PERCEPTIONS OF FLORIDA BEEF CATTLE PRODUCERS ON PREPAREDNESS FOR AN AGROTERRORISM ATTACK

By

JODI LYNN DEGRAW

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This document is dedicated to the life and memory of Terry M. DeGraw.

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Jodi Lynn DeGraw

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The purpose of this study was to identify Florida beef producers' current knowledge levels of agroterrorism and simultaneously measure perceived levels of an agroterrorism risk to the operation. The dependent variable for the study was the level of preparedness practices on a Florida beef cattle operation for an agroterrorism attack. The independent variable was the risk perceptions of the beef producer, whereby risk is the intensity of the feeling to a potential attack. A correlational research design guided this study with the aid of a descriptive survey. Of the 137 surveys distributed, 91 participants returned the instrument for a response rate of 66.4%. This convenience sample consisted of Florida beef cattle producers in attendance at the UF/IFAS Beef Cattle Short Course held on May 4-6, 2005.

The survey data were analyzed and descriptive statistics were reported using SPSS®11.5 for Windows™. Results confirmed that the majority of participants felt at risk for an agroterrorism attack and felt unprepared for an agroterrorism attack on their

farm. However, the respondents rated nearly all of the farm safeguards as being minor or of no importance, rarely or never practicing these safeguards. The preferred contact person concerning agroterrorism and biosecurity questions was the Florida Department of Agriculture and Consumer Services. The preferred source of published agroterrorism materials was the University of Florida. Yet, the following persons and agencies should be prepared and knowledgeable about agroterrorism, as they were rated favorably by the population as contact sources: the University of Florida-IFAS Cooperative Extension Offices and Extension agents, law enforcement, veterinarians, and the World Wide Web. The preferred method of delivery for agroterrorism educational materials was a weekend training workshop.

As of January 1, 2004 there were 950,000 beef cows in Florida, ranking the state 12th in beef cows nationally and third for States east of the Mississippi Rover (Florida Department of Agriculture and Consumer Services, 2004).The study sample population of beef producers consisted of a considerable portion of large operations, since 26.4% (N=24) of the respondents reported over 1,000 animals during the peak time of production. Moreover, these large operations account for a large portion of Florida's economic value in the beef cattle industry, as 14.3% (N=13) of the population reported an average annual gross receipt value of $1,000,000 or more.

Overall, this study provided insight into the development of educational materials and programs to promote the use of agroterrorism security practices by Florida beef cattle producers.

CHAPTER 1
INTRODUCTION

Following the September 11th terrorist attacks, the need for protecting our country has taken on a new definition. "Minutes after two hijacked airliners crashed into the World Trade Center on the morning of Sept. 11, 2001, the Federal Aviation Administration stopped all flights from U.S. airports. It marked the first time that air traffic came to a halt nationwide" (Meadows, 2004, p. 21). Soon after this attack, the United States was terrorized with letters containing anthrax spores in October 2001. These acts of terrorism were unexpected and allowed the criminals responsible to remain undetected. Just as acts of terrorism on buildings and through the mail can happen in any place at any time, criminals can also taint the American food supply quickly without being caught. The vulnerability of the food supply could allow terrorists access to cripple the United States. "A major problem is the inability to identify criminal intent rapidly in outbreaks of foodborne illness caused by common pathogens or animal-borne diseases" (Lee, Harbison, & Draughon, 2003, p. 664).

One of the most effective ways to defend the United States against future terrorist attacks is the use of preparation and defense plans. "Preparedness planning is critical to assess our susceptibility to eliminate contamination and to devise the most effective prevention strategies. Countries must do surveys of their particular water and food-production systems to assess the risks of contamination" (Khan, Swerdlow & Juranek, 2001, p. 11). Deliberate contamination of the food supply has occurred in the past and continues to be a threat today. For example, "in September, 1984, members of a religious

cult contaminated salad bars in The Dalles, Oregon, with Salmonella typhimurium; 751 people developed salmonellosis. This attack was reportedly a trial run for a more extensive attack that was planned to disrupt local elections later that year" (Sobel, Khan, & Swerdlow, 2002, p. 874). This is an example of Americans attacking fellow citizens, thus solidifying the need to apply food security techniques and educational programs both in small towns and globally.

Although many Americans purchase and consume food with confidence, there is reason to be concerned for the safety of the food supply. Florida's geographic location and extensive coastline increase the opportunity for terrorist accessibility. "Food and water are quite satisfactory vectors for pathogens causing both morbidity and mortality in target populations that are confined by geographic, industrial, or societal isolation" (Lee, Harbison, & Draughon, 2003, p. 666). For example, the abundance and low cost of food around the nation has lulled Americans into a comfort zone that could be ruined by a biological terrorist attack. "Because of the importance of agriculture to American economic, political, and social stability, addressing the bioterrorism threat to agriculture has taken on a new urgency" (Leviten & Olexa, 2003, p. 64).

The State of Florida is at increased risk due to unique geographic features. Florida has been referred to as a sentinel state because of the probability of a foreign animal or plant disease or agroterrorism event affecting Florida first (Christy, Wang, Lehtola, & Brown, 2004). "With 14 major seaports, 131 airports with public access, and 20 commercial airports, Florida's borders are truly porous and susceptible to entry" (Christy et al., 2004, p. 8). As a result of Florida's accessibility, over 75 million tourists enter the state annually, six million visiting from foreign countries (Christy et al., 2004).

The need to preserve the security of American food is an important matter that has always been a priority, as destruction of crops, animals, or farmlands have historically been used as weapons. Moreover, agricultural targets are considered "soft targets", because of their low profile and accessibility for terrorists to attack with limited navigability (Kohnen, 2000). The successful protection of the agricultural production industry is a key aspect in maintaining the normal life Americans have become accustomed to living. Maintaining a safe food supply is a necessity; "Contamination and adulteration of food and water for selected target populations are ideal methods for terrorists" (Lee, Harbison, & Draughon, 2003, p. 666).

In order to assess farm safety practices on Florida animal production operations, DeGraw (2004) surveyed the population of County Extension Directors in Florida's 67 counties. "In response to the survey information, it was apparent that most counties in Florida do not have a disaster preparedness plan or have the resources available to assist public livestock owners in a time of devastation" (DeGraw, 2004, p. 2). The study confirmed a need for county emergency management plans and a deficiency was noted in the availability of information and training material for animal operators in order to effectively manage animals and employees during disastrous situations (DeGraw, 2004).

A recently developed program, Florida State Agricultural Response Team (SART), was developed to reduce disaster response deficiencies and "SART's mission is to empower Floridians with training and resources to enhance animal and agricultural disaster response" (Wang, Lehtola, & Brown, 2005, p. 2). In 2005, the SART program provided training workshops to introduce the SART curriculum, which included lesson plans, participant workbooks, and table-top simulations for the general subject areas.

"Preliminary module topics included the core SART topics of Incident Command System, Aquaculture, Pets & Disasters, Plant Pathology, Livestock and Horses, Insect and Arthropod Issues, Agroterrorism Threats in Florida, and Biosecurity" (Wang et al. 2005, p. 3). The Florida SART program is a progressively evolving plan for a response to animal and agricultural emergencies and disasters (Wang et al., 2005).

Although agroterrorism against our food supply could potentially cause Americans to go hungry, the economic impact would be catastrophic; "agriculture is the largest sector of the United States economy, accounting for approximately one trillion dollars in overall impact annually, with an export market of approximately $190 billion" (Lee, Harbison, & Draughon, 2003, p. 664). The economic cost of a biological disease outbreak would affect both agricultural production operations and United States exports, resulting in lost revenue. "The deliberate introduction of a pathogen-fungus, bacterium, virus, or insect pest-into U.S. livestock, poultry, or crops could cause a disease outbreak that would drive food prices up, halt valuable exports, and ultimately cost taxpayers billions of dollars in lost revenue and industry renewal costs" (Kohnen, 2000, p. 2).

Consumer confidence is an important consideration in order to sell products and promote a social environment that successfully markets a food item. If consumers have low confidence in United States beef products, then sales will decrease as Americans choose to consume chicken, fish, and pork as an alternative. Another reason to be concerned about a bioterrorist attack on agricultural production is the centralization and related vulnerability of specific industries such as beef cattle. "Prior to the 1970s, most cattle and livestock operations were small-scale and numerous. However, as agriculture has become more industrial and corporate in nature, the number of specialized feedlots

have increased with lots of over 32,000 head of cattle increasing to 42 percent of all feedlot capacity in this country" (Leviten & Olexa, 2003, p. 65).

Problem Statement

Why then should Americans, and specifically Floridians, be concerned about the possibility of an agroterrorism attack? Is Florida at more risk for the introduction of a foreign disease or contaminated food product? Based on the above concerns, the purpose of this study was to identify beef producer's current knowledge levels of agroterrorism and simultaneously measure perceived levels of bioterrorism risk to the Florida beef cattle industry. The focus of the study will be to identify specific concerns and sensitive areas of agroterrorism, in hopes of formulating strategies to alleviate confusion with educational materials. The dependent variable for the study was the level of preparedness for an agroterrorist attack. The independent variable was the risk perceptions of the beef producer, whereby risk is the intensity of feeling a potential attack to their beef cattle operation. This study involved large-scale beef operations and was designed to gain insight and information from producers, and attempted to identify positive and negative perceptions of bioagent protective actions. "We firmly believe that ignorance is not bliss, and that heightened surveillance and risk management are the best extant defenses against bioterrorism," (Lee, Harbison, & Draughon, 2003, p. 669).

Objectives

The objectives of this study were to

1. Identify the current levels of knowledge about agroterrorism held by Florida's beef cattle producers,
2. Identify the level of preparedness against agroterrorism attack(s),
3. Determine the risk perceptions of the beef producer to bioterrorism and agroterrorism, and

4. With these data, determine producer's preferences for the delivery of agroterrorism educational materials.

Definition of Terms

For the purpose of this study, the definition of *food security* is the ready availability of nutritious, adequate, and safe food without having to resort to emergency food supplies, scavenging, stealing, or other desperate strategies (Foxell, 2001). *Agroterrorism* is defined as the intentional introduction of animal or plant pests or the cultivation or production of pathogenic bacteria, fungi, parasites, protozoans, viruses, or their toxic products for the purposes of causing poultry, livestock, crop, soil, or human disease, poisoning, or death (Foxell, 2001). Agroterrorism can include spreading a virulent disease among confined feed lot animals, poisoning civil or agricultural water sources, the introduction of pests intended to destroy food crops, or the use of food-borne pathogens to cause human disease. *Bioterrorism* is defined as an act of any person knowingly or maliciously introducing disease-causing agents or organisms to an animal, plant or human population, thus threatening food and water resources as well as human and animal life (EDEN, 2003).

CHAPTER 2
REVIEW OF THE LITERATURE

The September 11th terrorist attacks on the World Trade Center had an impact on attitudes toward United States security and increased the perceived risk of terrorism on American society. For example, the United States government immediately altered governmental structure and priorities to provide better protection. "The federal government went into a crisis-management mode (Chung, 2002), a homeland security organization was established to look at internal threats (Atchison, 2002; Fenner, 2002; Huddy, Khatib, & Capelos, 2002), and federal funds were redirected into defense spending and other relevant areas (Dawson & Guinnessey, 2002)" (as cited by Powell & Self, 2004, p. 56).

The term risk is often associated with thoughts of hazards. Accordingly Pidgeon defines risk perceptions as "people's beliefs, attitudes, judgments and feelings, as well as the wider social or cultural values and dispositions that people adopt, towards hazards and their benefits" (Bostrom, 2001, p. 102). However, most humans would vary their behavior when risk for a situation increases. A result of the terrorist attacks was emotional insecurities and a higher sense of personal risk felt by the American population (Powell & Self, 2004).

One theory that attempts to explain this reaction is Taylor's 1983 cognitive adaptation theory (Powell & Self, 2004). Cognitive adaptation occurs as people assess situations and draw upon past psychological resources to aid in coping. Therefore, when

a hostile event occurs, this method predicts that an individual will engage in the following three activities to help cope (Powell & Self, 2004):

1. A search for meaning in an event or experience
2. An attempt to gain mastery over the event or its consequences
3. The development of positive illusions to cope with the situation

Furthermore, a key variable in the above-described theory is the concept of personalized risk. "Personalized risk is a cognitive component of the theory that can influence whether an individual makes behavioral changes (adaptations) in response to a new event or experience" (Powell & Self, 2004, p. 58). This additional idea, associated with Taylor's 1983 theory, regards an individual's belief about the probability of personal injury or property damage and an individual's perception of personal control.

This theoretical notion is the driving force of this research study. In the event of a disaster on a Florida livestock operation, how prepared are farm operators and employees? Is the level of preparedness related to high perceived risk or low perceived risk? Is a low level of preparedness because of a lack of available information about agroterrorism and bioagents, or confusion about how to prepare the farm? In conclusion, "knowing the baseline knowledge, perceptions, and rates of high-risk behaviors in a target group is essential for the development of effective educational interventions in food safety" (Haapala & Probart, 2004, p. 72).

History of Biological Warfare

The threat of biological warfare is not a new concept for the United States. Man has used poisoning agents for assassination purposes since the beginning of civilization, not only against individual enemies, but also in times of war against armies (Frischknecht, 2003).

Table 1. Examples of biological warfare during the past millennium (Frischknecht, 2003)

Year	Event
1155	Emperor Barbarossa poisons water wells with human bodies, Tortona, Italy
1346	Mongols catapult bodies of plague victims over the city walls of Caffa, Crimean Peninsula
1495	Spanish mix wine with blood of leprosy patients to sell to their French foes, Naples, Italy
1650	Polish fire saliva from rabid dogs towards their enemies
1675	First deal between German and French forces not to use “poison bullets”
1763	British distribute blankets from smallpox patients to native Americans
1797	Napoleon floods the plains around Mantua, Italy to enhance the spread of malaria
1863	Confederates sell clothing from yellow fever and smallpox patients to Union troops, USA

Furthermore, in United States history, during World War I Imperial Germany initiated a program of bioagricultural warfare by shipping anthrax and glanders infected horses and mules from America to British and French armies. The animals were initially infected with needles subsequently allowing infection to spread naturally through fecal matter, coughing, or nasal discharge on the boat ride. Ultimately, more than 3,500 horses were infected and rendered useless for wartime service (Foxell, 2001).

More research and experimentation were developed during World War II, in particular the United States agricultural program focused on large-scale production and weaponization of anti-crop agents (Cameron, Pate, & Vogel, 2001). By the time the United States renounced all biological warfare in 1969, it had researched wheat stem rust, rice blast, rye stem rust, foot-and-mouth, rinderpest, and brucellosis (Cameron, Pate, & Vogel, 2001).

In recent history, the United States has been impacted by the intentional food contamination of salad bars in 1984, and again in 1994 when an estimated 224,000 people in the United States were infected during an outbreak of Salmonella enteritidis.

The Salmonella enteritidis was caused by contamination of pasteurized liquid ice cream that was transported in tanker trucks. The ice cream was then distributed nationally resulting in one of the largest foodborne disease outbreaks in United States history (Sobel, Khan, & Swerdlow, 2002).

Unfortunately, the world is "witnessing a renewed interest in biological warfare and terrorism owing to several factors, including the discovery that Iraq has been developing biological weapons (Zilinskas, 1997), several bestselling novels describing biological attacks, and the anthrax letters after the terrorist attacks on September 11, 2001" (Frischknecht, 2003, p. S51). In order to understand the scope and power of biological agents, Table 2 from the Centers for Disease Control lists the disease pathogen and time period of abuse.

