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## **Assessing Tennessee Livestock Producers' Awareness, Attitudes and Perceptions of Right-of-way Hay Harvesting**

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I am submitting herewith a thesis written by Sarah Joy Maccaro entitled "Assessing Tennessee Livestock Producers' Awareness, Attitudes and Perceptions of Right-of-way Hay Harvesting." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Leadership, Education and Communications.

Christopher T. Stripling, Major Professor

We have read this thesis and recommend its acceptance:

Carrie A. Stephens, Andrew P. Griffith

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Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

**Assessing Tennessee Livestock Producers' Awareness, Attitudes and  
Perceptions of Right-of-way Hay Harvesting**

A Thesis Presented for the  
Master of Science  
Degree  
The University of Tennessee, Knoxville

Sarah Joy Maccaro  
December 2016

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**To Mr. Grady Byron Givens and the Givens' Family**

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“Having then gifts differing according to the grace that is given to us, let us use them”

*Romans 12:6*

## ABSTRACT

In the state of Tennessee, statute 54-5-134, cutting hay along controlled access highway right-of-way, gives Tennessee agriculturalists the right to harvest hay along interstate medians and shoulders. Current maintenance is contracted out to private mowing companies and paid for by Tennessee taxpayers. Relatively few studies have been published on the topic of right-of-way hay harvesting, so this study was preliminary in nature. Through a questionnaire, this study sought to assess Hickman, Dickson, Williamson, Wilson and Rutherford county livestock producers' current awareness, attitudes, and barriers concerning right-of-way hay harvesting as well as to conduct economic impact analyses to determine producers' willingness to harvest hay from right-of-ways. Results indicated 7.2% of surveyed livestock producers were aware of their rights to this resource, and none of the producers had applied for a permit. While livestock producers were highly innovative in terms of general agricultural practices, there was a statistically significant decline in attitude towards right-of-way hay harvesting. The following four variables were identified and accounted for 29.6% of the variance in *Attitudes toward Right-of-way Hay Harvesting* scores: (a) willingness to cut hay off right-of-way if it can be sold, (b) alfalfa mix hay users, (c) willingness to pay someone else to cut hay off of right-of-way, and (d) producers that purchase their hay. There seems to be a moderate interest among producers to utilize the hay from right-of-ways, but further research and education can aid in increasing awareness and adoption.

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## **CHAPTER 1: INTRODUCTION**

For centuries, human survival has relied on the agriculture industry for food, heating, shelter, and clothing (Federico, 2005); however, fears of proper resource allocation are extremely prevalent in today's agricultural society (Food and Agriculture Organization of the United Nations, FAO, 2009). FAO predicts a world population of over 9.1 billion people or 2.3 billion more humans by 2050, which is 34% higher than today's population (FAO, 2009). Most growth is expected to occur in current developing countries, with the least developed countries, located in sub-Saharan African, seeing the largest growth (FAO, 2009). This predicted growth is significant because it consists of new challenges regarding food security (FAO, 2009). Agriculture will be faced with meeting new demands while facing, not only, a lack of new land to increase productivity, but also challenges such as smaller labor forces, larger increases in demand for food due to increasing economic conditions, competition with production of alternative biofuels, climate concerns, and sprawling urbanization (FAO, 2009). To meet the new demands of human satiety, there will need to be a 50% increase in agricultural production in the next 20 years (Hazell & Wood, 2007). By 2050, overall production will need to increase by 70-100% of today's production levels (Godfray, Beddington, Crute, Haddad, Lawrence, Muir...& Toulmin, 2010). Reaching these demands spurred on by developing countries' projected growth, economically and in population, is possible, but not without complete dedication from the world's agriculturalists (FAO, 2009). To that end, the next section will summarize how agriculture has historically met critical challenges and population growth.

## **Past Successes in Agricultural Growth**

Historically, agricultural growth has always met and surpassed demands set by an ever-growing population (Federico, 2005). From 1800 to 2000, the world's population increased by 600% while agricultural production grew by almost 1000% (Federico, 2005). As people from around the world became increasingly efficient in maximizing outputs by improving their practices, agriculture grew (Federico, 2005). Agriculturalists have utilized innovations (Federico, 2005) and risk taking (Knight, Weir, & Woldehanna, 2003) in order to reap a reward of increased agricultural production. Land acquisition, innovations of biology, chemical products, new cultivation practices, and machinery have historically driven agriculture's success (Federico, 2005). Through domestication and natural selection, agriculturalists have produced new plants and animals to meet their needs faster than natural evolution could provide (Federico, 2005). Efficiency in biological innovations was increased substantially as transportation became more accessible to allow a new crop or animal to find all of its possible, suitable environments (Federico, 2005). With the advent of chemical fertilizers and their increasing diversity and availability, crop production has seen steady production on the same plot of land, year after year (Federico, 2005). Finally, machinery has allowed agriculturalists to increase productivity by relying on tools to do multiple jobs that would otherwise require high inputs of human labor (Federico, 2005). For instance, the invention of barbed wire allowed farmers to enclose areas of American prairie and spend less time shepherding animals and more time doing other tasks (Federico, 2005).

In the wake of large projected demands from an increasing population, agricultural productivity and yield gains are slowing globally (FAO, 2009). To that end, FAO (2009) reported “globally the rate of growth in yields of the major cereal crops has been steadily declining, it dropped from 3.2 percent per year in 1960 to 1.5 percent in 2000” (p. 2). Parts of North America saw the peak of rapid growth in the early 1990s while other parts of Europe and Africa reached their peaks in the late 1990s (Ray, Ramankutty, Mueller, West & Foley, 2012) Furthermore, in China, researchers found yield gains are not occurring in 79% of their rice and 56% of their wheat fields (Ray et al., 2012). Similarly, Indonesia is not seeing gains in 81% of their rice croplands, and India has not had increased rates of gain in 37% of their rice and 70% of their wheat fields (Ray et al., 2012). With this in mind, Ray et al. (2012) called for investigation into why more than 25% of the world’s cereal cropland land is experiencing stagnated growth.

As mentioned earlier, land acquisition is one factor that has historically contributed to increased agricultural productivity (Evans, 2010; Smith, 1999). While there are still some untapped land resources available to accommodate a small amount of the increase in production needed (Alexandratos & Bruinsma, 2012), the FAO (2009) considers those sources of land unreliable as some of the acreage may only have the capacity to produce less desirable goods due to the conditions of the soil and climate. In addition, much of the land is under forest or in protected areas (Alexandratos & Bruinsma, 2012). Similarly, Federico (2005) stated agricultural land

could indeed be augmented with suitable (huge) investments and/or the sacrifice of most remaining forests. However, even in the most optimistic assessments,

about 50 to 60 percent of the total landmass will remain unfit for agricultural purposes, barring some spectacular, and so far unpredictable, technological breakthrough (p. 5).

Current land resources will have to compete with other human activities (Evans, 2010; Godfray, et al., 2010). In a publication titled, *Globalization and Scarcity: Multilateralism for a World with Limits*, the author explained land acquisition for an increase in food production will be competing with feed for animals, crops for biofuels, timber for building and fibers, as well as protection of forests, (Evans, 2010). Taking into account the land converted from forest cover to farm land, “the amount of arable land available globally fell from 0.39 hectares per person in 1960 to 0.21 hectares in 2007” (Evans, 2010, p.12). Additionally, Godfray et al. (2010) stated “agricultural land that was formerly productive has been lost to urbanization and other human uses” (p. 812). In order to see food security for the entire world, new innovations, technologies, and methods must be created to ensure a continuation of agricultural growth (FAO, 2009; Federico, 2005).

### **Meeting New Demands through Innovation**

Kiers, Leakey, Izac, Heinemann, Rosenthal, Nathan and Jiggins (2008) proposed agriculture is at a crossroad and innovation is going to direct agriculture into the future success the world needs. Currently, the Bill and Melinda Gates Foundation (2015) is offering monetary support to innovative agricultural studies and their impacts on growing sustainable agriculture in Africa. The World Bank (2015), who has set internal goals of eradicating extreme poverty by 2030, published a 700 page sourcebook that allows

organizations around the world to learn how to help local farmers become more efficient in their trade. Godfray et al. (2010) called for “changes in the way food is produced, stored, processed distributed, and assessed that are as radical as those that occurred during the 18th and 19th Industrial and Agricultural Revolutions and the 20th century Green Revolution”(p. 812). From meat grown in a lab (Bartholet, 2011) to vertical greenhouses in urban areas (Despommier, 2013), agriculturalists around the globe are turning to unique innovations to promote agricultural growth in unforeseen avenues. To that end, right-of-way hay harvesting is being explored as a means to increase resources efficiency (Cherney, Johnson, Petritz, & Sinha, 1990).

### **The Innovation of Right-of-Way Hay Harvesting**

Currently, the Kansas Department of Transportation (2014) is issuing permits for homeowners to collect hay on right-of-ways adjacent to their property. When Cherney et al. conducted their study, 18 of the 48 contiguous states had laws in place that allowed for right-of-way hay harvesting (1990). When surveying state right-of-way programs, readily available laws, rules and permits were collected for Michigan (Michigan Department of Transportation, 2009), Texas (Holland, 2013), Minnesota (Minnesota Department of Transportation (MnDOT), 2008) South Dakota (31-5-21.Mowing of ditches on state trunk highway, 2015) and Nebraska (Nebraska Department of Roads, 2014).

According to the Tennessee statute 54-5-134, cutting hay along controlled access highway right-of-way, farmers are able to petition to harvest hay off of the right-of-way (2015). Permits are issued by one of the four Tennessee Department of Transportation (TDOT) regional offices (TDOT, 2003). Permits are available for up to 3 miles or 50

acres (TDOT, 2003). Because 95% of Tennessee farms made less than \$100,000 in raw sales in 2014 (USDA, 2015), increases in profit margins are extremely important to part-time farmers to ensure enterprise continuation (Danehower, 2015), and the innovation of right-of-way hay harvesting may aid in better resource management at the farm as well as the state level (Cherney, et al., 1990).

With that in mind, for fiscal year 2016-2017, TDOT's budget was about \$1.88 billion of the state's \$34.78 billion total budget (State of Tennessee, 2016, p. A-8). State appropriation accounts for 40.3% of TDOT's total budget, while federal funds make up the remaining 53.2 % (State of Tennessee, 2016, p. A-9). Of every dollar paid in taxes in the state of Tennessee, approximately \$0.05 goes toward the budget (State of Tennessee, 2016). Only 1.8% of the budget comes from the department's own revenue (State of Tennessee, 2016. A-9). For the fiscal year 2016-2017, TDOT allocated \$306,323,900 towards maintenance (State of Tennessee, 2016), which includes right-of way-mowing (TDOT, 2015a) in addition to litter pick up, pavement sealing, guardrail repair, and so forth (TDOT, 2015b.) Tennessee currently contracts out 40% of this work to private businesses across the southeast (TDOT, 2015a). Every November, the state releases sections of the roadways to be bid upon to mow and sometimes collect litter. The lowest bidder typically receives the contracts for allotted areas (TDOT, 2015b).

