pollination of plants, control of water flow, and regulation of air quality (Jenerette et al., 2011).

Supporting Services: Supporting services are services that support the processes and sustainability of other ecosystem services. Creating habitats for the species, primary production, food and water cycle, photosynthesis, and soil formation are vital and natural processes in which living things will benefit from ecosystems (Brandt et al., 2014).

Cultural Services: The human culture, shaped by the elements of nature, changed its structure by reshaping their cities to nature to increase the benefits they provide from ecosystems over time. Cultural services are recreation and tourism opportunities, education, aesthetic values , and spiritual experiences. Hiking, hunting, fishing, camping, bird watching, cycling, horse riding, and watching scenery and wildlife are particularly prominent recreational activities in the forest ecosystem (Jennings et al., 2016). Apart from recreation, these services also offer people the opportunity for education and intellectual development; supports people to be in touch with nature and get to know nature (Jones et al., 2008). Therefore, cultural services are important not only for people's perception but also for socio-ecological research (Milcu et al., 2013).

Aesthetic values and spiritual experiences are related to the degree of satisfaction of people. The demand for these services changes in connection with the socio-economic, socio-cultural, and demographic structure. At the same time, this demand varies according to the people living in urban, rural, or semi-urban areas. Intense and fast living conditions in the urban environment and low green areas lead people to demand more recreational or psychological nature (Jennings et al, 2016).

2.2. Wildlife and wildlife habitats as Ecosystem Services

One of the significant types of ecosystems has been counted as “agroecosystems” or agricultural ecosystems locating the most fertile land which covers approximately 30% of Earth (Conway, 1987). Humans have been managing them to acquire nutrition and

other kinds of products and services. Besides providing food, these ecosystems offer recreational benefits like hunting and other activities that can make the enjoyment of wildlife possible for humans. That is, various kinds of biodiversity and wildlife services can be sustained thanks to the agroecosystems (Altieri, 1999).

People can utilize biodiversity and wildlife services in different ways by gaining different values which are classified as consumptive or non-consumptive. An example of consumptive value includes hunting and non-consumptive can be exemplified as watching the wildlife. Hunters can benefit from both values in a well-managed land by pursuing large and small game, at the same time, they can utilize non-consumptive value by taking pictures of animals (Walpole & Thouless, 2005).

While people might prefer a different type of values of agroecosystem services, these ecosystems provide various quality of recreational services. Farmland scattered with non-agricultural flora provide more wildlife population and diversity than the land that consist purely of plain fields (Hussain et al., 2016). An abundant wildlife heterogeneity without a doubt requires remnant woodlands, riparian areas, and wetlands. The abundance of bird species depends on the size of the field; while the size of the field declines, the number, and diversity of species increase since birds make use of the edges rather than the centers. Furthermore, the edges in forests supply excellent white-tailed deer habitat (Stedman et al., 2008)

Farmers can capture the values derived from abundant agroecosystem services, especially the ones related to the production of game species. In the case of deer hunting, habitat, and food required for the population growth are provided by agriculture which can also help hunters to access the land (Mozumder et al., 2007). Some of the regions provide farmers the opportunity of utilizing these values from hunting leases. They can

lease their land to deer hunters. For example, in Texas, private landowners have 99% of the land which paves the way to a potential hunting leases market. In this area, the lease rates might vary depending on the features of the land and kinds of the games (Earle, 2016).

It has also been suggested that the character of hunting on agricultural land increase the value of agricultural land. There have been a lot of studies that have tried to prove that there is a positive relationship between the quality of hunting land and the value of the agricultural area (Goodwin et al.,1993; Rhyne, 2020; Arnett and Southwick, 2015).

Miller (2007) suggested that the land prices in Texas can increase by USD 180 per acre from including hunting activities. Thus, the willingness to pay for the land depends on the quality of the hunting experience. Furthermore, access to hunting grounds is valuable and variable for hunters, and this value of access is most probably influenced by the quality of the access-related hunting experience (Knoche & Lupi, 2012).

2.3. Value of Ecosystem Services

The benefits that ecosystem services offer to people are measured by the "value" that individuals give to these benefits, and the value given to the same benefit differs according to the beneficiary.

According to Howarth and Farber (2002), environmental value is morality because we decide which objects are worth considering. However, there are aesthetic, spiritual, scientific, and cultural values related to our life. People choose between different ecosystem services and add more value to one than others. Other creatures and services that they do not value for people are also important. Even if they do not assign a certain value, people can benefit from ecosystems without realizing it. According to Costanza

(2000), people can only stop assigning value to their benefits when they find a "win-win" solution.

According to Hein et al. (2006), the reason nature attaches value to societies in the hope of finding a rational basis for decision making. To realize this hope, ecology and economics make mistakes about the definition and measurement of ecosystem services. This is because service units do not have a standard definition and therefore cannot be measured. Measuring ecosystem services economically on the concept of value is based on utilitarianism, and according to Wilson and Howarth (2002), measuring a qualitative is difficult and problematic. However, according to Costanza (2000), economic and non-economic benefits from ecosystem services are also not well measured because they are not understood much.

Plummer (2009) defines the value in the concept of ecosystem services as “the contribution of ecosystem services determined by the user to the goals, objectives, and conditions”. The values of ecosystem services, like environmental values, are also implicit and must be evaluated morally to reveal them (Himes and Muraca, 2018). Different functions consisting of ecosystem structures and processes reveal benefits by producing products and services of ecosystems, and individuals within communities can assign a value of their own to the acquired benefits.

In terms of environmental ethics, Chaikaew et al. (2017) mention two different values, instrumental and internal. Instrumental value is a function of utility and has a value since another value is reached. Natural objects gain instrumental value when defined as “source” and are only for instrumental value, human needs, and interests of nature. The intrinsic value, on the other hand, is the value that an object has for itself, and conservation of nature is due to the inner value it possesses. To guide decision-makers

and natural resource managers' decisions on natural resources, many studies have been conducted to measure the benefits offered by ecosystems (Anonymous, 2004). According to Rai et al. (2018), the benefit is not a measurable factor, but benefits that are not measurable in real life are also measured.

In terms of ecosystem functions, value is divided into three classes: ecological, socio-cultural, and economic (Villegas-Palacio et al., 2016). Ecological value is the importance of the ecosystem. It is defined by the integrity of the regulatory and habitat functions of ecosystems and ecosystem parameters such as diversity, rarity, and complexity. The use of relevant products and services should be limited to the continuity of ecosystem functions. Because the product and service potential of ecosystems depend on ecosystem processes and components. Ecological values show the current state of the health of the system with ecological indicators. Socio-economic values and perceptions play an important role in defining the value of natural ecosystems and functions for societies. Socio-cultural values show the importance that people attach to ecosystem services. The economic value defines the monetary value of ecosystem services.

Individuals assign or value an item based on their preferences and decisions. Valuation is defined as the contribution of an item in achieving a specific goal. Costanza (2000) states that individuals assign value to the service to which they provide maximum benefit and that they have certain goals in doing so. These objectives are defined as ecological sustainability, equal and fair distribution of resources, and efficient allocation of resources.

Depending on these three objectives, the valuation of ecosystem services is made in terms of efficiency, fairness, and sustainability (Schröter et al., 2017):

Efficiency based value is the value that people give with their independent, individual preferences and thinking of themselves; Justice-based value is the value given by individuals as individuals of society, thinking of existing and future societies and using scientific knowledge; sustainability-based value requires an assessment of the contribution to ecological sustainability. Scientific knowledge is very important, and the value of ecosystem services depends on the physical, chemical, and biological role within the long-term functions of the ecosystem. People, therefore, assign value as part of the whole system.

Although the transformation of natural ecosystems increases the benefits provided to people in the short term, it decreases in the long term because of deterioration in natural areas and problems in ecosystem functions (Vallecillo et al., 2019). In a report published by the International Association for Nature Conservation (IUCN), the Nature Conservation Organization (NCO), and the World Bank (WB), it is stated that the protection of natural ecosystems from being transformed into different uses provides various benefits for people and the economic value of the services in these ecosystems contributes to nature protection.

2.4. Methods of Valuation

Valuation methods are divided into two as economic and non-economic valuation. The valuation of ecosystem services depends on the type of ecosystem and the quality and quantity of available data. Although many methods have been developed for economic valuation, the lack of sufficient data for most developing countries appears to be the biggest constraint in the valuation of biodiversity and ecosystem services (Ma and Swinton, 2011). Due to the existence of this limitation, in cases where there is not enough data, it is more appropriate to use non-economic methods instead of economic valuation.

An advantage of non-economic methods, especially in terms of valuation of biological diversity, is that it provides valuable information about the importance of biological diversity for humans (Barkmann et al., 2008). Bawa and Gadgil (1997), state that various criteria are evaluated in the context of quantitative methods in the valuation of ecosystem services. These criteria are as follows:

The number of people: The number of people living dependent on certain natural resources. The number here does not include those who conserve and market natural resources and those who work in these industries.

Value of specific products: It is the value of certain products in unprocessed form or the income obtained by the country, which can be used to assess the contribution of natural ecosystems to traditional economies.

Contribution to household cash income: The contribution of ecosystem services to the cash income related to the amount and use of household products.

Household ratio dependent on ecosystem products: This ratio depends on the proximity to the ecosystem, the size of the basin, and the number of products removed. Quantitative data are not available, and dependency is expected to decrease with economic development.

Contribution to gross domestic product (GDP): GDP does not cover all ecosystem products; raw material is often the main input.

Economic valuation is the valuation of ecosystem services in economic (monetary) methods and assigning value to change in ecosystem services. The value measured in economic valuation is mostly instrumental, and some values such as internal values cannot be measured. Services are evaluated in monetary terms. Public preferences and direct and indirect benefits of users are measured. These methods take the ecosystems

and measure the gain or loss of individuals or communities as a result of the change in ecosystem services with or without consumption value (Knoche and Lupi, 2007).

Economic valuation methods are classified according to observed economic behavior or indirect monetary estimates. De Groot (2002) classifies economic valuation as direct and indirect market valuation, contingent and group valuation for ecosystem services.

2.4.1. Direct market valuation

This valuation is applied to "products" in question such as production, to some socio-cultural services like recreation, and regulatory services such as water supply from a certain area. Indirect market valuation: In the absence of a particular market, the value is measured by indirect methods. Different valuation methods such as voluntary payment or voluntary acceptance can be used to compensate for the availability or loss of certain services.

2.4.2. The revealed- preference method

It is based on the preference of individuals over market products over the real market. These methods are market price, prevention behavior, hedonic pricing, travel cost method, and random conditional benefit models. The usage values of the consumed product and/or service are measured according to their market values.

2.4.3. Nominal preference method

The nominal preference method is the only method used for the estimation of non-use or non-market values for some natural resources. This method is carried out with carefully structured questionnaires and is used to reveal individuals' preferences for the change of natural resources or environmental features.

Contingent valuation and choice modeling are among the most commonly used methods for the conservation of natural ecosystems, habitats, and biodiversity, and for the use of ecosystems by measuring non-use values and for their use in nature conservation studies (De Groot et al., 2002). The contingent valuation method has been used for many years in the US and developed countries to quantify natural resource benefits that are not included in the market as monetary value (Venkatachalam, 2004). The contingent valuation method determines the payment preferences of people in exchange for a certain ecosystem service in a hypothetical scenario. It is applied to estimate the economic value of all kinds of ecosystem services, especially non-use values.

With the contingent valuation method, under the conditions specified in the scenario, the economic value of all positive or negative changes in the supply of non-market goods and services can be determined by the voluntary payment amount that the participants reap. Specifically, it is the most used method to evaluate habitats and ecosystem services. It is a method applied by resource economists and policy analysts due to its ease of implementation and understandable method in developed countries (Loomis et al., 2000). In developing countries, the first applications of the contingent valuation method started to be made in the late 1980s on water supply, salting, recreation, tourism, and national parks. In the following years, the surface was expanded towards water quality, health, and biodiversity conservation (Arrow, 2001).

Although economic methods are an important tool for ecosystem services with no market value, they are not enough to make decisions regarding all environmental issues and they have various problems (Fisher et al., 2009). The most important of these problems is the different social perspective and monetary value on the concept of

"benefit" and the preference of individuals. Bawa and Gadgil (1997) list the problems encountered in determining the number of ecosystem services in traditional valuation methods and the points to be considered as follows:

- Methods of indirect use value and non-use values include subjective judgments of individuals. It evaluates the monetary valuation of societies that depend on ecosystems and those who do not share this culture.
- Inhomogeneous full monetary economies, when the individuals who have information about preferences and different options are included, valuation methods can be applied more easily.
- Despite the complex methods, it is difficult to quantify most benefits in monetary terms. Services that are difficult to evaluate by people such as concepts like medicinal plants used by the local people, ecological processes like pollination and nitrogen cycle, and existence value.
- Current and potential benefits may be evaluated differently by individuals. The current and potential perception of the benefit and cost of protecting a particular area by society in different sectors may differ. For example, the value of clean water and the air is higher for an urban person than for people living in a natural area.

2.5. Value of Land

The value of land depends on the location, physical, economic, and ecological activities taking place in the region. The location of the land plays an integral role in terms of proximities to resources such as roads, transport systems, amenities such as hospitals, and water, among others. Lands that are strategically located close to vast human settlements often attract high values compared to those found in regions with little or no human settlements (Jones, 2001). Physical and economic activities taking place in the

land, such as mining, construction of residential homes, accommodation of business premises, and farming, among others, tend to influence the value of the land. The value of land can be analyzed from the perspective of residential, economic rent, and expectation value.

Land value is usually referred to as the residual value, which plays a significant role when the land is considered for alternative uses. Lands with higher residual values often fetch higher values compared to those with less or lower residual values (Mathevet et al., 2003). Economic rent, on the other hand, constitutes the earnings of the land after a given period. The economic rent depends on a myriad of factors, such as the ecosystem value, structures, and business activities taking place. The economic rent determines the value of land, and in most cases used in the computation of the overall cost of leasing land. The value of land can be calculated based on the above perspectives and lease cost estimated depending on the existing factors.

Land value is reflected by the ecosystem services quality of the land. A myriad of ecological services has been implemented to improve the overall value and productivity of the land. Furthermore, the conservation programs improved and funded by The U.S. Department of Agriculture (USDA) supports private landowners to manage their lands properly. These programs are classified by their types such as working lands, land retirement, easement, partnership and grants, compliance, technical assistance, emergency assistance, watershed. Especially, “working lands” programs allow private land to remain in production when applying several conservation practices compatible with specific areas giving priority to the natural resource concerns (Stubbs, 2010).

According to Yuan et al. (2019), land comprises a myriad of territorial resources necessary for the survival of living organisms. The changes in land use patterns such as

hunting, agriculture, fishing, sports, and public parks cause a major change in the ecological pattern. The conservation pattern of any ecosystem determines the extent to which plants and wildlife transform into useful recreational resources. Yuan et al. (2019) presented factors that could aid in the valuation of an ecosystem; the elements include climate regulation, soil formation and protection, gas regulation, food production, recreation, raw material production, biodiversity maintenance, waste treatment, and water conservation. Improvement in each of the above factors largely transforms the value of an ecosystem and makes it highly productive in a short and long-term perspective.