Accessibility to Biological Weapons

From the information about bioagents listed in Table 2, the history and abuse of such pathogens illustrates the availability and ease with which countries can cause harm. In fact, individuals and non-governmental groups can easily obtain access to dangerous biological agents. The world-wide connection and accessibility of the Internet has allowed communications and computer hackers a source for producing and creating harmful products. "According to Dr. Glenn McGee, a biologist as well as a computer security expert, insecurities in the Internet itself allow the possibility of "viral hacking", wherein would-be agroterrorists no longer need "to find a tiny sample of smallpox [or bioagricultural pathogens on the open, gray, or black markets], when, as hackers, they can synthesize it from scratch on a $1,000 iMac connected to a $10,000 gene synthesizer" (Foxell, 2001, p. 109).

Table 2. Crucial biological agents (Frischknecht, 2003)

Disease	**Pathogen**	**Abused***
Category A	**(Major public health hazards)**	
Anthrax	*Bacillus antracis* (B)	First World War Second World War Soviet Union, 1979 Japan, 1995 USA 2001
Botulism	*Clostridium botulinum* (T)	-
Hemorrhagic fever	*Marburg virus* (V) *Ebola virus* (V) *Arenavirus* (V)	Soviet bioweapons program - -
Plague	*Yersinia pestis* (B)	Fourteenth-century Europe Second World War
Smallpox	*Variola major* (V)	18th century N. America
Tularemia	*Francisella tularensis* (B)	Second World War
Category B	**(public health hazards)**	
Brucellosis	*Brucella* (B)	-
Cholera Encephalitis	*Vibrio cholerae* (B) *Alphaviruses* (V)	Second World War Second World War
Food poisoning	*Salmonella, Shigella* (B)	Second World War USA, 1990s
Glanders	*Burkholderia mallei* (B)	First World War Second World War
Psittacosis	*Chlamydia psittaci* (B)	-
Q fever	*Coxiella burnetti* (B)	-
Typhus	*Rickettsia prowazekii* (B)	Second World War
Various toxic syndromes	Various bacteria	Second World War

* Does not include time and place of production, but only indicates where agents were applied and probably resulted in casualties, in war, in research or as a terror agent. Category C includes emerging pathogens that are made more pathogenic by genetic engineering, including hantavirus, Nipah virus, tick-borne encephalitis and hemorrhagic fever viruses, yellow fever viruses and multidrug-resistant bacteria. B, bacterium; P, parasite; T, toxin; V, virus.

The ability of physical resources and the technology to email or post genetic codes and formulas through the Internet has allowed greater access to shared information at an extremely fast rate. Throughout the world, people are educated with the techniques for growing and genetically manipulating microorganisms; the Internet also provides an instantaneous wealth of information. In fact, through 2001, explicit instructions were posted online to guide an individual through the process of producing a weaponized form of one of the agents of principal concern (Henderson, 2004).

Furthermore, the availability of bioagents that naturally occur in the environment make the proliferation of biological weapons seem attractive for people with limited resources. "Biological weapons sometimes are referred to as the poor man's nuclear weapon because they can be produced inexpensively, they require less technical staff and so little space or expensive equipment is needed" (Henderson, 2004, p. 50). Moreover, if one were determined enough to produce biological agents, it has been estimated that a functioning laboratory could be developed for no more than $250,000 (Henderson, 2004). Another benefit of biological weapons is the combination of low cost of production with the opportunity to infect large numbers of people over a large area. A 1970 study by the World Health Organization (WHO) discovered that 50 kilograms of anthrax could result in 200,000 casualties in a medium-sized city such as Boston. The United States Office of Technology Assessment (OTA) has estimated that an attack with less than 100 kilograms of aerosolized anthrax spores could cause as many as 3 million casualties, which compares to the lethality of a thermonuclear weapon (Koblentz, 2003/04).

Although the government goes to great lengths to protect and monitor the use of biotechnology, the positive aspect of educational research can also be used as a cover for

hostile purposes. The use of export controls has aided in the trade of national biological weapons, yet it is not foolproof for all situations; “Although domestic access to dangerous pathogens in the United States has been regulated since 1996, these pathogens (with the exception of *variola major*) are available in nature and from a number of germ banks around the world” (Koblentz, 2003/04, p. 94). Also, biological warfare agents provide a terrorist or state both diverse and flexible options for destruction. It has been noted in the literature that there are some thirty pathogens that have the physical and biological capabilities for a mass-casualty weapon (Koblentz, 2003/04).

As stated above, there are thousands of laboratories world-wide with at least one of the defined dangerous pathogens, and several select agents, such as anthrax, occur naturally. To further complicate the search to identify and destroy biological warfare factories, biological agents do not emit an identifying signal, as opposed to nuclear materials, so there is little to distinguish the activities of a would-be bioterrorist in the laboratory from those of the other scientists (Salerno et al., 2003) (Reppy, 2003). Considering the multiple obstacles that the United States has to overcome to detect another country, state, or organized group planning and producing a biological warfare attack, it is apparent that the most effective protection is preparedness planning using educational materials.

Dr. Rocco Casagrande, Director, Homeland Security Program Abt Associates, presented information in relation to prevention of attacks on agriculture at the 2004 AgrowKnowledge Agroterrorism conference in Cedar Rapids, Iowa. Dr. Casagrande listed specific measures to prevent an attack on agriculture. “Create more rapid response disease teams, routinely deploy idle teams for producer education, which includes 1)

recognition of important diseases, 2) Proper biosecurity practices, and 3) proper disease reporting structure" (Casagrande, 2004). The Florida SART program is an up-and-coming solution to Florida's agroterrorism educational gaps, satisfying Casagrande's listed prevention measures.

Agroterrorism

As a result of recent terrorist activity and war with Iraq, agricultural bioterrorism has received increased attention and discussion within academic, media, and government circles. Recent studies argue that agricultural bioterrorism represents a new and dire threat to United States national security (Cameron, Pate, & Vogel, 2001). The agricultural industry is vital to Americans' stomachs as well as national economic stability. Considering the economics, agriculture accounts for 13% of the United States gross domestic product (Casagrande, 2002). The article *Food as a Weapon* describes the economic importance of agriculture as "the largest sector of the United States economy, accounting for approximately one trillion dollars in overall impact annually, with an export market of approximately $190 billion" (Lee, Harbison, & Draughon, 2003, p. 664). Moreover, considering that United States agriculture supports the nation with a safe, affordable, and abundant food supply, and accounts for 15% of all global agricultural exports, agricultural terrorism is not simply killing animals and destroying crops; it is a method of crippling an economy (Lee, Harbison, & Draughon, 2003).

Is this concern for the safety of the food supply a valid point? Do Americans need to think about ways to preserve the security and longevity of the nation's food supply? The discovery and confirmation of a cow in the state of Washington that had mad cow disease, and was subsequently slaughtered and the meat shipped before being recalled raised concern about current agricultural system safeguards. This impacted not only the

United States but also the world, as import bans were immediately enforced and the United States system of food processing safety was under critical inspection. "In Washington state, when a single cow- already butchered and shipped out to restaurants and grocery stores- was diagnosed with mad-cow disease roughly 30 nations responded with import bans or other sanctions" (Hegland, 2004, p. 114). The cow was later traced to Canada, where it was born and raised; yet, the United States suffered the economic consequences. The top foreign importer of beef from the United States, Japan, suspended imports worth approximately $1.4 billion a year after the Washington state cow Bovine Spongiform Encephalopathy (BSE) case (Takada, 2004).

Mad Cow Disease

Mad Cow Disease, known scientifically as Bovine Spongiform Encephalopathy, or BSE, is a chronic degenerative disease that destroys the central nervous system in cattle. BSE has been infecting animals for many generations. It is believed that this disease originated from the prion disease scrapie that infects sheep. BSE is a transmissible spongiform encephalopathy (TSE). "TSE animal diseases found in the United States include scrapie in sheep and goats, chronic wasting disease in deer and elk, transmissible spongiform encephalopathy in mink, feline spongiform encephalopathy in cats, and in humans kuru, both classic and variant Creutzfeldt-Jakob disease" (USDA Fact Sheets, 2004). The cause of BSE has not yet been defined by scientists; but, the accepted theory is that the agent is a prion, or an abnormal cellular protein (USDA Fact Sheets, 2004).

Table 3. Transmissible Spongiform Encephalopathies (Henley & Herrmann, 2004)

Species affected	**Prion Disease**	**Transmissible to humans?**
Mink	Transmissible mink encephalopathy	No
Sheep and Goats	Scrapie	Historically no; questionable in newly discovered atypical cases
Deer and Elk	Chronic wasting disease	Possible (under investigation)
Cattle and Bison	Bovine spongiform encephalopathy	Yes (variant CJD)
Humans	Creutzfeldt-Jakob disease; variant CJD, Gerstmann-Straussler-Scheinker Disease, Kuru, fatal familial insomnia	Through contaminated medical products, instruments, possibly blood

One positive characteristic of this disease is that it is not spread through animal-to-animal contact. Cattle become infected with BSE after consuming feed contaminated with the infectious agent. The contamination of cattle feed occurs during the carcass rendering process. "During rendering, carcasses from which all consumable parts had been removed were milled and then decomposed in large vats by boiling at atmospheric or higher pressures, producing an aqueous slurry of protein under a layer of fat (tallow)" (Brown, Will, Bradley, Asher, & Detwiler, 2001, p. 6). The fat is then removed and the slurry is used to produce meat and bone meal product, which is subsequently packaged as animal feed. Therefore, the prions are passed onto cattle by feeding them prion-infected meat and bone-meal produced from infected rendered animals.

After it was determined that cattle were being infected from consuming cattle feed that contained meat and bone meal products, the U.S. Food and Drug Administration (FDA) decided to take action. The solution was decided in 1997, and stated that mammalian protein was no longer permitted in the manufacture of animal feed intended for cattle and/or other ruminants (USDA Fact Sheets, 2004). Although the source of

contamination has been identified and control measures are being enforced, cattle are still being diagnosed. The delay in diagnosis is attributed to the nature of BSE being a slow, progressive, incurable disease of the central nervous system in cattle (Foxell, 2001). Prior to the December 30, 2003 discovery of the BSE cow in Washington the prevention measures that were followed to prevent BSE in the United States were (Henley & Herrmann, 2004):

- Import restrictions on bovine-derived consumer products from high-risk BSE countries.
- Prohibition of the use of ruminant derived meat and bone meal in cattle feed.
- A surveillance system for BSE that involved annual testing of between 5000 and 20,000 cattle slaughtered for human consumption (out of about 35 million cattle slaughtered per year).

As a result of the BSE scare in December 2003, the USDA and FDA have added more stringent and all-encompassing guidelines to protect our food supply. These additional protective measures are (Henley & Herrmann, 2004):

- Defining high-risk materials banned for human consumption, including the entire vertebral column.
- Banning the use of advanced meat recovery systems on vertebral columns. These systems use brushes and air to blast soft tissue off of bone and led up to 30% of hamburger sampled to be contaminated with central nervous system tissue.
- Proposing an expanded annual surveillance to include about 200,000 high-risk cattle (sick, suspect, dead) and a random sample of 20,000 normal cattle over 30 months old.

Although the USDA and FDA are fighting for stronger food safeguards, are these new guidelines enough? Should consumers be confident about the food purchased at grocery stores and consumed in restaurants?

The detection of BSE can only be confirmed through postmortem analysis of brain tissue. Therefore, the bovine has to be monitored while alive, subsequently exhibit signs

and symptoms of BSE, and then be isolated and killed in order to test the brain tissue. The disease incubation period is within the range of 30 months to eight years, with only a few rare exceptions in younger animals (USDA Fact Sheets, 2004). To cause even more concern for the safety of the meat supply, BSE cannot be killed through cooking, irradiation, or sterilization processes.

Human Risk

The United States enjoys a safe, affordable, and abundant food supply, but can this source of food be destroyed by a terrorist attack? Do Americans have the right to be concerned that the food supply could cause death? Norman Schaad of the USDA Agricultural Research Service's Foreign Disease/Weed Science Research Unit believes that plant pathogens would be an easier choice as a weapon of mass destruction, and they would cause more damage to the food supply and the economy (Foxell, 2001). Victims of an attack on the food supply would experience famine. Another long term impact of induced food scarcity would be reduced nutritional levels, and subsequently the potential for outbreaks of unrelated diseases due to damaged immune systems. Moreover, even a small attack on American farms would result in lowered food confidence and decline in the purchase of that food product. "Even a bungled agroterrorist livestock disease-based stratagem that affected only a handful of farm animals- a probable outcome if the perpetrators were unfamiliar with agricultural pathogens or modern farming practices- would produce a transient climate of fear and panic among food buyers" (Foxell, 2001, p. 109).

An act of agroterrorism could be the result of many different motives. "Terrorists' motives vary widely. The perpetrator of an agroterrorist attack might be seeking revenge against a farmer" (Kohnen, 2000, p. 11). Terrorists may not always be foreign groups

preying on United States agriculture; they could also be a disgruntled employee seeking revenge by infecting or destroying animals on the farm. Or, a terrorist may simply be driven to attack, determined to create panic by causing a food scare. The USDA considers the two most important motivations for agroterrorism to be potential for profit by damaging United States exports or food prices and destruction of animal or plants from anti-GMO (genetically modified organisms) activists (Kohnen, 2000). Unfortunately, agroterrorism is "a multidimensional threat, involving a wide range of motives and perpetrators, and encompassing a wide range of actions, from single acts of sabotage to strategic wartime programs" (Kohnen, 2000, p. 12).

John Shutske, farm safety and health specialist with the University of Minnesota Extension, has three general recommendations for farm managers to protect their operations from terrorism. First, know who you are hiring, and consider a formal process to screen workers and check backgrounds and references. Make sure that workers are trained so that they know what to do in an emergency (Kurtz, 2002). Second, review all potential hazards in your operation (Kurtz, 2002). "Changes to farmstead security don't have to be costly. Simply closing and locking gates where there are multiple access driveways on and off a farmstead can dramatically improve security" (Kurtz, 2002, p.2). Third, plan and communicate with people inside and outside your operation, including your family, employees, suppliers, and your customers (Kurtz, 2002). Communication and preparation with employees, farm visitors, and family members is essential for the prevention of a domestic agroterrorism attack by a trusted farm employee or foreign perpetrator.

The production of grains, cereals, and livestock products in the United States is open and vulnerable for a potential terrorist attack. Feedlots for livestock are large and centrally located in the Mid-west, making it easier for terrorists to locate and infect large numbers of animals at once. Furthermore, the grain and cereal crops are geographically located in the central United States in an area known as the "Corn Belt." Joseph W. Foxwell describes 10 factors that contribute to our nation's vulnerability in his paper, "Current Trends in Agroterrorism (Antilivestock, Anticrop, and Antisoil Bioagricultural Terrorism) and Their Potential Impact on Food Security".

The first point of vulnerability is the concentration of the livestock industry: cattle feeding in Kansas; hogs in North Carolina, Nebraska, and Iowa; and poultry in Virginia, Georgia, Arkansas, Pennsylvania, and Maryland's Eastern shore district. It is common knowledge that cattle, hogs, and poultry are produced in specific geographic areas of the nation, "over 70% of U.S. beef cattle are currently produced within the locus of a 200-mile circle" (Foxell, 2001, p. 110).