### **Statement of the Problem**

As the human population continues to grow, agriculture faces new strains and challenges (Federico, 2005). Instead of acquiring new farm land (Alexandratos & Bruinsma, 2012), agriculture will have to turn to new innovations, technologies, and ideas to see the same



success of previous generations (Federico, 2005). Right-of-way hay harvesting may be part of the solution to increasing land use efficiency. The state of Tennessee spends millions of dollars on right-of-way maintenance (State of Tennessee, 2016). However, despite being legal in the state, as per State Statute 54-5-134 “Cutting hay along controlled access highway right-of-way” (2015) there is little evidence that Tennessee farmers are aware of their right to harvest hay on right-of-ways. No studies were found which explored farmer awareness, attitudes, or barriers regarding right-of-way hay harvesting. According to L.S. South (personal communication, February 12, 2015), an assistant general counsel in region two of TDOT, there has been one permit applied for to harvest hay on right-of-ways in the last six years. With pressures to increase efficiency and sustainability in agriculture and state resources, this study will seek to understand livestock producers’ views of Tennessee State Statute 54-5-134 (2015), cutting hay along controlled access highway right-of-way.

### **Purpose and Objectives**

The purpose of this study was to assess Hickman, Dickson, Williamson, Wilson and Rutherford county livestock producers’ current awareness, attitudes, and barriers concerning right-of-way hay harvesting as well as to conduct economic impact analyses to determine producers’ willingness to harvest hay from right-of-way. The objectives that guided this study were the following:

- Describe livestock producers’ current awareness, need, and utilization of Tennessee statute 54-5-134.

- Describe livestock producers' perceptions of barriers to participating in right-of-way hay harvesting.
- Describe livestock producers' attitudes toward agricultural modernization.
- Describe livestock producers' attitudes toward adoption of right-of-way hay harvesting.
- Determine if a significant difference exist in attitudes toward agricultural modernization and right-of-way hay harvesting.
- Determine willingness of livestock producers to pay someone else to harvest right-of-way hay.
- Determine if there is a difference in the amount livestock producers are willing to spend to harvest right-of way hay versus the amount they are willing to pay someone to harvest right-of-way hay.
- Determine factors impacting willingness to harvest right-of-way hay.

## **Significance and Stakeholders**

This study seeks to contribute to the limited knowledge base regarding the innovation of right-of-way hay harvest in Tennessee. Collection of data on Hickman, Dickson, Williamson, Wilson, and Rutherford county livestock producers' current awareness, attitudes, and barriers as well as to conduct economic impact analyses will provide preliminary information on the willingness of livestock producers to explore right-of-way hay harvesting as an additional agricultural practice.

Impending challenges, brought on by new population growth, are unique to this generation and are so complex and multifaceted that one solution will not cover

everything (Godfray, et al., 2010). By exploring right-of-ways hay harvest as a means to increasing enterprise sustainability via resource maximization, a small part of that large, interdisciplinary solution may be discovered. Providing information concerning producer innovativeness toward right-of-way hay harvesting will provide information to state and county level extension professionals that utilize needs assessments to design programming. Donaldson and Frank (2016) stated “needs assessment is a process to identify what people need where they live, work or play. The purpose is to use the information gained to make plans to meet those needs” (p. 5). Using the results of this study, extension professionals may be able to target areas of interest that may aid interested producers in overcoming perceived barriers of right-of-way hay harvesting. The results of this study may provide a foundation of information for future researchers and educators to build a state program that aids in the diffusion of the right-of-way hay harvest innovation.

In addition, the Tennessee state statute 54-5-134, cutting hay along controlled access highway right-of-way, does not allow for sale of harvested hay nor does it guarantee a permit year after year (2015), which may discourage producers from investing in fertilizers to increase hay quality. A study comparing productivity of rice farmers who own their land and lease their land found that farmers, who were not owners, invested less in the land, which resulted in lower yields (Koirala, Mishra, & Mohanty, 2014). Information collected on perceived flaws in the law may enable lobbyists and the legislature to consider changes to the law that would maximize efficiency and land use productivity. Finally, this research will answer the call of

Governor Bill Haslam's *Rural Challenge* to "help develop a strategy for ensuring growth and prosperity of agriculture and forestry over the next decade" (Johnson, Upchurch, & Arrington, 2013, p. 2).

### **Limitations**

The findings of this study may not be generalizable beyond the sample – 279 Tennessee Agriculture Enhancement Program (TAEP) recipients in Hickman, Dickson, Williamson, Rutherford and Wilson counties. Therefore, readers should use caution when generalizing the results unless data confirms the sample of this study is representative of other populations of livestock producers.

### **Assumptions**

The following assumptions were made for this study:

1. Participants involved in the study performed to the best of their ability.
2. Participants involved in the study responded truthfully.
3. Data collected were measured accurately.

### **Operational Definitions**

1. Interstate highway right-of-way, under TDOT (2003) rules, is described as "the median...or in other areas which have been approved by the Regional Landscape Supervisor" (p. 1). In addition these areas "shall be confined to rural areas" (TDOT, 2003, p. 1). Prohibited areas of cutting and baling are "regeneration areas,

seedling areas, crown vetch areas, wild flower areas, rest areas, and welcome station areas” (TDOT, 2003, p. 1).

2. Tennessee State Statute 54-5-134 (2015): Cutting hay along controlled access highway right-of-way a (1) reads, “residents of the state who derive a significant portion of their annual income by farming may petition the department for permission to cut and bale hay along the rights-of-way of interstate highways located within the state, and other controlled access highway facilities located within the state, whether totally or partially controlled; provided, that the hay is to be used for personal farming purposes and may not be sold.”
3. Tennessee Agricultural Enhancement Program is “a cost share program for Tennessee's Agricultural community” (Tennessee Department of Agriculture (TDA), 2016, par. 1). Goals of the cost share program include “allow producers to maximize farm profits, adapt to changing market situations, improve operation safety, increase farm efficiency and make a positive economic impact in their communities” (TDA, 2016, par.1).

## **CHAPTER 2: LITERATURE REVIEW**

The primary purpose of this study was to explore the innovation of right-of-way hay harvesting in Tennessee as a means for increasing and maximizing existing resources. Chapter 1 provided the objectives that framed this study. This chapter describes the theoretical framework and relevant literature.

### **Theoretical Framework**

Rogers' (2003) theory of diffusion of innovations served as the theoretical framework of this study. The adoption and utilization of a new idea or process is a difficult thing to diffuse through a society, even if there are clear advantages (Rogers, 2003). Not every invention or new idea is readily accepted as a norm (Rogers, 2003). "Innovation is more than an invention. Success is not based on technological performance in isolation, but rather how [it] builds knowledge, networks and capacity" (Kiers, 2008, p. 321). Because of this, understanding how people respond to and accept innovation is the key to ensuring its speed in adoption and longevity in success (Rogers, 2003).

Diffusion researchers throughout the years have arrived at very similar steps, thus the innovation-decision process was developed (Rogers, 2003). The innovation-decision process outlines the steps that are essential to carry a potential adopter from initial knowledge to adoption or rejection of an innovation (Roger, 2003).

As shown in Figure 1, the innovation-decision process is composed of five stages that flow into each other – the completion of one step leads to the subsequent stage (Rogers, 2003). The stages are as follows: (a) knowledge, (b) persuasion, (c) decision, (d)

implementation, and (e) confirmation (Rogers, 2003). With the aid of communication channels, an individual is able to transform into the next stage (Rogers, 2003). Duration of the innovation-decision process is dependent on the classification of the adopter as far as how quickly they adopt an innovation (Rogers, 2003). Rogers (2003) classified adopters as (a) innovators, (b) early adopters, (c) early majority, (d) late majority, and (e) laggards.

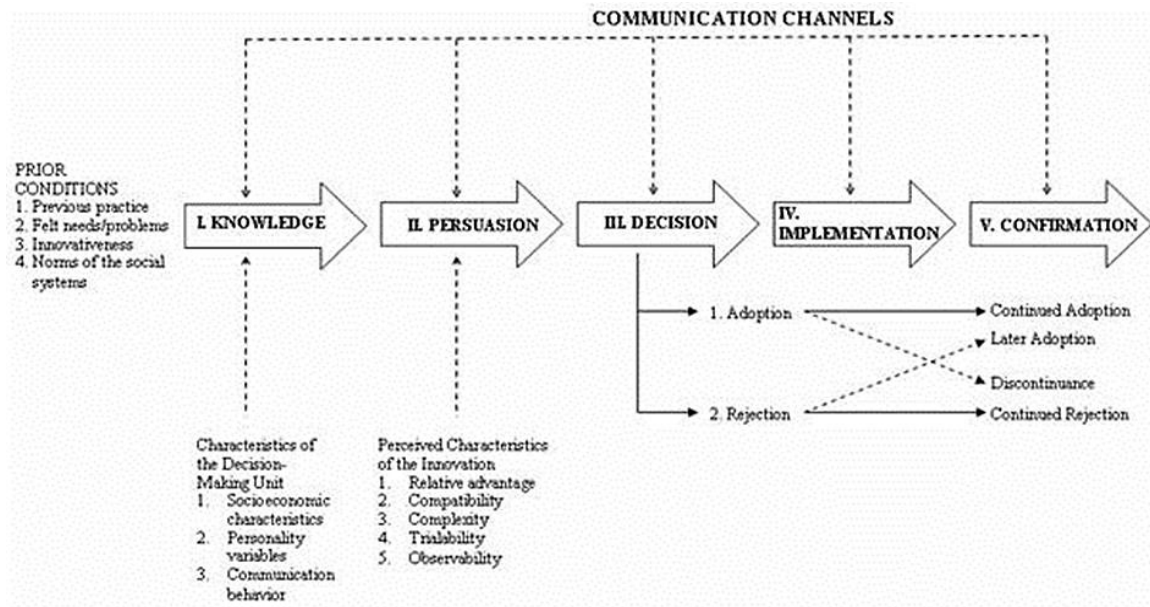


Figure 1. Innovation-decision process (Rogers, 2003, p. 170)

### **Knowledge Stage**

In order to persist through the innovation-decision process, an individual must acquire awareness or knowledge of an innovation (Rogers, 2003). This stage technically begins “when an individual (or other decision-making unit) is exposed to an innovation’s existence and gains an understanding of how it functions” (Rogers, 2003, p. 171). Initial awareness may be a passive act, but typically, more detailed learning is active and is

dependent on prior conditions outlined by Rogers (2003) as being (a) previous practice, (b) felt needs/problems, (c) innovativeness, and (d) norms of the social systems.

### ***Persuasion Stage***

Following the acquisition of awareness and knowledge of an innovation, the adopter moves forward by developing either a positive or negative attitude (Rogers, 2003). An attitude, as defined by Rogers (2003), “is a relatively enduring organization of an individual’s beliefs about an object that predisposes his or her actions” (p. 175). The information transforms from a purely cognitive state of the knowledge stage to being more active and affective, or a feeling (Rogers, 2003). Attitude development can be influenced by “(1) relative advantage, (2) compatibility, and (3) complexity” (Rogers, 2003, p. 175).

### ***Decision Stage***

Once an attitude has been formulated based on advantages and disadvantages of the innovation in the potential adopter’s viewpoint, the process continues into an active decision stage (Rogers, 2003). As outlined by Rogers (2003), an individual may choose to adopt the innovation, which is “a decision to make full use of an innovation as the best course of action available” (p. 177) or reject the innovation, which is “a decision not to adopt an innovation” (p. 177). Rejection of the innovation can occur at any point of the process as well in a passive manner, which could simply be exemplified by an individual forgetting that he or she heard of the innovation (Rogers, 2003).