Landowners in the United States have increasingly been under pressure to improve the quality and levels of the ecological systems. The rise in demand for recreational and hunting land has spurred multiple landowners in both the public and private domains to engage in activities that would improve the usefulness of the land (Jones et al., 2006). Most landowners charging hunting fees are to increase income and further maintain the wildlife habitat. The federal government and private landowners have engaged in measures that would improve the overall productivity of hunting land through numerous procedures. By conserving the wildlife and permitting game hunting, the federal and state regulations have created ample environments for quality outcomes.

Land value is the present value of future income or the sum of discounted future income from the land. If the land is leased to other users, the land value is the sum of present value or discounted future rental income. We can use the following equation (2.1):

$$\text{Land value} = \sum_{i=0}^{\infty}(Ri - Ci)/(1 + r)^{i} \quad (2.1)$$

Where i stands for the year; Ri and Ci are respectively the revenue (or rental income) and the costs in that year; r is the discounting rate. Suppose a land can generate an annual net hunting lease of $ 20 per acre forever, and the interest rate is 4%, then the land value contributed by hunting lease is $500 per acre (20/0.04=500).

2.5.2 Valuation Methods of Land

Land evaluations occur through the lens of economic and non-economic methods. The most commonly used method to evaluate land values is the comparison of the market value of a similar land with the expected value. Due to the fact lacking market information, more alternative methods are used, such as the hedonic price methods, replacement cost, productivity method, contingent valuation method, benefits transfer method, and replacement cost, among others (Hussain et al., 2016).

The hedonic pricing method takes into account the value of the goods and services offered in the land; in the context of hunting, the diversity and number of wildlife in the habitat aids in determining the land worth (Knoche and Lupi, 2012). In cases where land has a diverse and large amount of wildlife, the value goes high due to the perceived worth obtained by the hunters and people seeking hunting leases (Martinez-Jauregui et al., 2015). The hedonic price has been used to determine the fee payable for a land lease to enable the landowner to replenish and restore the usefulness after the hunting periods.

Replacement costs can also be referred to as damage or substitute costs. Under this approach, the cost of damage to the ecosystem or the land is determined. Damages such as triggering an imbalance in the ecosystem, for instance, interfering with crop pollination activities or causing the pollinating insects to migrate could lower the productivity of the land. Similarly, the replacement costs could be attributed to the decline in a given animal species, and replenishment after decline could take time. Thus, the land

valuation is done based on the estimated costs of replacing the diminished wildlife or recreational facilities at the end of the hunting period (Binder et al., 2017).

The productivity approach can also be used in the valuation of hunting land. The productivity method determines the extent to which the ecosystem contributes to different commodity production. An example is the case of deer, which is frequently managed for older age class males which produced large antlers, which in most cases, hunters are willing to pay premium prices. Improving the quality of games in the land makes them fetch higher value in the hunting market.

The contingent valuation method has also been used to determine the worth of lease land over the past years. The contingent approach entails estimation of the land value based on the distinct opinions of the users. The variety of land or ecosystem services are determined and worth estimated according to the perceptions of the population members. The determination of land pricing through contingent valuation differs between states. For instance, people in Mississippi may consider the land to be of higher cost based on location or amount of resources (Rhyne et al., 2009). Other lands can be highly valued due to the heritage or the animal species available. Such approaches aid in the estimation of the lease land values and enable landowners to set pricing based on certain socially perceived standards. The penultimate valuation method is the travel cost. This is the amount of money people pay to travel and visit a given site; the transportation alongside the entry costs are calculated over an estimated period and then used to set the value of the land or recreational facility. This approach caters to money that could have been collected during the lease period.

In terms of more especially hunting value, the use of the current market price of leasing recreational services should be firstly considered. In this context, the cost of such

leases is determined across different markets and then averaged to estimate the ideal pricing. During the determination of the market price, factors such as wildlife diversity, size of the land, game population, and lease periods are considered. Through the values, a final figure is arrived at and used as the standard market price for the commodity. As aforementioned, the United States market still lacks proper standards for calculating hunting land valuation. The above methods have not been extensively examined and, therefore, not guaranteeing accurate estimation of land prices.

2.5.3 Factors Influencing Land Valuation

Market conditions for any goods and services are mainly influenced by the forces of demand and supply. Demand refers to the quantity of a product or service needed in the market at any given time, while supply refers to the number of products or services delivered to the market at a given time. Under perfect market conditions, the demand and supply levels should be at equilibrium; this implies that the per-unit quantity of a commodity or service delivered be equivalent to the per-unit quantity required.

Land as a factor of production faces increased scarcity due to the finite nature. Despite the rapid expansion of the global population, land size has remained constant, leading to an imbalance in the supply and demand levels. The rising population density causes many people to constantly require land, while at the same time, the owners of the land parcels raise costs to meet the high demand and finite supply levels. The forces of demand and supply at any given time can, therefore, be used to calculate the value of the land.

The Ricardo theory of rent postulates that if all land possessed similar properties, unlimited in quantity, and bearing uniform quality, then no charges could be made in their use. However, land parcels bear different properties, limited in quantity, and non-uniform

in quality, leading to variations in the value (Kellerman, 1989). The bid rent theory revealed that the distance between a parcel of land, a central business district (CBD), directly influences the cost. Closeness to the CBD increases the value, while the distance from the CBD lowers the value. The theory affirms the concept of land location as highly critical in the valuation process (Alonso, 1960).

The prevalence of hunting in the United States has raised contention on the need to establish standardized measures and means for determining the value of the land before the lease. The lack of consistent valuation measures has led to cases of overpricing and underpricing of products and services in the market. Studies by Rhyne et al. (2009), Zhang et al. (2006), Shrestha and Alavalapati (2004), and Adams et al. (1992) have revealed various factors that influence the price tag placed on a given piece of land during leasehold.

Hunting would contribute to land value. Land value constitutes the net worth of the land alongside any improvements made to it. In the context of hunting, it refers to the value of the land alongside the value of the resources found therein. The improvements made in the ecosystem to augment recreational value significantly contributes to the lease price charged.

Munn and Hussain (2014) presented multiple perspectives through which land valuation could be performed. The key areas comprise the supply-side considerations, the demand-side considerations, hunting lease prices, and the issues prevalent in the hunting lease markets. Analysis of each of the above perspectives will provide a multifaceted approach through which the factors affecting land valuation can be analyzed. The supply-side considerations mainly comprise the landowner's decisions to permit hunting in their lands. According to Munn and Hussain (2014), the decision to permit hunting in given

land pegs on three major factors spanning resource attributes, socio-economic attributes of the landowner, and the land user characteristics.

Resource attributes refer to the physical conditions of the land, such as the size, existing game species, type of habitat, current use, and habitat improvements. Large parcels of land exceeding 1 acre tend to fetch higher lease prices due to the perceived large number of wildlife (Pope & Stoll, 1985). Notably, the landowners with large lands tend to have surplus portions leading to their willingness to permit hunting activities. Existing game species also determines the willingness and amount of lease prices paid for a given land. Lands with a variety of wildlife often fetch premium prices compared to lands with little wildlife diversity. Finally, the landowners engaging in habitat improvement practices are increasingly aware of the perceived values attached to their lands. The annual expenses incurred in maintaining the habitat enables them to calculate the land worth to determine the lease prices.

The landowner characteristics dwell on the individual perceptions of the land value and cost benefits. According to Munn and Hussain (2014), some landowners may consider leasing as having certain benefits, depending on the ability to balance the resources of time, materials, and labor used to protect their habitat. In cases where the opportunity costs exceed the lease price valuation, then the lease decision can be forfeited. Besides, the landowners that use their property for hunting may find it valuable and, therefore, not lease to second or third parties. The landowner characteristics, therefore, remains a key factor in determining the lease prices as their perceived values of the opportunity costs determine the outcome.

The final element of the supply side consideration is hunter behavior. Issues such as loss of control, privacy, and safety of the land due to the entrance of the hunters could

determine the availability or cost of the hunting lease lands. In cases where the landowner considers the hunters capable of compromising their privacy, control, and safety, they can decide to charge higher fees compared to cases where the threats are not imminent.

The demand side considerations stem from the perceptions that public hunting lands have become crowded and of low quality (Wszola et al., 2020). The hunters must, therefore, consider the various fees spanning the leases, purchase hunt, and permit hunt to gain access to the respective hunting areas. Notably, the majority of hunters consider factors such as outfitters from where they can gain accommodations, food, and other forms of shelter. The hunter's decisions to engage in a lease or purchase of hunting land peg on three major factors spanning the decision to acquire the lease, the hunter's willingness and preference to purchase the lease, and the game characteristics (Mensah et al., 2019). The decision by a hunter to purchase a lease depends on their age, income, and their perceptions of using on public lands compared to cases in the private lands. It was determined that hunters acquire more leases as their income levels increased (Zhang et. al., 2004).

Land ownership determines the nature of valuation. Mensah and Elofsson (2017) postulated that the value of hunting land mainly pegs on the nature of ownership. Recreational lands owned by the government are often communal, and public members have access after the acquisition of the relevant licenses. The fee charged for licensing is used in the maintenance of the wildlife habitat and conservation of the endangered species. Zhang et al. (2006) noted that the leasing cost of such land is often low due to the government subsidy. Privately owned land, on the other hand, amounts to a personal property where the owners have the right to dictate access and the applicable lease prices. Mingie, et al. (2019) observed that forestland lack consistent economic value. This

implies that the owners can attach a preferred price tag to attain economic benefits. Similarly, corporations may attempt to limit mass entry into forestlands by charging exorbitant prices to leasers. On the other hand, public land may not be overvalued due to the nature of ownership. Since the public has an interest in the land, the government tends to subsidize, leading to a reduction in the cost of access and for the most part, the access is free. Based on the above assumptions, land ownership remains a critical factor in determining the value during leaseholds or other related contracts.

The size of the land has also been cited as a key factor in lease valuation. Mingie et.al (2017) observed that the size of the land often determines the market and resource value. In an analysis of the current lease land rates, Munn and Hussain (2014) pointed out that the mean value per acre of forest land was valued at 1,598 USD; the value increased or decreased depending on the size of the leased land. Wildlife diversity increases as the size of the land increases which has a positive impact on the value of hunting land since the number of game species will affect the demand for the land positively. The size of land accommodates numerous recreational activities; the land can be used for hunting, fishing, and tourism leading to an improvement in the output. The marginal returns obtained from the use of land increases with the size. Engelman et al. (2018), therefore, argued that large parcels of land tend to fetch higher values compared to smaller parcels of land.

Wildlife regulations also determine the nature of land valuation. Laws and regulations on wildlife management tend to differ significantly between states. Whereas certain hunting activities are permissible in certain states, in other states, they may be against the law. For example, in Yellowstone and some of the other national parks, overpopulations of elk or deer have resulted in damage to the range. Hunting is prohibited

in most national parks and some national monuments. The hunting laws across different states hinge on the notion that the state governments have the power to exercise control over the harvest of wild animals found in their jurisdictions covered under the federal laws (Hussain et al., 2016). States have the authority to manage non-migratory animals while the federals manage migratory animals incorporation with states. Thus, whereas the government does not exercise explicit ownership of the wild animals, the laws tend to regulate the extent to which citizens have responsibility and control towards the animals. Based on these regulations, the areas with strict regulations may value their lands differently from the areas with minimal regulations.

The above factors tend to influence the extent of valuation in the United States. The US legal regulations and the socio-economic systems have not developed universal criteria for land valuation. Most forestlands, therefore, are valued based on the current market value, influenced by the forces of demand, supply, and market conditions. State-owned lands are maintained by the state and, therefore, the cost of access is subsidized. The government involvement in forestland maintenance and conservation lowers the value and makes it highly affordable for all groups. On the other hand, lands owned by individuals tend to be highly valued due to the nature of expenditure incurred during the valuation. The process of conservation and maintenance of the ecosystems is often costly, leading to the rise in valuation. Hoque and Kling (2016), in their study, observed that private ownership of forestlands has increased over the years.

2.6 Literature Review of Land and Ecosystem Service Value in Perspective

Ecosystem services constitute the natural conditions alongside the impacts on ecological processes to influence the survival of wildlife in natural habitats (Yuan et al., 2019). The ecosystem services establish a balance between climate, biodiversity, and the

vast resources needed for the survival of the organism in the ecological setup. A myriad of ecological services has been implemented to improve the overall value and productivity of the land.

The rise in demand for recreational and hunting land has spurred multiple landowners in both the public and private domains to engage in activities that would improve the usefulness of the land. According to Gómez-Baggethun et al. (2016), regular land-use of forest territories for various activities tend to transform ecological patterns, which in turn leads to decreased productivity. Unregulated activities such as hunting and fishing result in the diminishing of the number of wild animals. Such factors tend to lower the value of land and its overall attractiveness for hunting activities.

Conservation practices, therefore, need to be regularly implemented to ensure that a balance exists between the interactions of organisms within any environment. In the case of public land, the government often engages in activities that ensure improvements in land use, which in the end translates to upgrading inland. For example, The National Wildlife Federation works to reevaluate how energy development should occur on public lands while maintaining wildlife, water resources, and America's outdoor traditions. One of the major approaches used by governments in increasing land value is the development of policies that lead to land conservation.

Biodiversity also stands out as a critical factor that both the public and the private landowners utilize to improve the value of an ecosystem. Biodiversity refers to the various plants and animals that exist in a habitat. The levels of biodiversity are determined by various factors such as the nature of the food chain and the resources existing to support organic growth. A food chain comprises the linear sequence of creatures where energy and nutrients flow from one organism to the other. For instance, in most forest

ecosystems, the lowest items on the food chains comprise plants, which are consumed by herbivores, and the herbivores, in turn, are consumed by carnivores. Thus, at every level, the organisms seem to depend on one another for survival. Maintaining the food chain ensures that biodiversity is properly balanced, leading to improved productivity.

The government and private landowners have engaged in various actions to conserve the food chains and raise overall land productivity. In preserving the food chains, the most vulnerable species are protected or empowered to increase their overall productivity. On the other hand, carnivores such as wolves, coyotes, bears could also balance the deer population through hunting and downsizing them to acceptable levels. The quest by the landowners to maintain biodiversity in the land ensures that the area value remains significantly high throughout the use.

The cost of land maintenance remains a critical factor in the case of land valuation. Studies on the cost of hunting land have shown increased lease pricing, mainly triggered by the rising demand for hunting territories. Research on hunting as a recreational activity has not sufficiently exhibited the link between hunting valuation and land pricing. The majority of studies have indicated that a rise in hunting land valuation has led to a relative rise in lease land prices (Newell et al., 2019). Most private landowners increasingly seek to maximize revenues from the game activities, a factor that has influenced the level of land valuation.

Much of the reviewed literature reveals that multiple ecosystem services have been applied to increase the overall value of the land. Factors such as the nature of the land, lease terms, property characteristics, and diversity of game in any given land largely determine its use. The effect sizes have shown that the impact of such valuation triggers a relative rise in the cost of leasing land (Boman et al., 2011). The cumulative costs of

land maintenance expenses such as sod laying, mowing, trimming, planting, watering, fertilizing, add to the initial lease price leading to a higher valuation. The economic value and potential of the industry also make it lucrative and profitable in the unforeseeable future (Wittman et al., 2017). The government and stakeholders should invest in the game recreational activities to transform it into an economic venture that can support socio-economic growth in the respective regions. The billion-dollar value of the industry makes it a major avenue that could improve economic activity in both the short and long-term perspectives.