Also, the large "Corn Belt" ranges from Iowa, Indiana, Illinois, and parts of Kansas to Missouri, Nebraska, South Dakota, Minnesota, Ohio, and Wisconsin. A terrorist could destroy a crop of corn, soybeans, or wheat by targeting a particular state. However, it would be more difficult to destroy an entire plant crop, versus the ease of livestock transmission of disease between animals.

Secondly, the United States food business is moving toward centralized ownership and larger individual farms. Foxell predicts that within the next five years the American beef industry will be organized and aggregated to the degree that the thirty leading cattle feeding corporations will generate 50% of all beef products (Foxell, 2001). Major

companies are merging together to form dominant powers, therefore making themselves larger and more accessible targets.

Third, the production of livestock has turned to a method of dense housing. Animals are often crowded together on small lots, sharing feeding and watering troughs, and forcing more contact with other animals. These intensive proximity husbandry practices have increased the vulnerability to the spread of infectious diseases (Foxell, 2001). Furthermore, the densely packed confinement areas provide increased stress and strain on the cattle. The definition of these facilities is a Concentrated Animal Feeding Operation (CAFO). The General Accounting Office estimates that there are 450,000 such CAFOs nationwide (Foxell, 2001). The large facilities include dairy and beef cattle feedlots, hogs and poultry houses. Unfortunately, one trend that has developed as a result of CAFOs is lowered resistance to infectious diseases and an over-use of antibiotic drugs to control outbreaks. This trend has rippling consequences, potentially impacting the consumer, who may be exposed to antibiotics within the meat and milk products and slowly become antibiotic resistant as a result.

The fourth factor of vulnerability is the increased activity of international air travel. Americans are conveniently able to travel across the globe and then return home with the possibility of inadvertently bringing a foreign illness or pest. American crops and animals no longer enjoy the luxury of isolation that existed before the time of air travel. In addition, Foxell states that the fifth area of concern to agriculture is the reliance on pesticides and herbicides to control insects and weeds (Foxell, 2001). Finally, the remaining five factors concentrate on the vulnerability of crop, hybrid seeds, soil, and the variety of pathogenic agents that are foreign to animals and crops.

When all the above areas of concern are considered collectively, a terrorist has the capability to cause damage to the United States agriculture industry with ease. However, the strategy that would cause the most damage to the United States would be a focus on mass disruption, with the purpose to destroy the nation's infrastructure, rather than causing mass casualty. The nation as a whole should be prepared for extensive financial losses, economic crisis, and agricultural quarantine that would be the result of a successful agroterrorism attack on the Unites States.

Economic Impact

A successful agroterrorism attack on the United States may not harm the public through death, but it would be a substantial trade and economic issue (Foxell, 2001). United States agriculture is important to the global economy as well as the national economy. The United States accounts for 15% of all global agricultural exports, and in 1998 the United States produced nearly half of the worlds' soybeans, more than 40% of its corn, 20% of its cotton, 12% of its wheat, and 16% of its meat (Peters, 2003). Given the diversity of the agriculture industry, potential targets of agricultural bioterrorism range from field crops to farm animals; food items in transportation and storage facilities; to processing plants. Henry Parker, a researcher at the United States Department of Agriculture's Agricultural Research Service (USDA-ARS) states that "America is exceedingly vulnerable to agricultural bioterrorism. The reasons for this situation are numerous. To begin, there is limited appreciation for the economic and social importance of agriculture in the industrialized world. Abundant, affordable, and safe food supplies are largely taken for granted" (Peters, 2003, p. 23). Indeed, it is hard for Americans to imagine a life without the convenience of safe and affordable food at every nearby grocery store and neighborhood restaurant.

Therefore, even though RAND (a nonprofit research organization) officials estimate that no major United States city has more then a seven-day supply of food, the devastation of an agroterrorism attack would soon spread from pain in United States stomachs to the United States economy (Peters, 2003). Most importantly would be the loss of international trade markets. Members of the World Trade Organization (WTO) have the power to ban imports of plant or animal materials that may introduce exotic diseases into their territories (Wheelis, Casagrande, & Madden, 2002).

A recent example of such economic devastation from a disease was the foot-and-mouth disease outbreak in the United Kingdom. Foot-and-mouth disease (FMD) is a highly contagious viral infection that can rapidly infect cattle. According to Parker, more than 70 different strains of FMD exist, and it is the most infectious virus known, capable of spreading in wind-driven aerosol form more than 170 miles from its source (Peters, 2003). Moreover, it can be carried on clothes, hay, transportation vehicles, and even in nasal passages.

Taiwan's livestock industry has been suffering, as a result of a FMD outbreak, since 1997. In March of that year, the disease was confirmed in pigs and subsequently spread throughout the island within six weeks, shutting down pork exports and ultimately causing the slaughter of more then 8 million hogs (Peters, 2003). Parker states that the origin of the disease was reportedly traced back to a pig from China, suspected of being deliberately introduced into Taiwan, costing the nation an estimated $19 billion (Peters, 2003). Furthermore, the United Kingdom suffered from a FMD outbreak in 2001, where 4 million cattle were depopulated to contain the disease and the nation has suffered with a

loss of 30 billon pounds (US $48 billion), affecting both agriculture and tourism (Gewin, 2003).

The agricultural commodities in Florida are vital to the economic stability of the state. "Florida's 44,000 farmers grow more than 280 different crops on a commercial scale. Florida's agriculture and natural resources industries have an economic impact on our State economy estimated at more than $62 billion annually" (Florida Department of Agriculture and Consumer Services, 2004, p. 1). The reported Florida cash receipt for cattle and calves in 2002 was $333,413,000 (Florida Department of Agriculture and Consumer Services, 2004). As of January 1, 2004 there were 950,000 beef cows in Florida, ranking the state 12th in beef cows nationally and third for States east of the Mississippi River (Florida Department of Agriculture and Consumer Services, 2004) . Of the 15,800 beef cow operations in Florida, 80% have less than 50 head of cows, but of the top five beef producing counties, in several cases one or two owners/corporations may control the bulk of the cattle in that county (Dr. M. Hersom, University of Florida, Assistant Professor and Extension Beef Cattle Specialist, personal communication, July 8, 2005).

Risk Perceptions

Throughout history, humans have felt and lived with the feeling of risk. This ability to sense and avoid harmful conditions is necessary for the survival of all living organisms. Therefore, in recent decades risk assessment has been utilized to develop a safer and healthier environment per public demand. However, determining what the public feels is the highest risk factor can be difficult to pinpoint. Furthermore, experts may feel concern for a certain issue, whereas the public body may not perceive the same level of urgency. For example, the Environmental Protection Agency (EPA) has spent a

bulk of it's budget in past years for hazardous waste because the public believes that the cleanup of Superfund sites is the most serious threat to the country, but indoor air pollution is considered a more extreme health risk by experts (Slovic, 2001). Unfortunately, there is a difference of opinion between the experts and layperson, so who deserves the credit for being correct?

Experts are crowned with the title of being objective, wise, and rational when assessing risk; they examine the real risk. On the other hand, the public is viewed as relying on perceptions of risk; these opinions are subjective, hypothetical, emotional, foolish, and irrational (Slovic, 2001). The controversy between these conflicting views has resulted in the need for a better understanding and definition of risk. The recent development of chemical and nuclear technologies has been joined with the potential to cause catastrophic damage to the earth and the life forms that exist on it. The advanced technologies and potential hazards are difficult for the common citizen to understand; therefore, the intellectual discipline of risk assessment was designed to aid in identifying, characterizing, and quantifying risk (Slovic, 1987).

What is risk? Slovic (2001) defines risk as "the chance of injury, damage, or loss." Moreover, "the probabilities and consequences of adverse events are assumed to be produced by physical and natural processes in ways that can be objectively quantified by risk assessment" (Slovic, 2001, p. 3). Social science analysis has determined that risk is subjective, proclaiming that humans have invented risk to help them understand and cope with the uncertainties in life (Slovic, 2001). The public has an inherently broader foundation of risk, incorporating the complexities of dread, uncertainty, risk to future generations, catastrophic potential, equity, controllability, and past personal experiences,

that factor into the risk equation (Slovic, 2001). Slovic (1987) summarizes this clash of risk perception between the lay person and the expert as follows:

> Perhaps the most important message from this research is that there is wisdom as well as error in public attitudes and perceptions. Lay people sometimes lack certain information about hazards. However, their basic conceptualization of risk is much richer than that of experts and reflects legitimate concerns that are typically omitted from expert risk analysis. As a result, risk communication and risk management efforts are destined to fail unless they are structured as a two-way process. Each side, expert and public, has something valid to contribute. Each side must respect the insights and intelligence of the other. (p. 285)

Therefore, when considering the best method of communicating risk, it is important to control the definition of risk. Whoever, whether the public, experts, or government, defines the risk, will take control of the safest or best way to solve the problem at hand. "Defining risk is thus an exercise in power" (Slovic, 2001, p. 6).

So, why in this modern world of technology and advanced science are people more concerned about risk? As a whole, the public has become healthier and is living longer and stronger lives with the aid of medication and drug enhancements. Slovic (1994), has stated several hypotheses about factors that are contributing to perceptions of increased risk:

1. A greater ability to detect minute levels of toxic substances. The public can detect parts per billon of chemicals in water or air, yet we do not understand the health implications of this knowledge.

2. An increased reliance on new technologies that can have serious consequences if something goes wrong. Most of society lacks an understanding of technology and are suspicious in accepting its risks.

3. Society has experienced a number of catastrophic mishaps, such as the Challenger, Chernobyl, and Columbia. The intense media coverage of the "failures" of these supposed "fail-safe" systems increases doubt.

4. The extreme amount of litigation over risk problems, which highlights to the public attention to the problems, which then has experts at odds over the issue, and ultimately a loss of credibility on all sides.

5. The benefits of technology are often taken for granted. When the public fails to perceive any striking benefit from an activity, they become intolerant of any risk, regardless of the level.

6. The public is told that they have the ability to control elements of risk. For example: seatbelt use, diet control, exercise, or abstaining from smoking. This may lead to frustration over risks that cannot be self-controlled: pollution, pesticides, food contaminants or additives.

7. Psychological studies indicate that when people are wealthier, and have more to lose, they become more cautious in decision making.

8. The nature of today's risks. There is a greater potential for catastrophe due to societal complexities, potency, and technological advances.

When the above factors are considered as a whole, it is apparent the complexity of communicating risk levels to the public and how daunting a task risk communicators have when trying to alleviate panic as a risky situation becomes threatening. Furthermore, hazards that are seen as catastrophic also feel uncontrollable and involuntary (Slovic, 1994). Slovic (1994) has investigated these risk relationships through a factor analysis. Factor 1 is labeled as "Dread Risk" and is perceived as lack of control, dread, catastrophic potential, and fatal consequences. "The further toward 'Dread Risk' that a hazard appears in the space, the higher its perceived risk, the more people want to see its current risks reduced, and the more people want to see strict regulation employed to achieve the desired reduction in risk" (Slovic, 1994, p. 67). Overall, the perception of risk is a reality which impacts the lay person's way of life.

Risk Communication

During the September 11, 2001 attacks on the United States all eyes were pinned to news stations on television to learn how to deal with the panicked feelings resulting from the acts of terrorism. It was in these moments that the American public needed to hear risk communication to address specific questions and concerns. "There was widespread

uncertainty, fear, and anxiety about terrorism, but also about toxic dust. Initial attempts by the government failed to reassure the public about the dust's safety" (Aakko, 2004, p. 25). Traditionally, when officials would address public concerns, the communication would flow one-way, more in disseminating a message than addressing specific, diverse questions. To properly benefit from active risk communication, it is a two-way process, with active participation from both sender and audience. See Table 4 for the rules of risk communication.

Table 4. The Seven Cardinal Rules of Risk Communication (Aakko, 2004)

1. Accept and involve the public as a legitimate partner
2. Plan carefully and evaluate your efforts
3. Listen to the public's specific concerns
4. Be honest, frank, and open
5. Coordinate and collaborate with other credible sources
6. Meet the needs of the media
7. Speak clearly and with compassion

Successful risk communication incorporates the rules of Table 4 and the risk perceptions of the affected audience. Risk perceptions have a direct impact on how citizens respond to risk communication and risk management activities (Frewer, 2004). During the 1970's the focus of communication efforts was on changing public views of risk, with an emphasis placed on communication of technology acceptance. However, recently the focus of risk communication shifted toward restoring public trust in risk management, with an emphasis on more extensive public consultation and participation management (Frewer, 2004).

The original attempts at risk communication were not freely accepted, a result of the effort to change the public's view of risk to equal the views of experts of particular hazards; "this process has been described by Hilgartner 1990 as the 'deficit model,' which assumed that the public are in some way deficient in their understanding of risk,

and indeed other areas of science" (Frewer, 2004, p. 392). As a result of the "deficit model" the public lost trust in risk communication methods and lost confidence in risk management practices. However, the distrust was noted by risk communicators and currently a new method of risk management is in effect. Ultimately, there has been a cultural shift away from top-down communication practices to more consultative and inclusive decision making-processes; risk communication is re-orienting towards a citizen focus (Frewer, 2004).

Another factor in successful risk communication is trust. A trusting relationship between the public and the expert is necessary in developing successful and effective risk management practices. Furthermore, trust is particularly important when people feel little personal control over exposure to potential hazards. Institutions and organizations need to agree on methods to maintain public confidence in risk management practices. Jenson and Sandoe 2002 have noted a continued decline in public food safety confidence despite the new food safety institutions and the European Food Safety Authority (Frewer, 2004). They argue that "this is because communications about food safety issues that are based on scientific risk assessments do not reassure the public" (Frewer, 2004, p. 393). Lay people interpret scientific information and facts differently depending on personal perceptions. To better facilitate risk analysis and communication, there needs to be a greater understanding of individual differences in perceptions and information needs between the public and the risk communicator (Frewer, 2004).

Programs that communicate agroterrorism risk have been developed in several states including Florida and Minnesota. The Florida State Agricultural Response Team (SART) program held the first annual training events in Kissimmee, Belle Glade and

Tallahassee, Florida in spring 2005 in order publicize SART's missions and goals (Wang et al., 2005). Likewise, the University of Minnesota Extension Service has organized four regional workshops to educate about the intentional and unintentional threats that can affect agriculture (University of Minnesota Extension Service, 2005). John Shutske, coordinator for the event, feels that "The tragic events of Sept. 11, 2001 have made agricultural producers more aware of the need to protect their operations and the health of the public. Terroristic introduction of disease, contamination or other damaging agents has become a concern" (Kurtz, 2002, p. 1). Another state that has acknowledged the need to communicate and educate the public is Iowa. Iowa State University has teamed up with the Center for Food Security and Public Health to print CD's and hold workshops titled, "Bioterrorism Awareness Education" and "Agroterrorism Awareness Education" (Iowa State University, 2004).

Chapter Summary

This chapter attempted to review the current published literature concerning biological agents, terrorism, agroterrorism, risk perceptions, and risk communication. The motivation for agroterrorism research is a direct result from the September 11th terrorist attacks on the United States, and the potential for an attack on America's food supply. The theoretical framework that supports this study is Taylor's 1983 cognitive adaptation theory that attempts to explain the behavioral changes as a coping response to a catastrophic event. In addition, Slovic (2001) defines risk as the chance of injury, damage, or loss. Unfortunately, risk is subjective. To achieve successful risk communication, the public's perception of risk should be defined in order to design the most applicable educational program to increase terrorism preparedness and safety practices.