### ***Implementation Stage***

With the implementation stage, comes the first active behavioral change as the innovation is put into actual use if the innovation is adopted (Rogers, 2003). The implementation stage varies in length depending on the innovation and if the adopter is an individual or if they are a group (Rogers, 2003). Re-invention, defined as “the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation” (Rogers, 2003, p.180), can also occur in this stage. Re-invention is not considered a fault in the innovation, but could add difficulty to tracing the innovation as it diffuses through a population (Rogers, 2003). As for the adopter, re-invention of an innovation could allow the innovation to match their needs better, thus leading to higher rates of adoption (Rogers, 2003).

### ***Confirmation Stage***

Complete adoption of an innovation does not end at the implementation stage as there is an additional information seeking period following implementation (Rogers, 2003). In the confirmation stage, an individual may seek “reinforcement for the innovation-decision already made, and may reverse this decision if exposed to conflicting messages about the innovation” (Rogers, 2003, p.189). If an adopter experiences any sort of dissonance, they will seek to lessen or completely avoid it thus discontinuing the innovation (Rogers, 2003).

## **Public Land in America**

Dating back to 1862, with the passage of the Morrill Act, the United States government has aided agriculturalists in the form of use of public land and its proceeds

(Committee on the Future of Land Grant Colleges of Agriculture, CFLGCA, 1995). The Morrill Act granted land to states to sell in order to finance agricultural education institutions (CFLGCA, 1995).

The Fifth Amendment of the United States Constitution reads “nor shall private property be taken for public use, without just compensation” (Miceli, 2011, p. 3). This clause became known as *The Takings Clause* or more commonly as eminent domain (Miceli, 2011). The United States government has the right to purchase land when it is deemed more important for the greater good than just one private owner (Micheli, 2011). The law of eminent domain is often combatted at three levels, “(a) the public use limitation, (b) the definition of just compensation, and (c) the compensability of government actions that regulate land without actual physical control of it” (Micheli, 2011, p.14). Public interest that supersedes private ownership includes urban renewal, urban sprawl, conservation and land protection, and public projects (Micheli, 2011).

At the national level, the United States’ federal government owns over 650 million acres of land, or 30% of the total land area of the country (United States Department of Interior, 2014). At the state level, eminent domain trickles down, but has recently been limited in power due to the *Kelo v. City of New London* case in 2005 (Pemberton, 2007). The Supreme Court ruled in favor of Kelo and concluded the state of Connecticut had overstepped boundaries in seizing private land and transferring it to private owners, which the plaintiffs argued, could benefit the people of New London through economic development. The court’s decision led many states, including Tennessee, to revise old eminent domain laws (Pemberton, 2007).

In 2006, “the Tennessee General Assembly enacted Public Chapter 863 to revise Tennessee’s eminent domain statutes” (Pemberton, 2007, p. 15). The chapter limited the state’s power and “a narrow construction of the eminent domain statutes was required to prevent any unintentional enlargement of the state’s ability to take private land for public purposes” (Pemberton, 2007, pp. 15-16). The Tennessee Advisory Commission on Intergovernmental Relations (TACIR) (TACIR, 2013) reported “in response to the US Supreme Court’s 2006 decision in *Kelo v. City of New London*, the Tennessee General Assembly changed the state’s eminent domain law, greatly improving protections for property owners” (p. 3).

The term *public use* was defined in an updated law § 29-17-102 (TACIR, 2013). According to the 2015 Tennessee Code, public use is defined as the following:

(2) Public use shall not include either private use or benefit, or the indirect public benefits resulting from private economic development and private commercial enterprise, including increased tax revenue and increased employment opportunity, except as follows:

- (A) The acquisition of any interest in land necessary for a road, highway, bridge, or other structure, facility, or project used for public transportation;
- (B) The acquisition of any interest in land necessary to the function of a public or private utility, a governmental or quasi-governmental utility, a common carrier, or any entity authorized to exercise the power of eminent domain under title 65;
- (C) The acquisition of property by a housing authority or community development agency to implement an urban renewal or redevelopment plan in a

blighted area, as authorized by title 13, chapter 20, part 2 or title 13, chapter 21, part 2;

(D) Private use that is merely incidental to a public use, so long as no land is condemned or taken primarily for the purpose of conveying or permitting the incidental private use;

(E) The acquisition of property by a county, city, or town for an industrial park, as authorized by title 13, chapter 16, part 2 (2015).

Today, 245 million acres of national land is entrusted to the Bureau of Land Management (BLM) which are largely located in the western United States (BLM, 2016). While a majority of the provisions allowed by the BLM focus on oil and natural gas, 155 million acres are available for farmers and ranchers to graze, which bringing in \$14.5 million in fees (BLM, 2016). Ranchers are charged per animal per month to graze on protected national land, which is referred to as animal unit month or AUM (BLM, 2016). Grazing allowances may vary on drought conditions or restoration projects by the Bureau (BLM, 2016), while some experts call for more controlled surveillance to better protect the land (Veblen, Pyke, Aldridge, Casazza, Assal, & Farinha, 2014).

### **Right-of-Way Vegetation Management**

Since the first trails or early roads existed, vegetation management of traveled areas has been a concern (National Cooperative Highway Research Program, NCHRP, 2005). However, decimation of right-of-way vegetation is not the goal of vegetation management as advantages exist to the green space surrounding asphalt roadways (NCHRP, 2005). Besides aesthetic purposes, the greenery serves as “erosion control,

storm-water management, protection of wildlife habitat, control of noxious and invasive weeds and needs of special plant communities” (NCHRP, 2005, p. 7). Proper management techniques are vital to ensure commuter safety, especially at intersections and ramps, where visibility may be limited (NCHRP, 2005). By controlling growth of roadside vegetation, visibility for drivers is enhanced (Cherney et. al., 1990).

Management techniques are reliant on an array of conditions such as “the type of vegetation desired, the desired appearance of the roadside, soil conditions, roadway traffic, roadway use and visibility, adjacent land use, roadway location, and topography” (MnDOT, 2008, p. 11). Early management techniques involved clearing overgrowth by hand and allowing the grazing of vegetation by animals, but as time and vehicle types – namely horse and buggies to cars – have promoted the expansion and evolution of American roadways, these techniques have been modernized (NCHRP, 2005). Present day, common vegetation management involves mechanical control via roadside mowers and chemical control to interrupt the growth and reproductive processes of certain plants (NCHRP, 2005). For the most part, municipalities cut and leave grass to mulch (Piepensneider, Buhle, Hensgen, & Wachendorf, 2016).

According to Tennessee State Law 54-5-206, TDOT is required to maintain roads throughout the state, which includes the roadside vegetation (TN Code § 54-5-206). “(1) site distance, (2) reduce accidents, (3) surface drainage, (4) aesthetics, (5) control noxious & invasive weeds, (6) preserve the economic condition of our property and adjacent properties” (TDOT State Vegetation Management Committee, SVMC, 2015, p. 4) are cited reasons by TDOT to control roadside vegetation. According to the TDOT SVMC

(2015), current management practices in Tennessee are costly, poorly operated and unsustainable. These management practices include contracted mowing, trimming, and herbicide application (TDOT SVMC, 2015). The state of Tennessee's Department of Transportation formed a committee of two representatives from each of the four regions to refocus current management strategies in roadside vegetation management in 2015 (TDOT SVMC, 2015). Goals of this committee include implementing an Integrated Vegetation Management program that can benefit the state in the following ways: "(1) cost, (2) safety, (3) economic, (4) flexibility, (5) environmental, (6) aesthetics, and (7) public relations" (TDOT SVMC, 2015, p.10). The Integrated Vegetation Management program will include state mowing, trimming, and herbicide application, reliance on insects, animals, and plant pathogens in addition to utilization of native species and timing treatments for maximum efficiency (TDOT SVMC, 2015). As the Integrated Vegetation Management program progresses into fruition, the TDOT SVMC (2015) suggests greater reliance on chemical application, and even though that will lessen costs to compensate contracted mowers, recruiting farmers to harvest the vegetation could be economically advantageous (Cherney et. al., 1990) and potentially environmentally responsible because of the removal of clippings (Parr & Way, 1988)

Furthermore, studies investigating the removal of cut grass from right-of-ways in the European Union found, in the long term, removal of cuttings is important for maintenance and increasing biodiversity of the right-of-ways (Parr & Way, 1988). However, the functionality of the removal of cuttings was called into question due to it being "time-consuming, expensive, and raises problems of disposal" (Green, 1972,

p.383). The Environmental Protection Agency (2015) considers grass clippings a municipal waste. Some researchers have suggested instead of leaving grass to mulch, the grass cuttings should be removed and used for other purposes such as hay, compost, or biogas material (Cherney, et. al, 1990; Piepenschneider, et. al, 2016 Montgomeryshire Wildlife Trust (MWT; 2006).

The Living Highway Project, a community road partnership in Wales, is working to turn right-of-way clippings into a valuable resource (MWT, 2006). In a four-week study, they investigated the central question – “Is it feasible to collect forages off of roadsides on a large scale?” (MWT; 2006). In four separate trials, each lasting one week, challenges with weather, litter removal, logistics of machinery, changes in altitude, rough terrain and highway safety were all observed and overcome (MWT, 2006). The MWT utilized machinery that “would cut and collect simultaneously, had a large collection capacity, and which would cut to the side while being driven on the highway, without compromising road safety” (MWT, 2006, p. 25). Half of the cuttings were transported to a facility to be anaerobically digested for biogas production, while the other half went to a composting facility in an attempt to investigate both options (MWT, 2006).

While preliminary studies have determined the feasibility of cutting collections, further research needs to be conducted to analyze the most efficient and economically sound practices (Piepenschneider, et al., 2016; MWT, 2006). Two of the four cuttings were transported to a facility that composted materials for landfill cappings (MWT, 2006). Because they were mixed with other waste materials at the facility results could not be specified. However, tests showed that the cuttings were adequate for compost

production in the lab at School of Civil Engineering and the Environment at Southampton University as well as at Direct Laboratories, Wolverhampton (MWT, 2006). In addition to compost production the Living Highways Project, two cuttings were transported for analyses at the Department of Civil Engineering and the Environment at Southampton University (MWT, 2006). A biochemical methane production test showed that the right-of-way cuttings were still producing biogas at the end of a 48 day trial and were a “good quality feedstock for biogas production, green and leafy with very low levels of litter contamination” (MWT, 2006, p.50).

In a more recent study grass from right-of-ways in high or low management systems – detailed in the study as a 2-cut or 4-cut scenario – were found to be a suitable input for energy recovery (Piepenschneider, et al., 2016). After processing, this municipal waste was found to have the same level of energy production as a silage under the same management principles (Piepenschneider, et al., 2016).

Dating back to 1990, Cherney et al. determined that hay harvesting from the right-of-way was feasible as long as location specific challenges were overcome. In a report detailing the most beneficial vegetation management procedures by MnDOT, haying right-of-ways contributes to a decrease in maintenance fees and is considered, in moderation, a “viable option” (MnDOT, 2008, p. 70).

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## **CHAPTER 3: MATERIALS AND METHODS**

Chapter 1 provided an overview of the challenges facing agriculture in upcoming decades. Chapter 2 detailed the theoretical foundation for this study and provided relevant literature. This chapter describes the methodology used to conduct the study.