The decrease in the number of landowners willing to open their properties to hunting (allow access) has been a major threat to hunting as a recreational activity (Mozumder, 2007). One of the major arguments tabled against the rise in private ownership of hunting land is the inconsistent rise in prices. As articulated above, pricing differs between private landowners, whereas one group may charge exorbitantly for the recreational activities, others may decide to charge lower costs for similar services or resources. Therefore, as hunting activities become common in the current social scene, the need to establish universal valuation techniques becomes inherent over the years (Poudel et al., 2017). The above-mentioned factors influencing lease land valuation could highly influence the future of game hunting. Governments acquire a significant amount of wealth from the hunting licenses issued to members. For example, in 2016, hunting activities contribute $27.1 billion to the USA economy (Allen et al., 2018).

Studies have estimated the worth of the game hunting industry into billions of dollars (Poudel et al., 2017). The high value of the land makes it capable of driving economic growth across different states. Government intervention in forestland land management could become inevitable to enable tapping of the high market and economic

potential in the region. In the wake of the increased methods in land valuations, various speculations have arisen over the ability to influence land costs over both the short- and the long-run periods. Thus, the government and stakeholders should heavily invest in hunting recreational activities to transform it into an economical venture that can support socio-economic growth in the respective regions. The billion-dollar value of the industry makes it a major avenue that could improve economic activity in both the short and the long-term period.

CHAPTER 3

HUNTING AND WILDLIFE CONSERVATION IN THE US

3.1 Ownership of the US forests

Hunting is mostly conducted in forestland land in the United State. the US has about 7.5% of the world's forests and forests US covers 741 million acres area (FIA, 2012). There are three main following types of ownership of US forests: 1) *Federal forests*, mostly in the West, fall under the jurisdiction of various federal institutions and consist of forests in the lands owned by the Land Management Bureau (BLM), primarily national forests controlled by USDA Forest Service, and the U.S. National Park Service and the Department of Defense. Federal forests of the US covers 238.4 million acres. 2) *State forests*, under the control of each state, county, and municipal government own and manage 82.7 million acres of US forests. 3) *private forestland*; private entities own and manage 445 million acres of total US forests (NASF, 2012). About 44% of the total forest area is managed by public institutions; 76% of these publicly owned forests are under the control of the federal government; 21% are state institutions, and 3% are under the control of provincial and municipal administrations (Porter-Bolland et al., 2012). About 56% of forest areas are privately owned (Zhao et al., 2020).

Private forestlands are jointly owned by approximately 11 million private forest owners varies across the country. The private forest ownership is represented as low as 2% in Nevada and as high as 95% in Kansas (Jones, 2019). However, two-thirds of the private-owned forests (115 million ha) are owned by individuals, associations, partnerships, real estate agents, non-governmental organizations, clubs, associations, and other non-legal entities. The remaining one-third (55 million ha) is owned by the forest

industry and forest management companies, timber investment management organizations, and other companies (Zhao et.al, 2020).

The laws regulating land ownership have a large share in the high level of private forest ownership in the USA. General land laws such as Pre-emption (1841), Homestead (1862), Timber and Stone Act (1878) have been implemented based on the principle that forests will make the best and most economical development in an individual private property. Through the laws, people who bought these areas sold these small forest areas to timber companies, entrepreneurs, and speculators shortly after the transfer (Cochrane, 2003).

3.2 Hunting Leases

The agreement that is made between a landowner and a hunter for hunters to gain access to the land is called a hunting lease. Hunters attain the rights to make use of the hunting land with this agreement. The lease agreement includes details such as the amount of money and duration of the land use and other requirements (Mensa and Elofsson, 2017).

Having this lease is a very significant aspect of the process since communication plays a vital role in the fulfillment of the agreement (Zhang et al. 2004). Liabilities of each party must be clearly stated together with property details, amount to be paid, a maximum number of hunters that are authorized to utilize the land, the game being hunted, and other terms (Stedman et al., 2008). When the hunting lease is signed, the hunters can start to make use of the land. The duration of the leases may range from one day to a year or more. However, traditionally most hunters prefer a full-year lease that can allow them to have access (Munn et al., 2011). Moreover, it has been very crucial for hunters to have the exclusivity of hunting lease which can give them the authority to

decide when, where, and how to hunt together with the confidence that no one else has the permission to hunt in the leased land (Hussain et al. 2013).

The quality of hunting experience is most likely to depend on the number of money hunters are to pay like most recreational activities require (Knoche and Lupi, 2007). However, careful planning can make the hunting lease more affordable for the hunters. Among the criteria which has a significant impact on the value of hunting, a lease is without a doubt the geographic location of the demand and supply for hunting land. For example, the prices in the Midwest are between 20 to 40 USD per acre and the land provides excellent deer habitat (Mozumder et al., 2007). Nevertheless, in the Southern part of the country, the prices are less than the ones in Midwest although the habitat in the South is richer which can be explained by the geographical factor (Pierce et al., 2008). For this reason, it is crucial to be aware of the criteria which increase the value of the hunting lease and the features that are worth paying for. Below are the most important factors that affect the value of hunting leases (McShea et al., 2008);

Access:

Location is probably the most effective factor that helps the hunters to decide on the land lease. Because even if the hunting land is in the best state or has the most abundant species to hunt, it is not valuable if it is hard to reach. For this reason, hunters usually look for places that are easily accessible.

Huntable acres: The value of the lease depends on the number of acres that the hunters can utilize. However, a hunter needs to be realistic when deciding on the number of acres to lease as the number should be based on the capability to harvest deer.

The population of game species: The abundance of the game population on the leased land has a positive effect on the value of the lease. The more the deer population is, the more profound is the experience of the hunter.

Variety of game species: Hunters tend to pay more to access hunting lands if the habitat of the land allows hunting more than one game species at the same location.

3.3 Economic Implication

Hunting has been a great tradition in America since ancient times. Hunting did not only provide food but also clothing and tools to Native American tribes (McCorquodale, 1997). Hunting is a recreational activity enjoyed by people regardless of age, race, or social status. For this reason, hunting has been recognized as an activity that removes the boundaries that divide people due to their social and political classes (Mingie et al., 2019). For example, in deer hunting camps, people come to gather and meet at a single point that is their desire for hunting.

Apart from its recreational benefits, hunting also contributes to wildlife and ecosystem management. People interested in this sport support conservation activities of wildlife financially with significant funds; in this way; habitats for both game and non-game animals could be improved. Furthermore, funds acquired from this sport reinforce business and create job opportunities for a significant number of people. Therefore, the effect of the activity fluctuates throughout the USA economy and creates a fundamental economic force. It was estimated $185 million from hunting activities per day for the USA economy (Allen et al., 2018).

In 2016, approximately 11.5 million people participated in hunting. Deer hunters are the largest popular group within this number. 7.9 million hunters preferred deer hunting that includes mostly white-tailed deer. Other popular forms of hunting include

waterfowl (or migratory) bird hunting to the tune of 2.6 million active hunters, upland bird hunting is enjoyed by 1.9 million hunters. (Allen et al., 2018).

In 2016, Americans made 147 million hunting trips during the 184 million combined days. With these trips, hunters spent $7.1 billion only on equipment and $3.2 billion on transportation expenses. This amount reached $27.1 billion in total (Allen et al., 2018).

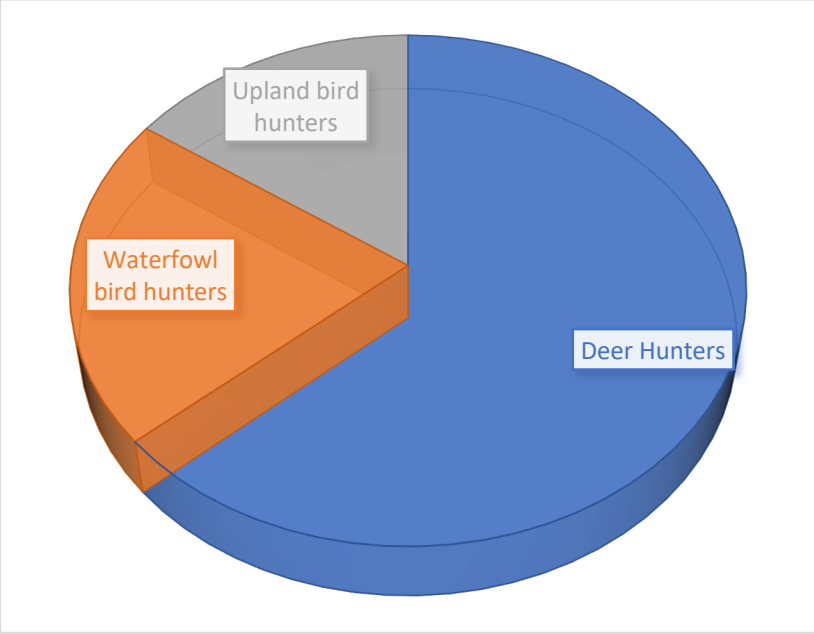

Figure 3.1. Most popular species hunted in USA in 2016
Source: Allen et al. (2018)

When hunting expense in Figure 3.2 is analyzed, the importance of the hunting activities to the USA economy can be understood. If the hunting industry was a company, it would be number 104 in Fortune 500 in terms of the revenue it generates. Deer hunting being the most popular type of hunting in America alone contributed $20.9 billion to the US GDP and supported over 305,400 jobs which put $12.4 billion as wages. Spending on deer hunting also accounted for $3.1 billion in federal and $1.9 billion in state and local tax revenues (Allen et al., 2018).

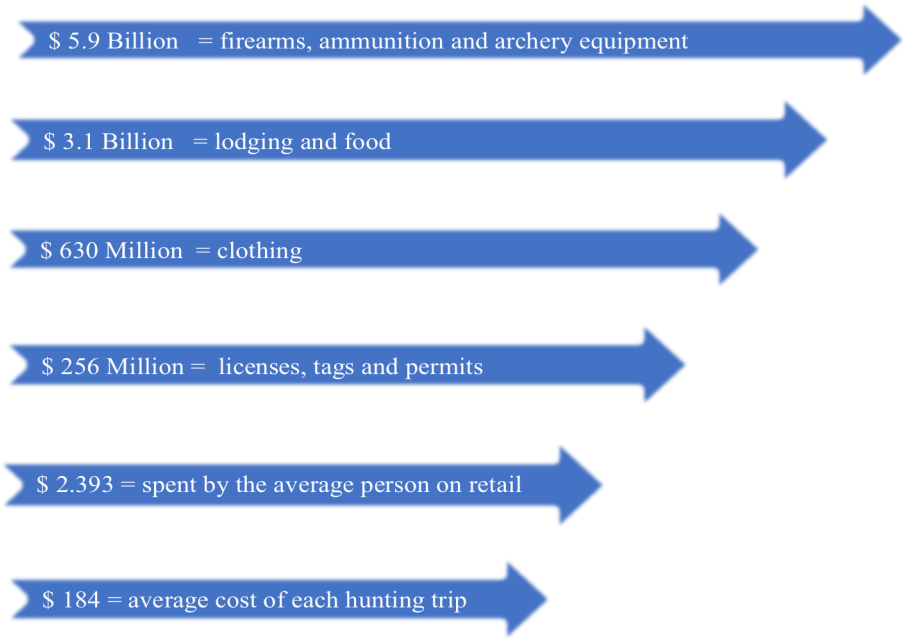

Figure 3.2. Other Key Spending for Hunting in USA in 2016

Source: Allen et al., (2018). Hunting in America: An Economic Force for Conservation.

The numbers in Table 3.1 and Table 3.2 demonstrate significance of deer hunting in the total hunting activities and its contributions to the US economy.

Table 3.1. Total and Deer Hunting based on Region in 2016

REGION	TOTAL HUNTING	DEER HUNTING
New England	273.000	182.000
Middle Atlantic	1.001.000	787.000
East North Central	2.871.000	2.482.000
West North Central	1.565.000	953.000
South Atlantic	1.623.000	1.132.000
East South Central	1.365.000	1.002.000
West South Central	1.700.000	746.000
Mountain	1.121.000	482.000
Pacific	7.91.00	375.000
United States total	11.453.000	7.905.000

Source: Allen et al. (2018)

Table 3.2: Economic Contribution of Deer Hunting in 2016

REGION	Retail Sales (mill, $)	Total Multiplier or Ripple Effect (mill, $)	GDP (mill, $)	Salaries and Wages (mill, $)	Jobs	State and Local Tax Revenues (mill, $)	Federal Tax Revenues (mill, $)
New England	258.9	438.7	234.3	138.7	2,600	23	36.2
Middle Atlantic	2,080	3,597.2	1,789.5	1,091	18,500	1924	273.5
East North Central	3,802.5	7,033.6	3,803.2	2,226.3	56,100	414.1	543.5
West North Central	881.7	1,559.8	827.4	478.2	12,600	79.9	115.9
South Atlantic	1,585.4	2,949.2	1,673	967.6	28,100	141.6	242.3
East South Central	1,711.5	2,901.1	1,894.8	1,190.1	65,000	125.3	269.1
West South Central	3,830.2	6,872.5	3,774.2	2,294.8	75,600	342	552.1
Mountain	1,163.3	1,996.5	925.9	589.6	16,200	99.1	139.6
Pacific	375.3	689.3	387.2	232.8	4,700	44.4	58.6
United States total	15,721.8	39,773.8	20,858.9	12,446.9	305,400	1,945.8	3,078.3

Source: Allen et al. (2018)

Deer hunting is the most popular kind in America generated $20.9 billion in GDP of the USA supporting more than 305.400 jobs. These jobs contribute to circulating $ 12.4 billion in wages. Tax revenues accounted for $5 billion in total (Allen et al., 2018).

3.4 The Role of Hunting in Green Economy

The need for the environment in which the social lives and the need for the economy both for the environment and the society is an indication that the link between society, environment, and economy is indispensable. The understanding of the

importance of the link between these three trends has been achieved through the sustainable development process and the path has been tried to continue with a new understanding called green economy (Loiseau et al., 2016). Being aware of the natural resources of the ecosystem, the balance between economic activities and natural resources should be in balance with the green economy. In other words, in the new process, economic activities should be organized in a sustainable framework and the risks that the activities may create on the ecosystem should be minimized (Alkon, 2012). Thus, with the green economic transformation process, the idea of environment and new employment opportunities in the new "green sectors" have emerged (Bina, 2013). In a green economy, employment to be created has also started to be designed in accordance with the standards. In this green economy, low carbon emission is considered important, resource and energy efficiency are considered, use of alternative energy sources is preferred, and biodiversity and ecosystem are taken into consideration (Mendonca et al., 2009).

There was no major economic and financial crisis in the world economy until the late 1960s, after the effects of the 1929 World Depression, which remained the biggest crisis in the development of capitalism, until the late 1960s. However, it is seen that the concept of crisis has entered into our lives much more after the 1990s. Along with the globalization and transparency process experienced in the financial markets in the world in the 1990s, the development of innovations in information technology in financial techniques and instruments added different dimensions to the crises experienced. The center of the crisis is no longer limited to one place, but it covers the whole world. In this process, problems experienced in any corner of the world manifest themselves simultaneously elsewhere (Pretty, 2013).