CHAPTER 3
METHODOLOGY

The purpose of this study was to identify beef producer's current knowledge levels of agroterrorism and simultaneously measure perceived levels of agroterrorism risk to the operation. This research study utilized a descriptive survey. The targeted research population was Florida beef cattle producers. The survey sampled Florida beef cattle producers that attended the UF-IFAS Beef Cattle Short Course, thus enabling conclusions to be drawn on the targeted research population.

The objectives of this study were to

1. Identify the current levels of knowledge about agroterrorism held by Florida beef producers,
2. Identify the level of preparedness against agroterrorism attack(s),
3. Determine the risk perceptions of the beef cattle producer to bioterrorism and agroterrorism, and
4. With this data, determine producer's preferences for the delivery of agroterrorism education materials.

The questionnaire consisted of 55 research-developed questions, ranging from 'What is the estimated size of your operation?' to 'If you feel your operation is at risk to terrorist activity, which aspects do you think are at greatest risk'? The descriptive questionnaire was reviewed by a panel of experts, which included the researcher's advisory committee and a topic specialist. It was pilot tested and revised before being administrated to the sample population. The survey instrument is included in Appendix A.

Research Design

The research design for this study utilized a descriptive questionnaire administered to a population of Florida beef producers. This convenience-sample of participants was selected based on the study objectives and attendance at the University of Florida Beef Cattle Short Course (BCSC). The principle investigator of this study distributed the questionnaire booklets with the assistance of Elizabeth Wang. At the beginning of the BCSC, per instructions from the BCSC Conference Director, during the check-in time of the conference, the researcher stood at the front desk and approached participants, discussed the survey purpose and requested their participation. Permission to conduct this study was granted from the University of Florida Institutional Review Board (IRB). The UF IRB office ensured that the rights and welfare of the human subjects involved in this study were protected. IRB approved the survey instrument and informed consent script on March 28, 2005 (see Appendices B and C).

Singly approaching participants proved to be difficult, time consuming, and too demanding for one person to reach out to every beef producer in attendance at the BCSC. Therefore, the principle investigator enlisted the assistance of Mrs. Wang to assist with the distribution of questionnaires to participants in the auditorium before the first speaker on May 6, 2005. Furthermore, the researcher made an announcement at the podium about the purpose of the survey and requested that it be completed and returned before the end of the day.

The goal of the researcher administering the survey in person was to increase the response rate by having greater influence and contact with the population being studied.

Population

In order to meet the objectives of the study, the defined population was Florida beef cattle producers. Each participant needed to have produced beef cattle or be currently in production. The targeted population was surveyed with a sample from participants attending the 54th Annual Beef Cattle Short Course (BCSC). In conversation with Dr. Tim Marshall (personal communication, July 11, 2005), University of Florida Professor of Beef Cattle Management and Program Committee member for the 2005 BCSC, he felt that the sample population of BCSC participants for this study was a representative sample of Florida beef cattle producers. Dr. Marshall stated that most beef cattle producers that attend the BCSC work large production operations (7-8 of the largest ranches in Florida attend) or smaller herds (around 1,000 cows). Florida is unique in that the state has more 500 herd cows than any other state, yet Florida is also home to Desert Ranch which boasts 40,000 brood cows (Dr. Tim Marshall, personal communication, July 11, 2005).

The BCSC was hosted and coordinated by the University of Florida IFAS Cooperative Extension Service. The topic areas highlighted at the 54th Annual BCSC included, *Maintaining Quality Production in a Dynamic Market Place; Management Factors Affecting Quality in the Herd; Practical Ranch Issues Facing Cattlemen Today; and Grass Fertilizer, and Management: Grazing Issues Affecting the Florida Cow Herd.* The BCSC early registration fee was $85.00 and the regular registration fee was $110.00. The registration fee included refreshment breaks, an exhibitor's reception, Thursday's luncheon, one Cattlemen's Steak-out ticket, and a proceedings. (University of Florida IFAS Extension, 2005)

Data Collection

The survey instrument was pilot tested March 15, 2005 at an Alachua County Cattlemen's Association Meeting in Newberry, Florida. As a result of the pilot test, the questionnaire was revised and finalized for use. Formatting changes included re-ordering the questions within the instrument, the addition of the answer choice Not Applicable for questions 20-27, an increase of demographic questions and the inclusion of question number 55 concerning preferred workshop delivery method. In the pilot study, the questionnaire was distributed and administered to a sample (N=51) with verbal instructions for the instrument and reason for the study. The response rate for the pilot was 84% (N=43).

Data for this study was collected at the University of Florida IFAS Extension Beef Cattle Short Course, May 4-6, 2005. The researcher began to distribute questionnaires on May 4 and continued to collect data until the conclusion of the conference on May 6. Of the 137 distributed questionnaires, 91 useable responses were returned to the researcher, for a response rate of 66.4%.

Instrumentation

The survey was developed with the aid of researchers and was adapted from a previously administered questionnaire by the Extension Disaster Education Network Homeland Security Survey of Agriculture and Horticulture Producers (EDEN, 2003). Although the EDEN survey was used as a model, much of this instrument was not applicable for this study population. Therefore, the questionnaire used for this study was created from an intensive literature review and review from a panel of experts. The survey consisted of 55 items and was reviewed by a panel of experts, which included the advisory committee and a topic specialist, for face and construct validity. The first page

of the instrument described the purpose of the study and defined the terms agroterrorism and bioterrorism. This was included to increase understanding of the study, with the aim of increasing the response rate. Part I of the survey was designed to measure perceptions about agroterrorism. It consisted of four Likert-type scale questions (see Appendix A), answers ranging from 5-Strongly agree; 4-Agree; 3-Neither Agree nor Disagree; 2-Disagree; and 1-Strongly Disagree. This section was designed to determine the risk perceptions of beef producers related to the chance of an agroterrorism attack in 1) the United States, 2) Florida, and 3) their operation. Their overall perception toward agroterrorism preparation was also considered.

The next section, Part II, was titled "Rate the Level of Perceived Threat". Questions 5-16 were again modeled after Likert-type scales, 5-Considerable threat; 4-Much threat; 3-Some threat; 2-Little threat; and 1-None. Participants were instructed to circle the number that best reflected the level of perceived threat they felt to their operation from risk to terrorist activity. See Table 5 for examples of questions.

Table 5. Questions Rating the Level of Perceived Threat

Operation Risk	**Scale**
Water Contamination	Considerable 5 4 3 2 1 None
Feed Contamination	Considerable 5 4 3 2 1 None
Animal Death	Considerable 5 4 3 2 1 None
Animal Disease Outbreak	Considerable 5 4 3 2 1 None
Chemical Contamination	Considerable 5 4 3 2 1 None
Loss of Income Due to Market Losses	Considerable 5 4 3 2 1 None
Tampering with Facilities	Considerable 5 4 3 2 1 None

Part III of the instrument, titled "Gaining Knowledge about Agroterrorism", included three questions. One question asked respondents about their attendance at agroterrorism workshops, and the answer options were: Yes, at least once; More than once; and No. The next question aimed to determine which three persons beef producers

would contact for advice during a breech of security on their farm. Respondents were asked to select their top three contacts from a list of ten choices: Veterinarian, Extension Agent, Florida Dept. of Agriculture, Another livestock producer, Law enforcement, USDA, Producer Association, State or county Emergency Management, Don't know, or Other (please specify). The final question in Part III inquired about biosecurity investments (time, money, or effort) made to the operation in reference to the September 11, 2001 terrorist attacks. Respondents had five answer options: Yes, before September 11, 2001; Yes, before and after September 11, 2001; Yes, after September 11, 2001; No; and Don't know.

Part IV of the instrument aimed to measure agroterrorism preparedness of the beef producer. Questions 20-27 were designed using a Likert-type scale to measure both feelings of importance toward livestock protection and how this relates to the degree of practice on the farm. Respondents were instructed to read each question and then respond twice, with two different scales. The first scale, evaluating the importance of each operation safeguard, was: 4-Major importance; 3-Moderate importance; 2-Minor importance; and 1-No importance. Then the same questions (20-27) had an additional scale, evaluating the degree to which beef producers practice each safety measure, and consisted of: 4-Always practice; 3-Moderate practice; 2-Rarely practice; 1-Never practice. The scale on the right also had the option for respondents to circle Not Applicable. Not Applicable as an answer choice was provided for beef producers who did not have a particular scenario apply to their operation. For example, if a beef producer does not hire employees, but instead is family owned and operated, then that

respondent would circle NA for question 25 regarding conducting a background check on potential hires.

The next three questions related to the access and availability of agroterrorism educational materials. Question 28 inquired about the participants' accessibility to educational materials that can specifically answer agricultural biosecurity questions. Respondents answered either yes, no or don't know. However, this question had an optional second part. If respondents answered yes, meaning that they did have access to educational materials, they were asked to supply the name of the material source in the blank space below the question. The write-in portion of this question, although optional, was encouraged in order to determine current available materials. Next, participants were questioned on the likeliness of contacting a particular source to learn more about agroterrorism or livestock specific biosecurity threats. This question was designed using a Likert-type scale, 5-Very likely; 4-Fairly likely; 3-Likely; 2-Unlikely; 1-Very unlikely. The contact question choices varied from Veterinarian, Extension agent, Law Enforcement, to Don't know who I would contact.

The next section was designed to more specifically determine where beef producers seek out published information about biosecurity. Questions 39-45 also utilized the Likert-type scale mentioned above, 5-Very likely; 4-Fairly likely; 3-Likely; 2-Unlikely; 1-Very unlikely. The final question before the demographics section referred to the Foot- and -Mouth Outbreak in England and the December 2003 discovery of a BSE cow in the U.S. This question (46) was included to measure the influence of these events on beef producers' decisions towards improving security on their operation. The scale for this

question was: 5-Strongly influenced; 4-Influenced; 3-Neither; 2-Minimal influence; 1-No influence.

The final portion of the instrument was Part V, which included demographic questions. A dichotomous choice question of gender was included to determine the percentage of male to female respondents (81.3% male, 98.9% total). Additional demographic questions included inquiries about length of time in the livestock business, number of cattle on the production facility, size of the operation, and average annual gross receipts value, all of which offered answers with range answers, which respondents were asked to reply with the one choice that best matched their situation.

Also, respondents were to circle the type of livestock production they operate, beef or dairy, or both. Respondents were also asked if their role(s) in the livestock production operation were 1) a landlord only; 2) an operator on land they owned; 3) an operator on rented land; 4) and/or other (where they would specify). With this particular question, respondents were encouraged to circle all scenarios that applied to them. In order to determine the level of technology and the future potential to apply biosecurity measures, the instrument inquired about the presence of a record keeping system on the livestock operation. Lastly, in accordance with the fourth study objective, the final question aimed to determine the preferred delivery method of agroterrorism educational materials if the Extension Service were to provide the service. Livestock producers were given the following answer choices, and instructed to select their top choice: Weekend Training Workshop; Read printed materials at your own pace; Take classes through the World Wide Web; and One-on-One contact with an Extension Agent.

Variables

The main independent variable in this study was risk perception. This is a subjective feeling from each farm operator, which reflects on circumstances, financial security, perceptions about the September 11th terrorist attack, and other miscellaneous variables. The dependent variable was the level of preparedness against bioagents. The level of preparedness was measured from responses to the survey. To measure this, level of preparedness was related to accessible educational materials, contact with an extension agents, attendance at a safety workshop, the practice of employee education training, and the identification of potential agroterrorism targets. The level and degree of protection against bioagents entering the farm operation was directly related to attitude toward bioterrorism on the farm. The September 11th attacks on America had a profound impact on risk perceptions and emotional stress; "American citizens, even those not directly affected by the attack, suffered from psychological and emotional problems that included an increased sense of vulnerability and personal risk" (Powell & Self, 2004, p. 57).

Data Analysis

The data from the survey was statistically analyzed using SPSS® 11.5 for Windows™. The objectives of the study called for computation of descriptive statistics, means, frequencies, and percentages. In order to analyze the data, the Likert-type scales were treated as ordinal data. To determine the reliability of the instrument, post hoc analysis was reported with Cronbach's Alpha coefficients ranging from 0.45 to 0.92. From the collected survey information suggestions were provided and solutions presented to improve upon current methods of relaying agroterrorism information. Kohnen (2000) states, "a livestock producer can reduce the epidemiological risk by increasing biosecurity measures at his facilities" (p. 22). This supports the notion that protection is

the number one defense when preventing the spread of a disease that could cause a decrease in consumer confidence and economic repercussions for Florida livestock producers. Furthermore, "a Biosecurity Training Program could entail a wide variety of activities such as educational mailings, presentations at local Farm Bureau meetings, and workshops at state and local levels" (Kohnen, 2000, p. 23).

Chapter Summary

This chapter described the methods used to address and answer the objectives of this study. The methodology determined for this research design took into account the purpose and objectives, and this chapter discussed the determined population, sample, instrumentation, data collection, variables and data analysis.

The design of this study was identified as correlational research utilizing a descriptive survey (Irani, 2004). The survey instrument was reviewed by a panel of experts, which included the advisory committee and a topic specialist, and was pilot tested for face and construct validity. Furthermore, the direct administration of the instrument was chosen to increase the response rate. The independent variable in this study was agroterrorism risk perceptions. This was defined as the range of feeling, high risk to minimal risk, applied to different aspects of the livestock operation. The dependent variable was the level of preparedness against bioagents and an agroterrorism attack.

CHAPTER 4
RESULTS

The purpose of this study was to identify beef producer's current knowledge levels of agroterrorism and simultaneously measure perceived levels of agroterrorism risk to the operation. Moreover, the focus of the research addressed the issues of bioterrorism, bioagents, livestock diseases, and ultimately, the preferred resources of educational material for Florida beef producers. The analyzed data from the survey results will determine risk perceptions, current agroterrorism safety operation practices, preferred persons/organizations as educational resources, and the preferred method of delivery for agroterrorism training materials.

The terrorist attacks on September 11, 2001 and the recent discovery of a BSE cow in the state of Washington have altered the attitudes and risk perceptions in the United States. Do Americans believe in the safety of the food they consume? Should beef producers be held accountable for each animal produced on his/her operation? Where do beef cattle operators go for more information about agroterrorism? How at risk do beef cattle producers feel our country, the state of Florida, and their farm is in the present state of the world?

In order to answer these questions a survey was developed modeling a similar EDEN web survey (EDEN, 2003). The 55 question survey instrument was research developed and reviewed by a panel of experts. The instrument was divided into sections by topic and consisted of the following (see Appendix A):

- Part I-Perceptions about Agroterrorism

- Part II-Rate the Level of Perceived Threat
- Part III-Gaining Knowledge about Agroterrorism
- Part IV-Agroterrorism Preparedness
- Part V-Demographics

The results for the study are reported in sequence with the study objectives stated in Chapter One:

- Identify the current levels of knowledge about agroterrorism held by Florida's beef cattle producers,
- Identify the level of preparedness against agroterrorism attack(s),
- Determine the risk perceptions of the beef producer to bioterrorism and agroterrorism, and
- With this data, determine the producer's preferences for the delivery of agroterrorism educational materials.

The survey data collection techniques outlined in Chapter 3 was followed. Of the 137 surveys distributed at the Beef Cattle Short Course, 91 useable responses were returned to the researcher. Therefore, a response rate of 66.4% (N=91) was achieved. The data was analyzed using SPSS® 11.5 for Windows™. In cases where a respondent failed to answer a question or part of a list of questions, the blank variable was coded as missing and left blank in the SPSS® data system.