### **Research Design**

A quantitative research approach was used, and the research design was descriptive survey research, which was exploratory in nature due to limited information available on right-of-way hay harvesting. A descriptive survey design was selected to gather information on respondents' awareness, attitude, barriers, and economic information related to agriculturalists' right to harvest hay from Tennessee right-of-ways. Survey research allows the researcher to assess a great number of respondents quickly and efficiently (Dillman, Smyth, & Christian, 2014).

### **Population, Sample, and Data Collection**

The target population for this study was livestock producers along Interstate 840 (I-840) in Tennessee. I-840, an interstate bypassing metropolitan Nashville, cuts through five counties: (a) Hickman, (b) Dickson, (c) Williamson, (d) Rutherford, and (e) Wilson (Haslam & Schroer, 2012). The 77.28 mile bypass originally was designed, in 1986, to alleviate Nashville traffic (Haslam & Schroer, 2012). Construction was completed in 2012 to connect I-840 to four interchanges of I-40, I-65, I-24, and I-40 (Haslam & Schroer, 2012). To build the four lane bypass, 681 tracts of land were purchased, amounting to over 5,000 acres (Haslam & Schroer, 2012) According to TDOT's traffic

history data set, there are sections of I840 that receive less than 10,000 vehicles per day, and the busiest sections of the road experience less than 45,000 vehicles a day (TDOT applications, 2016).

A convenience sample was derived from a public listing of Tennessee Agriculture Enhancement Program (TAEP) recipients. Because the TAEP program is publically funded, the contact information of farmers receiving cost-share is public information. A list of all TAEP recipients from 2013-2015 was obtained through public record. The list provided a reliable bank of producers in the I-840 area. Five hundred twenty-nine livestock producers whose residency was listed in the aforementioned counties were selected and contacted based on Dillman, et al. (2014) tailored design method. Five contacts were used and the protocols varied based on the mode of contact (electronic or mail). TAEP recipients with email addresses were contacted electronically four times using the Qualtrics survey software. Non-respondents of the electronic survey were also contacted by mail. Mail respondents were sent a prenotice, the survey, and three reminders with additional surveys.

Of the 529 TAEP recipients initially contacted, five members of the sample were recorded through correspondences as being deceased, which reduced the sampling frame to 524. Completed surveys were returned by 279 livestock producers or 53.2% of the sampling frame. Nonresponse was not addressed due to the sampling frame being a convenience frame.

The livestock producers in this study agreed to participate by signing an electronic or paper informed consent that was approved by the University of Tennessee's

Table 1. Demographic Profile of Livestock Producers Concerning Right-of-Way Hay Harvest

| Variable   | <i>f</i> | %    |
|--|----------|------|
| Gender   |          |      |
| Male   | 242      | 88.6 |
| Female   | 31       | 11.4 |
| Level of Education   |          |      |
| Some high school   | 6        | 2.2  |
| High School  | 65       | 23.9 |
| Trade or technical or vocational training                      | 25       | 9.2  |
| Some college   | 53       | 19.5 |
| Bachelor's degree  | 74       | 27.2 |
| Master's degree  | 29       | 10.7 |
| PhD degree   | 20       | 7.4  |
| Ethnicity  |          |      |
| White  | 266      | 96.4 |
| Hispanic or Latino   | 0        | 0.0  |
| Black or African American                                      | 4        | 1.4  |
| Native American or American Indian                             | 1        | 0.4  |
| Asian or Pacific Islander                                      | 0        | 0.0  |
| Other  | 0        | 0.0  |
| I prefer not to answer   | 5        | 1.8  |
| County of majority of farmland                                 |          |      |
| Hickman  | 31       | 11.2 |
| Dickson  | 48       | 17.3 |
| Williamson   | 45       | 16.2 |
| Rutherford   | 51       | 18.4 |
| Wilson   | 102      | 36.8 |
| Mileage from I-840 access point                                |          |      |
| 0 – 5 miles  | 55       | 19.8 |
| 5.1 – 10 miles   | 67       | 24.1 |
| 10.1 – 15 miles  | 52       | 18.7 |
| 15.1 – 20 miles  | 41       | 14.7 |
| 20.1 – 25 miles  | 27       | 9.7  |
| 25.1 – 30 miles  | 20       | 7.2  |
| 30.1 – 35 miles  | 6        | 2.2  |
| 35.1 miles or more   | 10       | 3.6  |
| Are you a full time farmer                                     |          |      |
| Yes  | 100      | 36.1 |
| No   | 177      | 63.9 |
| If you are full-time, are you retired from another profession? |          |      |
| Yes  | 78       | 67.2 |
| No   | 38       | 32.8 |

Institutional Review Board. The survey took approximately 15 to 20 minutes to complete. Demographics of the livestock producers who participated in this study are provided in Table 1. In addition, the average age of the surveyed producer was 57.7.

## **Instrumentation**

The questionnaire utilized for data collection was the *Right-of-way Innovation Questionnaire*, and was developed by the researcher using guidelines proposed by the tailored design method (Dillman et al., 2014). The *Right-of-way Innovation Questionnaire* was developed to assess livestock producers' current awareness, attitudes, and barriers concerning right-of-way hay harvesting as well as to conduct economic impact analyses to determine producers' willingness to harvest hay from right-of-ways. The questionnaire consisted of 12 demographic items, an 8 item *Agricultural Modernization* scale, 27 items to assess hay use and current practices, 5 items to assess knowledge of Tennessee state statute 54-5-134, a 7 item *Attitudes Toward Right-of-way Hay Harvesting* scale, 1 open-ended and 17 close-ended items to assess barriers of right-of-way hay harvesting and 10 items related to the economics of hay harvesting.

The *Agricultural Modernization* scale was adapted from Knight, et al.'s (2003) *Attitudes toward Modernization* scale. Because Knight et al.'s scale focused on crop production as opposed to overall general agriculture and to update item wording to a present day translation, slight wording changes were made to 5 of the 8 items by the researcher. For example, *I like to try new crops* was changed to *I like to try new things in agriculture* and *The way my father farmed is still the best way* was changed to *The way*

*the previous generation farmed is still the best way.* The *Agricultural Modernization* scale used a 5-point rating scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, 5 = *strongly agree*). Based on precedence set by previous researchers (Enochs, Smith, & Huinker, 2000; Haynes & Striping, 2014), livestock producers' *Agricultural Modernization* scores were categorized as low (1.00 to 2.33), moderate (2.34 to 3.67), and high innovation (3.68 to 5).

Furthermore, the *Attitudes Toward Right-of-way Hay Harvesting* scale was developed by modifying the *Agricultural Modernization* scale. One item was eliminated from the *Agricultural Modernization* scale because of the specificity of the scale to right-of-way hay harvesting. The remaining 7 items were modified to include right-of-way hay harvesting in each item. For example, *I want to try new farming techniques* was changed to *I am interested in trying right-of-way hay harvesting* and *I want to see new techniques tried first by others* was changed to *I want to see right-of-way hay harvest tried first by others*. The 27 hay use and current practices items were adapted from Penton Research's (2015) beef forage study, and the barrier items were developed using the current literature. The questionnaire also contained knowledge prompt regarding the Tennessee Statute 54-5-134, which was developed by the researcher. The *Attitudes Toward Right-of-way Hay Harvesting* scale used a 5-point rating scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, 5 = *strongly agree*). Based on precedence set by previous researchers (Enochs, et al., 2000; Haynes & Striping, 2014), livestock producers' *Attitudes Toward Right-of-way Hay Harvesting* scores were

categorized as low (1.00 to 2.33), moderate (2.34 to 3.67), and high innovation (3.68 to 5).

In 17 close-ended questions, producers were surveyed regarding their perceptions of possible barriers to participating in right-of-way hay harvesting. Producers were asked to describe their perceptions towards the list of possible barriers according to a 5-point scale (1 = strongly disagree, 2 = disagree, 3= neither agree nor disagree, 4=agree, 5= strongly agree).

As suggested by Dillman et al. (2014,), a preliminary questionnaire review was conducted by an expert panel consisting of an assistant professor of agricultural and resource economics, a TDOT lawyer, and an assistant professor of agricultural leadership, education and communications. The expert panel reviewed the questionnaire for face validity, flow, wording, and structure. Cognitive interviews were also conducted with five TAEP recipients from counties not included in this study. Dillman et al. (2014) recommends conducting cognitive interviews to ensure that “respondents comprehend questions as intended by the survey sponsor and whether questions can be answered accurately” (p. 244). Information from the interviews led to the following revisions: (a) rewording two items to improve clarity, (b) a gray background was added to the skip logic wording and the words were bolded to make the skip logic more apparent on the paper survey, and (c) the informed consent agreement or disagreement statements were bolded and underlined on the paper survey to make them more apparent.

After making these revisions, a sample of 38 TAEP recipients from Maury County were selected to take part in a pilot test as suggested by Dillman et al. (2014). For

the pilot test, one modification was made to the questionnaire. A suggestion/comment item was placed at the end of the survey to elicit questionnaire feedback. Based on the feedback one spelling error was corrected. Internal-consistency was assessed for the two scales using Cronbach's alpha. The pilot test reliabilities for the *Agricultural Modernization* and *Attitudes toward Right-of-way Hay Harvesting* scales were found to be .70 and .81 respectively.

### **Data Analysis**

Data was analyzed utilizing IBM SPSS Statistics 23. Descriptive statistics were used to summarize demographic information, hay use and current practices, knowledge of Tennessee state statute 54-5-134, barriers of right-of-way hay harvesting, and economics of hay harvesting. A summated mean was calculated for the *Agricultural Modernization* scale after reverse coding items 1, 3, 5, and 7. Additionally, a summated mean was calculated for the *Attitudes toward Right-of-way Hay Harvesting* scale after reverse coding items 1, 3, 5, and 6. A stepwise regression model was conducted through SPSS to examine factors that could account for variance in the summated mean scores of the *Attitudes toward Right-of-way Hay Harvesting* scale. Serving as the independent variable in the model, the *Attitudes toward Right-of-way Hay Harvesting* scale means represented the attitudes that surveyed producers held towards the innovation of right-of-way hay harvest.

Paired t-tests were utilized to determine if significant differences existed among the means in *Agricultural Modernization* and *Attitudes toward Right-of-way Hay Harvesting* in addition to the means of the amount livestock producers are willing to

spend to harvest right-of way hay versus the amount they are willing to pay someone to harvest right-of-way hay. In order to increase validity of outcomes, effect sizes were calculated for significant results using Dunlap, Cortina, Vaslow, and Burke's (1996) formula for Cohen's  $d$  to correct for overestimation due to the correlation between measures.



## CHAPTER 4: RESULTS

Chapter 1 provided an overview of the challenges facing agriculture in upcoming decades. Chapter 2 detailed the theoretical foundation for this study and provided relevant literature. Chapter 3 described the methodology used to conduct the study. This chapter presents the results of this study and has been organized based on the objectives.

### **Objective One: Describe Livestock Producers' Current Awareness, Need, and Utilization of Tennessee Statue 54-5-134**

As shown in Table 2, 18 or 7.2% of livestock producers were aware they had the right to harvest hay from state right-of-ways prior to the questionnaire. Four of the 18 or 1.6% of livestock producers indicated they learned of Tennessee Statue 54-5-134 from the UT extension service. None of the livestock producers who participated in this study had applied, received, or utilized a permit to harvest right-of-way hay.