The “We must produce more” approach, which dominates the majority of the 20th century, has brought many environmental problems and with this understanding, the increase in the population all over the world has caused excessive consumption of resources and the increase of wastes released to the environment and the ecosystem we live in cannot be renewed (Milani, 2000). While the destruction of nature, rapid population growth, poverty, consumption of resources, and unemployment have increased rapidly, all life in the world has been adversely affected by problems such as air, water, and soil pollution, deforestation, and desertification. Thus, the view that natural resources, which have been dominating for a long time, are self-renewing and have unlimited qualities, has been questioned with the emerging environmental problems and their negative effects on living life (Sdrolia and Zarotiadis, 2015).

At the beginning of the 21st century, the world economy started with the 2008 Global Financial Crisis and two major problems; the "Great Recession" caused by the crisis process continuing in Europe as a debt crisis, and "Ecological Crises" caused by global warming and climate change were confronted (Plumwood, 2002). With global production, a period of ecological crises emerging in the form of deprivation of water, air, and soil has begun to occur. Harmful gases that have an impact on greenhouse gas emissions increased by industrialization are envisaged to endanger human health and the existence of natural resources with an increase of 3-6 degrees if no measures are taken according to the OECD 2050 Environmental Forecast Report. In the same report, it is emphasized that leading countries should reduce their existing carbon dioxide emissions by 80% by 2050 (Tracey and Anne, 2008). In addition to the negative effects of ecological crises on human health, there is a need to acquire new principles that advocate ways to consume the basic substances that they will need to survive in the long run without

pushing the limits today. The crises of the countries have caused the question of the economic system and the need for strategies to create new employment opportunities (Hamdouch and Depret, 2010).

Today, a period has begun in which effective solutions for the problems caused by the imprudent practices of countries are sought. In addition to the fact that the policies to be implemented by governments to get out of the crisis should be the most appropriate policies in terms of economic efficiency, environmental integrity, and social equality, a strategic vision that would ensure compliance both at national and international level was also required (OECD, 2010). Governments have come to the conclusion that the concept of "green economy", which is compatible with international cooperation and sustainable development, is a solution that takes in to account ecological limits as well as leading the way out of their current crisis (United Nations Division for Sustainable Development, 2012).

Hunting tourism has an undeniable place and potential in the contribution of wildlife to national economies. All kinds of spending made by tourists coming to the area with hunting tourism also contribute significantly to the economy. In a study conducted by the National Shooting Sports Association in the United States in 2011, 38.3 billion dollars contributed to the country's economy from hunting revenues, this value is even higher than Google's income in 2011 ($ 37.9 billion) (National Social Security Fund, 2014).

The revenues from hunting tourism are not only income from hunting wild animals. In addition to these revenues, hunting expenses of hunters in the places they go for hunting, all kinds of hunting materials (weapons, clothing, etc.) they use, membership fees to hunting clubs, annual hunting taxes they pay and other expenses (transportation

expenses, all kinds of shopping expenses, etc.) has important contributions to the country's economy. According to the research conducted in the USA in 2006, 87.5 million people over the age of 16 spent $ 122.3 billion on travel and equipment expenses because of wildlife-related recreation activities (fishing, hunting, etc.) (Munn et al., 2010)

The contribution of wildlife resources to the country's economy and the success to be achieved in this field are closely related to the management of these resources in line with the principle of sustainability. According to Riley et al. (2002), the number of domestic wild animals that can be hunted in one country is one of the important ways to measure success in wildlife management. To manage wildlife resources sustainably, these resources must be protected, developed, and brought to the economy.

The world economy is seeking to recreate a sustainable economy and life against global warming and climate change risk that arises as a natural result of environmental destruction. In this context, sustainable development represents a very important step to use natural resources more effectively and to establish a safer life in the future. The green economy, on the other hand, is a road map for sustainable development. The Green New Order, which forms the green economy and its economic framework, advocates that all economic activities worldwide should be redesigned for environmental purposes. For this, financial policies, both at the global level and at the level of individual countries, need to be reconsidered from an environmental perspective.

The sustainability approach is a frequently used term in forestry, agriculture, and fisheries. The use of sustainable hunting and wildlife resources is to make use of hunting and wildlife resources planned in a way that does not affect the use of future generations (Salas and Kim, 2002). In ecologically sustainable hunting, species diversity, population and genetic diversity, and the preservation of the characteristic features of the habitat and

the natural landscape are also of great importance. To ensure sustainable hunting; the annual harvest should never exceed production, the management objectives should be clearly defined, the biological, social, and political conditions should be appropriate and allow effective management. Sustainable hunting cannot be accomplished without any of these (Kanstrup et al., 2018). To continue hunting, the damage to the population should also be prevented. This means understanding and learning about the ecosystems and ecology of populations.

In summary, we can say that sustainability has three dimensions. These are Ecology, Economy, and Sociocultural Structure (Robinson and Bennett, 2000). Ecology is the science that examines the relationship of living things with each other and their environment. Habitat boundaries cover the lowest layer of the atmosphere in which natural phenomena occur, to the deepest regions of the oceans, where some microorganisms are estimated to live. Seas, lakes, oceans, rivers, mountains, cliffs, vegetation, and natural phenomena between these borders, where biological events continue, are part of the eco-system. The structure we call the ecosystem is a system that is formed by the mutual relations of living things in a certain area and the inanimate environments that surround them, and that is continuous. The decomposers, on the other hand, are living things like bacteria, fungi, and arthropods, and regain the minerals in the deceased organisms into the natural cycle. Consumers use most of the energies to meet their needs and maintain their movement and vitality (Costanza et al., 2014).

For the sustainable use of natural resources, attention should be paid to keep the balance and cycles in the ecosystem intact. In the last 100 years, industrialization, urbanization, degradation of natural areas, increase in the amount of carbon released into the atmosphere, chemical effects have destroyed cycles in the ecosystem, causing many

living species to disappear and irreversible problems such as global climate changes (Mutandwa et. al., 2016).

The management of many renewable resources is based on the idea of using a certain part of the resource in the long term without any reduction in the resource. The number of animals hunted by a population should not exceed the annual natural growth rate of that population. For example, in a population that grows by 20% in a year, 20% can be harvested. Thus, while sustainability can be achieved, population growth is kept at "0" (Mingie, 2011). In a sense, this can be compared to money in a bank. There is no reduction in the principal when the bank's interest is only withdrawn. However, when the principal's excess interest is withdrawn, it causes the principal to decline and eventually end.

Figure 3.3. Relations between Hunting, Wildlife Animals, Landowners, and Green Economy.

The world economy is looking for building a sustainable economy and development and global warming, environmental damage, biodiversity loss, climate change problems are needed to take consideration for sustainability (Özçag and Hotunoglu, 2015).

Green economy is an approach that aims to protect natural resources while fulfilling the goals of achieving sustainable development, complementary, inclusive, and sustainability. If hunting could be carried out with a sustainable management plan, it can be an important financial tool to develop the economies without giving harm to wildlife.

In context, Figure 3.3 demonstrates the green economy is the intersection point of the hunting activities between all players. Apart from the social benefits of hunting activities for the nations, hunting has a significant contribution to the USA economy. According to the data of the National Shooting Sports Foundation (NSSF), economic contributions of 2011 hunting activities for the US' economy were 680,937 jobs, $ 26.4 billion for salaries and wages, $ 38.3 billion in total expenditures, $ 5.4 billion in state and local taxes, $ 6.4 billion in federal taxes and $ 86.9 billion in overall economic output (Southwick, 2012). These economic data also show that the win-win approach of the green economy can be established between hunters, landowners, and wildlife.

Landowners share a great economic contribution to hunting because the majority of US forests are in the hands of private landowners. To increase the efficiency of these lands without giving harm to the ecosystem, landowners have also huge responsibility to manage these lands incorporation with the government. In this scope, USDA Forest Service Forestry Incentive Programs play a vital role to support the private landowners both financially and technically (Ellefson et al., 2007). In the following section, the

importance of these programs and wildlife conservation in the USA will be explained in detail.

3.5 Wildlife Conservation and Management in the USA

In the 20th century, a system that aimed to conserve the wildlife in North America emerged showing a rare ethic of the environment (Heffelfinger et al., 2013).

It became an example for the other organizations since it could raise a voice against politics and capitalism (Prukop and Regan, 2005). It soon succeeded to be a noteworthy system by giving the wildlife priority and raising awareness in a culture where free enterprise and private property rights were more respected than those of the environment. The situation before Wildlife Conservation arose was terrifying as every individual who had firearms had to right to threaten wildlife without caring about the number of species that would have gone extinct. While hunting was accepted as a destructive act against the environment, thanks to this system hunting could be realized as a constructive recreational activity in the wildlife (Gurd et al., 2001).

In addition, in much of world history, wildlife has become the symbol of the hated power elite and is still destroyed. There was no 'protection ethics' in North America, rather complete neglect for the future of wildlife resources that continued until the nineteenth century. In these dark times, market hunters led wildlife to almost extinction. Still today, poachers have no protection morality and it is difficult, complicated, and daunting to generate this (Artelle et al., 2018).

It is a modern paradox that hunting is an ethical force that is protected in The North American model as hunting has not been associated with a kind of sport by people who do not hunt. However, the origin of this term is not a reference to competition or disrespectful armed search, but to the contrary. Original references to sport hunting are

based on ethical pursuit and the dignified, constrained, fair chase so defended by Theodore Roosevelt (Organ et al., 2012).

The North American Model of Wildlife Conservation was founded by the hunters in the 19th century and emerged as an opposing force to the wildlife massacre (Mahoney,2019). Because of this conservation system, a unique abundance of natural wildlife arose, and this provided new professions and contributed to the commonwealth. Because of some local laws that forbid the meaningless killing of wildlife and universal conservation agreements, a reliable and sustainable wildlife model suggests the use of resources moderately and carefully. Democracy could make this system possible and encouraged society to be a supporter of this unique conserving ethic (Antolin et al., 2002).

The basis of wildlife management is the preservation of the natural process. The aim is to protect the ecosystem and genetic diversity, considering all species. In the management of wildlife; it is essential to ensure the protection and development of the areas in which rare and endemic species that are threatened or endangered at the national or regional scale, or species of cultural and economic value. Below are the important criteria that "The North American Wildlife Conservation Model" has been taking into consideration while managing the wildlife (Antolin et al., 2002).

"The North American Model of Wildlife Conservation" could become successful as it has aimed to revolve around the sustainability of the population. This model which focuses on the conservation of wildlife came to be true after the destruction of the sources in the wild through the end of the 19th century and this system has been closely managed by law and supported by the best use of science. When it first started, the purpose was just to prevent the depredation of wildlife which resulted in the decline of the population

at that time. It is still a prevalent misinterpretation that hunting could cause the extinction of some species. Indeed, it is because of unauthorized hunting that some of the species are still in danger.

These days, hunters are an indispensable part of this conservation system due to both the funds they provide and the advocacy they have. The agencies are working on the best management styles to sustain the balanced harvest of each population. The allowed harvest level can be sustainable, with no adverse effects on the hunted species, or a recipe for achieving specific management objectives of animal abundance and demography. In this scope, the objective of the system is not only to protect the declining of the population of likely to be extinct species, but also to estimate the right amount of harvest.

3.5.1 Financial Aspects

The financial aspects of hunting and the contributions made by the hunters have not been realized by the majority. Most state conservation fundings are provided by hunters and anglers. 60 percentage fundings for state fish and wildlife agencies comes from state licenses and federal excise taxes (Watkins, 2019) Hunters are required to contribute financially to the wildlife to participate in wildlife activities. Thus, smaller rural communities can benefit from the wealth of the urban population thanks to hunting activities. In addition to the funds of hunters, some of the charities raise money which contributes to the conservation of better habitats. To sum up, the Northern conservation model focuses also on the financial aspects of hunting which could aid to balance the wildlife and manage it appropriately.

3.5.2 Scientific Data

The North American wildlife conservation model makes decisions on many actions to be taken based on the scientific data acquired because of close monitoring of

populations in wildlife. Priority is of course given to hunted species. A long history has been kept by the state and federal agencies to be able to use the data to forecast the among of harvest allowed for the following years. Analysis using artificial intelligence has been applied especially using the historic data of the species being most commonly hunted to avoid any possible disequilibrium in the wildlife (Organ et al., 2012).

The North American Model of Wildlife Conservation is a significant approach that has succeeded in saving many large vertebrate species from depletion to healthy or abundant populations today. The model includes several principles that are implemented collectively. The model is both a historical narrative and a broad set of principles that, collectively applied, has helped improve the management style of wildlife referred to as "form, function, and successes"

In the early 1990s a famous conservation scientist Valerius Geist articulated 7 principles that best summarize the core of the model (Organ et al., 2012):

1. The sources of wildlife are a public trust. The main principle of the model is its concept that advocates wildlife being owned by nobody but being regulated by the government for the goods of the public concerning the future.
2. Game markets are discarded. Irregular exploitation of animals for games and migratory birds and other game species has been replaced by federal, provincial, and state laws that regulate harvesting and immensely restrict meat sales of these animals.
3. Wildlife is regulated, and sources are allocated based on law. Utilizing any source in wildlife is managed by public laws and practices regulated by these laws. These laws and regulations determine which species can and cannot be

hunted, are considered endangered and deserving special protection, and other aspects of wildlife use.

4. Only with legal purpose wildlife can be killed. Destroying wildlife for meaningless purposes is considered improper under the model. Furthermore, many states have "immoral waste" laws that require hunters to collect as much meat as possible from the legally killed game.
5. Wildlife is a universal source. Since wildlife species travel across political borders, universal cooperation is essential to protect species that are usually hunted by humans. Throughout the world, many countries have adopted and implemented some rules to sustain the international management of wildlife.
6. Science is fundamental to decide on any actions in the management of wildlife. Theodore Roosevelt emphasized this and since then, this aspect has been crucial for the North American model. Many advances have been an achievement in wildlife management along with the improvement in science and technology.
7. Hunting democracy is standard. Each citizen has the chance to hunt in the United States and Canada under the law. Such an opportunity is not limited to social class, gender, color, belief, or land ownership.

Nevertheless, despite its principled foundation and many successes for the hunted and non-hunted species and habitat, the North American Model needs more careful scrutiny. Since the model represents a historical narrative to understand the basis and improvement of North American conservation and it also serves as present regulations. Furthermore, it is a potential recipe for future conservation achievement as well. All the elements within the model carry utmost importance since the model and our perception of wildlife will be undeniable in the conservation of wildlife in the 21st century.

3.5.3 Law Enforcement

Hunters not only contribute to sustaining the wildlife conservation efforts financially but also, contribute to it by obeying the rules enforced by the law.

If the rules are not obeyed, the model that is set up cannot be maintained which will result in the failure of regulated wildlife. Today, many officers who try to fulfill the enforcement of laws are working in the USA and they are paid with the funds supplied from hunters (Organ et al., 2012). The responsibilities of these officers are not limited to policing hunters, they also sustain the quality of water, protect the habitat, and prevent any vandalism act together with the trade of endangered species. There have been objections from people who are against hunting, but these groups do not provide alternative funding ways to maintain the protection force. For this reason, in the light of laws, the North American wildlife conservative model tries to regulate the hunting activities both in favor of hunters and wildlife.