Objective One

Identify the current levels of knowledge about agroterrorism held by Florida's beef cattle producers.

In order to determine results for objective one, questions concerning agroterrorism knowledge were included in the survey. Part III, Gaining Knowledge about Agroterrorism, asked participants a range of questions, from agroterrorism workshop attendance, desired person of contact if ever concerned about biosecurity, to biosecurity

investments before and/or after September 11th. The post-hoc reliability Cronbach's alpha value for objective one was 0.67. Respondents were asked, "Have you attended a workshop or general information session about biosecurity/agroterrorism?" (Question number 17, see Appendix A). Table 6 lists the frequency results. This question had a 100% (N=91) response rate, and the calculated mean was 0.37, with a standard deviation of 0.57.

Table 6. Attendance at a workshop/information session

Attendance	***f***	**%**
No	61	67.0
Yes, at least once	26	28.6
More than once	4	4.4
Total	91	100

In order to determine the preferred source of contact during a breech of security or during a suspected agroterrorism attack, beef producers were asked to choose their top three persons/organizations they would most likely contact. The descriptive statistics are listed in Table 7.

Table 7. Suspected agroterrorism on your operation, whom would you contact

	f	**%**
Law Enforcement	58	63.8
Florida Department of Agriculture	49	53.9
St. or County Emer. Mgt	28	30.8
Veterinarian	31	34.1
Extension Agent	24	26.4
USDA	14	15.4
Producer Association	13	14.3
Another livestock producer	11	12.1
Other	3	3.3
Missing values	42	46.2
Total	231	253.8

The final question, in Part III of the instrument, was written to better understand the beef producers' application of current agroterrorism knowledge. Question 19 asked, "Have you made considerable investments (time, money or effort) to make your operation more biosecure?" Respondents were to select one response, from the following choices: 1) Yes, before September 11, 2001; 2) Yes, before and after September 11, 2001; 3) Yes, after September 11, 2001; 4) No; and 5) Don't Know. For the purpose of consistency, Don't Know and blank responses were coded as missing values. See Table 8 for the frequency data.

Table 8. Have you made considerable investments (time, money, or effort)

	f	**%**
No	70	76.9
Yes, before and after Sept. 11, 2001	6	6.6
Yes, after Sept. 11, 2001	9	9.9
Total Responses	85	93.4
Missing values	6	6.6
Total	91	100

Objective Two

Identify the level of preparedness against agroterrorism attack(s).

Again, the purpose of this study was to determine current agroterrorism knowledge, perceptions, and how this relates to safety practices and levels of preparedness. In order to determine the degree to which preparedness is practiced on beef cattle production operations, Part IV of the survey instrument used a two-sided Likert-type scale design (see Appendix A). The post-hoc reliability Cronbach's alpha value for objective two was 0.81. For questions 20-27, respondents were requested to answer two scales. The Likert-type scale on the left side of each question was designed to determine respondents' opinion of the importance of each safeguard to better protect a livestock operation. The scale, a range from 1-4, rated the importance of the farm safety practice: 1=No

Importance; 2=Minor Importance; 3=Moderate Importance; 4=Major Importance. Table 9 lists the data for the "Importance of the Safeguard" scale.

On the right side of each question another Likert-type scale (scale of 1-4 and Not Applicable), was intended to measure the degree to which the beef producer practiced the indicated safeguard. The values for the "Degree to which you Practice" scale: 1=Never practice; 2=Rarely practice; 3=Moderate practice; 4=Always practice; and if the safeguard scenario did not apply to the respondents' beef cattle operation, they were encouraged to circle Not Applicable. However, when the data was analyzed in SPSS®, the blank and Not Applicable respondents were coded as missing values. Not Applicable is in essence a blank response, since it does not apply to the farm operations and if Not Applicable had been missing as an answer option, respondents would have left the scale blank for lack of application. Table 10 lists the data for the "Degree to which you Practice" scale.

In an effort to further understand the mean scores for the above responses, frequency statistics were computed for both Likert-type scales. See Table 11 for the frequency data for the importance of the specific operation safeguards. Likewise, frequency statistics were analyzed for the degree to which beef producers practice each farm safeguard, see Table 12 for this data.

Table 9. Reported Means: Importance of the Safeguard

Farm Safeguard	Mean	Std. Dev.	N
Isolating a new animal from the herd	3.43	0.75	84
Participate in training programs, to enable employees to recognize and report a disease outbreak	3.15	0.89	80
Background check on potential hires	2.94	1.09	78

Table 9. Continued

Regular employee meetings to determine their satisfaction levels	2.92	0.96	79
Limiting Visitors	2.85	0.93	87
Required waiting period for visitors	2.49	0.92	83
Require employees to wear coveralls	1.74	0.74	81
Require people entering to shower in and out	1.47	0.70	77

Table 10. Reported Means: Degree to which you Practice

Farm Safeguard	Mean	Std. Dev.	N
Isolating a new animal from the herd	3.29	0.86	77
Limiting Visitors	2.76	0.99	82
Background check on potential hires	2.56	1.14	64
Regular employee meetings to determine their satisfaction levels	2.54	1.04	68
Participate in training programs, to enable employees to recognize and report a disease outbreak	2.38	0.98	68
Required waiting period for visitors	1.87	0.86	77
Require employees to wear coveralls	1.38	0.77	69
Require people entering to shower in and out	1.09	0.34	67

Objective Three

Determine the risk perceptions of the beef producer to bioterrorism and agroterrorism.

Part I

The purpose of objective three was to determine the level of risk a beef producer in Florida felt to the possibility of a bioterrorism or agroterrorism attack. The state of Florida is at heightened risk due to the accessibility of sea ports and multiple international airports, which increases the probability of successful introduction of bioagents (Christy et al., 2004). Therefore, Parts I and II (questions numbered 1-16), and question number 46 specifically addressed risk perceptions in relation to agroterrorism. Part I (questions

Table 11. Frequency data: Importance of the Safeguard

Farm Safeguard	**No Importance**		**Minor Importance**		**Moderate Importance**		**Major Importance**		**Total**	
	f	**%**	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**
Isolating a new animal from the herd	2	2.2	7	7.7	28	30.8	47	51.6	84	92.3
Participate in training programs, to enable employees to recognize and report a disease outbreak	6	6.6	8	8.8	34	37.4	32	35.2	80	87.9
Background check on potential hires	12	13.2	12	13.2	23	25.3	31	34.1	78	85.7
Regular employee meetings to determine their satisfaction levels	9	9.9	12	13.2	34	37.4	24	26.4	79	86.8
Limiting visitors	6	6.6	27	29.7	28	30.8	26	28.6	87	95.6
Required waiting period for visitors	12	13.2	30	33.0	29	31.9	12	13.2	83	91.2
Require employees to wear coveralls and shoe covers	33	36.3	38	41.8	8	8.8	2	2.2	81	89.0
Require people entering to shower in and out	49	53.8	21	23.1	6	6.6	1	1.1	77	84.6

Table 12. Frequency data: Degree to which you Practice

Farm Safeguard	**Never Practice**		**Rarely Practice**		**Moderate Practice**		**Always Practice**		**Total**	
	f	**%**	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**
Isolating a new animal from the herd	3	3.3	11	12.1	24	26.4	39	42.9	77	84.6
Limiting Visitors	9	9.9	25	27.5	25	27.5	23	25.3	82	90.1
Background check on potential hires	16	17.6	13	14.3	18	19.8	17	18.7	64	70.3
Regular employee meetings to determine their satisfaction levels	15	16.5	14	15.4	26	28.6	13	14.3	68	74.7
Participate in training programs, to enable employees to recognize and report a disease outbreak	14	15.4	24	26.4	20	22.0	10	11.0	68	74.7
Required waiting period for visitors	30	33.0	31	34.1	12	13.2	4	4.4	77	84.6
Require employees to wear coveralls and shoe covers	52	57.1	11	12.1	3	3.3	3	3.3	69	75.8
Require people entering to shower in and out	62	68.1	-	-	4	4.4	1	1.1	67	73.6

numbered 1-4), asked respondents to circle the number of a Likert-type scale which best reflects their feelings to four separate statements. The corresponding scale values were: 1=Strongly disagree; 2=Disagree; 3=Neither agree nor disagree; 4=Agree; 5= Strongly agree. Blank responses were coded as missing values and were not included in the calculation of the mean value. The post-hoc reliability Cronbach's alpha for Part I was 0.45.

Question number one, stated "I think that an act of agroterrorism could happen somewhere in the U.S." This question had a 100% response rate (N=91), and reported a mean of 4.33, and a standard deviation of 0.65. Therefore, the study population felt that an act of agroterrorism could happen somewhere in the U.S. Question number two, "I think that an act of agroterrorism could happen somewhere in Florida", had a mean of 4.16 and standard deviation of 0.76, with a 100% (N=91) response rate. Although not as high a mean as question number one, the sample population conceded that an act of agroterrorism could happen somewhere in Florida. Next, question number three, "I think that an act of agroterrorism could happen on my operation", had a reported mean of 3.08, and a standard deviation of 1.15, with a 98.8% (N=90) response rate. Finally, question number four, "I feel prepared for an agroterrorism attack or some other biosecurity threat to my operation", had a reported mean of 2.69, and a standard deviation of 0.96, with a 98.8% (N=90) response rate. Frequency values for each question (1-4) are listed below in Tables 13-16.

Table 13. I think an act of agroterrorism could happen somewhere in the U.S.

Scale Value	***f***	**%**
Strongly disagree	1	1.1
Disagree	0	0.0
Neither agree nor disagree	3	3.3

Table 13. Continued

Scale Value	***f***	**%**
Agree	51	56.0
Strongly agree	36	39.6
Total	91	100.0

Table 14. I think an act of agroterrorism could happen somewhere in Florida

Scale Value	***f***	**%**
Strongly disagree	1	1.1
Disagree	2	2.2
Neither agree nor disagree	8	8.8
Agree	50	54.9
Strongly agree	30	33.0
Total	91	100.0

Table 15. I think an act of agroterrorism could happen on my operation

Scale Value	***f***	**%**
Strongly disagree	13	14.3
Disagree	9	9.9
Neither agree nor disagree	34	37.4
Agree	26	28.6
Strongly agree	8	8.8
Total	90	98.9

Table 16. I feel prepared for an agroterrorism attack or biosecurity threat to my operation

Scale Value	***f***	**%**
Strongly disagree	8	8.8
Disagree	33	36.6
Neither agree nor disagree	30	33.0
Agree	17	18.7
Strongly agree	2	2.2
Total	90	98.9

Part II

The second part of the survey instrument (questions numbered 5-16) was designed to determine the beef producers' risk perceptions for specific targeted areas of the beef cattle operation. For Part II, respondents were requested to "Rate the Level of Perceived

Threat" for each aspect of your operation by circling the number on a Likert-type scale which best reflected the level they felt their operation is at risk to terrorist activity. The scale values were coded 1-5 for the degree of perceived threat: 1=None (no threat felt); 2=Little threat; 3=Some threat; 4=Much threat; 5=Considerable threat. Specific areas of concern included: water contamination; feed contamination; animal death; animal disease outbreak; fertilizer theft/misuse; employee revenge; chemical contamination; zoonotic illness (disease transmitted from animal to human); loss of income due to market losses; tampering with facilities; tampering with fences/gates; other, please specify. The calculated Cronbach's alpha value for Part II was 0.92. The descriptive statistics for each area of concern are shown in Table 17.

The final instrument question that was designed to provide data for objective three was question number 46, "To what extent have the Foot and Mouth outbreak in England and the December 2003 discovery of a Bovine Spongiform Encephalopathy (BSE) case in the United States influenced any decisions towards improving the security on your operation?" This question was written to include past events that caused economic damage to both the United Kingdom and the United States. By reading this question and choosing from the Likert-type scale: 1=No Influence; 2=Minimal Influence; 3=Neither; 4=Influenced; 5=Strongly Influenced; respondents were required to consider past events of agriculture affected by bioagents, and consider how these situations influence their beef cattle operation. In Table 18 it is reported that respondents had a difference of opinion.

Table 17. Part II Descriptive Statistics

Perceived threat for each aspect of the beef cattle operation	**Mean**	**Std. Dev.**	**None**		**Little**		**Some**		**Much**		**Considerable**		**Total**	
			f	**%**	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**
Loss of income due to market losses	3.39	1.22	6	6.6	15	16.5	27	29.7	19	20.9	21	23.1	88	96.7
Animal disease outbreak	3.00	1.10	8	8.8	24	26.4	24	26.4	28	30.8	6	6.6	90	98.9
Tampering with fences/gates	2.91	1.14	11	12.1	22	24.2	28	30.8	22	24.2	7	7.7	90	98.9
Animal death	2.79	1.00	8	8.8	25	27.5	36	39.6	13	14.3	5	5.5	87	95.6
Water contamination	2.58	1.08	12	13.2	36	39.6	27	29.7	8	8.8	7	7.7	90	98.9
Feed contamination	2.46	1.00	14	15.4	36	39.6	29	31.9	7	7.7	4	4.4	90	98.9
Tampering with facilities	2.41	1.03	16	17.6	38	41.8	22	24.2	11	12.1	3	3.3	90	98.9
Chemical contamination	2.38	1.11	19	20.9	35	38.5	22	24.2	6	6.6	6	6.6	88	96.7
Zoonotic illness	2.30	1.03	19	20.9	42	46.2	14	15.4	13	14.3	2	2.2	90	98.9
Fertilizer theft/misuse	2.12	0.92	22	24.2	43	47.3	17	18.7	5	5.5	2	2.2	89	97.8
Employee revenge	1.88	1.07	41	45.1	31	34.1	10.0	11.0	4	4.4	4	4.4	90	98.9
*Other, please specify	1.80	1.30	3	3.3	1	1.1	-	-	1	1.1	-	-	5	5.5

*Other responses are listed in Appendix D.

Table 18. Foot-and-Mouth/BSE influenced operation security decisions.

Mean	3.38	
Median	4.00	
Std. Deviation	1.31	
N	88	
Scale	***f***	**%**
No Influence	12	13.2
Minimal Influence	11	12.1
Neither	14	15.4
Influenced	34	37.4
Strongly Influenced	17	18.7
Total	88	96.7

As seen in Table 18, the majority of respondents felt that the past events of Foot-and-Mouth in the United Kingdom and the BSE case in the United States had influence in decisions towards improving security on their operation. 18.7 % of the sample population felt that the animal disease outbreaks strongly influenced their safety decisions.

Objective Four

With this data, determine the producer's preferences for the delivery of agroterrorism educational materials.

The purpose of objective four was to determine where and how beef cattle producers acquire educational materials or information about agroterrorism and bioagents, and to use the information from the previous three objectives to provide adequate and accessible educational information. To satisfy this objective, question number 28 asked, "Do you have access to educational material that can answer your agricultural biosecurity questions?" This question provided answers of Yes; No; or Don't Know. If the survey respondent answered yes, they were encouraged to write in the said material source in the blank space by the question. For the purpose of reporting a valid

mean, don't know responses were coded as missing values. A response rate of 69.2% (N=63) was reported, and 30.8% of the population reported no, while 38.5% reported a yes response to question number 28. There were a total of 28 (30.8%) missing values, which were either don't know or blank responses.