Table 2. Livestock Producers' Awareness of Tennessee Statute 54-5-134

| Item                                       | <i>f</i> | %     |
|--|----------|-------|
| Aware of Tennessee State Statute 54-5-134? |          |       |
| Yes  | 18       | 7.2   |
| No   | 233      | 92.8  |
| Learned from UT Extension?                 |          |       |
| Yes  | 4        | 25.0  |
| No   | 12       | 75.0  |
| Applied for permit?                        |          |       |
| Yes  | 0        | 0.0   |
| No   | 16       | 100.0 |

As shown in Table 3, 99.2% of livestock producers utilized hay for feed, and 67.7% of livestock producers that harvested hay experienced a surplus (See Table 3). In 2015, livestock producers harvested, through various means, an average of 76.5% of the total hay utilized (See Table 4). The top three methods of livestock producers' hay harvesting included: (a) *I cut hay off my own land*, (b) *I cut hay off leased land*, and (c) *I cut hay off non-leased land with owner's permission*. The remaining 23.5% of hay reportedly utilized in 2015 was purchased. Livestock producers reported fescue (42.2%) and a grass mix (47.6%) as their top two types of hay harvested.

Table 3. Livestock Producers' Hay Use and Supply in 2015

| Items   | <i>f</i> | %    |
|---|----------|------|
| Do you use hay to feed livestock?                               |          |      |
| Yes   | 250      | 99.2 |
| No  | 2        | 0.8  |
| If you harvested hay in 2015, did you harvest a surplus of hay? |          |      |
| Yes   | 149      | 67.7 |
| No  | 71       | 32.3 |

In an inventory analysis of livestock owned by the livestock producers, beef cattle made up 86.4% of all animals, with 19,647 head. Dairy cattle were 844 head or 3.7% of all livestock. Goats and sheep were 788 and 770 head respectively, which is 3.5% and 3.4% of the inventory. Horses made up 1.6% with 362 head and other livestock with 318 head provided 1.4% to the total.

Table 4: Livestock Producers' 2015 Hay Harvesting Methods and Species

| Item   | %    |
|--|------|
| Method of hay harvest                                |      |
| I cut hay off my own land                            | 42.4 |
| I cut hay off of leased land                         | 20.6 |
| I pay someone to cut hay off my own land             | 6.0  |
| I pay someone to cut hay off of leased land          | 2.8  |
| I purchase my hay                                    | 23.5 |
| I cut hay off non-leased land with owner permission. | 14.2 |
| Other  | 0.2  |
| Species of hay utilized                              |      |
| Fescue   | 42.2 |
| Alfalfa  | 1.8  |
| Alfalfa mix  | 0.3  |
| Bermuda  | 2.7  |
| Bermuda mix  | 1.6  |
| Grass mix  | 47.6 |
| Other  | 6.9  |

## Objective Two: Describe Livestock Producers' Perceptions of Barriers to Participating in Right-of-Way Hay Harvesting

As displayed in Table 5, a majority of livestock producers agreed the following 12 items were barriers to participating in right-of-way hay harvesting: (a) *low quality hay*, (b) *roadside debris and litter*, (c) *contaminated with chemicals and metals*, (d) *hay transport*, (e) *the need for insurance and performance bond*, (f) *meeting deadlines set by governmental officials*, (g) *meeting deadlines set by current right-of-way contractors*, (h) *communicating with current right-of-way contractors*, (i) *having to plan around contracted litter removals*, (j) *slopes*, (k) *traffic* and (l) *narrow shoulders and medians on I-840*. The highest ranked items (a) *roadside debris and litter* and (b) *traffic* received 85.1% and 80% agreeance, respectively. Of the remaining items, *mixed species hay* and

*cannot legally sell hay* were the least concerning possible barriers to livestock producers with 28.4% and 28.0% disagreement respectively.

### **Objective Three: Describe Livestock Producers' Attitudes Toward Agricultural Modernization.**

The summated mean of the *Agricultural Modernization* scale was 3.71 ( $SD = 0.42$ ), which corresponds to high innovation. Examining attitudes toward agricultural innovation further revealed 51.5% of livestock producers possessed high innovative attitudes toward agriculture, and 48.5% possessed moderate innovation attitudes toward agriculture. None of the livestock producers possessed low innovation attitudes toward agriculture (See Table 6).

### **Objective Four: Describe Livestock Producers' Attitudes toward Adoption of Right-of-Way Hay Harvesting**

The summated mean for the *Attitudes toward Right-of-way Hay Harvesting* scale was 2.99 ( $SD = 0.63$ ), which corresponds to moderate innovation toward right-of-way hay harvesting. As shown in Table 6, 12.4% of livestock producers held a high attitude toward the innovative right-of-way hay harvesting, 11.6% held a low attitude toward the innovation of right-of-way hay harvesting, and 75.9% were moderate in attitude towards the innovation of right-of-way hay harvesting.

Table 5. Livestock Producers' Perceptions of Possible Barriers to Utilization of Their Rights According to Tennessee Statute 54-5-134

|  | Disagree |      | Neither agree nor disagree |      | Agree    |      |
|--|----------|------|----------------------------|------|----------|------|
|  | <i>f</i> | %    | <i>f</i>                   | %    | <i>f</i> | %    |
| Low Quality Hay  | 32       | 13.1 | 67                         | 27.5 | 145      | 59.4 |
| Optional hay testing fees                                | 53       | 21.6 | 120                        | 49.0 | 72       | 29.4 |
| Mixed species hay  | 67       | 28.4 | 99                         | 41.9 | 70       | 29.7 |
| Roadside debris and litter                               | 13       | 5.4  | 23                         | 9.5  | 206      | 85.1 |
| Contaminated with chemicals and metals                   | 19       | 7.8  | 57                         | 23.4 | 168      | 68.8 |
| Hay transport  | 33       | 13.5 | 52                         | 21.3 | 159      | 65.1 |
| Cannot legally sell hay                                  | 68       | 28.0 | 114                        | 46.9 | 61       | 25.1 |
| Strict rules   | 42       | 17.2 | 109                        | 44.5 | 94       | 38.4 |
| The need for insurance and performance bond              | 43       | 17.6 | 63                         | 25.7 | 139      | 56.7 |
| Meeting deadlines set by government officials            | 22       | 8.9  | 64                         | 26.1 | 159      | 64.9 |
| Meeting deadlines set by current right-of-way contactors | 22       | 8.9  | 70                         | 28.6 | 153      | 62.5 |
| Communicating with government officials                  | 37       | 15.1 | 91                         | 37.1 | 117      | 47.8 |
| Communicating with current right-of-way contactors       | 28       | 11.5 | 89                         | 36.3 | 128      | 52.2 |
| Having to plan around contracted litter removals         | 25       | 10.0 | 67                         | 27.3 | 153      | 62.4 |
| Slopes   | 15       | 6.1  | 45                         | 18.4 | 184      | 75.4 |
| Traffic  | 14       | 5.7  | 35                         | 14.2 | 197      | 80.0 |
| Narrow shoulders and medians on SR-840                   | 18       | 7.3  | 61                         | 24.8 | 137      | 67.8 |

Table 6. Livestock Producers' Agriculture and Right-of-way Innovation Scale Results

| Scale  | <i>M</i> | <i>SD</i> | Low      |      | Moderate |      | High     |      |
|--|----------|-----------|----------|------|----------|------|----------|------|
|  |          |           | <i>f</i> | %    | <i>f</i> | %    | <i>f</i> | %    |
| Attitudes toward Agricultural Modernization  | 3.71     | 0.42      | 0        | 0.0  | 126      | 48.5 | 134      | 51.5 |
| Attitudes toward Right-of-way Hay Harvesting | 2.99     | 0.63      | 29       | 11.6 | 189      | 75.9 | 31       | 12.4 |

## **Objective Five: Determine if a Significant Difference Exist in Attitudes toward Agricultural Modernization and Right-of-Way Hay Harvesting**

As shown in Table 7, a significant difference existed in the *Agricultural Modernization* mean and the *Attitudes toward Right-of-way Hay Harvesting* mean ( $p = .00$ ). The practical significance of the difference was assessed using Cohen's  $d$ , and the effect size was 1.35, which is a large effect size (Kotrlik, Williams, & Jabor, 2011).

Table 7. Change in Perceived Innovativeness According to Scale Results of Livestock Producers

|                                       | Mean<br>difference | <i>SD</i> | <i>SE</i> | <i>t</i> | <i>p</i> | <i>d</i> |
|---------------------------------------|--------------------|-----------|-----------|----------|----------|----------|
| Innovativeness posttests -<br>pretest | -0.73              | .64       | .04       | -18.14   | .00      | 1.35     |

## **Objective Six: Determine Willingness of Livestock Producers to Pay Someone Else to Cut and Harvest Right-of-Way Hay**

One hundred sixty nine or 74.1% of livestock producers indicated they were not interested in paying someone else to cut one acre of right-of-way hay for their own use. The remaining 25.9% of livestock producers indicated they would pay someone else to harvest right-of-way hay. The amounts livestock producers are willing to pay someone else to harvest right-of-way hay are provided in Table 8.

In regards to the state of Tennessee paying for right-of-way mowing, livestock producers perceived the state was paying on average \$83.69 for one acre of mowing. This average was derived after removing extreme outliers in the data. The minimum and

maximum values reported after outliers were removed were \$0 and \$650 an acre, respectively.

Table 8. Livestock Producers' Willingness to Pay Someone to Harvest One Acre of Right-of-Way Hay

| Response     | <i>f</i> | %    |
|--------------|----------|------|
| Nothing      | 169      | 74.1 |
| \$1-5        | 11       | 4.8  |
| \$6-10       | 8        | 3.5  |
| \$11-15      | 10       | 4.4  |
| \$16-20      | 11       | 4.8  |
| \$21-25      | 6        | 2.6  |
| \$26-30      | 7        | 3.1  |
| \$31 or more | 6        | 2.6  |

**Objective Seven: Determine if there is a difference in the amount livestock producers are willing to spend to harvest right-of way hay versus the amount they are willing to pay someone to harvest right-of-way hay.**

As shown in Table 9, no significant difference was found between difference in the amount livestock producers are willing to spend to harvest right-of way hay versus the amount they are willing to pay someone to harvest right-of-way hay. To that end, the mean difference was \$6.00 ( $SD = 13.39$ ,  $p > .05$ ).

Table 9. Difference in Willingness to Self-harvest Versus Pay Someone to Harvest Right-of-way Hay

|   | Mean difference | <i>SD</i> | <i>SE</i> | <i>t</i> | <i>p</i> |
|---|-----------------|-----------|-----------|----------|----------|
| Price willing to spend to harvest right-of way – Price willing to pay someone to harvest right of way hay | -6.00           | 13.39     | 3.46      | -1.74    | .10      |

## **Objective Eight: Determine Factors Impacting Willingness to Harvest**

### **Right-of-Way Hay**

To determine factors impacting willingness to harvest right-of-way hay, a stepwise multiple regression was performed to uncover variables that explained the variance in scores on the *Attitudes toward Right-of-way Hay Harvesting* scale, which was the dependent factor. The following independent variables were entered into the model: gender (male or female), age, level of education (some high school, high school, trade or technical or vocational training, some college, Bachelor's degree, Master's degree, or PhD degree), ethnicity (White, Hispanic or Latino, Black or African American, Native American or American Indian, Asian or Pacific Islander, Other or I prefer not to answer), county of farmland (Hickman, Dickson, Williamson, Rutherford, Wilson), acreage of farm, miles from I-840 (0-5, 5.1-10, 10.1-15, 15.1-20, 20.1-25, 25.1-30, 30.1-35, or 35 miles and over), whether they had full-time employment status on farm (yes or no), mean summated score of *Attitudes toward Modernization scale*, hay species use (fescue, alfalfa, alfalfa mix, Bermuda, Bermuda mix, grass mix, other), whether they had harvested a hay surplus (yes or no), method of collection (cut hay of my own land, cut hay off of leased land, pay someone to cut hay off own land, pay someone to cut hay off leased land, purchase hay, cut hay off non-leased land with owner permission, other), perceived cost to state for one acre of mowing, price willing to pay to cut hay off of I-840 (Nothing, \$1-5, \$6-10, \$11-15, \$16-20, \$21-25, \$26-30, and \$31 or more), willingness to cut hay if it could be sold (yes or no), willingness to cut hay if fertilizer could be used on right-of-



way (yes or no), and price willing to pay to have someone else cut one acre of right-of-way-hay (Nothing, \$1-5, \$6-10, \$11-15, \$16-20, \$21-25, \$26-30, and \$31 or more).