CHAPTER 4

EMPIRICAL STUDY HUNTING LEASES OF PRIVATE LANDS USING META-ANALYSIS

4.1. Introduction

Land use has changed over the years into distinct areas such as agriculture, residential, recreation, biodiversity conservation, and industrial purposes, among others. As industrialization and agriculture lead to the major use of land, hunting has emerged among the key economic activities that influence forest land value in the modern social and economic sectors (Dupras et al., 2016). The use of land in agriculture, industrialization, and residential purposes has significantly led to a rise in its valuation; nonetheless, recreational activities have equally been reported to greatly influence the cost of land in different parts of the United States and the world at large (Ma & Swinton, 2011). Given the escalating demands for wildlife hunting grounds, the cost of a land lease has significantly increased over the years (Henderson et al., 2010). The above findings align with the initial observation made that hunting activities have been on the rise over the past years as the valuation of hunting lands become increasingly significant and relevant within the social scene (Zhang et al., 2004).

The hunting land valuation can, therefore, be considered proportional to the changes in land prices, an implication that any rise or fall in prices is relative to the value of the leased land. In the wake of increased use of land for diverse purposes, researchers have delved into creating different approaches and methodologies to evaluate land value. Having many factors influencing the value of land causes valuation to be complex. The complexity of valuation of ecosystem services and land has led to many methodologies which were explained the Chapter 2. These methodologies cannot take all factors

affecting the land value into account, valuation methodologies have tried to create approaches to predict the closest value of land and ecosystem. The foundation idea of this meta-analysis was established to the idea which is different locations have different ecosystem quality therefore the location of a land and its ecosystem quality affect land value (Hussain et al., 2013). Starting from this idea, the ecosystem quality of a land site was determined as the benchmarker of the meta-analysis. Mississippi Delta land was chosen as the control of the meta-analysis because of its high quality of land site which is an important factor to provide a fruitful environment for game species and has an effect on game quality (Bender, 2008).

The Mississippi Delta land has supported a diversity of game and nongame wildlife species due to fertile soils, dynamic riverine flooding, and expansive stands of alluvial floodplain forests (Hodges and Switzer 1979, Jones et al., 2001). According to research conducted by Lukefahr and Jacobson (1998) in Mississippi, the environment had a much greater effect on antler development of yearlings than did the sire, as well as low heritability of antler characteristics. This research can be considered evidence not only for the effects of the environment on game quality but also for the importance of habitat management to improve the quality of the game. As an example, white-tailed deer which is the most common hunted game species in the US, are hunted not only for meat but also for antlers. The size of antler is considered an indicator of the quality of the game (Bender, 2008). To have big size antlers, a white-tailed deer male needs to grow its body size first. The body mass of male deer needs to be maximized for high-quality antlers and this generally occurs around 4.5 years and more age (Harmel, 1982, Brown, 1990). Therefore, habitat management needs to be performed in terms of nutrition, age management, animal densities (Geist, 1986). Keeping female densities low can increase habitat quality for

males as well as the overall productivity of herds. The same is true for males; selective harvesting of younger males increases resources available for older males (Bender, 2008). In this way, habitat management can improve hunting quality and contribute to hunting lease price and land value.

Another reason why the Mississippi Delta lands were chosen as the control group of the meta-analysis is that thirty-four of the Mississippi Delta landowners have made investments to improve their lands' ecosystem conditions for game species. These landowners have engaged in habitat management for hunting by vegetation management, plantings for food and cover, installation, and maintenance concealment (Jones et al., 2001). If these positive manipulations on habitat create price differences on hunting leases, private landowners can be encouraged to invest in habitat management. 66% of the United States are privately owned and they contribute 80% of wildlife habitats, thus private landowners' habitat management is important for landowners, hunters, ecosystem, and wildlife (Benson, 2001).

Private landowners hold the key to ecosystem management. They can manage the ecological features of their lands such as light, temperature, water supply, and mineral supply in the soil for the vegetation according to wildlife's needs for hunting (Ausden, 2007). Some implementations that are used by private landowners to improve ecosystem conditions for game habitat are mowing, pest species management, timber thinning and harvesting, disking, food plot establishment, and imposing harvest regulations on the game (Morrison et al., 2006). Their management is also important to decide which game species and which age range of the game are open for hunting in terms of the population status of wildlife habitat. Wildlife management is performed according to the population status of species. If private landowners engage in habitat management they need to know

the population status of wildlife in their lands. In this way, they can intervene by deciding to protect, harvest, to control the wildlife population in their lands for good not only for themselves but also for society and wildlife (Krausman and Cain. 2013).

This chapter analyzes the ecosystem quality of the land site and land value relationship via hunting leases. The hunting lease rate of Mississippi Delta land was determined of the control group of the meta-analysis as ecosystem services such as a variety of game species, game species' size of antlers, including water sources, easy access to the hunting area. Whereas the experimental group of the meta-analysis consists of unbiased and randomly chosen lands' hunting lease rates. Due to the not having data of all lands ecosystem quality, we are comparing the hunting lease rate of the high-quality land site with the hunting lease rates of lands that we do not have data about their land site qualities to analyze whether having a high-quality land site creates any price difference for the Mississippi Delta hunting leases.

The foundation of this meta-analysis is to establish the dynamic of cause and effect. The price difference of hunting lease rates was determined as the effect while the ecosystem quality of land sites was the determining cause for private land value. Hunting as one of the cultural and provisional ecosystem services is related to ecosystem quality. Ecosystem health and ecosystem management are important factors for wildlife to meet their needs such as food, water, cover, and space (Morrison et al., 2006).

Hunting is an activity in which humans are getting benefit from the ecosystem while the site of land is an important factor affecting the ecosystem quality of the land. Thus, ecosystem quality influences game habitat, in this way, the availability and quality of game species affect land value indirectly. Besides, hunting leases are impacting land value (Hussain et al., 2013).

The increase in demand for land on which consummative (hunting, fishing) and non-consummative (e.g. wildlife viewing, backpacking) recreational activities created viable and profitable business opportunities for private forest landowners (Marsinko et al. 1998, Busch 1987, McKee, 1986). Different locations have different quality of ecosystem and hunting opportunities (Cook, 2007). Therefore, in this meta-analysis, different locations hunting lease rates were compared with the Mississippi Delta land which has a high-quality ecosystem providing many hunting opportunities (Munn et al., 2007, Hussain et al., 2013).

We assume that a more valuable hunting ecosystem gets a higher lease price. Hunting lease rates of private lands were used as a tool analysis the ecosystem quality of the land site and land value relationship. Hunting lease rates from various random locations such as Kansas, Texas, Mississippi, and the southeastern United States were compared with hunting lease rates in the Mississippi Delta as controlled ecosystem services and hunting opportunities to illustrate whether the ecosystem quality of the land site makes any price difference on hunting leases.

Given the research objectives, meta-analysis befits the current research profile as it forms the basis upon which the effect sizes of the selected studies are evaluated to establish the overall effect (Nakagawa et al., 2017). The key distinguishing factor of the meta-analysis from the other study methods is to create a control group as a benchmark and compare the other observations, which is called the treatment group of the study. The subsequent sections define the general concept of a meta-analysis which is the methodology of the study, the reasons for its use for this study, and the pertinent factors attributed to its application in the research context.

4.2. Meta-Analysis

Proposed by Glass (1976), the meta-analysis was first introduced in the field of economics by Stanley and Jarrell in 1989 (Jarrell and Stanley, 1990), leading to its wide use in the current decade (Havranek et al., 2018). Meta-analysis is a method that combines the results of many studies and statistical analysis of the research findings obtained independently from each other on a subject. Meta-analysis constitutes the combination of outcomes from multiple scientific studies over a similar subject, and each study is believed to offer a different level of consistency in the findings (Cooper et al., 2019). Meta-analysis enables a researcher to compare the findings of various studies and arrive at a conclusion regarding the overall perception of the subject (Forscher et al., 2019). The increased use of meta-analysis has been precipitated by the quality of comparison made across different study findings.

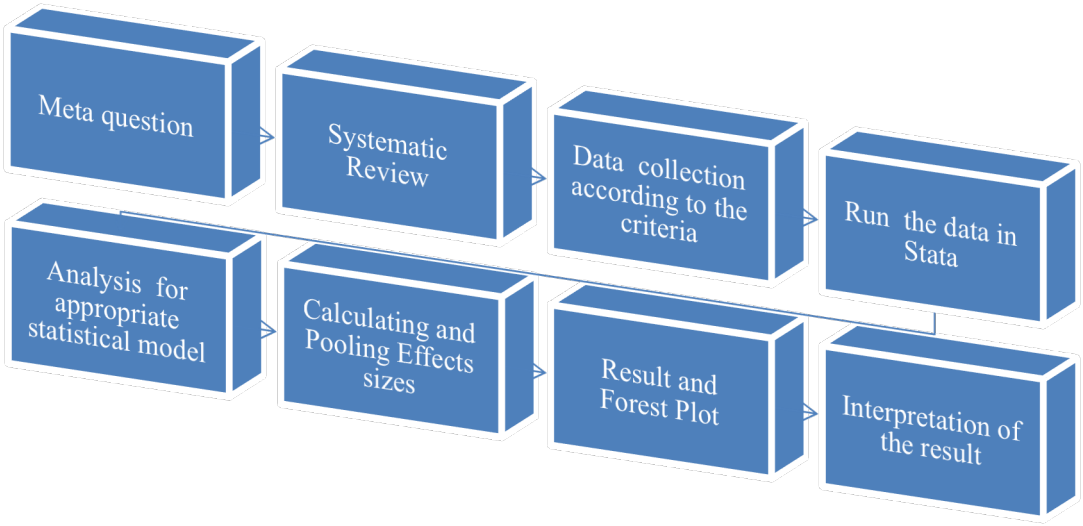

Figure 4.1. The Progress of the Meta-Analysis

Meta-analysis mainly focuses on the quantification of different study findings to exhibit a common trend in the data. The quantitative method enables the researcher to sufficiently examine the research journals and provide feedback on the relevance or significance of the findings (Nakagawa et al., 2016). This meta-analysis confirms the quantitative perspective of the data and analyzes the statistical outcomes to establish the commonality of the findings. The consistencies in the data computations could offer valid grounds upon which conclusions are made regarding the research question.

Whereas numerous study approaches such as systematic reviews, archival research, observational and case studies have been increasingly used in analyzing research findings, meta-analysis constitutes an ideal approach as it enables the researcher to compare findings from multiple studies to conclude on the data trends and consistency in outcomes (Nakagawa et al., 2017). The results often demonstrate the extent to which the findings address the study question. Statistical inferences made in meta-analysis makes can be accurate in answering a research question**.** According to Cooper et al. (2019), the findings of a meta-analysis can be interpreted and generalized to reveal certain trends in the study population. Meta-analyses entail a comparison of data from multiple studies carried out from diverse groups. The population diversity enables researchers to generalize the findings to different groups. Finally, the use of additional data can improve the accuracy and precision of the study findings (Cooper et al., 2019). The weighted average values obtained from multiple studies enable researchers to easily measure the overall strength of the study findings (Lee et al., 2016).

Amidst the multiple research methods, the benefits of using meta-analysis as a basis for comparing diverse studies outweigh the setbacks such as a variety of sample sizes, not conducted the studies for the same purposes. It is envisaged that the study

precision will be high, leading to correct interpretations that will improve the research outcome (Lee et al., 2016). In this study, a meta-analysis was used to determine how ecosystem quality influences the land's hunting lease price by comparing hunting lease rates on private lands in the USA. The scope of the current study spans decades of research conducted about hunting leases and land valuation. In this regard, meta-analysis is comprised of an ideal method as it enables a researcher to review multiple studies on a similar subject and establish findings based on weighted effects of individual studies and true effect sizes of all observations.

The methodology used in this study mainly involved quantitative research, where the findings from different studies are consolidated, and necessary computation done to assess any common trend in the values (Gogtay and Thatte, 2017). Quantitative studies often entail a distinct pattern where the variables are analyzed in terms of interactions, any resulting trend observed, and inference made based on the study question or research hypothesis. The gist of quantitative research dwells on the exploration of a given research problem to examine. The quantitative design enables researchers to develop a critical perspective or view of the problem, which, in the long-run, influences the quality of conclusions made in the study. The generation and quantification of numerical data form a basis upon which the findings are compared to the initially perceived study perspectives.

According to the research question of this meta-analysis, the data was collected by systematic review. After the data collection, the data were adjusted to the same year prices. The effect sizes of each observation were calculated with these adjusted data by the Stata software program and the result of the meta-analysis was illustrated by the Forest

Plot which is a graph to present the result of effect sizes, confidence and prediction intervals, p-value, and heterogeneity scores of the meta-analysis.

4.3 Data Collection for the Meta-Analysis

The material of the meta-analysis was collected from 13 publications: 8 journal articles, 2 bulletins, 2 theses, 1 conference included actual hunting lease rates of private lands in the USA. The studies were searched by various databases such as Google scholar, and AU library, among others. The selected studies comprised 22 observations collected from 13 studies related to hunting lease and land value. These studies researched hunting access, fee access for wildlife recreation, hunting lease income, the supply of hunting leases, market value of hunting leases, willingness to pay for hunting leases.

The studies selection for data were made according to these criteria:

1) All studies include actual hunting lease rates with the same unit (dollar per acre).

2) All the hunting lease rates belong to private lands (industrial and non-industrial private lands.)

3) All these private lands are in the USA.

4) All the studies need to include the mean of hunting lease rates, standard deviations of the mean, and sample size information.

The studies which do not meet these requirements were eliminated with the systematic review. A systematic review examined for relevance from the perspective of publication year, which was limited to studies published between 1990 and 2019, and the extent to which the subject was related to the study topic. The articles' abstracts were screened, and suitable publications were analyzed whether they carry selection criteria for this meta-analysis. The publications that met the selection criteria were then put

together and relevant data extracted to enable meta-analysis of 22 observations from these 13 studies and address the research question.

4.4. Literature Review of the Studies Used in the Meta-Analysis

In this part, studies to be used in the meta-analysis are examined to discover the factors affecting the hunting lease and its impact on private land value.

Goodwin et al. (1993) used the Tobit method to evaluate the open-ended contingent valuation survey with zero bids. The purpose of the study was to determine willingness to pay for hunting leases in non-industrial private land. The survey was applied to 568 hunters located in Kansas. At the time when the study was conducted, the popularity of public lands decreased due to the declining real budgets for public wildlife provisions and limited hunting opportunities for non-landowners, that's why it created opportunities for the private landowners to lease their land (Goodwin et al. 1993). The findings of the study suggested that contingent valuation surveys were helpful to reveal the distinctions in the preferences of the hunters to the willingness to pay for the leases. Furthermore, the Tobit model was found to be less advantageous than the double hurdle model in terms of evaluation of open-ended contingent valuation.

Another study conducted in the 1990s by Marsinko et al. (1998) evaluated the features of the hunting lease programs in industrial lands in the southern United States. After comparing the results with the earlier survey conducted with the same purpose, it was found out that there had been an increase in the utilization of leased lands over the 5 years. Besides, the indicators found from the study suggested that as the economic value of leasing started to be realized and wildlife management on the hunting lands was intensified. More firms have been actively engaging in the management of wildlife abundance and hiring professional wildlife managers since 1989. Recreational leasing has

given access control, public relations, and annual revenue opportunities to forest industry landowners (Marsinko et al. 1998).