The next grouping of questions (numbers 29-38), asked: "If you wanted to know more about agroterrorism or livestock specific biosecurity threats, how likely would it be for you to contact the following?" The contact list included: Veterinarian, Extension Agent, Florida Dept. of Agriculture, Another livestock producer, Law enforcement, USDA, Producer association, State or County Emergency Management, Don't Know who I would contact, and Other-please specify. In order to determine the probability of the surveyed beef producers to contact each of the above listed sources, a Likert-type scale was created to represent the likeliness of contact: 1=Very unlikely; 2=Unlikely; 3=Likely; 4=Fairly likely; 5=Very likely. The mean, standard deviation, and N are reported in Table 19 for questions 29-38.

Table 19. Likeliness of contacting for biosecurity threat questions.

Contact source	**Mean**	**Std. Dev.**	**N**
Florida Department of Agriculture	4.11	0.90	87
Extension Agent	3.99	1.04	86
Veterinarian	3.80	1.10	85
Producer Association	3.56	1.20	84
Law Enforcement	3.52	1.29	86
Another Livestock Producer	3.30	1.20	82
St. or county Emergency. Mgt.	3.07	1.32	84
Don't know who I would contact	1.92	1.19	50
Other, please specify*	5.00	-	1

*See Appendix D for the specified comments.

From the above listed mean values, it can be determined that the Florida Department of Agriculture and Consumer Services would be the most likely contacted

source during an agroterrorism attack or agroterrorism scare. Furthermore, Extension agents, veterinarians, and law enforcement officials should also be prepared to receive inquires about biosecurity threats or during a breech of security on a beef cattle operation.

In relation to the above set of questions, numbers 39-45 of the survey instrument asked respondents, "If you wanted to know more about agroterrorism or livestock specific biosecurity threats, where would you look for published information?" This set of questions used the same Likert-type scale listed above: 1=Very unlikely; 2=Unlikely; 3=Likely; 4=Fairly likely; 5=Very likely. See Table 20 for a report of the descriptive statistics.

Table 20. Where would you look for published information?

Information source	**Mean**	**Std. Dev.**	**N**
University of Florida	4.25	0.83	88
Extension Office	4.05	0.93	86
World Wide Web	3.93	1.14	87
Farm Magazine	3.60	1.09	88
Newspaper	2.44	1.11	85
Library Publications	2.29	0.96	83
Other, please specify*	5.00	0.00	3

*See Appendix D for the specified comments.

Based on the reported means in Table 20, it can be stated that the top source of published information is the University of Florida. The second and third preferred published information sources are the University of Florida IFAS Extension Office and the World Wide Web, respectively. The least desired source for livestock biosecurity threat information or agroterrorism related questions is library publications.

Lastly, question number 55 asked, "If the Extension Office were to concentrate on educating livestock producers about agroterrorism which delivery method would you prefer?" This question established the top choice of educational material delivery if an agroterrorism educational program was created by UF-IFAS Extension. The answer

choices were: Weekend training workshop; Read printed materials at your own pace; Take classes through the World Wide Web; or One-on-One contact with an Extension agent. Respondents were instructed to select the top choice from the listed options, and those who checked all the delivery methods, more than one, or did not select any were coded as missing values. The frequency values are reported in Table 21. The calculated Cronbach's reliability alpha value for objective four was 0.57. Responses for the "Other, please specify" were omitted due to the high number of blankly coded answers which originally caused an error in calculation of the alpha value.

Table 21. Preferred agroterrorism educational materials delivery method

Delivery Method	***f***	**%**
Weekend training workshop	38	41.8
Read printed materials at own pace	22	24.2
Take classes through the World Wide Web	8	8.8
One-on-One contact with an Extension Agent	10	11.0
Missing values	13	14.3
Total	91	100.0

Demographics

Part V of the instrument asked basic demographic questions about the beef producer and the operation. Of the sample population (N=91), 17.6% were female and 81.3% were male, and there was one missing value (1.1%). When asked "How many years have you been in the livestock production business", 2.2% (N=2) had been in production 1 day to 12months, 1.1% (N=1) for 13 months to 2 years, 2.2% (N=2) for 25 months to 3 years, 6.6% (N=6) for 37 months to 4 years, 3.3% (N=3) for 49 months to 5 years, and an overwhelming majority 83.5% (N=76) had been in production for more than 5 years. For this question (number 48, see Appendix A) there was one (1.1%) missing value. In order to determine the approximate size of production facilities the sample population of beef producers manage, question number 52 asked, "What is the

size of your operation?" Answer choices included: less than 1 acre – 99 acres; 100- 249 acres; 250-499 acres; 500-999 acres; 1000-1999 acres; or 2000 or more acres. Table 22 lists the frequency data for question number 52.

Table 22. What is the size of your operation?

	f	**%**
Less than 1 acre to 99 acres	16	17.6
100 acres to 249 acres	14	15.4
250 acres to 499 acres	9	9.9
500 acres to 999 acres	14	15.4
1000 acres to 1999 acres	8	8.8
2000 or more acres	29	31.9
Total	90	98.9

For this study it was pertinent to consider the economic impact and consequences that would result from a successful agroterrorism attack. Therefore, questions number 50 and 53 asked respondents to select the range of the number of cattle at peak time on their facility and the average annual gross receipts for the livestock-related segment of the operation, respectively. Blank responses were coded as missing values. See Table 23 for the frequency statistics.

Table 23. Operation Demographics

Number of Cattle at peak	***f***	**%**
1-50 animals	17	18.7
51-100 animals	18	19.8
101-300 animals	14	15.4
301-500 animals	11	12.1
501-1000 animals	5	5.5
1000+ animals	24	26.4
Missing values	2	2.2
Total	91	100.0
Average value of annual gross receipt	***f***	**%**
$1 to $9,999	16	17.6
$10,000 to $49,999	20	22.0
$50,000 to $99,999	10	11.0
$100,000 to $249,999	5	5.5
$250,000 to $499,999	10	11.0
$500,000 to $999,999	5	5.5
$1,000,000 or more	13	14.3

Table 23. Continued.

Average value of annual gross receipt	***f***	**%**
Missing values	12	13.2
Total	91	100.0

As reported in Table 23, the surveyed population holds a significant portion of the beef cattle market in Florida, with 26.4% (N=24) of the population reporting more than 1,000 cattle on their production facility, and 14.3% (N=13) reporting $1,000,000 or more in annual gross receipts. This claim is validated by the Florida Department of Agriculture and Consumer Services (2004), which reports that as of January 1, 2004 there were 950,000 beef cows in Florida, with 2002 cash receipts for Florida cattle and calves totaling $333,413,000. Therefore, if an agroterrorism attack were to be successful in Florida, the devastation would be felt both economically and most likely the plentiful food supply of beef would suffer.

Respondents were asked if they were: a Landlord only; Operator on land you own; Operator on rented land; Other, specify (See Appendix D for comments). Only 2.2% (N=2) are Landlords only, 57.1% (N=52) are operators on land they own, 17.6% (N=16) are operators on rented land, and 28.6% (N=26) reported some other identity. Finally, the surveyed beef producers were asked if they had a record keeping system on their livestock operation (question number 54, see Appendix A). An overwhelming majority of 90.1% (N=82) said “Yes”, 5.5% (N=5) said “No”, and 4.4% (N=4) either left it blank or selected “Don’t Know”.

Chapter Summary

The findings of the 91 respondents for this study were reported in this chapter. The results were organized by the objectives and demographics for the population were included. Statistics were shown to further describe the frequencies and means.

The objectives that guided these results were: 1) identify the current levels of knowledge about agroterrorism held by Florida's beef cattle producers; 2) identify the level of preparedness against agroterrorism attack(s); 3) determine the risk perceptions of the beef producer to bioterrorism and agroterrorism; 4) with this data, determine the producer's preferences for the delivery of agroterrorism educational materials. The results reported in this chapter will be reported in the conclusions, recommendations, and limitations, in the forthcoming chapter. A summary of the findings will guide recommendations for future research and the development of agroterrorism educational materials and workshops.

CHAPTER 5
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to survey the current knowledge and risk perceptions about agroterrorism of Florida's beef cattle operations. The study focused on specific security risks to the beef cattle operation and subsequently how or from whom the beef producer sought biosecurity information. The independent variable for this study was risk perception, how "at risk" the beef producer felt about the possibility of an agroterrorism attack. The dependent variable was the level of preparedness practiced on the beef operation. A research developed instrument was used to collect data, and data was recorded from 66.4% of the Beef Cattle Short Course participant population. The contents of this chapter reports conclusions, recommendations, and limitations of the study.

Objectives

The objectives for the study were to

- Identify current levels of knowledge about agroterrorism held by Florida's beef cattle producers,
- Identify the level of preparedness against agroterrorism attack(s),
- Determine the risk perceptions of the beef producer to bioterrorism and agroterrorism, and
- With this data, determine producer's preferences for the delivery of agroterrorism educational materials.

Procedure

The designated population for this study was a convenience sample of beef cattle producers that participated in the University of Florida IFAS Beef Cattle Short Course

(BCSC), May 4-6, 2005. During the BCSC, 137 surveys were distributed. Of the 137 distributed instruments, 91 useable questionnaires were returned to the researcher resulting in a 66.4% response rate. The survey instrument was modeled from a similar EDEN study designed for agriculture and horticulture producers and was improved following a pilot test (EDEN, 2003). The pilot test, conducted on March 15, 2005, was imperative to determine the validity and reliability of the instrument used in the study. The instrument data was collected at the BCSC, as participants completed the questionnaire during the May 4-6, 2005 conference. The instrument consisted of 55 research developed questions and was divided into parts satisfying the above objectives.

Data was analyzed using SPSS® 11.5 for Windows™. The study objective data was analyzed through descriptive statistics, predominantly with means and frequencies. The Likert-type scaled items were treated as ordinal data and coded in SPSS® accordingly. Each blank survey question was coded as missing data, and was not assigned a value in SPSS® to avoid skewing the mean values.

Conclusions

The conclusions of the research data are organized and analyzed in relation to the four objectives initially introduced in Chapter One.

Objective One

Objective one aimed to determine and describe the current knowledge levels of agroterrorism in the specific population of Florida beef cattle producers. Agroterrorism refers to an act of any person knowingly or maliciously using biological and/or chemical agents as weapons against the agricultural industry and/or the food supply. The term agroterrorism combines acts of terrorism with agricultural commodities and this study addresses the main threats and areas of concern for the agricultural commodity of Florida

beef cattle specifically. The surveyed sample consisted of 91 Florida beef cattle producers in attendance at the BCSC May 4-6, 2005. In order to satisfy the first study objective, Part III of the instrument asked participants about agroterrorism workshop attendance, preferred contact person if ever concerned about biosecurity, and biosecurity investments before and/or after September 11th.

When asked, "have you attended a workshop or general information session about biosecurity/agroterrorism?" 67% of the 91 respondents (N=61) reported never attending such an informational session. Only 28.6% (N=26) respondents had attended an informational session at least once, and a mere 4.4% (N=4) had participated in more than one workshop. These results indicate that Florida beef producers are not getting access to or are choosing not to access the educational materials necessary to provide adequate security on their respective operations. A lack of available workshop trainings offered to Florida beef cattle producers will increase the vulnerability to an agroterrorism attack by possibly slowing the detection of a foreign animal disease on a beef cattle production facility.

Next, when participants were asked to select the top three persons they would most likely contact if they suspected an act of agroterrorism, the contact source that was selected most frequently by the population was Law Enforcement (f=58, 63.8%). Furthermore, the frequency data in Table 7 reports the strength of the likelihood for contact when a beef cattle producer suspects an act of agroterrorism to their operation. This frequency data reaffirms the need to educate all contact sources listed in Table 7, especially Florida veterinarians, Florida law enforcement, IFAS Extension agents, State

and County emergency management, and the Florida Department of Agriculture and Consumer Services about agroterrorism and risk communication.

Lastly, the final question for objective one that determines the current application of agroterrorism knowledge and risk perceptions asks, "have you made considerable investments (time, money, or effort) to make your operation more biosecure?" An overwhelming majority of the population, 76.9% (N=70), said No. These respondents have not invested time, money, or effort to increase security on their operation, even after the September 11th terrorist attacks. A mere 6.6% (N=6) reported "Yes, before and after September 11, 2001" and 9.9% (N=9) reported "Yes, after September 11, 2001". This data verifies that Florida beef producers have not been significantly affected by the September 11th terrorist attacks, and have maintained the current level of security on their beef operation.

Objective Two

In order to satisfy objective two, a two-sided Likert-type scale of questions 20-27 was included to determine respondents' opinion of the importance of specific farm safeguards and the degree to which each beef producer practices that safeguard on his/her operation. The farm safeguard that was rated the highest in importance (on a scale of 1-4; 1=No importance, 4= Major Importance) was "Isolating a new animal from the herd" (M=3.43, Std. Dev. =0.75). Furthermore, "Isolating a new animal from the herd" was also rated highest (M=3.29, Std. Dev. =0.86) on the second Likert-type scale of "degree to which you practice" (on a scale of 1-4; 1=Never practice, 4=Always practice). The population agreed that isolating a new animal from the herd was the most important farm security safeguard and was practiced the most by the surveyed beef producers. The farm safeguard of "Participating in training programs to enable employees to recognize and

report a disease outbreak" was ranked as moderate importance (M=3.15, Std. Dev. =0.89), but was rarely practiced by the population (M=2.38, Std. Dev. =0.98). Although the beef producers felt this was a valid practice in order to maintain biosecurity, most of the population rarely practiced this safeguard. The surveyed respondents also determined that the two safeguards that held the least importance on a beef production facility were "Requiring employees to wear coveralls" and "Requiring people entering the facility to shower in and out", with reported means of 1.74 and 1.47, respectively. Moreover, these two safeguards were practiced the least among the respondents, M=1.38 and M=1.09, respectively.

Although the threat of terrorism has been heightened in the United States, Florida beef cattle producers do not feel that most farm safeguards are important nor do they practice these safeguards to protect their operation. Only two safeguards were considered moderately important, four safeguards were considered of minor importance, and two safeguards were of no importance to the sample population Likewise, the population felt that only one safeguard was moderately practiced, four were rarely practiced, and three safeguards were never practiced. These results indicate that the importance of farm safeguards is not considered by Florida beef cattle producers during the daily operations of the farm. This safety attitude, in relation to the practice of basic agroterrorism farm safeguards, results in most of the farm safety practices rarely or never being practiced. Therefore, a change in Florida beef cattle operator's attitudes towards farm safety will directly influence the degree to which they practice agroterrorism farm safeguards.

Objective Three

The purpose of objective three was to gauge the level of risk to an agroterrorism or bioterrorism attack perceived by the Florida beef producer. Part I (questions numbered 1-

4) of the instrument listed four statements with a Likert-type scale (1-5) with which respondents were to express their disagreement or agreement to the statements. For the statement, "I think an act of agroterrorism could happen somewhere in the U.S.", the majority of the population agreed, 56% (N=51) or strongly agreed, 39.6% (N=36). Furthermore, 54.9% (N=50) of the population agreed with the statement, "I think an act of agroterrorism could happen somewhere in Florida", and 33.0% (N=30) strongly agreed. However, when the statement focused on the probability of an agroterrorism attack happening on the beef producers' own operation, opinions shifted. For example, only 28.6% (N=26) agreed, 37.4% (N=34) neither agreed or disagreed, and 14.3% (N=13) strongly disagreed to the statement, "I think an act of agroterrorism could happen on my operation."