Four variables, shown in Table 10, explained 29.6% of the variance in attitude. Livestock producers who were willing to cut hay off of right-of-ways if they could sell it scored 0.47 points higher on the *Attitudes toward Right-of-way Hay Harvesting* scale. Alfalfa mix hay users scored 1.27 points lower on the *Attitudes toward Right-of-way Hay Harvesting* scale. Livestock producers who were willing to pay someone else to cut the hay scored 0.06 points higher per \$5 increment. Finally, producers who purchased their hay showed a 0.24 increase in their summated mean of the *Attitudes toward Right-of-way Hay Harvesting* scale.

Table 10. Summary of Stepwise Regression for Variables Impacting Attitudes Toward Right-of-Way Hay Harvesting Among Livestock Producers

| Variable  | <i>B</i> | <i>SE B</i> | <i>p</i> |
|---|----------|-------------|----------|
| Willingness to cut hay off right of way if it can be sold   | 0.47     | 0.10        | .000     |
| Alfalfa mix hay users                                       | -1.27    | 0.45        | .006     |
| Willingness to pay someone else to cut hay off right-of-way | 0.06     | 0.02        | .017     |
| Producers that purchase their hay                           | 0.24     | 0.11        | .032     |

*Note.* Full Model:  $R^2 = 0.319$ ; *Adjusted R*<sup>2</sup> = .0296

## **CHAPTER 5: DISCUSSIONS AND RECOMMENDATIONS**

The primary purpose of this study was to assess Hickman, Dickson, Williamson, Wilson and Rutherford county livestock producers' current awareness, attitudes, and barriers concerning right-of-way hay harvesting as well as to conduct economic impact analyses to determine producers' willingness to harvest hay from right-of-ways. Chapter 1 provided an overview of the challenges facing agriculture in upcoming decades. Chapter 2 detailed the theoretical foundation for this study and provided relevant literature. Chapter 3 described the methodology used to conduct the study. Chapter 4 presented the results of this study and was organized based on the objectives. Chapter 5 details the discussion, recommendations, and implications concerning the findings of this study.

### **Objective One: Describe Livestock Producers' Current Awareness, Need, and Utilization of Tennessee Statue 54-5-134**

Most livestock producers did not have prior knowledge of their right to harvest right-of-way hay. According to Rogers (2003), knowledge is the first step to adoption of an innovation. Without knowledge, an attitude towards an innovation cannot be made (Rogers, 2003). Because producers were learning of the innovation via this study, they had little time to process the law and develop more than an initial attitude. Sahin (2006) concluded, from a review of innovation in educational technology, that "uncertainty about the innovation's functioning... affect[s] the individual's opinions and beliefs about the innovation" (p.16). Because producers lacked the ability to process the law in terms of the outlined steps of the persuasion stage, (a) relative advantage, (b) compatibility, (c)

complexity, (d) trialability, and (e) observability, development of an attitude was shallow (Rogers, 2003). The lack of awareness among respondents impacts the remainder of the study, because respondents had very little time to develop an attitude toward the innovation and properly make any judgements regarding it.

The need for hay is evident according to data collected from livestock producers. Despite having normal rainfall through the hay harvesting months of 2015, except for a window from May 12, 2015 – May 26, 2015, in which rainfall was abnormally dry (National Drought Mitigation Center, 2015), 32.3% of livestock producers who harvested their hay, as opposed to purchasing it, did not have a surplus of hay. The term *selective perception*, which is defined as “the tendency to interpret communication messages in terms of the individual’s existing attitudes and beliefs” (Rogers, 2003, p.171) describes the importance of need in the innovation decision process. The livestock producers that did not obtain a surplus of hay in 2015, may be more apt to pursue more information concerning the innovation (Rogers, 2003).

Hay surpluses are vital to stable agricultural economics due to the impact on unforeseen drought (Coppock, 2011). Drought forces agriculturalists to make decisions about herd size, in relation to water supply, grazing capacity, cattle sale rates, hay production, and breeding stock (Coppock, 2011). Hay storage is another option for reducing the effects of drought (Coppock, 2011). In the 2010-2011 TAEP year, 37.9% of the \$14,184,693 budget was utilized on hay storage facilities for producers, so a large demographic of our surveyed producers have the capacity to store hay. A multi-year drought study in Utah concluded practice and preparedness changed in cattle ranchers

after droughts (Coppock, 2011). Self-reported tactics for drought management after a multi-year drought included: (a) improving irrigation for hay production, (b) increasing capacity for hay production, (c) increasing capacity for hay storage, (d) planning to use grass banks, and (e) using forward contracting for hay purchases (Coppock, 2011). This stands in contrast to the tactics utilized by unprepared ranchers for an earlier drought, where producers relied on emergency sale of livestock and buying of hay (Coppock, 2011). While 2015 was a good rain year according to drought monitoring, still over 30% of producers did not obtain a surplus, which could provide a safety buffer for unforeseen circumstance in their operations.

Furthermore, data showed the hay utilized by our sample in 2015 was 89.8% fescue or grass mix. This is interesting given livestock producers in the Austin, Texas area, where similar laws exist pertaining to the right to right-of-way hay harvest (W. Rehnberg, Texas Department of Transportation, personal communication, October 19, 2015), do not participate in right-of-way hay harvesting because they are wary of the mixture of species of grasses growing on right-of-ways. According to Bates (1999), the majority of grass in Tennessee is tall fescue or tall fescue mixed with orchard grass or timothy (1999). Livestock producers' current practice of cutting hay and feeding mixed grass hay may be conducive to right-of-way hay harvest adoption.

In 2015, of the hay acquired by livestock producers, 37.6% was derived from land they did not own – (a) *I cut hay off of leased land*, (b) *I pay someone to cut hay off of leased land*, and (c) *I cut hay off non-leased land with owner permission*. Because the right-of-way harvest permits are structured similarly to leased land (TDOT, 2003), the

common utilization of leased land and non-leased land agreements are important to consider. If farmers are already utilizing leased or borrowed land as an agricultural practice (Rogers, 2003), they may be more likely to adopt right-of-way hay harvesting once they are made aware of Tennessee Statue 54-5-134.

None of the livestock producers in this study had ever utilized their right to harvest hay from state right-of-ways. This finding is consistent with the researcher's conversation with L.S. South of TDOT who had only one remembrance of anyone applying for a permit in his region (L.South, personal communication, October 13, 2015). While rejection of the right-of-way hay harvesting innovation is one plausible explanation as to why livestock producers do not apply for right-of-way hay harvesting permits, Rogers (2003) diffusion of innovation theory suggests the absence of knowledge of Tennessee Statue 54-5-134 as another plausible explanation.

## **Objective Two: Describe Livestock Producers' Perceptions of Barriers to Participating in Right-of-Way Hay Harvesting**

The item *roadside debris and litter* earned the highest rank among all perceived barriers with 85.1% of surveyed producers agreeing that it would deter them from participating in right-of-way hay harvesting. TDOT also has concerns regarding roadway litter. According to TDOT (2016) "excessive litter can become a road hazard and litter can present a danger when mowing right-of-way" (p.12). In 2015, the state of Tennessee appropriated \$316,800 for litter cleanup in the counties represented in this study – Dickson, Hickman, Williamson, Rutherford, and Wilson (TDOT, 2016). As a result of Tennessee's initiatives to clean up their roadways through cleanup and educational

efforts, there have been consistent declines in the amount of litter on roadways (TDOT, 2016). By working to eliminate right-of-way litter, there is the potential to eliminate or greatly reduce the litter barrier for livestock producers. Furthermore, TDOT officials and livestock producers may be able to work together to align litter removal periods with hay harvesting periods to ensure that less litter ends up in right-of-way harvested hay.

One of the least deterring items for livestock producers in this study was *mixed species hay* with 28.4% of livestock producer disagreeing that it would deter them from adoption of right-of-way hay harvesting. This finding stood in opposition to W. Rehnborg (personal communication, October 13, 2015) and Cherney et al. (1990) who professed livestock producers would not be accepting of hay that contained several varieties of grasses. As previously stated, when considering current agricultural practices by livestock producers in Tennessee, producers are already utilizing mixed species hay and this may aid in the diffusion of right-of-way hay harvesting among livestock producers.

Livestock producers in this study indicated *low quality hay* was a potential barrier with 59.4% of producers agreeing with the item. This was a predicted deterrent by Rehnborg (personal communication, October 13, 2015) of Texas Department of Roads and Cherney et al. (1990). Cherney, et al. found “forage maturities different between sites” (p. 116), and this partly explains variation in hay quality on right-of-ways. However, Cherney et al. found the lowest quality hay harvested from right-of-ways in their study was sufficient for mature beef cattle in accordance with standards set by the National Research Council (1990). Beef cattle are the most prevalent species of livestock

owned by Tennessee livestock producers in this study. Because beef cattle operations are so commonplace in the region surveyed, the quality of hay may be high enough for these operations.

### **Objective Three: Describe Livestock Producers' Attitudes toward Agricultural Modernization**

Overall, livestock producers possessed high innovation in agricultural practices. Therefore, livestock producers in this study appear to be willing to adopt new agricultural practices and technology. According to Rogers (2003), innovativeness is a prior condition required of a potential adopter of an innovation (Rogers, 2003). Innovation is vital to agriculture in the upcoming decades as the adoption of new techniques and practice have been called upon to meet new satiety demands of a growing population (Kiers et al., 2008).

### **Objective Four: Describe Livestock Producers' Attitudes toward Adoption of Right-of-Way Hay Harvesting**

When attitudes were collected post knowledge prompt concerning the specific right-of-way hay harvest innovation, livestock producers possessed moderate attitudes of the innovation. Attitude can influence the risk factors associated with an innovation in farmers (Botterill & Mazur, 2004). Botterill and Mazur (2004) found risk perceptions are often over-exaggerated by the farming community. This may be caused by farmers having a nature of being risk averse, which can often be attributed to many factors, including lack of knowledge (Botterill & Mazur, 2004). Since the livestock producers in

this study were unaware of their right to harvest right-of-way hay prior to this study and sometimes exaggerate risk, this may explain why their attitudes towards right-of-way hay harvesting were moderate and not high as found in the agricultural modernization scores.

### **Objective Five: Determine if a Significant Difference Exist in Attitudes toward Agricultural Modernization and Right-of-Way Hay Harvesting**

A significant difference existed between the livestock producers' attitude toward agricultural innovation and the specific innovation of right-of-way hay harvesting.