Hussain et al. (2004) focused on estimating willingness to pay for non-industrial private hunting leases in Alabama. The study applied a censored probit model after generating the data via a contingent valuation survey. The results show that the variable which has the strongest effect on willingness to pay is the quality of the game. Other factors contributing to WTP are hunting experience, income level, number of dependents, and proposed bid price. Moreover, the study concludes that landowners in Alabama can increase the fees by taking the hunter characteristics such as their experience and household income into consideration and by concentrating on the improvement of game and site quality.

Henderson and Moore (2005) stressed the increased trend in wildlife recreation such as hunting, fishing, and wildlife watching, and increased revenue generated from these recreations. According to the study land lease and spending of participants in wildlife, recreations were rising and turned into farmland values. This study examined the effect of private hunting lease rates on industrial farmland values in Texas. The findings suggested that there was a positive relationship between the land values of countries and wildlife recreation income. As these recreational practices increased, land values of the farms rose too. However, wildlife recreation could increase the costs of agricultural production.

Zhang et al. (2006) applied a two-step approach to separately analyze the reasons why non-industrial private landowners participated in hunting leases and causes of rises in hunting lease fees. To fulfill the objective, the study applied a survey to 227 landowners in Alabama. According to the study, mainly waterfowl, deer, turkey were hunted in

Alabama. The result of the survey demonstrates that the type of land ownership, land size, location of the landowner, employment status, and personal security concern are the factors that make landowners decide to lease their lands. Furthermore, because of the applied survey, several criteria related to hunting lease fees were determined. These were features related to the site such as the existence and share of agricultural land in the hunting site, tract size, water availability throughout the year, access type and stream management area, wildlife management, and habitat. Furthermore, although game diversity was thought to be an important determiner, it did not end up as an explanatory variable due to its correlation with tract size.

Cook (2007) emphasized the importance of private hunting lease agreements such as the provision of wildlife in the US. Due to the recreation trends in the US., the private forest has a significant role in wildlife conservation. The study focused on determining the fundamental marginal values of annual hunting leases on industrial private lands. To fulfill this, the hedonic valuation method was applied. In this way, two forms of clients' responses were predicted: 1) competitive bidding results in the Georgian hunting rental market and 2) consumer response to the question of take-it or leave-it prices for a hunting rental price of a Northern State. While the regression for the Georgia region utilized forest stands and regional features to estimate observed rental prices, the regression for the northern lease uses the firm's rental offer price and additional lease information to estimate the consumer's feedback. Georgian rental price regression results show that statistically, significant price markers consist of the percentage of acres without planting area, the distance from more than 100,000 inhabitants, the total county acres of public hunting access substitutes, and the average forest property taxes paid per county. Northern regression results demonstrate that the lease offer price, the lease turning area, the

distance to more than 100,000 inhabitants, the number of hunters per district, and the estimated game crime prosecutions were important for estimating the number of rental applications received for each lease offer.

A study carried out by Munn et al. (2007) asserted the increasing trend in recreational activities. Hunting caused the demand for industrial private lands in Mississippi to increase. According to the study, because the majority of forest lands are privately owned, private landowners are at the center of the public debate on access to these private lands. The study also referred to earlier studies. Previous studies consistently suggested enhancing recreational activities and wildlife management. Furthermore, the study surveyed in 2003 by sending questionnaires to randomly selected landowners in Mississippi. The only requirement was having a minimum of 100 acres of land. The data obtained from the questionnaire classified according to predefined factors. In Mississippi mostly hunted species were deer, turkey, squirrel, rabbit, quail, and dove. Some of the important findings determined as a result of the study included that landowners usually allowed hunters to hunt white-tailed deer, agricultural and natural water bodies in the ownership class of 2,000- 4,999 acres added much larger shares to the period devoted to wage hunting compared to all other categories and only 2% of paid landowners had used the internet, although it was widely used in daily life and results showed that the problems about access to private lands experienced were less important than non-participants perceived.

Rhyne (2007) analyzed the hunting lease prices on 16th Section Lands in Mississippi using the hedonic method. The State of Mississippi owns over 640,000 acres of trust land known as "16th Section Land." Trustees manage land held in trust -- and 108 Mississippi public school districts serve as trustees for 16th Section Land, with the

Mississippi Secretary of State serving as the supervising trustee. As a result, it was determined that lands in the southwest Mississippi could generate more revenue than the lands in the rest of the state. The study suggested that this was likely to depend on the habitat improvement in the southwest. For this reason, it was suggested that to increase the hunting lease revenue, landowners needed to improve the wildlife habitat by increasing the number of trees and creating water ponds.

Kilgore et al. (2008) stressed the decreased access to private forest land in the US for hunting. For this reason, the study conducted a survey of more than 1000 private landowners in Minnesota to assess the cost of obtaining public hunting access rights. The findings of the survey illustrated that landowners showed modest interest to sell access rights. The study used a binary logistic regression and found out that the mean annual compensation needed to buy public access in Minnesota is $50 per acre. From the study, important determinants of the landowner's willingness to sell unrestricted public hunting access rights were determined. Some of them were compensation offered, landowner's use of the land for hunting, quality of the habitat, its market value, the location of the owner's residence, ownership intentions, current registration practices, and concern for property damage.

Munn and Hussain (2010) applied Blinder Oaxaca decomposition procedures to explore the determiners of local hunting lease rates and discrepancies between rates across Mississippi regions. The rate per acre in the west part of Mississippi is 26% greater than that of east Mississippi. Because of the decomposition procedure followed, there was a gap in resource endowments which was accounted for 43% to 69%. The major reason was determined to be the differences in habitat quality. Furthermore, the landowner in

east Mississippi was advised to reduce lease size and shorten contract lengths to enhance their rates.

Munn et al. (2011) discussed that earlier analysis of hunting leases should be improved, taking into account leasing decision, incremental payment willingness (WTP) for rents, and the number of rents purchased. The data required for the study were created based on the research of Mississippi residents and non-resident hunters. The results revealed that the decision to lease industrial private lands in Mississippi was affected by the enthusiasm of hunting, the availability of alternative hunting access options, the hunter's perception of public lands as being crowded, and household income. However, the number of purchased leases were determined by other access alternatives, the perceived crowd on public land. Namely, determiners of whether to buy and the number of leases to purchase were not similar according to the study. Furthermore, willingness to pay per acre changes between $ 0.56 to $ 6.40 based on the availability of other access options, public lands being perceived as crowded, diversity and abundance of game types on the leased land, and duration of the agreement. The study concluded that landowners in Mississippi could improve the revenue obtained from leases by $800 to $9,200 if they enhanced the management on the leased land and reorganized their lease agreements according to hunters' demands.

Neelam et al. (2012) emphasized the importance of understanding the factors that affect the supply of industrial private acreage for lease hunting to maintain hunting activities. The study used a different approach to the question of hunting leases by examining 2009 market data of Georgia where mostly deer is hunted. Besides the market data, the study also benefited from the earlier studies that worked on landowners' responses. The results of the multivariate regression illustrated that private hunting leases

affected by the site feature, market-related factors, and access-related factors such as location, transportation, and last but not the least; conservation programs and government support through the programs aimed at enhancing the habitat.

Hussain et al. (2013) stated that hunting lease was one of the factors affecting the industrial land values in Mississippi. Accordingly, the study used land sales transactions in the north part of Mississippi to show how industrial private land value is affected by hunting lease income. Traditional and spatial econometric modeling were also utilized in estimation procedures. A dollar increase in hunting lease rate per acre was determined to cause an 80% rise in the land value per acre. Furthermore, factors such as quality of the site, location, hunting opportunity, accessibility were found to be important determiners of hunting land value. The study concluded by stressing the importance of their findings for private landowners, hunters, and government in terms of valuation of lands and wildlife management.

To analyze whether the high quality of ecosystem affects a hunting lease value, and indirectly this land value, a land site where has a high quality of ecosystem services determined the benchmark of the analysis for comparison. The concept idea of this meta-analysis is established by comparing two interventions, which are the hunting lease prices of the Mississippi Delta land and the hunting lease prices of other lands to investigate the meta-analysis question. The meta-analysis question is “Is there a hunting lease price difference between the land with high-quality ecosystem services and the randomly chosen lands? To make the explanation of the calculation process more understandable, the control group of study is used to refer to the hunting lease prices of Mississippi Delta land, and the treatment group of study is used to refer to the hunting lease prices of other lands than the Mississippi Delta land at all the study long.

This study hypothesizes that there is a price difference between these two land groups' hunting leases, whereas the null hypothesis of the study is that there is not a price difference between treatment and control groups. In this meta-analysis, the treatment group includes 21 observations which are hunting lease rates ($ per acre) for private lands in the USA while the control group of the study is the Mississippi Delta hunting lease rate ($ per acre). Quantitative data of 22 observations were collected from 13 studies. The authors, publication years, venue, publication type, means, standard deviations, and sample sizes of the observations were reported in Table 4.1 as the raw data collecting from the publications. Furthermore, the last two columns of the table demonstrate the adjusted mean and adjusted standard deviations of the raw data.

4.5. Running Process of the Meta-Analysis

4.5.1 Adjusting to Same Year Price

Hunting lease rates of the studies belong to the 1993-2013 period. For better comparison, all prices of hunting lease rates and their standard deviations were converted to 2013 price by Consumer Price Index of US Bureau of Labors Statistics. The hunting lease rates of five observations in the meta-analysis belong to 2013. Therefore, all the prices were preferred to convert to 2013 to remain these five observations' prices in their original prices. Adjusted means and adjusted standard deviations of the observations were calculated and presented in Table 4.1.

Table 4.1. Hunting lease rates (dollar per acre) 1993–2013

Author (s), Year	Venue	location	Mean ($ per acre)	St. Dev.	Sample size (N)	Adjusted Mean	Adjusted St. Dev
Goodwin, B., et al. 1993	J Environmental Management	Kansas	31.32	85.18	568	19.43	52.83
Marsinko, A., et al. 1995	Conference	The SE.USA	2.54	0.54	43	1.66	0.36
Henderson and Moore 1997	Bulletin	Texas	4.2	2.29	114	2.89	1.58
Hussain, A., et al. 2004	S. J. of A. Forestry	Alabama	2.11	3.2	315	1.71	2.59
Zhang, D., et al. 2005	H.D. of Wildlife	Alabama	1.38	2.88	277	1.16	2.41
Rhyne, J. & Munn, I. 2007	Thesis	Mississippi	7.93	6.61	169	7.06	5.88
Cook, F. 2007	Thesis	Georgia	6.9	1.04	703	6.14	0.93
Cook, F. 2007	Thesis	Confidential in the USA	7.79	2.36	918	6.93	2.1
Munn, I., et al. 2007	Bulletin	S.E. Mississippi (Hattiesburg, Biloxi, Mobile, New Orleans)	3.69	0.82	13	3.28	0.73
Munn, I., et al. 2007	Bulletin	N.E. Mississippi (Tupelo, Columbus, Meridian, Tuscaloosa)	2.78	0.25	23	2.47	0.22
Munn, I., et al. 2007	Bulletin	S.W. Mississippi (Jackson)	7.51	1.6	29	6.68	1.42
Munn, I., et al. 2007	Bulletin	N.W. Mississippi (Greenville, Memphis)	10.24	3.43	10	9.11	3.05
Kilgore, M., et al 2008	H D. of Wildlife	Minnesota	16.15	9.56	456	14.93	8.84
Munn, I., and Hussain, A. 2010	Forest Science	Mississippi	12.75	8.5	218	11.93	7.96
Munn, I., and Hussain, A. 2010	Forest Science	Mississippi	6.98	5.31	497	6.53	4.97
Munn, I., et al. 2011	Forest Science	Mississippi	7.3	6.33	328	7.05	6.11
Neelam, P., et al. 2012	H. D. Wildlife	Georgia	12.22	0.74	159	12.05	0.72
Hussain, A., et al. 2013	Land Economics	Mississippi (Black Prairie)	16.3	6.52	10	16.3	6.52
Hussain, A., et al. 2013	Land Economics	Mississippi (Loess Hills)	18.14	5.25	14	18.14	5.25
Hussain, A., et al. 2013	Land Economics	Mississippi (North Central Hills)	21	12.13	21	21	12.13
Hussain, A., et al. 2013	Land Economics	Mississippi (Tombigbee Hills)	21.64	7	11	21.64	7
Hussain, A., et al. 2013	Land Economics	Mississippi (Delta)	24.49	12.51	40	24.49	12.51

The continuous data of observations such as adjusted means, adjusted standard deviations, and sample sizes, were entered in the Stata program to calculate effect sizes and the mean of overall effects of the observations in the meta-analysis. The meta-analysis used in this study followed a systematic approach, involving the determination of effect sizes for all individual observations in the study, calculation of the confidence interval for observed effects, and weighted the effect sizes via the random-effects statistical model, to calculate the mean of population overall effects (Lee et al., 2016).

4.5.2 Effect Sizes Estimation

Effect sizes make a meta-analysis possible and it shows how the treatment group differs from the control group of the study. If there is no difference between the control and treatment groups of the study H_0 (the null hypothesis), the effect size will be zero. Effect size estimates the difference between the null hypothesis and the alternative hypothesis H_A of the study. To estimate the overall effect of the study population, the observed effect of each observation is needed to be calculated and their effects need to be weighted to get how each of the observations has contributed to the overall summary effect of the study. To calculate the effect sizes, mean differences of treatment, and the control group of each observation are divided by their pooled standard error.

4.5.3 Standardized Mean Differences

The calculation of the effect sizes dwelt on the mean differences in each of the observations to obtain individual effect sizes. Mean differences of control and treatment group of the study, their standard deviations, and sample sizes are used to calculate their effects sizes in the study. If all individual studies in the meta-analysis generated with the same measurement scale and research methodology mean difference can be pooled

directly. However, data using in the meta-analysis generally is generated by different researchers, with different methodologies and different years.

To get a more precise effect size estimation, *standardized mean differences* need to be calculated by a dimensionless effect estimator. One of the dimensionless effect sizes estimators used in a meta-analysis is Hedge's g and it is preferable for effect sizes calculation when the sample size (N) of observations in the meta-analysis varies and have observations which have less than 20 samples. Hedge's g estimator not only pools but also weights the standard deviations of observations to calculate their standard error. Therefore, Hedge's g is also called corrected effect sizes. For this study, our sample sizes (N) varied between 10-568, and 4 of the sample size of observations are less than 20. Thus, Hedge's g estimator was used to calculate the effect sizes to see how diverse Mississippi Delta lands' hunting lease price (dollar per acre) than other lands' hunting lease prices (treatment group).