The wide range of responses for this statement may be a result of misinformation about the seriousness of agroterrorism or the confidence held by beef producers in seeking guidance in the event agroterrorism impacts the Florida beef industry. Considering that 37.4% of the population neither agreed nor disagreed that an act of agroterrorism could happen on their operation means that many producers felt uncertain about the probability of agroterrorism affecting them. However, since 87.9% of the population either agreed or strongly agreed that an act of agroterrorism could happen somewhere in Florida, beef cattle producers should be prepared for the possibility of an attack, considering that they strongly agree that it can happen in the state where their operation is located. These results illustrate that when beef producers were asked if agroterrorism could happen to them, they were less likely to agree, even though they agree it could happen somewhere in Florida.

The final statement, “I feel prepared for an agroterrorism attack or biosecurity threat to my operation”, received mixed responses. The majority of the population disagreed 36.6% (N=33), 33.0% (N=30) neither agreed nor disagreed, 18.7% (N=17) agreed, 8.8% (N=8) strongly disagreed and a small 2.2% (N=2) strongly agreed. These results prove that most respondents are unsure about preparation of their beef production facility for an agroterrorism attack. The majority of the population disagreed with this statement, and 33.0% was undecided concerning agroterrorism preparedness. These findings confirm that agroterrorism educational materials and training sessions need to be created in order to better prepare Florida beef cattle producers in the event of an agroterrorism attack.

Part II of the instrument (questions numbered 5-16) targeted risk perceptions of specific areas of the beef cattle operation. Respondents were asked to “Rate the Level of Perceived Threat” for each area that was listed, on a 1-5 scale, with 1=None (no threat felt) to 5=Considerable threat. The perceived threat of loss of income due to market losses was the largest area of concern for the population (M=3.39). However, the perceived threat of an animal disease outbreak was another significant concern for beef producers (M=3.00). The perceived threat of animal death and the perceived threat of tampering with farm fences/gates also were of concern, with reported means of 2.79 and 2.91 respectively. The area that producers felt was at the least risk to terrorist activity was the perceived threat of employee revenge, M=1.88. The majority of the population felt this area was of no threat, 45.1% (N=41), and 34.1% (31) felt it was of little threat.

The perceived threat of loss of income due to market losses was rated as the highest concern for Florida beef cattle producers. In the event of a successful agroterrorism

attack to a Florida beef cattle operation(s), economically the attacked operation(s) would suffer financially as a result of decreased consumer confidence and/or would suffer from a loss of livestock available for market sale. Therefore, to protect against a loss of profit due to market fluctuations, Florida beef producers need to consider the importance of the farm safeguards (questions 20-27) discussed in Objective two, and begin practicing them to further protect the operation and livestock.

Although the sample population rated employee revenge as the least perceived risk, attention should be focused on employee satisfaction and work ethic. Farm managers should have regular employee meetings and actively and professionally address specific concerns and questions of the employee. Employees often have unlimited access to the cattle operation and are trusted to care and maintain the production facility. Hence, risk communication with employees needs to be based on a trusting relationship, with the farm manager explicitly outlining farm safety risks, safety practices, and procedures and persons of contact if the employee suspects an agroterrorism attack to the operation.

To better understand the affect of global agricultural issues on Florida beef production operations the instrument question, “To what extent have the Foot and Mouth outbreak in England and the December 2003 discovery of a Bovine Spongiform Encephalopathy (BSE) case in the U.S. influenced any decisions towards improving the security on your operation?” was included. The majority of the population felt that these global issues had influenced their decisions of improving security, 37.4% (N=34). Additionally, 18.7% (N=17) of the respondents were strongly influenced, 12.1% (N=11) were minimally influenced, and 13.2% (N=12) have felt no influence. Therefore, the Foot and Mouth outbreak in the United Kingdom and the recent BSE case in the state of

Washington have indeed raised awareness within the Florida beef producer community, influencing decisions towards improving farm security. However, as reported in the previous objectives, Florida beef cattle producers have done little or nothing to practice further safety measures on their operations.

Objective Four

The final study objective aimed to utilize the beef producers' insights on their preferred sources of contact and printed material about agroterrorism and bioagents. First, the participants were asked, "do you have access to educational material that can answer your agricultural biosecurity questions?" The answer choices of Yes; No; or Don't Know prompted the following results: 38.5% (N=35) reported Yes, 30.8% (28) reported No, and 30.8% (N=28) answered Don't Know or were blank responses. From these results it can be stated that a majority of the population did not have access to agroterrorism educational materials, or did not know if they had access.

Questions 29-38 asked participants whom they would most likely contact if they wanted more information about agroterrorism or livestock specific biosecurity threats. A Likert-type scale was created to represent the likeliness to contact: 1=Very Unlikely to 5=Very Likely. The contact source that was preferred by the study population was the Florida Department of Agriculture and Consumer Services, M=4.11, Std. Dev. = 0.90. Contact sources that were rated favorably by the respondents and should be prepared for agroterrorism questions are the following: UF-IFAS Extension Agent, M=3.99; Veterinarian, M=3.80; Producer Association, M=3.56; Law enforcement, M=3.52; Another livestock producer, M=3.30; State or county emergency management, M=3.07; 50 respondents felt they didn't know who they would contact, M=1.92; and only one respondent specified some other source as a preferred contact (see Appendix D).

In relation to the preferred person/organization source, respondents were asked, “if you wanted to know more about agroterrorism or livestock specific biosecurity threats, where would you look for published information?” This question set duplicated the Likert-type scale for the previous set of questions (1=Very Unlikely to 5=Very Likely). The University of Florida received the highest preference as a published information source, M=4.25, Std. Dev. = 0.83. The Extension Office would likely receive information requests during an agroterrorism threat or attack, M=4.05, and the World Wide Web also yielded high preference, M=3.93. The two sources unlikely to be used as an information source are the newspaper and library publications, M=2.44 and M=2.29, respectively.

These results strengthen the call for applicable and accessible materials for the sample population. The University of Florida is viewed as the expert and preferred source of educational materials, as UF is the Land Grant research institution for the state. The UF-IFAS Extension Service is viewed as another top source for agroterrorism information, needing the most current agroterrorism preparedness information in the event of an agroterrorism threat or attack on Florida.

The final question applicable to objective four asked, “if the Extension Office were to concentrate on educating livestock producers about agroterrorism which delivery method would you prefer?” The educational delivery method preferred by 41.8% (N=38) of the participants was a weekend training workshop. The next preferred delivery method was reading printed materials at one’s own pace, 24.2% (N=22), followed by one-on-one contact with an Extension agent, 11.0% (N=10). The least desired delivery method was taking classes through the World Wide Web, 8.8% (N=8). There were 13

(14.3%) blank or incorrectly marked responses for this question. The sample population for this study was surveyed at the BCSC three-day workshop from Wednesday to Friday. This may have biased the sample population to choose weekend workshop as the preferred delivery method of agroterrorism training, as they were in attendance at the three day BCSC.

Limitations of the Study

A limitation to this study was the availability of the audience surveyed. It was not a random sample, instead a convenience sample. Participants were surveyed based on their attendance to the Beef Cattle Short Course. Therefore, if the survey instrument had been mailed out, there could have been a more representative sample.

Another limitation to the study was the population sample size. Although a response rate of 66.4% (N=91) is acceptable, more preparation to be allotted time on the BCSC agenda would have ensured a larger sample size.

Summary of Findings

Based on the literature reviewed in Chapter Two, the need for agroterrorism preparedness and biosecurity practices has been called to attention since the September 11th terrorist attacks, the Foot and Mouth disease outbreak in the United Kingdom, and the recent BSE case in the state of Washington. The need to protect America's safe, affordable, and abundant food supply should be a top priority in each beef producer's daily agenda. However, biosecurity safety practices may be perceived as costly, time consuming, and or too elaborate for many beef producers to implement on the production facility.

The objective of this study was to determine the agroterrorism risk perceptions held by Florida beef cattle producers. The study results determined that beef producers feel at

risk to agroterrorism. Most Florida beef producers felt that an act of agroterrorism could happen somewhere in the United States and somewhere in Florida. Furthermore, respondents mainly disagreed or neither agreed nor disagreed with feeling prepared for an agroterrorism attack to his/her operation. The population felt that agroterrorism could happen in the United States and/or Florida, but remained neutral about the probability of agroterrorism happening on his/her operation. Yet, if an act of agroterrorism were to happen, the majority of the population felt unprepared for an agroterrorism attack. These findings confirm the need for more educational materials and programs to better prepare Florida beef producers for bioterrorism and agroterrorism.

In order to prevent and better protect Florida beef operations from bioagents, there are specific protective measures that would provide a barrier for terrorist activity. The population only rated two safeguard practices moderately important: isolating a new animal from the herd and participating in training programs to enable employees to recognize and report a disease outbreak. Surprisingly, two safety practices were ranked at almost no importance: requiring employees to wear coveralls and requiring people entering the beef cattle operation to shower in and out. Yet, if a beef facility is to remain proactive against the introduction of bioagents, every possible method of protection should be practiced. But, the only safeguard moderately practiced by the population was isolating a new animal from the herd.

If beef producers are only consistently practicing the farm safeguard of isolating a new animal from the herd, then a successful agroterrorism attack could be achieved with relatively little effort. Kohnen (2000) states that livestock producers can reduce risk by increasing biosecurity measures at their facilities. But, “not all farms adhere to these

guidelines. A survey of 252 farms that raise hens for egg production, some with 200,000 egg layers, found that almost one-third of the sites allow nonbusiness visitors into the laying houses. More than 85 percent of dairy farms do not isolate new cows from the rest of the herd for any period of time" (Kohnen, 2000, p. 23). These findings are cause for concern, as biosecurity is in the beef producer's best interest. By practicing agroterrorism farm safety, the producer will ensure continued production of quality beef and a stable economic market.

In order to provide agroterrorism protection, Florida beef producers need information and educational materials. The preferred contact source concerning biosecurity questions is the Florida Department of Agriculture and Consumer Services. The preferred source of reference for published agroterrorism information is the University of Florida. The UF-IFAS Extension office was also ranked at the top as a published information source, with an Extension agent also ranked high as a contact source. The above mentioned organizations and individuals should prepare and familiarize themselves about agroterrorism and bioagents in order to inform the public with the most current and correct biosecurity practices. Yet, all contact sources and published information sources listed in Tables 19 and 20 should be educated and prepared for an agroterrorism attack or biosecurity threat to Florida beef cattle operations. Moreover, the preferred method of learning about agroterrorism and biosecurity practices is a weekend training workshop.

Overall, the population of beef producers consisted of large operations, 26.4% (N=24) respondents reported over 1,000 animals on his/her production facility at the peak time of year. Moreover, 14.3% (N=13) respondents reported an average annual gross

receipt value of $1,000,000 or more, representing a substantial portion of the Florida economic beef cattle market. In order to determine the percentage of beef cattle operations that track cattle and keep current records about operation activity, question 54 asked, “is there a record keeping system on your livestock operation?” An overwhelming 90.1% (N=82) of the respondents confirmed the presence of a record keeping system on their operation. This is encouraging as the United States Animal Identification Plan (USAIP) program is in the process of being instituted. The goal of the USAIP is, “to achieve a traceback system that can identify all animals and premises potentially exposed to an animal with a Foreign Animal Disease (FAD) within 48 hours after discovery” (United States Animal Identification Plan, 2003, p. 2).

The results from this study can be used to develop written educational materials about agroterrorism, bioterrorism, and bioagents. Specific farm safeguards and areas of concern can be identified and addressed. Furthermore, this study distinguishes the beef producer’s preferred contact person and printed material source, allowing the educational materials to be supplied to these individuals and organizations to be distributed to the public in a more timely and beneficial manner. Finally, the preferred method of delivery for agroterrorism educational materials is a weekend training workshop.

A recent example of agroterrorism workshop training was four regional workshops hosted by The University of Minnesota Extension Service titled, “Protecting Our Food System from Intentional Attack”. The full-day workshops, scheduled for June and July of 2005, were tailored to people working in Minnesota’s food industry. This included farming, food protection, manufacturing, and regulation, with a specific focus on dairy, meat, grain, and feed producers, extension educators, local emergency response, public

health care professionals, and food transportation personnel. (University of Minnesota Extension Service, 2005). John Shutske, agricultural health and safety specialist with Extension, and the event coordinator said, “even though the focus will be on intentional events, the program will be very helpful in planning for unintentional events. These include natural disasters, disease outbreaks and foodborne illness outbreaks that occur every year” (University of Minnesota Extension Service, 2005, p. 1). The UF-IFAS Extension Service could examine the format of this program and tailor it to apply to the needs of Florida livestock producers.

Recommendations

The findings from this research suggested that Florida beef producers need more accessible and applicable agroterrorism educational materials to better protect against bioagents. Florida beef producers identify with the national bioterrorism threat, and agree that agroterrorism could happen somewhere in Florida. Therefore, in order to preserve the Florida beef cattle business, preparatory actions needed to be taken to increase biosecurity on state-wide production facilities.

Further research needs to be conducted to determine the preferred delivery method of agroterrorism educational materials. A more exhaustive list of delivery methods should be offered to Florida beef cattle producers, including the choice of week-day training.

Multiple agroterrorism training workshops should be organized throughout Florida to begin the educational process. The workshops should follow the pre-test/post-test format, testing the risk perceptions and agroterrorism knowledge of the beef producers before the workshop and after the workshop. A follow-up survey should be conducted to

measure the application and practice of the learned workshop security measures on the beef operation.

A mail survey like this study should be conducted on Florida dairy cattle producers to determine their risk perceptions and agroterrorism knowledge. The mail survey would reveal similarities and any differences between dairy and beef producers' opinions of farm safeguards and preferred agroterrorism contacts. The reported data would effectively determine if the same agroterrorism weekend workshop training would benefit both dairy and beef producers simultaneously, or if their needs dictate differing methods.

Future agroterrorism materials should include discussion of the farm safeguard measure which includes the isolation of animal(s) that have been traveling and in contact with other animals and facilities, such as is the case with show animals.

The survey instrument used in this study could be adapted and administered to other livestock industries. It is recommended that individual instrument questions be tailored to apply to different animal industries for particular operation scenarios. For example, Part IV of the instrument, which measured agroterrorism preparedness in relation to specific farm safeguards, should be revised to inquire about farm safeguards that apply to other animal-related enterprises.

APPENDIX A
SURVEY INSTRUMENT

Agricultural Security Risks Survey for Florida Livestock Producers

Agricultural & Biological Engineering
College of Agricultural and Life Sciences
Frazier Rogers Hall
University of Florida
P.O. Box 110570
Gainesville, FL 32611-0570
Ph: (352) 392-1864

Purpose of the Study

The purpose of this study is to survey the current knowledge perceptions about Agroterrorism from Florida Beef and Dairy production operations. Your answers will serve as a guide when educational programs and materials are developed for homeland security. For this survey **Homeland Security** is a state of being prepared to prevent or reduce the impact of a terrorist attack on domestic natural resources, the economic sectors, or the American people.

This survey refers to two specific threats: **Agroterrorism** and **Bioterrorism**. For example, agroterrorism could involve the introduction of a foreign animal disease onto a farm, theft of chemicals for a meth lab, or acts of destruction by an activist group. Bioterrorism refers to an act of any person knowingly or maliciously introducing disease-causing agents or organisms to an animal, plant or human population, thus threatening food and water resources as well as human and animal life.

Please take a few minutes and answer each question to the best of your knowledge. You do not have to answer any question you do not wish to answer. The survey will take an estimated 15 minutes to complete. The responses you provide will remain confidential. Only summarized data will be reported in order to protect the identity of each individual respondent.