Overall, innovativeness of the livestock producers fell significantly from high to moderate when questioned specifically in regards to the right-of-way hay innovation. It can be interpreted that livestock producers held a more negative attitude towards the right-of-way hay harvest at the time of this study. Rogers (2003) stated that it is assumed that attitude will lead to action, but typically in practice, a discrepancy exists between attitude and practice. In addition, circumstance may play a large factor in moving to action (Rogers, 2003). For instance, a producer may have a moderate attitude during rainy years, but drought in the future may force them to consider attitudes they have developed. With that in mind, there are many factors that lead to adopt of an innovation (Rogers, 2003).

### **Objective Six: Determine Willingness of Livestock Producers to Pay Someone Else to Cut and Harvest Right-of-Way Hay**

Over a quarter of producers indicated they would be willing to pay someone else to cut and harvest hay off state right-of-ways. Additionally, 17.5% would be willing to



pay over \$10 an acre to someone to harvest the hay for them. Nothing in the most recent version of rules for Tennessee Statute 54-5-134 specifies that the permit holder has to be the one to physically collect hay (TDOT, 2003). If producers are willing to permit the land and contract out the work to others, then there may be viability in perusing the dissemination of information regarding the law.

Moreover, some livestock producers' willingness to pay someone to harvest right-of-way hay may indicate hay quality and yield are not factors discouraging these producers from adopting the practice using of right-of-way hay. Would these same producers be willing to purchase right-of-way hay from the state or state contractors? This question should be investigated further.

**Objective Seven: Determine if there is a difference in the amount livestock producers are willing to spend to harvest right-of way hay versus the amount they are willing to pay someone to harvest right-of-way hay.**

Statistically, there was no difference found between the amount a livestock producer was willing to pay to harvest hay on state right-of-ways, and the amount a producer would pay to have someone else harvest the hay for them. This may indicate that the value of right-of-way hay is found in having access to right-of-way hay and is not necessarily influenced by the method of harvesting the hay. Krugman and Wells (2015) defined a potential consumer's willingness to pay "as the maximum price at which he or she would buy a good" (Ch.6, section1, p. 1). Because the mean difference of \$6 was not

significant, it can be concluded that the amount livestock producers were willing to pay for right-of-way hay did not differ in terms of who was harvesting the hay.

## **Objective Eight: Determine Factors Impacting Willingness to Harvest Right-of-Way Hay**

Through multiple stepwise regression, the following four variables were identified that accounted for 29.6% of the variance in *Attitudes toward Right-of-way Hay Harvesting* scores: (a) willingness to cut hay off right-of-way if it can be sold, (b) alfalfa mix hay users, (c) willingness to pay someone else to cut hay off of right-of-way, and (d) producers that purchase their hay.

Investigating the effect of changing Tennessee law to allow the sale of right-of-way hay and allowing livestock producers to pay someone else to harvest the right-of-way hay may be of interest, since the opportunity to sale right-of-way hay and willingness by livestock producers to pay someone else to harvest the hay resulted in more favorable attitudes toward right-of-way harvesting. Furthermore, livestock producers who buy their hay supply possessed more favorable attitudes toward right-of-way hay harvesting. This may be the result of seeing Tennessee Statue 54-5-134 as a way to reduce their hay cost or willingness to purchase right-of-way hay. The effect the factors above had on attitude supports Rogers (2003). Rogers stated previous practice similar to an introduced innovation increases adoption. In this case, if livestock producers were allowed to purchase, sale, or pay someone else to harvest right-of-way, they may be more likely to harvest or support right-of-way hay harvesting. However, if livestock producers were feeding alfalfa mix hay, they were not as interested in right-of-way hay

harvesting. This may be due to the fact that alfalfa mix hay is a higher quality forage than other grass mixes (Bates, 1998), which are generally found in Tennessee grasslands (Bates, 1999).

### **Recommendations for Future Research**

Based on the findings of this study, the following recommendations for future research were made:

1. Due to the limited scope of this study, replication should be done statewide to accumulate more data as to livestock producers' current awareness, attitudes, and barriers concerning right-of-way hay harvesting as well as to conduct economic impact analyses to determine producers' willingness to harvest hay from right-of-way.
2. Future research should further explore factors that impact the adoption of right-of-way hay harvesting.
3. Since most producers were not aware of Tennessee Statue 54-5-134, future research is warranted on the effects of educational programming and promotion of the law. Would attitudes toward right-of-way hay harvesting differ after educational programming or promotion? Most producers in this study became aware of Tennessee Statue 54-5-134 by participating in the study and had only minutes to develop attitudes toward harvesting right-of-way hay. Additionally, does increased awareness result in more permits being obtained?
4. Future research should investigate the actual risk and impact of perceived barriers to right-of-way hay harvesting.

5. Because there was interest among livestock producers to sell right-of-way hay, as well as livestock producers interested in buying right-of-way hay, future research should investigate the feasibility of accommodating these interests.
6. Future research should determine if livestock producers are willing to purchase right-of-way hay from the State of Tennessee or state contractors.
7. Research is warranted to determine the quality of right-of-way hay.

### **Recommendations for Practice**

Based on the findings of this study, the following recommendations were made:

1. Livestock producers should be made aware of Tennessee Statue 54-5-134.  
Extension professionals in Tennessee can serve as a source of information, and Extension communication channels can be used to share information regarding Tennessee Statue 54-5-134. For example, livestock producers can be made aware of Tennessee Statue 54-5-134 during master beef and goat programming, and Tennessee Statue 54-5-134 can be discussed in Extension bulletins/fact sheets. Furthermore, the University of Tennessee and Tennessee State University Extension, private industry representatives, and other agricultural educators should utilize this study to develop educational programs in conjunction with TDOT officials to further educate livestock producers across the state of their rights.
2. Livestock producers that exhibit the factors determined to produce more favorable attitudes toward right-of-way hay harvesting should be targeted with information related to Tennessee Statue 54-5-134.

3. Perceived barriers may become lessened with education. Future practice should focus on educating interested livestock producers on how to minimize barriers related to right-of-way hay harvesting.
4. The state of Tennessee should continue efforts to reduce litter on right-of-way; reduced litter may encourage livestock producers to obtain permits.
5. Because there was interest among livestock producers to sell right-of-way hay, as well as livestock producers interested in purchasing right-of-way hay, the state of Tennessee should allow permit holders to sell hay to livestock producers.

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## **APPENDIX**

# IRB Approval



THE UNIVERSITY OF  
TENNESSEE  
KNOXVILLE

April 28, 2016

Sarah Joy Maccaro,  
UTK - Ag Leadership, Educ & Comm Prog

Re: UTK IRB-16-02976-XP

Study Title: Tennessee Livestock Producers' Awareness, Attitudes and Perceptions of Right-of-way Hay Harvesting

Dear Sarah Joy Maccaro:

The UTK Institutional Review Board (IRB) reviewed your application for the above referenced project. It determined that your application is eligible for expedited review under 45 CFR 46.110(b)(1), Category 7. The IRB has reviewed these materials and determined that they do comply with proper consideration for the rights and welfare of human subjects and the regulatory requirements for the protection of human subjects.

Therefore, this letter constitutes full approval by the IRB of your application (version 1.2) as submitted, including pre-notices v 1.1; cover letters v 1.0; reminders, third and fourth contacts v 1.0; instruments v 1.1; and the consent forms (v 1.2) that have been dated and stamped IRB approved. Approval of this study will be valid from 04/28/2016 to 04/27/2017. Please note that as per your conversation with the IRB Compliance Officer, your field test data may not be reported until the Form 4 Noncompliance issue is resolved.

In the event that subjects are to be recruited using solicitation materials, such as brochures, posters, web-based advertisements, etc., these materials must receive prior approval of the IRB. Any revisions in the approved application must also be submitted to and approved by the IRB prior to implementation. In addition, you are responsible for reporting any unanticipated serious adverse events or other problems involving risks to subjects or others in the manner required by the local IRB policy.

Finally, re-approval of your project is required by the IRB in accord with the conditions specified above. You may not continue the research study beyond the time or other limits specified unless you obtain prior written approval of the IRB.

Sincerely,

Colleen P. Gilrane, Ph.D.  
Chair

Institutional Review Board | Office of Research & Engagement  
1534 White Avenue Knoxville, TN 37996-1529  
865-974-7697 865-974-7400 fax ib@utk.edu

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## **Survey**

# **Right-of-way hay survey for producers of livestock in Hickman, Dickson, Williamson, Rutherford and Wilson Counties**

**1. What is your gender?**

- ☐ Male
- ☐ Female

**2. What is your age?**

\_\_\_\_\_

**3. What is the highest level of education you have completed?**

- ☐ Some high school
- ☐ High school
- ☐ Trade or technical or vocational training
- ☐ Some college
- ☐ Bachelor's degree
- ☐ Master's degree
- ☐ PhD degree

**4. What is your ethnicity?**

- ☐ White
- ☐ Hispanic or Latino
- ☐ Black or African American
- ☐ Native American or American Indian
- ☐ Asian / Pacific Islander
- ☐ Other
- ☐ I prefer not to answer.

**5. In what county do you own a majority of your farmland?**

- ☐ a. Hickman
- ☐ b. Dickson
- ☐ c. Williamson
- ☐ d. Rutherford
- ☐ e. Wilson

**6. Approximately, how many acres do you farm? (*Owned and rented*)**

\_\_\_\_\_ acres

**7. How many miles is your farmland from an access point to Tennessee State Route 840?**

- ☐ 0 - 5 miles
- ☐ 5.1-10 miles
- ☐ 10.1 – 15 miles
- ☐ 15.1 – 20 miles
- ☐ 20.1-25 miles
- ☐ 25.1 – 30 miles
- ☐ 30.1 – 35 miles
- ☐ 35.1 miles or more

**8. Are you a full-time farmer?**

- ☐ Yes
- ☐ No

**4. Answer if you are a full time farmer.**

**8a. Are you retired from another profession?**

- ☐ Yes
- ☐ No

**9a. Which category best reflects your total taxable household income (from both farm and non-farm sources) for 2015?**

- ☐ >\$10,000
- ☐ \$10,000-\$19,999
- ☐ \$20,000-\$29,999
- ☐ \$30,000-\$49,999
- ☐ \$50,000-\$99,999
- ☐ \$100,000-\$249,999
- ☐ \$250,000 or greater

**9b. What percent of your total taxable household income (both farm and non-farm sources) for 2015 do you estimate came from farming? (0% to 100%)**

\_\_\_\_\_

**9c. What percent of your 2015 farm income do you estimate came from your livestock operations? (0% to 100%)**

\_\_\_\_\_

**10. Do you agree with the following statements?**

|  | Strongly disagree     | Disagree              | Neither agree nor disagree | Agree                 | Strongly agree        |
|--|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| The way the previous generation farmed is still the best way.                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| I want to try new farming techniques.  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| I want to see new techniques tried first by others.                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| I am willing to listen to advice from extension agents.                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| It is foolish to try new things in agriculture.                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| I like to try new things in agriculture.                                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| I prefer traditional farm tools to new innovations.                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| I would be interested in a new innovation first and being an example farmer. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |

**11. Please indicate the total number of head you own today [replacement heifers, cows, bulls].**

| Species                | Number of head <u>today</u> |
|------------------------|-----------------------------|
| Beef Cattle            |                             |
| Dairy Cattle           |                             |
| Goats                  |                             |
| Sheep                  |                             |
| Horses, Donkeys, Mules |                             |
| Other                  |                             |