For study k, symbols in the equations are denoted by,

$\hat{\mu}_{ck}$: the observed mean of control group which is the hunting lease rates (dollar per acre) of Mississippi Delta land for this meta-analysis

$\hat{\mu}_{tk}$: the observed mean of treatment group which is the hunting lease rates (dollar per acre) of other lands than Mississippi Delta land for this meta-analysis.

s_{tk}^2 : standard deviation of treatment group

s_{ck}^2 : standard deviation of control group

n_{tk}: sample size of treatment group

n_{ck}: sample size of control group

The standardized mean difference with Hedge's g estimator for study k is,

$$\hat{g}_k = (1 - \frac{3}{4n_k - 9}) \frac{\hat{\mu}_{tk} - \hat{\mu}_{ck}}{\sqrt{((n_{tk}-1)s_{tk}^2 + (n_{ck}-1)s_{ck}^2)/(n_k - 2)}} \quad (4.1)$$

(Schwarzer et al., 2015)

4.5.4 Confidence Interval

The confidence intervals present the basic criteria upon which the predictive elements in a data distribution are assessed. In the calculation of confidence interval, the sampling error is computed to reveal the extent of bias in the study (Lee et al., 2016).

An approximate two-sided (1- α) confidence interval for the standardized mean difference is $z_{1-\frac{\alpha}{2}}$ denoting the 1- $\frac{\alpha}{2}$ quantile of the standard normal distribution.$\alpha$is the significance level where the standard error of the observations falls.

The confidence interval upper and lower limits of the standardized mean difference ($\hat{g}_k$) for study k,

$$CI\ Upper\ Limit = \hat{g}_k + \mathcal{Z}_{1-\frac{\alpha}{2}} S.E.(\widehat{g_k}) \quad (4.2)$$

$$CI\ Lower\ Limit = \hat{g}_k - \mathcal{Z}_{1-\frac{\alpha}{2}} S.E.(\widehat{g_k}) \quad (4.3)$$

Where standard error is

$$\text{S.E. } (\widehat{g_k}) = \sqrt{\widehat{Var}}(\hat{g}_k)$$

$$\widehat{Var}\ (\hat{g}_k) = ((n_{tk} - 1)s_{tk}^2 + (n_{ck} - 1)s_{ck}^2)/(n_k - 2) \quad (4.4)$$

For this study, the confidence interval is 95% and significance level α is 5%. Therefore, $\mathcal{Z}$ score is $z_{1-\frac{0.05}{2}} = z_{0.975}$, the area value of 0.975 corresponds 1.96 in the

z-score table with the 97.5% point of the standard normal distribution was used for calculations. (Schwarzer et al., 2015).

4.5.5 Fix Effect and Random-Effects Models

To pool effect sizes of observations and to get overall effect of the study, effects of the observations need to be weighted according to selection of the statistical model. Therefore, selection of the statistical model is very important in terms of weight the effect of studies and summarized result of the analysis. After calculating the individual effect sizes of the studies, these effect sizes need to be combined for getting an overall effect size.

There are two models to measure the overall effect size for meta-analysis. The *fixed effect model* which accepts the component of the observations in the meta-analysis belongs to homogeneous population (fixed) and affecting factors of the studies are same. Therefore, a fix effect model considers that there is only one true effect and differences between true effect and treatment effects of each observations are caused by sampling error (Borenstein et al, 2009).

The fix effect model estimate is shown by

$$\hat{\theta}_k = \theta + \sigma_k \epsilon_k , \qquad \epsilon_k \underset{\sim}{i.i.d.} N(0,1) \qquad (4.5)$$

Where $\hat{\theta}_k$ denotes the observed effect of study k, θ denotes the true effect of overall studies and $\sigma_k \epsilon_k$ denotes the variance of within study k.

The *random-effects model* which considers component of observations which does not come from a fixed homogeneous population but different populations. The random effect model stems from the assumption that samples used in the studies vary in

terms of characteristics and methods (Guolo & Varin, 2017). The cases of lease rates came from different locations (populations of the studies vary). Heterogeneity in the populations necessitates the use of random effect to prove sufficiently the assumption of exchangeability. The variance in the random-effects model not only emanates from the notion that the sampling error causes deviation from the true intervention but also that the studies fail to originate from a single population (Guolo & Varin, 2017). Therefore, random effects model considers not only the within-study variance but also between-study variance to estimate the mean of true effects of overall studies. The random-effects estimate is shown by

$$\hat{\theta}_k = \theta + u_k + \sigma_k \epsilon_k, \quad \epsilon_k \overset{i.i.d.}{\sim} N(0,1); \; u_k \overset{i.i.d.}{\sim} N(0, \tau^2) \tag{4.6}$$

Where u's and $\in$'s are independent variables, $\hat{\theta}_k$ denotes the observed effect of study k, u_k denotes the between-study variance of overall studies, and $\sigma_k \epsilon_k$ donates the within-study variance for study k. Thus, the variance of the observed effects is higher and the confidence interval range is wider at the random-effects model than the fix effect model.

One of the common mistakes among meta-analysis implementers is selecting the statistical model according to heterogeneity test of meta-analysis (Borenstein et al, 2009). The statistical model of a meta-analysis should be chosen according to the sampling frame of the observations. Data of observations of this meta-analysis come from different populations, locations, and researchers. Such is the case in the current data pool, where the participants vary in terms of the study population, regions of studies, and sample size of hunting leases. Therefore, the random-effects statistical model was chosen according to the sampling frame of the data to estimate the mean of overall effects of the studies.

4.5.6. Weighted Effect Size

The weighted effect sizes present the cumulative effect sizes of all the data sets used in the study. Through the weighted effect sizes, the combined strength of the studies is examined and interpreted based on the research question. The appraisal of results depicts the variation in the number of study participants, thereby necessitating the computation of the overall effect of the studies. Establishing a balance between the different research groups provides a firm basis upon which conclusions can be made in the study (Lee et al., 2016). Through the effect sizes, the strength of each study is exhibited and further utilized to calculate the weighted average of all studies used.

Through weighted mean, average effect sizes of all studies used in a meta-analysis are established (Lee et al., 2016). Selected statistical model is the main factor for weighting the effect sizes and obtaining the overall true effect for fix effect model or the mean of overall effects for random effects model. The weighted mean comprises the mean value of effect sizes and is calculated by the inverse variance method. The weighted sum of squares about the fixed effect calculation with $w_k = \frac{1}{\hat{\sigma}_k^2}$, where $\hat{\sigma}_k^2$ is the within study variance. This is also used to calculate the total variance of the study Q and homogeneity and heterogeneity Q test statistic.

$$Q = \sum_{k=1}^{K} w_k \left(\hat{\theta}_k - \hat{\theta}_F\right)^2 \tag{4.7}$$

$\hat{\theta}_k$ is calculated by $\hat{g}_k$ score for individual treatment effects (observed effect of each studies) and $\hat{\theta}_F$ depicts weighted mean of true effect (fix effect) of the study. The equation for fix effect $\hat{\theta}_F$ is estimated by,

$$\hat{\theta}_F = \frac{\sum_{k=1}^{K} \frac{\hat{\theta}_k}{\hat{\sigma}_k^2}}{\sum_{k=1}^{K} \frac{1}{\hat{\sigma}_k^2}} = \frac{\sum_{k=1}^{K} w_k \hat{\theta}_k}{\sum_{k=1}^{K} w_k} \tag{4.8}$$

The weights of the studies depend on total variance and, the total variance of the study Q includes not only the variance of within study ($\hat{\sigma}^2$) but also the variance of between study ($\hat{\tau}^2$) under the random effects model. Therefore, $\hat{\tau}^2$ also needs to be counted into weighting calculation. $\hat{\tau}^2$ can be estimated by likelihood estimate method or moment estimate method. There are generally two methods used to estimate $\hat{\tau}^2$, maximum-likelihood and moments estimate methods. When number of studies is small, and response of maximum-likelihood estimation is less straightforward, the moments estimate method is preferable.

The most common used moment estimator model is the DerSimonian and Laird model. To avoid biased downwards the resulting variance estimates, the DerSimonian and Laird moments estimator model was used to calculate $\hat{\tau}^2$ for this meta-analysis. The variance between studies was calculated by the DerSimonian Laird model with the equation below.

$$\hat{\tau}^2 = \frac{Q-(K-1)}{S} \tag{4.9}$$

Where Q is the total variance of the study and K total number of observations in the study and S is calculated by

$$S = \sum_{k=1}^{K} w_k - \frac{\sum_{k=1}^{K} w^2{}_k}{\sum_{k=1}^{K} w_k} \tag{4.10}$$

If $Q < (K-1)$, the total variance of the study is less than the expected variance which is also called the degree of freedom ($df = K-1$) and K is the total number of observations in the treatment group, $\hat{\tau}^2$ is set to 0 and random effects estimate $\hat{\theta}_R$ is set equal to the fixed effect estimate $\hat{\theta}_F$. Therefore, $\hat{\tau}^2$ value is taken in account to weight the observation effects under the random effects model. The weight of the observation k is calculated by the equation below under the random effects model.

$$w_k^* = \frac{1}{\hat{\sigma}_k^2 + \hat{\tau}^2} \tag{4.11}$$

The weighted mean of random effects $\hat{\theta}_R$ is estimated by effect size multiplied by weight and divided by the sum of the weights,

$$\hat{\theta}_R = \frac{\sum_{k=1}^{K} w_k^* \hat{\theta}_k}{\sum_{k=1}^{K} w_k^*} \tag{4.12}$$

and the variance of summary effect is denoted by

$$\widehat{Var}(\hat{\theta}_R) = \frac{1}{\sum_{k=1}^{K} w_k^*} \tag{4.13}$$

Upon determination of the weighted average, a confidence interval is used to determine the extent to which the values are distributed around the mean (Wiernik et al., 2017). The confidence interval lower and upper limits of the mean of random effects value $\hat{\theta}_R$ is calculated by

$$\hat{\theta}_R \pm \mathcal{Z}_{1-\frac{\alpha}{2}} S.E.(\hat{\theta}_R) \tag{4.14}$$

And percentage of the weight of observation in the total effect calculated by

$$100.\ \frac{w_1^*}{\sum_{k=1}^{K} w_k^*} \tag{4.15}$$

4.5.7. Prediction interval

The prediction interval gives a range where a future study's effect falling and observed with a certain probability in current analysis. The confidence interval estimates the uncertainty in the estimation of the mean observed effect for random effects estimator $\hat{\theta}_R$. To estimate the prediction interval, both uncertainty in estimating the mean observed effect and the between-study variance are needed to take into the account. Therefore, tau score ($\hat{\tau}^2$) calculate for the variance between studies.

Moreover, the tau score is not only used to correct the studies' variances, the overall standard error, and the weights but also to calculate the prediction interval. The confidence interval is the margin of error around the mean effect size, but the random effects size model does not assume that there is one true effect size and not assume that this mean represents all studies' topics in the analysis. The random-effects model assumes that there is a range of true effect sizes. $\hat{\tau}^2$ is used to generate that range which is called prediction interval. The true effect sizes fall between the prediction interval range depending on factors that are unmeasured but systematic.

$$\hat{\theta}_R \pm\ t_{K-2,1-\frac{\alpha}{2}} \sqrt{\widehat{Var}(\hat{\theta}_R) +\ \hat{\tau}^2} \tag{4.16}$$

Where $\hat{\tau}^2$ is the between study variance, $t_{K-2,1-\frac{\alpha}{2}}$ denotes the 1- $\frac{\alpha}{2}$ quantile of the t distribution with K-2 degrees of freedom (Schwarzer et al., 2015).

4.5.8. Heterogeneity

The estimation of effect sizes from individual studies are different from each other. This variation is determined as a study heterogeneity. Heterogeneity in meta-analysis presents the differences between the individual studies and between-study. Consideration of the heterogeneity helps to interpret the results of the analysis and decide whether the null hypothesis of the study will be accepted or rejected. One of the ways to measure the heterogeneity is Cochrane's Q heterogeneity test and it is also known Cochrane's χ^2 test ($Q \sim \chi^2_{K-1}$) (Borenstein et al, 2007). Cochrane's Q equation was presented to estimate the between study variance ($\hat{\tau}^2$) in the random effects model (see equation 4.9). Q is the weighted sum of squares about the fix effect estimate and also used to calculate the p-value for analysis of the null hypothesis. Another statistic used in this meta-analysis for the heterogeneity is I^2 which is scaled version of H^2 value. It is calculated by the equations presented below.

$$H^2 = \frac{Q}{K-1} \tag{4.17}$$

$$\text{If } Q > (K-1), \quad I^2 = \frac{H^2-1}{H^2}, \qquad \text{If } Q < (K-1) \quad I^2 = 0 \tag{4.18}$$

$$I^2 = \frac{\tau^2}{\sigma^2 + \tau^2}$$

The I^2 statistic estimates the proportion of total variability that occurs because of the heterogeneity rather than chance. For interpreting the heterogeneity via I^2 value, it is scaled as 25% low, 50% moderate, 75% high heterogeneity (Lin et al, 2016).

4.6. Results

As a result of the meta-analysis, a statistically significant result was found. There is a $2.22 (per/acre) price difference in average between the control group and the treatment group lands' hunting lease rates. The hunting lease price of Mississippi Delta land, which is the control group of the meta-analysis, was estimated $2.22 higher than other lands' hunting lease rates.

The overall effect of all studies, the effect sizes of each observation which are Hedge's g scores with 95% CI and their weights were presented at Table 4.2.

Table 4.2. The effect sizes with 95% CI and weights of effect sizes and the overall effect

Author (s) and Year of Publication	Hedges's g	95% Conf. interval		% Weight
Goodwin et al. 1993	-0.099	-0.419	0.222	4.83
Marsinko et al. 1995	-2.604	-3.187	-2.022	4.73
Henderson and Moore 1997	-3.316	-3.831	-2.801	4.77
Hussain et al. 2004	-4.714	-5.191	-4.236	4.78
Zhang et al. 2006	-2.814	-3.377	-2.250	4.74
Rhyne et al. 2007	-2.289	-2.697	-1.882	4.81
Cook 2007	-6.091	-6.536	-5.647	4.79
Cook 2007	-5.386	-5.783	-4.988	4.81
Munn et al. 2007	-1.909	-2.625	-1.194	4.66
Munn et al. 2007	-2.174	-2.807	-1.541	4.71
Munn et al. 2007	-1.837	-2.400	-1.273	4.74
Munn et al. 2007	-1.333	-2.064	-0.603	4.66
Kilgore et al. 2008	-1.039	-1.369	-0.710	4.83
Munn and Hussain 2010	-1.422	-1.780	-1.064	4.82
Munn and Hussain 2010	-3.062	-3.432	-2.692	4.82
Munn et al. 2011	-2.461	-2.833	-2.088	4.82
Neelam et al. 2012	-2.212	-2.620	-1.804	4.81
Hussain et al. 2013	-0.693	-1.389	0.002	4.68
Hussain et al. 2013	-0.561	-1.170	0.048	4.72
Hussain et al. 2013	-0.278	-0.802	0.246	4.76
Hussain et al. 2013	-0.242	-0.901	0.417	4.7
Theta ($\widehat{\theta}_R$)	**-2.222**	**-2.961**	**-1.482**	

The column of weights demonstrates the percentage of each observation effect on the overall effect. As a result, the overall mean of random effects of all observations estimated -2.222 with 95% confidence interval -2.961 lower and -1.482 upper limits.

According to Cohen's d effect size interpretation rule of thumb, 0.2 is small, 0.5 is medium, 0.8 and above score is accepted as large effect. Same interpretation method can be used for Hedges'g effect sizes scores (Durlak, J. 2009). The overall effect of the analysis shows that there is -2.222 averagely difference between treatment and control group. The lands hunting lease rates in the treatment group is -2.222 $ per acre lower than the control group land's hunting lease rate. This 2.222 score is statistically significant result according to Cohen's rule of thumb and it can be interpreted as there is large effect difference which is price difference for this meta-analysis between the groups.