Thank you for participating in the study.

Sincerely,

Jodi L. DeGraw
Graduate Assistant
Agricultural and Biological Engineering

Agricultural Security Risks Survey for Livestock Producers

PART I – Perceptions about Agroterrorism

Agroterrorism refers to an act of any person knowingly or maliciously using biological and/or chemical agents as weapons against the agricultural industry and/or the food supply, or using agricultural chemicals and machinery to perform an act of terrorism against any segment of the American population. Therefore, please **circle** the number which best reflects your feelings to the following statements:

(5) **Strongly** Agree
(4) Agree
(3) **Neither** Agree nor Disagree
(2) Disagree
(1) **Strongly** Disagree

	Strongly Agree	Agree	**Neither** Agree or	Disagree	**Strongly** Disagree
1. I think that an act of agroterrorism could happen somewhere in the U.S.	5	4	3	2	1
2. I think that an act of agroterrorism could happen somewhere in Florida.	5	4	3	2	1
3. I think that an act of agroterrorism could happen on my operation.	5	4	3	2	1
4. I feel prepared for an agroterrorism attack or some other biosecurity threat to my operation.	5	4	3	2	1

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PART II- Rate the Level of Perceived Threat

Rate the Level of Perceived Threat you feel for each aspect of your operation. Please **circle the number** which **best reflects** the level you feel your operation is at risk to terrorist activity.

Rate the degree of perceived threat for each aspect as:
(5) **CONSIDERABLE** threat
(4) **MUCH** threat
(3) **SOME** threat
(2) **LITTLE** threat
(1) **NONE** (No threat felt)

	Considerable	Much	Some	Little	None
5. Water Contamination	5	4	3	2	1
6. Feed Contamination	5	4	3	2	1
7. Animal Death	5	4	3	2	1
8. Animal Disease Outbreak	5	4	3	2	1
9. Fertilizer Theft/Misuse	5	4	3	2	1
10. Employee Revenge	5	4	3	2	1
11. Chemical Contamination	5	4	3	2	1
12. Zoonotic Illness (Disease transmitted from animal to human)	5	4	3	2	1
13. Loss of Income Due to Market Loss	5	4	3	2	1
14. Tampering with Facilities	5	4	3	2	1
15. Tampering with Fences/Gates	5	4	3	2	1
16. Other, **please specify:** _____	5	4	3	2	1

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PART III- Gaining Knowledge about Agroterrorism

17. Have you attended a workshop or general information session about biosecurity/agroterrorism?

____ Yes, at least once
____ More than once
____ No

18. If you suspected an act of agroterrorism (or breech of security) on your operation, from whom would you seek advice? (**Select the three** you would most likely contact).

____ Veterinarian
____ Extension Agent
____ Florida Dept. of Agriculture
____ Another livestock producer
____ Law enforcement
____ USDA
____ Producer Association
____ State or county Emergency Management
____ Don't know
____ Other (please specify) _____
_____

19. Have you made considerable investments (time, money or effort) to make your operation more biosecure?

____ Yes, before September 11, 2001
____ Yes, before and after September 11, 2001
____ Yes, after September 11, 2001
____ No
____ Don't know

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PART IV- Agroterrorism Preparedness

Below is a list of safeguards that one may practice on the farm in order to reduce the likelihood of loss of production due to disease introduction.

To the LEFT, circle the number which represents your opinion of the **importance of the safeguard** to better protect your livestock operation.

To the RIGHT, circle the **degree to which you practice** the indicated safeguard on your livestock operation, **if** the scenario does not apply to your farm, circle Not Applicable.

Importance of the Safeguard					**Degree to Which You Practice**			
Major Importance	**Moderate** Importance	**Minor** Importance	**No** Importance	Circle your responses	**Always** Practice	**Moderate** Practice	**Rarely** Practice	**Never** Practice
4	3	2	1	20. Limiting visitors	4	3	2	1
					Not Applicable			
4	3	2	1	21. Requiring a waiting period for visitors who have been on another farm	4	3	2	1
					Not Applicable			
4	3	2	1	22. Isolating a new animal for observation before introducing it to the entire herd	4	3	2	1
					Not Applicable			
4	3	2	1	23. Requiring employees to wear coveralls and shoe covers	4	3	2	1
					Not Applicable			

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Importance of the Safeguard					**Degree to Which you Practice**			
Major Importance	**Moderate** Importance	**Minor** Importance	**No** Importance	Circle your responses	**Always** Practice	**Moderate** Practice	**Rarely** Practice	**Never** Practice
4	3	2	1	24. Requiring people entering the facility to shower in and shower out	4	3	2	1 Not Applicable
4	3	2	1	25. Conducting a background check on potential hires	4	3	2	1 Not Applicable
4	3	2	1	26. Have regular meetings with employees to determine levels of their satisfaction	4	3	2	1 Not Applicable
4	3	2	1	27. Participate in a training program(s) that will enable employees to quickly recognize and report a disease	4	3	2	1 Not Applicable

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28. Do you have access to educational material that can answer your agricultural biosecurity questions? If you answer "Yes", please write in the material source in the blank space below:

_____ Yes
_____ No
_____ Don't Know

If you wanted to know more about agroterrorism or livestock specific biosecurity threats, how **likely** would it be for you to contact the following? Please **circle** the number which best represents your response.

(5) **VERY** Likely
(4) **FAIRLY** Likely
(3) **LIKELY**
(2) **UNLIKELY**
(1) **VERY** Unlikely

	Very Likely	**Fairly** Likely	**Likely**	**Unlikely**	**Very** Unlikely
29. Veterinarian	5	4	3	2	1
30. Extension Agent	5	4	3	2	1
31. Florida Dept. of Agriculture	5	4	3	2	1
32. Another Livestock Producer	5	4	3	2	1
33. Law Enforcement	5	4	3	2	1
34. USDA	5	4	3	2	1
35. Producer Association	5	4	3	2	1
36. State or County Emergency Mgt.	5	4	3	2	1
37. Don't Know Who I Would Contact	5	4	3	2	1
38. Other, **please specify:** _____	5	4	3	2	1

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If you wanted to know more about agroterrorism or livestock specific biosecurity threats, where would you look for published information? Please **circle** the number which best represents your response.

(5) **VERY** Likely (4) **FAIRLY** Likely (3) **LIKELY** (2) **UNLIKELY** (1) **VERY** Unlikely	**Very** Likely	**Fairly** Likely	**Likely**	**Unlikely**	**Very** Unlikely
39. Farm Magazine	5	4	3	2	1
40. Newspaper	5	4	3	2	1
41. On the World Wide Web	5	4	3	2	1
42. Library Publications	5	4	3	2	1
43. Extension Office	5	4	3	2	1
44. University of Florida	5	4	3	2	1
45. Other, **please specify**_____	5	4	3	2	1

46. To what extent have the Foot and Mouth outbreak in England and the December 2003 discovery of a Bovine Spongiform Encephalopathy (BSE) case in the U.S. influenced any decisions towards improving the security on your operation?

Strongly Influenced	5
Influenced	4
Neither	3
Minimal Influence	2
No Influence	1

<continued on next page>

PART V- Demographics

47. Are you:

_____ Male
_____ Female

48. How many years have you been in the Livestock production business? Select one.

_____ 1 day - 12 months
_____ 13 months - 2 years
_____ 25 months - 3 years
_____ 37 months - 4 years
_____ 49 months - 5 years
_____ More than 5 years

49. Indicate the type of Livestock production(s) that apply to you by **circling** from the choices:

BEEF DAIRY

50. Please select the number of cattle on your production facility during your peak time of the year (when you are at your maximum). Select one.

_____ 1-50 animals
_____ 51-100 animals
_____ 101-300 animals
_____ 301-500 animals
_____ 501-1000 animals
_____ 1000+ animals

51. Are you:

____ Landlord only
____ Operator on land you own
____ Operator on rented land
____ Other (specify) _____

<continued on next page>

PART V- Operation Demographics

52. What is the size of your operation?

____ Less than 1 acre to 99 acres
____ 100 – 249 acres
____ 250 – 499 acres
____ 500 – 999 acres
____ 1000 – 1999 acres
____ 2000 or more acres

53. What is the average value of your annual gross receipts for the livestock-related segment of your operation?

____ $1 to $9,999
____ $10,000 - $49,999
____ $50,000 - $99,999
____ $100,000 - $249,999
____ $250,000 - $499,999
____ $500,000 - $999,999
____ $1,000,000 or more

54. Is there a record keeping system on your livestock operation?

_____ Yes
_____ No
_____ Don't Know

55. If the Extension Service were to concentrate on educating livestock producers about agroterrorism which delivery method would you prefer? Please **select your top choice**:

_____ Weekend Training Workshop
_____ Read printed materials at your own pace
_____ Take classes through the World Wide Web
_____ One-on-One contact with an Extension agent

<continued on next page>

Thank you for your time!

Your participation in this questionnaire is appreciated and the information collected will be used to more effectively create Agroterrorism educational materials.

Do you have any additional comments, concerns, or questions about livestock security issues? Feel free to provide feedback in the blank space below:

APPENDIX B
INFORMED CONSENT FORM

UNIVERSITY OF FLORIDA

Institutional Review Board

98A Psychology Bldg.
PO Box 112250
Gainesville, FL 32611-2250
Phone: (352) 392-0433
Fax: (352) 392-9234
E-mail: irb2@ufl.edu
http://irb.ufl.edu

DATE: March 28, 2005

TO: Jodi DeGraw
PO Box 110570
Campus

FROM: Ira S. Fischler, Ph.D., Chair
University of Florida
Institutional Review Board 02

SUBJECT: **Approval of Protocol #2005-U-0336**

TITLE: *Perceptions of Florida Livestock Producers on Preparedness for a Bioterrorist Attack*

SPONSOR: None

I am pleased to advise you that the University of Florida Institutional Review Board has recommended approval of this protocol. Based on its review, the UFIRB determined that this research presents no more than minimal risk to participants, and based on 45 CFR 46.117(c), authorizes you to administer the informed consent process as specified in the protocol.

If you wish to make any changes to this protocol, **including the need to increase the number of participants authorized**, you must disclose your plans before you implement them so that the Board can assess their impact on your protocol. In addition, you must report to the Board any unexpected complications that affect your participants.

If you have not completed this protocol by March 26, 2006, please telephone our office (392-0433), and we will discuss the renewal process with you. It is important that you keep your Department Chair informed about the status of this research protocol.

ISF:dl

APPENDIX C
INFORMED CONSENT SCRIPT

INFORMED CONSENT SCRIPT

Protocol Title: **Perceptions of Florida Livestock Producers on Preparedness for a Bioterrorist Attack**

This consent will be read to the participants before administering the questionnaire.

My name is Jodi DeGraw and I am a graduate student in the Department of Agricultural and Biological Engineering at the University of Florida. Thank you for taking the time to participate in this study. Your participation is completely voluntary. There is no penalty for not participating. If you choose to participate, you will answer items on a confidential survey that will take about 10 minutes to complete. You can stop at any time without penalty and you do not have to answer any question you do not wish to answer.

All answers are confidential to the extent provided by the law. There are no known risks associated with this study and there is no compensation or other direct benefit to you for participation.

If you'd like to learn more about this study, please contact me at Frazier Rogers Hall, Gainesville campus, 352-392-1864 ext. 217. If you have any questions about your rights as a research participant, please contact the UFIRB Office, Box 112250, University of Florida, Gainesville, FL, 32611-2250, 352-392-0433. IRB #

By completing the questionnaire, you give me permission to report your responses anonymously in the final manuscript to be submitted to my faculty supervisor as part of my coursework.

Thank you.

APPENDIX D
SURVEY COMMENTS

The following is a listing of survey comments that were included on the instrument by the participants.

Question # 16: Rate the level of perceived threat you feel for each aspect of your operation. Other, please specify:

- Fire-range (need for management)

Question # 18: If you suspected an act of agroterrorism (or breech of security) on your operation, from whom would you seek advice? Other, please specify:

- FDACS, SART
- I was an intelligence analyst for the Dept. of Def. on biological warfare and have extensive literature on agroterrorism
- Florida Disaster Handbook, SART manual, ESF-17
- Internet searches
- IFAS
- U of F
- USDA, FDACS, State Vet
- USDA, FDACS, WWW, UF
- Educational materials from meetings
- IFAS website, DFAS website, USDA website
- Journals, Internet, trade magazines, Extension, etc

- Internet search
- BSE, Foot and Mouth
- Internet
- Fla. Dept. of Ag
- Not all-W.W.W.
- Internet
- No for pastures, yes for citrus

Question # 38: If you wanted to know more about agroterrorism or livestock specific biosecurity threats, how likely would it be for you to contact the following? Other, please specify:

- Internet

Question #45: If you wanted to know more about agroterrorism or livestock specific biosecurity threats, where would you look for published information? Other, please specify:

- Florida SART manual

Question # 46: To what extent have the Foot and Mouth outbreak in England and the December 2003 discovery of a Bovine Spongiform Encephalopathy (BSE) case in the U.S. influenced any decisions towards improving security on your operation?

- FCA, Farm Bureau, Fla. Dept. of Agriculture, I attended a seminar in Okeechobee as a result of

Question #51: Are you: Other, please specify.

- Employer of operator on operator owned land
- VP Ranch manager
- NRCS employee
- Manager
- Mgr/Consultant
- Manager
- Owned and rented land
- Ranch hand
- Ranch Foreman
- Cowboy
- Foreman
- Ranch Hand
- Ranch Manager
- Mngr. for Company
- Research Center
- Manager
- Farm Manager
- MGR.
- Cowhand
- Consultant
- Manager
- Manager

Question #54: Is there a record keeping system on your livestock operation?

- Somewhat deficient system

Question # 55: If the Extension Service were to concentrate on educating livestock producers about agroterrorism which delivery method would you prefer? Additional comments:

- One day workshop
- Weekday training
- You will have to use all of these to get us trained
- At Short course and qtr. meeting

Additional Comments on the back page of the survey:

- Farm security training will be most effective as a partnership between IFAS/Extension, FDACS, Emergency Management (ESF-17), Florida SART at local county level

- We do not allow anyone on premises-or around animals
- Because we reside at our ranch and our length of time in agriculture, we feel fortunate to be present to keep an eye on the pastures and herd
- Spray down boots w/ alcohol spray bottle

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BIOGRAPHICAL SKETCH

The author was born Jodi Lynn DeGraw on February 9, 1982, in Lakeland, Florida. She grew up in Polk County and graduated from Mulberry High School in May 2000. Her love for livestock began early through 4-H and FFA exhibiting horses.

Jodi earned her Associate of Arts degree in December 2000 from Polk Community College after completing many dual enrollment courses while still in high school. She spent a semester at Florida Southern College in Lakeland before transferring to the University of Florida in August 2001. While pursuing her undergraduate degree, Jodi became involved in numerous campus activities and honor societies. These included the UF Horse Judging Team, the Horseman's Association, the Forestry Club, the Agricultural Operations Management Club (AOM) club, the College of Agricultural and Life Sciences Ambassadors, the University Scholars Program, Gamma Sigma Delta, and Golden Key International Honor Society. Jodi earned her Bachelor of Science with honors in agricultural operations management specializing in environmental sciences in December 2003.

During her senior year, Jodi was accepted into graduate school and, through the combined degree program, began work on her Master of Science degree in agricultural and biological engineering with a focus on agricultural safety and a minor in agricultural education and communication.