**11. Do you use hay to feed livestock?**

- ☐ Yes  
☐ No

**13. Please indicate how much of the following hay species you utilize.**

*Please use percentages and verify that they equal 100%.*

| Species     | Percentage of total hay usage |
|-------------|-------------------------------|
| Fescue      |                               |
| Alfalfa     |                               |
| Alfalfa Mix |                               |
| Bermuda     |                               |

|             |             |
|-------------|-------------|
| Bermuda Mix |             |
| Grass Mix   |             |
| Other       |             |
| Total       | <b>100%</b> |

**14. Please record the typical amount of hay, in number of bales, fed in a year.**

| Size  | Number of bales fed |
|---|---------------------|
| Small round bales<br>(e.g., 4'x4'; 4'x5')             |                     |
| Large round bales<br>(e.g., 5'x5'; 5'x6')             |                     |
| Small square bales<br>(e.g., 3'x3'; 3'x4')            |                     |
| Large square bales<br>(e.g., 3'x3'x8' or<br>3'x4'x8') |                     |

**15a. How many acres of hay did you harvest in 2015?**

\_\_\_\_\_ acres

**15b. Did you harvest a surplus of hay in 2015?**

☐ Yes

☐ No

**16. Please indicate how you obtain your hay.**

*Please use percentages and verify that they equal 100%.*

| Method   | Percentage of hay obtainment |
|--|------------------------------|
| I cut hay off my own land                            |                              |
| I cut hay off of leased land                         |                              |
| I pay someone to cut hay off my own land             |                              |
| I pay someone to cut hay off of leased land          |                              |
| I purchase my hay                                    |                              |
| I cut hay off non-leased land with owner permission. |                              |
| Other  |                              |
| Total  | <b>100%</b>                  |

**In 1978, the state of Tennessee enacted the TN State Statute 54-5-134 - a law that still exists and was even recently updated.**

**Title 54 - Highways, Bridges And Ferries**

**Chapter 5 - State Highways**

**Part 1 - General Provisions**

**54-5-134 - Cutting hay along controlled access highway right-of-way.**

(1) Residents of the state who derive a significant portion of their annual income by farming may petition the department for permission to cut and bale hay along the rights-of-way of interstate highways located within the state, and other controlled access highway facilities located within the state, whether totally or partially controlled; provided, that the hay is to be used for personal farming purposes and may not be sold.

According to state law, you have the right to bale hay on TN SR-840's medians, shoulders, and interchanges with prior permission from **Tennessee Department of Transportation [TDOT]**. Through a permit application you could be granted the right to mow and bale 50 acres or 3 miles of right-of-way forage, whichever comes first, **per permit**.

With the construction of I-840, the state purchased 5,170 acres of right-of-way land from 681 different tracts. State law allows producers to utilize that land, along with any other interstates or highways, to make hay for their operations.

Rules are outlined in the law as well as safety measures for farmers and motorists on these right-of-ways. TDOT officials have the right to introduce rules.

(2) These rules and regulations shall include:

- (A) Restrictions on the hours and days during which cutting and baling activity may be performed;
- (B) Restrictions on the areas in which cutting and baling activity may be performed; and
- (C) Any other reasonable measures designed to minimize the possibility of traffic mishaps resulting from cutting, baling, and hauling of the hay.

In addition, insurance is currently required to be able to access the state right-of-ways. The following is the outline of the amount of insurance required by producers.

(c) The [TDOT] commissioner shall require that any individual granted a cutting permit possess, during the cutting and baling operation, minimum liability insurance in the amount of not less than \$1 million dollars per occurrence and \$300,000 per claimant.

A \$2,500 performance bond is required for each permit. This bond will be returned to the farmer if performance was satisfactory or no damages occurred.

Finally, you are able to apply for more than one permit meaning you may be granted more than 50 acres to utilize for personal hay harvest.

The purpose of this survey is to assess the current knowledge level of this law in livestock producers close to **SR-840**. In addition, the research will collect data on the attitudes, perceptions of barriers and potential economic implications of right-of-way hay harvesting.

**You were selected to be in this study because of your residency in a county that contains TN State Route 840. Please keep SR-840 in mind when answering the following survey questions.**

5. IF the answer to 17 is YES, answer 17a, 17b, 17c & 17d.
6. IF the answer to 17 is NO, continue to 18.

**17. Prior to this survey, were you aware that you had the right to mow, bale and harvest hay off of state route shoulders and medians?**

- ☐ Yes
- ☐ No

**17a. Did you learn of this from UT/TSU extension?**

- ☐ Yes
- ☐ No

**17b. Have you ever applied for a permit?**

- ☐ Yes
- ☐ No

**17c. Have you ever received a permit?**

- ☐ Yes
- ☐ No

**17d. Have you ever harvested hay from a state right-of-way legally?**

- ☐ Yes
- ☐ No



**18. Do you agree with the following statements regarding right-of-way hay harvest?**

|  | <b>Strongly<br/>Disagree</b> | <b>Disagree</b>       | <b>Neither<br/>agree nor<br/>disagree</b> | <b>Agree</b>          | <b>Strongly<br/>agree</b> |
|--|------------------------------|-----------------------|---|-----------------------|---------------------------|
| <b>The previous generation of farmers never tried right-of-way hay harvest and neither will I.</b> | <input type="radio"/>        | <input type="radio"/> | <input type="radio"/>                     | <input type="radio"/> | <input type="radio"/>     |
| <b>I am interested in trying right-of-way hay harvest.</b>   | <input type="radio"/>        | <input type="radio"/> | <input type="radio"/>                     | <input type="radio"/> | <input type="radio"/>     |
| <b>I want to see right-of-way hay harvest tried first by others.</b>                               | <input type="radio"/>        | <input type="radio"/> | <input type="radio"/>                     | <input type="radio"/> | <input type="radio"/>     |
| <b>I am willing to listen to advice from extension agents about right-of-way hay harvest</b>       | <input type="radio"/>        | <input type="radio"/> | <input type="radio"/>                     | <input type="radio"/> | <input type="radio"/>     |
| <b>It is foolish to try right-of-way hay harvest.</b>  | <input type="radio"/>        | <input type="radio"/> | <input type="radio"/>                     | <input type="radio"/> | <input type="radio"/>     |
| <b>I prefer traditional hay harvest to right-of-way hay harvest.</b>                               | <input type="radio"/>        | <input type="radio"/> | <input type="radio"/>                     | <input type="radio"/> | <input type="radio"/>     |
| <b>I would be interested in trying right-of-way hay harvest first and being an example farmer.</b> | <input type="radio"/>        | <input type="radio"/> | <input type="radio"/>                     | <input type="radio"/> | <input type="radio"/>     |

**19. Do you believe the following items would deter you from participating in right-of-way hay harvesting?**

|  | <b>Strongly Disagree</b> | <b>Disagree</b>       | <b>Neither agree nor disagree</b> | <b>Agree</b>          | <b>Strongly agree</b> |
|--|--------------------------|-----------------------|-----------------------------------|-----------------------|-----------------------|
| <b>Low quality hay</b>   | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Optional hay testing costs</b>                                | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Mixed species hay</b>   | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Roadside debris and litter</b>                                | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Contaminated with chemicals and metals</b>                    | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Hay transport</b>   | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Cannot sell hay legally</b>                                   | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Strict rules</b>  | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>The need for insurance and performance bond</b>               | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Meeting deadlines set by government officials</b>             | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Meeting deadlines set by current right-of-way contractors</b> | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Communicating with government officials</b>                   | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Communicating with current right-of-way contractors</b>       | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Having to plan cuttings around contracted litter removal</b>  | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Slopes</b>  | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Traffic</b>   | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |
| <b>Narrow shoulders and medians on SR-840</b>                    | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/>             | <input type="radio"/> | <input type="radio"/> |

**20. What are additional reasons you would not take advantage of right-of-way hay harvesting?**

|  |
|--|
|  |
|  |
|  |
|  |
|  |

**21. Do you think the right-of-ways on SR-840 should be maintained and mowed using taxpayer funds?**

- ☐ Yes
- ☐ No

**22. How much do you think it currently costs the state in taxpayer money to mow one acre of SR-840?**

\$\_\_\_\_\_

**23. How much would you be willing to pay, per acre, to cut hay off of SR-840's medians and shoulders?**

- ☐ Nothing
- ☐ \$1-5
- ☐ \$6 - \$10
- ☐ \$11 - \$15
- ☐ \$16 - \$20
- ☐ \$21 - \$25
- ☐ \$26 - \$30
- ☐ \$31 or more

7. IF the answer to 24 is YES, answer 24a & 24b.

8.

9. IF the answer to 24 is NO, continue to 25.

**24. Would you be willing to mow a portion of SR-840 at no cost if you could legally sell the harvested hay?**

- ☐ Yes
- ☐ No

**24a. How many acres would you be willing to mow and harvest of SR-840 if you could legally sell the harvested hay?**

- ☐ 0 -25 acres
- ☐ 26-50 acres
- ☐ 51 - 75 acres
- ☐ 76 - 100 acres
- ☐ 101 - 125 acres
- ☐ 126 - 150 acres
- ☐ 151 - 175 acre
- ☐ 176 - 200 acres
- ☐ Over 200 acres

**24b. How much would you sell a 1,000 pound bale of hay harvested from SR-840?**

- ☐ Nothing
- ☐ \$1-10
- ☐ \$11 - \$20
- ☐ \$21 - \$30
- ☐ \$31 - \$40
- ☐ \$41 - \$50
- ☐ \$51 - \$60
- ☐ \$61 or more

**10.**

**11. IF the answer to 25 is YES, answer 25a & 25b.**

**12.**

**13. IF the answer to 25 is NO, continue to 26.**

**25. If you were to obtain a permit for hay harvest on SR-840, would you want to have the opportunity to apply fertilizer to your permitted right-of-way as a direct cost to you?**

☐ Yes

☐ No

**25a. How much would it cost you in fertilizer, chemicals and application for an acre of hay in a normal setting?**

\$ \_\_\_\_\_

**25b. How much money would you be willing to spend on fertilizer for right-of-way hay harvest? (\$/acre)**

\$ \_\_\_\_\_

**26. How much would you be willing to pay someone to cut one acre of right-of-way hay on SR-840?**

☐ Nothing

☐ \$1-5

☐ \$6 - \$10

☐ \$11 - \$15

☐ \$16 - \$20

☐ \$21 - \$25

☐ \$26 - \$30

☐ \$31 or more

**Thank you for taking the time to record your thoughts on our survey.**

**Your participation is helping to advance agriculture in Tennessee!**

For more information on right-of-way hay harvesting in the state of Tennessee  
please visit:

<http://share.tn.gov/sos/rules/1680/1680-02/1680-02-02.pdf>

**Please place this survey into the enclosed return envelope and  
place in the mail at your earliest convenience.**

## **VITA**

Sarah Joy Maccaro was born on April 8<sup>th</sup>, 1994 in Long Island, New York. She was raised in Fairview, TN where she lived until leaving for the University of Tennessee in 2012 after graduating high school. She obtained her B.S. in Animal Sciences with a concentration in Biosciences in 2015. After interning with various experiment stations and the UT Extension Service, she made the decision to continue her education at UT in Agricultural Leadership, Education and Communications.