4.6.1. Forest Plot

Forest plot is a graphical display of estimated results observations in the meta-analysis and it was presented as Figure 4.3. The forest plot demonstrates the treatment and the control group's data which were used to run the meta-analysis. The authors of the studies, sample sizes, adjusted mean and standard deviations are demonstrated on the left side of the graph where the effect sizes of the observations, their 95% confidence interval lower & upper limits, and the weights of each observation are demonstrated on the right side of the graph. The estimation of a random effect enables to determine the distribution of effect sizes (Guolo & Varin, 2017).

The higher sample size leads to the shorter blue line because a confidence interval line demonstrates the variance with-in the study. The mean of the overall effects is demonstrated by a red diamond at the bottom of the graph. This diamond's horizontal

edges show the mean of overall effects' 95% confidence interval lower and upper limits. The 95% confidence level depicts the values of -2.961 and -1.482 for the upper credibility intervals and the lower credibility intervals, respectively. The gap between the two data intervals gives the representation of the range within which the true mean falls -2.22. Furthermore, the red line through the center of the diamond illustrates the prediction interval of the analysis.

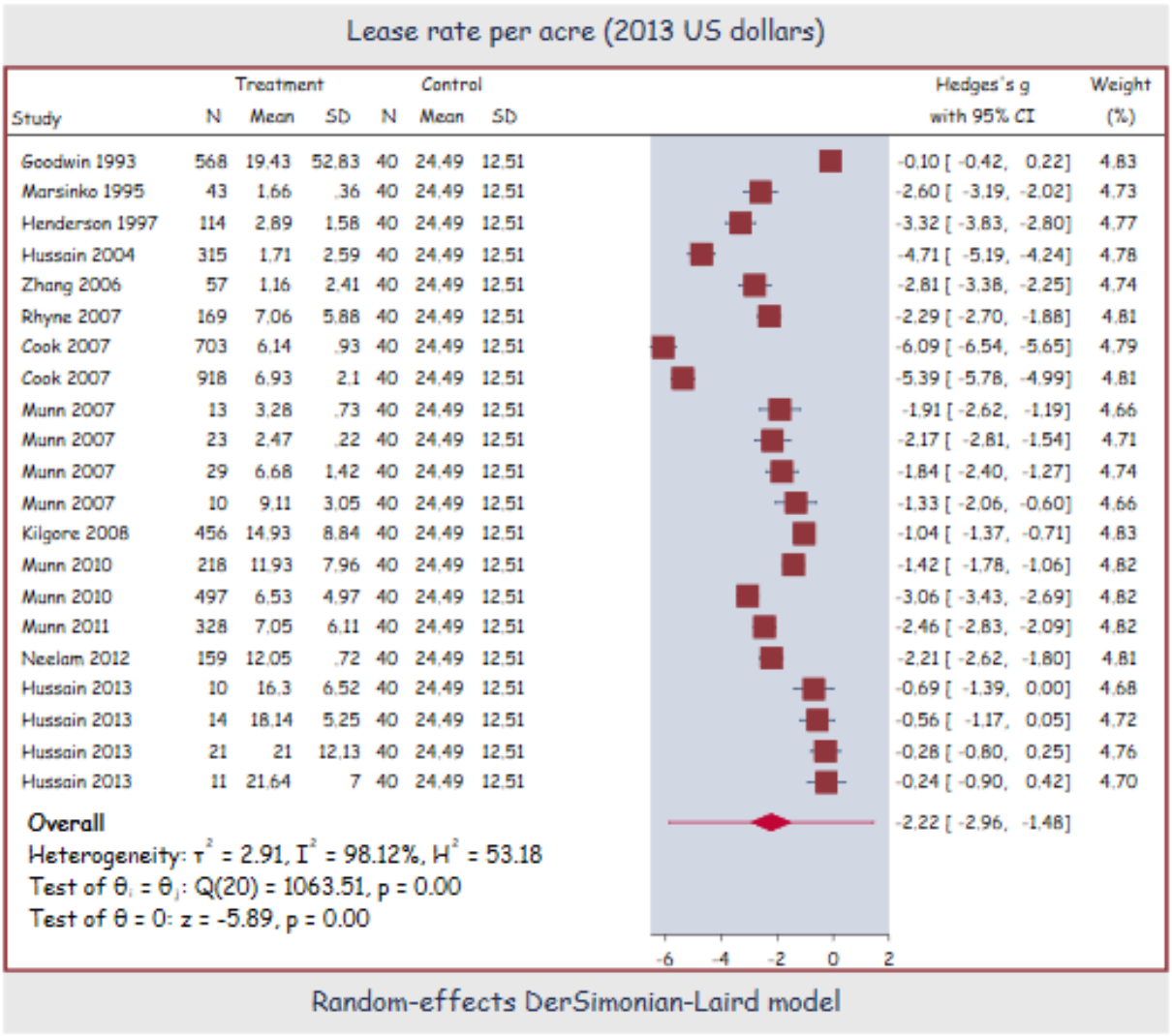

Figure 4.2. Forest Plot of the Meta-Analysis

Test of theta = 0 is given at the forest plot and it indicates that z test statistic equals -5.89 with a p-value of 0.00, which is statistically significant at the $\alpha = 0.05$ level. Q is the total variance of the study and also used to calculate the p-value for analysis of the null hypothesis and heterogeneity.

A z value standard score is used to test the null hypothesis and p value corresponds to the z test statistic. If p value less than significance level (α), the null hypothesis is rejected. Significance level, which is presented by α , equals to $1 - CI$ (confidence interval). Confidence interval is 95% for this study. Therefore, significance level α equals to 0.05 (1 - 0.95 = 0.05). The p value is estimated 0.00 by Stata program and presented at the bottom of the forest plot. The p value is lower than the significance level (α) and it means that the null hypothesis is rejected. This result states that the null hypothesis H_0 of this meta-analysis is rejected and the alternative hypothesis H_A is accepted. The result of the meta-analysis is statistically significant, suggesting the Mississippi Delta land's hunting lease rate is $2.22 higher than the other lands' hunting lease rates.

4.6.2. Heterogeneity Test

The total variance from Cochrane's χ^2 test estimate, $(Q \sim \chi^2_{21-1}) = Q(20)$ equals 1063.51 on 20 degree of freedom, with a p-value of 0.00, indicating statistically significant. Q statistic, which shows the total variance of the study, is used to calculate the heterogeneity. High heterogeneity values imply that two or more study groups have a distinct effect.

According to the sampling frame of the studies in this meta-analysis, the data was collected from a range of populations in which the effect size varies and $\hat{\theta}_R$ summarizes

this range of effects. To estimate the ($\hat{\tau}^2$) variance of between these studies, *DerSimonian-Laird* method was performed and the $\hat{\tau}^2$ value is estimated at 2.92. H^2 statistic is estimated 53.18 and it is used to estimate I^2. (To remember the relationships between $\hat{\tau}^2$, Q , H^2 and I^2 , the equation 3.9, 3.17 and 3.18 can be reviewed at methodology section). I^2 statistic is estimated as 98.12% for this meta-analysis and If 75 % $\leq I^2$ heterogeneity is evaluated as a high heterogeneity. I^2 value shows that the total variability between the studies occurs 98.12 % due to heterogeneity rather than chance.

4.7. Discussion

As a result of the meta-analysis, the control group which was the Mississippi Delta lands hunting lease prices were greater $ 2.22 than the lands in the treatment group. Such a high price difference is statistically significant and it can be interpreted that the ecosystem condition of Mississippi Delta lands was awarded at greater hunting lease prices. Ecosystem condition of the Mississippi Delta lands provided diverse game species including big game (e.g., white-tailed deer, eastern wild bobwhite, wild hogs), small game (e.g. rabbit, Northern bobwhite, gray and fox squirrel), and migratory birds (e.g., geese, waterfowl, mourning doves) by fertile alluvial soils and having one of the largest continuous wetland system in North America (Munn et al., 2007, Hussain et al., 2013).

If we consider that deer hunting average lease price of 2013 was $10.10 per/acre in the US, the $2.22 price difference can be evaluated economically meaningful (Mengak, 2014). we can assume the timberland can generate an annual hunting lease of $ 20 per acre, and the interest rate is 4%, then the land value contributed by hunting lease is $500 per acre (20/0.04=500), which is quite significant as most timberland prices range from $1000 to $3000 per acre in Alabama, a good representative for the Southern US in the late 2000s (Zhou et al., 2009). However, the heterogeneity result was very high. The high

heterogeneity likely resulted from the methodical differences among researchers, including the approaches, sample sizes, variation of populations (Littell et al., 2008). High heterogeneity is generally interpreted as a weakness of the relationship between the studies chosen for meta-analysis and it indicates that the observations of the meta-analysis come from very different populations. However, this weakness interpretation should not be valid for every meta-analysis. Most of the meta-analysis studies are conducted for medicines and health subjects and they investigate correlations between the treatment and the control group. Therefore, high heterogeneity can be interpreted as a weakness of these two groups' interactions and effects. However, If the meta-analysis investigates how to distinguish the treatment and control group of the study, high heterogeneity does not mean a comparison of apples and oranges. It means that the apples vary and belong to different populations but at least, all of them are apples. The key factor to interpret the heterogeneity correctly depends on the research question and the concept of the meta-analysis (Borenstein et al., 2010).

For this study, the heterogeneity indicates that lands of the hunting lease rates belong to very different populations. If we look at closely the effects sizes of the lease rates, the same researcher groups and close locations exhibit close estimates of hunting lease rates at the forest plot. To illustrate, two hunting lease rates from Cook (2007) exhibited close effect size estimates, one of the observations comes from Georgia' private lands and the lands in the other observation are confidential in the USA (The owners of the private lands did not allow the researcher to declare the locations of their lands). The effect sizes of these two observations are a close estimate and the reasons for the closeness may due to the location's closeness and data were collected by the same researcher and the same methodology.

Furthermore, a similar interpretation can be made on effect size estimates of four observations from Munn et al. (2007). The variance within studies shows relatively high because sample sizes were small and the variance between these four observations was low relative to the other observations in the meta-analysis. The effect size estimates were close among these four observations because the hunting lease rates belonged to very close locations. This closeness may affect to have similar habitat conditions and hunting opportunities because of the ecoregion of the lands. Another subgroup can be made among four observations from Hussain et al. (2013). The effect size estimates of these four locations' hunting lease rates are very close not only among each other but also the control group Mississippi Delta land's hunting lease rate. The variance within observations is relatively greater than other observations due to the sample sizes and the variance between the control group of the meta-analysis is low due to the closeness of the locations. Black Prairie, Loess Hills, North Central Hills, Tombigbee Hills are close locations to the Delta ecoregion, and these ecosystem qualities very similar to the Delta ecoregion. These interpretations of the forest plot estimates demonstrate that the location variation of the studies in the meta-analysis, methodology of the studies, the conductors of the researcher can be the reason for the heterogeneity. It can be interpreted that the group of the same researchers found similar results from their researches due to the approaches and methodology selection for their researches.

4.8. Limitation of the Meta-Analysis

Sample sizes of the observations were different, and this sample size gap increases the heterogeneity level. If more studies, which have a close number of samples, can be reached and compared, the heterogeneity level would be lower. Even 22 observations are a good number for a meta-analysis, more studies give a more accurate comparison. Even

the aim of this meta-analysis is not comparing ecosystem qualities of the lands in the meta-analysis, lack of ecosystem condition data for all lands in meta-analysis limits to analyze what are the factors affecting the $2.22 hunting lease price difference between the Mississippi Delta lands and other lands.

CHAPTER 5

CONCLUSION

Valuing of goods and services from nature is essential to give a price for non-market good and services: what value we are getting from and what we need to we pay for? While this thesis started with a general review of ecosystem services and their valuations, more focus was paid on hunting activities and hunting lease in private forestland in the US. The hunting lease is the value of wildlife habitat and ecosystem service provided to hunters. As a result of the meta-analysis, a statistically significant result found that the Mississippi Delta has $ 2.22 per acre averagely higher hunting rental prices than the other lands of our selected samples. Having high-quality ecosystem conditions led the Mississippi Delta lands to provide diverse game species, high quality, and quantity of wildlife for hunting.

This result is useful information for private landowners, hunters, and wildlife animals. First, this result shows that there is a market potential for better quality hunting experiences, and hunters would like to pay higher hunting rental prices for better hunting opportunities. Secondly, private landowners can improve their rental income by increasing their lands' ecosystem quality and hunting opportunities. While hunting is free at most of the public lands in the US, the private landowners still can make investments to increase the ecosystem and hunting quality to attract the hunters who are ready to make a payment for the high-quality hunting experience. Thirdly, fee-hunting can be used for wildlife conservation. According to the International Union for Conservation of Nature, in its "Policy Statement on Sustainable Use of Wild Living Resources," sustainable use of living resources is a significant tool for conservation in terms of providing social and economic benefits to people. If people derive benefit from wildlife, they tend to conserve

them. These benefits of wildlife, landowners, and hunters can be used to build a win-win situation for the sustainability of the green economy.

Wildlife is considered public domain according to the North American Model of Wildlife Conservation. This "everybody's goods" situation leads to end up with "no body's goods" results. About 60% of lands are privately owned, and 80% of these private lands contribute the wildlife in the US. Even the control of endangered, threatened species are entrusted to state and federal governmental control, *de facto* control on wildlife management belongs to the private landowners (Benson, 2001). Private landowners manage the habitat and control the access to hunting areas. The public trust doctrine of the model should be reviewed according to today's needs and the control and ownership of wildlife dilemma should be solved by the government.

Private landowners often see wild animals as a problem not only because of wildlife animals' damages on their farmlands but also errant behaviors of users who access the private lands (Deng and Munn, 2015). If the ownership and management dilemma is solved by making new regulations on the North American Model of Wildlife Conservation, the private land owners can consider the wildlife as an opportunity not a problem by fee-hunting and wildlife-watching recreational activities. They will make investments in the ecosystem and habitat of the wildlife (Mahoney, 2019).

The participation percentage of hunting has decreased since 1955 but nearly 60% of funding for state conservation still comes from hunters and anglers. The participation decline can be a problem to find funding for conservation in the future. Therefore, hunting should be used as a conservation tool and private landowners should be supported with incentives by the government to increase the participants and funding.

The quality of ecosystem services can be improved by making investments and through scientific management to improve wildlife habitats. Private landowners engage in ecosystem services enhancement to raise the value of their hunting lands. When multiple products are considered, the trade-offs must be evaluated so that the total value of the land can be maximized. Since many ecosystem services are public goods or common goods, government support to private landowners to enable them to improve the ecosystem would lead to increased productivity and social welfare from the forestland. Many private landowners incur personal expenses in maintaining their respective lands. The ability to afford such costs depend on their incomes, knowledge, information, demography, and socio-economic activities. Landowners with low income particularly need to be supported to enable them to invest in habitat improvement and thereby raise the overall value of land and contribute the conservation. Wildlife management extension service should be provided to help the landowner more effectively manage their lands that can generate higher rental lease.

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